Lochmaddy Ferry Terminal Upgrade Environmental Impact Assessment Report

COMHAIRLE NAN EILEAN SIAR

Volume 3

Appendices

April 2019

SKYE TRIANGLE
INFRASTRUCTURE WORKS

Contents

The numbering of the appendices provided here relates to the Volume 2 Chapters, i.e. Appendix A relates to Chapter 1 and Appendix G relates to Chapter 7. As not all chapters have appendices, not all letters are utilised, for example Chapter 4 has no appendices so there is no Appendix D.

Appendix A.1: The Environmental Impact Assessment Team

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Contents

1 Introduction

Affric Limited have led the Environmental Impact Assessment Report (EIAR) production, however it has been a team effort. Affric have worked closely with the client (Caledonian Marine Assets Ltd (CMAL) and Comhairle nan Eilean Siar (CnES)), their engineers (Wallace Stone) and with a variety of consultants to ensure that appropriate experts have contributed relevant technical input to the assessment. Table A.1 details the lead authors for each of the chapters. Further information with regard to the experience and expertise of the various companies and personnel involved in the production of the EIAR is provided in Section 2.

Table A.1: Lead Authors

Chapter	Lead Author(s)
1: Introduction	Redacted
2: Project Description	
3: Methodology	
4: Statutory Context & Policy	
5: Biodiversity	
6: Marine Mammals	
7: Benthic Ecology	
8: Fish Ecology	
9: Otters	
10: Noise and Vibration (In-air)	
11: Noise and Vibration (Underwater)	
12: Traffic, Access and Navigation	
13: Water Quality & Coastal Processes	
14: Schedule of Mitigation	
15: Conclusion	

2 The Companies

2.1 Affric Limited

Established in 2012, Affric are a growing and highly responsive environmental consultancy business providing a comprehensive range of environmental advice, surveys, planning support, stakeholder and project management services. With a broad and expanding portfolio of clients, they work on a diverse range of projects in the public and private sector from small and medium-sized enterprises to multi-national energy companies. Affric work with their clients to provide high quality tailored services, to ensure that any given project has the most appropriate expertise, irrespective of the sectors or regions in which they operate.

Chartered Environmentalist Redacted leads the Affric team. Her qualifications include a MSc in EIA, Auditing and Management Systems and BSc *(Hons)* in Environmental Chemistry, she recently completed a course in Marine Pollution Management. She previously led the Environmental Statement and EIAR production for the Invergordon Service Base Phase 3 and 4 developments and provided support through licensing, construction and into operations. In addition, she recently led the Tarbert Ferry Terminal Upgrade EIAR. Hence, she is ideally

positioned to produce the upfront chapters and topic specific chapters including Water Quality and Coastal Processes while managing the full production of the EIAR.

Redacted is a Redacted with specific expertise in Marine Mammals and underwater acoustics, holding an MRes in Marine Mammal Science. Having acted as the Redacted on the Invergordon Service Base Phase 3 Development he is familiar with the construction process and the effectiveness of mitigation in practice. He has produced marine ecology chapters for a variety of projects including: the Invergordon Service Base Phase 4 Development and the NorthConnect Interconnector High Voltage Direct Current cable application. In addition to authoring EIAR Chapters, he has also had a key role in the Construction Environmental Management Document production. Redacted also supervised the benthic survey work completed by Aspect and Apem.

Redacted is Affric's Otter expert, he regularly carries out otter survey work for harbour developments, identifying appropriate mitigation, in this instance has led Otter the chapter production.

Redacted as a Redacted Redacted supported the Affric team on a variety of Chapters and Appendices. He was co-author on the Benthic Ecology, Fish Ecology and Water Quality and Coastal Processes Chapters which drew upon knowledge gained from authoring similar chapters during the EIAR production for the Invergordon Service Base Phase 4 Development, the Kilfinichen Pier Development and Tarbert Ferry Terminal Upgrade.

2.2 TNEI Services Limited

TNEI's Planning & Environmental (P&E) Group noise team are competent in a range of acoustic disciplines with specialist knowledge of in-air environmental noise assessments, having worked on a wide variety of schemes including transportation, residential and commercial developments, oil and gas facilities, renewable energy developments (wind farms, solar, hydro and biomass) and a number of other sectors. The led author for the In-air Noise Chapter was Redacted a Member of the Institute of Acoustics PG Dip Acoustics & Noise Control with over 15 years' experience.

2.3 Subacoustech Environmental Limited

Subacoustech are specialists in underwater acoustic research and consultancy, providing support on behalf of government and commercial organisations. The Company possesses extensive experience of undertaking underwater noise modelling from activities relating to marine construction and assessing the impacts in accordance with the latest scientific publications. They have worked on both harbour and wind farm projects giving them a detailed understanding of piling noise levels and associated ecological receptors. The team was led by Redacted who has over 15 years' experience in the sector.

2.4 Wallace Stone LPP

Wallace Stone LLP was established in 1973 and is a member of the Association of Consulting Engineers. The company is particularly experienced in maritime civil engineering infrastructure, including; piers, harbours, ferry terminals and coastal protection. Wallace Stone provided

engineering, project management and assisted with the Traffic, Access and Navigation chapter to support to the Lochmaddy ferry terminal development. The preliminary and detailed design works and construction input to the EIAR process has been led by Redacted In addition, he has provided a review function to the EIAR ensuring the engineering and construction plans have been appropriately incorporated. Redacted with 28 years' experience primarily in the Ports and Harbour sector; designing and overseeing large and small harbour developments in the UK and overseas. Redacted has undertaken the road layout and marshalling area design; he has been designing road schemes for 20 years and is a member of the Institute of Highways and Transportation.

Appendix B.1: Lochmaddy Ferry Terminal Upgrade Programme

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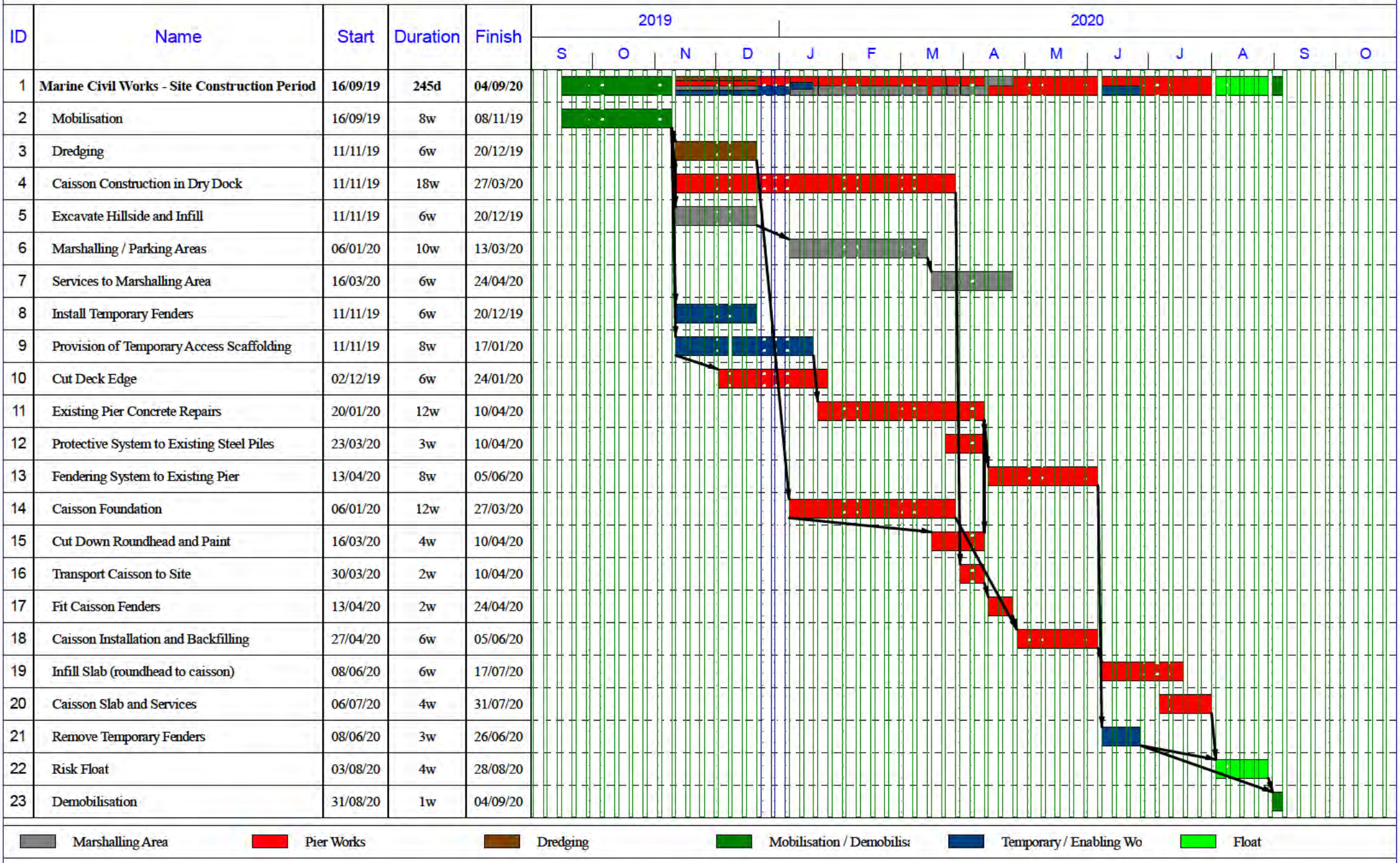
1975 - Lochmaddy Ferry Terminal

Indicative Construction Programme - Rev 3

06/02/19

ID	Name	Start	Duration	Finish
1	**Marine Civil Works - Site Construction Period**	**16/09/19**	**245d**	**04/09/20**
2	Mobilisation	16/09/19	8w	08/11/19
3	Dredging	11/11/19	6w	20/12/19
4	Caisson Construction in Dry Dock	11/11/19	18w	27/03/20
5	Excavate Hillside and Infill	11/11/19	6w	20/12/19
6	Marshalling / Parking Areas	06/01/20	10w	13/03/20
7	Services to Marshalling Area	16/03/20	6w	24/04/20
8	Install Temporary Fenders	11/11/19	6w	20/12/19
9	Provision of Temporary Access Scaffolding	11/11/19	8w	17/01/20
10	Cut Deck Edge	02/12/19	6w	24/01/20
11	Existing Pier Concrete Repairs	20/01/20	12w	10/04/20
12	Protective System to Existing Steel Piles	23/03/20	3w	10/04/20
13	Fendering System to Existing Pier	13/04/20	8w	05/06/20
14	Caisson Foundation	06/01/20	12w	27/03/20
15	Cut Down Roundhead and Paint	16/03/20	4w	10/04/20
16	Transport Caisson to Site	30/03/20	2w	10/04/20
17	Fit Caisson Fenders	13/04/20	2w	24/04/20
18	Caisson Installation and Backfilling	27/04/20	6w	05/06/20
19	Infill Slab (roundhead to caisson)	08/06/20	6w	17/07/20
20	Caisson Slab and Services	06/07/20	4w	31/07/20
21	Remove Temporary Fenders	08/06/20	3w	26/06/20
22	Risk Float	03/08/20	4w	28/08/20
23	Demobilisation	31/08/20	1w	04/09/20



Appendix C.1: Scoping Summary Table

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Scoping Summary Table

Consultee	Comment	Response	Where Considered
Marine Scotland (MS)	7.2.4 No specific section on Air Quality and Climate Change is required as part of the EIA report and is scoped out of the EIA process. The mitigation outlined above will be included in the schedule of Mitigation (SoM) and detailed site plans and/or the Construction Environment Management Plan (CEMP) to ensure successful implementation.	Appropriate mitigation included in the SoM and CEMD.	EIAR Chapter 14: Schedule of Mitigation
MS	7.3.1 Marine heritage sites could be impacted by both construction and dredging works, however these are to be undertaken within an existing Harbour Order, in an area which has previously been developed and it is unlikely any new sites will be discovered or disturbed.	A Protocol of Archaeological Discoveries has been included within the CEMD.	CEMD 9: Protocol for Archaeological Discovery
MS	7.4.1 The impacts of the construction phases of the development proposal on marine biodiversity are scoped into the EIA process.	Marine Biodiversity Considered in the EIAR.	EIAR Chapters 5 to 9
MS	7.4.2 The Lochmaddy Ferry Terminal Development is located in and is likely to have a significant effect on the Loch nam Madadh SSSI and SAC, and the Inner Hebrides and the Minches pSAC. The Loch nam Madadh SSSI and SAC is designated for coastal geomorphology; Fox tail stonewart (Lamoritgannium papulosum) (a non-vascular plant); mudflats; rocky shore; saline lagoon and tidal rapids; Otter (lutra lutra); intertidal mudflats and sandflats; lagoons; reefs; shallow inlets and bays and subtidal sandbanks. The Inner Hebrides and the Minches pSAC is designated for Harbour porpoise (Phocoena phocoena).	Effects on designated sites have been considered within the relevant biodiversity chapters of the EIAR.	EIAR Chapters 5 to 9
MS	7.4.3 A comprehensive mapping survey was completed in 1995 to survey the littoral and sublittoral habitats and communities in the Lochmaddy Area. However, the Lochmaddy development is located within the vicinity of the existing harbour, and no specific information exists on the benthic ecology or its status within the development footprint. The EIA report should include some habitat mapping as part of the assessment, these surveys should involve benthic video transects and grab sampling.	Benthic surveys including video transects and grab sampling have been undertaken and a habitat map developed.	EIAR Chapter 7: Benthic

Consultee	Comment	Response	Where Considered
MS	7.4.4 The dredging works, installation of the pier extension and the land reclamation for the extension of the marshalling area will result in the loss of habitat for marine habitat for benthic organisms, fish and potentially marine mammals within the harbour boundary. The pile driving and rock levelling have the potential to cause injury or disturbance to fish and cetaceans through the underwater noise emissions. Additionally, increased boat movements to transport construction materials could cause further disturbance, and could increase the risk of non-native species being introduced to the area.	Effects of dredging, pier extension and land reclamation on benthic, fish and marine mammals have been considered in the relevant biodiversity chapters. The introduction of non-native species has been considered in Water Quality and Coastal Processes.	EIAR Chapters 6 to 8 & 12
MS	7.4.5 With underwater noise being a main issue, impacts on marine ecology will be conducted following the completion of an underwater noise model. This will involve assessment of potential impacts to Harbour porpoise, other cetaceans and fish. These surveys will allow appropriate mitigation to be developed and implemented.	An underwater noise model has been completed and utilised in the assessment of effects on marine receptors.	EIAR Chapter 11: Noise (Underwater)
MS	7.4.6 Operationally, as the project is an upgrade and extension of an existing harbour, boat movements are expected to remain the same and therefore there is no additional risks to marine ecology from the operation of the site. No assessment of effects upon marine ecology during operation are required as part of the EIA process.	No assessment of operational effects on marine ecology has been completed.	
MS	7.4.7 It is unlikely that birds will be significantly impacted by the site preparation or construction as no habitat sites are expected within the proposed work areas. Birds identified during the baseline survey were not using the ferry terminal vicinity as a nesting habitat. No assessment of effects upon ornithology during construction and operation are required as part of the EIA process due to the lack of sensitive features within the area and the minimal potential for construction and operational impacts of the development.	No assessment on ornithology has been completed.	

Consultee	Comment	Response	Where Considered
MS	7.5.2 Operationally, the new ferry is larger than the existing ferry however with intermittent use of the port and relatively small change from existing conditions this is not considered significant. The developer will ensure the development is in keeping with the current use of the area and landscape character.	The design has ensured that the development is in keeping with the current use of the area and landscape character.	EIAR Chapter 2: Project Description
MS	7.5.3 Although the site is located in an NSA, the development will remain in keeping with the existing landscape and no assessment of landscape, seascape and visuals are required as part of the EIA process.	No assessment of landscape, seascape and visual effects has been completed.	
MS	7.6.1 Baseline surveys indicated that the underlying bedrock in the area of the development is the Lewisian Complex. The Loch nam Madadh SAC encompasses the development site and is designated for its coastal geomorphology, mudflats, rocky shores and shallow sandflats. The dredging and pilling works have the potential to affect land and soil quality within the marine environment through changes to the till structure and sediment deposition. The dredge material will be used as infill for the marshalling area extension therefore reducing the requirement for sea disposal. In order to minimise the potential effects, the applicant proposed the following mitigations: Soil contamination -Correct disposal of hazardous waste and contaminated water -Storage of chemicals and hydrocarbons in secondary containment, where applicable -Adequate spill response equipment on site -Installation of adequate surface water management facilities -Regular maintenance will be undertaken on equipment -Designated area for concrete contaminated equipment and tools Removal of underlying geology -Removal of rock area will be minimised through design informed by ground investigation - localised techniques to be utilised	Items included in the Schedule of mitigation and relevant sections of the EIAR.	EIAR Chapter 14: Schedule of Mitigation

Consultee	Comment	Response	Where Considered
MS	With the mitigations employed above, the assessment of impacts to Land and Soil is not required as part of the EIA process due to lack of significant potential impacts associated with the proposed development.	No assessment of land and soil quality effects have been completed.	
MS	7.7.2 The project is an upgrade of an existing ferry terminal, and therefore the applicant concludes no additional population, human health, or socioeconomic changes from the current baseline. Therefore, as assessment of impacts to population, human health and socio economics are not required as part of the EIA process.	No assessment of population, human health and socio-economic have been completed.	
MS	7.8.1 During the construction phases, underwater noise is likely to be generated during the piling and blasting works, and the increase in vessel traffic delivering materials. This could have the potential to disturb or injure marine mammals in the area. Noise and vibration associated with construction phases should be investigated further and are therefore scoped into the EIA process. An underwater noise model should be developed in order to predict the noise emission levels and frequencies at different ranges from the site. This model will inform the marine ecological risk assessment and if required, noise mitigation should be implemented.	An underwater noise model has been completed and utilised in the assessment of effects on marine receptors. There is no longer an intention to blast.	EIAR Chapter 11: Noise (Underwater)
MS	7.8.2 Operationally, it is unlikely that noise generation will increase significantly from the current baseline. Therefore, an assessment of impacts from noise and vibration during the operational phase are not required as part of the EIA process.	No operational noise (underwater) assessment has been completed.	

Consultee	Comment	Response	Where Considered
MS	7.9.2 In order to minimise the potential effects, the following mitigations should be employed: Material and water usage - Reuse of dredge material, where practicable - Waste hierarchy employed - Existing built infrastructure will be reused or upgraded wherever possible Waste -Limited number of construction employees on site -Segregated bins provided -Waste appropriately segregated -Hazardous waste and contaminated water will be disposed of correctly	Mitigation included in the Schedule of Mitigation, note the dredge material is not suitable for reuse.	EIAR Chapter 14: Schedule of Mitigation
MS	7.9.3 With the mitigations employed above, the assessment of impacts to Natural Resource Usage and Waste is not required as part of the EIA process due to the lack of significant potential impacts associated with the proposed development.	No assessment of natural resource usage and waste has been completed.	
MS	7.10.1 During the construction phases, marine traffic is expected to increase, and the EIA report should demonstrate that the issue of disturbance to other vessels has been addressed and mitigation measures identified if necessary.	Increase in vessel number during construction has been considered, under navigation.	EIAR Chapter 12: Traffic, Access & Navigation
MS	7.10.2 Construction and operational marine traffic and access are scoped into the EIA. The EIA report should further demonstrate that the issue of access to the marina should not change and access and maintenance to the pontoons should be identified.	Construction and operational effects on marine traffic are considered under navigation, this includes access to the marina from land and water.	EIAR Chapter 12: Traffic, Access & Navigation
MS	7.11.1 Water Quality and Coastal Processes are scoped into the EIA process during the construction and operational phases.	Water quality and coastal processes during construction and operation have been considered.	EIAR Chapter 13: Water Quality and Coastal Processes
MA	7.11.2 Dredging operations and the use of arisings for infill, could result in historic contaminants being released into the marine environment and reduced water quality. Operationally, no significant changes are anticipated to the current water quality.	Water quality effects associated with dredging are considered. Note the material is not suitable for reuse.	EIAR Chapter 13: Water Quality and Coastal Processes

Consultee	Comment	Response	Where Considered
MS	7.11.3 The proposed land reclamation has the potential to alter wave direction and local geomorphological characteristics, and the EIA report should demonstrate that these have been addressed and mitigation measures identified if necessary.	Effects on wave direction and local geomorphology are considered in coastal processes.	EIAR Chapter 13: Water Quality and Coastal Processes
MS	7.11.4 The EIA report should further demonstrate that the issue of flood / tidal surges have been addressed through a Flood Risk Assessment with an appropriate level of technical detail, and mitigation measures identified if necessary.	Flood are considered in the water quality chapter in alignment with CnES Scoping response, no specific mitigation was required. Tidal surges were scoped out further to discussion with SEPA and Marine Scotland see Appendix C.2.	EIAR Chapter 13: Water Quality and Coastal Processes
MS	7.12.1 The following impacts from major accidents and natural disasters require further consideration and should be scoped into the EIA process: -Severe storms -Flood / tidal surges (to be assessed in the Water Quality section) -Transport accidents	Further to discussion with SEPA and Marine Scotland it was agreed that Major accidents could be scoped out. Flood was considered under Coastal Processes Chapter 13. Transport accidents to be considered in Chapter 12. Severe storm and tidal surges were scoped out (Appendix C.2).	
MS	9.1.1 Where works are located in areas where Gaelic is spoken, applicants are encouraged to adopt best practice by publicising the project details in both English and Gaelic.	The application will be advertised in Gaelic and English in the local media and on the project website.	
Comhairle nan Eilean Siar (CnES)	1.Flood risk: It is noted that in your Scoping Report, and in response to SEPA's comments on this issue, you consider that the sheltered location of the proposed development means that you have 'scoped out' the need for a detailed Flood Risk Assessment and any need for the RIAR to address this matter in detail. It is nevertheless considered that further technical detail to prove 'no flood risk' is required. You should follow SEPA advice on this matter and also consult the Comhairle Flood Risk Officer for this area.	Flood is considered in the coastal processes' assessment. The Flood Risk Officer was contacted.	EIAR Chapter 13: Water Quality and Coastal Processes

Consultee	Comment	Response	Where Considered
CnES	2. Traffic Construction impacts: Anticipated traffic routes for rock armour and rock infill to be brought from outwith the site area and anticipated vehicle tonnages and mitigation measures for road maintenance should be identified.	Construction traffic is considered within the EIAR.	EIAR Chapter 12: Traffic, Access & Navigation
CnES	3. Impact on the pontoons: Plans should be clear about how access to and use of the pontoons can be maintained in a safe and convenient manner. They should also be clear about any changes that may be required to the pontoons.	Construction techniques taking account of pontoon requirements are explained in the project description. Effects on the pontoons are considered under navigation including access from land and water.	EIAR Chapter 2: Project Description, Chapter 12: Traffic, Access & Navigation

Appendix C.2: Email Correspondence

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Archived: 02 April 2019 10:16:34
From: Redacted
Sent: Thu, 26 Oct 2017 10:21:24 +0200Received: from pure maildistiller.com (dispatch1.mdlocal [10.80.45.110]) by dispatch1
To: Redacted
Redacted
Subject: Lochmaddy Ferry Terminal Upgrade Scoping - SEPA Response PCS/155641
Importance: Normal

Hi Reda

Thanks for sending in the below queries and information.

We have reviewed this and based on the information we hold, we agree that compared to the other locations in the Skye Triangle proposals, it is likely that Lochmaddy would be less impacted by wave action. Taking this into account, along with the water compatible nature of the development, it is likely that we would not be seeking further wave studies. However to ensure flood resilience throughout the lifetime of the development, a suitable freeboard, and other factors including climate change should be taken into account when designing the site. It has been stated that the areas of proposed land reclamation will be infilled to around 1.8m above MHWS. To enable us to provide more detailed advice on any required freeboard, we need details of the levels of the proposed infill, and any proposed built infrastructure to be provided relative to metres above Ordnance Datum.

We appreciate you might not have that information yet given the early stage of the proposals. Once you have that information, we strongly recommend that you email us again with the draft plans and site levels details to mAOD and we can then provide advice on whether the proposals are acceptable or whether greater freeboard is required.

We hope this is of help but happy to discuss further if this would assist.

Kind regards

RRed

Redacted
Redacted Red
Planning Service, SEPA, Graesser House, Dingwall Business Park, Dingwall IV15 9XB Direct Line: Redacted Email: Redacted

Redacted
Ard-Oifigear Dea bhaidh
Seirbheis an Dealbhachaidh, BDAA, Taigh Graesser, Pàirc Gnothachais Inbhir Pheofharain, Inbhir Pheofharain, IV15 9XB.
Fòn: Redacted

Please note that I normally only work on Tuesdays, Wednesdays and Thursdays.

For our planning guidance, please visit www.sepa.org.uk/environment/land/planning

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From: Redacted
Sent: 18 October 2017 17:09
To: Planning Dingwall Redacted
Cc: Redacted
Subject: RE: Lochmaddy Ferry Terminal Upgrade Scoping - SEPA Response PCS/155160

Hello R ed

Thank you for your phone call to discuss the Lochmaddy Scoping Report. Attached is my very non-engineering representation of the infill area and the potential for associated flooding.
There are two areas that may be infilled:

- Area 1 – This area will be infilled to extend the marshalling area. As you can see from the 'Close Drawing' there is very minimal wave direction that intersects with the infill, and when you review the 'Far Drawing' you will see that this is additionally protected by an southern landmass. This area will be tied into the existing marshalling area and is therefore likely to be ~1.8m above MHWS at its lowest point. This area will be rock armoured on the seaward side.
- Area 2 – This area may or may not be infilled depending on the need for additional parking. Parking issues were brought up as part of the community consultation and this has not yet been fully explored or designed. As shown in the 'Close Drawing', this area does intersect with a larger potential wave direction, however this is additionally buffered by the distance between any stakeholders and the infill. Again, if you review the 'Far Drawing' this area is protected by the landmass to the south. It is likely that this area will also be infilled to ~1.8m above the MHWS and rock armoured on the seaward side.

In addition to this, if there is a severe storm that results in flooding the ferry would not be running, and therefore the area most likely to be flooded would

not be in use.

Please get in touch if you require more information or have any concerns that are not addressed by that provided and I follow up for you.

Kind Regards, Reda

From: Redacted
Sent: 03 October 2017 08:57
To: Redacted
Cc: Redacted

Subject: RE: Lochmaddy Ferry Terminal Upgrade Scoping - SEPA Response PCS/155160

Hello Redact

Thank you for the additional clarification. In Reda's absence I provide initial feedback in green below. Reda is out of the office until 18th October, but if it would be helpful we could pencil in a telephone conference call for soon after she is back to discuss further if necessary.

Kind regards

Red

Redacted

Planning Service, SEPA, Graesser House, Dingwall Business Park, Dingwall, IV15 9XB
Direct line Redacted
Please note I am not at work Friday afternoons

From: Redacted
Sent: 02 October 2017 16:28
To: Redacted

Subject: RE: Lochmaddy Ferry Terminal Upgrade Scoping - SEPA Response PCS/155160

Dear Red

Thank you for your prompt feedback it is much appreciated. Please see below our comments to your queries.

a) Section 13.4 of the Scoping Report mentions the installation on an oil separator and new drainage system. Section 13.6 proposes scoping out terrestrial water quality. We request that this issue is assessed in some form as it is important to demonstrate that adequate space is available to treat surface water run-off. Please refer to Section 3 of our previous response for the issues we would expect to be assessed as part of this. In addition we support the proposal for waste water drainage to be directed to the public sewer. This should be shown on site plans. Please note Section 5 of our previous response in terms of existing waste water outfalls. These should be included within any site plans too.
The new surface water drainage system will tie into the existing surface discharge into the marine environment. The discharge of the surface water will be considered within the EIA under the water quality marine chapter as this is where the potential risk lies. Clarification helpful, thank you.

We do not believe that Ciria (2012) SUDS, which is written with urban development in mind, is suitable for the management of surface water in this coastal setting which we plan to discharge to the marine environment. With regards to drainage designs this is the same framework as the recent developments at Brodick, Kennacraig and Gourock.
Drainage designs have not been finalised but we are currently proposing that the marshalling area will be drained by gullies, kerb drains or channel drains with carrier pipes to an oil/silt interceptor. The interceptor then discharges into the sea through the rock armour foreshore. A non- return valve is fitted to prevent backflow into the interceptor should the outfall be below the extreme high-water level. This system will be checked regularly and fitted with an alarm that goes off if the oil compartment is full. The drainage requirements outlined in The SuDS Manual (CIRIA C753, 2015) are applicable to surface water drainage proposals for all types and scales of development. As per Cerian's original response, a detailed risk assessment will be required for the high risk areas. If that assessment identified the solution outlined above, then we are likely to consider is acceptable.

The pier facilities buildings are not being upgraded as part of this development there is no plans to upgrade the foul effluent drainage system and associated outfall. The existing pier drainage will be unchanged, this is only used for pedestrian assessing the vessel gangway and discharges over the quay edge. Design of the drainage on the new pier extension is still underway but as this may be used for cranes and operations there is the potential that this will be fitted with a drainage channel and interceptor. Full details will be provided in the water quality marine chapter. Clarification helpful, thank you.

b) Flood risk is mentioned in Sections 13 and 14 of the Scoping Report but it is not clear whether this is being assessed as part of the EIA or other supporting information. Please refer to Section 4 of our previous response and specifically Section 4.3 in terms of any proposed land reclamation. This should be

addressed in the forthcoming applications.

As per Section 13, flooding is not considered significant and was scoped out of the EIA. This is due to the size of the infill and the bay being protected from heavy wave energy, hence its suitability for mooring of vessels. A coastal wave study was proposed for Uig however their bay is open to the sea and hence their requirement for a wave wall. As you can see in the photos provided in Section 13 of the scoping document this is not the case for Lochmaddy it is almost completely surrounded by landmass. As per Cerian's original email response, we do not have a strong view on whether the information we have requested be within the EIAR or other supporting documentation, however, we will expect flood risk to be assess as per our previous response.

c) Section 11 of Scoping Report does not clarify whether borrow pits are required. We therefore assume that none are proposed. This should be stated within the applications. If this is not the case then the issues detailed in Section 6 of our previous response should be assessed.

As per Sections 2.3 and 11, dredge material will be used for infill, no borrow pits will be utilised for this project. In an attempted to keep these documents as concise and proportionate as possible an outline of all activities to be undertaken will be included, but activities not be undertaken will not be discussed. Thank you for confirming there will be no borrow pits.

d) We note the proposal for a CEMP throughout the Scoping Report and that this is will be a general repository for much of the proposed mitigation in the absence of assessment within the EIAR. As detailed in Section 7 of our previous response, our preference is that detailed site plans are submitted to demonstrate how impacts on the environment have been minimised through site design and that all mitigation should be detailed within a suitably robust schedule of mitigation as part of the application. Across Scotland, we have found that the use of maps, plans and a supporting schedule of mitigation are more effective at ensuring that mitigation is implemented than CEMPs. CEMPs tend to contain too much text and repetition to be useful to contractors and site operatives. As a result we will expect the applications to include detailed site plans and site specific schedule of mitigation.

I definitely agree that plans and engineering solutions are far better at managing environmental risks than management measures outlined within the Schedule of Mitigation and implemented through the CEMPs. However, mitigation measures within this scoping document are only proposed for those aspects that are not considered significant and can be minimised by implementing standard best practices. For example, 'plant and vehicles will be well maintained' and 'adequate spill response equipment on site.'

As such the mitigation measures outlined throughout the scoping report are operational solution bases on standard best practice and for this reason not suitable to be shown in site designs. As such, they sit better in a CEMP. A more robust review of mitigation measures will be undertaken for higher risks aspects during the EIA assessment, this will cumulate in the production of a Schedule of Mitigation which will inform the CEMP in accordance with the Highland Councils Guidance Note – Construction Environmental Management Process for Large Scale Projects, Figure 1 of which is provided below. In our experience the environmental management process proposed by Highland Council is very effective but acknowledge that it is important that the documentation produced is focused and written with the target audience in mind.

Site plans will be incorporated within the EIA Report, to support the project description section. Specific construction site layout plans will also be developed and included within the CEMP.

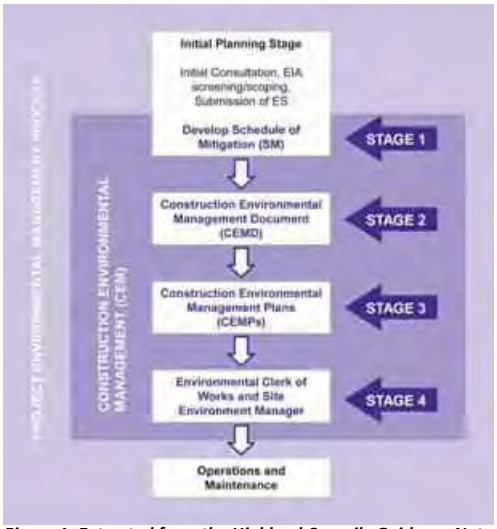

Figure 1: Extracted from the Highland Councils Guidance Note – Construction Environmental Management Process for Large Scale Projects

Your comments are noted and we welcome confirmation regarding the schedule of mitigation. As long as the submission also includes the site specific plans demonstrating how impacts on the environment have been minimised through site design then we will be content.

Please let me know if you are happy with our proposal or if you would like to discuss any elements further and we could potentially organise a face to face meeting.

Regards, Reda

From: Redacted
Sent: 26 September 2017 13:51
To: Redacted

Subject: Lochmaddy Ferry Terminal Upgrade Scoping - SEPA Response PCS/155160

Hi Redacted

Many thanks to both of you for the Lochmaddy scoping consultations and scoping report. As both sets of information are identical, we are responding to you both within this email to ensure consistency.

As you'll be aware, we previously provided screening and scoping advice for the three projects at Uig, Tarbert and Lochmaddy (attached). We have reviewed the proposed scope of the Lochmaddy EIA against this advice and have the following comments.

At the screening stage, we concluded that, in terms of our interests, the development was unlikely to have a significant effect (in the context of the Regulations) on the environment and therefore we did not request EIA. However we still requested that a number of topics were addressed as part of any subsequent Harbour Revision Order, Marine Licence or planning application submission.

We note a number of topics within our remit have been scoped out of the EIA but it is not clear if these will be detailed within any other supporting documentation for these applications. As detailed in our previous response (attached), we would expect all the topics listed to be addressed within the applications either within the EIAR or as part of other supporting information. For some of these topics, the scoping report already details proposed mitigation and why the issue does not need to be assessed as part of the EIA. For many of our topics, this information would suffice in the form of supporting information or within the schedule of mitigation however there are some issues detailed below which require further information or assessment. For the avoidance of doubt, we have no preference as to whether this is within the EIAR or as other supporting information. If it would assist, we would welcome the opportunity to comment on the draft EIAR or other supporting information.

a) Section 13.4 of the Scoping Report mentions the installation on an oil separator and new drainage system. Section 13.6 proposes scoping out terrestrial water quality. We request that this issue is assessed in some form as it is important to demonstrate that adequate space is available to treat surface water run-off. Please refer to Section 3 of our previous response for the issues we would expect to be assessed as part of this. In addition we support the proposal for waste water drainage to be directed to the public sewer. This should be shown on site plans. Please note Section 5 of our previous response in terms of existing waste water outfalls. These should be included within any site plans too.

b) Flood risk is mentioned in Sections 13 and 14 of the Scoping Report but it is not clear whether this is being assessed as part of the EIA or other supporting information. Please refer to Section 4 of our previous response and specifically Section 4.3 in terms of any proposed land reclamation. This should be addressed in the forthcoming applications.

c) Section 11 of Scoping Report does not clarify whether borrow pits are required. We therefore assume that none are proposed. This should be stated within the applications. If this is not the case then the issues detailed in Section 6 of our previous response should be assessed.

d) We note the proposal for a CEMP throughout the Scoping Report and that this is will be a general repository for much of the proposed mitigation in the absence of assessment within the EIAR. As detailed in Section 7 of our previous response, our preference is that detailed site plans are submitted to demonstrate how impacts on the environment have been minimised through site design and that all mitigation should be detailed within a suitably robust schedule of mitigation as part of the application. Across Scotland, we have found that the use of maps, plans and a supporting schedule of mitigation are more effective at ensuring that mitigation is implemented than CEMPs. CEMPs tend to contain too much text and repetition to be useful to contractors and site operatives. As a result we will expect the applications to include detailed site plans and site specific schedule of mitigation.

I hope the above assists but please do not hesitate to contact us if you have any queries.

Kind regards

Reda

Redacted

Planning Service, SEPA, Graesser House, Dingwall Business Park, Dingwall IV15 9XB Direct Line: Redacted

Redacted
Ard-Oifigear Dea bhaidh
Seirbheis an Dealbhachaidh, BDAA, Taigh Graesser, Pàirc Gnothachais Inbhir Pheofharain, Inbhir Pheofharain, IV15 9XB.
Fòn: Redacted

Please note that I normally only work on Tuesdays, Wednesdays and Thursdays.

For our planning guidance, please visit www.sepa.org.uk/environment/land/planning

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From: Redacted
Sent: 21 September 2017 12:21
To: Redacted

Subject: The Marine Works (Environmental Impact Assessment) Regulations 2017, Regulation 14 - Request for a Scoping Opinion, Lochmaddy Ferry Terminal

Upgrade.

Hello Redacted ,

I write to request a scoping opinion for the Lochmaddy Ferry Terminal Upgrade, on behalf of Comhairle nan Eilean Siar. This is in accordance with The Marine Works (Environmental Impact Assessment) Regulations 2017, Regulation 14.

Please find attached the Lochmaddy Ferry Terminal Development EIA Scoping Report for your information and review.

I anticipate a scoping opinion by the end of November 2017. Allowing for the 30 days consultation period as outlined in Regulation 14 (5) and the additional 5-week period required for Marine Scotland to adopt a Scoping Opinion as outlined in Regulation 14 (7). Please inform Affric Limited at the earliest opportunity, if this is not achievable, so that we can update the project delivery programme accordingly.

We look forward to receiving your scoping opinion. Should you have any further queries in the meantime please contact Redacted of this office.

Kind regards,

Redacted

Making it Happen

Redacted

Archived: 02 April 2019 10:16:47
From: Redacted
Sent: ed, 13 Dec 2017 12:49:07 +0100Received: from [193.109.254.3] (using TLSv1.2 with cipher DHE
To: Redacted

Subject: RE: The arine or s (Environmental mpact Assessment) Regulations 2017, Regulation 14 - Re uest for a Scoping Opinion, Lochmaddy Ferry Terminal Upgrade.
Importance: Normal

Hi Redac ,
d
In this instance Marine Scotland will not issue a second version of the scoping opinion.

SEPA s amended advice has come after the Scoping Opinion have been issued and the discussions held between yourself and SEPA have not been consulted on. As such, in order to address the amendment to the advice received from SEPA and to ensure compliance with regulation 6 3 of the EIA egulations, you should include a narrative in the relevant chapter s of the EIA eport e plaining how the issue has been considered and properly cite your email with SEPA in the eferences section.

In regards to section 7.11.3, the conclusions on the Scoping Opinion do not change and this should remain scoped into the EIA eport. In this section you should include the table from the Scoping eport and include some narrative referencing the table to demonstrate you have considered it and the conclusions which you have reached.

ind egards
Redact
d
Redacted

Frequently Asked Questions

From: Redacted
Sent: 29 November 2017 13:22
To: Redacted

Subject: RE: The Marine Works (Environmental Impact Assessment) Regulations 2017, Regulation 14 - Request for a Scoping Opinion, Lochmaddy Ferry Terminal Upgrade.

Hello Reda

Thank you for sending that through. As discussed on the phone, I do not believe a wave study is required as part of the EIA and I do not feel that severe storms and/or transport accident need to be considered within the major accidents and disasters section. Can you please confirm if you are happy with these conclusions

With regards to '*7.11.3 The proposed land reclamation has the potential to alter wave direction and local geomorphological characteristics, and the EIA report should demonstrate that these have been addressed and mitigation measures identified if necessary* .' I do not believe this is a significant risk as the area is almost entirely surrounded by land which protects it from wave action, as such making it an ideal location for a harbour. I have discussed the concerns regarding wave action with SEPA and they are also of the opinion that no wave study is required. SEPA previously stated '*We have reviewed this and based on the information we hold, we agree that compared to the other locations in the Skye Triangle proposals, it is likely that Lochmaddy would be less impacted by wave action. Taking this into account, along with the water compatible nature of the development, it is likely that we would not be seeking further wave studies.*' Please let me know if you would like me to forward these communications on to you.

With regards to ' *7.12.1 The following impacts from major accidents and natural disasters require further consideration and should be scoped into the EIA*

process: Severe storms, Flood / tidal surges (to be assessed in the Water Quality section) and Transport accidents.' I think there has been some confusion around the use of, 'further consideration required'. This sentence was used to show topics that raised either a location or a proposed use risk, not for inclusion into the EIA. The further consideration was undertaken during the scoping and presented in the table. These are further explained below.

- Transport accidents have the potential to arise due to the proposed use of the facility. Navigation issues at Lochmaddy, however, are limited by seabed depths at the berth. The close proximity of rocky foreshore to the North of the pier limits any potential room for movement when berthing. Additionally, the ferry draught is deeper than the sea depth surrounding areas of concern (i.e. shore and pontoon) as a result the ferry is not able to run ashore or hit the pontoon.
- Severe Storms are a risk due to the location of the development. However, after further consideration it was realised that: During construction, work would stop and the site would be made safe and during operation, ferries do not run, and would be berthed/tied up appropriately. As such, this is not considered a major accident or disaster risk.
- Flood and Tidal Surges where references out to the Water uality and Coastal Processes Chapter. Again, I don't think there is a major accident or disaster concern, however this will be included in the EIA to assess potential impacts.

Can you please let me know if you are happy with this conclusion and therefore happy for these to be excluded from the EIA Please let me know if you require any additional information.

Kind regards,

Red

From: Redacted
Sent: 17 November 2017 15:19
To: Redacted

Subject: RE: The Marine Works (Environmental Impact Assessment) Regulations 2017, Regulation 14 - Request for a Scoping Opinion, Lochmaddy Ferry Terminal Upgrade.

Dear Redact
d
Please see attached scoping opinion.

Please do not hesitate to contact us if you have any ueries.

ind egards
Redact
d
Redacted
Redacted

Frequently Asked Questions

From: Redacted
Sent: 21 September 2017 12:21
To: Redacted

Subject: The Marine Works (Environmental Impact Assessment) Regulations 2017, Regulation 14 - Request for a Scoping Opinion, Lochmaddy Ferry Terminal Upgrade.

Hello Redacted ,

I write to request a scoping opinion for the Lochmaddy Ferry Terminal Upgrade, on behalf of Comhairle nan Eilean Siar. This is in accordance with The Marine Works (Environmental Impact Assessment) Regulations 2017, Regulation 14.

Please find attached the Lochmaddy Ferry Terminal Development EIA Scoping Report for your information and review.

I anticipate a scoping opinion by the end of November 2017. Allowing for the 30 days consultation period as outlined in Regulation 14 (5) and the additional 5-week period required for Marine Scotland to adopt a Scoping Opinion as outlined in Regulation 14 (7). Please inform Affric Limited at the earliest opportunity, if this is not achievable, so that we can update the project delivery programme accordingly.

We look forward to receiving your scoping opinion. Should you have any further queries in the meantime please contact Redacted Redacted of this office.

Kind regards,

Redacted

Appendix E.1: Lochmaddy Ferry Terminal Upgrade Habitat Regulations Appraisal Pre-Screening Report

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Contents

1 Introduction

In conjunction with submitting an Environmental Impact Assessment Report (EIAR) to support a Marine Licence application for the proposed Lochmaddy Ferry Terminal Upgrade, this Habitats Regulations Appraisal (HRA) Pre-Screening Report provides information required for the competent authority to carry out an HRA, and, where required, an Appropriate Assessment (AA).

This report is designed to be read in conjunction with the EIAR and directs the reader to the chapters and section of the EIAR which are relevant to the designated site or qualifying species being discussed.

1.1 Legislative Basis

An HRA is required for this development due to its proximity to multiple Natura 2000 sites, including Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). The legislative context for this requirement is based on Article 6(3) of the Habitats Directive (92/43/EEC), Article 4(4) of the Birds Directive (2009/147/EC), and is implemented in Scotland through The Conservation (Natural Habitats, &c.) Regulations 1994 (the Habitats Regulations).

In Scotland, the Scottish Planning Policy document ensures that Ramsar sites, which are normally included in an HRA assessment, overlap with Natura sites and are therefore protected under the same legislation (Scottish Government, 2014). Therefore, Ramsar sites do not need considered separately as part of this HRA Screening report.

If a likely significant effect is predicted on a Natura Site at the first stage of the HRA, then an Appropriate Assessment (AA) must then be carried out. The AA must demonstrate that the proposal will not adversely affect the integrity of the site (SNH, 2017a).

It is the responsibility of the competent authority to carry out the HRA based on robust, scientific information provided by the developer about the proposed project. It is not the role of the developer to make an assessment on whether or not the proposal will have an adverse effect on any associated Natura sites.

1.2 Terminology

The terminology employed as part of the HRA process relates to likely significant effects (LSEs). Assessment of LSEs takes a precautionary approach and asks whether a project may have an effect, or have the possibility of having an effect, on a Natura site (SNH, 2017b). A project component is said to have an LSE on a designated site if "*it cannot be excluded, on the basis of objective information, that it will have a significant effect on the site*" (European Court of Justice C-127/02, 2004). The conservation objectives of the site provide the framework for considering the potential for LSEs.

It should be noted that the terminology used as part of the ecological impact assessments in the EIAR chapters refers to significance based on a matrix system. It is important, when using these documents in conjunction with one another, to be aware that the term 'significance' has different meanings in these two different contexts. In this HRA Pre-Screening report, the use

of the word 'significant' in relation to impact assessments is not employed within the pre-screening assessment, to avoid confusion.

1.3 Objectives

The objectives of this HRA Pre-Screening report are to summarise:

- The proposed development details;
- The Natura 2000 sites being considered with reference to the Lochmaddy Ferry Terminal Upgrade, along with these sites' qualifying features and conservation objectives;
- Details of the qualifying features for each of the scoped-in Natura sites.

This information will aid the competent authority in carrying out an HRA. This HRA Pre-Screening Report provides a reference as to where the relevant information required to complete the HRA is located within the EIAR, and as such should be read in conjunction with the EIAR and not as a stand-alone document. An indication of whether LSEs are expected is given for each designated site, but it is ultimately up to the competent authority carrying out the HRA to ascertain whether LSEs are present, and therefore whether an AA is needed for each designated site.

2 Project Summary

Caledonian Maritime Assets Limited (CMAL) and Comhairle nan Eilean Siar (CnES) are proposing to upgrade the existing Lochmaddy Ferry Terminal in order to accommodate a new ferry. The new ferry is currently being constructed for use on the Skye Triangle routes (Tarbert – Uig and Uig- Lochmaddy). The new ferry is larger and can carry more passengers and vehicles than the existing vessel. The proposed upgrades are required to allow the safe berthing of the larger vessel, and to provide facilities for the additional passengers and vehicles. The upgrades include the following components:

- Dredging to allow the larger ferry to berth and manoeuvre safely;
- Land reclamation to increase the marshalling area;
- Temporary works allowing the ferry service to operate throughout construction works;
- Demolition of the top of the existing pier roundhead to reduce its level to match the adjacent pier deck;
- Pier extension utilising a concrete caisson;
- Strengthening and concrete repairs to the existing concrete pier deck slab, cross beams and columns;
- Fender upgrade to the new and existing pier structure;
- Road lay-out upgrade to improve access to the ferry terminal;
- Carpark extension to increase existing provision; and
- Upgrade of services to facilitate the new terminal layout, and to provide potable water bunkering and cold ironing facilities to the new vessel.

Further details on the individual components of the project can be found in the EIAR Chapter 2: Project Description.

3 Designated Sites

The designated sites which have designated features relevant to the Lochmaddy Ferry Terminal Upgrade are shown in Table 3.1. The sites, or species within the sites, are scoped in or out depending on the level of ecological connectivity to the proposed works. A reduced list of designated sites and features is then taken forward for further assessment. Explanations for why certain sites or qualifying features are excluded is laid out in Section 3.1.

Table 3.1: Designated Sites Relevant to the Proposed Lochmaddy Ferry Terminal Upgrade

Site	Distance and Direction	Qualifying Feature(s)	Included in Further Assessment?
Loch nam Madadh **SAC**	Immediate vicinity	Otter (*Lutra lutra*) Intertidal mudflats and sandflats Lagoons Reefs Shallow inlets and bays Subtidal sandbanks	**IN**
North Uist Machair and Islands **SPA**	1.1km SW	Corncrake (*Crex crex*), breeding Dunlin (*Calidris alpina schinzii*), breeding Oystercatcher (*Haematopus ostralegus*), breeding Greenland barnacle goose (*Branta leucopsis*), non-breeding	OUT
Inner Hebrides & the Minches **cSAC**	5km by sea E	Harbour porpoise (*Phocoena phocoena*)	**IN**
Ascrib, Isay, & Dunvegan **SAC**	30km by sea E	Common seal (*Phoca vitulina*)	**IN**
North Harris Mountains **SPA**	40km NE	Golden eagle (*Aquila chrysaetos*), breeding	OUT
North Harris **SAC**	45km by sea (40km direct) N	Atlantic salmon *(Salmo salar)* Acid peat-stained lakes and ponds Acidic scree Alpine and subalpine heaths	OUT
Lewis Peatlands **SPA**	45km NE	Black-throated diver (*Gavia arctica*), breeding Black-throated diver (*Gavia arctica*), breeding Golden eagle (*Aquila chrysaetos*), breeding Golden plover (*Pluvialis apricaria*), breeding	OUT
Shiant Isles **SPA**	51km NE	Fulmar (*Fulmarus glacialis*), breeding Guillemot (*Uria aalge*), breeding Kittiwake (*Rissa tridactyla*), breeding Greenland barnacle goose (*Branta leucopsis*), non-breeding	OUT
Monach Islands **SAC**	52km by sea (28km direct) W	Grey seal (*Halichoerus grypus*) Dune grassland Machair Shifting dunes with marram	OUT
Sound of Barra **SAC**	60km by seaS	Common seal (*Phoca vitulina*) Reefs Subtidal sandbanks	OUT
Langavat **SAC**	95km by sea N	Atlantic salmon *(Salmo salar)*	OUT
Treshnish Isles **SAC**	130km by sea SE	Grey seal (*Halichoerus grypus*) Reefs	OUT
North Rona **SAC**	196km by sea NE	Grey seal (*Halichoerus grypus*) Reefs Sea caves Vegetated sea cliffs	OUT
South East Islay Skerries **SAC**	230km by sea SE	Common seal (*Phoca vitulina*)	OUT

3.1 Reasons for Designated Site or Species Exclusion

3.1.1 Special Protected Areas Designated for Ornithological Features

The 4 SPAs detailed in Table 3.1 are located more than 1km from the proposed Lochmaddy Ferry Terminal Upgrade, hence there is no potential for direct effects on these designated sites. As detailed in the Scoping Report, an initial ornithological survey was conducted in order to ascertain the avian species utilising the site, together with the value of the available habitat for breeding and non-breeding birds. None of the avian qualifying feature species associated with the 4 SPAs were recorded as being present in the area during the ornithological survey, and no valuable habitat for these species was identified (Affric Limited, 2017). As such, there is no potential for the proposed works to affect the SPAs or their qualifying features, hence the SPAs require no further consideration

3.1.2 North Harris SAC

The North Harris SAC is designated due to its importance to Atlantic salmon, together with terrestrial features including lake, pond, scree and heath features. The site is located 40km in a straight line from Lochmaddy, and hence there is no potential for direct effects on the terrestrial features of the site. With regard to Atlantic salmon, the rivers and streams within this site all feed into the west coast of Harris, which is approximately 45km by sea from the proposed works. It is considered extremely unlikely that salmon migrating to or from the rivers within this site will be present in the waters surrounding the Lochmaddy ferry terminal, on the east coast of the Outer Hebrides. As such, no connectivity is anticipated between the qualifying fish features of this site and the marine works at Lochmaddy, and hence this site is not considered further.

3.1.3 Monach Island SAC

The Monach Islands SAC is designated as a grey seal (*Halichoerus grypus*) breeding colony, as well as for terrestrial features including grasslands, machair and dune systems. The islands are located to the west of North Uist, 52km by sea and 28km in a straight line from the proposed works, hence there is no potential for direct impacts on the site's terrestrial features. The proposed ferry terminal upgrade is within foraging range of the grey seal features of the site. However, as detailed in the EIAR, Chapter 6: Marine Mammals, Section 6.4.2.3, grey seals are only rarely present in the waters surrounding the proposed works. As such it is considered extremely unlikely that the Lochmaddy Ferry Terminal Upgrade will result in negative effects for this site, or its qualifying features, hence no further consideration is required.

3.1.4 Sound of Barra SAC

The Sound of Barra SAC is designated due to its importance to common seals, as well as the presence of sensitive benthic features including reefs and sandbanks. The site is located 60km by sea south of Lochmaddy, between the southern end of South Uist and the north coast of Barra, hence there is no connectivity between the proposed works and the reef and sandbank features (JNCC, 2018). While the site also supports a significant presence of common seals, given the relatively short foraging distances of this species (typically 50 km) (SCOS, 2017), it is considered unlikely that common seals from the Sound of Barra SAC will be in the vicinity of the proposed working areas. Therefore, there is no potential for negative effects on this site or its qualifying features, and no further consideration of the Sound of Barra SAC is necessary.

3.1.5 Langavat SAC

The Langavat SAC is designated for the conservation of Atlantic salmon. This site meets the marine environment at Loch Ceann Hùlabhaig, on the west coast of Lewis. This is approximately 95km by sea from the proposed development. It is therefore considered extremely unlikely that salmon migrating to or from the Langavat SAC will be present in the waters surrounding the proposed works. As such, no connectivity is anticipated between this site and the marine works at Lochmaddy, hence this site is not taken forward for assessment.

3.1.6 Treshnish Isles SAC

The Treshnish Isles SAC is located approximately 130km by sea south-east of the proposed development. The SAC is designated primarily due to its importance to breeding grey seals *(Halichoerus grypus)* which is estimated to contribute just under 3% of the annual UK pup production (JNCC, 2018), but also due to the presence of reefs. However, as detailed in the EIAR Chapter 6: Marine Mammals, Section 6.4.2.3, grey seals are only rarely present in the waters surrounding the development or spoil ground, hence impacts on the designated breeding grey seal feature of the SAC are very unlikely. Furthermore, the significant geographic distance between the Treshnish Isles SAC and development site make it extremely unlikely for reef habitat connectivity to exist. Therefore, no impacts on the sites designated reef features are expected. Consequently, the rare presence of grey seals in the development or spoil disposal grounds and lack of benthic habitat connectivity, mean the site is not taken forward for assessment.

3.1.7 North Rona SAC

The North Rona SAC is located 196km by sea north-east from Lochmaddy and is designated as a grey seal breeding colony, as well as for the presence of reefs, sea caves and vegetated sea cliffs. North Rona SAC grey seal breeding colony contributes approximately 5% to the UK pup production (JNCC, 2018). The proposed ferry terminal upgrade is within foraging range of the grey seal features of the site. However, as detailed in the EIAR, Chapter 6: Marine Mammals, Section 6.4.2.3, grey seals are only rarely present in the waters surrounding the proposed works. It is therefore extremely unlikely that negative effects will result on the grey seal features of the North Rhona SAC, hence no further consideration of this site is made.

3.1.8 South East Islay Skerries SAC

The South East Islay Skerries SAC is designated due to its support of a nationally important common seal population. The uninhabited skerries and islands of the SAC are extensively used as pupping, moulting, and haul-out sites by this species (JNCC, 2018). However, the site is located 230km by sea south-east from the proposed works, and hence is outwith the relatively short foraging range of common seals (typically 50 km) (SCOS, 2017). Therefore, no ecological connectivity exists between Lochmaddy and the South East Islay Skerries SAC, and no further consideration of this site is required.

3.2 Designated Site Information

The Conservation Objectives of each of the designated sites taken forward by this report are provided in the following sections, together with an appraisal of each site's qualifying features.

The assessments conducted during the EIA for each site and its qualifying features are summarised, and references given to the relevant material within the EIAR.

3.2.1 Loch nam Madadh SAC

The Loch nam Madadh SAC is designated for Otter (*Lutra lutra*) and multiple marine features including lagoons, reefs, subtidal sandbanks, shallow inlets and bays and intertidal mudflats and sandflats. The site covers an approximate area of 2320.9ha, 75% consisting of marine areas/sea inlets. Tidal rivers, estuaries, mudflats, sandflats, lagoons (including saltwork basins) cover 12% of the site. The rest of the site consist of terrestrial habitats including freshwater, bogs, marshes and water fringed vegetation. No specific population figures for otter within the SAC could be identified. However, habitat within the SAC supports a dense otter population due to the highly productive area providing ample shelter and food for the species (JNCC, 2018). The site is taken forward for assessment as the proposed development is situated within the boundary of the SAC, hence there is connectivity to the site and its qualifying features.

The Conservation Objectives for the Loch nam Madadh SAC are shown in Table 3.2 and the qualifying features are shown in Table 3.3 with a summary of the assessment

It has been identified that proposed works will be undertaken within the Loch nam Madadh SAC designated site. This, combined with the techniques anticipated to be utilised during the construction of the Lochmaddy Ferry Terminal Upgrade, means that there is the potential for the works to have a LSE on the site. Therefore, it is probable an AA will be required.

Table 3.2: Loch nam Madadh SAC Conservation Objectives

Conservation Objective of the Designated Site	Main EIAR Chapter(s) to Inform Assessment
Overarching Conservation Objective: **To avoid deterioration of the qualifying habitats thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and** **To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features**	Chapter 9: Otters Chapter 7: Benthic Ecology
Further Conservation Objectives: **To ensure for the qualifying habitats that the following are maintained in the long term:** • **Extent of the habitat on site;** • **Distribution of the habitat within site;** • **Structure and function of the habitat;** • **Processes supporting the habitat;** • **Distribution of typical species of the habitat;** • **Viability of typical species as components of the habitat; and** • **No significant disturbance of typical species of the habitat.** **To ensure for the qualifying species that the following are maintained in the long term:** • **Population of the species a viable component of the site;** • **Distribution of the species within site;** • **Distribution and extent of habitats supporting the species;** • **Structure, function and supporting processes of habitats supporting the species; and** • **No significant disturbance of the species.**	Chapter 9: Otters Chapter 7: Benthic Ecology In Addition: Chapter 13: Water Quality & Coastal Processes

Table: 3.3: Loch nam Madadh SAC Qualifying Features

Species/ Feature	Relevant EIAR Chapter and Sections	Summary of Assessment
Intertidal mudflats and sandflats	Chapter 7 Section 7.4.4 & 7.5.1	No intertidal mudflats or sandflats are located within the immediate vicinity of the development, and there is no potential for detrimental indirect effects on these features.
Lagoons	Chapter 7 Section 7.4.4 & 7.5.1	The development is not located in a lagoon, and there is no potential for detrimental indirect effects on these features.
Reefs	Chapter 7 Section 7.4.4 & 7.5.1	No reefs or reef features are located within the vicinity of the development. There will be a loss of benthic flora, fauna, and habitat in the development footprint. However, this does not affect any reefs or reef features, and it is not expected that this will any detrimental effects on the wider Loch Maddy benthic communities, as the habitat loss is relatively small and localised in nature, in relation to the overall area of Loch Maddy.

Species/ Feature	Relevant EIAR Chapter and Sections	Summary of Assessment
Shallow inlets and bays	Chapter 7 Section 7.4.4 & 7.5.1	No shallow inlets or bays will be affected by the proposed development.
Subtidal sandbanks	Chapter 7 Section 7.4.4 & 7.5.1	No subtidal mudflats or sandflats are located within the immediate vicinity of the development, and there is no potential for detrimental indirect effects on these features.
Otter *(Lutra lutra)*	Chapter 9 Section 9.4.1, 9.5, 9.6 & 9.8 & Chapter 13 Section 13.5.1 & 13.6.1	In the absence of mitigation procedures, there is the potential to cause moderate disturbance, displacement and possible injury to the otter qualifying features of the SAC. This is due to noise from impact piling operations and general site works, barrier effects from fencing, and interactions with excavations, stored materials and plant. Through the implementation of an otter protection plan, the resulting effects on otters are reduced to minor, and the risk of entrapment and injury is effectively removed. Therefore, no population level effects are expected on the Loch nam Madadh SAC otter population, and the conservation objectives of the site will not be compromised.

3.2.2 Inner Hebrides & the Minches cSAC

The Inner Hebrides & the Minches candidate cSAC is designated for the conservation of harbour porpoise (*Phocoena phocoena*). The area is of key importance to the UK part of the harbour porpoise management unit, and is estimated to support approximately 5,438 individuals for at least part of the year, equating to approximately 32% of the management unit (SNH, 2016). It is suggested that the area within the cSAC, relative to the rest of the continental shelf, includes the best habitat for harbour porpoises and has been used consistently by the species over the last two decades (SNH, 2016). The site is taken forward for assessment because it is situated within 5km by sea of the proposed development, and 850m of the Stornoway dredge spoil ground, hence there is potential connectivity between the construction operations and the designated features of the cSAC.

The Conservation Objectives for the Inner Hebrides & the Minches cSAC are shown in Table 3.4 and the qualifying features shown in Table 3.5 with a summary of the assessment.

Connectivity has been identified between the Inner Hebrides and The Minches cSAC and the proposed works due to the highly mobile nature of the site's qualifying harbour porpoise features. This, combined with the techniques likely to be utilised during the construction of the Lochmaddy Ferry Terminal Upgrade, means that there is the potential for the works to have a LSE on the site. Therefore, it is likely an AA will be required.

Table: 3.4: Inner Hebrides & the Minches cSAC Conservation Objectives

Conservation Objective of the Designated Site	Main EIAR Chapter(s) to Inform Assessment
Overarching Conservation Objective: **To maintain site integrity and ensure the site continues to make a contribution to harbour porpoise remaining at favourable conservation status in UK waters.**	Chapter 6: Marine Mammals
Further Conservation Objectives: • **To avoid significant killing, injury, or disturbance of harbour porpoise; and** • **To maintain the habitat and prey of harbour porpoise in favourable condition.**	Chapter 6: Marine Mammals In addition: Chapter 11: Noise and Vibration (Underwater)

Table 3.5: Inner Hebrides & the Minches cSAC Qualifying Features

Species/ Feature	Relevant EIAR Chapter and Sections	Summary of Assessment
Harbour porpoise	Chapter 6, Sections: 6.5 and 6.6. Chapter 11, Section: 11.5.2.1.	In the absence of mitigation procedures, there is the potential to cause moderate disturbance and possible injury to the harbour porpoises designated under the cSAC. This is due to noise from impact piling operations and interactions with falling material during dredged spoil disposal at the Stornoway spoil ground. Through the implementation of a piling marine mammal protocol and a dredged spoil disposal marine mammal protocol, the resulting effects on harbour porpoise features of the Inner Hebrides & the Minches cSAC are reduced to minor. Therefore, no population level effects are expected on the Inner Hebrides and the Minches cSAC harbour porpoise, and the conservation objectives of the site will not be compromised.

3.2.3 Ascrib Isay & Dunvegen SAC

The Ascrib Isay & Dunvegan SAC is designated due to its importance to the UK common seal (*Phoca vitulina*) population. The complex of skerries, islets, undisturbed mainland shores and offshore islands in north-west Skye consistently support a breeding colony of the common seal and represents one of the larger discrete colonies in the UK, holding around 2% of the UK population (JNCC, 2018). This site is taken forward for assessment as it is within the foraging range of common seals from the development site.

The Conservation Objectives for the Ascrib Isay & Dunvegan SAC are shown in Table 3.6 and the qualifying features shown in Table 3.7 with a summary of the assessment.

Connectivity has been identified between the Ascrib Isay & Dunvegen SAC and the proposed works due to the highly mobile nature of the site's qualifying common seal features. This, combined with the techniques likely to be utilised during the construction of the Lochmaddy Ferry Terminal Upgrade, means that there is the potential for the works to have a LSE on the site. Therefore, it is likely an AA will be required.

Table 3.6: Ascrib Isay & Dunvegen SAC Conservation Objectives

Conservation Objective of the Designated Site	Main EIAR Chapter(s) to Inform Assessment
Overarching Conservation Objective: **To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features.**	Chapter 6: Marine Mammals
Further Conservation Objectives: **To ensure for the qualifying species that the following are maintained in the long term:** • **Population of the species as a viable component of the site;** • **Distribution of the species within site;** • **Distribution and extent of habitats supporting the species;** • **Structure, function and supporting processes of habitats supporting the species; and** • **No significant disturbance of the species.**	Chapter 6: Marine Mammals In addition: Chapter 11: Noise and Vibration (Underwater)

Table: 3.7: Ascrib Isay & Dunvegen SAC Qualifying Features

Species/ Feature	Relevant EIAR Chapter and Sections	Summary of Assessment
Common seal	Chapter 6, Sections: 6.5 and 6.6. Chapter 11, Section: 11.5.2.1.	In the absence of mitigation procedures, there is the potential to cause moderate disturbance and possible injury to the common seal qualifying features of the SAC. This is due to noise from impact piling operations and interactions with falling material during dredged spoil disposal at the Stornoway disposal site. Through the implementation of a piling marine mammal protocol and a dredged spoil disposal marine mammal protocol, the resulting effects on common seals are reduced to minor. Therefore, no population level effects are expected on the Inner Ascrib Isay & Dunvegan SAC common seals, and the conservation objectives of the site will not be compromised.

4 Cumulative and In-combination Effects

Cumulative and in-combination effects of the Lochmaddy Ferry Terminal Upgrade were assessed as part of the EIA process, as detailed in Chapter 3: Methodology.

Specifically, with regard to the HRA process, cumulative and in-combination effects were assessed for the following receptors:

- Chapter 6: Marine Mammals;
- Chapter 7: Benthic Ecology;
- Chapter 8: Fish Ecology; and
- Chapter 9: Otters.

No cumulative or in-combination effects were identified for any receptors relevant to the HRA process.

5 Conclusion

The EIAR did not predict any residual adverse impacts on any of the qualifying features of the designated sites assessed as part of this HRA Pre-Screening Report, and no cumulative or in-combination effects are anticipated. Information from this report can be used by the competent authority, in conjunction with the relevant EIAR Chapters and Sections as identified in this report, to carry out the HRA and any necessary AAs. It will be up to the competent authority to ascertain whether the proposal will adversely affect the integrity of the designated sites to be considered.

6 References

Affric Limited. (2017). Lochmaddy Ferry Terminal Development - EIA Scoping Report

European Court of Justice C-127/02. (2004). Directive 92/43/EEC -Conservation of natural habitats and of wild flora and fauna - Concept of "plan' or "project' - Assessment of the implications of certain plans or projects for the protected site. Case C-127/02. *Waddenvereniging and Vogelsbeschermingvereniging*.

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Scottish Government. (2014). *Scottish Planning Policy*. Edinburgh.

SNH. (2016). SAC Selection Assessment Document: Inner Hebrides and the Minches.

SNH. (2017a). Habitats Regulations Appraisal (HRA). In: Scottish Natural Heritage.

SNH. (2017b). Habitats Regulations Appraisal (HRA): likely significant effects. *Scottish Natural Heritage*.

Appendix G.1: Lochmaddy Pier Improvements – Subtidal Benthic Ecology Survey Report

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Lochmaddy Pier Improvements - Subtidal Benthic Ecology Survey Report

Aspect Land & Hydrographic Surveys Ltd.

APEM Ref P00002258b

May 2018

Redacted

Client:	Aspect Land & Hydrographic Surveys Ltd.
Address:	Unit 1, Thornhouse Business Centre Ballot Road Irvine KA12 0HW Ayrshire
Project reference:	P00002258
Date of issue:	4th June 2018

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Milton Bridge
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Report should be cited as:

"Lochmaddy Pier Improvements - Subtidal Benthic Ecology Survey Report (June, 2018). APEM Scientific Report P000002258b. Aspect Land & Hydrographic Surveys Ltd. 18pp."

Revision and Amendment Register

Version Number	Date	Section(s)	Page(s)	Summary of Changes	Approved by
1	04/06/2018	All	All	Document creation	Re

Contents

List of Figures and Tables

1. Introduction

APEM Ltd has been commissioned to undertake a survey of the subtidal benthic ecological habitats and species present around Lochmaddy Pier on the Isle of North Uist, on behalf of Aspect Land & Hydrographic Surveys (ALHS) and the Western Isles Council. Lochmaddy Pier is located in a sheltered bay on the east coast of the Isle of North Uist in the Outer Hebrides and provides a direct ferry link to the Isle of Skye. The aim of this survey is to provide data to enable an Environmental Impact Assessment (EIA) of proposed improvements to Lochmaddy Pier to be conducted.

In accordance with Saunders et al. (2011), this survey will gather information for the EIA process by identifying whether there are any benthic habitats or species of note present (i.e. priority, rare, protected or invasive) and identify the spatial distribution and abundance of these species in the area. This will allow an assessment to be conducted of how these habitats or species will be affected by the proposed development and the significance or implications of any damage or loss incurred, which is beyond the scope of this survey report but it is understood will be conducted by the Western Isles Council and Affric Ltd. for the proposed development.

The aim of the survey was to collect underwater video and grab samples to provide data on the subtidal benthic ecology habitats, community composition and sediment composition within the area of the proposed development, to enable the subtidal benthic ecology of the area to be characterised, and the effect of the improvements to Lochmaddy Pier to be assessed.

This report provides a full description of the survey and analysis conducted by APEM Ltd. to obtain the data for characterisation, and the complete datasets for use along with a summary description of the datasets obtained.

2. Methodology

2.1 Field survey

All survey permissions, including a Marine Licence Exemption and Crown Estate Consent, were obtained by CMAL prior to the survey commencing.

The survey operations were conducted in April 2018 from the vessel Remote Sensor, operated by ALHS and shown in Figure 2-1 below. Remote Sensor is an 8.4m catamaran survey vessel (MCA Cat III) with high manoeuvrability.

The survey was overseen by an attending marine ecologist from Affric Ltd., on behalf of the Western Isles Council, who conducted quality assurance during the survey and specified grab sample locations whilst on-site using the footage from the underwater video.

The methodologies for collection of the underwater video and grab samples are provided in Sections 2.1.1 and 2.1.2 below respectively.

Figure 2-1 The survey vessel Remote Sensor used for the Lochmaddy Pier subtidal benthic ecology surveys (Photo from APEM's survey at Tarbert Ferry Terminal in December 2017).

2.1.1 Underwater video survey

The underwater video survey was conducted on the 8th April 2018 in daylight hours.

APEM was provided with a specification of four transect routes for the underwater video survey by the Western Isles Council.

The four underwater video transects (plus an additional fifth transect) were completed using an Imenco 'Tiger Shark' underwater stills camera. This was mounted onto a frame along with a flash, lighting and multiplexer equipment as shown in Figure 2-2. A video recording device was used on the vessel to capture the video outputs of the DDV camera. The DDV camera was deployed from the Remote Sensor and captured imagery of the seabed looking vertically downward as the Remote Sensor navigated along the transects. The transects, as shown in Figure 2-3 and Table 2-1, are considered to provide a good coverage of the area of interest.

Upon initial deployment of the camera system on-site on the 6th April, a communication error between the camera and the video recording equipment was identified meaning that imagery of the seabed could not be viewed 'live' on the vessel. This was rectified through provision of a second camera system to site.

In addition, the first video recording attempt at Transect 5 had to be aborted due to the arrival of the CalMac Ferry from Uig on the Isle of Skye. This transect was completed after departure of the ferry.

Figure 2-2 The Imenco 'Tiger Shark' subsea camera and Imenco 'Lantern Shark' flash as mounted onto the ALHS frame which was deployed from the davit of the Remote Sensor.

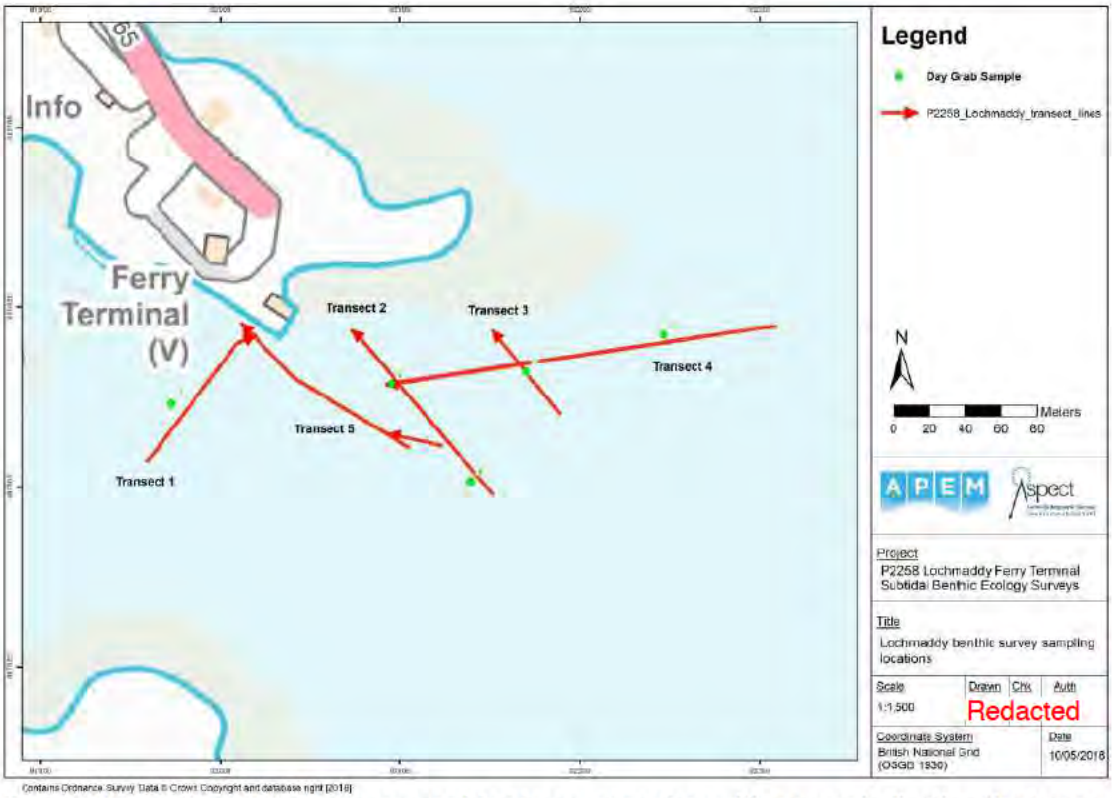

Figure 2-3 Location of the underwater video transect routes, with arrows indicating the transect direction flow, and location of the grab sampling stations.

Table 2-1 Start and end point coordinates for each underwater video transect. Coordinates are presented in the Ordnance Survey/British National Grid Project Coordinate System format.

Underwater video transect	Start coordinates		End coordinates	
	X	Y	X	Y
Transect 1	91958.27	867917.06	92019.64	867988.41
Transect 2	92151.21	867898.95	92071.97	867991.04
Transect 3	92188.46	867943.79	92150.35	867991.10
Transect 4a	92309.16	867993.32	92091.82	867960.74
Transect 4b	92091.87	867960.33	92090.89	867960.50
Transect 5a	92123.29	867926.51	92092.59	867933.32
Transect 5b	92104.53	867925.50	92010.77	867995.03

2.1.2 Grab sampling survey

The subtidal grab sampling survey was conducted on the 7th April 2018 in daylight hours. This survey was conducted before the underwater video survey due to the communication fault error encountered with the camera system upon initial deployment. The grab sampling stations were still able to target the main observed biotopes, however, based on previous vibracoring survey completed by ALHS. The representativeness of the grab sampling stations was checked during the underwater video survey on the 8th April as discussed in Section 2.1.1 above. They were found to be appropriate for use so no further stations were sampled.

It was stated by Western Isles Council that the requirement of the survey was to characterise the subtidal benthic ecology habitats, community composition and PSD for the purposes of conducting an EIA for the project to assess the habitat and species types that may be lost as a result of the proposed development. As the habitats affected will be lost under the footprint of the proposed development, they will be subject to a direct effect, and so there is no requirement to obtain replicate grab samples for compilation of a baseline dataset upon which a future monitoring programme for indirect effects could be defined. This also meant that there was no requirement to conduct formal *a priori* statistical power analysis to define the number of samples required by the survey, as the data collected prior to construction would not be quantitatively compared to any data collected post-construction and as such the statistical power of the survey design was not a relevant consideration.

Five grab sampling station locations around Lochmaddy Pier were agreed with Affric Ltd., and these are shown on Figure 2-3 with coordinates provided in Table 2-2. At each of these stations, grab samples were collected for macrobenthic and Particle Size Distribution (PSD) analysis using a 0.1 m^2 Day Grab. A single grab sample was obtained for macrobenthic analysis, and a further separate single grab sample was obtained for PSD analysis as close as possible to the original macrobenthic grab sample location.

Table 2-2 Coordinates for each grab sample station. Coordinates are presented in the Ordnance Survey/British National Grid Projected Coordinate System format.

Grab sample station	Site code	X	Y
Station 1	G01	92169.44	867971.42
Station 2	G02	92095.73	867959.07
Station 3	G03	91973.27	867948.23
Station 4	G04	92135.25	867903.33
Station 5	G05	92245.89	867987.34

Whilst conducting the grab sampling, a minimum sediment volume limit of 5 litres was defined as an acceptable size for a grab sample to be considered successful. If this minimum volume was not obtained then a further two attempts were to be made at the same location, followed by three attempts at a different location at least 50m from the original target. At station 2, the first PSD grab attempt was rejected due to a stone blocking the grab jaws. The second attempt retrieved a sample of a suitable size.

For each grab attempt the following information was recorded on the survey log-sheet:

- Survey name, location and project code;
- Survey Date;
- Survey Team staff;
- Site information including: site/replicate, sample position (lat/lon; WGS84), collection time, water depth, weather conditions;
- Sampling equipment including sieve mesh size;
- Salinity for later use in the WFD IQI calculation
- Sample description, including sediment description, grab depth in cm, volume, type, profile, concretions, surface features, burrows, algae, colour and colour changes, smell, etc.;

- Any obvious or notable (e.g. Annex 2 species) taxa observed;
- Notes (e.g. anoxia, anthropogenic debris, any problems encountered, etc.);
- Photograph of the unsieved sample (an example is presented in Figure 2-4 below).

Figure 2-4 Unsieved grab sample from Station 4 at Lochmaddy Pier.

Biological samples were sieved on board through a 1.0mm sieve as is standard for subtidal surveys in marine conditions. All material retained on the sieves was fixed with 4% buffered formaldehyde solution in seawater and stored in sealed crates.

2.2 Sample analysis

2.2.1 Macrobenthic analysis of grab samples

Samples were processed according APEM's in-house Standard Operating Procedures (SOP's) and in full compliance with North East Atlantic Marine Biological Analytical Quality Control Scheme (NMBAQC) guidance (Worsfold and Hall, 2010). To standardise the sizes of organisms and improve sorting efficiency, samples were sieved through a stack of sieves of 4.0, 2.0 and 1.0 mm meshes in a fume cupboard following UKTAG guidance for benthic invertebrate sample analysis for coastal waters (WFD-UKTAG, 2014). All biota retained in the sieves were then extracted under low power microscopes, identified and enumerated, where applicable.

Taxa were identified to the lowest possible practicable taxonomic level using the appropriate taxonomic literature. For certain taxonomic groups (e.g. nemerteans and, nematodes), higher taxonomic levels were used due to the widely acknowledged lack of appropriate identification tools for these groups. The NMBAQC Scheme has produced a Taxonomic Discrimination Protocol (TDP) (Worsfold and Hall 2010) which gives guidance on the most appropriate level to which different marine taxa should be identified, and this guidance was adhered to for the laboratory analysis. Where required, specimens were also compared with material maintained within the laboratory reference collection. Nomenclature followed the World Register of Marine Species (WoRMS), except where more recent revisions were known to supersede WoRMS.

At least one example of each taxon recorded from the surveys was set aside for inclusion in APEM's in-house reference collection. This collection acts as a permanent record of the biota recorded.

2.2.2 PSD analysis of grab samples

PSD analysis was performed in accordance with NMBAQC Scheme best practice guidance for PSA for supporting biological analysis (Mason, 2016). A combination of dry sieving and laser diffraction was used due to the range of particle sizes present in the samples.

The PSA data were entered into GRADISTAT (Blott and Pye, 2001) to produce sediment classifications, following Folk (1954) (Figure 2-5). Summary statistics were also calculated including mean particle size, sorting, skewness and kurtosis (following Blott and Pye, 2001).

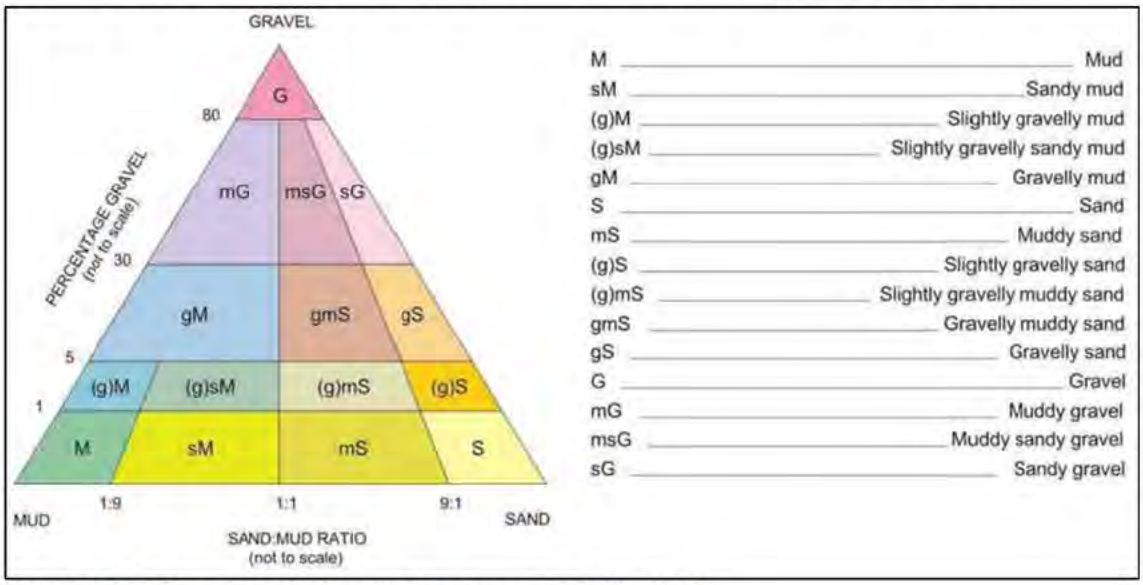

Figure 2-5 Folk sediment classification pyramid (Folk, 1954).

2.2.3 Imagery analysis of underwater video capture

The underwater video was analysed by an experienced marine benthic taxonomist and image analyst to provide habitat/biotope extent and transition data and enable the identification of any small-scale habitats outside the subtidal grab sampling target habitats (such as rock outcrops). The video captures for each transect were re-played in the laboratory and the biotopes and notable taxa along each transect identified and recorded. The timing of the transitions between each habitat along transects in the underwater video were also noted, and

these were then related to the vessel position within the survey logs to identify the position of habitat transitions.

3. Results

3.1 Macrobenthic analysis data

The full suite of enumerated macrobenthic data from each grab sample is provided in Appendix 1. A summary of the prevailing conditions at the time of each macrobenthic grab sample is provided in Table 3-1 below, and the biotopes assigned to each grab sample are provided in Table 3-2. The most abundant species (>200 individuals) were: *Melinna palmata* (n=623) present across all stations; *Kurtiella bidentata* (n= 293); *Thyasira flexuosa bidentata* (n= 210) present across all stations; and *Lumbrineris cingulate* (n= 208) also present across all stations.

Table 3-1 Depth and salinity conditions at the time of collection of each macrobenthic grab sample

Grab sample station	Collection time	Water depth (m)	Volume (l)	Salinity (ppm)
Station 1	09:00	6.7	10	30.25
Station 2	10:06	8.1	9.5	33.53
Station 3	10:42	7.9	12	30.04
Station 4	11:10	10.6	8	33.41
Station 5	11:52	9.7	11	28.10

Table 3-2 Biotopes assigned to macrobenthic grab samples

Grab sample station	Biotope	Description
Station 1	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments
Station 2	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments
Station 3	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments
Station 4	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments
Station 5	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments

3.2 PSD analysis data

The full suite of PSD analysis data from each grab sample is provided in Appendix 2. A summary of the prevailing conditions at the time of each PSD grab sample is provided in Table 3-3 below and the Folk (1954) classifications provided in Table 3-4. Finally, histograms of particle size classifications are presented in Figure 3-1 for each PSD grab sample.

Table 3-3 Prevailing water depth and salinity conditions at the time of collection of each PSD grab sample

Grab sample station	Time	Water depth (m)	Volume (l)	Salinity (ppm)
Station 1	09:29	7.9	12	30.25
Station 2	10:30	8.2	6	33.53
Station 3	10:58	8.0	8	30.04
Station 4	11:33	10.9	11	33.41
Station 5	12:15	10	12	28.10

Table 3-4 Visual descriptions and Folk (1954) classifications of PSD grab samples

Grab sample station	Blott and Pye (2012) classification	Folk (1954) classification
Station 1	Slightly gravelly sandy mud	Gravelly Mud
Station 2	Slightly gravelly sandy mud	Gravelly Mud
Station 3	Slightly gravelly muddy sand	Gravelly Muddy Sand
Station 4	Very slightly sandy mud	Mud
Station 5	Sandy mud	Sandy Mud

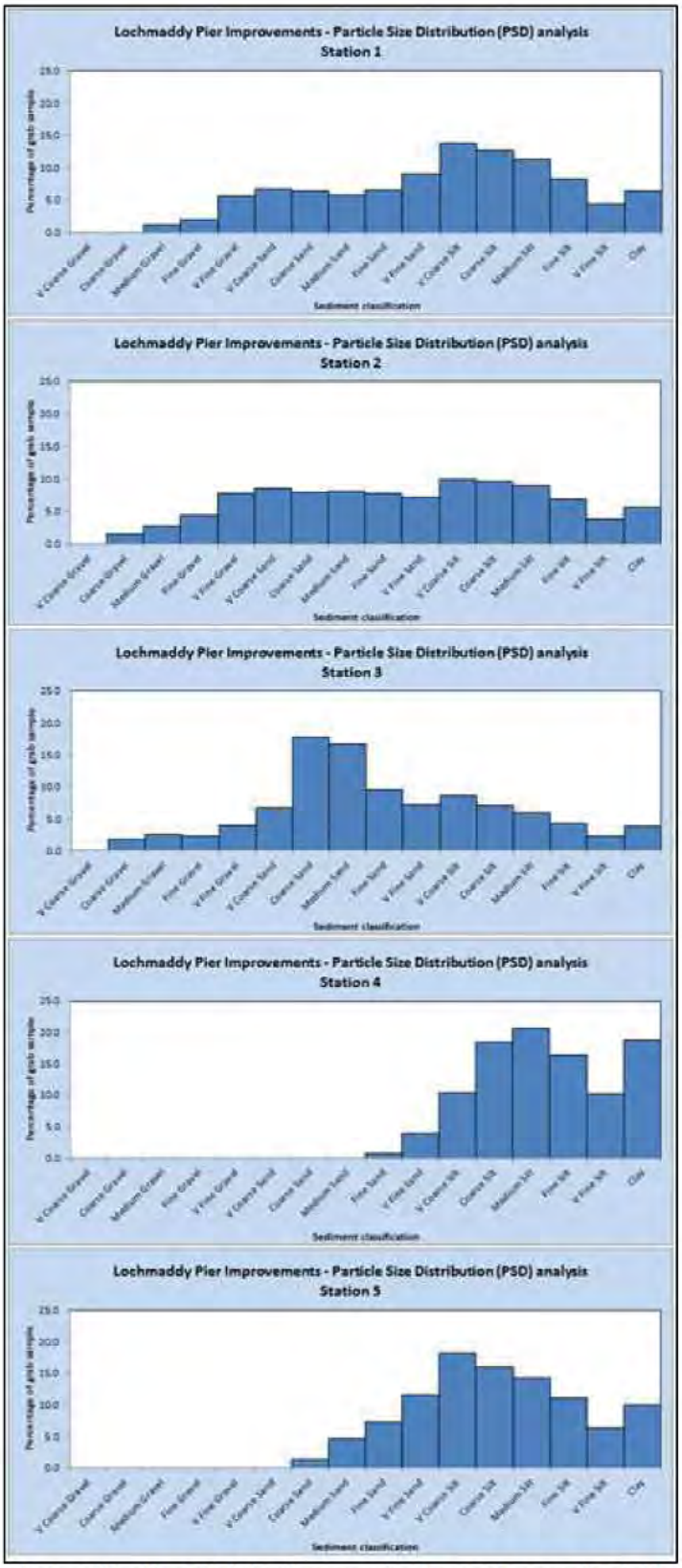

Figure 3-1 Sediment classification distribution graphs for each sample station

3.3 Underwater video data

The full suite of habitat classification data for each transect is provided in Appendix 3. The biotopes found to be present in Lochmaddy pier, with example images of each biotope from the underwater video survey, are provided in Figures 3-2, 3-3, 3-4 and 3-5. The biotopes identified by the underwater video imagery have been mapped along each of the transect routes in Figure 3-6.

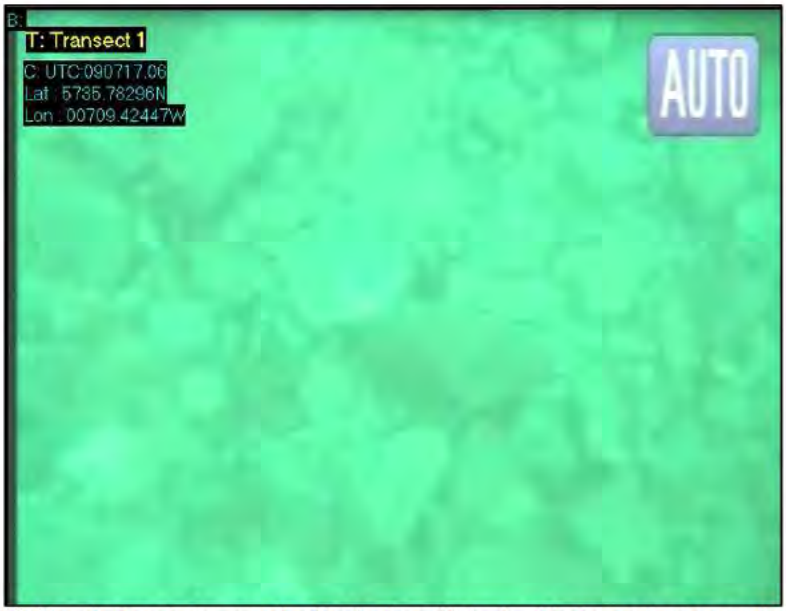

Figure 3-2 IR.HIR.Ksed: Sand or gravel-affected or disturbed kelp and seaweed communities

Figure 3-3 IR.MIR.KR.Ldig: Laminaria digitata on moderately exposed sublittoral fringe rock

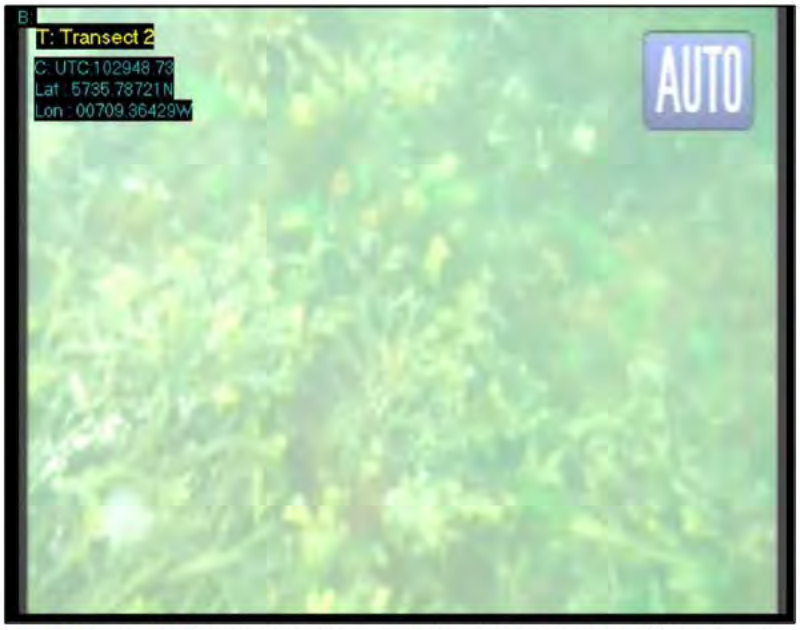

Figure 3-4 LR.LLR.F.Fserr.X: Fucus serratus on full salinity lower eulittoral mixed substrata

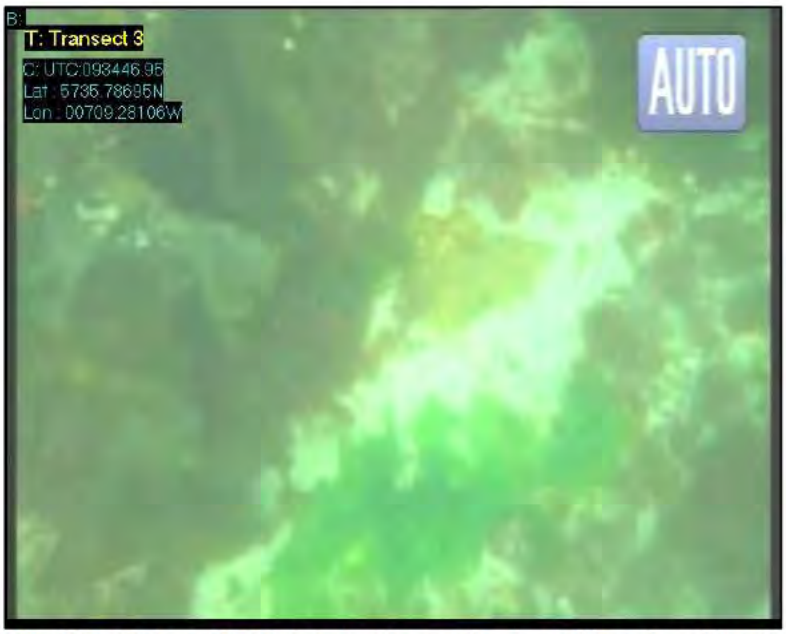

Figure 3-5 SS.SMp.KSwSS.LsacR.Mu: Laminaria saccharina with red and brown seaweeds on lower muddy sediments

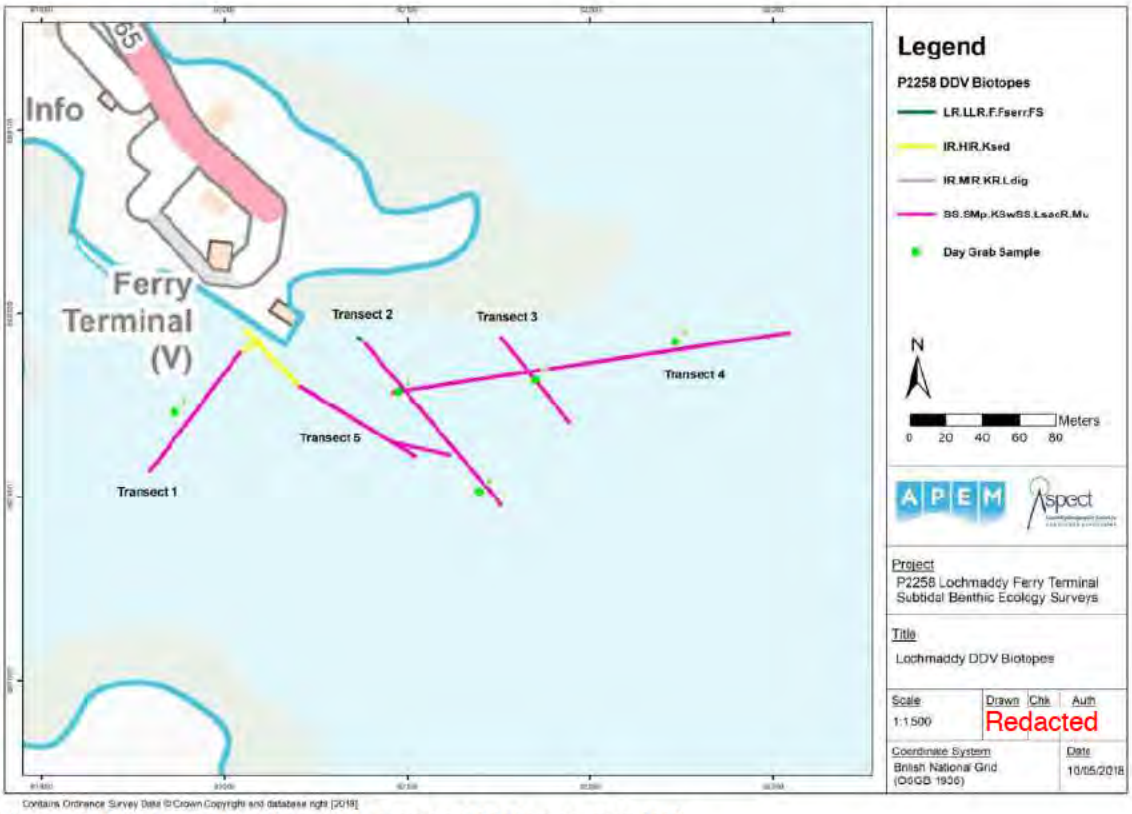

Figure 3-6 Transect routes with mapped biotopes overlaid.

3.4 Lochmaddy Pier biotope mapping

The macrobenthic count data, PSA data and underwater video biotope classification data has been compiled to allocate biotopes to each point along the underwater video transects and at the grab sample stations. Biotopes were allocated following JNCC's National Marine Habitat Classification for Britain and Ireland: Version 04.05 (Connor *et al.* 2004). EUNIS codes corresponding to each biotope have also been provided (JNCC 2010, Parry 2015).

As the survey coverage across Lochmaddy Pier has transects running down the shore at various depths, it has been possible to extrapolate between the known biotopes along the transects to provide a more complete biotope map of the harbour. This plan is shown in Figure 3-6. It is acknowledged that this is an extrapolation of the known data and so the biotope assignment away from the transects and grab sample locations is with a lower level of confidence to the biotope assignment at the grab sample stations and transects.

The biotope map presented in Figure 3-6 is an interpretive map based on an extrapolation of the raw data collected in the grab samples and along the underwater video transects, to delineate approximate habitat biotope boundaries within Lochmaddy Pier. Following the approach set out by Saunders et al. (2011) the confidence in this biotope map would be enhanced by conducting a geophysical survey of the harbour to allow the grab sample point data and underwater video line data to act as reference points for the habitats in the rest of the harbour defined using the geophysical survey.

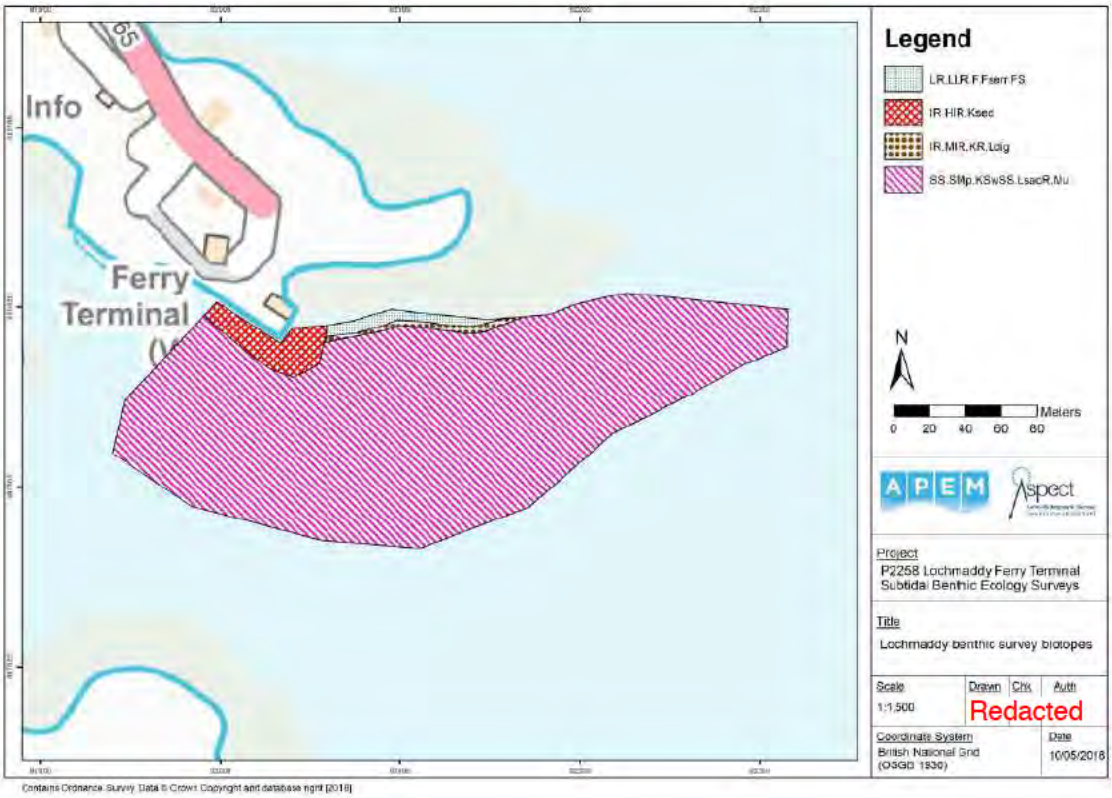

Figure 3-7 Lochmaddy Pier mapped subtidal benthic biotopes (Biotope code references: LR.LLR.F.Fserr.X - *Fucus serratus* on full salinity lower eulittoral mixed substrata; IR.HIR.Ksed - Sediment-affected or disturbed kelp and seaweed communities; IR.MIR.KR.Ldig - *Laminaria digitata* on moderately exposed sublittoral fringe rock; SS.SMp.KSwSS.LsacR.Mu - *Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments)

4. Conclusions

APEM's survey of the subtidal benthic ecological habitats and species present in Tarbert Harbour identified the following biotopes to be present on the seabed:

- **SS.SMp.KSwSS.LsacR.Mu**- Laminaria saccharina with red and brown seaweeds on lower muddy mixed sediments;
- **IR.HIR.Ksed** - Sediment-affected or disturbed kelp and seaweed communities;
- **IR.MIR.KR.Ldig** - *Laminaria digitata* on moderately exposed sublittoral fringe rock;
- **LR.LLR.F.Fserr.X** - *Fucus serratus* on full salinity lower eulittoral mixed substrata.

A full species list of individuals recorded within the grab samples in Lochmaddy Pier is provided in Appendix 1.

Biotopes SS.SMp.KSwSS.LsacR.Mu falls under the Scottish Priority Marine Feature (PMF) 'Kelp and seaweed communities on sublittoral sediment', which encompasses all biotopes under SS.SMp.KSwSS apart from SS.SMp.KSwSS.Tra (Mats of *Trailliella* on infralittoral muddy gravel) and SS.SMp.KSwSS.FilG (Filamentous green seaweeds on low salinity infralittoral mixed sediment or rock).

A single juvenile *Arctica islandica* individual was recorded at Station 3 and six *Virgularia mirabilis* were recorded at Station 5.

A single juvenile *Modiolus* individual was recorded at Station 5 but the PMF habitat associated with this species (SS.SBR.SMus.ModT - *Modiolus modiolus* beds with hydroids and red seaweeds on tide-swept circalittoral mixed substrata) was not recorded. Finally, a single juvenile *Mytilus edulis* was recorded at Station 2 but the PMF habitats associated with this species (LS.LBR.LMus.Myt - *Mytilus edulis* beds on littoral sediments; LS.LSa.St.MytFab - *Mytilus edulis* and *Fabricia Sabella* in littoral mixed sediment; SS.SBR.SMus.MytSS - *Mytilus edulis* beds on sublittoral sediment; IR.LIR.IFaVS.MytRS - *Mytilus edulis* beds on reduced salinity infralittoral rock) were not recorded.

None of the other biotopes or species identified are designated as Scottish Priority Marine Features (PMFs), or designated under the Conservation (Natural Habitats, &c.) Regulations 1994 and Conservation of Habitats and Species Regulations 2010.

Within the genus of red algae *Gracilaria* found to be present at Stations 1, 2 and 5, there is the potential for invasive non-native species (INNS) to be present, including those listed by the GB non-native species secretariat (NNSS), *Gracilaria multipartite* and *Gracilaria vermiculophylla*. The INNS Bonnemaisonia hamifera was also recorded at Station 1. The Aoridae and Chironomidae families recorded may have the potential to contain non-native species, and the Limnoria quadripunctata recorded at Station 2 are also non-native in the UK.

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Appendix 1 Macrobenthic data from grab samples

Letchworth
Herts, SG6 1LW

Marine Benthic Invertebrate Analysis Report

The analysis on adjacent tab(s) of this workbook has been carried out by APEM Ltd under method MINV-01.

Client Name:	Aspect Surveys Ltd.
Address:	Unit 1, Thornhouse Business Centre Ballot Road Irvine KA12 0HW Ayrshire
Phone Number:	Redacted
P.O. Number:	
Prepared by:	Redacted Redacted
Approved and issued by:	Redacted Redacted
Issue Date:	09/05/2018

If you have any comments or complaints regarding this or any other piece of work conducted by APEM Ltd, please contact D. Hall (Head of BioLabs) d.hall@apemltd.co.uk

APEM Report No. P00002258b_v1

APEM Report No. P00002258b_v1

Sample Number	Sample Date	Sample Method	Watercourse	Site Description	Analysis Type	Analysis Date	Analyst	QC Date	APEM location	Notes
61001	07/04/2018	Day Grab	Uist	St 1	1.0mm mesh	30/04/2018	Re	30/04/2018	Letchworth	-
61002	07/04/2018	Day Grab	Uist	St 2	1.0mm mesh	23/04/2018	R	25/04/2018	Letchworth	-
61003	07/04/2018	Day Grab	Uist	St 3	1.0mm mesh	20/04/2018	R	20/04/2018	Letchworth	-
61004	07/04/2018	Day Grab	Uist	St 4	1.0mm mesh	20/04/2018	R	20/04/2018	Letchworth	-
61005	07/04/2018	Day Grab	Uist	St 5	1.0mm mesh	24/04/2018	R	24/04/2018	Letchworth	-

A M e 22 v												
Samp e Numbe		6 00		6 002		6 003		6 004		6 005		
Sample Date		07 04 20 8		07 04 20 8		07 04 20 8		07 04 20 8		07 04 20 8		
Sample Method		Davy G ab		Davy G ab		Davy G ab		Davy G ab		Davy G ab		
Wate cou se		Ulst		Ulst		U st		U st		Ulst		
Site Desc p ion		St		St 2		St 3		St 4		St 5		
Ana ys s ype		0mm mesh		0mm mesh		0mm mesh		0mm mesh		0mm mesh		
Analysis Date		30 04 20 8		23 04 20 8		20 04 20 8		20 04 20 8		24 04 20 8		
Analyst												
Code	axa ID	Qua i e s	q	MA	q	MA	q	MA	q	MA	q	MA
AS060	e licul ridae											
C0000	Anima ia	eggs										
D024	Neo u ia											
D06 8	Vi gu a ia mi ab lis										6	
D0662	Act nia ia											
D0759	Edwa dsidae				3		2					
G000	Neme tea				3							
G0034	ubu anus po ymo phus		3									
G0039	Ce eb a u us											
HD000	Nema oda		3		2						5	
N00 7	Gol ng a vu ga s				2							
N0028	hysaenoca dia p oce a		3		5		3				2	
N0034	hascol on st ombus											
O050	Malmg an a da bouxi											
O065	Ha mothoe mpa	agg ega e	3									
O067	Malmg an a a emicolae				3							
O092	holoe ba bca (sensu e e sen)		3		3						5	
O094	holoe ino nata sensu ete sen)										3	
O 36	seudomys idea l mbata										2	
O 64	Eumida bahusiens s		2									
O 67	Eumida sanguinea	agg ega e										
O 76	a ana tis koste iensis											
O256	Glyce a alba		4		3		2				6	
O260	Glyce a lapidum	agg ega e										
O268	Glyc nde no dmanni											
027	Gon ada macu a a				5							
0305	sama he usca											
03 9	oda keops s capensis		4		2						3	
042	a exogona hebes											
0475	Eune e s long ss ma								7			
0484	a yne ela dume il i											
0494	Nephtys	uveni e			27		5					
0502	Nephtys ke sivalens s		2		38							
0539	Aponuph s bil neata											
0574	umb ne s c ngulata	agg ega e	53		20		50				84	
0638	otodo v l ea ke e steini		3									
0657	e toscoloplos mammosus											
0693	evinsen a g ac lis		2		3							
0699	a adone e y a		3		4						0	
07 2	Apis ob anchus tul be gi				2		3				36	
07 9	Unciopion dae											
0722	Aonides oxycepha a		9				2					
0733	aonice bahus ensis											
0746	onosp o c mu t b anch a a											
0747	onosp o c ci i e a											
077	seudopo ydo a species A											
0796	Spiophanes k oye i											
0804	Magelona a leni											
0829	Cau le e la alata											
0832	Chaetozone elakata											
0834	Chaetozone setosa											
0838	Ci i o mia	uveni e	3		29							
0839	Ci i o mia tentacu a a				8							
0878	D p oci us glaucus										9	
0906	Cap tal a											
09 9	Med omsatus agi is		5		5		7					
0923	Notomas us		0				0				4	
0955	e ochone	ype A									2	
0964	Eucl ymene oe sted i	agg ega e	26				2				37	
097	axi lel a a n s				2		3				9	
0990	Rhod ne g aci lo										2	
0 4	Ophel na acuminata						2					
025	Scal b egma in a um		7		7		2				8	
026	Scal b egma ce t cum						2					
093	Galathowen a oculata		4		8						2	
068	Owenia				2							
02	Amphictene au coma										2	
24	Melinna pa mia a		77		236		2 7		0		83	
39	Ampha ete indst oemi		3		5						3	
43	Amphictela m das											
74	e ebe l des		7		3		0				6	
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S0007	Neba ia bo eal s				4							
S0249	U othoe ma ina											
S0265	Metaphoxus u toni											
S0303	ys anassa ce atina											
S0305	ys anassa plumosa				2						4	
S0347	yphos tas long pes											
S04 5	Daxarn ne spinosa				2							
S04 6	Daxarn ne hea											
S0429	Ampel sca diadema		2									
S0440	Ampel sca tenu co n s				7		2					
S0503	Chei oc a us	emale										
S0505	Chei oc a us inte med us											
S0536	Sunamphitoe pe ag ca											
S0577	Ao dae	emale	0								8	
S0579	Ao a g ac i a											
S0593	Mic odeutopus anoma us											
S0657	ht sica ma ina											
S0839	inno ia quad ipunctata				4							
S 40	seudopa attana s ba ei											
S 42	anaxpsis g ac to des		2		7							
S 25	D astyl is aevis				3							
S 254	D astyl is ugosa				2						3	
S 350	H ppolyte va iams											
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S 577	ioca c nus	uveni e	2									
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W0292	acuna v ncta											
W0338	A vania beani										4	
W0344	A vania punctu a											
W037	Onoba sem cos a a				4		3				6	
W0377	usi l na sa sil				2				2		3	
W049	Euspi a ni ida											
W0603	Eul ma bil neata											
W0748	lt a pygmaea											
W0908	Megastomia concidea										2	
W0909	Odostom a acuta											
W0954	Megastomia conspicua											
W0967	agula ernest a a											
W 080	Retusa t uncatula											
W 569	Nucu a n t dosa										4	
W 570	Nucu a nucleus		5		9		5				25	
W 57	Nucu a su cata											
W 627	old e la ph l pp ana										5	
W 696	Myti ua edul s	uveni e										
W 698	Mod o us	uveni e										
W 805	Anomi dae	uveni e			2							
W 829	ucinoma bo eal s	uveni e										
W 837	hyaxi a exuosa		33		49		42				85	
W 906	Ku t el a b dentata		32		38		5				208	
W 95	a vica dium pinnu a um				2		6				3	
W 952	a vica dium scab um						6					
W2006	haxas pellucidus											
W202	Moe e la donac na		3				7					
W2023	Adsjo rraenia pygmaea											
W2059	Ab a alba		7		5		9				0	
W2062	Ab a p ismat ca											
W2072	A c ica is andica	uveni e										
W2098	Chame ea st iatula	uveni e										
W2 04	moc ea ovata											
W2 0	ol t tapes	uveni e	2									
W2 3	ol t tapes homboides	uveni e			2							
W2 24	Vene upis co uga a											
W2 24	Vene upis co uga a	uveni e										
W2 26	Dosinia	uveni e	2				5					
W2 28	Dosinia upinus											
W2 47	Mya t uncata	uveni e			8		3				2	
W2 57	Co bu a g bba						3					
W2 66	H a e la a ct ca											
W2229	h acia convexa	uveni e									3	
W2239	Coch odesma p aetenue	uveni e										
00 3	C sia											
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0265	C adosc upocel a a											
0480	Mic opo e la cl iata											
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ZB0 52	Amphiu a ch ajei											
ZB0 54	Amphiu a li o mia				5						0	
ZB0 6	Amphipho ra squamata				6		2				4	
ZB0 65	Oph u idae	uveni e									5	
ZB0 68	Oph u a a b da											
ZB0280	eptopentacta elongata				3							
ZB0300	Oes e g ensa dig fata											
ZC00 2	Ente rpneus a											
ZM0002	Rhodophyta											
ZM0 48	Bonnemaison a hami e a											
ZM0 70	alma a pa ma a											
ZM0 8	Rhodothamn e la											
ZM0 89	H ldenb andia											
ZM0406	hyl opho a											
ZM043	G aci a a											
ZM0443	ocamium ca t laigineum											
ZM050	Cal i hamnion											
ZM0507	Ce amium											
ZM055	uma a p umosa											
ZM0554	e othamn on p umu a											
ZM058	Hete os phonia plumosa											
ZM059A	Delesse a sangu nea											
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ZM0665	olysiphon a											
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ZR0004	Ectoca paceae											
ZR0288	Sphacela a											
ZR03 3	D c yo a d chotoma											
ZR0334	Desma est a aculeata											
ZR0382	ucus se a us											
ZS0 74	U va											
ZS0 95	C adopho a											

APEM Report No. P00002258b_v1

Sample Number	Sample Date	Site Description	Biotope	Description	EUNIS
61001	07/04/2018	Grab St. 1	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments.	A5.5214
61002	07/04/2018	Grab St. 2	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments.	A5.5214
61003	07/04/2018	Grab St. 3	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments.	A5.5214
61004	07/04/2018	Grab St. 4	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments.	A5.5214
61005	07/04/2018	Grab St. 5	SS.SMp.KSwSS.LsacR.Mu	*Laminaria saccharina* with red and brown seaweeds on lower muddy mixed sediments.	A5.5214

APEM Report No. P00002258b_v1

Code	Taxa ID	Qualifiers	Notes
D0618	Virgularia mirabilis		Represents priority habitat;
P0319	Podarkeopsis capensis		Traditional usage; but possibly a related species;
P0719	Uncispionidae		Possible undescribed species;
P0771	Pseudopolydora species A		Undescribed species;
P0834	Chaetozone setosa		May include undescribed species;
P0906	Capitella		Representative of organic enrichment;
P0955	Leiochone	Type A	Possible undescribed species;
P0964	Euclymene oerstedii	aggregate	May include undescribed species;
P1264	Chone		May include undescribed species;
S0007	Nebalia borealis		Rarely recorded;
S0577	Aoridae	female	May include non-native species;
S0839	Limnoria quadripunctata		Non-native in the UK;
T0003	Chironomidae	larva	May include non-native species;
W0748	Tritia pygmaea		Possibly close to northern limit of distribution;
W0954	Megastomia conspicua		Rarely recorded;
W1696	Mytilus edulis	juvenile	Commercially important;
W1698	Modiolus	juvenile	Represents priority habitat;
W2072	Arctica islandica	juvenile	OSPAR listed; Long lived;
ZM0148	Bonnemaisonia hamifera		Non-native in the UK;
ZM0431	Gracilaria		May include non-native species;

Appendix 2 PSD data from grab samples

APEM Pa ic e S ae Re u ts - ochmaddy (P o ect P2258)

Appendix 3 Underwater video analysis log

Station	Start time	End Time	Video track time	Start Lat	Start Long	End Lat	End Long	Assigned Biotope (MNCR Code)	Classification descriptor)	(Exact copy of MNCR	Notes	Reference image
Tr 1 - 2018-04-08_09.58.15_Biotope 1	09:58:37	10:06:09	00:07:32	5735.74376N	00709.47492W	5735.78140N	00709.42953W	SS.SMp.KSwSS.LsacR.Mu	Laminaria saccharina with red and brown seaweeds on lower muddy mixed sediments			
Tr 1 - 2018-04-08_09.58.15_Biotope 2	10:06:09	10:08:06	00:01:57	5735.78140N	00709.42953W	5735.78457N	00709.41901W	IR.HIR.Ksed	Sediment-affected or disturbed kelp and seaweed communities		Angular cobbles showing little algal growth with scattered less mobile boudlers where fo ise reds occur.	IR.HIR.KSed_ Sand or gravel-affected or disturbed kelp and seaweed communities_Tr 1_10_07
Tr 2 - 2018-04-08_11.22.19_Biotope 1	11:22:39	11:29:28	00:06:49	5735.74193 N	00709.28070W	5735.78644N	00709.36244W	SS.SMp.KSwSS.LsacR.Mu	Laminaria saccharina with red and brown seaweeds on lower muddy mixed sediments			
Tr 2 - 2018-04-08_11.22.19_Biotope 2	11:29:28	11:29:47	00:00:19	5735.78644N	00709.36244W	5735.787 8N	00709.36422W	R.MIR.KR.Ldig	*Lam naria digitata* on moderately exposed sublittoral fringe rock		man made boulder steep ledge	IR.MIR.KR.Ldig_Laminaria digitata on moderately exposed sublittoral fringe rock_Tr 2_06.57
Tr 2 - 2018-04-08_11.22.19_Biotope 3	11:29 47	11:29:57	00:00: 0	5735.78718N	00709.36422W	5735.78812N	00709.36689W	LR.LLR.F.Fserr.FS	*Fucus serratus* on full salinity lower eu ittoral mixed substrata		man made boulder steep ledge	LR.LLR.F.Fser.X_Fucus serratus on full salinity lower eulittoral mixed substrata_Tr 2_07. 0
Tr 3 - 2018-04-08_10.29.17_Biotope 1	10:29: 8	10:35:46	00:06:08	5735.76752N	00709.24684W	5735.79136N	00709.28854W	SS.SMp.KSwSS.LsacR.Mu	Laminaria saccharina with red and brown seaweeds on lower muddy mixed sediments			SS.SMp.KSwSS.LsacR Mu_Laminaria saccharina with red and brown seaweeds on lower muddy sediments_Tr 3_ 0_34
Tr 4 - 2018-04-08_10.40.39_Biotope 1	10:40 59	11:00:23	00:19:24	5735.79904N	00709.12994W	5735.77267N	00709.34474W	SS.SMp.KSwSS.LsacR.Mu	Laminaria saccharina with red and brown seaweeds on lower muddy mixed sediments			
Tr 4 - 2018-04-08 10.40.39 Biotope 1	11:00:39	11:03:00	00:02:21	5735.77245N	00709.34466W	5735.77250N	00709.34565W	SS.SMp.KSwSS.LsacR.Mu	Laminaria saccharina with red and brown seaweeds on lower muddy mixed sediments		attempt to find p ling at pier base	
Tr 5 - 2018-04-08_10:14:27_Biotope 1	10:14:49	10:20:05	00:05: 6	5735.75558N	00709.3 067W	5735.75798N	00709.34 88W	SS.SMp.KSwSS.LsacR.Mu	Laminaria saccharina with red and brown seaweeds on lower muddy mixed sediments		Interrupted by CalMac ferry arriving	
Tr 5 - 2018-04-08_11:06:57_Biotope 1	11:07: 8	11:12:59	00:05:41	5735.75427N	00709.32935W	5735.77248N	00709.39660W	SS.SMp.KSwSS.LsacR.Mu	Laminaria saccharina with red and brown seaweeds on lower muddy mixed sediments			
Tr 5 - 2018-04-08_11:06:57_Biotope 2	11:12:59	11:16:28	00:03:29	5735.77248N	00709.39660W	5735.78776N	00709.42838W	IR.HIR.Ksed	Sediment-affected or disturbed kelp and seaweed communities			

Appendix I.1: Lochmaddy Ferry Terminal Phase 1 Habitats and Otter Survey June 2017

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Lochmaddy Ferry Terminal
Phase 1 Habitats and Otter Survey

June 2017

Redacted

34 Valtos
Miavaig
Isle of Lewis
HS2 9HR

Summary

A Phase 1 habitat and otter survey were carried out on the area around the Lochmaddy Ferry Terminal, North Uist, in May 2017. There were small areas of intertidal habitat to the west and south of the ferry terminal. Much of the terrestrial habitat was semi-improved acid grassland, with some small areas of tall ruderal habitat. Otters frequent the area, with a recently used lie-up within 100m of the ferry pier. The islands to the west of the pier also had signs of use by otters. There were no recent signs of otters using the actual area of the proposed works at the ferry terminal.

1 Introduction

1.1 Site Description

The survey was the site of the proposed works at the ferry terminal Lochmaddy, North Uist and all habitat within 250m of the terminal.

1.2 Aims of Survey

A standard Phase 1 habitats and otter survey was carried out to identify the main habitat types present and to establish if there is evidence that otters use the site.

2 Methodology

Habitats

The phase 1 habitat survey was carried out following the methodology described in JNCC (2010) Handbook for Phase 1 habitat survey – a technique for environmental audit, JNCC, Peterborough.

As it was a relatively small site, and much of the area was built-up, a 1:2500 map was used.

A standard walkover survey of the site, including a 250m buffer zone, was carried out by Redacted on 24 and 25 May 2017. The survey was undertaken between 0900 and 1600 GMT in good weather conditions.

Otters

The survey was undertaken by Redacted an experienced otter surveyor with an SNH otter disturbance licence, number 13297. All shoreline and watercourses were checked for signs of otter (spraints, prints and digging), including evidence of runs, holts, lay-ups or couches. The rock armour along the shore was checked for otter lie-ups/holts. The walkover survey for otter was carried out and recorded according to the guidelines set out in Chanin P (2003) Monitoring the Otter' (*Lutra lutra*) Conserving Natural 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough.

All signs of otters were photographed and a grid reference recorded using a handheld GPS. Otter spraints were identified by sight and smell. All spraints found were categorized according to the guidelines set out in Chanin 2003.

The islands to the west of the ferry terminal were not accessed for the survey but were surveyed with a telescope from the mainland shore.

3 Results

Summary of Habitat Types

(see Appendix 1 for map of habitat types)

H1 Intertidal – brown algal beds

The intertidal areas to the south and west of the ferry terminal had an array of seaweeds typical of North Uist sea lochs - *Ascophylum nodosum*, *Fucus vesculosis*, *Pelvetia canaliculata*, *Fuscus spiralis*. *Ascophylum nodosum* var. *mackaii* was not found to be present.

Photographs 1 and 2
Brown algal intertidal areas west of the ferry terminal

H2 Saltmarsh
There were very thin strips of saltmarsh vegetation at the upper limits of the intertidal area to the north west of the ferry terminal.

Photograph 3
saltmarsh area west of ferry terminal

B1 Acid grassland

The crofts west of the ferry terminal and the headland to the south west, on the other side of the peninsula, were herb-rich semi-improved grassland, with a high proportion of *Juncus squarrosus*, *Rumex*, *Ranunculus acris* and occasional stands of *Iris pseudocorus.* Other areas, including the peninsula to the east of the ferry terminal, were shorter grassland, with some dwarf shrub cover.

Photograph 4
Acid grassland to west of ferry
Acid grassland to west of ferry

Photograph 5
Peninsula to the north of the ferry terminal – acid grassland with some dwarf shrub and stands of tall ruderal near to the livestock pens

Photograph 6
Acid grassland to the north west of the ferry terminal, on peninsula opposite Lochmaddy Hotel

C1 Bracken
The two islands to the west of the ferry terminal had extensive bracken.

Photograph7
Bracken-covered islands to west of terminal

C3.1 Tall ruderal
The area around the livestock pens to the north of the ferry terminal had stands of *Urtica dioica* and *Heracleum sphondylium*.

Photograph 8
Tall ruderal vegetation near the livestock pens by ferry car park

A1 Mixed plantation woodland
To the north west of the ferry terminal, adjacent to the Lochmaddy Hotel, is a small area of plantation woodland, with conifers dominating the western edge and mainly broadleaves to the east.

Photograph 9
Mixed plantation woodland west of ferry terminal

Target Notes

1 NF 92127 68053

Small peninsula to the east of the ferry terminal – short acid grassland with some dwarf shrub (mainly *Calluna vulgaris*) cover (less than 25%).

2 NF 92075 68059
Stands of *Urtica dioica* and *Heracleum sphondylium* adjacent to livestock pens.

3 NF 91901 68075

Interidal habitat in small bay to the west of the ferry terminal. *Ascophylum nodosum*, *Fucus vesculosis*, *Pelvetia canaliculata*, *Fuscus spiralis* present. Thin strand line of saltmarsh vegetation.

4 NF 91915 68099

Acid grassland down to shore, with stands of *Iris pseudocorus* and other long ruderal.

5 NF 91882 68129
Semi-improved herb rich acid grassland, patches with extensive *Juncus squarrosus, Ranunculus acris*

6 NF 91769 68121

Upper section of intertidal habitat had more extensive saltmarsh vegetation at the strandline.

7 NF 91854 68244
Small area of plantation woodland. Conifers along the western edge, rest mainly broadleaved, *Salix* sp and *Alnus glutinosa*.

Otters

Otter spraint sites, lie-ups and runs were found in the vicinity of the ferry terminal – see Appendix 2.

There is a recently used lie-up dug into the peat on the peninsula to the east of the ferry terminal at NF 92130 68029, with fresh spraints nearby (see photograph 10). There was no nearby freshwater and so it is unlikely to be used as a holt, more likely an occasional lie-up. There is a well-used footpath on the peninsula, and so the site is subject to disturbance, which would also reduce the likelihood of it being used as a holt.

Photograph 10

Otter lie-up with fresh spraints on the peninsula to the north of the pier.

There were other holes in the peat that were potential lie-ups but had no signs of recent use.

Photograph 11
Other holes in peat on peninsula to the north of the pier that could potentially be used as lie-ups

An otter was seen fishing in the bay at NF921680. There were other possible lie-ups amongst shoreline peat and boulders to the north of this bay.

The islands to the west of the ferry terminal had signs of use by otters (see photograph 7). There was an obvious run through the bracken on the westernmost island at NF 91785 68066, and signs of spraints on the shore where the vegetation was affected.

Photograph 12
Otter run through bracken on island to west of terminal

The height of the bracken made it difficult to see whether there were holes dug by otters. The peat soil is typical of other sites in Lochmaddy where otters have dug holts under the bracken. It is also possible that there is freshwater on the islands which would increase the likelihood of there being a holt.

4 Assessment

Habitats

The habitat types are typical of North Uist and there were no notable species present. The plantation woodland has provided habitat for breeding birds that would not usually be found around the east coast of North Uist. The acid grassland is common throughout the croftland areas of North Uist.

Otters

Otters are using the shore immediately to the east and north of the ferry terminal and the islands to the west. There was one lie-up on the peninsula to the east of the terminal with signs of regular use, and an otter was seen fishing in the bay to the north. The otters frequenting this area of Lochmaddy are tolerant of disturbance and have continued to use the area after other developments have been carried out in the vicinity of the ferry terminal.

5 Recommendations

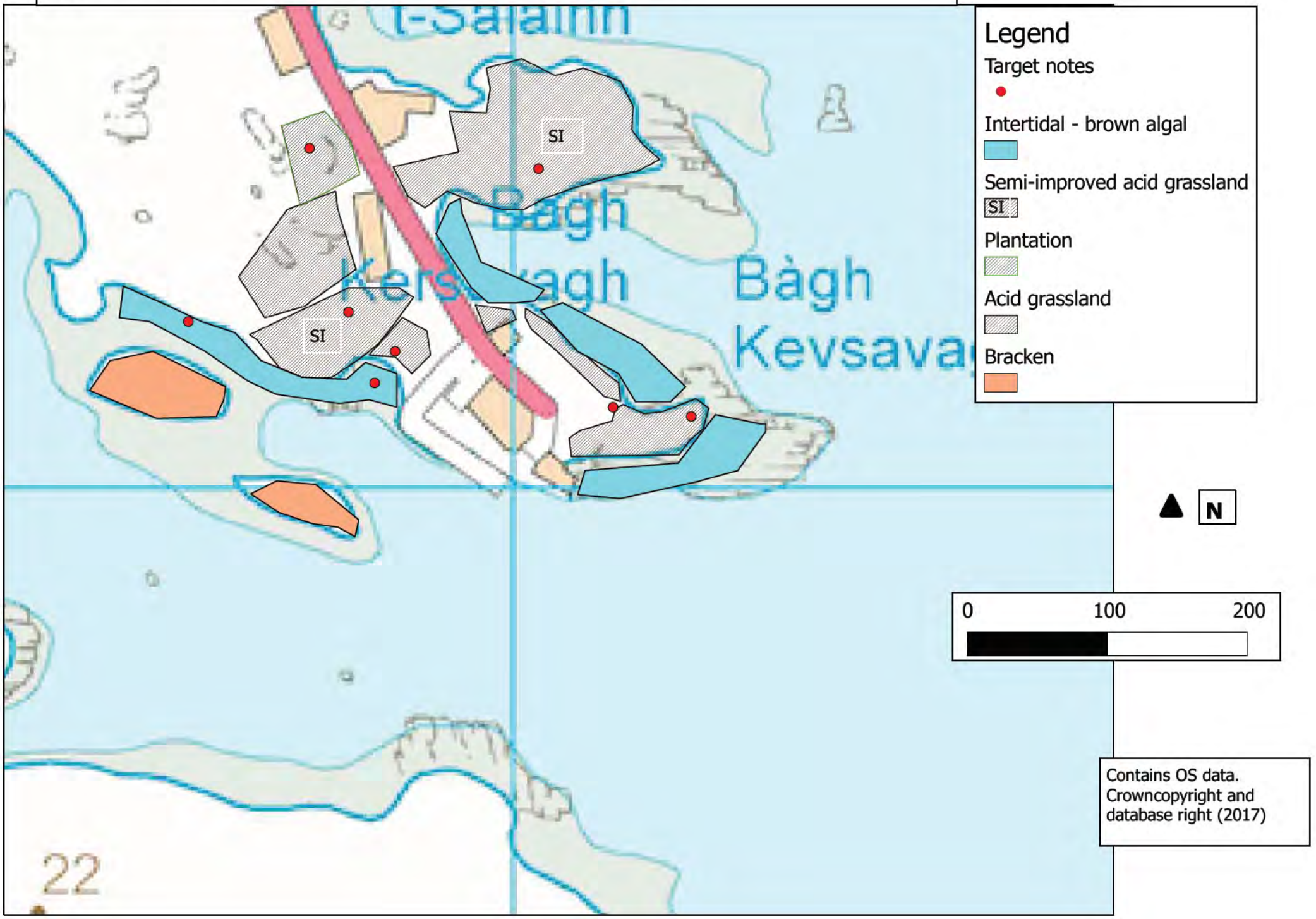
Habitats

There is no requirement for an NVC survey.

Otters

Otters are using the vicinity of the ferry terminal and a pre-construction survey is recommended. The islands to the west of the terminal may have otter resting places, and would be best surveyed when the bracken vegetation has died down. It is possible that a European Protected Species licence may be required, subject to the pre-construction surveys.

Appendix 1 Lochmaddy Ferry Terminal Phase 1 Habitats



Appendix 2 Lochmaddy Ferry Terminal Otter Survey

Appendix J.1: Baseline Noise Level Data

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

CERTIFICATE OF CALIBRATION

Date of Issue: 25 January 2017 **Certificate Number: TCRT17/1025**

Issued by:
ANV Measurement Systems
Beaufort Court
17 Roebuck Way
Milton Keynes MK5 8HL
Telephone Redacted
E-Mail: info@noise-and-vibration.co.uk
Web: www.noise-and-vibration.co.uk
Acoustics Noise and Vibration Ltd trading as ANV Measurement Systems

Approved Signatory

Redacted

Customer	TNEI Services Ltd Milburn House Dean Street Newcastle Upon Tyne NE1 1LE
Order No.	PO 5001
Description	Sound Level Meter / Pre-amp / Microphone / Associated Calibrator

Identification

Manufacturer	*Instrument*	*Type*	*Serial No. / Version*
Rion	Sound Level Meter	NA-28	00680882
Rion	Firmware		2.0
Rion	Pre Amplifier	NH-23	80933
Rion	Microphone	UC-59	01056
Rion	Calibrator	NC-74	34762316
	Calibrator adaptor type if applicable		NC-74-002

Performance Class 1

Test Procedure TP 2.SLM 61672-3 TPS-49

Procedures from IEC 61672-3:2006 were used to perform the periodic tests.

Type Approved to IEC 61672-1:2002 Yes Approval Number 21.21/07.01

If YES above there is public evidence that the SLM has successfully completed the applicable pattern evaluation tests of IEC 61672-2:2003

Date Received 23 January 2017 ANV Job No. TRAC17/01008

Date Calibrated 25 January 2017

The sound level meter submitted for testing has successfully completed the class 1 periodic tests of IEC 61672-3:2006, for the environmental conditions under which the tests were performed. As public evidence was available, from an independent testing organisation responsible for approving the results of pattern evaluation tests performed in accordance with IEC 61672-2:2003, to demonstrate that the model of sound level meter fully conformed to the requirements in IEC 61672-1:2002, the sound level meter submitted for testing conforms to the class 1 requirements of IEC 61672-1:2002.

Previous Certificate	*Dated*	*Certificate No.*	*Laboratory*
	05 November 2015	TCRT15/1303	ANV Measurement Systems

CERTIFICATE OF CALIBRATION

Certificate Number
TCRT17/1025

Sound Level Meter Instruction manual and data used to adjust the sound levels indicated.

SLM instruction manual title	Sound Level Meter	NA-28	
SLM instruction manual ref / issue		06-11	
SLM instruction manual source		Manufacturer	
Internet download date if applicable		N/A	
Case corrections available		Yes	
Uncertainties of case corrections		Yes	
Source of case data		Manufacturer	
Wind screen corrections available		Yes	
Uncertainties of wind screen corrections		Yes	
Source of wind screen data		Manufacturer	
Mic pressure to free field corrections		Yes	
Uncertainties of Mic to F.F. corrections		Yes	
Source of Mic to F.F. corrections		Manufacturer	
Total expanded uncertainties within the requirements of IEC 61672-1:2002		Yes	
Specified or equivalent Calibrator		Specified	
Customer or Lab Calibrator		Customers Calibrator	
Calibrator adaptor type if applicable		NC-74-002	
Calibrator cal. date		24 January 2017	
Calibrator cert. number		UCRT17/1033	
Calibrator cal cert issued by Lab		7623	
Calibrator SPL @ STP	94.02	dB	Calibration reference sound pressure level
Calibrator frequency	1002.52	Hz	Calibration check frequency
Reference level range	20 - 120	dB	

Accessories used or corrected for during calibration - Wind Shield
Note - if a pre-amp extension cable is listed then it was used between the SLM and the pre-amp.

Environmental conditions during tests	Start	End	
Temperature	23.31	23.32	± 0.20 °C
Humidity	36.0	35.5	± 3.00 %RH
Ambient Pressure	101.54	101.54	± 0.03 kPa

Response to associated Calibrator at the environmental conditions above.

Initial indicated level	94.0	dB	Adjusted indicated level	94.0	dB
The uncertainty of the associated calibrator supplied with the sound level meter ±				0.10	dB

Self Generated Noise — This test is currently not performed by this Lab.

Microphone installed (if requested by customer) = Less Than	N/A	dB	A Weighting
Uncertainty of the microphone installed self generated noise ±	N/A	dB	

Microphone replaced with electrical input device - UR = Under Range indicated

Weighting	A			C			Z		
	9.7	dB	UR	14.1	dB	UR	21.0	dB	UR
Uncertainty of the electrical self generated noise ±							0.12	dB	

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a coverage probability of approximately 95%. The uncertainty evaluation has been carried out in accordance with the Guide to the Expression of Uncertainty in Measurement published by ISO.

For the test of the frequency weightings as per paragraph 12. of IEC 61672-3:2006 the actual microphone free field response was used.

The acoustical frequency tests of a frequency weighting as per paragraph 11 of IEC 61672-3:2006 were carried out using an electrostatic actuator.

END

Calibrated by: Redacted

R 2

Additional Comments
None

Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Equipment Details

Instrument Manufacturer	Cirrus Research plc
Instrument Type	CR:171B
Description	Sound Level Meter
Serial Number	G078532

Calibration Procedure

The instrument detailed above has been calibrated to the publish test and calibration data as detailed in the instrument hand book, using the techniques recommended in the latest revisions of the International Standards IEC 61672-1:2013, IEC 61672-1:2002, IEC 60651:1979, IEC 60804:2001, IEC 61260:1995, IEC 60942:2003, IEC 60942:1997, IEC 61252:1993, ANSI S1.4-1983, ANSI S1.11-1986 and ANSI S1.43-1997 where applicable.
Sound Level Meters: All Calibration procedures were carried out by substituting the microphone capsule with a suitable electrical signal, apart from the final acoustic calibration.

Calibration Traceability

The equipment detailed above was calibrated against the calibration laboratory standards held by Cirrus Research plc. These are traceable to International Standards {A.0.6}. The standards are:

Microphone Type	B&K 4192	Serial Number	1920791	Calibration Ref.	S6450
Pistonphone Type	B&K 4220	Serial Number	613843	Calibration Ref.	S6388

Redacted

Calibrated by

Calibration Date	26 September 2017
Calibration Certificate Number	252819

This Calibration Certificate is valid for 12 months from the date above.

Cirrus Research plc, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire, YO14 0PH
Telephone: +44 (0) 1723 891655 Fax: +44 (0) 1723 891742
Email: sales@cirrusresearch.co.uk

Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Certificate Number: **114121**

Date of Issue: **26 September 2017**

Microphone Capsule

Manufacturer: **Cirrus Research plc** Serial Number: **206546A**

Model Number: **MK:224**

Calibration Procedure

The microphone capsule detailed above has been calibrated to the published data as described in the operating manual of the associated sound level meter (where applicable).

The frequency response was measured using an electrostatic actuator in accordance with BS EN 61094-6:2005 with the free-field response derived via standard correction data traceable to the National Physical Laboratory, Middlesex, UK.

The absolute sensitivity at 1 kHz was measured using an acoustic calibrator conforming to IEC 60942:2003 Class 1.

Date of Calibration: **25 September 2017**

Open Circuit Sensitivity at 1 kHz: **54.7 mV/Pa** **-25.2 dB rel 1 V/Pa**

Environmental Conditions

Pressure: **101.50 kPa**

Temperature: **24.0 °C**

Humidity: **54.0 %**

Calibration Laboratory

Laboratory: Cirrus Research plc
Acoustic House, Bridlington Road, Hunmanby
North Yorkshire, YO14 0PH, United Kingdom

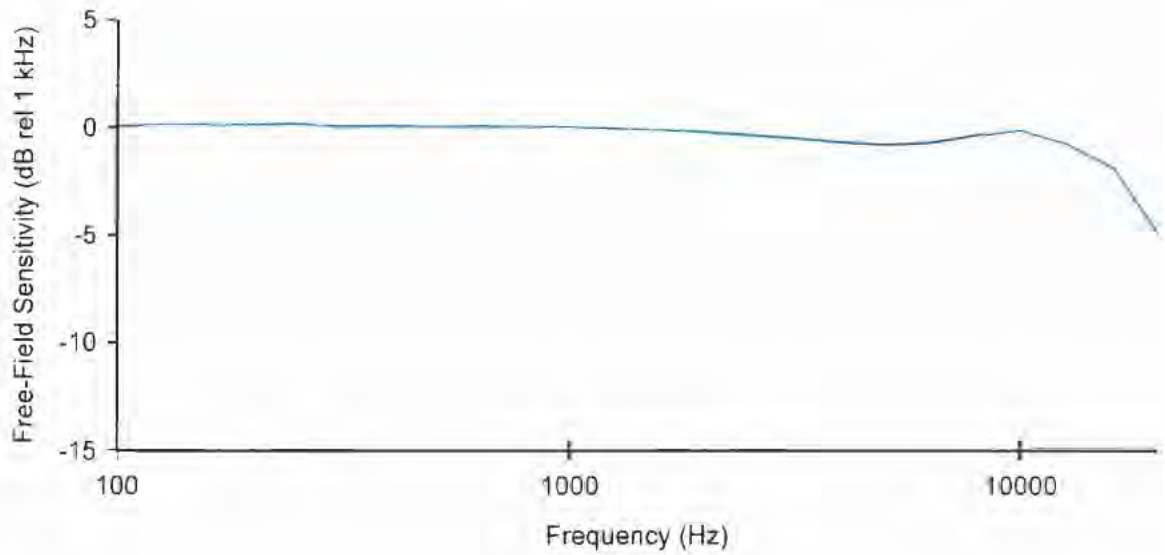
Redacted Redacted

Cirrus Research plc, Acoustic House, Bridlington Road
Hunmanby, North Yorkshire, YO14 0PH, United Kingdom
Telephone: 0845 230 2434 **Int**: +44 1723 891655
Email: sales@cirrusresearch.co.uk
Web: www.cirrusresearch.co.uk
UK Registration No. 987160

bsi. ISO 9001 Quality Management ISO 14001 Environmental Management
FM 531001 EMS 552104

Free-Field Frequency Response

Frequency (Hz)	Free-Field Sensitivity (dB rel 1 kHz)	Actuator Response (dB)
100	0.07	0.19
125	0.11	0.21
160	0.11	0.22
200	0.11	0.23
250	0.15	0.25
315	0.05	0.15
400	0.07	0.16
500	0.05	0.14
630	0.06	0.12
800	0.05	0.08
1 000	0.00	0.02
1 250	-0.07	-0.09
1 600	-0.14	-0.22
2 000	-0.27	-0.45
2 500	-0.40	-0.74
3 150	-0.53	-1.15
4 000	-0.71	-1.70
5 000	-0.82	-2.32
6 300	-0.74	-3.00
8 000	-0.40	-3.72
10 000	-0.15	-5.00
12 500	-0.76	-6.93
16 000	-1.88	-9.72
20 000	-4.90	-13.98



Certificate of Calibration

Cirrus Research plc
dedicated to noise measurement

Certificate Number: **114119**
Date of Issue: **26 September 2017**

Instrument

Manufacturer: **Cirrus Research plc** Serial Number: **78219**
Model Number: **CR:515**

Calibration Procedure

The sound calibrator detailed above has been calibrated to the published data as described in the operating manual and in the half-inch configuration. The procedures and techniques used are as described in IEC 60942:2003 Annex B – Periodic Tests and three determinations of the sound pressure level, frequency and total distortion were made.

The sound pressure level was measured using a WS2F condenser microphone type MK:224 manufactured by Cirrus Research plc.

The results have been corrected to the reference pressure of 101.33 kPa using the manufacturer s data.

Date of Calibration: **26 September 2017**

Calibration Results

Measurement	Level (dB)	Frequency (Hz)	Distortion (% THD + Noise)
1	94.01	1000.3	0.31
2	94.00	1000.3	0.31
3	94.02	1000.3	0.31

Average	**94.01**	**1000.3**	**0.31**
Uncertainty	± 0.13	± 0.1	± 0.10

The reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level.

Cirrus Research plc, Acoustic House, Bridlington Road
Hunmanby, North Yorkshire, YO14 0PH, United Kingdom
Telephone: 0845 230 2434 **Int**: +44 1723 891655
Email: sales@cirrusresearch.co.uk
Web: www.cirrusresearch.co.uk
UK Registration No. 987160

bsi. ISO 9001 Quality Management FM 531001 ISO 14001 Environmental Management EMS 552104

Environmental Conditions

Pressure:	**101.60 kPa**
Temperature:	**23.9 °C**
Humidity:	**52.2 %**

Evidence of Pattern Approval

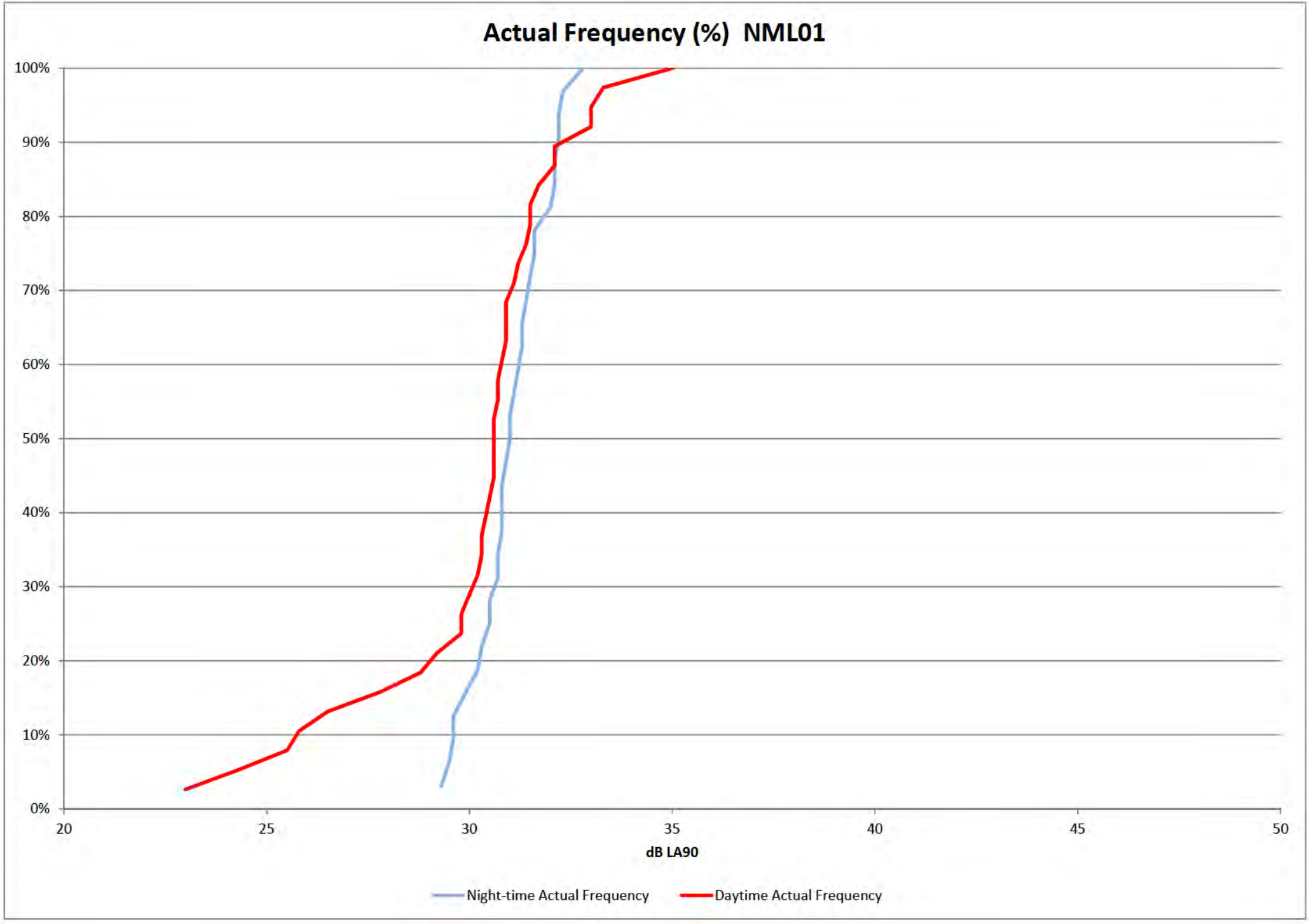
The manufacturer's product information indicates that this model of sound calibrator has been formally pattern approved to IEC 60942:2003 Annex A to Class 1. This has been confirmed with the PhysikalischTechnische Bundesanstalt (PTB).

Statement of Calibration

As public evidence was available, from a testing organisation responsible for approving the results of pattern evaluation tests, to demonstrate that the model of sound calibrator fully conformed to the requirements for pattern evaluation described in Annex A of IEC 60942:2003, the sound calibrator tested is considered to conform to all the Class 1 requirements of IEC 60942:2003.

Calibration Laboratory

Laboratory:	Cirrus Research plc Acoustic House, Bridlington Road, Hunmanby North Yorkshire, YO14 0PH, United Kingdom
Test Engineer:	Redacted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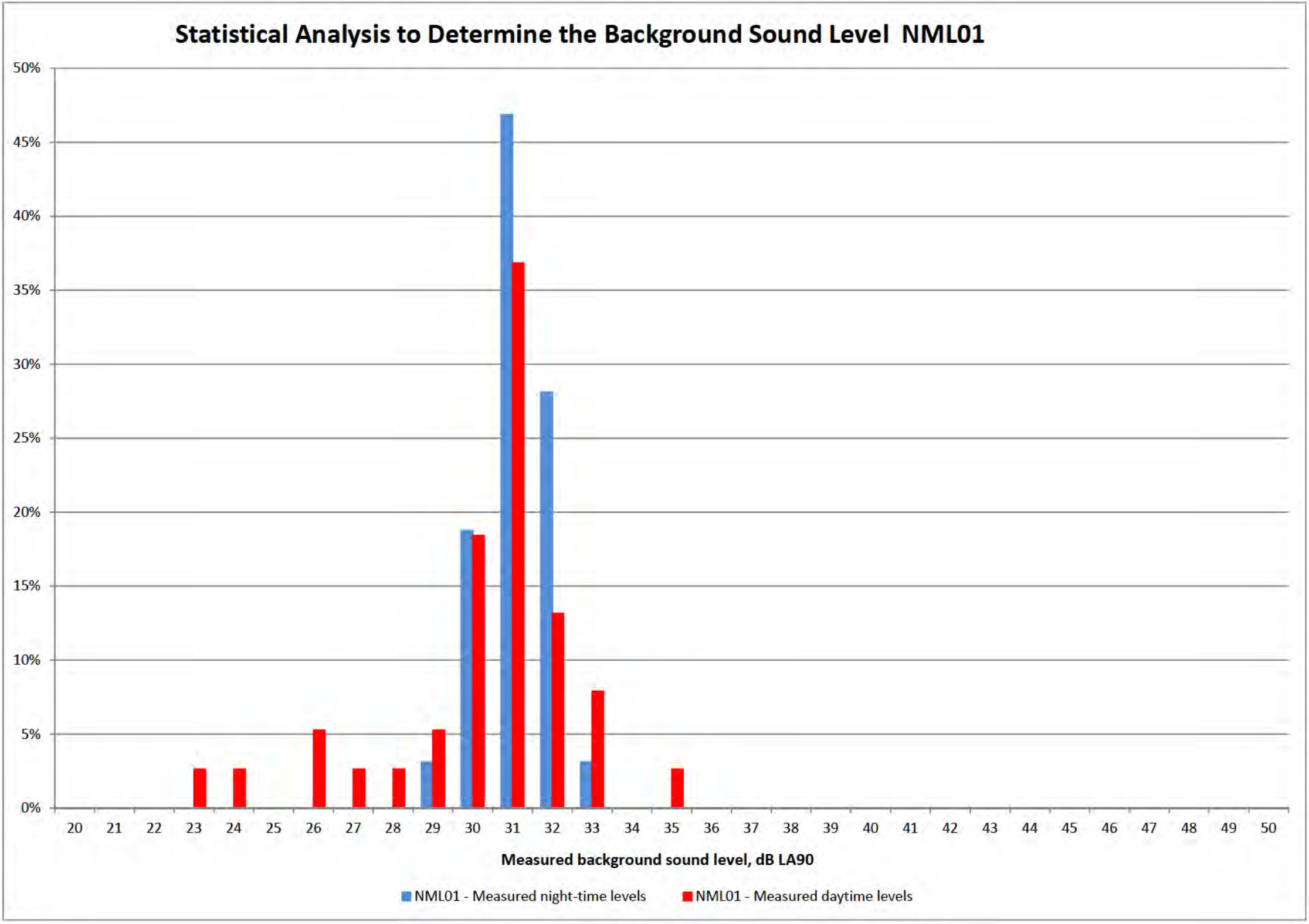
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
20
25
30
35
40
45
50
dB LA90
Night-time Actual Frequency
Daytime Actual Frequency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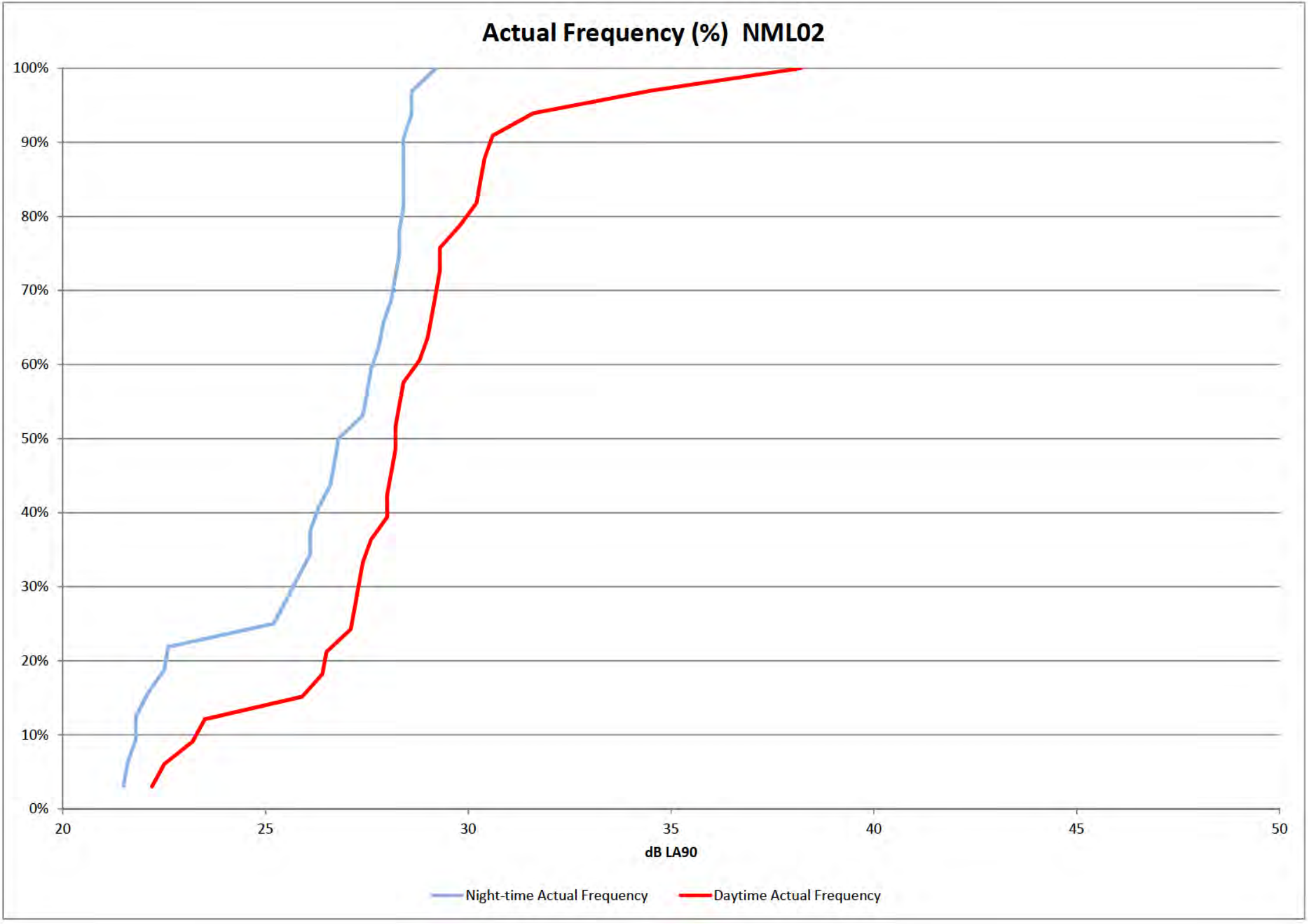
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
Measured background sound level, dB LA90
NML01 - Measured night-time levels
NML01 - Measured daytime levels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90%
80%
70%
60%
50%
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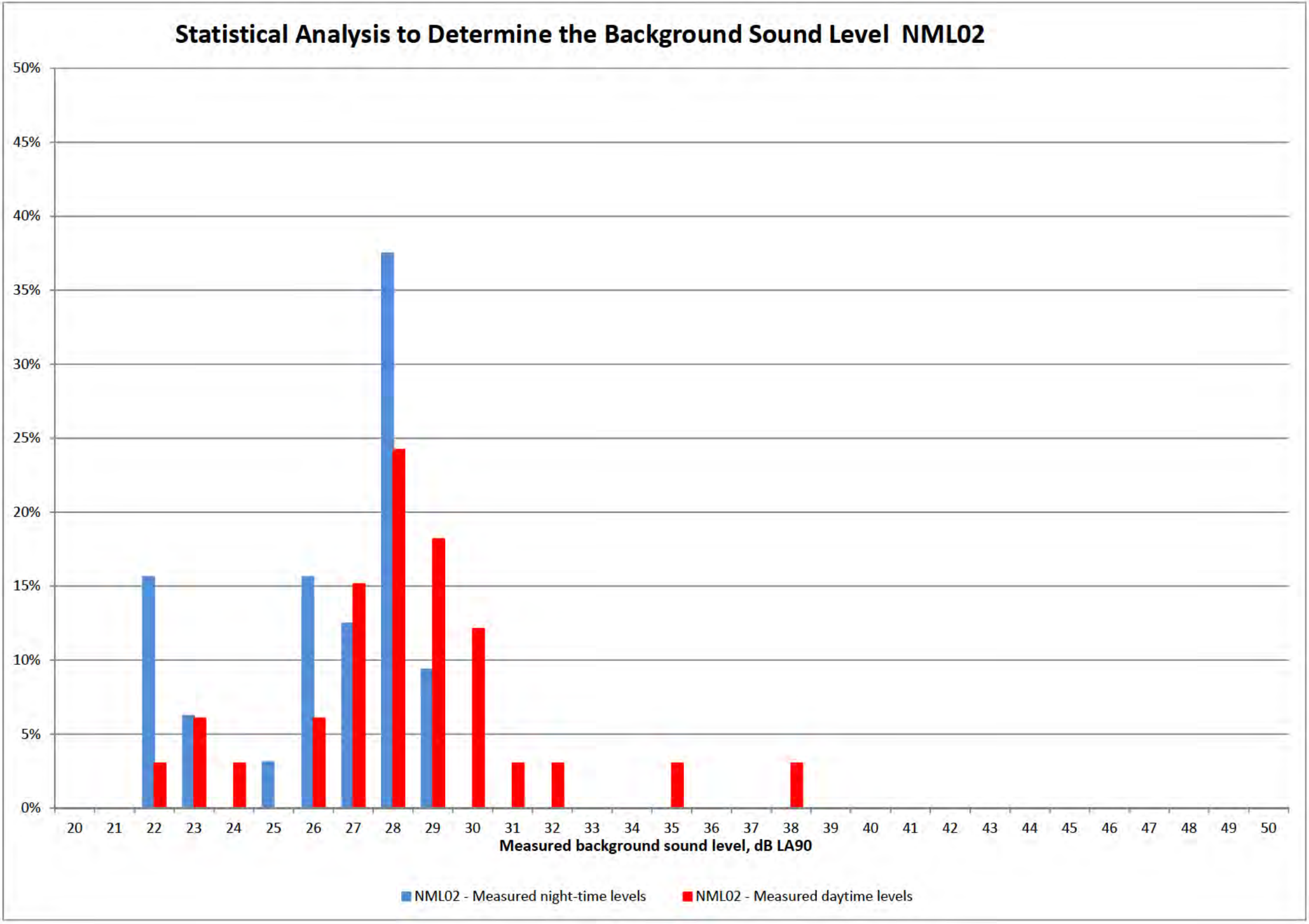
10%
0%
20
25
30
35
40
45
50
dB LA90
Night-time Actual Frequency
Daytime Actual Frequency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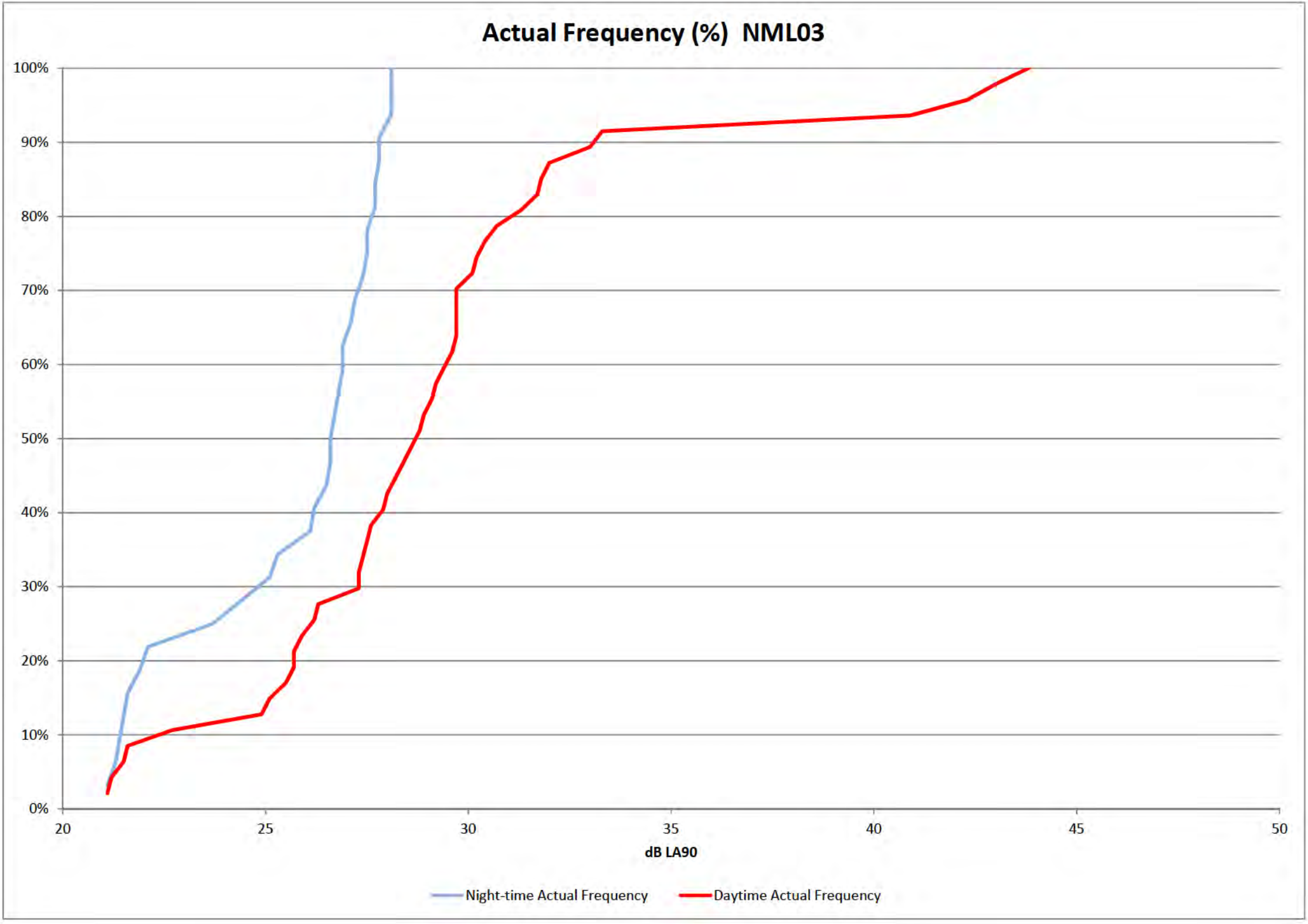
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
Measured background sound level, dB LA90
NML02 - Measured night-time levels
NML02 - Measured daytime levels


Actual Frequency (%) NML03
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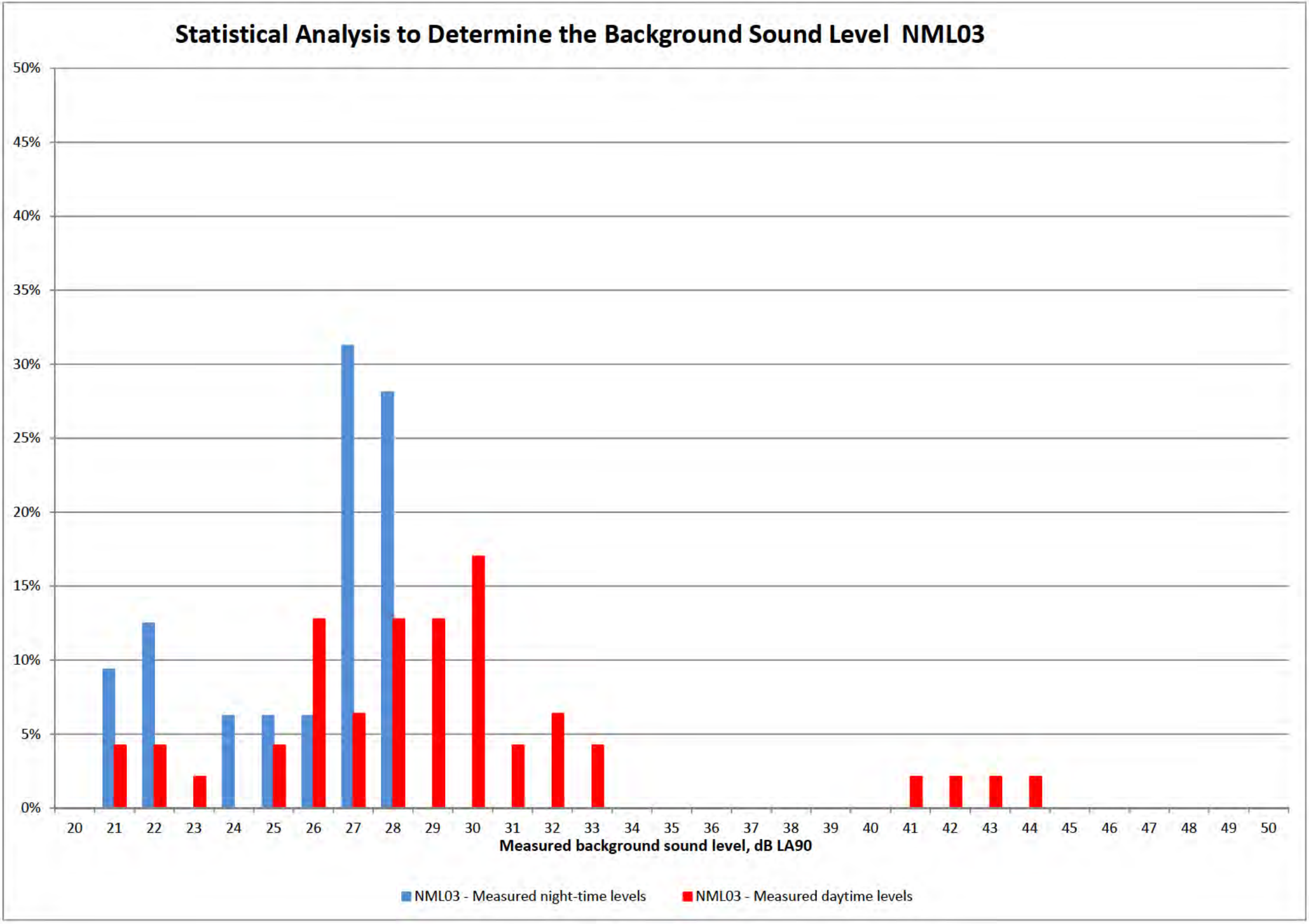
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
20
25
30
35
40
45
50
dB LA90
Night-time Actual Frequency
Daytime Actual Frequency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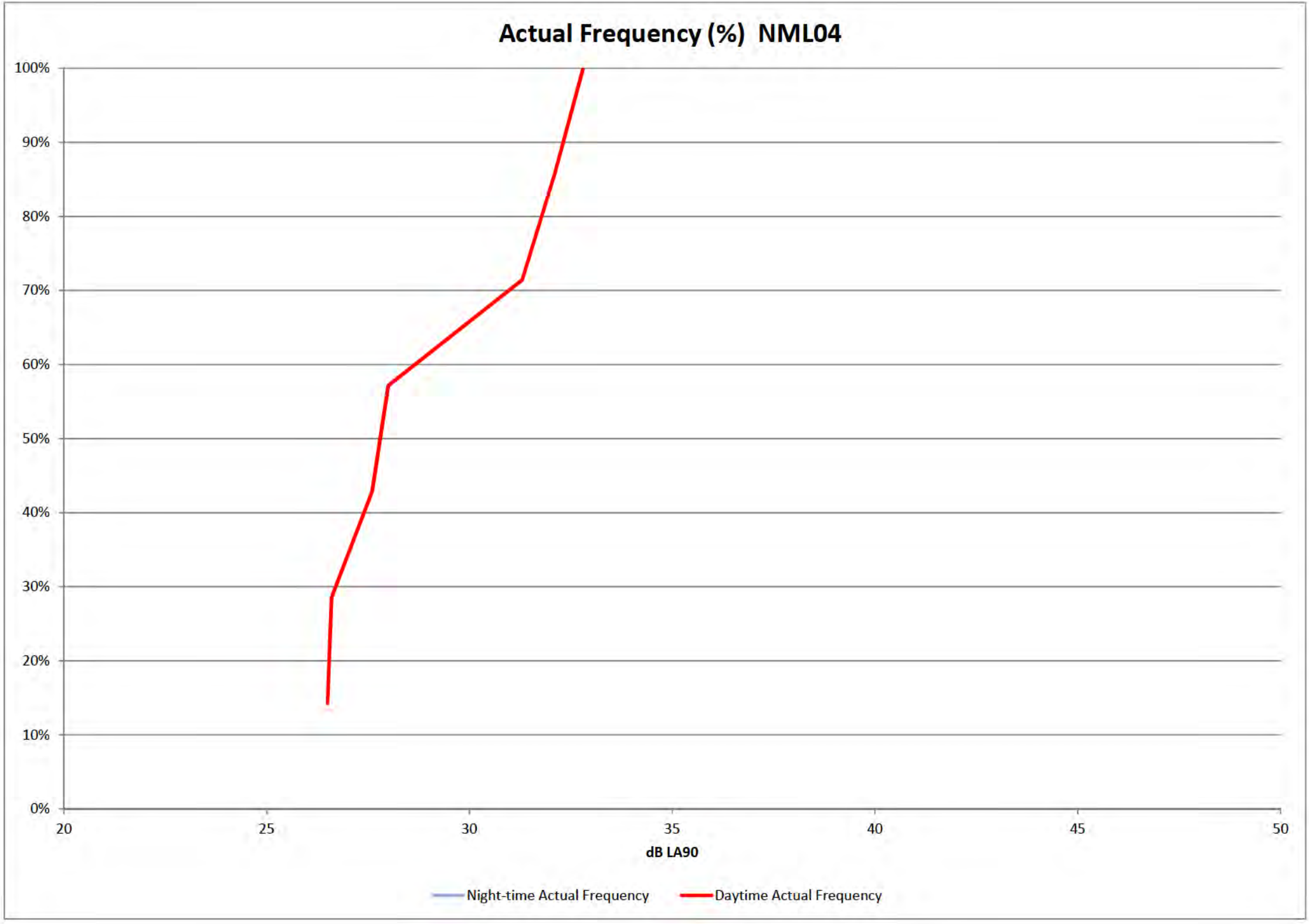
30%
25%
20%
15%
10%
5%
0%
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
Measured background sound level, dB LA90
NML03 - Measured night-time levels
NML03 - Measured daytime levels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80%
70%
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50%
40%
30%
20%
10%
0%
20
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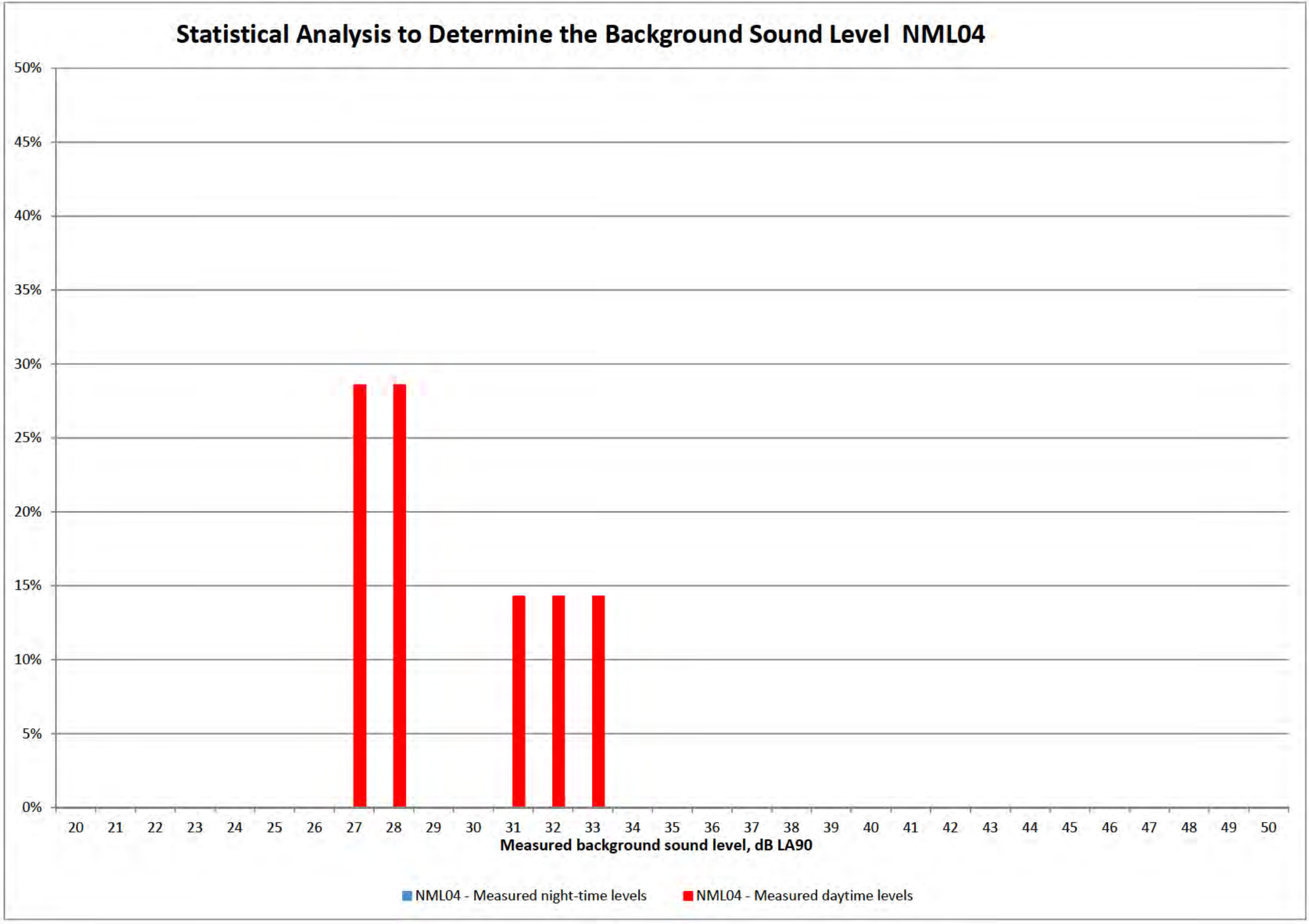
50
dB LA90
Night-time Actual Frequency
Daytime Actual Frequency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45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
Measured background sound level, dB LA90
NML04 - Measured night-time levels
NML04 - Measured daytime levels

Appendix J.2: Construction Noise Assessment Data

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Programme Task No.	Task Description	Duration of Works	Proposed Working Hours	Plant Type	Make and Model	Number on Site	Estimated % On Time
3	Dredging	6 Weeks	12hrs / Day	Dredger	Grete Fighter	1	30
				Excavator	JCB 220LC	1	10
5	Excavate Hillside and Infill	6 Weeks	12hrs / Day	Excavator	Volvo EC250EL	1	60
					Sany SY335C	1	60
					JCB 220LC	1	60
				Dumper	Bell B30E	1	60
				Lorry	N/A	1	25 deliveries per day (over estimation)
				Roller	Bomag BW 213DH	1	20
6	Marshalling Area/ Parking Area - (Earthworks / Rock Armour)	10 Weeks	12hrs / Day	Excavator	Volvo EC250EL	1	60
					Sany SY335C	1	60
					JCB 220LC	1	60
				Dumper	Bell B30E	1	60
				Lorry	N/A	1	25 deliveries per day (over estimation)
				Roller	Bomag BW 213DH	1	20
8	Install Temporary Fenders	6 Weeks	12hrs / Day	Generator	Clarke FG5100ES 5.5kVA	1	50
				Work Boat	Multicat	1	25
				60t Mobile Crane	LTM 1060-3.1	1	10
9	Provision of Temporary Scaffolding	8 Weeks	12hrs / Day	Generator	Clarke FG5100ES 5.5kVA	1	50
				Work Boat	Multicat	1	25
				60t Mobile Crane	LTM 1060-3.1	1	10
10	Cut Deck Edge	6 Weeks	12hrs / Day	Generator	Clarke FG5100ES 5.5kVA	1	75
11	Existing Pier Concrete Repairs	10 Weeks	12hrs / Day	Generator	Clarke FG5100ES 5.5kVA	1	75
				Work Boat	Multicat	1	25
				60t Mobile Crane	LTM 1060-3.1	1	10

Programme Task No.	Task Description	Duration of Works	Proposed Working Hours	Plant Type	Make and Model	Number on Site	Estimated % On Time
13	Fendering System to Existing Pier	8 Weeks	12hrs / Day	Tube Vibro Hammer	PVE 40VM	1	5
				Tube Impact Hammer	BSP CG300	1	5
				100t Crawler Crane	Kobelco CKE1100G	1	40
14	Caisson Foundation	12 Weeks	12hrs / Day	Dredger	Grete Fighter	1	30
				Work Boat	Multicat	1	60
				Concrete Lorry	Hymix P2 Series	1	5
				Excavator	JCB 220LC	1	40
18	Caisson Installation and Backfill	6 Weeks	12hrs / Day	Work Boat	Multicat	1	60
				Generator	Clarke FG5100ES 5.5kVA	1	75
				Dumper	Bell B30E	1	40
				Excavator	JCB 220LC	1	40
19	Infill Slab (Roundhead to Caisson)	6 Weeks	12hrs / Day	Concrete Lorry	Hymix P2 Series	1	10
				Generator	Clarke FG5100ES 5.5kVA	1	5
				Excavator	JCB 220LC	1	10
				100t Crawler Crane	Kobelco CKE1100G	1	40

Plant Used per Scenario

Programme Task	Task Description	Duration of Works	Proposed Working Hours	Plant Type	Make and Model	Number on Site	Estimated % On Time
Modelling Scenario 1: Placement of Rock Armour and Earthworks (Different locations for Hotel, Dwellings and Otters)							
5 & 6	Excavate Hillside and Infill, Marshalling/ Parking Area - (Earthworks / Rock Armour)	6 Weeks and 10 Weeks	12hrs / Day	Excavator	Volvo EC250EL	1	60
					Sany SY335C	1	60
					JCB 220LC	1	60
				Dumper	Bell B30E	1	60
				Lorry	N/A	1	25 deliveries per day (over estimation)
				Roller	Bomag BW 213DH	1	20
Modelling Scenario 2: Repairs to Existing Concrete							
11	Existing Pier Concrete Repairs	10 Weeks	12hrs / Day	Generator	Clarke FG5100ES 5.5kVA	1	75
				Work Boat	Multicat	1	25
				60t Mobile Crane	LTM 1060-3.1	1	10
Modelling Scenario 3: Fendering to Existing Pier							
13	Fendering System to Existing Pier	8 Weeks	12hrs / Day	Tube Vibro Hammer	PVE 40VM	1	5
				Tube Impact Hammer	BSP CG300	1	5
				100t Crawler Crane	Kobelco CKE1100G	1	40
Modelling Scenario 4: Caisson Installation							
18	Caisson Installation and Backfill	6 Weeks	12hrs / Day	Work Boat	Multicat	1	60
				Generator	Clarke FG5100ES 5.5kVA	1	75
				Dumper	Bell B30E	1	40
				Excavator	JCB 220LC	1	40

Noise Source Library used within Noise Model														
Name	ID	Type	Oktave Spectrum (dB)										A	lin	Source
			Weight	31.5	63	125	250	500	1000	2000	4000	8000			
Tracked excavator Volvo EC250EL	C2.3	Lw (c)		25.1	105.1	108.1	101.1	98.1	97.1	95.1	94.1	91.1	103	111.1	BS 5228-1:2009+A1:2014: Annex C
Tracked Excavator Sany 335C	C2.15	Lw (c)		28	105	113	98	101	98	96	91	85	104	114.2	BS 5228-1:2009+A1:2014: Annex C
Dump Truck (empty) Bell B30E	C2.31	Lw (c)		28	114	107	107	107	107	112	97	88	114.7	117.9	BS 5228-1:2009+A1:2014: Annex C
Lorry Rock armour delivery Lorry	C2.34	Lw (c)		28	101	106	106	106	102	101	96	94	108.1	112.2	BS 5228-1:2009+A1:2014: Annex C
Roller Bomag BW 213DH	C2.38	Lw (c)		28	108	103	105	100	95	90	82	74	101.6	111.1	BS 5228-1:2009+A1:2014: Annex C
Diesel generator Clarke 5100	C.4.76	Lw (c)		35.6	115.6	109.6	92.6	89.6	88.6	83.6	80.6	72.6	97	116.6	BS 5228-1:2009+A1:2014: Annex C
Tug Boat Multicat	TUG01	Lw	A					87					87	90.2	Aberdeen Harbour Expansion ES App. 20 d
Mobile telescopic crane Liebherr LTM 1060-3.1	C.4.45	Lw (c)		28	118	109	106	102	105	104	97	89	109.4	119.2	BS 5228-1:2009+A1:2014: Annex C
Hydraulic Hammer Rig	C3.3	Lw (c)		31	118	124	116	118	114	111	106	103	119.5	126.6	BS 5228-1:2009+A1:2014: Annex C
Drop Hammer Pile Rig Power Pack	C3.5	Lw (c)			107	93	88	87	94	91	81	74	96.8	107.6	BS 5228-1:2009+A1:2014: Annex C
Tracked mobile crane Kobelco CKE1100G	C.3.28	Lw (c)		28	109	105	94	90	87	85	79	74	94.5	110.6	BS 5228-1:2009+A1:2014: Annex C
Tracked excavator JCB220LC	C2.3b	Lw (c)		28	108	111	104	101	100	98	97	94	105.9	114	BS 5228-1:2009+A1:2014: Annex C

Appendix K.1: Lochmaddy Underwater Noise Technical Report

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Underwater noise propagation modelling at the Lochmaddy ferry terminal, North Uist, Scotland

Redacted

27th September 2018

Subacoustech Environmental Report No. P220R0102

Document No.	*Date*	*Written*	*Approved*	*Distribution*
P220R0101	*10/01/2018*	Redacted	Redac	Redacted
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This report is a controlled document. The report documentation page lists the version number, record of changes, referencing information, abstract and other documentation details.

List of contents

1 Introduction

Subacoustech Environmental have been instructed by Affric Limited to undertake acoustic propagation modelling for blasting, impact piling and other noise-making operations linked to the proposed upgrade at the Lochmaddy ferry terminal.

The purpose of the modelling is to estimate the received sound pressure levels in the region, with particular concern for the impacts on marine mammals and fish. This report has been prepared by Subacoustech Environmental Ltd for Affric and presents the results and findings of the modelling assessment.

1.1 Survey area

Figure 1-1 details the Lochmaddy ferry terminal site on the east coast of North Uist, Scotland. As the area of operational activity for the works is relatively small, a single representative modelling location has been selected (approximate coordinates: 57.5963°N, 007.1563°W) this is shown by the red marker in the figure below.

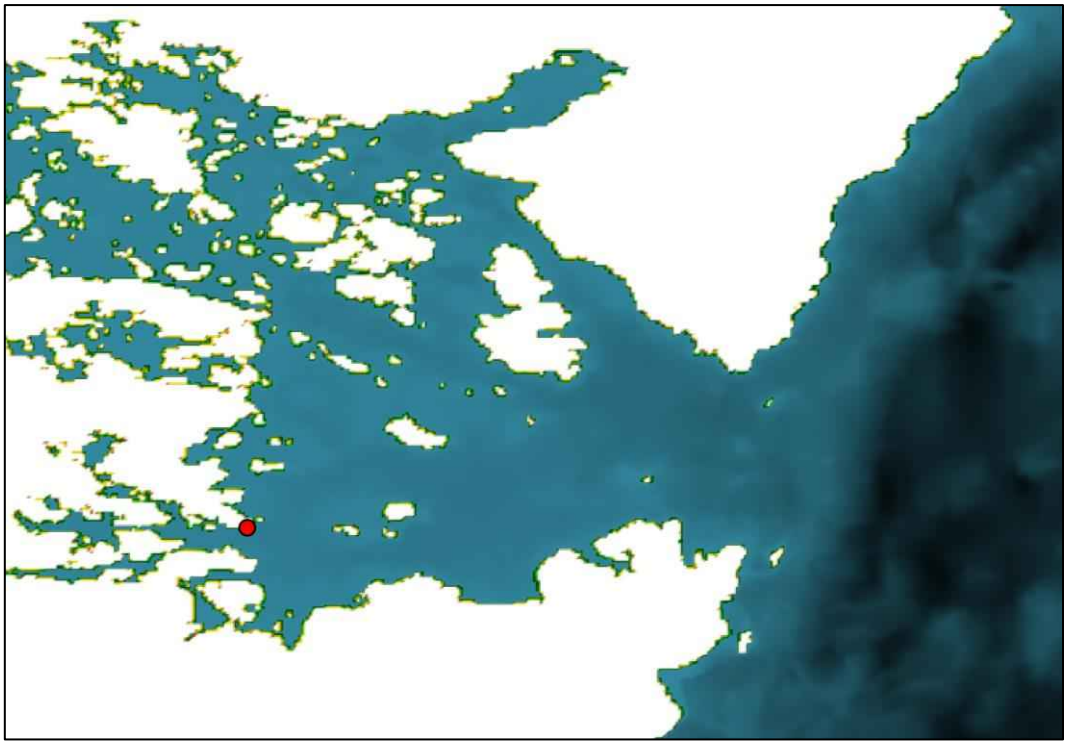

Figure 1-1 Image showing the location of Lochmaddy ferry terminal and the surrounding bathymetry (bathymetry supplied by Find Mapping Ltd - © British Crown and OceanWise, 2017. All rights reserved. Not to be used for Navigation.)

1.2 Blasting

Not much is known about the proposed blasting works at the Lochmaddy ferry terminals, and as such assumptions have been made based on a rock clearing blasting methodology for a similar sized operation. This methodology assumes 20 charges in boreholes being detonated in sequence with a few milliseconds delay. A maximum instantaneous charge weight (MIC) of 10 kg has been modelled. Each sequence is expected to take a total of 0.3 seconds.

1.3 Impact piling

Fender piles measuring 660 mm in diameter are to be installed at the ferry terminal using a hammer such as a BSP CX hydraulic piling hammer; blow energies are expected to be between 50 and 150 kJ. Six fender piles are expected to be installed within 2 weeks with each pile taking between 30 minutes and 1 hour to install depending on conditions.

1.4 Other noise sources

In addition to blasting and impact piling, there is the possibility of using vibratory hammer (vibro piling) to install the fender piles. Rock breaking using a machine mounted pecker is also being considered for removal of rocks. The activities have been considered using a high-level, simple modelling approach based on a conservative worst case.

Backhoe dredging and vessel movements are also expected during the terminal upgrades, however due to the low level of noise from these activities, they have only been assessed qualitatively.

1.5 Assessment overview

This report presents a detailed assessment of the potential underwater noise from works at the Lochmaddy ferry terminal and covers the following:

- Review of background information on the units for measuring and assessing underwater noise
- Discussion of the approach, input parameters and assumptions for the noise modelling undertaken;
- Presentation of detailed subsea noise modelling using unweighted metrics and interpretation of the results using suitable noise metrics and criteria; and
- Summary and conclusions

2 Measurement of underwater noise

Sound travels much faster in water (approximately 1,500 ms^{-1}) than in air (340 ms^{-1}). Since water is a relatively incompressible, dense medium, the pressures associated with underwater sound tend to be much higher than in air. As an example, background levels of sea noise of approximately 130 dB re 1 µPa for UK coastal waters are not uncommon (Nedwell *et al*, 2003 and 2007). This level equates to about 100 dB re 20 µPa in the units that would be used to describe a sound level in air.

2.1 Units of measurement

Sound measurements underwater are usually expressed using the decibel (dB) scale, which is a logarithmic measure of sound. A logarithmic scale is used because rather than equal increments of sound having an equal increase in effect, typically a constant ratio is required for this to be the case. That is, each doubling of sound level will cause a roughly equal increase in "loudness".

Any quantity expressed in this scale is termed a "level". If the unit is sound pressure, expressed on the dB scale, it will be termed a "Sound Pressure Level". The fundamental definition of the dB scale is given by:

$$Level = 10 \times \log_{10}\left(\frac{Q}{Q_{ref}}\right)$$

where Q is the quantity being expressed on the scale, and Q_{ref} is the reference quantity.

The dB scale represents a ratio and, for instance, 6 dB really means "twice as much as…" (such as a doubling of peak or RMS pressure, exposure etc). It is, therefore, used with a reference unit, which expresses the base from which the ratio is expressed. The reference quantity is conventionally smaller than the smallest value to be expressed on the scale, so that any level quoted is positive. For instance, a reference quantity of 20 µPa is used for sound in air, since this is the threshold of human hearing.

A refinement is that the scale, when used with sound pressure, is applied to the pressure squared rather than the pressure. If this were not the case, when the acoustic power level of a source rose by 10 dB the Sound Pressure Level would rise by 20 dB. So that variations in the units agree, the sound pressure must be specified in units of root mean square (RMS) pressure squared. This is equivalent to expressing the sound as:

$$Sound\ Pressure\ Level = 20 \times \log_{10}\left(\frac{P_{RMS}}{P_{ref}}\right)$$

For underwater sound, typically a unit of one micropascal (µPa) is used as the reference unit; a Pascal is equal to the pressure exerted by one Newton over one square metre; one micropascal equals one millionth of this.

2.2 Quantities of measurement

Sound may be expressed in many ways depending upon the type of noise, and the parameters of the noise that allow it to be evaluated in terms of a biological effect. These are described in more detail below.

2.2.1 Sound pressure level (SPL)

The Sound Pressure Level is normally used to characterise noise and vibration of a continuous nature such as drilling, boring, continuous wave sonar, or background sea and river noise levels. To calculate the SPL, the variation in sound pressure is measured over a specific time period to determine the Root Mean Square (RMS) level of the time varying sound. The SPL can therefore be considered a measure of the average unweighted level of sound over the measurement period.

Where an SPL is used to characterise transient pressure waves such as that from seismic airguns, underwater blasting or impact piling, it is critical that the period over which the RMS level is calculated is quoted. For instance, in the case of pile strike lasting, say, a tenth of a second, the mean taken over a tenth of a second will be ten times higher than the mean taken over one second. Often, transient sounds such as these are quantified using "peak" SPLs.

2.2.2 *Peak sound pressure level (SPL_{peak})*

Peak SPLs are often used to characterise sound transients from impulsive sources, such as percussive impact piling and seismic airgun sources. A peak SPL is calculated using the maximum variation of the pressure from positive to zero within the wave. This represents the maximum change in positive pressure (differential pressure from positive to zero) as the transient pressure wave propagates.

A further variation of this is the peak-to-peak SPL where the maximum variation of the pressure from positive to negative within the wave is considered. Where the wave is symmetrically distributed in positive and negative pressure, the peak-to-peak level will be twice the peak level, or 6 dB higher.

2.2.3 *Sound exposure level (SEL)*

When assessing the noise from transient sources such as blast waves, impact piling or seismic airgun noise, the issue of the period of the pressure wave is often addressed by measuring the total acoustic energy (energy flux density) of the wave. This form of analysis was used by Bebb and Wright (1953, 1954a, 1954b and 1955), and later by Rawlins (1987) to explain the apparent discrepancies in the biological effect of short and long-range blast waves on human divers. More recently, this form of analysis has been used to develop criteria for assessing the injury range from fish for various noise sources (Popper *et al*, 2014).

The Sound Exposure Level (SEL) sums the acoustic energy over a measurement period, and effectively takes account of both the SPL of the sound source and the duration the sound is present in the acoustic environment. Sound Exposure (SE) is defined by the equation:

$$SE = \int_0^T p^2(t)dt$$

where p is the acoustic pressure in Pascals, T is the duration of the sound in seconds, and t is the time in seconds. The Sound Exposure is a measure of the acoustic energy and, therefore, has units of Pascal squared seconds (Pa^2s).

To express the Sound Exposure on a logarithmic scale by means of a dB, it is compared with a reference acoustic energy level (${P^2}_{ref}$) and a reference time (T_{ref}). The SEL is then defined by:

$$SEL = 10 \times \log_{10}\left(\frac{\int_0^T p^2(t)dt}{{P^2}_{ref}T_{ref}}\right)$$

By selecting a common reference pressure P_{ref} of 1 µPa for assessments of underwater noise, the SEL and SPL can be compared using the expression:

$$SEL = SPL + 10 \times \log_{10} T$$

Where the SPL is a measure of the average level of the broadband noise, and the SEL sums the cumulative broadband noise energy.

This means that, for continuous sounds of less than one second, the SEL will be lower than the SPL. For periods greater than one second the SEL will be numerically greater than the SPL (i.e. for a sound of ten seconds duration, the SEL will be 10 dB higher than the SPL, for a sound of 100 seconds duration the SEL will be 20 dB higher than the SPL, and so on).

Weighted metrics for marine mammals have been proposed by the National Marine Fisheries Service (NMFS) (2016), these assign a frequency response to groups of marine mammals, and are discussed in detail in the following section.

3 Modelling methodology

Three modelling methodologies have been used for this assessment based on the likely severity of impact of each noise source based on noise levels previously measured by Subacoustech.

- High noise sources (blasting and impact piling) have been assessed using detailed modelling considering all environmental parameters;
- Moderate sources (vibro piling and rock breaking) use a simple modelling approach based on a conservative worst case; and
- Low noise sources (dredging and vessel movements) have been considered qualitatively based on previously measured data.

3.1 Detailed modelling inputs

To estimate the likely noise levels from blasting and impact piling operations, modelling has been carried out using an approach that is widely used and accepted by the acoustics community, in combination with publicly available environmental data and information provided by Affric. The approach is described in more detail below.

Modelling has been undertaken at one representative location to predict the levels of underwater noise from both the proposed blasting and impact piling activities. The modelling location is shown in Figure 1-1.

Modelling of underwater noise is complex and can be approached in several different ways. Subacoustech have chosen to use a numerical approach that is based on two different solvers:

- A parabolic equation (PE) method for lower frequencies (12.5 Hz to 250 Hz); and
- A ray tracing method for higher frequencies (315 Hz to 100 kHz).

The PE method is widely used within the underwater acoustics community but has computational limitations at high frequencies. Ray tracing is more computationally efficient at higher frequencies but is not suited to low frequencies (Etter, 1991). This study utilises the dBSea implementation of these numerical solutions.

These solvers account for a wide array of input parameters, including bathymetry, sediment data, sound speed and source frequency content to ensure as detailed results as possible. These input parameters are described in the following sections.

3.1.1 Bathymetry

The bathymetry data used in the modelling was supplied by Find Mapping Ltd; this data has a resolution of 1 arc second (a grid of squares measuring approximately 30 m by 60 m). A high tide of 4.8 m (Mean High Water Springs) has been used throughout the modelling as this represents a conservative approach with regards to noise propagation.

3.1.2 Sound speed profile

The speed of sound in the water, shown in Figure 3-1, has been calculated using temperature and salinity data from Marine Scotland (Bresnan *et al*. 2016) and the underwater sound speed equation from Mackenzie (1981).

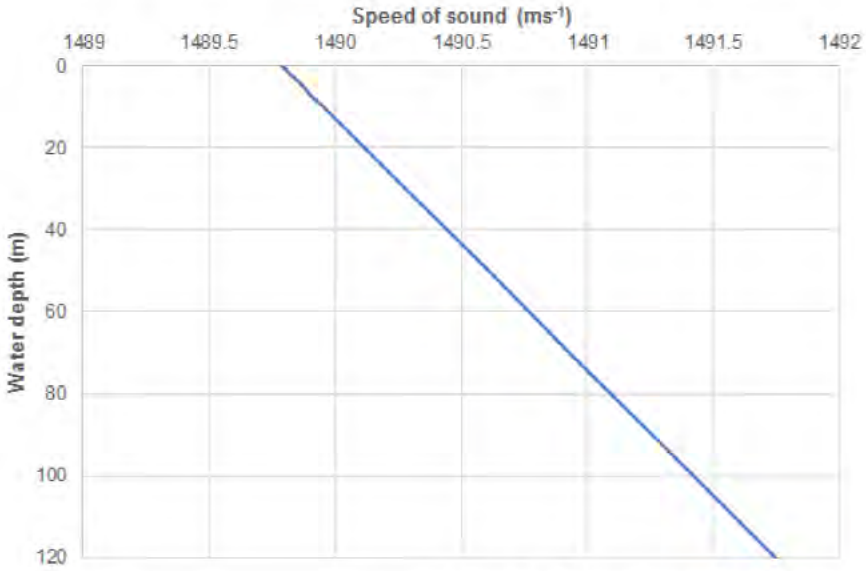

Figure 3-1 Sound speed profile used for modelling

3.1.3 Seabed properties

Based on data from Hansom *et al.* (2007) the seabed properties used for modelling were assumed to be predominantly gravel with limited coarse sand patches. Geo-acoustic properties for the seabed were based on available data from Jensen *et al.* (2011), and are provided in Table 3-1.

Seabed type	Compressive sound speed in substrate (ms^{-1})	Density profile in substrate (kg/m^3)	Attenuation profile in substrate (dB/wavelength)
Sand	1650	1900	0.8
Gravel	1800	2000	0.6

Table 3-1 Seabed geo-acoustic properties used for modelling

3.1.4 Blasting source levels

The assumed blasting methodology for Lochmaddy is based on a similar process carried out for rock clearance in a harbour and involves detonations at 20 borehole locations all within a period of approximately 0.3 seconds using a maximum instantaneous charge weight (MIC) of 10 kg.

When high explosives are confined to boreholes, the pressure wave is significantly reduced in level over that which would result from a charge detonated in the water without confinement. It has been reported as a result of numerous measurements of blast by Nedwell and Thandavamoorthy (1989), both in the laboratory and by monitoring during various consultancy projects, that the peak pressure from an embedded charge is reduced substantially to approximately 5% of that for a freely suspended charge.

The calculation that has been used to calculate peak pressure for waterborne borehole blasting, when conducted with no mitigation, is based on equations from Barrett (1996) and Arons (1954), modified using information from Nedwell and Thandavamoorthy (1989), and is as follows:

$$Peak\ Pressure\ (Pa) = 2.5 \times 10^6 W^{0.27} R^{-1.13}$$

For this formula, W is the charge weight (in kilograms) and R is the range (in metres) from the source. The estimates given using this equation have been found by Subacoustech Environmental to give reasonable agreement with typical values recorded during actual blasting operations, although there will always be natural variability due to precise site conditions, which is why this equation has only been used to calculate the source level at 1 m for borehole blasting.

Using the equation to calculate the SPL_{peak} source level for a 10 kg charge weight gives a source level of 253.4 dB re 1 µPa (SPL_{peak}) @ 1 m.

In order to carry out the detailed noise modelling of borehole blasting a source spectrum needs to be used. Figure 3-2 presents the third-octave levels from a blasting event shifted to achieve the required SPL_{peak} source level of 253.4 dB re 1 µPa for a 10 kg charge weight. This source level equates to a SEL source level of 218.5 dB re 1 μPa^2s for the MIC based on the 0.3s duration of all the proposed delays. The original source spectrum is based on measured data from borehole blasting in Singapore harbour taken by Subacoustech.

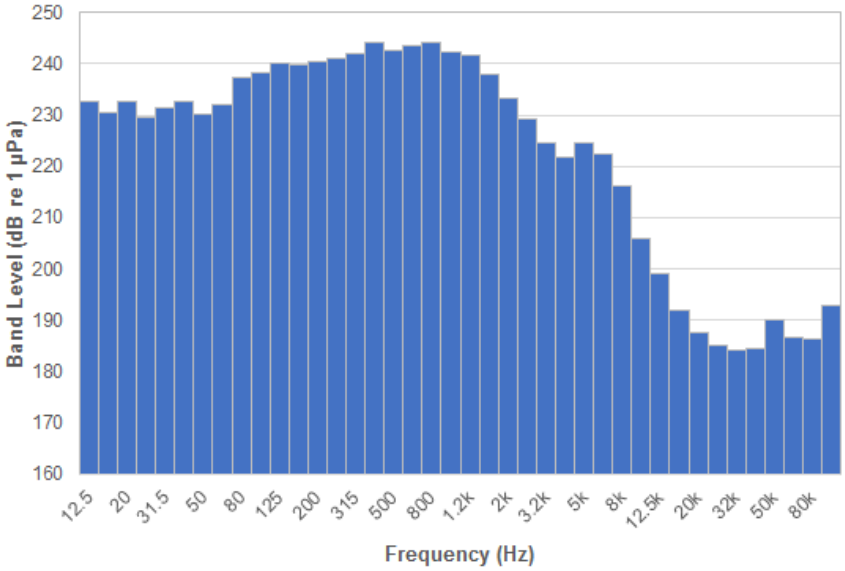

Figure 3-2 Source third octave band levels to be used to model borehole blasting (SPL_{peak})

3.1.5 Impact piling source levels

The proposed impact piling operations at Lochmaddy assume installation of 660 mm diameter piles using a blow hammer energy of between 50 and 150 kJ. In order to cover a range of the likely noise levels both 50 kJ and 150 kJ impact piling has been modelled.

The source levels used for the modelling of these two hammer energies is based on Subacoustech's extensive database of impact piling noise, with the predicted source level calculated from the blow energy and water depth of a piling location. These have been shown to be the primary factors determining the subsea noise levels produced. As the model assumes that the noise source acts as a single point, the water depth at the noise source (accounting for tide) has been used to adjust the source level to allow for the length of the pile in contact with the water.

The unweighted SPL_{peak} source levels estimated for Lochmaddy are:

- 197.1 dB re 1 µPa SPL_{peak} (50 kJ blow energy)
- 205.4 dB re 1 µPa SPL_{peak} (150 kJ blow energy)

These source levels equate to single strike SEL source levels of 173.2 dB re 1 μPa^2s for a 50 kJ hammer and 181.6 dB re 1 μPa^2s for a 150 kJ hammer

The third octave levels used for modelling are illustrated in Figure 3-3. As the frequency content is determined by the dimensions of the pile, the shape of the two spectra are the same for both blow energies, with the overall source levels adjusted.

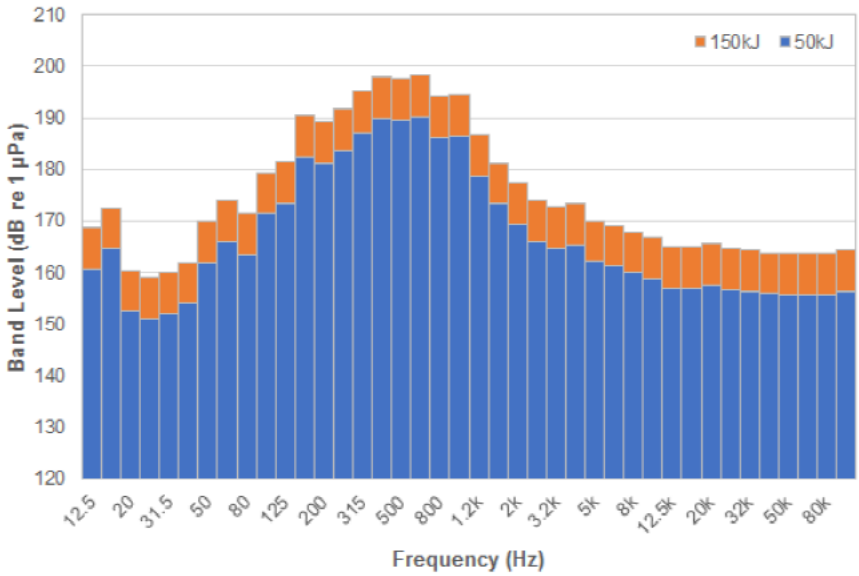

Figure 3-3 Source third octave band levels to be used to model impact piling (SPL_{peak})

It is likely that the energy and strike rate of the piling hammer will slowly increase (ramp-up) over time, however due to the limited information available, this modelling has assumed the same blow energy and strike rate (1 strike per second) over the entire duration of 1 hour. If a ramp-up or soft start were introduced it would likely act as a mitigating factor to the overall noise levels.

3.2 Simple modelling

Modelling of noise from vibro piling and rock breaking have been undertaken using a simple modelling approach; Subacoustech's SPEAR model. This methodology has been chosen due to either low levels of noise or limited data availability. This simple modelling methodology comprises of using existing measurement data from similar activities taken by Subacoustech and modifying the source level to best match the scenario being modelled.

3.2.1 Vibro piling and rock breaking source levels

Source levels used for vibro piling have been based on third octave band measurements undertaken by Subacoustech of the vibro piling of ~500 mm tubular piles in Brighton Marina using a PVE Dieseko 2350VM pile vibrator.

Source levels used for rock breaking are based on data from a report by Marshall Day Acoustics (Lawrence, 2016) and is, at the time of writing, the best available information on underwater noise levels from rock breaking activities. The proposed methodology does differ in that the measurements are of a ripper device, which penetrates the rock and pulls in up, whereas a peckering device is proposed for Lochmaddy. The differences between the rock breaking methods have been acknowledged and accounted for by modifying the source levels based on the differences in power outputs of the machinery.

The unweighted RMS source levels (1 s SEL) used for the SPEAR modelling are given in Table 3-2.

	Vibro piling	Rock breaking
RMS Source level @ 1 m	188.0 dB re 1 µPa	175.4 dB re 1 µPa

Table 3-2 Unweighted RMS source levels used for SPEAR modelling

The simple modelling is based on a simple geometric spreading model of the form $N \log_{10} R - \alpha R$ where R is the range and values for N and α are based on approximations from field measurements taken by Subacoustech. In contrast, the PE / Ray tracing solution is based on a physical approximations of

underwater wave propagation and considers variations in bathymetry, seabed type and sound speed profile for multiple depths and for each frequency band. With the simple methodology these factors are intrinsic to the conditions of the measurements. In practice, the complex numerical modelling is extremely resource intensive and a single scenario can take over 48 hours to complete and it is common practice to use different modelling techniques according to the source being modelled and the anticipated impact range.

3.2.2 Other noise sources

The low-level noise sources (backhoe dredging and vessel movements) have been assessed qualitatively in this report using measured noise levels from the Subacoustech noise measurement database.

3.3 Assessment criteria

3.3.1 Background

Over the past 20 years it has become increasingly evident that noise from human activities in and around underwater environments can have an impact on the marine species in the area. The extent to which intense underwater sound might cause an adverse environmental impact in a species is dependent upon the incident sound level, sound frequency, duration of exposure, and/or repetition rate of the sound wave (see for example Hastings and Popper, 2005). As a result, scientific interest in the hearing abilities of aquatic animal species has increased. These studies are primarily based on evidence from high level sources of underwater noise such as blasting or impact piling, as these sources are likely to have the greatest environmental impact and therefore the clearest observable effects.

The impacts of underwater sound can be broadly summarised into three categories:

- Physical traumatic injury and fatality;
- Auditory injury (either permanent or temporary); and
- Disturbance.

The following sections discussed the agreed upon criteria for assessing these impacts in key marine species. The metrics and criteria that have been used in this study to assess environmental effect come from the latest guidance from the U.S. National Marine and Fisheries Service (NMFS) concerning underwater noise and its effects on marine mammals (NMFS, 2016) and Popper *et al* (2014) for the impacts of noise on species of fish.

3.3.2 Marine mammals

Since it was published, Southall *et al* (2007) has been the source of the most widely used criteria to assess the effects of noise on marine mammals. NMFS (2016) was co-authored by many of the same academics from the Southall *et al* (2007) paper, and effectively updates it. In the updated guidelines, the frequency weightings have changed along with the criteria. As a result, the criteria have generally become more strict and potential impact ranges may increase substantially in some cases.

The NMFS (2016) guidance groups marine mammals into functional hearing groups and applies filters to the unweighted noise to approximate the hearing response of the receptor. The hearing groups given in the NMFS (2016) are summarised in Table 3-3.

The auditory weighting functions for each hearing group are provided in Figure 3-4.

Hearing group	Example species	Generalised hearing range
Low Frequency (LF) Cetaceans	Baleen Whales	7 Hz to 35 kHz
Mid Frequency (MF) Cetaceans	Dolphins, Toothed Whales, Beaked Whales, Bottlenose Whales (including Bottlenose Dolphin)	150 Hz to 160 kHz
High Frequency (HF) Cetaceans	True Porpoises (including Harbour Porpoise)	275 Hz to 160 kHz
Phocid Pinnipeds (PW) (underwater)	True Seals (including Harbour Seal)	50 Hz to 86 kHz

Table 3-3 Marine mammal hearing groups (from NMFS, 2016)

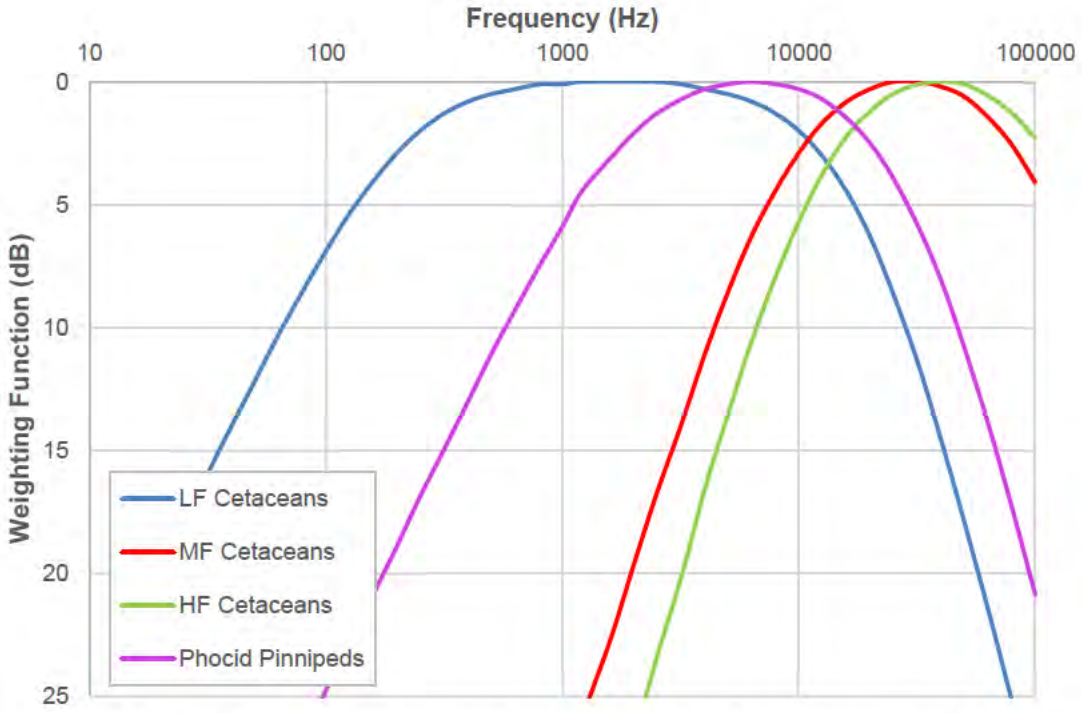

Figure 3-4 Auditory weighting functions for low frequency (LF) cetaceans, mid frequency (MF) cetaceans, high frequency (HF) cetaceans, phocid pinnipeds (PW) (underwater) (from NMFS, 2016)

Further discussion of the species weightings applied for this study are given in section 3.3.4.

NMFS (2016) presents unweighted peak criteria (SPL_{peak}) and cumulative, weighted sound exposure criteria (SEL_{cum}) for both permanent threshold shift (PTS) where unrecoverable hearing damage may occur and temporary threshold shift (TTS) where a temporary reduction in hearing sensitivity may occur in individual receptors. Table 3-4 and Table 3-5 summarise the NMFS (2016) criteria for onset of risk of PTS and TTS for each of the key marine mammal hearing groups for impulse and non-impulsive noise.

In the assessment of cumulative SEL values, a stationary animal model has been used assuming as a worst case, that the receptor stays at the same range from a noise source for its entire duration.

Impulsive noise	TTS criteria		PTS criteria	
Functional Group	SEL_{cum} (weighted) dB re 1 μPa^2s	SPL_{peak} (unweighted) dB re 1 μPa	SEL_{cum} (weighted) dB re 1 μPa^2s	SPL_{peak} (unweighted) dB re 1 μPa^2s
LF Cetaceans	168	213	183	219
MF Cetaceans	170	224	185	230
HF Cetaceans	140	196	155	202
PW Pinnipeds	170	212	185	218

Table 3-4 Assessment criteria for marine mammals from NMFS (2016) for impulsive noise (blasting and impact piling)

Non-impulsive noise	TTS criteria	PTS criteria
Functional Group	SEL_{cum} (weighted) dB re 1 μPa^2s	SEL_{cum} (weighted) dB re 1 μPa^2s
LF Cetaceans	179	199
MF Cetaceans	178	198
HF Cetaceans	153	173
PW Pinnipeds	181	201

Table 3-5 Assessment criteria for marine mammals from NMFS (2016) for non-impulsive noise (vibro piling and rock breaking)

3.3.3 Fish

The effects of noise on fish have been assessed using criteria from Popper *et al.* (2014), which gives specific criteria for mortality and potential mortal injury, recoverable injury and TTS, masking and behaviour from various stimuli, including blasting, impact piling and continuous noises. Species of fish are grouped by whether or not they have a swim bladder and whether than swim bladder is involved in its hearing. The criteria are given as unweighted SPL_{peak}, RMS, and SEL_{cum} values and are summarised in Table 3-6 to Table 3-8.

Blasting	Mortality & potential mortal injury	Impairment	
Type of animal		Recoverable injury	TTS
Fish: no swim bladder	229 – 234 dB SPL_{peak}	-	-
Fish: swim bladder not involved in hearing	229 – 234 dB SPL_{peak}	-	-
Fish: swim bladder involved in hearing	229 – 234 dB SPL_{peak}	-	-

Table 3-6 Assessment criteria for species of fish from Popper et al. (2014) for blasting noise

Impact Piling	Mortality & potential mortal injury	Impairment	
Type of animal		Recoverable injury	TTS
Fish: no swim bladder	> 219 dB SEL_{cum} > 213 dB SPL_{peak}	> 216 dB SEL_{cum} > 213 dB SPL_{peak}	>> 186 dB SEL_{cum}
Fish: swim bladder not involved in hearing	210 dB SEL_{cum} > 207 dB SPL_{peak}	203 dB SEL_{cum} > 207 dB SPL_{peak}	> 186 dB SEL_{cum}
Fish: swim bladder involved in hearing	207 dB SEL_{cum} > 207 dB SPL_{peak}	203 dB SEL_{cum} > 207 dB SPL_{peak}	186 dB SEL_{cum}

Table 3-7 Assessment criteria for species of fish from Popper et al. (2014) for impact piling noise

Shipping and other continuous noise	Mortality & potential mortal injury	Impairment	
Type of animal		Recoverable injury	TTS
Fish: no swim bladder	-	-	-
Fish: swim bladder not involved in hearing	-	-	-
Fish: swim bladder involved in hearing	-	170 dB RMS for 48 hours	158 dB RMS for 12 hours

Table 3-8 Assessment criteria for species of fish from Popper et al. (2014) for shipping and other continuous noises

Where insufficient data is available (shown by a dash in Table 3-6 to Table 3-8), qualitative criteria have been given, summarising the effect of the noise as having either a high, moderate or low effect on an individual in either the near-field (tens of metres), intermediate-field (hundreds of metres), or far-field (thousands of metres). This also includes information for masking and behavioural effect. These qualitative effects are reproduced in Table 3-9 to Table 3-11.

Blasting	Recoverable injury	TTS	Masking	Behaviour
Type of animal				
Fish: no swim bladder	(N) High (I) Low (F) Low	(N) High (I) Moderate (F) Low	N/A	(N) High (I) Moderate (F) Low
Fish: swim bladder not involved in hearing	(N) High (I) High (F) Low	(N) High (I) Moderate (F) Low	N/A	(N) High (I) High (F) Low
Fish: swim bladder involved in hearing	(N) High (I) High (F) Low	(N) High (I) High (F) Low	N/A	(N) High (I) High (F) Low

Table 3-9 Summary of the qualitative effects on fish from blasting noise from Popper et al. (2014) (N=Near-field, I=Intermediate-field, F=Far-field)

Impact Piling	Recoverable injury	TTS	Masking	Behaviour
Type of animal				
Fish: no swim bladder	-	-	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder not involved in hearing	-	-	(N) Moderate (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: swim bladder involved in hearing	-	-	(N) High (I) High (F) Moderate	(N) High (I) High (F) Moderate

Table 3-10 Summary of the qualitative effects on fish from impact piling noise from Popper et al. (2014) (N=Near-field, I=Intermediate-field, F=Far-field)

Shipping and other continuous noise Type of animal	Recoverable injury	TTS	Masking	Behaviour
Fish: no swim bladder	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder not involved in hearing	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: swim bladder involved in hearing	-	-	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low

Table 3-11 Summary of the qualitative effects on fish from shipping and other continuous noises from Popper et al. (2014) (N=Near-field, I=Intermediate-field, F=Far-field)

3.3.4 Weighted source levels

To undertake the modelling for the NMFS (2016) criteria with regards to the weighted criteria, the source levels were first adjusted using the auditory weighting functions shown in Figure 3-4. This significantly alters the source level for each functional group as shown in Figure 3-5 and Figure 3-6.

Noise from blasting and impact piling is predominantly low frequency in nature and reduces significantly at frequencies above 1 kHz. The blasting source levels given in Figure 3-5 and Figure 3-6 show that the weighting makes only a modest difference to source levels for LF cetaceans when frequency weightings are applied and a significant reduction for other functional groups. The source levels for the other noise sources show a similar pattern, a summary of the weighted source levels is given in Table 3-12 and Table 3-13.

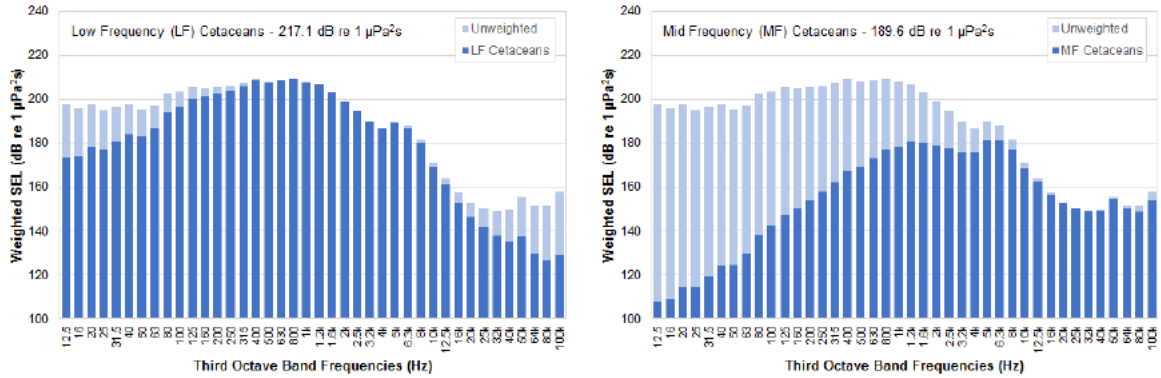

Figure 3-5 Unweighted and NMFS (2016) weighted SEL source level third octave values for LF and MF cetaceans (blasting)

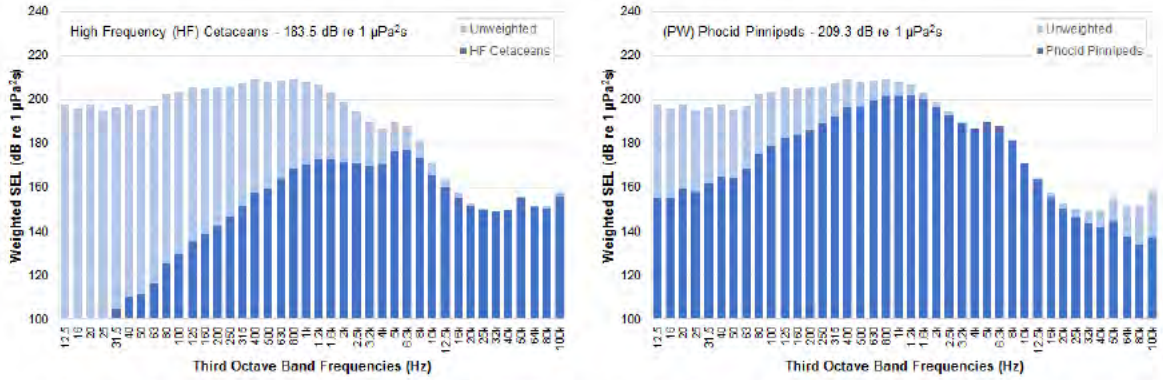

Figure 3-6 Unweighted and NMFS (2016) weighted SEL source level third octave values for HF cetaceans and phocid pinnipeds (blasting)

	Blasting source level (single pulse SEL) (0.3s)	Impact piling source level (50 kJ) (single pulse SEL)	Impact piling source level (150 kJ) (single pulse SEL)
Unweighted	218.5 dB re 1 µPa²s	173.2 dB re 1 µPa²s	181.6 dB re 1 µPa²s
LF Cetaceans	217.1 dB re 1 µPa²s	172.4 dB re 1 µPa²s	180.8 dB re 1 µPa²s
MF Cetaceans	189.6 dB re 1 µPa²s	144.6 dB re 1 µPa²s	153.0 dB re 1 µPa²s
HF Cetaceans	183.5 dB re 1 µPa²s	142.5 dB re 1 µPa²s	150.9 dB re 1 µPa²s
Phocid Pinnipeds	209.3 dB re 1 µPa²s	163.3 dB re 1 µPa²s	171.7 dB re 1 µPa²s

Table 3-12 Summary of the NMFS (2016) weighted source levels at 1 metre used for detailed modelling

	Vibro piling source level (1 second SEL)	Rock breaking source level (1 second SEL)
Unweighted	188.0 dB re 1 µPa²s	175.4 dB re 1 µPa²s
LF Cetaceans	185.6 dB re 1 µPa²s	174.8 dB re 1 µPa²s
MF Cetaceans	172.0 dB re 1 µPa²s	157.5 dB re 1 µPa²s
HF Cetaceans	167.2 dB re 1 µPa²s	154.9 dB re 1 µPa²s
Phocid Pinnipeds	183.6 dB re 1 µPa²s	169.1 dB re 1 µPa²s

Table 3-13 Summary of the NMFS (2016) weighted source levels at 1 metre used for simple modelling

4 Modelling results

4.1 Blasting

4.1.1 Unweighted SPL_{peak}

The SPL_{peak} noise level from borehole blasting using 10 kg charge weight is presented in Figure 4-1 for the maximum level in the water column. A cross section of a north-easterly transect (70°) is presented in Figure 4-2 to show the distribution of noise through the water column along with the water depth profile. These results have been analysed for their potential impact on marine mammals and fish using the criteria detailed in section 3.3 in Table 4-1 and Table 4-2.

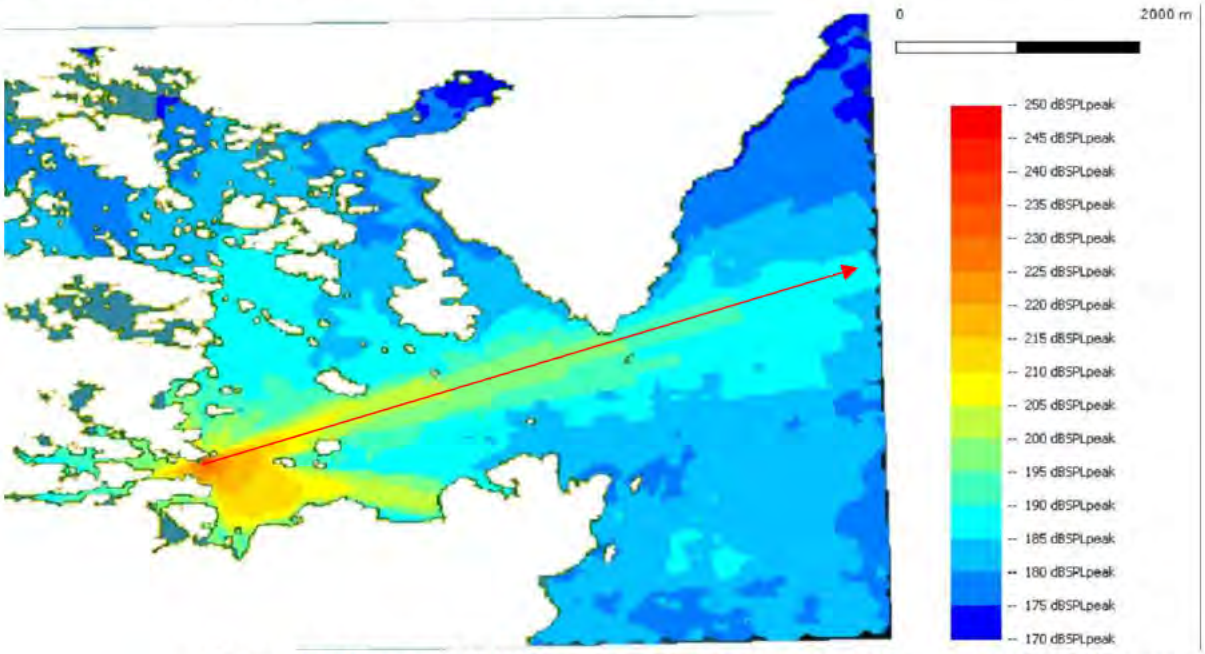

Figure 4-1 Blasting (10 kg charge weight), unweighted SPL_{peak} showing 70° transect

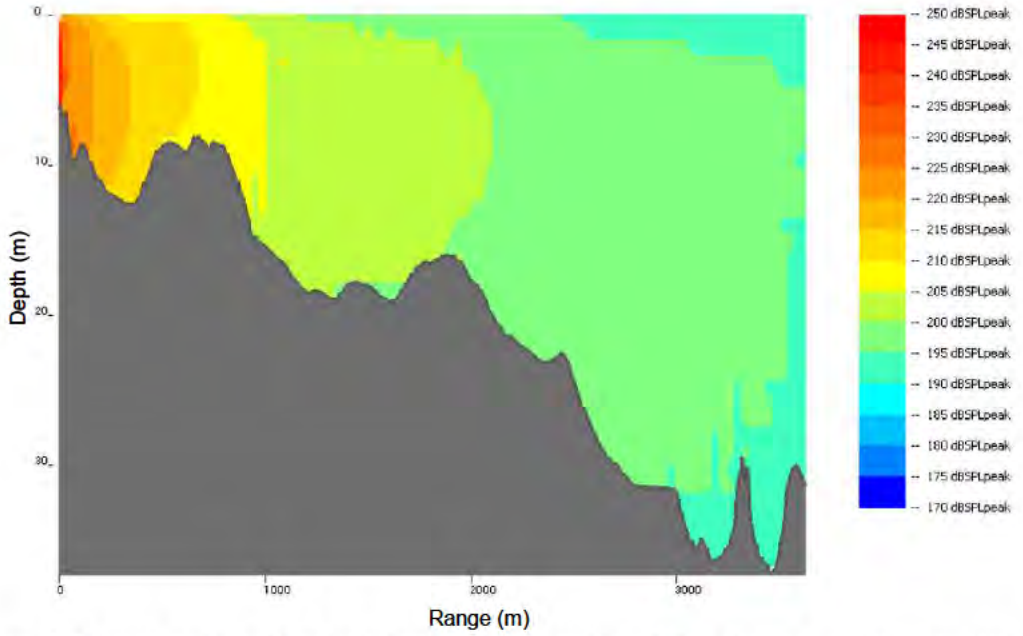

Figure 4-2 Cross section of the 70° transect from blasting (10 kg charge weight), unweighted SPL_{peak}

Threshold	Criteria SPL_{peak} (unweighted)	Blasting (10kg) SPL_{peak} Maximum range
LF Cetaceans TTS	213 dB re 1 µPa	670 m
MF Cetaceans TTS	224 dB re 1 µPa	160 m
HF Cetaceans TTS	196 dB re 1 µPa	3.6 km
PW Pinnipeds TTS	212 dB re 1 µPa	800 m
LF Cetaceans PTS	219 dB re 1 µPa	310 m
MF Cetaceans PTS	230 dB re 1 µPa	73 m
HF Cetaceans PTS	202 dB re 1 µPa	2.0 km
PW Pinnipeds PTS	218 dB re 1 µPa	390 m

Table 4-1 Maximum ranges to NMFS (2016) SPL_{peak} injury criteria for marine mammals from blasting noise based on the maximum level in the water column

Threshold	Criteria SPL_{peak} (unweighted)	Blasting (10kg) SPL_{peak} Maximum range
Mortality and potential mortal injury (upper bound)	234 dB re 1 µPa	57 m
Mortality and potential mortal injury (lower bound)	229 dB re 1 µPa	84 m

Table 4-2 Maximum ranges to Popper et al. (2014) SPL_{peak} mortality and potential mortal injury criteria for species of fish from blasting noise based on the maximum level in the water column

The results are based on the maximum predicted noise level in the water column and this approach has been used as it is not possible to predict the depth of a marine mammal at the time of a single impulsive event. Figure 4-2 indicates an even distribution of noise through the water column with the maximum generally occurring in the mid-water region indicating that the use of maximum noise level is a reasonable approach.

Given the proximity to the coast, only the maximum ranges have been presented above as any attempt to present a mean range would be subject to considerable bias from many very short transects and would therefore be misleading. In practice only a very small number of transects will be subject to the maximum range. Figure 4-3 shows the HF TTS ranges (which includes the greatest range) along each transect and only 4 transects exceed 3 km and 13 out of 180 transects exceed 1.5 km.

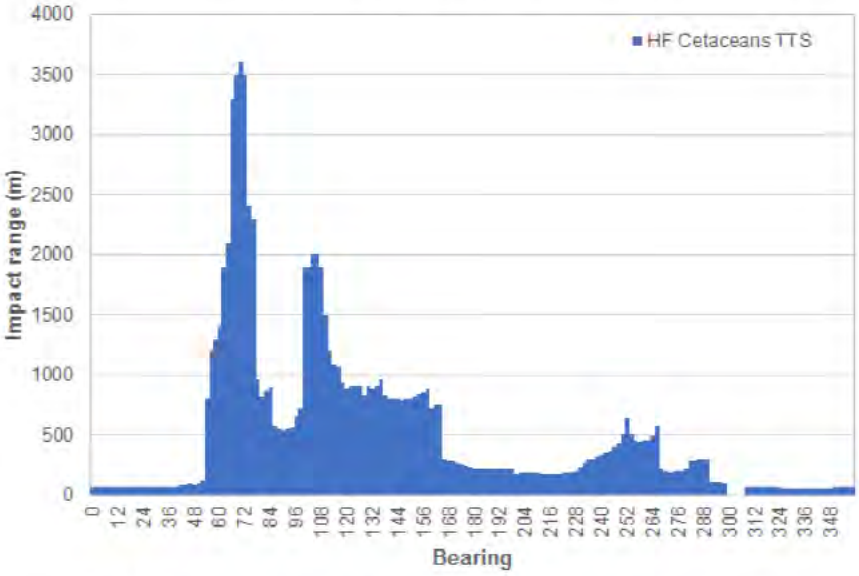

Figure 4-3 High Frequency Cetacean TTS ranges for each transect for blasting noise

4.1.2 SEL

As each blasting event can be defined as a single noise event (with multiple blasts happening over a period of approximately 0.3 s) it is unnecessary to calculate cumulative SEL values. A single pulse SEL source level has been derived using the SPL_{peak} data for the period of the blast, and from this, weightings have been applied to assess the noise using the NMFS (2016) criteria, as discussed in section 3.3.4. Table 4-3 presents the modelling impact ranges for blasting using the NMFS (2016) SEL criteria for TTS and PTS on species of marine mammal.

Popper *et al.* (2014) do not give SEL criteria for blasting noise.

Threshold	Criteria SEL (weighted)	Blasting (10kg) SEL_{ss} (0.3s) Maximum range
LF Cetaceans TTS	168 dB re 1 μPa^2s	1.7 km
MF Cetaceans TTS	170 dB re 1 μPa^2s	46 m
HF Cetaceans TTS	140 dB re 1 μPa^2s	940 m
PW Pinnipeds TTS	170 dB re 1 μPa^2s	620 m
LF Cetaceans PTS	183 dB re 1 μPa^2s	300 m
MF Cetaceans PTS	185 dB re 1 μPa^2s	2 m
HF Cetaceans PTS	155 dB re 1 μPa^2s	140 m
PW Pinnipeds PTS	185 dB re 1 μPa^2s	83 m

Table 4-3 Maximum ranges to NMFS (2016) weighted SEL injury criteria for blasting based on the maximum level in the water column

4.2 Impact piling

4.2.1 Unweighted SPL_{peak}

The SPL_{peak} noise level from impact piling for a 660 mm diameter pile using blow energies of 50 and 150 kJ are presented in Figure 4-4 and Figure 4-5 for the maximum level in the water column. Cross sections of a north-easterly transect (70°) are presented in Figure 4-6 and Figure 4-7 to show the distribution of noise through the water column along with the water depth profile. These results have been analysed for their potential impact on marine mammals and fish using the criteria detailed in section 3.3 in Table 4-4 and Table 4-5.

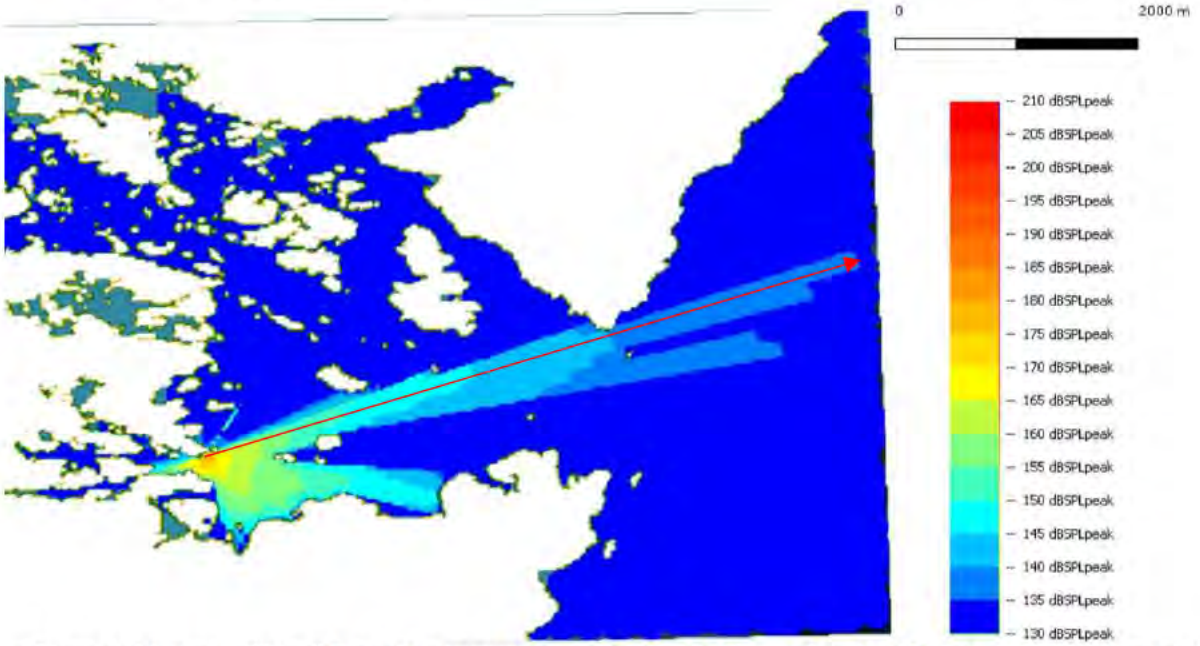

Figure 4-4 Impact piling (50 kJ blow energy), unweighted SPL_{peak} showing 70° cross section transect

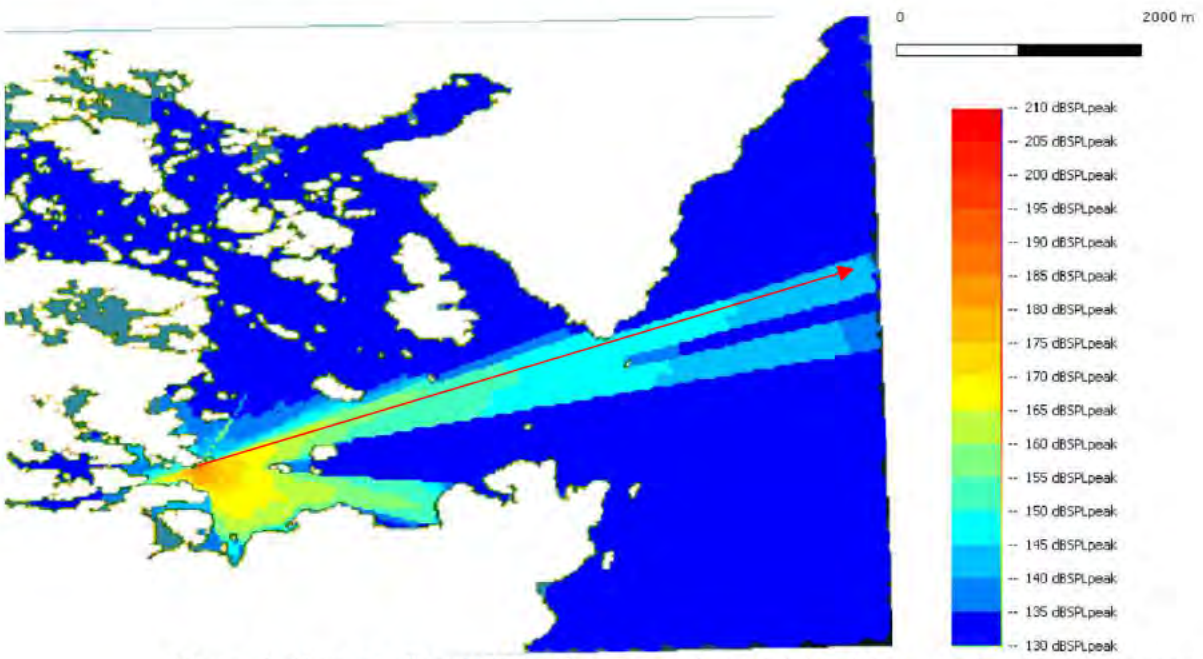

Figure 4-5 Impact piling (150 kJ blow energy), unweighted SPL_{peak} showing 70° transect

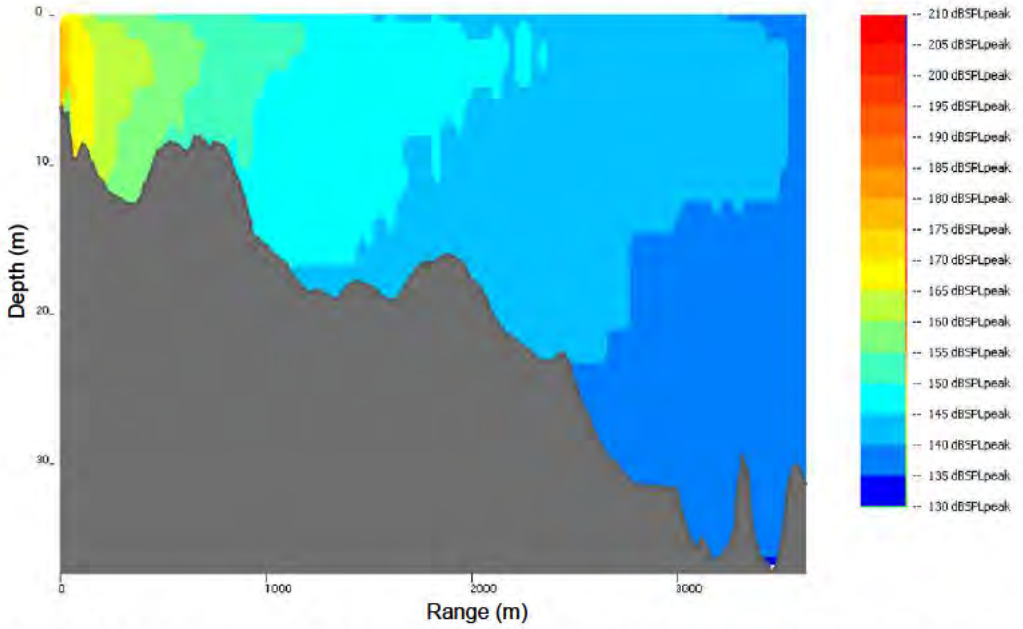

Figure 4-6 Cross section of the 70° transect from impact piling (50 kJ blow energy), unweighted SPL_{peak}

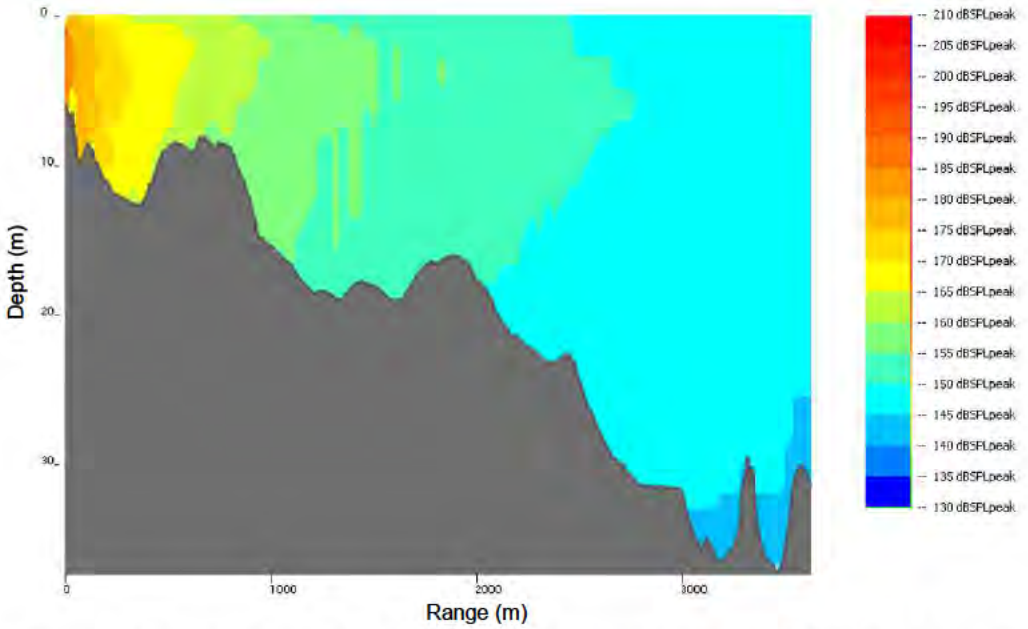

Figure 4-7 Cross section of the 70° transect from impact piling (150 kJ blow energy), unweighted SPL_{peak}

Threshold	Criteria SPL_{peak} (unweighted)	Impact piling (50 kJ) SPL_{peak} Maximum range	Impact piling (150 kJ) SPL_{peak} Maximum range
LF Cetaceans TTS	213 dB re 1 µPa	< 1 m	< 1 m
MF Cetaceans TTS	224 dB re 1 µPa	< 1 m	< 1 m
HF Cetaceans TTS	196 dB re 1 µPa	1 m	9 m
PW Pinnipeds TTS	212 dB re 1 µPa	< 1 m	< 1 m
LF Cetaceans PTS	219 dB re 1 µPa	< 1 m	< 1 m
MF Cetaceans PTS	230 dB re 1 µPa	< 1 m	< 1 m
HF Cetaceans PTS	202 dB re 1 µPa	< 1 m	2 m
PW Pinnipeds PTS	218 dB re 1 µPa	< 1 m	< 1 m

Table 4-4 Maximum ranges to NMFS (2016) SPL_{peak} injury criteria for marine mammals from impact piling noise for two hammer sizes based on the maximum level in the water column

Threshold	Criteria SPL_{peak} (unweighted)	Impact piling (50 kJ) SPL_{peak} Maximum range	Impact piling (150 kJ) SPL_{peak} Maximum range
Fish (no swim bladder) injury	213 dB re 1 µPa	< 1 m	< 1 m
Fish (with swim bladder) injury	207 dB re 1 µPa	< 1 m	< 1 m

Table 4-5 Maximum ranges to Popper et al. (2014) SPL_{peak} injury criteria for species of fish from impact piling noise for two hammer sizes based on the maximum level in the water column

As with the blasting results and shown in Figure 4-6 and Figure 4-7, the impact piling results indicate an even distribution of noise through the water column with the maximum occurring mid-to-upper-water region indicating again that the use of maximum noise level is a reasonable approach.

4.2.2 *Cumulative SEL (SEL_{cum})*

The noise from impact piling is a multiple pulse source and as such cumulative SEL values have been calculated assuming piling lasting 1 hour (the worst-case duration for piling). Table 4-6 and Table 4-7 present the impact ranges for marine mammal and fish assuming a stationary receptor. If a fleeing receptor were assumed for these results, the predicted impact ranges would be reduced.

Threshold	Criteria SEL_{cum} (weighted)	Impact piling (50 kJ) SEL_{cum} (1 hour) Maximum range	Impact piling (150 kJ) SEL_{cum} (1 hour) Maximum range
LF Cetaceans TTS	168 dB re 1 μPa^2s	780 m	1.4 km
MF Cetaceans TTS	170 dB re 1 μPa^2s	12 m	56 m
HF Cetaceans TTS	140 dB re 1 μPa^2s	620 m	1.2 km
PW Pinnipeds TTS	170 dB re 1 μPa^2s	200 m	570 m
LF Cetaceans PTS	183 dB re 1 μPa^2s	120 m	380 m
MF Cetaceans PTS	185 dB re 1 μPa^2s	< 1 m	2 m
HF Cetaceans PTS	155 dB re 1 μPa^2s	97 m	280 m
PW Pinnipeds PTS	185 dB re 1 μPa^2s	29 m	86 m

Table 4-6 Maximum ranges to NMFS (2016) weighted SEL_{cum} injury criteria for marine mammals from impact piling noise for two hammer sizes assuming a stationary animal and 1 hour of piling based on the maximum level in the water column

Threshold	Criteria SEL_{cum} (unweighted)	Impact piling (50 kJ) SEL_{cum} (1 hour) Maximum range	Impact piling (150 kJ) SEL_{cum} (1 hour) Maximum range
Fish (no swim bladder) mortality and potential mortal injury	219 dB re 1 μPa^2s	< 1 m	< 1 m
Fish (no swim bladder) recoverable injury	216 dB re 1 μPa^2s	< 1 m	1 m
Fish (with swim bladder not involved in hearing) mortality and potential mortal injury	210 dB re 1 μPa^2s	< 1 m	5 m
Fish (with swim bladder involved in hearing) mortality and potential mortal injury	207 dB re 1 μPa^2s	1 m	11 m
Fish (with swim bladder) recoverable injury	203 dB re 1 μPa^2s	4 m	31 m
Fish TTS	186 dB re 1 μPa^2s	92 m	270 m

Table 4-7 Maximum ranges to Popper et al. (2014) unweighted SEL_{cum} injury criteria for species of fish from impact piling noise for two hammer sizes assuming a stationary animal and 1 hour of piling based on the maximum level in the water column

4.3 Vibro piling and rock breaking (simple modelling)

Underwater noise from the piling using a vibratory pile driver along with rock breaking have been modelled using Subacoustech's SPEAR model. This is a simple model which uses Subacoustech's measurement database to estimate noise levels with range.

For vibro piling, ranges have been calculated for a stationary animal and are based on 1 hour of operation in a given 24-hour period (the same duration given for impact piling). The ranges for rock breaking have assumed a stationary animal and rock breaking being undertaken for up to 8 hours in a given 24-hour period. The predicted ranges are given in Table 4-8 and Table 4-9.

Threshold	Criteria SEL_{cum} (weighted)	Vibro piling (1 hour)	Rock breaking (8 hours)
LF Cetaceans TTS	179 dB re 1 μPa^2s	200 m	300 m
MF Cetaceans TTS	178 dB re 1 μPa^2s	40 m	40 m
HF Cetaceans TTS	153 dB re 1 μPa^2s	500 m	600 m
PW Pinnipeds TTS	181 dB re 1 μPa^2s	100 m	100 m
LF Cetaceans PTS	199 dB re 1 μPa^2s	10 m	20 m
MF Cetaceans PTS	198 dB re 1 μPa^2s	3 m	1 m
HF Cetaceans PTS	173 dB re 1 μPa^2s	40 m	50 m
PW Pinnipeds PTS	201 dB re 1 μPa^2s	10 m	7 m

Table 4-8 Ranges to NMFS (2016) SEL_{cum} non-impulsive injury criteria for marine mammals from vibro piling and rock breaking noise

Threshold	Criteria SPL_{RMS} (unweighted)	Vibro piling	Rock breaking
Fish (with swim bladder involved in hearing) recoverable injury	170 dB re 1 µPa (for 48 hours)	18 m	2 m
Fish (with swim bladder involved in hearing) TTS	158 dB re 1 µPa (for 12 hours)	87 m	14 m

Table 4-9 Ranges to Popper et al. (2014) SPL_{RMS} continuous noise injury criteria for species of fish from vibro piling and rock breaking noise

4.4 Other noise sources

4.4.1 Backhoe Dredging

Backhoe dredging is undertaken by an excavator mounted on a barge. All machinery is located on the deck of the barge, above the waterline. Noise radiates into the water through the hull of the barge or from the action of the excavator on the seabed. No noise generating plant is located in the water. Measurements undertaken by Subacoustech indicate that an unweighted RMS source level of up to 165 dB re 1 µPa could be expected. Measurement data show that underwater noise levels from backhoe dredging reduce quickly with range to approximately 133 dB re. 1 µPa within 50 m from the source.

For marine mammals, when NMFS weightings are applied levels are further reduced such that a stationary animal located at 50 m from the source would need to be exposed for a minimum of 19 hours in a 24-hour period for the TTS criteria to be exceeded.

For fish, the source level is below the recoverable injury criteria specified in Popper *et al.* (2014). The range at which the Popper *et al.* (2014) TTS criteria would be exceeded is less than 5 m.

4.4.2 Vessel Movements

Underwater noise from vessels varies significantly depending on the size, speed and operating conditions. Underwater noise from small vessels of the type typically used for inshore development projects (workboats, safety boats, dredging barges) have been measured by Subacoustech and source levels at 1 m have been found to be in the range of 140 dB to 160 dB RMS re 1 µPa with peak frequencies occurring between 100 Hz and 800 Hz.

At the time of writing no detail about the type of vessels or number of movements was available to enable a detailed assessment. However, no vessels likely to be involved in the construction works are likely to exceed the noise level of the existing ferry. Overall, vessel movements are likely to produce a lower noise level than the other sources considered in this report and as such are not expected to have a significant impact.

4.5 Discussion

The impact ranges seen in the preceding sections vary significantly depending on the functional hearing (species) group and the NMFS (2016) criteria that defines the onset of PTS and TTS.

NMFS (2016) requires that where an assessment includes both SPL_{peak} and SEL_{cum} then the greater of the two impact ranges should be used in the assessment. For blasting, the SPL_{peak} criteria gave rise to the greatest ranges across all functional groups. The greatest impact ranges were seen for HF cetaceans with blasting. This is not unexpected given the particularly strict SPL_{peak} criteria specified by NMFS (2016). This is also the case for the impact piling results. Table 4-10 summarises the maximum PTS ranges for each activity and species group.

	LF Cetaceans	MF Cetaceans	HF Cetaceans	PW Cetaceans	Fish
Blasting	310 m	73 m	2.0 km	390 m	84 m
Impact piling 150 kJ (1 hour)	380 m	< 10 m	280 m	86 m	31 m
Impact piling 50 kJ (1 hour)	120 m	< 10 m	97 m	29 m	< 10 m
Vibro piling (1 hour)	10 m	< 10 m	40 m	10 m	18 m
Rock Breaking	20 m	< 10 m	50 m	< 10 m	< 10 m
Dredging	< 20 m	< 10 m	< 50 m	< 10 m	< 10 m

Table 4-10 Maxium range to PTS criteria for each activity and species groups

Despite this, the SPL_{peak} ranges should still be considered conservative as physical processes in propagation alter the shape of the waveform and reduce the peaks with increasing range. NMFS (2016) refers to this effect (p27, paragraph 2) but it is not easily quantified or accounted for in the modelling.

5 Summary and conclusions

Subacoustech Environmental has undertaken a study of noise propagation for Affric Limited at the Lochmaddy ferry terminal, Scotland, for blasting, impact piling and other noise making activities.

The level of underwater noise from blasting and impact piling has been estimated using a parabolic equation (PE) method for lower frequencies and a ray tracing solution at higher frequencies. The modelling considers a wide variety of input parameters including source noise levels, frequency content, duty cycle, seabed properties and the sound speed profile in the water column. Full account is taken of the complex bathymetry in the area.

A representative location at the ferry terminal has been modelled to give worst case ranges into the open water.

Further simple modelling has been carried out to assess the effects of vibro piling and rock breaking in the area. A qualitative assessment of noise from dredging and vessel noise has also been completed.

Noise levels have been assessed in terms of the criteria provided by NMFS (2016) for SPL_{peak} and SEL_{cum} for marine mammals and Popper et al (2014) for SPL_{peak}, SEL_{cum} and SPL_{RMS} for fish. In the case of the NMFS (2016) criteria, the 1/3 octave band spectrum of the source level has been weighted according the LF, MF, HF and PW frequency weightings stipulated in the guidelines.

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Appendix L.1: Lochmaddy Ferry Terminal Marshalling Area and Traffic Improvements

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

CALEDONIAN MARITIME ASSETS LIMITED

LOCHMADDY FERRY TERMINAL

MARSHALLING AREA AND TRAFFIC IMPROVEMENTS

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March 2019

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	Name	Signature	Date
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This document has been reviewed for compliance with project requirements in accordance with Wallace Stone LLP Quality Management System.

CALEDONIAN MARITIME ASSETS LIMITED

LOCHMADDY FERRY TERMINAL

MARSHALLING AREA AND TRAFFIC IMPROVEMENTS

CONTENTS

CALEDONIAN MARITIME ASSETS LIMITED

LOCHMADDY FERRY TERMINAL

MARSHALLING AREA AND TRAFFIC IMPROVEMENTS

1. INTRODUCTION

1.1 General

Two new vessels are currently under construction on the Firth of Clyde. One of these vessels is due to enter service on the Skye Triangle Route (Uig (Skye) – Tarbert (Harris) – Lochmaddy (North Uist)). The new vessel is larger, heavier and has increased vehicle and pedestrian capacity compared to the current vessels servicing this route (primarily the MV Hebrides).

The existing shoreside facilities at Lochmaddy require upgrading to accommodate the new vessel and make provision for the potential increase in traffic resulting from the deployment of the larger vessel.

1.2 Construction

The existing marshalling area shall be extended by approximately 3,600m^2 to the north-west to provide improved marshalling, parking, security and manoeuvring arrangements. Also included will be a trailer park, relocation of existing marina facilities for the pontoons (which will remain in place where possible but except for dredging operations). Additional long stay car parking will be provided by extending the existing car park to the north of the terminal building. The reclamation will be through imported rockfill with geotextile and rock armoured slope protection. The reclamation area will also include drainage (via a bypass separator), ticketing kiosks, a cycle shelter and services. Bituminous surfacing will be tied into existing bituminous paved marshalling areas. The trailer park will be concrete surfaced to suit lorry manoeuvring.

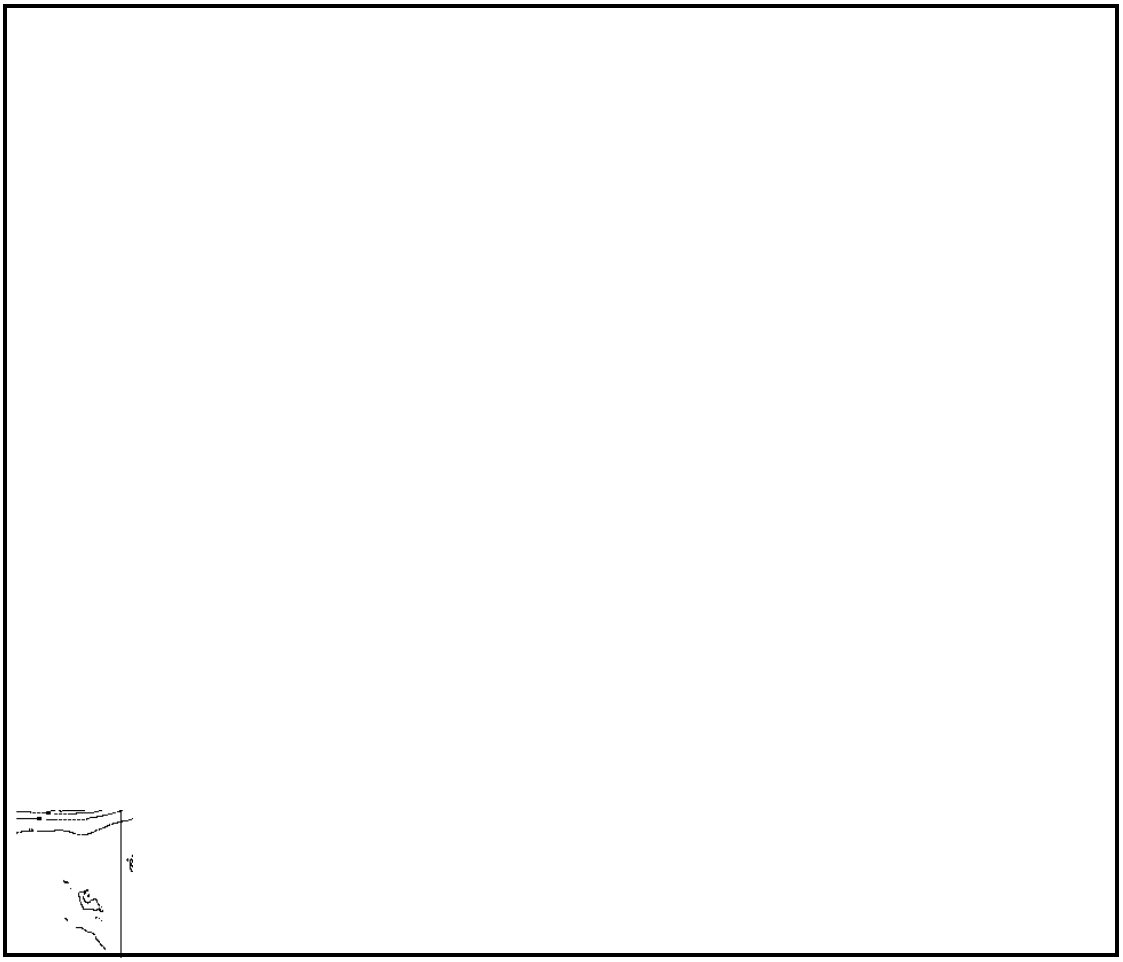


Figure 01 – Proposed Site Layout

2. EXISTING LAYOUT

The existing marshalling area can accommodate 110 cars, some of which are on curved lanes adjacent to the end of the linkspan. Check in is currently carried out in the queues, with no kiosk provided for staff.

There is provision for about 18 long stay car parking spaces on the land to the north of the terminal building, along with four lorry spaces. No other trailer parking is available near the terminal.

3. MARSHALLING AREA LAYOUT AND ROAD IMPROVEMENTS

The extended marshalling area will accommodate 198 cars, which is almost 50% in excess of the new vessel capacity. The exit lane from the ferry will be moved to the north-west, with a separate inbound lane serving the new trailer park area to the north-west edge of the reclamation works. This allows trailers to be dropped off and left for subsequent loading or taken off the ferry and parked while awaiting pickup.

Some additional lanes will be provided at the eastern edge of the present marshalling area, enabled by the acquisition of an area of land currently belonging to the adjacent house. This will minimise the requirement for the curved lanes of the present layout.

It is proposed that allowance be made for a check-in kiosk within the marshalling area. This must be located far enough back to allow vehicles to turn into their lane after checking in, but far enough forward to allow a queue of cars waiting to check in to be able to clear the public road. The proposed location allows about 12 vehicles to clear the road, assuming both sides of the kiosk are used.

To help improve traffic flow the Hotel is in agreement with a one-way system to their car park, with some alterations required at the north western exit to allow vehicles to turn towards the ferry terminal.

It is proposed to provide a mini roundabout on the A865 road at the entrance to the marshalling area. This will take the form of a painted button on the road, in order that larger vehicles may overrun it. Zebra Crossing marking will be provided at expected crossing points and a kerbed refuge island, dividing the exit lane in two, will divert traffic to the hotel or the A865, whilst also providing refuge for pedestrians crossing at each of the crossing points. A ghost island will be provided to separate the inbound and outbound lanes on the A865 to the west. Minimum kerb radii of 15 metres will be provided on the exit from the marshalling area/ferry to the hotel access, and to the A865 westbound.

Additional long stay car parking will be provided by taking two of the lorry parking/turning areas to the north of the terminal building, giving an additional 5 spaces, and by extending the present car parking by two lines of 8 bays to the east. This will provide an extra 21 car parking spaces, for long stay and Ferry Terminal staff use.

In the vicinity of the Terminal Building the turning area's east kerb-line will be moved further east to widen the existing road which will allow a large rigid bodied coach to make a U-turn, without encroaching on existing parking bays, and eliminate the need for making a 3 (or more) point turn. In order to accommodate this change the existing wall will be taken down, along with the old cattle run/access ramp and a new retaining wall, and footway, will be constructed in their place. A bus bay will be provided on the east kerb-line for additional drop off capability.

The present drop-off spaces in front of the terminal building will be retained, but the ones closest to the gated access at the pier will require to be moved north slightly. A walkway will be provided between the existing gates and the drop off spaces at the south of the turning area. This path/crossing point will take the form of a solid hatched marking, probably in red.

A cycle shelter will be provided within the marshalling area, adjacent to the upper end of the linkspan. Access to it will be along the road next to the linkspan from the ferry terminal building. This access road will be restricted to use by cycles and pedestrians only.

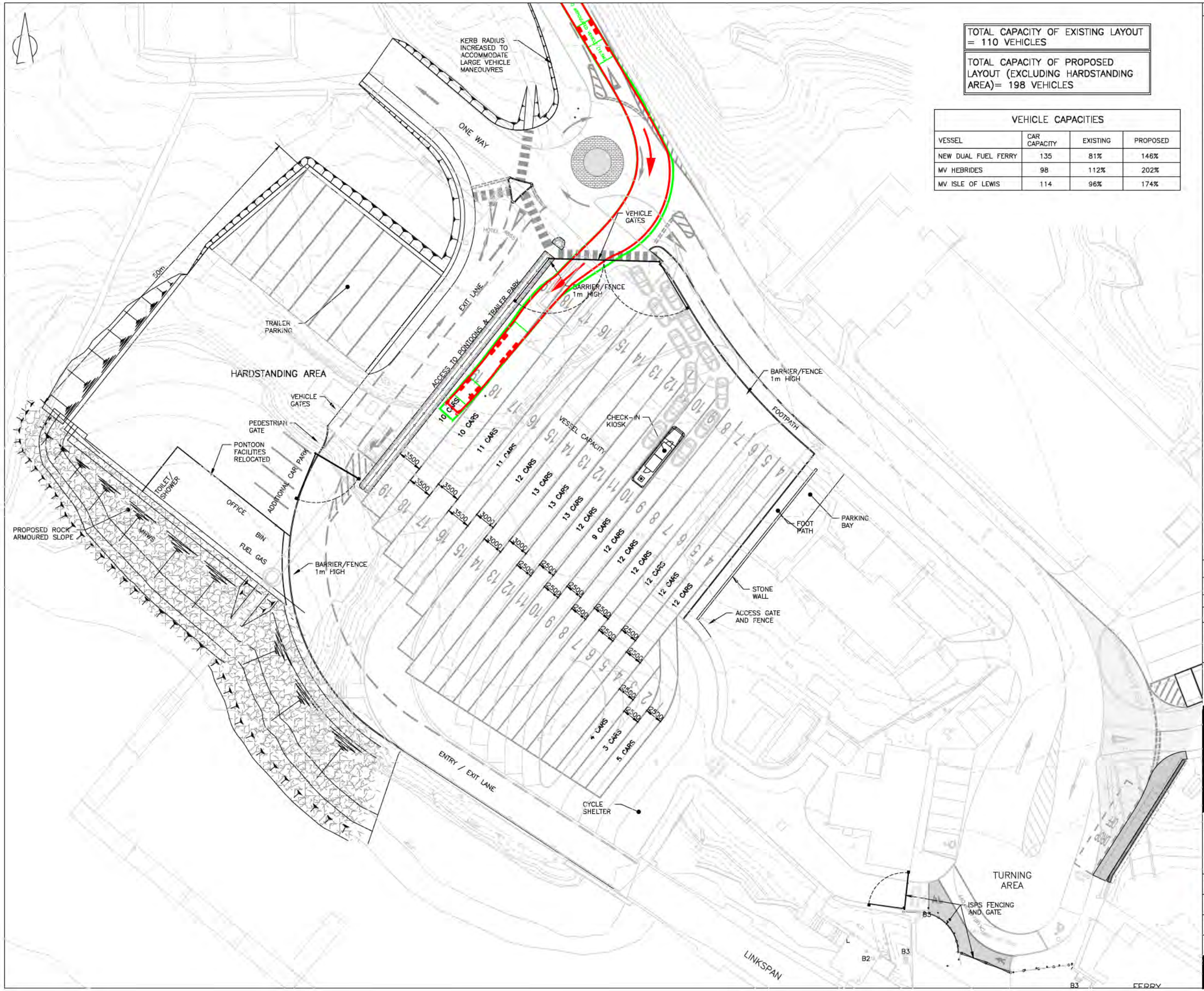
4. VEHICLE SWEPT PATHS

Swept paths have been run for articulated and rigid vehicles on a range of possible movements in and around the terminal building and marshalling area. These are shown in Drawings 1975/951 to 967 in Appendix A. Drawings 951 to 963 cover the maximum articulated vehicle, with 964 to 966 covering some of the manoeuvres with a large rigid vehicle where this might be more critical and 967 covers a manoeuvre that a large coach might make whilst u-turning in advance of the access to the pier. The provisions and restrictions of each are as noted below: -

Drawing 951 – A865 from west into marshalling area: roundabout directs traffic through gates into marshalling area.
Drawing 952 – A865 from terminal into marshalling area: no overrunning of roundabout.
Drawing 953 – A865 from terminal into lorry park: overruns roundabout and encroaches onto exit lane (not a regular manoeuvre).
Drawing 954 – U turn out from exit lane from ferry or lorry park into marshalling area (also shows marshalling area on to ferry): overruns roundabout.
Drawing 955 – from ferry into lorry park, into trailer parking south: no restrictions.
Drawing 956 – from ferry into lorry park, into trailer parking north: no restrictions.
Drawing 957 – from lorry park north to A865 west: encroaches lorry park access lane and overruns ghost island at A865.
Drawing 958 – from lorry park north to hotel: encroaches lorry park access lane, shows requirement for 15 metre radius kerb-line from exit lane to hotel.
Drawing 959 – from marshalling area west on to ferry: no restrictions, demonstrates that no encroachment occurs over other marshalling lanes.
Drawing 960 – A865 from west into terminal area and out to A865: demonstrates that manoeuvre can be made, encroaches onto existing bus stop area.
Drawing 961 – A865 from west to terminal, reverse into lorry turning south: no restrictions.
Drawing 962 – A865 from west to terminal, reverse into lorry turning north: no restrictions.
Drawing 963 – A865 from west to terminal, reverse onto pier and out to A865: encroaches into existing drop-off area, no other restrictions.
Drawing 964 – U turn from exit lane from ferry or from lorry park into marshalling area: encroaches into both exit lanes and overruns roundabout.
Drawing 965 – A865 from terminal into marshalling area: no restrictions.
Drawing 966 – A865 from west towards terminal, reverse into turning area then reverse onto pier and out to A865: no restrictions.
Drawing 967 – A865 from west into terminal area and out to A865: demonstrates that a U-turn manoeuvre can be made with a large coach by realigning the kerb-line and widening the existing road.

It is therefore noted that the proposed changes to the road layout can accommodate the range of possible vehicle movements, with occasional encroachment into other lanes.

Appendix A - SWEPT PATH DRAWINGS



TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES
TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
B	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacted		
A	18.04.18	ROAD LINES REVISED			

AMENDMENTS

CLIENT: Comhairle nan Eilean Siar

PROJECT: LOCHMADDY FERRY TERMINAL UPGRADE WORKS

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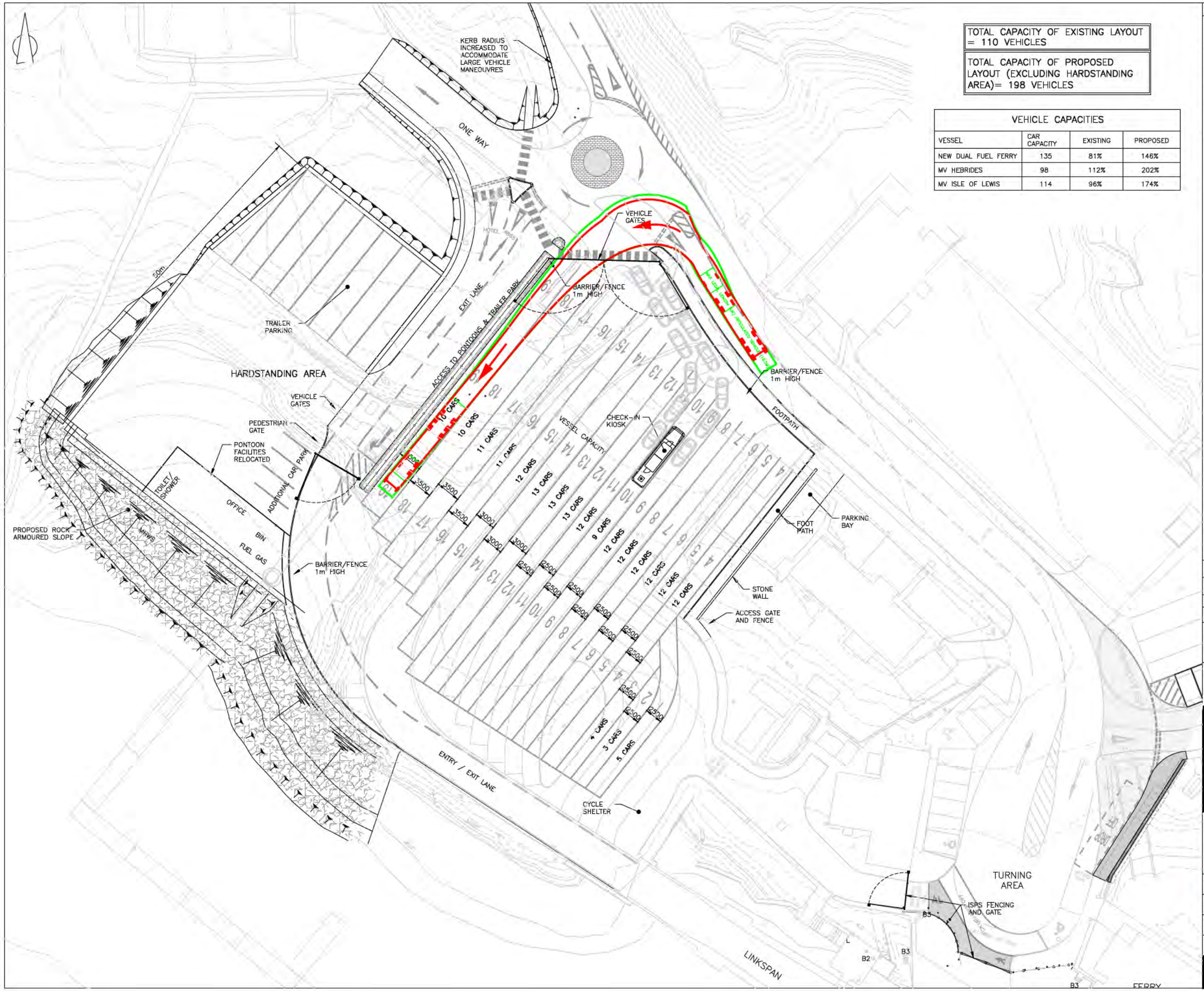
DRAWING TITLE: MAX LEGAL ARTIC SWEPT PATH RIGHT TURN TO MARSHALLING AREA

DRAWN	CHECKED	APPROVED
Redacted		
DATE 05.03.18	DATE 06.04.18	DATE 06.04.18

SCALE (A1) 1:250 | STAGE INFORMATION

REVISION A B

PROJECT No. 1975 | DRAWING No. 951



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LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
B	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacted		
A	18.04.18	ROAD LINES REVISED			

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DRAWING TITLE: MAX LEGAL ARTIC SWEPT PATH LEFT TURN TO MARSHALLING AREA

DRAWN	CHECKED	APPROVED
Redacted		
DATE 05.03.18	DATE 06.04.18	DATE 06.04.18

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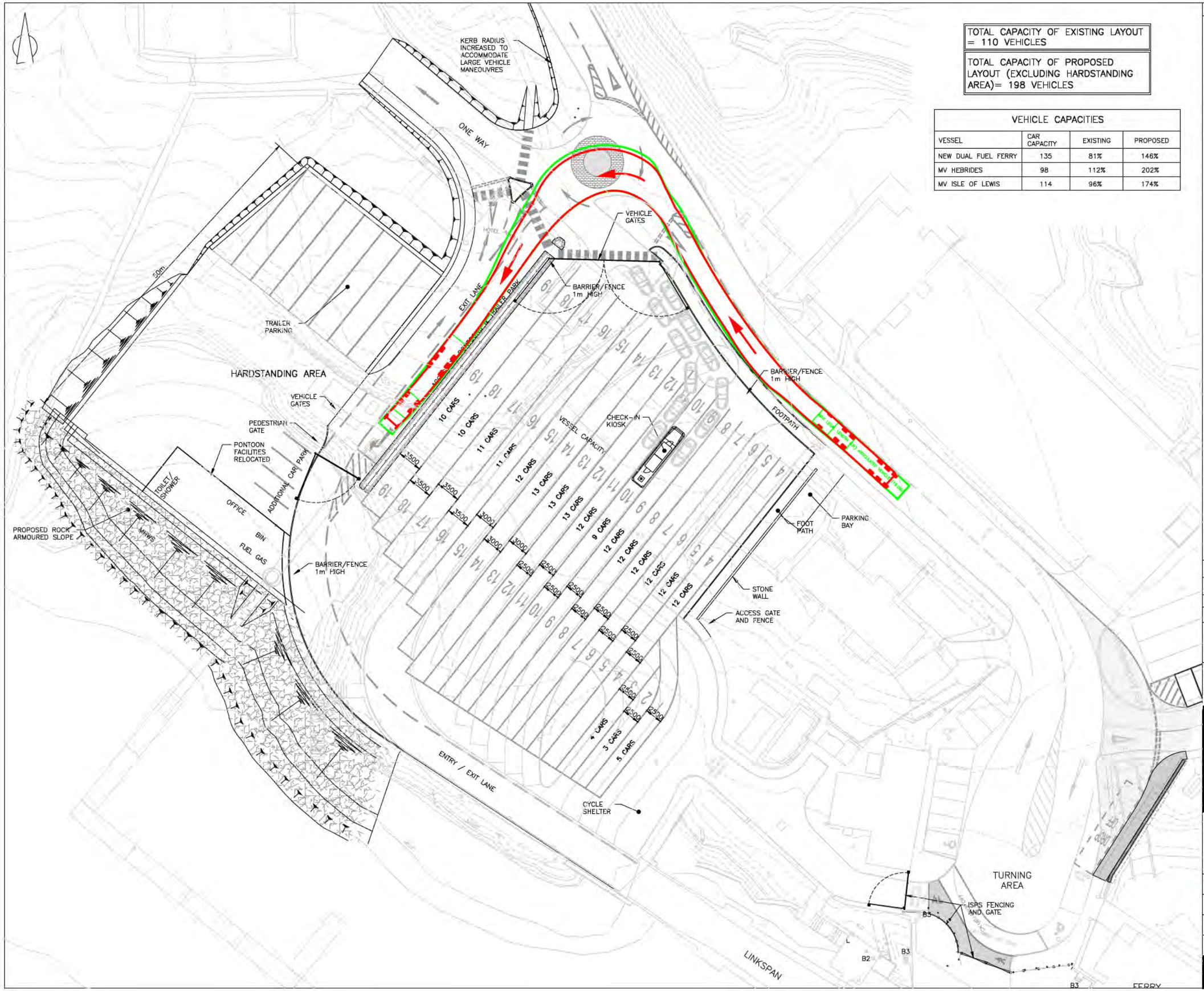

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LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
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A	18.04.18	ROAD LINES REVISED			

AMENDMENTS

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DRAWING TITLE: MAX LEGAL ARTIC SWEPT PATH LEFT TURN TO LORRY PARKING

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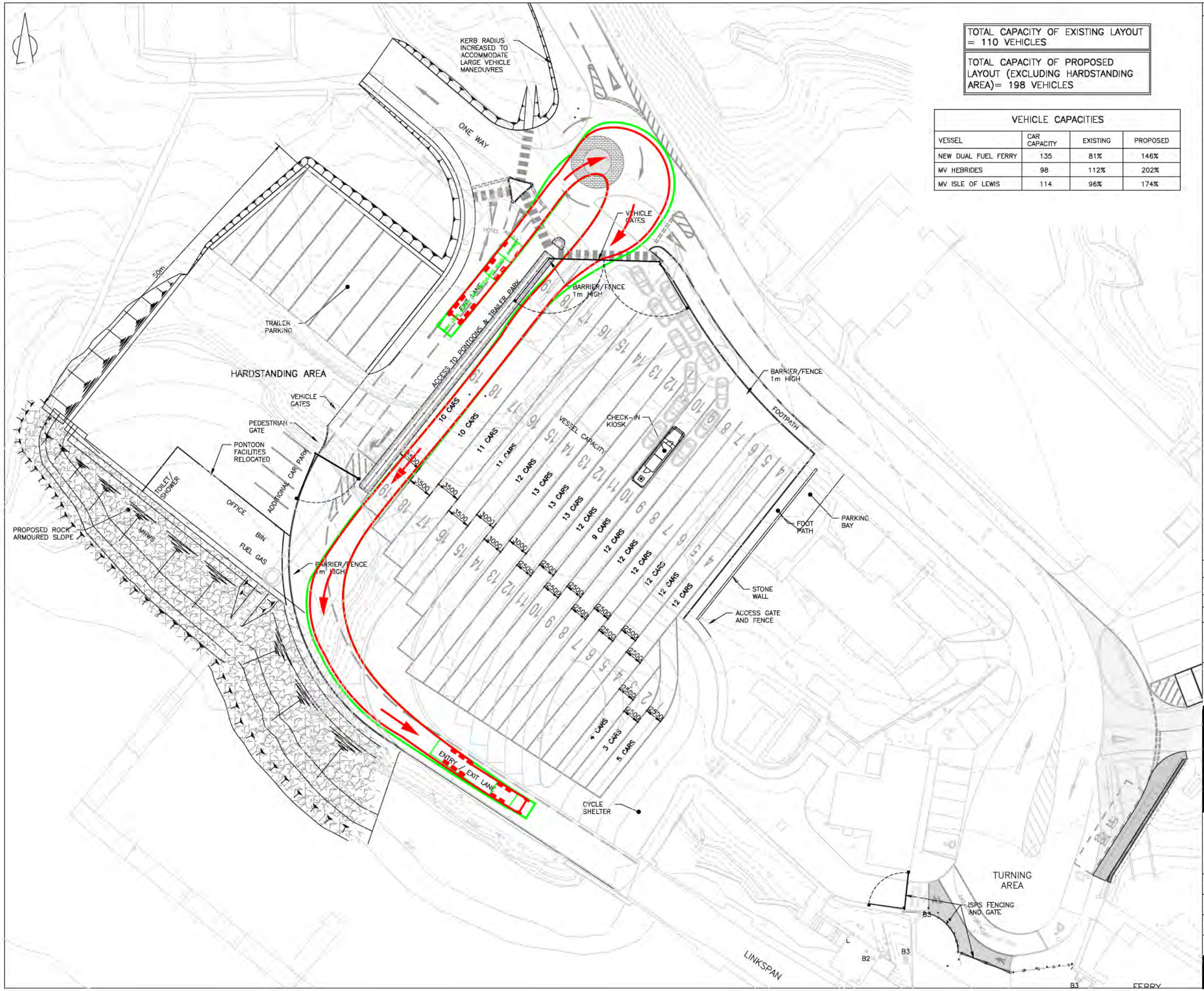

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LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
B	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacted		
A	18.04.18	ROAD LINES REVISED			

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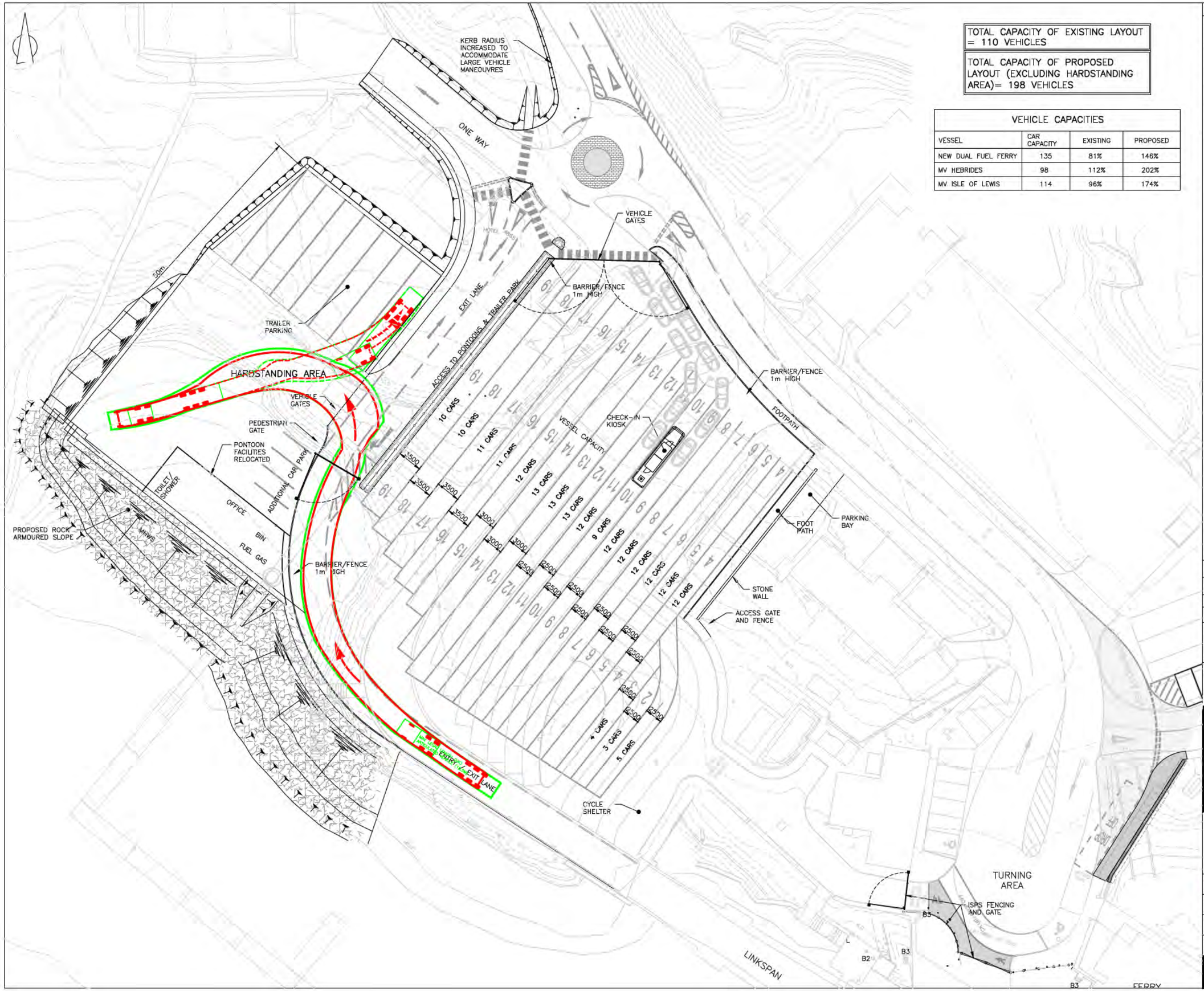

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LEGEND

OVER HANG SWEPT PATH
WHEEL TRACK SWEPT PATH
OVER HANG REVERSE SWEPT PATH
WHEEL TRACK REVERSE SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
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A	18.04.18	ROAD LINES REVISED			

AMENDMENTS

CLIENT
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PROJECT
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DRAWING TITLE
MAX LEGAL ARTIC SWEPT PATH LORRY PARK SOUTH EXTREMEITY

DRAWN	CHECKED	APPROVED
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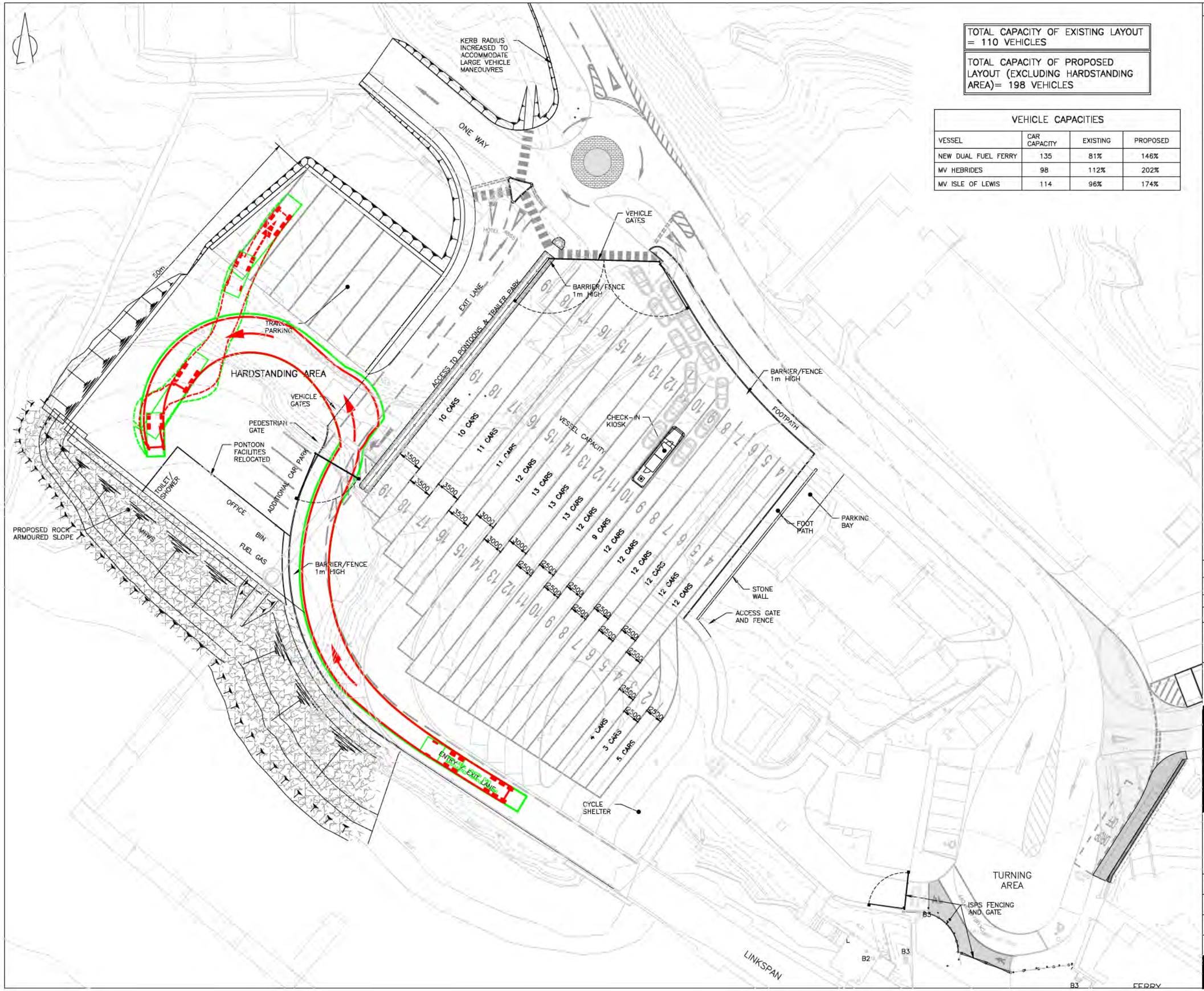

TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES
TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

OVER HANG REVERSE SWEPT PATH

WHEEL TRACK REVERSE SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
B	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacted		
A	18.04.18	ROAD LINES REVISED			

AMENDMENTS

CLIENT: Comhairle nan Eilean Siar

PROJECT: LOCHMADDY FERRY TERMINAL UPGRADE WORKS

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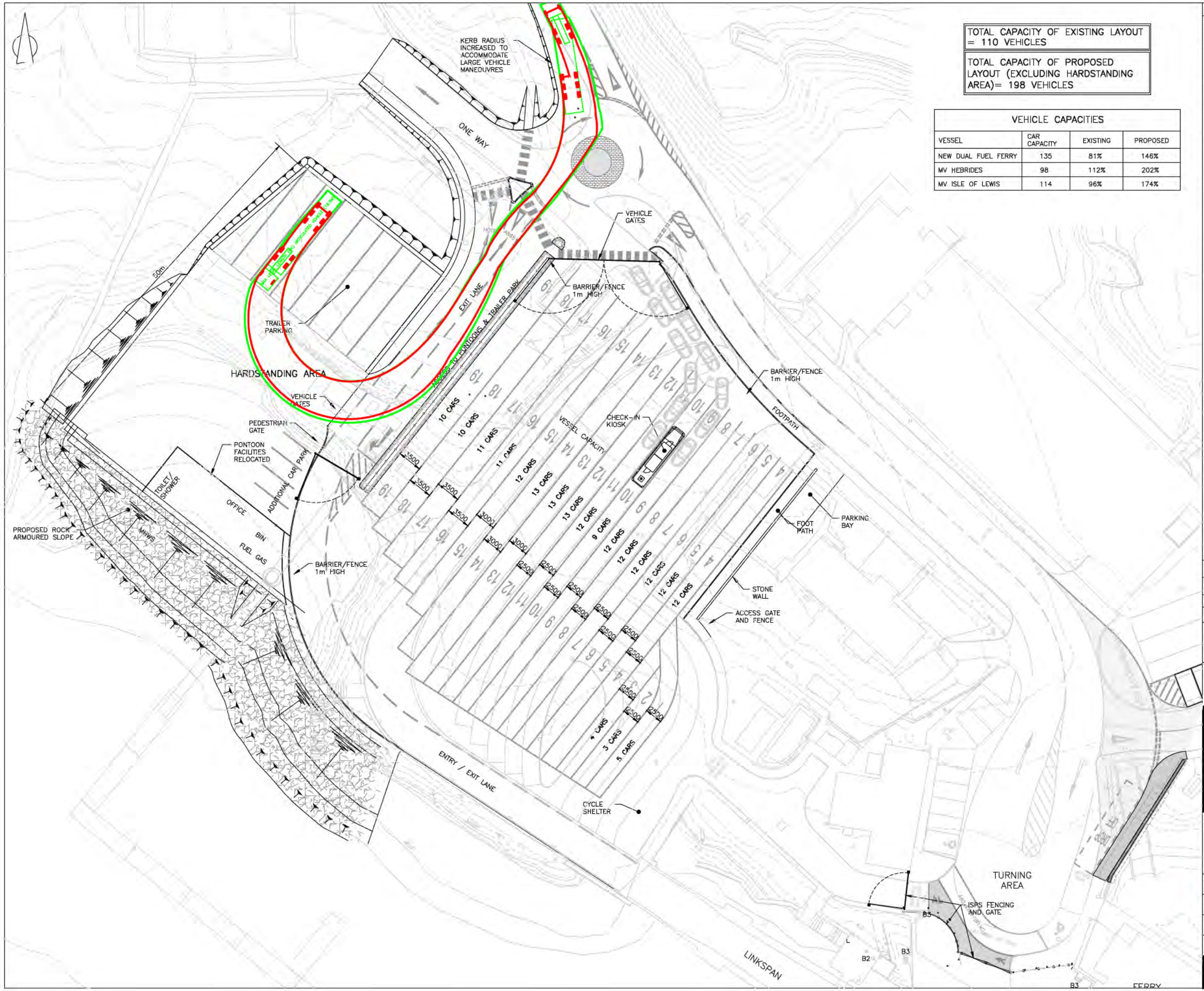
DRAWING TITLE: MAX LEGAL ARTIC SWEPT PATH LORRY PARK NORTH EXTREMEITY

DRAWN	CHECKED	APPROVED
Redacted		
DATE 05.03.18	DATE 06.04.18	DATE 06.04.18

SCALE (A1) 1:250 | STAGE INFORMATION

REVISION A B

PROJECT No. 1975 | DRAWING No. 956



TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES
TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
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   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
B	18.03.19	LAYOUT AND SWEPT PATH REVISED	Redacted		
A	18.04.18	ROAD LINES REVISED			

AMENDMENTS

CLIENT: Comhairle nan Eilean Siar

PROJECT: LOCHMADDY FERRY TERMINAL UPGRADE WORKS

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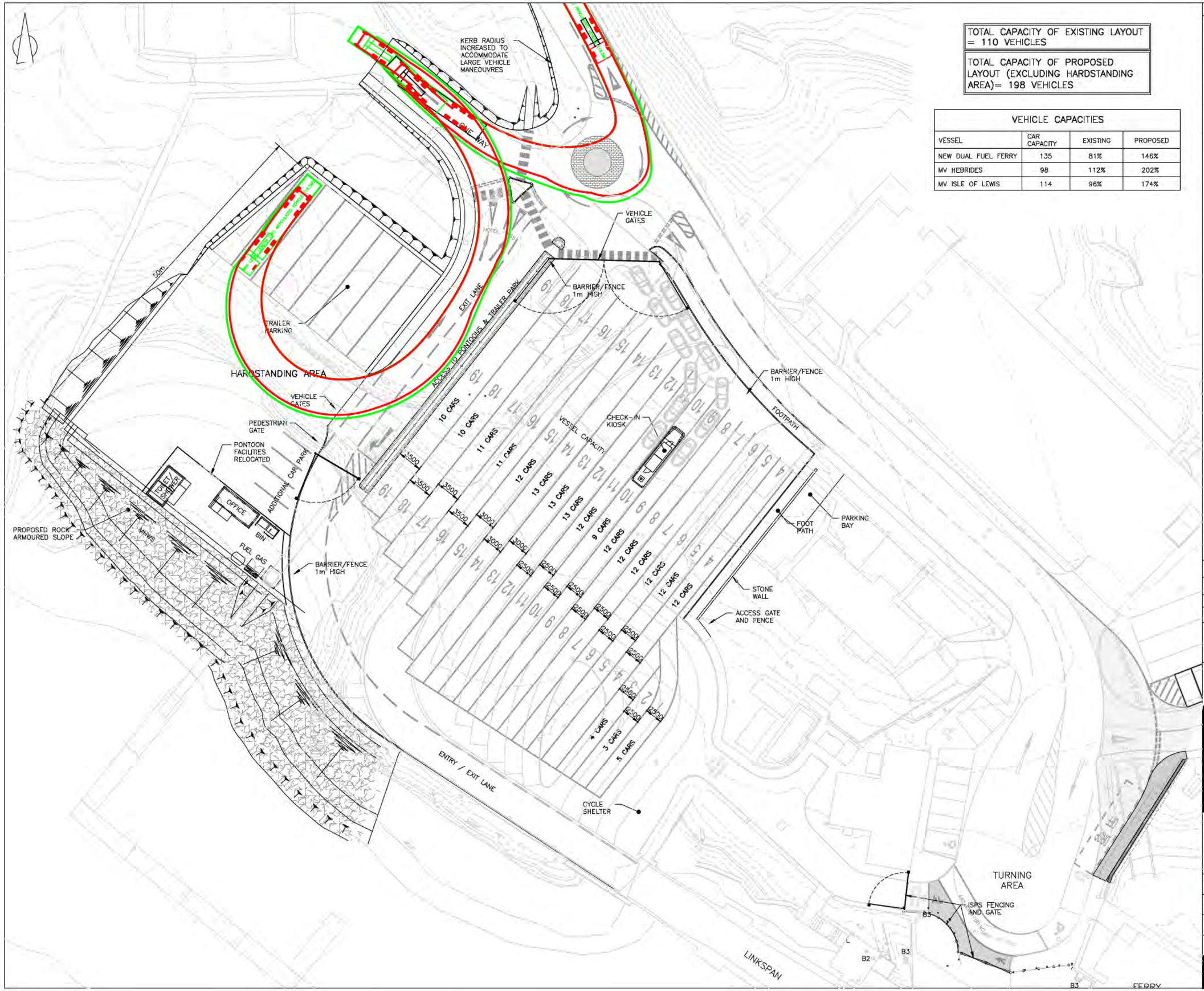
DRAWING TITLE: MAX LEGAL ARTIC SWEPT PATH LORRY PARK EXIT TO MAIN ROAD

DRAWN	CHECKED	APPROVED
Redacted		
DATE 05.03.18	DATE 06.04.18	DATE 06.04.18

SCALE (A1) 1:250 STAGE INFORMATION

REVISION A B

PROJECT No. 1975 DRAWING No. 957



TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES
TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
B	18.03.19	LAYOUT AND SWEPT PATH REVISED	Redacted		
A	18.04.18	ROAD LINES REVISED			

AMENDMENTS

CLIENT: Comhairle nan Eilean Siar

PROJECT: LOCHMADDY FERRY TERMINAL UPGRADE WORKS

Wallace Stone
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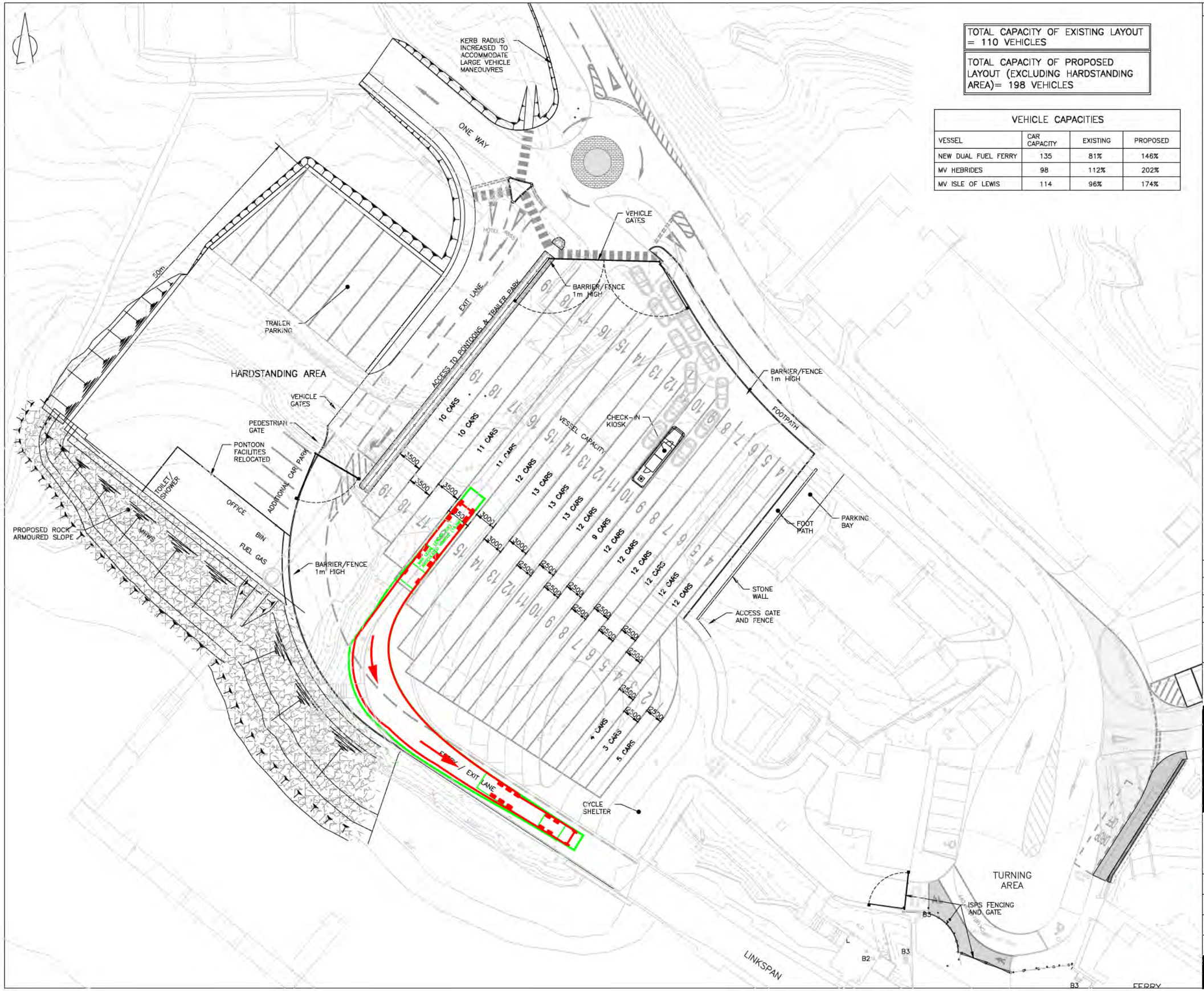
DRAWING TITLE: MAX LEGAL ARTIC SWEPT PATH LORRY PARK AND MAIN ROAD TO HOTEL

DRAWN	CHECKED	APPROVED
Redacted		
DATE 05.03.18	DATE 06.04.18	DATE 06.04.18

SCALE (A1) 1:250 | STAGE INFORMATION

REVISION A B

PROJECT No. 1975 | DRAWING No. 958



TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES
TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
B	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacted		
A	18.04.18	ROAD LINES REVISED			

AMENDMENTS

CLIENT: Comhairle nan Eilean Siar

PROJECT: LOCHMADDY FERRY TERMINAL UPGRADE WORKS

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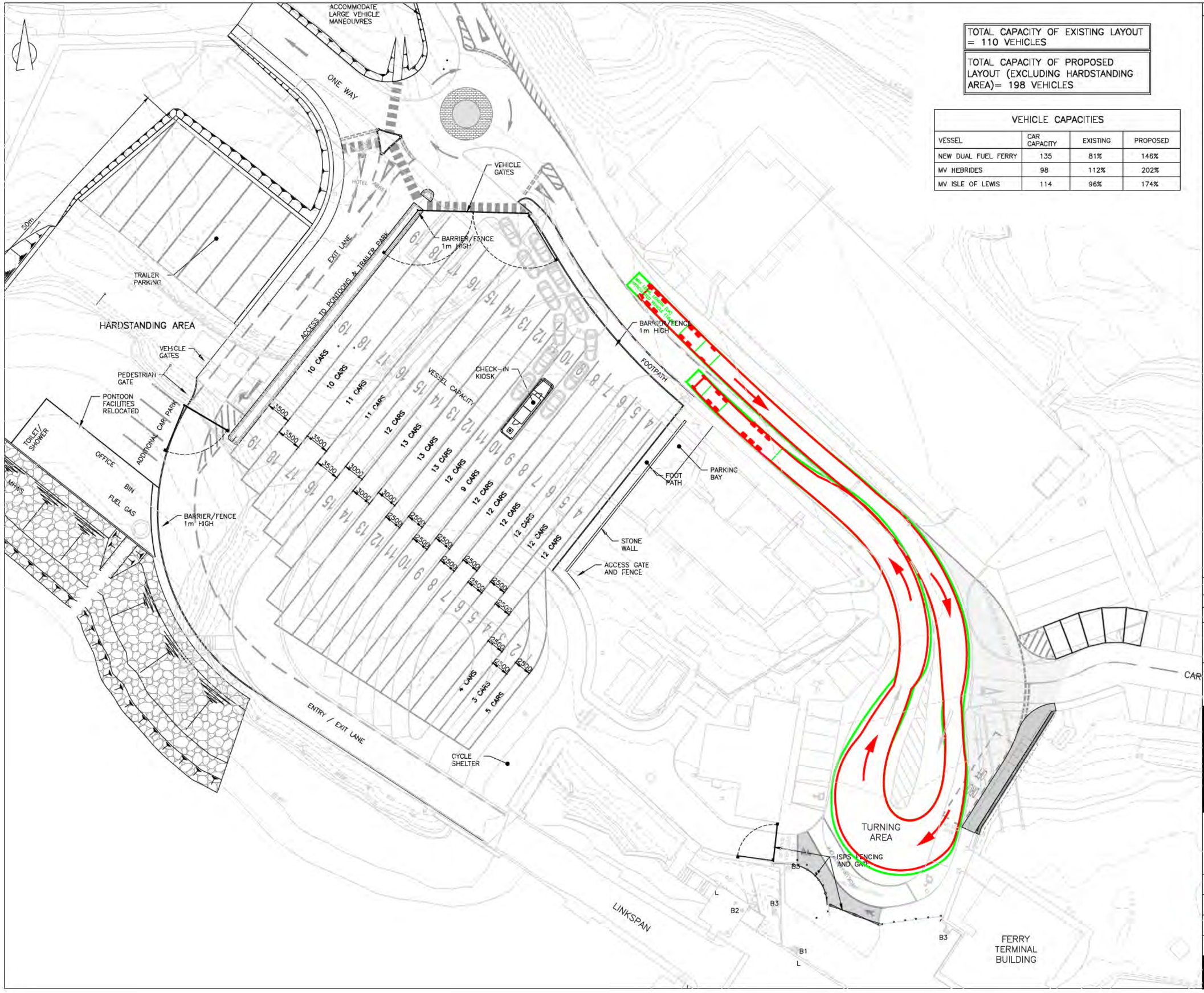
DRAWING TITLE: MAX LEGAL ARTIC SWEPT PATH MARSHALLING AREA TO LINKSPAN

DRAWN	CHECKED	APPROVED
Redacted		
DATE 05.03.18	DATE 06.04.18	DATE 06.04.18

SCALE (A1) 1:250 | STAGE INFORMATION

REVISION A B

PROJECT No. 1975 | DRAWING No. 959



TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES
TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
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   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

OVER HANG REVERSE SWEPT PATH

WHEEL TRACK REVERSE SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
A	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacte		

AMENDMENTS

CLIENT
Comhairle nan Eilean Siar

PROJECT
LOCHMADDY FERRY TERMINAL UPGRADE WORKS

Wallace Stone
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DRAWING TITLE
MAX LEGAL ARTIC SWEPT PATH U-TURN AT TERMINAL TURNING AREA

DRAWN	CHECKED	APPROVED
Redacted		
DATE: 09.04.18	DATE: 18.04.18	DATE: 18.04.18

SCALE (A1) 1:250
STAGE INFORMATION
REVISION A

PROJECT No. 1975
DRAWING No. 960

ACCOMMODATE LARGE VEHICLE MANEOUVRES

ONE WAY

VEHICLE GATES

HOTEL

50m

EXIT LANE

ACCESS TO PONTOONS & TRAILER PARK

BARRIER/FENCE 1m HIGH

TRAILER PARKING

HARDSTANDING AREA

VEHICLE GATES

PEDESTRIAN GATE

PONTOON FACILITIES RELOCATED

ADDITIONAL CAR PARK

TOILET/ SHOWER

OFFICE

BIN

FUEL GAS

MHWS

BARRIER/FENCE 1m HIGH

10 CARS
10 CARS
11 CARS
11 CARS
12 CARS
13 CARS
13 CARS
13 CARS
12 CARS
9 CARS
12 CARS
12 CARS
12 CARS
12 CARS
12 CARS
12 CARS
4 CARS
3 CARS
5 CARS

3500 3500 3500 3000 3000 3000 2500 2500 2500 2500 2500 2500 2500 2500 2500 2500 2500 2500

VESSEL CAPACITY

CHECK-IN KIOSK

BARRIER/FENCE 1m HIGH

FOOTPATH

FOOT PATH

PARKING BAY

STONE WALL

ACCESS GATE AND FENCE

ENTRY / EXIT LANE

CYCLE SHELTER

TURNING AREA

ISPS FENCING AND GATE

B5 B3 B2 B3 B1

LINKSPAN

FERRY TERMINAL BUILDING

CAR

TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES
TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

OVER HANG REVERSE SWEPT PATH

WHEEL TRACK REVERSE SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
A	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacte		

AMENDMENTS

CLIENT

Comhairle nan Eilean Siar

PROJECT

LOCHMADDY FERRY TERMINAL UPGRADE WORKS

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DRAWING TITLE

MAX LEGAL ARTIC SWEPT PATH
TERMINAL LORRY PARK
SOUTH SIDE ENTRY AND EXIT

DRAWN	CHECKED	APPROVED
Redacted		
DATE: 09.04.18	DATE: 18.04.18	DATE: 18.04.18

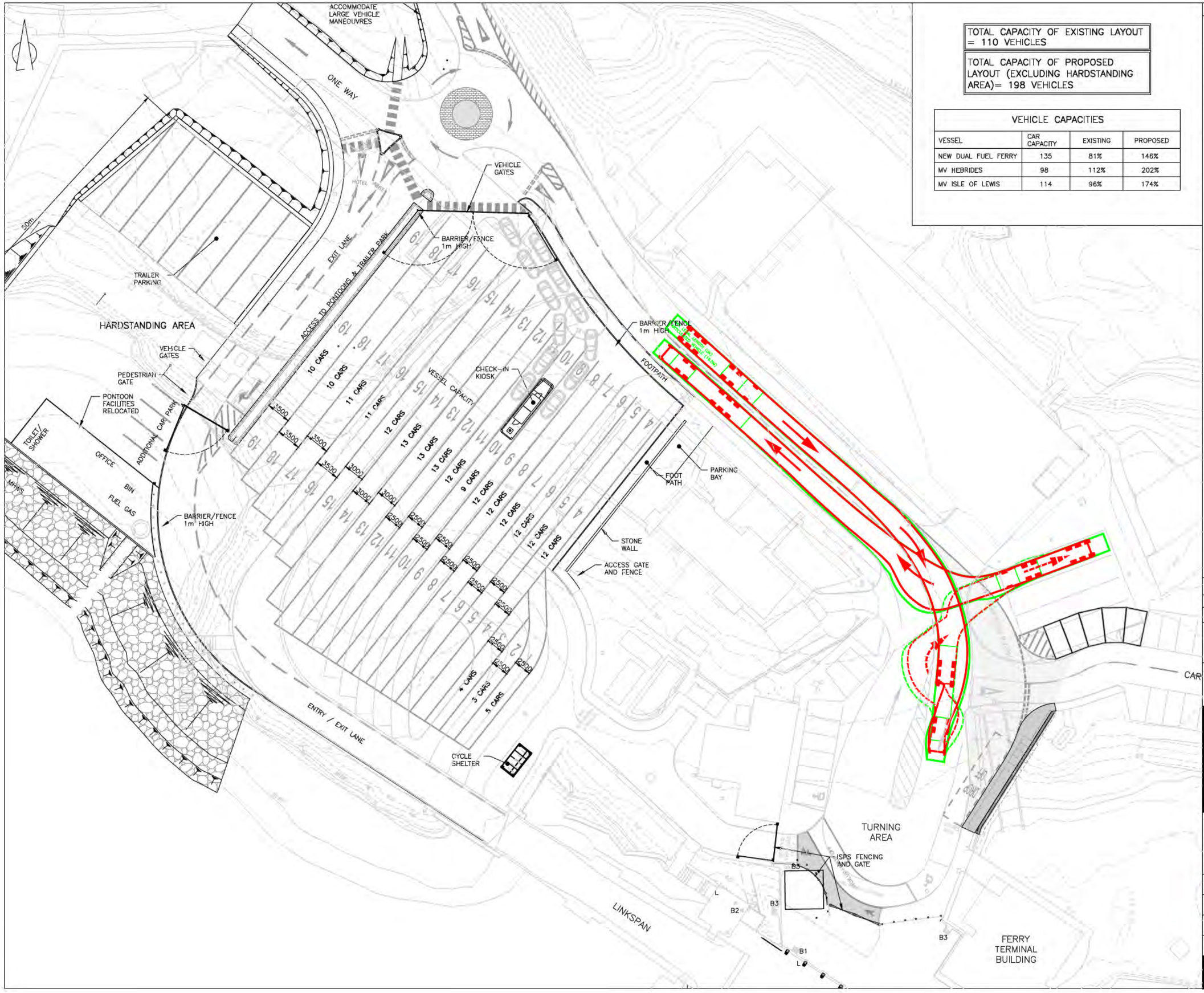
SCALE (A1) 1:250

STAGE: INFORMATION

REVISION: A

PROJECT No.: 1975

DRAWING No.: 961



TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES

TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
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GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
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4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

OVER HANG REVERSE SWEPT PATH

WHEEL TRACK REVERSE SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
A	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacte		

AMENDMENTS

CLIENT
Comhairle nan Eilean Siar

PROJECT
LOCHMADDY FERRY TERMINAL UPGRADE WORKS

Wallace Stone
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DRAWING TITLE
MAX LEGAL ARTIC SWEPT PATH TERMINAL LORRY PARK NORTH SIDE ENTRY AND EXIT

DRAWN	CHECKED	APPROVED
Redacted		
DATE: 09.04.18	DATE: 18.04.18	DATE: 18.04.18

SCALE (A1) 1:250
STAGE INFORMATION
REVISION A

PROJECT No. 1975
DRAWING No. 962

TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES

TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
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3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
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   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

OVER HANG REVERSE SWEPT PATH

WHEEL TRACK REVERSE SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
A	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacted		

AMENDMENTS

CLIENT: Comhairle nan Eilean Siar

PROJECT: LOCHMADDY FERRY TERMINAL UPGRADE WORKS

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DRAWING TITLE: MAX LEGAL ARTIC SWEPT PATH PIER ENTRY AND EXIT

DRAWN	CHECKED	APPROVED
Redacted		
DATE 09.04.18	DATE 18.04.18	DATE 18.04.18

SCALE (A1) 1:250 STAGE INFORMATION

REVISION A

PROJECT No. 1975 DRAWING No. 963

TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES

TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
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   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

OVER HANG REVERSE SWEPT PATH

WHEEL TRACK REVERSE SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
A	18.03.19	LAYOUT AND SWEPT PATH REVISED	Redacted		

AMENDMENTS

CLIENT

Comhairle nan Eilean Siar

PROJECT

LOCHMADDY FERRY TERMINAL UPGRADE WORKS

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DRAWING TITLE

LONG RIGID VEHICLE SWEPT PATH – LORRY PARK TO MARSHALLING AREA

DRAWN	CHECKED	APPROVED
Redacted		
DATE: 22.05.18	DATE: 22.05.18	DATE: 22.05.18

SCALE (A1) 1:250

STAGE: INFORMATION

REVISION: A

PROJECT No.: 1975

DRAWING No.: 964

TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES

TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

ONE WAY
VEHICLE GATES
BARRIER/FENCE 1m HIGH
EXIT LANE
ACCESS TO PONTOONS & TRAILER PARK
50m
TRAILER PARKING
HARDSTANDING AREA
VEHICLE GATES
PEDESTRIAN GATE
PONTOON FACILITIES RELOCATED
ADDITIONAL CAR PARK
TOILET/ SHOWER
OFFICE
BIN
FUEL GAS
MHWS
PROPOSED ROCK ARMOURED SLOPE
BARRIER/FENCE 1m HIGH
10 CARS
10 CARS
11 CARS
11 CARS
12 CARS
13 CARS
13 CARS
13 CARS
12 CARS
9 CARS
12 CARS
12 CARS
12 CARS
12 CARS
12 CARS
12 CARS
4 CARS
3 CARS
5 CARS
3500
3500
3500
3000
3000
3000
2500
2500
2500
2500
2500
2500
2500
2500
2500
VESSEL CAPACITY
CHECK-IN KIOSK
BARRIER/FENCE 1m HIGH
FOOTPATH
RIGID TRUCK
FOOT PATH
PARKING BAY
STONE WALL
ACCESS GATE AND FENCE
ENTRY / EXIT LANE
CYCLE SHELTER
TURNING AREA
ISPS FENCING AND GATE
LINKSPAN
FERRY TERMINAL BUILDING
B1
B2
B3
B3
B3
L
L
L

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH
WHEEL TRACK SWEPT PATH
OVER HANG REVERSE SWEPT PATH
WHEEL TRACK REVERSE SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
A	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacted		

AMENDMENTS

CLIENT
Comhairle nan Eilean Siar

PROJECT
LOCHMADDY FERRY TERMINAL UPGRADE WORKS

Wallace Stone
CONSULTING CIVIL ENGINEERS
GLASGOW 0141 554 8233 glasgow@wallacestone.co.uk
DINGWALL 01349 866775 dingwall@wallacestone.co.uk
HEBRIDES 01851 612454 hebrides@wallacestone.co.uk

DRAWING TITLE
LONG RIGID VEHICLE SWEPT PATH – MAIN ROAD EAST TO MARSHALLING AREA

DRAWN	CHECKED	APPROVED
Redacted		
DATE: 22.05.18	DATE: 22.05.18	DATE: 22.05.18

SCALE (A1) 1:250
STAGE: INFORMATION
REVISION: A

PROJECT No. 1975
DRAWING No. 965

TOTAL CAPACITY OF EXISTING LAYOUT = 110 VEHICLES

TOTAL CAPACITY OF PROPOSED LAYOUT (EXCLUDING HARDSTANDING AREA)= 198 VEHICLES

VEHICLE CAPACITIES			
VESSEL	CAR CAPACITY	EXISTING	PROPOSED
NEW DUAL FUEL FERRY	135	81%	146%
MV HEBRIDES	98	112%	202%
MV ISLE OF LEWIS	114	96%	174%

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

- OVER HANG SWEPT PATH
- WHEEL TRACK SWEPT PATH
- OVER HANG REVERSE SWEPT PATH
- WHEEL TRACK REVERSE SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
A	19.03.19	LAYOUT AND SWEPT PATHS REVISED	Redacted		

AMENDMENTS

CLIENT: Comhairle nan Eilean Siar

PROJECT: LOCHMADDY FERRY TERMINAL UPGRADE WORKS

Wallace Stone
CONSULTING CIVIL ENGINEERS
GLASGOW 0141 554 8233 glasgow@wallacestone.co.uk
DINGWALL 01349 866775 dingwall@wallacestone.co.uk
HEBRIDES 01851 612454 hebrides@wallacestone.co.uk

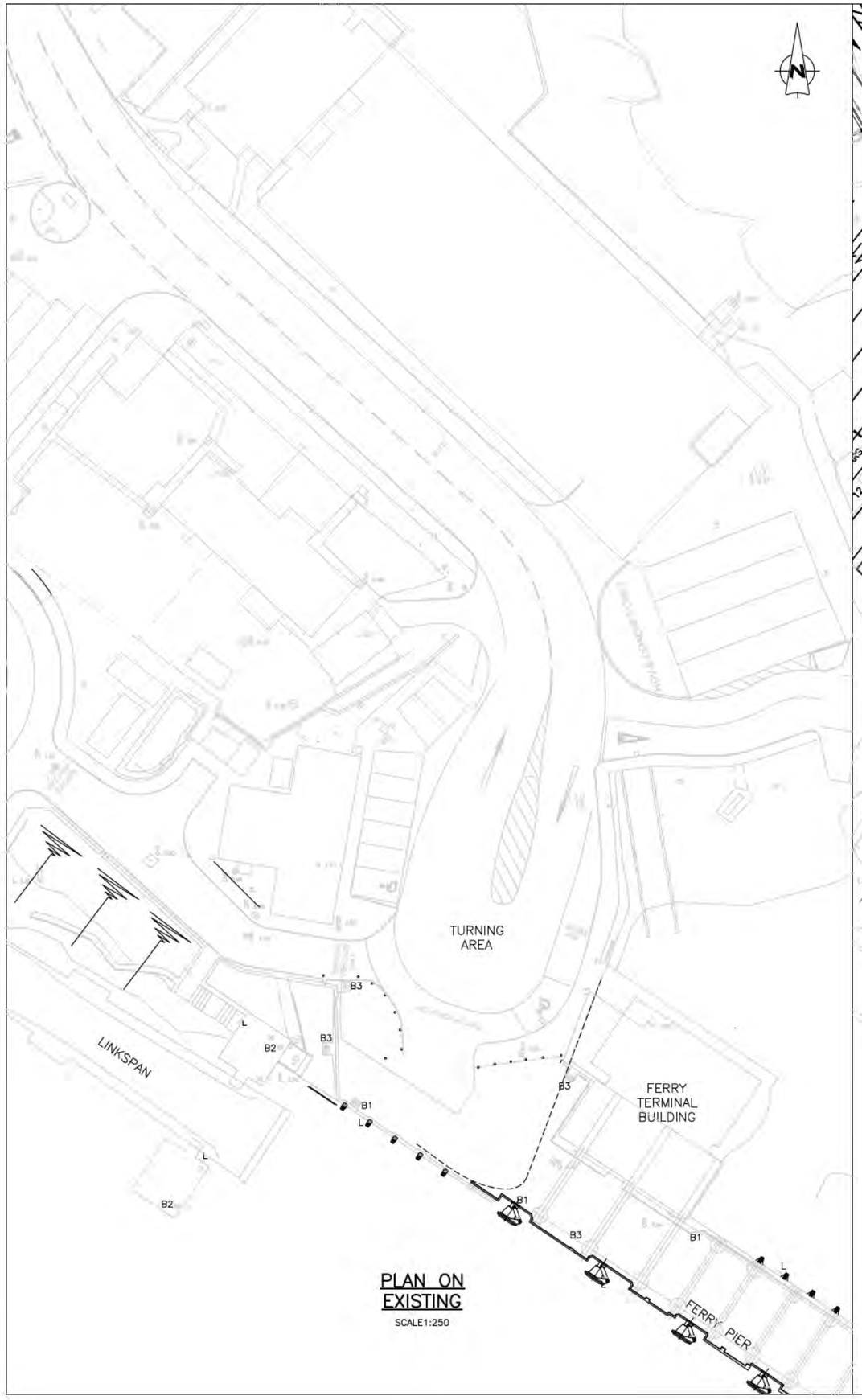
DRAWING TITLE: LONG RIGID VEHICLE SWEPT PATH – MAIN ROAD EAST TO PIER

DRAWN	CHECKED	APPROVED
Redacted		
DATE 22.05.18	DATE 22.05.18	DATE 22.05.18

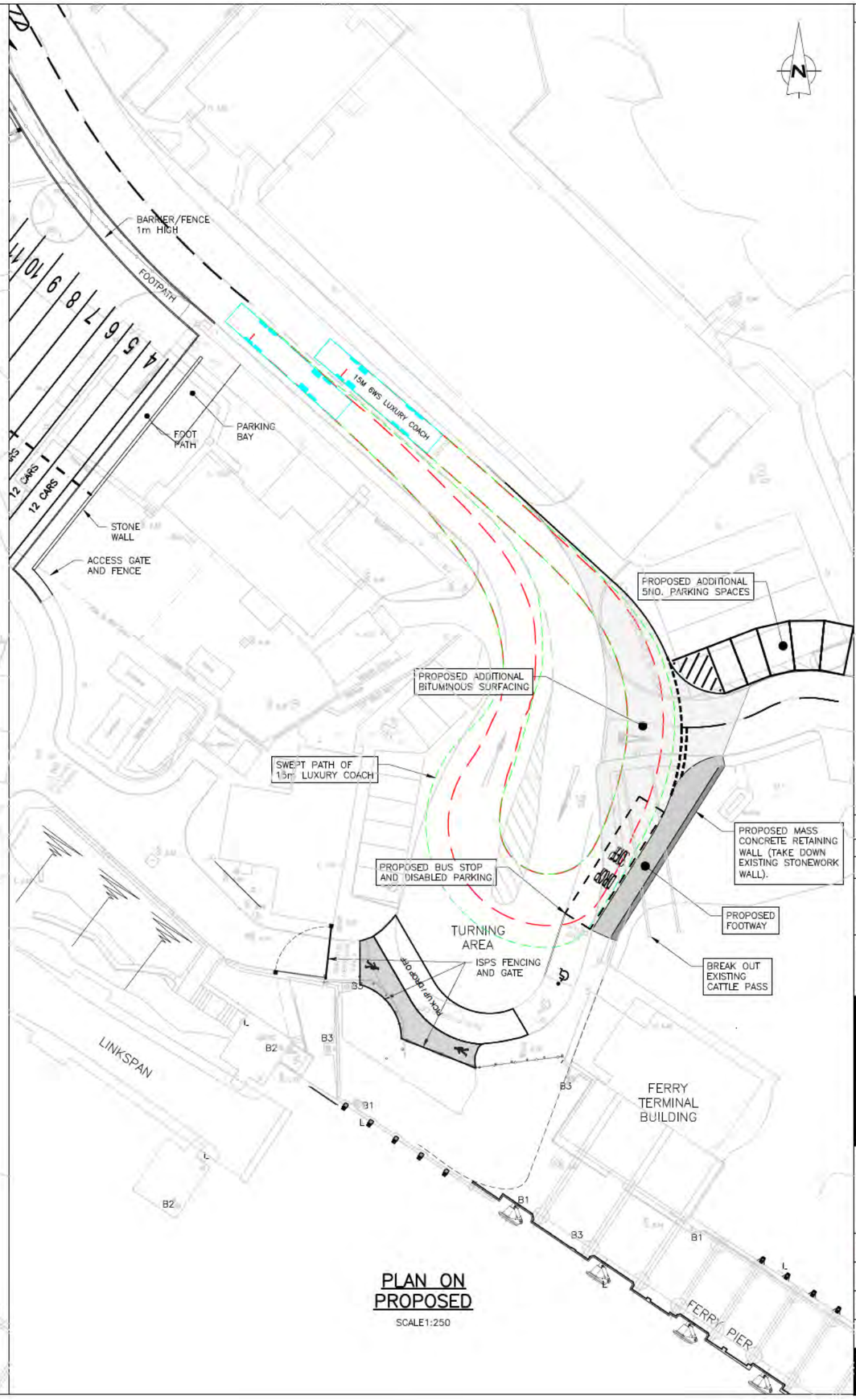
SCALE (A1) 1:250 STAGE INFORMATION

REVISION A

PROJECT No. 1975 DRAWING No. 966



PLAN ON EXISTING
SCALE1:250



PLAN ON PROPOSED
SCALE1:250

GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m
5. VEHICLE CAPACITIES ASSESSED USING NOMINAL VEHICLE LENGTH OF 4.5m.
6. IF A 5.0m NOMINAL VEHICLE LENGTH IS ASSUMED:
   EXISTING LAYOUT = 96 VEHICLES
   PROPOSED LAYOUT = 177 VEHICLES

LEGEND

OVER HANG SWEPT PATH

WHEEL TRACK SWEPT PATH

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D
A	25.03.19	PROPOSED LAYOUT UPDATED	Redacted		

AMENDMENTS

CLIENT
Comhairle nan Eilean Siar

PROJECT
LOCHMADDY FERRY TERMINAL UPGRADE WORKS

Wallace Stone
CONSULTING CIVIL ENGINEERS
GLASGOW 0141 554 8233 glasgow@wallacestone.co.uk
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HEBRIDES 01851 612454 hebrides@wallacestone.co.uk

DRAWING TITLE
15m LUXURY COACH SWEPT PATH – MAIN ROAD U–TURN

DRAWN	CHECKED	APPROVED
Redacted		
DATE 18.07.18	DATE 18.07.18	DATE 18.07.18

SCALE (A1) AS SHOWN
STAGE INFORMATION
REVISION A

PROJECT No. 1975
DRAWING No. 967

Appendix M.1: Vibrocore & Benthic Habitat Survey

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Aspect
Land+Hydrographic Surveys
CHARTERED SURVEYORS

TEL: 01294 313 399 • WEB: WWW.ASPECTSURVEYS.COM

VIBROCORE & BENTHIC HABITAT SURVEY

LOCHMADDY FERRY TERMINAL, NORTH UIST

APRIL 2018

PROJECT REF: A6555

REV: 00

Client:

Caledonian Maritime Assets Ltd
Municipal Buildings
Fore Street
Port Glasgow
PA14 5EQ

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

ices Approved Development Partner

Achilles®

QAS INTERNATIONAL ISO 9001:2008 REGISTERED FIRM

QAS INTERNATIONAL ISO 14001:2004 REGISTERED FIRM

QAS INTERNATIONAL BS OHSAS 18001:2007 REGISTERED FIRM

LIST OF CONTENTS

LIST OF FIGURES

DOCUMENT ISSUE RECORD

DATE	REVISON	COMPILED	CHECKED	NOTES
17/04/2018	00	Redacted	Redacted	FIRST ISSUE

1. INTRODUCTION

Aspect Land & Hydrographic Surveys Ltd (herein ALHS) were contracted by Caledonian Maritime Assets Ltd [herein CMAL] to carry out benthic survey and sediment sampling using video transects, grab samples and vibrocores. The Vibrocores will be reported in this document and the Benthic video and grab analysis will be reported under separate cover by APEM Ltd who carried out the analysis on this section of the work.

CMAL is in the process of planning and design for modifications to the existing pier infrastructure at Lochmaddy, North Uist to accommodate the arrival of a new, larger vessel on the route.

There is therefore a requirement to deepen areas around the terminal which necessitates dredging, which will have an impact on the local marine ecological environment.

The vibrocore survey was designed to provide core samples for analysis in order to understand the sediment type sub seabed and also to allow laboratory analysis in order to obtain dredging consent and to inform options on whether the material to be dredged could be used as infill in areas to be reclaimed.

The subtidal benthic ecology survey was undertaken by combined video survey and sediment grab survey. The video survey was used to ground-truth existing geophysical survey work conducted and also to inform the location of the grab sample locations.

2. GEODESY & DATUM

The horizontal datum used throughout the data gathering phase of the survey was OSGB36 (OSTN15). Data has been rendered in OSGB36 Datum, British National Grid.

The vertical datum for all bathymetric data is Chart Datum which at Lochmaddy, North Uist is 2.59m below OD. OSTN15 defines OSGB36 National Grid in conjunction with the National GPS Network.

In this regard OSTN15 can be considered error free (not including any GPS positional errors). The agreement between OSTN15 and the old triangulation network stations (down to 3rd order) is 0.1m rms.

3. SCOPE OF WORKS

The upgrading works require the completion of an EIA and to inform this assessment a benthic survey and a sampling / vibrocore survey, with associated testing and reporting, was necessary.

The vibrocore sampling and testing procedures conformed to Marine Scotland Guidance notes http://www.gov.scot/Topics/marine/Licensing/marine/Applications/predredge
All analysis was completed by a laboratory accredited to the ISO17025 standard for marine sediment analysis, and also engages in inter-comparison analysis exercises such as QUASIMEME. The LOD and sensitivity requirements were met as per those set out in the CSEMP Green Book.
The order of events on site was:

- Vibrocoring
- Benthic Video Transects
- Benthic Grab sampling

Conduct of the Vibrocoring first at Lochmaddy allowed the smooth transition into the second stage work at Tarbert in Harris with minimum personnel and equipment down time on the project.

Vibrocore sampling was to be carried out in the areas depicted in Figure 1 below. Vibrocore locations 1 to 4 were planned initially with 5-8 being added during the deployment in order to provide further detail around the location of the dolphin / round head.

The first four were sample and, described on site with the top, middle and bottom sections sent to the laboratory for analysis. The additional four were described on site and have not been retained.

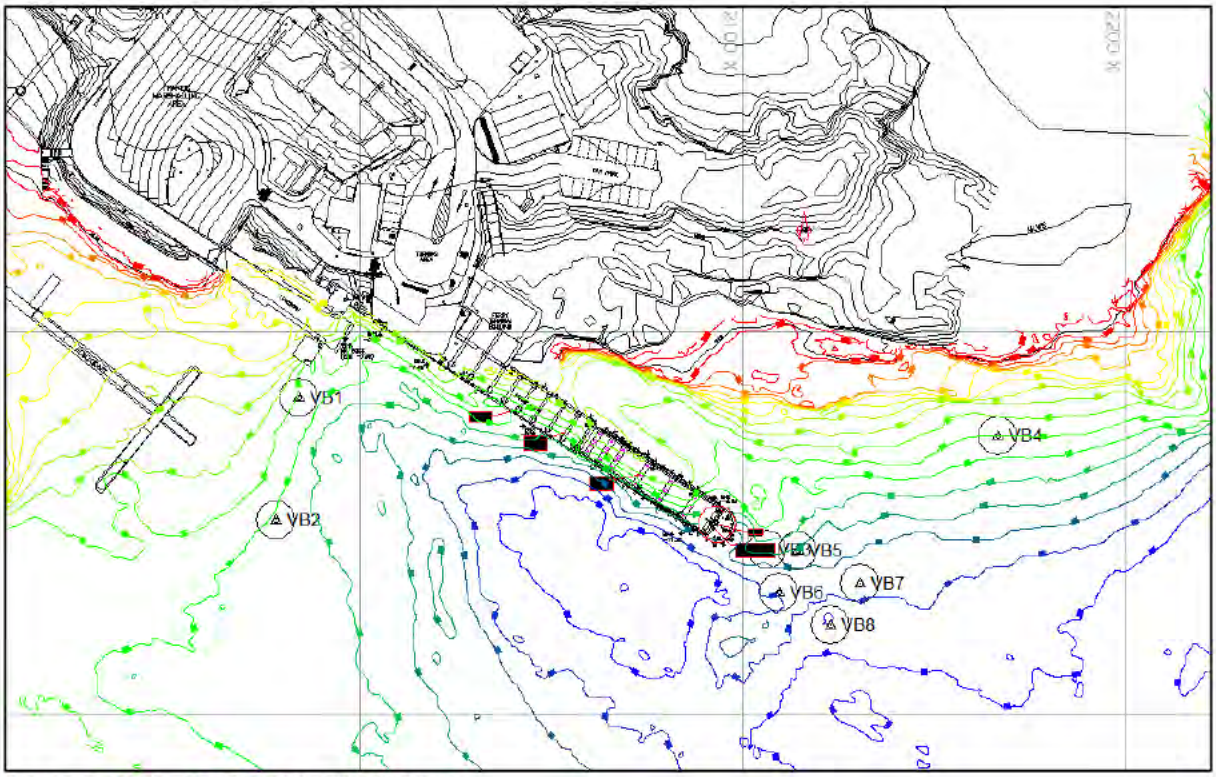

FIGURE 1 - INTENDED VIBROCORE LOCATIONS

All cores were cut to 3m maximum length. One vibrocore sample was retained at each of VB1-4.

4. SEQUENCE OF EVENTS

Works were completed in the following order to maximise productivity and minimise personnel and equipment down time.

DATE	EVENT
4 April 2018	Travel to Lochmaddy, North Uist and mobilise Remote Sensor. Mobilise and test Vibrocore for following day.
5 April 2018	Vibrocore survey VB1-4 and sampling. All Vibrocores sampled and sub samples frozen. Drop down camera mobilisation commenced
6 April 2018	Weather day Camera mobilisation continued. Camera found to be inoperative / STR Engineer ordered replacement camera after investigation with manufacturer. Mobilise Day Grab to allow sampling to be progressed until replacement camera arrived on site
7 April 2018	Grab Sampling and additional vibrocore sampling. Replacement Camera arrived on site. Drop down camera mobilised and tested.
8 April 2018	Video camera survey.

5. CONDUCT OF VIBROCORE SAMPLING

The SDI 4D lightweight vibrocore was used for the work. This system relies on fluidisation of the material immediately around the 76mm diameter aluminium sampling tube in order to advance the core into the seabed rather than overall mass.

The vessel was manoeuvred to each of the locations in turn and anchored fore and aft to avoid swinging during the sampling operation. The portability and simplicity of this equipment facilitates rapid deployment at an alternate location should the previous location provide a poor return.

The aim was to collect 4 cores distributed around the site. The cores were to be up to 3m in length, from sample points indicated on Figure 1 as VB 1-4. VB 5-8 were added while on site in order to provide more information around the planned location of the new round head.

The sediment was pushed out of the core tube prior to sampling the cores and then sampled with care being taken not to sample material that had come into contact with the sample tube wall. Each sample core VB1-4 was sub sampled for analysis.

Samples were sent to the laboratory for analysis from the top, middle and bottom of each of VB1-4. The remainder of these cores has been retained in case further analysis is required. VB 5-8 were described on site with the depth of penetration being recorded to allow an understanding of both the material type and minimum depth of overburden at each of these locations.

FIGURE 2 - VIBROCORE DEPLOYED ON REMOTE SENSOR

All vibrocore locations were sampled on 5th & 7th April 2018 as follows. Full details are in the Core logs that follow in section 6:

VIBROCORE POINT	SAMPLED EASTING	SAMPLED NORTHING	CORE LENGTH
VB1_1	91989.7	867980.5	2.14m
VB2_1	91975.9	867949.8	2.85m
VB3_1	92100.8	867945.7	0.45m
VB3_3	92084.7	867946.2	0.30m
VB4_1	92166.1	867967.2	2.10m
VB5_1	92116.8	867939.6	2.90m
VB6_1	92111.7	867933.0	1.70m
VB7_1	92130.5	867934.2	2.55m
VB8_1	92123.5	867925.7	2.10m

FIGURE 3 - SDI D-4 VIBROCORER ON DECK

6. SAMPLE ANALYSIS

Samples were split and described on site as follows.

Sample ID	1_1	Location ID	A6555
Collection Date / Time	05/04/2018 08:13	Weather	Sunny, little wind
Water Depth	4.5m	Sampler Name	Red
Easting	91989.7	Northing	867980.5
Latitude (ETRS89)	57° 35' 46.746	Longitude (ETRS89)	7° 9' 26.900

Notes on Sampling

Core length achieved 2.14m

1_1_1
Sub Sample Depth 0.0-0.5m
Green/Brown Silt & broken shell.
2.5Y3/2.
.

Laboratory PSD

Gravel	Sand	Silt
0.3%	16.6%	83.1%

1_1_2
Sub Sample Depth 0.5-1.0m
Green/Brown Silt & small amount of broken shell.
2.5Y3/2.

Laboratory PSD		
Gravel	Sand	Silt
0.3%	13.3%	86.4%

1_1_3
Sub Sample Depth 1.0-1.5m
Retained in pale

1_1_4
Sub Sample Depth 1.5-2.14m
Green/Brown Silt & small amount of broken shell.
2.5Y3/2.

Laboratory PSD		
Gravel	Sand	Silt
0%	14.7%	85.3%

Sample ID	2_1	Location ID	A6555
Collection Date / Time	05/04/2018 10:01	Weather	Sunny, little wind
Water Depth	4.5m	Sampler Name	Red
Easting	91975.9	Northing	867949.8
Latitude (ETRS89)	57° 35' 45.723	Longitude (ETRS89)	7° 9' 27.588

Notes on Sampling

Core length achieved 2.85m

2_1_1
Sub Sample Depth 0.0-0.5m
Silt, some organic matter and broken shell.Stiffer past 0.25m and lower shell content.
5YR3/1.

Laboratory PSD

Gravel	Sand	Silt
4.9%	36.8%	58.3%

2_1_2
Sub Sample Depth 0.5-1.0m
Retained in pale.

2_1_3
Sub Sample Depth 1.0-1.5m
Silt with broken shell and small amounts of organic matter. Stiffer with depth.
5YR3/1.

Laboratory PSD		
Gravel	Sand	Silt
1.7%	26.5%	71.8%

2_1_4
Sub Sample Depth 1.5-2.0m
Retained in pale.

2_1_5
Sub Sample Depth 2.0-2.3m
Retained in pale.

2_1_6
Sub Sample Depth 2.3-2.85m
Silt and broken shell.
2.5Y3/1.

Laboratory PSD		
Gravel	Sand	Silt
0%	10.8%	89.2%

Sample ID	3_1	Location ID	A6555
Collection Date / Time	05/04/2018 10:29	Weather	Sunny, little wind
Water Depth	5.5m	Sampler Name	Red
Easting	92100.8	Northing	867945.7
Latitude (ETRS89)	57° 35' 45.898	Longitude (ETRS89)	7° 9' 20.077

Notes on Sampling

Core length achieved 0.45m

3_1_1
Sub Sample Depth 0.0-0.45m
small-medium gravel, coarse sand and abundant broken shell. Medium gravel block at base. 10YR3/3.

Multiple attempts in and around this location at the end of the existing pier resulted in little penetration due to the coarse nature of the seabwed and the predominance of medium gravel that blocked the core tube and prevented liquificaiton of the sediment.

Laboratory PSD

Gravel	Sand	Silt
58.8%	23.4%%	17.8%

Sample ID	3_3	Location ID	A6555
Collection Date / Time	05/04/2018 12:24	Weather	Sunny, little wind
Water Depth	6.2m	Sampler Name	Red
Easting	92084.7	Northing	867946.2
Latitude (ETRS89)	57° 35' 45.874	Longitude (ETRS89)	7° 9' 21.045

Notes on Sampling

Core length achieved 0.3m

3_3_1
Sub Sample Depth 0.0-0.3m
Dark brown silt and medium gravel, fluid mud and broken shell.

This core also retained at location VB3 to allow sufficient material to allow all sampling analysis to be carried out at this location. The base of the core was vlocked and further penetration prevented by medium gravel.

Laboratory PSD

Gravel	Sand	Silt
58.8%	19.8%	21.4%

Sample ID	4_1	Location ID	A6555
Collection Date / Time	05/04/2018 12:39	Weather	Sunny, little wind
Water Depth	4.5m	Sampler Name	Red
Easting	92166.1	Northing	867967.2
Latitude (ETRS89)	57° 35' 46.750	Longitude (ETRS89)	7° 9' 16.254

Notes on Sampling

Core length achieved 2.1m

4_1_1
Sub Sample Depth 0.0-0.6m
Mud, fine sand and broken shell.
10YR3/2.

Laboratory PSD		
Gravel	Sand	Silt
7%	37.2%	55.9%

4_1_2
Sub Sample Depth 0.6-1.1m
Silt, mud and fine sand to 0.75m
then fine sand, broken shell and silt.
10YR3/2 to 0.75m then 10YR4/2

Laboratory PSD		
Gravel	Sand	Silt
11.2%	36.2%	52.5%

4_1_3
Sub Sample Depth 1.1-1.6m
Retained in pale.

4_1_4
Sub Sample Depth 1.6-2.1m
Mud, fine sand and broken shell. Small-medium gravel increasing in prevalence with depth
5Y4/1

Laboratory PSD		
Gravel	Sand	Silt
24.5%	28.3%	47.2%

Sample ID	5_1	Location ID	A6555
Collection Date / Time	07/04/2018 14:16	Weather	Clear, slight wind
Water Depth	5.9m	Sampler Name	Red
Easting	92116.8	Northing	867939.6
Latitude (ETRS89)	57° 35' 45.740	Longitude (ETRS89)	7° 9' 19.090

Notes on Sampling

Core length achieved 2.9m

Green/Brown Mud broken shell

Sample ID	6_1	Location ID	A6555
Collection Date / Time	07/04/2018 14:20	Weather	Clear, slight wind
Water Depth	6.3m	Sampler Name	Red
Easting	92111.7	Northing	867933.0
Latitude (ETRS89)	57° 35' 45.515	Longitude (ETRS89)	7° 9' 19.365

Notes on Sampling

Core length returned 1.7m

Green/Brown Silt, small amount of broken shell

Sample ID	7_1	Location ID	A6555
Collection Date / Time	07/04/2018 14:41	Weather	Clear, slight wind
Water Depth	6.3m	Sampler Name	Red
Easting	92134.5	Northing	867933.6
Latitude (ETRS89)	57° 35' 45.600	Longitude (ETRS89)	7° 9' 18.0

Notes on Sampling

Core length achieved 2.55m

Green/Brown Mud, broken shell, shell

Sample ID	8_1	Location ID	A6555
Collection Date / Time	07/04/2018 14:58	Weather	Clear, slight wind
Water Depth	6.5m	Sampler Name	Red
Easting	92123.5	Northing	867925.7
Latitude (ETRS89)	57° 35' 45.310 N	Longitude (ETRS89)	7° 9' 18.625 W

Notes on Sampling

Core length achieved 2.1m

Green/Brown Mud, some broken shell

The laboratory analysis was carried out by SOCOTEC. Each sub sample detailed in VB1-4 above has been analysed for Particle Size, Metals, WAC and Chemicals. The sample analysis is reported in the standard Marine Scotland format under separate cover that accompanies this report.

The samples have been analysed against the Action Levels quoted by Marine Scotland and are presented in the standard Marine Scotland spreadsheet format:

A6555_Lochmaddy_Pre-disposal Sampling Results Form_MAR00028.xlsx.

Details on the analysis of individual items are also provided in the accompanying laboratory records for each sample.

7. SURVEY VESSEL

ALHS' MCA Cat III survey vessel *Remote Sensor* was mobilised for the survey operations. The ability to achieve rapid mobilisation with this vessel meant that short weather windows could be taken advantage at this time of year when suitable longer weather windows to mobilise a larger vessel are limited.

The shallow draught and high manoeuvrability of *Remote Sensor* made it ideal for operating in the survey area which was both shallow and navigationally constrained. The vessel was transported to Lochmaddy by road and launched at the Marine Harvest slipway.

FIGURE 4 - ALHS' SURVEY VESSEL REMOTE SENSOR

8. SURVEY PERSONNEL

The following personnel were involved in the survey:

NAME	POSITION
Redacted	

All staff have marine survey experience, and adhered to Health & Safety instructions, including the wearing of life jackets at all times. All personnel participated in an induction to the vessel and toolbox talks on the conduct of all aspects of the operation prior to commencement of the work.

Annex A

Horizontal & Vertical Positioning System Precision

A6555

Differential GNSS Positioning Precision

	HORIZONTAL ACCURACY
dGPS	±0.5m + 1ppm RMS

Annex B
Standard Disclaimer

A6555

1. All client-supplied data is taken on trust as being accurate and correct, and the subcontractor cannot be held responsible for the quality and accuracy of that data set.

2. Geophysical interpretation of bathymetry and sonar is based on an informed opinion of the supplied data, and is subject to inherent errors out with the control of the interpretational hydrographer or geophysicist, which include but are not limited to GPS positioning errors, navigation busts, data quality, assumed speed velocity sediment profiles in the absence of Geotechnical data, sub bottom profile pulse width, and induced scaling errors therein associated with seismic signature. Seabed geomorphology and sub-seabed geology should be further investigated by visual or intrusive methods.

3. The limits of this survey are defined by the data set; out with the survey limits are not covered at any level by the subcontractor.

4. The data is accurate at the time of data acquisition, the subcontractor cannot be held responsible for environmental changes, and the client by accepting this report accepts that the environment of the seabed is subject to continuous change, that items of debris, hard contacts etc. may move, appear, be relocated or removed, thickness of surficial sediment change out with the knowledge of the subcontractor and they will not be held responsible for such actions at any level.

Annex C
Laboratory Analysis

A6555

TEST REPORT

UKAS TESTING
1252

Report No. EFS/185119 (Ver. 1)

SOCOTEC UK Limited Bretby (Marine)
Derwent House
Bretby Business Park
Ashby Road
Burton Upon Trent
Staffordshire
DE15 0YZ

Site: MAR00027

The 14 samples described in this report were registered for analysis by SOCOTEC UK Limited on 24-Apr-2018. This report supersedes any versions previously issued by the laboratory.
The analysis was completed by: 09-May-2018

The following tables are contained in this report:

Redacted

Date of Issue: 09-May-2018

Tests marked '^' have been subcontracted to another laboratory.
Where samples have been flagged as deviant on the Analytical and Deviating Sample Overview, for any reason, the data may not be representative of the sample at the point of sampling and the validity of the data may be affected.
SOCOTEC UK Limited accepts no responsibility for any sampling not carried out by our personnel.

			Units :	Mol/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
			Method Codes :	ANC	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	BTEXHSA	LOI(%MM)	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS
			Method Reporting Limits :	0.04	10	10	20	20	10	10	30	0.2	0.08	0.08	0.08	0.08	0.08	0.08	0.08
LAB ID Number CL/	Client Sample Description	Sample Date		Acid Neut. Capacity	Benzene	Ethyl Benzene	m/p Xylenes	MTBE	o Xylene	Toluene	Xylenes	L.O.I. % @ 450C	Acenaphthene	Acenaphthylene	Anthracene	Benzo(a)anthracene	Benzo(a)pyrene	Benzo(b)fluoranthene	Benzo(ghi)perylene
1901907	A6555 1_1_1	05-Apr-18		1.52	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	8.1	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
1901908	A6555 1_1_2	05-Apr-18		2.64	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	7.7	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
1901909	A6555 1_1_4	05-Apr-18		1.60	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	8.0	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
1901910	A6555 2_1_1	05-Apr-18		4.08	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	7.2	< 0.08	< 0.08	0.09	0.20	0.13	0.16	< 0.08
1901911	A6555 2_1_3	05-Apr-18		2.16	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	7.2	< 0.08	< 0.08	< 0.08	0.17	0.14	0.15	< 0.08
1901912	A6555 2_1_6	05-Apr-18		0.40	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	5.6	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
1901913	A6555 3_1_1	05-Apr-18		5.36	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	3.2	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
1901914	A6555 3_3_1	05-Apr-18		2.00	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	4.0	< 0.08	< 0.08	< 0.08	0.09	< 0.08	0.09	< 0.08
1901915	A6555 4_1_1	05-Apr-18		4.40	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	5.1	0.09	< 0.08	0.22	0.30	0.20	0.26	0.08
1901916	A6555 4_1_2	05-Apr-18		6.72	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	4.9	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
1901917	A6555 4_1_4	05-Apr-18		4.48	< 10.0	< 10.0	< 20.0	< 20.0	< 10.0	< 10.0	<30	3.4	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
1901919	QC Blank			<0.04	<10	<10	<20	<20	<10	<10	<30		< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08
1901920	Reference Material (% Recovery)			98	96	97	99	102	99	95	99	98	105	107	104	106	108	95.3	86.1

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Client Name	SOCOTEC UK Limited Bretby (Marine)
Contact	Redacted

Sample Analysis

MAR00027

Date Printed	08-May-2018
Report Number	EFS/185119
Table Number	1

Units :			mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	µg/kg	µg/kg	µg/kg	µg/kg	µg/kg
Method Codes :			PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PAHMSUS	PCBECD	PCBECD	PCBECD	PCBECD	PCBECD
Method Reporting Limits :			0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	1.28	5	5	5	5	5
LAB ID Number CL/	**Client Sample Description**	**Sample Date**	**Benzo(k)fluoranthene**	**Chrysene**	**Coronene**	**Dibenzo(ah)anthracene**	**Fluoranthene**	**Fluorene**	**Indeno(123-cd)pyrene**	**Naphthalene**	**Phenanthrene**	**Pyrene**	**Total PAH (Sum of USEPA 16)**	**PCB 101**	**PCB 118**	**PCB 138**	**PCB 153**	**PCB 180**
1901907	A6555 1_1_1	05-Apr-18	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 1.28	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901908	A6555 1_1_2	05-Apr-18	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 1.28	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901909	A6555 1_1_4	05-Apr-18	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 1.28	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901910	A6555 2_1_1	05-Apr-18	< 0.08	0.18	< 0.08	< 0.08	0.31	< 0.08	< 0.08	< 0.08	0.14	0.26	< 2.11	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901911	A6555 2_1_3	05-Apr-18	< 0.08	0.13	< 0.08	< 0.08	0.18	< 0.08	< 0.08	< 0.08	0.09	0.25	< 1.84	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901912	A6555 2_1_6	05-Apr-18	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 1.28	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901913	A6555 3_1_1	05-Apr-18	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 1.28	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901914	A6555 3_3_1	05-Apr-18	< 0.08	0.09	< 0.08	< 0.08	0.17	< 0.08	< 0.08	< 0.08	0.13	0.14	< 1.52	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901915	A6555 4_1_1	05-Apr-18	0.11	0.29	< 0.08	< 0.08	0.68	0.09	0.09	< 0.08	0.66	0.51	< 3.81	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901916	A6555 4_1_2	05-Apr-18	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 1.28	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901917	A6555 4_1_4	05-Apr-18	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 1.28	< 5.00	< 5.00	< 5.00	< 5.00	< 5.00
1901919	QC Blank		< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 0.08	< 1.28	<5.00	<5.00	<5.00	<5.00	<5.00
1901920	Reference Material (% Recovery)		90.0	101	92.6	93.4	101	105	109	106	100	102	101	87	90	84	89	75

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Client Name	**SOCOTEC UK Limited Bretby (Marine)**
Contact	Redacted

Sample Analysis

MAR00027

Date Printed	**08-May-2018**
Report Number	**EFS/185119**
Table Number	**1**

		Units :	µg/kg	µg/kg	pH Units	%	mg/kg	mg/kg	% M/M									
		Method Codes :	PCBECD	PCBECD	PHSOIL	TMSS	TPHFIDUS	TPHFIDUS	WSLM59									
		Method Reporting Limits :	5	5		0.1	10	10	0.02									
LAB ID Number CL/	**Client Sample Description**	**Sample Date**	**PCB 28**	**PCB 52**	**pH units (AR)**	**Tot.Moisture @ 105C**	**TPH Band (>C10-C40)**	**TPH by GCFID (AR)**	**Total Organic Carbon**									
1901907	A6555 1_1_1	05-Apr-18	< 5.00	< 5.00	7.6	86.8	31.8	37.2	3.14									
1901908	A6555 1_1_2	05-Apr-18	< 5.00	< 5.00	7.6	54.6	30.3	35.3	2.62									
1901909	A6555 1_1_4	05-Apr-18	< 5.00	< 5.00	7.6	85.9	30.2	35.5	3.31									
1901910	A6555 2_1_1	05-Apr-18	< 5.00	< 5.00	7.9	46.9	35.5	40.5	2.78									
1901911	A6555 2_1_3	05-Apr-18	< 5.00	< 5.00	8.1	45.5	56.3	61.1	2.08									
1901912	A6555 2_1_6	05-Apr-18	< 5.00	< 5.00	7.9	51.7	23.9	28.2	2.04									
1901913	A6555 3_1_1	05-Apr-18	< 5.00	< 5.00	8.1	24.4	61.0	65.7	1.93									
1901914	A6555 3_3_1	05-Apr-18	< 5.00	< 5.00	8	23.2	29.9	34.8	3.53									
1901915	A6555 4_1_1	05-Apr-18	< 5.00	< 5.00	8	37.6	22.4	27.6	1.67									
1901916	A6555 4_1_2	05-Apr-18	< 5.00	< 5.00	8.1	33.3	17.9	23.4	1.35									
1901917	A6555 4_1_4	05-Apr-18	< 5.00	< 5.00	8.2	26.9	10.5	16.4	0.80									
1901919	QC Blank		<5.00	<5.00			<10	<10	<0.02									
1901920	Reference Material (% Recovery)		80	90	101		92	92	102									

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Client Name SOCOTEC UK Limited Bretby (Marine)

Contact Redacted

Sample Analysis

MAR00027

Date Printed	**08-May-2018**
Report Number	**EFS/185119**
Table Number	**1**

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.479
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	86.8
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00027				Volume of water required to carry out 2:1 stage (litres)	0.196
					Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 1_1_1		s18_5119	CL/1901907	09-May-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	15.03	3	5	6
N	LOI450	Loss on Ignition (%)	38.8			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.4547	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.266	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	240.9	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<10.30	100		
N	PHSOIL	pH (pH units)	7.6		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	7.28		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.6	8.1	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	22900	3750					
U	ICPMSW	Arsenic	0.015	0.009	0.03	0.1	0.5	2	25
U	ICPWATVAR	Barium	0.02	<0.01	0.04	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.003	0.004	0.006	0.04	0.5	10	70
U	ICPMSW	Copper	0.002	<0.001	0.004	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.499	0.12	0.998	1.71	0.5	10	30
U	ICPMSW	Nickel	0.002	0.003	0.004	0.03	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.001	<0.001	0.002	<0.01	0.06	0.7	5
U	ICPMSW	Selenium	0.028	0.006	0.056	0.09	0.1	0.5	7
U	ICPMSW	Zinc	0.004	0.01	0.008	0.09	4	50	200
U	KONENS	Chloride	9060	1070	18120	21353	800	15000	25000
U	ISEF	Fluoride	0.8	0.6	1.6	6	10	150	500
U	ICPWATVAR	Sulphate as SO4	1180	333	2360	4459	1000	20000	50000
N	WSLM27	Total Dissolved Solids	17800	2920	35600	49040	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	28	27	56	271	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/2

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.200
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	54.6
					Equivalent Weight based on drying at 105°C (kg)	0.090
Site	MAR00027				Volume of water required to carry out 10:1 stage (litres)	0.790
					Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 1_1_2		s18_5119	CL/1901908	09-May-18		

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	3.58	3	5	6
N	LOI450	Loss on Ignition (%)	10.5			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.1321	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.077	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	66.7	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<3.00	100		
N	PHSOIL	pH (pH units)	7.6		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	3.61		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	10:1 Single Stage Leachate	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/2 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº	mg/kg (dry weight)			
U	WSLM3	pH (pH units) ºº	7.7	Calculated data not UKAS Accredited			
U	WSLM2	Conductivity (µs/cm) ºº	7650				
U	ICPMSW	Arsenic	0.004	0.04	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.001	0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.292	2.92	0.5	10	30
U	ICPMSW	Nickel	0.001	0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.001	0.01	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	<0.02	4	50	200
U	KONENS	Chloride	2440	24400	800	15000	25000
U	ISEF	Fluoride	0.5	5	10	150	500
U	ICPWATVAR	Sulphate as SO4	720	7200	1000	20000	50000
N	WSLM27	Total Dissolved Solids	5970	59700	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	19	190	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

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Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.433
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	85.9
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00027				Volume of water required to carry out 2:1 stage (litres)	0.242
					Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 1_1_4		s18_5119	CL/1901909	09-May-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	14.99	3	5	6
N	LOI450	Loss on Ignition (%)	36.2			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.4254	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.245	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	214.2	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<9.65	100		
N	PHSOIL	pH (pH units)	7.6		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	7.25		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8	8	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	21300	3250					
U	ICPMSW	Arsenic	0.031	0.014	0.062	0.16	0.5	2	25
U	ICPWATVAR	Barium	0.02	<0.01	0.04	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.004	0.005	0.008	0.05	0.5	10	70
U	ICPMSW	Copper	0.002	0.001	0.004	0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.099	0.058	0.198	0.63	0.5	10	30
U	ICPMSW	Nickel	0.002	0.002	0.004	0.02	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	<0.001	<0.001	<0.002	<0.01	0.06	0.7	5
U	ICPMSW	Selenium	0.029	0.005	0.058	0.08	0.1	0.5	7
U	ICPMSW	Zinc	0.003	<0.002	0.006	<0.02	4	50	200
U	KONENS	Chloride	8570	912	17140	19331	800	15000	25000
U	ISEF	Fluoride	0.8	0.6	1.6	6	10	150	500
U	ICPWATVAR	Sulphate as SO4	1110	449	2220	5371	1000	20000	50000
N	WSLM27	Total Dissolved Solids	16600	2540	33200	44147	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	29	22	58	229	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

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Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/2

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.173
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	46.9
					Equivalent Weight based on drying at 105°C (kg)	0.090
Site	MAR00027				Volume of water required to carry out 10:1 stage (litres)	0.817
					Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 2_1_1		s18_5119	CL/1901910	09-May-18		

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	3.31	3	5	6
N	LOI450	Loss on Ignition (%)	8.6			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.1129	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.063	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	66.9	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<4.12	100		
N	PHSOIL	pH (pH units)	7.9		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	4.85		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	10:1 Single Stage Leachate	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/2 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº	mg/kg (dry weight)			
U	WSLM3	pH (pH units) ºº	8.1	Calculated data not UKAS Accredited			
U	WSLM2	Conductivity (µs/cm) ºº	5950				
U	ICPMSW	Arsenic	0.002	0.02	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.078	0.78	0.5	10	30
U	ICPMSW	Nickel	<0.001	<0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.002	0.02	0.06	0.7	5
U	ICPMSW	Selenium	<0.001	<0.01	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	<0.02	4	50	200
U	KONENS	Chloride	1860	18600	800	15000	25000
U	ISEF	Fluoride	0.6	6	10	150	500
U	ICPWATVAR	Sulphate as SO4	259	2590	1000	20000	50000
N	WSLM27	Total Dissolved Solids	4640	46400	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	11	110	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.402
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	45.5
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00027				Volume of water required to carry out 2:1 stage (litres)	0.273
					Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 2_1_3		s18_5119	CL/1901911	09-May-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	2.48	3	5	6
N	LOI450	Loss on Ignition (%)	8.6			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.1099	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.063	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	103.3	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<3.52	100		
N	PHSOIL	pH (pH units)	8.1		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	2.57		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8	8.2	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	19000	2850					
U	ICPMSW	Arsenic	0.037	0.022	0.074	0.24	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.004	0.006	0.008	0.06	0.5	10	70
U	ICPMSW	Copper	0.001	0.002	0.002	0.02	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.248	0.107	0.496	1.26	0.5	10	30
U	ICPMSW	Nickel	0.003	0.004	0.006	0.04	0.4	10	40
U	ICPMSW	Lead	<0.001	0.002	<0.002	<0.02	0.5	10	50
U	ICPMSW	Antimony	0.007	0.007	0.014	0.07	0.06	0.7	5
U	ICPMSW	Selenium	0.025	0.005	0.05	0.08	0.1	0.5	7
U	ICPMSW	Zinc	0.003	0.008	0.006	0.07	4	50	200
U	KONENS	Chloride	7450	784	14900	16728	800	15000	25000
U	ISEF	Fluoride	0.9	0.7	1.8	7	10	150	500
U	ICPWATVAR	Sulphate as SO4	1050	580	2100	6427	1000	20000	50000
N	WSLM27	Total Dissolved Solids	14800	2220	29600	38973	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	28	23	56	237	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

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Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.459
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	51.7
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00027				Volume of water required to carry out 2:1 stage (litres)	0.216
					Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 2_1_6		s18_5119	CL/1901912	09-May-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	2.67	3	5	6
N	LOI450	Loss on Ignition (%)	7.3			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.1242	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.07	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	49.5	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<2.82	100		
N	PHSOIL	pH (pH units)	7.9		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	0.52		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8	7.9	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	23000	3070					
U	ICPMSW	Arsenic	0.041	0.014	0.082	0.18	0.5	2	25
U	ICPWATVAR	Barium	0.01	<0.01	0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.005	0.006	0.01	0.06	0.5	10	70
U	ICPMSW	Copper	0.002	0.001	0.004	0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.074	0.037	0.148	0.42	0.5	10	30
U	ICPMSW	Nickel	0.003	0.003	0.006	0.03	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.001	<0.001	0.002	<0.01	0.06	0.7	5
U	ICPMSW	Selenium	0.031	0.005	0.062	0.08	0.1	0.5	7
U	ICPMSW	Zinc	0.003	0.003	0.006	0.03	4	50	200
U	KONENS	Chloride	9370	831	18740	19695	800	15000	25000
U	ISEF	Fluoride	0.9	0.7	1.8	7	10	150	500
U	ICPWATVAR	Sulphate as SO4	1090	388	2180	4816	1000	20000	50000
N	WSLM27	Total Dissolved Solids	17900	2390	35800	44580	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	27	21	54	218	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

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Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.285
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	24.4
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00027				Volume of water required to carry out 2:1 stage (litres)	0.390
					Fraction of sample above 4 mm %	23.200
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 3_1_1		s18_5119	CL/1901913	09-May-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	1.99	3	5	6
N	LOI450	Loss on Ignition (%)	3.3			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.0793	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.049	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	80.7	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<1.80	100		
N	PHSOIL	pH (pH units)	8.1		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	5.54		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	8	8	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	7910	940					
U	ICPMSW	Arsenic	0.007	0.005	0.014	0.05	0.5	2	25
U	ICPWATVAR	Barium	0.03	<0.01	0.06	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	<0.001	<0.002	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	<0.001	<0.002	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.065	0.015	0.13	0.22	0.5	10	30
U	ICPMSW	Nickel	0.001	<0.001	0.002	<0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.003	0.002	0.006	0.02	0.06	0.7	5
U	ICPMSW	Selenium	0.008	0.002	0.016	0.03	0.1	0.5	7
U	ICPMSW	Zinc	0.005	<0.002	0.01	<0.02	4	50	200
U	KONENS	Chloride	2470	208	4940	5096	800	15000	25000
U	ISEF	Fluoride	0.7	0.4	1.4	4	10	150	500
U	ICPWATVAR	Sulphate as SO4	441	90	882	1368	1000	20000	50000
N	WSLM27	Total Dissolved Solids	6170	733	12340	14579	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	13	4.5	26	56	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.292
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	23.2
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00027				Volume of water required to carry out 2:1 stage (litres)	0.383
					Fraction of sample above 4 mm %	65.600
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 3_3_1		s18_5119	CL/1901914	09-May-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	3.59	3	5	6
N	LOI450	Loss on Ignition (%)	4.1			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.078	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.049	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	38.9	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<2.1	100		
N	PHSOIL	pH (pH units)	8		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	2.03		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.9	7.9	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	7490	1220					
U	ICPMSW	Arsenic	0.006	0.003	0.012	0.03	0.5	2	25
U	ICPWATVAR	Barium	0.02	<0.01	0.04	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	<0.001	<0.001	<0.002	<0.01	0.5	10	70
U	ICPMSW	Copper	<0.001	0.001	<0.002	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.07	0.017	0.14	0.24	0.5	10	30
U	ICPMSW	Nickel	<0.001	<0.001	<0.002	<0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.002	0.001	0.004	0.01	0.06	0.7	5
U	ICPMSW	Selenium	0.008	<0.001	0.016	<0.02	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	0.006	<0.004	<0.05	4	50	200
U	KONENS	Chloride	2320	284	4640	5555	800	15000	25000
U	ISEF	Fluoride	0.7	0.4	1.4	4	10	150	500
U	ICPWATVAR	Sulphate as SO4	421	104	842	1463	1000	20000	50000
N	WSLM27	Total Dissolved Solids	5840	948	11680	16003	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	9.5	3.4	19	42	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.363
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	37.6
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00027				Volume of water required to carry out 2:1 stage (litres)	0.312
					Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 4_1_1		s18_5119	CL/1901915	09-May-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	1.88	3	5	6
N	LOI450	Loss on Ignition (%)	5.7			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.0961	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.056	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	35.9	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<6.23	100		
N	PHSOIL	pH (pH units)	8		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	4.95		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.7	8.1	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	15700	2260					
U	ICPMSW	Arsenic	0.027	0.021	0.054	0.22	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.001	0.007	0.002	0.06	0.5	10	70
U	ICPMSW	Copper	0.002	0.005	0.004	0.05	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.288	0.072	0.576	1.01	0.5	10	30
U	ICPMSW	Nickel	0.003	0.006	0.006	0.06	0.4	10	40
U	ICPMSW	Lead	<0.001	0.006	<0.002	<0.05	0.5	10	50
U	ICPMSW	Antimony	0.01	0.006	0.02	0.07	0.06	0.7	5
U	ICPMSW	Selenium	0.019	0.002	0.038	0.04	0.1	0.5	7
U	ICPMSW	Zinc	0.003	0.021	0.006	0.19	4	50	200
U	KONENS	Chloride	5510	568	11020	12269	800	15000	25000
U	ISEF	Fluoride	1.1	0.7	2.2	8	10	150	500
U	ICPWATVAR	Sulphate as SO4	854	158	1708	2508	1000	20000	50000
N	WSLM27	Total Dissolved Solids	12200	1760	24400	31520	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	27	17	54	183	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Where individual results are flagged see report notes for status.

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.326
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	33.3
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00027				Volume of water required to carry out 2:1 stage (litres)	0.349
					Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 4_1_2		s18_5119	CL/1901916	09-May-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	1.43	3	5	6
N	LOI450	Loss on Ignition (%)	5.2			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.09	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.049	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	26.8	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<2.04	100		
N	PHSOIL	pH (pH units)	8.1		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	7.11		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.7	7.9	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	12700	1710					
U	ICPMSW	Arsenic	0.067	0.07	0.134	0.7	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.002	<0.001	0.004	<0.01	0.5	10	70
U	ICPMSW	Copper	0.002	<0.001	0.004	<0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.842	0.166	1.684	2.56	0.5	10	30
U	ICPMSW	Nickel	0.006	0.003	0.012	0.03	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.018	0.007	0.036	0.08	0.06	0.7	5
U	ICPMSW	Selenium	0.014	0.003	0.028	0.04	0.1	0.5	7
U	ICPMSW	Zinc	0.003	0.006	0.006	0.06	4	50	200
U	KONENS	Chloride	4300	406	8600	9252	800	15000	25000
U	ISEF	Fluoride	1	0.6	2	7	10	150	500
U	ICPWATVAR	Sulphate as SO4	775	127	1550	2134	1000	20000	50000
N	WSLM27	Total Dissolved Solids	9910	1340	19820	24827	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	57	8.8	114	152	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

WASTE ACCEPTANCE CRITERIA TESTING
BSEN 12457/3

Client	SOCOTEC UK Limited Bretby (Marine)				**Leaching Data**	
					Weight of sample (kg)	0.326
Contact	Redacted				Moisture content @ 105°C (% of Wet Weight)	26.9
					Equivalent Weight based on drying at 105°C (kg)	0.225
Site	MAR00027				Volume of water required to carry out 2:1 stage (litres)	0.349
					Fraction of sample above 4 mm %	0.000
Sample Description		**Report No**	**Sample No**	**Issue Date**	Fraction of non-crushable material %	0.000
A6555 4_1_4		s18_5119	CL/1901917	09-May-18	Volume to undertake analysis (2:1 Stage) (litres)	0.300
					Weight of Deionised water to carry out 8:1 stage (kg)	1.650

Note: The >4mm fraction is crushed using a disc mill

Accreditation	Method Code	Solid Waste Analysis (Dry Basis)	Concentration in Solid (Dry Weight Basis)	Landfill Waste Acceptance Criteria Limit Values		
				Inert Waste Landfill	Stable Non-reactive Hazardous Waste in Non-Hazardous Landfill	Hazardous Waste Landfill
N	WSLM59	Total Organic Carbon (% M/M)	0.77	3	5	6
N	LOI450	Loss on Ignition (%)	3.3			10
U	BTEXHSA	Sum of BTEX (mg/kg)	<0.0822	6		
U	PCBUSECD	Sum of 7 Congener PCB's (mg/kg)	<0.049	1		
N	TPHFIDUS	Mineral Oil (mg/kg)	14.4	500		
N	PAHMSUS	PAH Sum of 17 (mg/kg)	<1.86	100		
N	PHSOIL	pH (pH units)	8.2		>6	
N	ANC	Acid Neutralisation Capacity (mol/kg) @pH 7	4.3		To be evaluated	To be evaluated

Accreditation	Method Code	Leachate Analysis	2:1 Leachate	8:1 Leachate	Calculated amount leached @ 2:1	Calculated cumulative amount leached @ 10:1	Landfill Waste Acceptance Criteria Limit Values for BSEN 12457/3 @ L/S 10 litre kg-1 mg/kg (dry weight)		
			mg/l except ºº		mg/kg (dry weight)				
U	WSLM3	pH (pH units) ºº	7.7	7.8	Calculated data not UKAS Accredited				
U	WSLM2	Conductivity (µs/cm) ºº	11900	1510					
U	ICPMSW	Arsenic	0.021	0.024	0.042	0.24	0.5	2	25
U	ICPWATVAR	Barium	<0.01	<0.01	<0.02	<0.1	20	100	300
U	ICPMSW	Cadmium	<0.0001	<0.0001	<0.0002	<0.001	0.04	1	5
U	ICPMSW	Chromium	0.002	0.003	0.004	0.03	0.5	10	70
U	ICPMSW	Copper	0.001	0.001	0.002	0.01	2	50	100
U	ICPMSW	Mercury	<0.0001	<0.0001	<0.0002	<0.001	0.01	0.2	2
U	ICPMSW	Molybdenum	0.252	0.067	0.504	0.92	0.5	10	30
U	ICPMSW	Nickel	0.002	0.001	0.004	0.01	0.4	10	40
U	ICPMSW	Lead	<0.001	<0.001	<0.002	<0.01	0.5	10	50
U	ICPMSW	Antimony	0.006	0.003	0.012	0.03	0.06	0.7	5
U	ICPMSW	Selenium	0.013	0.001	0.026	0.03	0.1	0.5	7
U	ICPMSW	Zinc	<0.002	0.007	<0.004	<0.06	4	50	200
U	KONENS	Chloride	3960	366	7920	8452	800	15000	25000
U	ISEF	Fluoride	0.9	0.5	1.8	6	10	150	500
U	ICPWATVAR	Sulphate as SO4	871	161	1742	2557	1000	20000	50000
N	WSLM27	Total Dissolved Solids	9280	1180	18560	22600	4000	60000	100000
U	SFAPI	Phenol Index	<0.05	<0.05	<0.1	<0.5	1		
N	WSLM13	Dissolved Organic Carbon	12	6.2	24	70	500	800	1000

Template Ver. 1

Landfill Waste Acceptance Criteria limit values correct as of 11th March 2009.

Tests where the accreditation is set to U are UKAS accredited, those where the accreditation is set to N are not UKAS accredited

Sample Analysis

SOCOTEC UK Ltd Environmental Chemistry
Analytical and Deviating Sample Overview

Customer SOCOTEC UK Limited Bretby (Marine)
Site MAR00027
Report No S185119

Consignment No S74096
Date Logged 24-Apr-2018
In-House Report Due 08-May-2018

Please note the results for any subcontracted analysis (identified with a '^') is likely to take up to an additional five working days.

ID Number	Description	MethodID	ANC	BTEXHSA		CEN Leach Set			CustServ	LOI(%MM)	PAHMSUS	PCBECD	PHSOIL	TMSS	TPHRDUS		WSLM59
		Sampled	Acid Neut. Capacity	BTEX-HSA + MTBE analysis	MTBE (µg/kg)	CEN Leac(P)1	CEN Leac(P)2	CEN Leac(P)C	Report B >63 µm	L.O.I. % @ 450C	PAH (17) by GCMS	PCB-7 Congeners Analysis	pH units (AR)	Tot.Moisture @ 105C	TPH Band (>C10-C40)	TPH by GCFID (AR)	Total Organic Carbon
				✓	✓						✓	✓	✓	✓	✓	✓	✓
CL/1901907	A6555 1_1_1	05/04/18		E	E						E		E		E	E	E
CL/1901908	A6555 1_1_2	05/04/18		E	E						E		E		E	E	E
CL/1901909	A6555 1_1_4	05/04/18		E	E						E		E		E	E	E
CL/1901910	A6555 2_1_1	05/04/18		E	E						E		E		E	E	E
CL/1901911	A6555 2_1_3	05/04/18		E	E						E		E		E	E	E
CL/1901912	A6555 2_1_6	05/04/18		E	E						E		E		E	E	E
CL/1901913	A6555 3_1_1	05/04/18		E	E						E		E		E	E	E
CL/1901914	A6555 3_3_1	05/04/18		E	E						E		E		E	E	E
CL/1901915	A6555 4_1_1	05/04/18		E	E						E		E		E	E	E
CL/1901916	A6555 4_1_2	05/04/18		E	E						E		E		E	E	E
CL/1901917	A6555 4_1_4	05/04/18		E	E						E		E		E	E	E
CL/1901918	CRM	D	D	D	D	D	D		D	D	D	D	D		D	D	D
CL/1901919	QC Blank																
CL/1901920	Reference Material (% Recovery)																

Note: We will endeavour to prioritise samples to complete analysis within holding time; however any delay could result in samples becoming deviant whilst being processed in the laboratory.

If sampling dates are missing or matrices unclassified then results will not be ISO 17025 accredited. Please contact us as soon as possible to provide missing information in order to reinstate accreditation.

Deviating Sample Key

A	The sample was received in an inappropriate container for this analysis
B	The sample was received without the correct preservation for this analysis
C	Headspace present in the sample container
D	The sampling date was not supplied so holding time may be compromised - applicable to all analysis
E	Sample processing did not commence within the appropriate holding time
F	Sample processing did not commence within the appropriate handling time

Requested Analysis Key

	Analysis Required
	Analysis dependant upon trigger result - **Note: due date may be affected if triggered**
	No analysis scheduled
^	Analysis Subcontracted - **Note: due date may vary**

Where individual results are flagged see report notes for status.
The integrity of data for samples/analysis that have been categorised as Deviating may be compromised. Data may not be representative of the sample at the time of sampling.

Method Descriptions

Matrix	MethodID	Analysis Basis	Method Description
Soil	ANC	Oven Dried @ < 35°C	Quantitative digestion with Hydrochloric Acid back titration with 1M Sodium Hydroxide to pH 7
Soil	BTEXHSA	As Received	Determination of Benzene, Toluene, Ethyl benzene and Xylenes (BTEX) by Headspace GCFID
Soil	LOI(%MM)	Oven Dried @ < 35°C	Determination of loss on ignition for soil samples at specified temperature by gravimetry
Soil	PAHMSUS	As Received	Determination of Polycyclic Aromatic Hydrocarbons (PAH) by hexane/acetone extraction followed by GCMS detection
Soil	PCBECD	As Received	Determination of Polychlorinated Biphenyl (PCB) congeners/aroclors by hexane/acetone extraction followed by GCECD detection
Soil	PHSOIL	As Received	Determination of pH of 2.5:1 deionised water to soil extracts using pH probe.
Soil	TMSS	As Received	Determination of the Total Moisture content at 105ºC by loss on oven drying gravimetric analysis (% based upon wet weight)
Soil	TPHFIDUS	As Received	Determination of hexane/acetone extractable Hydrocarbons in soil with GCFID detection.
Soil	WSLM59	Oven Dried @ < 35°C	Determination of Organic Carbon in soil using sulphurous Acid digestion followed by high temperature combustion and IR detection
Water	ICPMSW	As Received	Direct quantitative determination of Metals in water samples using ICPMS
Water	ICPWATVAR	As Received	Direct determination of Metals and Sulphate in water samples using ICPOES
Water	ISEF	As Received	Determination of Fluoride in water samples by Ion Selective Electrode (ISE)
Water	KONENS	As Received	Direct analysis using discrete colorimetric analysis
Water	SFAPI	As Received	Segmented flow analysis with colorimetric detection
Water	WSLM13	As Received	Instrumental analysis using acid/persulphate digestion and non-dispersive IR detection
Water	WSLM2	As Received	Determination of the Electrical Conductivity (µS/cm) by electrical conductivity probe.
Water	WSLM27	As Received	Gravimetric Determination
Water	WSLM3	As Received	Determination of the pH of water samples by pH probe

Where individual results are flagged see report notes for status.

Report Notes

Generic Notes

Soil/Solid Analysis

Unless stated otherwise,
- Results expressed as mg/kg have been calculated on the basis indicated in the Method Description table.
  All results on MCERTS reports are reported on a 105ºC dry weight basis with the exception of pH and conductivity.
- Sulphate analysis not conducted in accordance with BS1377
- Water Soluble Sulphate is on a 2:1 water:soil extract

Waters Analysis

Unless stated otherwise results are expressed as mg/l

Nil: Where "Nil" has been entered against Total Alkalinity or Total Acidity this indicates that a measurement was not required due to the inherent pH of the sample.

Oil analysis specific

Unless stated otherwise,
- Results are expressed as mg/kg
- SG is expressed as g/cm^3@ 15^{o}C

Gas (Tedlar bag) Analysis

Unless stated otherwise, results are expressed as ug/l

Asbestos Analysis

CH Denotes Chrysotile **TR** Denotes Tremolite
CR Denotes Crocidolite **AC** Denotes Actinolite
AM Denotes Amosite **AN** Denotes Anthophylite
NAIIS No Asbestos Identified in Sample
NADIS No Asbestos Detected In Sample

Symbol Reference

^ Sub-contracted analysis.
$$ Unable to analyse due to the nature of the sample
¶ Samples submitted for this analyte were not preserved on site in accordance with laboratory protocols. This may have resulted in deterioration of the sample(s) during transit to the laboratory. Consequently the reported data may not represent the concentration of the target analyte present in the sample at the time of sampling
¥ Results for guidance only due to possible interference
& Blank corrected result
I.S Insufficient sample to complete requested analysis
I.S(g) Insufficient sample to re-analyse, results for guidance only
Intf Unable to analyse due to interferences
N.D Not determined **N.Det** Not detected
N.F No Flow
NS Information Not Supplied
Req Analysis requested, see attached sheets for results
Þ Raised detection limit due to nature of the sample
***** All accreditation has been removed by the laboratory for this result
‡ MCERTS accreditation has been removed for this result
§ accreditation has been removed for this result as it is a non-accredited matrix

Note: The Laboratory may only claim that data is accredited when all of the requirements of our Quality System have been met. Where these requirements have not been met the laboratory may elect to include the data in its final report and remove the accreditation from individual data items if it believes that the validity of the data has not been affected. If further details are required of the circumstances which have led to the removal of accreditation then please do not hesitate to contact the laboratory.

Sample Descriptions

Client : SOCOTEC UK Limited Bretby (Marine)

Site : MAR00027

Report Number : S18_5119

Note: major constituent in upper case

Lab ID Number	Client ID	Description
CL/1901907	A6555 1_1_1	MARINE SEDIMENTS
CL/1901908	A6555 1_1_2	MARINE SEDIMENTS
CL/1901909	A6555 1_1_4	MARINE SEDIMENTS
CL/1901910	A6555 2_1_1	MARINE SEDIMENTS
CL/1901911	A6555 2_1_3	MARINE SEDIMENTS
CL/1901912	A6555 2_1_6	MARINE SEDIMENTS
CL/1901913	A6555 3_1_1	MARINE SEDIMENTS
CL/1901914	A6555 3_3_1	MARINE SEDIMENTS
CL/1901915	A6555 4_1_1	MARINE SEDIMENTS
CL/1901916	A6555 4_1_2	MARINE SEDIMENTS
CL/1901917	A6555 4_1_4	MARINE SEDIMENTS
CL/1901918	CRM	QUALITY CONTROL SAMPLE
CL/1901919	QC Blank	QUALITY CONTROL SAMPLE
CL/1901920	Reference Material (% Recovery	QUALITY CONTROL SAMPLE

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID	**MAR00028**	
Issue Version	1	
Customer	Aspect Land & Hydrographic Surveys Ltd, Unit 1, Thornhouse Business Centre, Ballot Road, Irvine, Ayrshire, KA12 0HW	
Customer Reference	A6555	
Date Sampled	05-Apr-18	
Date Received	17-Apr-18	
Date Reported	09-May-18	
Condition of samples	Cold	Satisfactory

Redacted

Any additional opinions or interpretations found in this report, are outside the scope of UKAS accreditation.

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00028
Issue Version 1

Customer Reference A6555

		Units	%	%	%	%	%	% M/M
		Method No	ASC/SOP/303	ASC/SOP/303	SUB_01*	SUB_01*	SUB_01*	SOCOTEC Env Chem*
		Limit of Detection	0.2	0.2	N/A	N/A	N/A	0.02
		Accreditation	UKAS	UKAS	N	N	N	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Total Moisture**	**Total Solids**	**Gravel (>2mm)**	**Sand (63-2000 µm)**	**Silt (<63 µm)**	**TOC**
A6555 1-1-1	MAR/00028.001	Sediment	54.4	45.6	0.3	16.6	83.1	3.14
A6555 1-1-2	MAR/00028.002	Sediment	54.7	45.3	0.3	13.3	86.4	2.62
A6555 1-1-4	MAR/00028.003	Sediment	50.4	49.6	0.0	14.7	85.3	3.31
A6555 2-1-1	MAR/00028.004	Sediment	48.7	51.3	4.9	36.8	58.3	2.78
A6555 2-1-3A6555 2-1-3	MAR/00028.005	Sediment	42.0	58.0	1.7	26.5	71.8	2.08
A6555 2-1-6	MAR/00028.006	Sediment	47.3	52.7	0.0	10.8	89.2	2.04
A6555 3-1-1	MAR/00028.007	Sediment	26.5	73.5	58.8	23.4	17.8	1.93
A6555 3-3-1	MAR/00028.008	Sediment	37.5	62.5	58.8	19.8	21.4	3.53
A6555 4-1-1	MAR/00028.009	Sediment	37.1	62.9	7.0	37.2	55.9	1.67
A6555 4-1-2	MAR/00028.010	Sediment	37.5	62.5	11.2	36.2	52.5	1.35
A6555 4-1-4	MAR/00028.011	Sediment	30.4	69.6	24.5	28.3	47.2	0.80
Reference Material (% Recovery)			N/A	N/A	N/A	N/A	N/A	102
QC Blank			N/A	N/A	N/A	N/A	N/A	<0.02

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00028
Issue Version 1

Customer Reference A6555

		Units	mg/Kg (Dry Weight)							
		Method No	SOCOTEC Env Chem*							
		Limit of Detection	0.5	0.04	0.5	0.5	0.01	0.5	0.5	2
		Accreditation	UKAS	UKAS	UKAS	UKAS	N	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Arsenic**	**Cadmium**	**Chromium**	**Copper**	**Mercury**	**Nickel**	**Lead**	**Zinc**
A6555 1-1-1	MAR/00028.001	Sediment	6.6	0.26	47.6	22.5	<0.01	41.5	12.8	69.7
A6555 1-1-2	MAR/00028.002	Sediment	5.9	0.19	45	18.8	<0.01	38.6	12.0	63.7
A6555 1-1-4	MAR/00028.003	Sediment	9.2	0.26	48.9	24.7	<0.01	41.2	14.3	73.0
A6555 2-1-1	MAR/00028.004	Sediment	6.9	0.22	33.0	20.1	0.31	25.5	19.4	61.0
A6555 2-1-3	MAR/00028.005	Sediment	8.2	0.21	31.2	14.5	0.15	22.4	19.4	49.0
A6555 2-1-6	MAR/00028.006	Sediment	9.6	0.17	44.4	20.6	<0.01	38.0	14.3	66.7
A6555 3-1-1	MAR/00028.007	Sediment	4.9	<0.04	20.3	32.2	0.09	15.6	7.1	52.0
A6555 3-3-1	MAR/00028.008	Sediment	3.6	<0.04	20.1	45.0	0.05	16.4	6.7	50.0
A6555 4-1-1	MAR/00028.009	Sediment	6.6	0.19	24.0	29.4	0.19	18.0	16	47.0
A6555 4-1-2	MAR/00028.010	Sediment	6.9	0.09	23.4	9.4	0.02	17.6	6.7	30.0
A6555 4-1-4	MAR/00028.011	Sediment	5.2	<0.04	21.2	14.4	<0.01	16.7	4.0	25.0
Certified Reference Material 2702 (% Recovery)			105	97	99	105	105	101	102	103
QC Blank			<0.5	<0.04	<0.5	<0.5	<0.01	<0.5	<0.5	<2

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00028
Issue Version 1

Customer Reference A6555

		Units	µg/Kg (Dry Weight)	
		Method No	ASC/SOP/301	
		Limit of Detection	1	1
		Accreditation	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Dibutyltin (DBT)**	**Tributyltin (TBT)**
A6555 1-1-1	MAR/00028.001	Sediment	<1	<1
A6555 1-1-2	MAR/00028.002	Sediment	<5*	<5*
A6555 1-1-4	MAR/00028.003	Sediment	<5*	<5*
A6555 2-1-1	MAR/00028.004	Sediment	6.4	39
A6555 2-1-3	MAR/00028.005	Sediment	1	<1
A6555 2-1-6	MAR/00028.006	Sediment	<5*	<5
A6555 3-1-1	MAR/00028.007	Sediment	<1	<1
A6555 3-3-1	MAR/00028.008	Sediment	27.7	50.8
A6555 4-1-1	MAR/00028.009	Sediment	1.2	<1
A6555 4-1-2	MAR/00028.010	Sediment	<1	<1
A6555 4-1-4	MAR/00028.011	Sediment	<5*	<5*
Certified Reference Material BCR-646 (% Recovery)			64	72
QC Blank			<1	<1

* See Report Notes

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00028
Issue Version 1

Customer Reference A6555

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**ACENAPTH**	**ACENAPHY**	**ANTHRACN**	**BAA**	**BAP**	**BBF**
A6555 1-1-1	MAR/00028.001	Sediment	2.2	<1	3.3	3.9	3.0	9.4
A6555 1-1-2	MAR/00028.002	Sediment	2.1	<1	2.4	2.7	2.7	9.0
A6555 1-1-4	MAR/00028.003	Sediment	1.9	<1	1.9	2.9	2.2	7.7
A6555 2-1-1	MAR/00028.004	Sediment	24.2	18.6	50.6	236	278	298
A6555 2-1-3	MAR/00028.005	Sediment	8.9	25.8	106	253	245	209
A6555 2-1-6	MAR/00028.006	Sediment	1.6	<1	2.0	3.6	2.8	8.9
A6555 3-1-1	MAR/00028.007	Sediment	<1	<1	1.1	3.0	3.6	5.6
A6555 3-3-1	MAR/00028.008	Sediment	28.1	2.8	33.8	103	103	115
A6555 4-1-1	MAR/00028.009	Sediment	6.4	8.2	19.7	73.7	85.6	95.7
A6555 4-1-2	MAR/00028.010	Sediment	22.8	10.5	47.3	122	118	122
A6555 4-1-4	MAR/00028.011	Sediment	<1	<1	<1	<1	<1	2.6
Certified Reference Material CRM180013 1941b (% Recovery)			67	95	73	74	62	94
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries

Certificate of Analysis

Issuing Laboratory SOCOTEC, Marine Department, Specialist Chemistry, Etwall House, Bretby Business Park, Ashby Road, Bretby, Burton-upon-Trent DE15 0YZ

Test Report ID MAR00028
Issue Version 1

Customer Reference A6555

		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303
		Limit of Detection	1	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**BEP**	**BENZGHIP**	**BKF**	**C1N**	**C1PHEN**	**C2N**
A6555 1-1-1	MAR/00028.001	Sediment	10.7	9.9	1.4	31.9	33.4	60.0
A6555 1-1-2	MAR/00028.002	Sediment	10.0	8.8	1.0	29.5	32.1	66.7
A6555 1-1-4	MAR/00028.003	Sediment	8.7	7.7	<1	24.8	26.6	59 2
A6555 2-1-1	MAR/00028.004	Sediment	231	205	163	65.3	171	97.6
A6555 2-1-3	MAR/00028.005	Sediment	177	145	113	50.3	191	77.7
A6555 2-1-6	MAR/00028.006	Sediment	9.7	9.2	1.9	27.8	28.2	56.8
A6555 3-1-1	MAR/00028.007	Sediment	4.5	4.9	2.4	5.4	5.4	7.6
A6555 3-3-1	MAR/00028.008	Sediment	82.6	74.8	49.3	26.3	55.3	41.1
A6555 4-1-1	MAR/00028.009	Sediment	74.4	74.0	45.5	43.2	89.7	58.7
A6555 4-1-2	MAR/00028.010	Sediment	98.9	102	60.9	43.2	106	62.7
A6555 4-1-4	MAR/00028.011	Sediment	2.4	2.4	<1	6.7	7.5	11.6
Certified Reference Material CRM180013 1941b (% Recovery)			96	75	88	75	99	113
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries

Certificate of Analysis

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Test Report ID MAR00028
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		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303
		Limit of Detection	1	1	1	1	1	1
		Accreditation	N	UKAS	UKAS	UKAS	UKAS	UKAS
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**C3N**	**CHRYSENE**	**DBENZAH**	**FLUORANT**	**FLUORENE**	**INDPYR**
A6555 1-1-1	MAR/00028.001	Sediment	27.1	11.0	1.5	6.4	5.3	3.3
A6555 1-1-2	MAR/00028.002	Sediment	24.3	11.1	1.2	6.0	5.1	2.9
A6555 1-1-4	MAR/00028.003	Sediment	22.0	9.2	1.1	5.5	4.9	2.4
A6555 2-1-1	MAR/00028.004	Sediment	97.2	235	53.0	287	29.2	224
A6555 2-1-3	MAR/00028.005	Sediment	71.3	241	41.0	370	26.8	148
A6555 2-1-6	MAR/00028.006	Sediment	24.5	9.9	1.4	5.7	4.9	2.8
A6555 3-1-1	MAR/00028.007	Sediment	4.2	4.2	1.1	7.9	1.1	5.3
A6555 3-3-1	MAR/00028.008	Sediment	31.1	118	19.3	249	28.0	80.0
A6555 4-1-1	MAR/00028.009	Sediment	46.4	84.7	16.1	136	12.1	78.0
A6555 4-1-2	MAR/00028.010	Sediment	51.3	128	20.9	238	28.7	103
A6555 4-1-4	MAR/00028.011	Sediment	6.2	2.5	<1	1.5	1.1	1.1
Certified Reference Material CRM180013 1941b (% Recovery)			109	100	119	87	55	80
QC Blank			<1	<1	<1	<1	<1	<1

For full analyte name see method summaries

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		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303	ASC/SOP/303
		Limit of Detection	1	1	1	1	1
		Accreditation	UKAS	UKAS	UKAS	UKAS	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**NAPTH**	**PERYLENE**	**PHENANT**	**PYRENE**	**THC**
A6555 1-1-1	MAR/00028.001	Sediment	8.0	885	31.9	8.4	32000
A6555 1-1-2	MAR/00028.002	Sediment	8.0	778	25.2	7.3	28600
A6555 1-1-4	MAR/00028.003	Sediment	6.6	508	19.6	6.3	25600
A6555 2-1-1	MAR/00028.004	Sediment	29.0	112	174	397	107000
A6555 2-1-3	MAR/00028.005	Sediment	24.5	71.0	177	433	73400
A6555 2-1-6	MAR/00028.006	Sediment	8.1	129	19.1	6.7	27300
A6555 3-1-1	MAR/00028.007	Sediment	1.8	2.4	5.9	7.0	11300
A6555 3-3-1	MAR/00028.008	Sediment	17.4	38.4	165	232	41600
A6555 4-1-1	MAR/00028.009	Sediment	15.1	30.5	84.9	143	51100
A6555 4-1-2	MAR/00028.010	Sediment	19.8	35.1	188	234	52100
A6555 4-1-4	MAR/00028.011	Sediment	1.6	9.3	5.3	1.8	10800
Certified Reference Material CRM180013 1941b (% Recovery)			65	62	89	78	100
QC Blank			<1	<1	<1	<1	<100

For full analyte name see method summaries

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		Units	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)	µg/Kg (Dry Weight)
		Method No	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302	ASC/SOP/302
		Limit of Detection	0.08	0.08	0.08	0.08	0.08	0.08	0.08
		Accreditation	N	N	N	N	N	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**PCB28**	**PCB52**	**PCB101**	**PCB118**	**PCB138**	**PCB153**	**PCB180**
A6555 1-1-1	MAR/00028.001	Sediment	0.37	0.35	0.11	<0.08	<0.08	<0.08	<0.08
A6555 1-1-2	MAR/00028.002	Sediment	0.71	0.67	0.21	<0.08	<0.08	<0.08	<0.08
A6555 1-1-4	MAR/00028.003	Sediment	0.35	0.30	0.10	<0.08	<0.08	<0.08	<0.08
A6555 2-1-1	MAR/00028.004	Sediment	0.48	0.47	0.39	0.26	0.47	0.48	0.20
A6555 2-1-3	MAR/00028.005	Sediment	0.36	0.31	0.11	<0.08	<0.08	<0.08	<0.08
A6555 2-1-6	MAR/00028.006	Sediment	0.21	0.20	<0.08	<0.08	<0.08	<0.08	<0.08
A6555 3-1-1	MAR/00028.007	Sediment	0.30	0.30	0.13	<0.08	<0.08	<0.08	<0.08
A6555 3-3-1	MAR/00028.008	Sediment	0.33	0.31	0.12	0.09	<0.08	<0.08	<0.08
A6555 4-1-1	MAR/00028.009	Sediment	0.35	0.31	0.15	0.13	<0.08	0.13	<0.08
A6555 4-1-2	MAR/00028.010	Sediment	0.37	0.33	0.10	<0.08	<0.08	<0.08	<0.08
A6555 4-1-4	MAR/00028.011	Sediment	0.34	0.31	0.11	<0.08	<0.08	<0.08	<0.08
Certified Reference Material SRM 1941b (% Recovery)			68	88	97	98	114	94	95
QC Blank			<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08

For full analyte name see method summaries

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		Units	mg/Kg (Dry Weight)	
		Method No	*SUB_02	
		Limit of Detection	0.1	0.1
		Accreditation	N	N
Client Reference:	**SOCOTEC Ref:**	**Matrix**	**Diuron**	**Irgarol**
A6555 1-1-1	MAR/00028.001	Sediment	< 0.2	< 0.2
A6555 1-1-2	MAR/00028.002	Sediment	< 0.2	< 0.2
A6555 1-1-4	MAR/00028.003	Sediment	< 0.1	< 0.1
A6555 2-1-1	MAR/00028.004	Sediment	< 0.1	< 0.1
A6555 2-1-3	MAR/00028.005	Sediment	< 0.1	< 0.1
A6555 2-1-6	MAR/00028.006	Sediment	< 0.1	< 0.1
A6555 3-1-1	MAR/00028.007	Sediment	< 0.1	< 0.1
A6555 3-3-1	MAR/00028.008	Sediment	< 0.1	< 0.1
A6555 4-1-1	MAR/00028.009	Sediment	< 0.1	< 0.1
A6555 4-1-2	MAR/00028.010	Sediment	< 0.1	< 0.1
A6555 4-1-4	MAR/00028.011	Sediment	< 0.1	< 0.1

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Test Report ID MAR00028
Issue Version 1

Customer Reference A6555

REPORT NOTES

Method Code	Sample ID	The following information should be taken into consideration when using the data contained within this report
*SUB_01	MAR00028.001-011	Analysis was conducted by an approved subcontracted laboratory.
*SUB_02	MAR00028.001-011	Analysis was conducted by an approved subcontracted laboratory.
SOCOTEC Env Chem*	MAR00028.001-011	Analysis was conducted by an internal SOCOTEC laboratory. UKAS accredited analysis by this laboratory is under UKAS number 1252.
ASC/SOP/301	MAR00028.002, 003, 006, 011	The matrix of this sample has been found to interfere with the result for this test. The sample has therefore been diluted, but in doing so, the detection limit for this test has been elevated.
ASC/SOP/303	MAR00028.001-011	Chrysene is known to coelute with Triphenylene and these peaks can not be resolved. It is believed Triphenylene is present in these samples therefore it is suggested that the Chrysene results should be taken as a Chrysene (inc. Triphenylene).This should be taken into consideration when utilising the data.

DEVIATING SAMPLE STATEMENT

Devaiation Code	Devation Definition	Sample ID	Deviation Details. The following information should be taken into consideration when using the data contained within this report
D1	Holding Time Exceeded	N/A	N/A
D2	Handling Time Exceeded	N/A	N/A
D3	Sample Contaminated through Damaged Packaging	N/A	N/A
D4	Sample Contaminated through Sampling	N/A	N/A
D5	Inappropriate Container/Packaging	N/A	N/A
D6	Damaged in Transit	N/A	N/A
D7	Insufficient Quantity of Sample	N/A	N/A
D8	Inappropriate Headspace	N/A	N/A
D9	Retained at Incorrect Temperature	N/A	N/A
D10	Lack of Date & Time of Sampling	N/A	N/A
D11	Insufficient Sample Details	N/A	N/A

Certificate of Analysis

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Test Report ID MAR00028
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Method	Sample and Fraction Size	Method Summary
Total Solids	Wet Sediment	Calculation (100%-Moisture Content).Moisture content determined by drying a portion of the sample at 105°C to constant weight.
Particle Size Analysis	Wet Sediment	Wet and dry sieving followed by laser diffraction analysis.
Total Organic Carbon (TOC)	Wet Sediment	Carbonate removal and sulphurous acid/combustion at 800°C/NDIR.
Metals	Air dried and seived to <63µm	Aqua-regia extraction followed by ICP analysis.
Organotins	Wet Sediment	Solvent extraction and derivatisation followed by GC-MS analysis.
Polyaromatic Hydrocarbons (PAH)	Wet Sediment	Solvent extraction and clean up followed by GC-MS analysis.
Total Hydrocarbon Content (THC)	Wet Sediment	Solvent extraction and clean up followed by GC-FID analysis.
Polychlorinated Biphenyls (PCBs)	Air dried and seived to <2mm	Solvent extraction and clean up followed by GC-MS-MS analysis.

Analyte Definitions

Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name	Analyte Abbreviation	Full Analyte name
ACENAPTH	Acenaphthene	C2N	C2-naphthalenes	THC	Total Hydrocarbon Content
ACENAPHY	Acenaphthylene	C3N	C3-naphthalenes	AHCH	alpha-Hexachlorcyclohexane
ANTHRACN	Anthracene	CHRYSENE	Chrysene	BHCH	beta-Hexachlorcyclohexane
BAA	Benzo[a]anthracene	DBENZAH	Diben[ah]anthracene	GHCH	gamma-Hexachlorcyclohexane
BAP	Benzo[a]pyrene	FLUORANT	Fluoranthene	DIELDRIN	Dieldrin
BBF	Benzo[b]fluoranthene	FLUORENE	Fluorene	HCB	Hexachlorobenzene
BEP	Benzo[e]pyrene	INDPYR	Indeno[1,2,3-cd]pyrene	PPDDE	p,p'-Dichorodiphenyldicloroethylene
BENZGHIP	Benzo[ghi]perylene	NAPTH	Naphthalene	PPDDT	p,p'-Dichorodiphenyltrichloroethane
BKF	Benzo[k]fluoranthene	PERYLENE	Perylene	PPTDE	p,p'-Dichorodiphenyldicloroethane
C1N	C1-naphthalenes	PHENANT	Pyrene		
C1PHEN	C1-phenanthrene	PYRENE	Phenanthrene		

Appendix M.2: Assessment of Tidal Flood Levels

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

CALEDONIAN MARITIME ASSETS LIMITED

LOCHMADDY FERRY TERMINAL

UPGRADE WORKS

ASSESSMENT OF TIDAL FLOOD LEVELS

Caledonian Maritime Assets Limited
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Port Glasgow
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April 2018

Member of the Association for Consultancy and Engineering

Document No: 1975/DOC/008

This document was prepared as follows:-

	Name	Signature	Date
Prepared By	Redacted		12.04.2018
Checked By			13.04.2018
Approved By			13.04.2018

and revised as follows:

REVISION STATUS INDICATOR

Page No	Date	Revision	Description of Change	Initial

This document has been reviewed for compliance with project requirements in accordance with Wallace Stone LLP Quality Management System.

CALEDONIAN MARITIME ASSETS LIMITED
LOCHMADDY FERRY TERMINAL
UPGRADE WORKS

ASSESSMENT OF TIDAL FLOOD LEVELS

CONTENTS

CALEDONIAN MARITIME ASSETS LIMITED
LOCHMADDY FERRY TERMINAL
UPGRADE WORKS

ASSESSMENT OF TIDAL FLOOD LEVELS

1. Introduction

As part of the major upgrading works proposed at Lochmaddy Ferry Terminal to accommodate the new, larger ferry, the existing marshalling area is to be extended to provide for the substantial increase in vehicle numbers.

While the finished surface levels at the extended marshalling area will be dictated by the levels and gradients of the existing area, and cannot be amended to any extent, an assessment of tidal flood risk has been proposed to establish what the effects might be in extreme conditions.

This report considers the factors affecting extreme tide levels at the Lochmaddy Ferry Terminal, and presents the results of an assessment of tidal flood levels at the site in a 1 in 200 year event.

2. Factors Affecting Water Level

Water level at extreme events is governed by four factors: -

- **Astronomical**

  The gravitational effect of the sun and the moon combine depending on their positions relative to the earth to determine the tidal range. During spring tides, which occur every fortnight, the range is larger than the mean with higher high tides and lower low tides. During neap tides which occur in between springs, the range is smaller than the mean with lower high tides and higher low tides.

  Tidal range varies between sets of spring tides. The highest ranges tend to occur around the equinoxes. The average value of all the high spring tides in the year is known as mean high water at springs (MHWS), and the average value of all low spring tides as mean low water at springs (MLWS).

  Once or twice a year the peak values, known as highest astronomical tide and lowest astronomical tide (HAT and LAT) occur.

  In the absence of significant meteorological effects, the level of the tide at any given time is predictable with a fair degree of accuracy. Tables of predictions are published by the Admiralty for standard ports around the country, with variations for a large number of secondary 'ports'.

  All tidal data and predictions are quoted relative to Chart Datum (CD) which approximates to lowest astronomical tide. Differences between CD and Ordnance Datum (OD) are listed in Admiralty tide tables for all standard and secondary ports.

- **Meteorological**

  Atmospheric pressure has a marked effect on water level, low pressure raising and high pressure lowering the level from its predicted value. The extent to which the level is affected and the time over which effects are experienced depends on the depth and size of the depression or anti-cyclone, and the speed and direction of its movement. The topography of the surrounding coastline also affects the way in which the level is modified.

  This kind of effect is referred to hereafter as a pressure surge. Its effects tend to cover large areas of water at any one time.

- **Topographical**

  Where wind is blowing onshore during a severe event, it tends to drive water level up and also to hold high tide levels for longer than the norm. Where the coastline is constricted locally by bays or inlets, this effect can be more pronounced.

  This effect is referred to hereafter as a wind surge. Its effects can be localised.

- **Wave Run-Up**

  Where wind is blowing on shore during a severe event, waves breaking on the shore will run-up to levels considerably above theoretical still water level. The extent to which this effect is experienced at any given location is governed by the fetch in the direction of the wind, the length of time it blows from that direction, the topography of the surrounding shoreline, and the local sea bed slope.

3. Combination of Factors

In assessing a severe weather event it is normal to consider a specific return period, such as 100 years, as the design criterion. Return period is defined as that period that, on average, separates two occurrences. It should be noted that this does not mean that exactly that number of years will separate two such occurrences.

For an event with a return period of 100 years, therefore, there is a 1% probability of occurrence in any one year, even the one following the occurrence. For a time interval equal to the return period there is a 63% probability of occurrence within the return period.

The probability of the overall event is obtained by combining the probabilities of each of the factors occurring simultaneously. It is normal to assume that where factors are independent of each other, their probabilities can be multiplied together.

Where factors can be affected by each other, their combined probability requires to be assessed.

It is assumed here that predicted tide level is independent of pressure surge (but see 5.2.4 below), wind surge and wave run-up, that pressure surge and wind surge can be dependent on a common cause, that pressure surge and wave run-up are independent of each other, and that wind surge and wave run-up can be dependent on a common cause.

4. Levels at Lochmaddy Ferry Marshalling Area

Levels around the perimeter of the proposed extension to the marshalling area are summarised below, and shown on marked up drawing no. 1975-SK909 in the Appendices.

Location	Reduced Level (in m. above OD)
Existing road level at linkspan abutment	+ 3.88m
Western extremity of existing area	+ 4.16m
Western extremity of proposed extension	+ 4.29m

These points are all along the outer edge of the marshalling area (existing and proposed), which is the lowest edge of the area. All other points on the marshalling area are higher.

5. Extreme Water Levels at Lochmaddy Terminal

5.1 Predicted Tide Levels

The level of Chart Datum at Leverburgh, the nearest secondary port, can be obtained by reference to the information in Admiralty tide tables.

The level assumed is 2.59 metres below Ordnance Datum. The relevant predicted still water tidal levels at Lochmaddy are thus: -

Highest Astronomical Tide (HAT)	+ 3.01m OD
Mean High Water at Spring Tides (MHWS)	+ 2.21m OD
Mean High Water at Neap Tides (MHWN)	+ 1.01m OD

In assessing tidal flood levels at Lochmaddy, it is proposed to consider an extreme event with a return period of 200 years. This event has a probability of 0.5% (or 0.005) of occurring in any one year.

For calculation of the 1 in 200 year event it is necessary to assess the probability of various tide levels occurring during any particular storm.

It is assumed that all storms will be of sufficient duration to include one high water period.

The probability of any storm occurring at or above MHWN level is 1.0.

MHWS is exceeded by about one sixth of all high tides, and hence the probability of any storm occurring at that level or above is one sixth (0.167).

HAT is reached by approximately one two hundredth of high tides, leading to a probability of any storm occurring at that level of one two hundredth (0.005).

5.2 Storm Effects

5.2.1 Pressure Surge

Surge effects have been modelled over the Northwest European continental shelf (Flather, 1987) and by the DEFRA Joint Probability Study of 2005 and predictions produced for surge effects around the UK coastline.

The models used have made allowance for the effect of pressure surge and to a certain extent for overall wind surge. It is assumed no local wind surge affects are included. North Uist lies on the predicted contour of one metre surge in a 50 year event.

During the violent storm of January 2005, the continuous tide gauge at Stornoway on Lewis recorded a maximum surge of 1.14 metres above predicted water level 2 hours after low water, where its effect would have been largely unnoticed. At the time of high water, the recorded surge was 0.64 metres above predicted water level.

It is not known how much of the surge at Stornoway resulted from pressure effects and how much from wind and topographical effects, although recorded wind directions might lead to the assumption that the effects were mostly pressure-related.

Based on the above theoretical and empirical data, values assumed for surges at Lochmaddy have been assessed, and are included in the table below.

The 200 year extreme still water level calculated here from first principles (3.8m above Ordnance Datum with assessed pressure surge) can be compared to levels published elsewhere for reference. The most recent analysis (Defra 'Technical Report on Joint Probability and Dependence' (2005) refers to 'Estimates of Extreme Sea Conditions' by Proudman Laboratories, which is based on tide records. The table in the Proudman report for extreme sea levels indicates a 200 year still water level for Stornoway (similar to tide levels in Lochmaddy) of 3.4m above Ordnance Datum.

These reports suggest a clear dependency between tide level and surge magnitude, reducing the surge level at high water. While adoption of this principle, and the lower predicted extreme 200 year still water level requires a degree of caution, we are content to use the recognised research value of 3.4m above Ordnance Datum.

Return Period	Assessed Pressure Surge	Pressure Surge from Defra Tech. Report
1 year	0.8 metres	0.4 metres
33 years	1.0 metres	0.5 metres
200 years	1.3 metres	0.7 metres

It is assumed that these figures include all pressure effects, and wind effects at Lochmaddy in general.

In the absence of any local wind surge, the extreme still water levels for the 200 year event are predicted as follows: -

Tide Level	Probability	Surge	Probability	Combined Probability	Predicted Water Level
+ 3.0m (HAT)	0.005	0.4m	1.0	0.005	+ 3.4m
+ 2.2m (MHWS)	0.167	0.5m	0.03	0.005	+ 2.7m
+ 1.0m (MHWN)	1.0	0.7m	0.005	0.005	+1.7m

5.2.2 Wind Surge

Local wind surge will be experienced on some occasions at this rather open sea loch and will add an estimated further component of 0.6m in the most extreme events.

However, as the wind surge generated between Skye and Uist in easterly storms would open out into the wider loch after entering the outer loch, the wind surge effect at Lochmaddy would be reduced by around one third. There are some inlets to the west of the terminal site that could result in trapped water being driven up to a higher level, although their impact would be relatively minor.

As local surge would require prolonged easterly winds, the probability of any overall storm surge accompanying prolonged easterly winds must be assessed.

Assuming that 10% of storms might include prolonged easterly winds at the site at the peak of the surge, it is necessary to reduce the relevant storm return period by a factor of ten to retain the overall 200 year event.

Thus the following values are appropriate when a local wind surge occurs at the site.

Return period	Pressure Surge with Easterlies
1 month	0.25 metres
3 years	0.4 metres
20 years	0.6 metres

Extreme still water levels at Lochmaddy for the 200 year event with local easterly wind surge are then predicted as follows, with the 1 in 10 year wind surge assessed as 0.4m: -

Tide Level	Probability	Pressure Surge	Probability	Wind Surge	Probability	Combined Probability	Predicted Water Level
(HAT) + 3.0m	0.005	0.25m	10	0.4m	0.1	0.005	+ 3.65m
(MHWS) + 2.2m	0.167	0.4m	0.32	0.4m	0.1	0.005	+ 3.0m
(MHWN) + 1.0m	1.0	0.6m	0.05	0.4m	0.1	0.005	+ 2.0m

5.2.3 Wave Run-up

Wave run-up is likely to be quite limited at this site. As described above, waves approaching from the east will be refracted as they expand into the wider bay and around the numerous islands that lie east of the site. The refraction of waves in this manner will reduce their magnitude from an estimated 2m in the one year event at the entrance to the loch to less than 1 metre by the time they have penetrated past the piled pier. Further refraction to the north-west will reduce the wave height to around 0.5m, with the waves running along the armoured slope that defines the boundary of the marshalling area. Wave run-up is unlikely to exceed 0.3m. This figure is confirmed by a wave study for the new pontoons in 2013.

The impact of waves running along the armoured slopes will be reduced by the absorption of wave energy in the voids between armour and stones.

Large amounts of wind-driven spray will be carried some distance westward in these extreme conditions, but it will not cause overtopping of the armoured slopes, as the wind is blowing the spray away from the slope.

5.3 Climate Change

Predictions of climate change vary significantly depending on the model adopted. However, they all anticipate increased water levels in general, increased frequency of storm events, and increased severity of the most extreme events. Current efforts to reduce the emissions considered responsible for these factors are gathering pace and may result in some slowing of sea level rise. The likely rate of progress and effectiveness of measures proposed are a matter of conjecture, and may change as a result of political pressure.

It is therefore considered imprudent to make any definite assumptions about likely extreme water levels 50 years or more from now, beyond general trends.

In the circumstances the allowance of an additional 250mm on extreme water levels is considered appropriate.

6. Conclusions

From Section 5 above, the extreme maximum still water level in the 200 year return period at Lochmaddy Ferry Marshalling Area, excluding any effects of climate change, is assessed at 3.4m above Ordnance Datum. Making a suitable allowance for wind surge and the wave action that is possible at the site, the maximum run-up level in the 200 year return period is assessed at +3.95m Ordnance Datum.

The predicted maximum run-up level is based on calculations, historical records of water level and current values for HAT, MHWS and MHWN.

In this extreme 200 year event, which might be experienced at any time, the predicted run-up level at the lowest point of the existing marshalling area, at the inner end of the linkspan, will result in wave action running over the surface by 100mm. As the marshalling area is graded upwards away from this point, the effects of this extreme event will be limited to the southeast corner of the existing area and a short length of the exit lane, exactly as at present. All new works, including the lowest, southern edge will be well above this level, and will be unaffected by wave run-up.

The effects of the extreme 200 year event are not expected to have any significant impact on the operation or integrity of the ferry terminal. All ferry services would be suspended during such conditions.

It is universally accepted that, as a result of climate change, future high water levels are likely to exceed those currently experienced by a significant margin.

The allowance of 250mm proposed in Section 5.3 above is considered a realistic estimate, based on current observations, of the extent to which the predicted values might be exceeded over the next 50 years.

It is recommended that future increases in tidal level are monitored, and measures taken, if required, when the linkspan comes up for replacement in the future, to raise levels locally as required.

Appendix A – Photographs

Photo 1: Lochmaddy Ferry Terminal

Photo 2: South end of marshalling area, and shore to be occupied by extension

Photo 3: West side of marshalling area

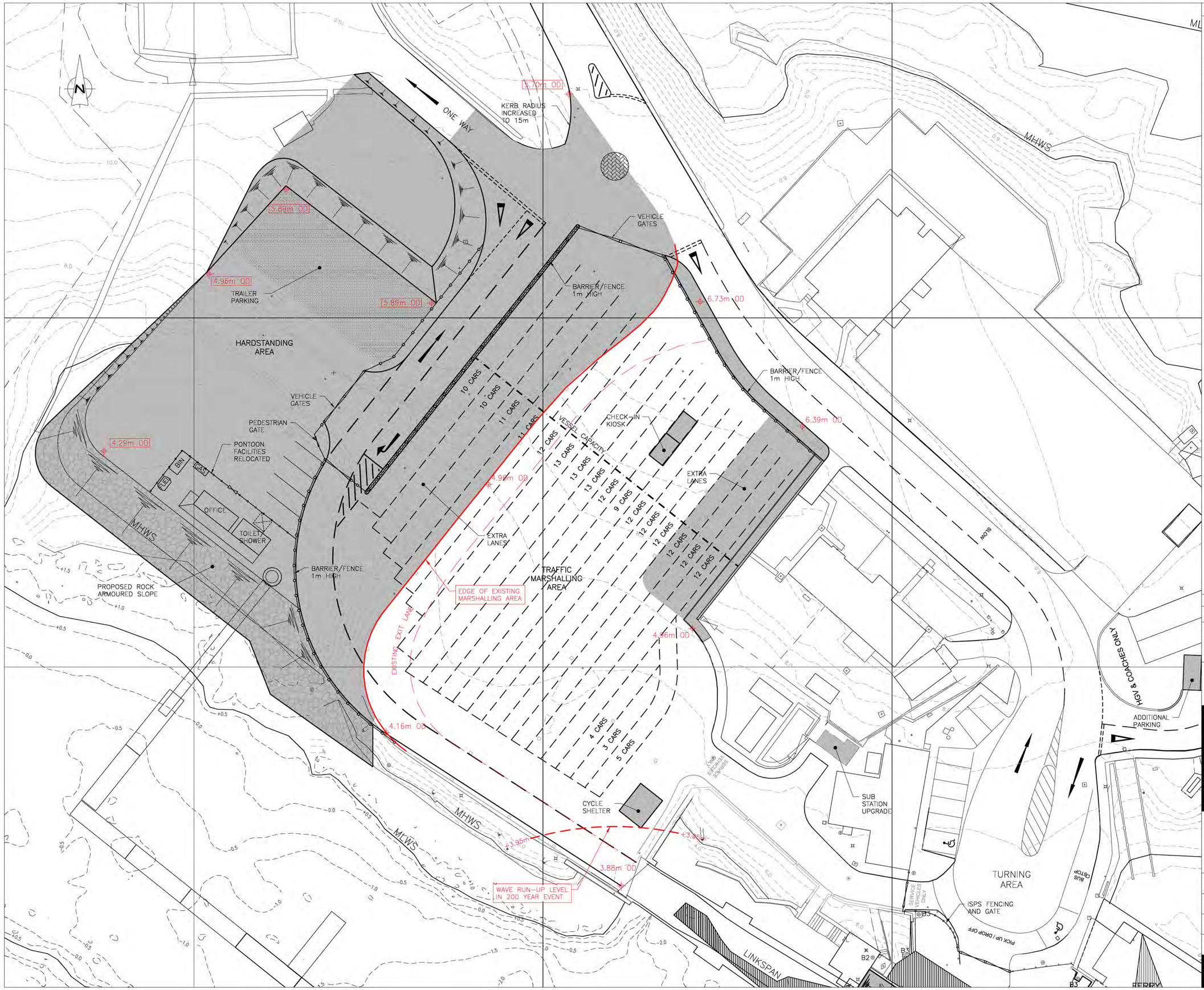
Photo 4: Marshalling area from east – note slope to south

Photo 5: South side of marshalling area – lowest point at mid-left

Photo 6: Marshalling area – lowest point at gate and signs

Photo 7: Armouring on outside of south edge of marshalling area

Appendix B – Drawing



GENERAL NOTES

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES AND RELATE TO CHART DATUM UNLESS NOTED OTHERWISE.
3. ORDNANCE DATUM IS 2.59m ABOVE CHART DATUM.
4. H.A.T. +5.6m LAT +0.1m
   M.H.W.S. +4.8m M.L.W.S +0.7m
   M.H.W.N +3.6m M.L.W.N +1.9m

LEGEND

- 6.73m OD — EXISTING LEVELS TO ORDNANCE DATUM
- 6.73m OD — PROPOSED LEVELS TO ORDNANCE DATUM
- PROPOSED WORKS

REV	DATE	DETAILS	DRAWN	CHK'D	APP'D

AMENDMENTS

CLIENT

Comhairle nan Eilean Siar

PROJECT

LOCHMADDY FERRY TERMINAL UPGRADE WORKS

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DRAWING TITLE

MARSHALLING AREA PROPOSALS AND RUN–UP LEVEL

DRAWN	CHECKED	APPROVED
Redacted		
DATE 19.04.18	DATE 19.04.18	DATE 19.04.18

SCALE (A1) 1:250 STAGE INFORMATION

REVISION

PROJECT No. 1975 DRAWING No. SK909

Appendix M.3: Water Framework Directive Assessment

CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

Appendix M.3

Water Framework Directive assessment: scoping template for activities in estuarine and coastal waters

Use this template to record the findings of the scoping stage of your Water Framework Directive (WFD) assessment for an activity in an estuary or coastal water.

If your activity will:

- take place in or affect more than one water body, complete a template for each water body
- include several different activities or stages as part of a larger project, complete a template for each activity as part of your overall WFD assessment

The WFD assessment guidance for estuarine and coastal waters will help you complete the table.

Your activity	Description, notes or more information
Applicant name	Comhairle nan Eilean Siar (CnES)
Application reference number (where applicable)	
Name of activity	Lochmaddy Ferry Terminal Upgrade
Brief description of activity	Pier upgrade, land reclamation and capital dredge.
Location of activity (central point XY coordinates or national grid reference)	NF 920 680
Footprint of activity (ha)	2.52 ha
Timings of activity (including start and finish dates)	August 2019 to August 2021
Extent of activity (for example size, scale frequency, expected volumes of output or discharge)	See Volume 2, Chapter 2: Project Description of Lochmaddy Ferry Terminal Upgrade Environmental Impact Assessment Report (EIAR).
Use or release of chemicals (state which ones)	None

Water body[1]	Description, notes or more information
WFD water body name	Loch Maddy
Water body ID	200391
River basin district name	Scotland
Water body type (estuarine or coastal)	Coastal
Water body total area (ha)	1520
Overall water body status	High (2017)
Ecological status	High (2017)
Chemical status	Pass (2017)
Target water body status and deadline	Good
Hydromorphology status of water body	High (2017)
Heavily modified water body and for what use	No
Higher sensitivity habitats present	Loch Maddy is designated as a SAC with Lagoons, Shallow inlets and bays, intertidal mudflats and sandflats, reefs and subtidal sandbanks being the qualifying features. None of which are found within the development footprint.
Lower sensitivity habitats present	No
Phytoplankton status	High in 2007 no further data available.
History of harmful algae	No
WFD protected areas within 2km	Yes (Loch nam Madadh SAC)

[1] *Water body information can be found in the Environment Agency's catchment data explorer and the water body summary table. Magic maps provide additional information on habitats and protected areas. Links to these information sources can be found in the WFD assessment guidance for estuarine and coastal waters.*

Specific risk information

Consider the potential risks of your activity to each of these receptors: hydromorphology, biology (habitats and fish), water quality and protected areas. Also consider invasive non-native species (INNS).

Section 1: Hydromorphology

Consider if hydromorphology is at risk from your activity.

Use the water body summary table to find out the hydromorphology status of the water body, if it is classed as heavily modified and for what use.

Consider if your activity:	Yes	No	Hydromorphology risk issue(s)
Could impact on the hydromorphology (for example morphology or tidal patterns) of a water body at high status	Requires impact assessment	Impact assessment not required	Yes – Change in water depths associated with land reclamation, dredging and dredge disposal.
Could significantly impact the hydromorphology of any water body	Requires impact assessment	Impact assessment not required	Potentially at a very local level.
Is in a water body that is heavily modified for the same use as your activity	Requires impact assessment	Impact assessment not required	No

Record the findings for hydromorphology and go to section 2: biology.

Section 2: Biology

Habitats

Consider if habitats are at risk from your activity.

Use the water body summary table and Magic maps, or other sources of information if available, to find the location and size of these habitats.

Higher sensitivity habitats [2]	Lower sensitivity habitats [3]
chalk reef	cobbles, gravel and shingle
clam, cockle and oyster beds	intertidal soft sediments like sand and mud
intertidal seagrass	rocky shore
maerl	subtidal boulder fields
mussel beds, including blue and horse mussel	subtidal rocky reef
polychaete reef	subtidal soft sediments like sand and mud
saltmarsh	
subtidal kelp beds	
subtidal seagrass	

[2] *Higher sensitivity habitats have a low resistance to, and recovery rate, from human pressures.*

[3] *Lower sensitivity habitats have a medium to high resistance to, and recovery rate from, human pressures.*

Consider if the footprint[4] of your activity is:	Yes	No	Biology habitats risk issue(s)
0.5km^2 or larger	Yes to one or more – requires impact assessment	No to all – impact assessment not required	No
1% or more of the water body's area			No
Within 500m of any higher sensitivity habitat			Potentially, surveys required to determine.
1% or more of any lower sensitivity habitat			No

[4] *Note that a footprint may also be a temperature or sediment plume. For dredging activity, a footprint is 1.5 times the dredge area.*

Fish

Consider if fish are at risk from your activity, but only if your activity is in an estuary or could affect fish in or entering an estuary.

Consider if your activity:	Yes	No	Biology fish risk issue(s)
Is in an estuary and could affect fish in the estuary, outside the estuary but could delay or prevent fish entering it or could affect fish migrating through the estuary	Continue with questions	Go to next section	No
Could impact on normal fish behaviour like movement, migration or spawning (for example creating a physical barrier, noise, chemical change or a change in depth or flow)	Requires impact assessment	Impact assessment not required	
Could cause entrainment or impingement of fish	Requires impact assessment	Impact assessment not required	

Record the findings for biology habitats and fish and go to section 3: water quality.

Section 3: Water quality

Consider if water quality is at risk from your activity.

Use the water body summary table to find information on phytoplankton status and harmful algae.

Consider if your activity:	Yes	No	Water quality risk issue(s)
Could affect water clarity, temperature, salinity, oxygen levels, nutrients or microbial patterns continuously for longer than a spring neap tidal cycle (about 14 days)	Requires impact assessment	Impact assessment not required	No – Construction could affect water clarity but will be localised and highly unlikely to be continuous for 14 days.
Is in a water body with a phytoplankton status of moderate, poor or bad	Requires impact assessment	Impact assessment not required	No – Loch Maddy had a High status in 2008. No more recent data available.
Is in a water body with a history of harmful algae	Requires impact assessment	Impact assessment not required	No

Consider if water quality is at risk from your activity through the use, release or disturbance of chemicals.

If your activity uses or releases chemicals (for example through sediment disturbance or building works) consider if:	Yes	No	Water quality risk issue(s)
The chemicals are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment	Impact assessment not required	Yes - Potential for loss of containment of hydrocarbons (fuels and oils) during construction and operations.
It disturbs sediment with contaminants above Cefas Action Level 1	Requires impact assessment	Impact assessment not required	Yes – some samples found levels of contaminants above AL1.

If your activity has a mixing zone (like a discharge pipeline or outfall) consider if:	Yes	No	Water quality risk issue(s)
The chemicals released are on the Environmental Quality Standards Directive (EQSD) list	Requires impact assessment[5]	Impact assessment not required	No – surface water outfalls, but separators will prevent the release of EQSD listed chemicals, that could arise.

[5] *Carry out your impact assessment using the Environment Agency's surface water pollution risk assessment guidance, part of Environmental Permitting Regulations guidance.*

Record the findings for water quality go on to section 4: WFD protected areas.

Section 4: WFD protected areas

Consider if WFD protected areas are at risk from your activity. These include:

- special areas of conservation (SAC)
- special protection areas (SPA)
- shellfish waters
- bathing waters
- nutrient sensitive areas

Use Magic maps to find information on the location of protected areas in your water body (and adjacent water bodies) within 2km of your activity.

Consider if your activity is:	Yes	No	Protected areas risk issue(s)
Within 2km of any WFD protected area[6]	Requires impact assessment	Impact assessment not required	Yes – The dredging works and infilling works during the construction phase will result in disturbance loss of benthic habitats within the Loch nam Madadh SAC. However, none of the qualifying benthic features of the SAC are found within the development footprint. The works may also disturb the designated feature Otter (*Lutra lutra*).

[6] *Note that a regulator can extend the 2km boundary if your activity has an especially high environmental risk.*

Record the findings for WFD protected areas and go to section 5: invasive non-native species.

Section 5: Invasive non-native species (INNS)

Consider if there is a risk your activity could introduce or spread INNS.

Risks of introducing or spreading INNS include:

- materials or equipment that have come from, had use in or travelled through other water bodies
- activities that help spread existing INNS, either within the immediate water body or other water bodies

Consider if your activity could:	Yes	No	INNS risk issue(s)
Introduce or spread INNS	Requires impact assessment	Impact assessment not required	Yes – Via ballast water and biofouling associated with equipment and vessels required for construction.

Record the findings for INNS and go to the summary section.

Summary

Summarise the results of scoping here.

Receptor	Potential risk to receptor?	Note the risk issue(s) for impact assessment
Hydromorphology	Yes	Change in water depths associated with land reclamation, dredging and dredge disposal.
Biology: habitats	Potential	Survey required to identify benthic habitats present.
Biology: fish	No	Considered in EIAR Chapter 8: Fish
Water quality	Yes	Loss of containment of contaminants during construction and operations.
Protected areas	Yes	Loss of benthic habitat and potential disturbance of Otter.
Invasive non-native species	Yes	Via ballast water and biofouling associated with equipment and vessels required for construction.

If you haven't identified any receptors at risk during scoping, you don't need to continue to the impact assessment stage and your WFD assessment is complete.

If you've identified one or more receptors at risk during scoping, you should continue to the impact assessment stage.

Include your scoping results in the WFD assessment document you send to your activity's regulator as part of your application for permission to carry out the activity.