Nassau County Vulnerability Assessment: Phase I

REPORT OF VULNERABILITY ASSESSMENT

JUNE 19, 2019

The Balmoral Group

Executive Summary:
Vulnerability Assessment & Public Outreach

Nassau County applied for a Resiliency Planning Grant (RPG) through the Florida Department of Environmental Protection to assess vulnerabilities in two areas of the County: 1) east of I-95 on the mainland, 2) and west of I-95 and south and west of A1A/SR 200/301. Amelia Island was not included in the request due to Vulnerability Assessment work conducted in 2013, and the remaining of western Nassau was not included at this time to keep the scope of work manageable for purposes of the grant time period. It is anticipated that the remainder of western Nassau will be addressed through a second phase of Vulnerability Assessment.

Flooding, stormwater, and drainage are top of mind with elected officials and community based on recent storm events like Hurricanes Matthew and Irma, but also because of everyday flooding after typical summer thunderstorms. It is not uncommon for the County to hear on a weekly basis from citizens in the county regarding road flooding issues or that they have been dropped from their flood insurance. An example of this is illustrated by the County Road and Bridge Department's open work orders map. Blue flags indicate open work orders related to drainage and flooding; while present throughout the County, a concentration around Callahan demonstrates existing vulnerabilities.

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The community has indicated they are ready for action. This Vulnerability Assessment for the County's rapidly growing areas, and areas with demonstrated existing flooding issues, helps better prepare Nassau County and dovetails well with existing long-range planning projects that are underway. The County should also be prepared to address sea level rise impacts throughout the County due to tidally-influenced water bodies extending well into Western Nassau. Increasing sea level can lead to increased stresses on or losses of tidal wetlands, changes to the landforms of estuaries, tidal wetlands, and tidal rivers, increased instability of beaches, barrier islands, and inlets, and increased threats to coastal fresh water supplies. As a community with a geography dominated by floodplains and wetlands, the County must take sea-level rise seriously. A rise in sea-level will have impacts on infrastructure, development, community health, and the economy.

Nassau County Planning and Economic Opportunity (PEO) Department staff are working on numerous long-range planning initiatives in the proposed project areas. The timeline for these projects is roughly all over the next 18-24 months. Having a Vulnerability Assessment conducted now is an opportune time to make sure we are adequately addressing future impacts of flooding and SLR as the County progresses on these planning projects. This not only helps the County plan for our citizens, it will also help the County plan internally in terms of siting future infrastructure projects.

These projects are directly related to projected growth trends for Nassau County. In Spring 2018, the PEO Department released a Growth Trends report with projections relative to population and potential future land areas expected to be impacted as a result of this growth. The proposed areas for this Vulnerability Assessment, which are areas of existing population concentration and growth, are projected to be the areas continuing to grow over the next ten years. Additionally, the East Nassau Community Planning Area (Wildlight) is in the proposed Vulnerability Assessment area. This 50-year plan will result in a significant increase only in terms of population and developed land area. Incorporating resiliency into all of these planning efforts represents the holistic planning approach the County wishes to see implemented.

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In early 2019, Nassau County adopted the state statutory requirements regarding "Peril of Flood" into the County's Comprehensive Plan. This was an important step forward in resilience and adaptation planning for the County. Having a Vulnerability Assessment completed will move the County further along the Adaptation Planning process suggested by the State of Florida in the *Florida Adaptation Planning Guidebook*, as depicted to the right.

The Balmoral Group was contracted to perform the vulnerability assessment. Data were collected from a variety of sources and compiled to evaluate two areas; the "East", meaning east of I-95 on the mainland, and "West", meaning west of I-95 and south of A1A/SR 200/301. Maps were prepared to provide relevant data, and public outreach events were conducted on May 20, 2019 in Yulee and on May 21, 2019 in Callahan. Both events attracted approximately 30 members of the public. Attendees included citizens, representatives of County staff leadership in Planning, Building, Engineering, and Emergency Management, a Planning and Zoning Board member, a County Commissioner, the St. Johns River Water Management District, and the media.

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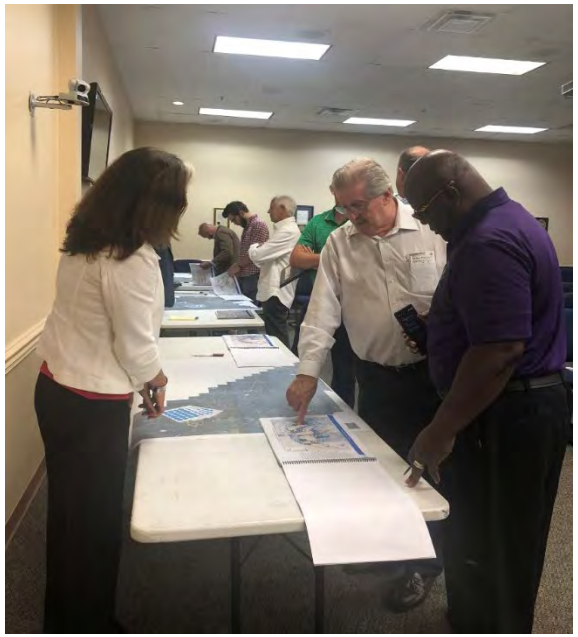
Public feedback at the outreach events focused on flooding experiences relating to Hurricane Irma (about two years prior to the meeting dates; September 2017); concerns about the concentration of septic systems and/or mobile homes in areas denoted as vulnerable; the extent to which inland areas appeared vulnerable; and concerns relating to the effects of additional new development on existing flooding issues. Residents were invited to provide edits on hard copy maps at the meeting, to show specific recent flood incidents that they were aware of.



Introduction & Background to Data Collection

Throughout this report, maps describe relevant data. As planning efforts will respond differently to episodic flooding versus long-term changes in flooding conditions, the maps are organized by type of flooding or inundation for each new datapoint introduced, as follows:

1. The first map in each sequence provides data regarding episodic flooding or inundation, based on satellite data reflecting the presence or absence of surface water (described in more detail in the next section). When pertinent, maps that illustrate the West area, include a zoomed section near the intersection of I-95 and SR 200 to provide a closer inspection of relevant data (see map at right).

2. The second map in each sequence provides data in the context of storm surge inundation, based on NOAA-modeled impacts at each hurricane category.

3. The third and final map provides sea level rise projections for each area.

Figures 1 and 2 relate existing land use and development patterns against future land use and current zoning, followed by several series of slides describing the three types of flooding or inundation data used throughout the assessment, described here as Episodic (water frequency); Event-driven (storm surge) and sea level rise.

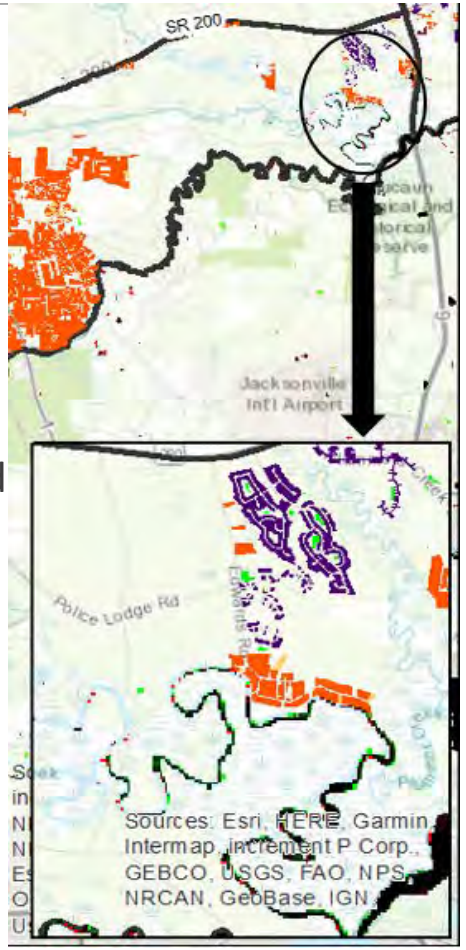


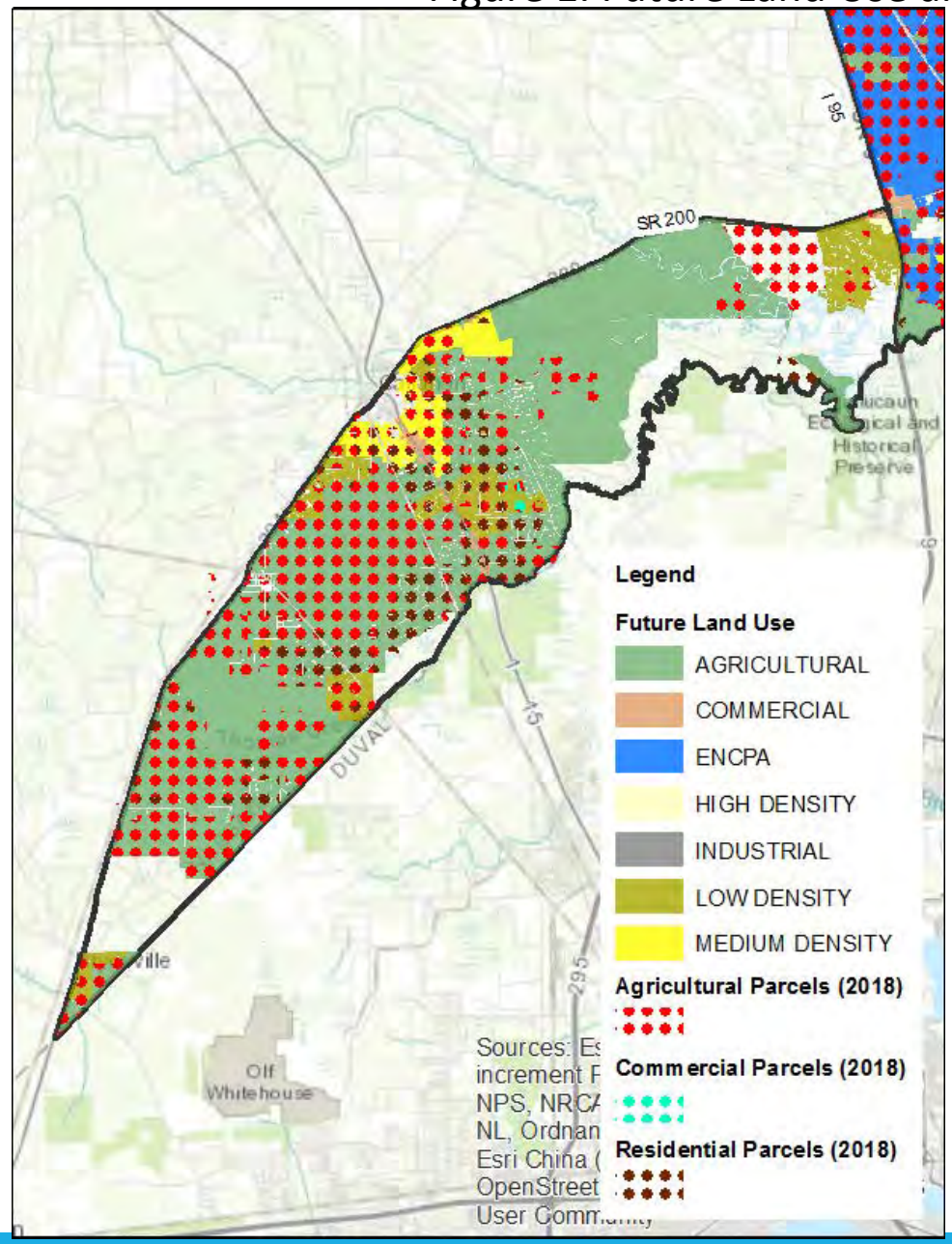
Table of Figures

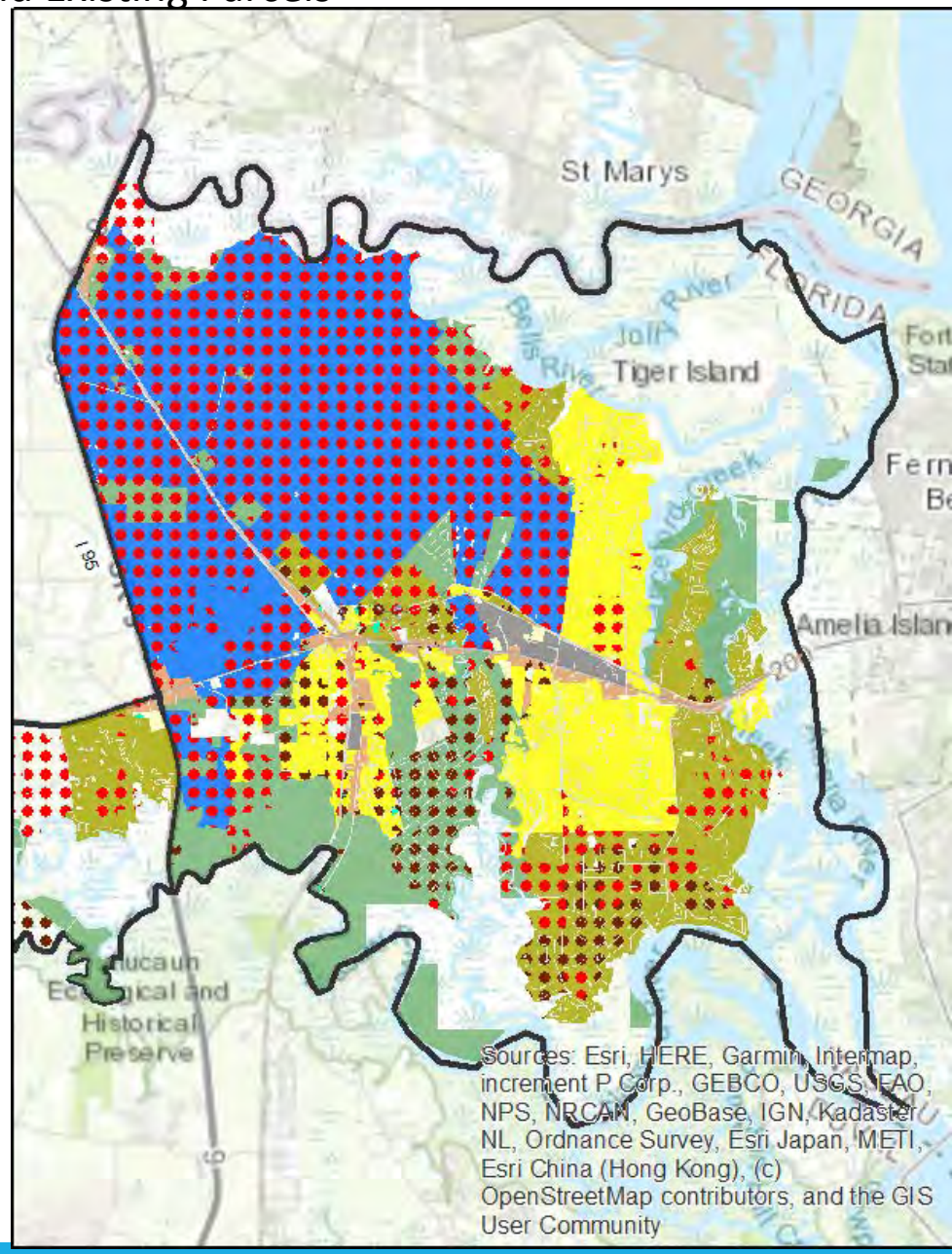
Figure 1. Future Land Use and Existing Parcels

Figure 1 compares the Future Land Use Map (FLUM; shown with solid colors) and 2018 parcel data (shown with dotted colors) to establish zones where planned future use has been superseded by existing uses. For example, there are several places in both study areas where future land use is labelled as agriculture, but development has already occurred (mostly residential).

In the West study area, there are residential parcels between Callahan and the county borderline with Duval County that are labelled as agricultural in the FLUM.

In the East study area, there are areas that have development but are also labelled as agricultural on the FLUM. These areas are mostly manufactured homes south of SR 200, but include a few commercial and industrial parcels near SR 200 and US Highway 17.

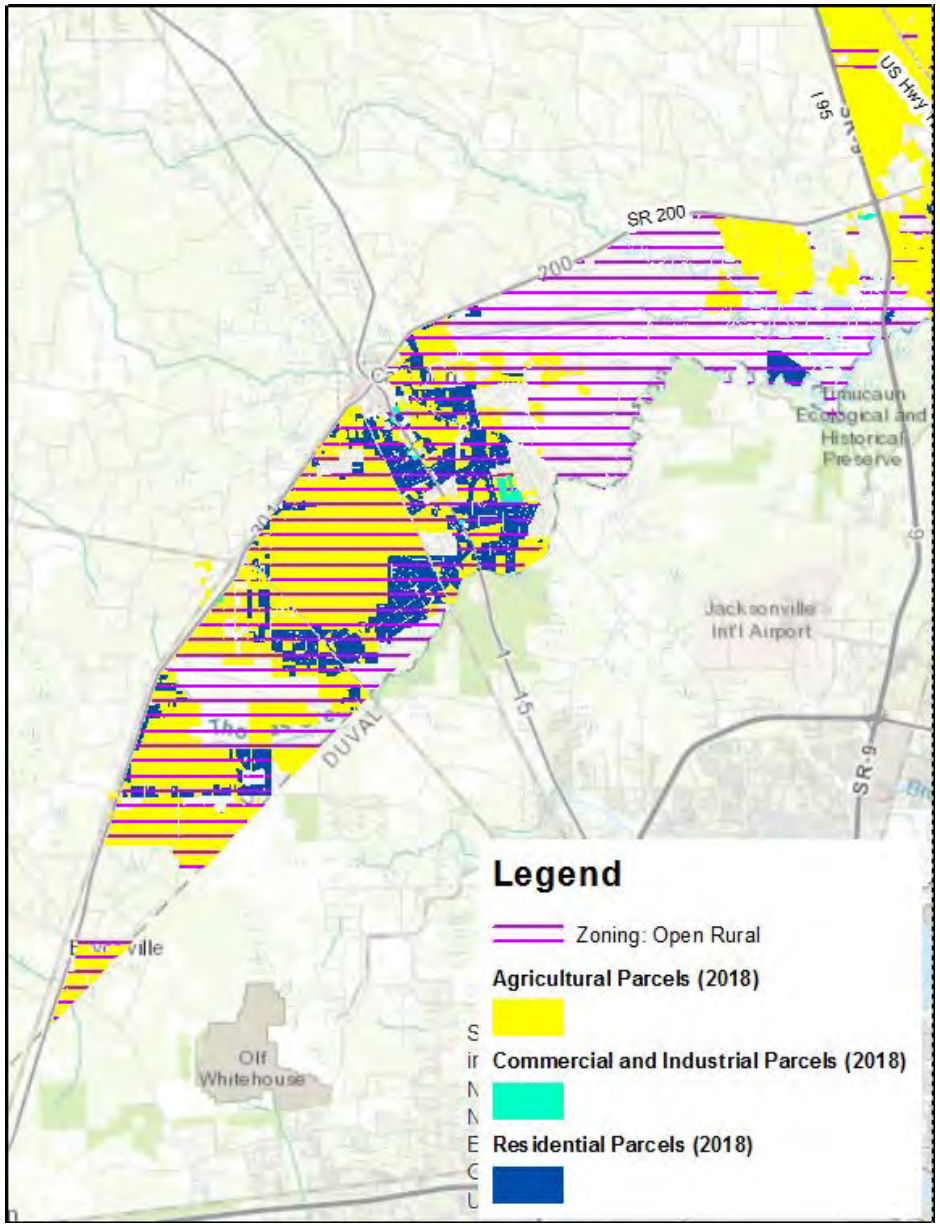


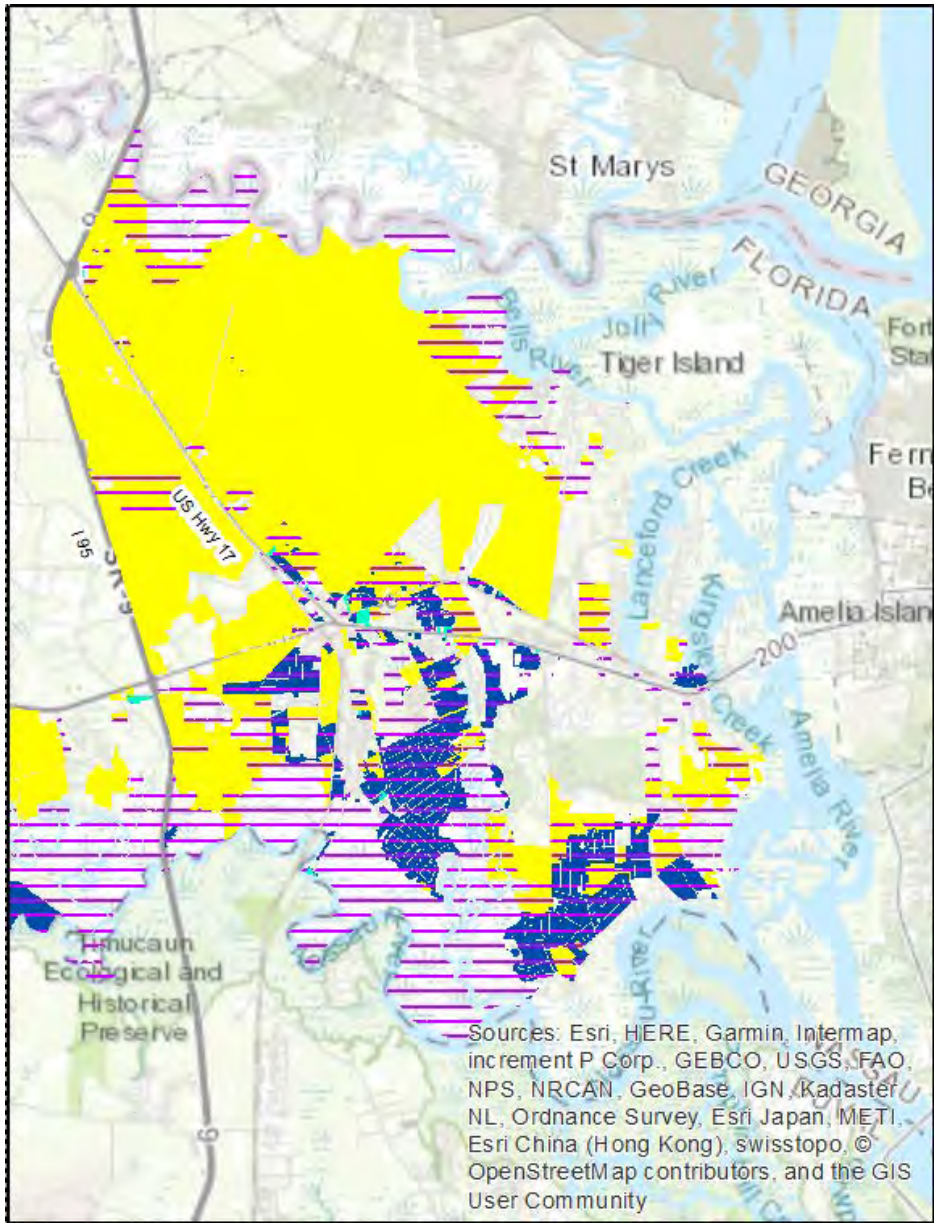


Sources: TBG Work Product; Nassau County FLUM; DOR

Figure 2. Zoning and Existing Parcels

Zoning information was also reviewed, to understand current land uses in the context of the vulnerability assessment. Figure 2 compares land zoned as open rural (purple hashed line), 2018 agricultural, commercial/industrial, and residential parcels (solid color). The pattern is similar to the one shown with future land use designations, where there are sections zoned as open rural, but there is already some ongoing development (mostly residential).





Sources: TBG Work Product; Nassau County FLUM; DOR

Information about satellite data reflecting water frequency

Satellite data* representing water frequency provides information about how often an area was under water in 1984-1999 compared to conditions during 2000-2015. The results were mapped as follows:

- Red represents a percent loss of surface water occurrence between the two time periods (brighter red = higher loss)
- Black areas represent no change, and
- Green represents a percent increase of water occurrence (brighter green = higher increase).

For instance, between the two periods, the East study area had a net gain of 11,120 acres in surface water occurrence (losing approximately 990 acres, but gaining 12,110 acres). It is significant that the satellite data shows increased flooding in locations that are planned for additional residential development, especially in locations near the Intracoastal Waterway; this may have implications for future planning projects.

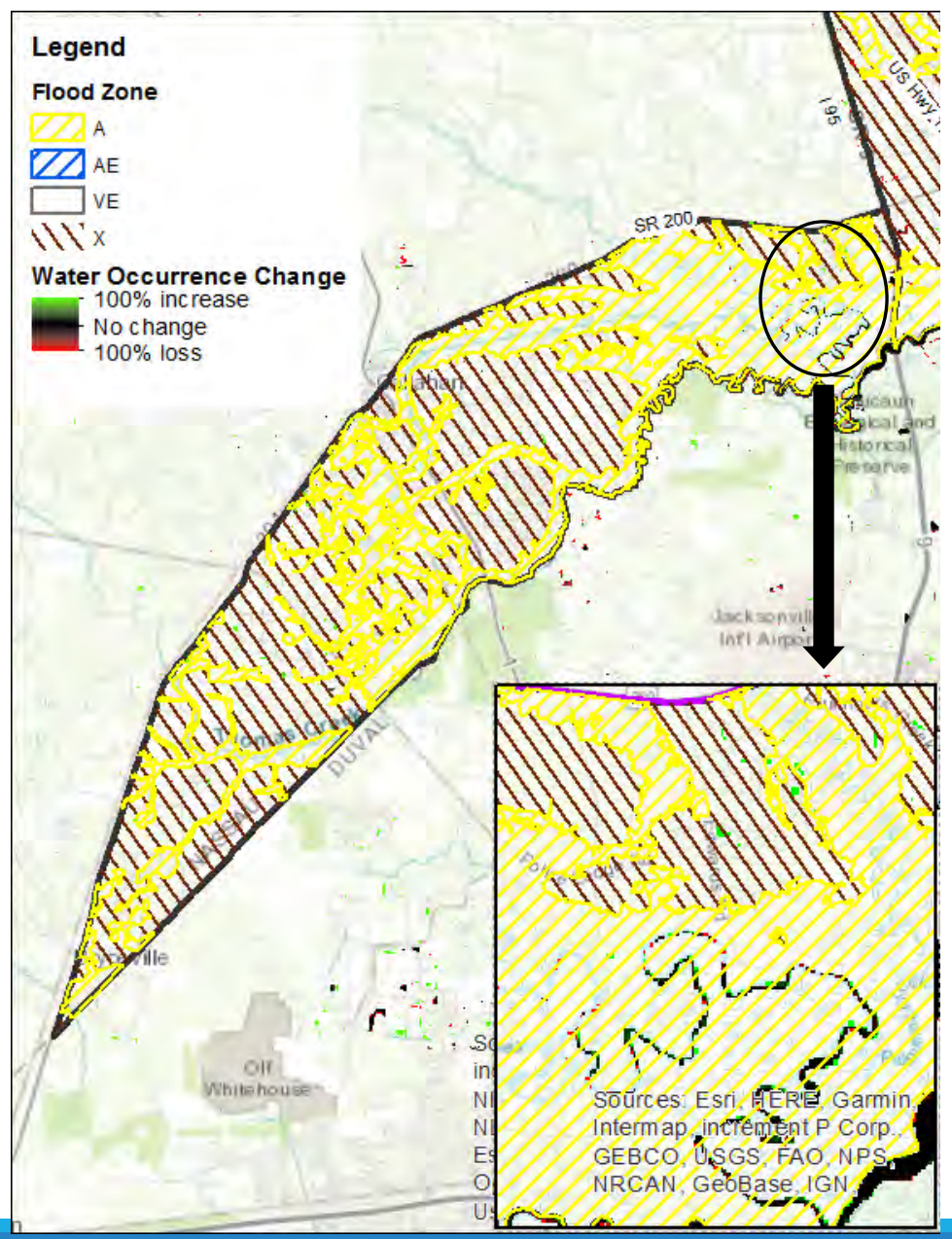
However, the data are limited in some locations. For instance, within the study area boundaries, there are more data near the Intracoastal Waterway, while data are more limited inland. This is because the published data exclude imagery with factors such as cloud cover that could misidentify the presence of water in a given place.

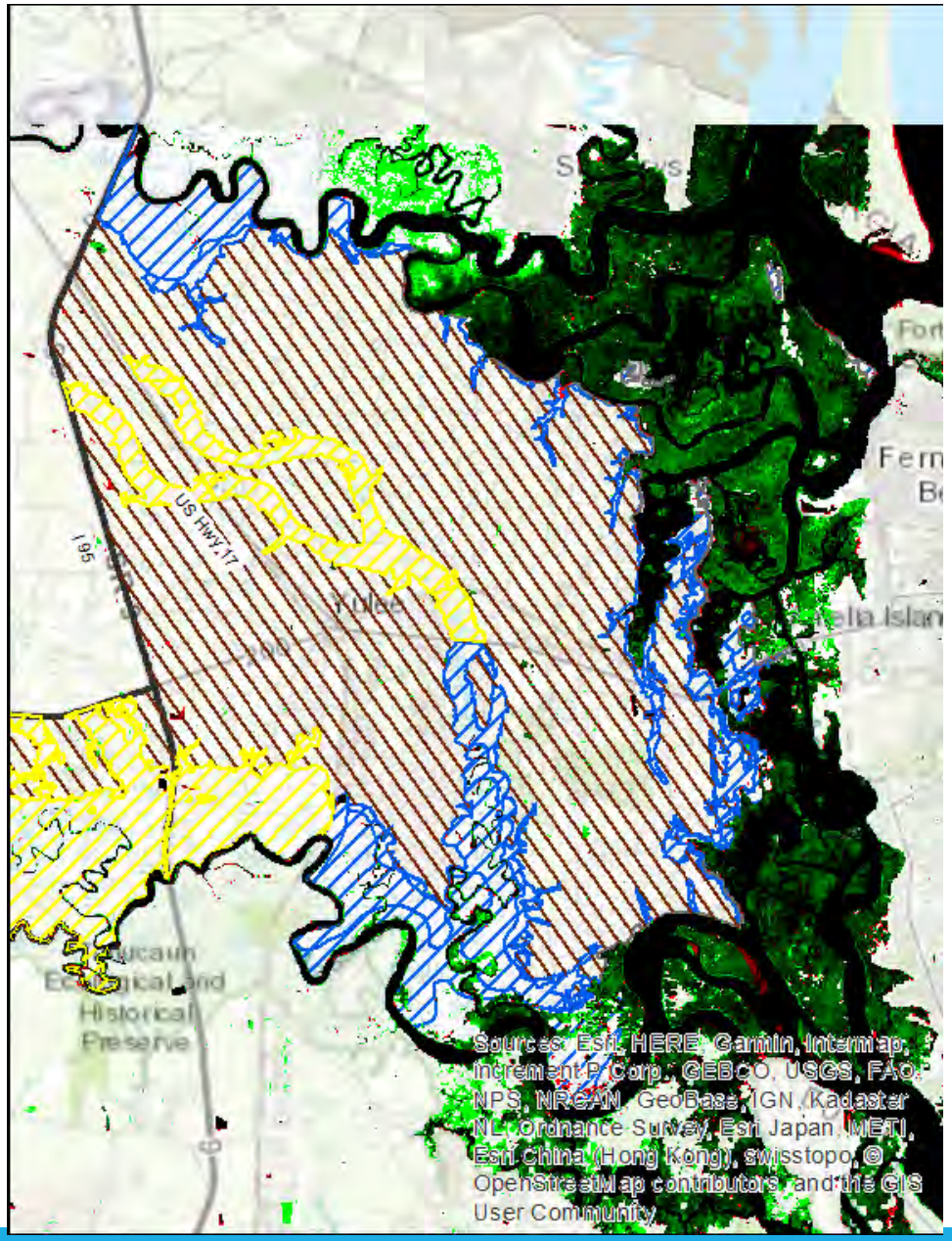
* Published by the European Commission Joint Research Centre (EC JRC).

Series 1 Map 1. Flood Zones and Water Occurrence Change

Data regarding flooding incidence were compiled from a variety of sources, including FEMA flood zone designations and satellite data showing water frequency changes between 1984 and 2015. The maps at right show the study areas by flood zone to see where Flood Zones rated X overlap with increased surface water frequency. Additionally the maps show areas rated Flood Zone A or AE, meaning they have a greater than 1% chance of flooding in a given year according to FEMA hydrologic mapping.

The bright green areas and red areas illustrate areas of increased or decreased water occurrence. Bright green areas show water present significantly more frequently in 2015 than in the 1984-1999 period, while red areas reflect areas where water was commonly present during the 1984-1999 period but not any longer, likely due to human alteration.



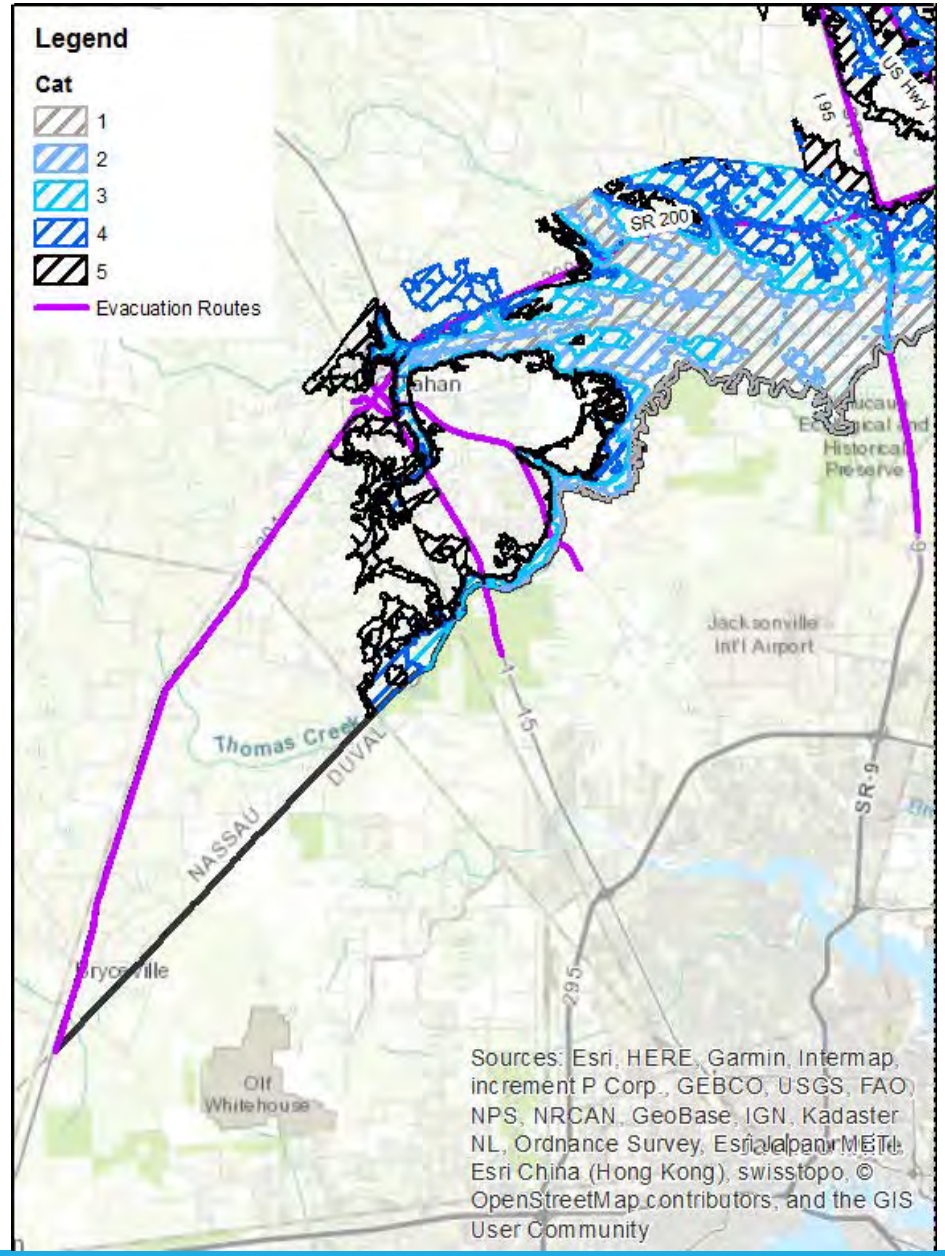


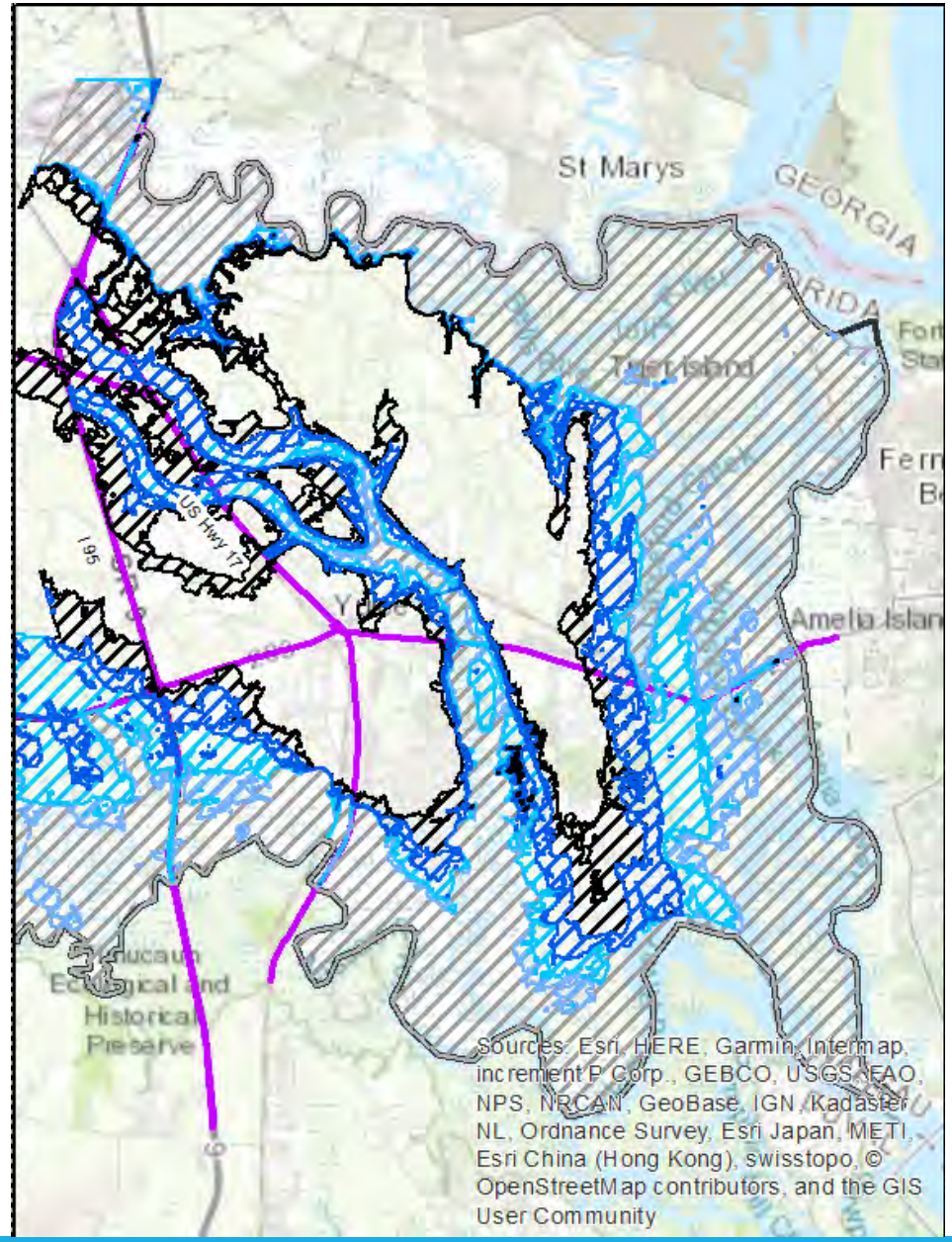
Sources: TBG Work Product; FEMA; EC JRC/Google

Series 1 Map 2. Storm Surge Projections

Storm surge data from the National Oceanic and Atmospheric Administration (NOAA) have been mapped for each category of storm and overlaid with the East and West study area boundaries. Evacuation routes are included for reference. Large sections of both the East and West study areas are impacted by even the weakest and most frequent storm, Category I. The most impacted sections would be on SR 200 between Callahan and the intersection with I-95. Other areas impacted include lands adjoining St. Marys River.

Importantly, NOAA maps do not incorporate sea level rise with the storm surge projections. Thus, a Category I storm combined with a 1 ft. sea level rise may be closer to a Category II storm in impact, but this is not shown in the storm surge maps.



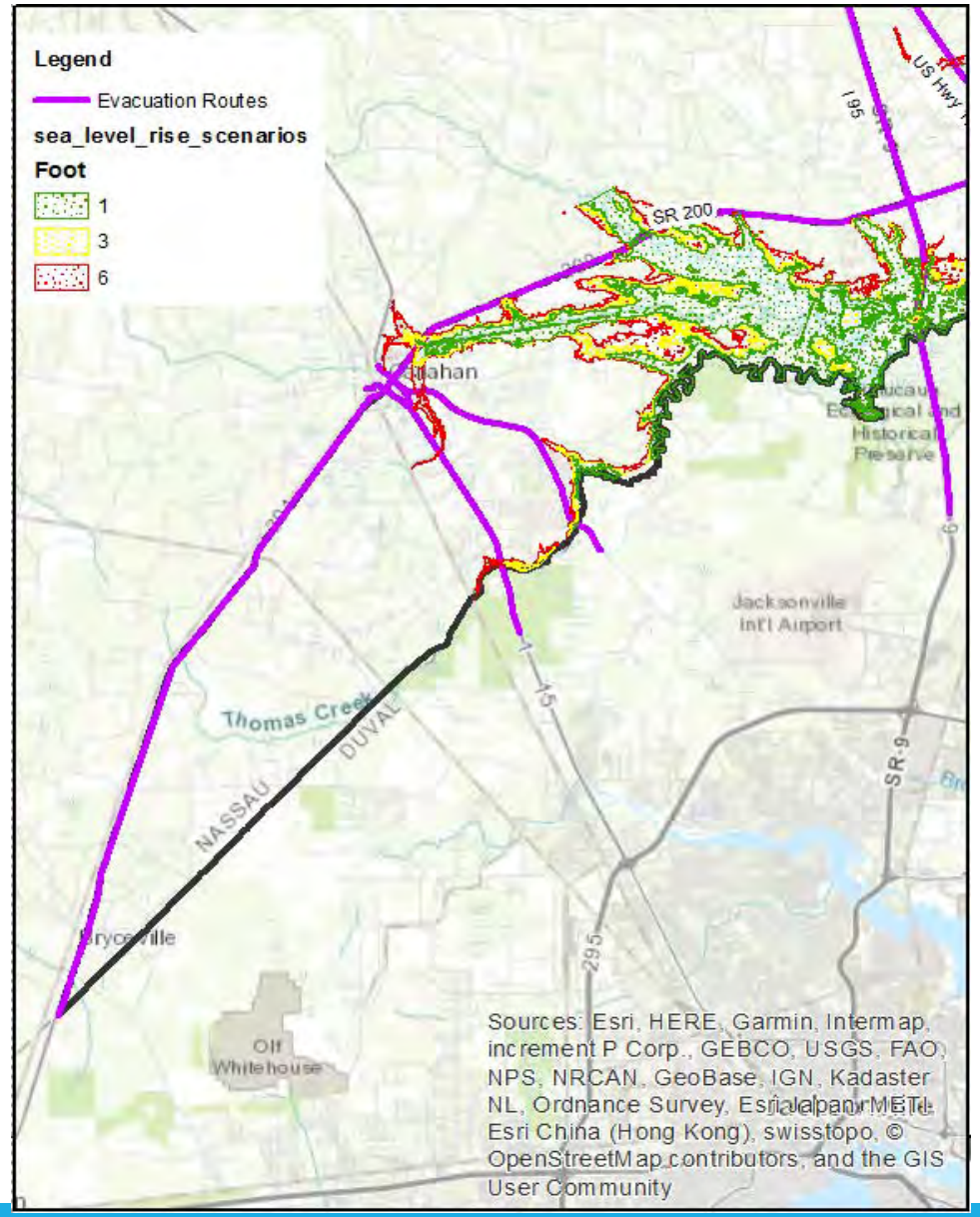


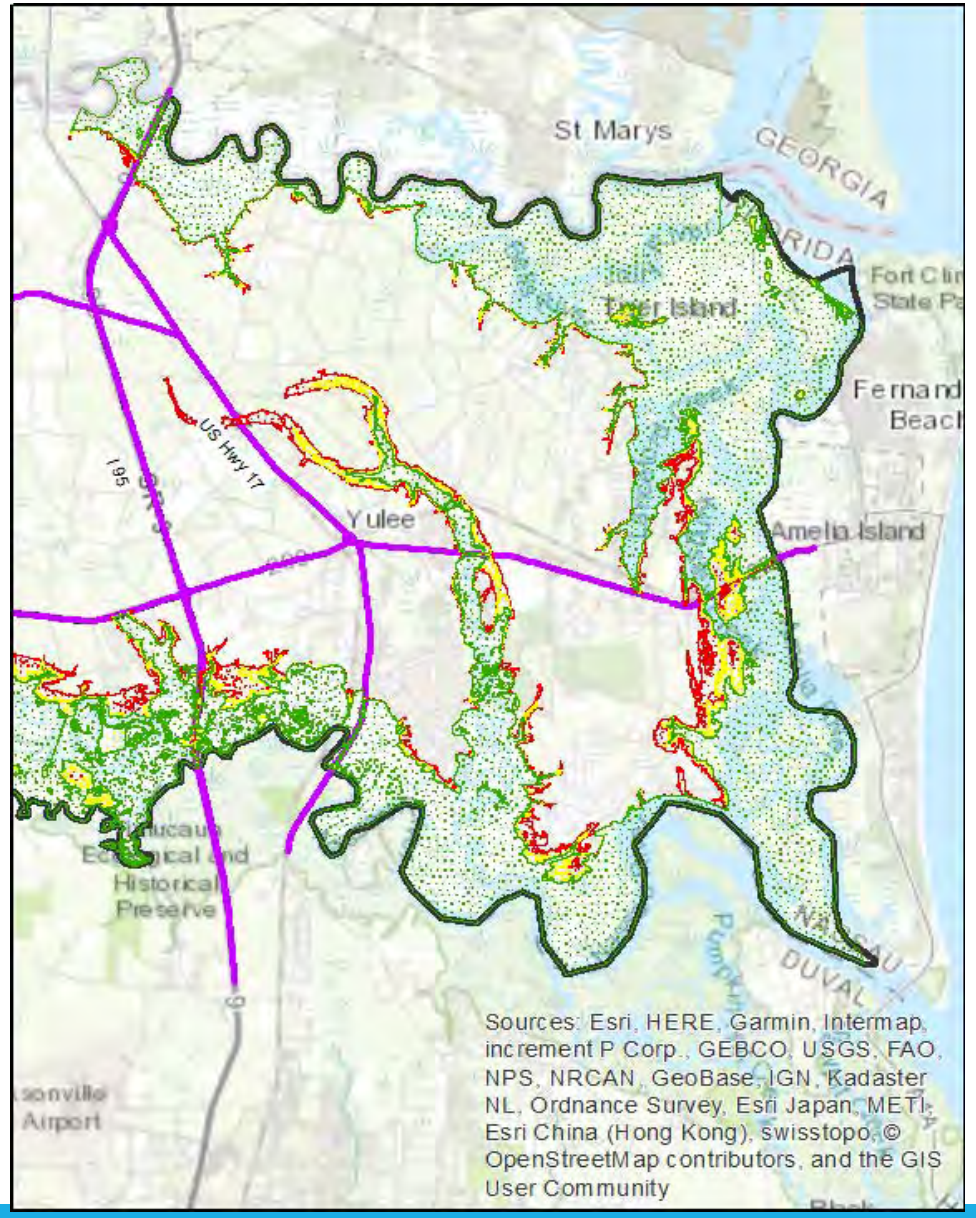
Sources: TBG Work Product; NOAA

Series 1 Map 3. Sea Level Rise Projections in the West and East study areas

Sea level rise data were compiled from the National Oceanic and Atmospheric Administration (NOAA). The data were mapped to show areas anticipated to be inundated by sea level rise of +1, +3 and +6 feet (ft.). Low-lying areas proximal to the St. Marys River, Nassau River and the Intracoastal Waterway would be most impacted according to sea level rise projections.

As with storm surge, large portions of the County are impacted by the 1 ft. sea level rise scenario, which is the scenario with the highest probability of occurring.



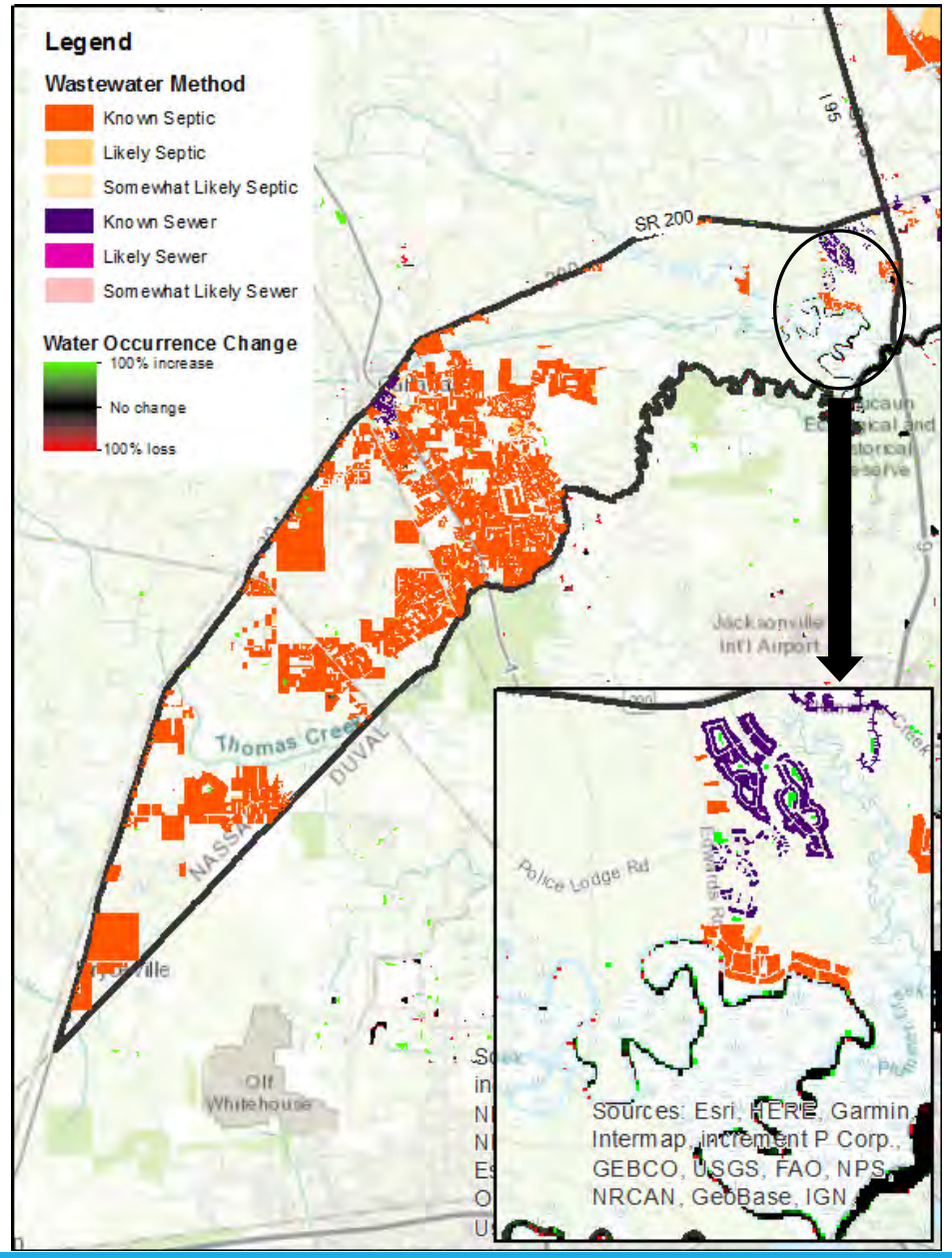


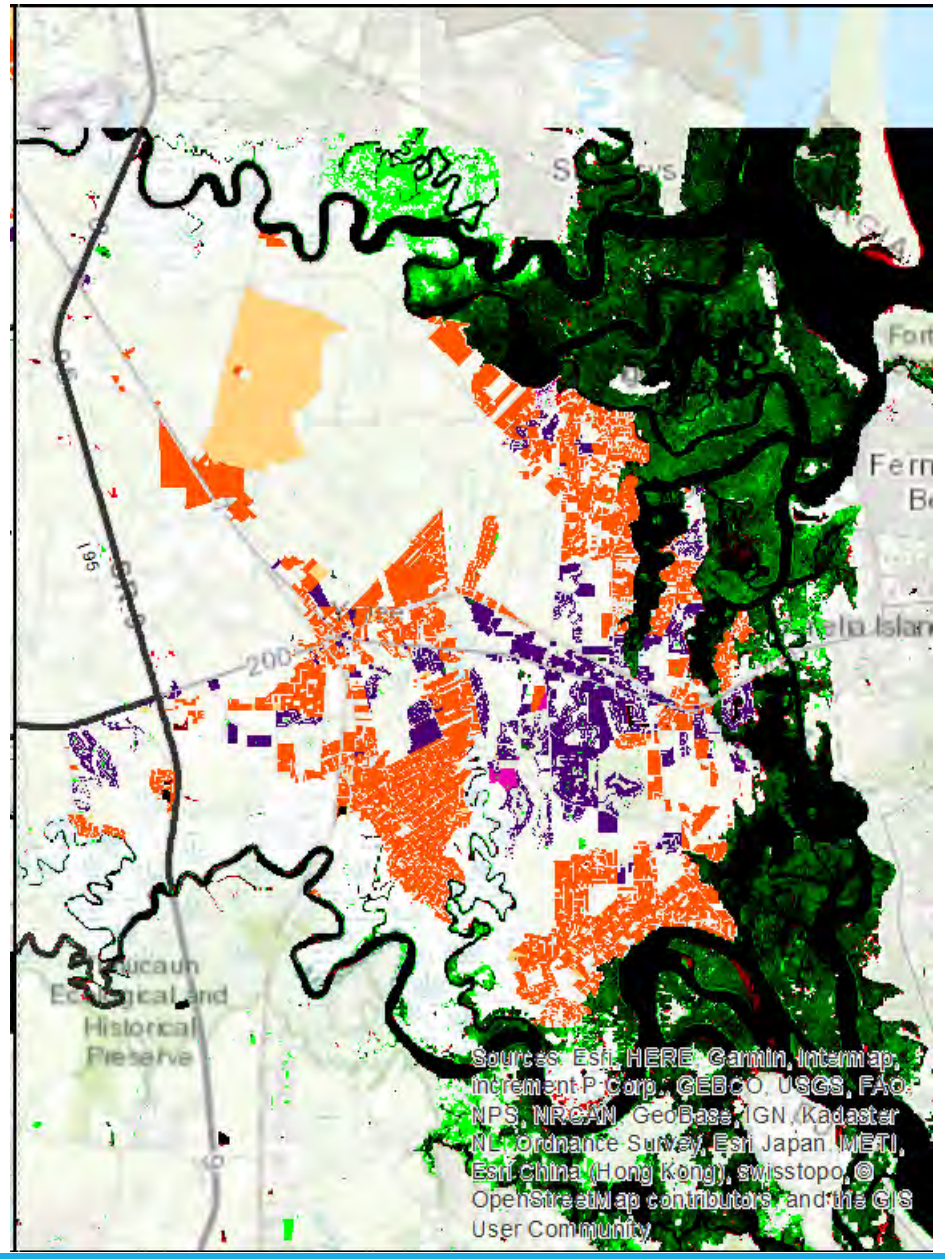
Sources: TBG Work Product; NEFRC; NOAA

Series 2 Map 1. Wastewater Treatment Method and Water Occurrence Change

Wastewater treatment methods have been collected from the Department of Health. This map series shows parcels classified with septic or sewer as their reported wastewater treatment method compared to episodic flooding. In summary, almost half of the parcels (48%) within the East and West areas are on septic, 28% use sewer, and there are no reliable data (or is unknown) for the remaining 25%. In the East area, parcels near the Intracoastal Waterway are the most affected by a more frequent presence of surface water and most of those parcels use septic tanks as their wastewater treatment method. In the West area, water frequency has increased near the intersection of SR 200 and I-95.

Increased water frequency is likely to increase the probability of health risks (and costs) associated with lack of central sewerage. A recent EPA study found that 70% of housing lots with septic tanks meeting standard Florida siting and depth requirements contained fecal coliform exceeding EPA standards during the wet season; higher water frequency is likely to increase this risk.

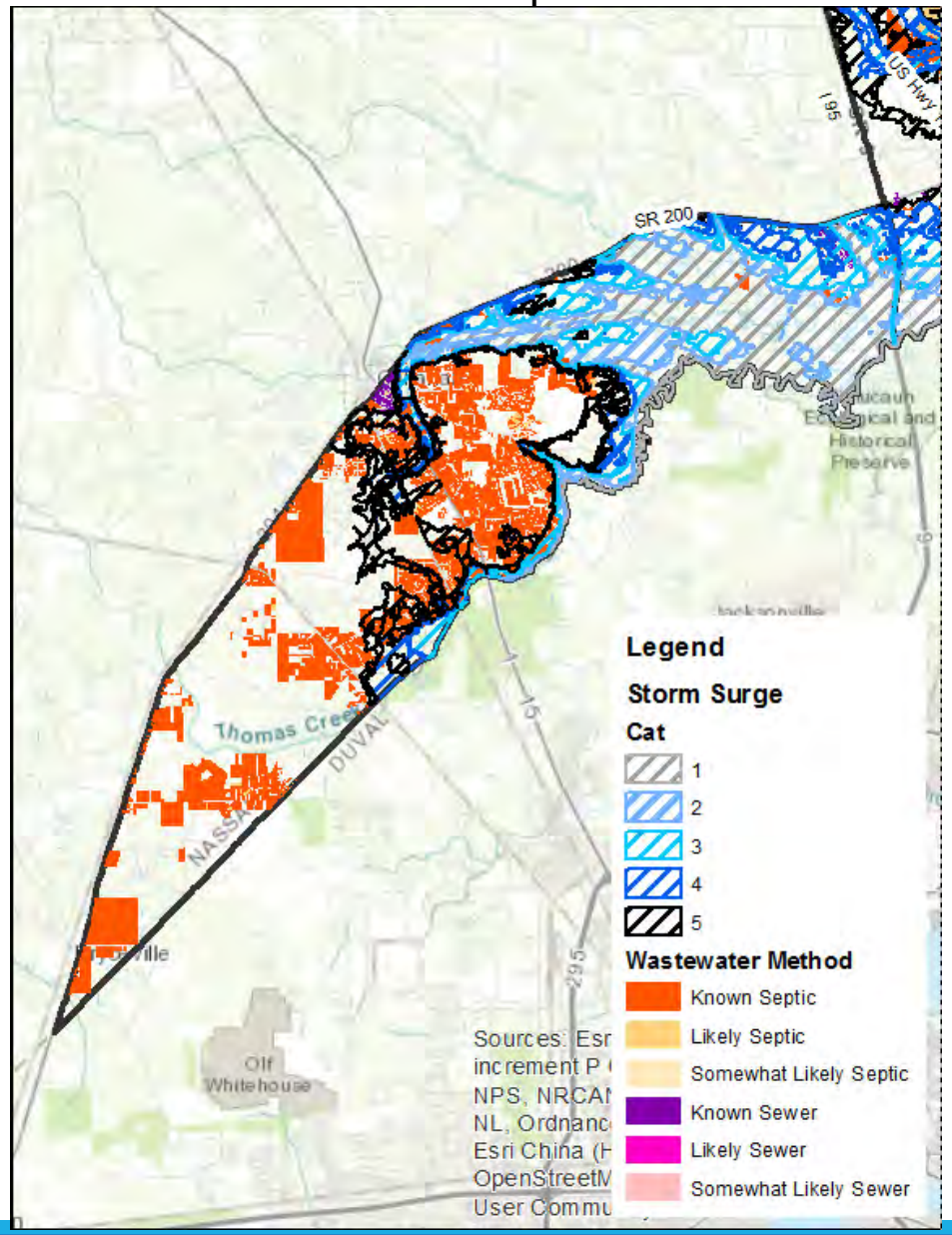


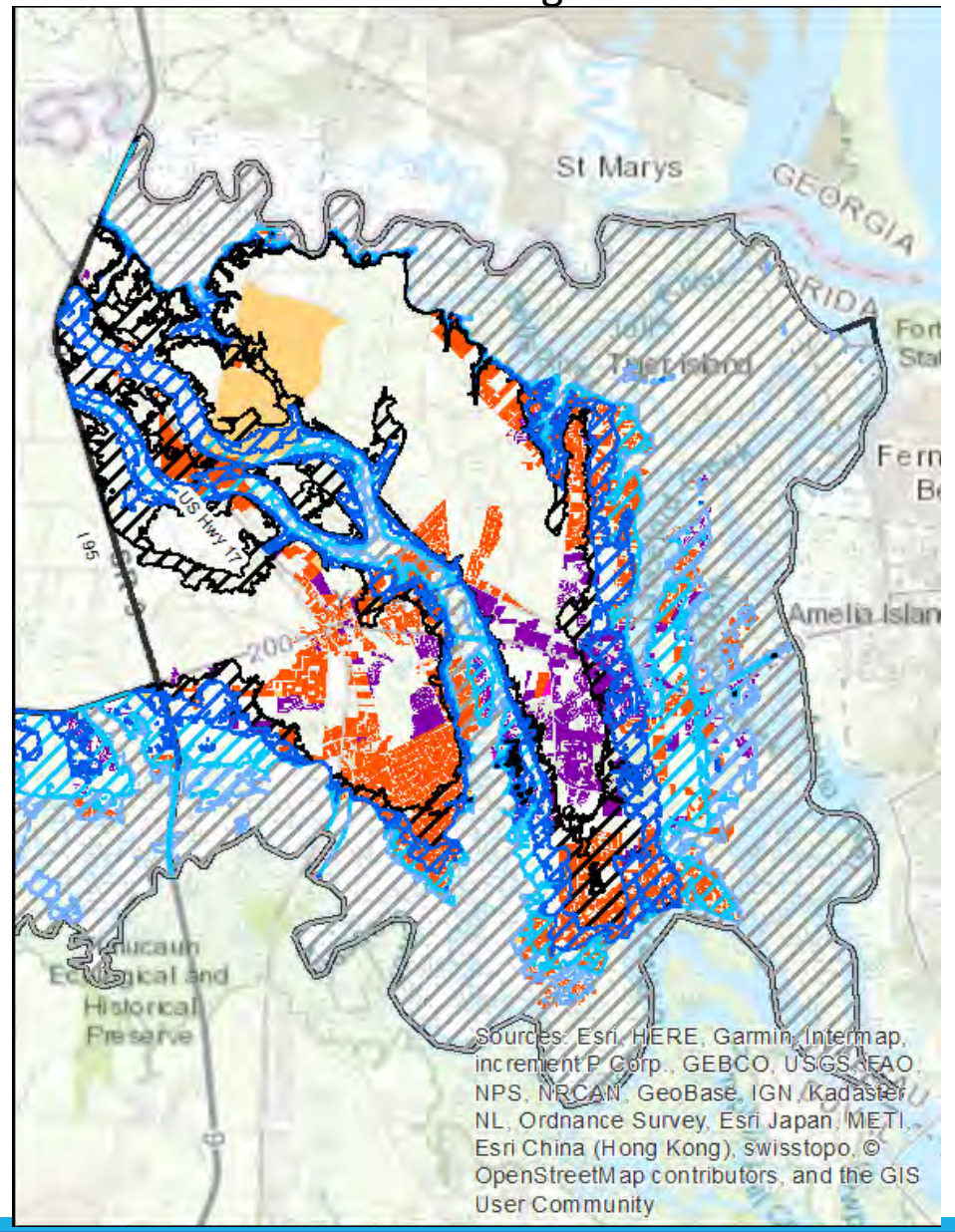


Sources: TBG Work Product; U.S. Department of Health; EC JRC/Google

Series 2 Map 2. Wastewater Treatment Method and Storm Surge

Series 2 Map 2 overlays wastewater treatment methods with storm surge to evaluate if there are locations at risk in case of event-driven flooding. Parcels using sewer are mostly concentrated in the center of the East area, and appear to be vulnerable from storm surge, only at the highest categories of storm surge projections. Storm surge affects many more parcels with septic in the East study area than in the West study area.

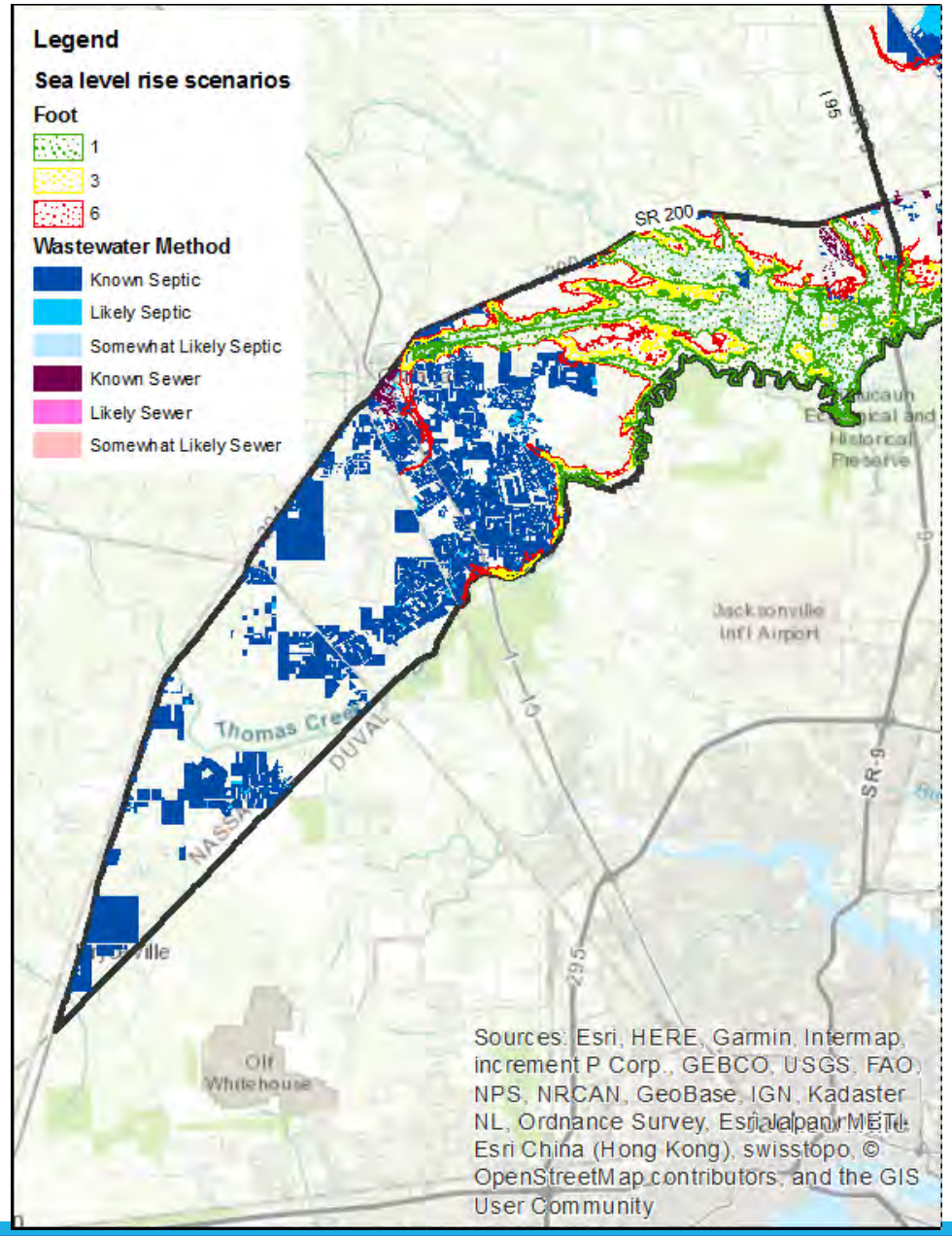


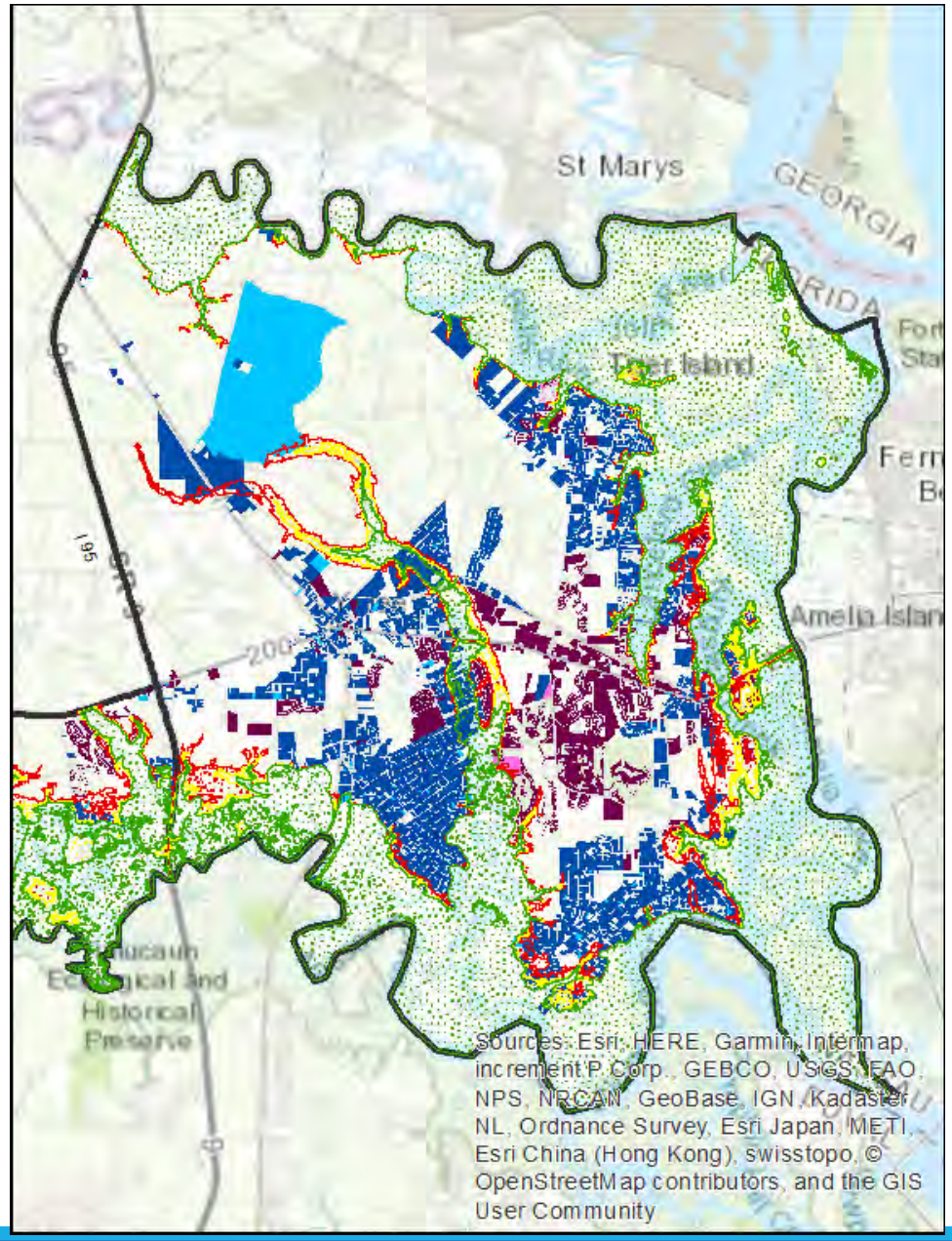


Sources: TBG Work Product; U.S. Department of Health; NOAA

Series 2 Map 3. Wastewater Treatment Method and Projected Sea Level Rise

Series 2 Map 3 overlays wastewater treatment methods with 1, 3 and 6 ft. sea level rise scenarios. Sea level rise would affect mostly parcels near the Intracoastal Waterway or St. Marys River, which are mostly septic. Most manufactured homes use septic as their wastewater treatment method, representing a hazard not only for the homes' structures but also a health hazard if sea levels rise. Manufactured homes that are south of SR 200 and west of I-95 would be the most exposed to sea level rise.

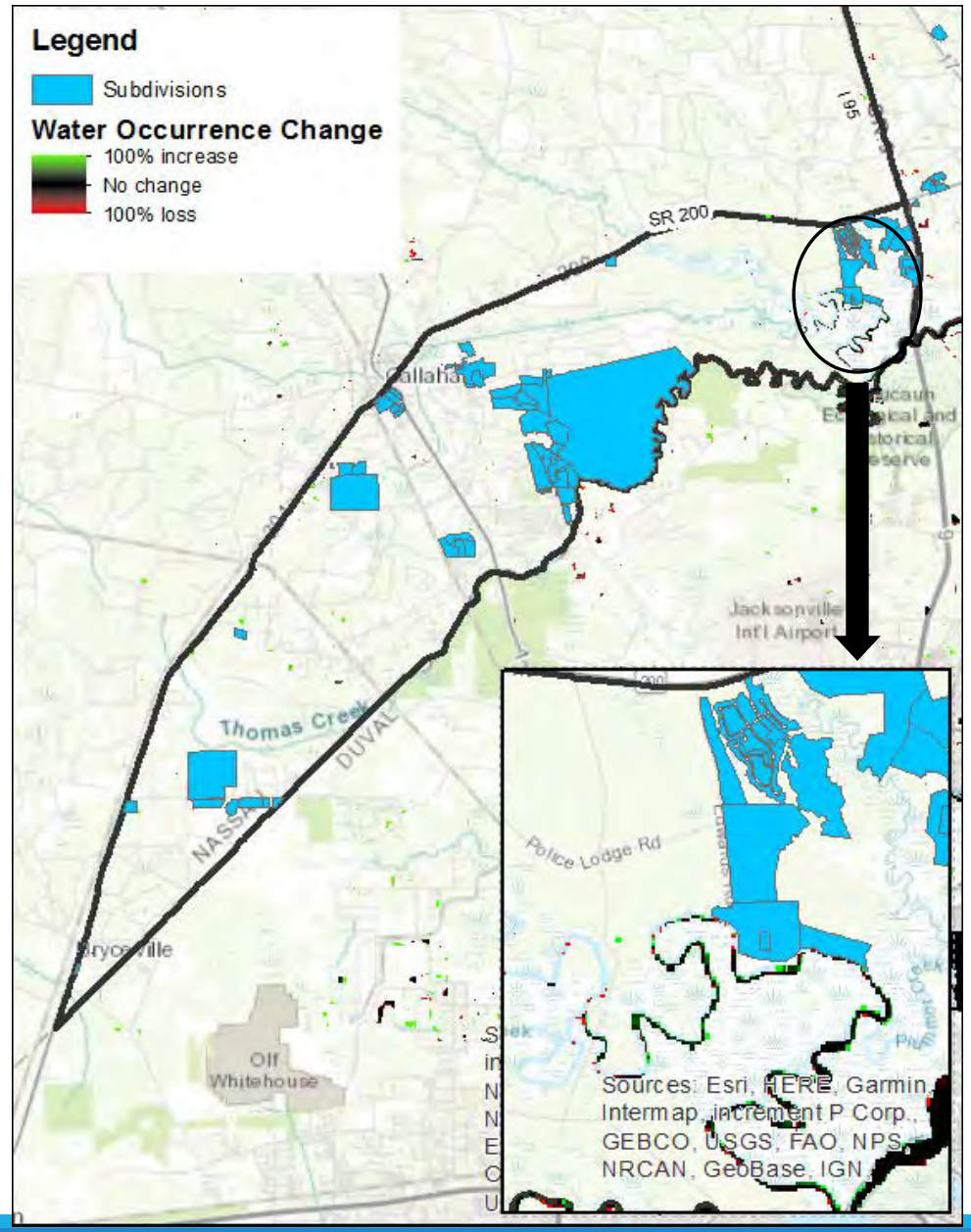


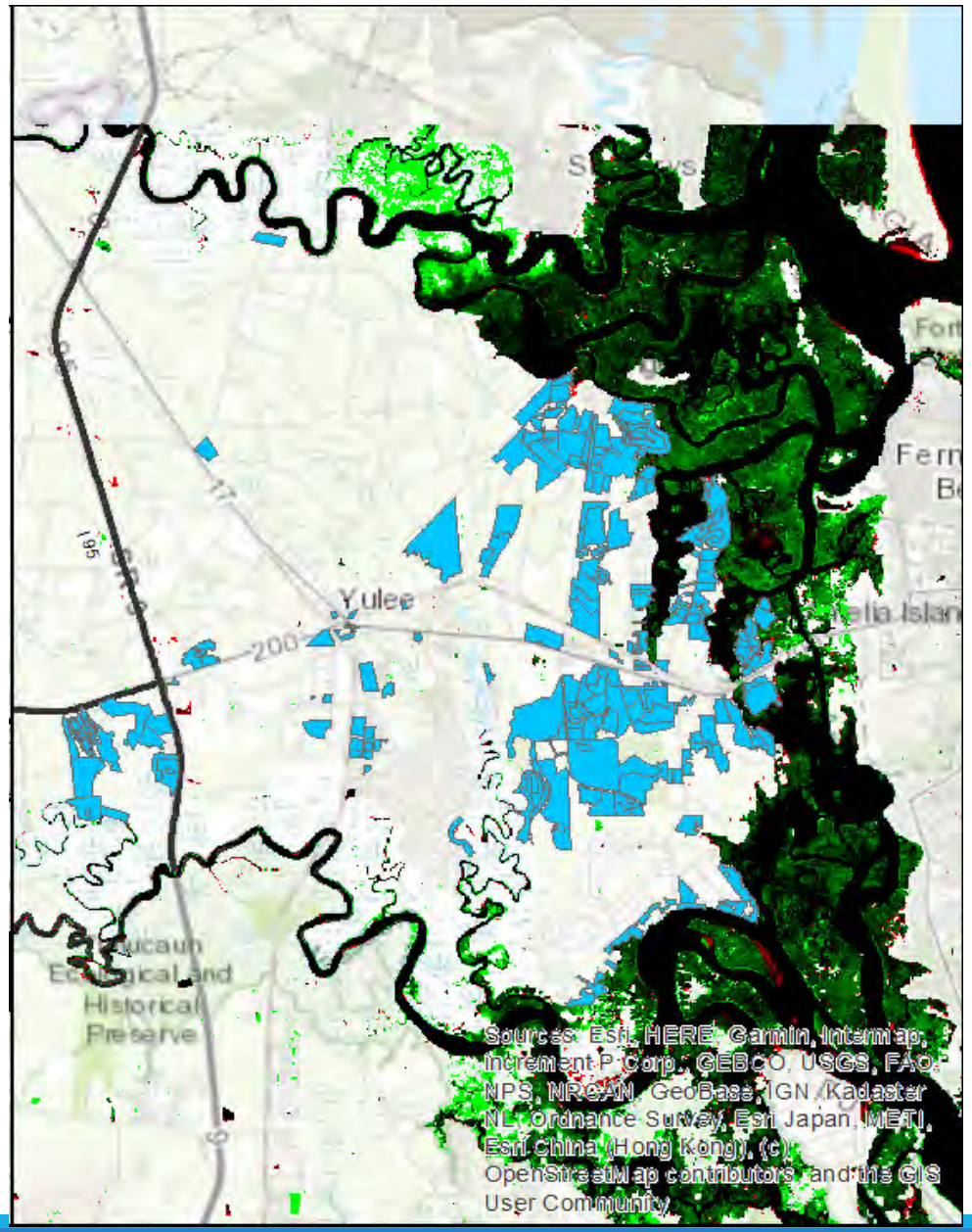


Sources: TBG Work Product; U.S. Department of Health; NOAA

Series 3 Map 1. Planned Subdivisions and Water Occurrence Change

Approved subdivisions that have limited or no overlap with existing developed residential parcels are shown in Series 3. There is overlap with increased frequency of surface water in the East study area.

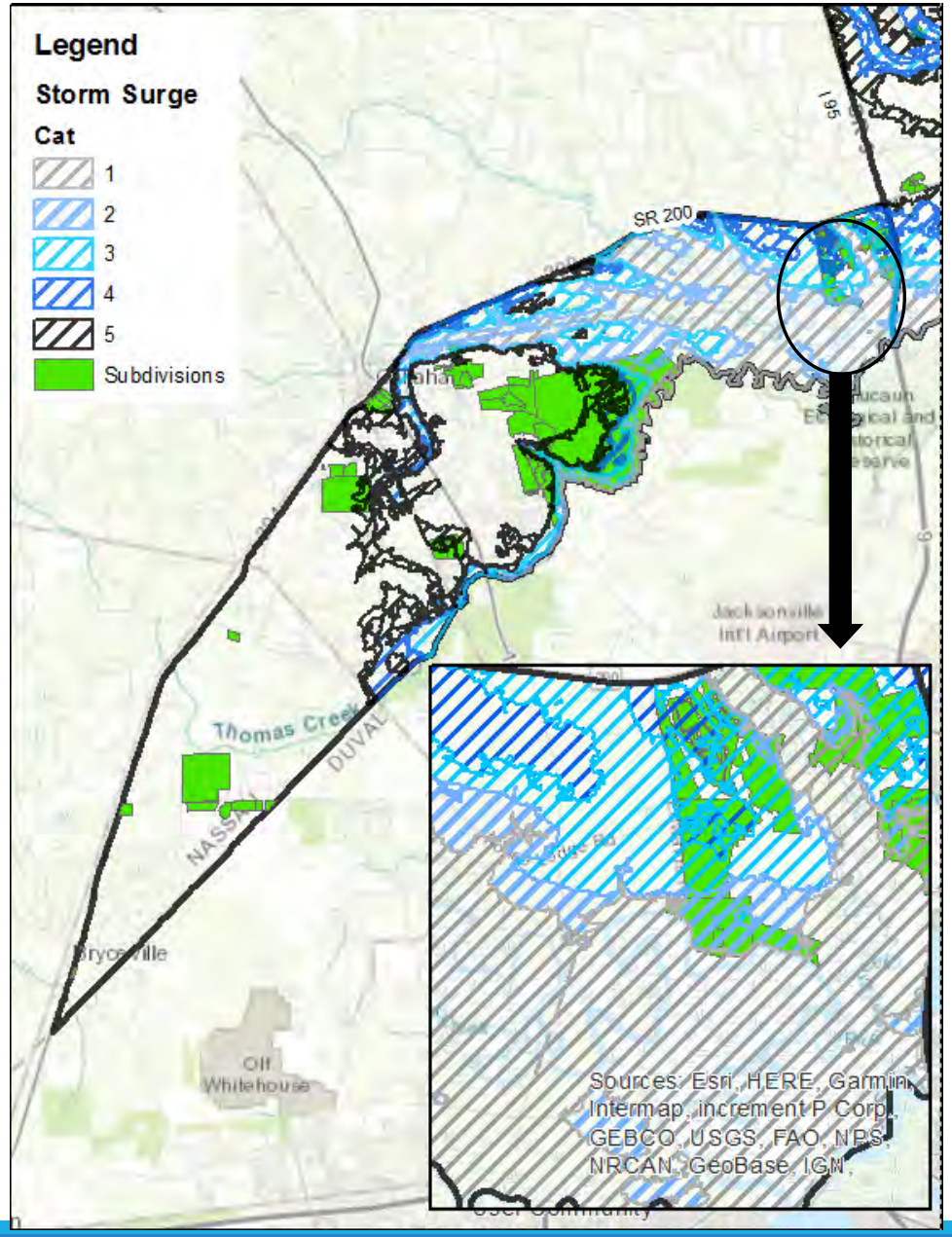


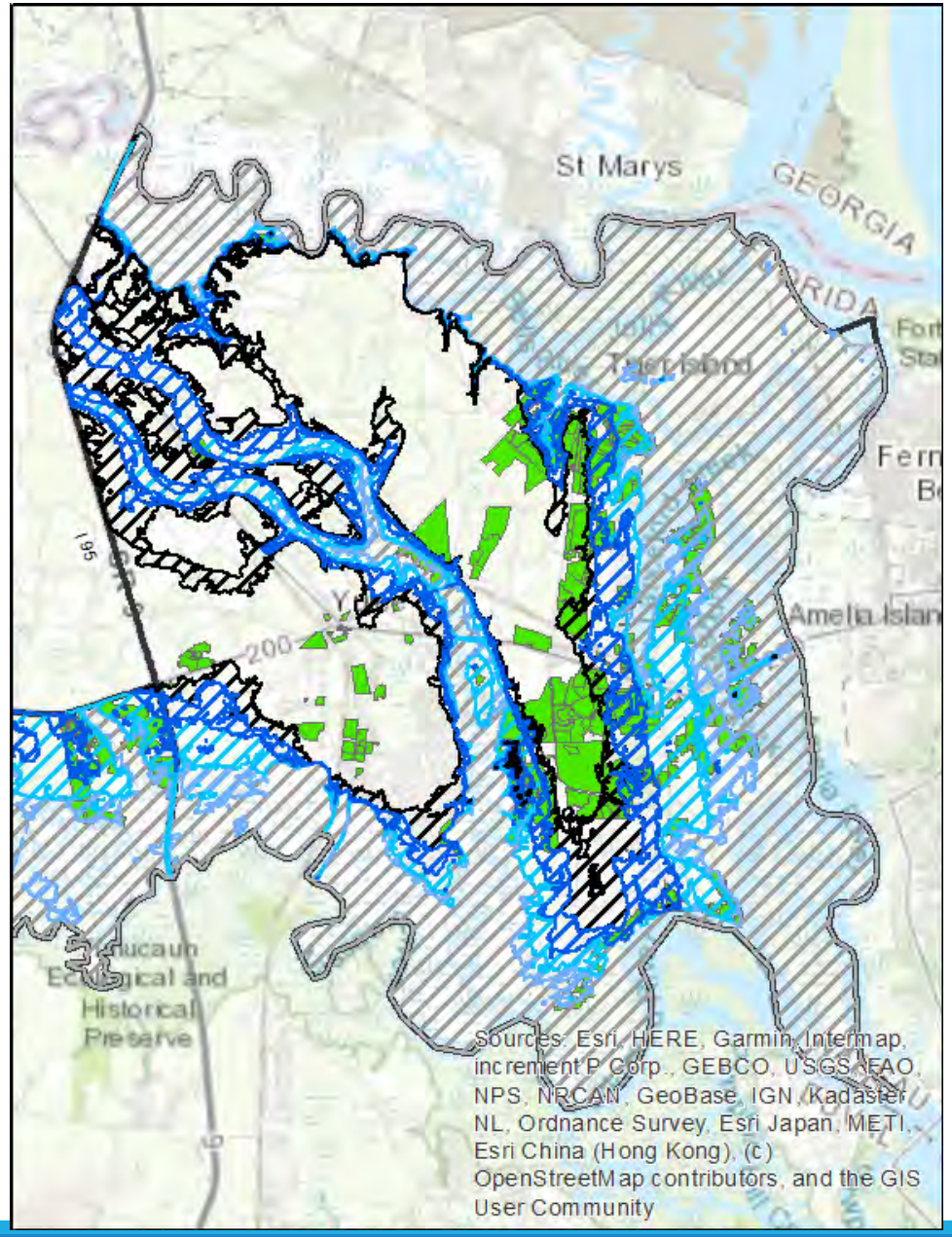


Sources: TBG Work Product; EC JRC/Google

Series 3 Map 2. Planned Subdivisions and Storm Surge

In relation to storm surge and proposed development, there is significant overlap in both study areas. In the East area, the closer the planned development is to the Intracoastal Waterway, the higher the probability to be impacted by a Category 1 storm surge. In the West, planned subdivisions near the intersection of I-95 and SR 200 (zoomed section in the map) would be impacted by even the weakest storm (Category 1).

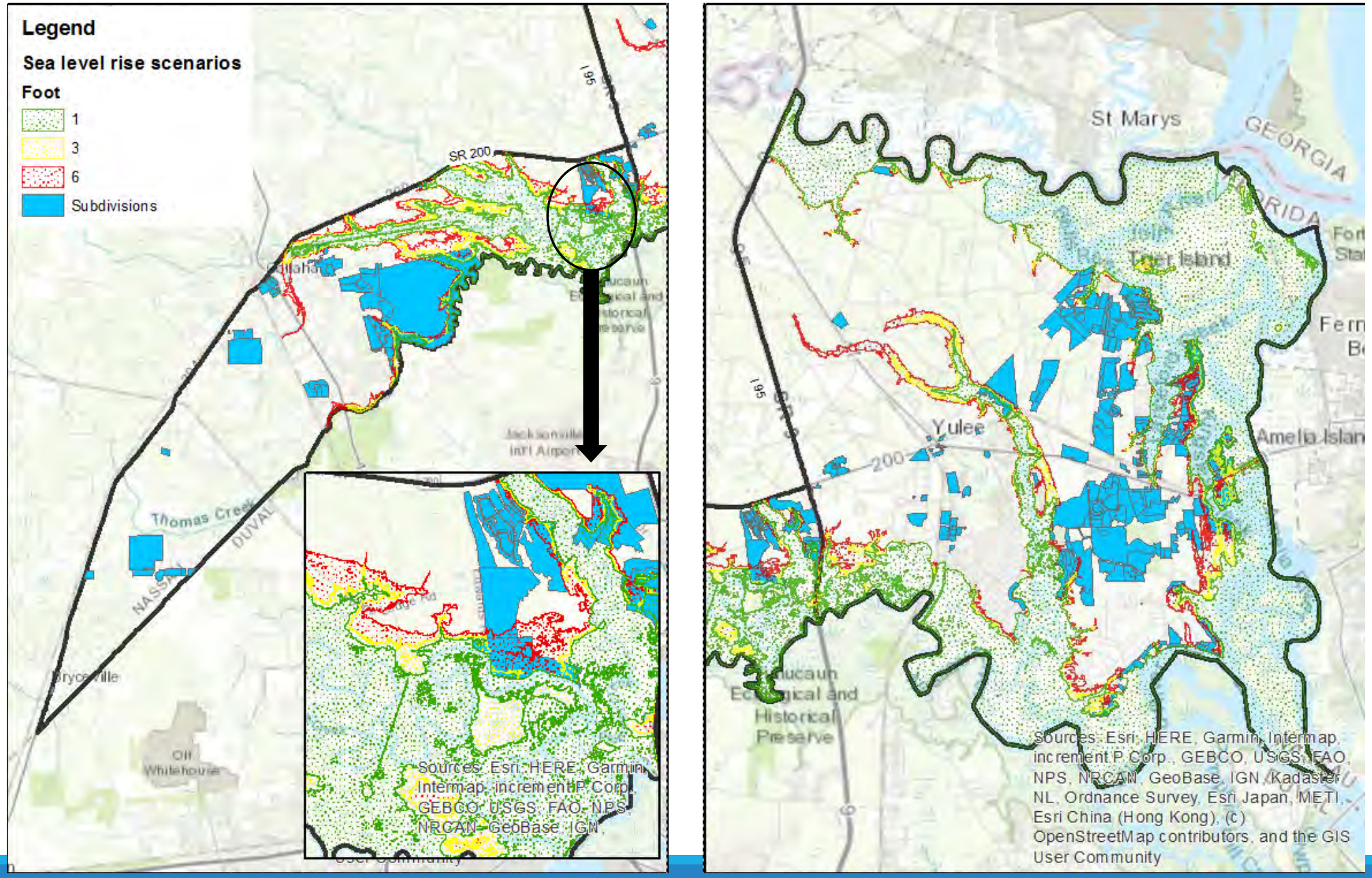




Sources: TBG Work Product; NOAA

Series 3 Map 3. Planned Subdivisions and Projected Sea Level Rise

There is overlap with respect to projected sea level rise in the West study area near the intersection of I-95 and SR 200. In the East study area, risk to sea level rise increases towards existing coastal floodplains (i.e., St. Marys River).

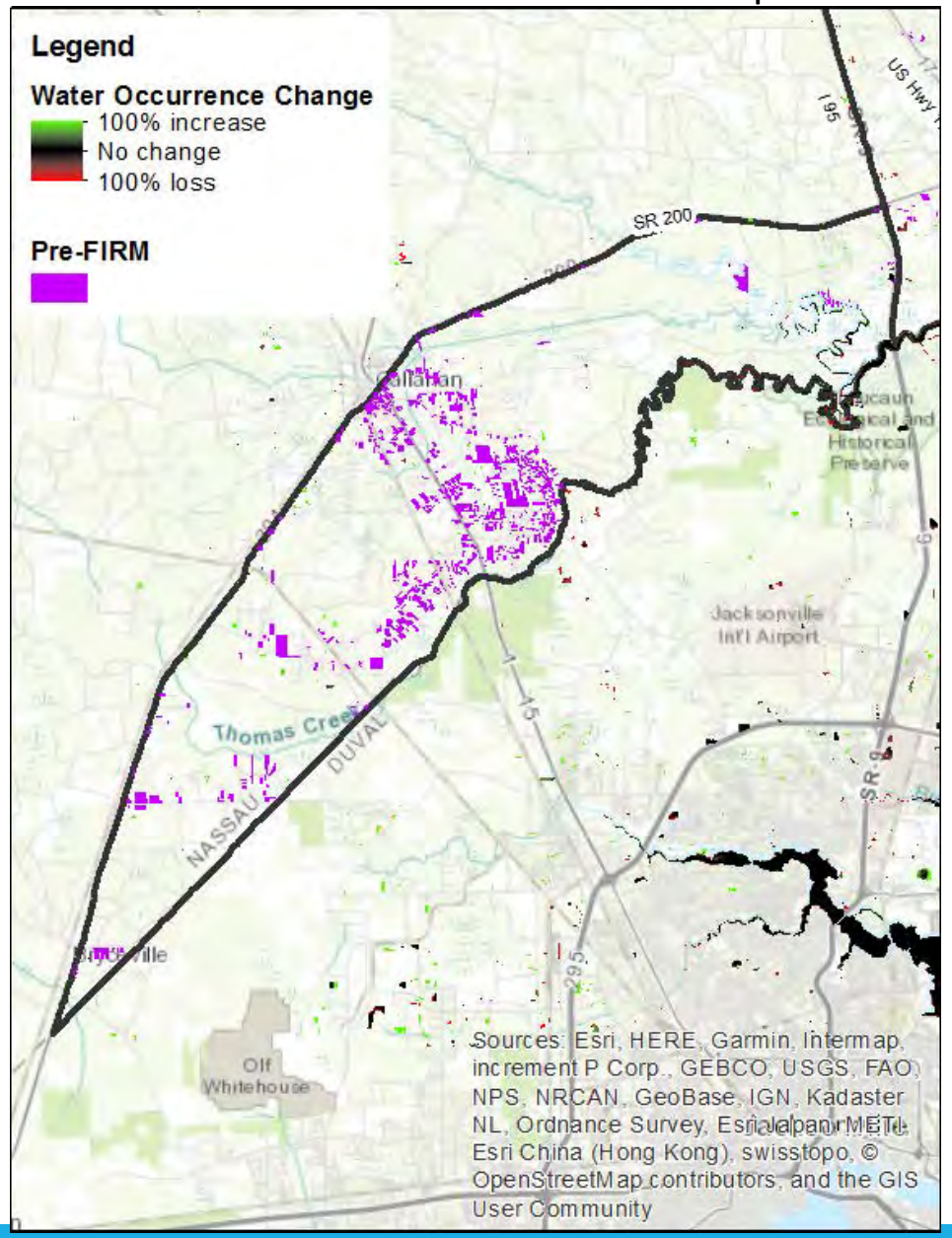


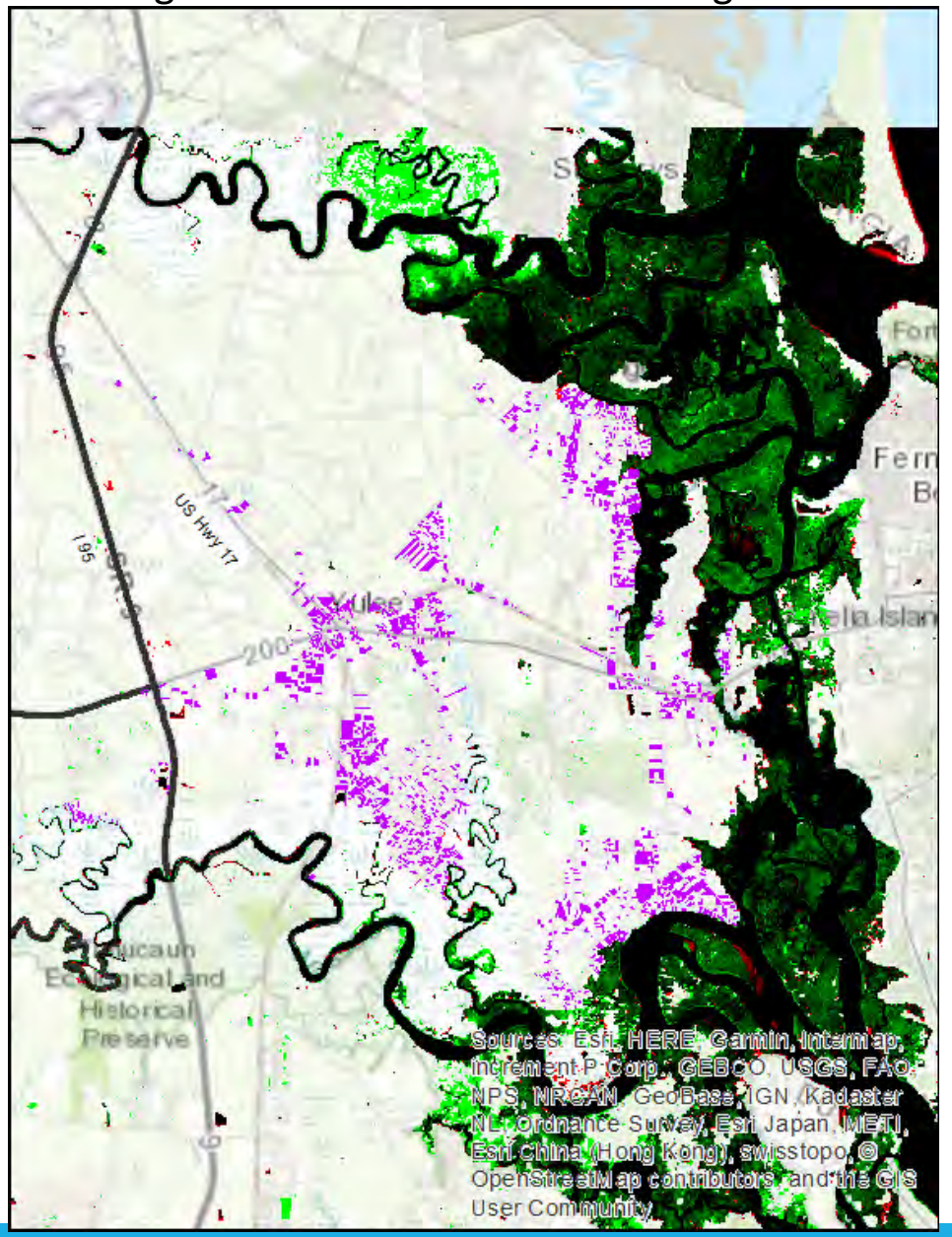
Sources: TBG Work Product; NOAA

Series 4 Map 1. Pre-FIRM Buildings and Water Occurrence Change

"Pre-Flood Insurance Rate Map (FIRM) buildings are those built before the effective date of the first Flood Insurance Rate Map (FIRM) for a community" (FEMA).

In Nassau County, the first FIRM is from 1984, so Series 4 Map 1 compares buildings that were built before this date to water occurrence. About 17% of the buildings are Pre-FIRM in the East and West areas. In the East area, Pre-FIRM buildings that are more likely to have seen water occurrence changes are those closer to the Intracoastal Waterway, in the East area, and those near I-95 in the West area.



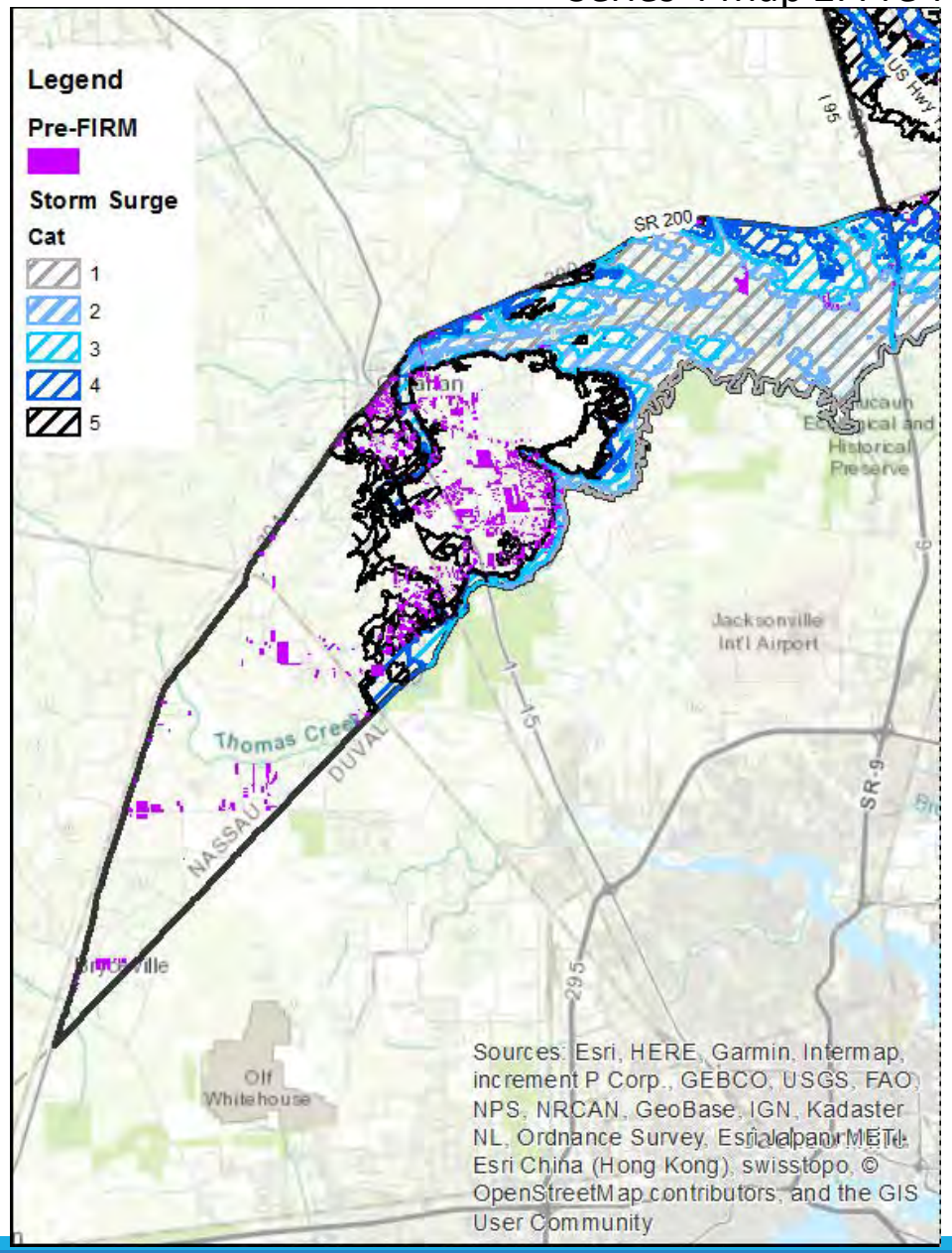


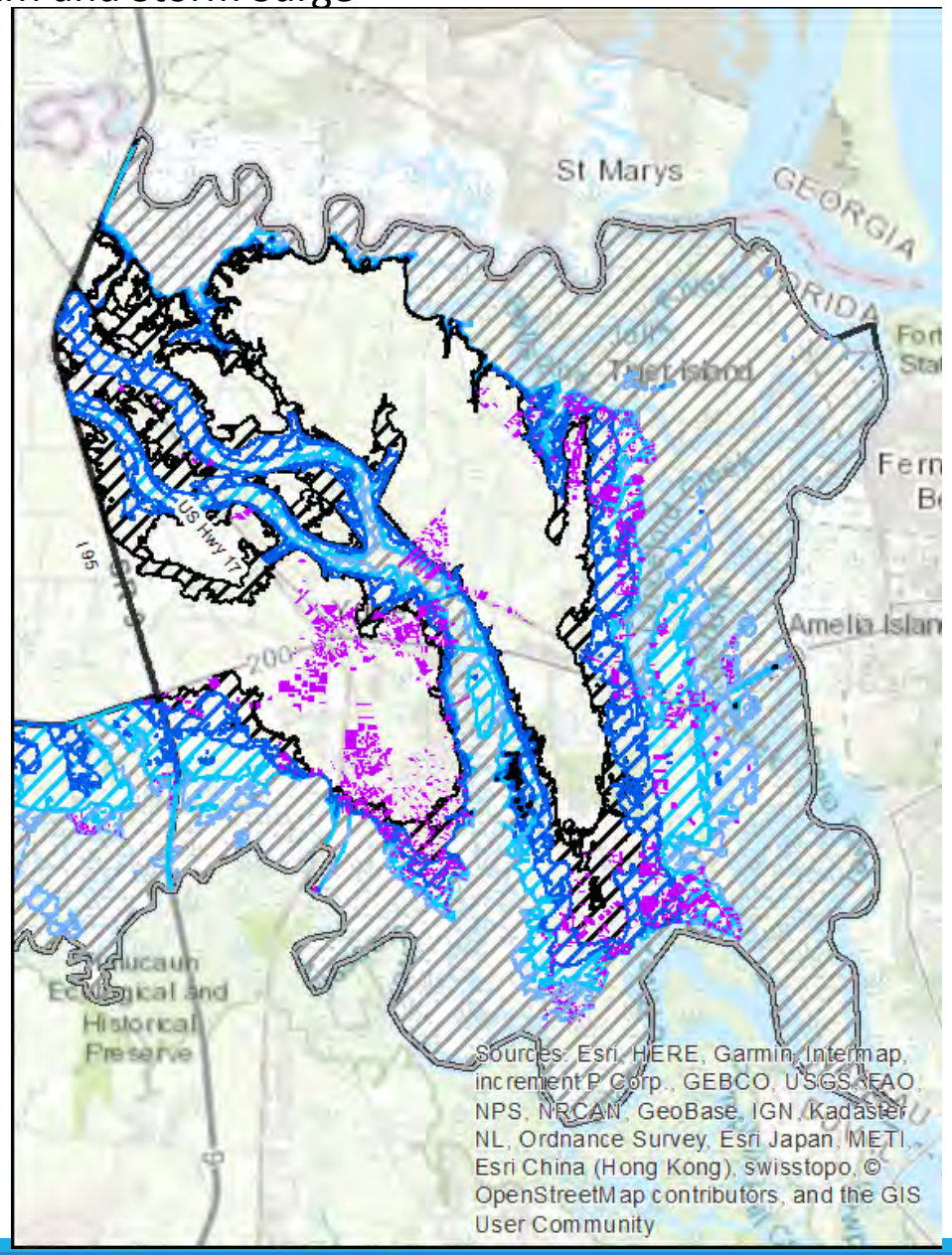
Sources: TBG Work Product; DOR; EC JRC/Google

Series 4 Map 2. Pre-FIRM and Storm Surge

Series 4, Map 2 compares Pre-FIRM buildings against storm surge to assess buildings that are at higher risk. Overall, half of the Pre-FIRM buildings are within a storm surge. This overlap is more evident in the East area near Tiger Island (approximately 70% of the Pre-FIRM buildings are within a storm surge) and South of SR200 (approximately 60%).

In the West area, Pre-FIRM buildings near Callahan or the County borderline with Duval could be affected with higher category storm surges.

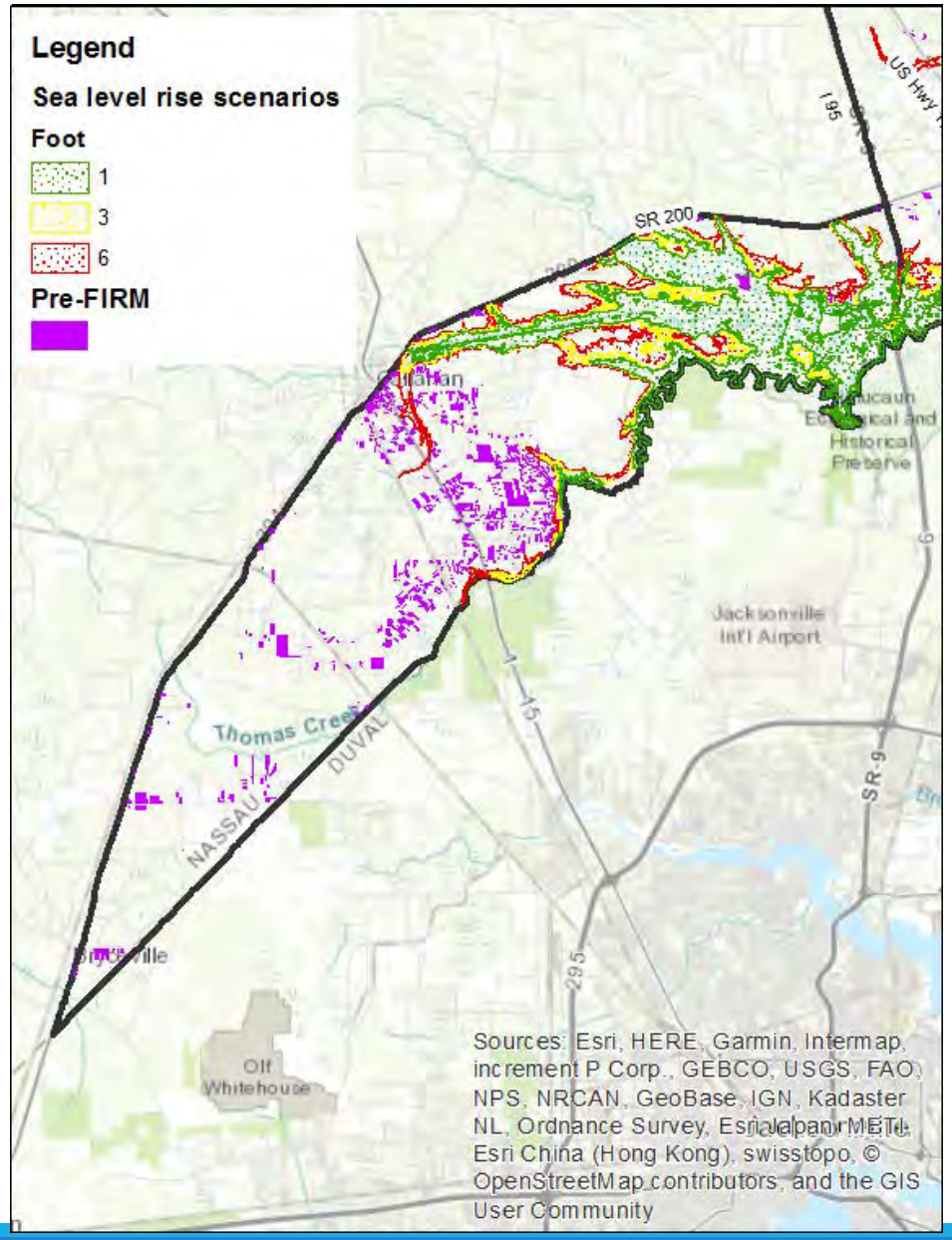


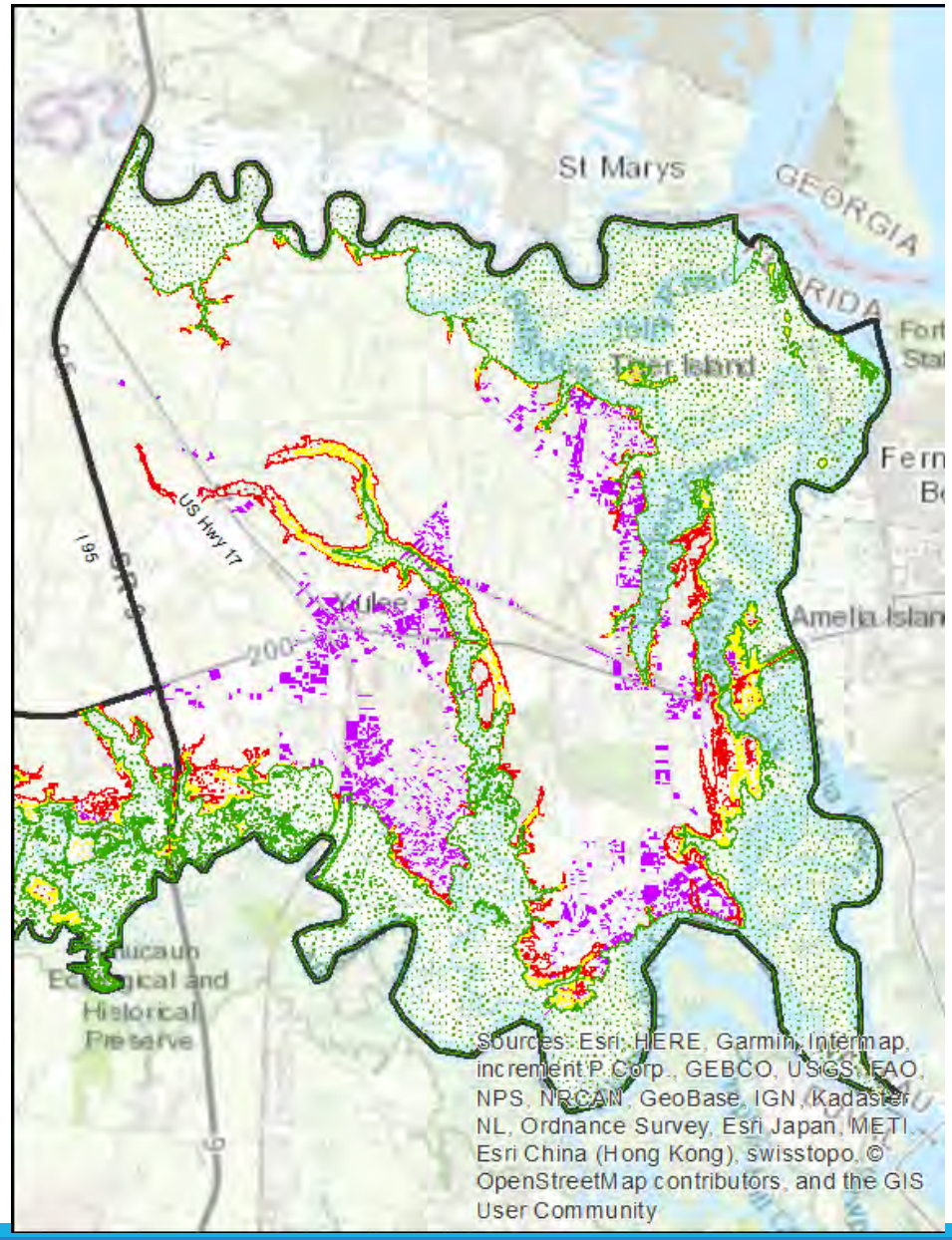


Sources: TBG Work Product; DOR; NOAA

Series 4 Map 3. Pre-FIRM and Projected Sea Level Rise

Series 4 Map 3 compares Pre-FIRM buildings against sea level rise to assess vulnerability to long-term sea level rise. Approximately 86% of the Pre-FIRM buildings in the East and West areas, don't overlap with any sea level rise scenario. But many Pre-FIRM buildings in the East area are close to the 6 ft. scenario. In the West area, about 96% of the Pre-FIRM buildings don't overlap.





Sources: TBG Work Product; DOR; NOAA

2018 DOR parcel land use codes were used to estimate the number of parcels and the total property just value that would be impacted by the different sea level rise scenarios (Table 1). There are 21,391 residential parcels (DOR use codes 0 to 9) and 429 commercial parcels (DOR use codes 10 to 39) within the two study areas. For example, under a 6 ft. sea level rise scenario, there would be approximately $730 million and $11 million worth of residential and commercial parcels at risk, respectively. Categories are not mutually exclusive. That is, parcels impacted under a 1 ft. scenario are also in the 3 ft. and 6 ft. scenarios.

Table 1. Residential and Commercial Parcels Impacted by Sea Level Rise

	RESIDENTIAL		COMMERCIAL	
SLR Scenario (Ft)	Number of Residential Parcels	Total Just Value (dollars)	Number of Commercial Parcels	Total Just Value
1	1557	392,126,967	8	3,754,724
3	2166	501,567,876	13	4,618,934
6	3306	729,324,392	29	10,775,477

Using the same cumulative approach conducted for sea level rise, the numbers of residential and commercial parcels impacted by the different storm surge categories are described in Table 2, i.e., parcels within a Category 1 storm surge are in the higher categories. For example, under a Category 5 storm surge, there would be approximately $1.9 billion and $100 million worth of residential and commercial parcels at risk, respectively.

Table 2. Residential and Commercial Parcels Impacted by Storm Surge

	RESIDENTIAL		COMMERCIAL	
Storm Surge Category	Number of Residential Parcels	Total Just Value	Number of Commercial Parcels	Total Just Value
1	1913	464,876,228	11	4,274,469
2	3629	742,442,352	28	18,682,008
3	7239	1,288,552,830	67	37,125,945
4	9317	1,549,135,493	110	59,723,022
5	12094	1,865,390,760	164	99,653,063

Table 3 shows the number and value of residential and commercial parcels that are in A or AE flood zones within the two areas.

Table 3. Residential and Commercial Parcels Impacted by Flood Zone

	RESIDENTIAL		COMMERCIAL	
Flood Zone	Number of Residential Parcels	Total Just Value	Number of Commercial Parcels	Total Just Value
A	2004	235,020,752	27	9,117,319
AE	2470	556,859,422	23	17,129,242

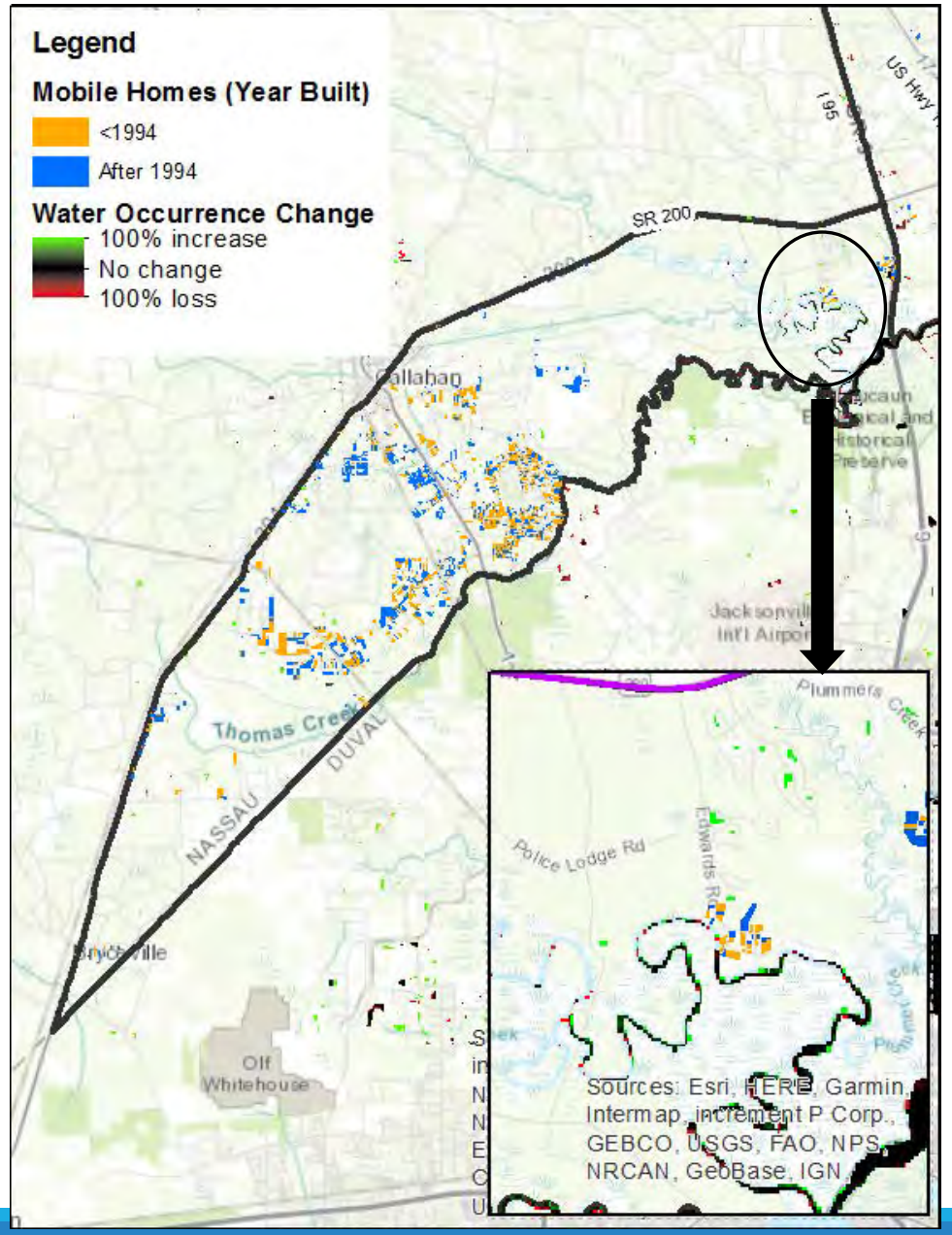
Series 5 Map 1. Manufactured Homes by Year Built and Water Occurrence Change

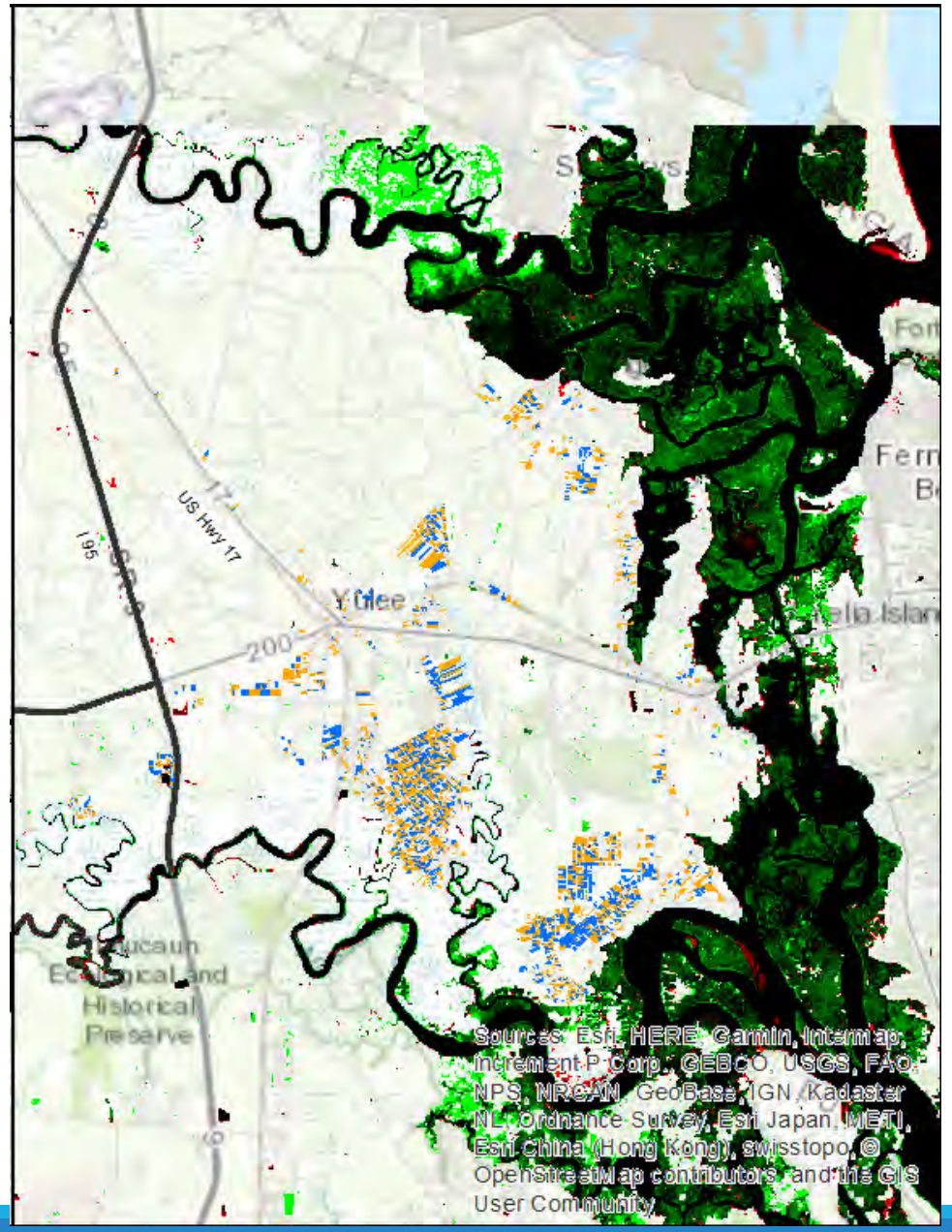
Given the high number of manufactured/mobile homes in Nassau County, locations of manufactured homes were mapped against alternative flooding scenarios.

Using the wind safety standards imposed on manufactured homes by the U.S. Department of Housing in 1994 and parcel data from the Florida Department of Revenue, mobile homes were classified into two groups (before 1994 and after 1994) to evaluate relative exposure of the two types of manufactured homes.

Overall, approximately 53% of the mobile homes within the East and West areas were built before 1994.

In the East area, risk to increasing water occurrence or episodic flooding is likely south of SR 200.

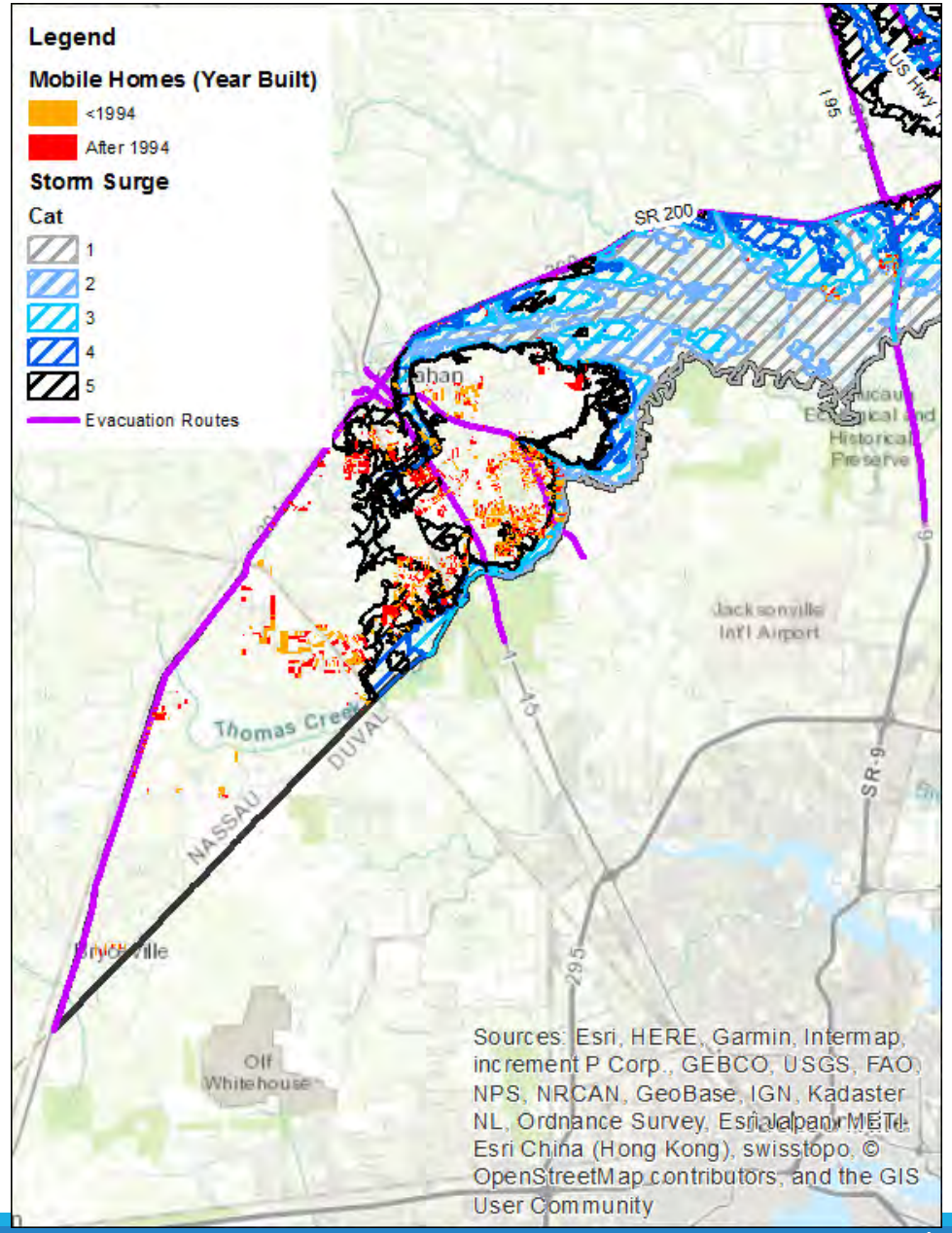


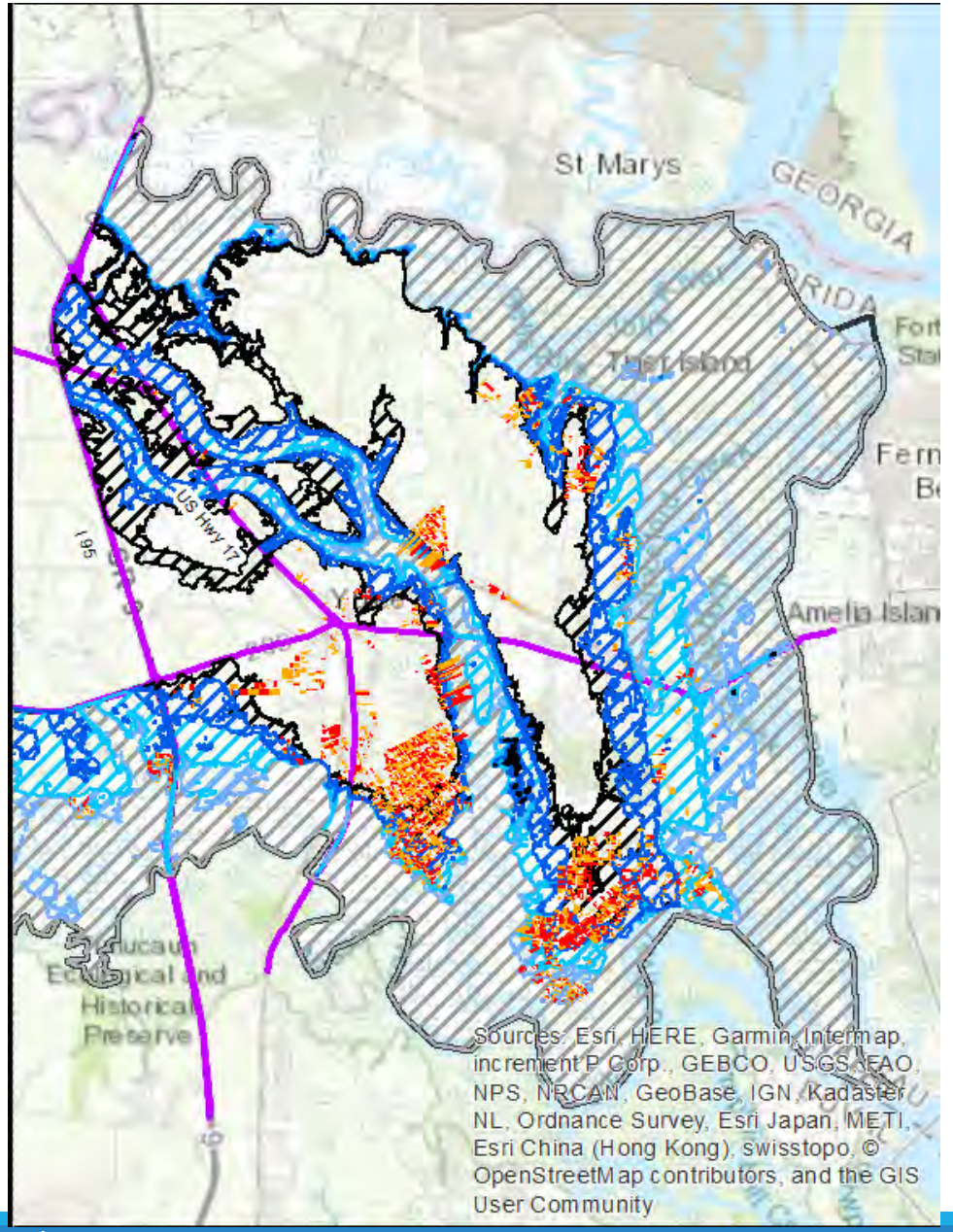


Sources: TBG Work Product; DOR; EC JRC/Google

Series 5 Map 2. Manufactured Homes by Year Built and Storm Surge

Manufactured homes were compared to storm surge to assess vulnerable locations to event-driven flooding (Series 5 Map 2). Half of the manufactured homes built before 1994 are within any storm surge category. In the East area, 65% of the manufactured homes, without taking into account the year built, are within a storm surge. This share is lower in the West area, as 30% of the manufactured homes are within a storm surge.

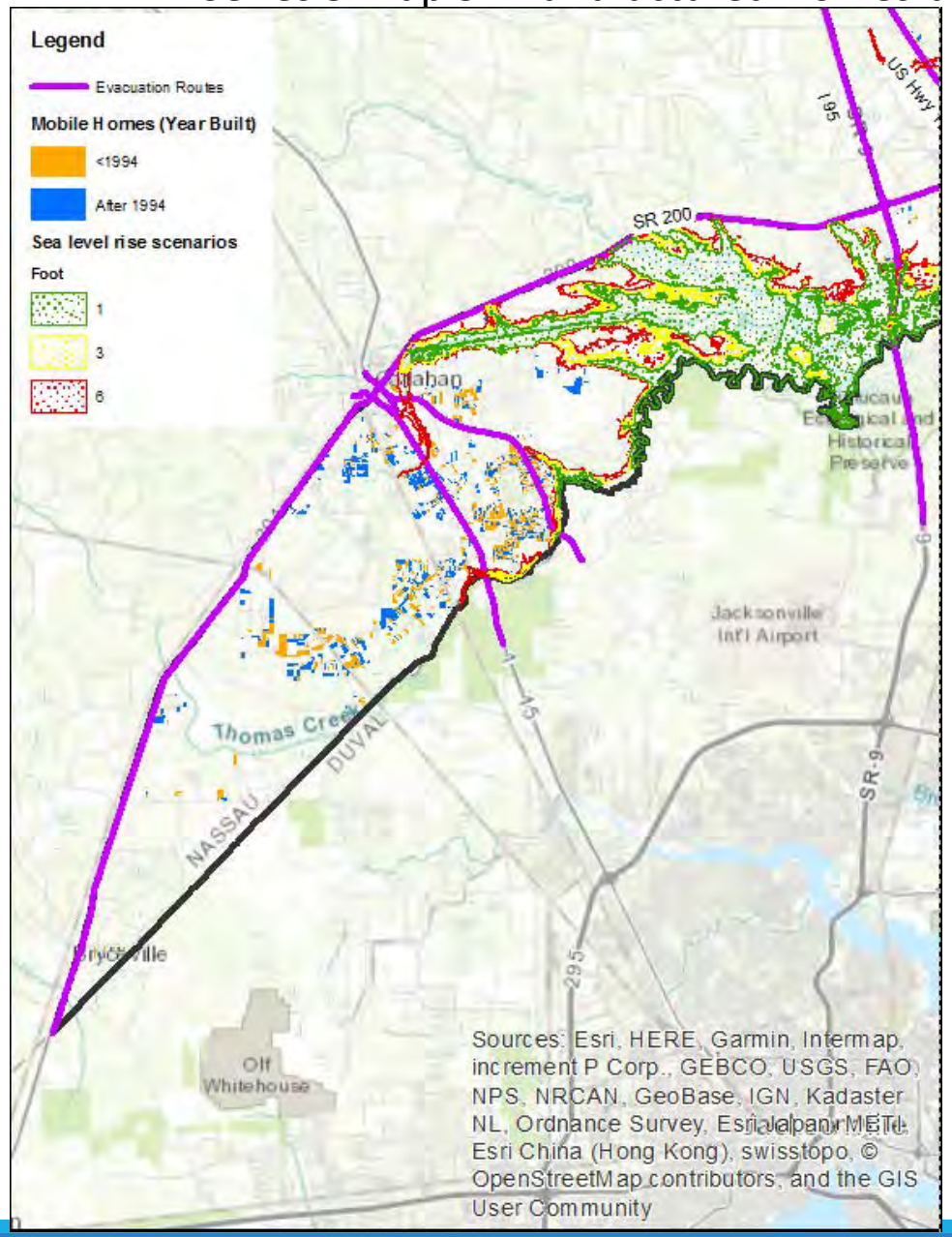


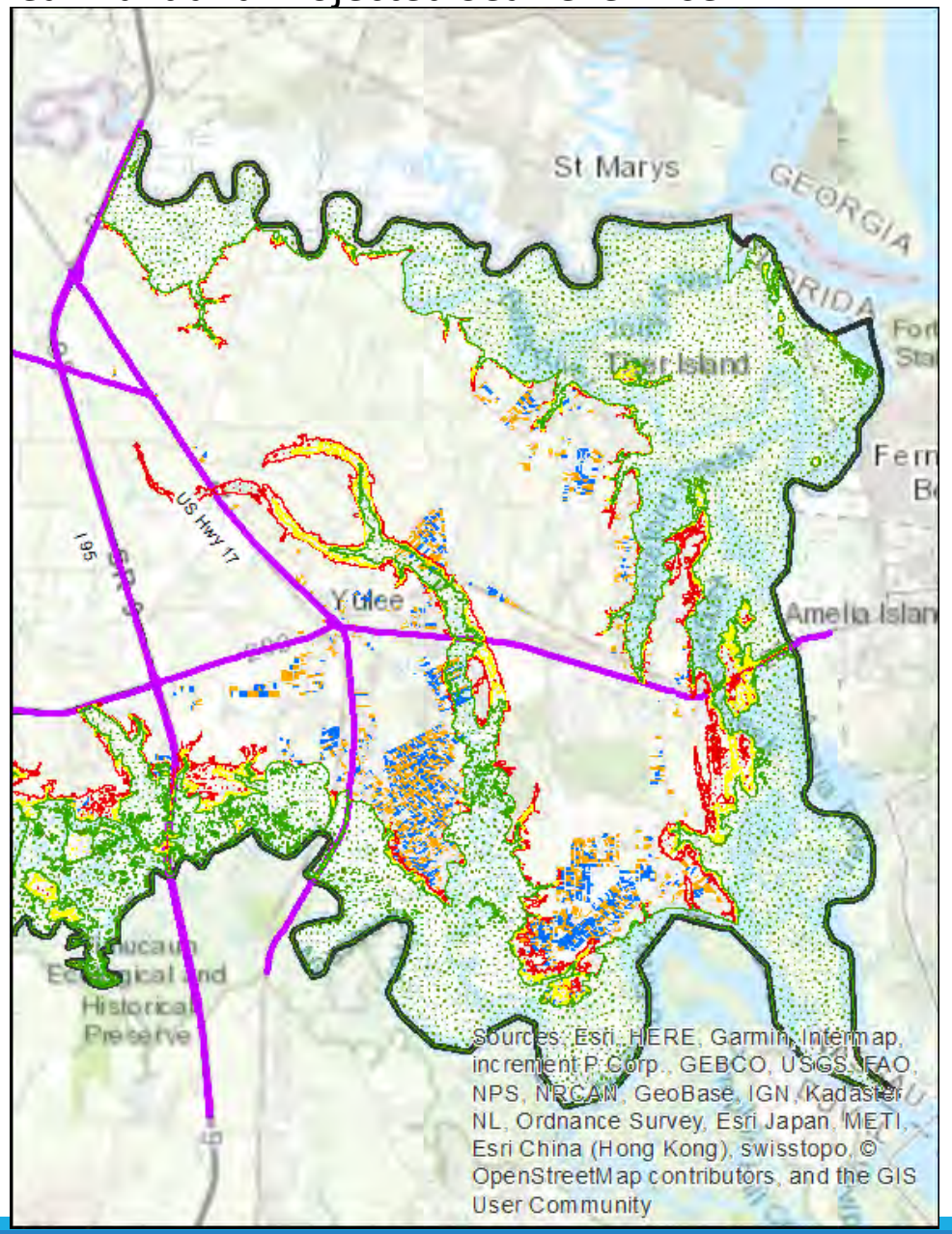


Sources: TBG Work Product; DOR; NOAA

Series 5 Map 3. Manufactured Homes by Year Built and Projected Sea Level Rise

Manufactured homes were also mapped against sea level rise to see if there any long-term risks associated for those communities where manufactured homes are predominant.
Overall, 11% of the manufactures homes, without taking into account the year built, in the East and West areas overlap with a projected sea level rise scenario.





Sources: TBG Work Product; DOR; NOAA

Demographic and Socioeconomic Information to Identify Vulnerable Populations

Census data (ACS 2012-2016) were used to assemble maps of population data by racial composition, age cohort, income, share of population with a disability, and employment. Block Group data were used for these populations, except for disability, which is available only at the Tract level.

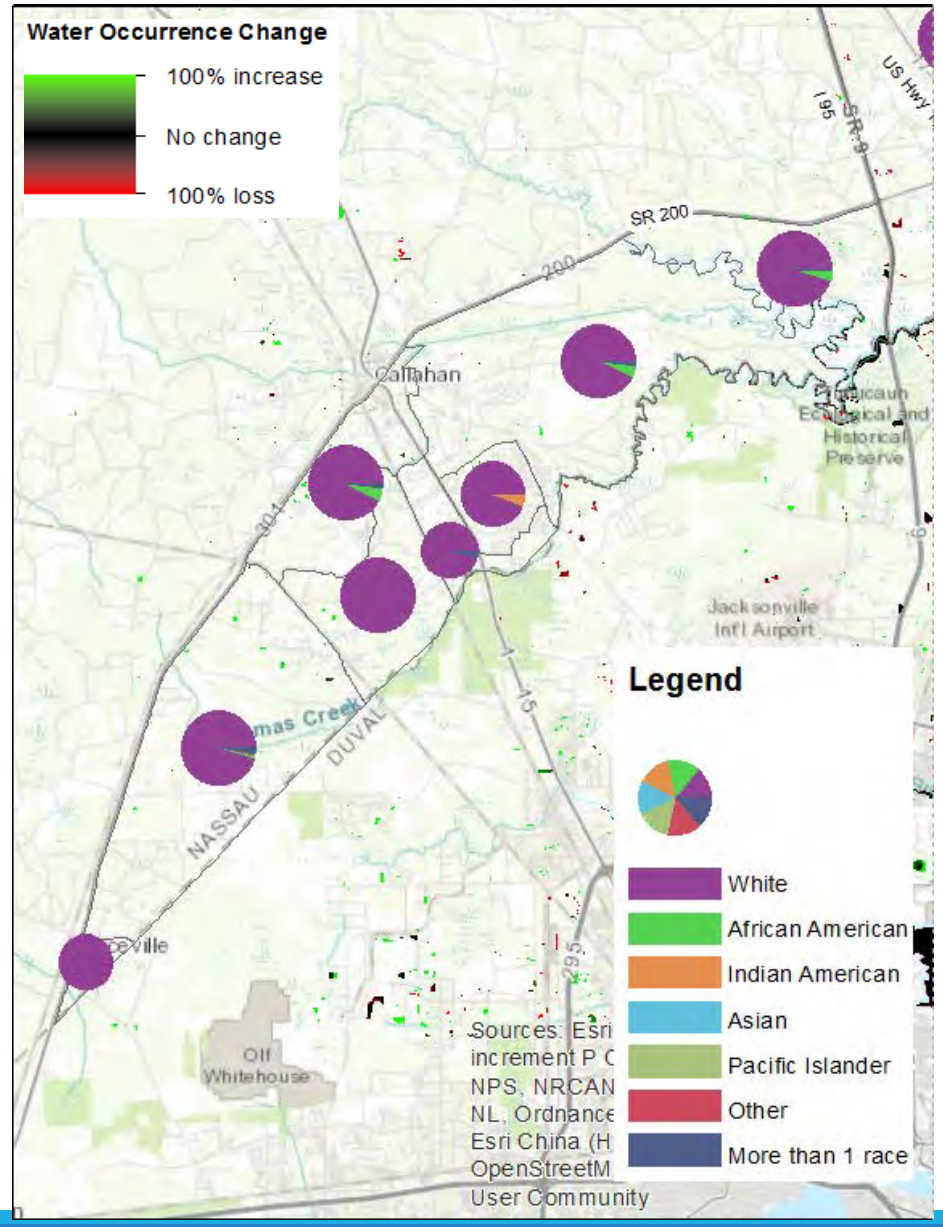
As defined by the U.S. Census Bureau, Census Tracts are subdivisions of a county that generally have a population between 1,200 and 8,000 people. Block Groups are geographic and statistical subdivisions of Census Tracts.

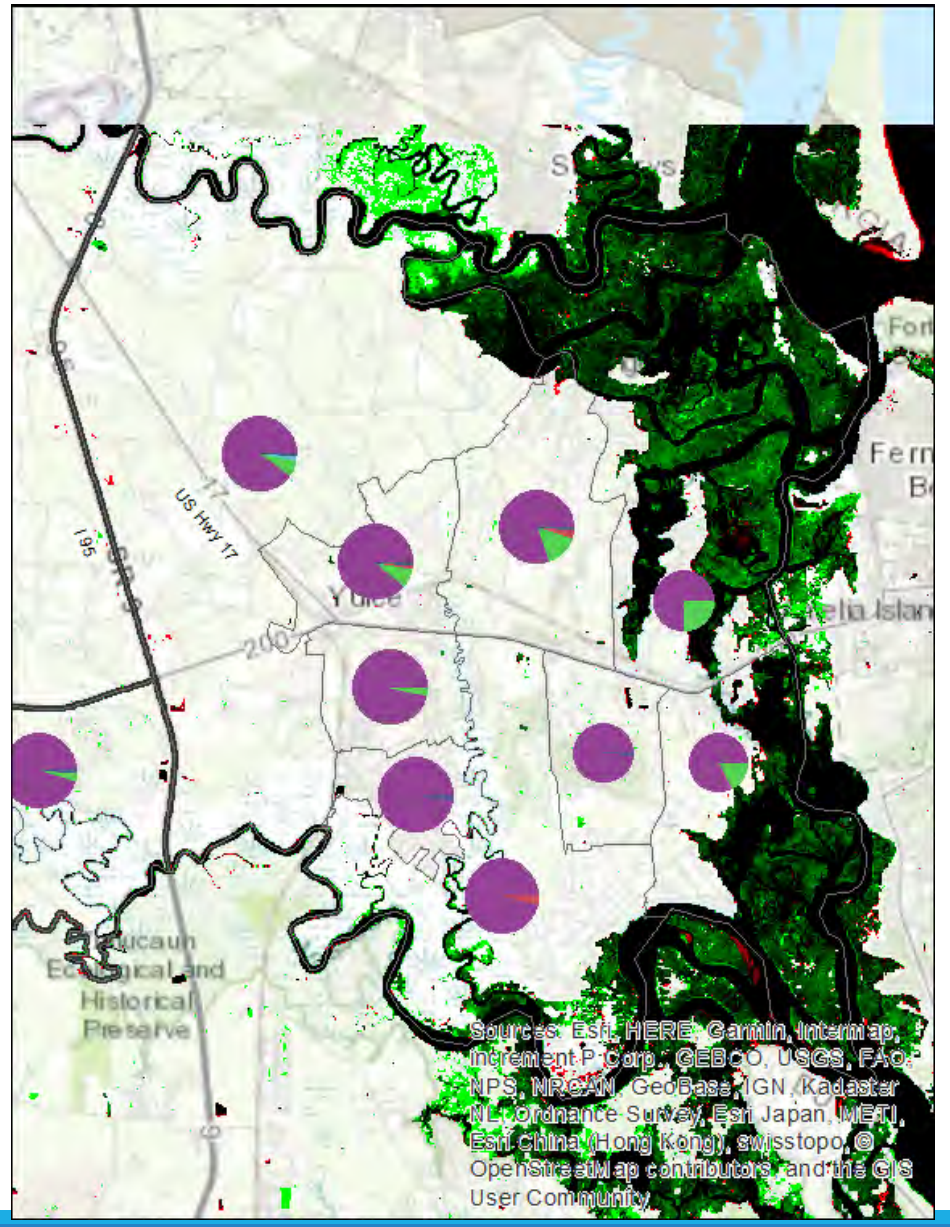
Employment data was collected from the U.S. Census Bureau OnTheMap application[1], which uses longitudinal employer-household data that include the residence of workers and where the workplace is. The most recent available data are for 2015 and it were collected for workplace location, regardless of where the workers live, at the Block Group level.

1. U.S. Census Bureau OnTheMap application. U.S. Census Bureau. (2017). LEHD Origin-Destination Employment Statistics (2002-2015). Washington, DC: U.S. Census Bureau, Longitudinal Employer-Household Dynamics Program, accessed on March 6, 2019 at https://onthemap.ces.census.gov. LODES 7.3

Series 6 Map 1. Racial Composition and Water Occurrence Change

Regarding racial composition, pie charts were created to show the share of population of a given race within a block group and these were mapped against water occurrence (Series 6 Map 1). Even though Nassau County has a high share of white population (purple in the pie charts), the patterns show that the concentration of African Americans (green in the pie charts) increase in places closer to the Intracoastal Waterway, making them more vulnerable to more frequent episodic events.

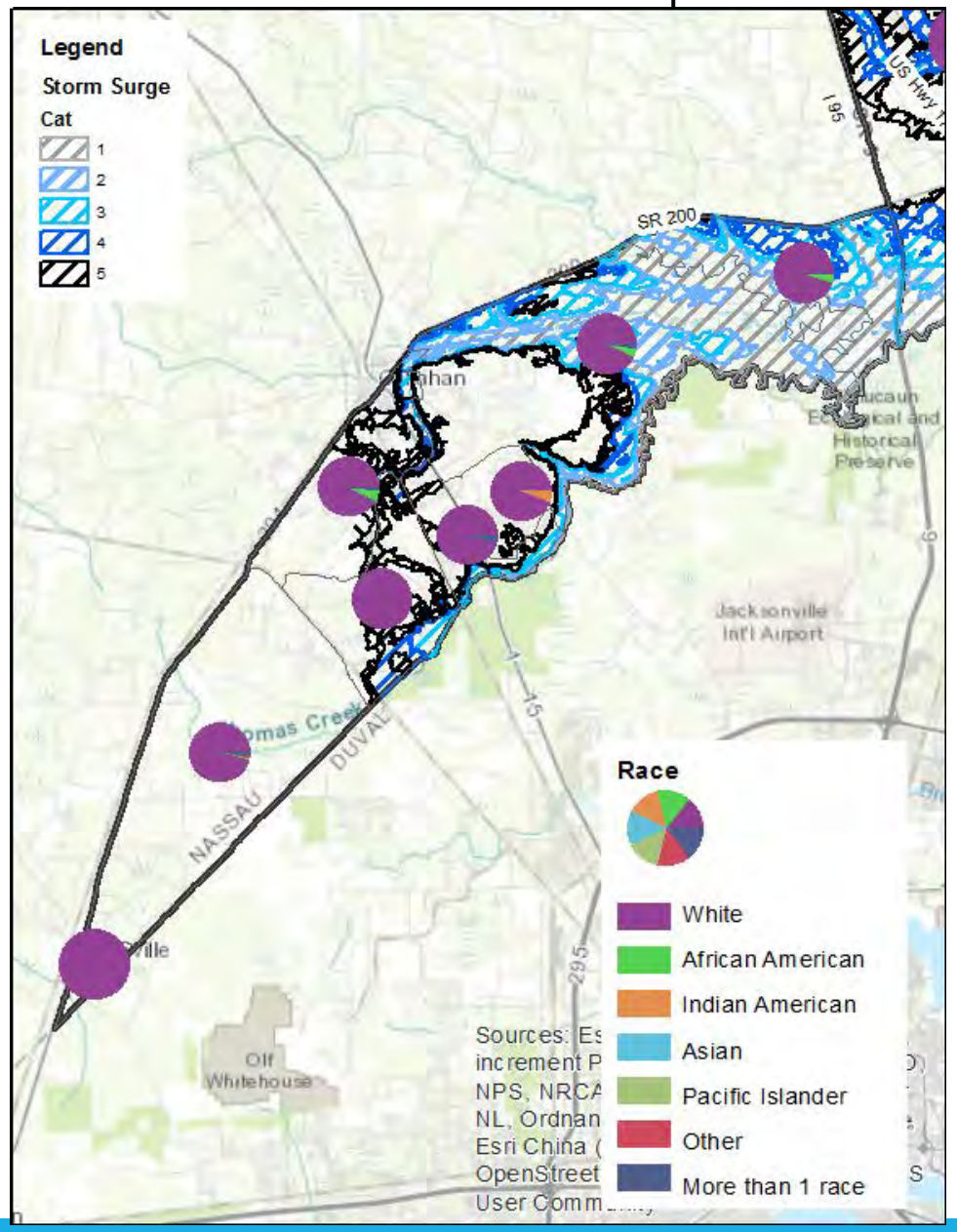


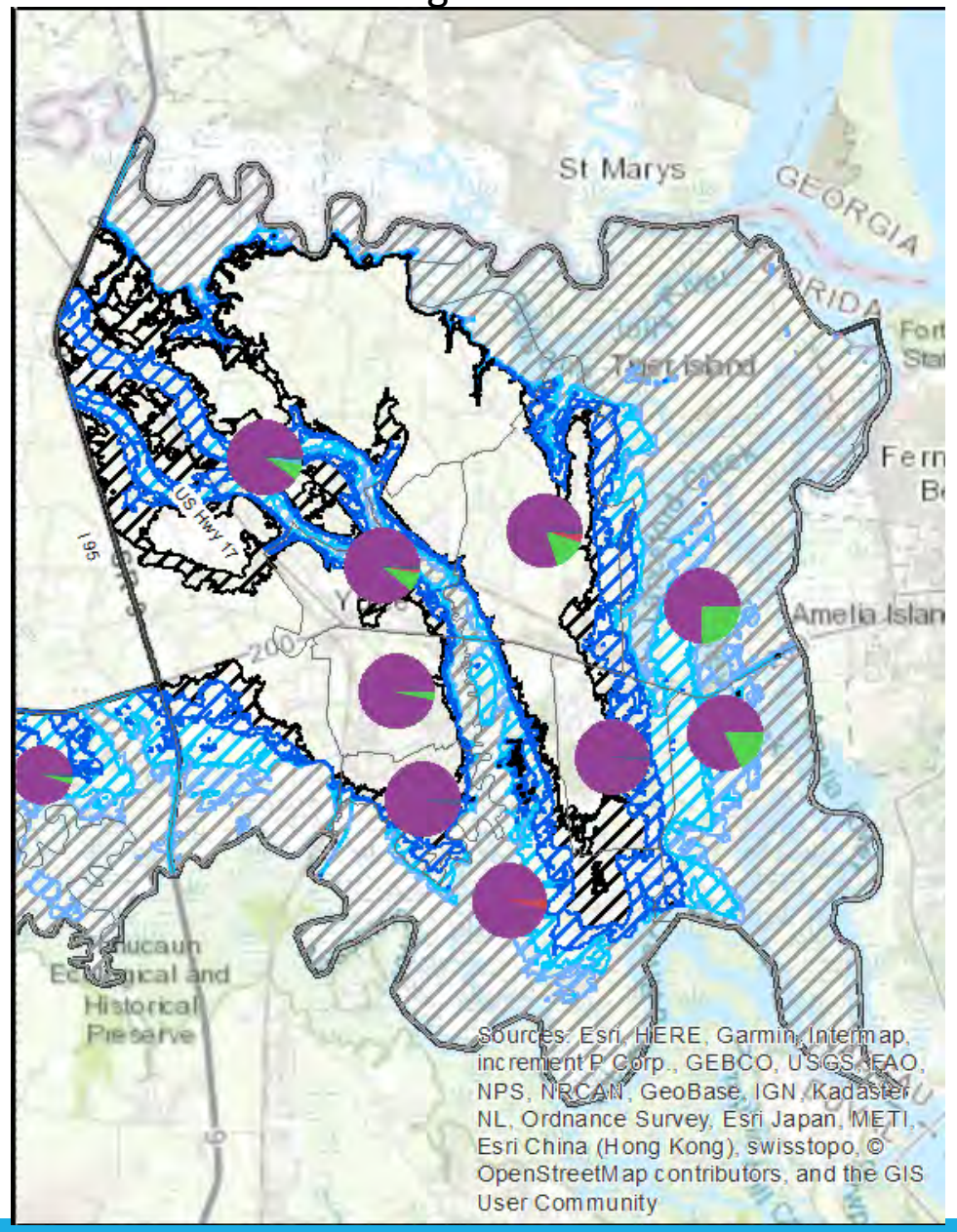


Sources: TBG Work Product; U.S. Census; EC JRC/Google

Series 6 Map 2. Racial Composition and Storm Surge

Series 6 Map 2 illustrates race and storm surge, to assess which populations are more vulnerable in the case of storm surges. Block groups in the East study area that are closer to the Intracoastal Waterway have a higher concentration of African Americans (green color in the legend) making them vulnerable even by the weakest and most likely storm surges. In the West study area, block groups that are closer to I-95 (where white population comprises more than 93% of the total population) are more vulnerable in the case of storm surges.

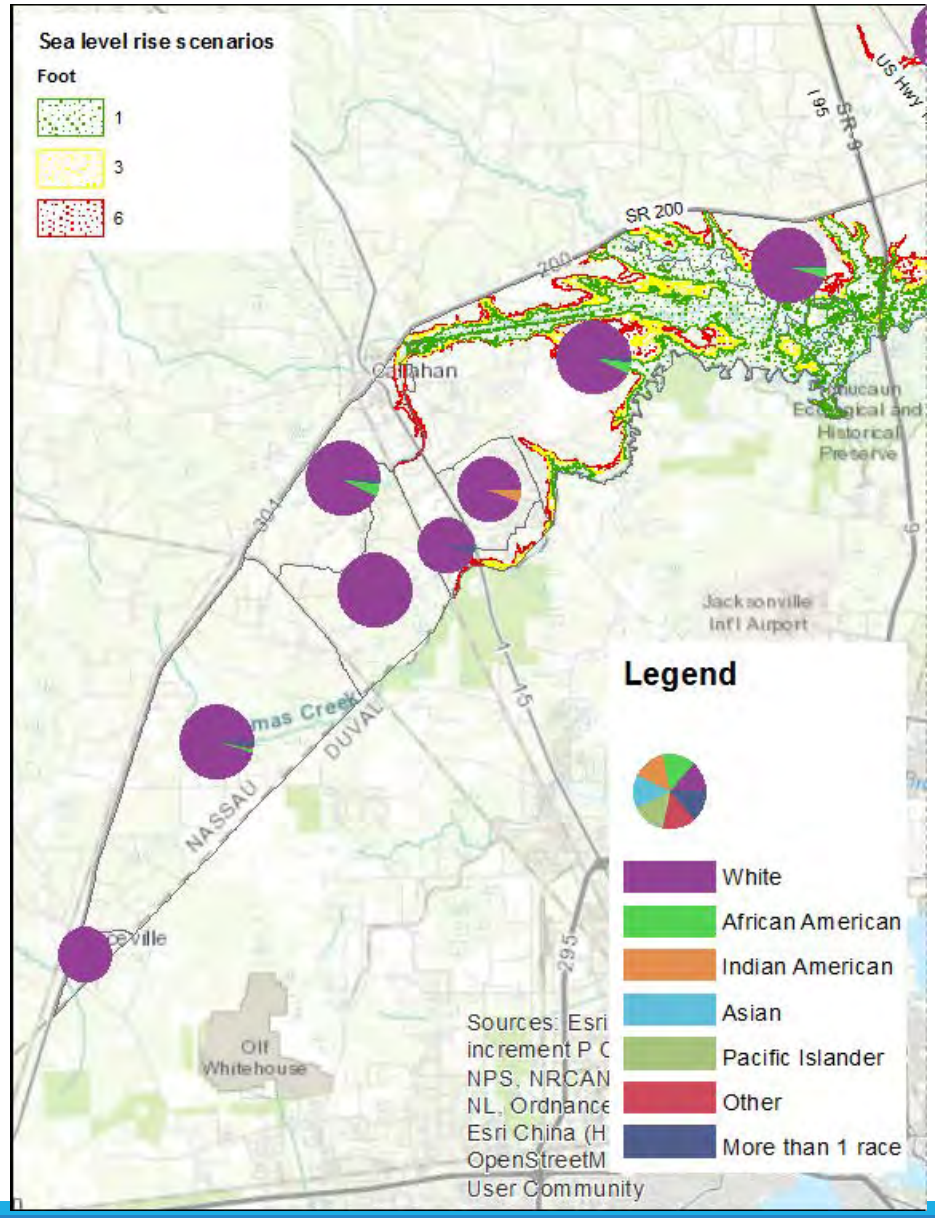


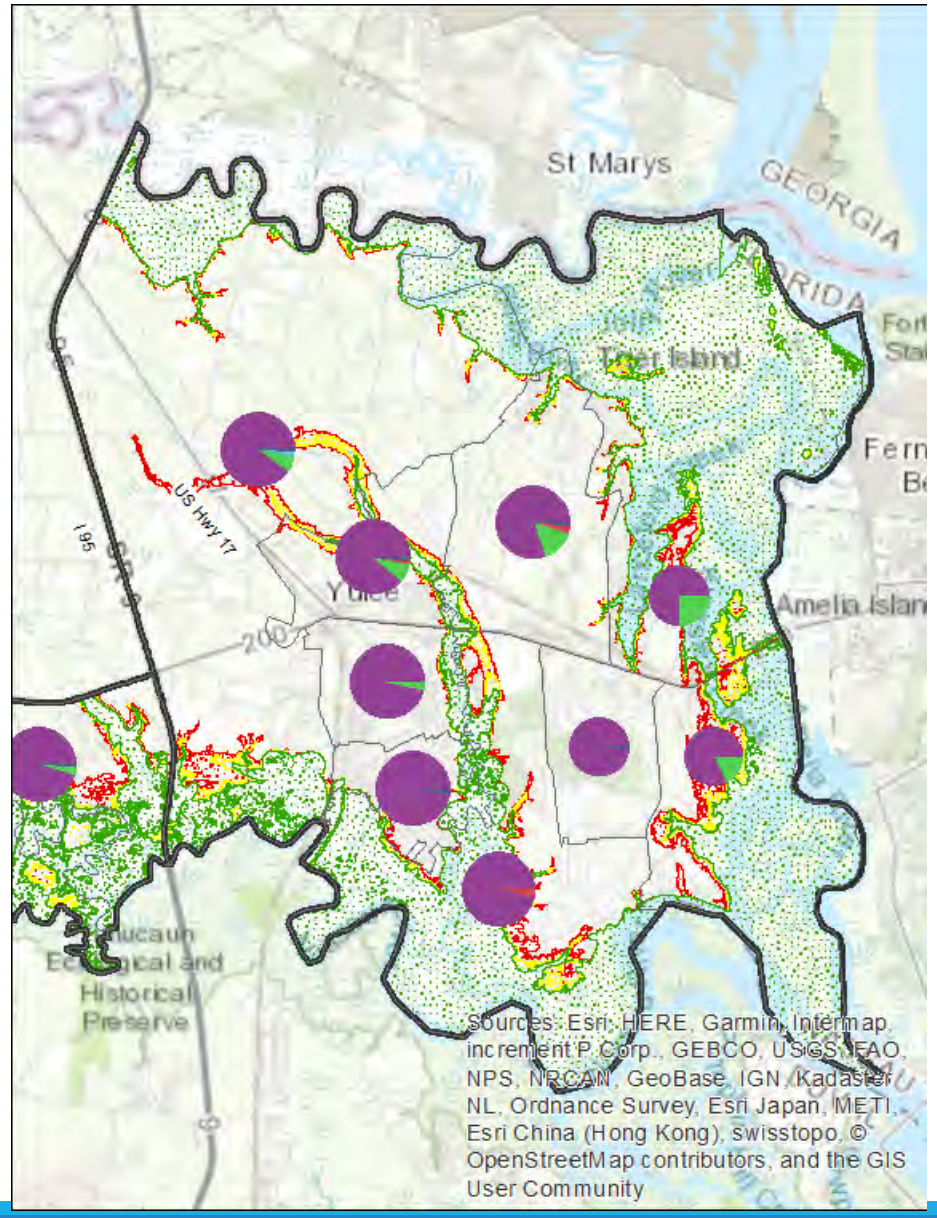


Sources: TBG Work Product; U.S. Census; NOAA

Series 6 Map 3. Racial Composition and Projected Sea Level Rise

Series 6 Map 3 illustrates race and storm surge, to assess which populations are more vulnerable to sea level rise. In the East area that is closer to the Intracoastal Waterway, the concentration of African Americans increase (green in the legend) making them more vulnerable to any sea level rise scenario. The West area, Block Groups closer to I-95 are more impacted by sea level rise and these are predominantly White population.

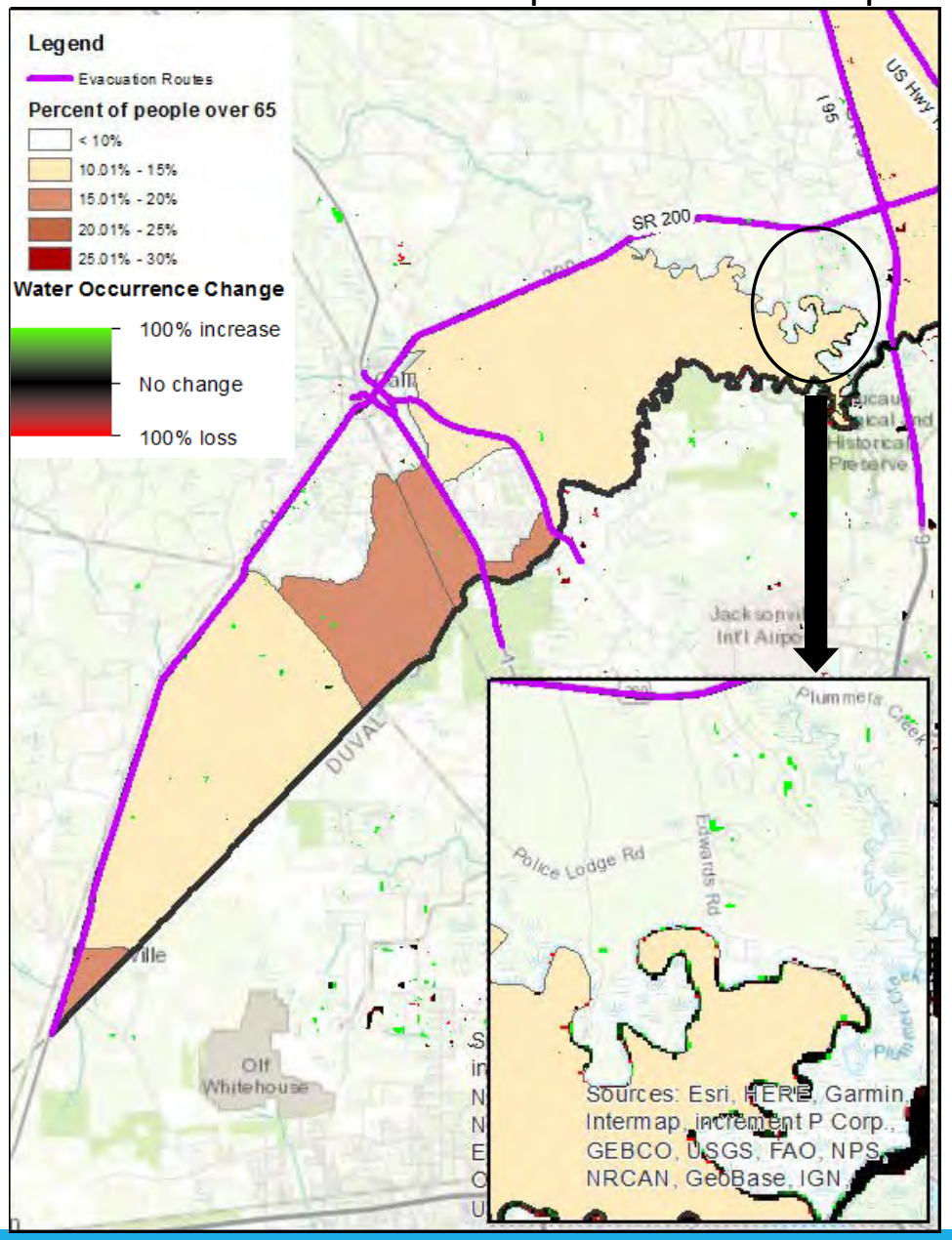


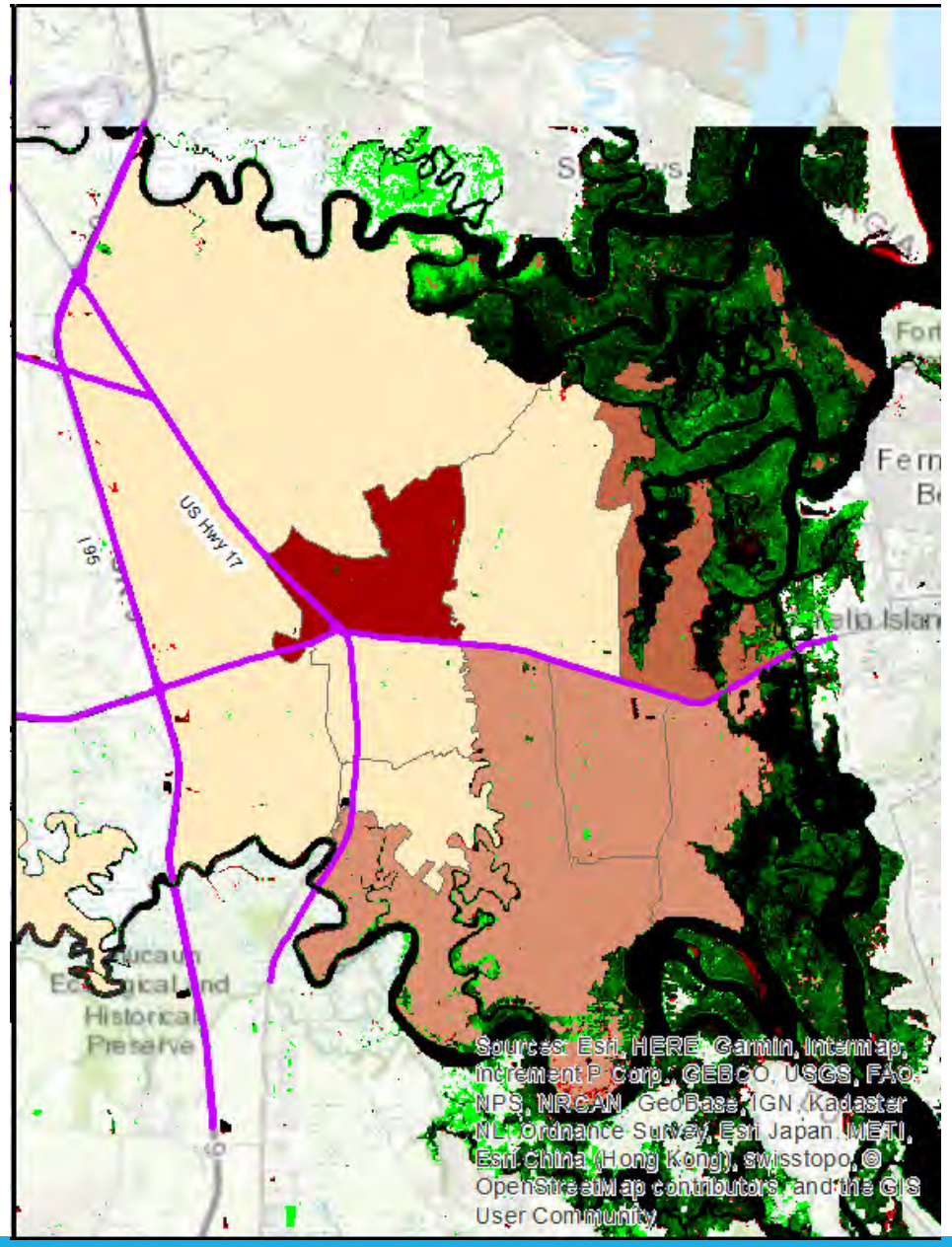


Sources: TBG Work Product; DOR; NOAA

Series 7 Map 1. Percent of Population over 65 and Water Occurrence Change

Series 7 Map 1 shows the confluence of elderly populations with flooding incidence data. In the East area, block groups near the coast show higher shares of elderly population and these overlap with higher flooding incidents. In the West area, there is limited overlap with flooding incidents.

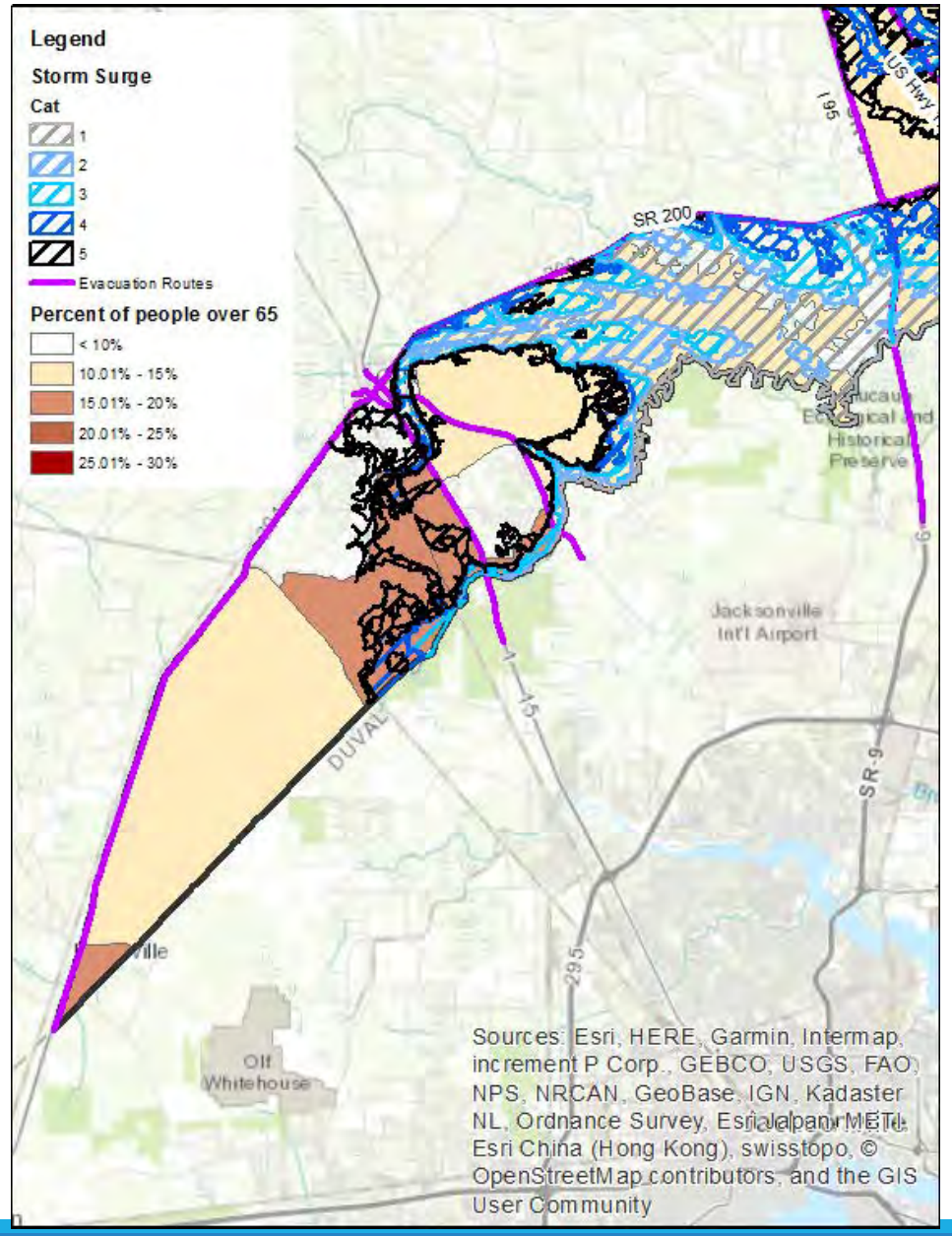


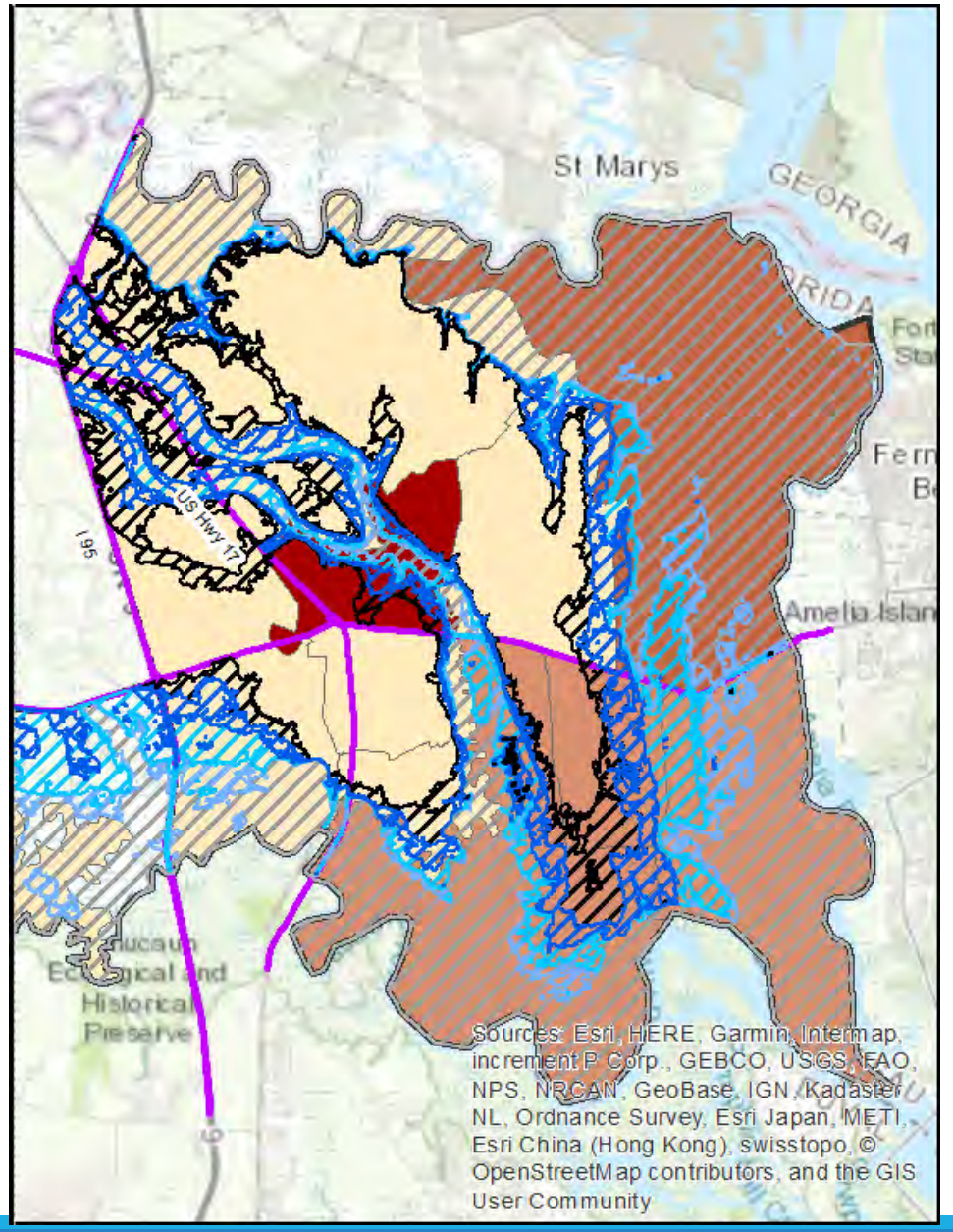


Sources: TBG Work Product; U.S. Census; EC JRC/Google

Series 7 Map 2. Percent of Population over 65 and Storm Surge

Series 7 Map 2 shows the confluence of elderly populations with storm surge to see if the elderly are more vulnerable to event-driven flooding. Block groups indicating higher shares of elderly population overlap areas with higher storm surge likelihood (around the Intracoastal Waterway) and the stronger storm surge category (block group adjoining the intersection of U.S. Highway 17 and SR 200).

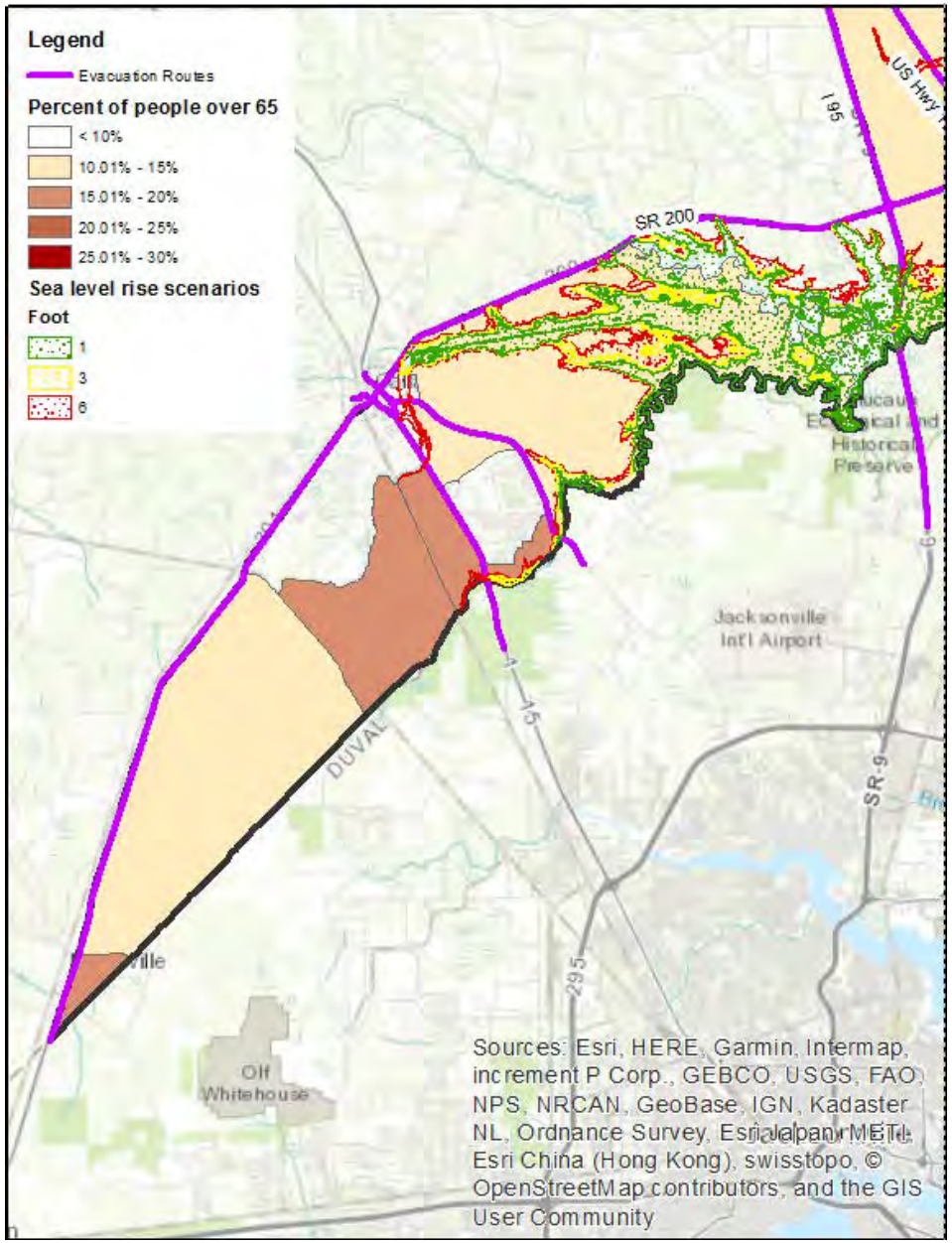


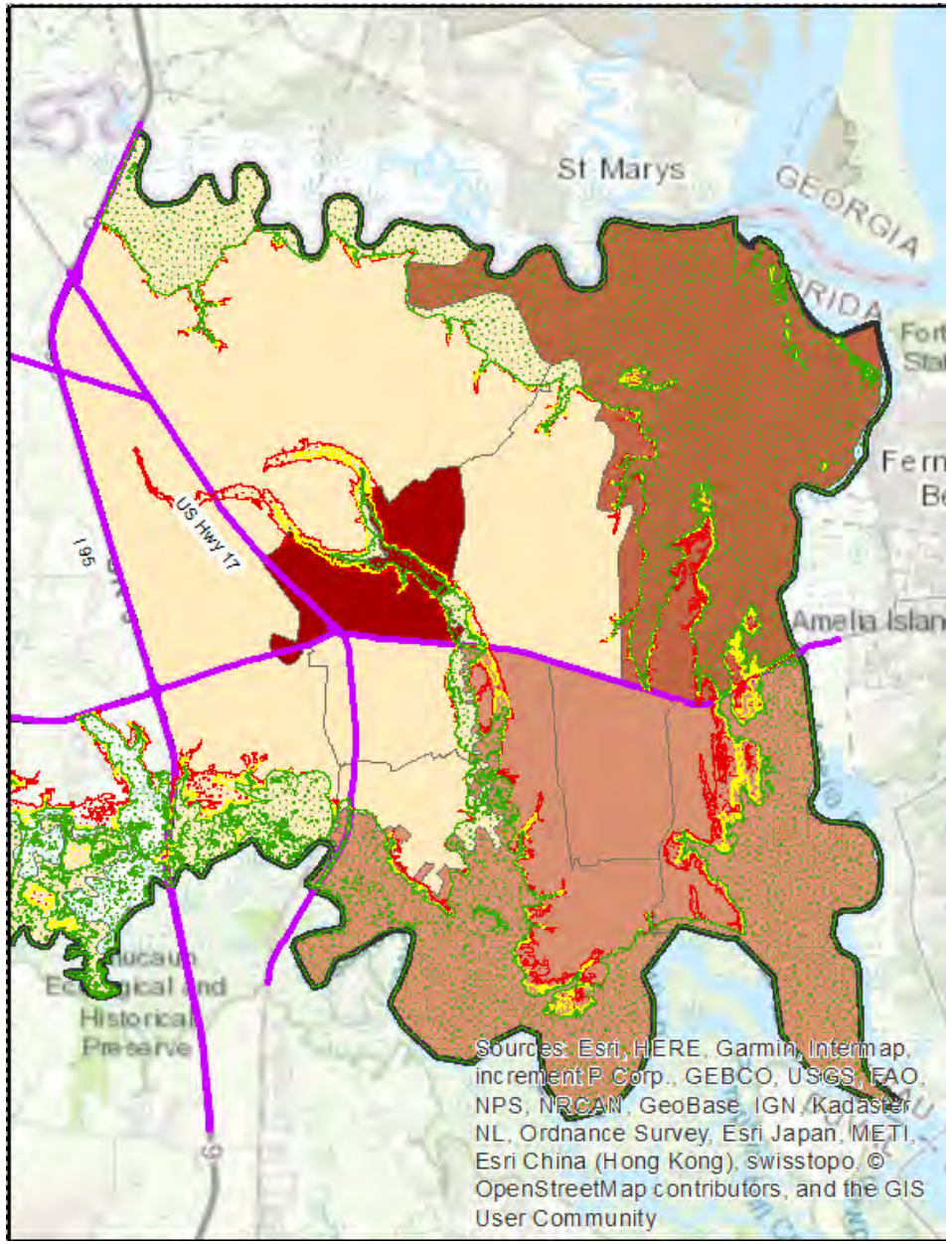


Sources: TBG Work Product; U.S. Census; NOAA

Series 7 Map 3. Percent of Population over 65 and Projected Sea Level Rise

Series 7 Map 3 shows the confluence of elderly populations with sea level rise scenarios to see if the elderly are more vulnerable to this type of flooding. Areas indicating higher shares of elderly population overlap with sea level rise, just west of the Intracoastal and within the block group in the center of the East study area. Block groups with the higher share of elderly populations within the West study area are not affected by sea level rise.

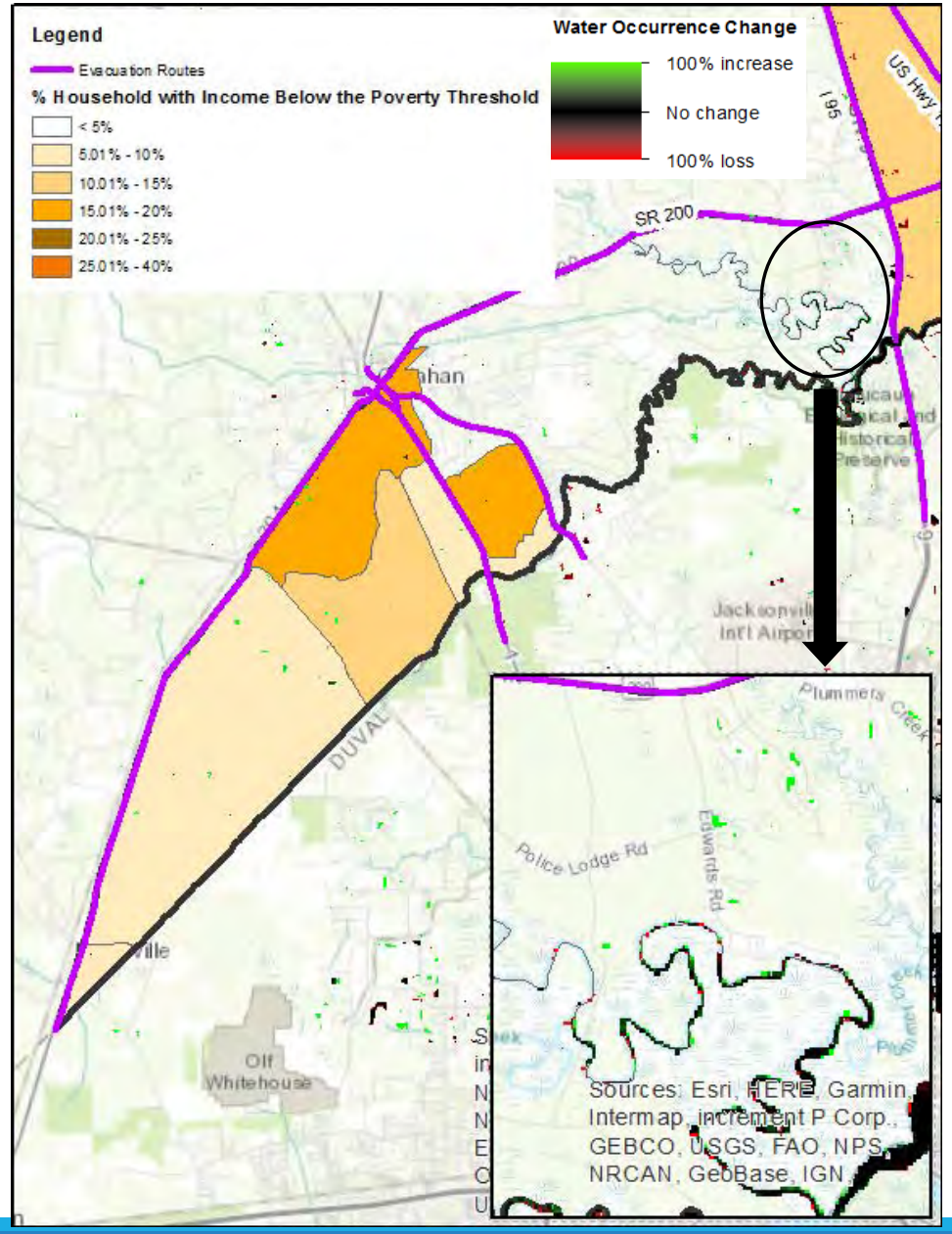


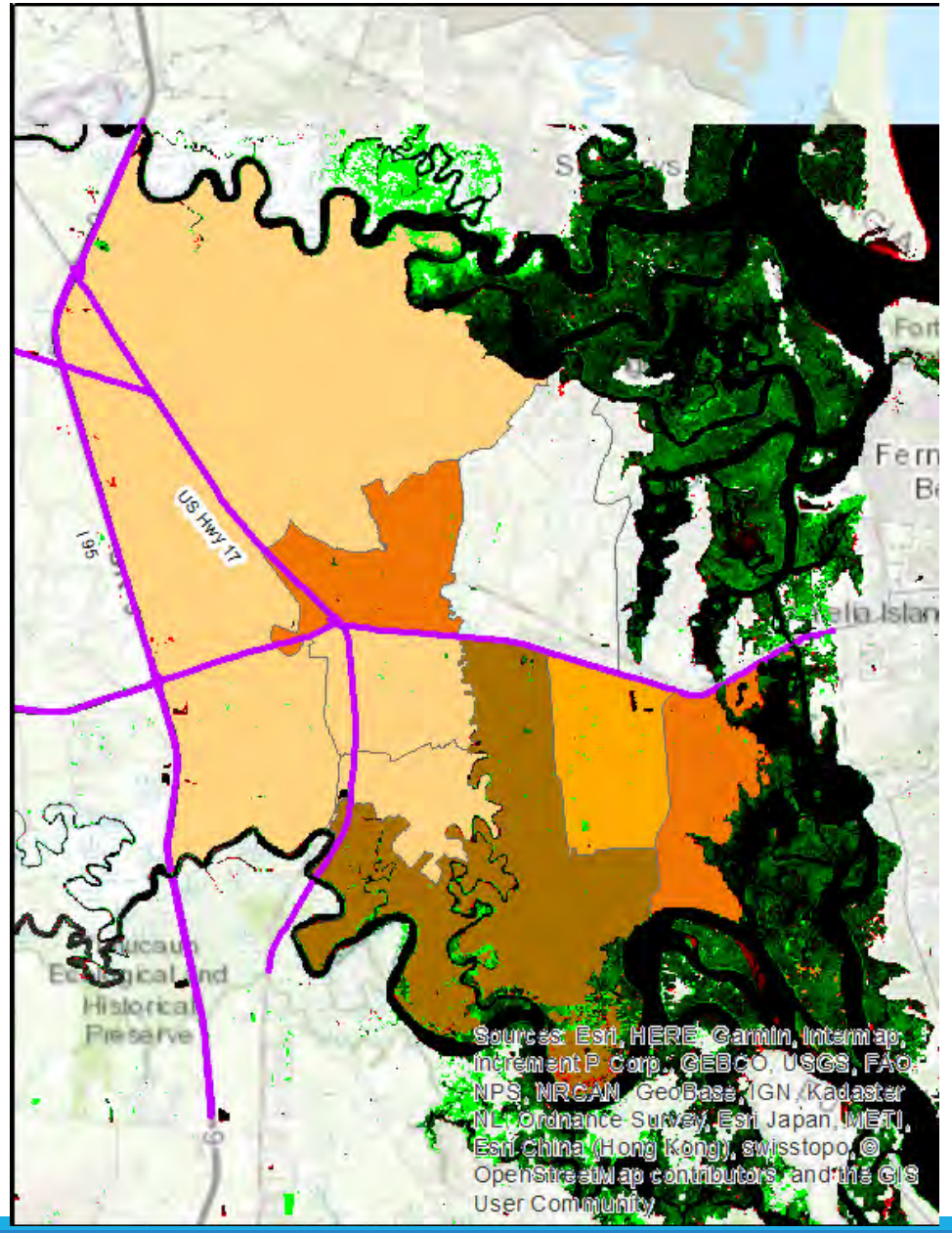


Sources: TBG Work Product; DOR; NOAA

Series 8 Map 1. Percent of Households with Income below Poverty Threshold and Water Occurrence Change

Series 8 Map 1 illustrates block groups with higher shares of households living on incomes below the poverty threshold. The highest share of households living below the poverty threshold are in the East area south of SR 200, where episodic events have had a significant increase.
In the West area, the highest share of households living below the poverty threshold is the block group near Callahan. These households appear to have no impacts from current episodic events.

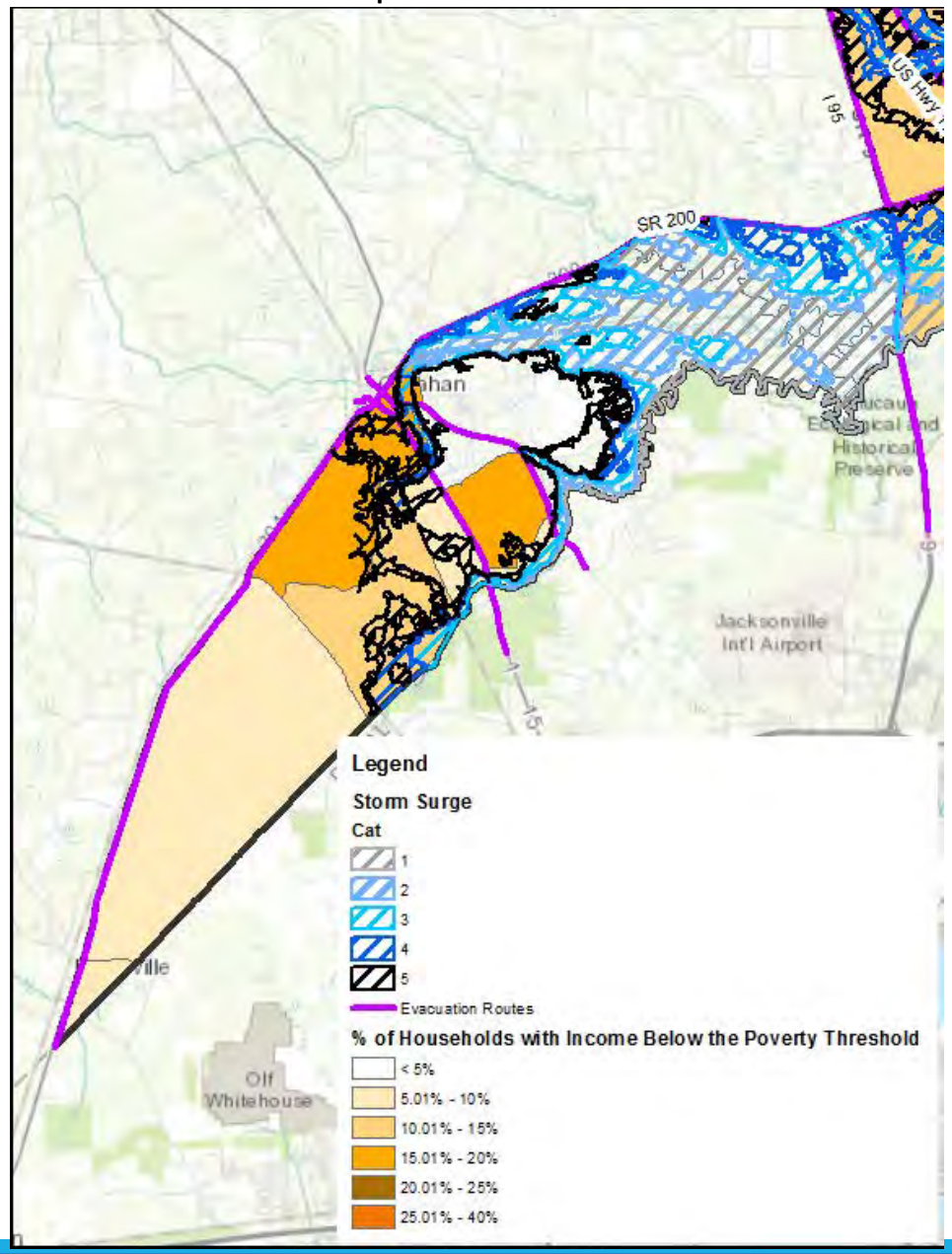


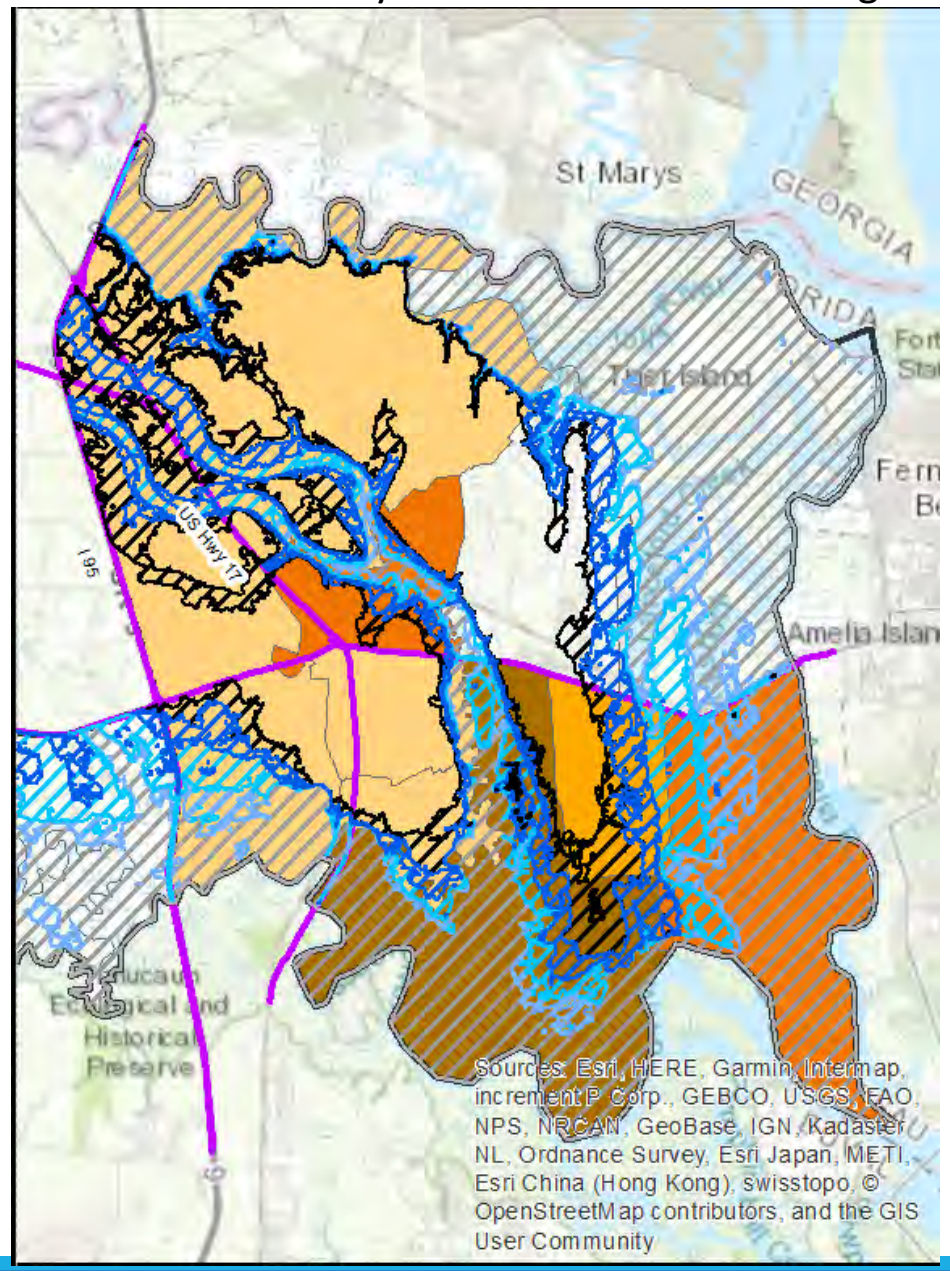


Sources: TBG Work Product; U.S. Census; EC JRC/Google

Series 8 Map 2. Percent of Households with Income below Poverty Threshold and Storm Surge

To determine if poorer households are more exposed to event-driven flooding, the percent of households living with incomes below the poverty threshold were mapped against storm surge. In the East, households with incomes below the poverty threshold that are in block groups south of SR 200 impacted by water occurrence, the block group north of the intersection of SR 200 and U.S. Highway 17, would be impacted by Category 1 storm surge. In the West area, the highest share of impacted households is near Callahan, and would be affected by a Category 3 or higher storm surge.

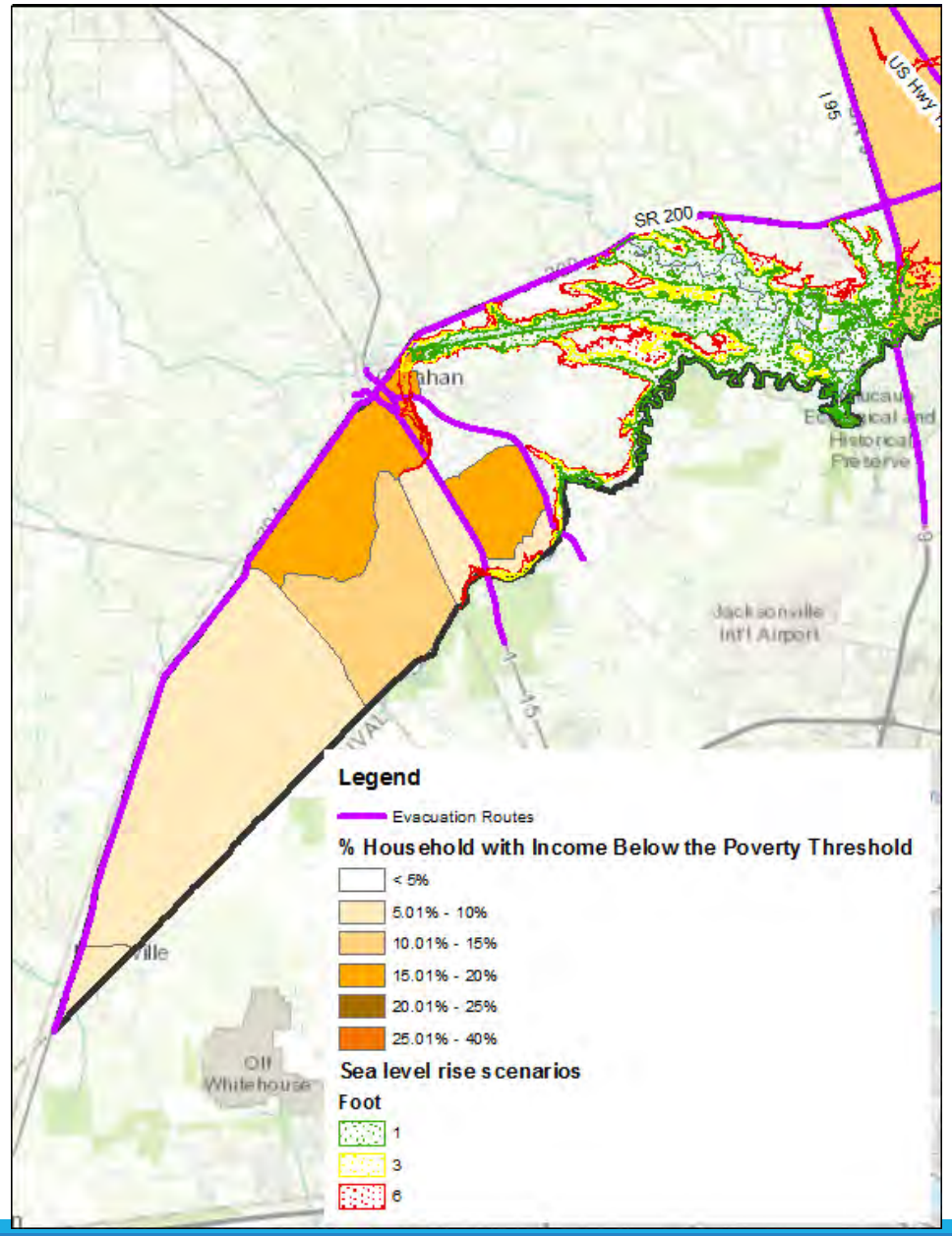


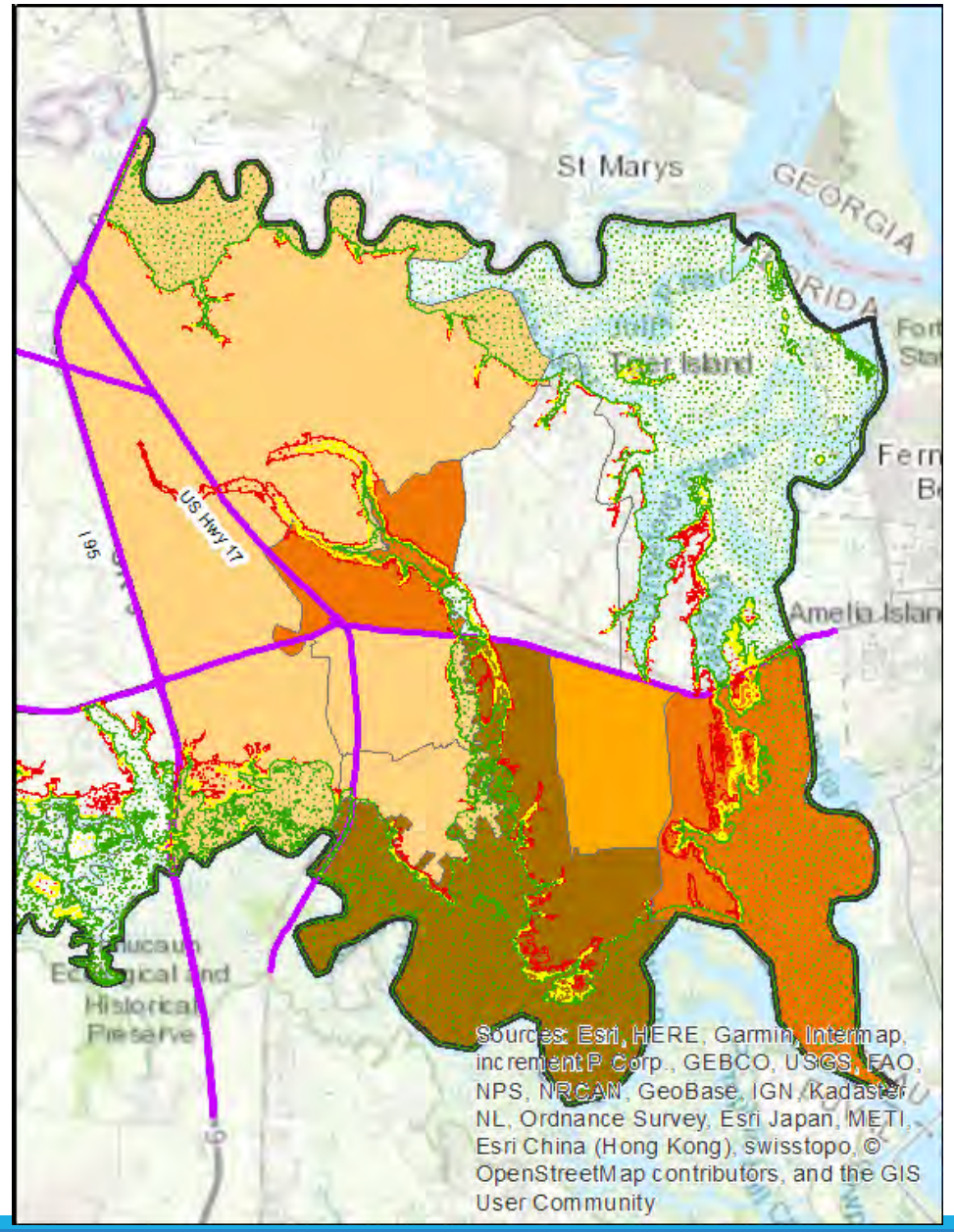


Sources: TBG Work Product; U.S. Census; NOAA

Series 8 Map 3. Percent of Households with Income below Poverty Threshold and Projected Sea Level Rise

Likewise, to determine if poorer households are more exposed to flooding under a more long-term perspective, households living with incomes below the poverty threshold were mapped against sea level rise. Block Groups within the East area that have been described throughout series 8 would be impacted by all three sea level rise scenarios.
In the West area, impacts of sea level rise (even at 6 ft.) on households with income below the poverty threshold will be relatively minor.

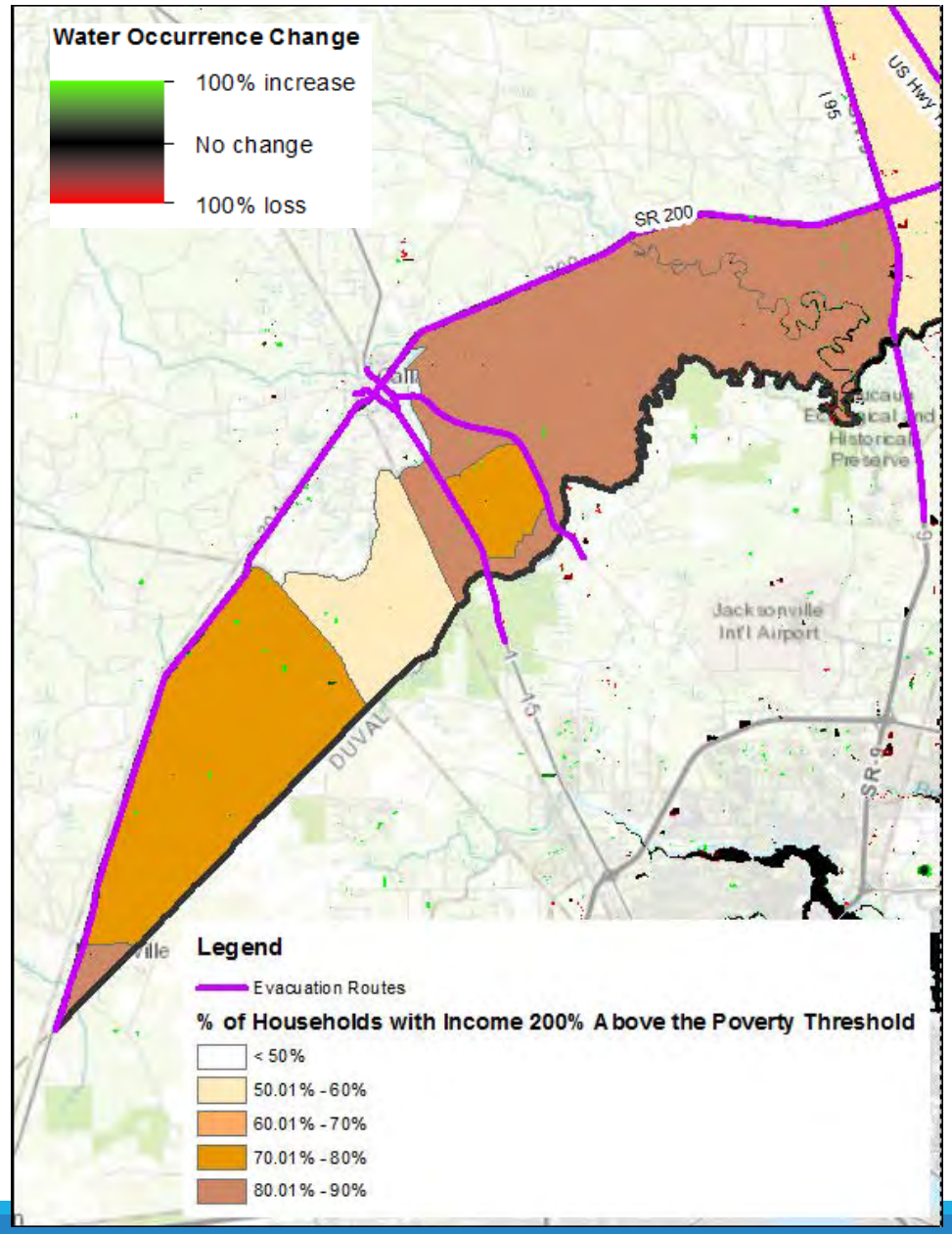


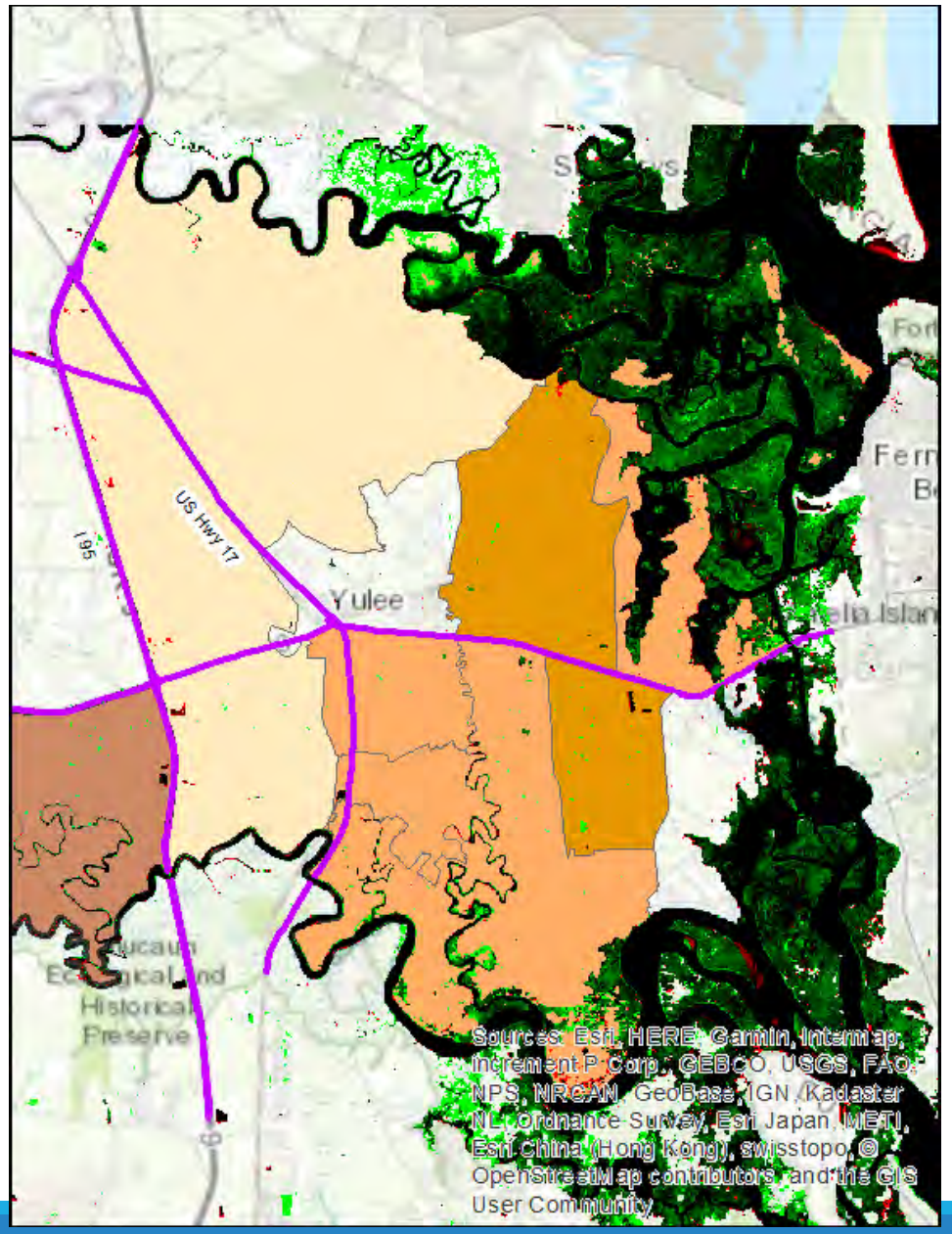


Sources: TBG Work Product; DOR; NOAA

Series 9 Map 1. Percent of Households with Income 200% above Poverty Threshold and Water Occurrence Change

It is also important to evaluate whether locations with higher income households have been impacted by episodic events (Series 9 Map 1). Within the study area, the highest share of households living on incomes 200 percent above the poverty threshold, is in the West study area close to the intersection of SR 200 and I-95, where there has been some increase of episodic events. In the East study area, there is limited overlap between increased episodic events and block groups with a higher percent of households living on incomes 200% above the poverty threshold.

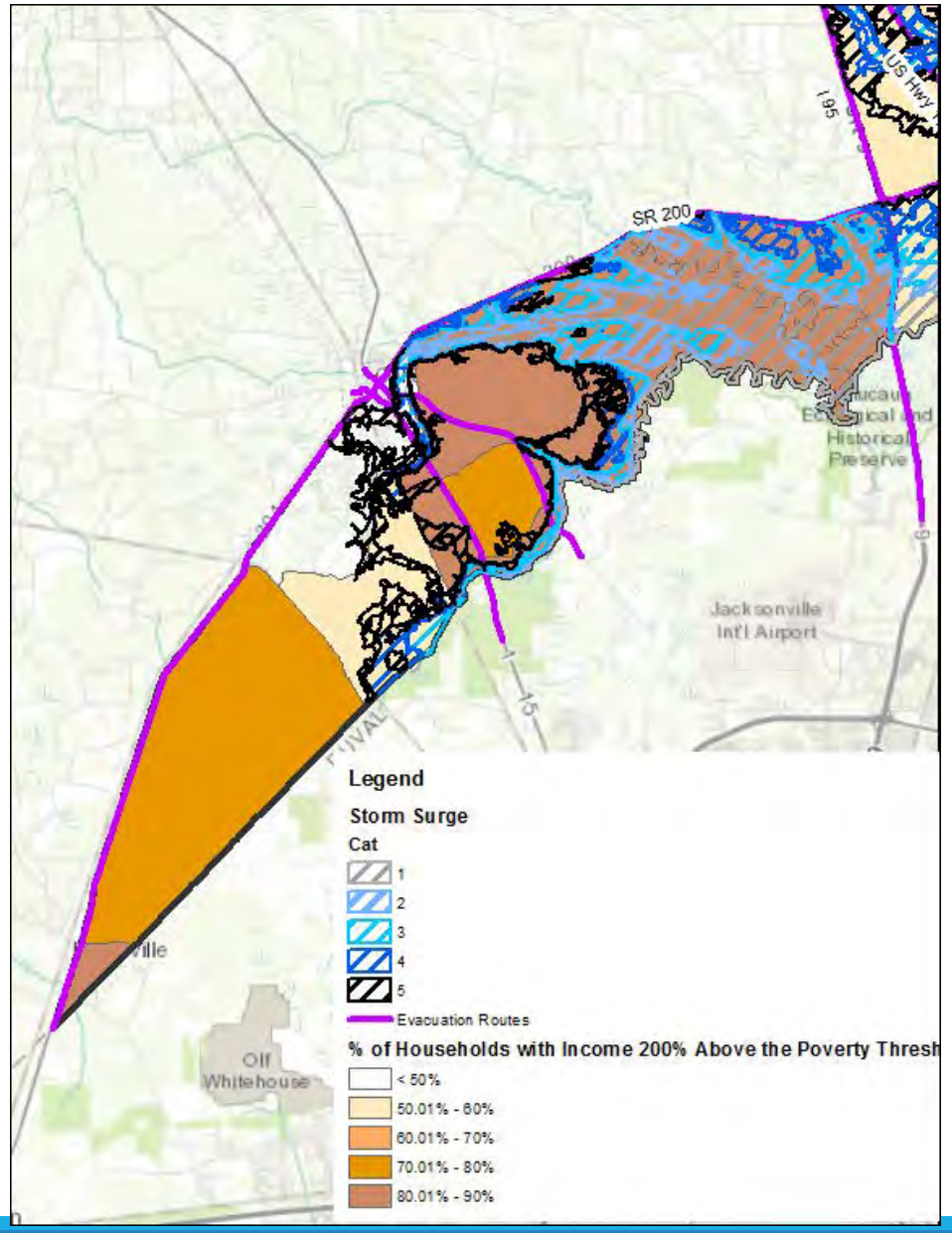


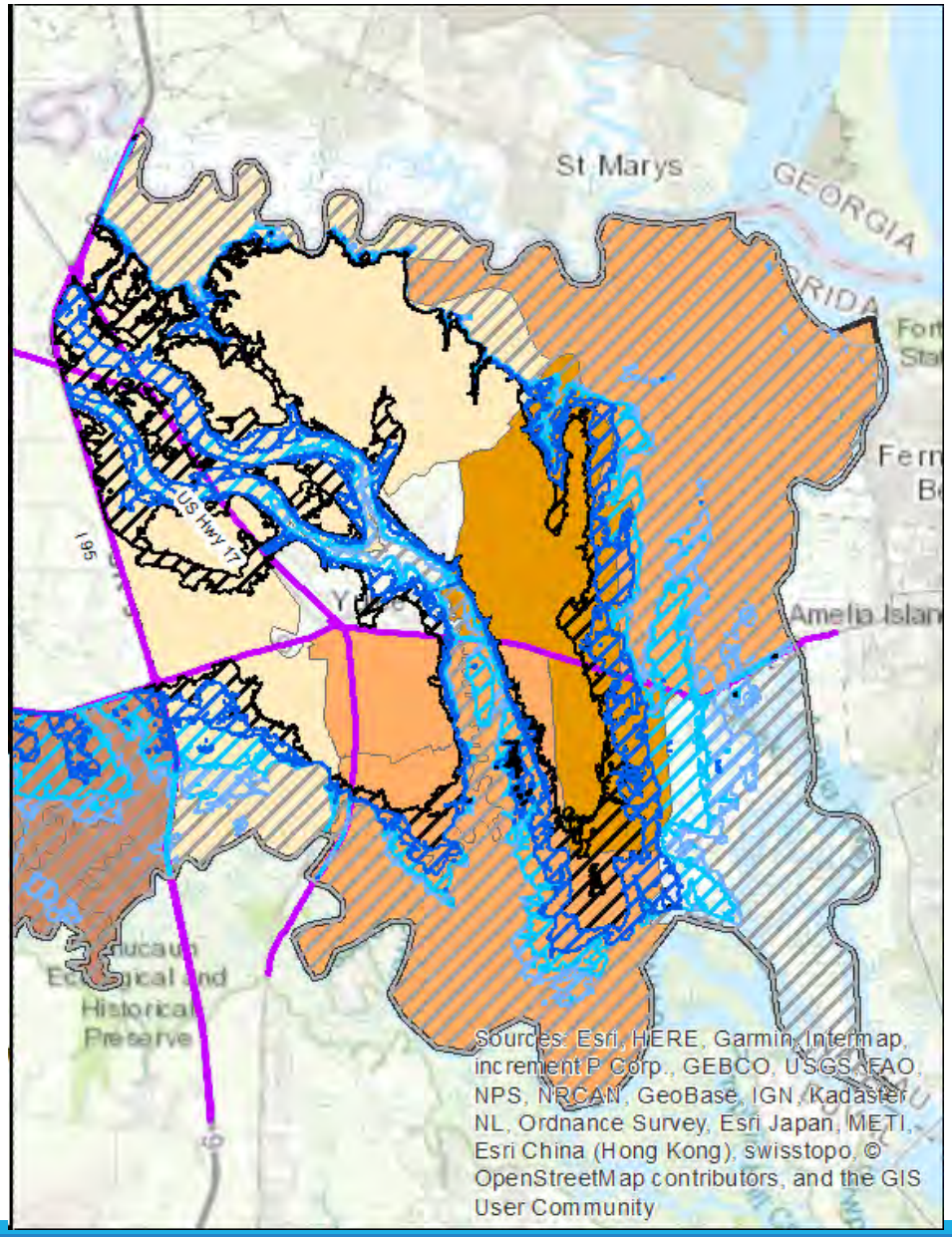


Sources: TBG Work Product; U.S. Census; EC JRC/Google

Series 9 Map 2. Percent of Households with Income 200% above Poverty Threshold and Storm Surge

Series 9 Map 2 compares the percent of households living on incomes 200 percent above the poverty threshold to storm surge. The highest share of households living on income 200 percent above the poverty threshold are in the West study area close to the intersection of SR 200 and I-95, and the eastern portion of the East study area. These are significantly impacted even by the weakest and most likely storm surge projections.

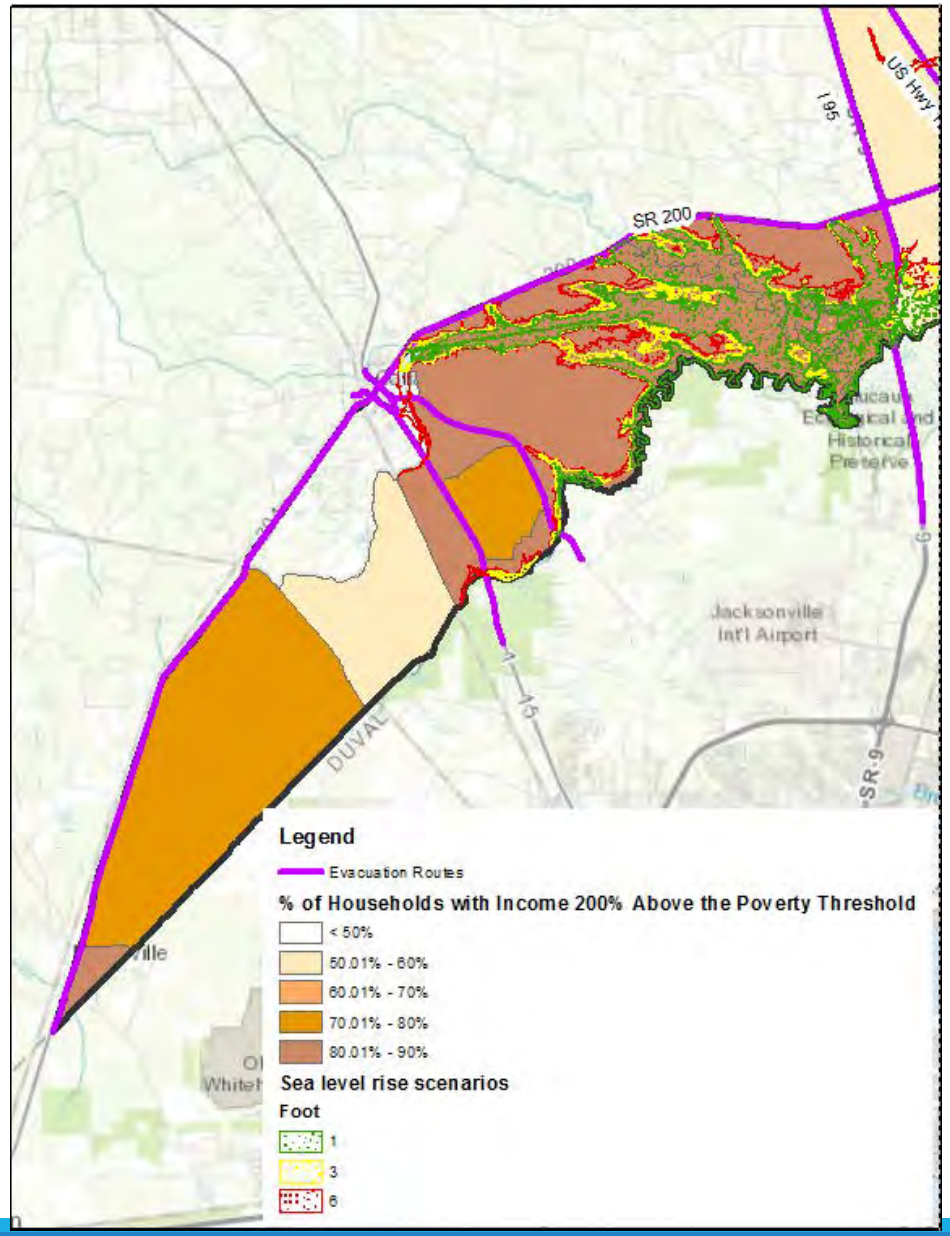


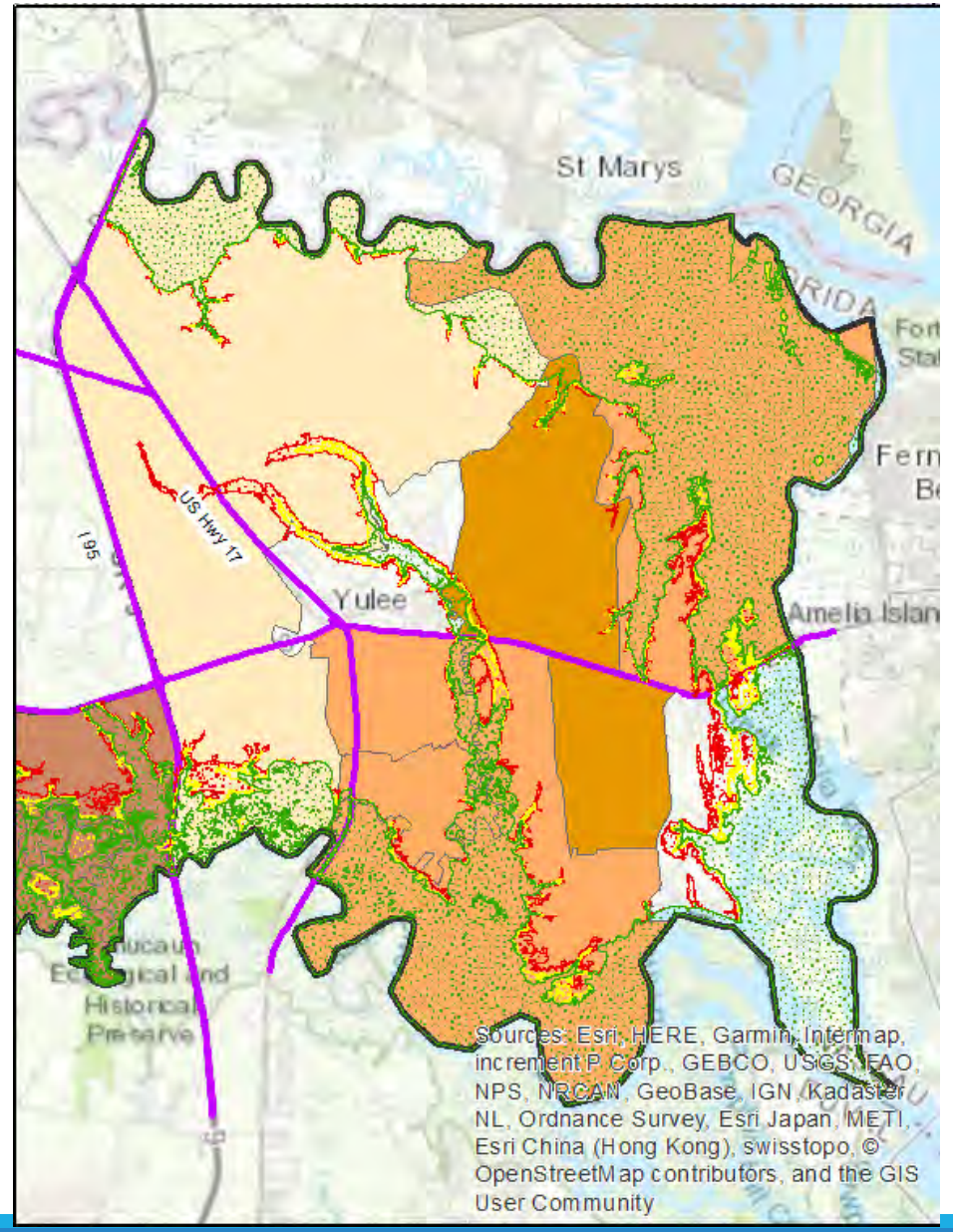


Sources: TBG Work Product; U.S. Census; NOAA

Series 9 Map 3. Percent of Households with Income 200% above Poverty Threshold and Projected Sea Level Rise

Series 9 Map 3 compares the percent of households living on incomes 200 percent above the poverty threshold to sea level rise. Large areas in the East area south of SR 200 and east of the Intracoastal will be impacted even under a 1 ft. sea level rise scenario. The block group with the highest share of households living on incomes 200% above the poverty threshold is in the West study area near I-95. This is the portion of the West study area most impacted by sea level rise.



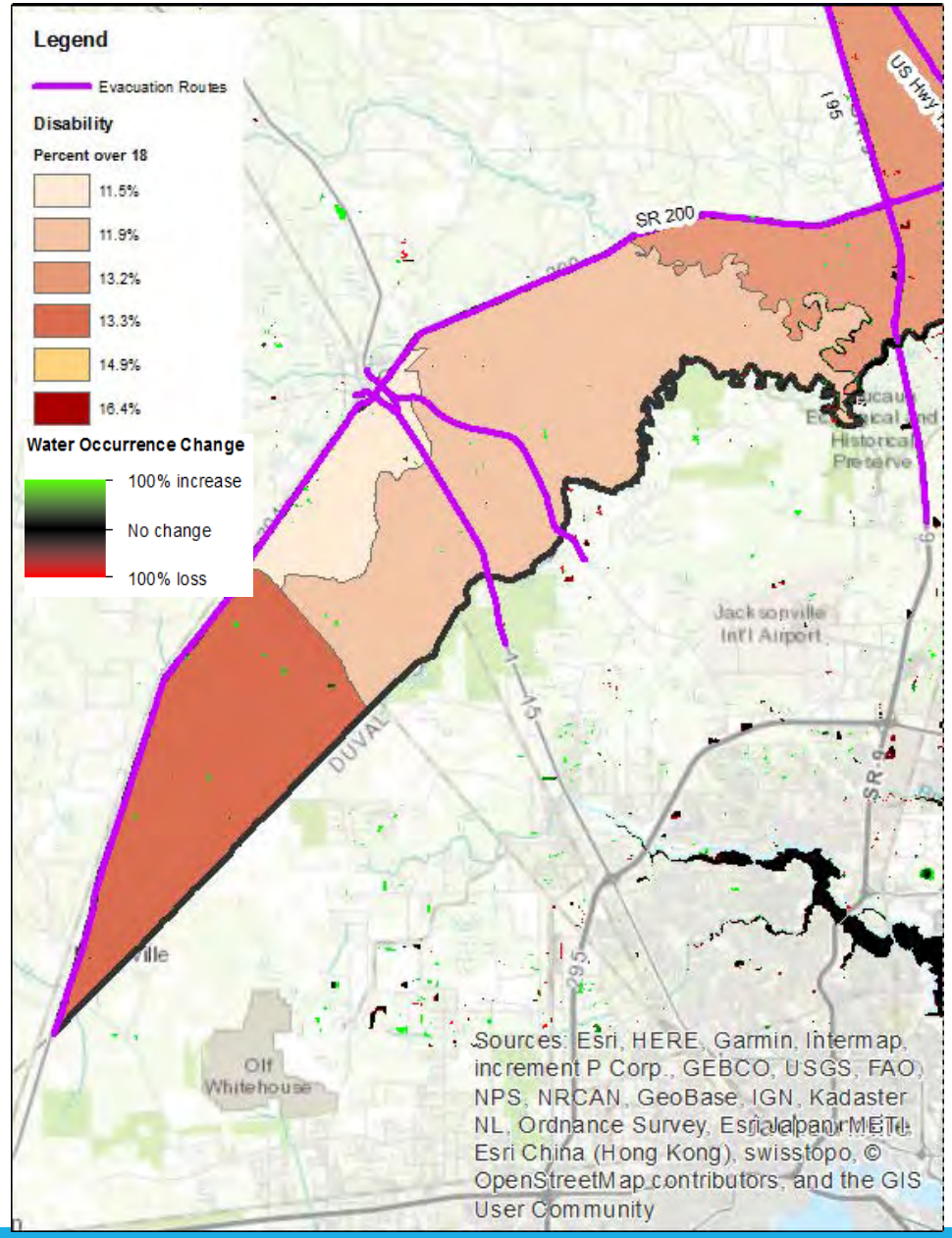


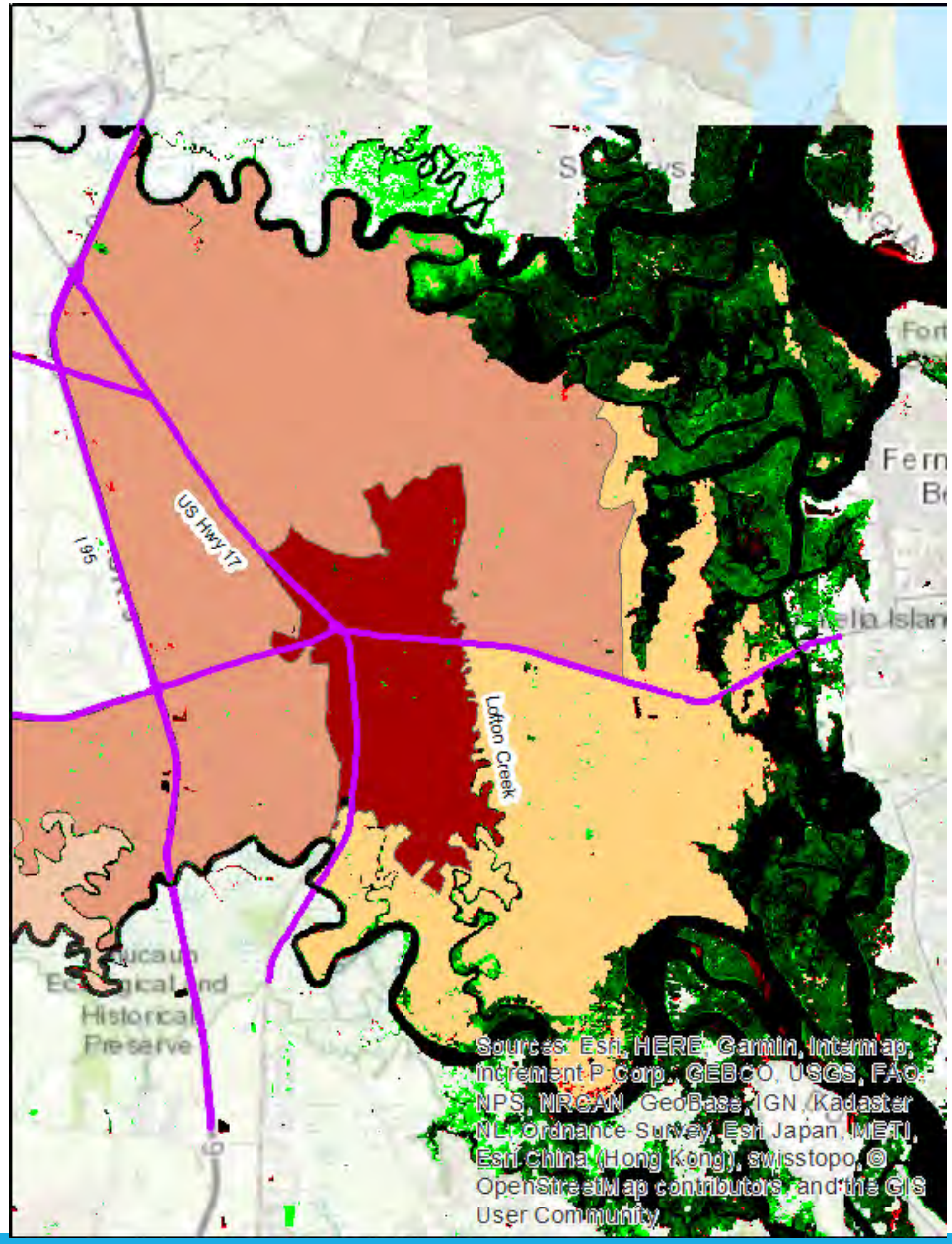
Sources: TBG Work Product; DOR; NOAA

Series 10 Map 1. Percent of Disabled Non-institutionalized Population over 18 and Water Occurrence Change

Non-institutionalized population refers to all U.S. civilians not residing in institutional group quarters facilities such as correctional institutions, juvenile facilities, skilled nursing facilities, and other long-term care living arrangements (U.S. Census Bureau). Series 11 Map 1 shows the percent of non-institutionalized population with a disability over 18 years old.

The highest shares are concentrated in two areas: the first, in the center of the East area (which is where the highest share of elderly population is). Episodic events have increased around the Lofton Creek. However, this population would be mostly impacted by storm surge projections and by sea level rise around the Lofton Creek. The second area with the highest share is in the most inland area within the West area. In this area, episodic events are limited.

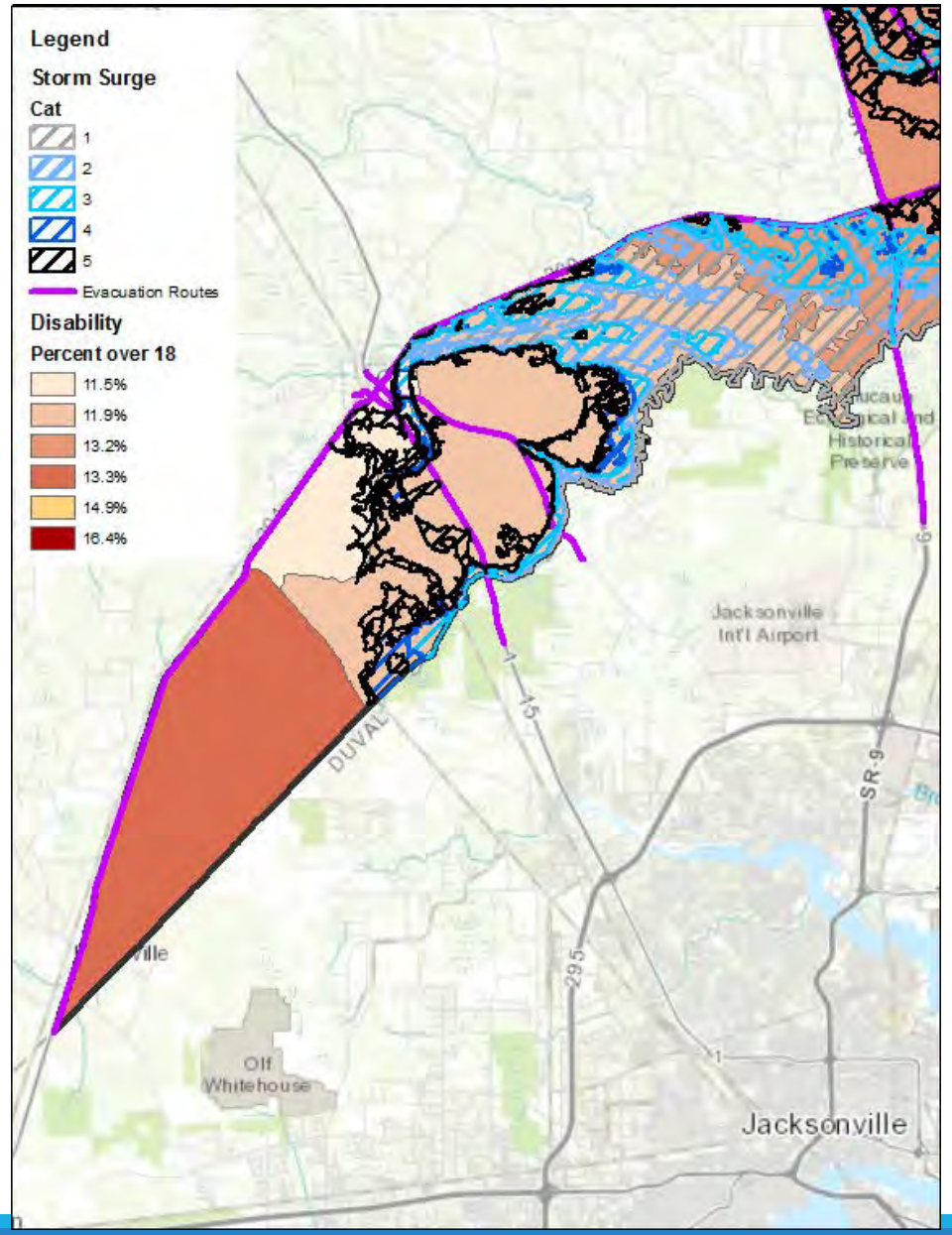


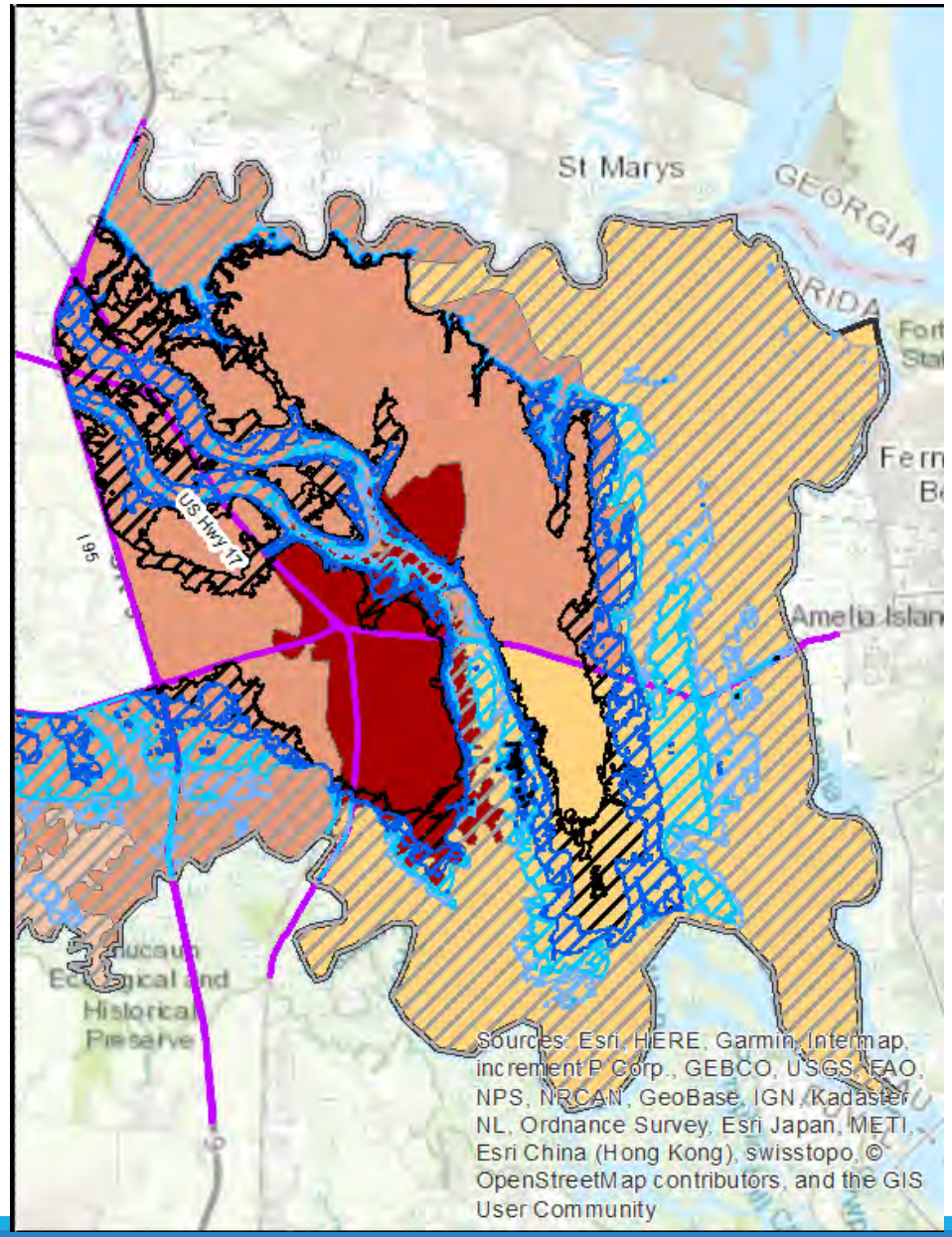


Sources: TBG Work Product; U.S. Census; EC JRC/Google

Series 10 Map 2. Percent of Disabled Non-Institutionalized Population over 18 and Storm Surge

To assess if population with a disability is more exposed to event-driven flooding, the percent of non-institutionalized population with a disability was mapped against storm surge. The most impacted non-institutionalized disabled population by storm surge projections is around the Lofton Creek. Census tract with the highest percentages of this population, in the East area, are impacted even by Category 1 storm surge. In the West area, the Census tract with the highest share of disabled population wouldn't, be affected by storm surge.

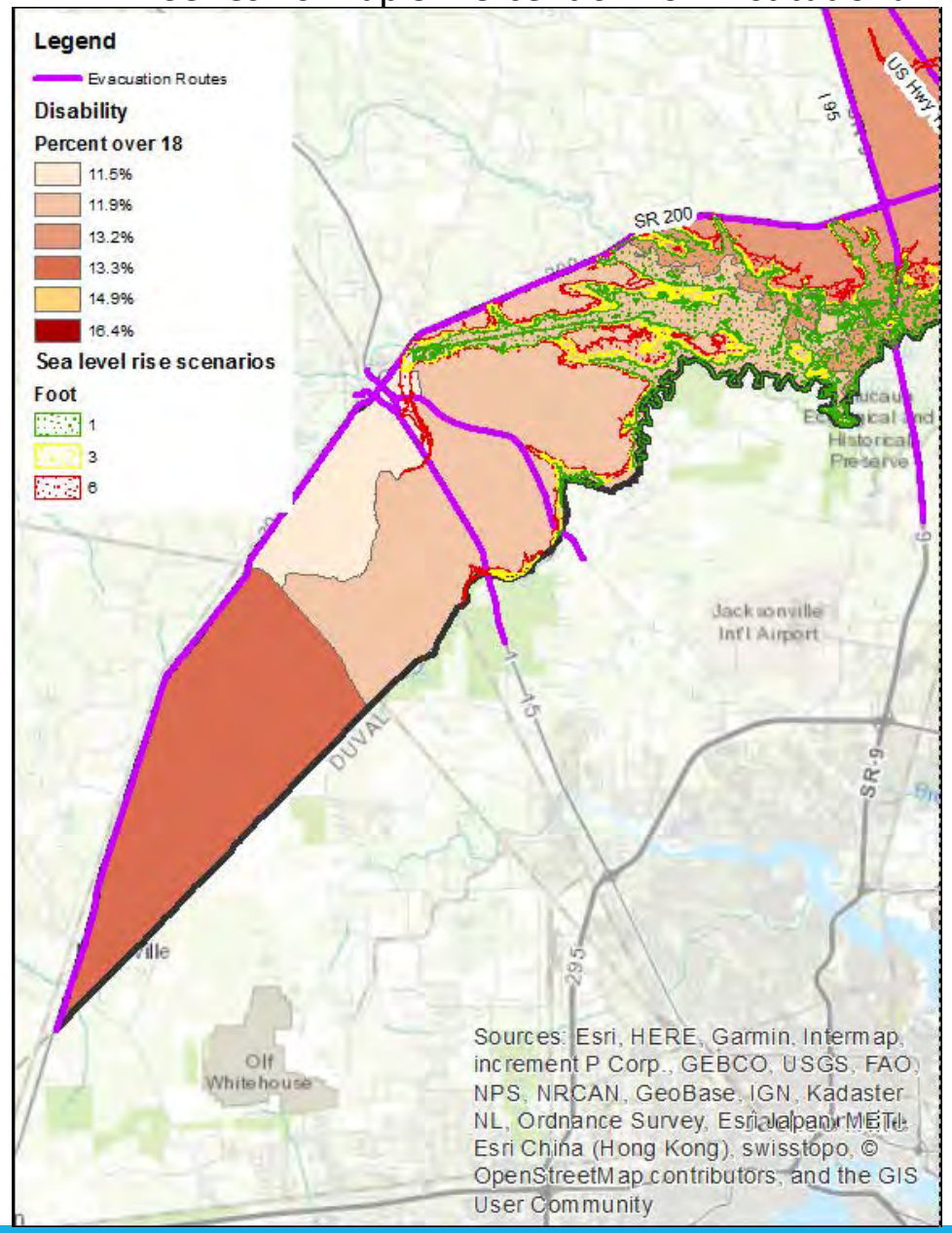


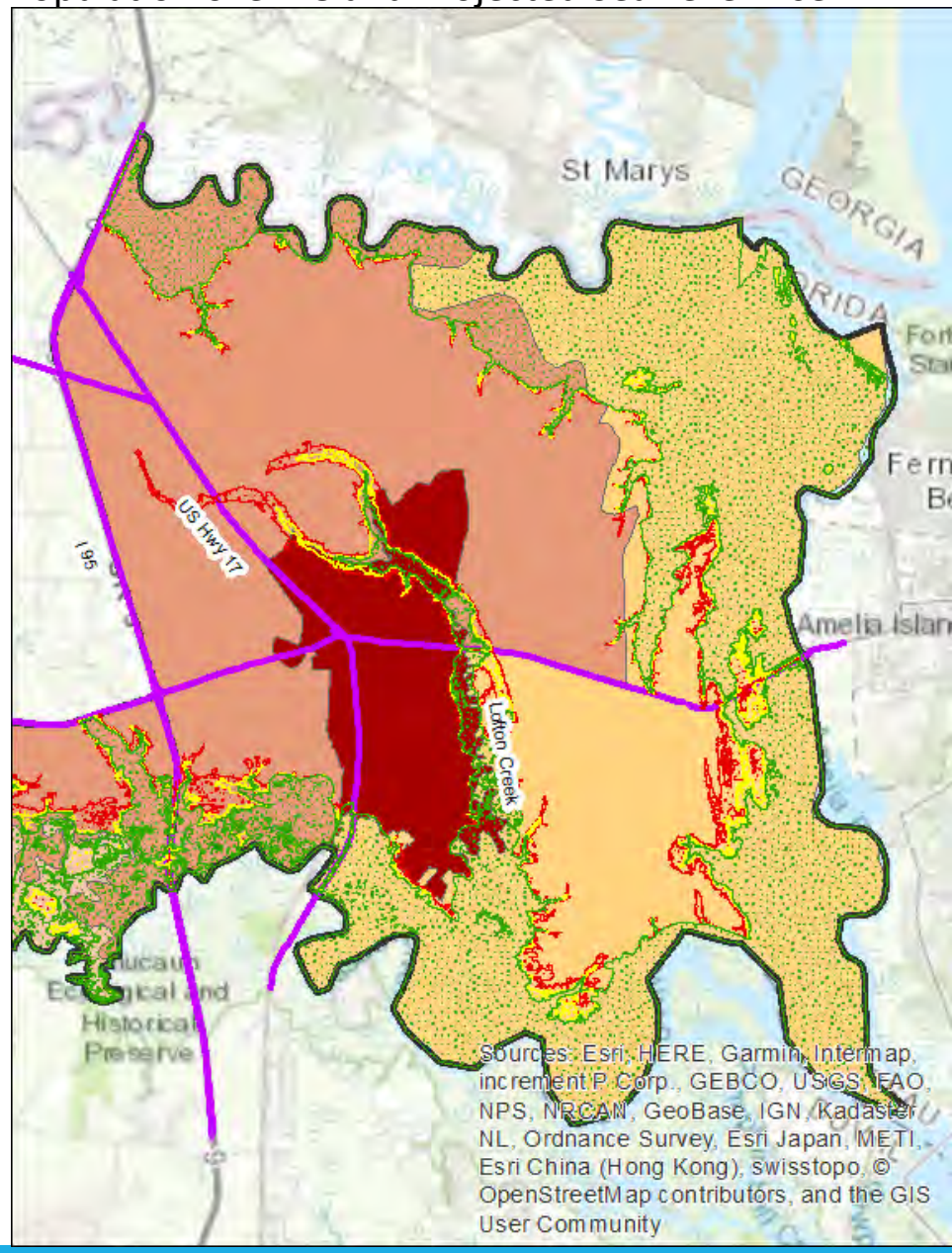


Sources: TBG Work Product; U.S. Census; NOAA

Series 10 Map 3. Percent of Non-Institutionalized Population over 18 and Projected Sea Level Rise

Similarly, to assess exposure of the disabled population to long-term sea level rise, the percent of non-institutionalized population with a disability was mapped against the three sea level rise scenarios. The most impacted disabled population by sea level rise is around the Lofton Creek. Census tracts with the highest percentages of this population, particularly in the East study area are impacted by even a 1 ft. rise.

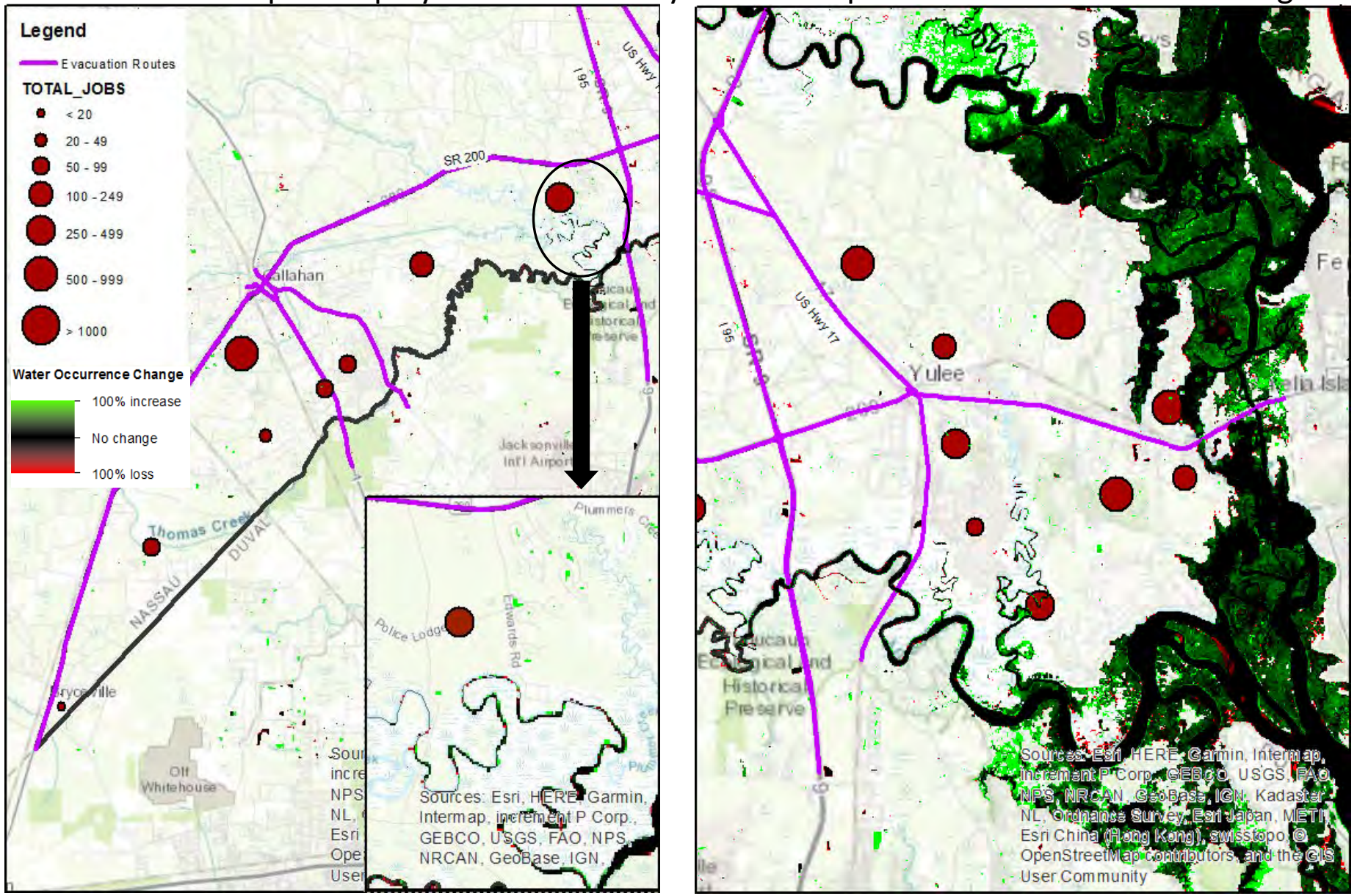




Sources: TBG Work Product; DOR; NOAA

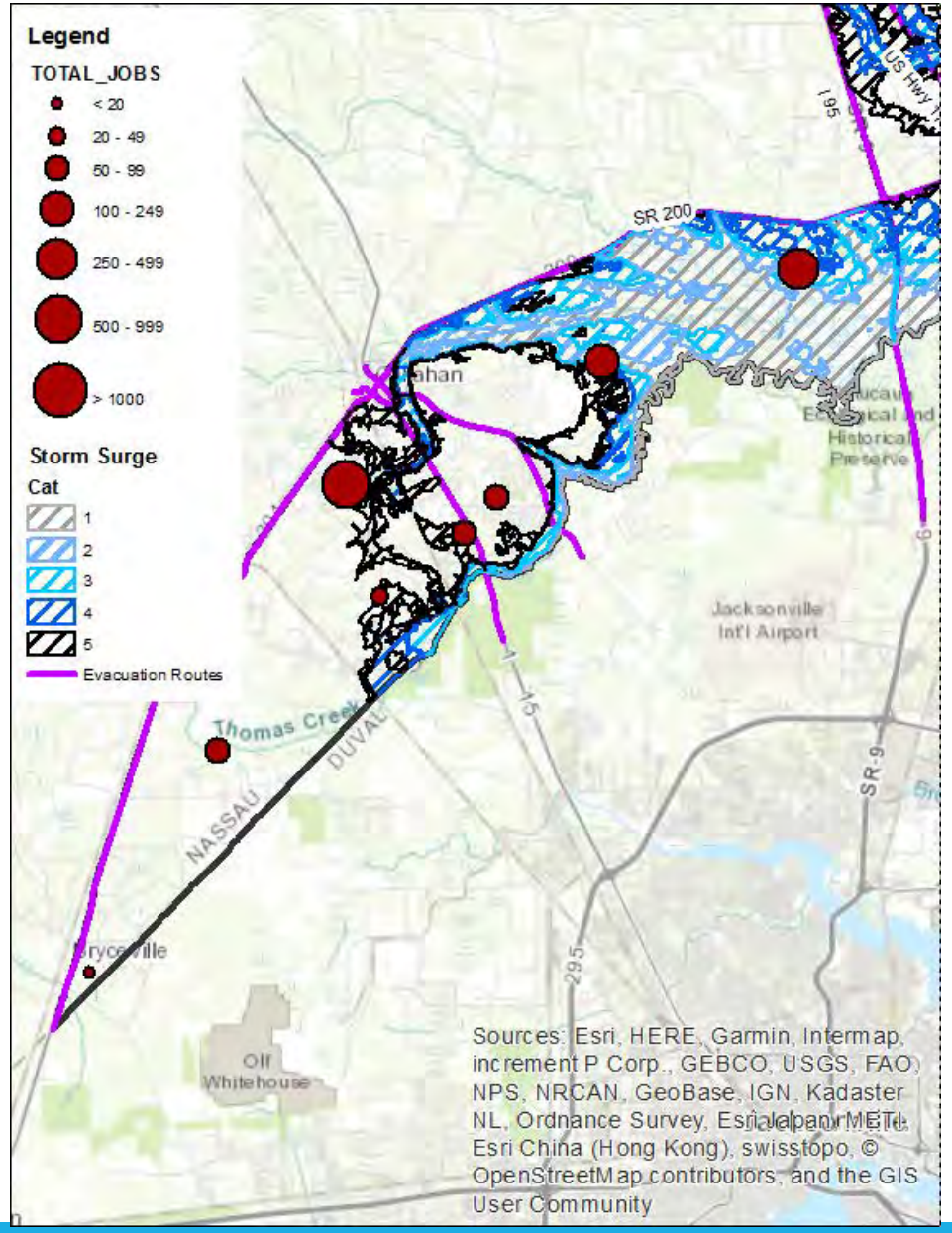
Series 11 Map 1. Employment Location by Block Group and Water Occurrence Change

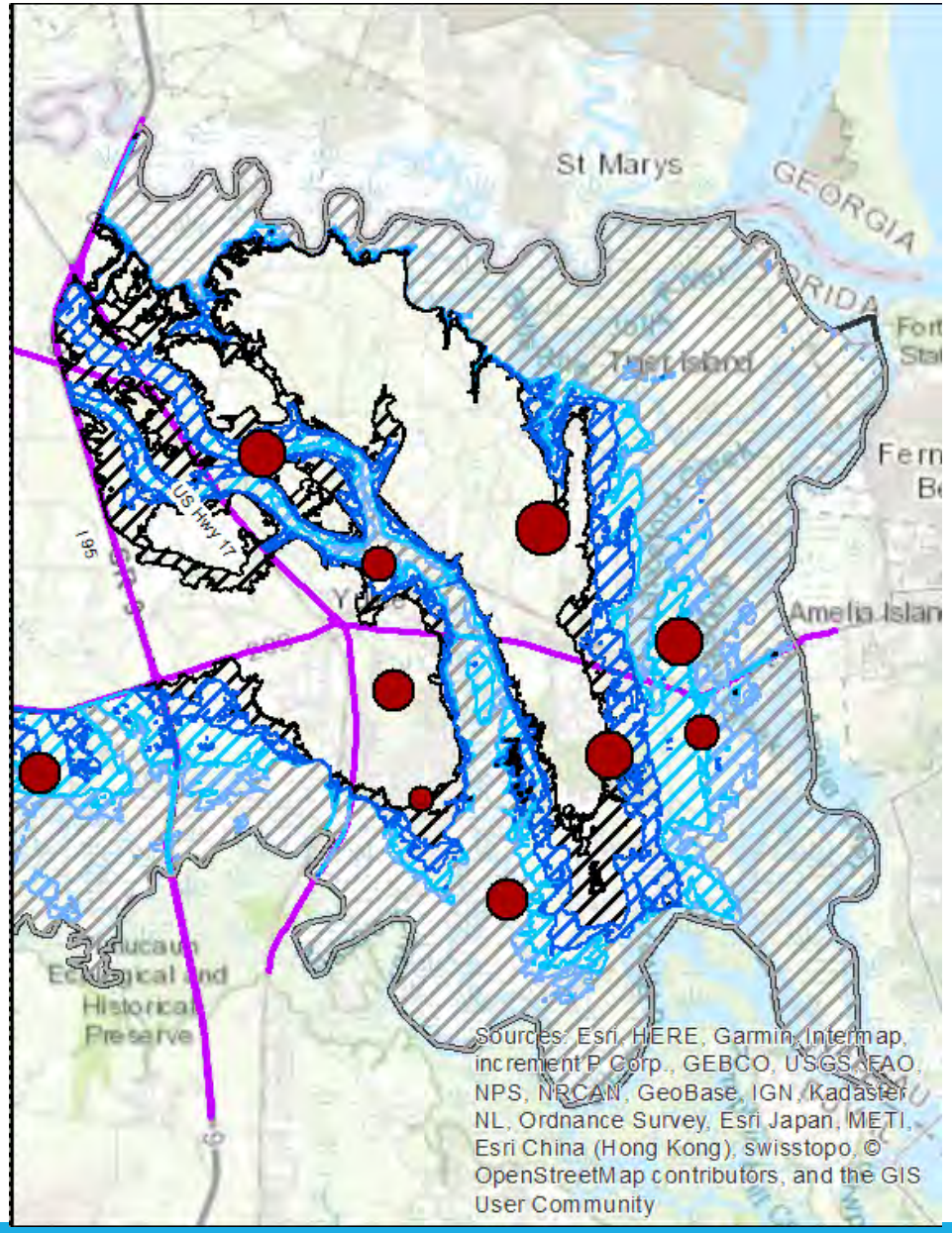
Series 11 illustrates the location of employment by block groups in 2015. These data include location of the workplace, but does not take into account the residences of workers (ie, access to work is not addressed).
The size of the dot depends on the number of reported workers in a block group that is within the study area.
Additionally, the location of the dots in series 11 maps do not necessarily represent where employment is concentrated within that particular block group.
Within both study areas, the employment centers that have been impacted by episodic events are those closest to the Intracoastal Waterway.



Series 11 Map 2. Employment Location by Block Group and Storm Surge

In contrast, Series 11 Map 2 evaluates how employment would be affected by storm surge. In the East area, the largest employment is in block groups north of SR 200, where some sections of the East Nassau County Community Planning Area (ENCPA) would be. These would see limited impacts of a Category 1 storm surge. Affected areas increase with higher storm surge projections. In the West area, the largest employment is found near Callahan, which wouldn't have many impacts until a Category 3 storm surge.

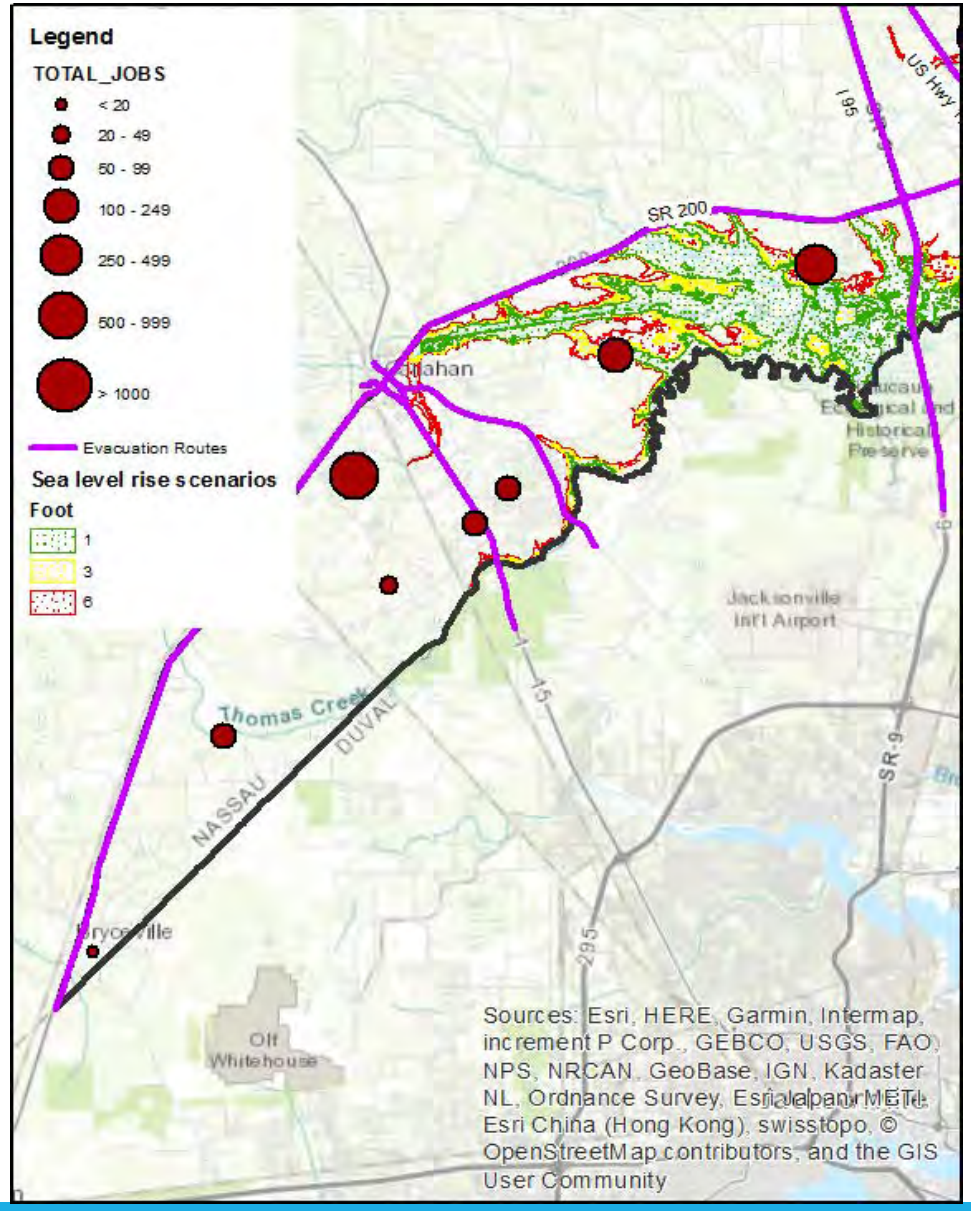


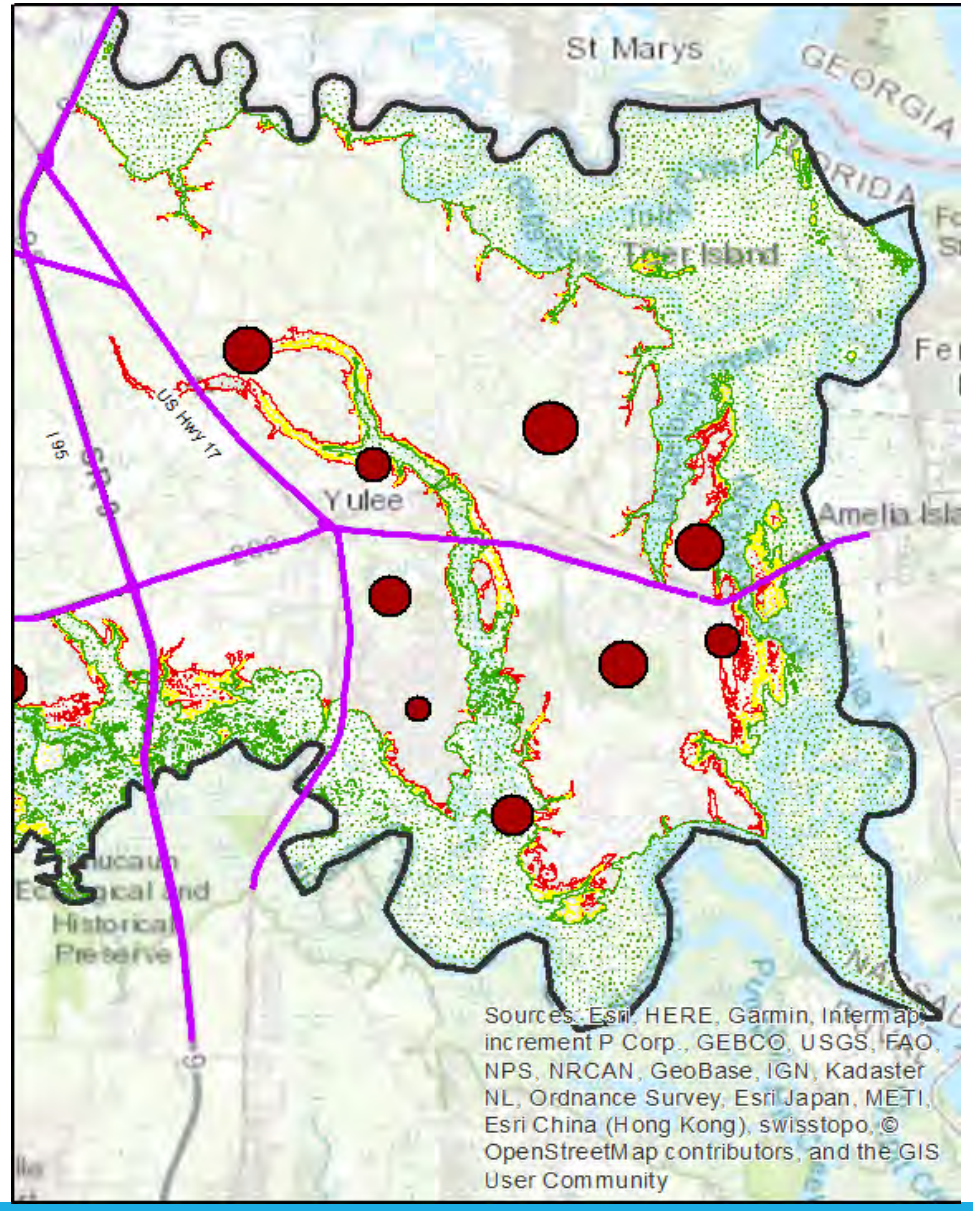


Sources: TBG Work Product; U.S. Census; NOAA

Series 11 Map 3. Employment Location by Block Group and Projected Sea Level Rise

Similarly, Series 11 Map 3 illustrates the location of employment with respect to sea level rise. Affected areas include block groups just west of I-95 and in the eastern parts of the East area north and south of SR 200. In the West area, the largest employment is near Callahan, where there is minimal sea level rise.



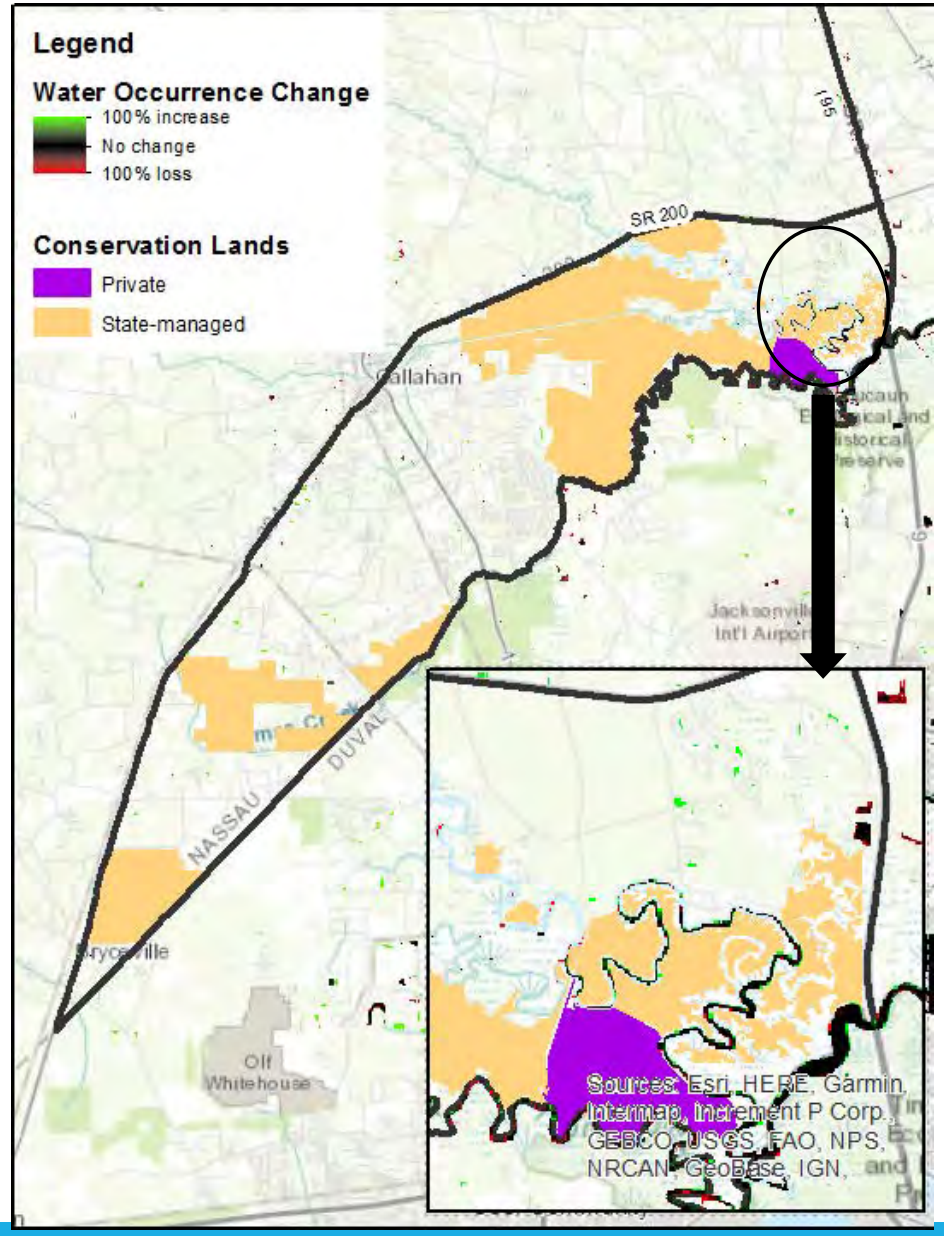


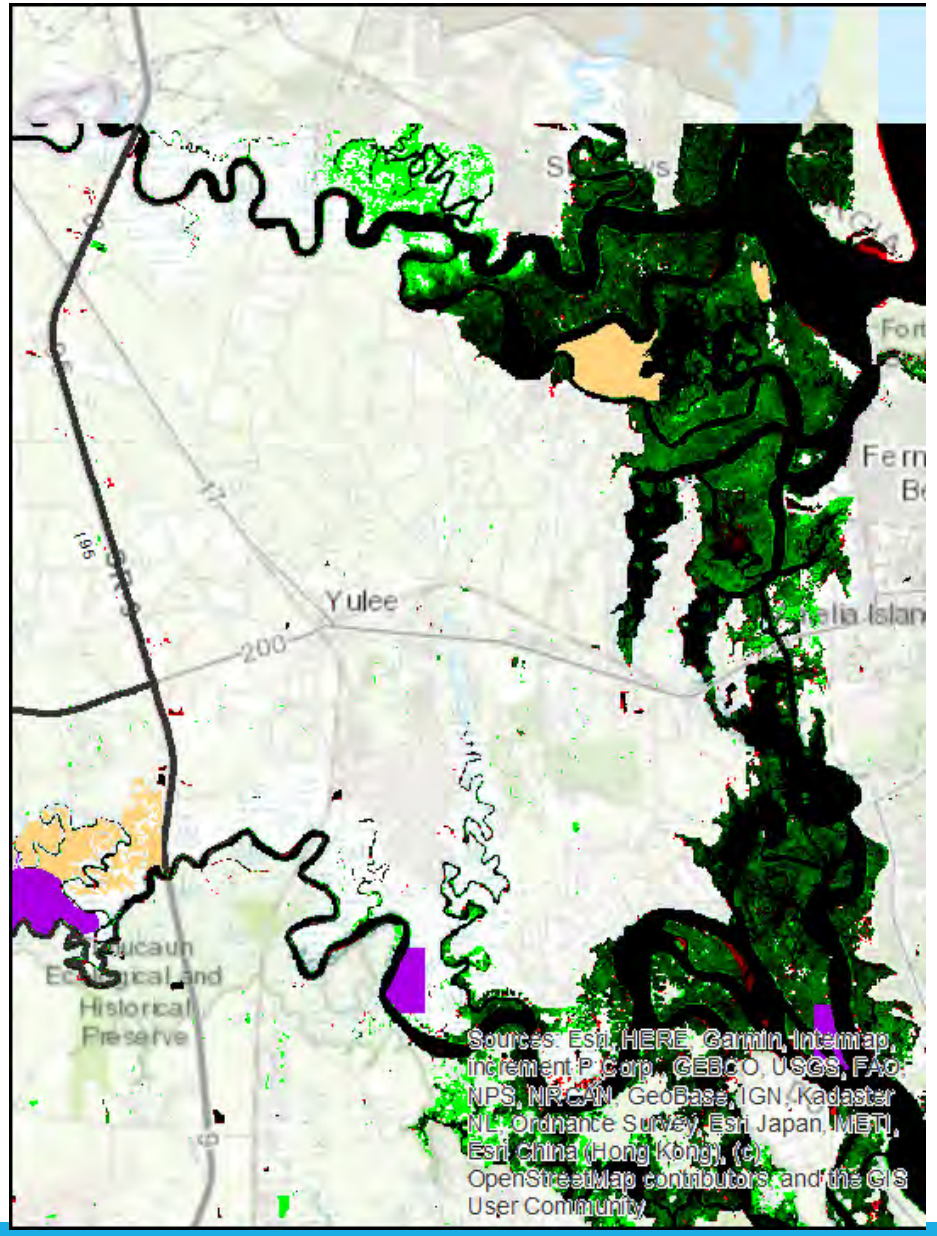
Sources: TBG Work Product; DOR; NEFRC; NOAA

Series 12 Map 1. Conservation Lands and Water Occurrence Change

The Florida Natural Areas Inventory (FNAI) has areas managed by federal, state, local and private agencies for conservation. Within the East and West areas there are approximately 32,000 and 3,000 acres that are managed by state and private agencies, respectively. Series 12 Map 1 shows existing state and privately managed conservation lands in the context of increased water frequency.

Additionally, according to data from FNAI and the Natural Resources Conservation Service (NRCS), there are no conservation easements within the study area.

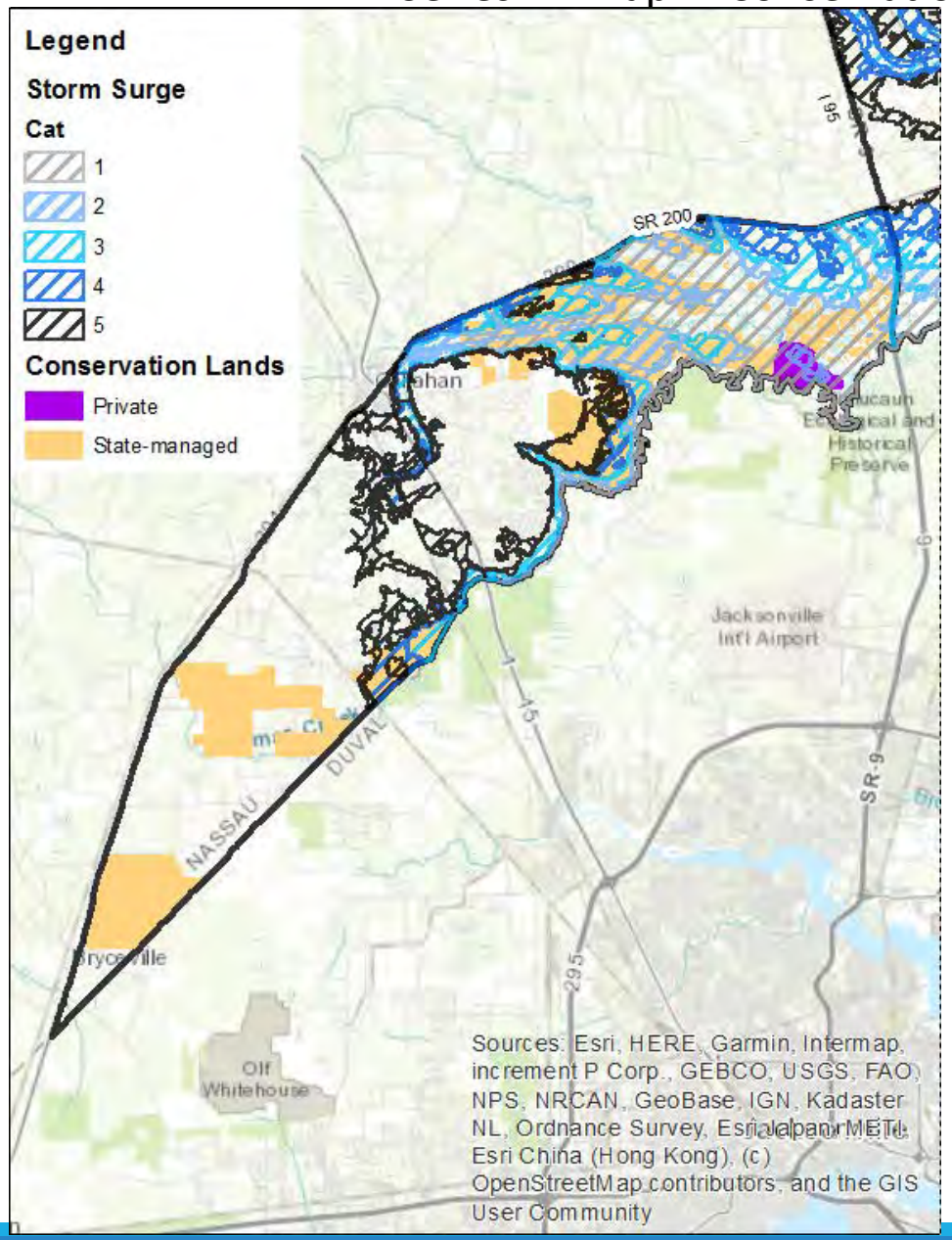


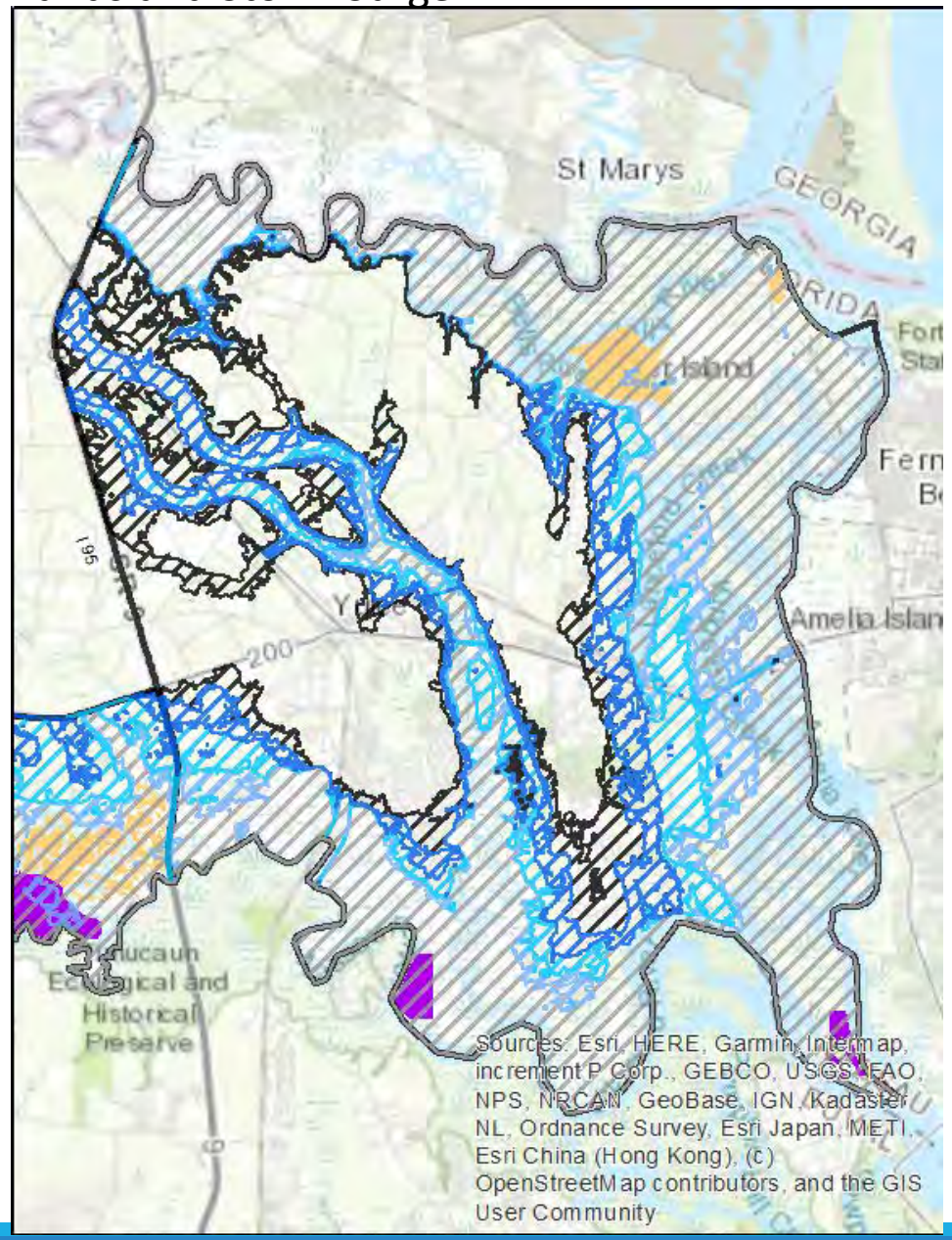


Sources: TBG Work Product; FNAI; EC JRC/Google

Series 12 Map 2. Conservation Lands and Storm Surge

Series 12 Map 2 shows existing conservation lands in the context of storm surge zones. More than 60% of the conservation lands overlap with potential storm surges. The majority of this overlap is in the West study area (East of Callahan and south of SR 200), but there is additional overlap in the East study area in Tiger Island and in the surroundings of St. Marys River.

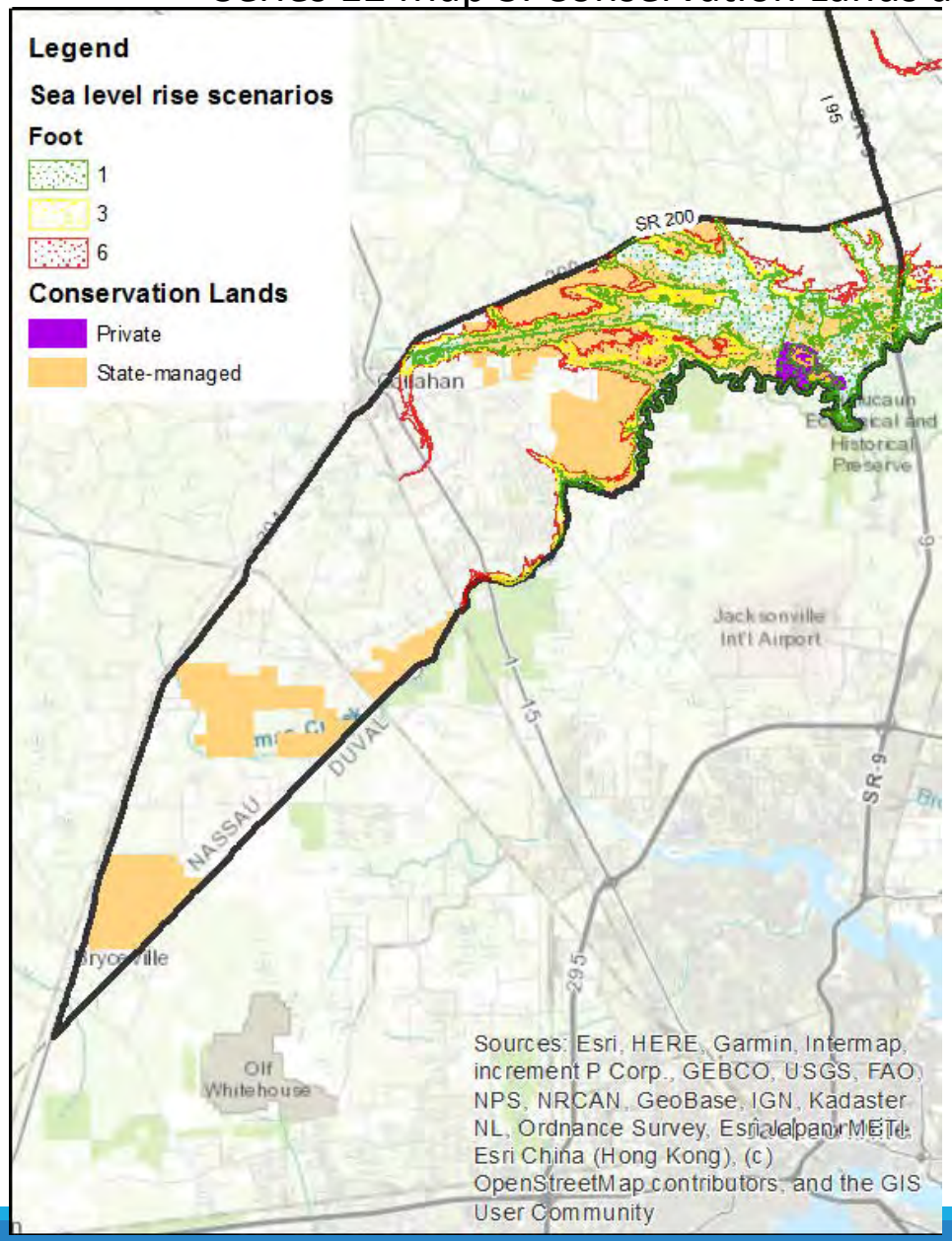


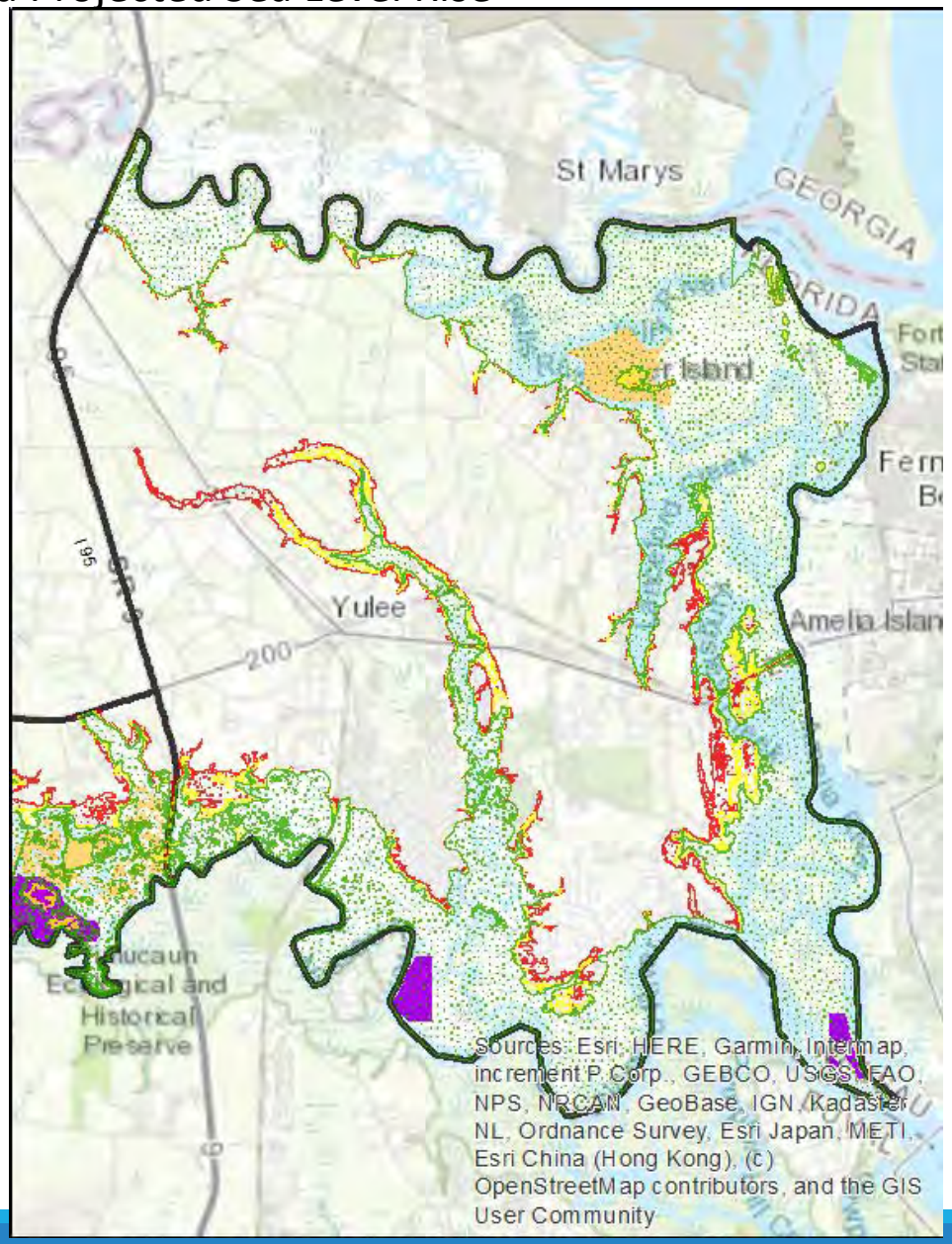


Sources: TBG Work Product; FNAI; NOAA

Series 12 Map 3. Conservation Lands and Projected Sea Level Rise

Series 12 Map 3 shows existing conservation lands in the context of projected sea level rise. In the West, near the intersection of SR200 and I95, and in the East, near Tiger Island, there is substantial overlap with the minimal sea level rise projections.

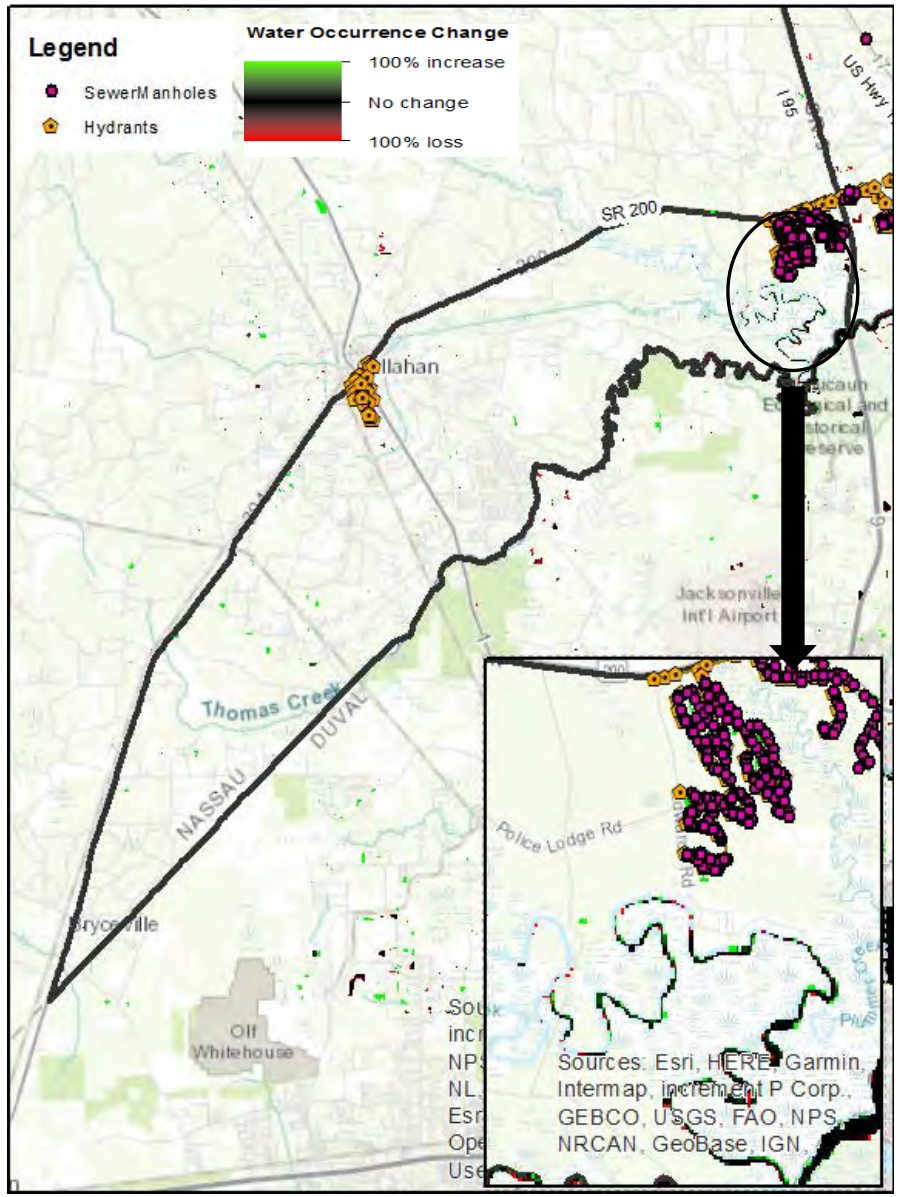


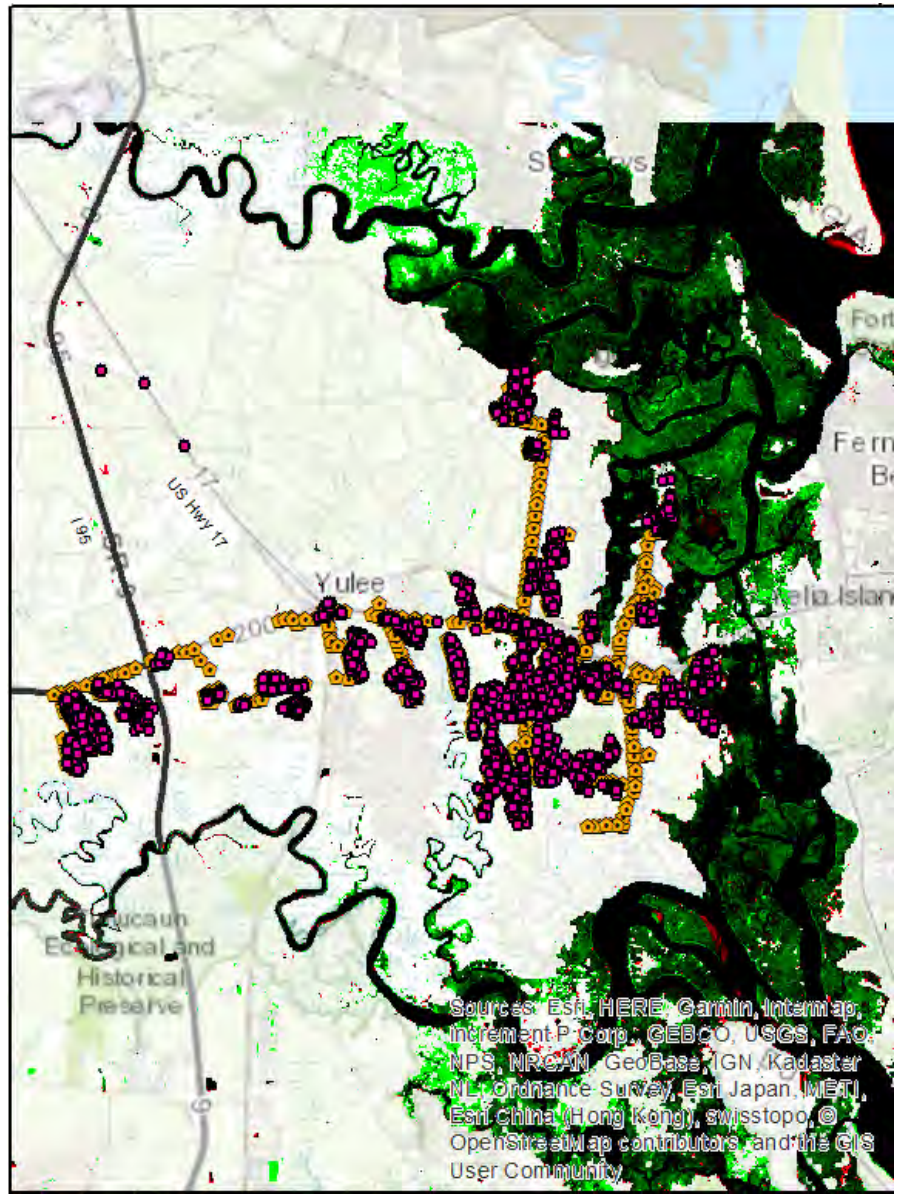


Sources: TBG Work Product; FNAI; NOAA

Series 13 Map 1. Critical Infrastructure: Hydrants and Sewer Manholes and Water Occurrence Change

Series 13 Map 1 is an initial assessment of the County's critical infrastructure as it shows existing hydrants and sewer manholes in the context of water frequency changes. Most structures are around the center of the East study area, where there haven't been issues with increased water occurrence. There is no overlap between hydrants in the West study area and increased water occurrence.

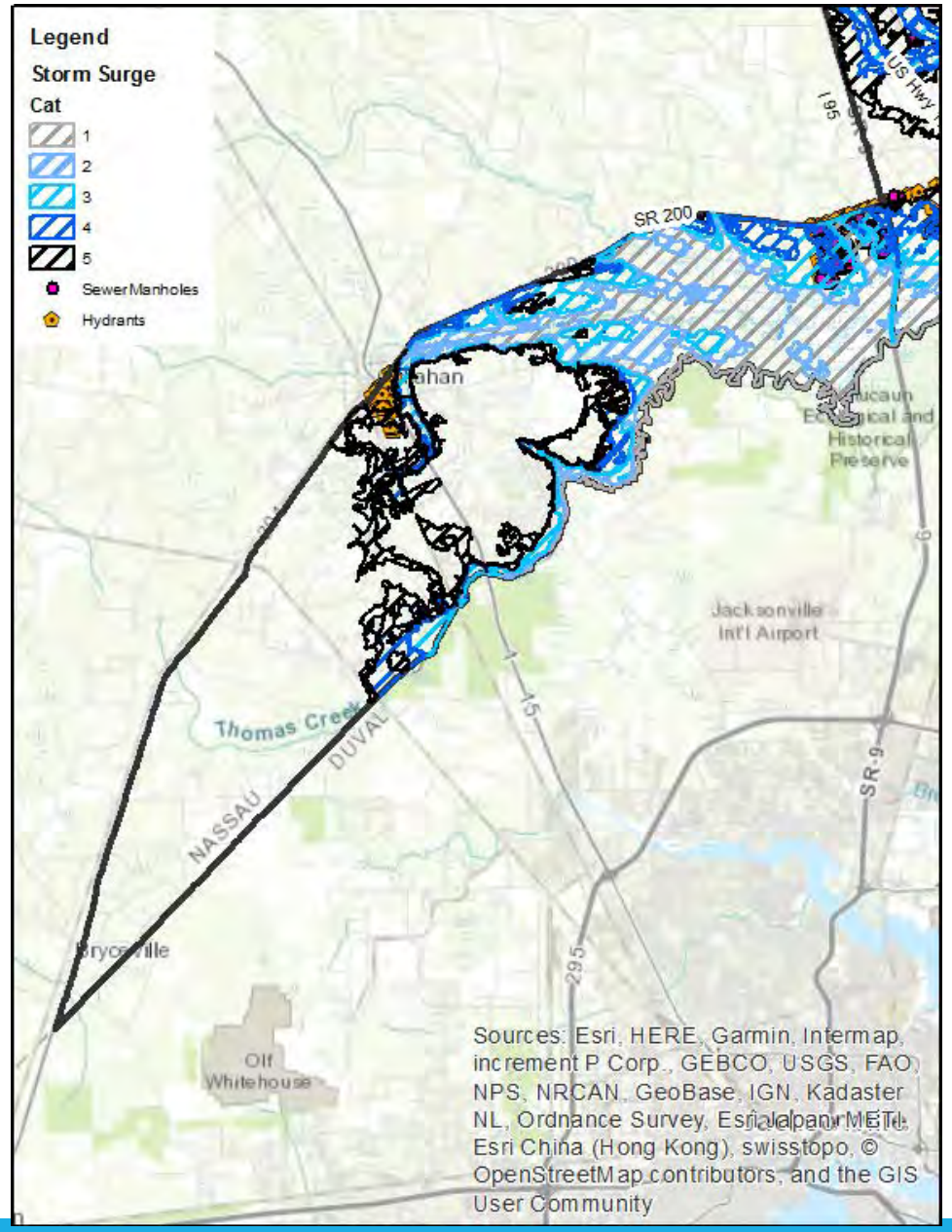


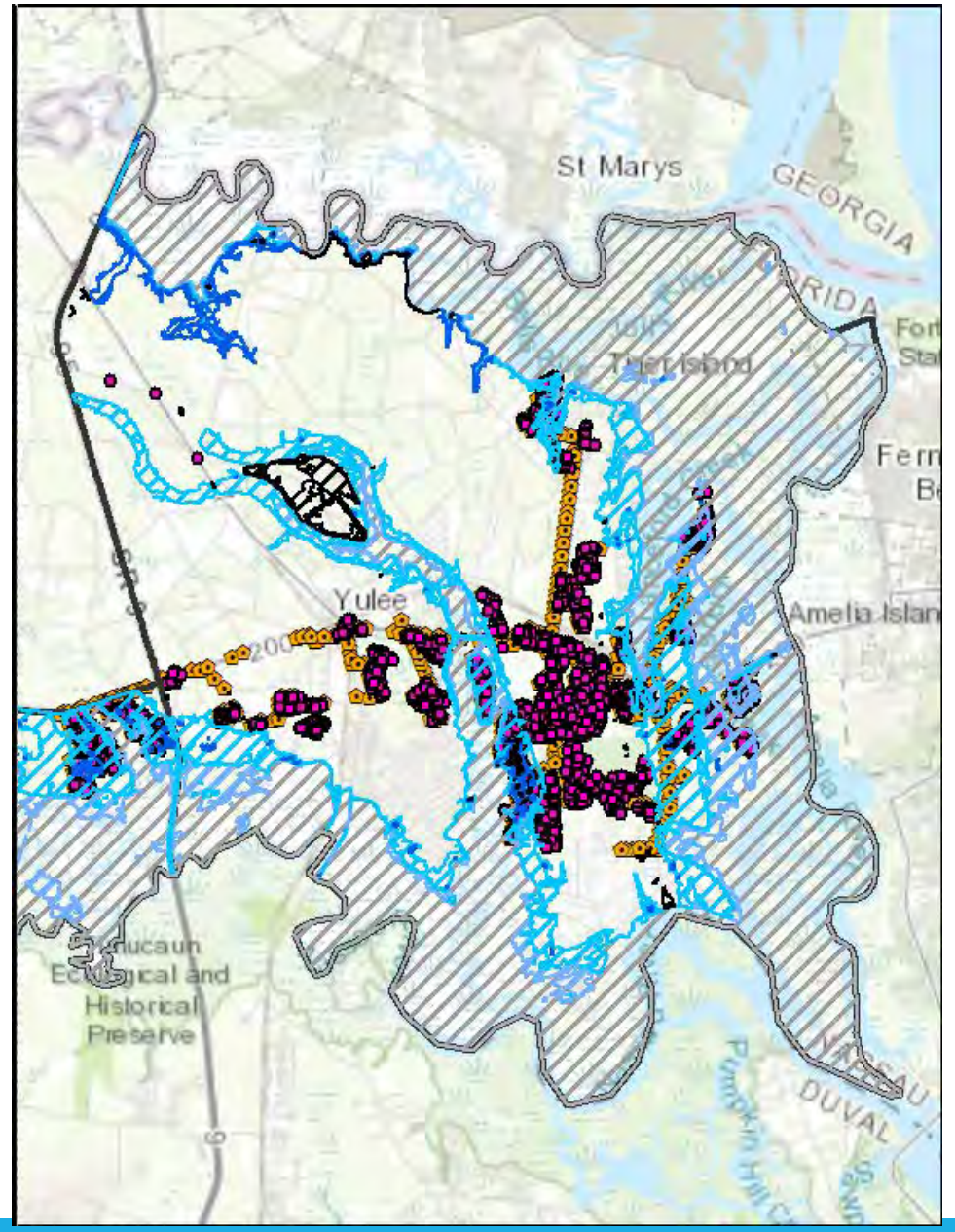


Sources: TBG Work Product; Nassau County Engineering; EC JRC/Google

Series 13 Map 2. Critical Infrastructure: Hydrants and Sewer Manholes and Storm Surge

Series 13 Map 2 shows existing hydrants and manholes in the context of storm surge zones. In the East study area, there is substantial overlap between sewerage manholes and areas likely to be inundated in Category 1 or Category 2 storms. In the West study area, the overlap between hydrants and storm surge would mostly be under a Category 5 storm surge.

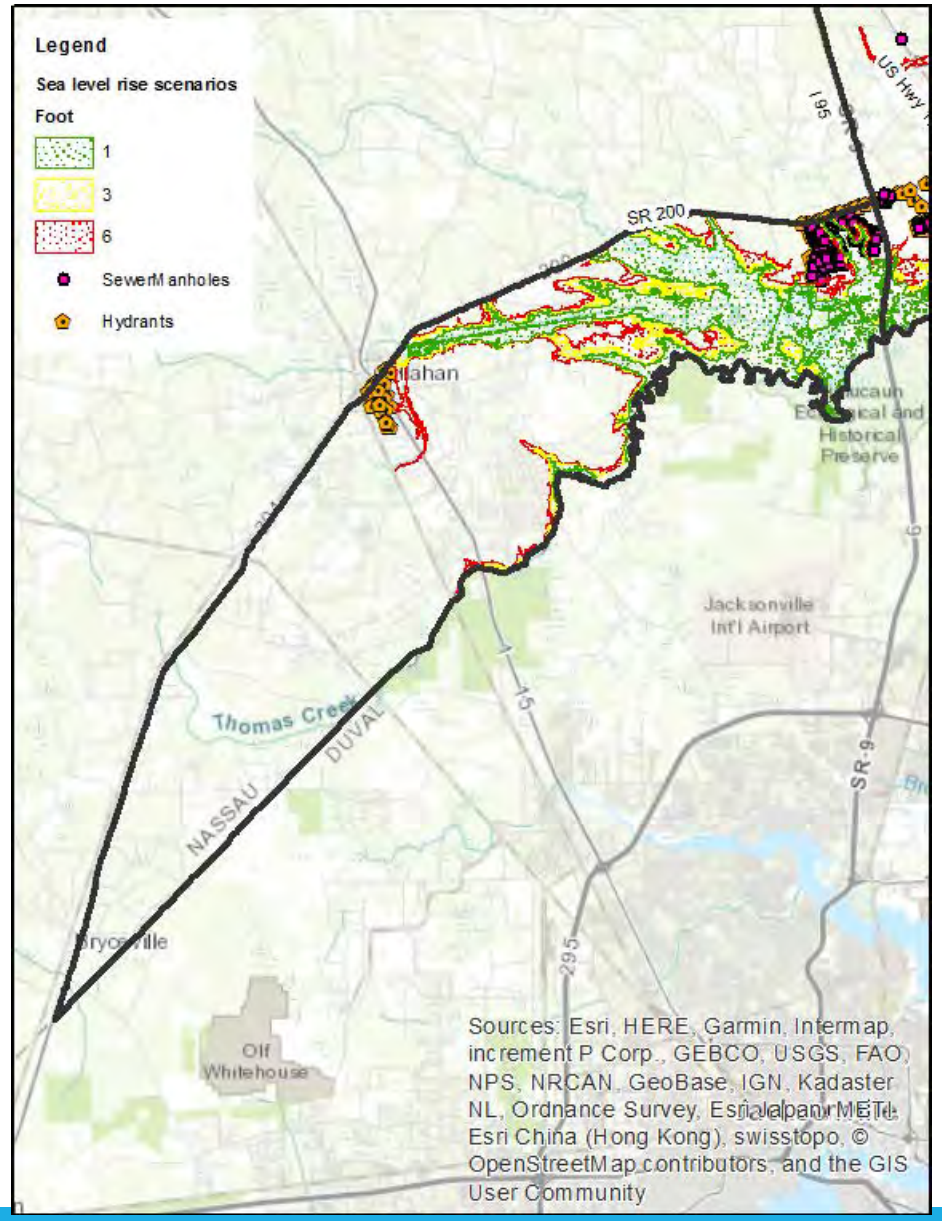


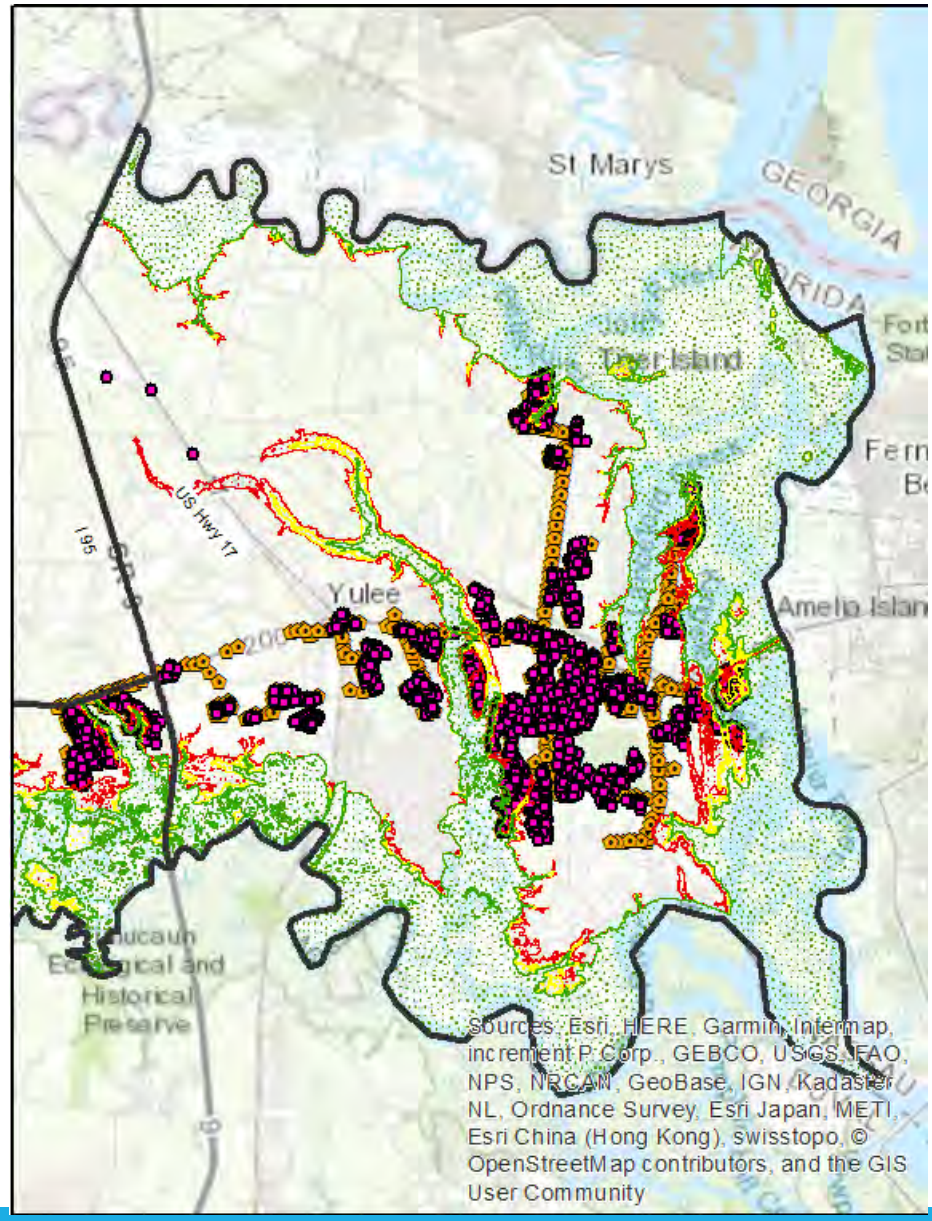


Sources: TBG Work Product; Nassau County Engineering; NOAA

Series 13 Map 3. Critical Infrastructure: Hydrants and Sewer Manholes and Sea Level Rise

Series 13 Map 3 shows existing hydrants and manholes in the context of sea level rise. Relative to other risks, there is less overlap in both study areas between sewerage manholes or hydrants and areas likely to be inundated in sea level rise scenarios.



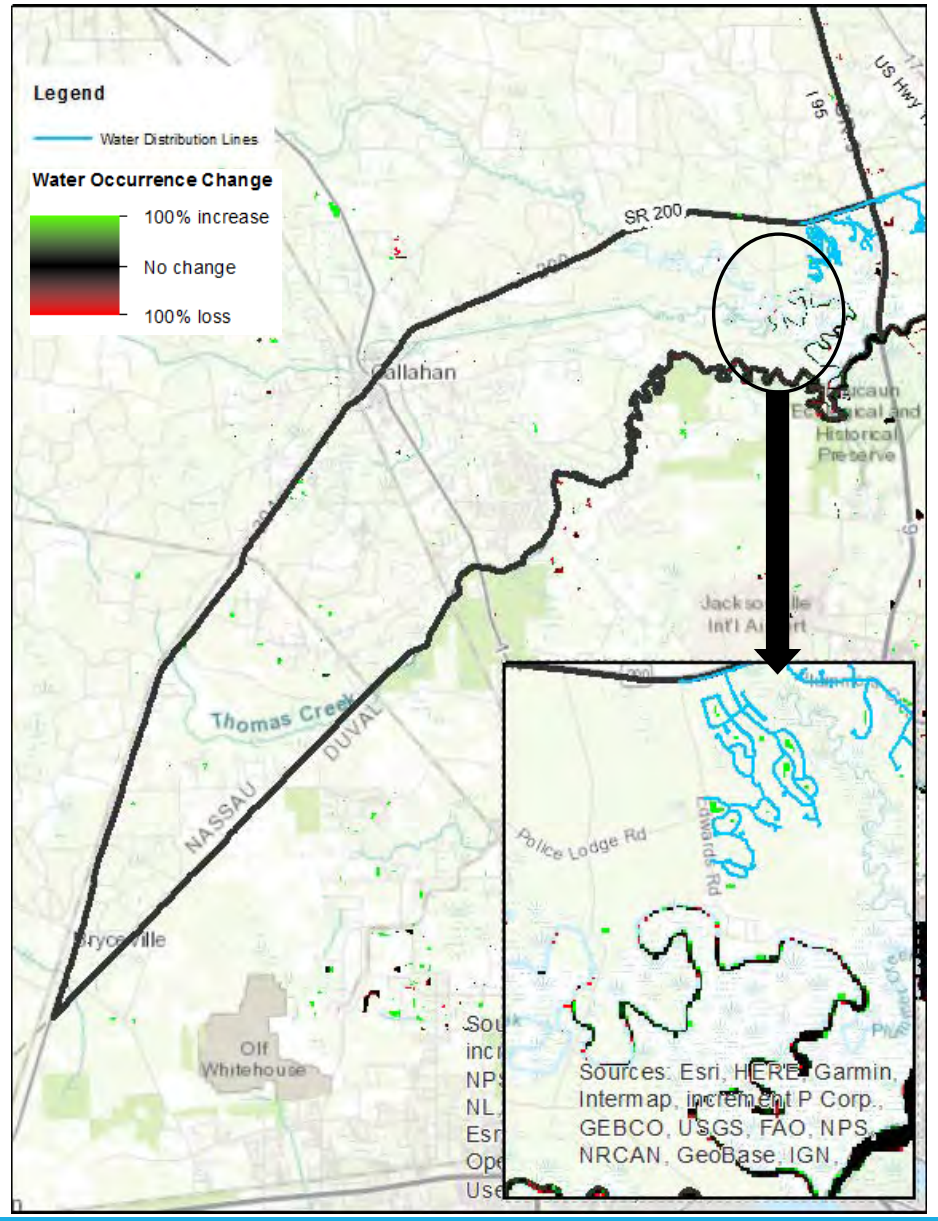


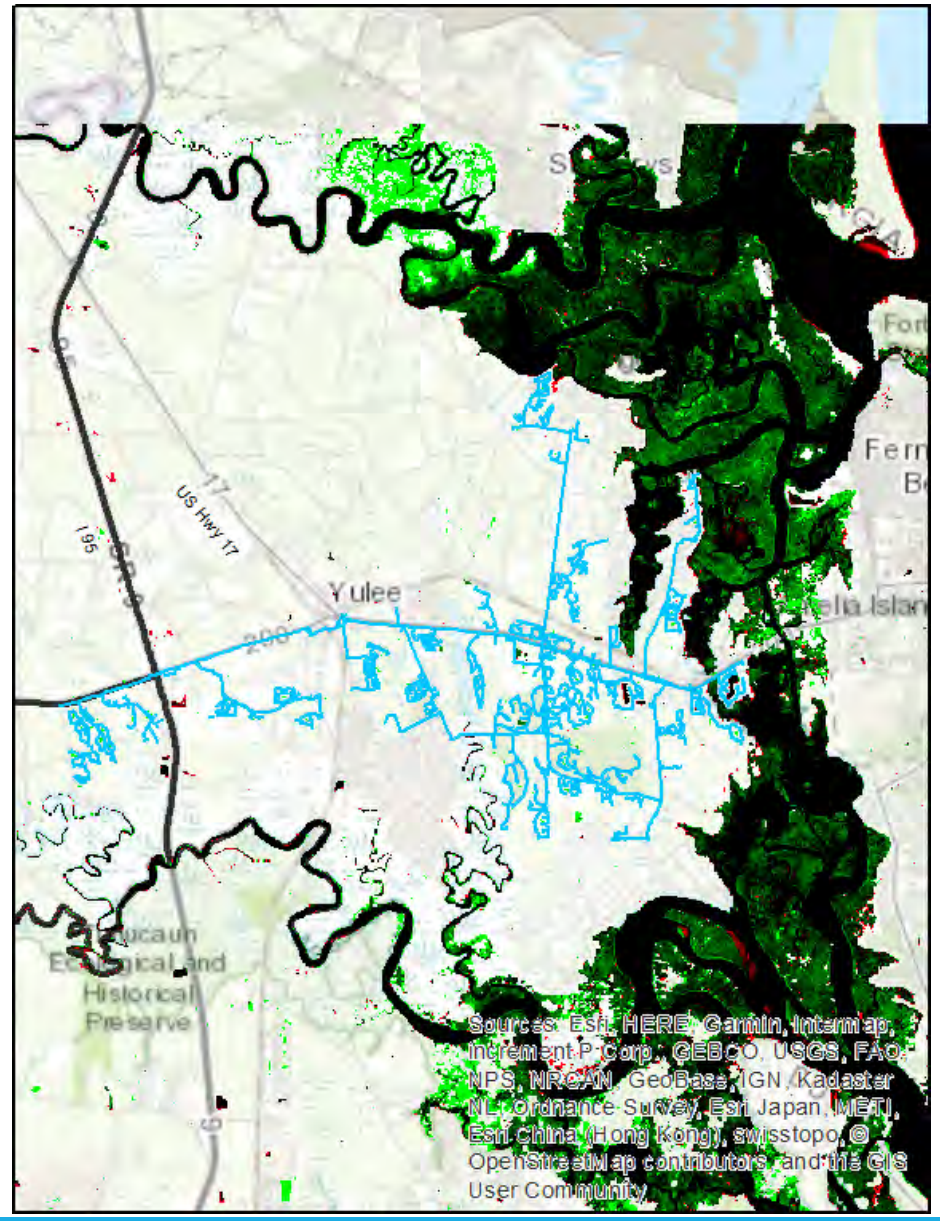
Sources: TBG Work Product; Nassau County Engineering; NOAA

Series 14 Map 1. Critical Infrastructure: Water Distribution Lines and Water Occurrence Change

Water distribution pipelines are an additional portion of the County's critical infrastructure. Series 14 Map 1 shows water distribution pipelines in the context of water frequency, with limited overlap in both study areas.

Additionally, there are ongoing efforts by JEA to complete a vulnerability assessment of all their facilities and systems to sea level rise, rainfall and storm surge events. This should provide additional insight on how exposed this study area is to current and future flooding events.

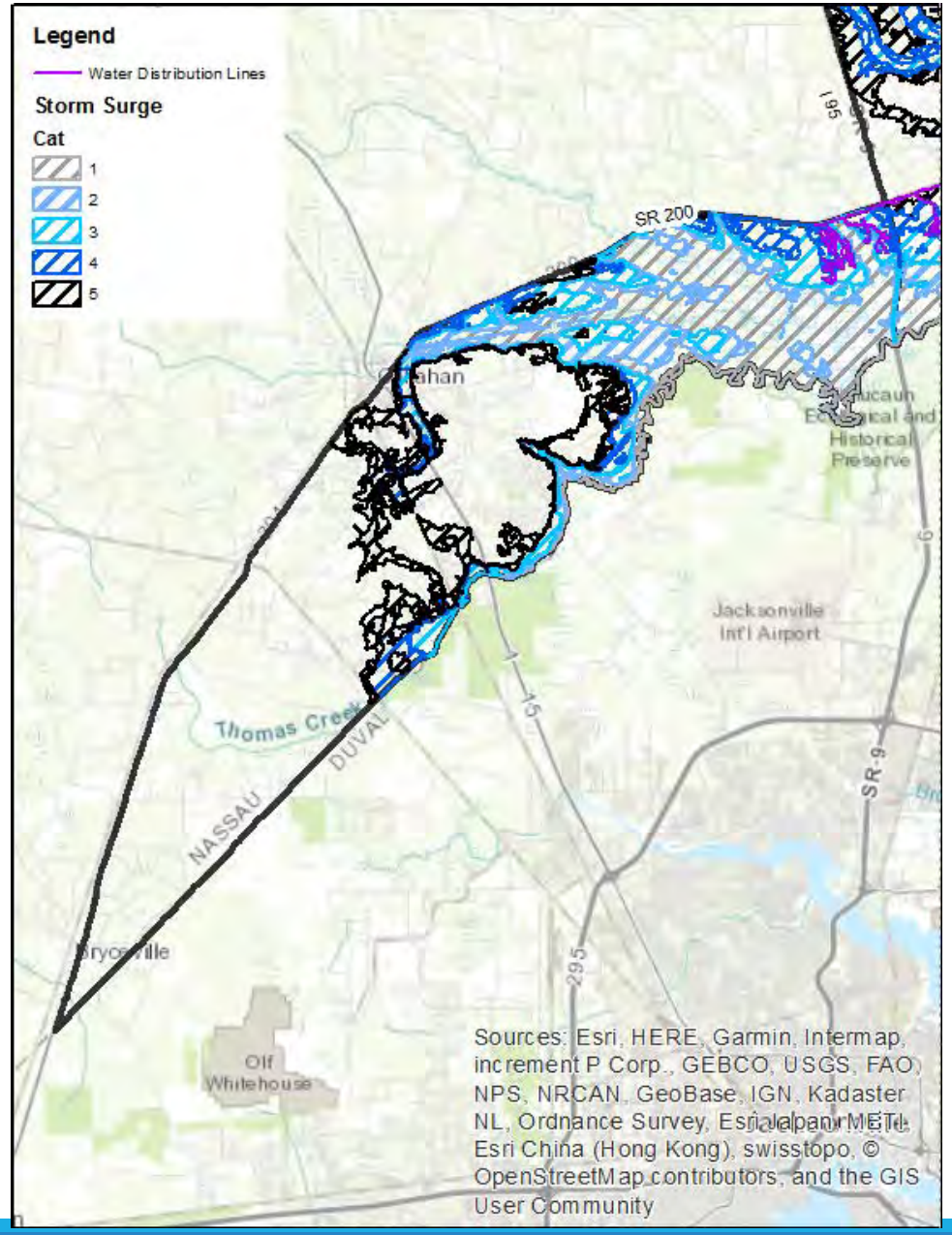


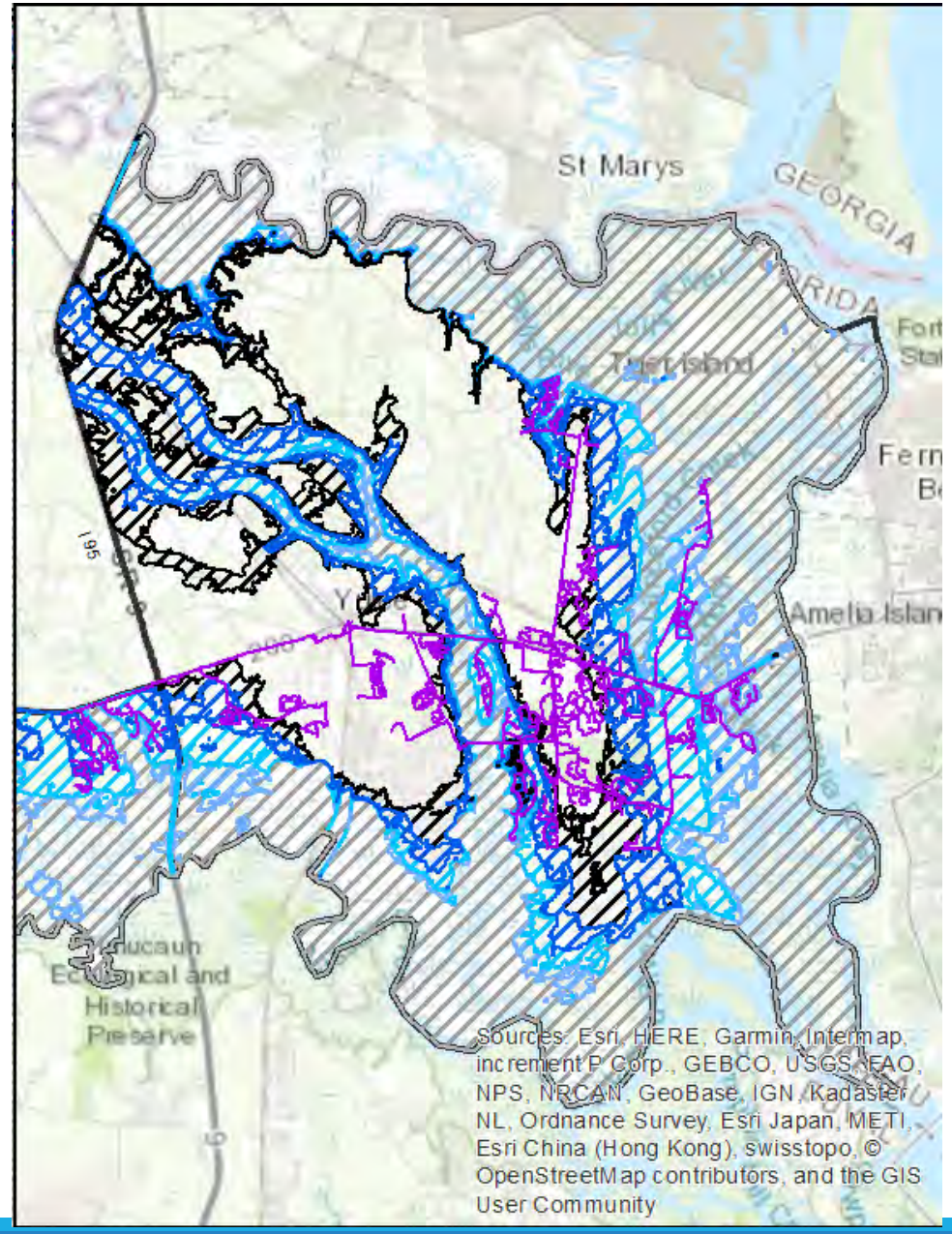


Sources: TBG Work Product; Nassau County Engineering; EC JRC/Google

Series 14 Map 2. Critical Infrastructure: Water Distribution Lines and Storm Surge

Series 14 Map 2 shows exposure of water distribution pipelines to event-driven flooding (storm surge), with reasonable overlap during Category 1 and Category 2 storms in the East study area. In the West study area, there is overlap during a Category 3 storm near the intersection of SR 200 and I-95.

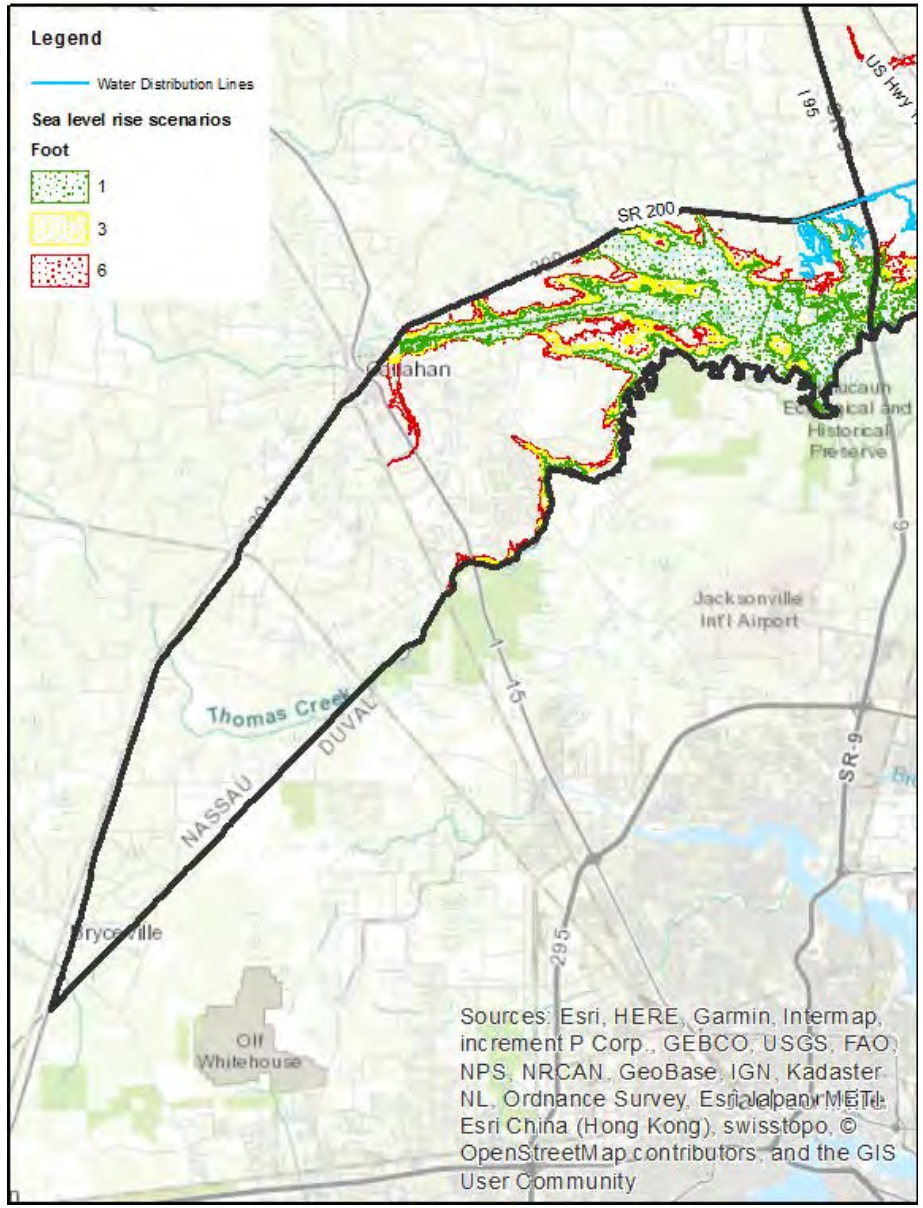


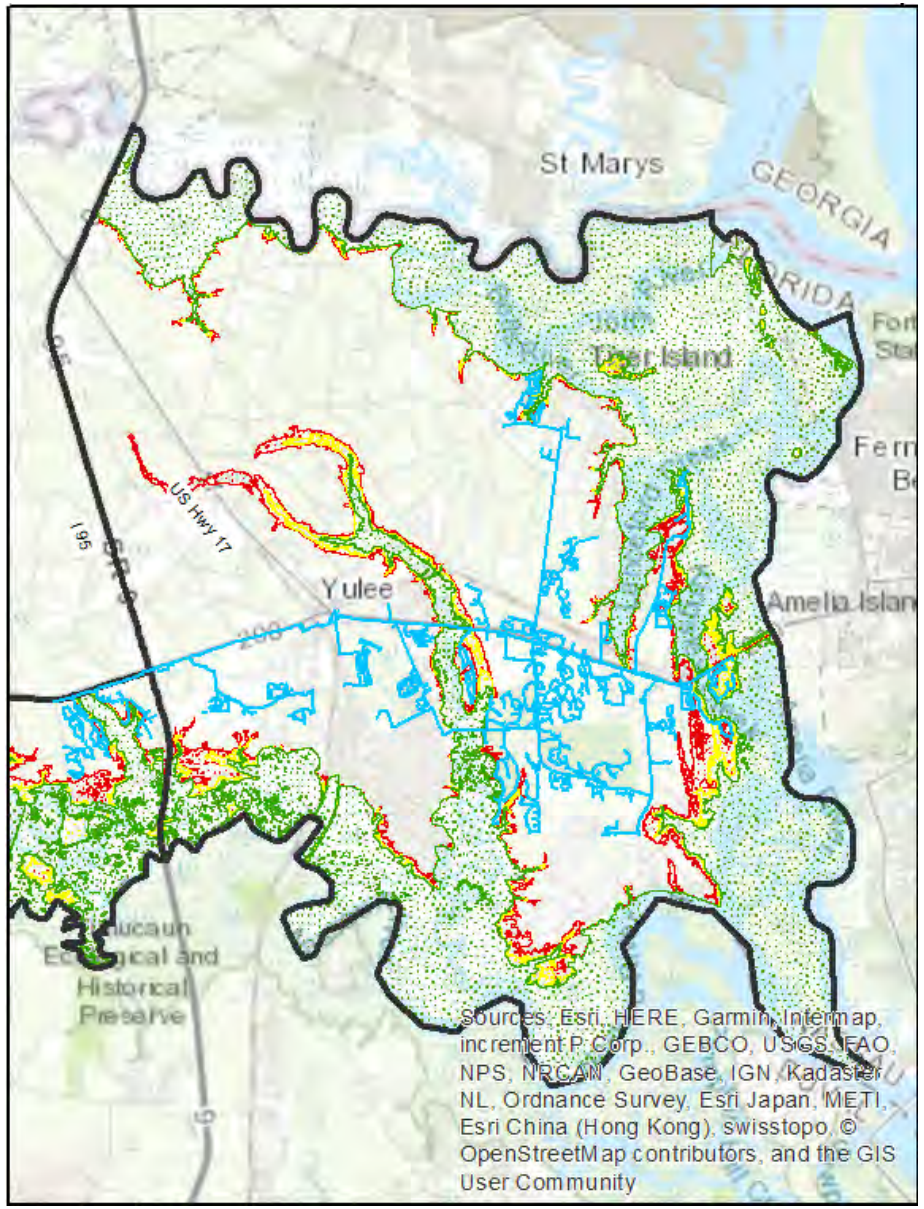


Sources: TBG Work Product; Nassau County Engineering; NOAA

Series 14 Map 3. Critical Infrastructure: Water Distribution Lines and Projected Sea Level Rise

Series 14 Map 3 shows the exposure of water distribution pipelines in the context of sea level rise. In the East study area, there is relative limited overlap in the 1 ft. sea level rise scenario. In the West study area, there is only overlap in the 6 ft. scenario.

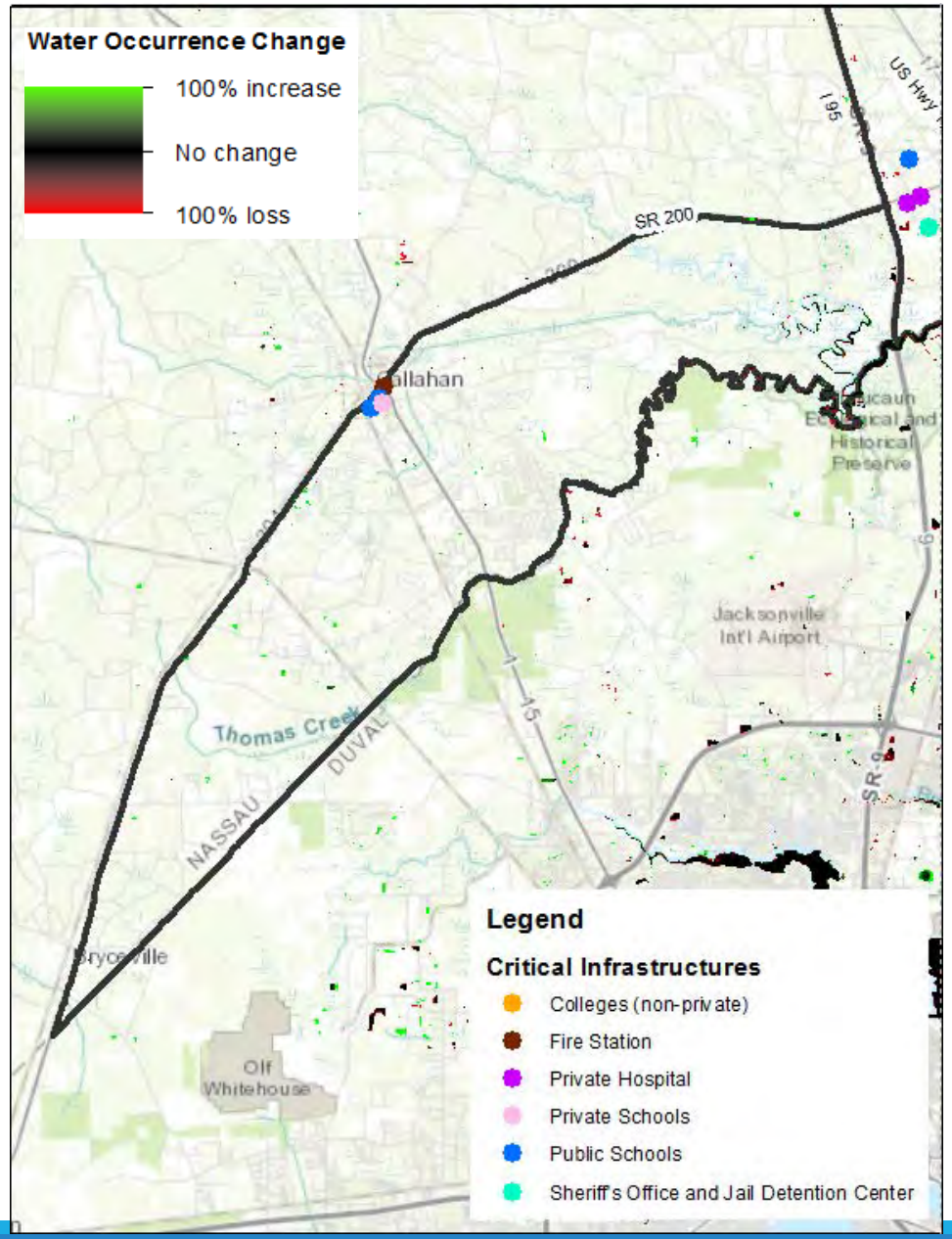


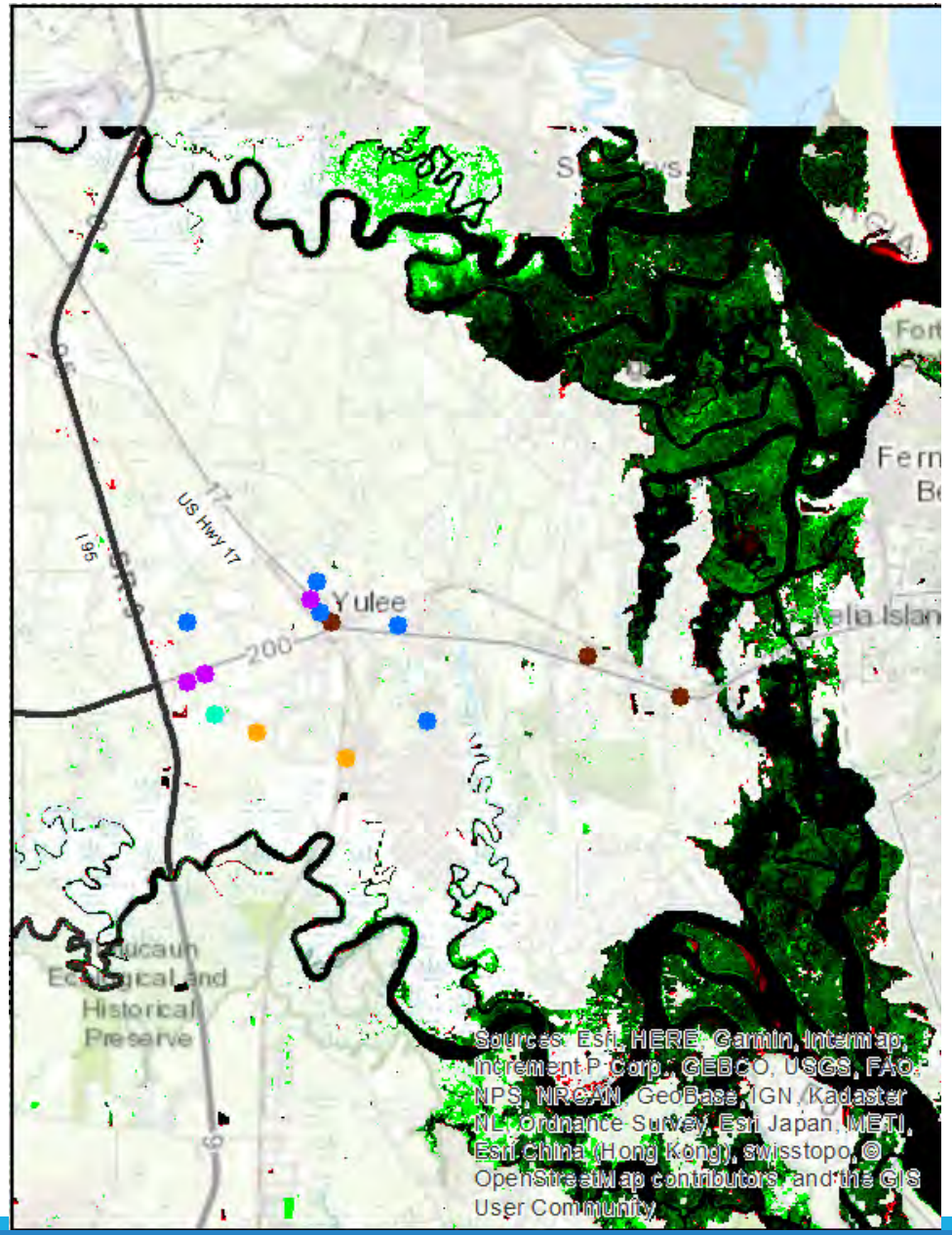


Sources: TBG Work Product; Nassau County Engineering; NOAA

Series 15 Map 1. Critical Infrastructure and Water Occurrence Change

Series 15 Map 1 shows critical infrastructure such as fire stations, schools, police stations and hospitals in the context of water frequency change. In both study areas, these infrastructures have not been impacted by more frequent episodic events.

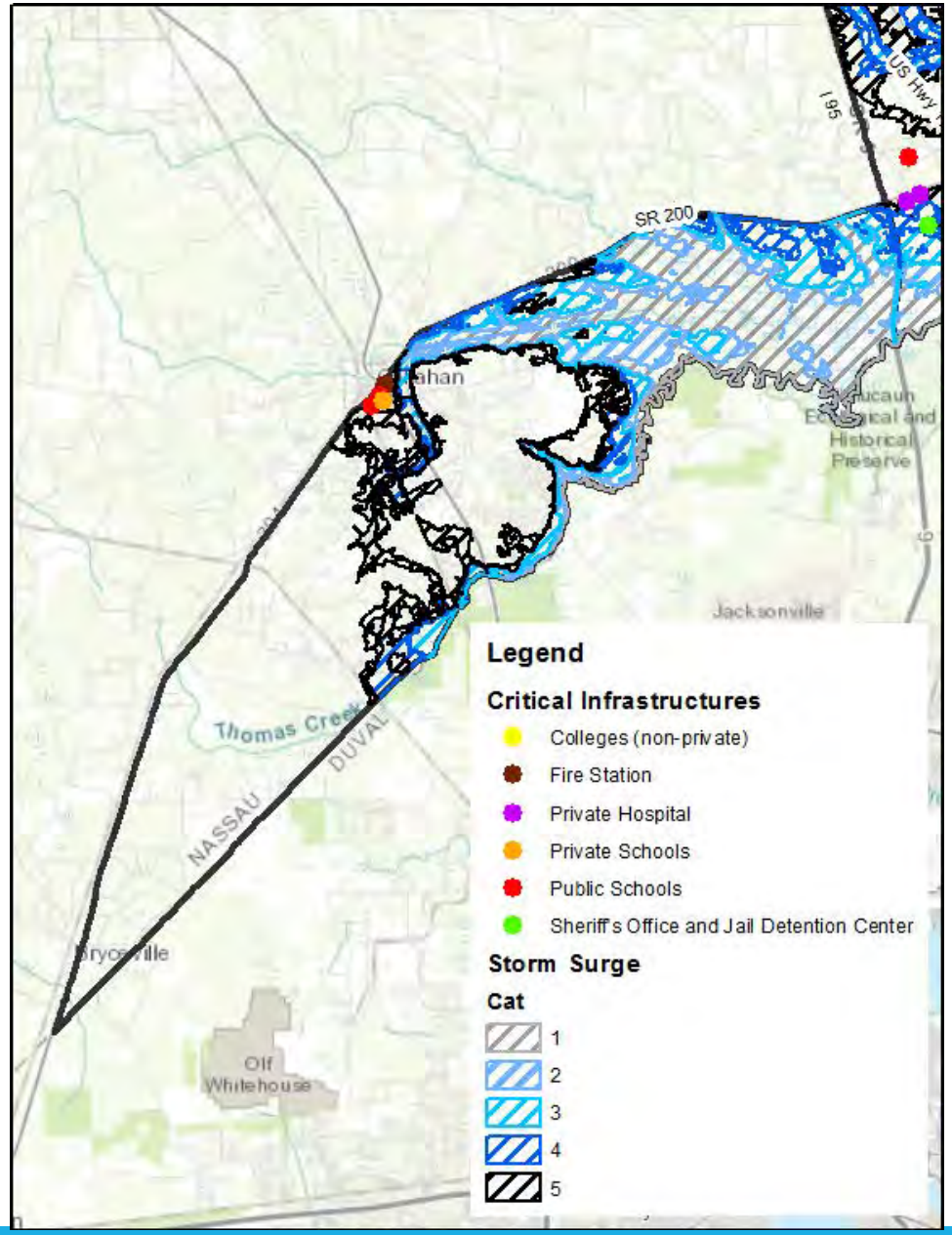


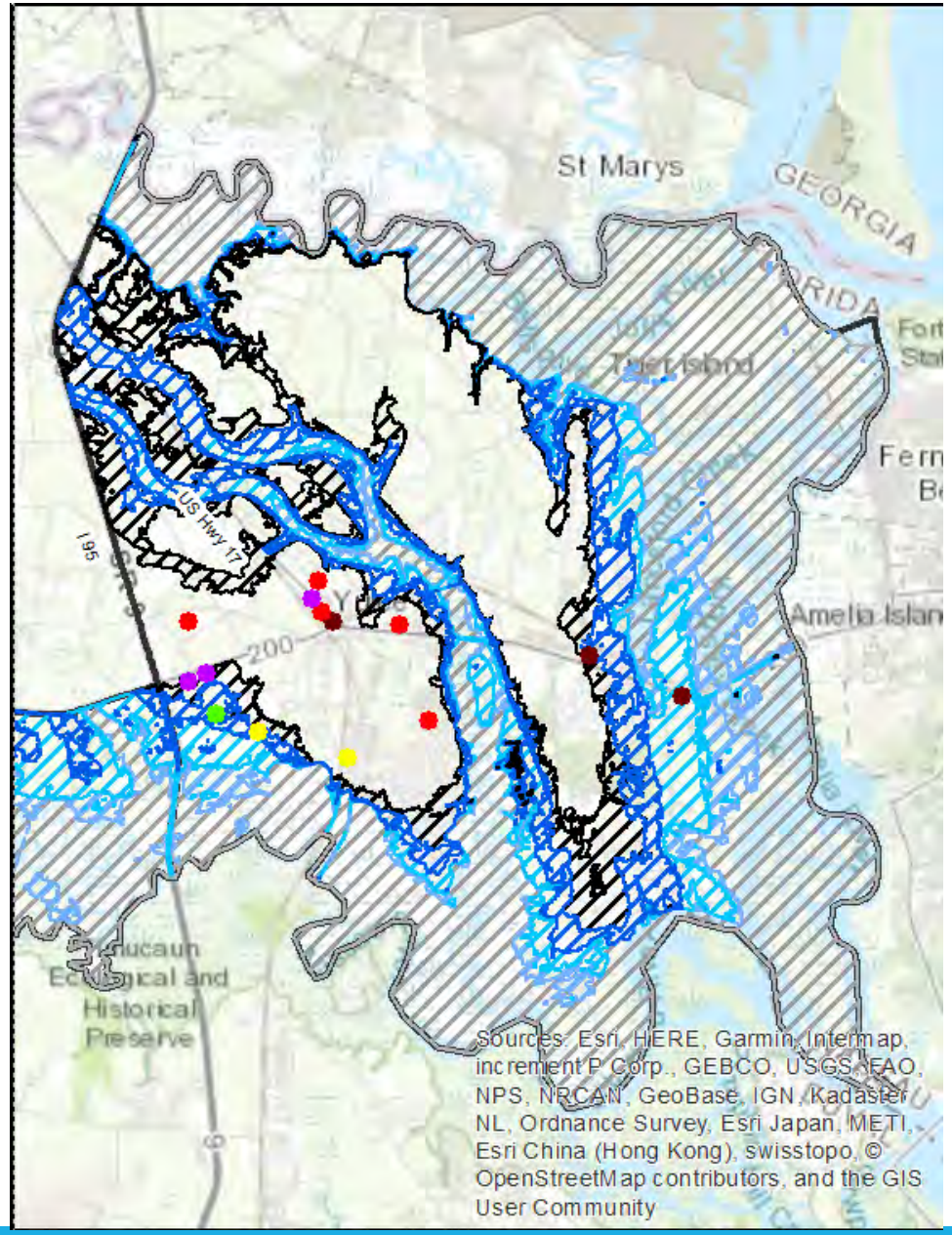


Sources: TBG Work Product; DOR; EC JRC/Google

Series 15 Map 2. Critical Infrastructure and Storm Surge

Series 15 Map 2 shows critical infrastructure such as fire stations, schools, police stations and hospitals in the context of storm surge. Only one facility in the East study area is exposed to a Category 3 storm surge while there are five exposed to a Category 5 storm surge. Critical infrastructures in the West study area are just outside of a Category 5 storm surge.

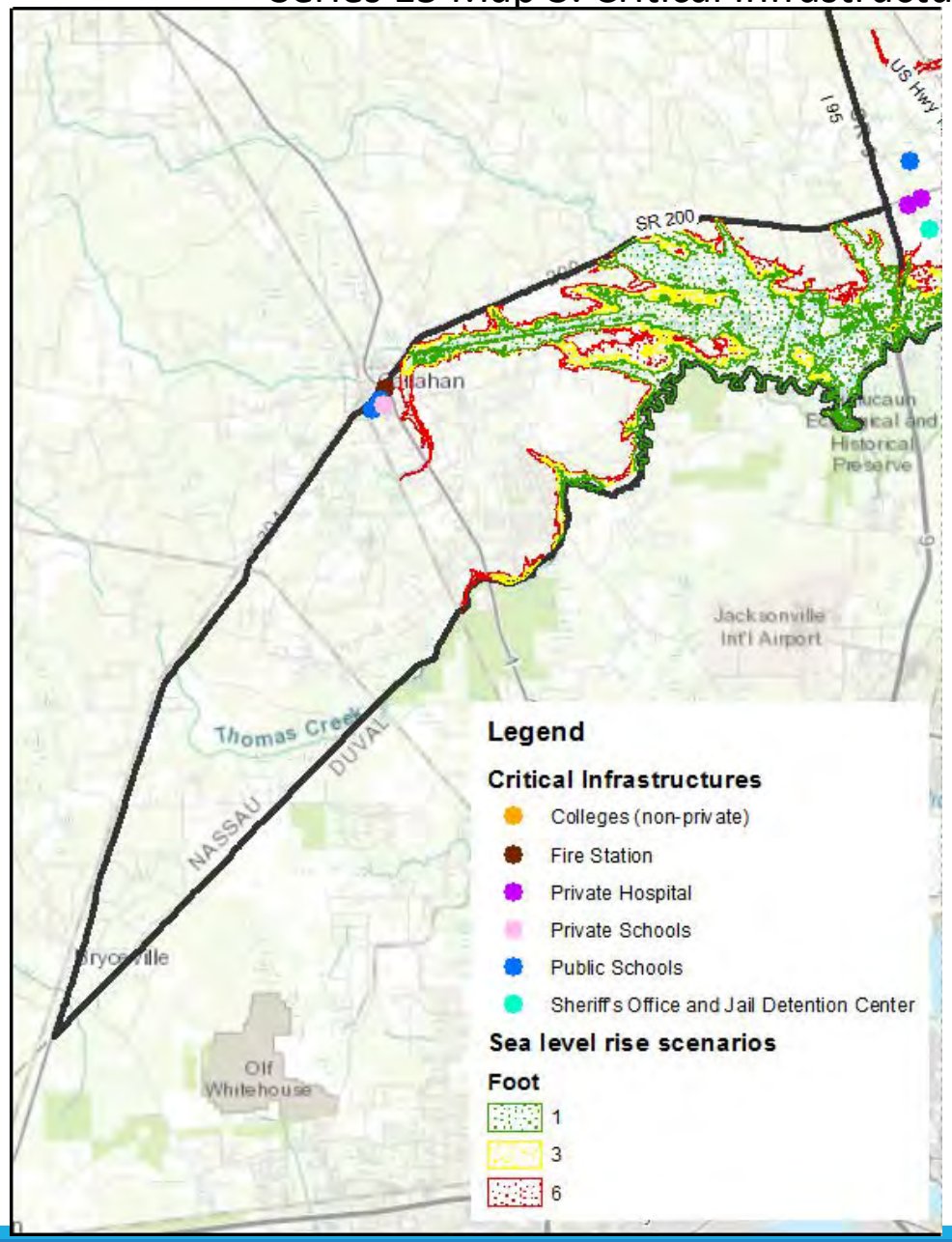


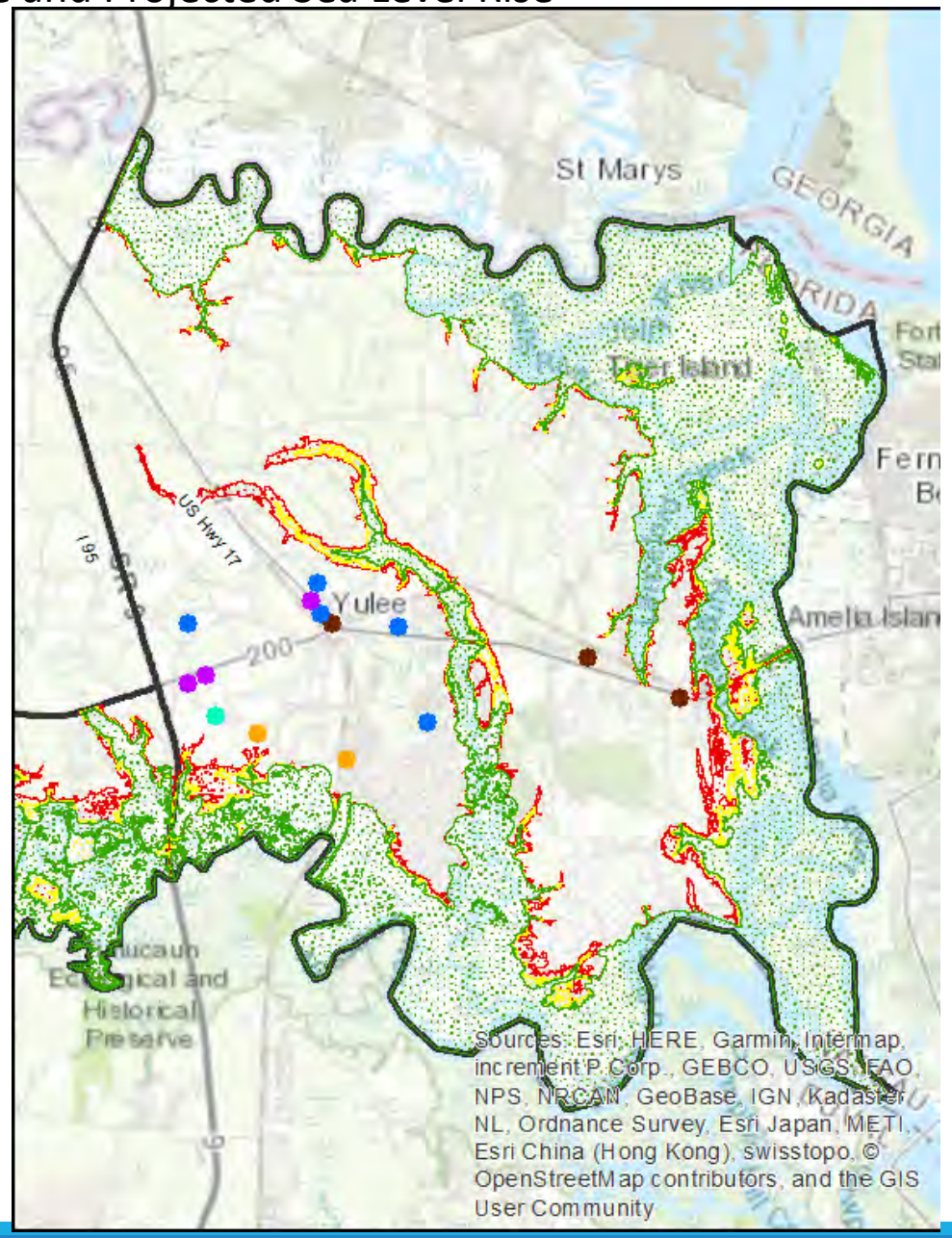


Sources: TBG Work Product; DOR; NOAA

Series 15 Map 3. Critical Infrastructure and Projected Sea Level Rise

Series 15 Map 3 shows critical infrastructure such as fire stations, schools, police stations and hospitals in the context of sea level rise. No facilities within either study area would be directly in harm's way for the highest probability scenario of 1 ft. sea level rise.

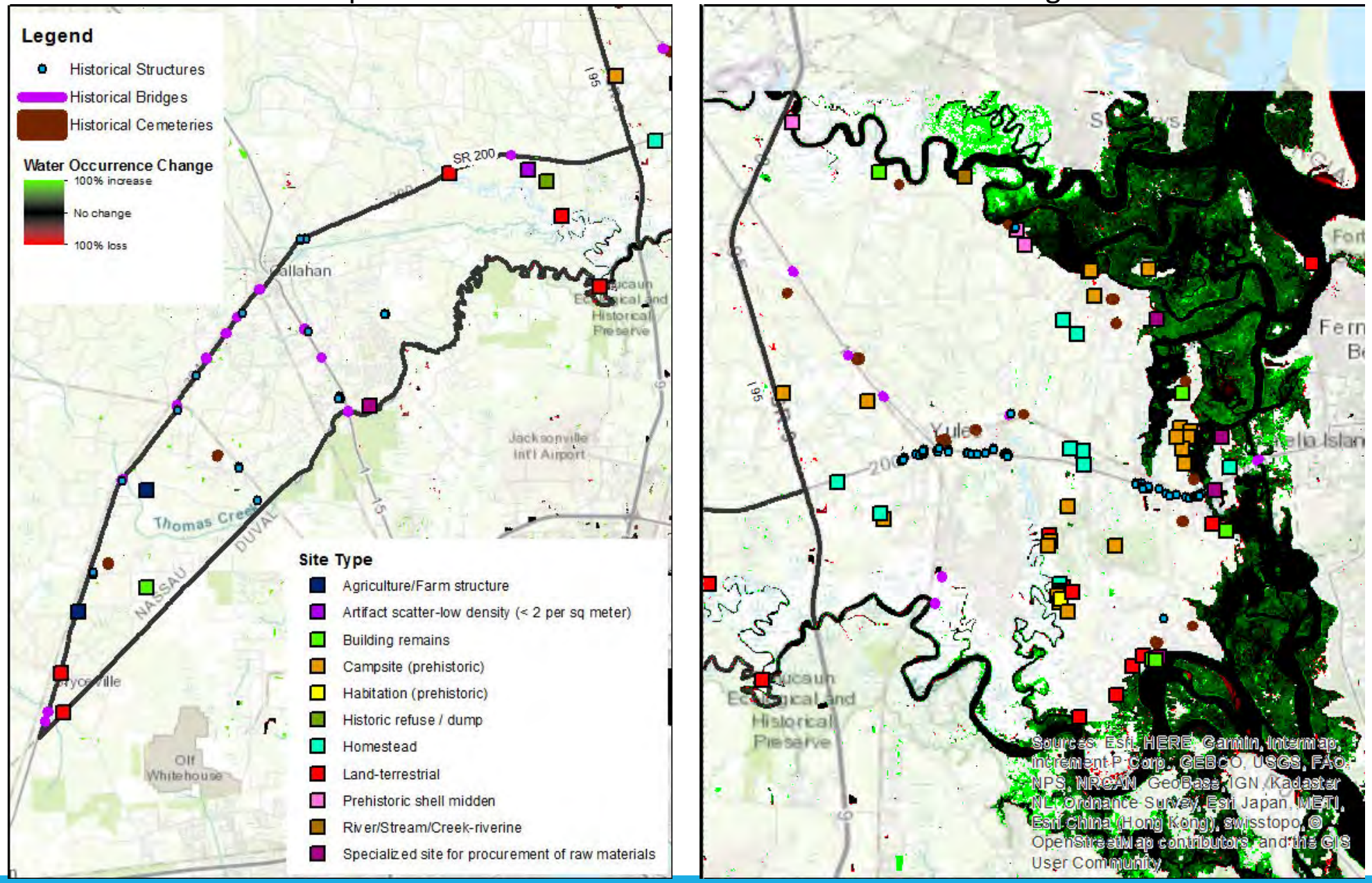




Sources: TBG Work Product; DOR; NOAA

Series 16 Map 1. Cultural Resources and Water Occurrence Change

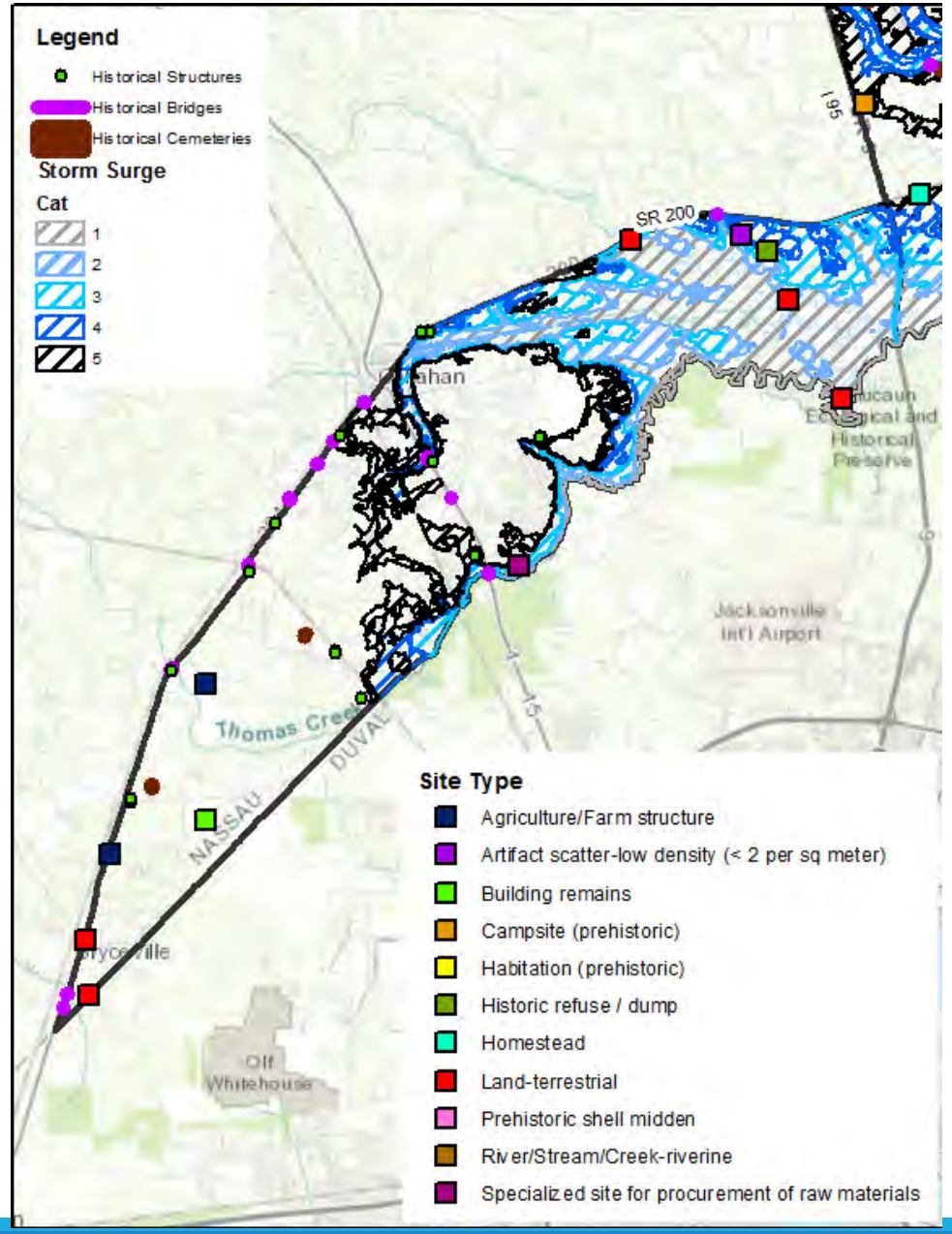
To evaluate if the County's cultural assets are at risk from an episodic flooding perspective Series 16 Map 1 compares episodic events with historical structures, bridges, cemeteries and archaeological sites. Cultural resources data are from the Florida Master Site from the Florida Division of Historical Resources. Overall, most historical structures and bridges haven't been impacted by changes in water frequency. However, in the East study area, archaeological sites near Tiger Island or St. Marys River have been impacted.

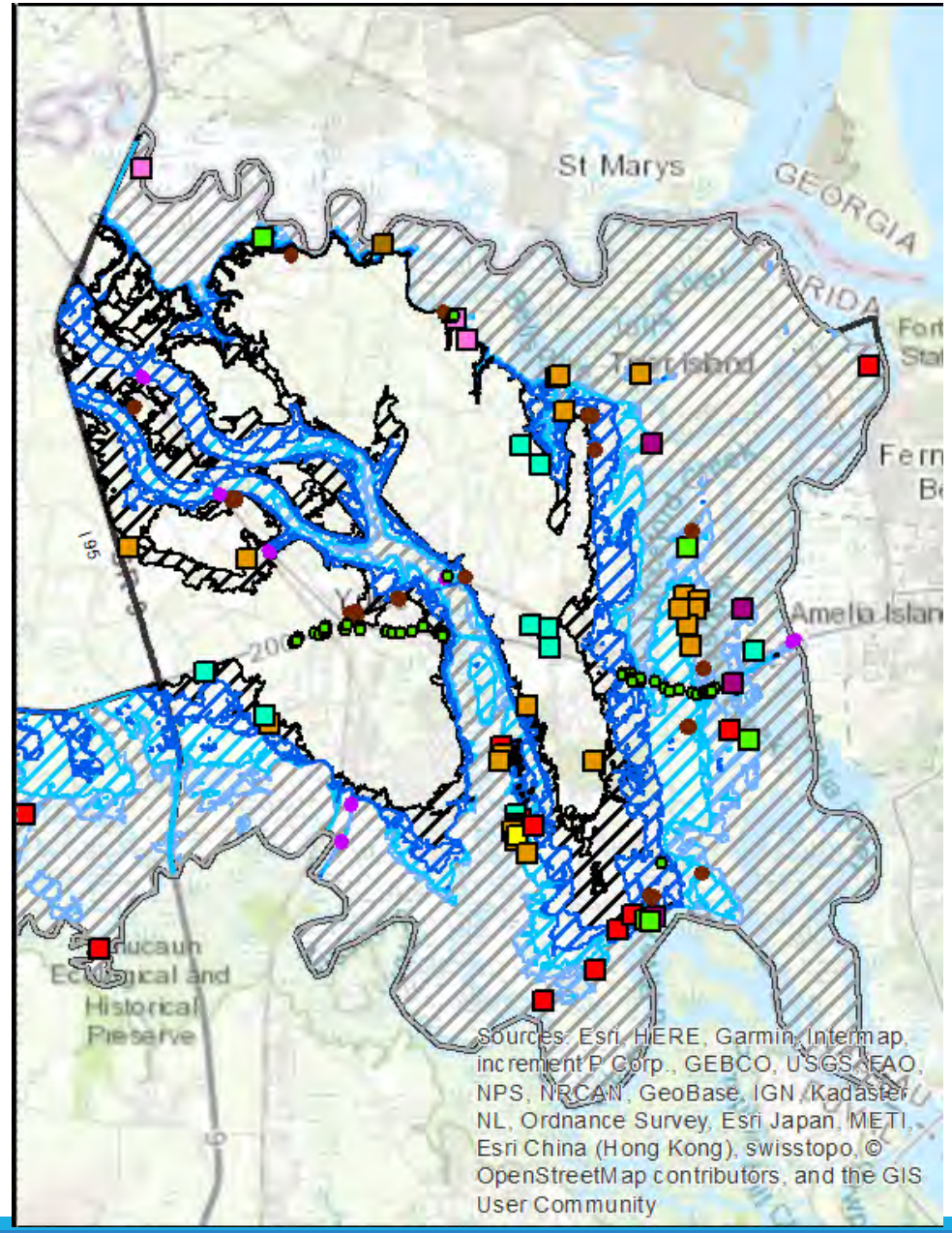


Sources: TBG Work Product; Florida Division of Historical Resources; EC JRC/Google

Series 16 Map 2. Cultural Resources and Storm Surge

Series 16 Map 2 compares cultural resources to storm surge projections. This helps to assess the risk at which the County's assets are at risk from event-driven flooding. Historical and cultural resources in the West study area are either at no risk or would only be at risk in the lowest probability / highest damage storms. In the East study area, however, about half would be in the path of a storm surge and about 15% would be impacted in a Category 1 storm surge.

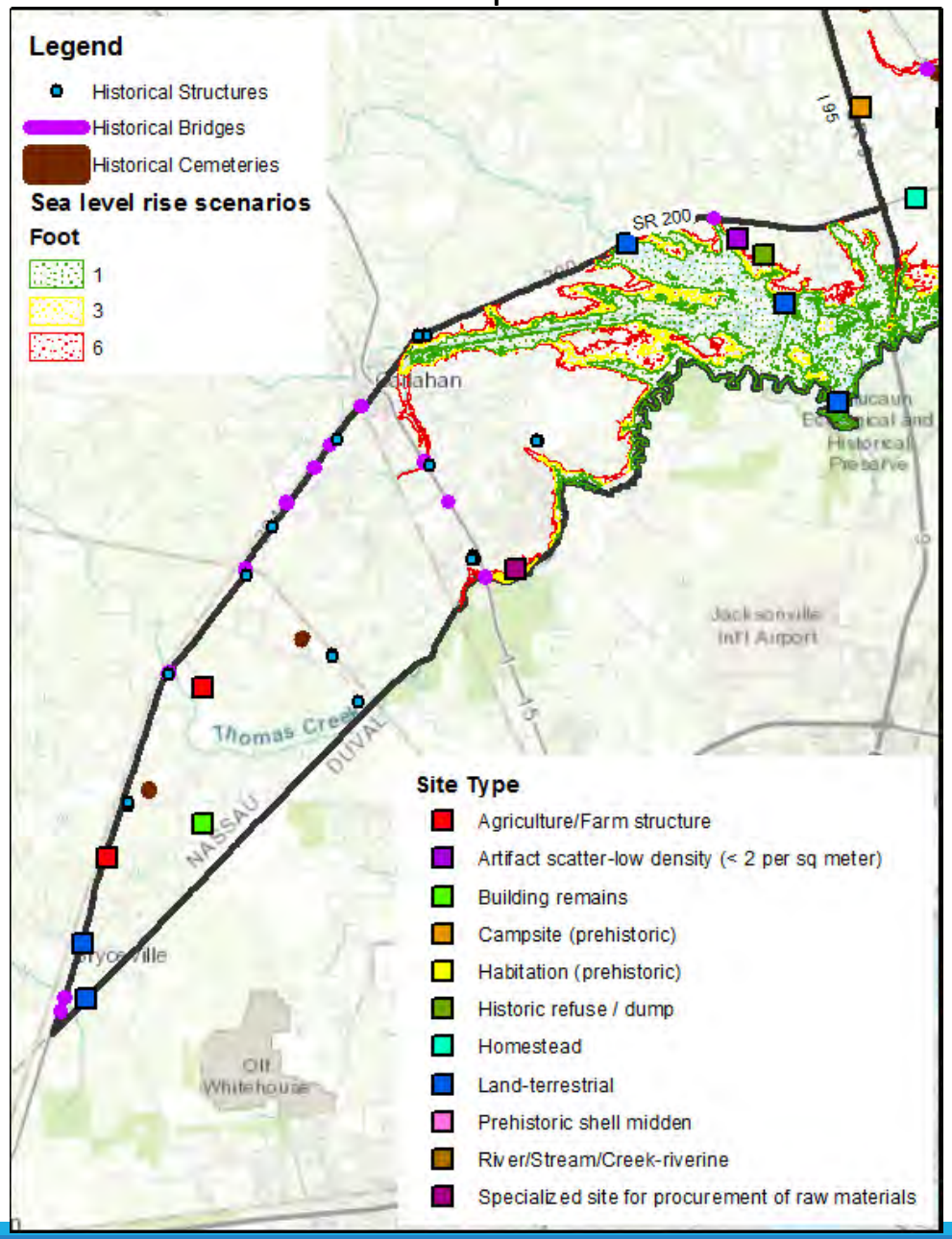


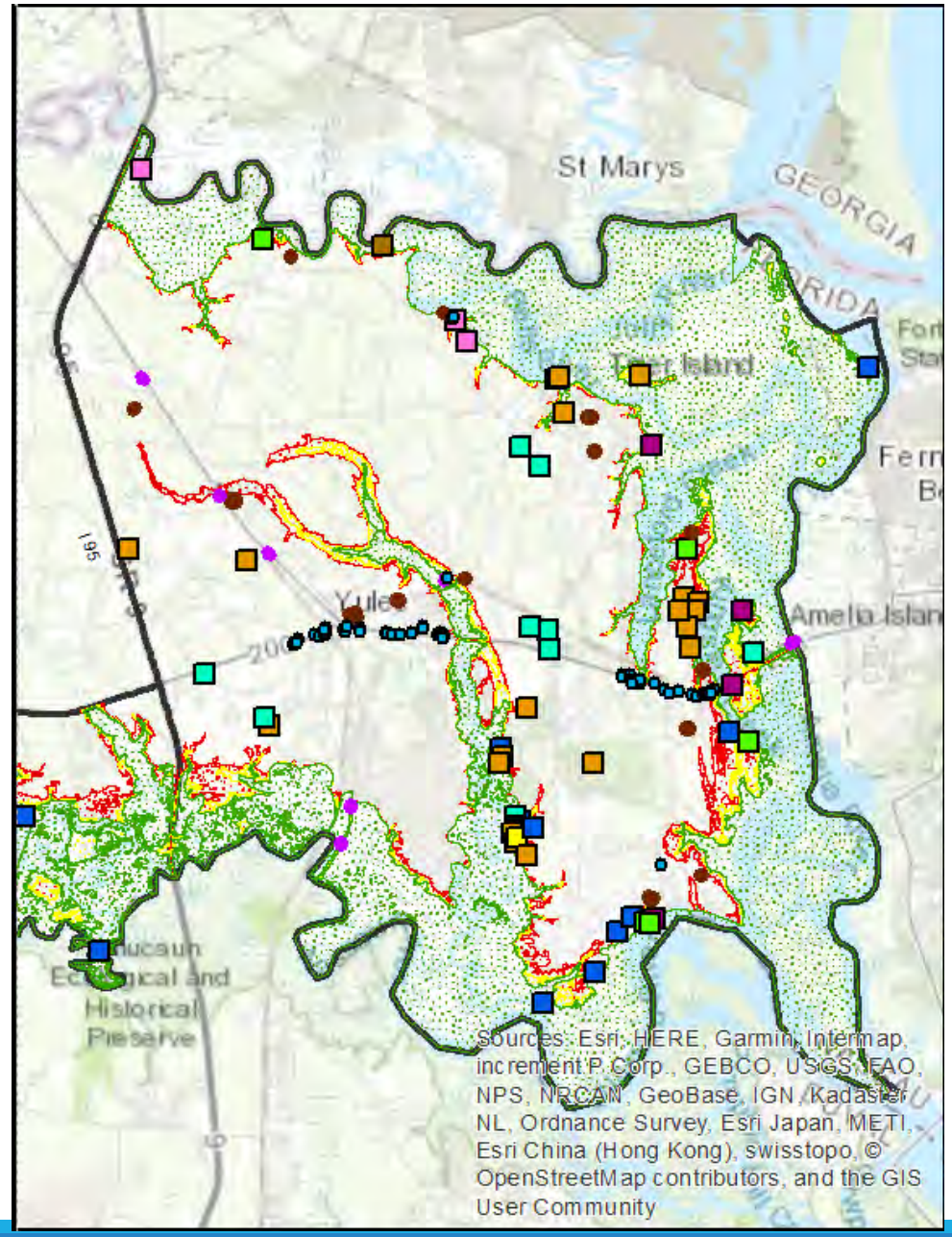


Sources: TBG Work Product; Florida Division of Historical Resources; NOAA

Series 16 Map 3. Cultural Resources and Sea Level Rise

Series 16 Map 3 relates cultural resources to sea level rise. This helps to assess which County assets are at risk to sea level rise. Most historical and cultural resources appear to be outside the projected sea level rise scenarios. In the West study area, a few sites overlap only the 6 ft. sea level rise scenario. In the East study area, only sites that are near to Tiger or Amelia Island would be impacted by the 1 ft. sea level rise scenario.

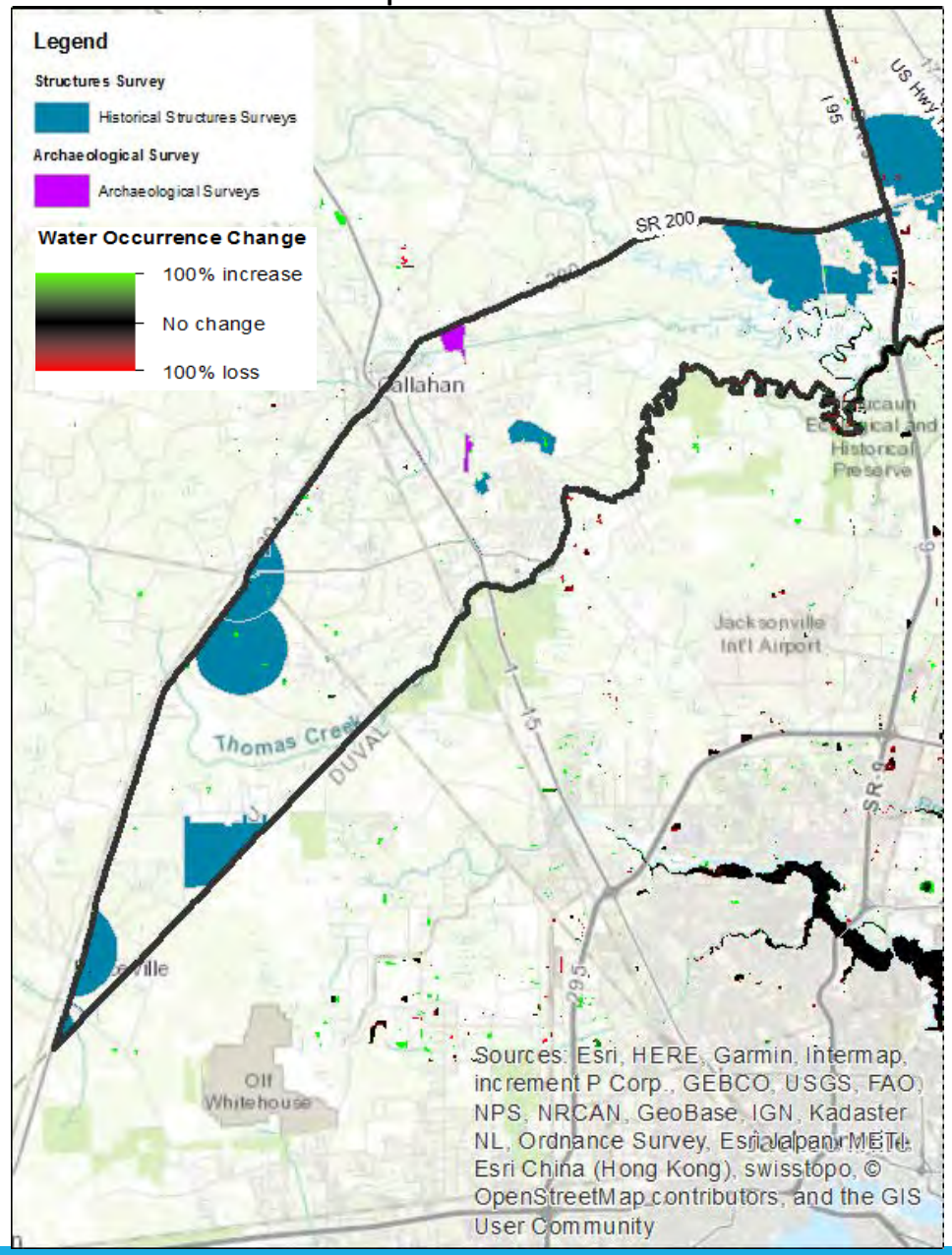


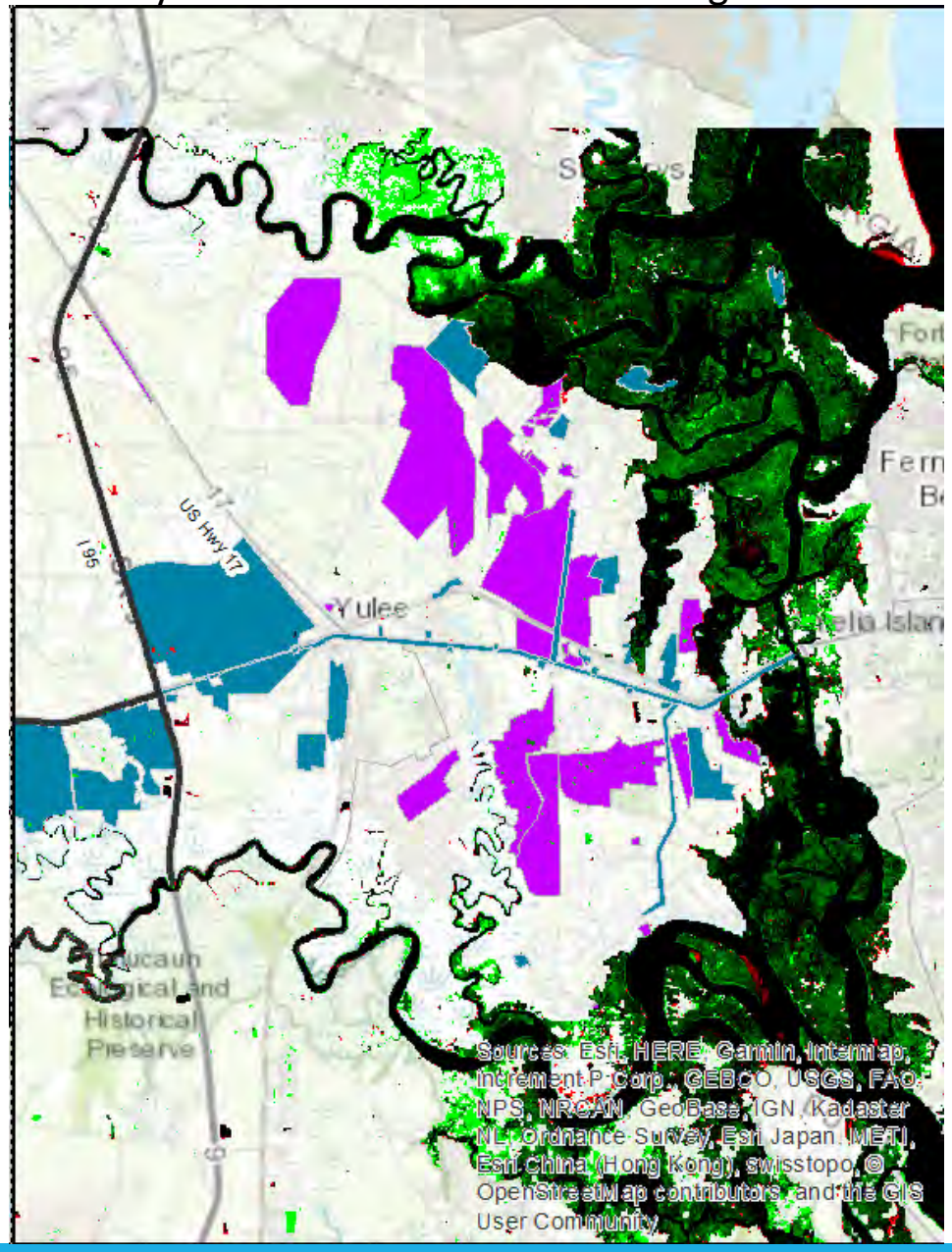


Sources: TBG Work Product; Florida Division of Historical Resources; NOAA

Series 17 Map 1. Cultural Resources Assessment Surveys and Water Occurrence Change

Areas that have been surveyed for historical structures or archaeological sites were compared with water frequency occurrence. Similar to Series 16, this helps to assess the vulnerability of the County's cultural assets. Archaeological sites near Tiger Island (in the East study area) such as a pre-historic campsite, would be the most impacted by increases in water frequency. There is limited overlap between surveyed areas and increased water occurrence.

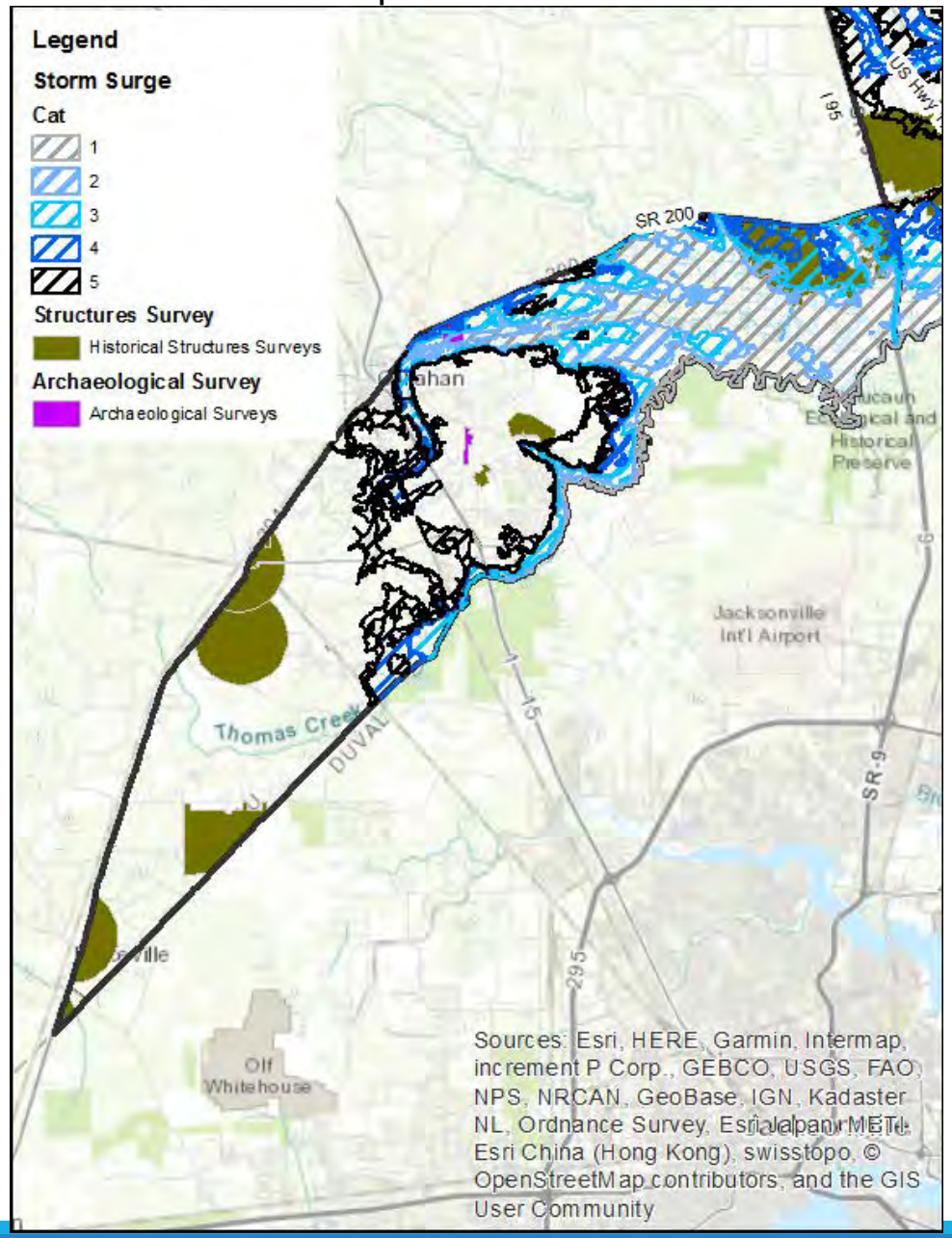


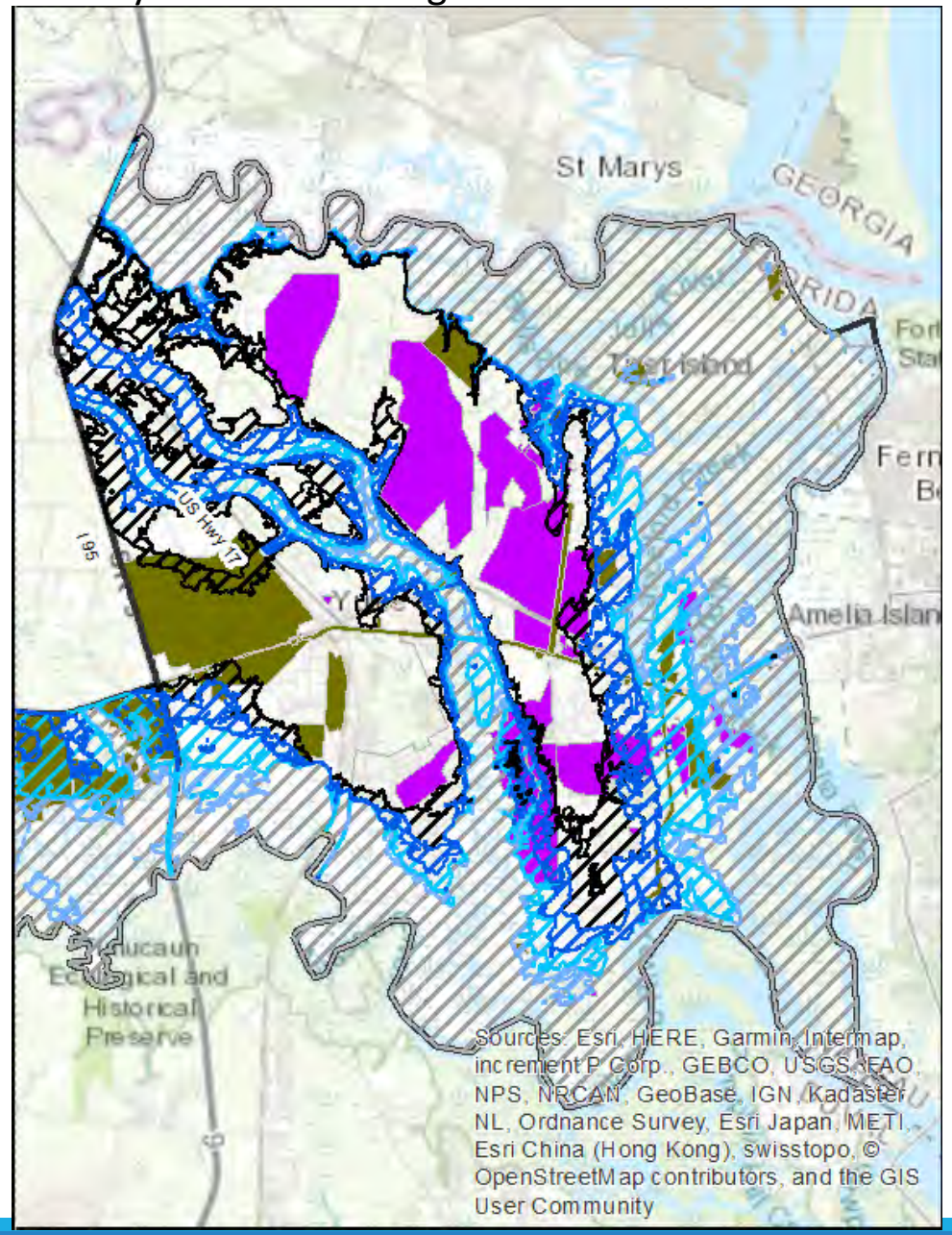


Sources: TBG Work Product; Florida Division of Historical Resources; EC JRC/Google

Series 17 Map 2. Cultural Resources Assessment Surveys and Storm Surge

To evaluate the exposure of cultural assets to event-driven flooding, Series 17 Map 2 compares areas that have been surveyed for cultural resources to storm surge. Many archaeological sites in the East study area are within the lowest risk/highest probability of occurring storm surge categories. In the West study area, only those structures that are close to the intersection of SR 200 and I-95, are within a storm surge.

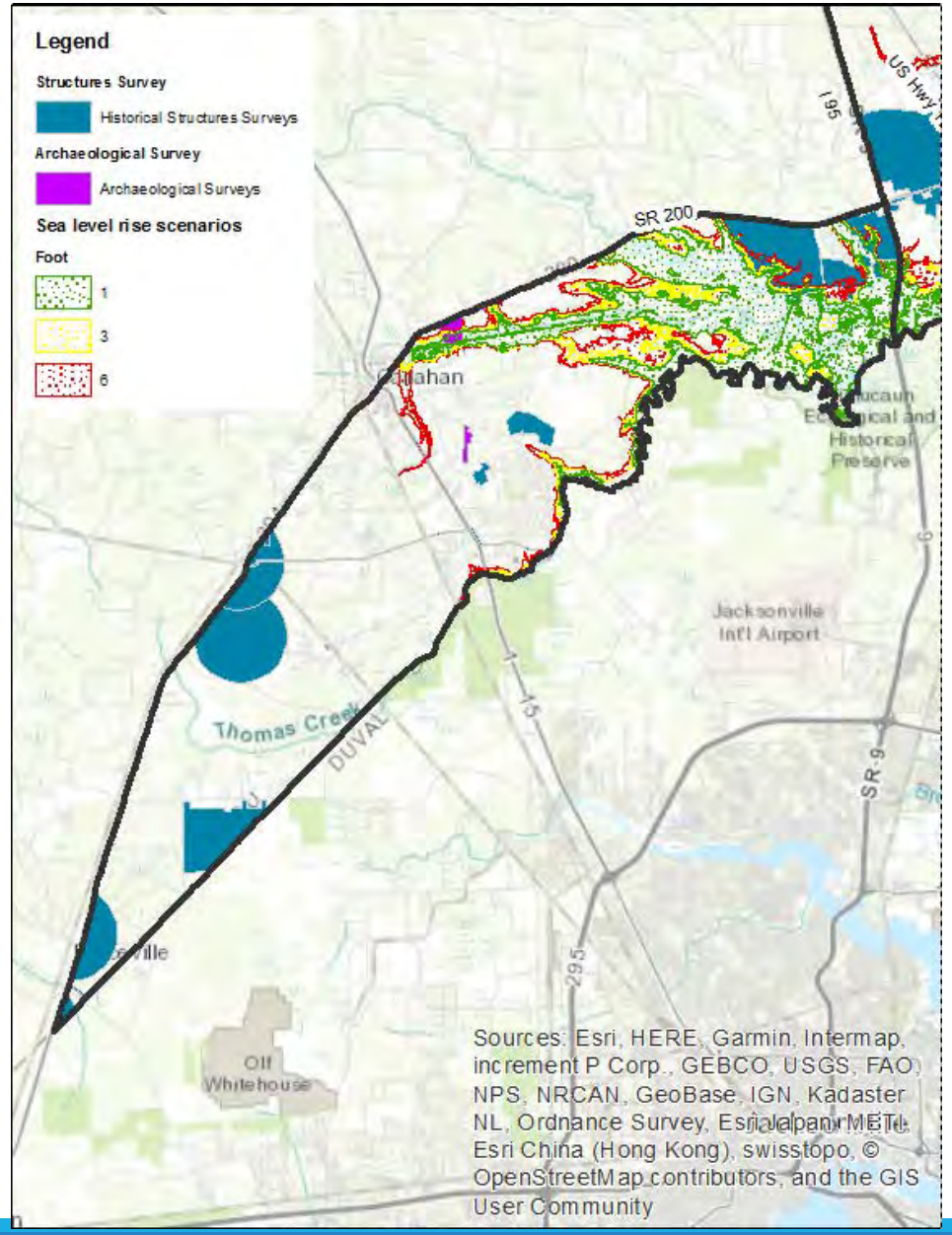


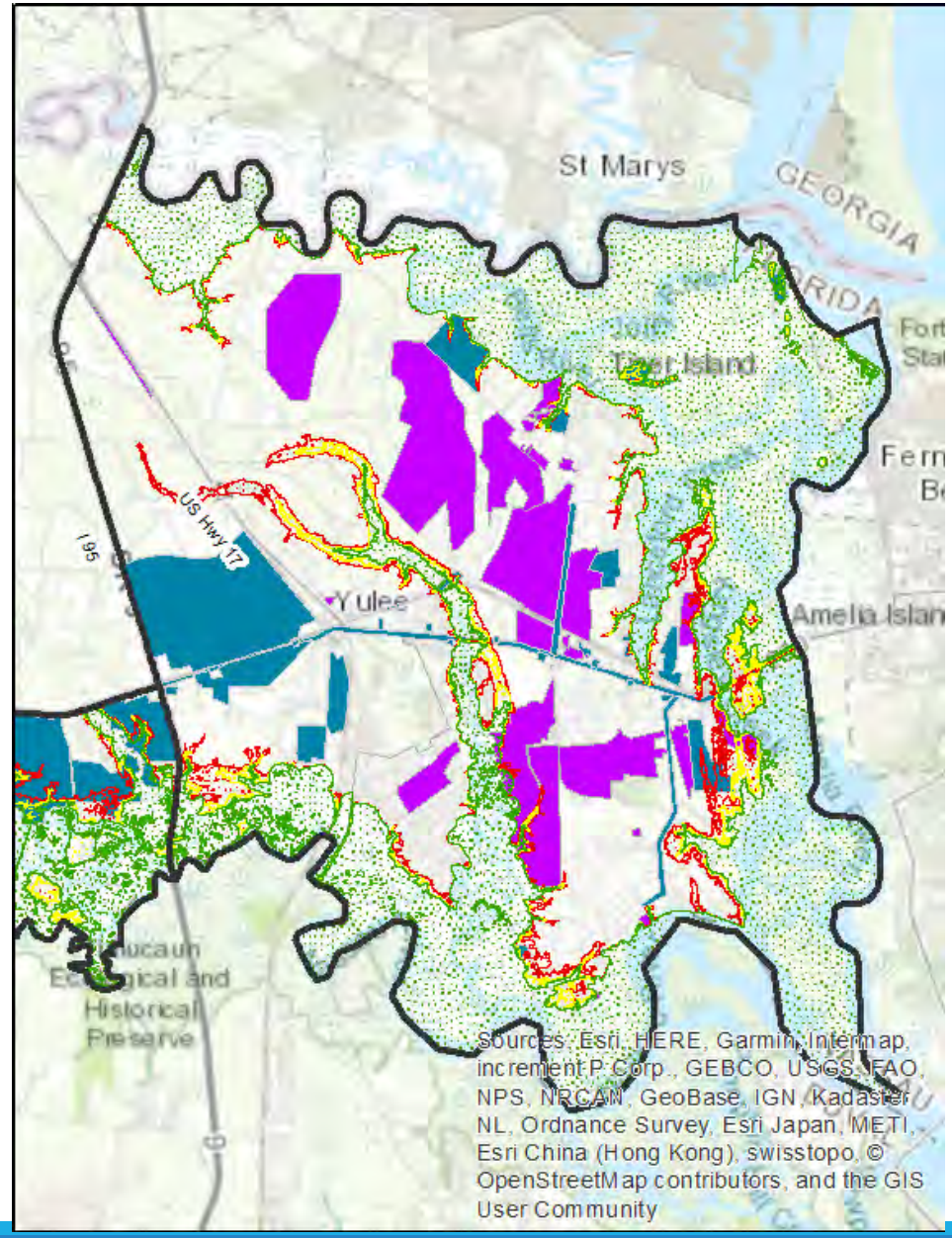


Sources: TBG Work Product; Florida Division of Historical Resources; NOAA

Series 17 Map 3. Cultural Resources Assessment Surveys and Projected Sea Level Rise

To evaluate the exposure of cultural assets to sea level rise, Series 17 Map 3 compares areas that have been surveyed for cultural resources to sea level rise scenarios. There is limited overlap of surveyed areas and sea level rise, except for those sites near the Intracoastal Waterway in the East study area, and those near the intersection of SR 200 and I-95 in the West study area.

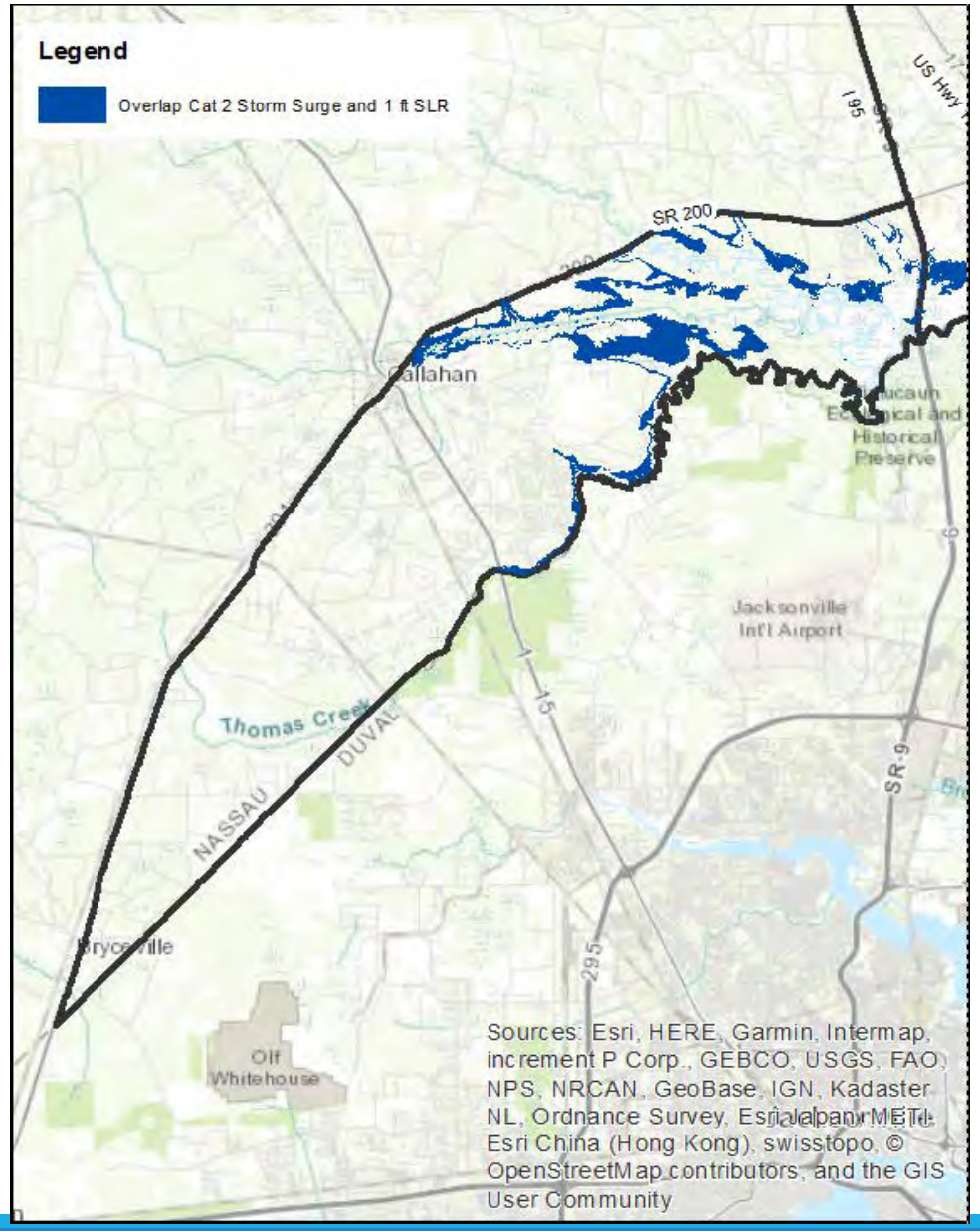


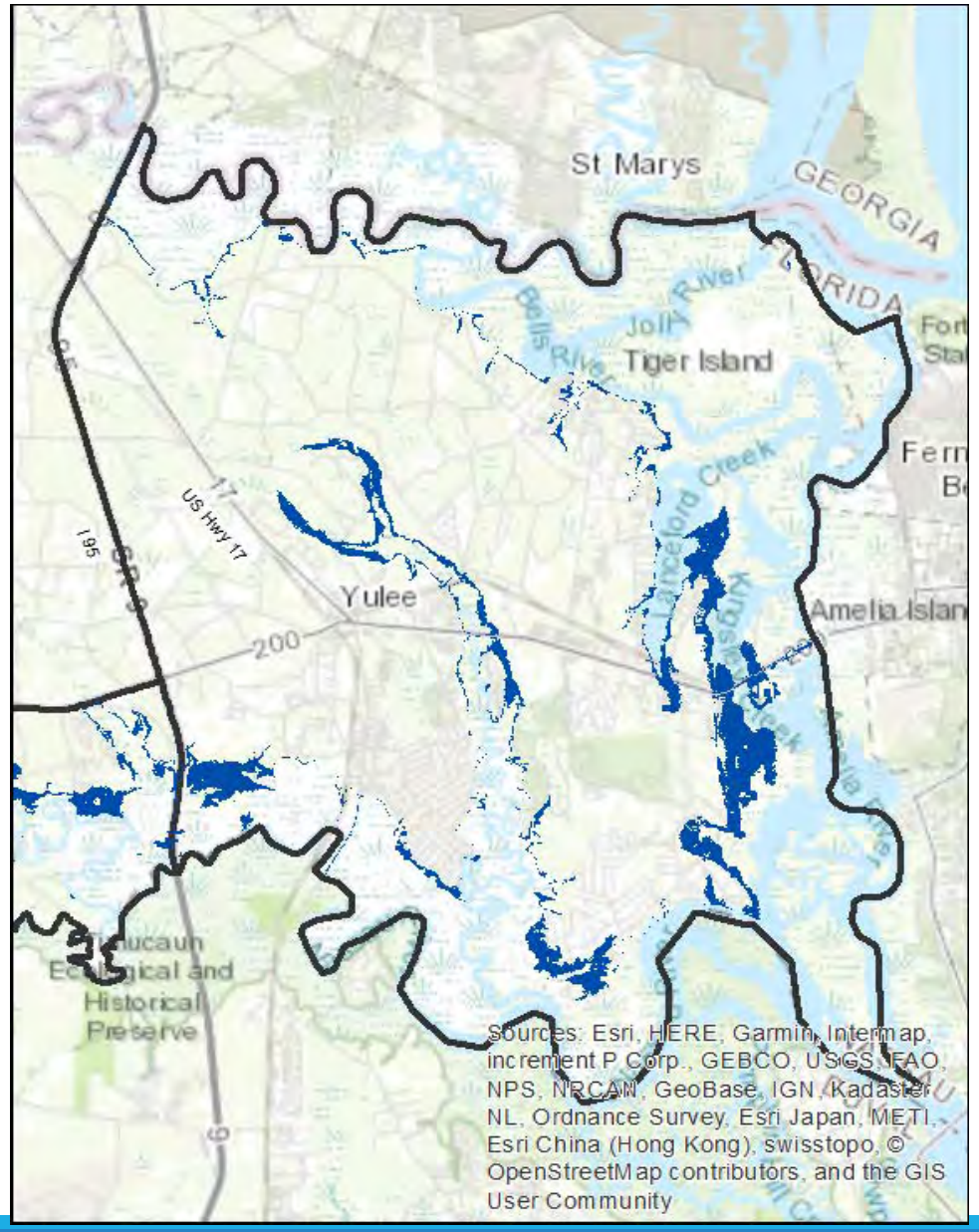


Sources: TBG Work Product; Florida Division of Historical Resources; NOAA

Figure 3. Overlap between a Category 2 Storm Surge and a 1 ft. Sea Level Rise Scenario

Since the storm surge maps shown throughout this report do not incorporate sea level rise, Figure 3 shows an example illustrating a combination of increased sea levels and storm surge. Shaded sections in the map represent where a current Category 2 storm surge zone overlaps with a 1 ft. sea level rise zone, potentially indicating areas with greater risk than existing Category 1 storm mapping would reflect. Both study areas include regions of increased risk.





Sources: TBG Work Product; NOAA

Vulnerability Assessment: Findings

Nassau County conducted a vulnerability assessment focused on issues relating to flooding, drainage and storm events, in two areas of the County: east of I-95 on the mainland, and west of I-95 south and west of A1A/SR 200/301. Both areas have additional development planned for locations that may be vulnerable to increased hazards.

The maps included in the vulnerability assessment reflect several overriding themes:

1. Most of the study area is affected by the highest probability scenarios, including Category I storms and minimal sea level rise (1 ft.), including areas that are reasonably distant from the coastline. This may serve as a surprise to some residents and may begin a dialogue on measures that are needed to protect these areas from damage in future.

2. Large areas that are served by septic tanks are also vulnerable to impact from even minimal storm surge and sea level rise.

3. Vulnerable populations appear to be disproportionately affected by Cat I storm effects and minimal sea level rise.

4. Data reflecting increased water frequency is concentrated in areas with disproportionately high rates of poverty.

Public outreach found that residents are concerned about maintenance of flow ways that allow stormwater to recede after heavy rainfall events; development has altered drainage patterns and is believed to have exacerbated flooding in areas near creeks and streams. Residents recognize that additional development is likely to increase stormwater issues.

Sources

- European Commission Joint Research Centre (EC JRC)
- National Oceanic and Atmospheric Administration (NOAA)
- Northeast Florida Regional Council (NEFRC)
- Florida Department of Revenue
- Florida Division of Historical Resources
- Florida Natural Areas Inventory
- U.S. Census Bureau Topologically Integrated Geographic Encoding and Referencing (TIGER) data
- U.S. Census Bureau Longitudinal Employer-Household Dynamics data
- U.S. Department of Health, Florida Water Management Inventory