



A U S T R A L I A N T R A N S P O R T S A F E T Y B U R E A U

MARINE SAFETY INVESTIGATION

REPORT 152

Independent investigation into the
steering gear failure
on the Australian flag motor vessel

Warden Point



off the east coast of Australia
on 10 November 1999

COMMONWEALTH DEPARTMENT OF TRANSPORT AND REGIONAL SERVICES



Department of Transport and Regional Services
Australian Transport Safety Bureau

Report No 152

Navigation (Marine Casualty) Regulations
investigation into the steering gear failure
on the Australian flag motor vessel
Warden Point
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FIGURE 1:
Warden Point leaving Port Kembla



Summary

On 9 November 1999, the Australian flag bulk carrier *Warden Point* was southbound off the north coast of New South Wales, en route to Melbourne, with a cargo of fly ash. At about 0230, the weather changed due to an intense low-pressure system approximately 300 nautical miles to the south. By 0800 the vessel was experiencing near gale force winds from the south. The vessel was pitching heavily in large seas submerging the lower poop deck, at times, under 2–3 m of water.

At 1400, the duty engineer reported that the rope locker hatch lid, on the lower poop deck, was leaking and that water had entered the rope locker and adjoining steering flat. The crew subsequently managed to reseal the hatch lid after some problems due to waves that were periodically sweeping the deck and running over the hatch.

At 2330, Australian Eastern Standard Time (EST), the second mate came on the bridge to take the watch. After the watch was handed over he instructed the 12–4 integrated rating (IR) to go through the accommodation and advance the clocks 1 hour, he also instructed the IR to check the rope locker and steering flat. The IR rang back a short time later to report that the rope locker and steering flat were awash and that the water was running over the steering motors. The second mate started the stand-by steering motor and called the duty engineer. Just as he put the phone down one steering motor failed, followed by the other motor about 10 seconds later. The second mate stopped the ship and called the master. The time was 0115, Australian Eastern Summer Time (EDT), 10 November 1999, with the vessel east of Sugarloaf Point,

north of Newcastle. Once the vessel lost headway it became beam-on to the large sea and rolled heavily.

All the engineers and integrated ratings were called to the engine room to work on restoring the steering and pumping the steering flat and rope locker dry. Both steering motors were dismantled and found to be damaged beyond repair. There was no spare motor so the lower rated stand-by main engine jacket cooling water pump motor was used to make an emergency repair. While the crew were completing the emergency repairs to the steering the cargo shifted, causing a port list of 2–3° and a noticeable trim by the head.

At 0852 on 10 November 1999, with the steering finally restored, the vessel headed for Newcastle, the nearest port of refuge, to effect permanent repairs. However, Newcastle Port closed at 1526 on 10 November 1999, due to the bad weather, and the decision was made to divert *Warden Point* to Port Kembla.

Warden Point arrived at the Port Kembla pilot boarding ground at 1000 on 11 November 1999 by which time the list had increased to over 5°. The steering was limited to a maximum of 15° helm and the vessel was berthed using two tugs. At 1236, the vessel was finally made fast alongside no.1 coal berth. The ship's engineers and shore contractors worked into the night on the steering gear and rope locker hatch lid. The cargo was inspected and found to have moved in both holds. The list was corrected by re-trimming the cargo in no.1 hold.

Warden Point departed Port Kembla at 0830 on 12 November 1999 and completed the voyage to Melbourne without further incident.

Sources of Information

The master and crew of *Warden Point*

Queensland Cement Ltd

Pozzolanic Industries Ltd

Australian Maritime Safety Authority

Sydney Ports Corporation

Newcastle Ports Corporation

The NSW Bureau of Meteorology

Lloyds Register

The Fly Ash Resource Centre

Marine Accident Investigation Branch, UK

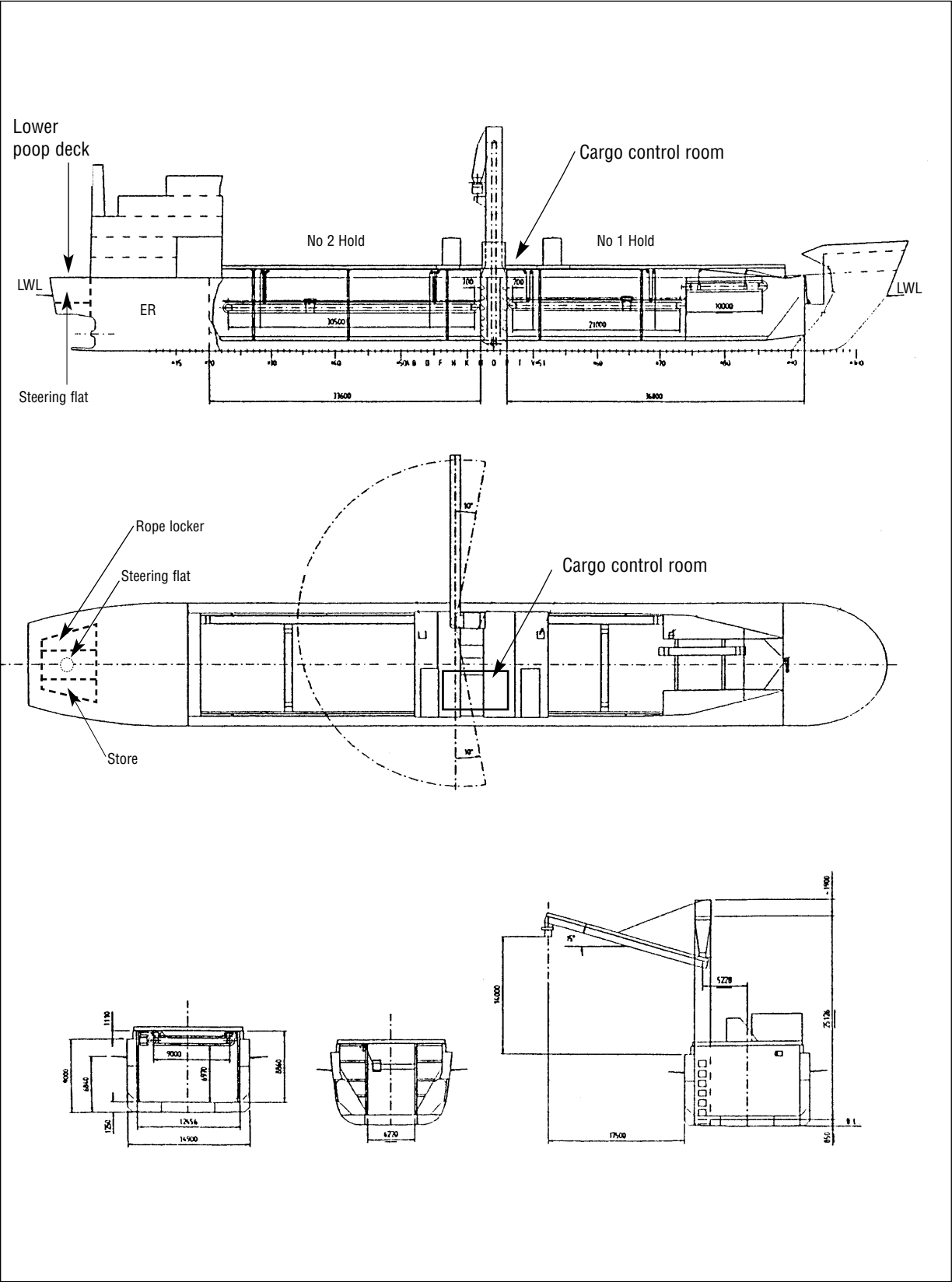
References

Code of Safe Practice for Solid Bulk
Cargoes (BC Code)

Lloyd's Rules and Regulations for the
Classification of Ships

International Convention for the Safety of
Life at Sea (SOLAS)

FIGURE 2:
Warden Point general arrangement of holds and self-unloading system



Narrative

Warden Point

Warden Point (fig. 1) is an Australian flag bulk carrier of 6 127.7 deadweight tonnes at its summer draught of 6.987 m. Queensland Cement and Lime Co. Ltd (QCL) own the vessel with the registered agent being Cementco Shipping Pty Ltd of Brisbane, which is a division of QCL. It is classed with Lloyd's Register as a ✱100 A1 Bulk Carrier Strengthened for Heavy Cargoes, with ✱LMC¹ and UMS² notations.

Warden Point, formerly *Red Sea*, was built in 1978 by Gotaverken, Solevesborg, Varu, Sweden. The vessel has an overall length of 105.64 m, a beam of 14.95 m and a moulded depth of 9.00 m. The ship was purchased by QCL in 1990 and converted from a gearless bulk carrier to a self-discharging cement carrier.

The vessel has two cargo holds, each hold has a width of 12.53 m and a depth of 6.79 m, number 1 hold is 36.8 m long and number 2 hold is slightly shorter at 33.6 m in length (fig. 2). The cargo self-unloading system consists of PLC (programmable logic controller) controlled transverse and longitudinal scraper conveyors in each hold, which feed a bucket elevator located on the port side between the holds. The cargo is then discharged overboard to the reception facility via a slewing boom conveyor fed from the top of the bucket elevator. The cargo system control gear is located between the two holds in a cargo control room. There are inspection windows in the bulkhead between the cargo control room and the

holds, which allow the cargo to be sighted. *Warden Point* is loaded by a shore-based boom conveyor via circular loading ports in the main hatch covers.

Main propulsion is provided by a 12 cylinder, B&W Alpha 120281 medium speed diesel engine, producing 2 200 kW. The main engine is clutched into a reduction gearbox and drives a single controllable pitch propeller giving the vessel a service speed of 12 knots. Electrical power is provided by a 300 kW shaft generator, driven by the main engine, and two auxiliary diesel generator sets each of 200 kW. The vessel is also fitted with a single 250 kW bow thruster.

Warden Point is fitted with a rotary vane steering system manufactured by A.S Tenfjord Mek.Verkested (fig.3). The system consists of two fixed displacement hydraulic pumps driving the rotary vane 'rudder motor' (hydraulic rudder actuator) via integral, solenoid actuated, hydraulic directional control valves, and independent piping. The steering pumps are mounted horizontally 100 mm above the deck, on the forward side of the 'rudder motor'. When operated alone, each pump is capable of meeting the requirements of class with regard to the speed of rudder actuation. The usual shipboard procedure is to run a single pump when en route and both pumps for any pilotage. The steering gear has three modes of operation; automatic from the bridge when the autopilot is engaged, non-follow-up steering when hand steering from the bridge, and emergency steering effected by manually operating the directional control valves on the steering pumps in the steering flat.

¹ Notation assigned when machinery is constructed and installed under Lloyd's Special Survey in accordance with Lloyd's rules.

² Notation denotes ship may be operated with the machinery spaces unattended.

FIGURE 3:
Warden Point's steering flat



FIGURE 4:
Warden Point's steering flat escape hatch



Warden Point's accommodation superstructure is located aft, with the engine room located immediately below the accommodation. Access to the engine room is via an internal stairway from the accommodation. The steering gear is located in a flat at the after end of the engine room. The steering flat is approximately 5.5 m in length and 4.5 m wide. Internal access to the steering flat is through a door from the generator flat. An escape hatch from the steering flat leads to the open lower poop deck above (fig. 4). Located above the lower poop deck is the upper poop deck, also open, and an external staircase links the two decks.

A rope locker is located on the port side adjacent to the steering flat. The rope locker is approximately 5.5 m in length and 3.6 m wide at the forward end tapering to 1.5 m at the after bulkhead. The only access to the rope locker is via a hatch located on the lower poop deck. The hatch consists of a coaming raised above the level of the lower poop deck and a hinged hatch lid secured, at the time of the incident, by 3 lever dogs which engage on wedges welded to the inside of the coaming. At the time of the incident the rope locker hatch was secured in the same fashion as the steering gear hatch shown in figure 4. A non-watertight bulkhead divides the rope locker and steering flat. There are various penetrations in the dividing bulkhead including; cable conduits, 'mouse holes' around transverse frames on the after bulkhead and two 220 x 190 mm rectangular 'ports' located approximately 500 mm above the deck. The forward port is shown in figure 3. Neither the rope locker nor the steering flat were fitted with bilge alarms at the time of the incident. The steering flat has a fixed bilge suction, the rope locker, however, does not. A paint locker/store is located on the starboard side of the steering flat. Access to this space is via a door from the steering flat.

The Australian crew of *Warden Point* consists of a master and three mates, chief and three engineers, seven integrated ratings (IR's) and two catering staff.

The master in command on 10 November 1999 had 41 years of seagoing experience in the British and Australian merchant shipping fleets. He had been employed since 1985 by Cementco Shipping and had been on *Warden Point* for the previous 2 years.

The chief engineer on *Warden Point* had 19 years of seagoing experience and the last 9 years with Cementco Shipping. He had been chief engineer on the vessel since 1994.

The deck officers aboard *Warden Point* work the usual 4 hours on, 8 hours off, watch system both at sea and in port working cargo. The engineers work 'daywork' through the day and the first, second and third engineers rotate through a one-in-three 'duty engineer' roster for callouts at night.

Warden Point underwent a major dry-docking program in Nantong, China, between November 1998 and January 1999. During this docking the entire double bottom structure, from the tank tops down and from the collision bulkhead to the forward engine room bulkhead was cropped and renewed. An enhanced survey program was also carried out at this time. New rubber seals were fitted to both the steering gear escape hatch and the rope locker hatch lids at this time.

The trade

Since 1990 QCL has been a wholly owned subsidiary of the Swiss-based multinational Holderbank Financiere Glaris Ltd which is one of the world's leading suppliers of cement and building related materials, with interests in 65 countries. The QCL group is Queensland's largest manufacturer and distributor of cement and one of Australia's

major marketers of concrete materials. Member companies of the QCL group include Queensland Cement Ltd and Pozzolan Industries Ltd.

QCL have two vessels engaged in various sectors of their operation. *Warden Point* is the smaller vessel and carries cement powder from Gladstone to Townsville as its primary trade. *Warden Point* also carries a portion of the 90 000 tonnes of fly ash that QCL ship from Gladstone to Pozzolan Industries in Melbourne each year. Typically, *Warden Point* would complete 7–8 fly ash voyages per year.

Fly ash

Fly ash is a combustion by-product that is collected by electrostatic precipitation from the flue gases of coal-fired power stations. It is a fine brown or grey cohesive powder composed primarily of aluminosilicate glass, mullite, haematite, magnetite spinel and quartz. Fly ash particles generally have a diameter less than 250 microns and are spheroidal when viewed under a microscope.

The Australian Manual of Safe Loading, Ocean Transport and Discharge Practices for Dry Bulk Commodities has a useful description of fly ash:

Fly Ash is a fine powder used as a partial cement replacement material, which becomes almost fluid in nature when aerated or significantly disturbed thereby creating a very minimal angle of repose. After loading is completed deaeration occurs over several hours and the material settles into a stable mass...

The fly ash shipped by *Warden Point* to Melbourne, is a by-product of the Gladstone power station. It is a very fine powder with 20–40 per cent of the particles smaller than 7 microns. The fly ash is used by Pozzolan in their production of concrete and concrete products as a supplementary cementitious material.

On *Warden Point*, the fly ash is loaded in much the same way as cement powder with the self-unloading equipment being lifted prior to the aerated fly ash being poured into the hold and then allowed to settle. The aerated fly ash pours relatively flat with only slight mounds formed under the loading ports and does not normally require trimming. After loading is completed, the self-unloading equipment is lowered onto the surface of the cargo.

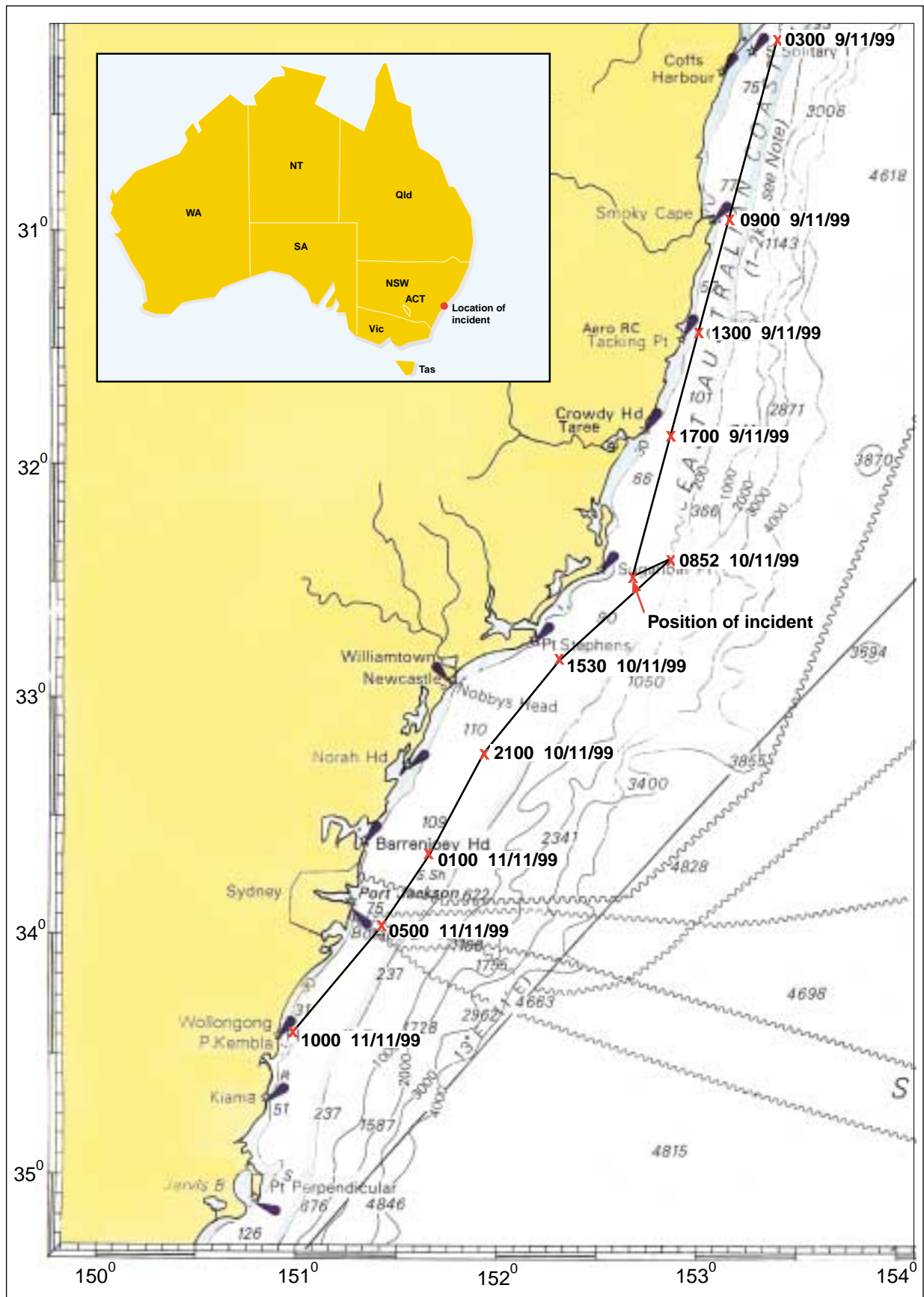
There is some disagreement regarding the stowage factor of fly ash. Pozzolan Industries quote a specific gravity of 2.05–2.55 which makes the stowage factor approximately 0.43m³/t. The Australian Manual of Safe Loading quotes a stowage factor of 0.8–1.2m³/t and the Code of Safe Practice for Solid Bulk Cargoes (BC Code) quotes the stowage factor as 1.26m³/t. The crew of *Warden Point* stated that, after settling, a cargo of fly ash occupied almost the same volume as powdered cement which suggests a stowage factor of approximately 0.67–1.0m³/t.

Being a cohesive substance there is no appropriate ‘angle of repose’ quoted for bulk fly ash in the current 1998 edition of the BC Code. Previous editions before 1987 however quoted an approximate angle of repose of 40°.

Voyage 554

Warden Point completed the loading of 5 737 tonnes of fly ash at Gladstone, and sailed for Melbourne at 1136 on 7 November 1999 on voyage 554. The vessel was not carrying any significant ballast and was loaded to its summer marks with a mean draught of 6.965 m. Just after departure, the mooring lines were stowed in the after rope locker and the hatch lid dogged down. The vessel cleared Gladstone channel at 1324. There was a light northerly breeze blowing and the seas were slight, on

FIGURE 5:
Warden Point's approximate track 9,10,11 November 1999



a low swell. The second steering pump was stopped after the pilotage was complete, leaving the starboard pump running for the voyage south.

Good progress was made south for the first day and a half, with the speed averaging over 11 knots. The ship's routines were maintained including regular deck and engine room maintenance. At approximately 1800 on 7 and 8 November the routine watertight integrity rounds were completed by the integrated rating on the 4–8 watch. During these rounds the IR checked the rope locker hatch and noted it as being secure.

At approximately 0230 on 9 November, just north of Coffs Harbour, NSW, *Warden Point* experienced a southerly change in the weather. The sea and swell began to increase rapidly and, by 0800 the wind was force 7 from the southwest and the seas were rough on a short steep swell. The ship, on a course of 190°, was pitching moderately at times, taking heavy spray on the forecastle and shipping green seas onto the lower poop. The ship's speed had fallen to just over 8 knots as a result of the sea and wind on the bow.

Warden Point continued on throughout the day into the progressively deteriorating weather. By the early afternoon, the lower poop deck was being regularly submerged under 2–3 m of green water. There were heavy seas also being shipped over the forecastle and number 1 hatch. The vessel's speed had fallen to just over 6 knots.

At approximately 1400, the first engineer (duty engineer) reported to the bridge that the rope locker hatch lid (on the lower poop deck) was leaking and water had entered the rope locker and steering flat. The chief engineer and master were called and a party was organised to go aft to fix the leaking

hatch lid. The party on the poop initially consisted of the chief IR and second mate, who attempted to reseal the rope locker hatch lid by using silicone sealant. The chief IR would open the hatch between waves and hold it while the second mate applied the sealant. The vessel was slowed and turned to minimise the pitching. While making these repairs, the lower poop was swamped by a wave, and the two men had to grab anything they could to prevent themselves being swept overboard. Both men were submerged for up to 10 seconds and sustained cuts, abrasions and bruises in this incident. The chief engineer, who had been watching from the upper poop deck, told the men to abort the attempt to reseal the hatch.

A second attempt to seal the hatch was made with self adhesive foam sealing rubber obtained from the engine room. The chief engineer and the second mate went back to the lower poop deck and managed to fit additional strips of sealing rubber to the rope locker hatch lid. The hatch was again dogged and found to be holding reasonably well.

The first engineer, meanwhile, set about rigging up a portable bilge pump to pump the water from the rope locker. The pump suction was passed through one of the ports in the dividing bulkhead between the steering flat and the rope locker and the discharge line passed up and out onto the deck via the engine room access stairs and aft accommodation door. After the rope locker had been pumped dry, the pump was left rigged and the steering flat and rope locker monitored for further water ingress.

At approximately 1800, the 4–8 IR again completed the watertight integrity rounds and filled in the checklist to indicate that, among other things, he had checked the rope locker hatch and found it secure.

At 1930 the first engineer noted a ‘small’ amount of water in the rope locker on his rounds.

The first engineer conducted his final engine room inspection for the day at 2200 and noticed 100–200 mm of accumulated water in the rope locker. He pumped the rope locker dry, using the ready-rigged portable bilge pump, then went to bed.

The second mate arrived on the bridge at 2330 to take over the watch. *Warden Point* was east of Sugarloaf Point and had maintained a speed of just over 6 knots in the preceding four hours into the ‘rough to very rough head seas and moderate/heavy swell’. The wind was estimated at force 7–8 from the southwest and the conditions were still deteriorating. The vessel had pitched heavily at times and had taken green water over the lower poop deck with every heavy pitch.

After the second mate had taken over the watch he instructed the 12–4 IR to advance the communal area clocks 1 hour from Australian Eastern Standard Time (EST) to Australian Eastern Summer Time (EDT). He also requested that the IR check the steering flat and rope locker for any water ingress. The IR rang back a short time later from the duty mess to say that there was water in the steering flat and that it was running over the steering motors. The second mate told the IR to wait in the duty mess. He started the port steering pump, and immediately contacted the first engineer to tell him that there was water in the steering flat. At this time the ‘alarm/overload’ light came up for the starboard steering motor on the steering control panel on the bridge. The port steering motor ‘alarm/overload’ light came up about 10 seconds after this. The time was 0115 EDT, 10 November 1999.

Once the steering motors had failed, the second mate called the master and brought

the propeller pitch control lever back to zero. The first engineer, by this time, had arrived in the engine room to find the steering flat awash with 200–300 mm of water. Water was also flowing through the open steering flat door, over the storm sill, into the adjoining generator flat. He immediately called the chief engineer.

With the propeller at zero pitch, *Warden Point* quickly lost speed and turned to become starboard beam-on to the very rough sea. The wind was force 7–8. The vessel started rolling heavily, regularly taking green water over the main deck and hatch covers.

The master arrived on the bridge and instructed the second mate to extinguish the navigation lights and display the ‘not-under-command’ lights.

After being called by the first engineer, the chief engineer got dressed and ran to the engine room. When he arrived he could smell paint fumes and, as the vessel rolled to starboard, he could see the water in the steering flat flowing into the generator flat. The chief engineer looked from the generator flat into the steering flat and saw water running ‘full flow’ through the two bulkhead ports from the rope locker into the steering flat, on the starboard roll. Rags, a mop, and a 25-litre paint drum, which had emptied itself, had been washed from the adjoining store and were floating around the steering flat. The chief engineer noticed that the ‘fault’ lights were illuminated on the starter panels for the two steering motors, and that the steering alarm was ringing. He cancelled the alarm, and told the first engineer to call out the other engineers. The 12–4 IR had already started to pump out the steering flat using the portable bilge pump.

The chief engineer rang the master at this time to say that they had lost both steering motors and that the steering flat was

flooding. He indicated that he would report the situation to the master again as soon as he could and rang off.

The master contacted the QCL marine manager and informed him of the situation. AusSAR was also contacted with the master indicating that he did not feel that assistance was required at that point. The time was 0131, EDT.

The remainder of the engineers quickly arrived in the engine room and the chief engineer instructed the first and second engineers to blank the two division bulkhead ports between the steering flat and rope locker. The third engineer was directed to get the port diesel generator ready for operation, as it was midway through a 2000 hr service and consequently not available for immediate use.

The first and second engineers quickly fabricated and fitted blanking pieces to the two ports while the chief engineer used the bilge/ballast pump to pump out the generator flat and then attempted to pump out the steering flat. His attempts were soon frustrated by a floating rag, which was sucked up the bilge suction line from the steering flat.

At this time the main engine was still running on heavy fuel with the shaft generator connected to the switchboard supplying the ship's electrical power. The starboard diesel generator was set as first 'stand-by'. Once the third engineer had fitted an oil filter and filled the sump with oil, the port diesel generator was ready for service and was placed on second 'stand-by'.

At about 0230 the chief engineer decided to connect the two diesel generators to the switchboard instead of the main engine shaft

generator, as the main engine's governor characteristics were not as good with varying load. There were ongoing problems pumping the water from the steering flat with the suction of the portable bilge pump regularly becoming blocked by floating debris. At this point, the chief engineer went to the bridge to update the master and request more assistance.

The rest of the IR's were called and, after arriving in the engine room, were instructed by the chief engineer to keep the portable bilge pump going and get the steering flat dry. The first and second engineers were instructed to start removing the starboard steering motor to the workshop. The chief and third engineers were concentrating on clearing a rag from the steering flat bilge suction line.

The ship continued to roll heavily to port.

The first and second engineers eventually succeeded in dismounting the starboard steering motor from its pump and manhandling the heavy motor to the workshop. This was achieved with the vessel rolling heavily and water, paint, and other debris running around and over the motor as the engineers worked on it. The motor was quickly stripped and the motor's windings found to be damaged beyond repair.

The first and second engineers then dismounted and stripped the port steering motor to find that the windings of this motor were also damaged. As there were no spare steering motors on board, the chief engineer directed the first engineer to look for any motor in the engine room, which may be used as a replacement. The shaft size and mounting flange pitch circle diameter were the critical criteria. By this time the water had been pumped out of the steering flat and the IR's then worked on

securing a tarpaulin over the rope locker hatch.

The main engine was stopped at 0400.

At about this time the first engineer reported back to the chief engineer that the main engine stand-by jacket water pump motor looked as though it might fit although it was not rated at the same power as the original steering motors. This motor was subsequently removed; the shaft size and mounting flange were compared and found to be the same as the original steering motors, whereupon work commenced fitting the motor to the starboard steering pump.

At 0630 the port diesel generator tripped off the switchboard. The generator was found to be running slowly. The chief engineer directed the third engineer to find the problem and get the generator back on line. After a closer inspection, the third engineer found salt water (tested by taste) in the generator's fuel. The diesel service tank drain was opened and a considerable quantity of water was found in the tank. The chief, third engineer and two IR's started to drain the service tank.

The chief engineer was concerned at this stage that the ship could blackout. The starboard diesel generator was now the only generator supplying the ship's power and was also drawing fuel from the contaminated service tank.

The crew continued to drain the diesel service tank, eventually draining an estimated 2000 litres of seawater. The heavy fuel service tank was also checked for water and drained of approximately 200 litres. The chief engineer did not know where the water was coming from but assumed that it was probably coming from the service tank air

vents (breathers) on the starboard side of the main deck. He had never seen water in these tanks during his time on the vessel. He thought at this time that the breathers might have sheared off at deck level.

Once the water had been drained from the service tank and its fuel lines, the port diesel generator was successfully restarted and connected to the switchboard.

The first and second engineers reported to the chief engineer at about this time to say that they had wired up the replacement steering motor and they were ready to try it. They had checked the motor's direction of rotation, as the steering pumps rotate only one way.

The steering gear was then tested both on emergency steering and on 'hand' from the bridge and found to be operating satisfactorily. The main engine was restarted and clutched in and, at 0852, *Warden Point* resumed the passage.

Warden Point had drifted approximately 11 miles³ in a northeasterly direction in the 7 hours, 47 minutes while not-under-command.

Once making way, it was apparent that *Warden Point* had acquired a pronounced port list of 2–3 degrees. The vessel also appeared to be trimmed by the head and was taking more water over the forecastle. The chief engineer informed the master that the replacement steering motor was slightly under-rated and was concerned that the motor may overload. They agreed to limit the helm orders to a maximum of 15° to port and starboard. The autopilot had also malfunctioned and so the ship was manually steered from the bridge.

³ Miles referred as Nautical miles = 1 852 metres.

The master initially decided to head for Newcastle, which was the nearest port of refuge at only 60 miles away. AusSAR was notified of the vessel's status and new destination port. The master contacted the QCL marine manager and told him that they were under way and heading for Newcastle. The marine manager then spoke to a shipping agent in Newcastle who explained that the conditions existing at the harbour entrance were very bad. The agent felt that it would be difficult for the Newcastle tugs to leave the harbour to assist *Warden Point* if the vessel had problems outside the entrance.

With the steering operating on only one under-rated motor, the marine manager had real concerns for the safety of the vessel if an attempt was made to enter Newcastle harbour. The master and marine manager conferred and the decision was made to head to Newcastle, anchor, and wait for the weather to improve.

After this conversation, the marine manager had further discussions with the agent in Newcastle who indicated that the swell was increasing. The QCL shipping agent in Port Kembla was contacted and this port was confirmed as an option. The marine manager spoke again with the master regarding the destination port. They talked about heading for Port Kembla with Sydney as an intermediate option and the marine manager said that he would ensure tug assistance was available en route if required.

At 1215, the master informed the chief engineer that he had conferred with the marine manager and the decision had been made to divert the vessel to Port Kembla. The chief engineer rang the QCL marine superintendent expressing his concerns about the steering motor being under-rated, the 2–3 degree list, and the water in the fuel

tanks. (Later in the day it was apparent the breathers had not been damaged and there was no further water ingress into the service tanks).

The marine superintendent transferred the chief engineer's call to the marine manager. The chief engineer again expressed his concerns and when he suggested that they had had a cargo shift to cause the list, the marine manager expressed doubt. The marine manager indicated the last time the ship took a list the sounding pipes for the port high wing tanks had been sheared off in heavy weather causing these tanks to fill. The marine manager then instructed the chief engineer to get the mate to 'strip' the water out of the port high wing tanks.

The mate reported back a short time later to indicate that the port high wing tanks were already empty. The marine manager was informed that the tanks were dry and that there must have been a cargo shift, causing the list. The marine manager asked if it was possible for the cargo gear to be used to level the cargo. The master replied that he did not want to send anyone out to the cargo control room located midships on the main deck in the poor conditions. The master also indicated to the marine manager that he was quite comfortable with the vessel's stability. At this time the marine manager informed the chief engineer, via the master, that any further contact with the QCL office should be through the master only.

The vessel continued the passage to Port Kembla.

At 1526 on 10 November, the Newcastle duty pilot informed the master of *Warden Point* that the port was closed due to the heavy weather. The master informed AusSAR of his intention to divert to Port Kembla at this time.

At 1750 water was again found to be leaking into the rope locker. On further inspection it was found that the tarpaulin covering the hatch had been washed loose. The tarpaulin was re-lashed, the leak stopped, and the locker pumped dry.

At 1800 the jury-rigged starboard steering motor stopped. The bridge rang down to the engine room to say that they had lost steering again. Investigation revealed that one fuse had blown on the three phase supply to the motor. The fuse was replaced and the motor restarted. Control was passed back to the bridge. Shortly after the steering was restored, the autopilot was re-engaged and found to be working satisfactorily.

Gale force southwesterly winds continued throughout the night of 10 November.

Warden Point continued to experience rough to very rough seas and heavy swells with water being taken over the forecastle and poop. The steering gear flat and rope locker were monitored continuously throughout the night. During the night the list increased from 2–3 degrees to over 5 degrees by daylight.

At 1000 on 11 November *Warden Point* finally arrived at the Port Kembla pilot boarding ground. A pilot was taken on board and two tugs attended the vessel for the passage to the berth. Initially the vessel was put alongside no.6 outer berth, port side alongside, arriving at 1100. After coming alongside, the vessel started to damage the wharf's timber facings due to the port list and ground swell in the outer harbour. The owner of the wharf attended the vessel and rang the harbour master to say that '*Warden Point* was in poor shape and, due to the list, was damaging his wharf'. The vessel was ballasted upright but was still experiencing the effects of the swell. As a consequence, the harbour master had the ship moved to

the inner harbour no.1 coal loader berth, where it arrived at 1236.

Contractors attended the vessel to modify the rope locker hatch lid. Six new screw-down dogs were fitted. The crew and cargo insurance assessors inspected the cargo holds after arrival. The cargo in no.1 hold was found to have shifted both to port and forward. The cargo in this hold was subsequently re-trimmed using the cargo discharge equipment. The fly ash in no.2 hold was found to have shifted and submerged the cargo discharge equipment. The discharge equipment could not be lifted clear to re-trim the cargo in this hold as a result of the weight of the fly ash. There was also found to be a small amount of water ingress into the holds through leaks in the hatch covers.

Two new steering motors arrived at 1930 on 11 November and were fitted and tested by the ship's engineers, these repairs being completed by 2230. An Australian Maritime Safety Authority (AMSA) surveyor attended the vessel at 0700 on 12 November and, after inspecting the steering gear and repairs to the rope locker hatch, cleared the vessel for sea.

Warden Point left the berth at 0808 on 12 November resuming the passage to Melbourne. The remainder of the voyage was completed without incident. On arrival in Melbourne a 'sucker' truck was used to pump out the fly ash covering the conveyors in no.2 cargo hold allowing the cargo discharge gear to be lifted clear. The discharge was then completed in the usual fashion.

Warden Point's approximate track for 9, 10, 11 November is shown in figure 5. The events and causal factors chart for the incident is reproduced in figure 8.

FIGURE 6:
Rope locker hatch after new dogs were fitted



Comment and analysis

Flooding of the steering flat

The flooding of *Warden Point's* steering flat was the result of the leaking hatch lid on the adjoining rope locker. Once sufficient seawater had entered the rope locker, it overflowed through the ports in the division bulkhead into the steering flat.

The initial leak through the rope locker hatch was caused by a combination of the seawater running over and around the hatch and an ineffective seal between the hatch lid and the coaming. The three dogs on the hatch lid exerted insufficient clamping pressure to maintain a positive seal between the hatch lid and the hatch coaming.

There had been previous voyages when *Warden Point* had encountered large seas and the lower poop deck had been partially submerged when the vessel had pitched heavily. The rope locker hatch lid had leaked on some of these voyages in the past. The crew stated on this occasion that the combination of *Warden Point's* course, speed, loaded draught and the state and prevailing direction of the sea, was causing the lower poop deck to be submerged under 2–3 m of 'green water' at times.

Data was obtained from the Bureau of Meteorology regarding the NSW coastal weather forecasts and observations, in addition to wave-rider buoy records (peak and significant wave heights) from the ports of Newcastle, Sydney and Port Kembla. This data shows that the weather experienced by *Warden Point* at its various positions on

9,10,11 November 1999 was severe and the recorded observations in the deck logbook were accurate. There is no reason to doubt the crew's statement that there was 2–3 m of seawater over the lower poop deck during this time.

Rope locker hatch

Warden Point was built to Lloyd's Register survey in compliance with the classification Society's rules applicable at the time of build in 1978. The construction of the rope locker hatch was in accordance with these rules. Quoting from Lloyd's Registers Published Rules and Regulations, Part 3, Chapter 11, Section 6.1, 'Small hatchways on exposed decks':

- 6.1.6 Hatch covers are to be of steel, weathertight and generally hinged. The means of securing are to be such that weathertightness can be maintained in any sea condition.

The Lloyd's definition of weathertight:

- 6.3.1 A closing appliance is considered to be weathertight if it is designed to prevent the passage of water into the ship in any sea conditions.

The lever and wedge dogs fitted to the rope locker hatch lid, when new, would have provided the weathertight seal required by the class rules. Over the course of the vessel's lifetime the dogs, wedges and seal had worn to the point where a satisfactory 'weathertight' seal was not maintained.

The crew were aware that the hatch closures were worn and, according to their statements, the hatch sealing had been mentioned for inclusion in the previous dry-dock specification. The hatch lid had subsequently been fitted with new sealing rubber during the docking but the worn hatch lid dogs and coaming wedges had not been refurbished.

It was the afternoon of 9 November, two days after sailing, that the crew discovered that the hatch lid was leaking. Up to this time the hatch seal had been effective. The effect of the sea over the lower poop deck in the preceding 12 hours of rough weather had probably ‘worked’ the hatch lid to the point where the soft new sealing rubber could not provide enough pressure to effectively hold the hatch dogs tight on their wedges. After the additional sealing rubber had been fitted, the crew indicated that they felt confident that the hatch lid was sufficiently tight and thus took no other action to seal the hatch.

The action taken by the crew in resealing the hatch lid in the adverse conditions on the afternoon of the 9th was perilous. The chief integrated rating and the second mate both sustained minor injuries when the lower poop deck was swamped by a wave. Neither man was wearing a safety harness at the time.

After resealing the rope locker hatch, a regular watch on the rope locker and steering flat was maintained to ensure that there was no further excessive water ingress. The 4–8 IR conducted the watertight integrity rounds at approximately 1800, which included a check of the rope locker hatch. The first engineer conducted engine room inspections at 1930 and 2200 that evening. He pumped 100–200 mm of water out of the rope locker during his final rounds. At this point, the first engineer attributed the build up of water to small leaks from the hatch lid over the preceding 6 hours or so. Excessive leakage through the rope locker hatch lid would have been obvious to the first engineer as he pumped water from the rope locker. Consequently, at this time the rope locker hatch was probably reasonably weathertight.

When the crew placed the tarpaulin over the rope locker hatch, after the steering flat had been flooded, they noted that the three hatch dogs were slack but still engaged on the coaming wedges. Under the circumstances the most likely conclusion is that, in the 2 hours between 2230 and 0030, the rope locker hatch lid dogs were loosened by the action of the waves over the lower poop deck. Once the dogs were slack the rope locker would have taken water with every wave over the poop deck.

After arriving in Port Kembla, contractors fitted the rope locker hatch with six butterfly dogs (fig. 6). This type of dog provides very positive screw down pressure and, for a hatch that does not have to be opened from the inside, offers far more security than the original lever and wedge dogs.

Division bulkhead

The division bulkhead between the rope locker and steering flat had a number of open penetrations, the lower two being the ports which allowed the passage of water from the rope locker to the steering flat.

Warden Point’s keel was laid in May 1977. At the time of building, vessels had to be constructed to meet the requirements of the 1960 Safety of Life at Sea Convention (SOLAS).

Lloyd’s Register submitted:

There are no SOLAS requirements in respect of bulkhead divisions between rope store and steering gear flat for vessels of less than 4000grt where the keel was laid before 1 May 1980. A0 bulkheads became mandatory after this date for all ships above 500grt (78 Protocol of SOLAS 74).

An ‘A class’ bulkhead is steel without open penetrations.

Bilge pumping

Warden Point's steering flat is fitted with a fixed bilge suction and drainage well. The rope locker is not fitted with any fixed drainage arrangements and is dependent on the rigging of a portable bilge pump with its suction line run through one of the ports in the division bulkhead. When asked to clarify their requirements for the drainage of such spaces Lloyd's Register submitted:

All compartments are required to be provided with drainage arrangements. In this case it would appear in the absence of watertight bulkheads, drainage of the rope store was effected through the bilge well in the steering flat.

Clearly the drainage arrangements for the rope locker were inappropriate as the two ports are the lowest penetrations in the division bulkhead and are located approximately 500 mm above the deck. This means the rope locker must fill to this level before the water is able to run through and be pumped out of the steering flat bilge well. On an even keel the volume of sea water retained in the rope locker would be approximately 7m³.

Bilge alarms

There were no bilge alarms fitted in the steering flat or rope locker to warn of water ingress. Had there been a bilge alarm fitted in either of these spaces, early detection of the leaking rope locker hatch would have allowed the crew to take action to prevent the steering motors from becoming submerged and burning out. *Warden Point* has a UMS notation to its class. As the machinery spaces may be left unattended, Lloyd's Register have specific requirements regarding the monitoring of bilge levels in these spaces to protect against flooding.

With regard to *Warden Point's* steering flat and rope locker, Lloyd's submitted that there

was no requirement to fit bilge alarms to either space under their rules or the applicable SOLAS convention at the time the ship was constructed. Given the obvious risk of flooding from both the steering flat escape hatch and the rope locker hatch, it would have been prudent to fit a bilge alarm in either or both spaces at the time of building, or subsequently, although not strictly required by the rules.

Failure of the steering motors

Warden Point's two steering pumps are mounted on low angle iron sections welded directly to the deck in the steering flat. Each steering pump runs fully submerged inside a small integral oil tank with the electric motor and solenoid control valves mounted on the outside of the tank. The electric motor is mounted horizontally and the bottom of the motor casing is approximately 100 mm above the deck level. The low mounting of the steering pumps means that the motors will be wet with a relatively small quantity of water in the steering flat.

Lloyd's rules stipulate a minimum ingress protection (IP) rating of IP22 for electric motors fitted in the steering flat. An IP22 rating means that the motor must be protected against ingress from medium sized foreign bodies >12.5 mm diameter and water dripping at an angle up to 15° from the vertical.

The steering pump electric motors in use on *Warden Point* are of totally enclosed design with an ingress protection rating of IP55. The IP55 rating means that they are protected from dust and water jets from any angle, as such, they exceeded the Lloyd's requirement. However, this type of motor is not designed to be run submerged. Once sufficient seawater had entered the steering flat, it could have penetrated the motor casings via small leaks around the terminal

boxes, cable glands or motor end covers. Once inside the motor casings, the seawater would have had sufficient conductivity to cause a short circuit in the motor windings resulting in the type of ‘burn out’ damage found by the engineers.

Emergency repairs

After stripping the two steering gear motors, and finding both the motor windings damaged beyond repair, the engineers found themselves with few choices. With no spare steering motor on the vessel, their only real option was to find a compatible motor amongst those fitted to other systems. There was no other feasible method by which the engineers could have restored any steering given the limited resources they had available.

In this instance they were fortunate enough to find that the main engine stand-by jacket water circulating pump motor was compatible. This motor has a slightly lower rating at 7.9kW/14.3 amps, when compared to 8.2kW/15.0 amps of the original motors. Nevertheless it was adequate to operate the steering hydraulics at almost 100 percent capacity. When this motor was installed, it operated the system satisfactorily.

Warden Point has an ‘unbalanced’ single pintle rudder. With this type of rudder the hydrodynamic forces on the rudder increase as the angle increases. The steering gear hydraulic system pressure acts to balance the hydrodynamic forces and thus must increase with increasing rudder angles. The chief engineer felt that the motor being lower rated was a cause for concern and prudently recommended that the steering be limited to 15° of helm. By limiting the rudder angle, the chief engineer also limited the maximum system operating pressure and consequently the load on the steering motor.

On the afternoon of 10 November one of the fuses failed on the 3-phase supply to the replacement electric motor which resulted in another steering failure. As the replacement fuse did not fail as well, the first fuse failure may have been caused by damage sustained when the original steering motor’s windings short-circuited.

Water in the fuel

Compounding the failure of the steering motors was the contamination of the fuel by sea water. The diesel and heavy fuel service tank breathers were inspected after *Warden Point* had arrived in Port Kembla. The service tank breathers are fitted beside each other adjacent to the bulwark on the starboard side, after end, of the main deck (fig. 7). The breathers consist of steel standpipes, approximately 800 mm high,

FIGURE 7:
Fuel service tank breathers



mounted above the deck level with the tank vent at the top. The vents consist of a cylindrical air inlet/outlet, fitted with gauze, which is enclosed by a screw down fabricated steel cap with an integral 'tortuous path' to prevent water ingress. The diesel tank breather was found to be in a particularly poor state of repair with the vent cap's screw-down thread stripped and the fabricated tortuous path galleries badly corroded. The heavy fuel breather was in a better state of repair. Both tank breathers had not been maintained for a considerable period of time.

In view of the condition of the service tank breathers, there is little doubt that they were the point of entry for the seawater drained from the tanks. For such a large amount of water to be taken, particularly into the diesel service tank, the breathers must have spent a considerable time submerged. This verifies the observations of the crew concerning the sea conditions they experienced at the time of the incident.

Load Line Convention

The International Convention on Load Lines, 1966:

...established uniform principles and rules with respect to the limits to which ships on international voyages may be loaded having regard to the need for safeguarding life and property at sea;

The regulations for determining load lines contain specific construction requirements with respect to maintaining a vessel's watertight integrity. Included in these requirements are rules for the construction of hatchways on the freeboard deck, such as the rope locker hatch, and air pipes or tank breathers.

Warden Point has a current International Load Line Certificate (1966). In order to

maintain the certificate, the vessel must undergo periodic surveys (every 5 years) to ensure that the structure, equipment, arrangements, material and scantlings fully comply with the requirements of the present convention. *Warden Point's* last load line survey was conducted on 30 January 1999 during the dry-docking in Nantong. The condition of the rope locker hatch sealing arrangements and the fuel tank breather should have been scrutinised by the Lloyd's surveyor during this survey. The worn hatch dogs and the wasted diesel fuel tank breather cast some doubt on the thoroughness of this survey.

Shift of cargo

On arrival in Port Kembla on 11 November, both of *Warden Point's* cargo holds were inspected via two windows in the cargo control room. The cargo in each hold was found to have shifted. In no.1 hold the cargo had moved to port and forward and in the no.2 hold the cargo had moved to fill the space between the upper and lower scrapers of the longitudinal and transverse conveyors. The cargo in no.1 hold was subsequently re-trimmed, however the conveyors could not be lifted in no.2 hold due to the weight of the fly ash covering the scrapers.

After leaving Gladstone the fly ash had time, with the good weather experienced on November 7 and 8, to deaerate and settle. Once this had occurred the cargo would have formed a stable mass. When *Warden Point* started to pitch into the deteriorating weather on 9 November, the fly ash cargo was subjected to considerable disturbing forces. At this time, it is possible that the top of the cargo was sufficiently disturbed to entrain air and become significantly mobile. With the loss of steering and the time spent rolling broadside to the heavy sea, the fly ash moved to port. The shift of cargo could

have occurred slowly, over a period of time, or in one or more discrete ‘events’ when the ship took large rolls to port.

The master stated that he considered that the vessel was ‘sitting quite well’ most of the time that they were ‘not-under-command’. Once underway again he felt that, if they had lost the steering again with the deteriorating weather, they would have had to try to keep the vessel’s head to the sea using the bow thruster.

Once on passage again, and pitching into the heavy sea, the list increased through the night of 10 November from 2–3° to over 5° by daylight. With regard to the increase in list the master submitted:

I would like to make the point that Warden Points bunkers were in No.3 starboard double bottom tank. As fuel is used the ship develops a port list. This happens every voyage and is corrected by ballast. On the morning of the 11th I instructed the First Mate to ballast a starboard ballast tank with an amount I estimated to replace the oil consumed.

Warden Point consumes around 12 tonnes of heavy fuel per day. During the night of 10 November, there would have been approximately 6 tonnes of fuel drawn from the no.3 starboard double bottom tank. Thus the fuel consumed would have increased the port list during the night by a calculated 0.15°. For the list to increase the reported 2–3° to port during the night, there must have been continued cargo movement in addition to the fuel consumed.

In both holds the main longitudinal conveyor is located on the port side. A smaller longitudinal conveyor is located at the forward end of no.1 hold where the cargo hold is stepped in as the shell plate flares towards the bow. The longitudinal conveyors and the two transverse conveyors are lowered onto the surface of the cargo after loading is complete. General shipboard

practice is to stow the transverse conveyors, and the forward longitudinal conveyor in no.1 hold, on the cargo at the centre of the holds. Given the size and location of the conveyors, they would have had some stabilising effect on the surface of the cargo. The forward longitudinal conveyor in no.1 hold, particularly, would have acted like a partial ‘shifting board’ and helped prevent lateral movement of the cargo in the forward section of no.1 hold.

Past events

A number of long-serving crew members on *Warden Point* related to the investigation instances of fly ash cargoes moving in the past.

In a submission, Cementco Shipping provided a statement from an employee who had served as mate on *Warden Point* 7 years earlier when a fly ash cargo had shifted. He indicated that a wedge of cargo on the port side of no.2 hold had collapsed in heavy weather and caused a list of approximately 3 degrees to starboard. Initially there was some concern on board and the master, at the time, had mustered the crew in lifejackets. The mate and two other crew members were sent to the cargo control room where they discovered the cause of the list which was subsequently corrected by ballasting. The practice on board at the time was to load cargo favoring the starboard side, to offset the weight of the bucket elevator located on the port side. This loading practice was discontinued after this incident 7 years ago.

In submission, AMSA stated with regard to this incident:

We can confirm that at least one other incident involving a shift of Fly Ash has occurred. *Warden Point* developed a starboard list of about five degrees on 30 March 1993 when it encountered heavy weather during a voyage from Gladstone to Melbourne.

The investigation of the incident concluded that a wedge of cargo was left on the port side during loading. The master was of the opinion that the ship had developed a port list during loading and this had allowed the cargo to flow to form the wedge. To compensate for this, the starboard wing tank was ballasted. During heavy weather the wedge shifted and levelled the cargo in the hatch. The additional ballast in the wing tanks caused the ship to list. This was corrected by de-ballasting the wing tank.

The measures Queensland Cement were asked to take included a review of their loading procedures to prevent recurrence of the incident, to establish the angle of repose of unaerated Fly Ash and to advise AMSA of future shipments of Fly Ash.

Melbourne University subsequently carried out tests to determine the angle of repose of fly ash with differing moisture contents. These tests indicated that the angle of repose is greater than 45°. The result was qualified by questioning the relevance of a static test to a dynamic situation.

Another type of incident occurred, on voyage 544. The sounding pipes to the port high wing tanks were sheared off in heavy weather when *Warden Point* was heading south with fly ash. The vessel took a list due to water entering the ballast tanks and some cargo was damaged as a result of seawater entering the holds via leaking hatch covers. The vessel was diverted to Brisbane where the cargo was inspected and water ingress through the broken sounding pipes was discovered as being the cause of the list. The marine manager's assumption, on the morning of the 10 November, that the cause of the list was seawater in the port high wing tanks, can probably be attributed to this recent experience on voyage 544.

On 21 April 2001, just prior to publishing this report *Warden Point* experienced another shift of a fly ash cargo. The ship was southbound for Melbourne north east of

Eden on the New South Wales south coast when it was rolled heavily to starboard by two large waves in succession. A portion of cargo moved in both holds which caused the vessel to list 10° to starboard. The ship was subsequently hove to and the crew operated the cargo discharge equipment to re-trim the cargo and bring the ship upright. The crew estimated that 184 tonnes of cargo had moved to cause the list.

Stability

Warden Point is equipped with a loading computer, stability software and an approved stability booklet. The maximum shear forces and bending moments were calculated for the various stages of the fly ash cargo loading for voyage 554. Draughts were taken, before and after the cargo loading, and the loaded quantity calculated by the mate.

However, no stability calculations were performed to ascertain the vessel's final loaded condition and no stability calculations were subsequently performed when the steering gear and rope locker compartments became flooded, or when the vessel developed the list to port.

There were some problems using the loading computer during this period. The stability software on the computer had not been updated to reflect some changes made to the double bottom tanks in the Nantong drydocking. The stability book, however, was current and contained all of the required information. The stability book contained a worked example of a loaded condition, which was very similar to *Warden Point's* condition departing Gladstone. It appears that the assumption was made that this example was probably 'close enough to' *Warden Point's* actual condition after the completion of loading and, in any case, that there was an excess of stability.

The cargo manifest supplied to the vessel contained no information on the stowage factor of the Gladstone power station fly ash. Even if an initial stability calculation had been performed, it would have been impossible to ascertain the vessel's centre of gravity accurately with the stowage factor of the cargo unknown. On *Warden Point* it appears to have been the practice in the past to assume that the stowage factor of the fly ash is the same as that for the regular powdered cement cargoes.

The stowage factor for the fly ash loaded at Gladstone should have been accurately ascertained and provided to the master prior to the cargo being loaded.

As part of the investigation, *Warden Point*'s initial stability was calculated by a naval architect. The stability was also calculated for the condition of the steering compartment being flooded. The initial stability calculations showed that *Warden Point* exceeded all of the minimum stability criteria including a GM (metacentric height) of 0.99 m and a maximum GZ (righting lever) of 0.80 m at 50°. The calculations performed, assuming the steering compartment flooded, showed a slightly reduced metacentric height of 0.97 m when the free-surface effect of this compartment was taken into account.

When considering the shift of the cargo and the consequent reduction of stability, the most likely scenario is that the list to port was developed in a discrete event or events, ie. some fly ash moved during a heavy roll/or rolls, and then stabilised in a new position. This type of shift results in an effective raising of the vessel's centre of gravity and a translation to port. Stability calculations were performed by the naval architect based on this assumption ie. that a 'wedge' of cargo moved to port and remained there, stable. His calculations

showed that a shift of approximately 92 tonnes of cargo was required to produce the 5° list to port. The movement of cargo caused a slight rise in the position of the vertical centre of gravity and thus a slight reduction in the metacentric height. The net result was a small loss of stability for the relatively small angles of list involved. With the ship's excess of initial stability, the 5° list to port did not represent a large risk when considered in isolation.

If a significant amount of the fly ash had remained fluid and had been flowing freely with the movement of the ship ie. acting as a free-surface, *Warden Point*'s motion, when making way in the heavy seas, would have been markedly affected. The ship's roll and pitch amplitudes and periods would have been substantially larger and longer than usual. Such a change in the ship's movement would have been obvious to the crew. No record or account of such movements were given.

Without knowing the exact mass, position and the way in which the cargo moved, it is not possible to make an accurate quantitative assessment of the effect of the cargo shift on the vessel's stability.

Passage to Port Kembla

The master's initial decision to head to Newcastle at 0852 on 10 November after *Warden Point* had regained steerage was logical and correct. The vessel had a port list of 2–3°, was being hand-steered after the automatic pilot had failed, there were concerns about the poor weather conditions, steering was by a jury-rigged steering motor and there was water contamination of the fuel service tanks. At a position approximately 60 miles away, the time of arrival at Newcastle would have been around 1800 that evening.

The Newcastle harbour master indicated to the investigation that the port had been closed to inward traffic between 1230 on the 10th and 0600 on the 12th of November, with the swell height averaging 8.0 m at the entrance. The maximum swell height during this period was recorded as 12.5 m.

As the morning progressed it became apparent that *Warden Point* was not going to be able to enter the port of Newcastle. The marine manager conferred with the master to consider alternatives. At this point, the master made the decision to head towards Newcastle and anchor outside the port. However after further consideration, and discussions with shipping agents in Newcastle and Port Kembla, the marine manager again conferred with the master and the decision was made to alter course for Port Kembla.

The anchorage outside the port of Newcastle offered *Warden Point* no protection from the sea conditions prevailing on 10 November. The Newcastle harbour master also indicated to the investigation that conditions in the anchorage were difficult during the period from 10–12 November and that many vessels had weighed anchor to ride out the weather clear of the coast. *Warden Point's* master felt, quite rightly, that it would have been perilous for the crew to go onto the forecastle to anchor the vessel in the prevailing conditions. Given the weather conditions and the poor holding ground characteristics of the anchorage off Newcastle the decision to divert to an another port was the best alternative under the circumstances.

The master and marine manager discussed the alternative ports and apparently the master made the decision to head for Port Kembla with the Sydney ports as intermediate options. The statements to the investigation regarding this decision are

somewhat contradictory. While the master and marine manager maintain that the decision was the master's, the chief engineer indicated that the master had told him, around 1215 on 10 November, that the marine manager had directed them to head for Port Kembla. Why Port Jackson at 40 miles, and Port Botany at 30 miles nearer than Port Kembla, were not considered to be better choices is a matter for some conjecture.

In submission the master stated:

Of the three ports, Sydney, Port Botany, and Port Kembla I ruled out Port Botany as it could not be compared to Sydney for facilities or a safe harbour (this has been known since 1788). Sydney was closer but it offered no shelter outside the Heads to embark a pilot or make a tug fast. It would have been difficult and dangerous to have a pilot launch alongside in weather conditions obtaining. The low freeboard and deck rails of the *Warden Point* could have damaged the launch and hurt its crew. Also my own crew would have been exposed to the elements on deck or the forecastle.

Port Kembla was further but had the advantage of offering some shelter from Red Point and the Five Islands whilst taking pilot and making tugs fast.

The marine manager had reassured the master by indicating that he would ensure that there would be tug assistance available if required en route in case the vessel needed to be towed into port. Sydney Ports Corporation supplied evidence to the investigation that they had had no request on 10 November from QCL regarding the availability of a berth or tug assistance for *Warden Point*, if required. Both of the Sydney ports were open with berths and tug assistance available if *Warden Point* had elected to use them. A number of ships did enter the two Sydney ports on 11 November. Three ships entered Port Jackson, and two entered Port Botany, all these vessels safely embarked pilots from launches. Under the

circumstances, with the poor weather conditions, the condition of the vessel, and the concerns about the steering gear, it is difficult to reconcile the master's decision to head to Port Kembla and not Port Jackson some 5–6 hours steaming time closer.

In the event, *Warden Point*'s list increased on the night of 10 November, to be over 5° on arrival in Port Kembla. The crew indicated that the preceding early hours of the morning were particularly concerning with the vessel rolling about the increasing list.

Conclusions

These conclusions identify the different factors contributing to the incident and should not be read as apportioning blame or liability to any particular organisation or individual.

On 9,10, 11 November 1999 *Warden Point* experienced a series of events in which the ship suffered significant damage and which endangered the vessel and crew.

1. The initial failure of *Warden Point*'s steering gear was a result of the steering pump motors failing after contact with seawater.
2. The seawater gained access to the steering gear flat via the two lowest penetrations in the bulkhead between the steering flat and the adjacent rope locker, which had been flooded as a result of its leaking hatch lid.
3. The rope locker hatch lid leaked as a result of seawater over the lower poop deck, and the poor seal between the hatch lid and the hatch coaming. The rope locker hatch lid had not been maintained in a watertight condition in that the worn dogs and wedges were not exerting sufficient clamping pressure to secure the hatch lid given the recent fitment of soft new sealing rubber.
4. The seawater contamination of the fuel service tanks was a result of poorly maintained breather vents and the weight of seawater over the vents in the poor weather conditions.
5. The vessel's initial list to port was a result of the fly ash cargo shifting. The shift of cargo was the direct result of the movement of the vessel when

lying starboard beam-on to the large sea.

Although not contributing factors, it is further considered that:

6. The initial stability conditions for the vessel should have been calculated after completion of loading at Gladstone. Some assessment of the vessel's stability should also have been made after the cargo had shifted.
7. Safety harnesses and lifelines would have minimized the risk of crew members being swept overboard when working on resealing the rope locker hatch while the lower poop deck was being regularly swamped by waves.
8. The absence of a bilge alarm fitted in either the rope locker or steering flat prevented the crew being alerted to the water ingress in sufficient time to avert the failure of the steering motors.
9. The knowledge of the transportation properties of the Gladstone power station fly ash is insufficient; an accurate stowage factor needs to be ascertained and the 'cohesive' categorisation of the cargo reviewed. Adequate measures also need to be prescribed to minimise the risk of cargo shifting in adverse conditions.
10. The decision to divert the vessel to Port Kembla, rather than a closer port of refuge, may have unnecessarily endangered the vessel and crew with the continued movement of the cargo.
11. The efforts of the crew on the days of 9,10, 11 November, in resealing the rope locker hatch, restoring the steering and navigating *Warden Point* safely to port in such adverse conditions, were commendable.

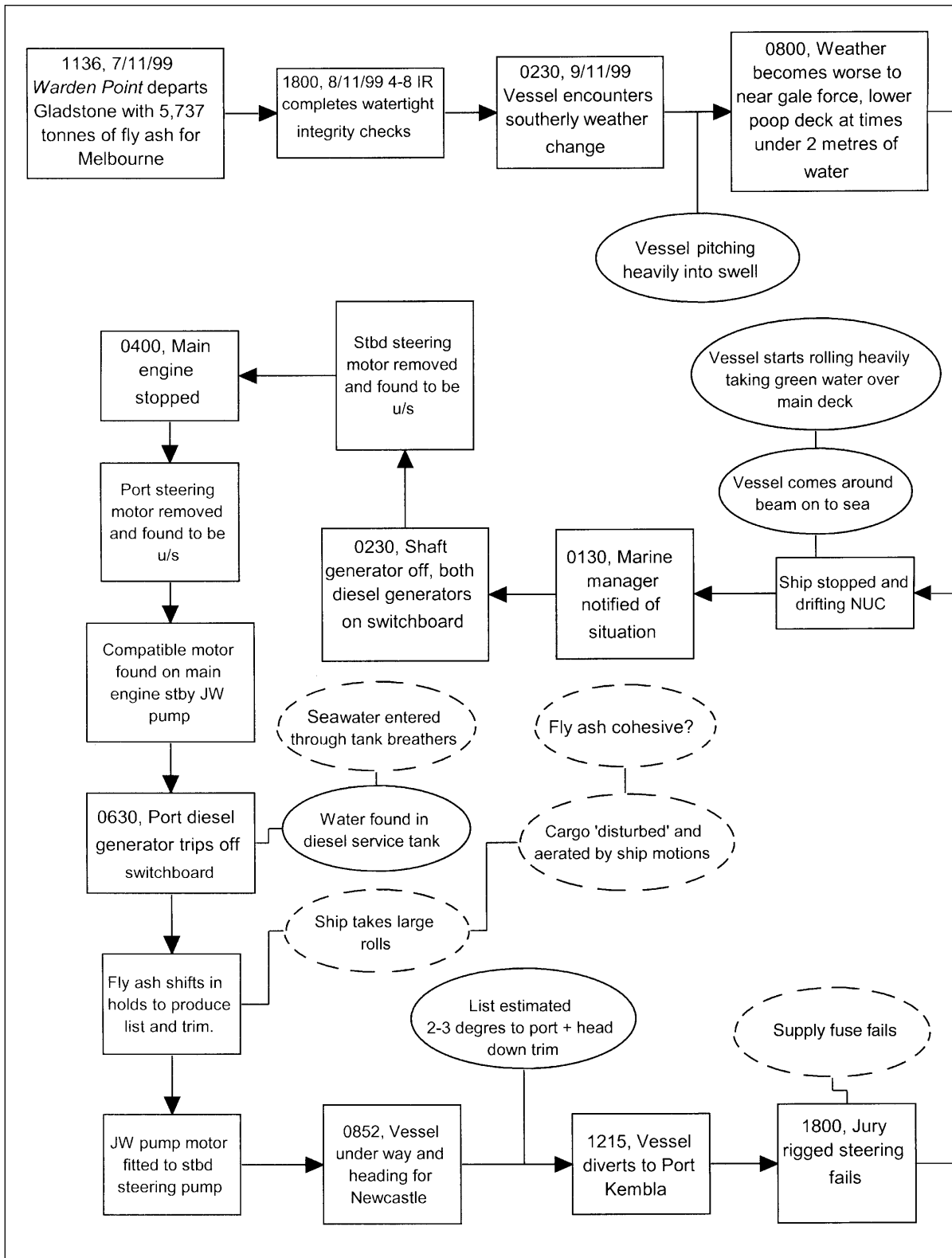
Recommendations

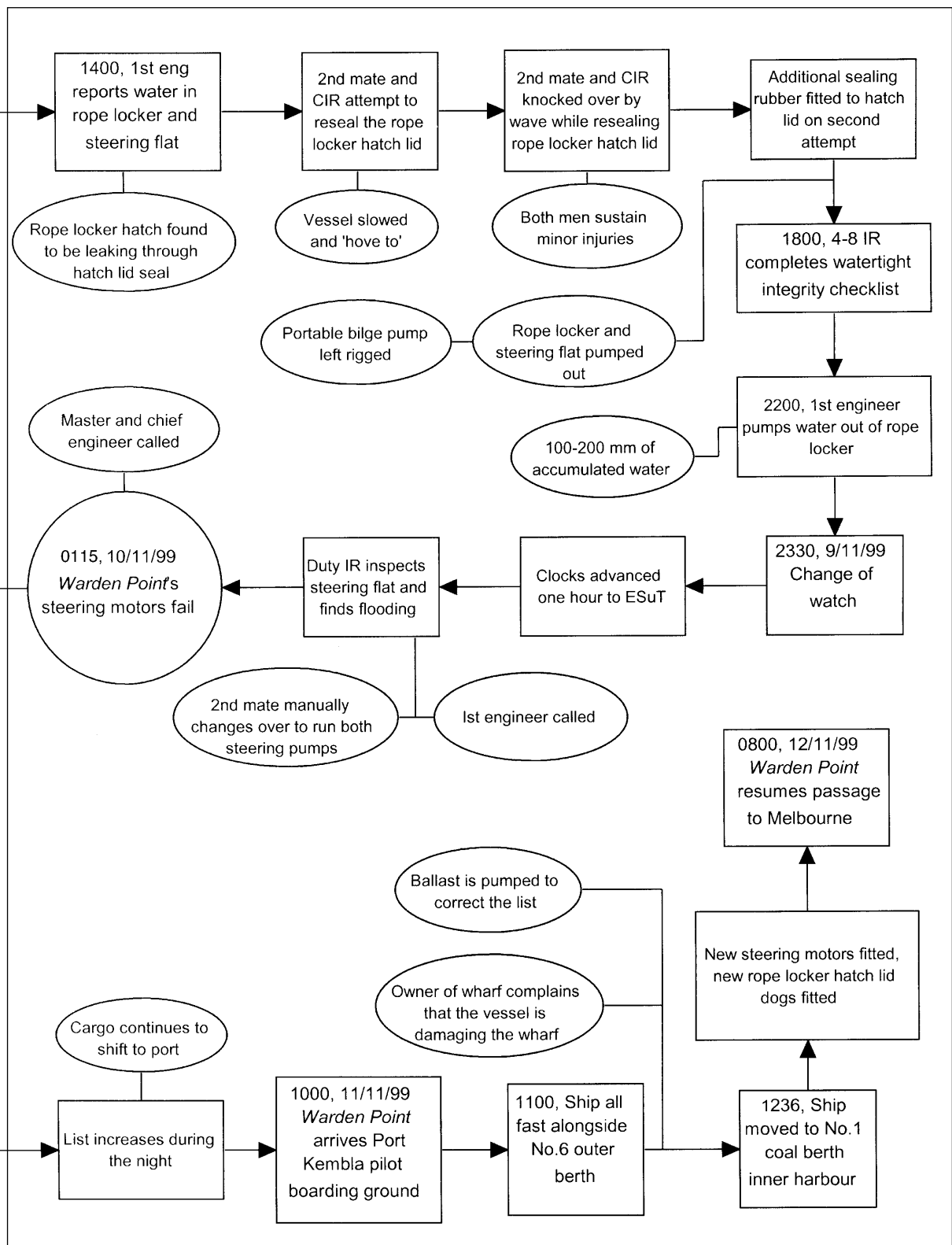
These recommendations are published recognising that corrective action may already have been taken by parties to address the safety issues identified by the investigation.

To the ship operators and the Australian Maritime Safety Authority

Review the physical properties of Gladstone power station fly ash with a view to establishing a safe method of carrying the cargo by sea.

FIGURE 8
Warden Point events and causal factor chart





Submissions

Under sub-regulation 16(3) of the Navigation (Marine Casualty) Regulations, if a report, or part of a report, relates to a person's affairs to a material extent, the Inspector must, if it is reasonable to do so, give that person a copy of the report or the relevant part of the report. Sub-regulation 16(4) provides that such a person may provide written comments or information relating to the report.

The final draft of the report was sent to the following:

The Master, *Warden Point*

The Chief Engineer, *Warden Point*

Marine Manager, Cementco

Lloyd's Register, Brisbane

Australian Maritime Safety Authority

Submissions were received from the Master, the Marine Manager and the Australian Maritime Safety Authority. The text of the draft was amended and portions of the submissions included as appropriate.

Warden Point

Name	<i>Warden Point</i> (formerly Red Sea)
IMO No.	7636822
Flag	Australian
Classification Society	Lloyds Register
Vessel type	Bulk Carrier
Owner	Queensland Cement and Lime Company Ltd.
Year of build	1978
Builder	Gotaverken, Solevesborg, Varu, Sweden
Gross tonnage	3 893.76
Summer deadweight	6 127.7 tonnes
Length overall	105.64 m
Breadth, extreme	14.95 m
Depth	9.00 m
Draught (summer)	6.987 m
Engine	B & W Alpha 120281
Engine power	2 200 kW
Service speed	12 knots
Crew	17 (Australian)

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