

Ports and Waterways Safety Assessment

Workshop Report

Straits of Mackinac, Michigan



United States Coast Guard
Marine Transportation Systems Directorate



Providing Navigation Safety Information
for America's Waterways Users

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Background and Purpose

The United States Coast Guard (USCG), Marine Transportation Systems Directorate, is responsible for developing and implementing policies and procedures that facilitate commerce, improve safety and efficiency, and inspire dialogue with ports and waterway 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, waterway users and port authorities, and 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 objectives 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) Waterway 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 VTM activities within their geographic areas of responsibility.

62 ports/waterways have been assessed or reassessed 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 effective and meet the needs of waterway users and stakeholders.

PAWSA Waterway Risk Model and 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 diagram below shows the six general risk categories, and corresponding risk factors, that make up the Waterway Risk Model.

Waterway Risk Model					
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
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic



- ***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 workbooks 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. Workbook 1 is used to numerically evaluate the baseline risk levels using pre-defined qualitative risk descriptions for pre-defined risk factors. Workbook 2 is used to assess the expertise of participants 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. Workbook 3 is used to evaluate how effective the existing 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 workbook 4 to identify additional risk intervention strategies and then evaluate how effective those new strategies could be at reducing risks.

Straits of Mackinac PAWSA Workshop

A PAWSA workshop to assess navigation safety on the Straits of Mackinac was held in St. Ignace, Michigan on 24-25 July, 2019. The workshop was attended by 30 participants representing waterway users, stakeholders, environmental interest groups, and Federal, State and local regulatory authorities. The purpose of the workshop was to bring waterway users, stakeholders and members of the Straits of Mackinac maritime community together for collaborative discussions. The sponsor of the workshop was Coast Guard Sector Sault Sainte Marie.

Participants discussed the quality of vessels and their crews that operate on the waterway; the volume of commercial, non-commercial and recreational small craft vessel traffic using the waterway, navigational and waterway conditions that mariners encounter when transiting the assessment area, and the potential environmental impacts that could result from a marine casualty or incident on the waterway.

Over the two-day workshop, the participants discussed and then numerically evaluated 24 risk factors in the PAWSA Waterways Risk Model. Baseline risk levels were first evaluated using pre-defined qualitative risk descriptions for each risk factor. Participants then discussed existing risk mitigation strategies, evaluated how effective those mitigation strategies were at reducing risk, and then determined if the risks were balanced. For those risk factors that were not balanced by existing mitigations, or where there was no consensus that risks were balanced, or not balanced, by existing mitigations, the participants engaged in further discussions and completed workbook 4 to identify additional risk mitigation strategies and evaluated how effective those new strategies could be at reducing risk. The results of the baseline risk level survey, existing risk mitigation strategies, additional risk intervention strategies, and participant comments and observations are outlined in this report.

The primary goal of a PAWSA workshop is to improve coordination and cooperation between government agencies and the private sector. A PAWSA workshop is intended to involve stakeholders in decisions affecting them, and provide the Coast Guard and members of the waterway community with an effective tool to evaluate risk and work toward long-term solutions tailored to local circumstances.

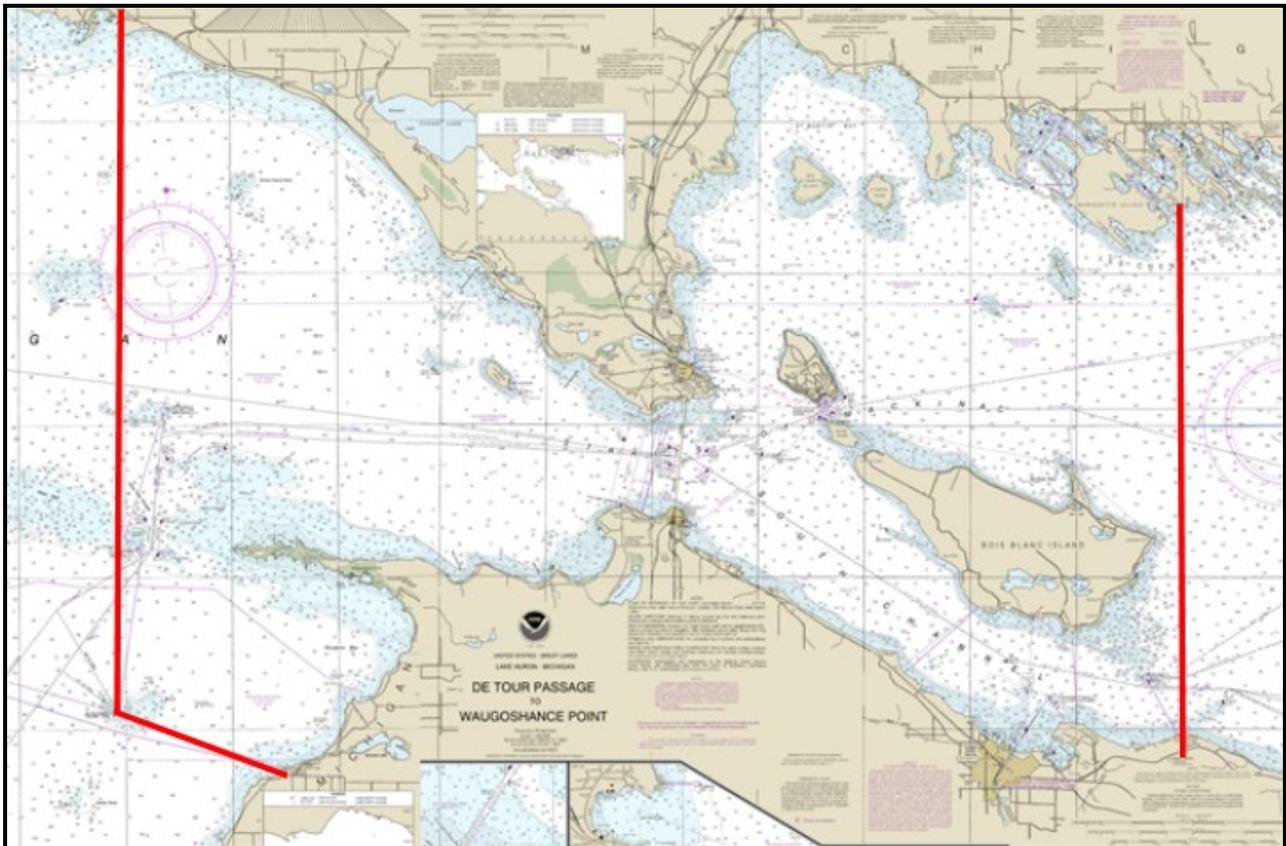
In support of these goals, this report should be viewed as a starting point for continued dialogue within the Straits of Mackinac maritime community. The Coast Guard will use this PAWSA report, together with other information, to determine whether, and to what extent, regulatory or other actions are needed to address navigation safety risk. Any rulemaking efforts will follow Coast Guard public notice and comment rulemaking procedures to allow for public participation in the process.

The United States Coast Guard, Marine Transportation Systems Directorate and Coast Guard Sector Sault Sainte Marie, extend a sincere appreciation to the workshop participants for their contributions to the Straits of Mackinac 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 all Straits of Mackinac stakeholders to further improve safe and efficient navigation on the Straits of Mackinac

Section 1: Straits of Mackinac PAWSA - Assessment Area

The geographic bounds of the assessment area is shown below, and included the navigable waters of the Straits of Mackinac described in the Regulated Navigation Area (RNA) listed in Title 33, Code of Federal Regulations, Part 165.994¹. The RNA is bounded by longitudes 084°20' W and 085°10' W and latitudes 045°39' N and 045°54' N (NAD 83), including Grays Reef Passage, the South Channel between Bois Blanc Island and Cheboygan, MI, and the waters between Mackinac Island and St. Ignace, MI.

Nautical charts 14881 and 14911 were displayed for reference and to annotate geographic locations associated with participant comments and observations; the excerpts from the annotated charts are included as appendix C to this report.



¹ Straits Of Mackinac, Michigan, Regulated Navigation Area: <https://www.federalregister.gov/documents/2018/10/01/2018-21132/regulated-navigation-area-straits-of-mackinac>

Section 2: Baseline Risk Levels

The first step in the workshop was the completion of workbook 1 to determine a baseline risk level value for each risk factor in the Waterway Risk Model. To establish the baseline risk levels, participants discussed each of the 24 applicable factors in the Waterway Risk Model and selected a qualitative description for each risk factor that best described the conditions in the assessment area. These qualitative descriptions were converted to discrete values using numerical scales that were developed during earlier PAWSA workshops. What results is the risk level for each risk factor, not taking into account any actions already implemented to reduce risk.

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. 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.

The table below shows the baseline risk level values for all risk factors evaluated by the workshop participants.

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
3.3	5.1	3.1	3.4	8.8	5.5
Shallow Draft Vessel Quality	Volume of Small Craft Traffic	Water Movement	Dimensions	Petroleum Discharge	Environmental
6.1	5.2	3.0	3.1	6.3	9.0
Commercial Fishing Vessel Quality	Traffic Mix	Visibility Restrictions	Bottom Type	Hazardous Materials Release	Aquatic Resources
9.0	7.0	5.5	4.9	3.6	7.8
Small Craft Quality	Congestion	Obstructions	Configuration	Mobility	Economic
8.0	3.1	6.5	6.8	7.9	6.3

Section 3: Team Expertise Cross-assessment

The second step in the workshop was the completion of a team expertise cross-assessment (workbook 2). 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-assessment was 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 self-assessment 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 risk categories in the Waterway Risk Model.

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

Team Expertise -- Distribution

Risk Category	Top 1/3	Mid 1/3	Lower 1/3
Vessel Conditions	34%	36%	30%
Traffic Conditions	37%	26%	36%
Navigational Conditions	37%	38%	25%
Waterway Conditions	28%	43%	28%
Immediate Consequences	39%	35%	26%
Subsequent Consequences	35%	24%	41%

All Categories Average	35%	34%	31%
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Section 4: Existing Risk Mitigations

The third step in the workshop was for participants to evaluate the effectiveness of existing mitigation strategies in reducing the risk level for each risk factor. Workbook 3 is used for two purposes. First, after the participants describe the risk mitigation strategies that already exist to help reduce the risk level for their waterway, workbook 3 is used to evaluate the effectiveness of those strategies in reducing the risk level for each factor in the model. What results from that evaluation is the present risk level, taking into account those existing mitigations. Second, the participants decide whether the risk mitigation strategies already in place adequately balance the resulting risk level. If, for any given risk factor, there is consensus (defined as 2/3 of the workshop participant teams in agreement) that existing mitigations do adequately deal with those risks, then that risk factor is dropped from further discussion.

For risk factors show in green (Balanced) there was consensus that risks were balanced by existing mitigations.

For risk factors shown in yellow (Maybe) there was no consensus that risks were balanced by existing mitigations.

For risk factors shown in red (Rising) there was no consensus, and the book 3 mitigated risk level was higher than the book 1 baseline risk level.

For risk factors shown in red (NO) there was consensus that risks were NOT balanced by existing mitigations.

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	
3.3	3.0	5.1	4.0	3.1	3.0	3.4	2.9	8.8	5.8	5.5	5.4
Balanced		Balanced		Balanced		Balanced		Maybe		Maybe	
Shallow Draft Vessel Quality		Volume of Small Craft Traffic		Water Movement		Dimensions		Petroleum Discharge		Environmental	
6.1	4.3	5.2	5.23	3.0	2.9	3.1	2.9	6.3	5.2	9.0	7.7
Balanced		Rising		Balanced		Balanced		Maybe		Maybe	
Commercial Fishing Vessel Quality		Traffic Mix		Visibility Restrictions		Bottom Type		Hazardous Materials Release		Aquatic Resources	
9.0	7.0	7.0	6.9	5.5	5.1	4.9	4.1	3.6	3.3	7.8	7.3
NO		NO		Maybe		Balanced		Balanced		Maybe	
Small Craft Quality		Congestion		Obstructions		Configuration		Mobility		Economic	
8.0	7.1	3.1	3.2	6.5	5.2	6.8	5.5	7.9	6.5	6.3	6.1
NO		Balanced		Balanced		Balanced		Balanced		Maybe	

Risk Factor	
Book 1 Score	Book 3 Score
Consensus Reached?	

EXPLANATION

Book 1 Score	Level of risk - not taking into account existing mitigations
Book 3 Score	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
Rising	No consensus, and the Book 3 score is higher than the Book 1 score
NO	Consensus that existing mitigations DO NOT adequately balance risks

Following the workshop, errors discovered in the PAWSA Decision Support Tool (MS excel file) incorrectly calculated the Shallow Draft Vessel Quality and Volume of Commercial Traffic risk factors as being not balanced (maybe); once the errors were corrected these two risk factors were calculated as being balanced by existing mitigations. The errors also resulted in decimal point changes for 12 risk factors. The numbers shown in parentheses are the incorrect risk levels that were reported at the workshop

For the following 13 risk factors, there was consensus (defined as 2/3 of the workshop participant teams agreeing) that risks were balanced by existing mitigations:

<u>Risk Factor</u>	<u>Base Line Risk Level</u>	<u>Risk Level with Existing Mitigations</u>
Mobility	7.9	6.5 (6.6)
Configuration	6.8	5.5 (5.4)
Obstructions	6.5	5.2 (5.1)
Shallow Draft Vessel Quality	6.1	4.3
Volume of Commercial Traffic	5.1	4.0 (3.8)
Bottom Type	4.9	4.1
Hazardous Materials Release	3.6	3.3 (3.4)
Congestion	3.1	3.2 (3.0)
Deep Draft Vessel Quality	3.3	3.0
Winds	3.1	3.0
Water Movement	3.0	2.9
Dimensions	3.1	2.9
Visibility Impediments	3.4	2.9 (2.8)

For the following seven risk factors, there was no consensus that risks were balanced, or not balanced, by existing mitigations:

<u>Risk Factor</u>	<u>Base Line Risk Level</u>	<u>Risk Level with Existing Mitigations</u>
Environmental	9.0	7.7 (7.8)
Aquatic Resources	7.8	7.3
Economic	6.3	6.1
Personnel Injuries	8.8	5.8 (5.9)
Health and Safety	5.5	5.4
Petroleum Discharge	6.3	5.2 (5.4)
Visibility Restrictions	5.5	5.1 (5.0)

For one risk factor, there was no consensus that risks were adequately balanced by existing mitigations and the book 3 mitigated risk level was higher than the book 1 baseline risk level:

<u>Risk Factor</u>	<u>Base Line Risk Level</u>	<u>Risk Level with Existing Mitigations</u>
Volume of Small Craft Traffic	5.2	5.23 (5.3)

For the remaining three risk factors, there *was consensus that risks were NOT balanced* by existing mitigations:

<u>Risk Factor</u>	<u>Base Line Risk Level</u>	<u>Risk Level with Existing Mitigations</u>
Small Craft Quality	8.0	7.1
Commercial Fishing Vessel Quality	9.0	7.0
Traffic Mix	7.0	6.9

Section 5: Additional Risk Intervention Strategies

The last step in the workshop process was to complete workbook 4, wherein workshop participants propose additional risk interventions for those risk factors that were not balanced by existing mitigations. Participants suggested additional risk intervention strategies², and then evaluated how successful the proposed strategies could be at lowering risk levels. Due to workshop time constraints, the workshop participants elected to complete workbook 4 for the Traffic Mix, Environmental and Aquatic Resources risk factors.

The table below shows each proposed mitigation strategy strategies, as worded by the participants, and the predicted risk level that could be obtained if the proposed strategy was implemented.

Risk Factor	General Strategy	Proposed Mitigation	Mitigated Risk Level (Prior to Proposal)	Predicted Risk Level (Proposal Implemented)
Traffic Mix	Other Actions	Establish and expand boating safety certification requirements for all users, to include a proficiency component.	6.9	3.1
	Rules and Procedures	Make the Straits of Mackinac designated pilotage waters requiring a mandatory Federal Pilot to be in the pilothouse.	6.9	3.6
	Active Traffic Management	Establish a Vessel Movement Reporting System (VMRS).	6.9	4.4
Environmental	Waterway Changes	Construct Line 5 tunnel in 2024, to remove the potential for an anchor to strike a submerged oil pipeline.	7.7	2.8
	Active Traffic Management	Institute a Vessel Movement Reporting System (VMRS) to actively manage vessel transits to minimize the risk of a marine casualty that could result in the discharge of marine pollutants.	7.7	4.4
	Other Actions	Identify and remove or replace all underwater infrastructure (oil, natural gas, electrical, etc.) subject to an anchor strike, to eliminate the potential for the discharge of marine pollutants.	7.7	4.8
	Coordination and Planning	Continue to research and champion in-situ burning as a practical oil removal tactic for the Straits of Mackinac.	7.7	5.2
	Rules and Procedures	Revise the Oil Pollution Act of 1990 (OPA) to acquire sufficient environmental response resources for the Straits of Mackinac.	7.7	5.5
Aquatic Resources	Active Traffic Management	In the event of an accident, reroute vessel traffic away from oil recovery operations to expedite and improve the efficiency of clean-up operations.	7.3	5.9
	Coordination and Planning	Conduct a baseline study of environmentally sensitive aquatic areas and catalogue them in a Geographic Information System (GIS).	7.3	6.5

² The recommended additional risk intervention strategies should not be construed to represent the views of or statements by the United States Coast Guard.

Appendix A

Workshop Participants

Participant	Organization
John Greenway	Chamber of Marine Commerce
Patrick Holt	Cheboygan County Sherriff
Mike Schmeltzer	Durocher Marine
Bob Lehto	Enbridge Incorporated
Steve Ruberg	Great Lakes Environmental Research Laboratory
Tom Rayburn	Lake Carriers Association
Allison Smart	Little River Band of Ottawa Indians
Terry Heyns	M/V Burns Harbor
Tim Wickersham	M/V Carson J. Callaway
Travis Cook	M/V Kristen D
Julie Neph	Mackinac Bridge Authority
Mark Wilk	Mackinac County Sherriff
Sam Barnwell	Mackinac Marine Rescue
Michael Rancilio	Marine Pollution Control
Joseph Haas	Michigan Department of Environment, Great Lakes, and Energy
Jen Wolf	Michigan Department of Natural Resources
Brian Adam	NOAA National Weather Service - Gaylord
Tom Loeper	NOAA Navigation Manager/Office of Survey
Steve Stanek	S/S Alpena
Beau Vallier	Star Line
Tracy Lawrence	TC Energy
Jennifer McKay	Tip of the Mitt Watershed Council
Syed Ali	Transport Canada
Kevin Sprague	U.S. Army Corps of Engineer
Angela Pickett	U.S. Pipeline and Hazardous Materials Safety Administration
Michael Hjerstedt	U.S. Coast Guard Sector Sault Marie
Mark Gill	U.S. Coast Guard Sector Sault Marie
Steve Keck	U.S. Coast Guard Sector Sault Marie
Andrew Babione	U.S. Coast Guard Station St Ignace
Jon Olney	Western Great Lakes Pilots Association

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Appendix B

Participant Observations - Trends in the Port and Existing Risk Mitigations

The workshop participants are local subject matter experts and these comments capture their opinions and analysis, providing a general sense of the ideas discussed during the workshop. These comments include various perspectives representing widely different interests and should not be construed to represent the views of or statements by the United States Coast Guard.

Deep Draft Vessel Quality

(Vessels 1600 Gross Tons and higher engaged in commercial trade)

Trends/Observations:

- Vessels evaluated under this category included Tank Vessels, Chemical Ships, Bulk Cargo Carriers, and Cruise Ships.
- The majority of deep draft vessels transiting the assessment area are engaged in the iron ore trade and are in full compliance with statutory requirements. The vessels operate in a fresh water environment which reduces the impact of rusting and equipment being damaged from a salt water environment, and are placed in a lay-up status for several months during the winter season which allows for an extended dock side availability that facilitates completion of maintenance and repair requirements.
- Foreign flagged vessels, including Canadian flagged vessels, are subject to the USCG 96-hour Notice of Arrival and Departure (NOAD)¹ reporting regulations that identify and prioritize foreign flagged commercial vessels for USCG Port State Control (PSC)² vessel inspections.
- In 2018 there were approximately 3,300 ship visits to the Great Lakes, the majority of which were Canadian flagged vessels. In 2018, the Coast Guard conducted 164 safety PSC examinations on foreign flagged vessels transiting the Great Lakes system and did not issue any detention orders.
- U.S. flagged deep draft vessels are subject to USCG inspection regulations. Canadian flagged vessels are similarly subject to Transport Canada vessel inspection and certification regulations³. Both of these inspection regimes include requirements for crewmember training, demonstration of proficiency, and pollution response training.
- All foreign flagged vessels entering the Great Lakes system are subject to the International Convention for the Safety of Life at Sea (SOLAS)⁴ and International Convention for the Prevention of Pollution from Ships (MARPOL)⁵ requirements.

¹ USCG NOAD regulations: <https://www.govinfo.gov/content/pkg/FR-2015-01-30/pdf/2015-01331.pdf>

² USCG PSC regulations: <https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Commercial-Vessel-Compliance/Foreign-Offshore-Compliance-Division>

³ Transport Canada – Vessel Inspection and Certification: <https://www.tc.gc.ca/en/services/marine/vessel-inspection-certification.html>

⁴ SOLAS Convention: [http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-\(SOLAS\),-1974.aspx](http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Safety-of-Life-at-Sea-(SOLAS),-1974.aspx)

- Foreign flagged vessels entering the Great Lakes system are subject to both U.S. and Canadian Saint Lawrence Seaway inspection requirements. Both U.S. and foreign flagged deep draft vessels are required to have U.S. federally licensed pilots onboard during their entire Great Lakes voyage.
- Deep draft commercial vessels are subject to USCG and Flag State Administration inspection and certification requirements. The vessels must also meet applicable classification society requirements⁶.
- Crew proficiency is also very good. Vessel crews are subject to extensive licensing and testing requirements. Many deck officers on U.S. and Canadian flagged vessels also have completed pilotage testing requirements and hold pilotage endorsements to their licenses.
- Ship handling proficiency is very high for deep draft vessel deck officers because the nature of the iron ore trade requires numerous docking and un-docking maneuvers as the vessels are in steady state of loading cargo, getting underway, transiting for relatively short durations (compared to off-shore deep draft vessel voyages), docking and unloading cargo.

Existing Mitigations:

- USCG Vessel Inspection regulations
- USCG Port State Control regulations
- USCG Notice of Arrival and Departure reporting regulations
- Transport Canada Vessel Inspection and Certification regulations
- SOLAS and MARPOL Convention requirements
- Federal Pilotage requirements for foreign flagged vessels.

Shallow Draft Vessel Quality

(Vessels less than 1600 Gross Tons engaged in commercial trade)

Trends/Observations:

- Vessels evaluated under this category included towing vessels, small passenger vessels, ferries, charter vessels, dive vessels, and dinner cruisers.
- Participant comments indicated that the material condition and crew proficiency on passenger vessels is very high. Passenger vessels are subject to Coast Guard vessel inspections regulations and are inspected at least annually. The vessel masters are normally the only licensed positions on the passenger vessel, with crew members serving on a mostly seasonal basis.

⁵ MARPOL Convention: [http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-\(MARPOL\).aspx](http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Prevention-of-Pollution-from-Ships-(MARPOL).aspx)

⁶ Vessel Classification Societies: <http://maritime-connector.com/wiki/classification-society/>

- The normal operating season for the majority of small passenger vessels is from the beginning of April to the end of November when the ice season starts. Vessels are laid up over the winter months which allows for dedicated periods for maintenance and repair.
- There are 26 small passenger vessels homeported in the Straits of Mackinac that are subject to either USCG Subchapter T⁷ or Subchapter K⁸ inspection requirements. Inspections are conducted annually and include conducting emergency drills to demonstrate crewmember proficiency.
- One small passenger vessel provides passenger and cargo transportation services between Cheboygan and Bois Blanc Island.
- Approximately 20 small passenger vessels provide passenger and cargo transportation services between Mackinaw City, St. Ignace, and Mackinac Island.
- There are 10 towing vessels homeported in the Straits of Mackinac subject to USCG Subchapter M⁹ inspection requirements.
- The USCG conducts boardings on charter vessels to ensure the captains have USCG issued licenses and the vessels have the required safety equipment; safety deficiencies are rarely found.
- Charter vessel operators are proactive in requesting USCG Auxiliary Vessel Safety Checks¹⁰ (dockside examinations) to receive a discount on their insurance, which is an incentive to properly maintain the vessels safety equipment.

Existing Mitigations:

- USCG Subchapter T and K - Passenger Vessel Inspection regulations
- USCG Subchapter M – Towing Vessel Inspection regulations
- Vessel crews are required to carry out emergency drills annually
- USCG law enforcement boarding
- USCG Auxiliary Vessel Safety Checks

Commercial Fishing Vessel Quality:

Trends/Observations:

- Commercial fishing vessels that operate in the assessment area consist mostly of tribal commercial fishing vessels.
- Tribal fishing vessels are regulated by the Chippewa Ottawa Resource Authority (CORA)¹¹, which establishes commercial and subsistence fishing regulations.

⁷ USCG Subchapter T: <https://www.govinfo.gov/content/pkg/CFR-2012-title46-vol7/pdf/CFR-2012-title46-vol7-chapI-subchapT.pdf>

⁸ USCG Subchapter K: <https://www.govinfo.gov/content/pkg/CFR-2012-title46-vol4/pdf/CFR-2012-title46-vol4-chapI-subchapK.pdf>

⁹ USCG Subchapter M: <https://www.govinfo.gov/content/pkg/CFR-2016-title46-vol5/pdf/CFR-2016-title46-vol5-chapI-subchapM.pdf>

¹⁰ USCG Auxiliary: <http://cgaux.org/>

¹¹ Chippewa Ottawa Resource Authority: <https://www.1836cora.org/>

- Operators of tribal commercial fishing vessels are not required to be licensed by the USCG; their vessels are, however, required to complete dockside fishing vessel safety examinations conducted by the USCG¹².
- One participant commented that while the majority of tribal fishing vessel operators are not very well trained and their vessels are not well maintained, there are some tribal fishing vessel operators who are very well trained and operate their vessels safely. The placement of their fishing vessel nets in the ferry routes to and from Mackinac Island have posed an obstruction hazard for small passenger vessels.
- Many tribal fishing vessel operators have extensive experience fishing and operating in the assessment area and have developed expert local knowledge. Fishing has been their lifetime career so they tend to have years of experience operating on the water.
- Fishing vessel operators view their trade as a lifestyle versus an occupation, and are personally invested in their fisheries. They look at “function over form”, in that the function of the vessel is more important than the vessel's physical appearance.
- Interactions between USCG and tribal fishing vessel operators has been positive, and in cases where violations were issued the operators are appreciative of the emphasis on safety that the USCG places on their commercial fishing operations. They appreciate that the USCG is out on the water conducting boardings because they know not only is the USCG inspecting them, but the (USCG) will also be the ones they call for assistance if they need rescuing.

Existing Mitigations:

- USCG dockside fishing vessel safety examinations
- Chippewa Ottawa Resource Authority (CORA) tribal fishing vessels regulations
- Memorandums of Understanding (MOU) between USCG and Tribal Nations to promote coordinated commercial fishing vessel safety examinations

Small Craft Quality

Trends/Observations:

- Small craft evaluated under this category included power driven recreational vessels, jet skis, sailing vessels, and human powered craft such as paddleboards, kayaks, rowboats and canoes.
- Small craft operators generally lack navigational experience, knowledge of the Rules of the Road, and the constraints that deep draft vessels have when maneuvering and transiting in restricted, congested waters.
- Round Island Passage and the waters to the southwest of Mackinac Island are areas that experience very close passing and meeting situations between deep draft vessels and small craft.

¹² USCG Fishing Vessel Safety Division: <https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Commercial-Vessel-Compliance/Fishing-Vessel-Safety-Division/>

- The high number of small craft that operate in the assessment during the busy summer season results in daily close quarter's situations between ferry vessels and small craft operators.
- Ferries routinely have to slow down and/or alter course to safely pass small craft operators who are generally not aware of the dangers that larger vessels pose to smaller vessels.
- Human powered craft (kayaks, paddle craft) are easy to rent and do not require any formalized training before operating on the water. Limited boating experience and the lack of knowledge of the Rules of the Road frequently results in close encounters between human powered craft/small craft operators and small passenger vessels (ferries) and deep draft commercial vessels.
- Small craft operators also generally lack an understanding of the limited maneuvering characteristics of large deep draft vessels and the navigational challenges they encounter when transiting a very narrow shipping channel.
- The State of Michigan is heavily promoting standup paddle board and kayak usage on the waterway trails that run the coastline in and around Mackinac Island, increasing the number of human powered craft operating in close proximity to deep draft and powered craft vessels. A voluntary program is promoted that encourages paddle board operators to affix a sticker to the paddle craft listing their name and a contact number to assist search and rescue efforts if the paddle craft is found adrift within no one aboard.
- The number of small craft operators who required emergency assistance has remained fairly steady the last few years. In 2016, the USCG responded to 41 search and rescue cases within the assessment area. In 2017, the number of cases was 31, and in 2018 the number of cases was approximately 30.
- From 2016 to 2018, the USCG conducted approximately 700 law enforcement boardings on small craft vessels; 45 boardings resulted in the USCG terminating the voyage (directed to vessel to proceed to the dock and moor) due to unsafe conditions.
- Federal, state and local law enforcement authorities promote National Safe Boating Week leading up to the Memorial Day weekend. This initiative focuses on encouraging safe boating practices for recreational boaters.
- Leading up to the busy July 4th holiday, the USCG promotes a safety program titled Operation Dry Water which focuses on Boating under the Influence (BUI) awareness and prevention.

Existing Mitigations:

- USCG Auxiliary Vessel Safety Checks
- USCG Law Enforcement boardings
- Paddle craft stickers that list operator names and contact numbers
- National Safe Boating Week
- Operation Dry Water

Volume of Commercial Traffic

Trends/Observations:

- In 2018 there were approximately 3,300 arrivals to the Great Lakes system from foreign flagged vessels, the vast majority of which were Canadian flagged. Most Canadian flagged vessels operate exclusively upon the Great Lakes, with voyages to and from the U.S. ports transporting mostly iron ore.
- The assessment area is considered a transient waterway with almost all deep draft commercial traffic passing through the area to deep water ports located outside the assessment area. The number of commercial vessels that transited through the assessment area annually is approximately 2,000 which includes tank vessels, tugs and tows, articulated tug barges and bulk carriers.
- Numerous small passenger vessels run established routes to Mackinac Island from several departure points in Mackinaw City and St. Ignace. The vessels vary in size from smaller passenger vessels that carry less than 50 passenger, to larger high-speed ferries that carry in excess of 300 passengers. During the busy summer tourist season there are approximately 120 round trip voyages each day to Mackinac Island from the two departure ports. There is very close coordination among the ferry vessel operators to minimize the impacts of congestion due to numerous ferry vessels arriving and departing from Mackinac Island.
- During the summer operating season (mid-April to Mid-December – referred to as “soft water” months) there are approximately 50 small passenger vessel and deep draft commercial vessel transits per day within the assessment area. During the winter season (mid-December to Mid-April – referred to as “hard water” months), there are approximately 10 deep draft commercial vessel transits per day.
- Vessels that transit during the winter season are under “positive control” during Operation Taconite¹³, which means that vessel movements are monitored and controlled by USCG Vessel Traffic Service (VTS) Sault Sainte Marie¹⁴. Under Operation Taconite, vessels are sometimes escorted by USCG ice breakers due to ice conditions.
- Three Regulated Navigation Areas¹⁵ have been established to control vessels movements through the assessment area during the winter ice season. A Regulated Navigation Area¹⁶ has also been established that prohibits vessels from anchoring or remaining in areas that contain submerged cables or pipelines.

Existing Mitigations:

- Good communications between commercial vessel operators
- Positive control vessel movements and ice breaker escorts during the domestic ice

¹³ USCG Operation Taconite: https://www.atlanticarea.uscg.mil/Portals/7/Ninth%20District/Documents/Sector_SSM_Documents/OP_TACONITE_Overview.pdf?ver=2017-06-30-145216-067

¹⁴ USCG Vessel Traffic Service Sault Sainte Marie: <https://www.atlanticarea.uscg.mil/Our-Organization/District-9/Ninth-District-Units/Sector-Sault-Sainte-Marie/Services/VTS/>

¹⁵ USCG Regulated Navigation Area - CFR 165.901: <https://www.law.cornell.edu/cfr/text/33/165.901>

¹⁶ USCG Regulated Navigation Area - CFR 165.944: <https://www.law.cornell.edu/cfr/text/33/165.944>

- Regulated Navigation Areas

Volume of Small Craft Traffic

Trends/Observations:

- The heaviest volume of small craft traffic is experienced from June to the beginning of September. Small craft traffic is also heaviest on weekends.
- Small craft from other ports transit the assessment area which increases traffic seasonally. There are a few boat launches within the assessment area for small craft to depart from; most small craft traffic originates from the five marinas located in the assessment area: Mackinac Island, St. Ignace, Mackinaw City, Cheboygan/Duncan Bay and Cedarville/Hessel.
- There are two annual sailboat races each year (Port Huron to Mackinac Race and the Chicago Yacht Club Race to Mackinac) that significantly increases the number of small craft operating in the assessment area.
- Seasonal waterside events increase small craft traffic volumes; in 2018 there were four fireworks shows and eight regattas. In 2019, an annual event (Mighty Mac Swim) was held that involved approximately 400 participants who swam across the Straits of Mackinac. These events required the sponsor to submit a marine event application to USCG Sector Sault Sainte Marie.
- In the late spring to late summer, weekly firework shows occur in St. Ignace and Mackinaw City. These firework displays occur on the weekend.

Existing Mitigations:

- USCG permitting requirements for marine events

Traffic Mix

Trends/Observations:

- The traffic mix in the assessment area included deep draft commercial vessels, small passenger vessels, powered small craft, sailing vessels, and human powered craft.
- Deep draft vessel traffic generally follows established track lines marked on navigation charts. The lines, referred to as LCA (Lake Carriers Association) track lines, show the routes that deep draft vessels will normally follow. Navigating on the LCA track lines is a well-established procedure for deep draft vessels.
- Round Island Passage, just south of Mackinac Island, is an area that experiences heavy traffic mix and congestion between deep draft vessels navigating Round Island Passage and small passenger vessels (ferries) entering and departing Mackinac Island harbor. The area is considered a “choke point” because it is the primary route used by deep draft vessels traveling through the assessment area and ferry vessels entering and departing Mackinac Island harbor. Many of the small passenger vessels and ferries are built for maximum speeds and efficiency. Vessels operating at high speeds and maneuvering in close proximity to small craft, small passenger vessels and deep draft vessels increases Traffic Mix risks.

- Deep draft vessels transiting through Round Island Passage channel sometimes slow down for the passage, and occasionally encounter small craft traffic in the channel that do not move out of the way of deep draft vessels which have limited maneuvering options due to the narrow channel dimensions. Calm weather conditions also attract large numbers of small craft to the Round Island Passage area, further increasing the mix of traffic and contributing to congestion.
- Season events such as sail boat races and regattas bring in large numbers of sailing vessels and powered small craft, but the duration they are present is short and manageable.
- The channel under the Mackinac Bridge is long, wide, and strait which mitigates close quarters interactions between small craft and deep draft vessels.
- Traffic mixing between small craft and commercial vessels occurs primarily during the busy summer boating season which lasts from Memorial Day to Labor Day. During this time period the greatest numbers of small craft are operating on the water in close proximity to the larger deep draft commercial vessels that are transiting the area.
- Commercial vessel operators are constantly in contact with each other as they approach Round Island Passage. Agreements are reached to ensure that deep draft vessels do not meet/pass in this area due to channel dimension limitations and the high number of small craft and ferry vessels operating in the area.

Existing Mitigations:

- Good communications between commercial vessel operators
- Transit planning
- LCA (Lake Carriers Association) track lines

Congestion

Trends/Observations:

- Congestion is seasonal and occurs primary in the Round Island Passage area. As explained in the Traffic Mix risk factor, this area is considered a “choke point” which results in various types of vessels operating in very close proximity to each other.
- Other areas that experience small craft congestion are at the entrances to the marinas.
- Small craft vessel congestion also occurs periodically when sail boat races or regattas take place, congestion increases for short durations but is manageable.

Existing Mitigations:

- Good communications between commercial vessel operators
- Transit planning
- LCA (Lake Carriers Association) track lines

Winds

Trends/Observations:

- The prevailing wind directions are from the North and West. 20 knot winds are not uncommon; during the winter the season (approximately October to May), wind speeds are generally higher.
- Weather reports are provided by meteorological sensors located at the Mackinac Island Airport, Chippewa International Airport (located approximately 40 miles from the assessment area), and the Cheboygan County Airport. There are differences between what is being reported from the airport locations and what is actually observed on the water. The cause of these differences is attributed to the much higher elevation of the Mackinac Island Airport, and the distances between the assessment area and the Chippewa International Airport and Cheboygan County Airport. Winds speeds have been observed higher on the water than what the airport sensors are reporting.
- National Oceanographic and Atmospheric Administration (NOAA) weather forecasting includes the Real-time Great Lakes Weather Data and Marine Observations¹⁷ system that includes numerous weather buoys with sensors that broadcasts wind speeds, wind gusts, wind direction, air temperatures, dew points, cloud cover, sea level pressure, water temperatures, wave heights, and wave periods
- Winds are well forecasted and mariners are aware of predicted winds speeds. Winds blowing from the west are funneled under the Mackinac Island Bridge which increases the velocity to speeds much higher than what the airport weather sensors are reporting.
- Winds are lighter in the summer period (June, July and August), the strongest winds are experienced during the winter months.
- Sustained winds or 20 knots or more are experienced on average two days per month.

Existing Mitigations:

- NOAA - Real-time Great Lakes Weather Data and Marine Observations
- Meteorological information provided by airports

Water Movement

Trends/Observations:

- Currents are predictable with average speeds of approximately two knots. As water flows through the Straits of Mackinac from Lake Michigan into Lake Huron the currents get stronger, slow down, stop and then reverse direction.
- Modeling has been performed by the NOAA Great Lakes Coastal Forecasting System¹⁸ that shows currents are wind driven, and change direction approximately every 1.5 days.

¹⁷ Great Lakes Weather Data and Marine Observations: <https://coastwatch.glerl.noaa.gov/marobs/>

¹⁸ Predicting Currents in the Straits of Mackinac: <https://www.glerl.noaa.gov/pubs/brochures/straits.pdf>

- Water stratification also occurs. Stratification is a condition in which a warm water layer is on the top of water, and a cold water layer is at the bottom. This leads to different current directions; the warm water is moving in one direction, and the cold water is moving in the opposite directions.
- Currents in Round Island Passage can be a concern for deep draft vessels under certain circumstances. As deep draft vessels approach Round Island Passage from the east, strong currents can cause the vessels to be set up to a 25 degree angle from the intended course. The impact of this extreme set has resulted in vessels electing to avoid transiting Round Island Passage by either going north around Mackinac Island, or going south around Bois Blanc Island through the South Channel.
- Wave heights in the Straits of Mackinac are on average approximately two feet. Wave heights are four to six feet for around 20 days per year, and exceed six feet for approximately three days per year.
- The USCG routinely issues Broadcast Notice to Mariners (BTM)¹⁹ that alert waterway users to issues that could impact safe navigation.

Existing Mitigations:

- NOAA - Great Lakes Coastal Forecasting System
- NOAA - Real-time Great Lakes Weather Data and Marine Observations
- USCG Broadcast Notice to Mariners

Visibility Restrictions

Trends/Observations:

- During the winter months the area experiences reduced visibility due to lake effect snow²⁰, which can reduce visibility to less than a half-mile when snow bands pass through.
- Reduced visibility due to fog usually occurs during the summer months. Fog is present on average more than 24 days per year but only lasts for approximately six hours or less before it dissipates.

Existing Mitigations:

- NOAA - Great Lakes Coastal Forecasting System
- NOAA - Real-time Great Lakes Weather Data and Marine Observations
- USCG Broadcast Notice to Mariners

Obstructions

Trends/Observations:

- Obstructions in the assessment area include ice flows during the winter season (typically January through April). Un-lit buoys may also pose an obstruction hazard for small craft operating at night.

¹⁹ USCG BTM: <https://www.law.cornell.edu/cfr/text/33/72.01-25>

²⁰ Lake effect snow: <https://www.weather.gov/safety/winter-lake-effect-snow>

- Tribal fishing vessel operators have placed their fishing nets along the ferry routes used by the small passenger vessels transiting to and from Mackinac Island which has resulted in vessels running over the nets and fouling their propellers.
- Rocks and log pilings in the Duncan Bay area (just east of Cheboygan) are a hazard to navigation for small craft.
- Increased Great Lakes water levels, currently 50 inches above low water datum, have resulted in higher than normal amounts of debris (trees, dock pilings, etc.) entering the shipping lanes.

Existing Mitigations:

- Regulation Navigation Areas
- USCG Broadcast Notice to Mariners
- USCG Domestic Ice Breaking Operations

Visibility Impediments

Trends/Observations:

- Jetties that protect marinas are a visibility impediment for smaller, low profile craft entering and departing the marinas.

Existing Mitigations:

- Good communication between commercial vessel operators
- Local knowledge

Dimensions

Trends/Observations:

- There are three areas within the assessment area that have reduced channel dimensions that impact deep draft vessel transits: Round Island Passage channel is 1,250 feet wide with a 30 foot project depth; Poe Reef Channel is 1,200 foot wide with a 30 foot project depth; and Grays Reef Passage is 3,000 feet wide with a 25 foot project depth. These are constrictive areas where large vessels generally avoid passing each other.
- Although water depths remain fairly steady from year to year, the U.S. Army Corps of Engineers (USACE) conducts annual bottom surveys and published the results.
- Dredging has been authorized and funded for Mackinaw City harbor, to begin in November 2019. The USACE also conducts periodic dredging of the smaller harbors and marinas.

Existing Mitigations:

- USACE dredging and bottom surveys

Bottom Type

Trends/Observations:

- The bottom type in the assessment area is primarily a mix of sand, clay and mud. Hard bottom (rock) areas are present around Round Island Passage and Grays Reef Channel.
- Small craft are impacted by shallow water and shoaling in the Duncan Bay area and the approaches to the Cheboygan River.

Existing Mitigations:

- USACE dredging and bottom surveys

Configuration

Trends/Observations:

- The assessment area is mostly open with fairly straight channels. Areas that have converging traffic include Grays Reef, Round Island Passage and the South Channel.
- The entrance to Grays Reef Passage requires a turn that is almost 90 degrees.
- The entrance to the Cheboygan River has a sharp turn that vessels must make when entering and departing the river.

Existing Mitigations:

- USACE dredging and bottom surveys

Personnel Injuries

Trends/Observations:

- The largest cruise ships that transit the area are all under 500 feet and carry less than 500 passengers. Transits by these vessels is very infrequent.
- Tourism is a significant contributor to the Michigan Upper Peninsula economy. There are approximately 1 million passengers transported within the assessment area each year.
- This baseline risk factor was scored very high due to the large numbers of people that are transported by small passenger vessels and ferries.

Existing Mitigations:

- Mass rescue operation plans have been developed and exercised for both summer and winter (ice season) environments
- Firefighter training is conducted on deep draft vessels and includes confined space entry rescues.
- Procedures are in place to quickly outfit USCG rescue helicopters with lifesaving devices for deployment when there are large numbers of persons reported in the water.
- Land based ice rescue teams.

Petroleum Discharge

Trends/Observations:

- Tank vessels and tanks barges transport petroleum products through the assessment area. Tank barge traffic is very limited, with only one 70K gross ton tank barge and one 100K gross ton tank barge regularly transiting through the assessment area.
- Canadian tank vessels transit the area and average in size between 8K to 15K gross tons.
- There are several contingency plans that outline spill response efforts in the event of a petroleum discharge. These include the Northern Michigan Area Contingency Plan²¹ and the USCG Maritime Transportation System Recovery Plan²².
- The USCG has established Marine Transportation System Recovery Units (MTSU)²³ and plans to assist in restoring port functions and resuming commercial activity as quickly as possible following a significant port disruption.
- Waterways that transport large volumes of petroleum products generally have large quantities of private sector pollution response resources that are immediately available if needed. The low volumes and frequency of petroleum products being transported through the assessment area is very low compared to these other waterways. This has resulted in limited private sector pollution response resources being available to immediately respond to a pollution incident within the assessment area. A recommendation was made to amend the Oil Pollution Act of 1990 (OPA) to acquire the staging of sufficient pollution response resources in the Straits of Mackinac to more quickly mitigate the immediate impacts from a pollution discharge incident.

Existing Mitigations:

- Open-water recovery capabilities
- USCG Marine Transportation System Recovery Plan
- USCG Marine Transportation System Recovery Units
- Oil Spill Response and Removal Organizations
- Northern Michigan Area Contingency Plan
- Geographic Response Plans
- Annual pollution response exercises
- Regulation Navigation Areas

²¹ Northern Michigan Area Contingency Plan:

<https://homeport.uscg.mil/Lists/Content/Attachments/59931/NMACP%20October%202019.pdf>

²² USCG MTSRP:

<https://homeport.uscg.mil/Lists/Content/Attachments/58837/Marine%20Transportation%20System%20Recovery%20Plan%20REV2.pdf>

²³ USCG MTSRU: <https://homeport.uscg.mil/Lists/Content/Attachments/1626/MTSRU%20Information%20Sheet%20v4%200.pdf>

Hazardous Materials Release:

Trends/Observations:

- Bulk Hazardous materials are not transported through the assessment area. There are non-bulk hazardous materials shipment transported via small passenger vessels (ferries) to Mackinac Island and Bois Blanc Island. These shipment are primary fuel trucks.

Existing Mitigations:

- USCG Marine Transportation System Recovery Plan
- USCG Marine Transportation System Recovery Units
- Oil Spill Response and Removal Organizations
- Northern Michigan Area Contingency Plan
- Geographic Response Plans
- Annual pollution response exercises
- Regulation Navigation Areas

Mobility:

Trends/Observations:

- A waterway closure would have significant impacts to the local community. Supplies are delivered via ferry to Boise Blanc Island, so any extended waterway closure would disrupt shipments of propane, heating oil and food. Impacts would be felt in 24 hours.
- The Straits of Mackinac is the only passage for iron ore shipments to the steel mills located in lower Lake Michigan. These steel mills normally have limited supplies of iron ore stored, so a waterway closures in excess of a week could impact steel production.
- There is no rail support or over the highway truck support to compensate for a waterway closures, if the waterway is disrupted there is no other way to move cargo between Lake Michigan and Lake Huron.

Existing Mitigations:

- USCG Marine Transportation System Recovery Plan
- USCG Marine Transportation System Recovery Units
- Oil Spill Response and Removal Organizations
- Northern Michigan Area Contingency Plan
- Geographic Response Plans
- Annual pollution response exercises
- Regulation Navigation Areas

Health and Safety:

Trends/Observations:

- A major marine casualty would have a significant impact on the waterway. Shutting down the waterway would have a major impact on the steel mills who rely upon regular iron ore shipments to keep the mills operating.
- The assessment area is surrounded by Mackinaw City, Mackinac Island, and St. Ignace, each with small populations of under 5,000 people. Although these are not large communities, there are significantly larger numbers of people present, particularly on Mackinac Island and Mackinaw City, during the tourist season. Population numbers during the tourist season can approach 50K people.
- Seasonal events such as the Mackinac Bridge walk can draw between 25K and 40K people to the assessment area.
- There are 12 public water supplies around the assessment area that could be impacted as a result of a pollution discharge.
- Limited hospital facilities in the area increases risks for the Health and Safety risk factor. The largest hospital is in Petoskey, which is located approximately 35 miles from the assessment area.
- Systems are in place to send emergency alerts to the community through cell phones similar to Amber alerts.

Existing Mitigations:

- USCG Marine Transportation System Recovery Plan
- USCG Marine Transportation System Recovery Units
- Oil Spill Response and Removal Organizations
- Northern Michigan Area Contingency Plan
- Geographic Response Plans
- Annual pollution response exercises
- Regulation Navigation Areas

Environmental:

Trends/Observations:

- The Straits of Mackinac is a very culturally important area to the Native American tribes in Michigan.
- Michigan Natural Features Inventory²⁴ has identified 12 unique terrestrial community complexes in the assessment area that are designated as critically impaired, imperiled or rare, that totals 60,000 acres of unique habitat. These areas includes sand dunes, coastal wetlands, coastal fens, and Great Lake marshes. Areas of conservation and preservation status in this area include state environmental areas, state parks, and

²⁴ Michigan Natural Features Inventory: <https://mnfi.anr.msu.edu/>

wilderness areas that include Mackinaw State Park, Cheboygan State Park and Michigan Island National Wildlife Refuge²⁵.

- There are 47 federal and state threatened and endangered species found within the assessment area including Houghton's Goldenrod, Blanding's turtles, Eastern Massasauga rattlesnakes, Lake Huron Tansy, Pitcher's Thistle, and Piping Plovers. There are 38 of the state's total 55 species of reptile and amphibians present in the Straits of Mackinac and adjacent counties, 40 fish species have conservation status. The area is a very important spawning habitat for a number of the fish.
- Approximately 90% of the assessment area is designated as environmentally sensitive.
- There are several contingency plans that outline spill response efforts in the event of a petroleum discharge. These include the Northern Michigan Area Contingency Plan and the USCG Maritime Transportation System Recovery Plan.
- Environmentally Sensitive Index (ESI)²⁶ maps of the assessment area are in the process of being updated by the Environmental Protection Agency (EPA).
- Deep draft vessels entering the Great Lakes from sea and sailing internationally are required to comply with SOLAS requirements. Chapter 9 of SOLAS (Management for the Safe Operation of Ships) requires vessels to comply with the requirements of the International Safety Management (ISM) Code²⁷ which provides international standards for the safe management and operation of ships and for pollution prevention. The ISM Code requires vessels owner and operators to establish a Safety Management System (SMS) which outlines procedures for maintaining the vessels equipment. The procedures are then verified through audits by recognized organization. The ISM Code is not applicable to vessels that operate only on the Great Lakes, which increases the risk associated with the Environmental risk factor.

Existing Mitigations:

- USCG Marine Transportation System Recovery Plan
- USCG Marine Transportation System Recovery Units
- Oil Spill Response and Removal Organizations
- Northern Michigan Area Contingency Plan
- Geographic Response Plans
- Annual pollution response exercises
- Regulation Navigation Areas
- Environmentally Sensitive Index Maps

²⁵ Michigan Island National Wildlife Refuge: https://www.fws.gov/refuge/michigan_islands/

²⁶ Environmental Sensitivity Index (ESI) Maps: <https://response.restoration.noaa.gov/maps-and-spatial-data/download-esi-maps-and-gis-data.html#GreatLakes>

²⁷ International Safety Management Code: <http://www.imo.org/en/OurWork/HumanElement/SafetyManagement/Pages/ISMCode.aspx>

Aquatic Resources:

Trends/Observations:

- Medicinal plants along the coastline are harvested by Tribal members. Tribal subsistence fishing is also a big part of the Tribal culture.
- There are numerous environmentally sensitive locations and species present in the assessment area that includes important wetlands with protected status, endangered species, culturally-significant species, and fish spawning grounds.

Existing Mitigations:

- USCG Marine Transportation System Recovery Plan
- USCG Marine Transportation System Recovery Units
- Oil Spill Response and Removal Organizations
- Northern Michigan Area Contingency Plan
- Geographic Response Plans
- Annual pollution response exercises
- Regulation Navigation Areas
- Environmentally Sensitive Index Maps

Economic:

Trends/Observations:

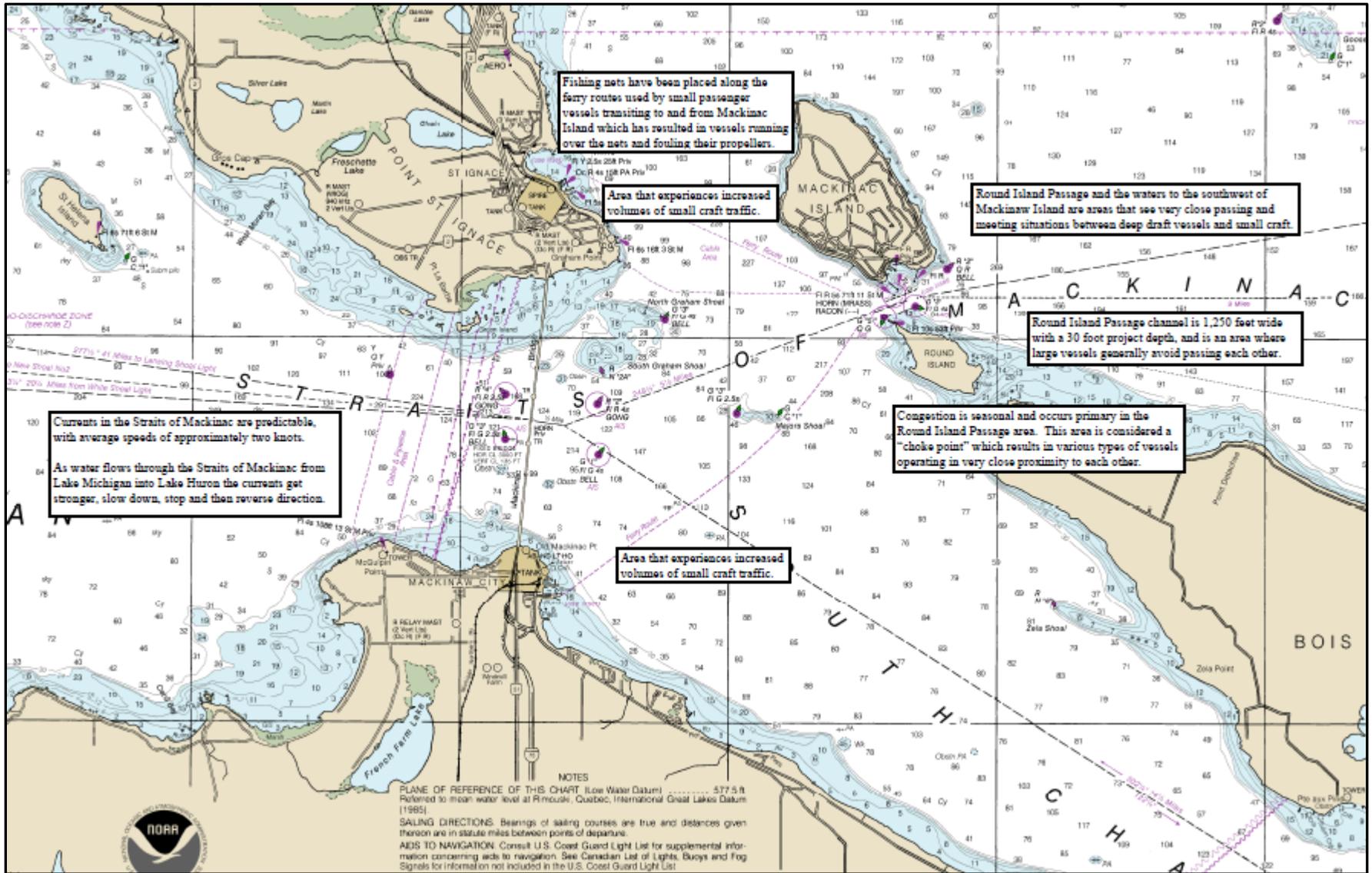
- Approximately \$500 billion worth of cargo passes through the Soo Locks annually, with approximate 40 percent of the cargo being transported through the Straits of Mackinac. A long term closure of the waterway would have a national impact on steel production due to iron ore shipments that must transit through the area.
- The impact from an oil discharge would have a regional impact on Michigan's shoreline, and a national impact to the iron ore transportation/steel production industry. The commercial fishery industry would also be heavily impacted.

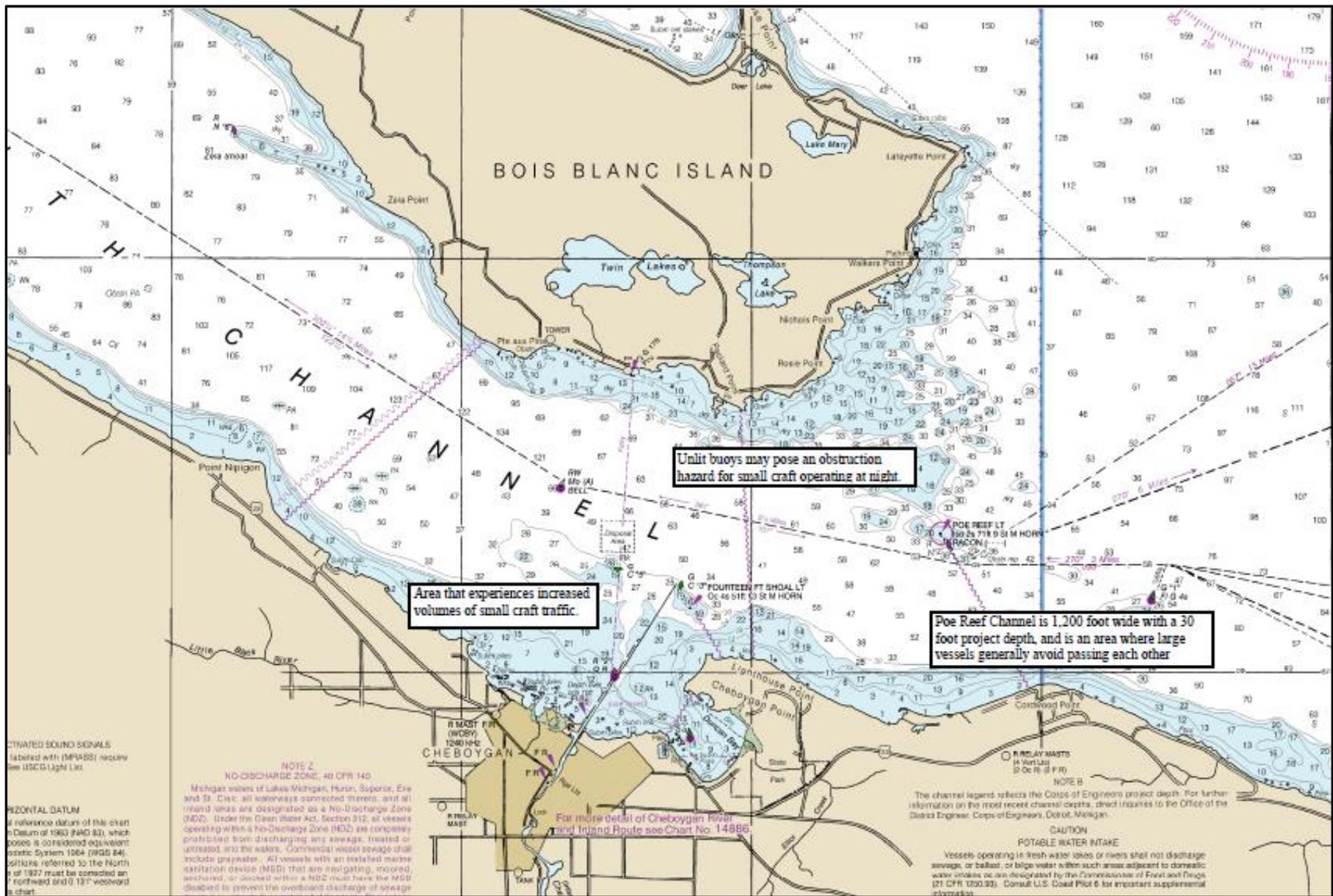
Existing Mitigations:

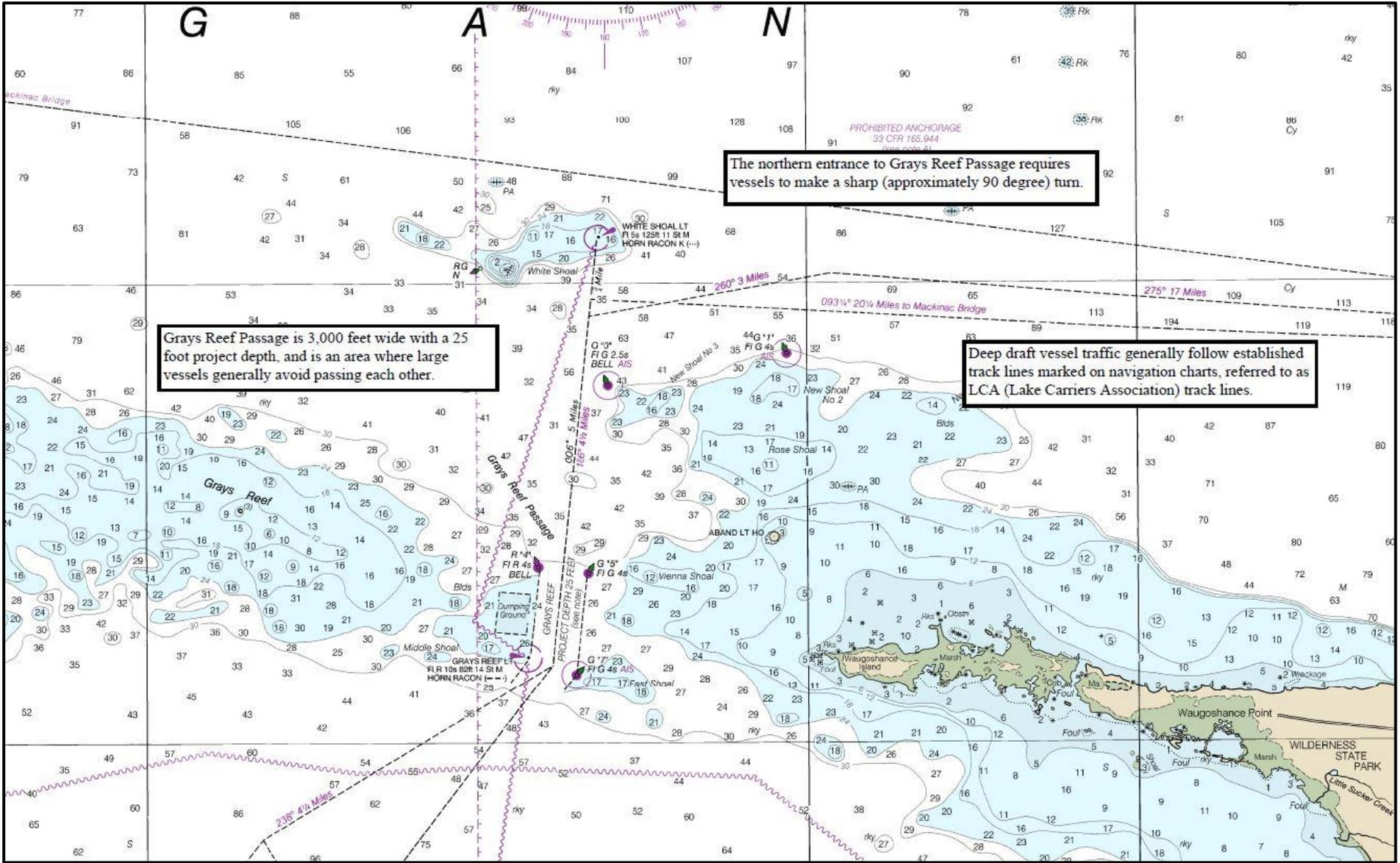
- USCG Marine Transportation System Recovery Plan
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- Oil Spill Response and Removal Organizations
- Northern Michigan Area Contingency Plan
- Geographic Response Plans
- Annual pollution response exercises
- Regulation Navigation Areas
- Environmentally Sensitive Index Maps

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Appendix C







Appendix D

References

Michigan Department of Environment, Great Lakes, and Energy:

https://www.michigan.gov/egle/0,9429,7-135-3307_4131_4154---,00.html

Michigan Department of Natural Resources: <https://www.michigan.gov/dnr/>

Michigan Department of Natural Resources – Boat Operator Age Restrictions:

https://www.michigan.gov/dnr/0,4570,7-350-79119_79144_79641-37311--,00.html

Michigan Natural Features Inventory: <https://mnfi.anr.msu.edu/>

Michigan Island National Wildlife Refuge: https://www.fws.gov/refuge/michigan_islands/

Lake Carriers' Association: <http://www.lcaships.com/>

EPA - Environmental Sensitivity Index (ESI) Maps: <https://response.restoration.noaa.gov/maps-and-spatial-data/download-esi-maps-and-gis-data.html#GreatLakes>

Chippewa Ottawa Resource Authority: <https://www.1836cora.org/>

USCG - Vessel Inspection Regulations: <http://www.ecfr.gov/cgi-bin/ECFR?page=browse>

USCG - Vessel Traffic Services: <https://www.navcen.uscg.gov/?pageName=vtsLocations>

USCG Auxiliary - Requirements for Recreational Boats:

<http://www.cgaux.org/boatinged/classes/2011/bss.php>

U.S. Navigation Rules: <http://www.navcen.uscg.gov/?pageName=navRuleChanges>

USCG Notice of Arrival and Departure Regulations: <https://www.govinfo.gov/content/pkg/FR-2015-01-30/pdf/2015-01331.pdf>

USCG Port State Control Program: <https://www.dco.uscg.mil/Our-Organization/Assistant-Commandant-for-Prevention-Policy-CG-5P/Inspections-Compliance-CG-5PC-/Commercial-Vessel-Compliance/Foreign-Offshore-Compliance-Division>

USCG Regulated Navigation Area - CFR 165.901: <https://www.law.cornell.edu/cfr/text/33/165.901>

USCG Regulated Navigation Area - CFR 165.944: <https://www.law.cornell.edu/cfr/text/33/165.944>

Transport Canada – Vessel Inspection and Certification: <https://www.tc.gc.ca/en/services/marine/vessel-inspection-certification.html>

U.S. Army Corps of Engineers - Regulatory Policies: <http://www.usace.army.mil/Missions/>

U.S. Army Corps of Engineers - Vessel Transit Statics: <http://www.navigationdatacenter.us/>

National Oceanic and Atmospheric Administration (NOAA) - National Ocean Service:

<https://oceanservice.noaa.gov/>

NOAA - Great Lakes Weather Data and Marine Observations: <https://coastwatch.glerl.noaa.gov/marobs/>

NOAA - Predicting Currents in the Straits of Mackinac:
<https://www.glerl.noaa.gov/pubs/brochures/straits.pdf>

Great Lakes - St. Lawrence Seaway System:
<http://www.greatlakes-seaway.com/en/commercial/transiting/vessel-inspection/index.html>

State-Specific Boating Safety Requirements: <http://www.americasboatingcourse.com/lawsbystate.cfm>

United States Power Squadrons: <https://www.usps.org/>

National Safe Boating Council: <https://www.safeboatingcouncil.org/>

The American Waterways Operators: <http://www.americanwaterways.com/>

Life Lines Brochure - Safety Tips That Could Save Your Life
http://www.americanwaterways.com/commitment_safety/lifelines.pdf

Recreational Boating Safety - Accident Statistics:
http://www.uscgboating.org/statistics/accident_statistics.php

American Canoe Association: <http://www.americancanoe.org/>

Appendix E

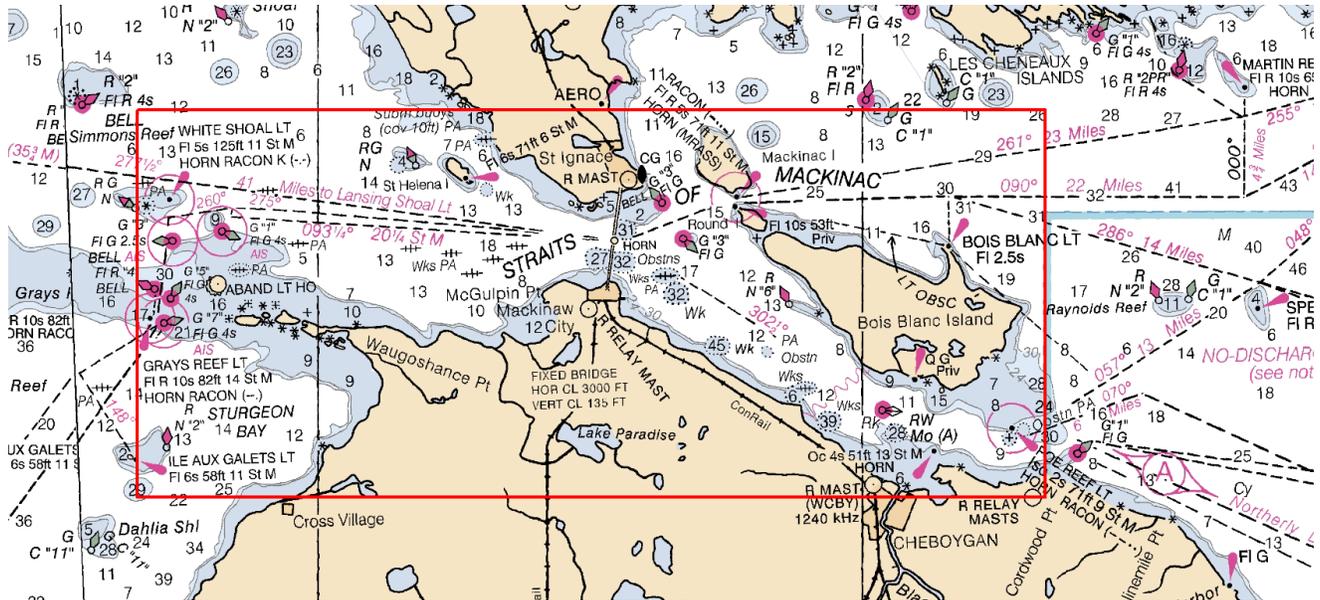
Abbreviations and Acronyms

ACP	Area Contingency Plan
AIS	Automated Identification System
ANPRM	Advance Notice of Proposed Rulemaking
ATON	Aids to Navigation
BUI	Boating under the Influence
BTM	Broadcast Notice to Mariners
COTP	Captain of the Port
CORA	Chippewa Ottawa Resource Authority
EPA	Environmental Protection Agency
MARAD	Maritime Administration
MARPOL	International Convention for the Prevention of Pollution from Ships
MTS	Marine Transportation System
MTSRU	Marine Transportation System Recovery Unit
NDG	National Dialogue Group
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
OSRO	Oil Spill Response Organization`
PAWSA	Ports and Waterways Safety Assessment
PDF	Personal Flotation Device
PSC	Port State Control
PORTS	Physical Oceanographic Real-Time System
RNA	Regulated Navigation Area
SOLAS	International Convention for the Safety of Life at Sea
STCW	Standards of Training Certification of Watchkeeping
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
VHF	Very High Frequency
VMRS	Vessel Movement Reporting System
VTM	Vessel Traffic Management
VTS	Vessel Traffic Service

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Straits of Mackinac Waterway Profile Information Sector Sault Sainte Marie (2019)

Ports and Waterways Safety Assessment, Straits of Mackinac



Waterway Navigational Attributes

1. Traffic: The Straits of Mackinac is a crucial waterway for commercial shipping; U. S., Canadian, and other foreign flag vessels carry important materials and commodities through the Straits. Passenger ferries operate between Mackinac Island and Mackinaw City/St. Ignace and a ferry operates between Bois Blanc Island and Cheboygan, ice conditions permitting. Furthermore, commercial fishing vessels, self-propelled, and motorized recreational vessels typically operate between the months of April and November.

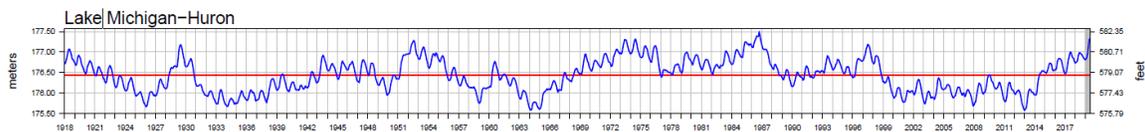
2. Wind: Average wind velocities are light to moderate, around 10 knots from April to November. Winds are predominately out of the northwest for the majority of the year. Destructive winds may occur during thunderstorms in the summer months and during the winter.

3. Water Level and Current: The currents in the Straits of Mackinac are complex, variable, and can be extraordinarily fast. Overall, water flows from Lake Michigan to Lake Huron. However, research has found that it also oscillates and changes direction every 1.5 days. These exchanges, caused by wind, are often very fast and can move about 80,000 cubic meters of water per second. This can cause currents of up to 1 meter per second.

This year, the water level remains around 50 inches above Low Water Datum. Higher than normal water levels have been the general trend over the past few years and is expected to continue into the near future.

Lakes Michigan-Huron Water Levels (1918–2019)

— Monthly Mean Level — Long Term Average Annual



(Courtesy of USACE Detroit District)

4. Obstructions: The navigable channels in the Straits of Mackinac are generally clear of obstructions. Shoaling is known to occur in bends and along spillages within the Straits. Changes in lake levels have created the extinction of some traditional shoaling areas. 46 federal aids to navigation mark the waterway; predominant shoals are clearly marked by 8 light houses. An additional 16 fixed aids to navigation and 30 buoys mark the channels and other obstructions.

Ice conditions in the Straits of Mackinac are harsh and unpredictable. Ice thickness averages 17 inches with an average maximum thickness of 25 inches. Ice forms early in January; the ice thickness remains constant through the end of March. Ice throughout the Straits of Mackinac is very susceptible to wind action and the nature of the ice cover is unpredictable. The wind action causes considerable ridging and broken tracks to close rapidly. Windrows four to six feet thick are common, and ridges as deep as 30 feet have been reported. Ice conditions on the Lake Michigan side of the Straits are typically more hazardous and unpredictable than those on the Lake Huron side.

5. Dimensions: The PAWSA considers an area that encompasses all navigable waters of the Straits of Mackinac bounded by longitudes 084°20'W and 085°10'W and latitudes 045°39'N and 045°54'N. This area includes Grays Reef Passage, the South Channel between Bois Blanc Island, MI and Cheboygan, MI, and the waters between Mackinac Island, MI and St Ignace, MI.

6. Bottom Type: The primary bottom types of northern Lake Huron and northern Lake Michigan are sand and mud, with the occasional rock cluster.

7. Waterway Configuration: The northwest part of Lake Huron forms the approach to, and the east part of, the Straits of Mackinac. At its extreme northwest end, the lake narrows abruptly to a width of 4 miles between Old Mackinac Point and Point St. Ignace, the narrowest part of the Straits of Mackinac. The northwest end of the lake is obstructed by shoals, Reynolds Reef and Spectacle Reef near mid-lake and Martin Reef off the north shore, and by several islands, Bois Blanc Island the largest. The two main shipping channels through this area lead north and south of Bois Blanc Island. The northeastern most point (Old Mackinac Point) of the lower peninsula of the State of Michigan, is on the south side of the narrowest part of the Straits of Mackinac at the entrance to Lake Michigan. The point is marked by an abandoned lighthouse.

8. Number of Passengers/Inspected Vessels: There are 26 inspected small passenger vessels and 10 inspected towing vessels homeported within the Straits of Mackinac. These vessels receive a Coast Guard Certificate of Inspection.

9. Volume of Petroleum: There is one fixed petroleum facility in the Straits of Mackinac. There are also numerous mobile transfer operations providing fuel and other petroleum products to commercial vessels. In 2018, regulated transfers totaled more than 82,000,000 gallons of product. The Coast Guard does not collect the quantity of petroleum products being carried in vessels in this waterway.

10. Volume of Chemicals: There are no chemical facilities in the Straits of Mackinac that transfer hazardous materials. The movement of hazardous materials through the Straits is minimal; most vessels carrying hazardous materials transit east from Lake Michigan.

11. Mobility: The Mackinac Bridge crosses the Straits of Mackinac between Mackinaw City and St Ignace to connect the upper and lower Michigan peninsulas. The center span of the suspension bridge is 3000' wide with a vertical clearance of 148' at the center decreasing to 135' at each end.

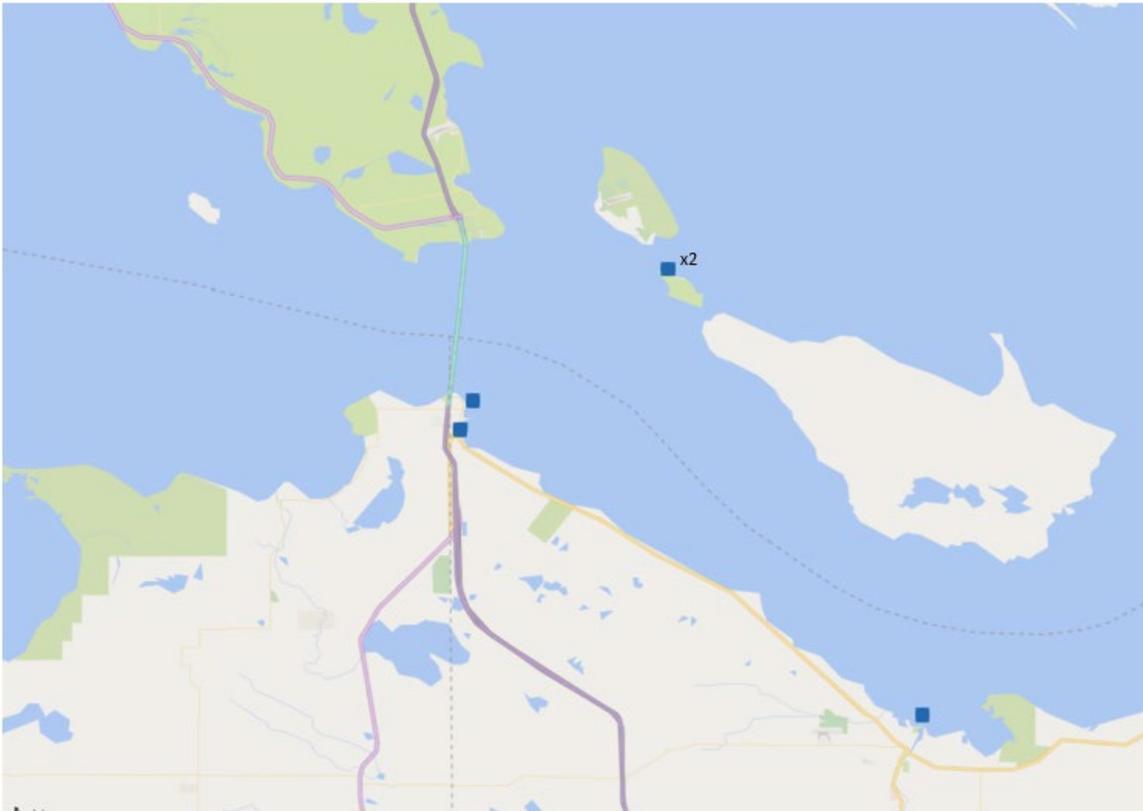
12. Cargo Tonnage History: Sector Sault Sainte Marie estimates from April 2018 through March 2019 more than a million passengers and 39 million tons of cargo moved through the Straits of Mackinac. The majority of these products included iron ore, petroleum products, salt, and miscellaneous break bulk cargo.

Waterway Casualty History

- Data is aggregated from MISLE from 2009 – 2018 (10 years)
- The data includes all of Coast Guard Sector Sault Sainte Marie’s area of responsibility (Lake Superior, Northern Lake Huron, and Northern Lake Michigan)
- 367 Total Marine Casualty Investigations within this time period

Reportable Marine Casualties in Sector Sault Sainte Marie AOR (2009-2018)	
Allision/Collision	31
Fire	10
Flooding	6
Grounding	38
Loss of Electrical Power	3
Loss/Reduction of Vessel Propulsion/Steering	14
Material Failure/Malfunction	239
Injury	26

The below graphic illustrates the five reported groundings, within the PAWSA boundaries, from 2009 through 2018.



Current Vessel Traffic Management Measures

1. Situational Awareness for Each Ship:

- Own Vessel's Position and Intention: Situational awareness is derived by Automatic Identification System (AIS) data, radar, and radio communication between vessels.
- Safety advisories are broadcasted via Broadcast Notice to Mariners and the Coast Guard Sector Command Center's Safety Marine Information Broadcasts.

Planned and Anticipated Changes

1. Changes in Waterway Activities and Future Traffic Levels:

- Commercial vessel transits of the Straits of Mackinac have remained relatively steady over the past few years and a reduction in transits are not anticipated.
- Recreational vessel traffic in the Straits of Mackinac has increased over the past few years. As the popularity of self-propelled crafts have steady increased, so has the waterway's usage.

2. USCG Regulations of note:

- 1 Permanent Security Zone
 - a. Mackinac Bridge, Straits of Mackinac (33 CFR 165.928): This security zone is enforced Labor Day of each year; 6 a.m. to 11:59 p.m. (midnight) (local).
- The Captain of the Port will close and open the regulated navigation areas, listed below, as ice conditions dictate. Prior to opening and closing these areas, the Captain of the Port will give interested parties not less than 72 hours notice of the action.
 - a. 33 CFR 165.901 Great Lakes - Lake Huron. The waters of Lake Huron known as the South Channel between Bois Blanc Island and Cheboygan, Michigan.
 - b. 33 CFR 165.901 Great Lakes - The waters of Lake Huron between Mackinac Island and St. Ignace, Michigan.
 - c. 33 CFR 165.901 Great Lakes - Lake Michigan. The waters of Lake Michigan known as Gray's Reef Passage.
- Regulated Navigation Area; Straits of Mackinac (33 CFR 165.944 - All navigable waters of the Straits of Mackinac bounded by longitudes 084°20' W and 085°10' W and latitudes 045°39' N and 045°54' N, including Grays Reef Passage, the South Channel between Bois Blanc Island and Cheboygan, MI, and the waters between Mackinac Island and St. Ignace, MI. This regulated navigation area prohibits certain persons and vessels from anchoring within submerged pipeline and cable areas. Coast Guard Sector Sault Sainte Marie's Marine Safety Information Bulletin 001-18 establishes conditions that the Captain of the Port

must be notified of anchoring within the prescribed area.

Additional Waterway Activity

1. Coast Guard Enforcement Boardings:

- Approximately 700+ boardings from 2016 – 2018

2. Facilities:

- There are 13 Coast Guard regulated waterfront facilities in the Straits of Mackinac. From 2016 – 2018, the below discrepancies were found during Coast Guard inspections.

Safety:

- 08 deficiencies noted

Security:

- 17 deficiencies noted

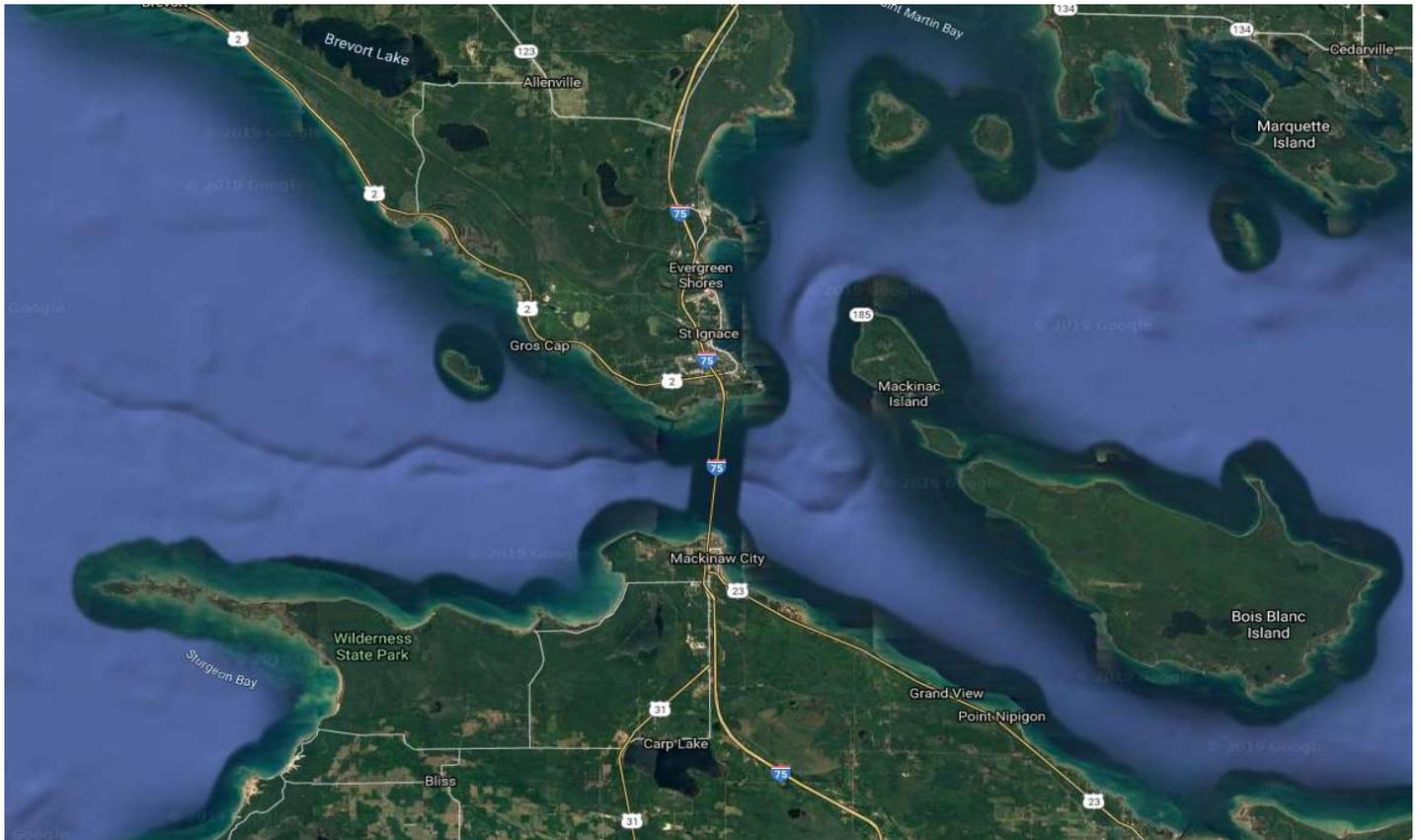
3. Marine Events 2016-2018:

	2016	2017	2018
Fireworks	18	18	4
Regatta	3	9	8
Swim	1	2	1
Total	22	29	13



STRAITS OF MACKINAC PORTS AND WATERWAY SAFETY ASSESSMENT (PAWSA)

Traffic Statistics Apr 2018 – Mar 2019



Prepared by US Coast Guard Navigation Center

DESCRIPTION AND METHODOLOGY

Traffic Data:

Traffic data in this report is from the Nationwide Automated Information System (NAIS) collected by the US Coast Guard. Maps were created in ArcMap 10.5.1 by the Navigation Center. The data covers the Straits of Mackinac area. The intent of providing this data is to better inform discussion at the PAWSA workshop.

The heat maps on the following pages show traffic density by category. Density of traffic is relative to each type; therefore, the colors represent different values from map to map. Density is represented on a green, yellow, red scale where low density is green and high density is red. The total transits on each map and monthly summary on page 2 can be used to compare traffic across maps. A *transit* starts when a vessel enters the area and ends when the vessel is unmoving for 5 hours or turns off their AIS transponder. Densities are calculated by enumerating the length of transits per square mile for the whole year $\frac{\text{Miles transited}(\text{year})}{\text{mile}^2}$. The monthly total graph on each map provides a sense of seasonal variation. The vessel category "Other Vessels" includes Dredgers, pleasure craft, sailing vessels, high-speed craft, Search and Rescue craft, Law Enforcement craft, and various reserved categories for ship type ID.

* *See page 9* – The category "All Others" includes vessels that are broadcasting either the incorrect or an unknown ship type AIS code. From this dataset, it has been discovered that there are at least 913 tracks skewing the transit numbers and heat maps due to ferries improperly entering their ship types into AIS.

Weather Data:

Weather data was downloaded from NOAA's National Center For Environmental Information (gis.ncdc.noo.gov) for the two weather stations located at Mackinac Island Airport and Cheboygan County Airport. This data range pertains to the period from July 1, 2018 – June 30, 2019.

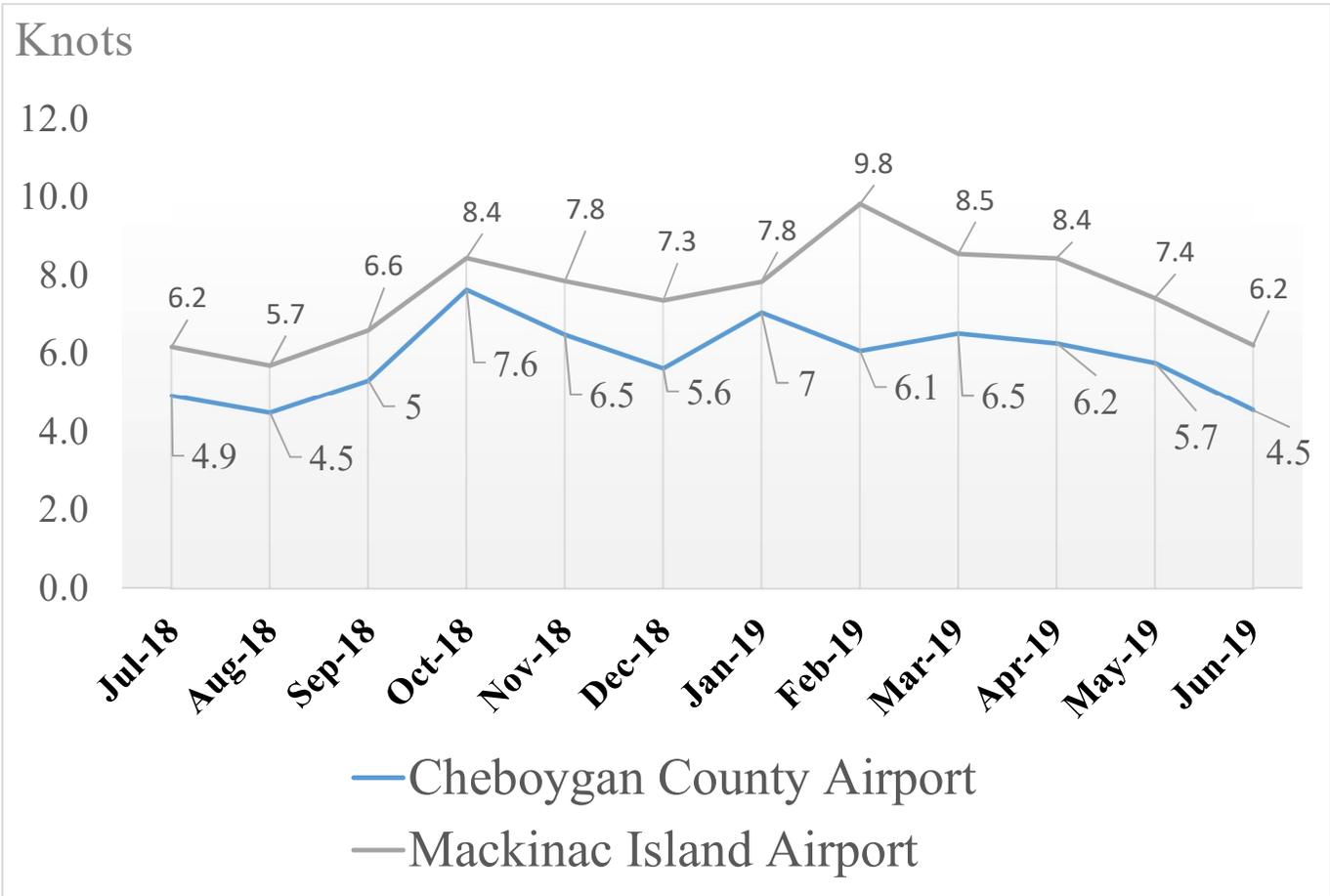
The graphs on the following pages plot the monthly averages of wind speed (knots) and visibility range (miles). Each line graph pertains to a specific weather station. The tables on the following pages also break out the number of days in each month in which the wind speed was observed by the station to have exceeded 20 knots and the visibility range was observed as less than one mile.

Weather Stations



For more information please contact:
LT Marcus Fair
Waterways Risk Assessment and Support Division
703-313-5998
marcus.l.fair@uscg.mil

Monthly Average Wind Speed



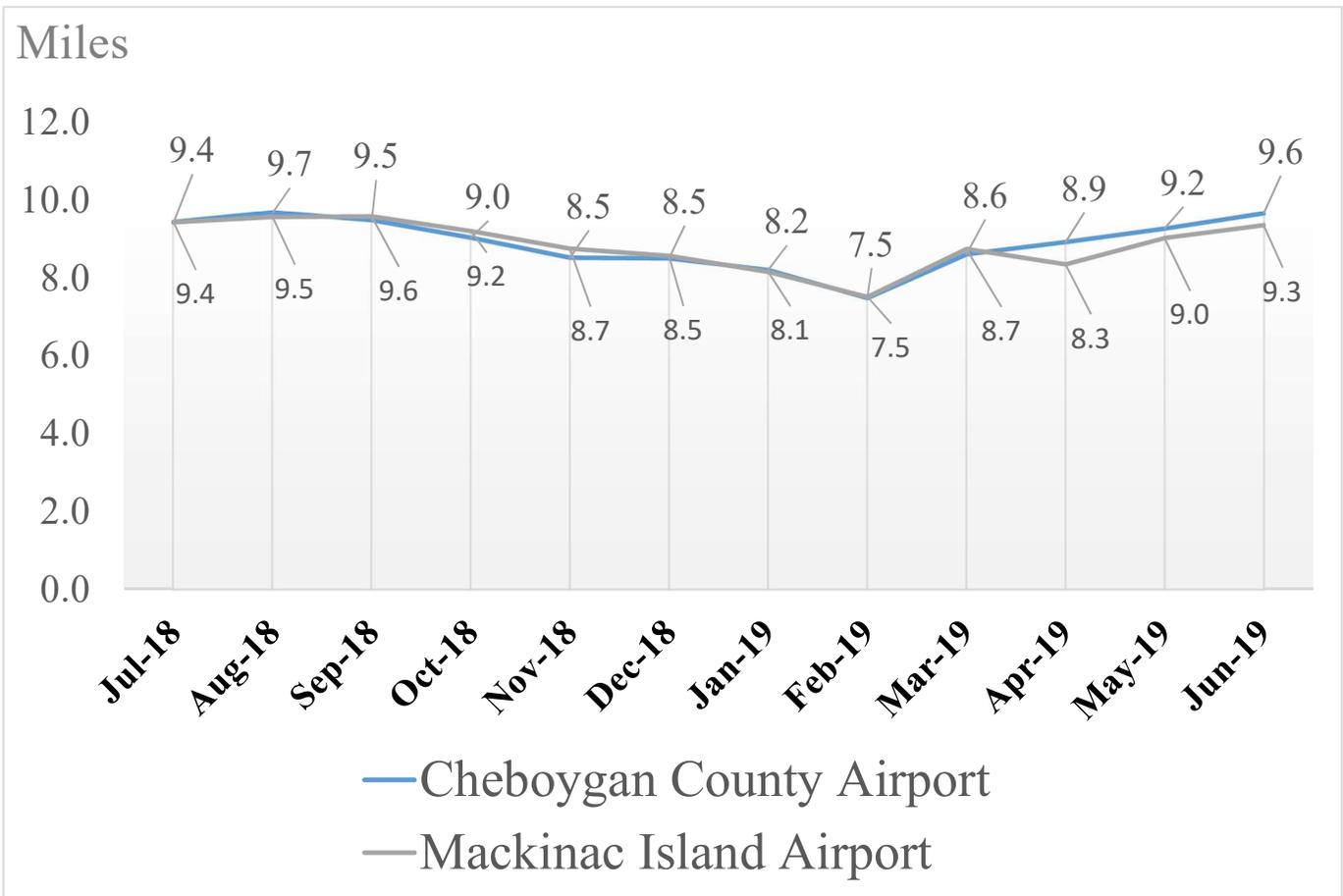
Cheboygan County Airport

Month	No. of Days Wind Speed > 20 Knots
July	0
August	0
September	1
October	6
November	1
December	2
January	6
February	5
March	3
April	6
May	3
June	1
Total Over 1 Year	34

Mackinac Island Airport

Month	No. of Days Wind Speed > 20 Knots
July	0
August	2
September	2
October	8
November	5
December	3
January	6
February	11
March	7
April	9
May	3
June	0
Total Over 1 Year	56

Monthly Average Visibility



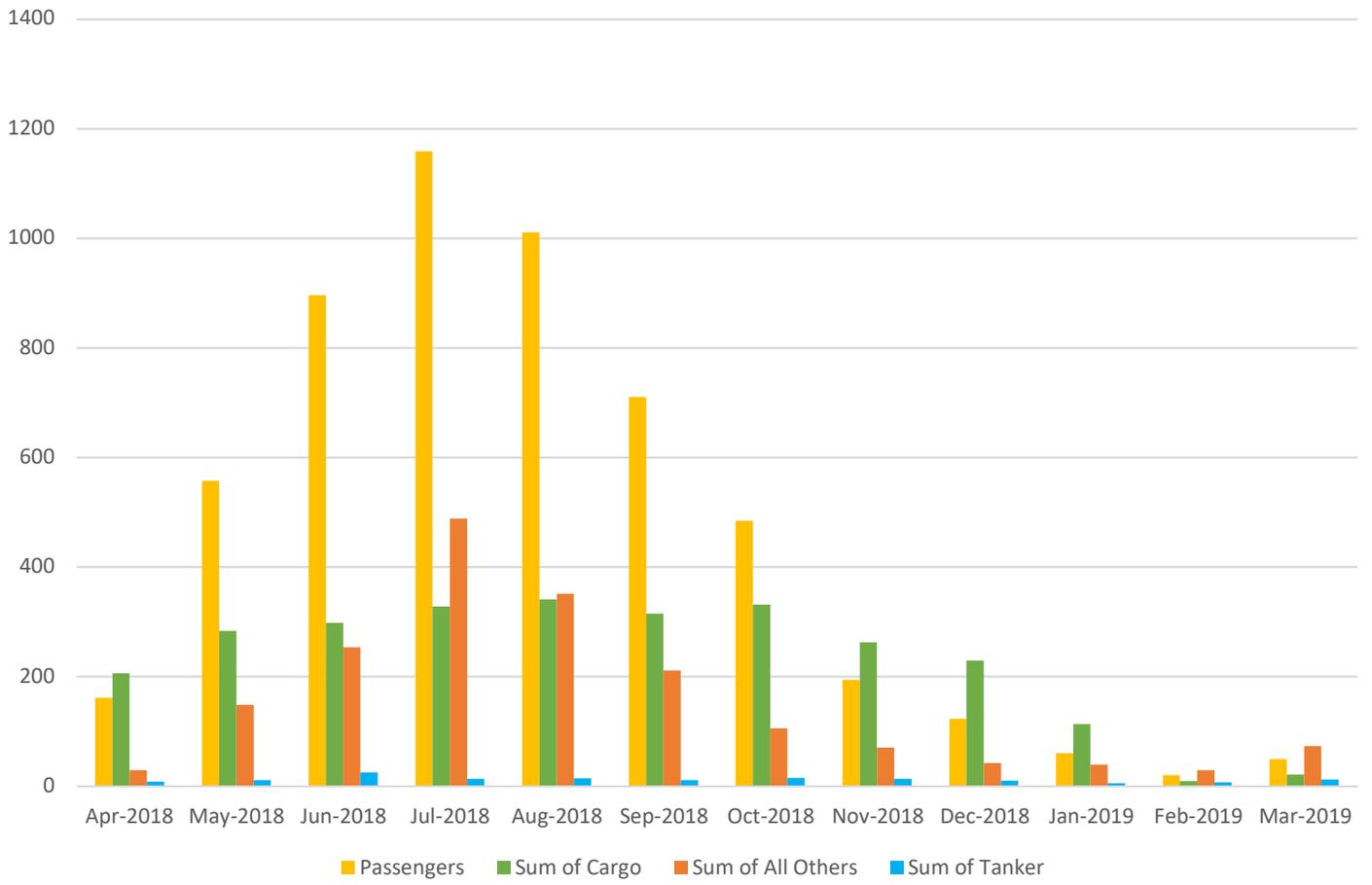
Cheboygan County Airport

Month	No. of Days Visibility < 1 Mile
July	2
August	2
September	5
October	3
November	3
December	5
January	11
February	9
March	6
April	7
May	2
June	1
Total Over 1 Year	56

Mackinac Island Airport

Month	No. of Days Visibility < 1 Mile
July	3
August	1
September	0
October	2
November	5
December	5
January	9
February	10
March	5
April	10
May	7
June	7
Total Over 1 Year	64

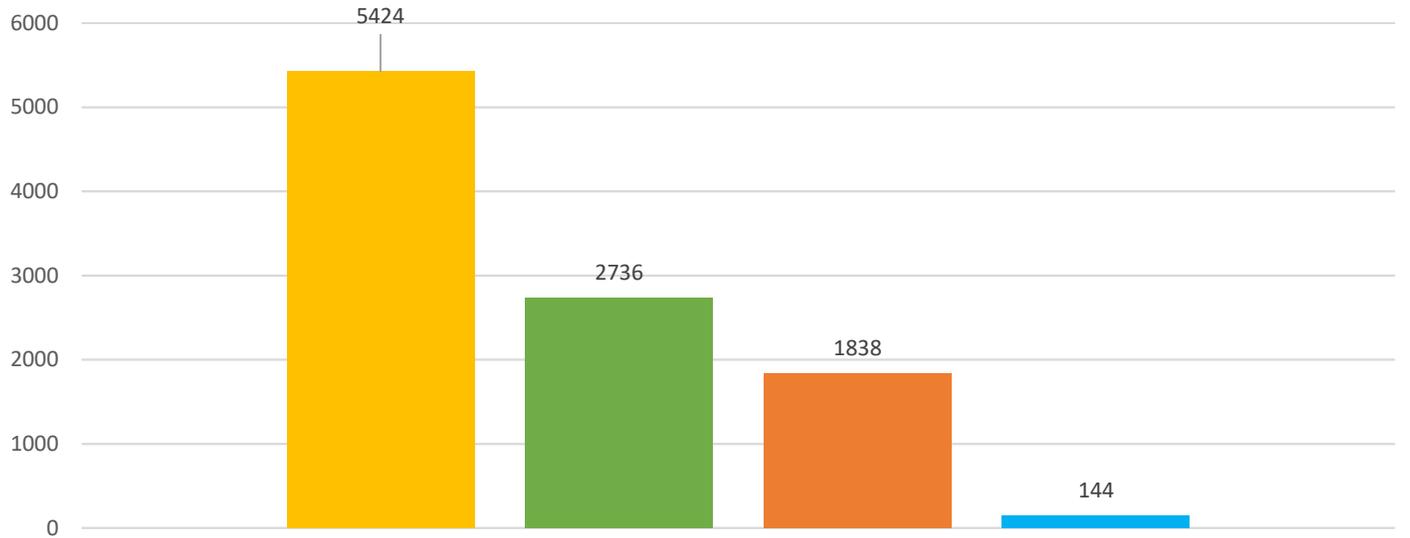
Monthly Summary



Passenger Vessels		53%
Bulk Carrier Vessels		27%
Other Vessels		18%
Tankers		1%

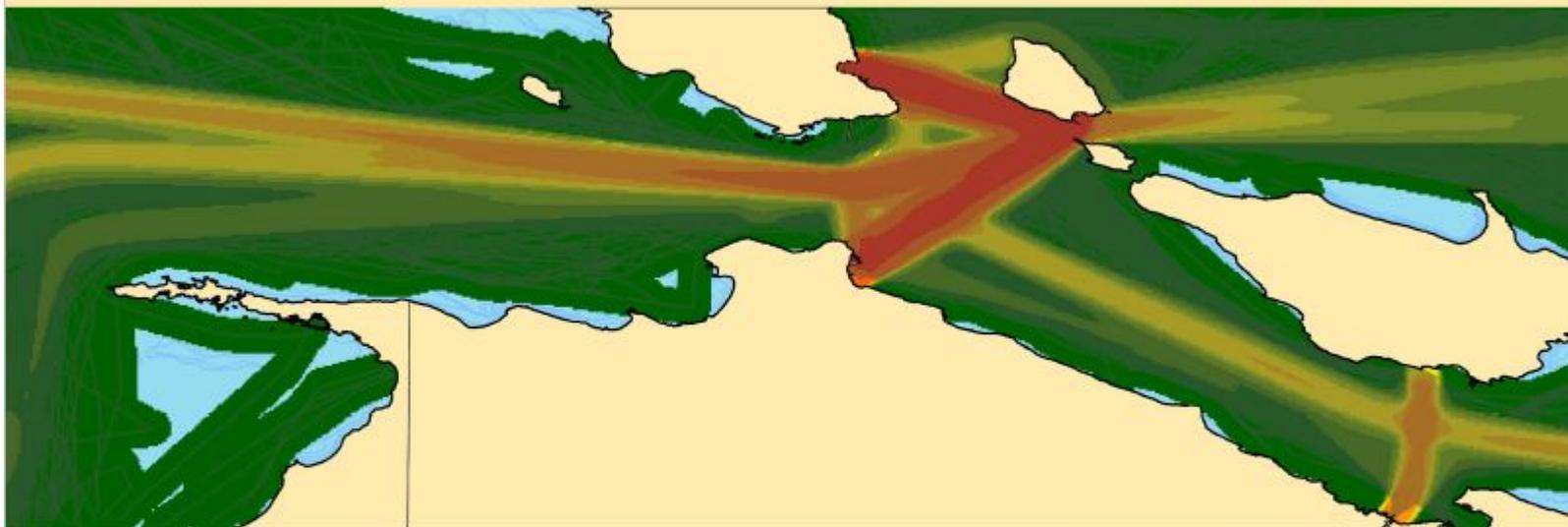
Traffic statistics come from the same NAIS data. Vessel type is user defined. The category 'Other Vessels' includes public vessels, tugs, and recreational boats.

Annual Summary



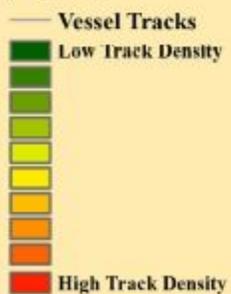
Straits of Mackinac All Vessels

From April 2018 - March 2019



Total Transits: 10,142

Legend



Source: NAIS
Prepared by Coast Guard Navigation Center



1:300,000