

**Washington State Ferries**  
**Report of Formal Investigation**  
**M/V Walla Walla Grounding Incident**  
**15 April 2023**



**Investigation Authority:**

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## Executive Summary

The Washington State Ferries (WSF) passenger vessel *M/V Walla Walla* was assigned to the Seattle-Bremerton route on April 15, 2023. At 1636 of that date, while sailing from Bremerton to Seattle through Rich Passage, the *Walla Walla* experienced propulsion failure and ran aground near Lynwood Center on the southwestern side of Bainbridge Island. There were no fatalities or injuries. Upon initial damage assessment and follow-up inspections while grounded, the vessel did not take on water or show any signs of negative structural integrity issues. A plan was made to safely remove the passengers from the *Walla Walla*. The on-watch crew, with assistance from local marine transit assets and local fire, law enforcement and USCG personnel, safely evacuated passengers from the *Walla Walla* to support vessels between 1957 and 2210. The passengers were returned to Bremerton via the support vessels. The *Walla Walla* was refloated with the rising tide and tow assist at approximately 0032 April 16, 2023, and then towed to WSF terminal facilities in Bremerton where it was secured at 0245. A full summary of the events, actions and causes of this marine casualty are contained in this report and attached appendices.

## Pre-incident Events

The *Walla Walla* departed from the Bremerton Terminal at 1619, bound for the Seattle Terminal at Pier 52. The vessel had a full crew complement consisting of 11 deck crew (watch hours 1600-0200) and four engine room crew (watch hours 0610-1830). The passenger count at departure was 596. The weather was overcast with light rain, eight nautical mile visibility, a south-southeasterly wind of 5-10 knots, and calm seas. NOAA Tide calculations for Clam Bay, Rich Passage, were 1316-8.71', 2000-0.14' and 0323-11.45'. A falling tide was in effect while the *Walla Walla* transited Rich Passage. The engine room crew had started their shift at 0600 April 15, 2023. Before departure at approximately 1615, oiler #1 and oiler #2 did a check of the vessel's steering gear followed by an engine room round. All appeared in proper working order.

## Grounding

The captain had command of the pilothouse on the #2 end of the vessel and the helmsperson was at the ship's helm aft steering station. The chief mate was in the non-operating #1 end pilothouse. At approximately 1632, the *Walla Walla* was approaching Pt. Glover on a course of 060 T with 130 RPMs making 17.5 knots over the ground with a following current. At this point, the first indication of propulsion failure was noticed by the captain. The propulsion control system alarms and other alarms were sounding simultaneously in the operating #2 pilothouse. The chief mate was observing the same alarms in the non-operating #1 end pilothouse. Initial attempts by the captain to contact the engine room were unsuccessful. Engine tachometers in the pilothouses were bouncing between 50 rpm and 150 rpm. Alarm light indicators displayed that propulsion had been lost at both the #1 end and the #2 end of the vessel.

The same alarms were sounded simultaneously in the engine control room (ECR). Oiler #1 was sent to start the off-line generator. Oiler #2 was sent to the running ships service generator and hand pumped the fuel priming handle a few times. Oiler #2 noticed the engine speed surged slightly after the few hand pumps of the handle and then returned to the ECR. The ECR experienced a low frequency alarm indicating #1556 frequency was dropping to 55-56hz and recovering to 57-58hz and then dropping again. The chief engineer started the #2556 (oil temp 56 degrees). Oiler #2 hand pumped the F/O pump on #1556 which caused the engine speed to pick up, then lose propulsion again. #1556 tripped its

breaker on low frequency, the vital generator did the same and the vital ships service generator buss-tie remained closed and did not open. The emergency generator self-started and picked up the load and one buss, including steering pumps 1B and 2B. All alternator exciters tripped and reset. All motor exciters then tripped, manually reset excluding 1B, 2B and #2 standby which would not reset. Paralleled #1556 and #2256 for the vital generator. The vessel grounded without restoration of the propulsion plant.

At 1635 the captain ordered the anchor to be dropped to slow the vessel's speed through the water. The captain called the chief mate to the operating pilothouse. The chief mate while enroute to the operating pilothouse heard the captain order via the radio and the ship's whistle to drop the anchor. The captain notified the ECR and told them to brace for impact. The captain sounded the general alarm, secured the watertight doors, ordered full astern of the engine order telegraph (if power was re-established), and made PA announcements for the crew and passengers to brace for impact.

At 1636 the vessel *Walla Walla* ran aground near Lynwood Center on Bainbridge Island. The vessel grounded slowly on a soft, muddy shoreline. The impact of the vessel running aground was almost imperceptible.

### Post-incident Actions

Procedures for abandoning ship Stage 1 egress were implemented. At 1644, passengers donned life jackets and the engine room crew were directed to conduct a flooding assessment and inspect the watertight integrity of the vessel. The deck crew performed manual draft readings. (Note: Manual draft readings had to be taken throughout the incident due to the Automated Draft Indicating system not functioning.) At 1645, it was noted that there was no breach of the hull or flooding below the waterline. Marine evacuation slides #1 and #2, and inflatable buoyant apparatus #7 were deployed.

The captain requested that responding Bainbridge Island fire, law enforcement and USCG personnel board the *Walla Walla* to assist with passengers and help with crowd control management. Passengers



were becoming anxious due to the information that they would have to remain onboard until the vessel could float free at approximately 2330 that evening. There were three medical emergencies reported to the pilot house during Stage 1 egress.

The WSF Emergency Operations Center (EOC) relayed a plan to the *Walla Walla* captain for the evacuation of passengers from the vessel. If determined safe, Kitsap Transit would have two of their vessels, *Commander* and *Waterman*, transfer passengers from *Walla Walla* and transport passengers back to the Bremerton ferry terminal.

At approximately 1951, the vessel *Commander* and the vessel *Waterman* were on scene to receive passengers from the *Walla Walla*. It was determined that it was safer to transfer passengers to the Kitsap Transit vessels than to abandon ship to the shore or into life rafts. Passenger transfer began at approximately 1957 and was completed at 2210. The passengers were returned to Bremerton. Remaining fire, police and USCG personnel departed the *Walla Walla* once there were no remaining passengers on board.

At 0032, the tug *Protector* was made fast to the *Walla Walla*, took a slight strain on the line and the *Walla Walla* floated free and was pulled into deeper water. Another hull inspection for watertight integrity showed no hull breach, and there were no unusual vibrations or noises. The anchor and cable were released from the vessel and marked with a buoy for later retrieval. The *Walla Walla* was then towed to the WSF Bremerton terminal and made fast in slip #2 at 0245.

The drug and alcohol testing of the *Walla Walla* crew was conducted by the Bremerton terminal supervisor, commencing at 0258 and completed at 0630 April 16, 2023.

A full investigation and analysis of the incident was initiated by WSF executive management.

### Finding of Facts

- Due to a total loss of propulsion, the *Walla Walla* intentionally grounded at 1636, April 15, 2023, near Lynwood Center on the southwestern side of Bainbridge Island.
- Fatigue was not a contributing factor in the decision to intentionally ground the vessel.
- Drug and alcohol tests from the crew all showed negative.
- There were no fatalities or injuries to passengers or crew as a result of the grounding.
- The *Walla Walla's* loss of propulsion was a result of water contamination in the two day tanks that provide the oil/water interface. This water contamination resulted in gross bacterial and fungal growth to the extent that the fuel filtration system was overcome, and the ships service diesel and vital generator engines could not function.
- The in-line Racor filters of the two ships service diesel generators were contaminated with black sludge. Thirteen sites were sampled and five were microscopically examined and showed bacterial or fungal growth.
- On April 13, 2023, the *Walla Walla* received 67,000 gallons of diesel fuel that were pumped into the No. 1 and No. 2 main fuel storage tanks. On April 19, 2023, fuel samples were taken from both fuel storage tanks by way of sounding tubes in each of the main tank's deep spots. The test results of both tanks showed the fuel was clean and dry. This fuel remained clean since receiving fuel on April 13, 2023. Having been stored in these tanks, this fuel could not be the source of the black, water-based sludge found in the No. 2 centrifugal oily

water separator, in the fuel oil coalescer, or in the two fuel storage tanks surveyed after the grounding.

### Contributing Factors

- Contaminated water was used as a priming medium for the Alpha-Laval Centrifugal Fuel Filters. The source comes from the two day tanks (each holding 6,000 gallons of diesel fuel). The two day tanks supply fuel to the fuel oil manifold which then disperses the fuel to the running machinery. Fuel from the day tanks supplies the propulsion and ships service generators. These two day tanks were contaminated with a black, watery based sludge.
- The operational requirement for the Alpha-Laval Fuel Oil centrifuge oily-water separator is to have the engine room oilers regularly “shoot” the centrifuge to keep them functioning and online.
- Priming the separator with the very contaminant it is designed to extract from the diesel fuel before it gets to the coalescer would have contributed to moisture in the day tanks.
- Oiler #2 hand pumped the F/O pump on #1556 which caused the engine speed to pick up, then lose propulsion again. #1556 tripped its breaker on low frequency, the vital generator did the same, and the vital ships service generator buss-tie remained closed and did not open.
- The #1 ships service diesel generator tripped. The vital buss-tie failed to open causing the vital generator breaker to trip.

### Conclusion

Vessel engineers found the deep spots of the two-day tanks supplying fuel to the ship service diesel generator were contaminated with black water-based sludge. The black watery sludge had clogged the on-line fuel filter for the #1 ship service diesel generator. The engine became unstable and the #1 ships service generator, #2 ships service generators and vital generator were offline, causing the vessel to lose propulsion.


The water contamination in the day tanks provided the oil/water interface which, in turn, resulted in gross bacterial and fungal growth to the extent that the fuel filtration system was overwhelmed, and the ships service diesel and vital generator engines could not function.

The source of the water contamination (determined to be fresh water) was the water used as a priming medium for the Alpha-Laval Centrifugal Fuel Filters.

In addition, the #1 ships service diesel generator tripped. The vital buss-tie failed to open causing the vital generator breaker to trip.

The captain and crew followed procedures and policies outlined in the Safety Management System (SMS) Deck Operations Manual 12, specifically, DECK EMER 0230 Loss of Propulsion, DECK EMER 0240 Loss of Steering, and DECK OPER 1010 Passenger Counting. The captain followed SMS Route Manual 13 ROUTE BREM 0100 which outlines procedures for possible intentional grounding areas and emergency resources.

The WSF Operations Watch Center activated the Incident Command System (ICS) and EOC for a Level 2 event for the *Walla Walla* grounding, as outlined in SMS EOCT Manual 4, EOCT ADMN 0010. The



purpose of the ICS is to facilitate the command, control, and coordination of all facets of the response to an emergency, often in cooperation with multiple external agencies. The goal is to stabilize the incident while protecting lives, the environment, and property. Objectives for this incident were met.

Training, policies, and procedures followed by the captain and crew resulted in no loss of life or injuries due to the incident, minimal damage to property, and no environmental pollution.

## Appendix 1 - *Walla Walla* Crew Compliment/Vessel Specifications

Certificate of Inspection states crew compliment for the *Walla Walla* to carry passengers as:

- 1 Captain and 1<sup>st</sup> class pilotage
- 1 Mate and 1<sup>st</sup> class pilotage
- 1 Mate
- 4 Able Seamen
- 3 Ordinary Seamen
- 1 Chief Engineer
- 1 Assistant Engineer
- 1 Oiler
- 1 Oiler/Wiper

*M/V Walla Walla* specifications:

Official Number	546382
VHF Radio Call Sign	WYX2158
Class	Jumbo
Year Built	1973
Tonnage, Gross/Net	3,246/1,198
Length	440'
Beam	87'
Draft	18'
Vertical Height	74
Freeboard	7' 7"
Vehicle Deck Clearance, Tunnel	15'6"
Vehicle Deck Clearance, Wings	7' Lower, 9' Upper
Vehicle Capacity	206
Passenger Capacity	2,000***
Crew Compliment	14
Propulsion	Diesel Electric
Control System	Engine Room Control/Telegraph
Horsepower	10,000
Main Engines (total)	EMD (4)
Propeller Size	13'
Fuel Capacity	125,000 Gallons
Fresh Water Capacity	16,000 Gallons
Sewage Capacity	20,000 Gallons



## Appendix 2 - Safety Management and Training


All WSF crew members are trained in emergencies including but not limited to fire, rescue, abandon ship, crowd management, anchor drills, and medical emergencies. There are USCG-required drills conducted weekly, quarterly, and annually. WSF maintains the Safety Management System (SMS), an internal training program, and reference resources comprised of:

- FAST (Fire and Safety Training) Manual: The FAST manual is a two-volume, self-directed training reference for WSF fleet crews. The manual is designed to augment fire and boat drills with in-depth training across a wide spectrum of other fire- and safety-related job skills. It is a vital training guide and part of the body of documentation forming the SMS. In this incident specifically, Unit 1-Emergency Management and Unit 3-Abandon Ship applied.
- The SMS applies to all vessels and terminals, the Eagle Harbor Maintenance Facility, and applicable shoreside support operations. The programmatic policies and procedures cover safety, emergency response, environmental protection, and security with the goal of ensuring overall SMS program consistency. The written documentation of the SMS is subdivided functionally:
  - Manuals 2 through 12 are department-specific manuals. These manuals contain policies and procedures directly applicable to those employees working at terminals, on vessels, in the warehouse, at the Eagle Harbor Maintenance Facility, and at WSF headquarters.
  - Manuals 13 through 40 are route- and vessel-specific manuals, which contain information unique to those routes or vessels.

Appendix 3 - Walla Walla Course

Nautical Chart of Rich Passage between Bainbridge Island and Port Orchard. The red dots abeam of Pt. Glover put the vessel on a course of 060° T and shows the vessel grounding area.



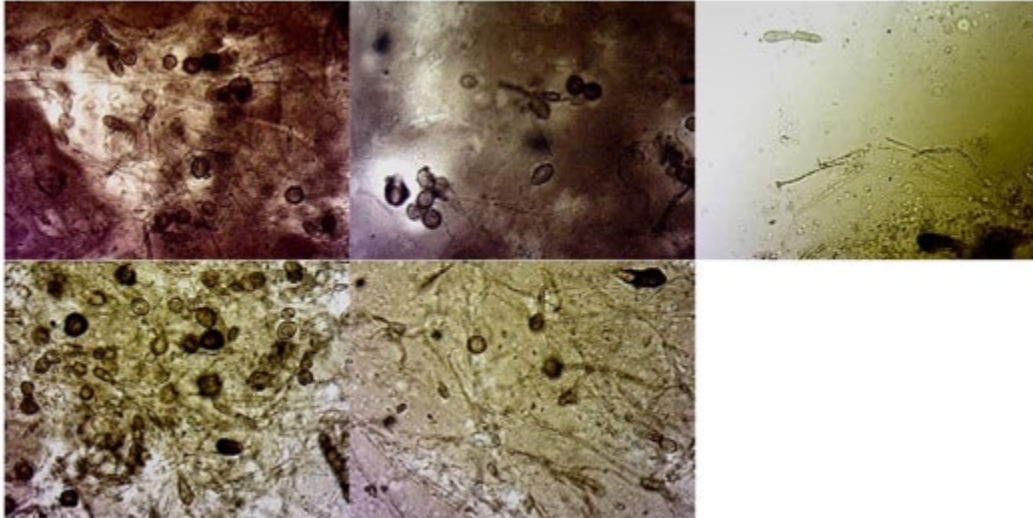


#### Appendix 4 - Crew Fatigue

The *Walla Walla* deck crew works four 10-hour shifts with watch hours 1605-0205. April 15, 2023, was day number two of their scheduled work week. The captain completed the 96-Hour work/rest history worksheet as required, indicating 14 hours of rest prior to the starting time of the shift on April 15, 2023.

## Appendix 5 - Fluid Test Results

A total of 13 sites were sampled of the in-line filters on the ships service diesel generator and the vital generator. An examination of five of the 13 sites sampled showed bacterial or fungal growth as noted below.



Sample testing comments:

- Thick dark sludge is composed of microbial structures (primarily fungus) and metallic debris.
- Aqueous samples contain low levels of chlorine which suggest freshwater contamination.
- Viable microbial growth can take up to seven days.

Additional measures were taken, with the results of the samples grown on sterile medium as pictured below.



## Appendix 6 - Walla Walla Hull Damage

The company Subsea Global Solutions performed a hull inspection of the *Walla Walla* after the grounding. The results are as follows:

- The #2 end rudder (end which ran aground) had a coating loss and four sheared anodes due to the grounding. Coating loss down to bare metal was found on the port and starboard side, approximately the full length of the rudder. No damage was found during the rudder pitch test.
- The #2 end propeller was found with two bent propeller blades. Both had an aft ward deflection and are believed to be from a separate occasion. One of the propellers had a bend at the .9 radius on the leading edge approximately 10 inches wide and deflected over approximately 60 degrees. The other blade had an aft ward bend at the .9 radius on the trailing edge approximately five inches wide and deflected over approximately 40 degrees. All the blades had minor knicks throughout the blade edges.
- Grounding indications were found on the center keel starting from the leading edge of the stern tube to frame 70 on port and starboard sides, coming up approximately two feet from the flat bottom. No damage was sighted in the shell plating, aside from coating loss down to bare metal.

## Appendix 7 - After Action Captain Interview Summary

An interview conducted with the captain after the grounding found that crowd control of the passengers, with the number of crew onboard, was challenging. Communications in the pilothouse were overwhelming. The captain was receiving information and orders from the USCG via the operations center. The captain stated that any information to and from the USCG needs be directly with the captain, not via the operations center, as this led to some miscommunication.

Obtaining an accurate passenger count from the main passenger cabin several times was difficult. The crew used different approaches to try and obtain an accurate passenger count as the event unfolded. The crew first instructed individuals to raise their hands for a headcount. Later, the crew guided passengers to walk in a single-file to the opposite end of the vessel (toward the corresponding passenger assembly station), where a stationary crew member counted passengers as they passed by. The captain stated that at no time was an accurate count of passengers obtained that matched the departure count of 596 passengers.



The captain stated that not all agencies involved with the grounding understood WSF's Stage 1 egress for abandoning ship. Stage 1 egress for abandoning ship is to ready the passengers (donning lifejackets) and all equipment needed to abandon ship (marine evacuation slides, crew rescue boats and any additional inflatable buoyant apparatus). If it is determined by the captain that it is safer to abandon the vessel than to remain onboard, then Stage 2 egress and Stage 3 egress would be implemented.

The utilization of the emergency evacuation slide for agencies to board the vessel was effective, and the transfer of passengers to the Kitsap Transit vessels was considered safe, secure and highly successful.




## Appendix 9 - After Action Deck Crew Interview Summary

The impact of the vessel running aground was very soft and almost unnoticeable. The captain made PA announcements several times to brace for impact and sounded the general alarm. Without these notifications to the public, passengers may not have realized the vessel ran aground. After the grounding, Stage 1 egress actions were implemented. This includes searching all evacuation zones and sending passengers to the assembly stations in the main passenger cabin to don life jackets and to obtain a passenger count. Crews evacuating passengers from their vehicles were challenged by passengers not wanting to leave their vehicles due to the perceived threat of the emergency being low. All vehicle passengers eventually complied with the crew. At the assembly stations crew members were passing out life jackets, passenger evacuation action cards, and passenger information cards. The number one end assembly station was used initially to gather all 596 passengers but became overcrowded very quickly. This made communication with the passengers difficult. Both assembly stations were then utilized to gather all passengers.

Emergency actions cards were distributed to selected passenger volunteers to help with minimizing passenger movements about the vessel during Stage 1 egress. The crew sent passengers in teams of two to the stairwells to prevent passengers returning their vehicles. As time evolved during Stage 1 egress, and passengers were informed that they would be staying on the vessel until the tide was high again at approximately 2330, they became agitated and anxious. At this time the USCG and law enforcement were on scene and the captain requested their presence onboard to assist with crowd control. The deck crew stated that once the USCG and law enforcement were aboard the crowd seemed to calm down. The crew stated that they were concerned that if the USCG and law enforcement did not board the vessel that the crowd had a high potential to overwhelm the crew and their ability to keep the situation under control. The designated passenger volunteers at the top of stairwells were changed out every couple of hours. It was noted by crew members that some of the volunteers wandered off after a while and did not contact a crew member for a replacement. Passengers were challenging crew members and the passenger volunteers to return to their vehicles due to the expected waiting time until 2330.

Passenger counting was very difficult. The vessel crew tried different techniques to obtain an accurate passenger count. The crew used manual counting clickers to count the passengers. They had passengers sit and raise their hand, and the passengers would be counted, and they would put their hand down. They had passengers move from one end of the main cabin to the other end with a fixed crew member at a doorway that passengers passed through counting one by one. All passenger counts obtained were passed to the pilothouse. At no time was an accurate count obtained of 596 passengers as stated at the departure time of the vessel. Passenger information cards were distributed as well to try and obtain an accurate passenger count. It was reported by some deck crew that there were not enough passenger information cards to pass out to all passengers. It was also noted that about half of the passengers attached the information card to their life jacket or clothing as instructed. About half of the passengers returned the bottom portion of the passenger information card to a crew member. Crew members stated that those were then delivered to the pilothouse or the second mate's office. No deck crew could confirm where the completed bottom portions of the passenger information cards were at the end of the event. One crew member thought they had ended up at the Bremerton ferry terminal. The crew stated they did the best they could while dealing with multiple medical emergencies, crowd control efforts, and taking frequent manual freeboard measurements.



When passengers were transported back to the Bremerton ferry terminal, one group was offloaded in the auto slip of the Bremerton ferry terminal, the rest were offloaded at the Kitsap Transit ferry dock adjacent to the WSF ferry terminal. Passengers left their lifejackets at the Kitsap Transit dock. WSF terminal personnel had to carry all lifejackets back to the WSF terminal. Passengers were told when and where they could retrieve their vehicles the next day while onboard the *Walla Walla*. However, passengers that needed overnight accommodation had no clear instructions of where they could stay or how to get from the ferry terminal to overnight accommodations.

Crew members stated that communications between crewmembers was difficult due to the limited number of handheld radios for crew members. Communication from the pilothouse using the public address system was difficult to decipher at times due to the large number of people in the assembly stations. The deck crew utilized the bullhorns in the passenger assembly stations to give instructions and information to the passengers, however these devices are very directional and cannot be heard by everyone at the same time.



## Appendix 10 - Observations, Lessons Learned and Key Recommendations:

- **Egress/Emergency Response:**
  - Vessel emergency action plan guidebook (laminated checklist in the pilothouse) and Form EMER 2 (abandon ship response checklist) includes the launching of MES in Stage 1 egress while the muster list states that launching the MES marks the transition between Stage 2 and Stage 3 egress and lists the duty of MES launching as a function contained within Stage 2. Volume 1 of the FAST manual tacitly supports the muster list in Units 3-2 mentioning MES launching within the Stage 2 and 3 sections, although it's designation as a Stage 2 function is not made explicit. Recommend a comprehensive audit review of Form EMER 2, FAST manual Unit 1-*Emergency Management* and Unit 3-*Abandon Ship*, the emergency action plan guidebook, and muster list instructions.
  - There were three medical emergencies reported to the pilothouse during Stage 1 egress. These emergencies occurred after the grounding. Deck crews initially responded to the medical emergencies then passed control to Bainbridge Island Fire Department because the crew members had other actions to perform. Cross training with outside agencies and assets needs to be maintained.
- **Crowd Control:**
  - Public perception of the threat of the emergency was low, due to the gentle impact of the grounding, no breach of the hull or no fire requiring immediate evacuation of the vessel. Initial crowd control was effective, however the passenger's lack of perceived danger and the length of sequestration led to crowd control issues for the existing number of crew members. Crowd control became more difficult as passengers became anxious and irritated. Suggest providing enhanced crowd control training to crews. The presence of the USCG and law enforcement once onboard had a positive effect on the crowd.
  - The Emergency Evacuation Plan (EEP-FAST Unit # 3-1) relies heavily on passenger volunteers to assist crew members with crowd control efforts in the three stages of egress. The current procedure has passengers searching evacuation zones and sending passengers to assembly stations. Passengers may not be familiar with the evacuation zone layout of the vessel and have no means to communicate with the crew members.
  - When there is one vessel operating on this route, require additional deck crew on the vessel for crowd control in the event of an emergency, considering any special events that are taking place on the east side of Puget Sound.
- **Communications:**
  - The captain stated that it was not clearly defined from their perspective as to who the decision makers and directions being received in the pilothouse were coming from within the WSF EOC and the USCG. Continued cross training for WSF deck officers regarding industry jargon, functions, and framework of an ICS is recommended. Communication channels with the captain need to be clearly established. Provide two dedicated handheld MHz radios to communicate directly with the WSF EOC.
  - There are not enough handheld radios for crew members to communicate effectively. Every crew member needs some form of communication device.
  - The public address system and bullhorns used to communicate information to passengers were not as effective as they could be. Currently the pilothouse has no way

- to control/adjust the volume output of the public address system. New technologies may provide a better way to communicate information to the passengers. For example, use the existing public information monitors located throughout the main cabin areas to have information displayed in text format for the passengers.
- Lack of a designated WSF representative at the Bremerton ferry terminal once passengers arrived back at the terminal to clarify instructions, refer to overnight accommodations and where accommodations were available, reimbursement for those expenses, and any general concerns of passengers. Recommend an onsite representative is designated and assigned by the EOC, probably closest person near incident with ICS/EOC experience or who works in WSF planning and/or communications divisions.
  - Ensure outside agencies are fully aware of WSF's emergency evacuation plan (EEP) process, with special attention to WSF's stages of egress.
  - **Passenger Counts:**
    - Insufficient number of passenger information cards available for all passengers. Assess/count and resupply.
    - Safety Management Manual 12 DECK OPER 0100 *Passenger Counting* to include processes for accurately counting passengers while in Stage 1 egress.
    - Collection of the passenger information cards (number in party, contact information, how they boarded the vessel) and gathering of the cards was insufficient. Develop new strategies to obtain and track passenger information. There were 41 passenger information cards (top portion) and 6 passenger information cards (the bottom portion) delivered to the WSF operations office after the incident. How and when the cards were handed out and any information about how, where, and when the cards were collected is unknown.
  - **Equipment-Deck:**
    - Automatic draft indicating system (ADIS) not operating for free board measurements. This measures the freeboard of the vessel, not the actual draft under the keel. The captain stated that an excessive amount of time was spent converting ADIS (a freeboard measurement) information to actual measurements of the draft under the keel. Add fathometers to the vessel, this information gives clear draft clearance under the keel.
    - While the anchor was being deployed, there was no way to verify how much scope of chain had been deployed. The anchor chain should be marked with color as is industry standard.
    - The car deck cleats should be stamped with the safe working load. This provides the pilothouse and any outside asset with the correct information for towing the vessel or removing the vessel from the shoreline.
    - Crew members in the cabin had a difficult time wearing the horse collar type life jacket and using the handheld radio while performing other functions due to the constrictive nature of the life jacket. Consider providing slimmer, more comfortable life jackets for the cabin deck crew to wear during emergencies.
    - Additional terminal personnel or deck personnel to collect life jackets left behind by passengers at Kitsap Transit terminal. Gear assessment and accounting needed after any incident.

- During the incident there was not sufficient room to work in the pilothouse. An additional chart table or space to work is needed during an emergency.
- **Equipment-Engine:**
  - Requirements for the inspection and recording of maintenance of both day tanks annually to ensure they are free of contamination.
  - Find and correct the source of air entry into the primary filters.
  - Redesign the low point drain for the day tanks for better water removal.
  - Increase the dosage amount of fuel biocide (vessel has been using the brand BIOBOR).
  - Process accurately documenting and supervising engine room oilers when fuel within the Alpha-Laval fuel oil centrifuge has drained down due to inactivity and an oiler must then fill the Alpha-Laval fuel oil centrifuge interior with water before it can function.
  - Process needed for supervising and documenting in the engine room logbook that the oiler must regularly “shoot” down the Alpha-Laval centrifuge to keep it functioning and on-line.