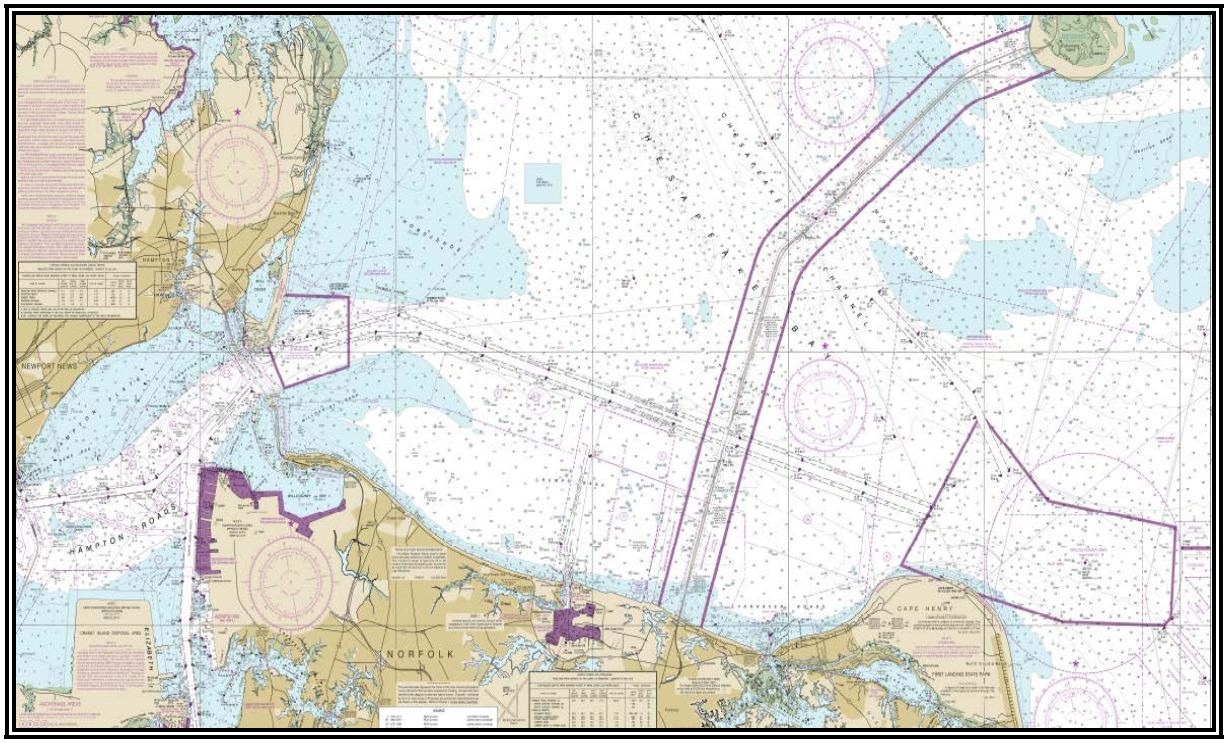
Ports and Waterways Safety Assessment

Workshop Report

Hampton Roads, Virginia



United States Coast Guard
Marine Transportation Systems Directorate

Providing Navigation Safety Information
for America's Waterways Users

Executive Summary

The United States Coast Guard (USCG), Marine Transportation System Management Directorate, is responsible for developing and implementing policies and procedures that facilitate commerce, improve safety and efficiency, and inspire dialogue with port and waterways users with the goal of making waterways as safe, efficient, and commercially viable as possible.

Through the 1997 Coast Guard Appropriations Act, the Coast Guard was directed to establish a process to identify minimum user requirements for new Vessel Traffic Service (VTS) systems in consultation with local officials, waterways users and port authorities, and also to review private / public partnership opportunities in VTS operations. The Coast Guard convened a National Dialogue Group (NDG) comprised of maritime and waterway community stakeholders to identify the needs of waterway users with respect to Vessel Traffic Management (VTM) and VTS systems. The NDG was intended to provide the foundation for the development of an approach to VTM that would meet the shared government, industry, and public objective of ensuring the safety of vessel traffic in U.S. ports and waterways, in a technologically sound and cost effective way.

From the NDG came the development of the ***Ports and Waterways Safety Assessment (PAWSA) Waterways Risk Model,*** and the ***PAWSA workshop process***. PAWSA is a disciplined approach designed to identify major waterway safety hazards, estimate risk levels, evaluate potential mitigation measures, and set the stage for the implementation of selected risk reduction strategies. The process involves convening a select group of waterway users and stakeholders and facilitating a structured workshop agenda to meet the risk assessment objectives. A successful workshop requires the participation of professional waterway users with local expertise in navigation, waterway conditions, and port safety. In addition, stakeholders are included in the process to ensure that important environmental, public safety, and economic consequences are given appropriate attention as risk interventions are identified and evaluated.

The long-term goals of the PAWSA process are to:

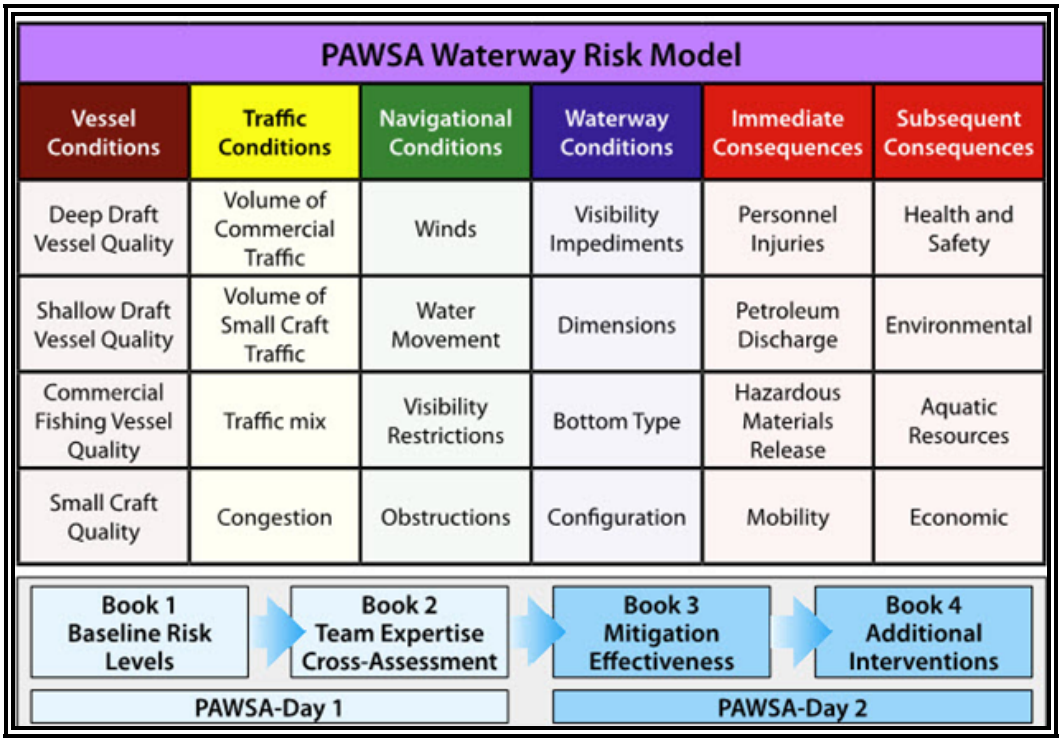
1) Provide input when planning for projects to improve the safety of navigation;
2) Further the Marine Transportation System (MTS) goals of improved coordination and cooperation between government and the private sector, and involving stakeholders in decisions affecting them;
3) Foster development and/or strengthen the roles of Harbor Safety Committees within each port; and
4) Support and reinforce the role of Coast Guard Sector Commanders/Captains of the Port (COTP) in promoting waterway and vessel traffic management activities within their geographic areas of responsibility.

Fifty-three ports/waterways have been assessed using the PAWSA process. The risk assessment process represents a significant part of joint public-private sector planning for mitigating risk in waterways. When applied consistently and uniformly in a number of waterways, the process is expected to provide a basis for making best value decisions for risk mitigation investments, both on the local and national level. The goal is to find solutions that are cost effective and meet the needs of waterway users and stakeholders.

PAWSA Waterway Risk Model / PAWSA Workshop process

The PAWSA Waterway Risk Model includes variables dealing with both the causes of waterway casualties and their consequences. In the Waterway Risk Model, risk is defined as a function of the probability of a casualty and its consequences. The risk model includes variables associated with both the causes and effects of vessel casualties. Figure 1 below shows the six general risk categories, and corresponding risk factors, that make up the Waterway Risk Model.

Figure 1



- ***Vessel Conditions*** – The quality of vessels and their crews that operate on a waterway.
- ***Traffic Conditions*** – The number of vessels that use a waterway and how they interact with each other.
- ***Navigational Conditions*** – The environmental conditions that vessels must deal with in a waterway.
- ***Waterway Conditions –*** The physical properties of the waterway that affects vessel maneuverability.
- ***Immediate Consequences*** – The instantaneous impacts to the port as a result of a vessel casualty.
- ***Subsequent Consequences*** – The longer-term impacts felt days, months, and even years afterwards.

Workshop activities include a series of discussions about the port/waterway attributes and the vessels that use the waterway, followed by completion of survey books to establish baseline risk levels, evaluate the effectiveness of existing risk mitigations, and identify additional risk intervention strategies to further reduce risk in the port / waterway. Survey book 1 is used to numerically evaluate the baseline risk levels using pre-defined qualitative risk descriptions for pre-defined risk factors. Survey book 2 is used to assess the expertise of each other with respect to the risk categories in the model. Those expertise

assessments are used to weight inputs obtained during the other steps in the workshop process. Survey book 3 is used to evaluate how effective the mitigation strategies are at reducing risks, and to determine if the risks are well balanced or not. For those risk factors where risk is judged to be not well balanced by existing mitigations, participants use survey book 4 to identify additional risk intervention strategies and then evaluate how effective those new strategies could be at reducing risks.

Hampton Roads PAWSA Workshop

A PAWSA workshop for the Port of Hampton Roads was held in Portsmouth, Virginia, from 13-14 July, 2016. The workshop was attended by 24 participants, representing waterway users, regulatory authorities, military vessel operators, and stakeholders with an interest in the safe and efficient use of Hampton Roads from both a commercial, military strategic port, and recreational perspective. Over the course of the 2-day workshop, participants discussed and evaluated each of the 24 risk factor that make up the Waterways Risk Model.

Participants outlined the challenges deep draft commercial vessels encounter when entering the port of Hampton Roads and navigating safely within the confines of the Thimble Shoal Channel. Discussions focused on the unique operating and vessel transiting conditions in the Port of Hampton Roads involving the interactions between commercial shipping and United States Naval vessels transiting the restricted Thimble Shoal Channel, which serves as the main shipping channel leading from the entrance to the Chesapeake Bay, to the ports of Norfolk and Portsmouth located along the Elizabeth River.

For each of the 24 risk factors evaluated, participants discussed and then numerically evaluated the baseline risk levels using pre-defined qualitative risk descriptions for each risk factor. Participants then discussed existing risk mitigation strategies, evaluated how effective the mitigation strategies were at reducing risk, and then determined if the risks are well balanced. For 17 of the 24 risk factors evaluated, there was consensus (defined as 2/3 of the workshop participant teams being in agreement) that risks were well balanced by existing mitigations. For 4 risk factors (Small Craft Quality, Volume of Small Craft Traffic, Dimensions, and Mobility), there was consensus that risks were NOT well balanced by existing mitigations. For the remaining 3 risk factors (Configuration, Hazards Materials Release, and Economic), there was no consensus among the participants that that risks were well balanced by existing mitigations. For these seven risk factors, the participants engaged in further discussions to identify additional risk intervention strategies, and then evaluated how effective those new strategies could be at reducing risk.

To further reduce risks relating to Small Craft Quality, the participants recommended mandatory education, testing, and licensing for small craft operators. To reduce risks associated with the Volume of Small Craft Traffic using the Hampton Roads waterway, participants recommended increased enforcement of existing rules/regulations and increased and stronger interactions between law enforcement personnel and companies and vendors who provide small craft rental services to the general public. Sector Hampton Roads was proposing to establish a Harbor Safety Committee for the Port of Virginia to widen the outreach to all boaters of the region for all types of safety issues and promote best practices. To further reduce risks for the Dimensions risk factor, participants were unanimous in their opinion/recommendation that dredging the channels wider and deeper would improve safety, and provide the ability for large Commercial and U.S. Naval vessels to transit inbound/outbound 24/7 in most weather and sea states without the one-way traffic restrictions currently in place.

Additional mitigations to reduce impacts to Mobility (infrastructure that is critical to the Marine Transportation System), included increased coordination between transportation committees and Federal, State, and local agencies that are responsible for the maintenance of roads, bridges, and waterways. The numerous vehicular and railroad lift-bridges crossing the Elizabeth River were also identified as prone to frequent failures, and should be repaired in order to reduce waterway closures.

Mitigations to reduce the risks associated with channel Configurations included establishing a Vessel Traffic Service, evaluating new channel designs, establishing an anchorage at the Chesapeake Bay entrance, dredging channels wider and deeper to improve safety, and upgrading railroad bridge infrastructure. Increased response agency coordination and shore side support capability were identified as mitigations to a Hazardous Material Release.

Actions recommended to reduce the risk of economic impacts to the port included widening and deepening of the channels to maintain 24/7 two-way navigation during inclement weather and sea states, and increased coordination and planning among response agencies to strengthen Continuity of Operations Plans, designed to ensure port operations continue when critical infrastructure is impacted by major marine casualties and emergencies. Though outside the Regulated Navigation Area in which this study was focused, it is noted that the Atlantic Ocean Channel turns to the east to avoid the Dam Neck Restricted Area southeast of the entrance to the Chesapeake Bay. Vessel operator practices show that deep draft vessels alter course to avoid this restricted area adding transit time to vessel journeys and incurring additional operating costs to the company. The Virginia Maritime Association has proposed the U.S. Navy reassess the restricted area and consider shifting the north eastern boundaries to facilitate a more direct route from sea to the Chesapeake Bay. The Coast Guard is in discussion with appropriate Federal agencies to facilitate this proposal.

The results of the baseline risk level survey, existing risk mitigation strategies, additional risk intervention strategies, and participant comments and observations in the Port of Hampton Roads, are outlined in this report.

Conclusion

The goal of a PAWSA workshop is not only to further the Marine Transportation System objective of improved coordination and cooperation between government and the private sector, and involving stakeholders in decisions affecting them, but to provide the Coast Guard Sector Commanders and members of the waterway community with an effective tool to evaluate risk and work toward long term solutions tailored to local circumstances. To find solutions both cost effective and meet the needs of waterway users and stakeholders. In support of this goal, this report should be viewed as a starting point for continuing dialogue within the Hampton Roads maritime community.

The United States Coast Guard, Marine Transportation System Management Directorate, extends a sincere appreciation to the workshop participants for their contributions to the Hampton Roads PAWSA workshop. Their expertise was critical to the success of the workshop, and their recommendations will greatly assist the Coast Guard as it continues to work with the maritime community to further improve safety and efficiency in the Port of Hampton Roads, Virginia.

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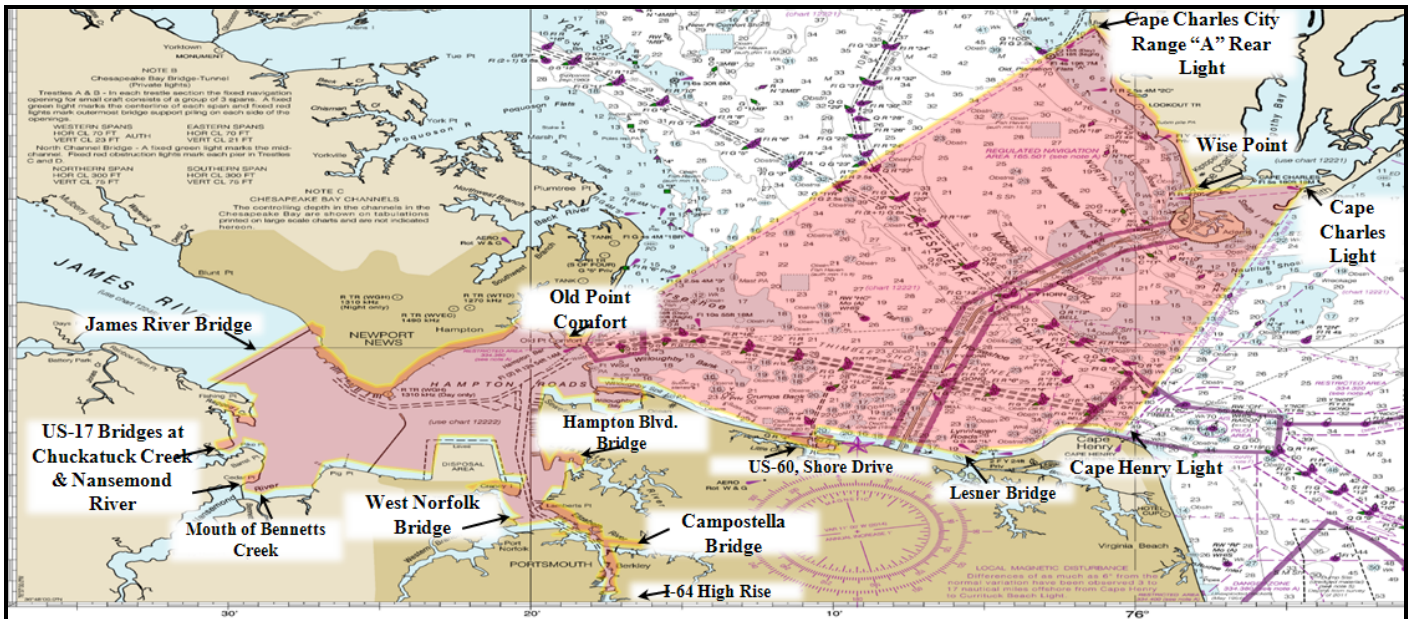
Table of Contents

Page

Section 1: Hampton Roads PAWSA - Assessment Area

The geographic area assessed during the workshop included all waters located within the Regulated Navigation Area (RNA) described in Title 33 Code of Federal Regulations Parts 165.1 through 165.13, and Part 165.501.

Figure 2



RNA Counterclockwise from Cape Henry Light

Cape Henry → Cape Charles → Wise Point →Cape Charles City Range "A" Rear Light → Old Point Comfort → James River Bridge →

US-17 Bridge at Chuckatuck Creek & Nansemond River (Mills Godwin Bridge) → Mouth of Bennetts Creek → West Norfolk Bridge →

I-64 Bridge → Campostella Bridge → Hampton Boulevard Bridge at Lafayette River → US Rt 60 Bridge along Shore Drive → Lesner Bridge → Cape Henry Light

Speed Restrictions

Little Creek: 5 knots
Southern Branch Elizabeth River: 6 knots
Norfolk Harbor Reach: 10 knots if over 300 gross tons

Anchoring Restrictions

No vessel over 65ft may anchor in the RNA not in an anchorage
Vessel over 100 gross tons within 2nm of CBBT or I-664 Bridge must have anchor ready

Other Requirements

**DST submission requirement*
**No vessel with draft less than 25ft may use Thimble Shoal Channel except to cross it*
**Requires corrected charts, operative radar, a pilot*
**Notice of Arrival, greater than 300 gross tons*

Section 2: Baseline Risk Levels

The first step in the Hampton Roads PAWSA workshop was the completion of survey book 1 to determine a baseline risk level value for each risk factor in the Waterway Risk Model. To establish the baseline risks level, participants discussed each of risk 24 applicable factors in the Waterways Risk Mode and selected a qualitative description for each risk factor that best described the conditions in the port. These qualitative descriptions were converted to discrete values using numerical scales that were developed during earlier PAWSA workshops.

On those scales, 1.0 represents low risk (best case) and 9.0 represents high risk (worst case), with 5.0 being the mid-risk value. Figure 3 below shows that 15 of 24 risk factors were scored at or above the mid-risk value. Risk values highlighted in red (values at or above 7.7) denote very high baseline risk levels; risk values highlighted in green (values at or below 2.3) denote very low baseline risk levels.

Figure 3

Baseline Risk Levels					
Vessel Conditions	Traffic Conditions	Navigational Conditions	Waterway Conditions	Immediate Consequences	Subsequent Consequences
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
2.1	6.2	4.6	4.6	6.0	9.0
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
3.1	6.2	3.3	8.2	8.2	7.6
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
4.8	6.0	3.0	3.2	7.1	8.0
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
8.4	7.2	3.1	8.3	9.0	8.8

As the participants discussed trends and observations for each of the 24 risk factors, their comments and observations were documented for inclusion in this workshop report. Appendix B is a summary of participant comments and observations on trends in the port and existing risk mitigations.

Section 3: Team Expertise Cross-assessment

The second step in the Hampton Roads PAWSA workshop was the completion of a team expertise cross-assessment. The team expertise cross-assessment was conducted early in the workshop process and was used to weigh the relative strengths of each team with respect to the six risk categories. The results of the team expertise cross-assessments were used to weight the inputs that each team provided in the other workbooks completed during the workshop.

After being presented with the concepts underlying the model, each participant team was asked to discuss (among themselves) how their background and experience aligns with the model. They then verbally presented their conclusions to the other teams. These presentations gave all teams a sense of where everyone thought they were strong – or perhaps not so strong. After all teams had spoken, each team then evaluated whether they were in the top, middle, or lower third of all teams present with respect to knowledge and expertise in the six risk category areas.

The participants assessed their own and all the other participant teams' level of expertise for each of the six categories in the Waterway Risk Model. Overall, 43% of the participant teams were placed in the upper third, 31% in the middle third, and 26% in the lower third of all teams. While the "ideal" split should be closer to a 33% / 33% / 33% distribution, the expertise in the room were strong and evenly distributed for all categories. Appendix A is a list of the PAWSA workshop participants and the workshop facilitation team.

The following table further breaks down the participants' expertise for each risk category.

Figure 4

Team Expertise -- Distribution

Risk Category	Top 1/3	Mid 1/3	Lower 1/3
Vessel Conditions	44%	23%	32%
Traffic Conditions	36%	41%	23%
Navigational Conditions	49%	28%	22%
Waterway Conditions	47%	26%	27%
Immediate Consequences	57%	27%	16%
Subsequent Consequences	25%	41%	35%
All Categories Average	43%	31%	26%

Section 4: Existing Risk Mitigations

The third step in the Hampton Roads PAWSA workshop was for participants to evaluate the effectiveness of existing mitigation strategies in reducing the risk level for each risk factor. Participants discuss existing risk mitigations for all risk factors in the model, and then evaluated how effective they though the mitigations were at reducing risks.

For 17 risk factors (green), there was consensus that risks were well balanced by existing mitigations.

For 3 risk factors (yellow), there was no consensus that risks were well balanced by existing mitigations.

For 4 risk factors (red), there was consensus that risks were not balanced.

Consensus is defined as 2/3 of the workshop participant teams being in agreement.

Figure 5

Mitigation Effectiveness					
Vessel Conditions	**Traffic Conditions**	**Navigational Conditions**	**Waterway Conditions**	**Immediate Consequences**	**Subsequent Consequences**
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
2.1 2.2	6.2 5.6	4.6 4.1	4.6 3.8	6.0 5.2	9.0 6.8
Balanced	Balanced	Balanced	Balanced	Balanced	Balanced
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
3.1 3.0	6.2 6.4	3.3 2.9	8.2 8.1	8.2 6.3	7.6 6.4
Balanced	NO	Balanced	NO	Balanced	Balanced
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
4.8 4.9	6.0 5.5	3.0 2.7	3.2 2.9	7.1 6.9	8.0 7.2
Balanced	Balanced	Balanced	Balanced	Maybe	Balanced
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
8.4 8.8	7.2 7.0	3.1 3.5	8.3 7.9	9.0 8.8	8.8 8.3
NO	Balanced	Balanced	Maybe	NO	Maybe

Risk Factor	
Book 1 Score	Book 3 Score
Consensus Reached ?	

	EXPLANATION
Book 1	Baseline risk level
Book 3	Level of risk taking into account existing mitigations
Balanced	Consensus that risks are well balanced by existing mitigations
Maybe	No Consensus that risks are well balanced by existing mitigations
Not Balanced	Consensus that existing mitigations do NOT adequately balance risk

Section 5: Additional Risk Intervention Strategies

The workshop participants next completed survey book 4 for those for those risk factors that were still not balanced by existing mitigations (Small Craft Quality, Volume of Small Craft Traffic, Dimensions, Configuration, Hazardous Material Release, Mobility and Economic). Participants suggested additional risk intervention strategies to further reduce risk, and then evaluated how successfully a proposed risk intervention strategy could be at lowering risk levels for each these risk factors.

Appendix C is a description of each risk intervention general strategy. Appendix D describes all risk intervention strategies proposed and evaluated by the participants, including the number of participant teams that voted for each additional risk intervention strategy.

The table below shows the expected reduction in risk when taking the actions specified by the participants.

Figure 6

Additional Interventions					
Vessel Conditions	**Traffic Conditions**	**Navigational Conditions**	**Waterway Conditions**	**Immediate Consequences**	**Subsequent Consequences**
Deep Draft Vessel Quality	Volume of Commercial Traffic	Winds	Visibility Impediments	Personnel Injuries	Health and Safety
Balanced	Balanced	Balanced	Balanced	Balanced	Balanced
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
Balanced	Enforcement 5.6	Balanced	Coordination / Planning 4.9	Balanced	Balanced
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Balanced	Balanced	Balanced	Balanced	Other Actions 6.3 Caution	Balanced
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
Rules & Procedures 6.4	Balanced	Balanced	Waterway Changes 7.4	Other Actions 7.0	Coordination / Planni 7.0 Caution

Risk Factor
Intervention Category
Risk Improvement

	EXPLANATION
Intervention Category	Intervention general strategy that most participants selected for furthur risk mitigation actions.
Risk Improvement	The amount that present risk levels might be reduced if new mitigation measures were implemented

Appendix A **Workshop Participants**

Mr. Rob Lemonde	**Virginia Port Authority**
Captain Frank Rabena	**Virginia Pilots Association**
Captain Whiting Chisman	**Virginia Pilots Association**
Mr. R. Clinton	**McAllister Towing**
Captain Kevin Eley	**Virginia Independent Pilot**
Captain Tyler Moore	**Virginia Independent Pilot**
Captain Trafton Jordan	**Virginia Independent Pilot**
Mr. David White	**Virginia Maritime Administration**
Mr. Raymond Newlon	**Virginia Maritime Administration**
LCDR Edward Alexander	**U.S. Navy**
Captain William "Billy" Moore	**U.S. Navy**
BM1 Michael Wojciechowski	**U.S. Coast Guard**
BM1 Correll Saint	**U.S. Coast Guard**
BMC Joey Bucciero	**U.S. Coast Guard**
LCDR Barbara Wilk	**U.S. Coast Guard**
CDR Ken Kostecki	**U.S. Coast Guard**
Mr. Mason Keeter	**Vane Brothers**
Mr. Eric Legaspi	**U.S. Army Corps of Engineers**
Captain Hugh McCrory	**Norfolk Tug**
Mr. Peter Owen	**DHS Central Virginia**
Ms. Staci C. Neal	**Commonwealth of Virginia**
Ms. Michelle Thornton	**U.S. Coast Guard Auxiliary**
LT Joe Carrier	**National Oceanographic and Atmospheric Administration**

U.S. Coast Guard Facilitation team

LCDR Jamie Rickerson – lead facilitator	**LT Ben Earling**
LT Christopher McCann	**Mr. Burt Lahn**

Appendix B

Participant Observations - Trends in the Port and Existing Risk Mitigations

Deep Draft Vessel Quality

Trends / Observations:

Note: For the purposes of this workshop, a deep draft vessel is defined as any vessel of 1600 Gross Tons or greater. This is different than previous workshops.

Participants discussed the general trend of the construction of larger vessels with minimally manned crews; better vessel quality has been observed especially since companies have begun to phase out ships that are older than 15 years.

There are over 5,000 deep draft commercial vessel arrivals/departures annually. The majority of vessels calling on the port are of high quality, with approximately 50 Port State Control actions taken/issued annually. When Port State Control actions are issued to substandard vessels, regulatory authorities closely consider the impact of the detention(s) on other Maritime Transportation System users, including shore side facilities and other commercial vessels. The size of vessels calling on the port continues to increase and many container ships have "dead slow" speeds much higher than in the past.

The Port of Virginia is a low sulfur diesel port, and as such, low sulfur diesel has had an impact on engine performance (loss of propulsion) and maintenance schedules. The unintended impacts of establishing emission control areas resulting in use of low sulfur fuels have caused operational challenges. Vessels required to switch to low sulfur fuel oil initially experienced issues with the changeover, and there continue to be cases where improper fuel change over procedures are suspected of leading to losses of propulsion. Operators have taken proactive steps to incorporate more extensive fuel change over procedures into the Safety Management Systems (SMS).

Existing Mitigations:

- Increased internal and international voluntary training programs being implemented by vessel owners.
- Vessels' increased reporting to the USCG before arrival with any mechanical or navigational equipment problems; if vessels are limited to one radar, for example, the USCG is notified and restrictions are put in place (e.g. vessel may only transit during daylight hours only).
- Requirement to have tug escort; if there is a subpar vessel, the additional horsepower helps to maneuver.
- USCG providing direction for situations when ship equipment is discovered to be compromised;
- High level of real-time communication within the port between all stakeholders to include vessel, USCG, Pilots, facilities, and tugs.
- Consistent and clear communication between Coast Guard Sectors with regard to substandard vessels transiting multiple COTP zones.

Shallow Draft Vessel Quality

Trends / Observations:

Note: For the purposes of this workshop, a deep draft vessel is defined as any vessel *less than* 1600 Gross Tons. This is different than previous workshops.

The shallow draft community consists mostly of passenger vessels and tow/tug operators. There are over 6,000 tug trips per year. The majority of vessels are of high quality. The towing vessel industry is about to become subject to vessel inspections by the USCG. The trend that was discussed for passenger vessels is that during challenging economic periods, quality of vessels decreases as some operators take maintenance short cuts to reduce costs. There has been a positive trend in quality improvement over the past decade.

Existing Mitigations:

- Virginia Maritime Association Towing Vessel safety seminar.
- Vessel operators are knowledgeable of the waterways and maintain professional crews.
- Ongoing implementation of 46 CFR, Subchapter M by the USCG.
- USCG required drills and exercises and voluntary additional exercises by stakeholders.
- Robust and open communications have been established that improve daily operations, and facilitate a smooth response to incidents, emergencies, or major changes in the port status.

Commercial Fishing Vessel Quality

Trends / Observations:

Large numbers of fishing vessels transit the RNA. Several larger trawlers transit the RNA departing out of Newport News and Hampton Roads. There are instances of commercial vessels fishing within the RNA, but most fishing vessels transit the RNA as opposed to actively fishing within the RNA itself. There is no significant number of commercial fishing vessel related casualties (groundings/collisions/allisions).

Existing Mitigations:

- Mandatory examinations for vessels that operate outside of three nautical miles, crew requirements, limited licensing requirements.
- Communications safety.
- Voluntary Commercial Fishing Vessel Examination Program for vessels that operate within three miles of land.
- 46 CFR Subchapter C (uninspected vessels) requirements.
- Vessels over 5 net tons are required to be documented.

Small Craft Quality

Trends / Observations:

Lack of operational knowledge is a significant contributor to incidents and close calls for this class of vessels. The Commonwealth of Virginia has a mandatory boating safety course requirement for all boaters provided through the Virginia Department of Game and Inland Fisheries. With the boating safety course providing education and a minimum standard for the recreational boater, the two biggest concerns with regard to small craft continue to be an understanding of Rules of the Road and traffic awareness. Of particular concern is small craft transiting inside the Regulated Navigation Area and the noticeable lack of understanding of vessel lighting, especially towing configurations. Small craft fishing in/near the channels adjacent to the Chesapeake Bay Bridge Tunnel (CBBT) disregard commercial traffic entering, transiting, or exiting the deep draft channel. There is concern about navigational safety as recreational boaters become more dependent on Global Positioning System (GPS) navigation and losing situational awareness and not exercising prudent navigational practices. This seems to lead to poor traffic awareness and lack of understanding of the ability of large vessels to adjust course. Human powered vessels, such as kayaks, paddle boards, etc. are becoming a major concern as this population appears to be growing

rapidly. Paradise Creek is a common kayaking location which often comes into conflict with towing vessels. Under the Rules of the Road, kayaks and paddleboards are considered vessels however; paddle boarders and kayakers may not realize this while operating on the waterways.

Existing Mitigations:

- Voluntary training exists but very few people actually take advantage of it.
- Boater safety requirements (state).
- USCG Auxiliary conducts free vessel safety checks and provides free boating safety classes.
- USCG Auxiliary provides informational fliers/documents for human powered vessel operators. Primary means of outreach is boat shows, boat docks, festivals, etc. or other public outreach avenues.
- Mandatory Commonwealth of Virginia training requirements exist for small craft operators.

Volume of Commercial Traffic

Trends / Observations:

Volume continues to trend upward for commercial ship arrivals. The number of docks has not changed, but efficiency has improved. With approximately 5000 deep draft commercial vessels arrivals each year, the limited number of anchorages for commercial vessels is a concern. The port of Norfolk also is home to the largest U.S Naval Base with daily naval vessel movements ranging from 3 to 18. Commercial vessel traffic statistics from 2005 to June 2016 are included in Appendix E.

Existing Mitigations:

- High Value Unit Business rules are followed to ensure safe, efficient transits of Liquefied Natural Gas (LNG) vessels, large container ships, and naval vessels.
- Restrictions when certain vessels transit the channel to prevent close crossing of large vessels.
- Effective communication strategies and close coordination improves safety.
- Good schedule coordination/communication strategy amongst stakeholders including pilots, military, Coast Guard, tugs.

Volume of Small Craft Traffic

Trends / Observations:

Small craft definition included power driven recreational vessels and human-powered craft, such as kayaks and paddleboards. The spring and fall boating seasons see a dramatic increase in small craft traffic volumes. Marine Events do not have a significant impact on vessels transiting within the navigational channels, however, the influx of small craft during 4th of July and Harbor Fest is a concern. Recreation vessel statistics from 2011 to June 2015 are included in Appendix E. Paradise Creek has a kayak launch, which is quite busy in the summer months. These human powered vessels are becoming more prevalent and can pose a challenge to the towing vessels in the area since the kayaks may not be properly lit during dawn or dusk and lack of knowledge of Rules of the Road.

Existing Mitigations:

- Auxiliary Channels tend to keep small craft traffic out of the main shipping channels.
- Well-marked channels assist small craft operators to transit throughout the port.

Traffic Mix

Trends / Observations:

The waterways exhibit a large mix of vessels with increasing levels of interaction and conflicts. The Port of Hampton Roads is a multiple-use waterway which results in channel closures for movement of high profile/High Value Unit vessels (Naval, Ultra Large Container Vessel, LNG, etc.). Advance notice of vessel movements does not always occur, which results in the disruption/delay of inbound/outboard transits. The Virginia Maritime Association is working to reduce or eliminate channel closures for single commercial or naval vessel movements. Both waterways users and stakeholders are collectively working together for a deeper, wider, safer main shipping channel to accommodate the increases in traffic volumes and vessels sizes. A deeper/wider channel would allow port partners to more efficiently manage large vessel movements, maintain 24/7 two-way navigation in most weather conditions, and accommodate navigation safety requirements for the movement of large naval vessels. Large vessels proceed slowly through the channel becoming susceptible to the effects of winds. Lack of access to deep water anchorages and shallow channels requires significant vessel movement coordination.

Existing Mitigations:

- Speed restrictions.
- High level of awareness among commercial operators including tug, towing, pilots, and captains.
- Risk is reduced due to work by the Marine Transportation System Planning subcommittee, efforts by the Virginia Maritime Association, and close communications channels between port partners, military, and commercial organizations.

Congestion

Trends / Observations:

Deeper and wider federal navigation channels are needed for large vessel movements to be unrestricted. Vessels experience difficulty transiting under bridges along the Elizabeth River during scheduled vehicular and railroad bridge operations and during bridge repair and maintenance. Vessel transits can be challenging due to the scheduled openings may not coincide with a beneficial tide. For towing vessels, the most congested area is near the Elizabeth River southern branch. Small craft can become a real issue along the Intracoastal Waterway and the Southern Branch as towing vessels and small craft need to transit while the bridges are lifted. High capacity passenger vessels have minimum impact and are not considered as a significant issue. Container ships and high capacity passenger vessels typically have a fixed schedule allowing coordination of vessel transits. Naval vessels typically transit during daylight hours.

Commercial deep draft anchorages are inadequate for the amount of deep draft vessels calling upon the port. To alleviate the lack of anchorages available to commercial vessels, the Coast Guard is considering amending the regulations for Hampton Roads anchorages by establishing a new anchorage, near Cape Charles, Virginia, on the Lower Chesapeake Bay. An Advance Notice of Proposed Rule Making (ANPRM) was published on April 19, 2016 in the Federal Register which solicited public comments on the proposed anchorage. Public comments can be viewed by visiting https://www.regulations.gov and entering in docket number USCG-2015-1118 as the search criteria. Figure 7 (page 23 of this report) shows the location and boundaries of the proposed anchorage.

LNG vessels enter the Chesapeake Bay and proceed north to the Cove Point LNG facility in Maryland. LNG vessels are not allowed to take or load ship stores while moored at the LNG facility/dock, which forces them to proceed south and back to the Port of Hampton Roads and accept supplies while at anchorage in the vicinity of Norfolk Naval Base. It was also noted that the Cove Point LNG plant has

been approved to construct and operate as an export facility which will result in a significant increase of LNG vessel traffic. Figure 8 (page 24 of this report) shows the location of the Cove Point LNG facility.

Existing Mitigations:

- Reporting requirements outlined in the Regulated Navigation Area and open communication channels among agencies, committees, and other port entities reduces congestion risks.
- Strong coordination within the operators of the port to make common sense decisions when congestion arises.
- Coast Guard Sector Hampton Roads has a local notification process called Marine Safety Information Bulletin to aid in informing the local maritime community.
- Adjacent to the Point Comfort area, commercial towing vessels monitor traffic departing for the Norfolk Naval base.

Winds

Trends / Observations:

With the increased size of commercial vessels calling on the port, winds have an impact during the transit through Thimble Shoals Channel and while mooring due to the large sail area. During hurricane season, the maritime community is on high alert. Cape Hatteras, North Carolina through southeastern Virginia is the generation zone for winter storms. Nor'easters are challenging because they are unpredictable and can linger over the area. These unnamed storms tend to be problematic for planning and preparedness. The ever larger ships calling upon Virginia have increased sail area, which, as a result of crabbing, increases their effective width as they transit the channels even in normal conditions.

Existing Mitigations:

- Port stakeholders monitor weather conditions 24 X 7.
- Heavy weather alerts are readily distributed and heavy weather plans are readily at hand for use.
- Frequency of heavy weather exercises.
- Tug/Pilot assistance is normally readily available if needed in an emergency.
- Good communication between port partners and the National Weather Service.
- Good seamanship that dictates caution or avoidance.

Water Movement

Trends / Observations:

Tides are predictable, with exception of Intracoastal Waterway (ICW) and areas impacted by wind. Wind and tide working against one another can have an impact on towing/barge operations. Sustained high winds affect currents and can actually reverse natural currents. The winter season has more frequent incidents of wind driven low tides. Within the ICW, wind driven low tides can happen throughout the year.

Existing Mitigations:

- Published tide tables assist, but local knowledge prevails as wind has a greater affect on water movement than natural tides and currents.
- Meteorological data is readily available to plan/prepare for changes in water movement, including a National Ocean Service Physical Oceanographic Real-Time System (PORTS).

Visibility Restriction

Trends / Observations:

There are two weeks in spring and fall when the fog tends to get heavier and unpredictable. This is due to atmospheric differences between air and sea temperature. No significant man made visibility restrictions or issues were noted.

Existing Mitigations:

- Restriction of movement based on visibility conditions.
- The port community has a good relationship with the National Weather Service to be alerted of conditions that may produce fog.

Obstructions

Trends / Observations:

There is always floating debris, but U.S. Army Corps of Engineers (USACE) vessels move through the harbor daily collecting debris which is mostly manmade. Approximate 100 tons are removed annually. The James River is a significant source of debris due to heavy rains which increases water flow. Crab pots and other fishing apparatus are a consistent concern largely in anchorages but not as much of a concern within main channels.

Existing Mitigations:

- USACE Debris Boats actively patrol the waterway collecting debris.
- Broadcast Notice to Mariners reduces risk by alerting mariners of obstructions.

Visibility Impediments

Trends / Observations:

Background lighting hinders visibility of buoys and range lights. There is a large, outdoor neon sign on the east bank of the Elizabeth River that can make it difficult to see aids to navigation (ATON) at night. The lights from parking lots at facilities and business located along the Elizabeth River also make ATON difficult to see.

Existing Mitigations:

- Good communication between port partners.

Dimensions

Trends / Observations:

A deeper and wider channel is required to improve safety and allow unimpeded use of the main shipping channel, Thimble Shoal Channel. The participants again stated that a deeper and wider channel would allow port partners to more efficiently manage large vessel movements and accommodate navigational safety requirements for the movement of large naval vessels. The original channel was designed in 1950, well before post-PANAMAX vessels and 10,000+ TEU container ships began calling on the port. In the very near future, 14,000TEU container ships are expected to begin calling on the port. As it is currently designed, it requires one-way traffic for the larger commercial and naval vessel vessels.

Existing Mitigations:

- Channel dredging is authorized, but unfunded.

Bottom Type

Trends / Observations:

It was discussed that the bottom type did not pose any significant risks. The bottom of the channels and associated waterways is mostly sandy. Seasonal shoaling occurs from Lighted Buoy 15 to the Chesapeake Bay Bridge Tunnel.

Existing Mitigations:

- Navigational charts for the port provide good information.
- Annual surveys and dredging are conducted to ensure charted depths are accurate.

Configuration

Trends / Observations:

Sewells Point to Towne Point is an area where channel configuration is a concern. Smaller vessels join the main shipping channel in this area. Thimble Shoal Channel is long and narrow which precludes large vessels from using the channel at the same time to avoid a meeting or overtaking situation. Larger vessels will require one-way traffic transits. Vehicular and rail-road bridges crossing the Elizabeth River pose problems, particularly bridges along the Southern Branch due to frequent breakdowns which impact vessel movements. Due to the age and condition of some bridges, replacement parts must be manufactured from scratch, requiring longer repair periods and modified operating schedules.

Existing Mitigations:

- Waterways operators continue training for vessels and area familiarization.
- Good communications between port and waterways users.

Personnel Injuries

Trends / Observations:

Cruise ships pose a minimal personnel injury risk. LNG vessels traversing through waterway were considered a major personnel risk. Risk from petroleum shipments was considered low. Towing/Harbor Tug operations also posed low risk to personnel injury from towing operations.

Existing Mitigations:

- Coordinated incidence response team, semi-annual training, and an annual Coast Guard Search and Rescue forum all contribute to drive down risk.
- Sheer volume of response agencies available in the port area of operations.
- With the high number of trauma centers in the area, risk from personnel injuries was considered balanced.

Petroleum Discharge

Trends / Observations:

Most common oil spills are typically nuisance spills of approximately 2-3 gallons. The most probable cause of a major spill would results from a collision situation, especially if the collision involved a tank vessel which can carry between 15,000 and 140,000 barrels of oil. It was stated that a petroleum discharge was a low probability/high consequence event. The increase in large vessel traffic volumes and daily petroleum shipments increases the risk of a petroleum discharge. The port previously experienced 1,000,000 barrel petroleum shipments from Suez Tankers. Shipments this large may return if the economy improves.

Existing Mitigations:

- Quadrennial pollution response exercises, along with routine training and exercise programs, provide great confidence in spill response.
- Improved ship design and double hulls.
- Waterway scheme, pilots, tugs, and other waterway users have strong communications to avoid collisions/allusions.
- Coordinated incidence response teams and the Area Contingency Plan help to balance the risk.

Hazardous Materials Release

Trends / Observations:

All vessels transit Thimble Shoal Channel en route the Southern Branch of the Southern Branch. Hazardous materials include petro-chemicals, fertilizer, Imodium sulfate, benzene, phenol, and block asphalt. Phenols and phosphates move by barge, which is especially risky when maneuvering under bridges. The port sees approximately two chemical vessel shipments per month and phenol is transported weekly by barge. Future LNG vessel arrivals will result in over 300 vessel transits annually. Liquefied Propane Gas (LPG) vessel arrivals in 2016 totaled 13. Aging shore side infrastructure including terminals, piers, and tanks increases the risk of a hazardous material release.

Existing Mitigations:

- Advance declaration of hazmat with the USCG.
- Procedures are in place to mitigate risks posed by LPG shipments.
- Strong relationships are in place between waterway users and stakeholders, and response resources are robust.

Mobility

Trends / Observations:

The port was estimated to have an economic impact of approximately $242 million per day. Due to the restricted waters west of the Chesapeake Bay Bridge Tunnel, a major issue in Thimble Shoal Channel or at either of the Chesapeake Bay Bridge Tunnels would have a port-wide impact on vessel movements. If a railroad bridge has a breakdown and is not able to be lifted, the response resources needed to fix and reopen the bridge are not clearly identified or readily available which can lead to significant waterway disruptions. One recent railroad bridge failure lasted for 3 days and closed the waterway to commercial vessel traffic. If a major incident occurs on the Elizabeth River, vessels transiting the ICW would also be impacted.

Existing Mitigations:

- Robust Incident command system (ICS).
- Response organizations are immediate available to respond to incidents which impact vessel movements.
- Robust noncommercial/military/commercial salvage operations are readily available.
- Department of Defense salvage response capabilities are present in the port and can be called upon if needed.

Health and Safety

Trends / Observations:

There are over 1 million people living in the Hampton Roads assessment area that could be potentially affected by major hazardous materials spill. In addition to vessel traffic, trains, trucks, and pipelines

carrying hazardous material also pose a risk health and safety. Container cargo also poses a risk due to explosions/leaks.

Existing Mitigations:

- Reviews of new facilities proposed for construction in the port.
- Coordinated incidence response team, robust medical and response infrastructure, and response planning and exercises reduce the risk to health and safety.

Environmental

Trends / Observations:

Protected areas are identified in the port Area Contingency Plan. Seasonally between June and September, there are different locations for nesting/foraging areas for threatened birds; the USCG cited buoys as being one area of concern for nesting of endangered birds.

Existing Mitigations:

- Comprehensive environmental review by the USCG for all activities that require a safety or security zone and events requiring a Marine Event Permit.
- Close relationship and comprehensive reviews between USCG, VA Department of Environmental Quality, and Virginia Marine Resources Commission for marine events.
- Robust environmental response resources.

Aquatic Resources

Trends / Observations:

Shellfish, rockfish, sturgeon, shad, and crab populations are at risk. Aquatic populations frequently require a long time to recover from major pollution incidents.

Existing Mitigations:

- Government, business and community partnerships work collectively via the Elizabeth River Project to promote environment quality/stewardship for all users of the river.
- Risk to aquatic resources is reduced due to the community awareness, education, and academic research.

Economic

Trends / Observations:

Given the strategic importance of the port to the national and international economies, any degree of shutdown will affect trade and have severe financial implications at the global scale. If a vessel experiences a casualty in a major channel, the impact would be port-wide, including military and commercial vessels moving to different ports due to traffic congestion. If other large ports experience a closure and traffic is diverted to the Port of Hampton Roads, the impact from increased vessel traffic would have a direct impact on port operations. Shore side commerce is impacted when vessels have difficulty entering port and arrival times are delayed. Tourism plays a major role in the port.

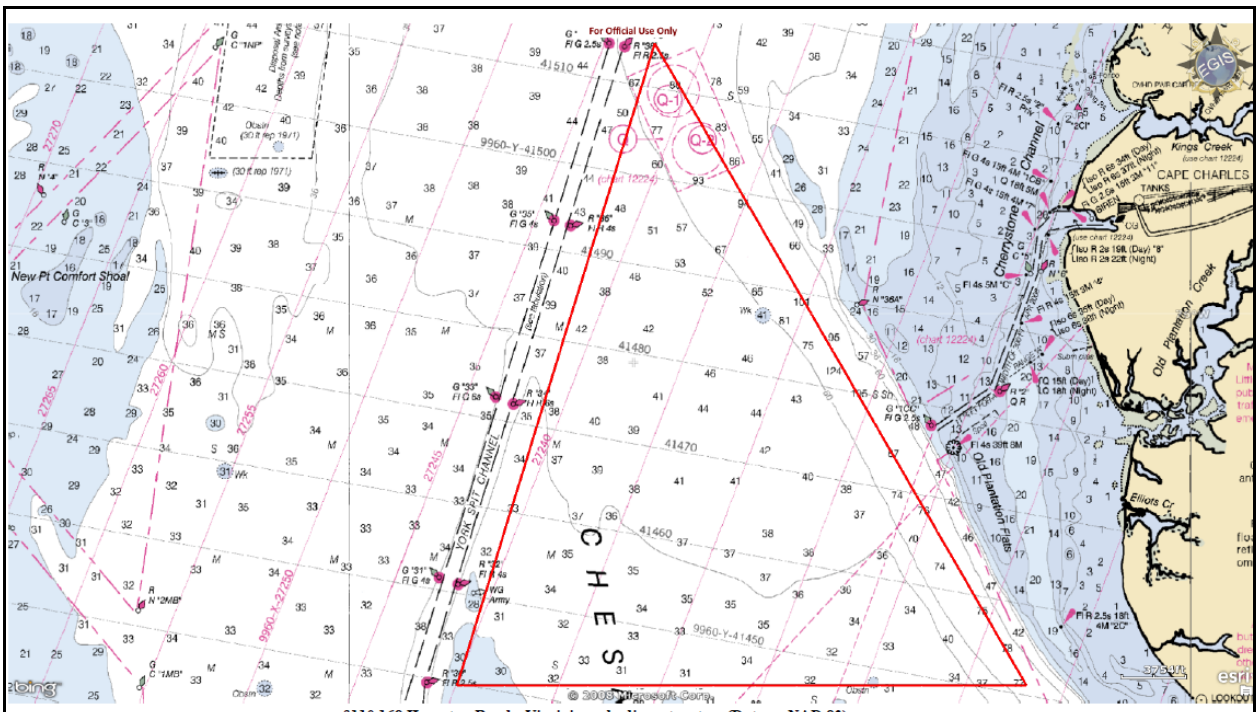
Existing Mitigations:

- All previous cited risk mitigation efforts contribute towards economic risk mitigation.
- Redirection of ships to other ports.
- Port-wide and company business continuity plans/continuity of operations plan.
- Strong relationships between waterfront labor and port employers.
- Organization, communication, and coordination among port entities are strong.

Figure 7

Illustration of contemplated anchorage “R”, Lower Chesapeake Bay, York Spit Channel, Cape Charles Anchorage ground

Illustration of contemplated anchorage “R”, Lower Chesapeake Bay, York Spit Channel, Cape Charles Anchorage ground.



§110.168 Hampton Roads, Virginia and adjacent waters (Datum: NAD 83)

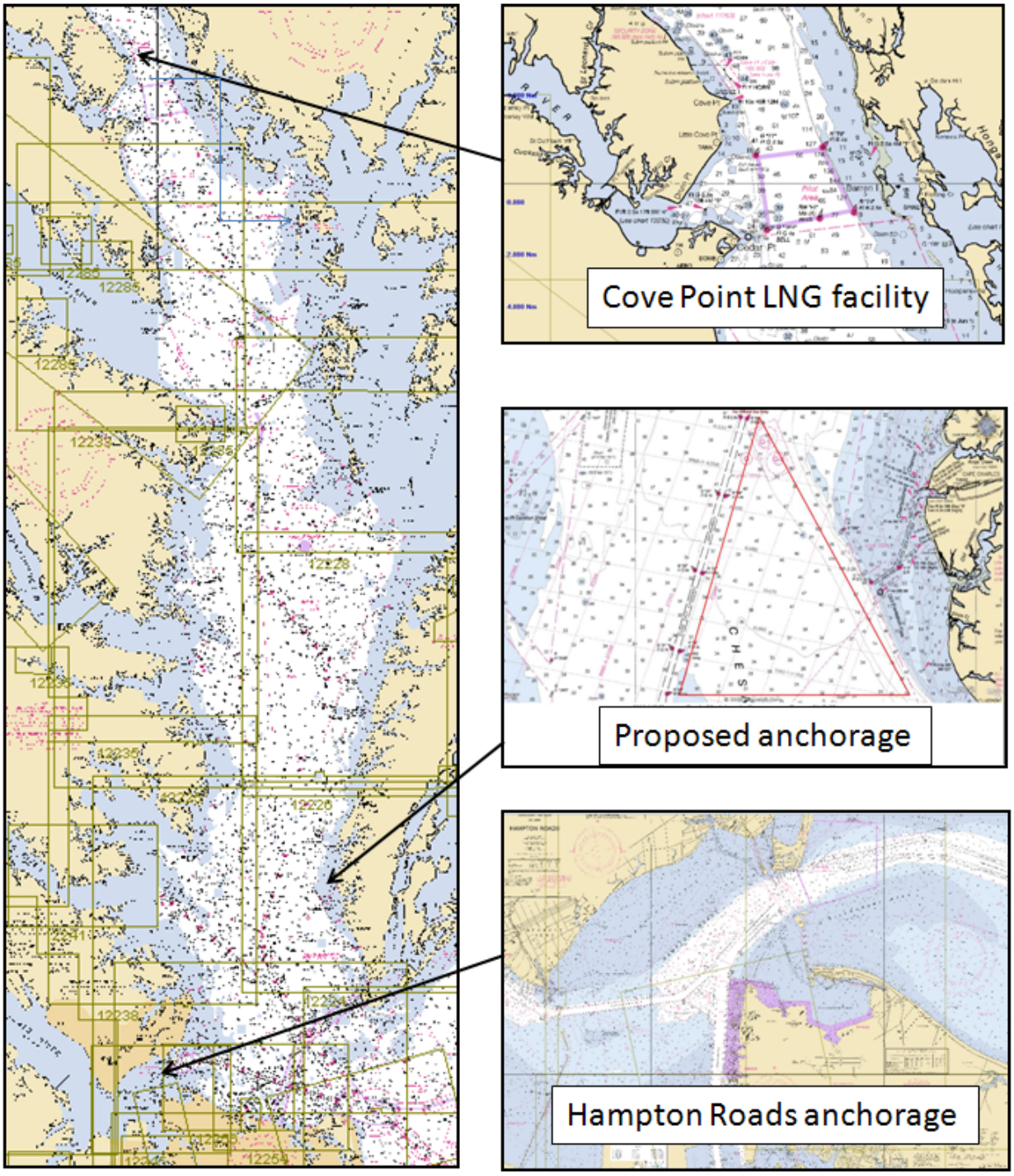
(7) ***Anchorage R.*** *Lower Chesapeake Bay, York Spit Channel, Cape Charles Anchorage.*

The waters bounded by a line connecting the following points:

Latitude	*Longitude*
37°17′33″ N	76°06′22″ W
37°11′29″ N	76°01′57″ W
37°11′29″ N	76°08′43″ W

Figure 8

Cove Point Maryland Liquefied Natural Gas Facility, proposed anchorage near Cape Charles, Virginia, Hampton Roads anchorage.



Appendix C

Definitions – Additional Risk Mitigation Strategies

Coordination / Planning	Improve long-range and/or contingency planning and better coordinate activities / improve dialogue between waterway stakeholders.
Voluntary Training	Establish / use voluntary programs to educate mariners / boaters in topics related to waterway safety (Rules of the Road, ship/boat handling, etc.)
Rules & Procedures	Establish / refine rules, regulations, policies, or procedures (navigation rules, pilot rules, standard operating procedures, licensing, required training and education, etc.).
Enforcement	More actively enforce existing rules / policies (navigation rules, vessel inspection regulations, standards of care, etc.).
Navigation / Hydro Info	Improve navigation and hydrographic information (Notice to Mariners, charts, Coast Pilots, Light Lists, Automatic Identification System (AIS), tides and current tables, etc.).
Radio Communications	Improve the ability to communicate bridge-to-bridge or ship-to-shore (radio reception coverage, signal strength, reduce interference & congestion, monitoring, etc.).
Active Traffic Mgmt	Establish / improve a Vessel Traffic Service: information / navigation / traffic organization.
Waterway Changes	Widen / deepen / straighten the channel and/or improve the aids to navigation (buoys, ranges, lights, DGPS, etc.).
Other Actions	Risk mitigation measures needed that do not fall under any of the above risk mitigation strategies.

Appendix D

Additional Risk Intervention Strategies

(The number listed before each risk intervention strategy is the number of participant teams who voted for that particular risk mitigation strategy.)

Small Craft Quality

Coordination / Planning	(1) engage small craft associates and vendors
Voluntary Training	(3) mandatory training/increased outreach
Rules & Procedures	(4) mandatory testing/licensing
Enforcement	(4) increased enforcement of existing rules/regulations
Radio Communications	(1) engage recreational boating safety subcommittee/community
Other Actions	(2) markings/stickers for paddle boarders/kayakers
	(2) engage insurance vendors
	(1) mandatory AIS carriage
	(1) public education to avoid commercial traffic

Volume of Small Craft Traffic

Coordination / Planning	(1) consistent messaging, engage small craft associates/businesses
Voluntary Training	(2) increase education/outreach initiatives
Enforcement	(4) increased enforcement of existing rules/regulation; interactions with small craft rental vendors
Waterway Changes	(1) establish waterway monitoring system
Other Actions	(1) increased public awareness campaign
	(1) Establish a Harbor Safety Committee for the Port of Virginia to widen the outreach to all boaters of the region for all types of safety issues and promote best practices.

Dimensions

Coordination / Planning	(2) continued coordination between DOD/Maritime Sector
Active Traffic Mgmt	(2) establish a Vessel Traffic Service
Waterway Changes	(9) dredge channels wider/deeper to improve safety and provide the ability for large Commercial/Naval vessels to transit inbound/outbound without restrictions (one-way traffic)
Other Actions	(1) seek/obtain funding for dredging operations

Configuration

Radio Communications	(1) establish a Vessel Traffic Service
Waterway Changes	(1) evaluate new channel designs/continued dredging
	(1) establish anchorage at the Chesapeake Bay entrance
Other Actions	(1) dredge channels wider/deeper to improve safety, and provide the ability for large Commercial/Naval vessels to transit inbound/outbound without restrictions (one-way traffic)
	(1) upgrade bridge infrastructure

Hazardous Materials Release

Coordination / Planning	(3) increase response coordination
Enforcement	(2) increase shore side support/capability
Other Actions	(2) evaluate condition of shore side terminals, tank and facility inspections

Mobility

Coordination / Planning	(1) increased coordination between transportation committees/agencies (roads/bridges/waterways)
Other Actions	(3) repair bridges (prone to failure) to reduce waterway closures

Economic

Coordination / Planning	(2) increased coordination between COOP/response agencies
Other Actions	(1) improve planning
	(1) Shift northeast corner of Dam Neck Restricted Area to allow direct route from sea to Chesapeake Bay for vessels approaching from southern ports.

Port of Virginia

*Ship Calls**

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	176	196	187	168	146	141	159	164	158	155	164	167
Feb	156	179	181	155	129	153	133	149	140	141	143	157
Mar	179	197	214	162	137	163	153	173	158	162	163	171
Apr	177	184	188	168	133	149	157	161	156	157	159	162
May	189	195	204	161	148	167	146	158	163	172	172	173
Jun	185	193	185	152	159	165	147	160	152	154	172	169
Jul	181	187	197	158	149	151	156	173	168	176	174	
Aug	185	207	190	168	155	164	151	172	163	169	169	
Sep	191	191	183	164	157	142	153	166	152	167	164	
Oct	192	207	190	165	152	165	165	158	154	175	179	
Nov	192	199	189	160	142	139	152	172	148	163	167	
Dec	175	203	181	152	151	142	156	160	153	166	171	
Total	**2,178**	**2,338**	**2,289**	**1,933**	**1,758**	**1,841**	**1,828**	**1,966**	**1,865**	**1,957**	**1,997**	**999**

**Does not include layberth*

Port of Virginia

Container Units

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	88,850	96,957	94,942	98,520	79,674	81,812	91,527	88,749	90,900	96,225	111,322	109,767
Feb	83,646	93,109	91,800	98,133	75,595	87,394	87,615	89,577	96,404	102,289	101,184	124,458
Mar	94,824	98,406	106,596	97,471	77,422	94,509	91,506	96,351	102,564	112,006	129,873	120,519
Apr	95,753	94,849	97,866	106,400	81,724	83,985	92,967	97,200	102,986	114,875	120,552	121,746
May	97,950	99,855	99,183	101,272	80,408	92,296	91,640	102,987	110,920	117,079	133,411	124,753
Jun	91,674	96,947	95,876	93,561	79,844	92,382	88,007	97,346	101,391	107,280	122,919	123,974
Jul	96,286	92,962	99,822	100,001	81,041	88,575	96,557	104,430	117,769	119,841	130,146	
Aug	100,555	102,794	111,117	106,580	85,649	99,536	87,048	109,136	114,230	124,656	125,276	
Sep	97,976	95,490	101,921	102,446	89,359	88,141	93,794	104,275	105,464	115,827	122,308	
Oct	108,157	108,964	113,921	108,694	90,175	99,933	98,656	100,478	117,704	126,100	131,076	
Nov	102,831	98,601	107,948	99,670	87,430	93,033	93,552	113,288	110,369	119,267	114,412	
Dec	93,750	98,694	100,599	88,111	84,222	79,140	89,182	106,005	104,210	117,693	112,269	
Total	**1,152,252**	**1,177,628**	**1,221,591**	**1,200,859**	**992,543**	**1,080,736**	**1,102,051**	**1,209,822**	**1,274,911**	**1,373,138**	**1,454,748**	**725,217**

Port of Virginia

TEUs

		2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	Export Loads	79,645	54,809	64,664	71,433	69,867	72,685	78,065	83,349	76,360
	Import Loads	70,002	55,634	51,330	64,939	62,271	62,405	69,836	79,733	84,186
	Total Empties	21,108	27,551	28,103	22,893	22,162	23,676	19,371	28,914	32,299
	Total TEUs	170,755	137,994	144,097	159,265	154,300	158,766	167,272	191,996	192,844
Feb	Export Loads	81,070	58,763	72,858	67,183	75,708	79,139	81,436	76,150	82,065
	Import Loads	73,530	55,223	60,737	61,659	62,752	68,595	77,647	76,846	99,883
	Total Empties	17,735	19,373	21,454	24,803	18,590	21,657	20,442	25,109	38,779
	Total TEUs	172,335	133,359	155,049	153,646	157,050	169,390	179,524	178,105	220,726
Mar	Export Loads	83,652	64,383	77,834	76,702	79,521	87,649	93,016	96,565	89,455
	Import Loads	67,923	53,377	63,306	60,140	68,117	70,954	80,520	105,719	91,059
	Total Empties	17,881	18,976	26,122	22,913	19,081	20,915	24,298	27,127	32,673
	Total TEUs	169,456	136,736	167,262	159,754	166,719	179,518	197,834	229,410	213,186
Apr	Export Loads	88,012	65,024	69,329	73,539	75,193	83,128	91,701	92,568	82,323
	Import Loads	76,400	54,487	56,636	64,573	68,954	74,001	87,113	87,124	92,429
	Total Empties	20,604	24,563	21,154	23,143	25,497	22,241	22,577	30,485	40,502
	Total TEUs	185,016	144,074	147,119	161,254	169,644	179,370	201,390	210,177	215,254
May	Export Loads	78,754	64,106	72,525	71,395	83,206	84,841	91,686	91,802	80,729
	Import Loads	73,790	54,293	65,445	62,843	72,084	77,915	84,855	94,615	92,439
	Total Empties	22,959	23,038	23,566	24,301	23,294	28,612	27,692	44,095	46,231
	Total TEUs	175,503	141,437	161,536	158,539	178,584	191,368	204,232	230,511	219,398
Jun	Export Loads	76,479	65,992	68,316	69,526	75,581	76,399	81,781	81,363	81,810
	Import Loads	65,910	54,490	67,022	60,049	71,130	72,839	77,135	87,173	93,630
	Total Empties	20,521	17,970	25,363	21,875	21,719	26,626	27,488	44,982	41,233
	Total TEUs	162,910	138,452	160,701	151,449	168,430	175,864	186,403	213,517	216,672
Jul	Export Loads	77,715	65,423	61,111	71,247	73,709	88,399	82,534	83,438	
	Import Loads	73,730	58,313	65,771	68,534	78,709	89,411	95,080	96,919	
	Total Empties	21,528	18,434	27,063	27,295	27,966	27,328	30,157	45,632	
	Total TEUs	172,973	142,170	153,945	167,076	180,384	205,137	207,771	225,988	
Aug	Export Loads	80,904	68,823	68,069	66,532	78,029	83,210	85,852	77,388	
	Import Loads	76,454	60,431	72,959	62,960	81,770	90,565	89,698	93,044	
	Total Empties	25,856	21,751	34,094	22,484	28,859	24,554	38,805	49,637	
	Total TEUs	183,214	151,005	175,122	151,975	188,658	198,329	214,355	220,069	
Sep	Export Loads	81,361	70,008	60,866	68,437	78,224	80,570	77,346	76,254	
	Import Loads	74,024	63,706	65,747	67,022	76,750	80,029	87,040	92,722	
	Total Empties	23,723	23,729	26,393	28,591	27,344	24,587	36,728	46,545	
	Total TEUs	179,108	157,443	153,006	164,050	182,318	185,185	201,113	215,520	
Oct	Export Loads	78,746	70,232	73,317	73,367	73,756	90,190	86,909	78,780	
	Import Loads	79,838	63,222	75,750	71,695	72,946	92,093	98,066	100,230	
	Total Empties	30,142	26,328	26,451	27,715	28,628	24,314	36,130	54,456	
	Total TEUs	188,726	159,782	175,518	172,776	175,330	206,597	221,105	233,466	
Nov	Export Loads	73,011	73,163	72,511	71,594	86,419	89,169	93,442	81,039	
	Import Loads	69,623	59,463	67,159	66,387	85,116	79,329	84,586	85,371	
	Total Empties	29,714	21,951	23,541	25,964	27,184	24,420	30,736	37,062	
	Total TEUs	172,348	154,577	163,211	163,945	198,720	192,918	208,764	203,472	
Dec	Export Loads	62,726	71,105	62,931	74,381	87,596	83,465	90,759	79,134	
	Import Loads	57,035	57,292	54,818	58,074	69,719	75,985	86,305	83,026	
	Total Empties	31,173	19,802	20,703	21,845	28,435	21,641	26,212	34,879	
	Total TEUs	150,934	148,199	138,452	154,300	185,750	181,091	203,276	197,039	
Total	Export Loads	942,075	791,831	824,331	855,334	936,809	998,843	1,034,526	997,828	492,740
	Import Loads	858,259	689,931	766,680	768,874	870,318	934,119	1,017,879	1,082,520	553,624
	Total Empties	282,944	263,466	304,007	293,821	298,759	290,571	340,633	468,922	231,716
	Total TEUs	**2,083,278**	**1,745,228**	**1,895,018**	**1,918,029**	**2,105,887**	**2,223,532**	**2,393,038**	**2,549,270**	**1,278,081**

Port of Virginia

General Cargo (Short Tons)

		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Jan	Container	1,196,362	1,290,916	1,289,722	1,473,042	1,130,182	1,182,992	1,293,567	1,257,011	1,317,975	1,454,091	1,594,184	1,508,228
	Breakbulk	44,496	41,409	32,344	34,144	32,932	15,563	22,520	36,934	30,135	29,576	25,002	19,652
	Total General Cargo	1,240,858	1,332,325	1,322,066	1,507,186	1,163,114	1,198,555	1,316,087	1,293,945	1,348,110	1,483,667	1,619,186	1,527,880
Feb	Container	1,138,925	1,244,518	1,304,172	1,498,646	1,085,477	1,320,745	1,202,539	1,322,650	1,416,350	1,535,431	1,459,696	1,699,326
	Breakbulk	29,591	47,263	35,818	16,104	21,912	18,320	22,560	25,442	24,017	24,287	22,782	11,919
	Total General Cargo	1,168,516	1,291,781	1,339,990	1,514,750	1,107,389	1,339,065	1,225,099	1,348,092	1,440,367	1,559,718	1,482,478	1,711,246
Mar	Container	1,288,197	1,396,400	1,508,012	1,512,582	1,166,863	1,406,822	1,308,098	1,454,678	1,535,832	1,680,998	1,915,940	1,725,534
	Breakbulk	46,292	46,509	32,389	32,712	21,087	20,324	29,485	32,011	25,064	29,201	25,383	18,347
	Total General Cargo	1,334,489	1,442,909	1,540,401	1,545,294	1,187,950	1,427,146	1,337,583	1,486,689	1,560,896	1,710,199	1,941,323	1,743,881
Apr	Container	1,295,513	1,305,127	1,416,131	1,616,915	1,168,527	1,243,767	1,332,420	1,374,768	1,508,442	1,692,343	1,749,967	1,680,294
	Breakbulk	45,240	34,835	28,846	29,973	27,407	14,996	32,981	33,867	26,664	37,781	23,463	16,134
	Total General Cargo	1,340,753	1,339,962	1,444,977	1,646,888	1,195,934	1,258,763	1,365,401	1,408,635	1,535,106	1,730,124	1,773,430	1,696,428
May	Container	1,352,776	1,387,562	1,458,858	1,490,660	1,265,140	1,322,713	1,269,673	1,476,528	1,563,727	1,681,095	1,803,667	1,675,852
	Breakbulk	43,285	45,161	35,212	25,416	10,314	26,337	15,823	25,161	29,112	36,559	28,775	13,557
	Total General Cargo	1,396,061	1,432,723	1,494,070	1,516,076	1,275,454	1,349,050	1,285,496	1,501,689	1,592,839	1,717,654	1,832,442	1,689,409
Jun	Container	1,276,121	1,321,466	1,391,982	1,405,452	1,194,781	1,278,371	1,253,824	1,411,722	1,432,664	1,387,288	1,608,222	1,684,458
	Breakbulk	63,622	40,975	27,423	34,349	11,043	22,627	45,570	34,347	28,781	30,812	28,355	28,459
	Total General Cargo	1,339,743	1,362,441	1,419,405	1,439,801	1,205,824	1,300,998	1,299,394	1,446,069	1,461,445	1,418,100	1,636,577	1,712,917
Jul	Container	1,275,340	1,272,442	1,395,352	1,447,565	1,201,141	1,209,612	1,300,135	1,423,635	1,673,260	1,190,731	1,681,449	
	Breakbulk	34,737	46,119	27,489	29,468	19,540	23,425	31,960	24,377	37,584	23,675	27,227	
	Total General Cargo	1,310,077	1,318,561	1,422,841	1,477,033	1,220,681	1,233,037	1,332,095	1,448,012	1,710,844	1,214,406	1,708,676	
Aug	Container	1,350,650	1,377,226	1,511,916	1,579,497	1,249,876	1,224,728	1,163,433	1,480,208	1,611,609	1,348,155	1,544,323	
	Breakbulk	25,135	34,254	27,363	25,069	14,569	23,353	22,062	25,431	42,053	30,987	23,610	
	Total General Cargo	1,375,785	1,411,480	1,539,279	1,604,566	1,264,445	1,248,081	1,185,495	1,505,639	1,653,662	1,379,142	1,567,933	
Sep	Container	1,277,988	1,284,442	1,409,257	1,408,498	1,283,827	1,121,796	1,234,558	1,433,153	1,492,175	1,517,837	1,536,873	
	Breakbulk	46,886	36,223	35,528	34,411	13,226	11,957	37,437	30,165	17,384	20,951	18,048	
	Total General Cargo	1,324,874	1,320,665	1,444,785	1,442,909	1,297,053	1,133,753	1,271,995	1,463,318	1,509,559	1,538,788	1,554,921	
Oct	Container	1,379,531	1,462,447	1,591,754	1,504,491	1,311,914	1,330,334	1,310,955	1,372,413	1,722,191	1,718,447	1,636,862	
	Breakbulk	34,994	33,377	32,327	25,043	24,909	33,449	29,015	25,314	23,950	22,406	28,174	
	Total General Cargo	1,414,525	1,495,824	1,624,081	1,529,534	1,336,823	1,363,783	1,339,970	1,397,727	1,746,141	1,740,853	1,665,036	
Nov	Container	1,385,556	1,368,943	1,580,267	1,372,086	1,309,762	1,303,797	1,299,359	1,616,439	1,664,488	1,759,681	1,588,141	
	Breakbulk	42,090	39,504	17,046	27,679	12,646	14,393	29,494	51,166	28,068	20,281	18,755	
	Total General Cargo	1,427,646	1,408,447	1,597,313	1,399,765	1,322,408	1,318,190	1,328,853	1,667,605	1,692,556	1,779,962	1,606,896	
Dec	Container	1,248,314	1,394,349	1,499,089	1,180,829	1,312,095	1,123,171	1,299,819	1,532,378	1,565,530	1,767,245	1,562,664	
	Breakbulk	42,377	32,012	37,954	28,516	19,320	29,110	28,651	27,929	23,248	21,545	26,145	
	Total General Cargo	1,290,691	1,426,361	1,537,043	1,209,345	1,331,415	1,152,281	1,328,470	1,560,307	1,588,778	1,788,790	1,588,809	
Total	Container	15,465,273	16,105,838	17,356,512	17,490,263	14,679,585	15,068,848	15,268,380	17,155,583	18,504,243	18,733,342	19,681,988	9,973,692
	Breakbulk	498,745	477,641	369,739	342,884	228,905	253,854	347,558	372,144	336,060	328,060	295,719	108,068
	Total General Cargo	**15,964,018**	**16,583,479**	**17,726,251**	**17,833,147**	**14,908,490**	**15,322,702**	**15,615,938**	**17,527,727**	**18,840,303**	**19,061,402**	**19,977,707**	**10,081,760**

Recreational Boat Statistics					
County/City	**2011**	**2012**	**2013**	**2014**	**2015**
Chesapeake, City of	6,543	6,455	6,415	6,419	6,369
Hampton, City of	4,564	4,513	4,470	4,429	4,197
Newport News, City of	3,011	2,913	2,799	2,829	2,813
Norfolk, City of	4,250	4,150	4,053	3,902	3,790
Northampton County	1,814	1,815	1,809	1,800	1,800
Portsmouth, City of	2,490	2,410	2,319	2,283	2,241
Suffolk, City of	3,324	3,291	3,305	3,251	3,287
Virginia Beach, City of	13,516	13,466	13,467	13,449	13,340
Total number of registered recreational boats operating in the Regulated Navigation Area	**39,512**	**39,013**	**38,637**	**38,362**	**37,837**

Appendix F

Waterways Management / Best Practices

Vessel Conditions / Operations	Navigation Safety	References / Statistics
Official Virginia Boating Safety Course Online https://www.boat-ed.com/virginia/?gclid=CLnmqcbYk84CFdQ2gQodW7UIuQ	**U.S. Navigation Rules** http://www.navcen.uscg.gov/?pageName=navRuleChanges	**Recreational Boating Safety - Accident Statistics** http://www.uscgboating.org/statistics/accident_statistics.php
Virginia Department of Game and Inland Fisheries http://www.dgif.virginia.gov/	**USCG Auxiliary -Requirements -Recreational Boats** http://www.cgaux.org/boatinged/classes/2011/bss.php	**U.S. Army Corps of Engineers - Vessel Transit Statics** http://www.navigationdatacenter.us/
US Coast Guard - Vessel Inspection Regulations http://www.ecfr.gov/cgi-bin/ECFR?page=browse	**State-Specific Boating Safety Requirements** http://www.americasboatingcourse.com/lawsbystate.cfm	**The American Waterways Operators** http://www.americanwaterways.com/
U.S. Army Corps of Engineers **General Regulatory Policies - Permitting** http://www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Federal-Regulation/	**National Oceanic and Atmospheric Administration** **Safe Boating Weather Tips** http://www.nws.noaa.gov/om/brochures/safeboat.htm	
American Canoe Association http://www.americancanoe.org/	**Life Lines Brochure - Safety Tips That Could Save Your Life** http://www.americanwaterways.com/commitment_safety/lifelines.pdf	