Ports and Waterways Safety Assessment Workshop Report

Savannah, Georgia
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Providing Navigation Safety Information for America's Waterways Users

Released By:
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Executive Summary

Coast Guard Marine Safety Unit Savannah sponsored a Ports and Waterways Safety Assessment (PAWSA) workshop in Savannah, GA, from March 6, 2024, to March 7, 2024. Thirteen participants representing a range of waterway users, stakeholders, federal, state, and local regulatory and public safety authorities met to collaboratively assess navigational safety on the waterways adjoining the Port of Savannah. Prior to the workshop, the Coast Guard Navigation Center (CG NAVCEN) facilitated a stakeholder engagement meeting on January 17, 2024, to enhance community outreach and prepare stakeholders for the formal workshop. This report provides a visual depiction of the study area and contains the full list of workshop participants and their associated organizations. The first day of workshop included discussions about port and waterway attributes and vessel traffic in relation to the sixteen Waterway Risk Factors (WRFs) in the PAWSA Waterway Risk Model, which is described in more detail in this report. The Baseline Risk Value (BRV) and Risk Characterization for each WRF were established based on participants' survey responses. BRV quantifies the overall risk, whereas Risk Characterization assesses the potential consequence, risk trend, risk tolerance, and effectiveness of existing mitigation strategies for a specific WRF. The metrics from the BRV and Risk Characterization were combined to quantitatively prioritize WRFs to inform discussions during the next phase of the workshop. During the second day, participants reviewed and validated the aggregated survey ranking of the WRFs and conducted follow-on discussions to identify and develop risk mitigation strategies. The five numerically highest WRFs ranked by participants are documented in the table below with their associated Waterway Risk Condition. This report contains a full list of prioritized WRFs with additional details.

Waterway Risk Condition	WRF
Navigation	Tides and Currents
Waterway	Dimensions
Traffic	Volume of Commercial Traffic
Vessel Quality & Operation	Recreational Vessel Quality
Vessel Quality & Operation	Large Commercial Vessel Quality

The recommended mitigation strategies and participant observations documented in this report will meaningfully facilitate continued collaboration between the Coast Guard and waterway stakeholders to improve safe and efficient navigation within the Savannah Marine Transportation System (MTS). The Director of Marine Transportation Systems (CG-5PW), CG NAVCEN, CG Sector Charleston, and CG Marine Safety Unit Savannah extend their sincere appreciation to participants for their contributions to the Savannah PAWSA workshop.

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CHAPTER 1. GENERAL

A. Background and Purpose

1. CG-5PW is responsible for developing and implementing policies and procedures that facilitate commerce, improve safety and efficiency, and maximize the commercial viability of the MTS. In the late 1990s, the Coast Guard convened a national dialogue group (NDG) comprised of maritime stakeholders to identify the needs of waterway users with respect to Vessel Traffic Management (VTM) and Vessel Traffic Service (VTS) systems. A major outcome of the NDG was the development of the PAWSA process, which the Coast Guard established as the formal model for facilitating stakeholder discussion to identify VTM improvements and determine candidate VTS waterways. In 2020, CG NAVCEN modernized the PAWSA process to create a more flexible tool available to Sector Commanders to engage the maritime community for purposes of monitoring and improving the health of the MTS within their area of responsibility.

2. The current PAWSA process involves convening a select group of waterway users and stakeholders to facilitate a structured workshop agenda to meet pre-identified risk assessment objectives. A successful workshop involves the participation of professional waterway users with local expertise in navigation, waterway conditions, and port safety. Stakeholder involvement is central to ensuring that important environmental, public safety, and economic consequences receive appropriate attention as risk interventions are identified and evaluated. The workshop culminates in a written report that includes proposed risk mitigations developed by participants, which is made publicly available on the CG NAVCEN's website, https://www.navcen.uscg.gov/ports-and-waterways-safety-assessment-final-reports.

3. The PAWSA process strives to achieve the following objectives:

    a. Gather stakeholder input to identify major waterway trends, safety hazards, and potential mitigation strategies.

    b. Bolster public-private partnership and enhance cooperation across the MTS.

    c. Generate a stakeholder driven report that captures data gathered from the PAWSA to prioritize future projects impacting the MTS.

B. Methodology

1. Waterway Risk Conditions and WRFs. The PAWSA process is designed to convert qualitative experience, observations, and opinions of participants into quantitative assessments. This method utilizes numerical comparison among sixteen WRFs for purposes of facilitating consensus among participants to better inform conversations regarding risk mitigation strategies within an identified study area. The Waterway Risk Condition categories and associated WRFs are outlined in Table 1 below and further defined in Appendix B.

Waterway Risk Conditions	**Navigation**	**Vessel Quality & Operation**	**Traffic**	**Waterway**
WRFs	Winds	Large Commercial Vessels	Volume of Commercial Traffic	Dimensions
	Currents and Tides	Small Commercial Vessels	Volume of Recreational Traffic	Obstructions
	Visibility Restrictions	Commercial Fishing Vessels	Waterway Use	Visibility Impediments
	Bottom Type	Recreational Vessels	Congestion	Configuration

Table 1-The four Waterway Risk Condition categories and sixteen WRFs.

2. Waterway Risk Model. The PAWSA Waterway Risk Model defines risk as the product of the probability of an unwanted event and the consequences resulting from that event. Figure 1 provides a visualization of the relationship between the probability of an unwanted event for each Waterway Risk Condition and the impact of the risk in terms of Immediate and Subsequent Consequences. Appendix B provides an explanation of Immediate and Subsequent Consequences as defined by the PAWSA Waterway Risk Model.

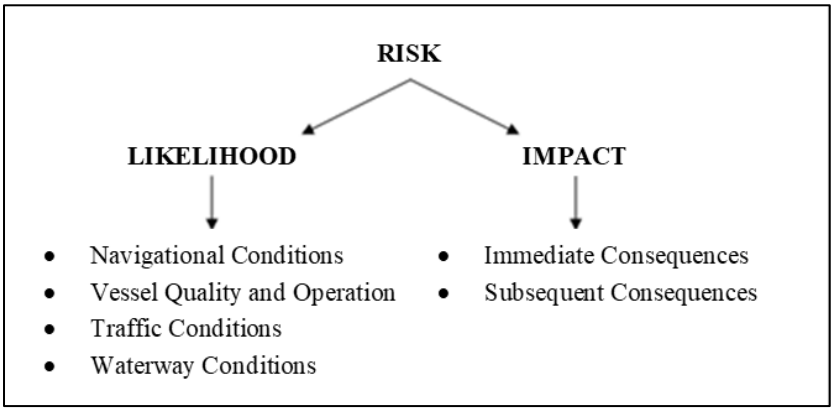

Figure 1- Relationship between risk, likelihood, and impact.

3. WRF Survey. During day one of the workshop participants are led through individual discussions for each WRF identified in Table 2. Each discussion concludes with the completion of a three-part participant survey that establishes the BRV and Risk Characterization for each risk factor. Following completion of all surveys, the WRFs are numerically prioritized by BRV and Risk Characterization from greatest to least. At the beginning of the second day of the workshop, the order of the risk factors are presented to participants for validation and consensus to prioritize mitigation strategy discussions and development. A description of the methodology to calculate the BRV and Risk Characterization is provided in the following sub-sections.

   a. BRV. This value is calculated using numerical values attained from Part One and Part Two of the survey that are then input into the formula outlined in Figure 2.

      (1) Part One. The first section of the survey asks participants to evaluate the Risk Level of a specific risk factor based on four options specific to each individual WRF. Risk Levels are presented as written options to participants. Each written option has an associated numerical value between one and four based on their likelihood. Appendix B contains a list of the WRFs and the associated Risk Level options with their attributed numerical value.

      (2) Part Two. The second section of the survey asks participants to assign the Impact Level for Immediate and Subsequent Consequences associated with each risk factor. Appendix B contains the list and definition of Immediate and Subsequent Consequences.

         (a) The Impact Level of Immediate and Subsequent Consequence are presented as three choices for each WRF. The choices correlate to the numerical values shown in Table 2.

Impact Level of Consequence	**Numerical Value**
None or hardly any impacts	0
Moderate impact	0.5
Impacts are likely severe	1

Table 2- Impact level of consequences with associated numerical value.

         (b) The numerical values for Risk Level from Part One and Impact Level from Part Two of the survey are used in the formula outlined in Figure 2 to calculate the associated BRV for each WRF. The BRV numerically ranges between zero and eight, with zero representing low BRV and eight representing high BRV.

$$\text{BRV} = (\text{Risk level}) \times \left(\frac{\sum \text{Immediate Consequences}}{4} + \frac{\sum \text{Subsequent Consequences}}{4} \right)$$

Figure 2- Risk Value formula.

b. Risk Characterization. Risk Characterization is ascertained from Part Three of the survey. It provides additional context to the BRV generated from Part One and Part Two of the survey and is mainly used by facilitators to better guide participant discussion.

(1) Part Three. The third section of the survey asks participants to evaluate Risk Characterization in terms of the Current Risk Level, Risk Trend, and Current Mitigations. Table 3 provides the associated available selections for each Risk Characterization Category. Questions to ascertain Risk Characterization are standard for all WRFs. The answers to these questions are calculated by plurality, wherein the option that was most frequently selected by participants serves as the prevalent group consensus for each question. In the event a plurality cannot be determined, PAWSA facilitators examine the raw data and determine the most appropriate selection.

Risk Characterization Category	Available Selections
Current Risk Level	We could benefit by accepting more risk
	The level of risk is acceptable, keep the status quo
	Unacceptably high risk
Risk Trend	Increasing
	Decreasing
	Staying the same
Current Mitigations	Acceptable
	Acceptable, but tenuous
	Unacceptable, we need more or better mitigations

Table 3- WRF Survey Part Three, Risk Characterization categories.

CHAPTER 2. SAVANNAH PAWSA WORKSHOP

A. PAWSA Study Area

1. The geographical area for the Savannah PAWSA included the Savannah River as depicted in Figure 3. The coordinates bounding the Savannah study area were: 31.971°N, 081.164°W and 32.150°N, 080.774°W. Graphic representations of this study area were used to facilitate discussion with participants. Additionally, geographically referenced comments were collected during the workshop and are documented as chartlets in Appendix D.

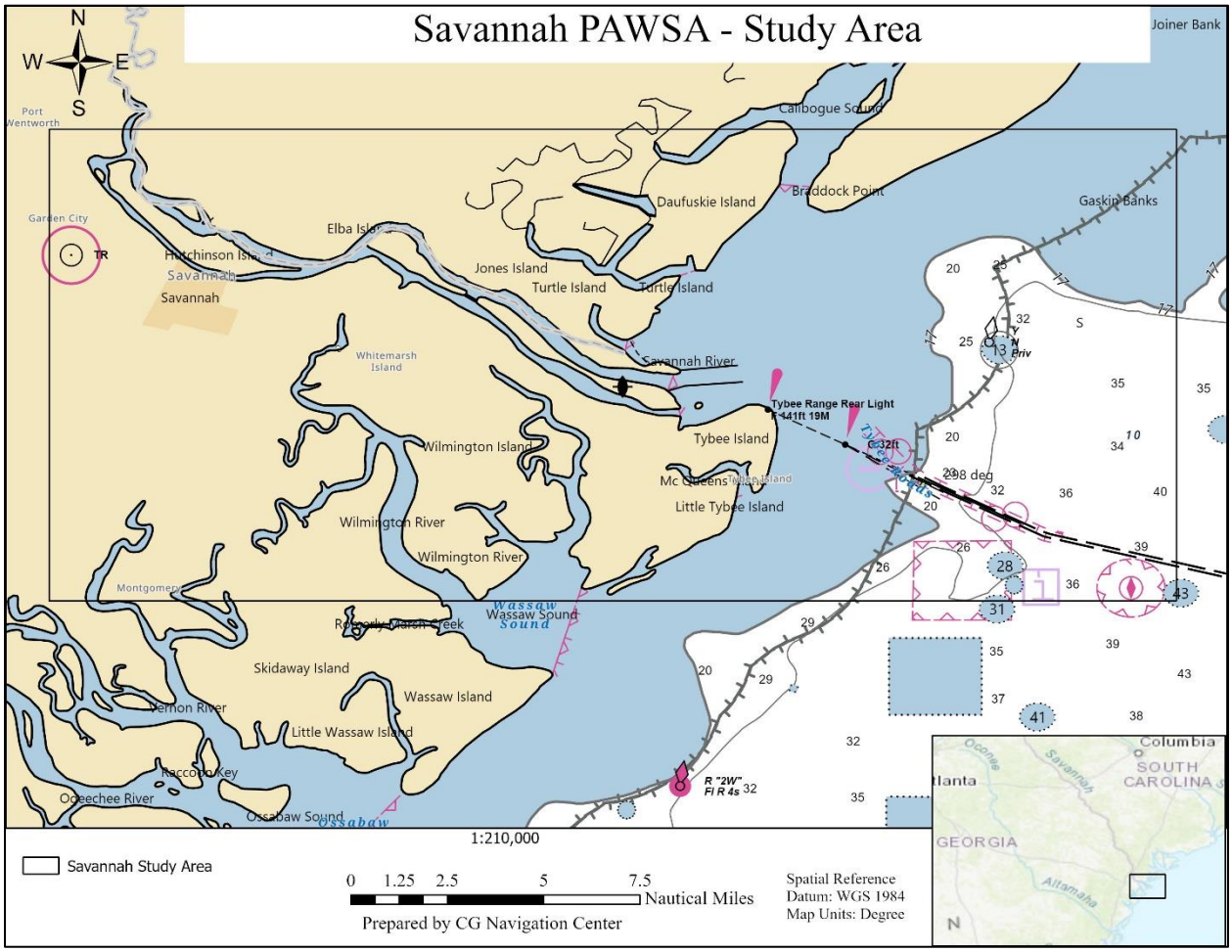

Figure 3- Savannah PAWSA workshop study area.

B. BRV

1. The resultant BRV using the methodology described in Chapter 1.C for the Savannah PAWSA workshop is depicted in Figure 4.

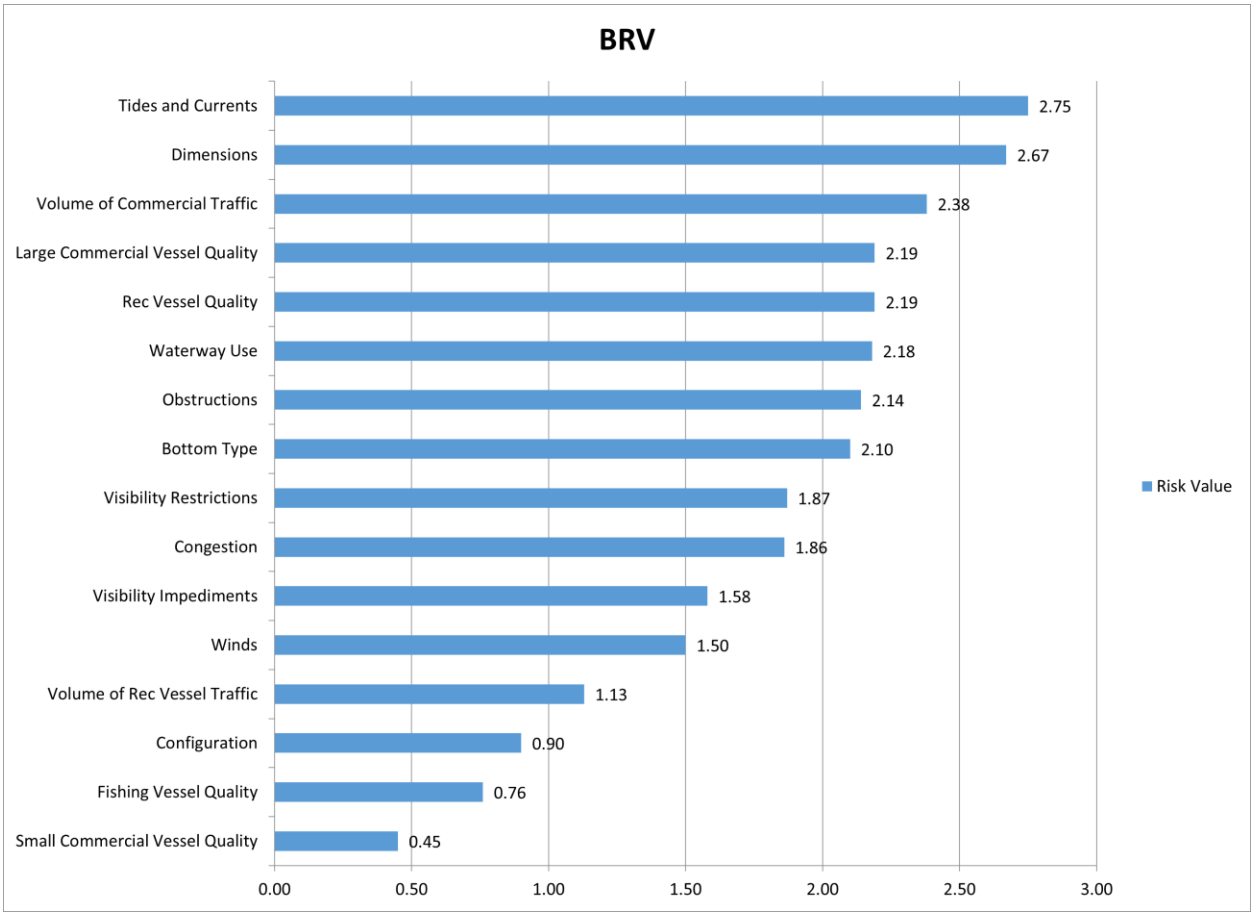

Figure 4- Savannah PAWSA workshop WRF BRV.

2. The five highest priority WRFs and their associated Waterway Risk Condition for the Savannah PAWSA prior to combining the BRV with the Risk Characterization results are documented in Table 4.

Waterway Risk Condition	WRF
Navigation	Tides and Currents
Waterway	Dimensions
Traffic	Volume of Commercial Traffic
Vessel Quality & Operation	Large Commercial Vessel Quality
Vessel Quality & Operation	Recreational Vessels

Table 4- Five highest priority WRF based on BRV.

C. Risk Characterization

1. The resultant Risk Characterization using the methodology described in Chapter 1.C for the Savannah PAWSA Workshop is presented in Table 5.

WRF Risk Characterization				
Waterway Risk Condition	**WRF**	**Current Risk Level**	**Current Risk Trend**	**Current Mitigations Are**
Navigation	Winds	Acceptable risk, keep the status quo.	Same	Acceptable
Navigation	Tides and Currents	Acceptable risk, keep the status quo.	Same	Unacceptable, we need more/better mitigations
Navigation	Visibility Restrictions	Acceptable risk, keep the status quo.	Same	Acceptable
Navigation	Bottom Type	Acceptable risk, keep the status quo.	Same	Acceptable
Vessel Quality & Operation	Large Commercial Vessels	Acceptable risk, keep the status quo.	Same	Acceptable
Vessel Quality & Operation	Small Commercial Vessels	Acceptable risk, keep the status quo.	Same	Acceptable
Vessel Quality & Operation	Fishing Vessels	Acceptable risk, keep the status quo.	Same	Acceptable
Vessel Quality & Operation	Recreational Vessels	Acceptable risk, keep the status quo.	Increasing	Unacceptable, we need more/better mitigations
Traffic	Volume of Commercial Traffic	Acceptable risk, keep the status quo.	Increasing	Acceptable but tenuous
Traffic	Volume of Recreational Traffic	Unacceptably high risk.	Increasing	Acceptable
Traffic	Waterway Use	Acceptable risk, keep the status quo.	Same	Acceptable
Traffic	Congestion	Acceptable risk, keep the status quo.	Same	Acceptable but tenuous
Waterway	Dimensions	Acceptable risk, keep the status quo.	Increasing	Acceptable but tenuous
Waterway	Obstructions	Acceptable risk, keep the status quo.	Same	Acceptable
Waterway	Visibility Impediments	Acceptable risk, keep the status quo.	Same	Acceptable
Waterway	Configuration	Acceptable risk, keep the status quo.	Same	Acceptable but tenuous

Table 5- Savannah PAWSA workshop WRF Risk Characterization.

D. Validation WRF Prioritization.

1. The combined WRF BRV and Risk Characterization results are depicted below in Table 6. These results were presented to participants to validate the prioritization order of WRFs for mitigation strategy dialogue and development. The rows highlighted in green in Table 6 represent the highest priority WRFs for the Savannah PAWSA workshop participants following the prioritization validation discussion.

		Risk Characterization		
WRF	**BRV**	**Current Risk Level**	**Current Risk Trend**	**The Current Mitigations Are**
Tides and Currents	2.75	Acceptable, keep the status quo.	Same	Unacceptable, we need more/better mitigations
Dimensions	2.67	Acceptable risk, keep the status quo.	Increasing	Acceptable but tenuous
Volume of Commercial Traffic	2.38	Acceptable, keep the status quo.	Increasing	Acceptable but tenuous
Recreational Vessel Quality	2.19	Acceptable, keep the status quo.	Increasing	Unacceptable, we need more/better mitigations
Large Commercial Vessel Quality	2.19	Acceptable, keep the status quo.	Same	Acceptable
Waterway Use	2.18	Acceptable, keep the status quo.	Same	Acceptable
Obstructions	2.14	Acceptable, keep the status quo.	Staying the same	Acceptable
Bottom Type	2.10	Acceptable, keep the status quo.	Same	Acceptable
Visibility Restrictions	1.87	Acceptable, keep the status quo.	Same	Acceptable
Congestion	1.86	Acceptable, keep the status quo.	Same	Acceptable but tenuous
Visibility Impediments	1.58	Acceptable, keep the status quo.	Same	Acceptable
Winds	1.50	Acceptable, keep the status quo.	Same	Acceptable
Volume of Recreational Traffic	1.13	Acceptable, keep the status quo.	Increasing	Acceptable
Configuration	0.90	Acceptable, keep the status quo.	Same	Acceptable but tenuous
Fishing Vessel Quality	0.76	Acceptable, keep the status quo.	Same	Acceptable
Small Commercial Vessel Quality	0.45	Acceptable, keep the status quo.	Same	Acceptable

Table 6- Combined BRV and Risk Characterization results for all WRFs.

2. Following subjective evaluation, participants selected Tides and Currents, Dimensions, Volume of Commercial Traffic, Recreational Vessel Quality, and Visibility Impediments as the most significant WRFs that contributed to potential incidents in the Savannah PAWSA study area. WRFs were ordered by the participant's criticality of concern. Table 7 presents WRFs in descending priority order from high to low. Mitigation strategies were discussed and developed in this order.

Waterway Risk Condition	WRF
Vessel Quality & Operation	Tides and Currents
Traffic	Dimensions
Traffic	Volume of Commercial Traffic
Vessel Quality & Operation	Recreational Vessel Quality
Waterway	Visibility Impediments

Table 7- Validated and prioritized WRFs listed from top to bottom.

E. Risk Mitigation Strategies

1. The validated list of WRFs was used to prioritize discussion and development of risk mitigation strategies. Facilitators directed participants to capture potential mitigation strategies on sticky notes, which were then consolidated and grouped to identify major themes. From this bank of action items, participants were encouraged to create specific, measurable, actionable, realistic, and timebound (SMART) goals as well as general goals. Both kinds of mitigation strategies developed by participants are represented in this report. Recommended mitigation strategies documented in this section received consensus among workshop participants. Mitigation strategies are documented in order of significance to participants.

2. Participant comments are listed in Appendix C of this report and are referenced throughout this subsection to provide support of documented developed mitigation strategies.

3. <u>WRF – Tides and Currents.</u>

   a. Participants requested that accurate tide and current information is provided to the public to ensure safe navigation within the area. The concerns expressed include the necessity for real-time tide and current data and the coordination with relevant stakeholders when these conditions abruptly change. Participants recommended the following additional mitigations:

      (1) Improved advertising for mariners regarding sources to access accurate and current weather data. Participants recommended modeling this system after the National Weather Service, which offerseasy accessibility and the capability to provide alerts for high water events.

(2) Enhanced collaboration between the National Oceanic Atmospheric Administration and the Savannah Pilots Association to identify precise installation locations for tide and current sensors.

(3) Use the National Oceanic Atmospheric Administration East Coast Hydrodynamic model to forecast currents. This model would not replace the necessity of live sensors but would provide a more accurate forecast.

b. Participants identified that notification when water is released from New Savannah Bluff Lock and Dam in August, GA is important information for stakeholders. Participants recommended the following additional mitigation:

(1) Request official notification from Army Corps of Engineers or the development of an alert system that can notify appropriate stakeholders in the event of a release.

c. Participants emphasized that the jetty at the mouth of the Intracoastal Waterway in the Savannah River is only visible from mid to low tide. Participants recommended the following additional mitigation:

(1) Install markers or signage every 150-200 feet to enhance the visibility of this hazard during high tide.

4. WRF – Dimensions.

a. Participants noted that the Savannah River accommodates a diverse range of commercial vessels. However, due to the river's narrow dimensions, choke points pose significant safety concerns. It is common practice for vessels to halt and allow others to pass, especially when encountering high-powered boats, to prevent conflicts and ensure safe navigation. Participants recommended the following additional mitigation:

(1) Widen specific areas of the Savannah River to mitigate congestion and improve traffic flow. Participants expressed that areas near Hutchinson Island, Elba Island, and Bird Island should be evaluated for potential expansion to facilitate a wider channel.

b. Participants expressed concern that current depths in the Savannah River constrain large commercial vessel movement. Participants recommended the following additional mitigation:

5. Increased frequency of dredging to enable safer navigation of large commercial vessels operating in the Savannah River. WRF – Volume of Commercial Traffic.

a. Volume of inbound large commercial container vessel traffic typically increases during flood tides. Port worker schedules are fixed and do not vary based on vessel traffic flow. The combined influx of large vessels during flood tides and inflexibility of port work schedules contributes to periodic congestion and operational delays.

Participants recommended the following additional mitigations:

(1) Evaluate the flexibility of port worker schedules to enable vessel movements at varying times to reduce congestion and peak traffic periods.

(2) Conduct a study to assess the feasibility and potential location to establish an offshore anchorage.

6. WRF – Recreational Vessel Quality and Operation.

a. Participants explained that the number of recreational vessels operating in the Savannah River is increasing. During holidays and special events, participants perceive an increase in fatalities and injuries, due to Boating Under the Influence (BUI) incidents. Participants acknowledged that the Coast Guard and additional law enforcement agencies lack the personnel and equipment to patrol these waters at the capacity recommended by the stakeholders. Participants recommended the following additional mitigations:

(1) Increase Law-Enforcement presence and employ coalitions to expand area of control by:

(a) Increasing police presence throughout the Savannah River particularly between the Intracoastal Waterway and container terminals.

(b) Increasing focused patrols in locations where dredge equipment is present during high-risk times such as weekend nights, holidays, and special events.

(c) Establishing a formal coalition with the Coast Guard and Marine Patrol to increase enforcement of BUI statutes and regulations.

b. Participants believe that crews of recreational vessels lack sufficient training and familiarity with
navigation rules. Participants recommended the following additional mitigations:

(1) Support Coast Guard Auxiliary efforts to provide free education and safety courses for recreational boaters. The Coast Guard Auxiliary offers educational resources at boat ramps, schools, marinas, boat shows, and a variety of other locations.

(2) Establish a requirement for all recreational operators to complete a boater safety course to ensure all mariners have a rudimentary understanding of navigation rules and familiarity with the local area.

c. Participants expressed that there is a lack of navigational safety awareness and familiarity among recreational boaters. Participants discussed addressing proficiency issues nationally through federal statue or regulation. Participants recommended the following additional mitigations:

(1) Require and impose a national licensing standard for recreational vessel operators.

d. Moored vessels on the Savannah River are vulnerable to surging from vessel wakes. Participants recommended the following additional mitigation:

(1) Provide outreach to the public to notify about the dangers and risks of mooring vessels in the vicinity of known commercial vessel wake zones.

e. Recreational vessels operating in the Intercoastal Waterway are prone to wakes from large commercial vessels. Participants recommended the following additional mitigation:

(1) Establish speed restrictions in the Intercoastal Waterway to mitigate the impact of vessel wakes.

7. <u>WRF – Visibility Impediments.</u>

a. It was observed that commercial vessels are increasing in size and eventually may not be able to pass safely beneath the Talmadge Memorial Bridge. Participants recommended the following mitigations:

(1) Raise or remove the Talmadge Memorial Bridge. There is an ongoing study to assess the feasibility of raising the height of the Talmadge Memorial Bridge by 21 feet.

(2) Evaluate the potential to construct an underwater tunnel similar to the Chesapeake Bay Bridge Tunnel to eliminate vessel bridge height restrictions. Participants discussed that construction of a tunnel may restrict vessel draft in the future and be cost prohibitive.

Appendix A. Workshop Participants

Participant	Organization
Cruises, Tours, and Charters	
1. Bradley Cheek	Savannah Riverboat
2. Daniel Foulds	Freedom Boat Club
Federal Agencies	
3. Kyle Ward	National Oceanic and Atmospheric Administration
Physical Infrastructure	
4. Johnathan Broadie	U.S. Army Corps of Engineers
Port Operations	
5. Thomas Beason	Bottom Line Echo
6. Morris Bozard	Southern LNG
7. Chris Rice	Georgia Port Authority
8. David Wilson	East Coast Terminals
Public Safety and Emergency Management	
9. Mike Dick	Garden City Fire Department
10. David Middleton	Georgia Department of Transportation
Towing Industry	
11. Jim Myatt	Myrick Towing
12. Joe Myatt	Moran Towing
13. Andrew Zeigler	Crecent Towing

Appendix B. Waterway Risk Model Terms and Definitions

A. Waterway Risk Conditions and WRF Definitions. The Ports and Waterway Safety Assessment (PAWSA) Waterway Risk Model uses sixteen WRFs categorized under four Waterway Risk Conditions. Definitions for each Waterway Risk Condition and their associated WRF are provided in this section.

1. Waterway Risk Condition - Navigation. The environmental conditions that affect vessel navigation, such as wind, currents, and weather.

    a. WRF -Winds. The difficulty in maneuvering vessels resulting from increased and unpredictable winds, particularly if the wind is from abeam.

    b. WRF - Tides and Currents. The difficulty in maneuvering vessels caused by water movement flow and speed, often affected by seasonal variations and sustained winds. Tide rips and whirlpools can be created by strong currents and affect the maneuverability of smaller vessels. The frequency of occurrence and the location of the strongest currents in the waterway are critical considerations (e.g., if current speed can exceed vessel speed, timing is critical when transiting the area).

    c. WRF - Visibility Restrictions. The natural conditions that may prevent a mariner from seeing other vessels, aids to navigation, or landmarks, such as fog, severe rain squalls, etc.

    d. WRF - Bottom Type. The material on the waterway bottom or just outside the channel, such as hard rock, mud, coral, etc.

2. Waterway Risk Condition - Vessel Quality and Operations. The quality of vessels and their crews that operate on a waterway. Each waterway has what are considered to be high risk vessels, such as old vessels, vessels with poor safety records, vessels registered in certain foreign countries, vessels belonging to financially strapped owners, vessels with inexperienced crews and operators, etc. When assessing risk, the following items should be considered (as appropriate) for each risk factor: maintenance, age, flag, class society, ownership, inspection record, casualty history, language barriers, fatigue related issues, and local area knowledge.

    a. WRF - Large Commercial Vessels. The quality of the large commercial vessel itself and the proficiency and quality of the crew. Large vessels are those ocean-going vessels, often engaged in international trade, that usually are constrained by their draft to use dredged channels where such channels exist. Large vessels include such things as: oil tankers, container ships, break bulk cargo ships, and cruise liners.

    b. WRF - Small Commercial Vessels. The quality of the small commercial vessel itself and the proficiency and quality of the crew. Small vessels include all other commercial craft EXCEPT commercial fishing vessels. Examples

include tugs and towboats, offshore supply vessels, charter fishing boats, and small passenger vessels (inspected under 46 CFR Subchapters T and K), such as dinner cruises and ferries.

c. WRF - Commercial Fishing Vessels. The quality of the commercial fishing vessel itself and the proficiency and quality of the crew. These vessels are included because they are not required to undergo annual vessel inspections nor are the crewmembers required to hold USCG licenses; therefore, there may be a greater potential for increased incidents involving commercial fishing vessels.

d. WRF - Recreational Vessels. The quality of the recreational vessel itself and the proficiency and operating knowledge of the individuals who operate them. Recreational vessels include all boats used for noncommercial purposes (e.g., pleasure craft or craft used by indigenous people for transportation or subsistence fishing). They can be powered by an engine, the wind, or human exertion. Examples include yachts, personal watercraft (a.k.a., jet skis), and kayaks. Besides local knowledge, understanding of the rules of the road and inebriation also should be considered for this risk factor.

3. Waterway Risk Condition - Traffic Conditions. The number of vessels that use a waterway and their interactions.

a. WRF - Volume of Commercial Traffic. The amount of commercial vessel traffic using the waterway (i.e., the more vessels there are on the water, the more likely that there will be a marine casualty). Deep draft and shallow draft commercial vessels as well as commercial fishing vessels are included in this risk factor. Shoreside infrastructure is also addressed in this risk factor (i.e., can it handle the volume of commercial traffic within the waterway).

b. WRF - Volume of Recreational Traffic. The amount of non-commercial vessel traffic using the waterway. The volume may vary depending on the time of day, the day of the week, the season of the year, or during a major marine event.

c. WRF - Waterway Use. The interaction between vessels or boats of different sizes using the same waterway and their maneuvering characteristics. Conflicts occur as risk increases with each type of vessel's maneuvering characteristics and actions that are often different and unpredictable (e.g. commercial mariners and recreational mariners using deep draft vessels and shallow draft vessels within the same waterway).

d. WRF - Congestion. The ability of the waterway to handle the volume and density of traffic. Risk increases when a large number of vessels uses a small geographic area for an extended period of time. Risk also increases substantially when you get a larger than normal number of vessels together for a short time (e.g., fishing tournament or short season commercial fishery).

4. Waterway Risk Condition - Waterway Conditions. The physical properties of the waterway that affect vessel maneuverability.

    a. WRF - Visibility Impediments. The man-made objects (e.g., moored ships, condominiums, background lighting, etc.) or geographic formations (e.g., headlands, islands, etc.) that prevent a mariner from seeing aids to navigation or other vessels.

    b. WRF - Dimensions. The room available for two vessels to pass each other within the waterway.

    c. WRF - Obstructions. Floating objects in the water that impede safe navigation and could damage a vessel, such as ice, debris, fishing nets, etc.

    d. WRF - Configuration. The arrangement of a waterway, including elements such as waterway bends, multiple and converging channels, and perpendicular traffic flow.

B. WRF Survey. During the first day of the PAWSA workshop, facilitators guide participants through a discussion about each WRF. Following each dialogue, participants take a three-part survey that is used to prioritize the development and discussion of mitigation strategies during the second day of the PAWSA. The following sections provide the associated numerical values, selection options, and definitions for Part One and Part Two of the WRF Surveys that are utilized to calculate the BRV of each WRF.

1. Part One. This first section of the survey asks participants to evaluate the likelihood of a specific WRF based on four available selections. Likelihoods are presented as written options to participants. Each written option has an associated numerical value between one and four based on the likelihood of the condition. Tables 1- 4 in this appendix provide the four written options and associated point value for each WRF.

Waterway Risk Condition - Navigation	
WRF - Winds	
Selection Option	**Point Value**
Strong winds affect maneuverability less than twice a month and are well forecasted.	1
Strong winds affect maneuverability more than twice a month but are well forecasted.	2
Strong winds affect maneuverability less than twice a month but without warning.	3
Strong winds affect maneuverability more than twice a month and without warning.	4
WRF – Tides and Currents	
Selection Option	**Point Value**
Fast tidal and seasonal currents are weak.	1
Fastest tidal and seasonal currents are moderate.	2
Fastest tidal and seasonal currents are strong but do not affect maneuverability.	3
Fastest tidal and seasonal currents are strong and affect maneuverability.	4
WRF – Visibility Restrictions	
Selection Option	**Point Value**
Restricted visibility occurs less than 24 days a year.	1
Restricted visibility occurs more than 24 days a year but usually persists less than 6 hours.	2
Restricted visibility occurs more than 24 days a year but usually persists less than 24 hours.	3
Restricted visibility occurs more than 24 days a year and usually persists more than 24 hours.	4
WRF – Bottom Type	
Selection Option	**Point Value**
Deep water throughout the waterway; no channel is needed, vessel breakdown unlikely to result in grounding or allision.	1
Soft bottom with no hard obstructions.	2
Soft bottom with some hard obstructions.	3
Hard or rocky bottom.	4

Table 1- Selection options and point values for WRFs categorized under the Waterway Risk Condition – Navigation.

Waterway Risk Condition - Vessel Quality and Operation	
WRF – Large Commercial Vessel Quality and Operation	
Selection Option	**Point Value**
All of the large commercial vessels using the waterway are materially sound and are operated proficiently.	1
Most of the large commercial vessels using the waterway are materially sound and are operated proficiently.	2
Many of the large commercial vessels using the waterway are materially sound and are operated proficiently.	3
Some of the large commercial vessels using the waterway are materially sound and are operated proficiently.	4
WRF – Small Commercial Vessel Quality and Operation	
Selection Option	**Point Value**
All of the small commercial vessels using the waterway are materially sound and are operated proficiently.	1
Most of the small commercial vessels using the waterway are materially sound and are operated proficiently.	2
Many of the small commercial vessels using the waterway are materially sound and are operated proficiently.	3
Some of the small commercial vessels using the waterway are materially sound and are operated proficiently.	4
WRF – Commercial Fishing Vessel Quality and Operation	
Selection Option	**Point Value**
All of the commercial fishing vessels using the waterway are materially sound and are operated proficiently.	1
Most of the commercial fishing vessels using the waterway are materially sound and are operated proficiently.	2
Many of the commercial fishing vessels using the waterway are materially sound and are operated proficiently.	3
Some of the commercial fishing vessels using the waterway are materially sound and are operated proficiently.	4
WRF – Recreational Vessel Quality and Operation	
Selection Option	**Point Value**
All of the recreational vessels using the waterway are materially sound and operated proficiently.	1
Most of the recreational vessels using the waterway are materially sound and operated proficiently.	2
Many of the recreational vessels using the waterway are materially sound and operated proficiently.	3
Some of the recreational vessels using the waterway are materially sound and operated proficiently.	4

Table 2- Selection options and point values for WRFs categorized under the Waterway Risk Condition – Vessel Quality and Operation.

Waterway Risk Condition - Traffic	
WRF – Volume of Commercial Traffic	
Selection Option	**Point Value**
Light commercial traffic.	1
Moderate Commercial Traffic.	2
Heavy commercial traffic but waterway infrastructure handles load easily.	3
Heavy commercial traffic and vessels regularly have to wait for berths.	4
WRF – Volume of Recreational Vessel Traffic	
Selection Option	**Point Value**
Light recreational use of the waterway.	1
Moderate recreational use of the waterway.	2
Heavy recreational use of the waterway but seasonal.	3
Heavy recreational use of the waterway year-round.	4
WRF – Waterway Use	
Selection Option	**Point Value**
Predominately a single use waterway serving one interest.	1
Multiple use waterway but no conflicts occurring.	2
Multiple use waterway and some minor conflict occurring.	3
Multiple use waterway and major conflicts occurring.	4
WRF – Congestion	
Selection Option	**Point Value**
No congestion ever occurs in the waterway.	1
Congestion only occurs in small areas for limited times.	2
Congestion occurs regularly but flow of vessel traffic is not impeded.	3
Congestion occurs regularly and flow of vessel traffic is impeded.	4

Table 3- Selection options and point values for WRFs categorized under the Waterway Risk Condition – Traffic.

Waterway Risk Condition – Waterway Condition	
WRF – Visibility Impediments	
Selection Option	**Point Value**
No visual impediments on the waterway.	1
Visibility impediments that do not impact navigation.	2
Visibility impediments that sometimes impact navigation.	3
Visibility impediments that often impact navigation.	4
WRF – Dimensions	
Selection Option	**Point Value**
No waterway constrictions.	1
Waterway constrictions (width and depth) exist but never impact navigation.	2
Waterway constrictions (width and depth) exist and sometimes impact navigation.	3
Severe waterway constrictions often impact navigation.	4
WRF – Obstructions	
Selection Option	**Point Value**
No obstructions.	1
Some obstructions not affecting navigation.	2
Obstructions sometimes affect navigation.	3
Obstructions often affect navigation.	4
WRF – Configuration	
Selection Option	**Point Value**
Current waterway configuration is adequate for navigation.	1
Current configuration is inadequate but does not pose a safety concern.	2
Current configuration poses a safety concern.	3
Current configuration poses a significant safety concern.	4

Table 4-Selection options and point values for WRFs categorized under the Waterway Risk Condition – Waterway Condition.

2. Part Two. This portion of the survey asks participants to assign an Impact Level for Immediate and Subsequent Consequences for each WRF. Definitions for terms associated with Part Two of the Survey are provided in this section.

    a. Immediate Consequences. The instantaneous impacts of a vessel casualty (i.e., what happens right after a collision, allision, or grounding). These include the following events or categories –

        i. Personnel Injuries. The maximum number of expected casualties. People can be injured, killed, or need to be rescued.

        ii. Petroleum Discharge. The largest petroleum spill in the most probable worst-case scenario.

iii. Hazardous Materials Release. The largest chemical or hazardous material spill in the most probable worst-case scenario.

iv. Mobility. The infrastructure that is critical to the Marine Transportation System within the waterway (i.e., the significant structures upon which moving people and cargo through the marine transportation system depend). The waterway can be blocked and the shoreside Marine Transportation System can be disrupted, ultimately causing greater problems moving cargo through a port—both on the water and ashore.

b. Subsequent Consequences. The longer-term effects of a marine casualty that are felt hours, days, months, and even years afterwards, such as shoreside facility shut-downs, loss of employment, destruction of fishing areas, decrease or extinction of species, degradation of subsistence living uses, and contamination of drinking or cooling water supplies. These include the following events:

i. Health and Safety. The potential consequences to the community that lives or works on or near the waterway. Risk is increased when more people live or work in close proximity to a waterway.

ii. Environmental. The risks to wetlands and endangered species and how sensitive people are to the quality of their environment. The more sensitive, the more people will expect in terms of both preparedness and response effectiveness for any marine accident that threatens environmental quality.

iii. Aquatic Resources. Water dwelling life forms harvested for commercial or recreational reasons. Timing of a marine casualty could affect the seriousness of the consequences (i.e., some species are only in the waterway at certain times of the year).

iv. Economic. The extent of the impact if a particular waterway is closed for some period.

Appendix C. Participant Comments

A. Background.

1. This appendix documents participant observations and recommendations expressed during the workshop with respect to specific issues of concern within the study area. Discussion during the first day of the workshop was recorded and subsequently transcribed using professional services. Comments were compiled and categorized by most applicable Waterway Risk Condition and WRF.

B. Waterway Risk Condition - Navigation.

1. WRF – Winds.

a. Key concerns include wind speed, direction, predictability, and their impact on vessel movement. Large vessels with significant sail area are particularly affected by winds. Specific issues include summer gales and ultra-large container vessels affected by winds exceeding 15 knots inshore and 25 knots offshore.

b. Recreational boaters are often unexpectedly caught in sudden storms with winds reaching up to 50 knots. Situational awareness and monitoring weather forecasts are crucial for mitigating risks. Mobile phones are the predominate resource in the region for checking weather forecasts.

c. Winds can change suddenly, posing challenges for prediction and response. An example of concern is the loading of Liquefied Natural Gas ships, which are affected by wind conditions necessitating careful attention to mooring lines. Operations are suspended if wind speeds exceed 15 knots for preparation and 20 knots for disconnection.

2. WRF - Tides and Currents.

a. The Savannah River experiences a significant tidal range and strong currents, which present challenges for vessel maneuverability and predictability. The tide ranges from nine feet at high tide to one foot at low tide and varies across the study area. Spring tides create shallows, posing risks for recreational boaters and leading to groundings on beaches and sandbars.

b. Participants recommended a study to evaluate the frequency and impact of tides and currents on operations, pinpointing specific areas and conditions. Compared to other ports, sensors and instrumentation in the Savannah has limited capability to provide real-time data.

c. Vessels in the Savannah River are restricted by tides. Currents and tides create shoaling, form shallow areas in the Savannah River, and create navigation challenges for deep draft vessels. The Army Corps of Engineers actively monitors and mitigates shoaling impacts and enacts proactive measures.

3. WRF – Visibility Restrictions.

a. The Savannah River experiences substantial fog due to temperature difference between cold river water and warm air.. Fog along the river primarily occurs from the end of October to March, with peak occurrences in December and January. Fog can create significant closures, sometimes lasting up to 160 hours in a month. These closures impact vessel schedules and operations, leading to delays and anchorage congestion.

b. Participants highlighted that dredging operations pose hazards during limited visibility and expressed concerns about recreational vessels navigating near dredging equipment. Despite fog-related closures, certain operations, such as towing and dredging, persist with enhanced communication and safety protocols in place.

c. Visibility issues pose significant risks to both small recreational and commercial vessels, increasing the likelihood of collisions and allisions due to reduced visibility. Recreational vessels particularly struggle with navigation and maintaining radio contact in limited visibility, especially in proximity to bunkering operations and dredging sites.

4. WRF – Bottom Type.

a. The bottom type in the area is predominantly muddy, which impacts maneuverability and necessitates continuous dredging to maintain adequate depth. A fluid mud layer extends from downtown upriver, fluctuating between depths of 38 feet and 42 feet, thereby affecting the handling capabilities of deep draft vessels. Channels can become obstructed due to the accumulation of mud. Navigation through these areas can be hazardous without up-to-date depth information.

b. Vessels are susceptible to grounding on concealed jetties during high tides, necessitating precise navigation and ongoing monitoring to mitigate incidents.

c. Strong currents and a high sediment load contribute to unpredictable variations in depth. For instance, Fields Cut where the Wright River meets South Carolina requires regular dredging due to rapid silt deposition, emphasizing the need for consistent maintenance.

C. Waterway Risk Condition - Vessel Quality and Operation.

1. WRF - Large Commercial Vessels.

   a. The Talmadge Memorial Bridge air gap is 185 feet. A bridge, with an ideal height of 235 feet, comparable to the Suez Canal Bridge, would provide a greater clearance for commercial vessel traffic to transit.

   b. Language barriers persist during operations, impacting efficiency and safety. Basic English proficiency among crews is often lacking, complicating communication during critical maneuvers.

   c. The operations of large vessels are subject to stringent regulations due to the critical nature of their activities and the minimal tolerable margin for error. Critical incidents such as engine failures or steering losses are exacerbated by narrow channels and swift currents.

2. WRF - Small Commercial Vessels.

   a. Fire prevention regulations are well-received by the small commercial vessel fleet in Savannah.

   b. Small commercial vessels present minimal concern. Vessels effectively communicate and have favorable regulatory compliance. Crews typically possess basic English proficiency, but communication can pose a challenge during critical maneuvers.

   c. There is a preference for Third Party Organization inspections over Coast Guard led inspections due to cost-effectiveness and convenience.

3. WRF - Commercial Fishing Vessels.

   4. Commercial fishing is not prevalent in the Savannah River. However, commercial fishing vessels operate in nearby locations such as Darien, Brunswick, and Hilton Head.

   a. The quality and maintenance of commercial fishing vessels vary significantly, primarily due to economic constraints.

   b. There is a significant concern regarding the limited responsiveness of commercial fishing vessels on radio communications, particularly in channels.

5. WRF - Recreational Vessels.

    a. Recreational vessel crews frequently lack adequate training and familiarity with navigation rules. There is minimal training and no mandatory proficiency testing for recreational boat operators, which sharply contrasts with aviation standards where rigorous training and proficiency tests are obligatory.

    b. Recreational boaters commonly lack situational awareness and understanding of vessel maneuverability, resulting in multiple fatalities from collisions with dredge operations and commercial traffic.

    c. There is an influx of recreational boating issues associated with alcohol on the weekends. Participants requested an increase in law enforcement presence to reduce Boating Under the Influence incidents.

D. Waterway Risk Condition - Traffic.

1. WRF - Volume of Commercial Traffic.

    a. There is significant conflict between commercial and recreational traffic due to the increased number of large vessels and the absence of a safety zone to separate different types of vessels.

    b. Historically, pilots employed a notification system for incoming and outgoing vessels. The cost of high fees associated with this system restrict access for some users. To address this issue, it is recommended that a more centralized, publicly accessible system should be developed to benefit all waterway users.

    c. Marine Traffic is a free online resource available to reactional boaters to better understand and plan voyages around commercial vessels traffic.

2. WRF - Volume of Recreational Traffic.

    a. During holidays such as Labor Day and the Fourth of July, increased activity on the Savannah River leads many experienced boaters to avoid the water due to the influx of inexperienced individuals. There are a high number of incidents during St. Patrick's Day celebration including drownings, primarily due to alcohol consumption and swimming.

    b. Despite the relatively low volume of traffic, Fields Cut poses a high level of risk because it is a significant interaction point for recreational and commercial traffic.

    c. Shark Tooth Island and other land masses in the Savannah River reduce the width of the navigational channel and enable the generation of vessel wakes from marine traffic with potential to capsize smaller vessels.

d. Identified choke points and high-risk areas need further attention, with possible solutions including better signage and increased awareness among recreational boaters.

3. WRF - Waterway Use.

a. The river accommodates a wide variety of vessel types, including container ships, bulk carriers, recreational boats, tankers, Liquified Natural Gas carriers, passenger vessels, and dredgers. Due to its small size, the port experiences high diversity and density of vessels daily, limiting maneuverability and causing congestion.

b. A choke point exists on the river where recreational traffic volume is high. The narrow entry often causes two vessels to meet simultaneously, leading to safety concerns. A common practice is to stop and let the other vessel pass to avoid conflicts, particularly when other boats are high-powered, or the operators appear to be under the influence of alcohol.

c. Vessel size significantly influences whether the river operates with one-way or two-way traffic. Larger vessels and Liquified Natural Gas carriers impose restrictions on other traffic due to their size and safety protocols.

4. WRF – Congestion.

a. Holidays and events such as the Fourth of July, Memorial Day, and the Christmas Boat Parade significantly increase congestion. Seasonal factors, especially during summer, further contribute to congestion.

b. Inclement weather events delay vessel movements creating increased congestion and economic impacts to the port. .

c. There is a noticeable increase in vessel traffic, particularly recreational traffic, over the past decade.

d. Seasonal fishing activity is influenced by regulatory openings and closures, while spring and summer months experience surges in tourism and recreational boating.

e. Volume of large container vessel traffic increases at the end of summer in preparation for the holiday retail season.

E. Waterway Risk Condition - Waterway.

1. WRF – Dimensions.

a. Specific areas within the waterway should be widened to alleviate congestion and enhance traffic flow. Narrow channels and conflicting traffic can create maneuverability challenges.

b. The Atlantic Intercoastal Waterway at Elba Island is an area with various blind and sharp turns.

c. St. Augustine Creek is an area only used by recreational vessels that has various blind and sharp turns.

2. WRF – Obstructions.

a. Participants discussed the challenges with debris management. These difficulties include identifying and mitigating submerged debris, as well as legal and logistical challenges in their removal and disposal. Environmental and operational impacts are significant during inclement weather events, with increased debris often affecting recreational vessels.

b. High-risk areas include bridges, dredge pipelines, and specific derelict docks. Debris can cause significant operational issues for vessels, and challenges arise regarding responsibility and funding for removal. There are also occasional issues with derelict vessels sinking and obstructing navigation.

3. WRF - Visibility Impediments.

a. Signage indicating the presence of jetties when submerged by high tides should be increased or, as an alternative, jetties should be raised to an elevation visible at all tide levels.

b. There have been several near-miss incidents involving container vessels and tankers attributed to visibility impediments at terminals.

4. WRF – Configuration.

a. A study is underway to identify critical areas of the river that need to be widened.

b. There are no designated anchorage areas for container vessels near the Savannah River. Available space in the waterway is a constraint. A study to identify possible anchorage locations should be conducted within the waterway.

5. There are no regulatory or statutory requirements to maintain recreational docks or to dredge creeks and similar shallow water areas that are primarily trafficked by recreational vessels.

Appendix D. Geospatial Participant Comments

Facilitators captured participant observations that made specific geographic references. Observations were transferred to an ArcGIS online web-application to generate the chartlets reflecting the location and specific context of each comment. The chartlets are included below, represented in Figures 1-3. The Savannah Habor Pilots were unable to provide representation during the PAWSA Workshop. Their feedback was received post workshop and is shown in Table 2 and represented in Figures 4 and 5.

Geospatial Comments	
Point	**Comment**
1	Jetties north of Tybee Island become submerged during high tides and frequently cause recreational vessel groundings.
2	Signage at the entrance of the Savannah River jetty should be enhanced to denotate the presence of the jetty when submerged during high tide. Current signage is only visible from low to mid tide.
3	It's important to monitor the shifting shoal in the area because impacts small to medium-sized vessels. The shoal is regularly marked and surveyed but, requires ongoing attention due to its propensity to change quickly.
4	Shallow shoaling at the pinch point on the Intercoastal Waterway near Ramshorn Creek Lighted Buoys 40 and 39 often results in Buoy 40 being embedded in the sand at low tide.
5	Participants requested action on the derelict dock on the Intercoastal Waterway at Pine Island in Ramshorn Creek.
6	The junction of Fields Cut and Wright River is a significant choke point in the waterway.
7	There is a proposed increased monitoring and management where recreational vessels cross the Savannah River, due to the heightened interaction between recreational and commercial traffic.
8	There need to be additional measures to manage the significant interface between recreational and commercial traffic at Elba Island Cut and Fields Cut.
9	The proximity of the red Intercoastal Waterway #2 beacon to the green #37 Savannah River beacon often confuses inexperienced recreational boaters.
10	The South Elba Island rock jetty becomes submerged when the tide exceeds 5 feet and poses a grounding risk to recreational vessels passing on the Intercoastal Waterway.
11	Novice recreational boaters frequently ground when navigating the intersection of the Wilmington River and the Intercoastal Waterway at Skidaway River.
12	Most boaters are untrained and intoxicated when navigating the city front area and are unaware of the port's busy conditions and associated risks.
13	It is recommended to install a tide and current sensor to provide live data in this area.
14	Untrained recreational boaters pose a safety risk in the Kings Island and Marsh Island Turning Basins.

Table 1- Geospatial Comments.

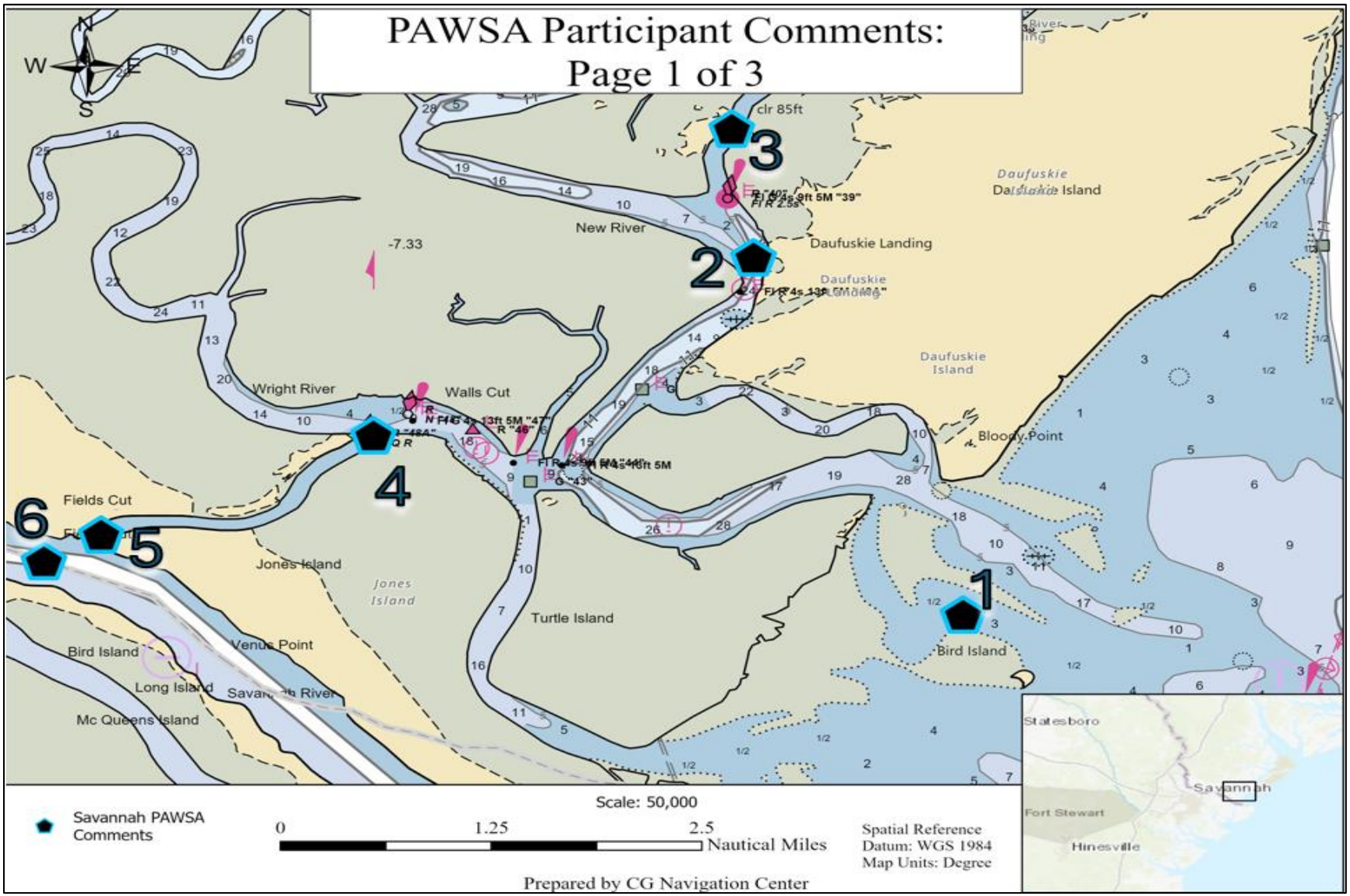

Figure 1- Mapped location of geospatial comments of Participants, 1-6.

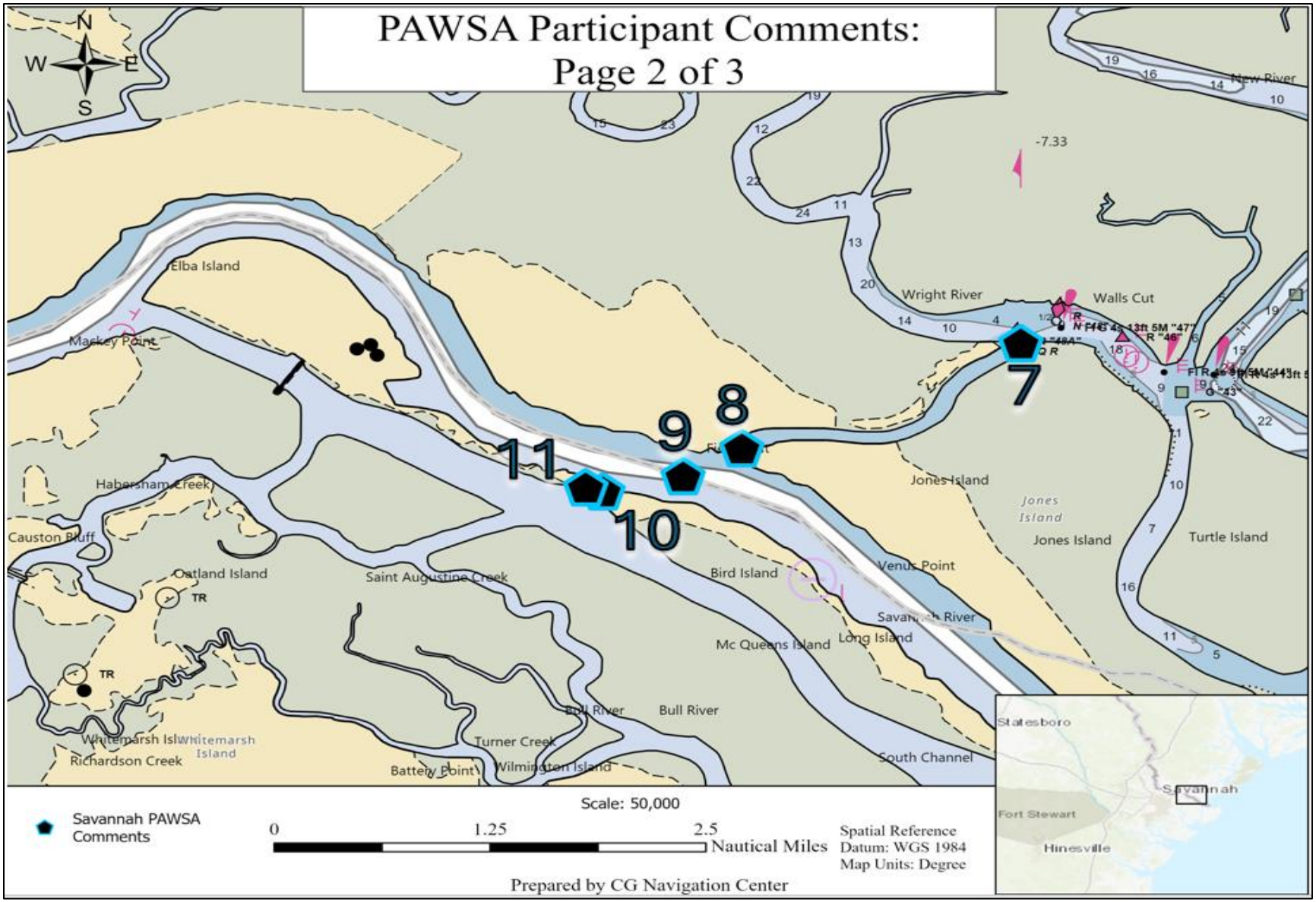

Figure 2- Mapped location of geospatial comments of Participants, 7-11.

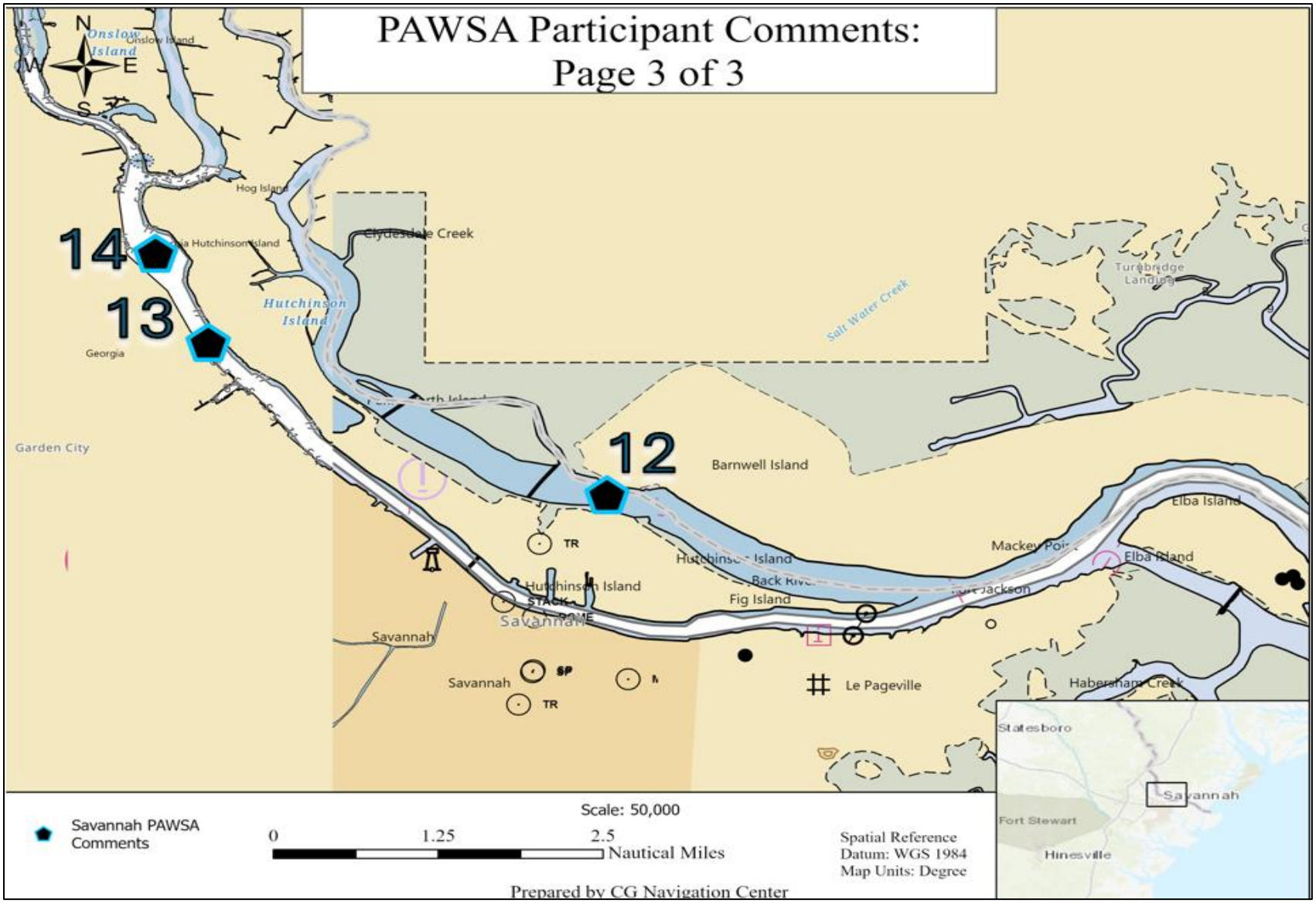

Figure 3- Mapped location of geospatial comments of Participants, 12-14.

Geospatial Comments	
Point	**Comment**
1a	Many Tybee Island visitors are unaware of the significant wakes created by large vessels transiting the area. To address this, it has been suggested that additional signage be installed, or that supplementary educational resources be made readily available to those visiting the beach.
2a	The jetty runs a straight line between two points and is only visible at low tide, presenting a hazard to navigation.
3a	Submerged pilings from derelict berths are not visible at high water and pose a danger to vessels.
4a	This rock jetty at Northeast Bank is only visible at low water.
5a	This rock jetty at Northeast Bank (a different jetty then referenced in comment #4) is only visible at low water.
6a	This submerged rock pile that is not visible at high water and should be marked to ensure safe navigation.
7a	There is a need to mark submerged dredge pipelines and anchors, as their buoys may be unlit and create a potential hazard.
8a	Vessels should transit with caution in the vicinity of the Savannah Yacht Center due to construction and lift operations.
9a	The submerged pipeline from the oxygenation plant needs to be clearly marked.
10a	Measures are needed at Garden City Container Terminal to safely manage large commercial vessel traffic.
11a	Various extinguished and/or missing aids to navigation in this area should be repaired or replaced.
12a	Small vessel traffic is vulnerable to tugboat propeller wash in this area.

Table 2- Geospatial Comments, from Savannah Harbor Pilots.

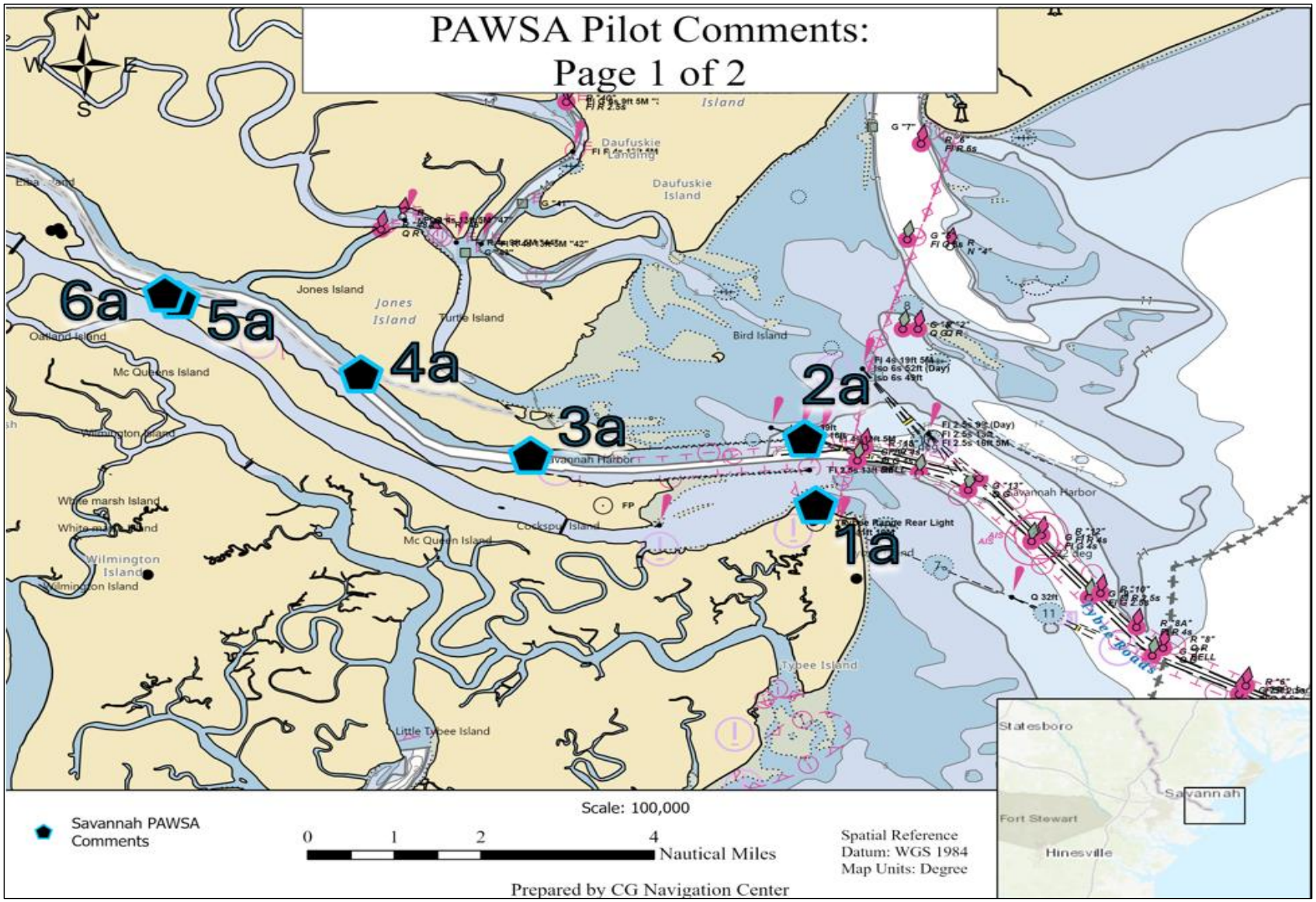

Figure 4- Mapped location of geospatial comments of Pilots, 1a-6a.

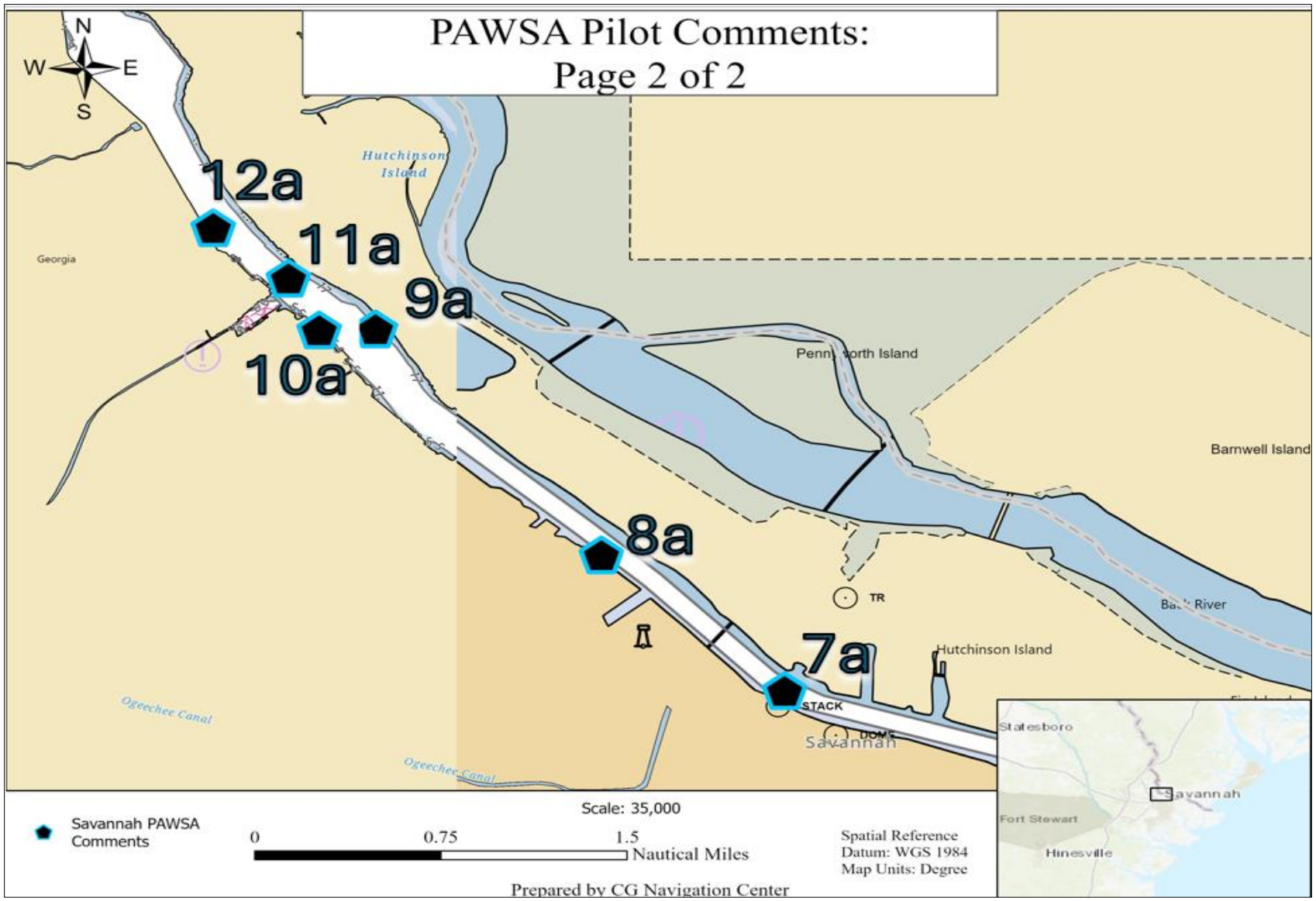

Figure 5- Mapped location of geospatial comments of Pilots, 7a-12a.