Investigation of a marine accident by the Barbados Maritime Ship Registry Investigation Department (BMSR ID) is conducted within the framework of the Barbados Merchant Shipping Act (2024). The sole objective of such investigation is the prevention of future accidents through the ascertainment of its causes and circumstances. It shall not be the purpose to determine liability or apportion blame. This report is not written with litigation in mind.

The conduct of BMSR ID investigations is guided by MSC.255(84) [International Maritime Organisation Resolutions on International Standards and Recommended Practices for Safety Investigations into Marine Accidents or Incidents (Casualty Investigation Code)], IMO Resolution A.1075(28) [Guidelines to Assist Investigators in the Implementation of the Casualty Investigation Code], and the Marine Accident Investigators International Forum (MAIIF) Manual.

Engine room flooding leading to abandonment and grounding of MV BLUE LAGOON, Lanyu Island, Taiwan

Blue Lagoon (formerly Sterling Tora)

This investigation was conducted with the full co-operation and assistance of the Taiwan Transportation Safety Board (TTSB)

BMSR ID Safety
Investigation Report 1/2025

SUMMARY

On 1 October 2024, the Barbados registered bulk carrier Blue Lagoon was on passage from Caofeidian, China to Singapore when the engine room started to flood due to a fractured seawater pipe. The ship was pitching and rolling heavily as Typhoon Krathon approached. The efforts to stop and mitigate the flooding were unsuccessful and the evacuation of the crew by helicopter commenced as the ship drifted towards Lanyu Island and was completed after the ship had grounded. The ship was a total loss but there was no significant pollution. Other than the captain, who sustained broken ribs during the evacuation, none of the crew were injured.

The investigation identified:

- The source of the flooding was a fractured weld on a connection flange on the main seawater pipe connecting the high and the low sea chests.
- The rate of water ingress could not be estimated as inspection of the fracture has not been possible.
- The stresses resulting from the ship pitching, and it rolling up to 20° might have been sufficient to cause the weld on the seawater pipe flange to fracture.
- Blue Lagoon's engineers were very quick to respond to the seawater ingress from the fractured pipe but efforts to pump out the seawater from the bilges using the emergency suction and ballast pumps, and to isolate the fractured section of the seawater pipe to stop the seawater ingress, were unsuccessful.
- It is feasible that emergency pumping arrangements were not configured as intended and that the fractured pipe was never isolated.
- Blue Lagoon's engineers were possibly not familiar with the seawater system.
- The change of ownership, management, registration and crew of Blue Lagoon were not well planned or considered and impeded crew familiarisation.
- The intention of Blue Lagoon's captain to evacuate non-essential crew and anchor with tug assistance was not understood by the operators at Keelung Radio, and no assistance was initially available due to the weather and sea conditions.
- The evacuation of all of Blue Lagoon's crew was a very positive outcome.

Following the accident, Unimanager SIA**,** Blue Lagoon's technical manager has reviewed the process followed for the change of ownership and management of Blue Lagoon and has undertaken, amongst other things, to ensure better crew preparation should a similar situation occur in the future. In view of this undertaking, no recommendations have been made.

FACTUAL INFORMATION

Narrative

All times GMT +8

Engine Room Flooding

During the early morning of 1 October 2024, the Barbados registered bulk carrier Blue Lagoon (previously named Sterling Tora) was on passage from Caofeidian, China to Singapore. By 0200, the ship had passed between the mainland of Taiwan and Orchid Island (also referred to as Lanyu Island) **(Figure 1)** and was making good a course of 165° at a speed of 3.4 knots over the ground. The ship's main engine was in bridge control and set to full ahead with about 80 revolutions per minute (rpm) set.

The ship was experiencing high seas with wave heights between 6m and 9m, and a south-easterly, Beaufort Force 8 wind. The second officer (2/O) was the bridge watchkeeper, and he was accompanied by a lookout. The fourth engineer (4/E) was the on-watch engineer in the engine room, and he was accompanied by a motorman.

Figure 1 – Electronic Chart Display and Information System (ECDIS) Extract (0200)

Shortly before 0300, the 4/E, who was working in the engine room, and the motorman, who was just completing a set of safety rounds, were alerted by an alarm. The 4/E immediately went to the engine control room (ECR) to investigate and saw a high-level bilge alarm had activated. The 4/E and the motorman made their way down to the lower level of the engine room and quickly identified that seawater was flooding into the engine room between the high and the low sea chests. They lifted the deck plates and saw that a large seawater pipe had fractured. The pressure of the water ingress was very high, and they quickly lowered the plates.

The 4/E returned to the ECR and, at 0305, he telephoned the chief engineer (C/E) in his cabin to notify him of the situation. He also informed the second engineer (2/E) and requested his assistance. By now, the high-level bilge alarm below the main engine had also activated.

The C/E and the 2/E dressed and went to the lower platform of the engine room. They arrived at about 0311 and saw the deck plates being partially lifted by the pressure of the seawater ingress. They lifted the deck plates and saw the fracture on the seawater pipe, but they were unable to see or feel the nature of the damage due to the water pressure and the water spray being generated. The C/E and the

2/E lowered the deck plates. They then opened the emergency valves and started the bilge and fire pumps to discharge the water from the bilge. The water level in the bilge remained below the deck plates, but it continued to rise.

At 0324, the C/E telephoned the captain from the ECR and informed him of the water ingress. The captain mustered all of the deck officers on the bridge and, following a further call from the engine room to stop the main engine, a reduction of the main engine speed started at 0332. The lights indicating that the ship was 'not under command' were also turned on. The main engine telegraph was set to 'Stop' at 0336.

With the water level in the engine room continuing to rise, the C/E, 2/E, 4/E and the motorman remained on the engine room's lower platform. Between them, they attempted to close the sea chest isolation valves manually (CV01 and CV03 on the high sea chest, and CV02 and CV04 on the low sea chest **(Figure 2)**), or to check that they were closed.

The engineers' accounts of who closed or checked the individual valves were inconsistent and contradictory. Consequently, the precise details of the action taken, regarding who did what, and how the positions of the valves were checked is uncertain. Some accounts highlighted that the situation was extremely stressful and that the valve hand wheels were difficult to turn and required two persons. The C/E's understanding was that all four of the isolation valves were closed, but the pressure at which seawater continued to spray from the fracture in the main seawater pipe remained unchanged.

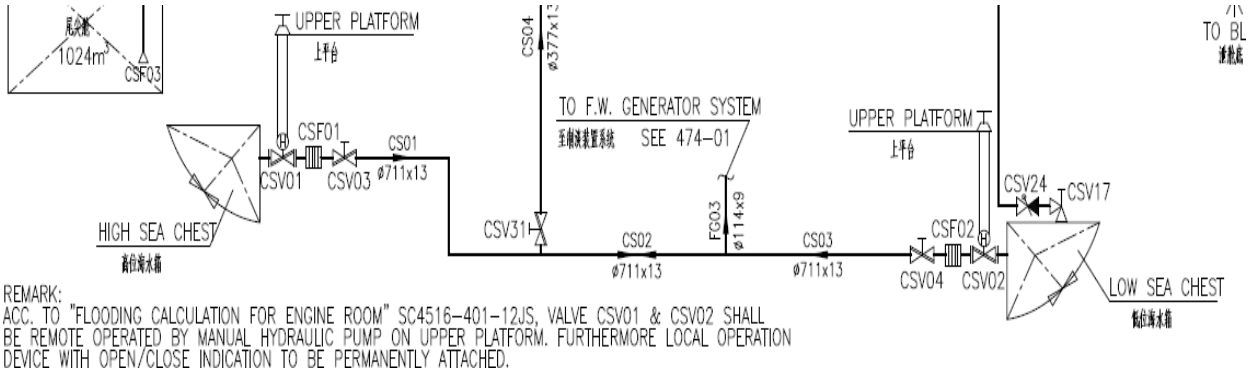

Figure 2 – Diagram showing the sea chests and associated valves.

Meanwhile, the electro-technical officer (ETO) arrived in the ECR and was instructed by the C/E to shut down the two auxiliary generators that were running. Accordingly, the generators were stopped and, at 0343, the ship experienced a blackout. Among other services, power supplies to the bilge and fire pumps had been lost. The ETO immediately went to the emergency generator room to start the emergency generator.

At about the same time, the C/E informed the captain that the sea chest valves had been closed, but the water ingress from the fractured pipe was continuing. He also instructed everyone in the engine room to go to the ECR. At 0344, the main engine automatically commenced a safety shut down.

At 0346, the ETO started the emergency generator and electrical services supplied from the emergency switchboard were restored. The bilge and fire pumps remained stopped. As Blue Lagoon slowed and lost headway, the ship started to drift to the north-north-east at a speed of about 3 knots **(Figure 3)**.

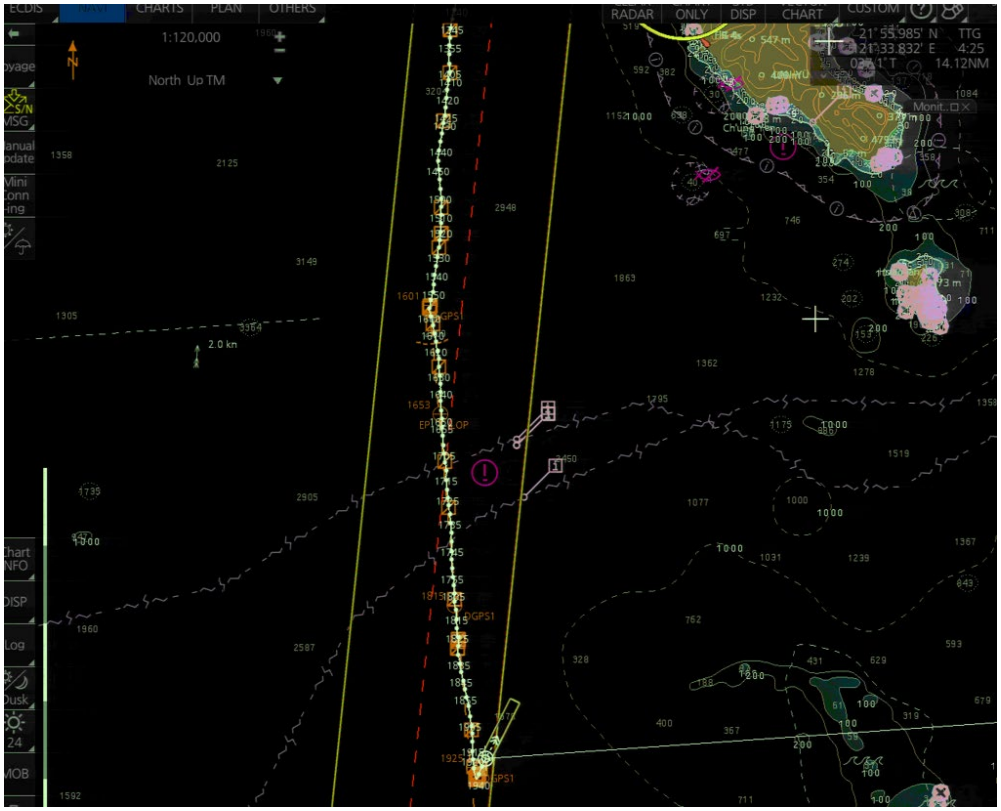

Figure 3 – ECDIS Extract at 0350

On the instruction of the C/E, the ETO contacted the ship's fitter who went the ECR. The fitter was collected from the ECR by the C/E and taken down to look at the fractured pipe. The position of the fracture was forward of the main engine, to port of the centreline towards the high sea chest. The fracture appeared to be on the weld of a connection flange and was about one quarter of the pipe's circumference. The fitter advised that he was not able attempt any form of repair until the water ingress had been stopped.

At 0350, the captain called the ship manager to advise of the situation. Thirty minutes later he transmitted a distress message on Very High Frequency (VHF) Digital Selective Calling (DSC)[1].

Abandonment and Grounding

At 0423, Keelung Radio responded to the distress message and called Blue Lagoon on VHF Channel 16. The captain informed Keelung Radio that the engine room was flooding and that the ship required assistance to anchor in shallower water. He stressed that there was currently no requirement to abandon the ship.

Over the next 25 minutes, Blue Lagoon's captain passed more information as requested by Keelung Radio. This included the ship's position, the number of crew and their nationalities, the amount of fuel carried, and the ship's destination. During this period, Keelung Radio contacted the Taiwanese Maritime Rescue Coordination Centre (MRCC) to report the situation and requested the Maritime Port Bureau (MPB) to provide tug assistance. It also reported the situation to the Coast Guard Administration (CGA), the National Air Service Corps (NASC), and the Ministry of National Defence (MND) to determine the feasibility of air rescue.

[1] DSC is a standard for transmitting predefined digital messages via the different frequency bands used by maritime radio systems It is a core part of the Global Maritime Distress Safety System (GMDSS)

In response, Keelung Radio was informed that CGA vessel operations and the Taitung rescue aircraft operations were suspended due to the adverse weather conditions.

At 0448, Blue Lagoon's captain asked Keelung radio if any assistance was being arranged. He also advised that the ship was drifting towards Lanyu Island, which was 15 miles to the north-north-east, at a speed of about 3 knots, and that the crew were at their muster station. Shortly after, Keelung Radio contacted the NASC to determine the conditions in which a rescue helicopter could be dispatched. At about the same time, Blue Lagoon's captain advised that the ship had a free-fall lifeboat and that the crew had donned lifejackets.

At 0504, Blue Lagoon's captain informed Keelung Radio that the vessel was able to drop its anchors but that tug assistance was required because the main engine could not be re-started. He also stated that non-essential crew needed to be evacuated from the ship, which was still drifting towards Lanyu Island at a speed of 2.2 knots.

By 0515, the wind had reduced, enabling air rescue operations to commence. Keelung Radio advised Blue Lagoon that a helicopter would be launched when the crew were abandoning the ship but that tugs were not available due to the weather. Blue Lagoon's captain re-iterated the need for tug assistance and the evacuation of non-essential personnel. He had identified sixteen crew to be evacuated, leaving himself, the C/E and the bosun, who was required to drop the anchors, on board. However, the captain experienced some difficulty in getting the operators at Keelung Radio to understand his plan. At 0545, Blue Lagoon was 13 miles southwest of Lanyu and was drifting towards the island at a speed of 1 knot **(Figure 4)**.

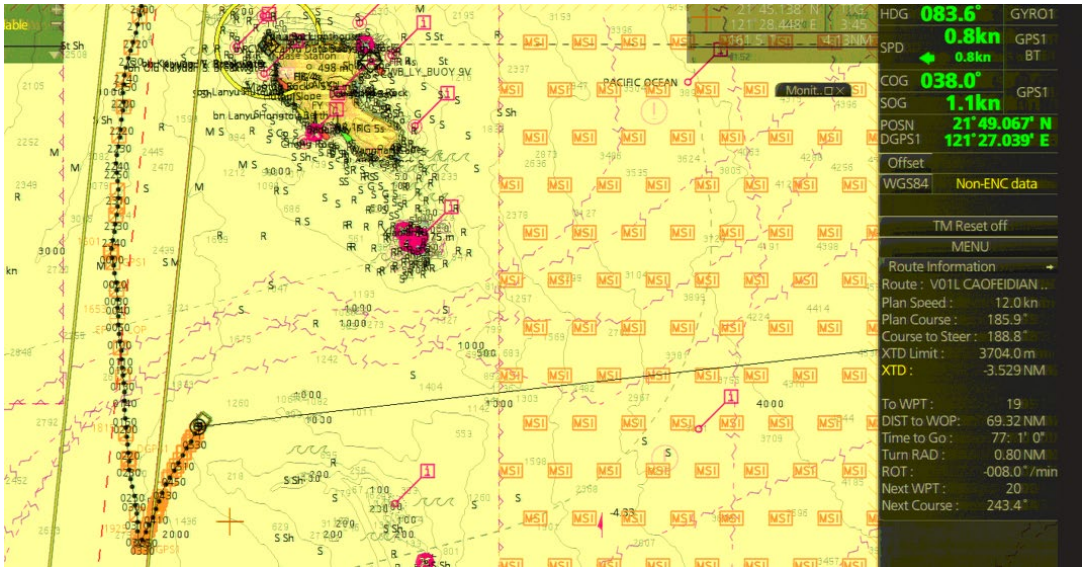

Figure 4 – ECDIS extract at 0545.

At 0602, Keelung Radio called Blue Lagoon and passed the telephone number of a tug operator for the captain to call. Four minutes later a Black Hawk helicopter took off from Taitung and, at 0625, the Coast Guard vessel *Kaohsiung* sailed from Kaohsiung with an estimated time of arrival on scene of 2000. The rescue helicopter was expected to arrive at Blue Lagoon at 0630, but it could not locate the ship due to poor visibility in heavy rain. Consequently, the helicopter returned to Taitung. Meanwhile, Blue Lagoon's captain requested that Keelung Radio contact the tug operator as the mobile phones on board the ship were not working due to there being no network coverage.

By 0709, Blue Lagoon was less than 11 miles from Lanyu Island and closing at a speed of 1.7 knots. The ship's crew had moved to the bridge and seawater was still flooding into the engine room, but the height of water level was unknown. The captain's intention remained to evacuate most of the crew and to drop anchor.

The weather conditions slowly improved and at 1027 rescue helicopter NA 703 took off from Taitung. It arrived at Blue Lagoon at 1058 and six crew were hoisted from the ship **(Figure 5)** and taken to Lanyu. Meanwhile, the Coast Guard vessel Kaohsiung returned its base after encountering hurricane force winds and 7m seas.

Figure 5 – First group of the crew being evacuated by helicopter

At 1147 rescue helicopter Z-491 took off from Taitung and arrived at Blue Lagoon at 1221. However, hoisting operations were stopped after the hoist cable parted due to the effects of the weather conditions and ship motion. The helicopter returned to Taitung without any of the ship's crew on board. Shortly after, at about 1225, the starboard anchor was let go with 13 shackles of cable. This was done just before the ship crossed the 100m depth contour to try and slow its drift towards Lanyu Island. However, no change in the ship's heading, drift rate or direction was apparent.

At about 1300, the port anchor was also let go as Blue Lagoon crossed the 50m depth contour, but the ship grounded several minutes later **(Figure 6)**. The captain was now concerned about the dangerous deck conditions and the potential breaking up of the ship. Keelung Radio advised the crew to stay on deck wearing lifejackets and be prepared to swim ashore if necessary.

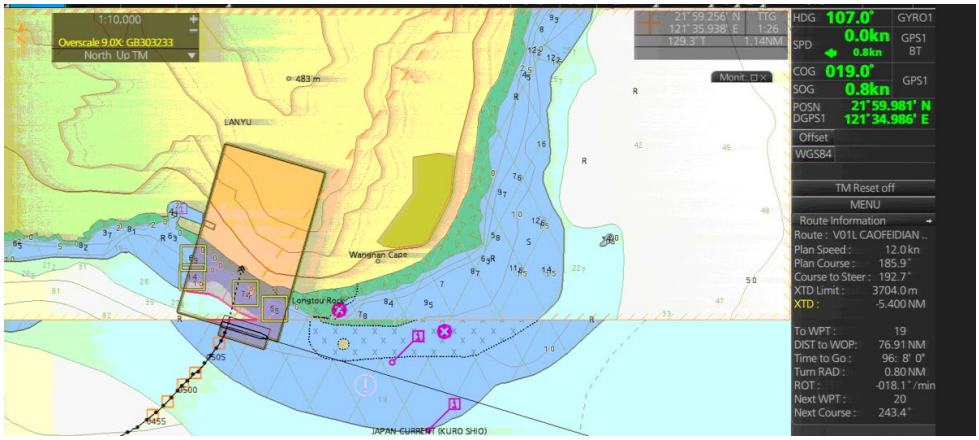

Figure 6 – ECDIS extract at 1306

Between 1339 and 1355, rescue helicopter NA-703 hoisted seven crew from Blue Lagoon and dropped them off at Lanyu Airport at 1400. The helicopter had sufficient fuel to return to Blue Lagoon and returned to the ship to evacuate the remaining crew, which included the captain **(Figures 7 and 8)**. By 1415, all the Blue Lagoon's crew had been evacuated.

Figures 7 & 8 – The last of the crew being air-lifted from Blue Lagoon

There was no significant pollution following the grounding, and the 240t of fuel oil that was onboard at the time was removed by mid-October 2024.

The Passage

Blue Lagoon sailed from Caofeidian on 24 September carrying 65000t of furnace slag for passage to El Dekheila, Egypt via Singapore. The ship's draught was 13.51m forward and 13.73m aft. The passage south was interrupted the following day due to the suspension of movements through a military exercise area. Blue Lagoon then made good a speed of about 10 knots towards the Taiwan Straits. On 26 September 2024, the ship experienced smooth seas and a light breeze but by the end of the following day, the sea had become moderate in a fresh south-easterly breeze.

The weather conditions and sea state continued to deteriorate during 28 September, and by 2000 the next evening the wind had increased to Beaufort Force 7 and the sea was very rough. Blue Lagoon was now rolling up to 10° and spray was coming over the bow as the ship pitched. At 2000 on 30 September, deck log records indicate that the wind was gale force, and the sea state was high (6m – 9m waves). The ship was pitching and rolling up to 20°.

During the passage the captain used the AMI weather routing service. In view of the weather forecast and the imminent arrival of Typhoon Krathon, he amended the ship's voyage plan to pass to the east of Taiwan rather than to the west through the Taiwan Straits in order to provide more sea room and clearance from navigational hazards.

Ownership and Management

On 5 September 2024, Sterling Tora was renamed Blue Lagoon on the transfer of ownership to Makeba Ltd. At the time, the ship was at anchor in anchorage No.6 in Lianyungang, China. On the same day, the technical and International Safety Management (ISM) was transferred from Fleet Management Ltd (FML) in Cyprus to Unimanager SIA based in Riga, Latvia, and commercial management was transferred to Authentic Carriers, based in Athens, Greece. The ship's registration was also transferred to the Barbados Maritime Ship Register (BMSR). The following day, Blue Lagoon's crew embarked, and Sterling Tora's crew disembarked.

Preparations for the changeover of Sterling Tora's ownership, management, registration and crew started on 28 June 2024 when the ship was inspected over 2 days by an FML technical superintendent in Singapore. In addition, a ship's engineer contracted by Makeba Ltd embarked for an extended period to observe the ship's operations on behalf of the prospective owners and technical managers. An American Bureau of Shipping (ABS) surveyor also attended the ship on 28 June to commence the ship's annual inspection. A visit of a technical superintendent from Unimanager in Singapore was scheduled but was cancelled.

After sailing from Singapore, Sterling Tora discharged cargo in Zhenjiang, China, where an ABS surveyor completed the ship's annual inspection; no significant deficiencies were identified. Following delays due to cargo disputes, Blue Lagoon sailed on 2 September 2024 for passage to Lianyungang. Since arriving on board, the ships' engineer representing the prospective owners and technical managers was permitted to observe the ship's operations without restriction and was in regular communication with Unimanager's technical superintendent.

The Unimanager technical superintendent accompanied by a quality manager had travelled to China several days before the handover in anticipation of visiting Sterling Tora but was unable to embark due to the ship's distance offshore. On 5 September, A 'Protocol of Handover of Technical Management' was signed on board by the ship's outgoing captain on behalf of FML. It was not signed by a representative of Unimanager. The Protocol stated that the transfer of ship management was agreed by both parties and occurred at 1430 on 5 September 2024.

At 1330 on 6 September 2024, Blue Lagoon's crew joined the ship by boat transfer, with the ships' engineer who had been onboard to witness the ship's operations taking over as the 2/E. Sterling Tora's crew left the vessel 10 minutes later. There was no handover between the on-coming and off going crews. Stores were then embarked and the deck officers, including the captain, familiarised themselves with the bridge equipment. The ship shifted anchorage later that day.

On 7 September, a BMSR appointed surveyor, and an ABS surveyor embarked to conduct pre-registration and class status surveys respectively. The Unimanager

technical superintendent and quality manager also embarked at the same time. Between 1320 and 1940, diving operations were conducted on the ship's hull. All visitors disembarked at 2305.

Over the next few days, Blue Lagoon's crew continued to familiarise themselves with the vessel, and diving operations continued until 9 September. On 18 September, a certificate of class was re-issued by ABS, and the ship commenced a 3-day passage to Caofeidian, China, where 65500 t of furnace slag was loaded. The ship sailed from the Caofeidian outer anchorage for passage to Singapore on 25 September.

Inspections and Surveys

The deficiencies and observations recorded during the Barbados Maritime Ship Registry pre-registration inspection on 7 September 2024 are shown at **Figure 9**.

Item	Observation
1-Deficiency	three nationality of crewmembers signed employment contract with owner (MAKEBA LTD, India office) but no specific MLC Reg. 1.4 compliance certificate
2-Deficiency	one engine room seawater pump is leaking seriously
3-Deficiency	one hydraulic motor is leaking at forward cross deck for mooring winch was found leaking
4-Observation	SMC/ISSC and MLC interim audit and inspection to be conducted for management system inplementation onboard
5-Observation	IAFS record for 2020 drydocking at IMC Yongyue Shipyard sighted but no others sighted

Note:
No2 Deficiency has been rectified before I Leaving the ship at 23:00 of 7 Sept.. 2024
Item 4 (Observation): Rina auditor has attended the ship on 8 Sept. 2024 for interim audit, we had a short conversation on the phone
Item 5 (Observation): Previous IAFS Record provided

Figure 9 – Extract of BMSR pre-registration inspection report

The inspection report also noted that fire and abandon ship drills were not conducted because these drills were not allowed by the China Marine Safety Agency (MSA) within port limits, and that there was no familiarisation information available for the newly joined crew. The report stated "*Due to new takingover, everybody was trying to get themselves as familiarized as soon as possible. It was real challenging for all parties concerned*" sic.

The vessel status report issued by ABS following the visit of its surveyor in Lianyungang did not identify any notable deficiencies relevant to the circumstances of the ship's later flooding. The report stated that the examinations of the cooling seawater piping and sea valves were next due to be completed on 10 March 2025.

Sterling Tora last underwent a port state control inspection in Vung Tau, Vietnam in December 2023 when no deficiencies were identified. The ship had previously detained in May 2023 during an expanded inspection in Rotterdam, Netherlands due to four deficiencies connected with: safety management; lights, shapes and sound signals; ballast, fuel and other tanks; and cargo and other hatchways.

Crew

Blue Lagoon's 19 crew comprised three nationalities, Ukrainian, Russian and Egyptian. All of the crew, apart from the 2/E who was already on board, joined the ship in Lianyungang on 6 September 2024. The crew were contracted by crewing agents on behalf of the owner and the contract lengths of the officers was 4 months (+/- 1). Other than the 2/E, none of the other crew had been onboard the

ship previously and none received a handover from their opposite numbers during the crew changeover. All of the crew had experienced difficulty sleeping during the latter part of the passage to Singapore due to the sea conditions.

The captain was a Ukrainian national who first went to sea as a deck cadet in 1986. After graduating from a maritime academy in 1993 and serving as a junior deck officer, he was a chief officer for 12 years until becoming a captain in 2015. As a captain, he had chiefly worked on board bulk carriers of different sizes worldwide. This was his third contract with Makeba Ltd, the first two contracts being on board ice-class ships.

The C/E was also a Ukrainian national who had been at sea for 24 years, working as a C/E for about the last 12 years on various ship types. This was his first contract for the ship's owners.

The 2/E was a Russian national who had previously completed about five contracts as a third engineer, and a similar number as a 2/E. All of the 2/E's contracts had been on board bulk carriers. He had joined Blue Lagoon on 28 June to observe and become familiar with the ship's operations in readiness for its change of ownership and management. The 2/E was under the impression that the owner or technical manager would send another person to accompany him in this role.

Notwithstanding the national conflict between Russia and Ukraine at the time of the grounding, the relationships between the Ukrainian and Russian crew members were reported to be amicable and professional.

Engine Room Watchkeeping

Blue Lagoon was provided with an Unmanned Machinery Space (UMS) notation, and the engine room was not manned after sailing from Lianyungang. However, in view of the worsening sea conditions experienced during the latter half of the voyage, the C/E decided that the engine room would be manned. Accordingly, a 6 hour on, 6 hours off watchkeeping routine was established with the 2/E and fitter keeping the 6-12 watches and the 4/E and the motorman keeping the 12-6 watches. A 6-hour watchkeeping routine was implemented because the 3/E was in bed suffering from sea sickness.

Seawater Cooling System

Description

Seawater was used as the medium to cool Blue Lagoon's main engine and auxiliary machinery. The seawater was drawn from two sea chests **(Figure 10)**. The 'high' sea chest on the ship's port side and the 'low' sea chest was on the ship's starboard side.

Figure 10 – The main seawater pipe from a sea chest filter

The sea chests were located between the ship's side and acted as a reservoir and filter by allowing seawater to flow through removable gratings. Ship's side valves **(Figure 2)** CSV 01 (high sea chest) and CSV 02 (low sea chest) were used to control seawater entering the sea chest. Both of these valves were located on the engine room's floor and could be operated by hand, or remotely from the engine room's upper platform using a hydraulic pump. The valves were certified by ABS.

After passing through the ship's side valves seawater passed through a filter and then through valves CSV 03 (high sea chest) and CSV 04 (low sea chest). Valves CSV 03 and CSV 04 allowed the isolation of the sea chest filters, enabling them to be cleaned. The main seawater pipeline connecting the high and low sea chests

was 10m in length and 711mm in diameter with a thickness of 13mm. It was made of seamless stainless steel, which was epoxy lined.

Maintenance

The cleaning of the sea chest filters had previously been a monthly maintenance task on board Sterling Tora. Maintenance records from Sterling Tora indicate that the sea chest filters were last cleaned on 24 August 2024; no water ingress through the sea chest valves when closed was recorded. The records also show that all seawater valves and pipelines were inspected on 9 and 21 August respectively **(Figure 11)**.

Current Job Status

Task	Last Action Date	Action Taken	Original Due Date	Component Running Hours	Details of Work Done / Spares Used
Sea Water Valves Monthly Inspection	21 Aug 2024	Completed	21 Aug 2024	N/A	CHECKED AS PER INSTRUCTIONS BELOW. FOUND SATISFACTORY.
Overboard Pipeline Monthly Inspection	13 Aug 2024	Completed	13 Aug 2024	N/A	INSPECTED FOUND SATISFACTORY
Sea Water Pipeline Monthly Inspection	09 Aug 2024	Completed	09 Aug 2024	N/A	Inspected.Found satisfactory
Sea Water Valves Five Yearly Inspection	25 Nov 2023	Completed		N/A	Initial Set up
Sea Chest & Overboard Valves Ten Yearly Maintenance	25 Nov 2023	Completed		N/A	Initial Set up

Figure 11 – Extract of Sterling Tora's Planned Maintenance System Records

Following the change of ownership, other than the repair to the defective seawater cooling pump that had been identified by the BMSR surveyor on 7 September 2024, no maintenance tasks had been undertaken on Blue Lagoon's seawater cooling system.

Operation

When Blue Lagoon's crew joined on 6 September 2024, the low sea chest was the only sea chest that was in use. The low sea chest remained the only sea chest in use until the high sea chest was also opened during the passage from Caofeidian to Singapore. This action was taken by the C/E who was concerned at the high seawater temperature. Neither the 2/E nor the 4/E were aware this action had been taken, and none of the ship's engineers, apart from the C/E, had operated the sea chest valves.

Emergency Bilge Suction

Emergency bilge suction was provided on board Blue Lagoon by opening the emergency bilge suction valve (BGV 25), which was required to be marked accordingly. The suction end of the emergency bilge line was a bell mouth (i.e. no suction strainer was fitted). Blue Lagoon was fitted with two ballast pumps, which could be used to pump the bilge on opening the emergency valve. The capacity of each ballast pump was 1250 m^3 per hour.

Survey

Between 30 November and 1 December 2024, divers conducted an underwater survey of Blue Lagoon's engine room with a focus on valve positions. Initially, the divers surveyed the high and lower sea chest without difficulty, although visibility was impaired by mud and silt. The divers were able to identify damage on the lower engine level such as cracks, holes, and severe damage to pipes and valves, but were unable to verify the status of many valves. An extract of the dive survey is at **Figure 12**.

No.	Tank Valves	Orientation	Date of inspection	Additional Info	Comment
1	CSV01 (Sea Chest)	CLOSE	30/Nov/24	Green Valve	FOLLOWED DIAGRAM, NO VISIBLE NAME TAG
2	CSV02 (Sea Chest)	OPEN	01/Dec/24	Green Valve	FOLLOWED DIAGRAM, NO VISIBLE NAME TAG
3	CSV24 (Low SC)	UNVERIFIED	01/Dec/24	NIL	DIVER UNABLE TO LOCATE, NO VISIBLE NAME TAG
4	CSV17 (Low SC)	CLOSE	01/Dec/24	Green Valve	FOLLOWED DIAGRAM, NO VISIBLE NAME TAG
5	CSF01	UNVERIFIED	01/Dec/24	NIL	DIVER UNABLE TO LOCATE, NO VISIBLE NAME TAG
6	CSF02	UNVERIFIED	01/Dec/24	NIL	DIVER UNABLE TO LOCATE, NO VISIBLE NAME TAG
7	CSV03	CLOSE	30/Nov/24	Green Valve	FOLLOWED DIAGRAM, NO VISIBLE NAME TAG
8	CSV04	UNVERIFIED	01/Dec/24	Green Valve	FOLLOWED DIAGRAM, NO VISIBLE NAME TAG, SPINDLE SHAFT BENDED
35	BGV25	UNVERIFIED	01/Dec/24	NIL	DIVER UNABLE TO LOCATE, NO VISIBLE NAME TAG

Figure 12: Extract of results from the dive survey 30 November-1 December 2024

No further attempts were made to survey the fractured seawater pipe and valve positions during the ship's removal and disposal due to the hazardous conditions experienced.

ANALYSIS

Purpose

The purpose of a marine safety investigation is to determine the circumstances and safety factors of the accident as a basis for making recommendations, and to identify lessons, to assist in the prevention of further marine casualties or incidents occurring in the future. It is not for the purpose of apportioning liability or blame.

Scope

Blue Lagoon grounded on Lanyu Island and was abandoned by its crew as a result of the ship's engine room flooding which resulted in the loss of propulsion. This section of the report will:

- examine the reasons why the flooding occurred
- explore why the crew's actions to stop and mitigate the flooding were unsuccessful, and
- review the actions of both the ship's crew and the shoreside services with respect to the crew and ship survival.

Seawater Ingress

The source of the flooding in Blue Lagoon's engine room was a fracture in the main seawater pipe connecting the high and the low sea chests. Given the ship's draught, the seawater pipe would have been pressurised to about 2.2 bar, and any fracture would potentially have generated significant seawater ingress. Assuming a discharge coefficient of 0.6, and the pipe being completely open, the resulting ingress would be approximately 218 tonnes per minute. However, the fracture in Blue Lagoon's seawater pipe was reported to have extended approximately one quarter of the pipe's circumference. It would therefore have been approximately 56cm in length, and although the discharge coefficient would be much lower, it is impossible to estimate, particularly as it has not been possible to access and inspect the fracture in detail.

Likewise, because it has not been possible to conduct a metallurgical analysis of the fractured weld, its causation remains speculative. The split in the seawater pipe was reported to be at the site of a weld on a flange connection, and flange connections are potentially weaker points in a seawater pipeline's structure. As such, they are susceptible to vibration and stresses that result from a ship's motion. In this case, at the time of the fracture to Blue Lagoon's seawater pipe, the ship was experiencing gale force winds, 6m to 9m high waves and was pitching, and rolling up to 20°. In such conditions, the torsional, racking, and sheer stresses on the ship might have been sufficient to cause the weld on the seawater pipe flange to fracture.

Mitigating Action

As the engine room was manned in response to the deteriorating weather and sea conditions, Blue Lagoon's engineers were very quick to respond to the seawater ingress from the fractured pipe. The 4/E and the motorman immediately investigated the bilge alarm. The C/E was immediately informed of the situation, and the 2/E was requested to assist. However, although the C/E and 2/E were quick to arrive in the engine room, the efforts to pump out the seawater from the bilges using the emergency suction and ballast pumps, and to isolate the fractured section of the seawater pipe to stop the ingress, were unsuccessful. The intentional shutting down of the generators also resulted in a blackout.

Without an accurate estimation of the rate of flooding, or an accurate and comprehensive survey of the pumping arrangements and seawater valves, the reasons for the crew's inability to mitigate or stop the water ingress are unclear. It is feasible that, although the use of ballast pumps would not have been possible after the blackout, the emergency pumping arrangements were not configured as intended given the capacities of the ballast pumps. In addition, given that CVS02 was identified as being open during the dive survey during 30 November and 1 December 2024, and the position of CVS04 was not verified **(Figure 12)**, it is possible that the fractured pipe was never isolated from the low sea chest.

Blue Lagoon's engineers were working in very difficult and stressful conditions with the ship's motion being particularly uncomfortable. However, the inconsistent and contradicting accounts of the engineers regarding the closure of the seawater isolation valves, along with the C/E's understanding was that all four of the isolation valves (CVS01 and CVS03 on the high sea chest and CVS02 and CVS04 on the low sea chest) were closed, possibly indicates that the stress levels of the engineers were increased by their lack of familiarity with the seawater system. Although valve failure cannot be discounted, maintenance records **(Figure 11)** show that all seawater valves and pipelines were inspected by ship's crew on 9 and 21 August respectively, and that the sea chest filters were cleaned on 24 August. The ABS status report also indicated that classification society examinations of the seawater piping and valves were not due to be completed until 10 March 2025. The maintenance and inspections of the sea chests and their associated valves were therefore up to date when the vessel's ownership was transferred, and there was nothing to indicate that the sea chest valves were not functioning correctly.

Familiarisation

Other than the C/E, none of Blue Lagoon's engineers had operated, or even touched, the sea chest isolation valves, and the C/E's experience had been limited to opening the high sea chest valves during the passage from Caofeidian. The 2/E had never witnessed the operation of the valves during his extended time on board since joining on 28 June 2024, even though the sea chest filters had been cleaned on 26 August, and the filters had not been cleaned since the ship changed ownership, management, flag and crew between 5 and 6 September.

Notwithstanding that the 2/E had been on board for over 2 months when Blue Lagoon changed crews, the absence of a handover between the off-going and on-coming crews, the absence of planned maintenance records, and the absence of crew familiarisation procedures and records was significant. That the crew changeover occurred within 10 minutes without any handover, that the ship shifted anchorage later the same day, that the ship's new technical manager was unable to visit prior to handover, that the BMSR pre-registration survey did not take place until 7 September, and that drills were not allowed to be conducted within Caofeidian port limits, indicates that the change of ownership, management, registration and crew were not well planned or considered.

Emergency Response

Blue Lagoon's captain broadcast a distress alert via DSC after being informed that the engineer's attempts to stop the water ingress had been unsuccessful. It is evident from the outset that he wanted helicopter assistance to disembark non-essential crew to the shore, and tug assistance to anchor his ship in shallow waters. The ship was drifting towards Lanyu Island at about 3 knots, but the island was still 15 miles away and the captain assessed there was sufficient time available to save the bulk carrier. However, notwithstanding that the operators Keelung Radio initially had difficulty in understanding the captain's intentions, no helicopter assets were available due to the weather and sea conditions, and although a coastguard vessel sailed from Kaohsiung, it had to return to port when hurricane force winds were encountered.

However, following the resumption of helicopter operations as soon it was deemed safe to do so, crew evacuation commenced, albeit with several difficulties. Although the captain attempted to arrest Blue Lagoon's movement towards Lanyu Island by dropping anchors immediately before crossing the 100m and 50m depth contours, this had little or no effect and did not prevent the ship from grounding. Given the weather and sea conditions, the eventual evacuation of all of Blue Lagoon's crew was a very positive outcome.

CONCLUSIONS

- The source of the flooding in Blue Lagoon's engine room was a fractured weld on a connection flange on the main seawater pipe connecting the high and the low sea chests.
- It is impossible to estimate the rate of water ingress, particularly as it has not been possible to access and inspect the fracture in detail.
- At the time of the fracture to Blue Lagoon's seawater pipe, the ship was experiencing gale force winds, 6m to 9m high waves and was pitching, and rolling up to 20°. In such conditions, the torsional, racking, and sheer stresses on the ship might have been sufficient to cause the weld on the seawater pipe flange to fracture.
- Blue Lagoon's engineers were very quick to respond to the seawater ingress from the fractured pipe.
- The ship's engineer's efforts to pump out the seawater from the bilges using the emergency suction and ballast pumps, and to isolate the fractured section of the seawater pipe to stop the seawater ingress, were unsuccessful.
- It is feasible that emergency pumping arrangements were not configured as intended and that the fractured pipe was never isolated from the low sea chest.
- The inconsistent and contradicting accounts of the engineers regarding the closure of the seawater isolation valves, along with the C/E's understanding of the status of the sea chest valves, possibly indicates their lack of familiarity with the seawater system.

- The change of ownership, management, registration and crew of Blue Lagoon were not well planned or considered and impeded crew familiarisation.
- The intention of Blue Lagoon's captain to evacuate non-essential crew and anchor with tug assistance was not understood by the operators at Keelung Radio, and no assistance was initially available due to the weather and sea conditions.
- The eventual evacuation of all of Blue Lagoon's crew was a very positive outcome.

ACTION TAKEN

Unimanager SIA has

Reviewed the process followed for the change of ownership and management of Blue Lagoon and should a similar situation occur in the future:

- If possible, recruit crews directly through its own crewing agent. Otherwise, insist on having a greater influence over crew selection regarding interviews and training.
- Ensure that at least two observers are embarked to witness ship operations prior to transfer, one of whom will be a technical superintendent.
- At an early stage, request the latest technical superintendent's inspection report (with photographs) from the existing manager.
- Insist on greater control of the timing and location of the transfer.

RECOMMENDATIONS

In view of the actions taken, no recommendations have been made on this occasion.

SHIP PARTICULARS	
Vessel's name	Blue Lagoon
Flag	Barbados
Classification society	American Bureau of Shipping
IMO number	9481427
Type	Bulk Carrier
Registered owner	Makeba Ltd
ISM and Technical Manager	Unimanager
Commercial Manager	Authentic Carriers
Year of build	2009
Construction	Steel
Gross tonnage	43498
Minimum safe manning	15
Authorised cargo	
Port of departure	Caofeidian, China
Port of arrival	Singapore
Type of voyage	International
Cargo information	67500t Furnace slag
Manning	19
Date and time	1 October 2024 0305
Severity	Very Serious Marine Casualty
Location of incident	15nm SSW of Lanyu Island, Taiwan
Place on board	Engine Room
Injuries/fatalities	One serious injury sustained during the crew evacuation
Damage/environmental impact	No significant pollution. All fuel oil bunkers were successfully removed.
Ship operation	On Passage
External & internal environment	Wind SE Force 8, Sea state 7. Visibility moderate
Persons on board	19
Shore Authority Involvement and Emergency Response	
Involved parties	Keelung Radio Taiwanese Coastguard
Assets used	Helicopters
Actions taken	Crew evacuated by helicopter in 3 groups