

# Technical Note

Project North Lincolnshire Green Energy Park  
Subject Marine Traffic Assessment  
Project no 0046658  
Date 29 January 2021

Revision	Description	Issued by	Date	Approved (signature)
00	For information	JO	29.01.2021	 <small>Digitally signed by Paul Brenton Reason: I am approving this document Date: 2021.02.04 11:20:20Z00'00'</small>

## 1 Introduction

This Technical Note has been prepared to summarise the key findings from the marine traffic assessment. Much of the information contained is based on discussions and information provided by and with ABP (Humber Estuary Services – the Harbour Authority). In addition, the note identifies the existing marine infrastructure at Flixborough Wharf and a section of the River Trent downstream.

## 2 Existing River infrastructure

### 2.1 Flixborough Wharf

Flixborough is one of a number of wharves on the River Trent. Predominantly, the wharf handles steel and bulk cargoes and is able to accommodate vessels up to a maximum of 100m length overall (LOA), with a draft of up to 5.5m during Spring Tides. The southern (upstream) berth is serviced by overhead gantry crane, capable of lifts up to 35 tonnes, and mobile crawler cranes for general offloading and loading at the northern (downstream) berth. Loading shovels assist for the handling of bulk cargoes, and a dedicated weighbridge and lorry wheel wash for bulk cargoes are located within the site. Flixborough Wharf operates a dedicated steel terminal and has access to the national rail network via their own line.

The wharf is an open-piled structure with a total approximately length of 230m, of which approximately 155m is actually quayside adjacent to the water, with a deck height of +5.885mOD. The front of the wharf has timber fendering that appears to run to the river bed based on the structural drawings provided by Solar21 as shown in Figure 2-1. The structural drawing produced by Alan Wood and Partners is contained within Appendix A.

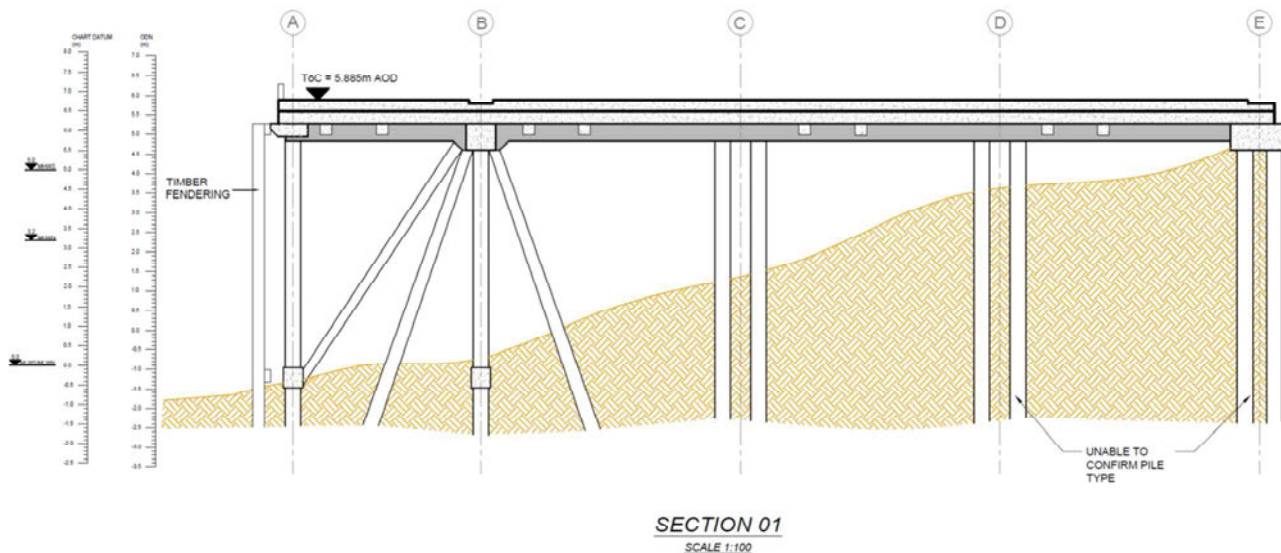


Figure 2-1 – Cross section of Flixborough Wharf taken from GA Plans of Existing Wharf

Figure 2-2 shows a view of the wharf from the River, showing the piles and timber fenders along with the cranes previously described.

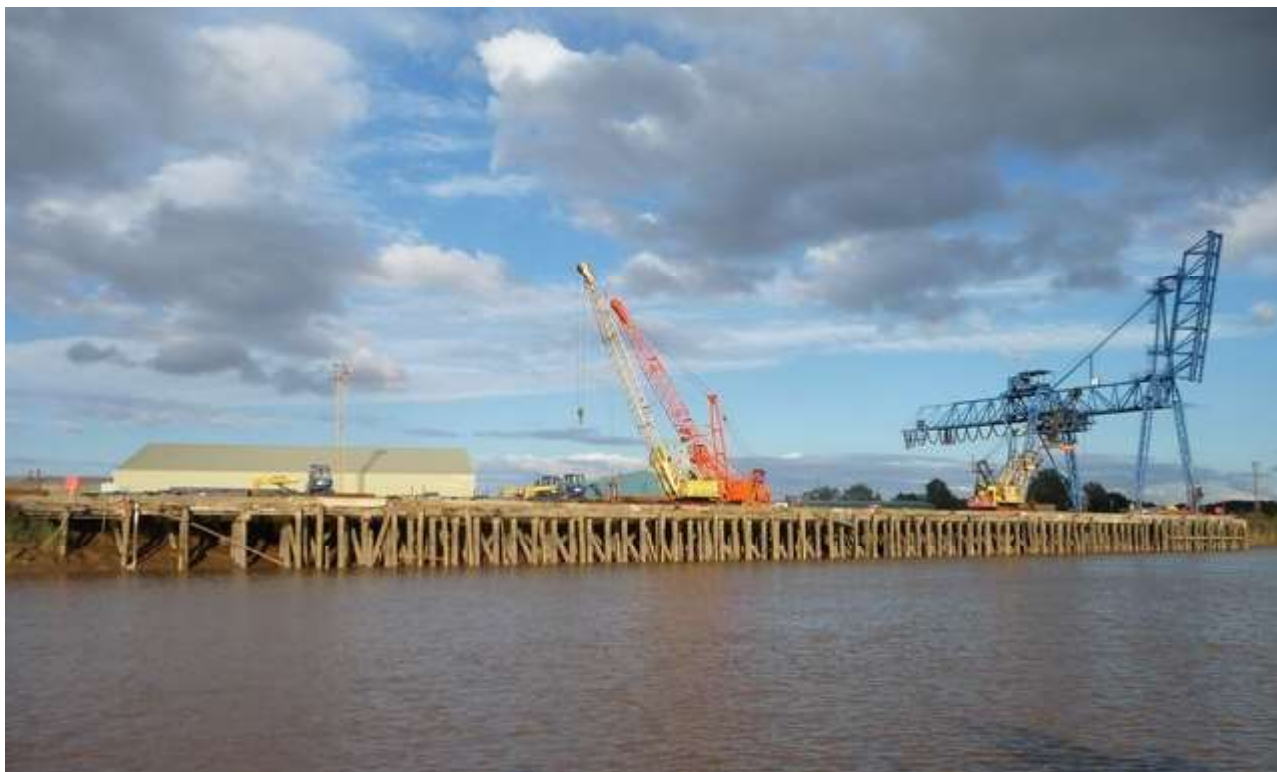


Figure 2-2 – Photograph of Flixborough Wharf (source: [redacted])

## 2.2 River Trent

Marine traffic enters the River Trent from the River Humber located north and downstream of the Flixborough Wharf. Between Flixborough and the Humber there is only one additional facility located at Burton Stather, the Kings Ferry Wharf. The River Trent enables two-way traffic.

Figure 2-3 shows the stretch of the River Trent from the Humber to Flixborough Wharf identifying the existing navigational aids and location of Burton Stather.

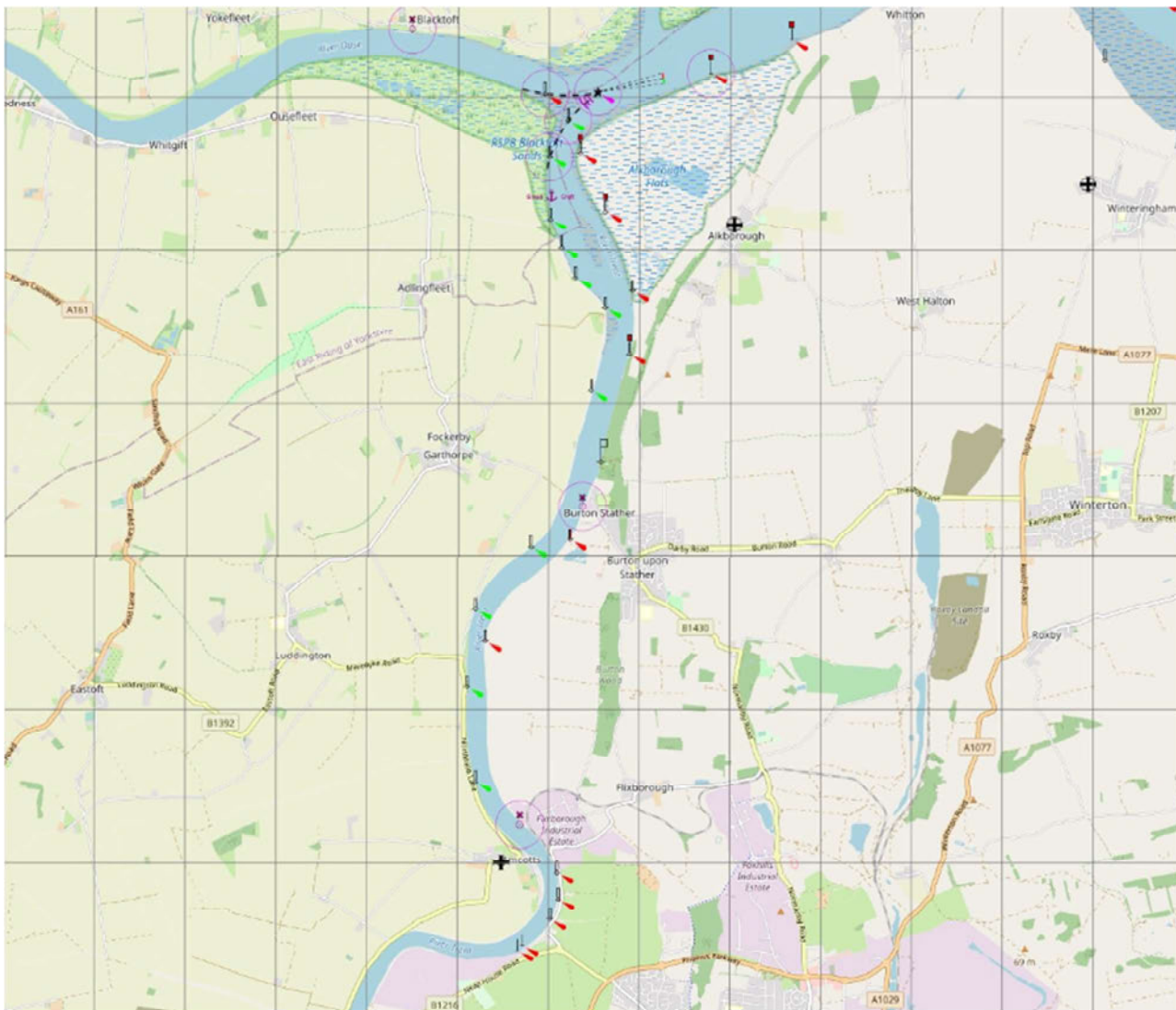


Figure 2-3 – Overview of the River Trent between the Humber and Flixborough Wharf including the navigation aids (Source: [redacted])

### 3 Water and bed levels

The River Trent is located within the tidally influenced section of the Humber, and so water levels within the river will fluctuate significantly within hours. Table 3-1 and Table 3-2 show the present day tide levels applicable to Flixborough and Burton Stather that have been taken from ABP’s published hydrographic survey chart from the bi-annual survey conducted on 27<sup>th</sup> October 2020. It is noted that the levels in this table are expected to increase in the future due to sea level rise as a result of climate change.

**Table 3-1 – Flixborough Tide Levels**

Tidal Reference	Present Day (2020)	
	Level (mOD)	Level (mCD)
Mean High Water Springs (MHWS)	5.90	5.00
Mean High Water Neaps (MHWN)	4.10	3.20
Mean Low Water Neaps (MLWN)	0.90	0.00
Mean Low Water Springs (MLWS)	0.90	0.00
NOTES:		
1. 0mCD = +0.90mOD as specified in the ABP chart		
2. The spring tidal range between MHWS and MLWS is 5.00m		

**Table 3-2 – Burton Stather Tide Levels**

Tidal Reference	Present Day (2020)	
	Level (mOD)	Level (mCD)
Mean High Water Springs (MHWS)	6.30	5.20
Mean High Water Neaps (MHWN)	4.60	3.50
Mean Low Water Neaps (MLWN)	1.40	0.30
Mean Low Water Springs (MLWS)	1.10	0.00
NOTES:		
1. 0mCD = +1.10mOD as specified in the ABP chart		
2. The spring tidal range between MHWS and MLWS is 5.20m		

Figure 3-1 shows the bathymetry of the River Trent in the area of Flixborough Wharf, and part of the river downstream from the wharf. The data was provided by ABP, with the survey dated 27<sup>th</sup> October 2020. The depths shown are in metres relative to Chart Datum (mCD).

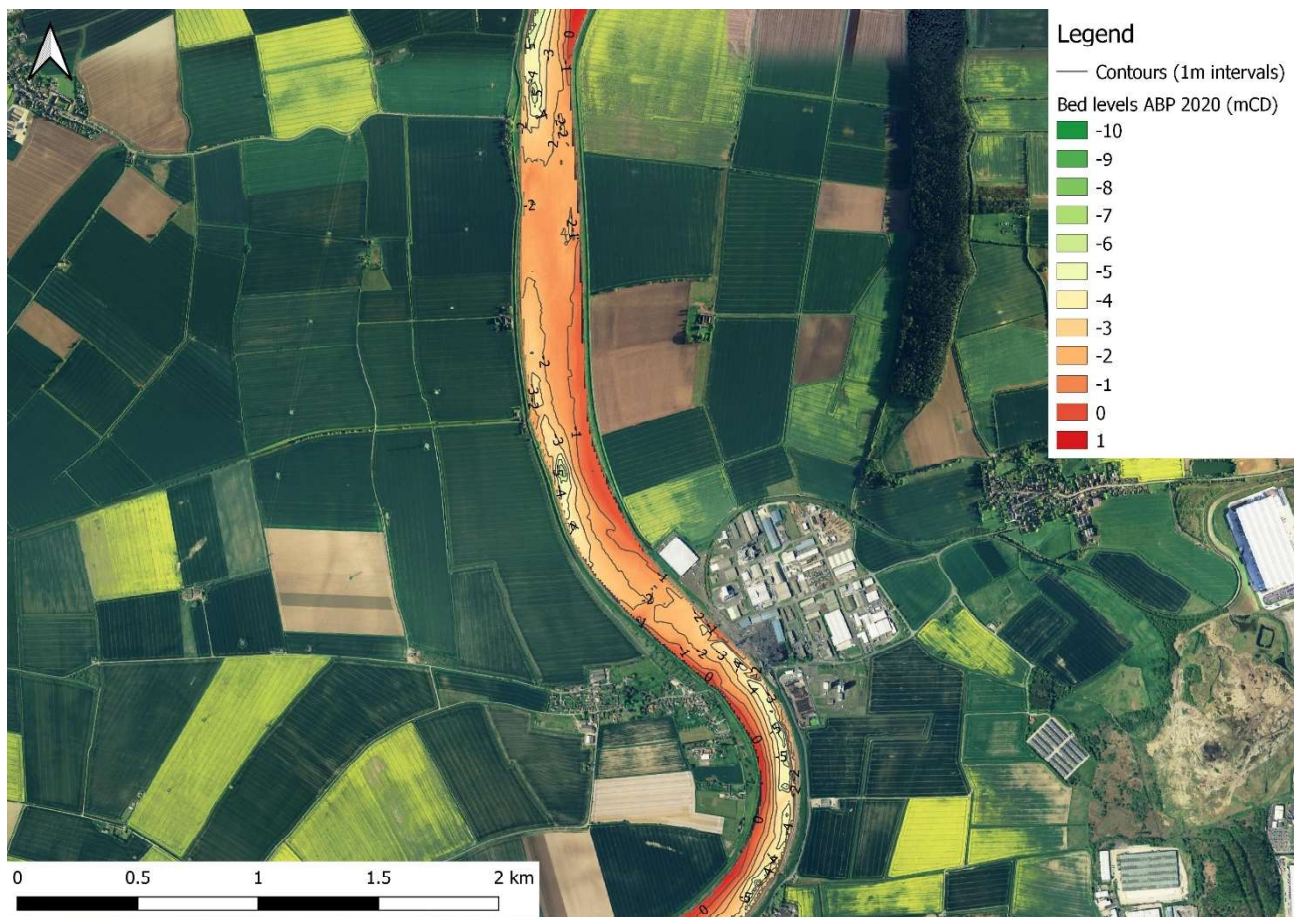


Figure 3-1 – Bathymetry at Flixborough Wharf and part of the river immediately downstream (Source: ABP 27<sup>th</sup> October 2020)

## 4 Outline Strategy

The current marine traffic strategy for operations at the wharf are as follows:

- Offloading of containerised waste
- Loading of empty containers
- Offloading of bulk materials, primarily aggregate one vessel every five days
- Loading of pre-fabricated concrete blocks
- Loading of CO<sub>2</sub>
- Offloading/loading of steel

The current strategy assumes the existing wharf will not be extended due to the limitations around vessel access due to tides.

## 5 Input Data

The following information has been obtained through consultation with ABP based on their internal analysis of their recorded dataset for the River Trent. The data was provided via email and meetings. The below summarises when the information was provided:

- Email correspondence 11 December 2020 from ABP to Solar21 – breakdown of vessel movements entering the River Trent and typical vessel information
- Email correspondence 12 January 2021 from ABP to BH – number of vessels that could access and depart Flixborough Wharf on a Spring high tide
- Email correspondence 13 January 2021 from ABP to BH – breakdown of vessel movements arriving at Flixborough Wharf in relation to spring and neap tides with a percentage ratio

- Virtual meeting 14 January 2021 between BH and ABP – agreed a process for assessing the marine traffic and provision of a typical vessel operating in the River Trent. Minutes of the meeting are available in Appendix B.

**5.1 ABP information**

**5.1.1 Vessel movements**

From ABP’s analysis of their recorded dataset for the River Trent, over a 12-month period, 350 commercial vessels entered the River Trent and there were approximately 800 vessel movements in the approximate area.

The breakdown of vessel arrivals is shown in Table 5-1.

**Table 5-1 - No. of vessels arriving at Flixborough between 2019-2020**

Tidal Period	No. of Vessels Arriving	% Vessels Arriving
Spring	181	62%
Neap	113	38%
Total	294	

ABP consider that a maximum of four vessel movements could occur on a single spring high tide; two vessels arriving and two vessels departing the wharf, irrespective of vessel size below the maximum.

**5.1.2 Vessel size**

Based on their data, ABP identified the average size vessel and maximum size vessel that operate within this section of the River Trent, as summarised in Table 5-2:

**Table 5-2 - Average and maximum vessel sizes operating in the River Trent**

	Length Overall (LOA)	Draft
Average Vessel	85m	4m
Maximum Vessel	99m	5.5m

Following subsequent consultation with ABP, it was agreed that a likely vessel for further assessment, due to its suitable characteristics and size, is the bulk carrier MV FAST JEF (IMP no. 9136101). FAST JEF is a general cargo ship built in 1996, with a LOA 88.0m and a beam of 12.5m. It has a maximum draught (fully loaded) of 4.65m. The technical specifications of FAST JEF can be found in Appendix C.



Figure 5-1 Image of FAST JEF (Source: [Fast Jef](#) [redacted])

### 5.2 Tidal Window

A preliminary review of the available tidal window for transit within the stretch of the River Trent between the Humber and Flixborough Wharf has been undertaken, based on the following:

- The tidal information is taken from ABP’s survey chart for Flixborough as presented in Table 3-1 and using the ‘rule of 12’ to predict an assumed typical tidal curve.
- An average of the bed level points at Flixborough Wharf was calculated using the published ABP survey data, provided to BH, as presented in Figure 3-1. This gives an approximate bed level of -1.5mCD.
- For safe navigation, an additional underkeel clearance (UKC) has been included in addition to the draft. General guidance is given by PIANC with a 10% allowance of a vessel draft.
- The maximum loaded draft of 4.65m is assumed based on the typical vessel (FAST JEF).
- The required depth for the vessel to access is +3.6mCD.

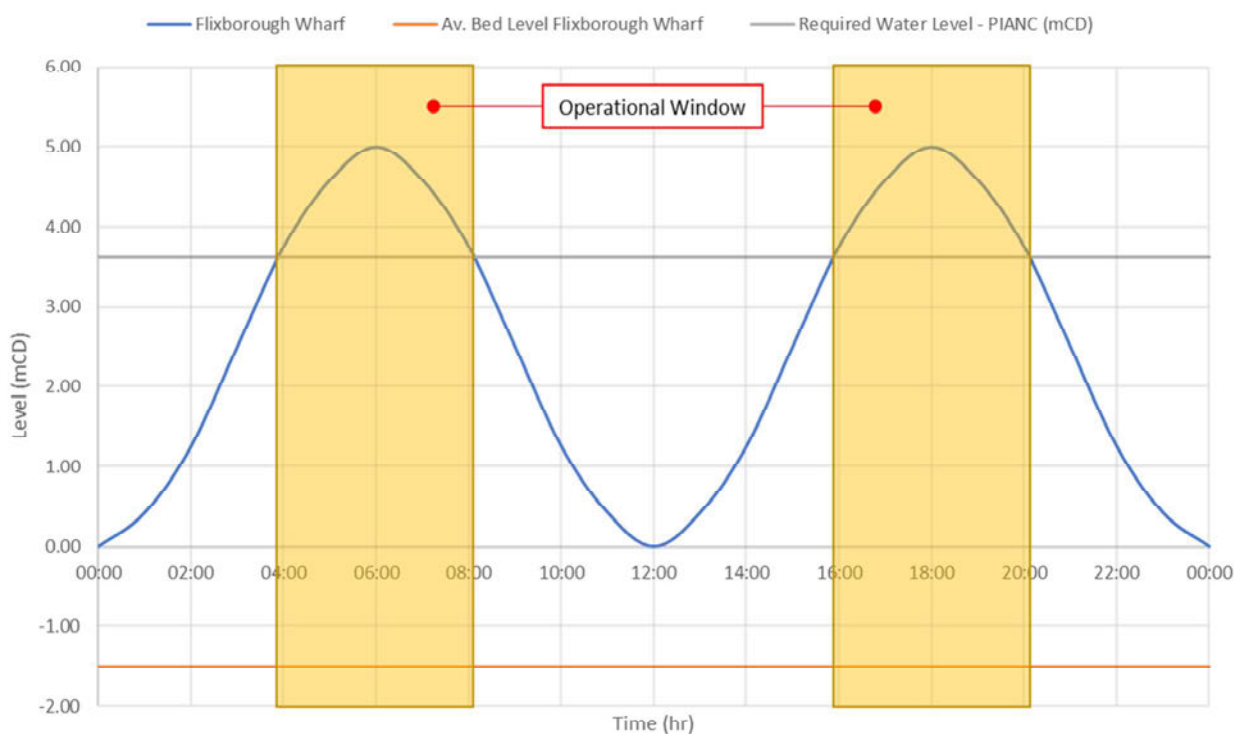


Figure 5-2 Assumed tidal curve indicating the possible operational window available at Flixborough Wharf

The review suggests that the operational window available for accessing Flixborough Wharf is limited to approximately two hours either side of high tide.

It is noted that the tidal information downstream of Flixborough Wharf at Burton Stather (ref: Table 3-2), would suggest a slightly larger operational window is available downstream. This would allow the vessels to commence their transit to Flixborough from the Humber before the two hour window before high tide as identified in Figure 5-2.

### 5.3 Assumptions

The following assumptions have been made based on the available data and discussion between BH and ABP:

- The maximum number of vessel movements during a high tide is two vessels arriving at the wharf and two vessels departing and sailing downstream to the Humber in each spring tidal cycle.
- It is noted that there may be operational constraints that limit vessels (e.g. pilotage), however, for the purpose of estimating a worst-case number of vessels to feed into environmental studies, such as noise and air impacts, it is assumed that this does not limit movements.
- Only the typical vessel specified here is considered for the vessel movement numbers. ABP have previously expressed their concerns with operating larger vessels within the River Trent on a frequent basis.
- All vessels will be travel under their own steam - no barges and tugs will operate in the river.
- The minimum navigable window will be approximately two hours either side of high tide to allow the vessels to sail from the Humber to Flixborough Wharf.
- Due to the potential small navigable window, arrival, unloading, and departure may not be possible on the same high tide. It is assumed that a 'not always afloat but safely aground' (NAABSA) condition will be acceptable at Flixborough Wharf.

## 6 Traffic Assessment

Using the vessel numbers provided by ABP and the assumptions stated above, an assessment has been conducted to calculate the number of additional vessel movements and percentage increase of vessel operations that could occur at Flixborough Wharf as a result of the proposed project.

The calculations are provided in Appendix D, a summary of the approach and results are presented below.

Two scenarios have been considered:

- 24-hour operations with two high-tides, and
- a 12-hour operation where only one high tide is utilised.

### 6.1 Assessment approach

The marine traffic assessment has been calculated based on the following approach:

- The number of additional vessels arriving during a Neap period is calculated based on the ratio of vessels arriving in a Spring/Neap tide given by ABP.
- The number of vessels arriving and departing per year are calculated for both Spring and Neap tides, assuming 26 spring tides per year and 26 neap tides per year.
- The total vessel movements per year at Flixborough are then compared to the information on vessel movements from ABP to allow for a percentage increase of vessel operations to be calculated.

### 6.2 Results

The results suggest the following:

- For **24-hour** operations, there could be approximately an additional **1,777** vessel movements per year resulting in a 402% increase in movements at Flixborough Wharf.



- For **12-hour** operations, there could be approximately an additional **594** vessel movements per year resulting in a 201% increase in movements at Flixborough Wharf.

Imposed operational constraints would impact the efficiency of the vessel movements. The current operational hours at Flixborough Wharf are thought to be from 06:00 to 16:00 (as identified by RMS Ports), and it is understood that there would be significant local resistance to extending these, particularly when combined with a significant increase in daytime traffic. It is therefore recommended that for further studies relating to the project the 12-hour operation (a single high tide per day) should be assumed.

A breakdown of the vessel movements associated with the 12-hour operation and the related percentage increase of vessel operations at Flixborough Wharf are given in Table 6-1:

**Table 6-1 Summary of results for calculating percentage increase of vessel operations at Flixborough Wharf**

<b>Tide</b>	<b>No. of vessels movements at Flixborough Wharf (2019-2020)</b>	<b>No. of vessels movements proposed at Flixborough Wharf</b>	<b>No. of additional vessel movements at Flixborough Wharf</b>
Spring Tides	362	728	366
Neap Tides	226	454	228
<b>Total</b>	<b>588</b>	<b>1,182</b>	<b>594</b>

## 7 Summary

This assessment utilised data provided by ABP from their analysis of vessel movement data between 2019 to 2020. The number of additional vessel movements that could occur during the spring tide is assumed from information provided by ABP. The assessment considered both 24-hour and 12-hour operations at the wharf.

Based on the information received, there does not appear to be justification for extending the current wharf, as only two vessels could arrive on a single high tide due to the limited tidal window. The berthing and transit of any additional vessels to and from Flixborough Wharf is not thought to be feasible.

In addition, there are likely operational constraints that would restrict the number of vessel movements. So, a 24-hour operation is considered to be unrealistic, and the estimated vessel movements calculated for the 12-hour operation should be used for assessing the impact of the project. For that scenario, there is estimated to be capacity for an additional **594 vessel movements per year**, approximately doubling current usage.

It is noted that the estimated vessel movements are somewhat theoretical and so present a realistic worst-case for environmental impact studies. The numbers should not be used for creating a business case for transporting goods and supplies to and from the project by river without further consultation with ABP, RMS Ports and consideration with the wider transport strategy for the project.

## Appendix A: Flixborough Wharf Structural Drawing



## Appendix B: Minutes of meeting with ABP

## Minutes

Subject North Lincolnshire Green Energy Park Job no 0046658  
Place Teams Call Date 14 January 2021  
Present Andrew Firman (AF) – ABP Apologies  
Jonathan Ogilvie (JO) – BH  
Distribution As above

**Objective of meeting: To discuss the vessel movement information ABP had provided prior to the meeting**

Item	Action
<b>1.0 Introduction</b>	
1.1 JO outlined to AF the reason for the call was to discuss the data ABP had provided via email and to obtain some further clarification in order to allow BH to determine the number of vessel movements that could occur in the River Trent.	
1.2 AF highlighted that he was slightly concerned with providing too much information as he did not want ABP's data to be used to determine a business case. JO assured AF that the vessel movements are to determine a possible "worst case" from an environmental perspective such as assessing noise and air.	
<b>2.0 Vessel movements</b>	
2.1 Discussion on the possible additional vessel movements that could take place within the River Trent associated with the Flixborough Wharf and agreed that the maximum number of vessel movements during high tide is two vessel sailing in to arrive at the wharf and two vessels departing the wharf and sailing downstream to the Humber.	
2.2 AF highlighted that there will be numerous operational aspects that could mean this scenario may not occur every time. JO acknowledged this but clarified that this would still in theory be the maximum and AF agreed.	
2.3 JO queried if the River Trent was two way or single traffic, AF confirmed that it is two way.	
2.4 AF provided further information on when vessels would need to depart / sail into the river and suggested it would be a window around 2 hours of high tide, with the departing vessel most likely requiring to depart first. AF felt there is sufficient time for the required vessel movements, i.e. two in 2 out.	
2.5 JO asked if AF could provide some guidance on the typical vessels that operate to determine a suitable standard vessel that could operate at the	

wharf. AF suggested a couple of vessels but it was agreed that "Fast Jef" was the best example of a bulk carrier (sea snake) with dimensions of:

- Length of 87.94m
- Beam of 12.9m
- Draft of 4.8m (loaded)
- DWT of 3,180

*Post meeting note: JO obtained vessel specification for Fast Jef from the following website link: [Fast Jef](#) [REDACTED]*

- 2.6 JO outlined his thoughts on how best to calculate the total number of vessel movements to determine the possible percentage increase in vessel movements due to the project. By using the maximum two in two out during spring high tides and assuming unloading/loading could take place prior to the next high tide. Then use the ratio between vessel movements during spring and neap tides to apply a reduction to consider the possible limitations in access during the lower neap high tides. Then use the total of 800 vessel movements in a year to determine the percentage increase of vessel movements due to the project. AF had no objections to the method.
- 2.7 AF suggested contacting RMS Ports for further detail around the operations at the port for unloading and loading timings.

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### 3.0 Other

- 3.1 AF confirmed if further discussions are required it is best to arrange a call.
- 

The minutes detailed herein reflect the author's recollection of the discussions held during the meeting detailed above. If you feel that these minutes are inaccurate; proposed additions, corrections and/or comments must be submitted to the author in writing within five working days of the date of these minutes. If no written responses are received within this period, these minutes will be deemed the official record of the meeting.

## Appendix C: Vessel Specifications for "FAST JEF"



## Fast Lines Belgium NV

Ernest van Dijckkaai 15/17  
2000 Antwerpen  
BELGIUM

VAT No. BE 416.137.027

### MV FAST JEF – main particulars



IMO Nr 9136101

Type : General Cargo

Built : 1996 in Barkmeijer Stroobos Holland

Flag : Belgium , Home Port : Antwerpen

Call Sign : ONEE , MMSI : 205465000

L.O.A : 87,99 m , L.P.P. : 83,78 m

Beam: 12,50 m Depth moulded 06,00m

DWAT : 3202 DWCC summer : 3085 , DWCC winter : 2985

Draught fully laden : 04,65 m (summer) , Draught fully laden : 04,55 m (winter)

Airdraft in ballast : 11,20 m

Distance between keel and top of hatchcoaming : 7,71m ( to calculate distance between waterline and top of hatch coaming deduct draft )

Draft in full ballast condition : F - 2,73 m A - 03,36m

Freeboard (summer) 1180mm

TPC - 10,00 mt/cm , FWA - 101 mm

Grain capacity : 147262 cuft / 4170 cbm (without 2 bulkheads)

bale capacity : 145194 cuft / 4112 cbm (with 2 bulkheads inside the hold stowed aft)

1 Hold - dimensions : length 61,80m x breadth 10,20m x height 06,69 m

1 Hatch - dimensions : 61,80m x 10,20m - Hatch covers pontoon type 10 sections

GT : 2066 NT : 1043 according to 1969 convention

Permissible loads : Tanktop (steelfloored) : 12 mt /m<sup>2</sup> Hatch covers : 1,5 mt/m<sup>2</sup>

Bulkheads : 2 moveable bulkhead in 5 positions

Container intake : 74 TEU in the hold + 40 TEU = total 114 TEU

Class : BV - AUT-UMS Strenghtbottom

Pandi : Raets Marine

Telephone : 00447702671347 , Inmarsat C : 581 420546510 , Email : 420546510@inmc.eik.com

Main engine : MAK 8M20 - 1000 kW / 900 rpm

Speed consumption : 11 Kn on 4,8 cbm Gasoil per day , 0,2 cbm Gasoil per day for generator

Vessel fitted with bowthruster : Veth type VT 150 output 220 kW

Rudder : Flap type - manufacturer : Hinze

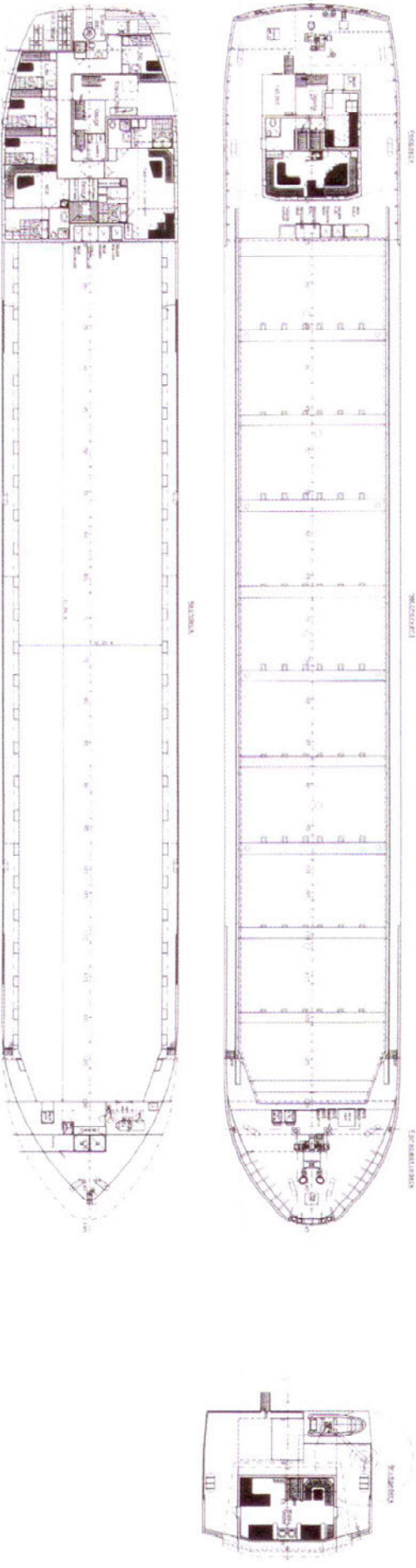
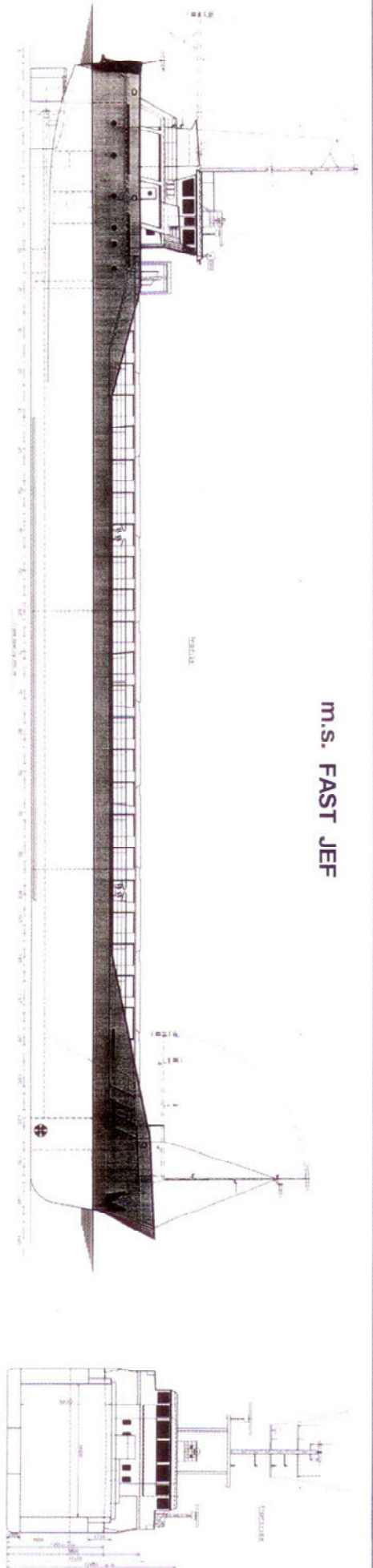
Capacities : bunkers 176 cbm Gasoil ( spec 0,86 mt/cbm DMA )

Fresh water : 58 cbm , Luboil : 3 cbm , Ballast : 1466 cbm

**All particulars believed to be correct and given in good faith , but without guarantee**



# m.s. FAST JEF



Main particulars	
Length over all	87,99 m
Length b.p.p.	83,73 m
Breadth mid.	12,50 m
Depth	6,00 m
Draught	4,64 m
Deadweight	3202 tons
Gross tonnage	1997 GT / 2066 GRT
Speed	11 kn
Class	Bureau Veritas
Classification	I 3/3 Cargo Ship Deep Sea MACH AUT MS Heavy Cargo BRG

Hold particulars	
Length	61,80 m
Width	10,20 m
Height	5,74 m
Capacity	147,300 cbh
Hatchovers / mat. / type	10 / steel / ponton
Movable bulkheads	2
Containercap. in hold	74 TEU
Containercap. on deck	40 TEU
	114 TEU total

Engine room bulkhead A60 insulated  
CO<sub>2</sub> fire extinguishing system in hold

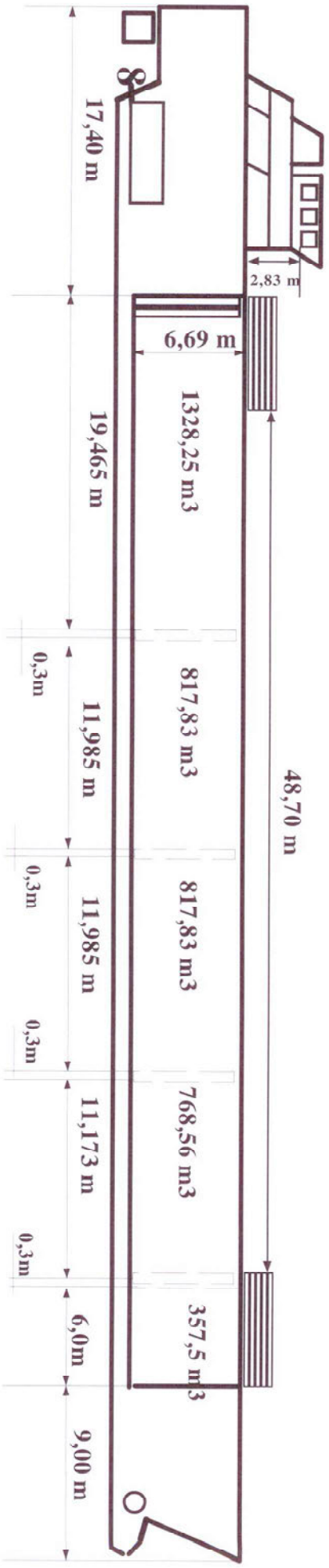
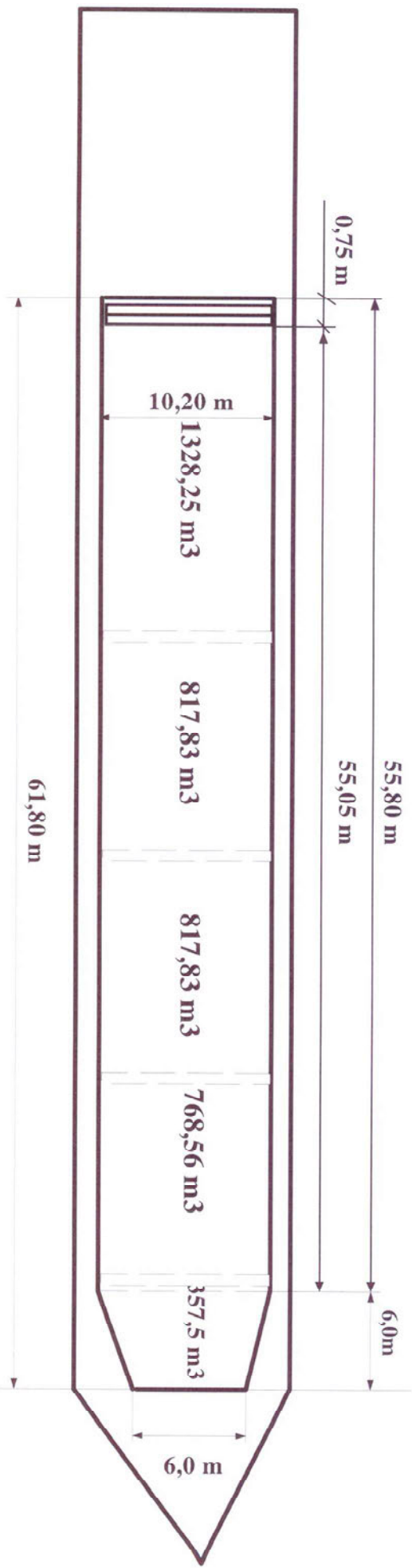
Tank capacities	
Fuel	176 m <sup>3</sup>
Freshwater	58 m <sup>3</sup>
Lub oil	3 m <sup>3</sup>
Ballastwater	1466 m <sup>3</sup>

Machinery	
Main engine	MAN
Type	8K/20
Output	1000 kW / 900 rpm
Reduction gear	Lohmann + Stohtfort
Type / reduction	GWE 39-43S / 4:1
Propeller	ø 2350 mm, 5 blades
Rudder	Hinze, flap type
Steering gear	Listwin / Frydenba
Auxiliary engine I	Valmet
Type / output	620 DSG / 90 kW / 1500 rpm
Alternator I	Stamford
Capacity	LCM 274 E 23
Auxiliary engine II	Valmet
Type / output	620 DSG / 90 kW / 1500 rpm
Alternator II	Stamford
Capacity	LCM 274 E 23
Auxiliary engine III	Valmet
Type / output	320 DSG / 53 kW / 1500 rpm
Alternator III	Stamford
Capacity	LCM 224 G 23

Bowthrust engine	
Type	Scania
Bowthrust	DS 11
Type / output	Veih
Ballast pumps (2x)	VT 150 / 220 kW
Capacity	K & R
Ballastwater sep.	S-100-60-175
Type	140 m <sup>3</sup> / h at 15 mwc
Capacity	Facet
Fuel separator	CPS-SBV
Type	1 m <sup>3</sup> / h
Fuel separator	Alfa Laval
Capacity	MAB 1039
Air compressors (2x)	0,9 m <sup>3</sup> / h
Type	Sperre
Capacity	HF-277
AC unit	12 m <sup>2</sup> / h at 30 bar

Navigational equipment  
GMDSS equipped, with Inmarsat C Satcom

**FAST JEF - hold dimensions : 61,80m (length) x 10,20m (width) x 6,69 m (height)**  
 max permissible tanktop load 12 mt/m<sup>2</sup>



**Total capacity of the hold without bulkheads : 4163 m<sup>3</sup> = 147262 cuft**

**Total capacity of the hold with 2 bulkheads : 4112 m<sup>3</sup> = 145194 cuft (stowed in aft position)**

**Dimensions of 1 bulkhead : 10,20m (width) x 6,555 m (height) x 0,3m (thick) = 20,06m<sup>3</sup>**

**Capacity in the hold occupied by 2 bulkheads stowed in the afterpart : 0,75m x 10,20 m x 6,69m = 51,18m<sup>3</sup>**

**Always take into consideration spaces between bulkheads and cargo , between rows, layers of cargo for lashing , securing and handling purposes**

**All above details belived to be correct given in good faith but without guarantee**

## Appendix D: Marine Traffic Assessment Calculation Sheets

<b>DURO HAPPOLD</b>	<b>Project:</b>	0046658	North Lincolnshire Green Energy Park			Author	Jonathan Ogilvie
	<b>Package:</b>	ABP Vessel movement information and calculations				Date	22/1/21
	<b>Sheet:</b>	Information from ABP				Checked	Paul Brenton
	<b>Document:</b>	Vessel Movement	<b>Rev.</b>	00	22/1/21	Date	22/1/21

The following information was provided to BH following consultation with ABP

### 1 Total vessel movements for a year

For a 12 month period ABP provided the following marine traffic information based on a review of their vessel tracking records

350 commercial vessel entered the River Trent

800 vessel movements (approx number in the area up to Flixborough Wharf)

### 2 Vessel Information

	LOA (m)	Draft (m)
Average vessel	85	4
Largest vessel	99	5.5

A typical vessel was identified by ABP "Fast Jef" with the following dimensions:

LOA (m)	87.99
Beam (m)	12.5
Max draft (loaded)	4.65
DWT (tons)	3202

### 3 Vessel Movements

#### Single Spring Tide

no of vessels arriving	2	<i>2 arriving plus 2 departing would be achievable with most vessels</i>
no of vessels departing	2	

#### Flixborough tidal arrivals (2019 - 2020)

	no of vessels	%
Spring tide	181	62%
Neap tide	113	38%
Total	294	100%

<b>DURO HAPPOLD</b>	<b>Project:</b>	0046658	North Lincolnshire Green Energy Park			Author	Jonathan Ogilvie
	<b>Package:</b>	ABP Vessel movement information and calculations				Date	22/1/21
	<b>Sheet:</b>	Vessel Movement - 12hr				Checked	Paul Brenton
	<b>Document:</b>	Vessel Movement	Rev.	00	22/1/21	Date	22/1/21

## 1 Input Data

No. of vessel arriving during Spring 2019 -2020	181	
No. of vessel arriving during Neap 2019 -2020	113	
No. of additional vessel arriving during spring high tide	2	
No. of additional vessel departing during spring high tide	2	
No. of spring tides per year	26	>>spring tides are 2 weeks apart
No. of neap tides per year	26	
Total no. of vessels arriving River Trent (per year)	350	>>Commercial vessels in a year
Total no. of vessels movements within River Trent (per year)	800	

## 2 Assumptions

12 hr operations 7 days a week (1 high tide and low tide a day)  
Reduction in vessels arriving and departing during neap will be the same

## 3 Calculations

### 1 Calculating the number of additional vessels arriving during Neap

No. of additional vessels arriving during Neap 1.25

### 2 No. of vessels arriving during to Flixborough due to project

Spring Tides 2 >> capped at 2 vessels  
Neap Tides 1.2

### 3 Calculate the no. of vessels arriving per year per tide

Spring Tides 364 vessel arriving per year  
Neap Tides 227 vessel arriving per year

### 4 Calculate the no. of vessels departing per year per tide

Spring Tides 364  
Neap Tides 227

### 5 Total vessel movements per year at Flixborough

Spring Tides 728  
Neap Tides 454  
Total 1182

### 6 No. of additional vessel movements

Spring Tides 366  
Neap Tides 228  
Total 594

### 7 % increase of vessel operations

Flixborough Wharf 201%  
Total vessel movement 174%

<b>DURO HAPPOLD</b>	<b>Project:</b>	0046658	North Lincolnshire Green Energy Park			Author	Jonathan Ogilvie
	<b>Package:</b>	ABP Vessel movement information and calculations				Date	22/1/21
	<b>Sheet:</b>	Vessel Movement - 24hr				Checked	Paul Brenton
	<b>Document:</b>	Vessel Movement	Rev.	00	22/1/21	Date	22/1/21

### 1 Input Data

No. of vessel arriving during Spring 2019 -2020	181	
No. of vessel arriving during Neap 2019 -2020	113	
No. of additional vessel arriving during spring high tide	4	
No. of additional vessel departing during spring high tide	4	
No. of spring tides per year	26	>>spring tides are 2 weeks apart
No. of neap tides per year	26	
Total no. of vessels arriving River Trent (per year)	350	>>Commercial vessels in a year
Total no. of vessels movements within River Trent (per year)	800	

### 2 Assumptions

24 hr operations 7 days a week (2 high tides and 2 low tides a day)  
Reduction in vessels arriving and departing during neap will be the same

### 3 Calculations

#### 1 Calculating the number of additional vessels arriving during Neap

No. of additional vessels arriving during Neap 2.50

#### 2 No. of vessels arriving during to Flixborough due to project

Spring Tides 4 >>capped at 2 vessels  
Neap Tides 2.5

#### 3 Calculate the no. of vessels arriving per year per tide

Spring Tides 728 vessel arriving per year  
Neap Tides 454 vessel arriving per year

#### 4 Calculate the no. of vessels departing per year per tide

Spring Tides 728  
Neap Tides 454

#### 5 Total vessel movements per year at Flixborough

Spring Tides 1456  
Neap Tides 909  
Total 2365

#### 6 No. of additional vessel movements

Spring Tides 1094  
Neap Tides 683  
Total 1777

#### 7 % increase of vessel operations

Flixborough Wharf 402%  
Total vessel movement 322%