Appendix 1

Report on Stability Investigation - FV '*Meridian*'

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1. *Introduction*

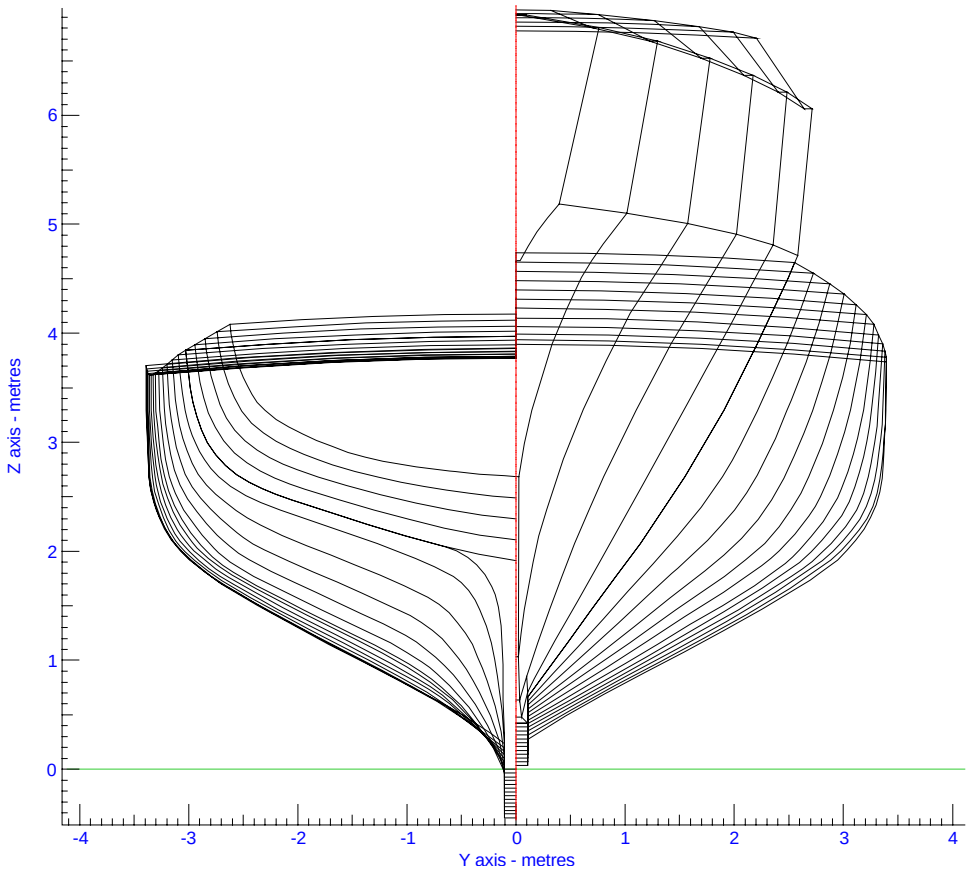
The objective of this report is firstly, to assess the general stability of the fishing vessel 'Meridian' in light of the data in the original stability information booklet (SIB) produced in 1984 and secondly, to assess the stability in a number of possible accident conditions.

Section 1 describes the generation of the computer model from the hull lines plan and other drawings. Section 2 explains the means by which the hull and the compartments were defined for the analysis and Section 3 specifies the vessel's principal dimensions. Section 4 illustrates the relationship between KN and righting lever values and outlines the assumptions made in the computation of this data. Section 5 details the stability and freeboard requirements included in the Fishing Vessels (Safety of 15-24 Metre Vessels) Regulations 2002; all fishing vessels in the range specified must comply with these. Section 6 describes the nine loading conditions in the 1984 stability information booklet (SIB) and compares the data in the booklet with the information computed for this report. In light of this comparison, Section 7 makes an assessment of the 1984 SIB. Section 8 examines the vessel's condition immediately prior to the accident whilst Section 9 considers the accident condition itself. In view of the Meridian's apparently good stability, Section 10 discusses the nature of the capsize. Section 11 is comprised of the report's conclusions and the data in the appendices form the basis for the analysis.

2. *Hull and compartment definition*

The shape of the vessel's hull and its compartments and tanks were defined by measurements taken from the lines plan and other drawings. Half breadth and height dimensions for 10 transverse sections through the hull were recorded on the computer to create a coordinate model of the hull shape. An additional 27 sections were interpolated automatically from the input section data to refine the model – see diagram 1 below. Appendix 4 is comprised of section, plan, profile and isometric views of this hull model.

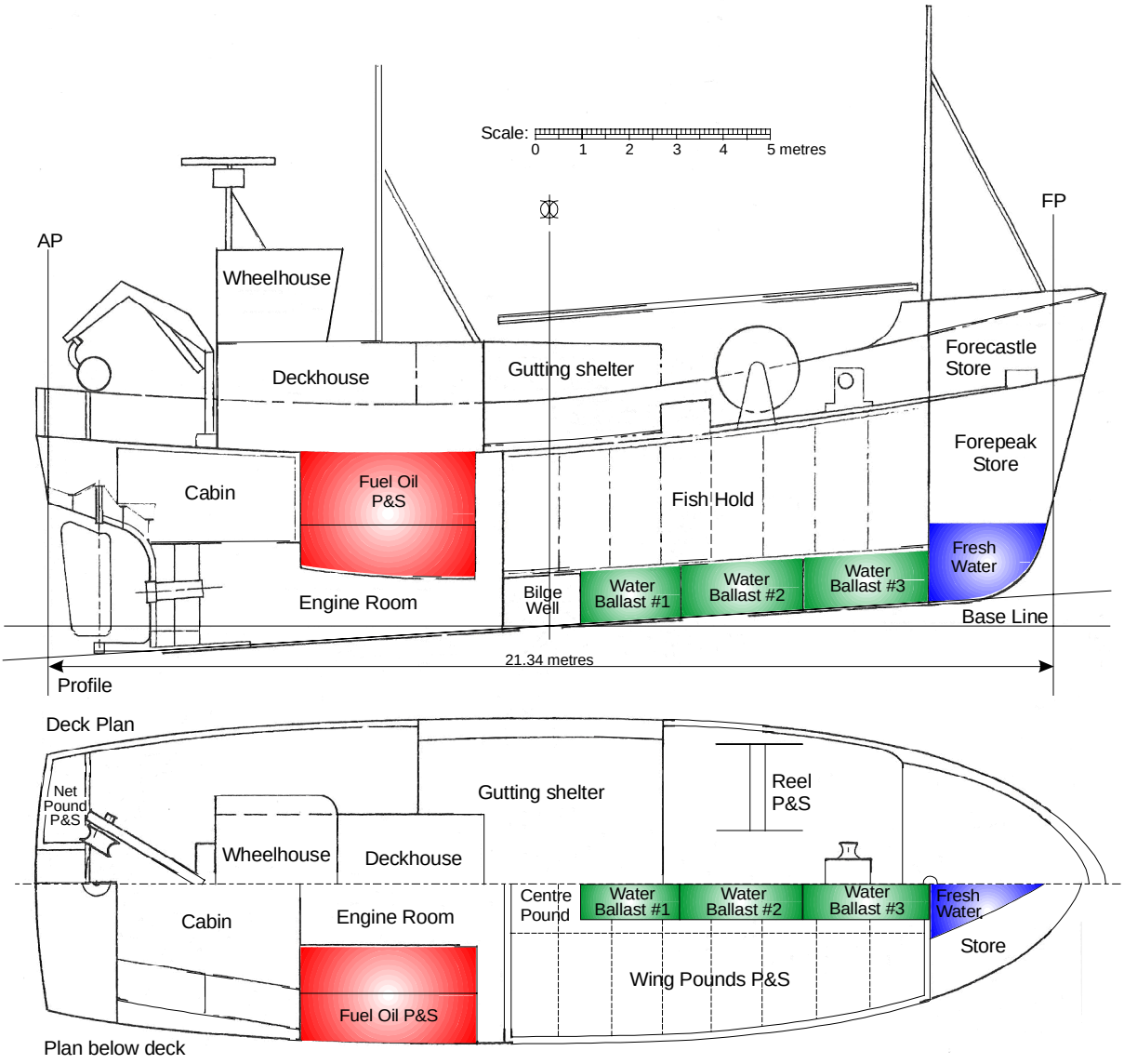
Diagram 1 – Hull sections of fishing vessel 'Meridian'



All

longitudinal dimensions were taken about an Aft Perpendicular (AP) located at the aft end of the datum waterline at its intersection with the transom centreline. The Forward Perpendicular (FP) is located 21.34 metres forward of the AP at the intersection of the forward face of the stem with the datum waterline. All vertical dimensions were taken about a Base Line passing through the the lowest point of the keel at midships on the LBP. The same horizontal and vertical datums were used in the 1984 SIB. These datums are shown on the general arrangement drawing below.

Diagram 2 – General Arrangement of fishing vessel 'Meridian'



The vessel's principal compartments are listed in table 1 below with their frame positions and lengths:

Table 1 – Compartment locations and lengths

No.	*Compartment*	*Frame Nos.*	*Length - metres*
1	Forepeak store	Bow to 36 (WTB)	3.24
2	Forecastle store	Bow to 36 (WTB)	3.72
3	Fishroom	18 (WTB) to 36 (WTB)	9.04
4	Engine room	10 (Non WTB) to 18 (WTB)	4.27
5	Shaft tunnel	4 (Stern post) to 10 (Non WTB)	3.20
6	Cabin and aft peak	Stern to 10 (Non WTB)	5.33
7	Deckhouse	6.75 (WTB) to 17.3 (WTB)	5.68
8	Wheelhouse	6.75 (WT) to 11 (WT)	2.67
9	Gutting shelter	15 (Non WT) to 25 (Non WT)	5.33

The geometry of compartments Nos. 1 to 6 in the list above were derived by the computer system from the hull model whilst compartments Nos. 7 to 9 were defined by measurement from the construction drawings.

The locations and capacities of the vessel's main tanks are listed in table 2 below:

Table 2 – Tank locations and capacities

No.	*Tank*	*Location*	*Capacity metres^3*	*Content's SG*	*Capacity tonnes*	*Capacity in 1984 SIB (% diff) - tonnes*
1	Fuel Oil - Port	10 to 17	9.06	0.84	7.61	7.72 (+1.4%)
2	Fuel Oil – Stbd	10 to 17	9.06	0.84	7.61	7.72 (+1.4%)
3	Water ballast #1	21 to 25	3.60	1.025	3.69	4.13 (+11.9%)
4	Water ballast #2	25 to 30	4.34	1.025	4.44	3.49 (-21.4%)
5	Water ballast #3	30 to 36	3.13	1.025	3.21	2.65 (-17.4%)
6	Fresh water	36 to bow	2.02	1.0	2.02	2.17 (+7.4%)

The capacity for the fuel tanks in the 1984 SIB is close to that computed for this report (1.4% greater). However, there is a variation ranging from 7.4% to 21.4% between the 1984 data for the ballast and fresh water tanks and the data computed for this report. These are significant, but not unusual and there are a number of possible explanations for such discrepancies. For example, the tank data produced for this report measures the full tank capacity taken from the computer system, whereas the data in the 1984 SIB may be a measured capacity including air voids or structure (such as the keel) not detailed on the construction drawings.

Further details on the tanks, including longitudinal and vertical centres of gravity and free surface moments are to be found in Appendix 8.

3. Principal dimensions

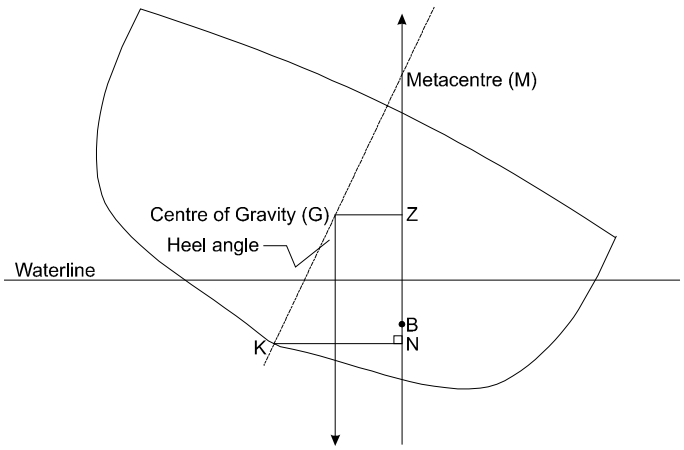
The vessel's principal dimensions are as follows:

Length Overall (LOA)..... : 22.656 metres
Length Between Perpendiculars (LBP) ..... : 21.340 metres
Maximum moulded beam (at deck level)..... : 6.790 metres
Depth (base line to deck edge at midships) .. : 3.705 metres
Lightship displacement..... : 114.50 tonnes (from lightship trial in 2004)
Draught midships at lightship displacement .. : 2.387 metres about Base Line
Keel rake ..... : 1.10 metres over LBP

4. Hydrostatic, KN and tank data

Appendices 5 and 6 are comprised of hydrostatic and free-trim KN data computed from the hull model. The diagram below illustrates the relationship between KN values and righting levers (GZ):

Diagram 3 – Relationship of KN to righting lever (GZ)



It should be noted that the KN data used for the calculation of the stability data in section 6 of this report includes the volume of the hull below the foredeck and the main deck but excludes the volume of the deckhouse and wheelhouse. This is normal practice in compiling a stability booklet for submission to the MCA as these structures will not be completely watertight in most cases. The same assumption was made in the 1984 SIB.

However, when the accident occurred, it is likely that the wheelhouse and deckhouse did provide additional buoyancy and righting moment, albeit temporarily as water would have flooded through vents, opening windows, etc., into these spaces in the event of a capsize. To reflect this, an additional set of free-trim KN data including the volume of the deckhouse and wheelhouse has been produced (see Appendix 7) and the projected accident conditions have been assessed using this data. Note that the heel range for the KN data in Appendix 6 was from 0 to 90 degrees, as this is normal practice for the production of a stability information booklet. The data in Appendix 7, by contrast, was taken from 0 to 180 degrees, i.e. from upright to fully inverted, so that the vessel's stability could be examined throughout the heel range and particularly beyond 90 degrees.

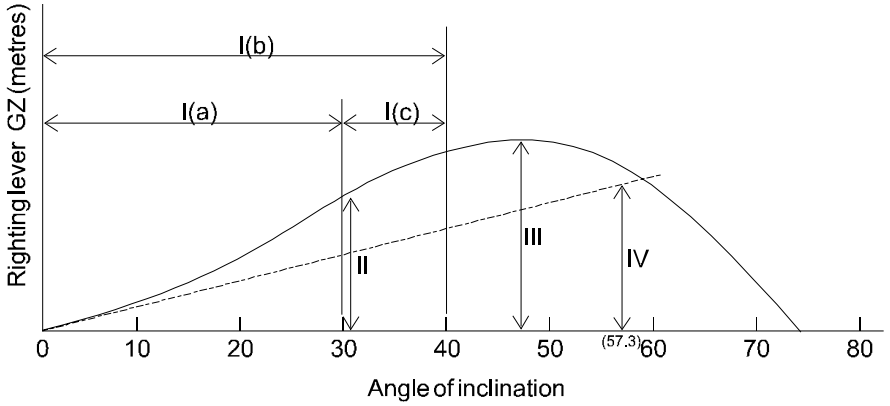
Appendix 8 is comprised of tables of the calibration, centres of gravity and free surface effects data for the vessel's fuel, ballast and fresh water tanks.

5. *Criteria used for assessment of stability and freeboards*

The MFV 'Adelphi' (renamed 'Meridian') was completed by the builders, McTay Marine Ltd. in September 1976 and the stability booklet was approved in August 1984. At that time, the Fishing Vessel Safety Provisions Rules 1975 were in force. These were superseded in 2002 by the Fishing Vessels (Safety of 15-24 Metre Vessels) Regulations 2002. However, the criteria used to assess stability remained the same in the 2002 regulations.

Merchant Shipping Notice 1770(F) draws attention to the provisions of the 2002 regulations. Paragraph 3.1.2 of 1770(F) requires that any fishing vessel of 15 metres in length or greater must comply with the following stability requirements:

Diagram 4 – Example of righting lever curve with requirement key points



I) The area under the righting lever curve (GZ curve) shall not be less than:
   (a) 0.055 metre.radians up to an angle of 30 degrees;
   (b) 0.09 metre.radians up to an angle of 40 degrees or such lesser angle of heel at which the lower edges of any opening in the hull, superstructure, deckhouses, or companionways being openings which cannot be closed weather-tight are immersed;
   (c) 0.030 metre.radians between the angles of heel of 30 degrees and 40 degrees or such lesser angle as defined in (b) above;

II) The righting lever (GZ) shall be at least 0.20 metres at an angle of heel equal to or greater than 30 degrees;

III) The maximum righting lever (GZ) shall occur at an angle of heel not less than 25 degrees;

IV) In the upright position the transverse metacentric height (GM) shall not be less than 350 millimetres;

In addition to the stability requirements, paragraph 3.2.1 of MSN 1770(F) specifies that fishing vessels of over 15 metres registered length shall be designed, constructed and operated so as to maintain adequate freeboards in all foreseeable operating conditions. It should be noted that whilst the stability requirements had been introduced under the 1975 Safety Provisions Rules, the freeboard requirements were not in force when the vessel was completed in 1976.

Under MSN 1770(F), the following minimum freeboard values would apply to the Meridian:

Minimum freeboard (H_{min})	=	LBP/40	= 0.534 metres
Forward freeboard (Hf_{min})	=	0.75 + 6.6LBP/240	= 1.337 metres
Aft freeboard (Ha_{min})	=	0.24 + LBP/37.5	= 0.808 metres

Note that where a watertight forecastle extends more than 0.07 x LBP aft of the FP, as in this instance, Hf_{min} may be taken about the top of the foredeck at the side.

6. Assessment of stability booklet loading conditions

A fishing vessel is judged to comply with the requirements if it exceeds the stability and freeboard criteria stated in Paragraph 5 in 'all foreseeable operating conditions'. It is usual practice, therefore, for any stability submission to the MCA relating to a fishing vessel to include an assessment of these parameters in a sequence of loading conditions representative of a voyage profile. Additional conditions are also included examining the stability in intermediate loading conditions and with alternative loads on board.

The following loading conditions were created for the 1984 SIB (see pages 38 to 45 of that document) and were recreated on the computer for this report:

1. Lightship
2. Departure from Port - Fuel, FW and Ballast Tanks full, 12 tonnes ice, 600 boxes
3. Arrival at Grounds
4. Departure from Grounds – Full catch – 600 boxes iced fish, fuel and fresh water 35%
5. Arrival in Port - 600 boxes iced fish, fuel and fresh water 10%
6. Departure from Grounds, 20% catch – 120 boxes iced fish, fuel and fresh water 35%
7. Arrival in Port – 20% catch - 120 boxes iced fish, fuel and fresh water 10%
8. Departure from Grounds, Max. catch – 75 tonnes fish in bulk in hold
9. Arrival in Port, Max. catch – 75 tonnes fish in bulk in hold

The deadweight makeup of these conditions and the trim and stability data computed for them is to be found in Appendix 1. As noted in section 4, the KN data used for these conditions does not include the volume of the deckhouse or the wheelhouse. Transverse centres of gravity have not been included in the deadweight tables for these conditions as it would not be normal practice to include these in a stability booklet for submission to the MCA. Note also that tank content's LCG, VCG and free surface moment data have been reproduced from the 1984 SIB so as to provide the best comparison with that data.

Table 3 on the following page summarises the results of the trim and stability analyses for the nine conditions listed above and compares the results with the equivalent data in the 1984 SIB. The data produced for this report confirms that the vessel complied with the stability criteria in all conditions, exceeding them in most cases by a substantial margin.

Some variation in the two sets of data is apparent, but in general the values computed for this report are similar to, or exceed those in the 1984 SIB, showing that the level of stability was at least as good as the SIB indicated. It should be noted that the variation is greatest in the characteristics measured at higher angles of heel, i.e. the area under the righting lever curve to 40˚ and between 30˚ and 40˚. This is probably because the SIB used KN data at 15 degree increments beyond 30˚ of heel, whereas the data for this report was computed from KN data computed at 5 degree increments. This smaller heel increment gives a higher definition to the righting lever curve and hence a more accurate measurement of the areas under the curve.

Table 3 - Comparison of trim and stability data from 1984 SIB with data recomputed for this report

		Condition Number (SIB Page No.)																								
		1 (page 38)			2 (page 39)			3 (page 40)			4 (page 41)			5 (page 42)			6 (page 43)			7 (page 44)			8 (page 45)			9 (page 46)		
Stability, Draft and Freeboard	**Min.**	**SIB**	**Report**	**% diff**	**SIB**	**Report**	**% diff**	**SIB**	**Report**	**% diff**	**SIB**	**Report**	**% diff**	**SIB**	**Report**	**% diff**	**SIB**	**Report**	**% diff**	**SIB**	**Report**	**% diff**	**SIB**	**Report**	**% diff**	**SIB**	**Report**	**% diff**
Area under GZ to 30° heel (m.radians)	0.055	0.122	0.125	2.5%	0.119	0.122	2.5%	0.121	0.125	3.3%	0.118	0.124	5.1%	0.115	0.121	5.2%	0.124	0.128	3.2%	0.121	0.126	4.1%	0.110	0.126	14.5%	0.110	0.114	3.6%
Area under GZ to 40° heel (m.radians)	0.09	0.181	0.186	2.8%	0.166	0.177	6.0%	0.171	0.183	7.0%	0.167	0.180	7.8%	0.164	0.177	7.3%	0.178	0.189	6.2%	0.174	0.184	5.7%	0.149	0.185	24.2%	0.151	0.164	8.6%
Area under GZ 30° - 40° (m.radians)	0.03	0.059	0.061	3.4%	0.047	0.054	14.9%	0.050	0.057	14.0%	0.049	0.056	14.3%	0.049	0.055	12.2%	0.054	0.060	11.1%	0.053	0.059	11.3%	0.039	0.059	51.3%	0.041	0.050	22.0%
Maximum GZ 30° - 90° (metres)	0.20	0.360	0.368	2.2%	0.316	0.350	8.2%	0.330	0.362	9.7%	0.322	0.357	10.9%	0.321	0.352	7.8%	0.348	0.374	7.5%	0.343	0.366	6.7%	0.261	0.354	35.6%	0.267	0.315	18.0%
Angle of maximum GZ (degrees)	25	30	29	-3.3%	25	26	4.0%	26	27	3.8%	26	27	3.8%	26	27	3.8%	27	28	3.7%	26	28	7.7%	22	28	27.3%	22	26	18.2%
GM fluid (metres)	0.35	1.200	1.168	-2.7%	1.107	1.098	-1.4%	1.129	1.117	-1.1%	1.079	1.088	0.8%	1.056	1.071	1.0%	1.154	1.142	-1.0%	1.137	1.132	-0.4%	1.080	1.147	6.2%	1.054	1.033	-2.0%
Draft at FP about USK (metres)	N/A	1.370	1.379	0.7%	1.950	1.957	0.2%	1.910	1.914	0.2%	2.245	2.257	0.5%	2.110	2.117	0.1%	1.830	1.841	0.6%	1.750	1.761	0.6%	3.060	3.075	0.5%	3.070	3.056	-0.5%
Draft at AP about USK (metres)	N/A	3.360	3.347	-0.4%	3.490	3.519	0.9%	3.440	3.463	0.7%	3.355	3.380	0.7%	3.320	3.342	0.8%	3.410	3.433	0.7%	3.380	3.395	0.4%	3.270	3.279	0.3%	3.230	3.226	0.1%
Mean draft about USK (metres)	N/A	2.360	2.363	0.1%	2.738	2.738	0.0%	2.670	2.689	0.7%	2.819	2.818	0.0%	2.729	2.729	0.0%	2.620	2.637	0.6%	2.560	2.578	0.7%	3.180	3.177	-0.1%	3.150	3.141	-0.3%
Freeboard at FP about foredeck edge (metres)	1.337	5.005*	4.991	-0.3%	4.425*	4.417	-0.1%	4.465*	4.460	-0.1%	4.130*	4.118	-0.3%	4.265*	4.258	-0.1%	4.545*	4.533	-0.3%	4.625*	4.612	-0.3%	3.315*	3.295	-0.6%	3.305*	3.313	0.2%
Freeboard midships about main deck edge (metres)	0.534	1.344*	1.338	-0.4%	0.966*	0.965	-0.1%	1.034*	1.015	-1.8%	0.885*	0.886	0.1%	0.975*	0.975	0.0%	1.084*	1.066	-1.7%	1.144*	1.125	-1.7%	0.524*	0.524	0.0%	0.554*	0.560	1.1%
Freeboard at AP about aft deck edge (metres)	0.808	1.271*	1.280	0.7%	1.141*	1.111	-2.6%	1.191*	1.167	-2.0%	1.276*	1.251	-2.0%	1.311*	1.289	-1.7%	1.221*	1.197	-2.0%	1.251*	1.235	-1.3%	1.361*	1.348	-1.0%	1.401*	1.400	-0.1%

* The 1984 SIB does not include freeboards as these were not required. The freeboard figures in the table have been obtained by subtracting the SIB drafts from the vessel depth

7. General assessment of 1984 stability booklet

The 1984 SIB was well prepared by consultants who were very familiar with the operation of fishing vessels and with the production of stability information for such vessels. The comparative data produced for this report indicates that the SIB is accurate within the limits of the computer programs (BSRA programs were used for the production of hydrostatic and KN data) that were then available, and included all that would have been expected in such a document.

The SIB presented a vessel that complied with the relevant 1975 Fishing Vessel Safety Rules, indeed, exceeded the provisions of these rules by a significant margin in all the conditions assessed. The data produced for this report has confirmed that assessment. In addition, had the freeboard regulations been in force at the time, the vessel would also have complied with these, again, by a significant margin in all conditions.

8. The vessel's condition immediately prior to the accident

The Meridian departed from port on the 11th October, 2006 and had been at sea for fifteen days when the accident occurred on the 26th October. The vessel was due to return to port on the 31st October. No firm information is available for the original fuel and water levels in the tanks when the vessel sailed, nor for fuel and water consumption during the period that it had been at sea. However, in terms of the deadweights aboard at the time of the accident, the vessel was certainly not in a condition similar to any of those in the 1984 SIB principally because there was no fish catch aboard.

It has therefore been assumed that the vessel's fuel and fresh water tanks were about 50% full at the time of the accident. This condition was modelled on the computer and Appendix 2 includes a listing of the condition deadweights and the related trim and stability information. It should be noted that this is based on KN data which includes the volumes of the deckhouse and wheelhouse; the rationale for this is explained in Section 4. The tank data produced for this report has also been used for the calculation of the trim and stability as it gives a more accurate assessment of the free surface moments when the vessel is heeled; the free surface moments in the SIB would have been based on the free surface of the tank contents only when the vessel was upright.

The data computed for the vessel condition immediately prior to the accident confirms the general picture given by the SIB, i.e. that the vessel had a good level of intact stability at the time of the accident, with all measured characteristics in excess of the requirements.

9. The vessel's accident condition

It has been noted that the EPIRB signal was received less than an hour after a private telephone call was made from the vessel and less than half an hour after a routine automatic location signal was transmitted from the vessel to DEFRA. This information suggests that, whatever the nature of the accident, it happened quickly.

It is considered unlikely that the vessel foundered (i.e. sank without initially capsizing) as such an accident would almost inevitably have given time for the crew to use a radio or telephone and/or send up emergency flares. It would probably also have given time for some or all of them to escape from the vessel in the liferaft.

The conclusion, therefore, is that the vessel probably suffered a rapid capsize brought on by the action of waves. Some possible elements of such a capsize, for example, the effects of large quantities of water taken on deck, can be measured using a statical stability analysis, the methodology used in this report. However it should be noted that this can only be an approximate assessment; by definition, statical stability inclines a static vessel on a flat horizontal water surface, not a rolling and pitching vessel on the slope of a wave. A better understanding of any vessel's behaviour in a wave pattern which might threaten capsize is to be achieved through a dynamic stability analysis, particularly given that Section 6 of this report indicates that the Meridian had a good level of intact statical stability.

Appendix 3 is comprised of four further conditions which are intended to focus any possible further work on the cause of the accident through a dynamic stability analysis. The first considers the effect on the vessel's stability of a large quantity (9.6 tonnes) of flood water in the engine room, taken in perhaps through an open hatch or a failed skin fitting. The object of including this condition was to find out whether severe flooding would have made the vessel unstable and initiated a capsize. However, the data indicates that the vessel would still have had a good stability reserve, indeed, it would still have complied with the intact stability requirements. In other words, in such a condition it is almost inevitable that the crew would have had time to raise the alarm before the vessel foundered if the accident had been initiated by severe flooding.

The second condition looks at the possibility of significant flooding in the fishroom, in this instance with an arbitrary 40 tonnes taken aboard. The data indicates that the vessel would not comply with the intact stability requirements but would still have a good stability reserve.

The third condition examines the possibility of significant flooding occurring, this time in the forecastle store as a result of the watertight door being left open, for example. Water flooding into this compartment above the level of the coaming would flow out by the same door aperture, perhaps not as quickly, but nevertheless within a few seconds. The condition therefore examined a case where seawater to the level of the access hatch coaming (4 tonnes, approximately 17% of the total volume) had flooded into the store. Again, the vessel would still have an adequate stability reserve, complying with all the intact stability criteria with the exception of the angle at which the maximum righting lever occurs. Once again, the data indicates that flooding might have contributed to the accident, but was not sufficient in itself to put the vessel in a condition where the crew could not raise the alarm. The indication is that there must have been a more significant factor.

It is known that weather and sea conditions had worsened rapidly in the area at the time of the accident and it can safely be assumed that quantities of water were being taken onto the deck regularly through the freeing ports and even over the bulwarks in breaking seas. In normal circumstances, this water would run off at varying rates through the freeing ports as the vessel rolled.

The last condition in Appendix 3 considers the stability of the vessel with an arbitrary 19 tonnes of seawater taken on deck on one side simulating the weight effect, but not the dynamic effect, of a large wave breaking over the bulwarks on a stern quarter and sweeping forward under the gutting shelter. The quantity represents a volume of water to the height of the bulwarks at midships vertically, between the aft end of the deckhouse and the forward end of the gutting shelter longitudinally, and between the side of the deckhouse and the bulwarks transversely. The data shows that such a volume of water would have been sufficient to capsize the vessel, but this assessment must be heavily qualified. Apart from the bulwarks and the deckhouse side, there would be little constraint on such a volume of water; as soon as it came on-board it would start to drain off the deck over the bulwarks and through the freeing ports, so the quantity would have reduced very rapidly along with its effect on stability as the vessel heeled in response to the weight of water. In a vessel such as the Meridian with a good range of stability (i.e. in excess of 70 degrees in the accident condition), the water on deck would have been shed completely long before the vessel had rolled to the angle at which capsize would occur. It is not considered that water taken on deck would be sufficient to capsize such a well-found vessel by itself.

The effects on stability of rolling in a seaway in response to the wave pattern can be severe, and in particular, the effects of synchronous rolling where wave period and vessel roll period are coincident can be very serious indeed, and this effect can be exacerbated by quantities of water on deck. As previously stated, such an accident scenario moves the investigation outside the range of a statical stability analysis. In this context, it is to be noted that the Meridian had a relatively high GM value in all the conditions investigated, implying that it would respond rapidly to oncoming seas.

10. After the accident was initiated

There are two further points that can be made if it is assumed that the vessel suffered a rapid capsize brought on by a combination of the action of the waves, synchronous or semi-synchronous rolling and quantities of water on deck.

As stated in Section 4, the volumes of the deckhouse and wheelhouse contribute significantly to the vessel's range of stability, albeit temporarily. The fourth condition in Appendix 3 indicates that the effect of these volumes is to give a second peak to the righting lever curve with its maximum at about 112 degrees of heel. If the deckhouse and wheelhouse remained largely intact (i.e. with minor rather than major flooding) as the capsize developed, the righting lever curve indicates a positive range of stability of over 150 degrees. In other words, provided that major flooding of any compartment did not occur as the vessel went over, the capsizing moment must have been sufficient to roll the vessel to within about 25 degrees of complete inversion otherwise it would have partially or fully righted itself. However, it should be noted that if major flooding had been occurring as the capsize developed, through open or broken wheelhouse windows, for example, the effect would be to abruptly reduce the heel angle from which the vessel could right itself. This can be seen from the righting lever curve for the fourth condition in Appendix 3; the Meridian would not right itself when thrown to more than 70 degrees of heel, i.e. the nadir of the curve, if flooding into the wheelhouse and/or deckhouse reduced the righting levers, and hence the righting moment, to below zero.

Given that, the impetus of wave action sufficient to roll the Meridian, a vessel with good stability, to its capsize angle of between 70 and 150 degrees, depending on the degree of watertightness of deckhouse and wheelhouse, must have been very considerable indeed.

11. Conclusions

The analysis in Section 6 of this report indicates that the Meridian was a well-found vessel, complying with both the standards in force at the time of her construction and today.

Section 9 argues that it is most unlikely that the accident was caused primarily by major flooding of one or more compartments leading to the vessel's foundering (i.e. sinking without initially capsizing) unless this occurred only seconds before the accident. If the vessel had foundered, the crew would have had time to raise the alarm and/or escape in the liferaft.

The data computed for the third loading condition in Appendix 3 indicates that large quantities of water taken on deck could certainly have helped to initiate the accident, but the vessel's range of stability was such that this water would have been shed over the bulwarks and through the freeing ports long before the angle of capsize was reached. In other words, water taken on deck could not have been the sole cause of the accident.

In light of this, the most likely principal cause for the accident was a rapid capsize and since the vessel was in very poor weather conditions at the time, it follows that such a capsize was probably caused by wave action. Without further information, it is speculative to consider whether such action was the result of a large breaking wave simply knocking the vessel over, or the effect of synchronous or semi-synchronous rolling in a wave pattern, or a combination of the two.

Section 10 argues that, given that the evidence shows that the Meridian probably had a high level of stability at the time the accident occurred, the force or combination of forces capsizing it must have been very considerable indeed, particularly if the deckhouse and wheelhouse remained largely watertight as the vessel went over.

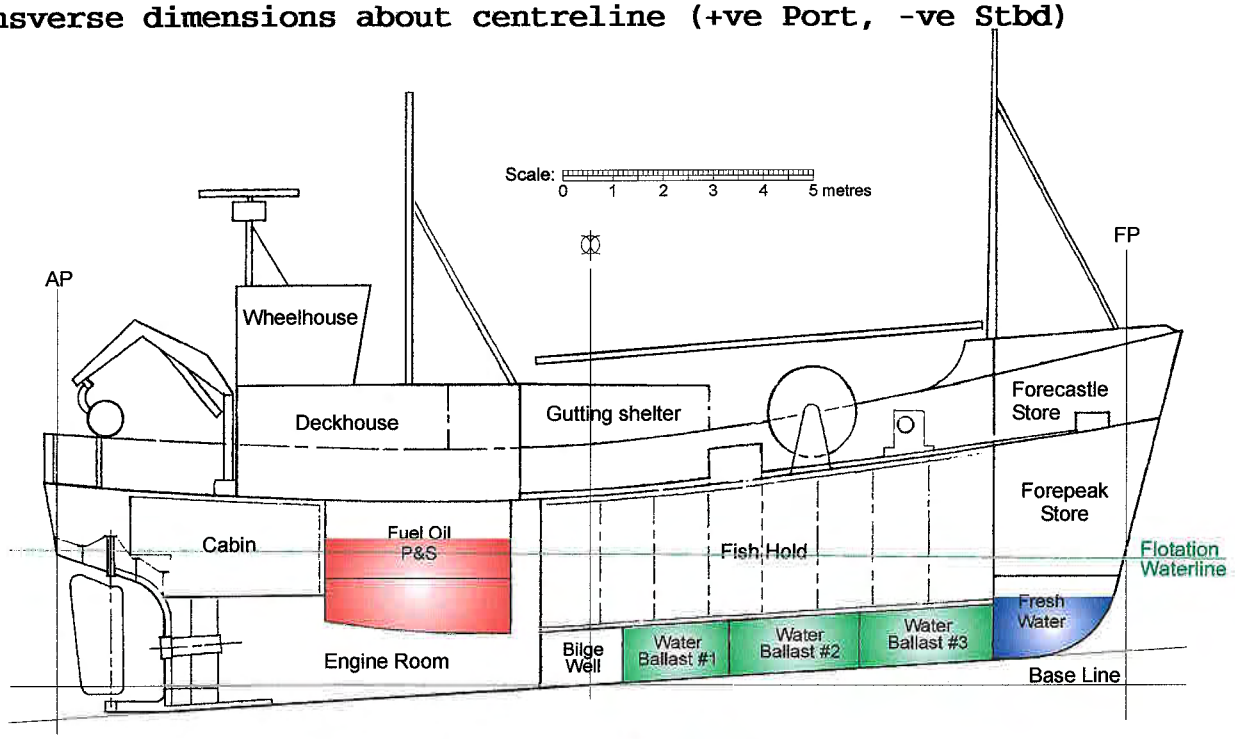
Appendix 2

Trim and stability data for vessel in the estimated loading condition prior to the accident

DEADWEIGHT TABLE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel and Fresh Water, 100% Ballast Water
State.....: Hull without added appendages
Water SG..: 1.025
Compliance: Vessel passes requirements in this condition

Longitudinal dimensions about Aft Perpendicular (-ve aft, +ve forward)
Vertical dimensions about Base Line (USK) (+ve above, -ve below)
Transverse dimensions about centreline (+ve Port, -ve Stbd)



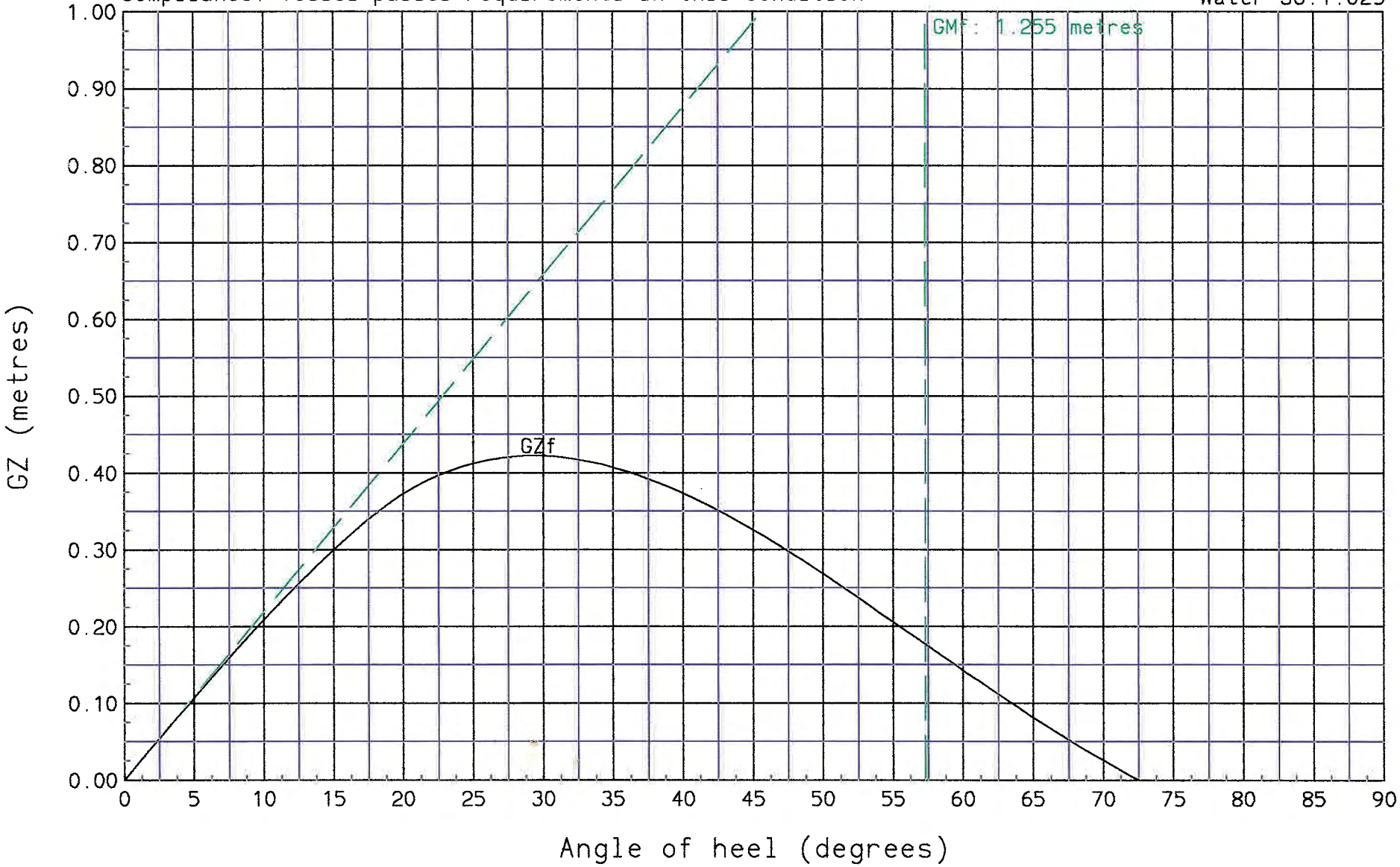
	Deadweight Item	Weight tonnes	LCG metres	Longitudinal moment t.m	TCG metres	Transverse moment t.m	VCG metres	Vertical moment t.m	Free Surface moment t.m
1	Crew and effects	1.200	7.000	8.400	0.000	0.000	5.000	6.000	-
2	Stores	0.400	6.000	2.400	0.000	0.000	4.300	1.720	-
3	Fishing gear	3.500	9.000	31.500	0.000	0.000	4.500	15.750	-
4	Fuel - Port	3.805	7.346	27.952	2.168	8.249	1.890	7.191	3.772
5	Fuel - Stbd	3.805	7.346	27.952	-2.168	-8.249	1.890	7.191	0.915
6	Ballast Water - Tank #1	3.688	12.273	45.263	0.000	0.000	0.891	3.286	0.000
7	Ballast Water - Tank #2	4.444	14.636	65.042	0.000	0.000	1.013	4.502	0.000
8	Ballast Water - Tank #3	3.208	17.218	55.235	0.000	0.000	1.136	3.644	0.000
9	Fresh Water	1.065	19.500	20.768	0.000	0.000	1.100	1.172	0.300
10	Ice in lockers	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	Empty boxes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	Boxed iced fish in hold	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	DEADWEIGHT TOTAL	25.115	11.328	284.511	0.000	0.000	2.009	50.456	4.987
	LIGHTSHIP	114.500	9.704	1111.108	0.000	0.000	3.180	364.110	-
	DISPLACEMENT	139.615	9.996	1395.619	0.000	0.000	2.969	414.566	4.987
	Free Surface Correction (Total Free Surface Moment/Displacement)						0.036		
	VCG fluid						3.005		

GZ PLOT

22.66 metre MFV

Condition.: On Passage - 50% Fuel and Fresh Water, 100% Ballast Water
State.....: Hull without added appendages
Compliance: Vessel passes requirements in this condition

Water SG:1.025



SAILING STATE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel and Fresh Water, 100% Ballast Water
State.....: Hull without added appendages
Water SG..: 1.025
Compliance: Vessel passes requirements in this condition

DRAFT SUMMARY (DIMENSIONS IN METRES)	Maximum	Actual
Draft at FP about keel line	-	1.865
Draft at midships about keel line	-	2.630
Draft at AP about keel line	-	3.396

FREEBOARD SUMMARY (DIMENSIONS IN METRES)	Minimum	Actual
Freeboard at FP about foredeck edge	1.337	4.509
Freeboard at midships about deck edge	0.534	1.073
Freeboard at AP about deck edge	0.808	1.234

STABILITY DATA

Heel angle degrees	Trim about Base Line metres on LBP	Draft at midships LBP about Base Line	KN metres	KGxSIN(Heel) metres	Righting moment tonne.metres	GZ fluid metres
0	0.431 by stern	2.630	0.000	0.000	0.000	0.000
5	0.432 "	2.616	0.369	0.262	14.962	0.107
10	0.409 "	2.572	0.731	0.522	29.175	0.209
15	0.368 "	2.498	1.077	0.778	41.844	0.300
20	0.324 "	2.393	1.401	1.028	52.039	0.373
25	0.294 "	2.267	1.682	1.270	57.571	0.412
30	0.281 "	2.126	1.925	1.503	58.959	0.422
35	0.287 "	1.970	2.131	1.724	56.824	0.407
40	0.306 "	1.803	2.305	1.932	52.127	0.373
45	0.334 "	1.625	2.451	2.125	45.486	0.326
50	0.370 "	1.437	2.571	2.302	37.501	0.269
55	0.416 "	1.241	2.667	2.462	28.737	0.206
60	0.477 "	1.036	2.745	2.602	19.962	0.143
65	0.550 "	0.825	2.805	2.724	11.396	0.082
70	0.652 "	0.607	2.850	2.824	3.582	0.026
75	0.777 "	0.387	2.879	2.903	-3.247	-0.023
80	0.907 "	0.171	2.894	2.959	-9.197	-0.066
85	1.086 "	-0.050	2.886	2.994	-15.045	-0.108
90	1.271 "	-0.276	2.848	3.005	-21.902	-0.157

STABILITY SUMMARY	Minimum	Actual
Area under GZ curve between 0.00 and 30.00 degrees (metre.radians)	0.055	0.141
Area under GZ curve between 0.00 and 40.00 degrees (metre.radians)	0.090	0.212
Area under GZ curve between 30.00 and 40.00 degrees (metre.radians)	0.030	0.071
Maximum GZ (metres)	-	0.422
Angle of heel at which maximum GZ occurs (degrees)	25.000	29.470
Maximum GZ between 30 and 90 degrees (metres)	0.200	0.422
Positive GZ heel range (degrees)	-	72.534
GM solid (metres) (upright)	-	1.291
Free Surface correction (metres)	-	0.036
GM fluid (metres) (upright)	0.150	1.255

Appendix 3

Trim and stability data for vessel in the estimated accident loading condition

DEADWEIGHT TABLE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel and Water - 19t Water on deck (to Port)
State.....: Hull without added appendages
Water SG..: 1.025

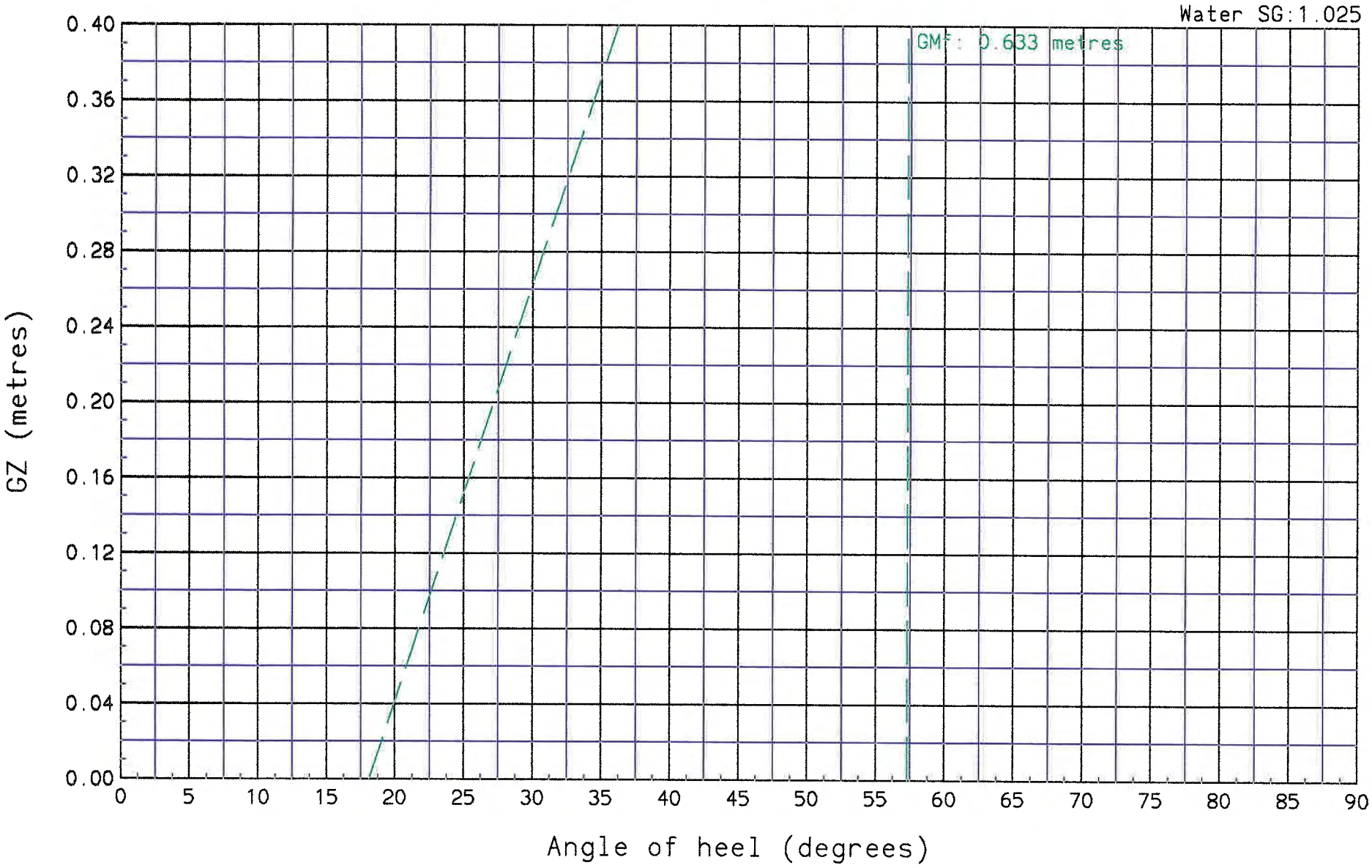
Longitudinal dimensions about Aft Perpendicular (-ve aft, +ve forward)
Vertical dimensions about Base Line (USK) (+ve above, -ve below)
Transverse dimensions about centreline (+ve Port, -ve Stbd)

	Deadweight Item	Weight tonnes	LCG metres	Longitudinal moment t.m	TCG metres	Transverse moment t.m	VCG metres	Vertical moment t.m	Free Surface moment t.m
1	Crew and effects	1.200	7.000	8.400	0.000	0.000	5.000	6.000	-
2	Stores	0.400	6.000	2.400	0.000	0.000	4.300	1.720	-
3	Fishing gear	3.500	9.000	31.500	0.000	0.000	4.500	15.750	-
4	Fuel - Port	3.805	7.346	27.952	2.168	8.249	1.890	7.191	3.772
5	Fuel - Stbd	3.805	7.346	27.952	-2.168	-8.249	1.890	7.191	0.915
6	Fresh Water	1.065	19.500	20.768	0.000	0.000	1.100	1.172	0.300
7	Ice in lockers	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
8	Empty boxes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
9	Boxed iced fish in hold	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
10	Water on deck (to Port)	19.000	8.706	165.414	2.265	43.035	4.299	81.681	4.731
	DEADWEIGHT TOTAL	32.775	8.677	284.385	1.313	43.035	3.683	120.705	9.718
	LIGHTSHIP	114.500	9.704	1111.108	0.000	0.000	3.180	364.110	-
	DISPLACEMENT	147.275	9.475	1395.493	0.292	43.035	3.292	484.815	9.718
	Free Surface Correction (Total Free Surface Moment/Displacement)						0.066		
	VCG fluid						3.358		

GZ PLOT

22.66 metre MFV

Condition.: On Passage - 50% Fuel and Water - 19t Water on deck (to Port)
State.....: Hull without added appendages



SAILING STATE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel and Water - 19t Water on deck (to Port)
State.....: Hull without added appendages
Water SG..: 1.025

DRAFT SUMMARY (DIMENSIONS IN METRES)	Maximum	Actual
Draft at FP about keel line	-	1.647
Draft at midships about keel line	-	2.666
Draft at AP about keel line	-	3.686

FREEBOARD SUMMARY (DIMENSIONS IN METRES)	Minimum	Actual
Freeboard at FP about foredeck edge	1.337	4.722
Freeboard at midships about deck edge	0.534	1.034
Freeboard at AP about deck edge	0.808	0.941

STABILITY DATA

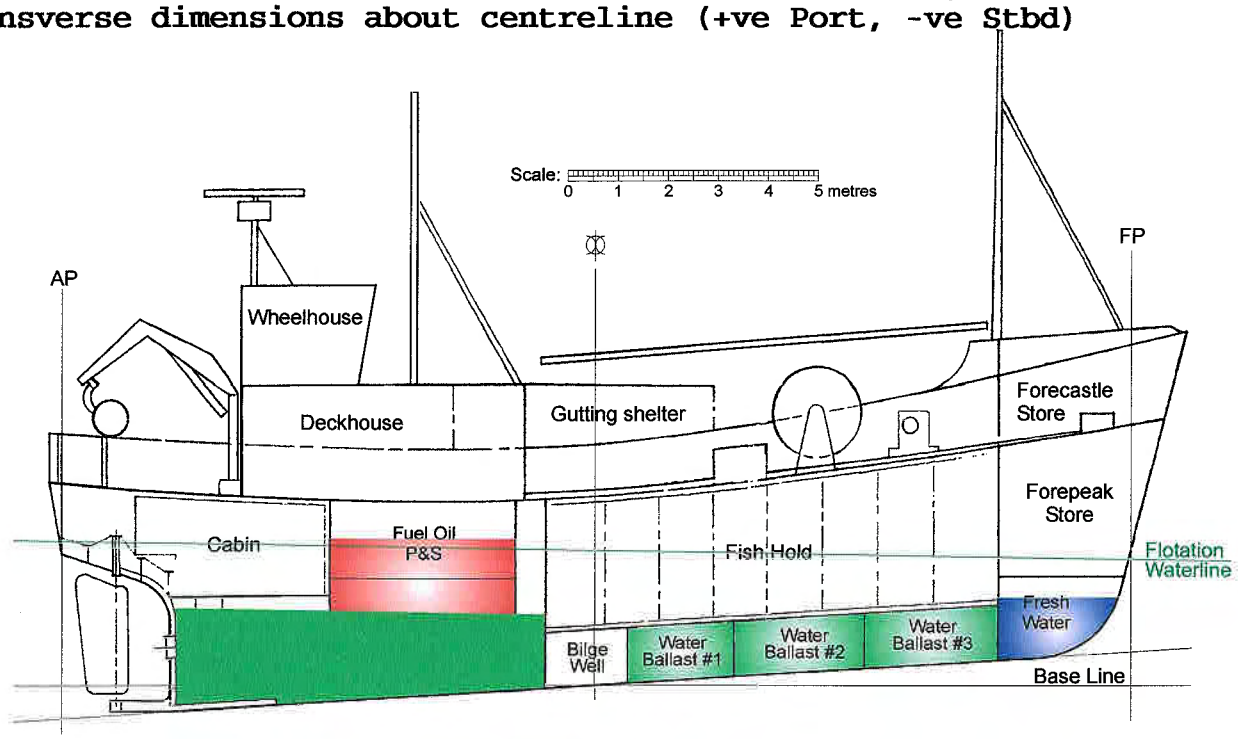
Heel angle degrees	Trim about Base Line metres on LBP	Draft at midships LBP about Base Line	KN metres	KGxSIN(Heel) metres	Righting moment tonne.metres	GZ fluid metres
0	0.940 by stern	2.666	-0.292	0.000	-43.035	-0.292
5	0.935 "	2.652	0.080	0.293	-31.330	-0.213
10	0.917 "	2.610	0.448	0.583	-19.942	-0.135
15	0.895 "	2.539	0.800	0.869	-10.124	-0.069
20	0.880 "	2.442	1.124	1.148	-3.578	-0.024
25	0.892 "	2.328	1.406	1.419	-1.968	-0.013
30	0.925 "	2.198	1.651	1.679	-4.147	-0.028
35	0.975 "	2.054	1.864	1.926	-9.201	-0.062
40	1.033 "	1.897	2.049	2.158	-16.129	-0.110
45	1.093 "	1.729	2.209	2.374	-24.353	-0.165
50	1.154 "	1.550	2.346	2.572	-33.364	-0.227
55	1.215 "	1.362	2.461	2.751	-42.683	-0.290
60	1.282 "	1.165	2.557	2.908	-51.656	-0.351
65	1.356 "	0.960	2.637	3.043	-59.898	-0.407
70	1.450 "	0.747	2.701	3.155	-66.894	-0.454
75	1.566 "	0.528	2.750	3.243	-72.655	-0.493
80	1.692 "	0.306	2.780	3.307	-77.638	-0.527
85	1.856 "	0.082	2.791	3.345	-81.592	-0.554

STABILITY SUMMARY	Minimum	Actual
Area under GZ curve between 0.00 and 30.00 degrees (metre.radians)	0.055	-0.053
Area under GZ curve between 0.00 and 40.00 degrees (metre.radians)	0.090	-0.064
Area under GZ curve between 30.00 and 40.00 degrees (metre.radians)	0.030	-0.011
Maximum GZ (metres)	-	0.000
Angle of heel at which maximum GZ occurs (degrees)	25.000	0.000
Maximum GZ between 30 and 90 degrees (metres)	0.200	0.000
GM solid (metres) (upright)	-	0.699
Free Surface correction (metres)	-	0.066
GM fluid (metres) (upright)	0.150	0.633

DEADWEIGHT TABLE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel & Water, 100% Ballast Water, E/R flooded
State.....: Hull without added appendages
Water SG..: 1.025
Compliance: Vessel passes requirements in this condition

Longitudinal dimensions about Aft Perpendicular (-ve aft, +ve forward)
Vertical dimensions about Base Line (USK) (+ve above, -ve below)
Transverse dimensions about centreline (+ve Port, -ve Stbd)



	Deadweight Item	Weight tonnes	LCG metres	Longitudinal moment t.m	TCG metres	Transverse moment t.m	VCG metres	Vertical moment t.m	Free Surface moment t.m
1	Crew and effects	1.200	7.000	8.400	0.000	0.000	5.000	6.000	-
2	Stores	0.400	6.000	2.400	0.000	0.000	4.300	1.720	-
3	Fishing gear	3.500	9.000	31.500	0.000	0.000	4.500	15.750	-
4	Fuel - Port	3.805	7.346	27.952	2.168	8.249	1.890	7.191	3.772
5	Fuel - Stbd	3.805	7.346	27.952	-2.168	-8.249	1.890	7.191	0.915
6	Ballast Water - Tank #1	3.688	12.273	45.263	0.000	0.000	0.891	3.286	0.000
7	Ballast Water - Tank #2	4.444	14.636	65.042	0.000	0.000	1.013	4.502	0.000
8	Ballast Water - Tank #3	3.208	17.218	55.235	0.000	0.000	1.136	3.644	0.000
9	Fresh Water	1.065	19.500	20.768	0.000	0.000	1.100	1.172	0.300
10	Ice in lockers	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	Empty boxes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	Boxed iced fish in hold	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
13	E/R flooded to 1.5m	7.629	7.597	57.958	0.000	0.000	0.822	6.271	26.343
14	Accomm area flood water	1.980	4.046	8.011	0.000	0.000	0.546	1.081	7.741
	DEADWEIGHT TOTAL	34.724	10.093	350.480	0.000	0.000	1.665	57.809	39.071
	LIGHTSHIP	114.500	9.704	1111.108	0.000	0.000	3.180	364.110	-
	DISPLACEMENT	149.224	9.795	1461.588	0.000	0.000	2.827	421.919	39.071
	Free Surface Correction (Total Free Surface Moment/Displacement)						0.262		
	VCG fluid						3.089		

GZ PLOT

22.66 metre MFV

Condition.: On Passage - 50% Fuel & Water, 100% Ballast Water, E/R flooded
State.....: Hull without added appendages
Compliance: Vessel passes requirements in this condition

SAILING STATE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel & Water, 100% Ballast Water, E/R flooded
State.....: Hull without added appendages
Water SG..: 1.025
Compliance: Vessel passes requirements in this condition

DRAFT SUMMARY (DIMENSIONS IN METRES)	Maximum	Actual
Draft at FP about keel line	-	1.845
Draft at midships about keel line	-	2.704
Draft at AP about keel line	-	3.564

FREEBOARD SUMMARY (DIMENSIONS IN METRES)	Minimum	Actual
Freeboard at FP about foredeck edge	1.337	4.527
Freeboard at midships about deck edge	0.534	0.998
Freeboard at AP about deck edge	0.808	1.065

STABILITY DATA

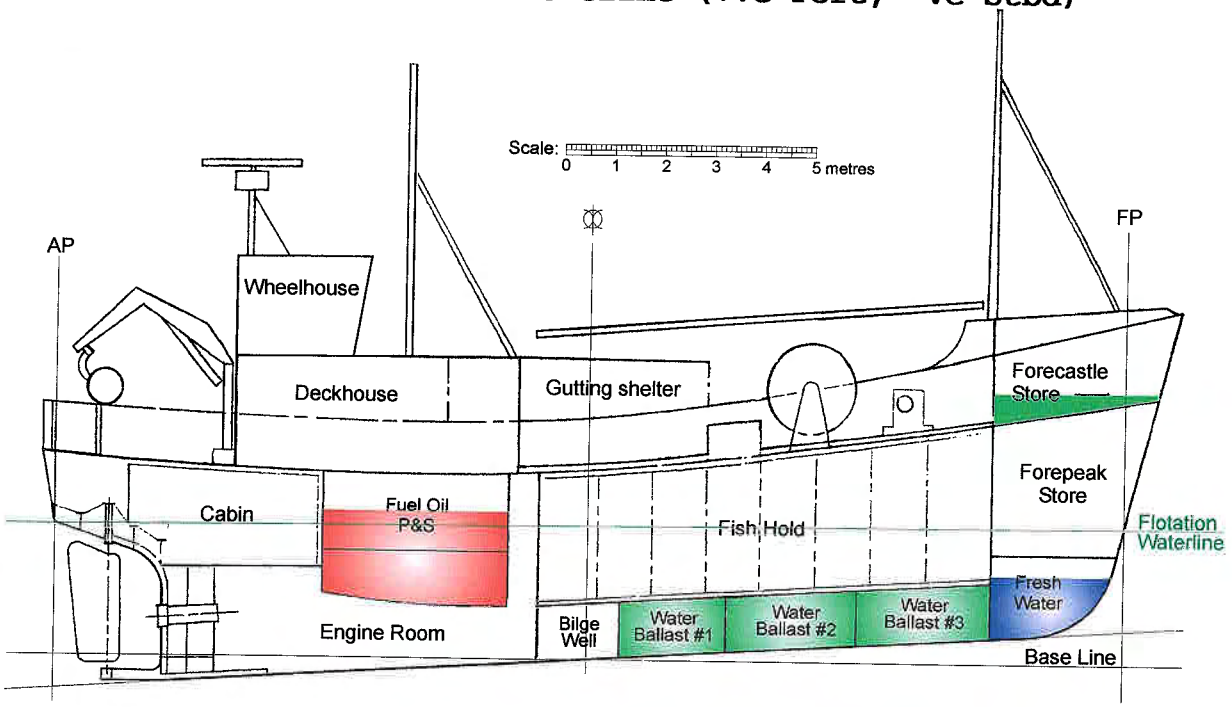
Heel angle degrees	Trim about Base Line metres on LBP	Draft at midships LBP about Base Line	KN metres	KGxSIN(Heel) metres	Righting moment tonne.metres	GZ fluid metres
0	0.619 by stern	2.704	0.000	0.000	0.000	0.000
5	0.615 ''	2.690	0.368	0.269	14.775	0.099
10	0.593 ''	2.647	0.730	0.536	28.850	0.193
15	0.566 ''	2.576	1.077	0.800	41.401	0.277
20	0.541 ''	2.477	1.395	1.057	50.541	0.339
25	0.536 ''	2.360	1.670	1.306	54.352	0.364
30	0.552 ''	2.227	1.905	1.545	53.747	0.360
35	0.586 ''	2.080	2.106	1.772	49.805	0.334
40	0.631 ''	1.922	2.276	1.986	43.380	0.291
45	0.681 ''	1.751	2.419	2.184	35.058	0.235
50	0.736 ''	1.571	2.538	2.367	25.532	0.171
55	0.797 ''	1.380	2.634	2.531	15.403	0.103
60	0.867 ''	1.180	2.710	2.675	5.230	0.035
65	0.948 ''	0.974	2.773	2.800	-4.020	-0.027
70	1.054 ''	0.759	2.818	2.903	-12.714	-0.085
75	1.168 ''	0.540	2.844	2.984	-20.874	-0.140
80	1.304 ''	0.317	2.853	3.042	-28.305	-0.190
85	1.463 ''	0.092	2.841	3.077	-35.278	-0.236
90	1.640 ''	-0.134	2.806	3.089	-42.200	-0.283

STABILITY SUMMARY	Minimum	Actual
Area under GZ curve between 0.00 and 30.00 degrees (metre.radians)	0.055	0.128
Area under GZ curve between 0.00 and 40.00 degrees (metre.radians)	0.090	0.185
Area under GZ curve between 30.00 and 40.00 degrees (metre.radians)	0.030	0.058
Maximum GZ (metres)	-	0.366
Angle of heel at which maximum GZ occurs (degrees)	25.000	26.815
Maximum GZ between 30 and 90 degrees (metres)	0.200	0.360
Positive GZ heel range (degrees)	-	62.772
GM solid (metres) (upright)	-	1.422
Free Surface correction (metres)	-	0.262
GM fluid (metres) (upright)	0.150	1.160

DEADWEIGHT TABLE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel & Water, 100% B/Water, Fo'c'sle flooded
State.....: Hull without added appendages
Water SG..: 1.025
Compliance: Vessel passes requirements in this condition

Longitudinal dimensions about Aft Perpendicular (-ve aft, +ve forward)
Vertical dimensions about Base Line (USK) (+ve above, -ve below)
Transverse dimensions about centreline (+ve Port, -ve Stbd)

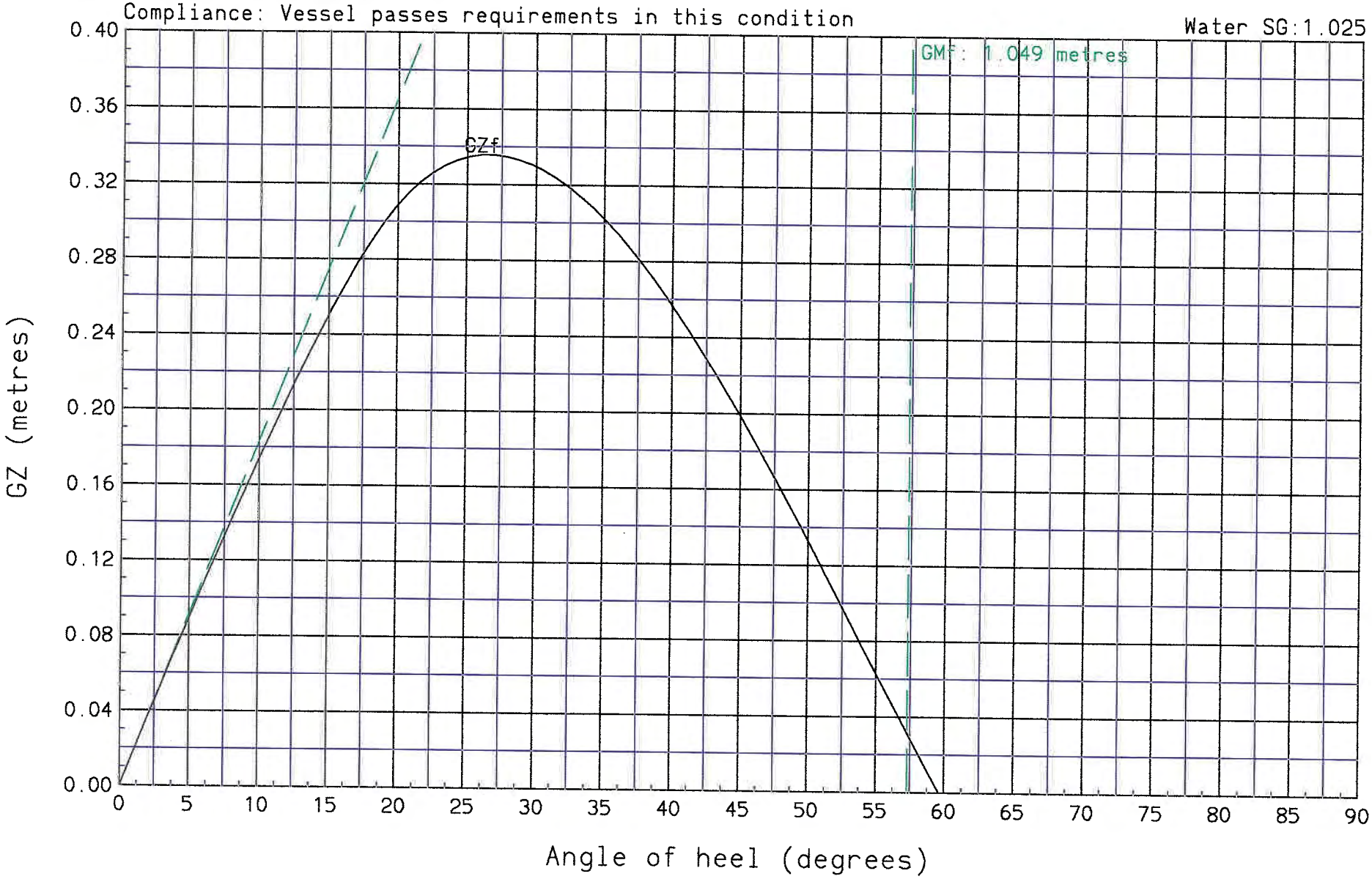


	Deadweight Item	Weight tonnes	LCG metres	Longitudinal moment t.m	TCG metres	Transverse moment t.m	VCG metres	Vertical moment t.m	Free Surface moment t.m
1	Crew and effects	1.200	7.000	8.400	0.000	0.000	5.000	6.000	-
2	Stores	0.400	6.000	2.400	0.000	0.000	4.300	1.720	-
3	Fishing gear	3.500	9.000	31.500	0.000	0.000	4.500	15.750	-
4	Fuel - Port	3.805	7.346	27.952	2.168	8.249	1.890	7.191	3.772
5	Fuel - Stbd	3.805	7.346	27.952	-2.168	-8.249	1.890	7.191	0.915
6	Ballast Water - Tank #1	3.688	12.273	45.263	0.000	0.000	0.891	3.286	0.000
7	Ballast Water - Tank #2	4.444	14.636	65.042	0.000	0.000	1.013	4.502	0.000
8	Ballast Water - Tank #3	3.208	17.218	55.235	0.000	0.000	1.136	3.644	0.000
9	Fresh Water	1.065	19.500	20.768	0.000	0.000	1.100	1.172	0.300
10	Flood water in fo'c'sle	4.000	19.660	78.640	0.000	0.000	5.046	20.184	16.577
	DEADWEIGHT TOTAL	29.115	12.473	363.151	0.000	0.000	2.426	70.640	21.564
	LIGHTSHIP	114.500	9.704	1111.108	0.000	0.000	3.180	364.110	-
	DISPLACEMENT	143.615	10.265	1474.259	0.000	0.000	3.027	434.750	21.564
	Free Surface Correction (Total Free Surface Moment/Displacement)						0.150		
	VCG fluid						3.177		

GZ PLOT

22.66 metre MFV

Condition.: On Passage - 50% Fuel & Water, 100% B/Water, Fo'c'sle flooded
State.....: Hull without added appendages
Compliance: Vessel passes requirements in this condition



SAILING STATE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel & Water, 100% B/Water, Fo'c'sle flooded
State.....: Hull without added appendages
Water SG..: 1.025
Compliance: Vessel passes requirements in this condition

DRAFT SUMMARY (DIMENSIONS IN METRES)	Maximum	Actual
Draft at FP about keel line	-	2.057
Draft at midships about keel line	-	2.678
Draft at AP about keel line	-	3.300

FREEBOARD SUMMARY (DIMENSIONS IN METRES)	Minimum	Actual
Freeboard at FP about foredeck edge	1.337	4.318
Freeboard at midships about deck edge	0.534	1.026
Freeboard at AP about deck edge	0.808	1.331

STABILITY DATA

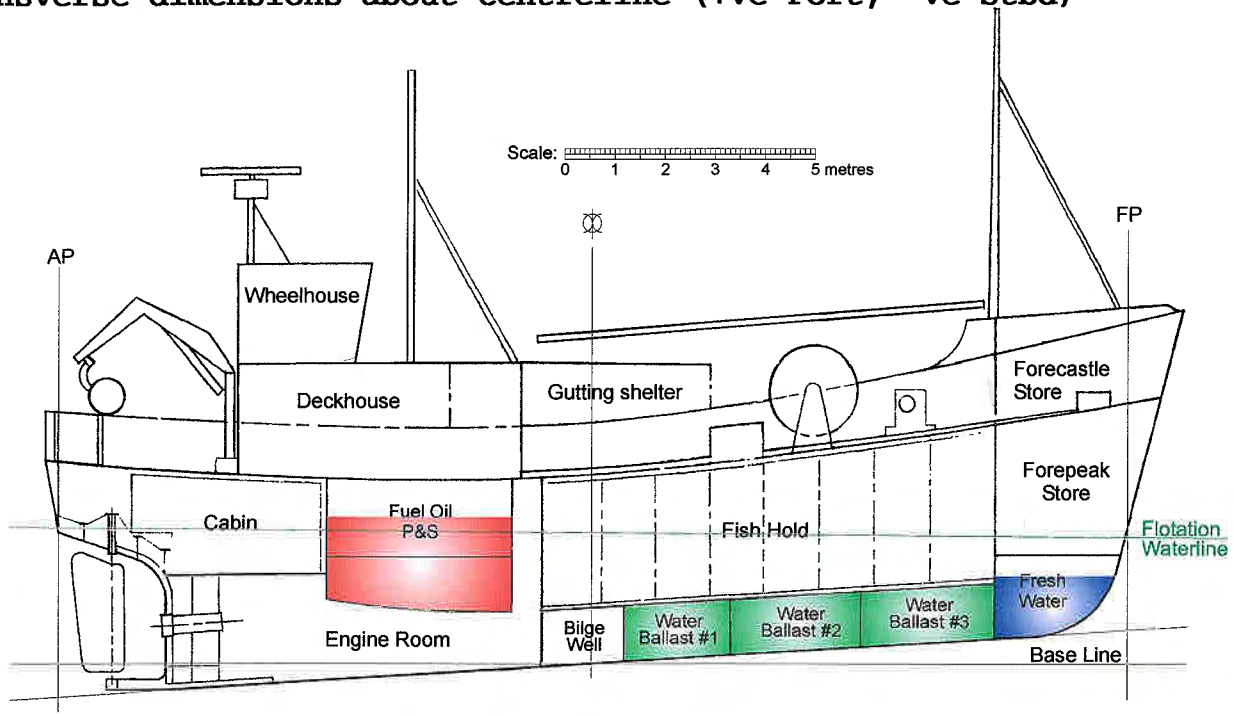
Heel angle degrees	Trim about Base Line metres on LBP	Draft at midships LBP about Base Line	KN metres	KGxSIN(Heel) metres	Righting moment tonne.metres	GZ fluid metres
0	0.143 by stern	2.678	0.000	0.000	0.000	0.000
5	0.141 "	2.663	0.366	0.277	12.839	0.089
10	0.114 "	2.619	0.726	0.552	24.963	0.174
15	0.076 "	2.545	1.072	0.822	35.869	0.250
20	0.030 "	2.440	1.396	1.087	44.378	0.309
25	0.003 by bow	2.314	1.677	1.343	48.010	0.334
30	0.017 "	2.172	1.918	1.589	47.329	0.330
35	0.015 "	2.018	2.125	1.822	43.392	0.302
40	0.002 by stern	1.850	2.299	2.042	36.864	0.257
45	0.029 "	1.672	2.445	2.247	28.526	0.199
50	0.067 "	1.484	2.567	2.434	19.053	0.133
55	0.119 "	1.286	2.666	2.603	9.044	0.063
60	0.189 "	1.080	2.746	2.752	-0.759	-0.005
65	0.272 "	0.867	2.809	2.880	-10.197	-0.071
70	0.390 "	0.647	2.857	2.986	-18.511	-0.129
75	0.516 "	0.426	2.887	3.069	-26.188	-0.182
80	0.659 "	0.207	2.902	3.129	-32.620	-0.227
85	0.838 "	-0.005	2.903	3.165	-37.725	-0.263
90	1.011 "	-0.232	2.869	3.177	-44.340	-0.309

STABILITY SUMMARY	Minimum	Actual
Area under GZ curve between 0.00 and 30.00 degrees (metre.radians)	0.055	0.116
Area under GZ curve between 0.00 and 40.00 degrees (metre.radians)	0.090	0.168
Area under GZ curve between 30.00 and 40.00 degrees (metre.radians)	0.030	0.052
Maximum GZ (metres)	-	0.336
Angle of heel at which maximum GZ occurs (degrees)	25.000	26.710
Maximum GZ between 30 and 90 degrees (metres)	0.200	0.329
Positive GZ heel range (degrees)	-	59.610
GM solid (metres) (upright)	-	1.199
Free Surface correction (metres)	-	0.150
GM fluid (metres) (upright)	0.150	1.049

DEADWEIGHT TABLE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel and Fresh Water, 100% Ballast Water
State.....: Hull including deckhouse and wheelhouse
Water SG..: 1.025
Compliance: Vessel passes requirements in this condition

Longitudinal dimensions about Aft Perpendicular (-ve aft, +ve forward)
Vertical dimensions about Base Line (USK) (+ve above, -ve below)
Transverse dimensions about centreline (+ve Port, -ve Stbd)

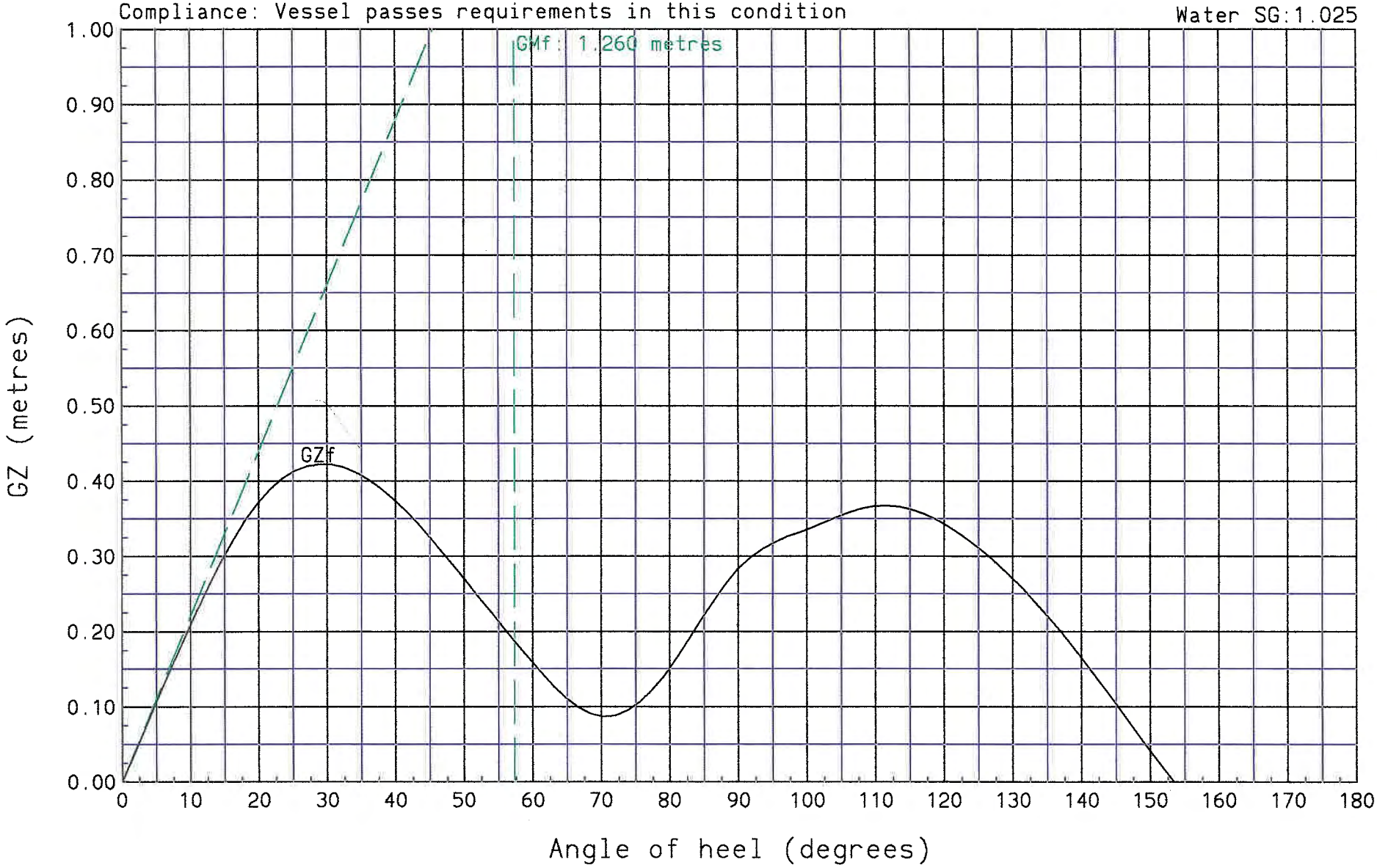


	Deadweight Item	Weight tonnes	LCG metres	Longitudinal moment t.m	TCG metres	Transverse moment t.m	VCG metres	Vertical moment t.m	Free Surface moment t.m
1	Crew and effects	1.200	7.000	8.400	0.000	0.000	5.000	6.000	-
2	Stores	0.400	6.000	2.400	0.000	0.000	4.300	1.720	-
3	Fishing gear	3.500	9.000	31.500	0.000	0.000	4.500	15.750	-
4	Fuel - Port	3.805	7.346	27.952	2.168	8.249	1.890	7.191	3.772
5	Fuel - Stbd	3.805	7.346	27.952	-2.168	-8.249	1.890	7.191	0.915
6	Ballast Water - Tank #1	3.688	12.273	45.263	0.000	0.000	0.891	3.286	0.000
7	Ballast Water - Tank #2	4.444	14.636	65.042	0.000	0.000	1.013	4.502	0.000
8	Ballast Water - Tank #3	3.208	17.218	55.235	0.000	0.000	1.136	3.644	0.000
9	Fresh Water	1.065	19.500	20.768	0.000	0.000	1.100	1.172	0.300
10	Ice in lockers	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
11	Empty boxes	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
12	Boxed iced fish in hold	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	DEADWEIGHT TOTAL	25.115	11.328	284.511	0.000	0.000	2.009	50.456	4.987
	LIGHTSHIP	114.500	9.704	1111.108	0.000	0.000	3.180	364.110	-
	DISPLACEMENT	139.615	9.996	1395.619	0.000	0.000	2.969	414.566	4.987
	Free Surface Correction (Total Free Surface Moment/Displacement)							0.036	
	VCG fluid							3.005	

GZ PLOT

22.66 metre MFV

Condition.: On Passage - 50% Fuel and Fresh Water, 100% Ballast Water
State.....: Hull including deckhouse and wheelhouse
Compliance: Vessel passes requirements in this condition



SAILING STATE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel and Fresh Water, 100% Ballast Water
State.....: Hull including deckhouse and wheelhouse
Water SG..: 1.025
Compliance: Vessel passes requirements in this condition

DRAFT SUMMARY (DIMENSIONS IN METRES)	Maximum	Actual
Draft at FP about keel line	-	1.865
Draft at midships about keel line	-	2.630
Draft at AP about keel line	-	3.396

FREEBOARD SUMMARY (DIMENSIONS IN METRES)	Minimum	Actual
Freeboard at FP about foredeck edge	1.337	4.509
Freeboard at midships about deck edge	0.534	1.073
Freeboard at AP about deck edge	0.808	1.234

STABILITY DATA

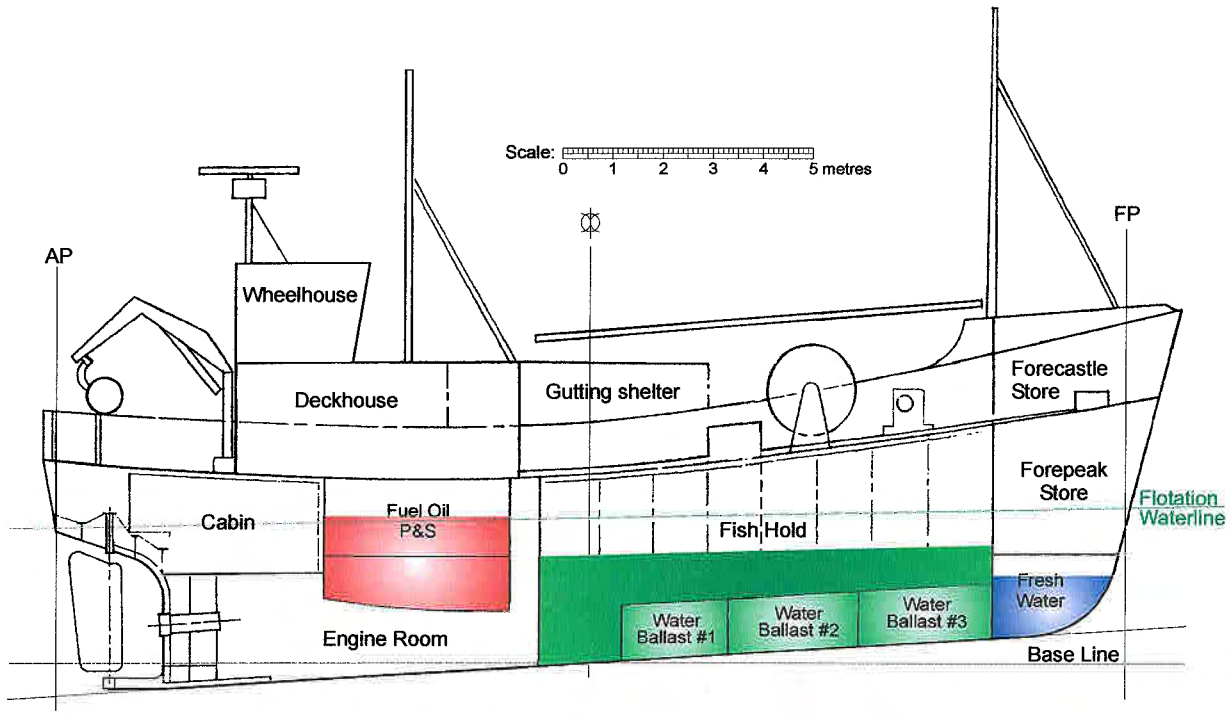
Heel angle degrees	Trim about Base Line metres on LBP	Draft at midships LBP about Base Line	KN metres	KGxSIN(Heel) metres	Righting moment tonne.metres	GZ fluid metres
0	0.431 by stern	2.630	0.000	0.000	0.000	0.000
10	0.409 "	2.572	0.731	0.522	29.175	0.209
20	0.324 "	2.393	1.401	1.028	52.039	0.373
30	0.281 "	2.126	1.925	1.503	58.957	0.422
40	0.306 "	1.803	2.305	1.932	52.142	0.373
50	0.364 "	1.435	2.572	2.302	37.729	0.270
60	0.428 "	1.020	2.761	2.602	22.077	0.158
70	0.483 "	0.551	2.911	2.824	12.139	0.087
80	0.495 "	0.033	3.111	2.959	21.157	0.152
90	0.497 "	-0.534	3.289	3.005	39.611	0.284
100	0.507 "	-1.134	3.295	2.959	46.889	0.336
110	0.523 "	-1.728	3.191	2.824	51.238	0.367
120	0.605 "	-2.268	2.946	2.602	47.906	0.343
130	0.752 "	-2.724	2.572	2.302	37.742	0.270
140	0.934 "	-3.076	2.097	1.932	23.029	0.165
150	1.085 "	-3.317	1.544	1.503	5.770	0.041
160	1.153 "	-3.457	0.956	1.028	-9.968	-0.071
170	1.145 "	-3.525	0.401	0.522	-16.804	-0.120
180	1.140 "	-3.559	-0.000	-0.000	-0.000	-0.000

STABILITY SUMMARY	Minimum	Actual
Area under GZ curve between 0.00 and 30.00 degrees (metre.radians)	0.055	0.141
Area under GZ curve between 0.00 and 40.00 degrees (metre.radians)	0.090	0.212
Area under GZ curve between 30.00 and 40.00 degrees (metre.radians)	0.030	0.071
Maximum GZ (metres)	-	0.422
Angle of heel at which maximum GZ occurs (degrees)	25.000	30.037
Maximum GZ between 30 and 90 degrees (metres)	0.200	0.422
Positive GZ heel range (degrees)	-	153.455
GM solid (metres) (upright)	-	1.296
Free Surface correction (metres)	-	0.036
GM fluid (metres) (upright)	0.150	1.260

DEADWEIGHT TABLE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel & Water, 100% B/Water, Fishroom flooded
State.....: Hull without added appendages
Water SG..: 1.025

Longitudinal dimensions about Aft Perpendicular (-ve aft, +ve forward)
Vertical dimensions about Base Line (USK) (+ve above, -ve below)
Transverse dimensions about centreline (+ve Port, -ve Stbd)

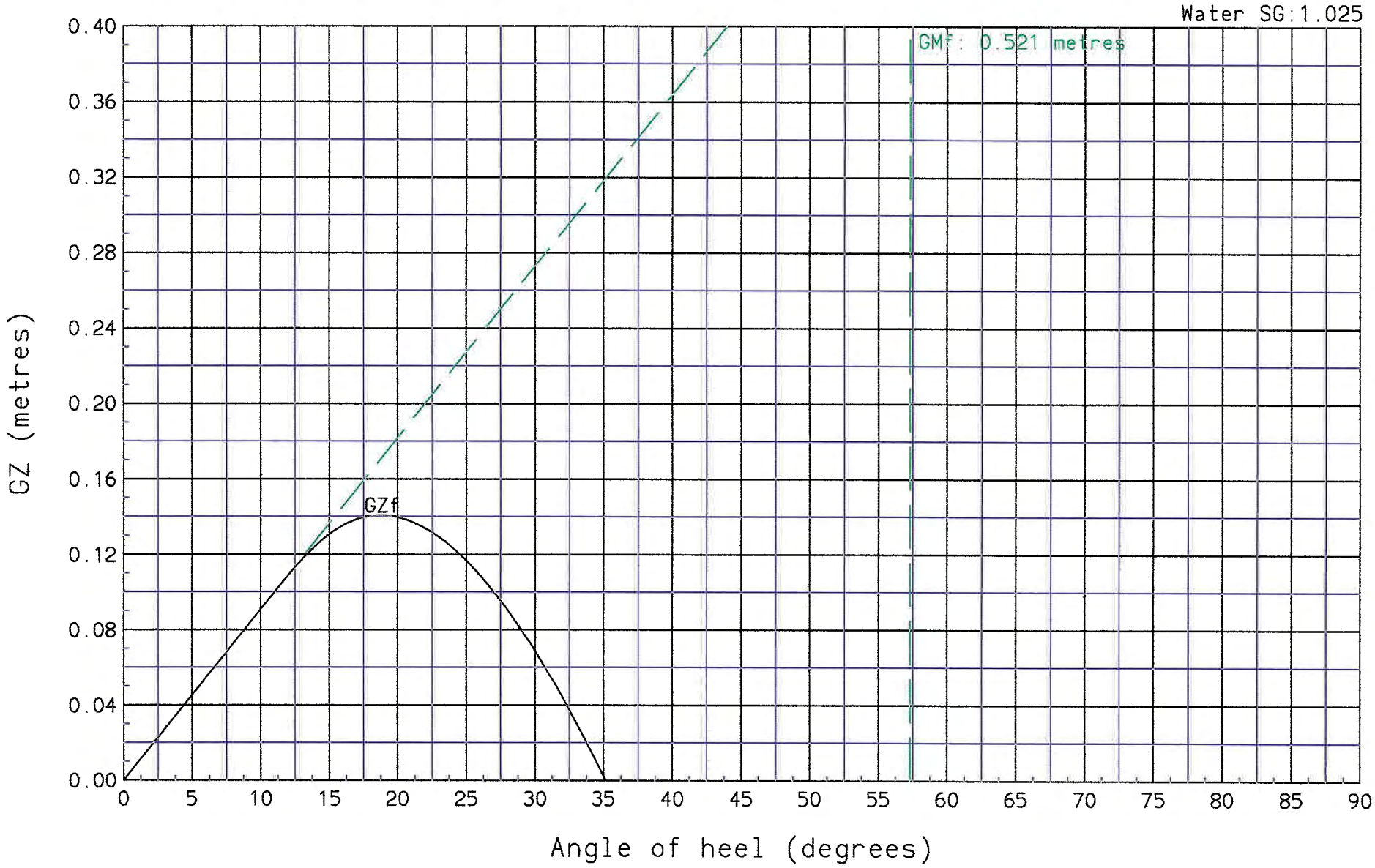


	Deadweight Item	Weight tonnes	LCG metres	Longitudinal moment t.m	TCG metres	Transverse moment t.m	VCG metres	Vertical moment t.m	Free Surface moment t.m
1	Crew and effects	1.200	7.000	8.400	0.000	0.000	5.000	6.000	-
2	Stores	0.400	6.000	2.400	0.000	0.000	4.300	1.720	-
3	Fishing gear	3.500	9.000	31.500	0.000	0.000	4.500	15.750	-
4	Fuel - Port	3.805	7.346	27.952	2.168	8.249	1.890	7.191	3.772
5	Fuel - Stbd	3.805	7.346	27.952	-2.168	-8.249	1.890	7.191	0.915
6	Fresh Water	1.065	19.500	20.768	0.000	0.000	1.100	1.172	0.300
7	Flood water in fishroom	40.000	13.239	529.560	0.000	0.000	1.726	69.040	130.095
	DEADWEIGHT TOTAL	53.775	12.060	648.531	0.000	0.000	2.010	108.064	135.082
	LIGHTSHIP	114.500	9.704	1111.108	0.000	0.000	3.180	364.110	-
	DISPLACEMENT	168.275	10.457	1759.639	0.000	0.000	2.806	472.174	135.082
	Free Surface Correction (Total Free Surface Moment/Displacement)						0.803		
						VCG fluid	3.609		

GZ PLOT

22.66 metre MFV

Condition.: On Passage - 50% Fuel & Water, 100% B/Water, Fishroom flooded
State.....: Hull without added appendages



SAILING STATE

Vessel....: 22.66 metre MFV
Condition.: On Passage - 50% Fuel & Water, 100% B/Water, Fishroom flooded
State.....: Hull without added appendages
Water SG..: 1.025

DRAFT SUMMARY (DIMENSIONS IN METRES)	Maximum	Actual
Draft at FP about keel line	-	2.431
Draft at midships about keel line	-	2.901
Draft at AP about keel line	-	3.371

FREEBOARD SUMMARY (DIMENSIONS IN METRES)	Minimum	Actual
Freeboard at FP about foredeck edge	1.337	3.944
Freeboard at midships about deck edge	0.534	0.803
Freeboard at AP about deck edge	0.808	1.260

STABILITY DATA

Heel angle degrees	Trim about Base Line metres on LBP	Draft at midships LBP about Base Line	KN metres	KGxSIN(Heel) metres	Righting moment tonne.metres	GZ fluid metres
0	0.159 by bow	2.901	-0.000	0.000	-0.000	-0.000
5	0.168 "	2.887	0.360	0.315	7.649	0.045
10	0.187 "	2.843	0.718	0.627	15.312	0.091
15	0.217 "	2.769	1.065	0.934	22.010	0.131
20	0.234 "	2.676	1.374	1.234	23.534	0.140
25	0.232 "	2.567	1.642	1.525	19.648	0.117
30	0.216 "	2.443	1.873	1.804	11.614	0.069
35	0.185 "	2.304	2.072	2.070	0.429	0.003
40	0.140 "	2.151	2.243	2.320	-12.834	-0.076
45	0.082 "	1.986	2.389	2.552	-27.335	-0.162
50	0.007 "	1.807	2.513	2.764	-42.267	-0.251
55	0.085 by stern	1.615	2.617	2.956	-57.021	-0.339
60	0.195 "	1.413	2.702	3.125	-71.152	-0.423
65	0.324 "	1.200	2.769	3.271	-84.340	-0.501
70	0.470 "	0.979	2.819	3.391	-96.245	-0.572
75	0.610 "	0.755	2.849	3.486	-107.185	-0.637
80	0.748 "	0.529	2.860	3.554	-116.736	-0.694
85	0.883 "	0.304	2.854	3.595	-124.733	-0.741
90	1.050 "	0.082	2.835	3.609	-130.170	-0.774

STABILITY SUMMARY	Minimum	Actual
Area under GZ curve between 0.00 and 30.00 degrees (metre.radians)	0.055	0.049
Area under GZ curve between 0.00 and 40.00 degrees (metre.radians)	0.090	0.053
Area under GZ curve between 30.00 and 40.00 degrees (metre.radians)	0.030	0.003
Maximum GZ (metres)	-	0.141
Angle of heel at which maximum GZ occurs (degrees)	25.000	18.909
Maximum GZ between 30 and 90 degrees (metres)	0.200	0.069
Positive GZ heel range (degrees)	-	35.172
GM solid (metres) (at angle of equilibrium)	-	1.324
Free Surface correction (metres)	-	0.803
GM fluid (metres) (at angle of equilibrium)	0.150	0.521