Scottish & Southern
Electricity Networks

SHEPD Subsea Cable Reopener Submission
Recovery of Protection Costs under Licence Condition CRC3F: Recovery of uncertain costs
February 2019

About SSEN

Scottish Hydro Electric Power Distribution plc (SHEPD), is a subsidiary of Scottish and Southern Energy Power Distribution Limited (SSEPD), along with Southern Electric Power Distribution plc (SEPD) and Scottish Hydro Electric Transmission plc. SSEPD and its subsidiaries are all members of the SSE plc group (SSE). Scottish and Southern Electricity Networks (SSEN) is a trading name of SSEPD.

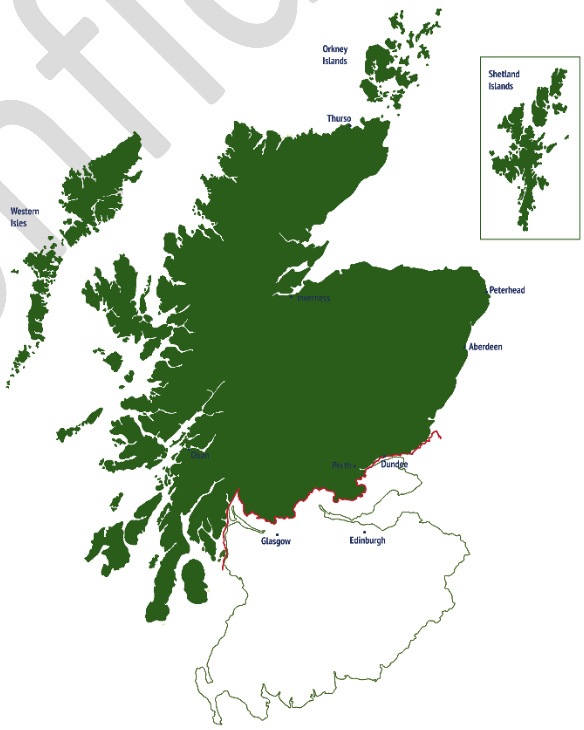
SHEPD is responsible for maintaining the electricity networks supplying over 772,000 homes and businesses across northern Scotland. The electricity distribution network comprises 9,144 substations and 49,154km of overhead lines.

As well as distributing electricity to the major towns and cities of Aberdeen, Dundee, Inverness and Perth, SHEPD also connects customers in remote rural areas and Scottish islands. It owns and operates over 100 subsea cable links. These subsea cables are generally installed between the mainland and an island but there are also critical links within the island groups themselves.

Due to the nature of SHEPD's distribution network, subsea cable links either form part of an interconnected network or are radial feeds with no alternative means of supply; SHEPD has 36 subsea cables that are a single point, radial feed. The loss of these cables requires local generation to maintain supply to customers and support the network.

SHEPD's subsea cable network offers an essential service to its customers, providing a safe and reliable supply of electricity to homes and businesses and critical links for the export of renewable generation to the GB mainland.

Figure 1: SHEPD's Distribution Service Area



Contents

Tables

Figures

Appendix

Appendix A:	**Proactive Project Descriptions**
Appendix B:	**CNAIM Extract February 2019**
Appendix C:	**Summary of Subsea Cable Protection Costs I (Excel)**
Appendix D:	**Summary of Subsea Cable Protection Costs II (Excel)**
Appendix E:	**Summary of Subsea Cable Protection Costs – Phased (Excel)**
Appendix F:	**Summary of Subsea Cable Protection Costs – Assumptions and Apportionment Method (Excel)**
Appendix G:	**Subsea Electricity Cable Consultation: What you need to know**
Appendix H:	**Subsea Electricity Cables: Cost Benefit Analysis Methodology**
Appendix I:	**Subsea Electricity Cables: Cost Benefit Analysis Methodology Statement Stakeholder Consultation Final Report**
Appendix J:	**Subsea Electricity Cables Cost Benefit Analysis Methodology Stakeholder Consultation**
Appendix K:	**Subsea Electricity Cables Cost Benefit Analysis Model: Method Statement Executive Summary**
Appendix L:	**Health costs associated with an increase in fuel poverty rates**
Appendix M:	**Submarine Electricity Cables Cost Benefit Analysis Method Statement**
Appendix N:	**BN-NET-ENG-013 - Distribution CBRM Data Source Governance**
Appendix O:	**PLN-NET-CAB-400 - Submarine Electricity Cables Plan**
Appendix P:	**SP-NET-CAB-405 - Minimum Requirements for Submarine Electricity Cable - Inspections**
Appendix Q:	**SP-NET-CAB-406 Minimum Requirements for Submarine Electricity Cable – Route Survey**
Appendix R:	**Marine licences for Shapinsay Stronsay**
Appendix S:	**Complete Marine Licences application for Rousay Westray**
Appendix T:	**Baseline Orkney-Hoy North CBA v6.8**
Appendix U:	**Orkney-Hoy North CBA Recommendation**

Executive Summary

Background

In its RIIO-ED1 business plan SHEPD requested an allowance of:

- **£44.6m**[1] to proactively replace **112km** of subsea cables; and
- **£15.1m** to cover the costs associated with managing subsea cables faults.

In its final determination Ofgem granted an allowance of:

- **£36.9m** to replace circa **85.1km** of subsea cables (based on a unit rate of £0.43m/km); and
- **£14.9m** to manage subsea cable faults.

No provision was made for Subsea Cable Costs associated with protecting cables as there was no specific requirement for this at the time of submitting our RIIO-ED1 Business Plan in July 2013 or our resubmission in March 2014. Instead, provision was made under licence condition CRC3F (Arrangements for the recovery of uncertain costs) to determine an appropriate adjustment to revenue during RIIO-ED1, once there was a greater certainty regarding protection requirements following the introduction of Scotland's National Marine Plan[2](NMP) on 27 March 2015.

National Marine Plan and Licensing Arrangements

The NMP was developed in accordance with the Marine (Scotland) Act 2010[3] (the Act), which required provisions to be made "in relation to functions and activities in the Scottish marine area", including licensing of marine activities and protection of the area and its wildlife.

Scotland's NMP covers both Scottish inshore waters (0-12 nautical miles from shore) and offshore waters (12-200 nautical miles). It sets out strategic policies for a wide range of activities including fishing, aquaculture, ports, harbours etc. relating to the sea and sea bed.

Marine licensing arrangements ensure the NMP's general policies and objectives are achieved. This includes supporting economically productive marine activities, mitigating potential conflict between users, ensuring the highest standards of quality and safety and ensuring all marine activities take into account environmental and climate change considerations. Specifically, marine licensing arrangements cover all activities relating to deposits and removals to the sea and/or seabed, dredging and construction. As such it encompasses activities associated with our subsea cable replacement and fault programmes.

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[1] All prices are quoted in 2012/13 prices, unless otherwise stated.
[2]Scotland's National Marine Plan: https://www.gov.scot/publications/scotlands-national-marine-plan/

[3]Marine (Scotland) Act 2010: http://www.legislation.gov.uk/asp/2010/5/contents

The marine licensing regime requires all relevant details regarding proposed activities to be clearly defined before being assessed by the Marine Scotland Licensing Operations Team to determine whether they can proceed and any conditions that must apply.

The introduction of the NMP and associated licensing regime in 2015 required a significant change in approach to subsea cable inspection repair, installation and protection in RIIO-ED1, relative to DPCR5. In addition to focusing on economic and efficient technical or engineering solutions for subsea cable replacement and fault management, we are now required to consider much wider policy objectives for the marine environment (as referenced above and set out in section 2.1 of this document). In particular, we are now required to:

- Carry out greater levels of engagement with all stakeholders for all marine licensable activities (inspections, surveys, installation, decommissioning and removal of subsea cables).
- Carry out significantly more detailed and rigorous inspection of subsea cables to meet obligations in relation to coexistence with other marine users and marine licence applications.
- Evidence burial and protection requirements, which we have demonstrated through a bespoke marine license CBA.
- Carry out greater levels of investment associated with burial and protection to protect the marine environment and users, and, where required, remove cables following decommissioning.
- Clearly evidence compliance with these additional requirements.

Marine Licensing Cost Benefit Analysis (CBA)

Following the passing of the Marine (Scotland) Act 2010 into law, Marine Scotland's starting position was to have all new cables fully protected. Adopting this approach would have resulted in costs, ultimately borne by customers, in excess of four times that included in this submission. In order to ensure a proportionate, risk-based approach to subsea cable protection under the new NMP, SHEPD instigated a consultation with a broad range of stakeholders, including Scottish Government, Ofgem, Marine Scotland and Scottish Natural Heritage, in September 2015. This process resulted in the development of a robust Cost Benefit Analysis (CBA) methodology and tool that has allowed alternative protection requirements to be analysed on a case by case basis, in a transparent and consistent manner, to determine the most economic and efficient solution. Assessments are conducted against the following agreed criteria:

- Health and Safety
- Socio-Economic impact
- Environmental impact
- Wider economic and engineering considerations

The licensing regime requires protection proposals for each subsea cable project to be consulted upon to ensure all stakeholders have an opportunity to comment and the final decision considers the impact on all interested parties.

Following this approach, SHEPD has replaced four[4] subsea cables in RIIO-ED1 and has obtained marine licenses for four. A further four[5] projects are currently under development. To date all marine licences have been granted without any objections and the method and level of burial and protection for each project has been based on specific circumstances of the project, such as seabed topography, tidal conditions, marine life, fishing activity, risk to other users, environmental impact and cost to SHEPD's customers. The approach has ensured that overall the most economic and efficient protection solution have been identified and implemented.

Our RIIO-ED1 Subsea Cable Replacement and Fault Programme

Planned Replacement Programme

Looking across the entire RIIO-ED1 period, SHEPD's risk-based approach to asset management has identified 16[6]cables (95.2km) that need to be replaced under the planned replacement programme in RIIO-ED1:

- 3 cables (26.0km) have been proactively replaced;
- 3 cables[7] (9.2km) are currently under development; and
- 10 cables (60.0km) are planned for the last 4 years of RIIO-ED1.

SHEPD is currently forecasting total replacement costs for these projects in the order of **£39.8m**. This is broadly in line with SSEN's RIIO-ED1 replacement allowance of £36.9m. However, it should be noted one further project (Pentland Firth East) has also been identified as critical following the recent inspection campaign. As intimated to Ofgem, SHEPD plans to seek additional funding for this project (replacement and associated protection costs) under the High Value Project reopener, provided for under licence condition CRC3F.

Faults Programme

In relation to subsea cable faults, SHEPD has experienced 9 faults to date and is forecasting 23 faults over the entire RIIO-ED1 period, giving a total forecast cost (excluding protection costs) of **£15.9m,** relative to an allowance of £14.9m**.** The total number of faults forecast is based on 3.6 faults per annum over the remaining RIIO-ED1 period. This is based on historical fault rates over the last 10 years and includes faults on the subsea cable from the cable joint or pole termination, through the shore ends, tidal sections, and the deep-water sections.

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[4] To date we have replaced Rousay Westray, Shapinsay Stronsay, Harris Scalpay and Lerwick Bressay (this later cable was replaced following a fault).

[5] To date we have been granted the required licences for Mossbank Yell, Yell Unst (1), Yell Unst (2) and Bute Cumbrae (Fault).

[6] The Pentland Firth East Cable (SHEPD_33) has also been identified as needing to be replaced and will be developed under the High Value Project reopener mechanism.

[7] Bute Cumbrae is not included here as it is not part of the planned programme, it is being replaced following fault.

Based on historical data, SHEPD expects 44% of all future faults to require end to end replacement, meaning 6.3 faults over the remaining RIIO-ED1 period are likely to require replacement. This equates to 19.0km.

Further detail regarding the background to this reopener, our RIIO-ED1 planned subsea cable replacement and fault programme and marine licensing regime can be found in Part 1 of this document.

Subsea Cable Protection Costs for RIIO-ED1 and This Reopener

To support our planned subsea cable replacement and fault programme for RIIO-ED1, we set out in Part 2 of this document the basis on which we are now seeking to recover **£58.9m** for protection costs under the Subsea Cable Cost reopener provided for under licence condition CRC 3F. **All prices are quoted in 2012/13 prices, unless otherwise stated.**

In particular, Part 2 of this document provides detail of anticipated protection requirements under the NMP and associated marine licensing regime, along with details of costs incurred on projects completed to date and how these have informed forecasts for projects under development or still to be completed in RIIO-ED1. For instance, it explains that cost forecasts are based on individual project designs as outlined in Appendix A, to ensure compliance with legal obligations under the NMP, and explains why we expect to:

- Undertake a further 20km of burial, in addition to the 8km carried out on projects completed in RIIO-ED1 to date; and
- Install approximately 460 rock bags and circa 10km of rock placement.

It should be noted that the level of protection and associated cost that we are now seeking to recover are significantly lower than the £260m protection costs anticipated in our September 2015 statement as part of our consultation on the development of the marine licensing CBA methodology. These cost savings have primarily been achieved through:

- Improved inspection data which has allowed us to demonstrate seabed conditions and associated risks associated with electricity subsea cables to a greater level of detail and certainty; and
- Application of the CBA methodology, to ensure full costs and benefits of all burial and protection options are transparent and assessed in a robust and consistent manner.

These measures have ensured the protection costs that we now seek to recover under this reopener for RIIO-ED1 are proportionate, economic and efficient and in the interest of all marine users and electricity customers.

The protection costs for RIIO-ED1 are further detailed in Part 2. A summary of costs and profile across RIIO-ED1 is set out in Table 1 below.

Table 1: Forecast Protection Cost Categories (£m) over RIIO ED1 period

2012/13 Prices	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22	2022/23	Total
Proactive Replacement	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Faults	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CBA	[redacted]	[redacted]	[redacted]	[redacted]					[redacted]
Indirect	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Protection Costs	**1.8**	**7.0**	**4.9**	**10.7**	**4.2**	**4.5**	**12.3**	**13.5**	**58.9**

1 Introduction

In our business plan submission for RIIO-ED1 we requested an allowance of £44.6m to replace 112km of subsea cable and £15.1m to manage subsea cable faults. In the final determination Ofgem granted an allowance of £36.9m to replace circa 85.1km of subsea cable (based on an assumed unit rate of £0.43m/km) and £14.9m for subsea cables faults.

It was recognised, at the time, both by Ofgem and us, that Marine Scotland was preparing the National Marine Plan, and that this would include more onerous provisions for the protection of cables on the seabed (including removal of decommissioned cables). The method and level of required protection, and therefore cost, was uncertain so the Subsea Cable Reopener was introduced under licence condition CRC3F (Arrangements for the recovery of uncertain costs). This allows us to apply for revenue to be adjusted to cover the additional actual and forecast costs of protection once they are better understood, referred to in the licence as Subsea Cable Costs.

The definition of relevant Subsea Cable Costs covered by the reopener is set out in licence condition CRC3F as follows:

‘***costs incurred, or expected to be incurred, by the licensee in applying recognised and approved measures to protect cables laid on the seabed beyond laying the cable on the seabed and securing it from the low tide mark as the cable emerges from the water in accordance with licensing requirements imposed by Marine Scotland*** ‘.

Based on this definition, we have included in this reopener submission all relevant subsea cable protection costs incurred or forecast to be incurred in RIIO-ED1. This includes items such as increased costs of inspections and surveys driven by the National Marine Plan; costs associated with burial of cables, costs associated with other methods of protection such as the use of rock bags, additional licensing costs, the associated costs for stakeholder engagement and consenting, and the costs of decommissioning and removing redundant cables to the extent set out in the licences issued by Marine Scotland.

The Subsea Cable Reopener is an essential mechanism to allow SHEPD to recover the efficiently incurred actual and forecast costs of protecting subsea cables as required by the Scotland’s National Marine Plan. In this submission we have also set out details of the subsea cables we have or expect to replace in RIIO-ED1 and explain the assessment process that we followed to determine which cables would be replaced, using an evidence and risk-based approach. This submission sets out details of the corresponding level of and method of protection required for each cable we have selected and, from this, set out the cost of protection for each cable as required by Scotland’s National Marine Plan.

We have replaced four cables already in this price control period and have evidenced the costs incurred and how these have informed the forecast costs of the projects that have not yet been undertaken. We have also set out our approach to cable faults, the cables we have assessed are most at risk of faulting and proposals for repairing or replacing them over the RIIO-ED1 period.

Part 1: RIIO ED1 Subsea Cable

2 Background

2.1 National Marine Plan

The Marine (Scotland) Act 2010 was introduced to:

'*make provision in relation to functions and activities in the Scottish marine area, including provision about marine plans, licensing of marine activities, the protection of the area and its wildlife including seals and regulation of sea fisheries; and for connected purposes'.*

The Act requires that National and, if necessary, Regional Marine Plans are drawn up that, amongst other things, state:

'*the Scottish Ministers' policies (however expressed) for and in connection with the sustainable development of the area to which the plan applies'.*

Scotland's National Marine Plan (NMP) was published on 27 March 2015. It covers both Scottish inshore waters (0-12 nautical miles from shore) and offshore waters (12-200 nautical miles). It sets out strategic policies for a wide range of activities including fishing, aquaculture, ports and harbours and many other activities relating to the sea and the sea bed. As such, it encompasses activities associated with subsea cable replacement and fault programmes.

Marine licensing covers activities relating to deposits and removals to the sea and/or seabed, dredging, construction work and use of explosives. The marine licensing process takes into consideration specific aspects of each proposed development before deciding on whether the development should go ahead or the conditions under which it can proceed.

The licensing of marine activities is designed to ensure that the NMP's General Policies are addressed. They include supporting economically productive activities, mitigating potential conflicts from interactions with other users, living within environmental limits and delivering climate change objectives. The NMP recognises that subsea power cables are of vital economic importance and will remain so for the foreseeable future

For subsea cables the NMP has five objectives.

1. Protect subsea cables whilst achieving successful seabed user co-existence.
2. Achieve the highest possible quality and safety standards and reduce risks to all seabed users and the marine environment.
3. Support the development of a Digital Fibre Network, connecting Scotland's rural and island communities and contributing to world-class connectivity across Scotland.
4. Safeguard and promote the global communications network.
5. Support the generation, distribution and optimisation of electricity from traditional and renewable sources to Scotland, UK and beyond.

The five objectives are underpinned by four main policies which explains that the licence application procedure is set out to ensure that:

1. Cable owners should engage with decision makers early in their planning process to notify of any intention to lay, repair or replace cables.
2. Cables should be appropriately routed and protected where feasible.

3. A risk-based approach should be taken regarding the removal, or otherwise, of redundant cables.
4. For the landfall of cables, owners should ensure they consider the policies relating to flooding and coastal protection as well as Scottish Planning Policy and Local Development Plans.

To help understand the relative impact on all interest groups, a robust Cost Benefits Analysis (CBA) methodology was developed through extensive stakeholder engagement and consultation since the beginning of RIIO-ED1. For electricity distribution network projects this ensures a robust, consistent and transparent approach is followed which sets out the options available and the relative costs and benefits of each in relation to the objectives and policies set out above. This helps ensure economic and efficient engineering decisions around routing and protection of cables are progressed without having a disproportionate impact on other users, marine wildlife and the environment.

The main outcomes of the creation of the NMP for SHEPD are that, for any new cable we install, we need to consider appropriate levels and methods of protection. These include burial under the sea bed, being weighted down with concrete mattresses, rock bags or other methods of minimising the possibility that other users of the marine environment could come into contact with the cables or there could be a detrimental impact on safety or the marine environment. Critically the NMP also sets out detailed requirements for decommissioning, including the need to remove redundant cables from the sea floor for similar reasons.

The removal of cables under the NMP also represents a step change from the previous practice of leaving the cables in situ after they have been decommissioned. While we understand and support the aims of the NMP, we are mindful this would also have a significant impact on charges paid by customers in the SHEPD Distribution Services Area, and as with other protection considerations, the CBA has been developed to ensure all costs and benefits are taken into consideration in determining requirements.

2.2 Marine Licences

As set out above, the introduction of the NMP and marine licences generated a shift change in the way we consider subsea cable replacement and fault management, specifically in relation to protection methods and requirements. Whilst our approach had previously focused on installing new cables to maintain security and reliability of supply at the least cost to our customers, this now needs to be balanced against much wider policy objectives for the marine environment, as mandated by the NMP, and requires us to adopt a holistic, risk-based approach.

However, the Marine Scotland Licences are only one part of the licensing regime for work undertaken in the sea. A greater number of associated licences are now required as a consequence of the marine licensing arrangements to inform burial and/or protection decisions or to carry out the physical activity of burial and protection. For example, the subsea cable team now need to obtain licences (or exemptions) and submit evidence for: exemption for noisy activity; European Protected Species (EPS) licence, Basking Shark licence, seabed surveys, sediment sampling; construction, harbour licences, works licences and removal of old cables licences. These must then be obtained by the SHEPD subsea cable team from a variety of agencies such as Marine Scotland, Scottish Natural Heritage (SNH), Scottish Environmental Protection Agency (SEPA), Crown Estates (Scotland) and local authorities.

So far in RIIO-ED1 we have replaced four subsea cables and have obtained the relevant licences for another four. The process of applying for and gaining relevant marine licences has also involved applying for and gaining approximately 160 associated licences and/or permissions, to deliver all elements of these projects.

Separate licences are now required for each aspect of the cable replacement process as set out below.

2.3 Cable Inspection and Survey Licences

Ahead of any cable inspections and surveys, all relevant consents and licences need to be in place. Under the Marine Scotland's licensing regime, this requires us to consider the following:

1. A European Protected Species Licence (EPS) is required under the Conservation (Natural Habitats, &c) Regulations 1994[8] (as amended) where there is potential for the presence of vessels or underwater noise from the proposed survey activities to injure or cause disturbance to a European Protected Species. Where there is potential to cause a disturbance, an EPS Licence is required. The Habitats (Scotland) Regulations 1994[9] provide the protection given to European Protected Species of animals and plants. Scottish inshore waters are internationally important for many cetaceans with at least 23 species of whales, dolphins and porpoise occurring in this area. Some activities in the marine environment may kill, injure or disturb cetaceans, which are protected species, therefore the licensing system ensures that any marine activities do not disturb any European Protected Species.

2. An assessment of the potential impact on basking sharks is required as per the Wildlife and Countryside Act 1981[10] (as amended). This may require a Basking Shark Licence to be secured in some cases.

3. An assessment under the Habitats Regulation Appraisal (HRA) process is required to assess if the cable inspections or any subsequent surveys are likely to have a significant effect on a European conservation site (either alone or in combination with other plans or projects). The HRA Regulations state that 'the effects of a project on the integrity of a European conservation site need to be assessed and evaluated as part of the HRA process'. This includes any European conservation sites with a marine component as well as any terrestrial or coastal European conservation sites with qualifying features that could potentially be impacted.

4. An assessment of the impact on Nature Conservation Marine Protected Areas (NCMPAs) is required in accordance section 126 of the Marine and Coastal Access Act 2009[11].

5. An assessment of potential impacts on designated seal haul-out sites must be completed in accordance with Act 117 of the Marine Scotland Act (2010).

6. Provision of information to support a Marine Licence Notice of Exempted Activity for the benthic sediment sampling component of any surveys which will be undertaken according to SNH Guidance Notice No. 45 – Subsea Cable and Oil and Gas Pipeline Proposals – Benthic Habitat and Species Survey Requirements. Following this assessment, it may be necessary to apply for a notice of intention to carry out an exempt activity.

7. An application for a Crown Estates Scotland Seabed Survey Licence is also required where engineering data is being collected to understand the behaviour, properties, habitats of the seabed

[8] Conservation (Natural Habitats, &c) Regulations 1994: http://www.legislation.gov.uk/uksi/1994/2716/contents/made
[9]The Habitats (Scotland) Regulations 1994: http://www.legislation.gov.uk/uksi/1994/2710/contents/made
[10] Wildlife and Countryside Act 1981: http://www.legislation.gov.uk/ukpga/1981/69

[11]Marine and Coastal Access Act 2009: https://www.legislation.gov.uk/ukpga/2009/23/contents

(e.g. cone penetration tests, vibrocores, grab sampling) to inform suitable cable routes and protection measures.

2.4 Cable Installation, Protection and Decommissioning Licences

Ahead of any installation, including burial, protection, and decommissioning, all relevant consents and licences need to be in place.

Under Part 4 of the Marine (Scotland) Act 2010, a Marine Licence Application for Construction Projects is required for the installation of subsea cables in Scottish waters. However, subsea cables do not require a formal Environmental Impact Assessment (EIA), to assess the environmental consequences of the planned work, as they are not listed on either Schedule 1 or Schedule 2 of the Marine Works (Environmental Impact Assessment) Regulations 2017[12].

Although a formal EIA is not required for subsea cables, Marine Scotland advises, in its 2015 Guidance for Marine Licence Applications[13] that:

"*applicants for marine licences for subsea cables should consider the scale and nature of their projects and give consideration to the need for a proportionate environmental assessment*".

For larger projects, where there is potential for the subsea cable to impact on the natural environment, it is recommended by Marine Scotland, in its Guidance, that an assessment of potential impacts on these receptors is carried out and results of the assessment along with relevant information about the Project is provided to support the Marine Licence application. SHEPD's applications identify environmental receptors in the area and include an assessment of the potential impacts for those cases that are considered particularly sensitive based on desktop studies and survey information. Our assessment is then submitted to Marine Scotland to obtain either an exemption, where an immaterial impact is identified, or to support a licence application, including a method statement on how the impact will be mitigated during installation, burial, protection or decommissioning works.

If the cable route for installation or decommissioning lies within a Marine Spatial Plan area, the policies within this must be considered. These plans generally identify areas of constraint and/or opportunities for development that have been identified to reduce potential conflicts between marine activities and encourage co-existence between multiple users. It also provides a framework to ensure a better-informed decision-making process regarding the timing of activities and deployment of resources. For example, several licences we have submitted to date have taken longer to determine or required further analysis as they impact on multiple areas within one campaign (Inspections of Orkney and Clyde) and multiple species (Orkney landfall birds and otters).

Furthermore, we are required to consider the impact of our proposed cable installation on internationally, nationally and locally important sites (including Nature Conservation Marine

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[12] Marine Works (Environmental Impact Assessment) Regulations 2017: http://www.legislation.gov.uk/uksi/2017/588/contents/made

[13] Marine Scotland, Guidance for Marine Licences Applications Version 2 (June 2015) https://www2.gov.scot/Resource/0052/00524064.pdf

Protected Areas, Special Areas of Conservation, Special Protection Areas and Ramsar sites (internationally important wetlands)).

3 Marine Licensing Framework

Under the Marine (Scotland) Act 2010 Scottish Ministers are responsible for the marine licensing system and enforcement of most matters in Scottish inshore and offshore waters and the Marine Scotland Licensing Operations Team (MS-LOT) issue licences on their behalf.

The licensing regime allows regulation of the deposit and removal of substances and objects in the seas around Scotland and requires activities to be undertaken in accordance with licence conditions. The activities that now require a marine licence and that are relevant to SHEPD are:

- Marine Construction
- Sampling & Instrument Deployments
- Dredging of minerals, all capital dredging, maintenance dredging by means of water injection, agitation, plough, side-casting and removal of sediment (e.g. sampling),
- Removal of substances/objects from the seabed using a vessel or similar activities including Dredging & Sea Disposal

A key feature of the marine licensing system is that decisions relating to any of the activities listed above will be taken in accordance with the UK Marine Policy Statement, the Scottish National Marine Plan and, in due course, the Scottish Regional Marine Plans. Marine plans, including the current Marine Policy Statement, inform marine licensing and other decision-making functions of all public authorities.

3.1 Pre-application Consultation

Prior to submitting a marine licence application, a Pre-Application Consultation must now be conducted in the relevant areas of impact and engage all interested parties such as local communities, environmental groups and local residents. This must run for a minimum of 12 weeks and evidence of compliance must be included as part of the marine licence submission. The requirement to carry out pre-application consultations is an additional requirement that was introduced under the Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013[14], which came into force on 6 April 2014.

The prescribed classes of activities which require a Pre-application consultation (PAC) are:

- Subsea cables over 1853 metres (approx. 1 nautical mile) in length and where the inter-tidal boundary is crossed.
- Reclaiming land, where the area exceeds 10,000 square metres.
- Any bridge, causeway or walkway, including pontoons, over 50 metres in length.
- Construction works or alterations (other than for a renewable energy structure or fish farms) (does not apply) exceeding 1000 square metres.

[14] Marine Licensing (Pre-application Consultation) (Scotland) Regulations 2013: http://www.legislation.gov.uk/ssi/2013/286/made

3.2 Marine Licence Application

It normally takes up to 14 weeks to secure a marine licence, from application submission to final licence issue (this is in addition to the Pre-Application Consultation process set out above). It should be noted however, that this timescale applies to straightforward cases without objections or other outstanding issues to be resolved. If objections are made, or if there are any other issues to be dealt with, then the determination period may take longer e.g. applications that require Environmental Impact Assessments (EIAs). Both screening and scoping activities, to determine whether a full EIA is required, have a 28-day consultation period.

The application must, specifically, include full details of the pre-application consultation and outcome; accurate co-ordinates of the location of the works with a chart clearly showing the area the work is to be carried out in (this is particularly important where remedial work is to be carried out or the cable is to be removed); and details of fishing liaison mitigation action plans which outline how we will undertake work in close proximity to other marine users. Other project specific studies and analysis will be submitted as relevant or requested by the licensing authority or statutory stakeholders.

To avoid interference with legitimate users of the sea, and in accordance with the NMP, there is a general presumption, in the NMP, in favour of subsea cable protection and burial. As such, marine licence applications also need to be accompanied by a burial plan showing in detail where an applicant expects to achieve burial and where, e.g. due to underwater obstacles or seabed conditions, this may be difficult to achieve. Where burial is not planned, an applicant must provide robust data and analysis to support a claim for not burying and provide details of how a cable will be protected. Where no protection is planned, suitable justification must be provided with an application.

3.3 Additional Marine Licence Requirements for Subsea Cables

Under the new marine licensing regime, we are specifically required to consider natural and historical heritage issues, navigation and impacts on fishing activity for subsea cables. As such we have appointed a Fisheries Liaison Officer to help facilitate communication with the fishing industry and ensure we independently identify and consider all relevant issues on each project conducted to date.

Emergency inspection and repair of cables does not require a marine licence. However, an applicant must still provide detailed design of works to be carried out, detailed and accurate location information (coordinates), timescale and criticality of works, and an estimate of potential wider impact on the marine environment. Works must be approved by the Marine Scotland Licensing Operations Team (MS-LOT) to obtain an exemption.

4 Marine Licence Cost Benefit Analysis (CBA)

As set out above, the policies set out in Scotland's National Marine Plan mean we have had to significantly change our approach to cable replacement and fault management for RIIO-ED1. As a starting point, the NMP policies favour the adoption of the relatively high cost solution of burying cables under the seabed or fully protecting them; compared to our historical and generally lower cost solution of laying the cables on the seabed. The NMP states that it is for the applicant to justify an alternative level of burial and protection. We agreed with stakeholder to develop a robust CBA methodology.

Through our proactive lead in the development of a robust CBA model and methodology, and extensive stakeholder engagement and industry consultation, we have ensured alternatives for installation and protection are considered and analysed on a project by project basis. This has ensured every decision is safe, ethical, responsible, economic and efficient. It also ensures appropriate consideration is given to the full impact on the marine environment and all relevant marine users, securing appropriate protection but also value for money for our customers.

The methodology considers:

- Alternative installation, burial and protection methods;
- Relevant impacts (positive and negative) that different protection methods have on the full range of stakeholders and assessment criteria e.g. environment or the economy; and
- Informs the approach to evaluation and financial assessment of material impacts.

4.1 Stakeholder Voice

Beginning in 2015, SHEPD undertook three years of extensive consultation with over a thousand individuals and organisations to collaboratively develop and establish a transparent CBA methodology. Organisations involved included:

- Members of fishing, Aquaculture, Renewables, Tourism, Recreational and Cable Installation Industries and their representative bodies
- Scottish Government
- Ofgem
- Local Authorities
- Crown Estate Scotland
- Marine Scotland
- Northern Lighthouse Board
- Maritime and Coastguard Agency
- Scottish Natural Heritage
- Scottish Environment Protection Agency
- Historic Scotland
- Harbour and Port Authorities
- National Health Service
- Advocates for the Fuel Poor and Consumers
- Non-government organisations including Scottish Environment LINK
- Customers
- Academia

Through the consultation, stakeholders helped define the various benefits and risks associated with different installation, protection and decommissioning methods. Stakeholder input (including Ofgem, Scottish Government and Marine Scotland) has allowed the CBA methodology to establish an agreed best practice for assigning a financial value to alternative protection options, and to evaluate the impact a cable replacement programme would have on all interested parties, including customers and the communities we serve and work with, as well as other marine users and the natural environment.

As a responsible developer, the model and methodology allows SHEPD to develop a final solution and demonstrate its appropriateness as part of a marine licence application.

The process of engagement during consultation and in the development of the methodology and model included workshops, four written consultations and independently commissioned studies over the first half of the RIIO-ED1 period. Through this we sought opinion on key subjects such as; the cable installation methods we used, the positive and negative impacts of different installation methods and the way that we quantify, monetise or otherwise evaluate these impacts.

The development of the model can be seen in the following documents:

- Subsea Electricity Cable Consultation: What you need to know (September 2015)[15]
- Subsea Electricity Cables: Cost Benefit Analysis Methodology Statement (December 2015)[16]
- Subsea Electricity Cables: Cost Benefit Analysis Methodology Statement Stakeholder Consultation Final Report (July 2016)[17]
- Subsea Electricity Cables Cost Benefit Analysis Methodology Stakeholder Consultation (November 2017)[18]
- Subsea Electricity Cables Cost Benefit Analysis Model: Method Statement Executive Summary (January 2019)[19]
- Health costs associated with an increase in fuel poverty rates (January 2019)[20]

As a result of our engagement we identified four central impact areas. They are defined in the methodology as:

- Health and Safety
- Socio-Economic
- Environmental
- Wider economic and engineering

These four impact areas are further broken down in Table 2 below.

Table 2: Final Cost Benefit Analysis (CBA) Categories and Impacts

[15] See Appendix G - Subsea Electricity Cable Consultation: What you need to know
[16] See Appendix H - Subsea Electricity Cables: Cost Benefit Analysis Methodology
[17] See Appendix I - Subsea Electricity Cables: Cost Benefit Analysis Methodology Statement Stakeholder Consultation Final Report
[18] See Appendix J - Subsea Electricity Cables Cost Benefit Analysis Methodology Stakeholder Consultation
[19] See Appendix K - Subsea Electricity Cables Cost Benefit Analysis Model: Method Statement Executive Summary
[20] See Appendix L - Health costs associated with an increase in fuel poverty rates

Category	No	Type	Name
Health and Safety impacts	1	Benefit	Decreased health and safety risk to marine vessel operators from cable snagging
	2	Net benefit/ cost	Net change in health and safety risk to cable laying vessel operators Note, this is based on trade-off between: (i) lower fault rates leading to less time at sea; and (ii) longer installation, repair, and decommissioning time requiring longer time at sea
	3	Cost	Increased health costs associated with an increase in fuel poverty rates caused by higher energy prices
Socio-economic impacts	4	Benefit	Decreased damage costs to marine vessel operators from cable snagging
	5	Benefit	Decreased risk of energy outages for island communities due to lower fault rates
	6	Cost	Increased distribution costs leading to lower renewable generation on islands and lower Gross Value Added (GVA)
	7	Cost	Increased cost of fuel poverty eradication programme due to higher fuel bills
	8	Cost	Increased cost to fishing operators due to loss of access to fishing grounds during cable installation
	9	Benefit	Decreased risk of energy outages for renewable generators due to lower fault rates
Environmental impacts	10	Cost	Increased distribution costs leading to lower renewable generation on islands and higher Greenhouse Gas (GHG) emissions
	11	Net benefit/ cost	Net change in GHG emissions from use of backup diesel generators Note, this is based on trade-off between: (i) lower fault rates resulting in a reduction in diesel usage; and (ii) longer repair time resulting in an increase in diesel usage
	12	Net benefit/ cost	Net change in seabed and marine environment value Note, this is based on trade-off between: (i) lower fault rates resulting in a reduction in the frequency of impacts on the seabed during repair events; and (ii) greater extent of impacts on the seabed due to wider footprint from cable protection methods (aside from Horizontal Directional Drilling)
Wider Economic and Engineering impacts	13	Cost	Increased installation costs associated with protection
	14	Net benefit/ cost	Net change in repair costs Note, this is based on trade-off between: (i) lower fault rates resulting in fewer repairs; and (ii) longer repair time because cables are protected
	15	Cost	Increased cost of decommissioning associated with protection
	16	Benefit	Decreased risk of outage charges due to lower fault rates
	17	Cost	Increased cost of maintenance surveys associated with protection
	18	Net benefit/ cost	Net change in use costs of using backup diesel generators Note, this is based on trade-off between: (i) lower fault rates resulting in a reduction in diesel usage; and (ii) longer repair time resulting in an increase in diesel usage

The final RIIO-ED1 CBA methodology was agreed by stakeholders and published on our website in January 2019[21]. As a publicly available methodology this allows us and stakeholders to compare different cable installation and protection methods on a case by case basis, to determine the appropriate installation method and percentage of burial, protection and removal for each cable, taking into consideration the unique characteristics of the depth of the sea, the seabed conditions and type of marine activities in close proximity to our cable.

Engaging with local communities on local investment plans is a key element of our decision-making process. We ensure that our modelling scenario considers all relevant local circumstances and

[21] See Appendix M – Submarine Electricity Cables Cost Benefit Analysis Method Statement

represents best societal value, represented by the option with the lowest negative cost in the CBA, over the investment period.

The option with the best societal value becomes our preferred option for the subsequent and detailed local Marine Scotland Licensing process for individual investment projects.

The preferred option is then consulted on under the marine licensing process, as set out above, to allow local stakeholders to comment on whether the preferred option is suitable. The modelled scenarios are then used to support marine licence applications for planned replacement works. To date this has been highly successful with all six[22] marine licences granted to date being determined with no objections from stakeholders.

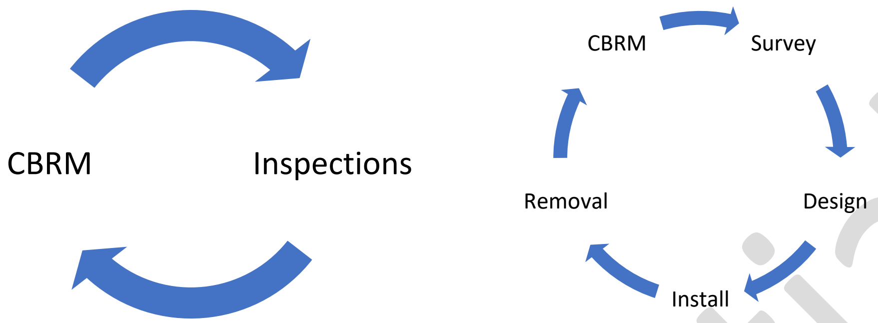
A Quad Party group, involving Scottish Government, Marine Scotland, Ofgem and SHEPD, monitors the progress and appropriateness of the CBA on a quarterly basis but also ensures that any other matters regarding the installation, related impacts and risk can be discussed and addressed at the earliest opportunity.

[22] Lerwick-Bressay and Harris-Scalpay did not require a marine licence as an alternative solution to a subsea cable was installed.

5 Risk Based Approach to Investment Management

Our cable replacement programme follows the stages set out in Figure 2 below. The first cycle involves looking at the need to replace a subsea cable and the second cycle looks at the most efficient and economical method of replacement.

Figure 2: Risk Based Approach to Investment Management



5.1 CBRM: Asset Health Assessment

CBRM (Condition Based Risk Management) is the asset management system adopted by Distribution Network Operators (DNOs) across GB in 2016. It evaluates the condition and risk associated with assets that make up the SSEN distribution networks, including subsea cables. CBRM achieves this by analysing a range of inputs for cables such as age, location and depth, and then applies an algorithm developed via a DNO working group with help from EA Technology Ltd to provide a common industry approach to determining asset health and criticality. CBRM is utilised by the SSEN Asset Management team to meet the requirements of Standard Licence Condition 51 (Network Asset Indices Methodology)[23] and provides a comprehensive view of the current risk to the security and reliability of the distribution network. Our key governance document for CBRM[24] (BN-NET-ENG-013] provides further details of the 29 data fields that are relevant for subsea cables (see Appendix B where we have provided a data extract from CBRM for our current subsea cable portfolio). Details include the unique cable reference (SHEPD_XX), Asset Health (HI1 to 5), Criticality (CI1 to 4) and cable length.

After the first year of RIIO-ED1, the CNAIM (Common Networks Asset Indices Methodology) was used to re-base the RIIO-ED1 Health and Criticality targets for assets and replaced the DNO specific inputs previously used in CBRM. CNAIM is a common framework of definitions, principles and calculation methodologies, adopted across all GB Distribution Network Operators, for the assessment and forecasting of asset risk. This is the methodology currently used for regulatory reporting.

For subsea cables CNAIM takes a series of inputs such as Section ID, length, whether the cable is in service or not, the conductor material and cable construction, the operating voltage, the cable manufacturer and year of manufacture. Other environmental factors such as the wind / wave energy rating, and the depth and seabed characteristics at which the cables are laid, are also gathered to

[23] Reference Common Network Asset Indices Methodology. https://www.ofgem.gov.uk/system/files/docs/2016/01/dno_common_network_asset_indices_methodology_draft_v4_0.pdf

[24] See Appendix N – BN-NET-ENG-013 - Distribution CBRM Data Source Governance

inform the asset assessment and the investment decision. The condition data is gathered and includes dates and Remotely Operated Vehicle (ROV) /dive assessments, the date and assessment of the Shore End Inspections, and the condition of the Terminal Pole.

The models used within CNAIM also provide future predictions of Asset Health based on several factors:

- Environmental factors
- Inspection data
- Fault information
- Reported damage to cable
- Condition monitoring data – this may suggest the cable is performing in a different manner to that forecast
- Wider network changes which impact on performance due to load characteristics

For instance, in relation to environmental factors, where a subsea cable has a sharp change of direction (more than 30 degrees in a length of 4m or under) this is likely to impact on the subsea cable's asset health. Historically this was not recorded but with new inspection technology available this can now be identified. As a result the impact on asset vulnerability and risk of failure or deterioration and reduction in associated asset life can be monitored and more accurately determined. For instance, while at HI3 the asset is unlikely to experience any loss of performance during significant environmental impact, at HI4 there is likely to be a greater impact on cable performance due to the mechanical strength of the armour being degraded.

While the benefits of this more robust approach using CNAIM in RIIO-ED1 is evident, it has required a significant increase in the quality, quantity and diversity of asset data collected and used to ensure asset health is identified in a robust and consistent manner.

The CNAIM system needs condition data to accurately forecast the health of an asset. If there is limited condition data, then the system is less likely to produce a HI score that accurately reflects condition or appropriately triggers intervention. This was the case prior to RIIO-ED1, but as set out in our business plan, SSEN along with other DNOs has focused on collecting additional data to improve understanding and provision of documentary evidence of the condition of all assets giving a more robust risk-based approach to asset management.

The CNAIM system produces a health and criticality matrix for each cable, every time there is a change in data. The CNAIM system is uploaded monthly to reflect the most recent inspection data.

The assessment of subsea cable asset health used to inform our subsea cable replacement programme and fault strategy has been made in accordance with the Appendix of the subsea cable guidance document[25] (PLN-NET-CAB-400).

5.2 Asset Health

Asset Health is a broad measure of the importance of an asset across a wide range of risks, including environmental, financial and interruption. Where a cable has a high health score (HI5) it will have a greater chance of failure, than a cable which has a low asset health score (HI1). Table 3 provides an illustration of each of the five HI ratings.

[25] See Appendix O - PLN-NET-CAB-400 - Submarine Electricity Cables Plan

Table 3: How asset health is determined and categorised.

Asset HI	Ofgem Description	Description	Key Points	Image
HI1	**New or as New**	HI1 is where there are no concerns over asset health. An HI1 score would indicate a subsea cable which is new and recently passed commissioning.	• The subsea cable outer serving has no visible damage; • There is no exposed armour; • There is no exposed insulation.	
HI2	**Good or serviceable condition**	HI2 is where there are no health concerns or need for remedial works.	• The subsea cable outer serving may have visible damage; • There are small number of sections with damaged armour; • There is no exposed insulation.	
HI3	**Deterioration requires assessment and monitoring**	HI3 is where a subsea cable is exhibiting signs that it is starting to age. At HI3 it may be suitable to attempt certain repairs on the subsea cable. It is not expected to require replacement at this stage.	• The subsea cable outer serving has areas of visible damage; • There are numerous sections of exposed armour; • There is no exposed insulation.	
HI4	**Material deterioration, intervention requires consideration**	Generally, a subsea cable which is HI4 will display several sections in poor health. It is normally not economic to consider any repair or maintenance works when the cable is in this condition, however this is considered on a case by case basis.	• The subsea cable outer serving has visible damage and at points it is no longer present; • There are significant sections of exposed armour, with corroded armour visible; • There is no significant exposed insulation.	
HI5	**End of serviceable life, intervention required.**	HI5 is where a subsea cable is at risk from condition-based failure. Replacement is the only suitable option for a subsea cable of HI5 category. Any repair or maintenance efforts will generally not succeed and / or will not be economic.	• The subsea cable outer serving has visible damage and has little or none left; • There are significant sections of exposed armour, with major corrosion to the armour; • Armour is likely to have lost mechanical strength; • There is exposed insulation.	

5.3 Criticality

Asset Criticality is a broad measure of the importance of an asset across a wide range of risks, including environmental, financial and interruption. Where a cable has a high criticality score (CI4) it will have a greater impact in the event of failure, than a cable which has a low criticality score (CI1). For example, where a single fault will not result in loss of supply to customers this results in a lower network criticality score for the cable than one where there is no alternative supply. In CNAIM all assets are measured against assets within the same category, therefore the relative criticality of the subsea cable asset type is likely to be under stated.

To help determine which, if any, subsea cables need to be replaced and when, the Subsea Asset Health Selection Matrix in Figure 3 is used. In the matrix Health and Criticality are colour coded to help determine the priority for investment with Red being high priority and Green being low priority.

Figure 3: Subsea Asset Health Selection Matrix

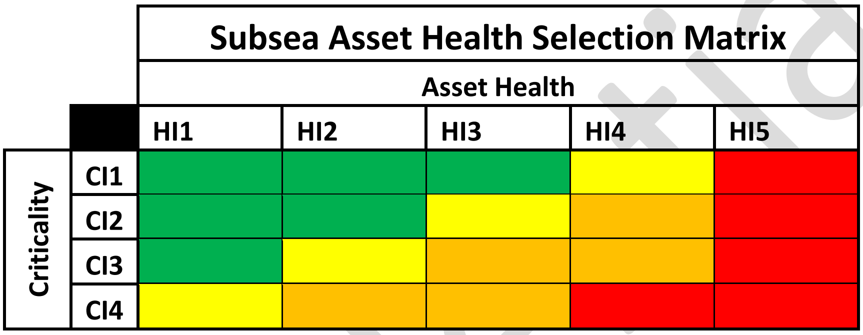


Figure 3 illustrates that based on red being a high priority, all assets with HI5 will be deemed as a high priority for intervention. These assets are further ordered by Criticality Index, so HI5 assets with a CI4 rating are the highest priority.

The risk profile associated with subsea cables is significantly higher than that of any other asset operated by SSEN, this is due to several factors:

- Lead time for cable replacement;
- The requirement to run significant levels of diesel or portable generation during a fault to maintain security of supply; and
- The remote location of the islands which can make access and mobilisation more difficult.

This output is used by the SSEN Asset Management team to determine where the current risk exists for our subsea cable fleet and what cables should be inspected to verify their current health condition. The output is also used to inform investment decisions.

6 Subsea Cable Inspections

Our subsea cable inspection campaign is an important part of our risk-based approach to asset management. As set out in our RIIO-ED1 business plan we have implemented a robust programme of inspection over the current price control period to better understand the condition of all our assets, including subsea cables, and to inform our replacement and maintenance programme. However, more detailed and accurate data has also been required under the NMP and marine licensing regime to discharge obligations to maintain accurate information on subsea cable locations and surrounding marine environments and to support marine license applications and associated CBAs to determine the level and method of protection required for each project. Seabed conditions and depth of burial information is also essential to support proposals regarding decommissioning and removal of existing cables. For example, where we can demonstrate existing cables have self-buried over time and have achieved a depth of cover of 600mm or greater,there may not be any requirement to recover redundant cables. Finally, improved information has also facilitated co-existence with other marine users as required under the NMP and helped deliver policy objectives to maintain a safe marine environment.

As part of our commitment to meet these obligations a new inspection policy[26] (SP-NET-CAB-405 Minimum Requirements for Subsea Electricity Cable Inspections) has been introduced in RIIO-ED1 This requires inspection of all our subsea cables on a 4 to 8-year cycle (4 years for highest risk cables to 8 years for lowest risk cables).

Table 4 provides an overview of the length and number of cables that we have inspected since the beginning of RIIO-ED1. To date we have inspected 312km of subsea cables. This represents 70% of our total portfolio of 111 live cables.

Table 4: Inspection Programmes - RIIO-ED1 to Date

Year	Number of Cables	CNAIM Cable Length (m)	Inspected Length (m)
2016	26	134,499	52,454*
2017	12	112,475	111,475
2018	40	148,555	148,555
Total	**78**		**312,484**

*The 4 longest cables in our portfolio were only partially inspected.

Given the importance of additional requirements under the NMP and marine licensing regime, we have also developed a minimum inspection requirement specification, outlined within SP-NET-CAB-405. This includes the following key requirements:

Figure 4: Inspection Requirements

Inspection Requirement	Marine Licence	CNAIM
Document the cable position	✓	✓
Document any damage, exposure, suspensions, burial or other significant points of interest	✓	✓

[26] See Appendix P – SP-NET-CAB-405 - Minimum Requirements for Submarine Electricity Cable - Inspections

Document depth of burial	✔	✖
Detail any debris in contact or in close proximity to the cable	✔	✖
Bathymetric surveying using Multibeam Echo Sounder (MBES) and Side Scan Sonar (SSS) to identify areas of scour, debris, trawl scars etc.	✔	✔
High Definition (HD) video recordings and still images of the cable inspection showing: date, time, location, depth, sea current and other points of interest that are deemed necessary (i.e. cable or protection damage, any discarded fishing equipment, discarded anchors, Priority Marine Features such as reef habitats, mussel beds, Heritage points of interest, etc.	✔	✖

Given the requirements set out above we have also adopted a variety of inspection methods as set out below, to ensure high-quality data is available for our subsea cables.

6.1.1 Remotely Operated Vehicles (ROVs)

Cable inspections by ROVs, deployed from offshore vessels, are the most efficient and hence main method used in the offshore environment. There are a wide range of ROVs available ranging in size, power, depth rating, method of propulsion etc. They are selected based on the cable routes for inspection and tidal conditions expected to give the required granularity of information, evidence and confidence in data.

ROVs can be equipped with various sensors for acquiring information during the inspection including the seabed topography in the locality of the cable. Larger ROVs can be equipped with additional sensors, cameras, lighting and can operate heavier cable tracking systems.

ROVs operate with a tether connected to the support vessel. This allows real-time control by the operator which is useful during the visual inspection of a cable on the surface of the seabed or during cable tracking where a cable is buried.

6.1.2 Autonomous Underwater Vehicles (AUVs)

Autonomous Underwater Vehicles (AUVs) are similar to ROVs but are typically smaller, making them suitable for road transportation for more difficult to reach areas. They are predominantly launched from an offshore vessel in the marine environment. In high current conditions ROVs offer more power and steadier alignment to the cable.

Similar to ROVs, AUVs can be equipped with sensors for acquiring information during inspection, including the seabed topography in the locality to the cable. AUVs have the benefit of being able to be operated with a pre-programmed route without intervention.

6.1.3 Diver Swim Inspection

In shallow waters which are not suitable for vessels, and to bridge any gap between the land and marine near shore inspections, a diver swim inspection may be undertaken. The objective of a diver inspection is to inspect the cable and marine environment within the surf zone. This will be conducted from the cable landing point to overlap with the near shore vessel inspection limit. An underwater video of the centreline is undertaken, with any points of interest such as start/stop of cable burial and or protection, damage or items of debris (on or in close proximity to the subsea electricity cable) are recorded. Where the cable is buried, then either a probe or other system for detecting the depth of burial of the cable can be used.

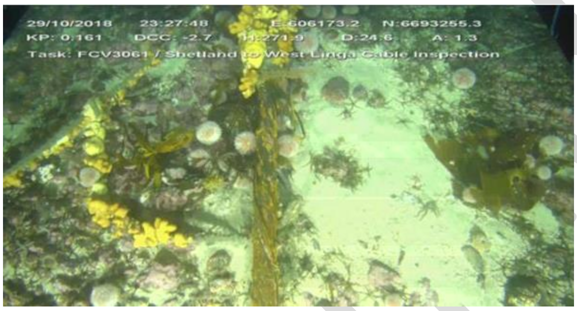
When all inspection data (Inspection report and HD Video) is received it is reviewed by an internal subject matter expert, with the support of external technical experts where required, and a summary report for each cable is prepared outlining key findings.

6.2 Inspection Data

While the subsea cable inspections carried out in 2013 were used to inform our RIIO-ED1 subsea cable replacement programme, we have subsequently undertaken three main inspections campaigns in RIIO-ED1 (2016, 2017 and 2018).

The approach taken for these inspections was to use one vessel, with a combination of ROV and dive inspection facilities, deployed depending on sea depth, to get an end to end view of the condition of the marine environment and subsea cable. As can be seen in Figure 5, the images returned are of high quality. This has provided information on cable condition, burial depth and seabed condition. To comply with marine licence requirements, we need data on the entire length of each individual cable to provide a complete data set, including details of self-burial, details of whether the cable has moved significantly, or if the cable is sitting near any priority marine features such as mussel beds, or reefs, which would impact on the route and level of protection (or removal) required.

Figure 5: Inspection Data Quality – SHEPD 88 Shetland West_Linga



Our inspection programme for the rest of RIIO-ED1 is currently being finalised. A summary of the cables and lengths is included in Table 5. As set out in our policy, the priority will be to inspect high-risk cables identified in CNAIM.

Table 5: Inspection programme until the end of RIIO-ED1

Year	Number of Cables	Total Cable Length (m)
2019	2	78,310
2020	30	63,503
2021	42	59,099*
2022	0	
2023	0	
Total	74	200,912
*A number of decommissioned cables will also be inspected ahead of RIIO ED2		

7 Current Subsea Cable Replacement Programme for RIIO-ED1

Our subsea cable replacement programme has developed over the course of RIIO-ED1, informed by the inspections campaigns that have been carried out during this period. The information gathered from inspections is fed into the risk-based methodology employed by CNAIM to give an HI and CI score as described in section 5.1 above. All cables that are in our replacement programme fall into the red area of the Health and Criticality Matrix in Figure 3 and have been assessed as being most at risk from failure. From the inspections that have been carried out to date 95.2km have been identified for replacement.

Although the CNAIM score gives a good guide as to which cables to replace and in which order, it does not take into account things such as:

- economies of scale associated with replacing cables in the same location at the same time, for example the Shetland Cables are being replaced as a single programme of work;
- the high cost of fixed diesel generation or alternative means of supply should the cable fail; and
- impact on local renewable generation ability to export.

As a result, additional assessment is required to prioritise cable replacement within the HI5 category, to reflect actual impact of failure of the cables.

It should be noted; the programme may be subject to change as new inspection and fault information comes to light over the price control period.

Table 6 below summarises those cables that we have replaced and those that we currently plan to replace in RIIO-ED1 using the risk-based approach to asset management set out above. Individual project summaries, providing further evidence and justification of the need to replace each cable in RIIO-ED1 are provided in Appendix A.

The level of planned replacement expenditure (excluding protection) currently forecast for RIIO-ED1 is in line with that forecast in our business plan and the allowance provided by Ofgem. This programme will also deliver our RIIO-ED1 outputs (HI, CI/CML) and is critical to maintaining security and reliability of supply.

Table 6: RIIO-ED1 Replacement Programme

Cable Name	CBRM Reference	Installed Length (m)	[redacted]	Status	[redacted]
Faulted Cables					
Lerwick Bressay North	SHEPD_118	440	[redacted]	Complete	[redacted]
Bute Cumbrae Centre (2)	SHEPD_30	4,620	[redacted]	Programmed	[redacted]
Proactive Replacement					
Shapinsay Stronsay	SHEPD_153	14,770	[redacted]	Complete	[redacted]
Rousay Westray	SHEPD_149	10,450	[redacted]	Complete	[redacted]
Harris Scalpay East (2)	SHEPD_62	770	[redacted]	Complete	[redacted]
Mossbank Yell South (2)	SHEPD_43	4,000	[redacted]	Installation Started	[redacted]
Yell Unst North (1)	SHEPD_44	2,600	[redacted]	Installation Started	[redacted]
Yell Unst South (2)	SHEPD_61	2,600	[redacted]	Installation Started	[redacted]
Carradale Arran North (1)	SHEPD_74	6,440	[redacted]	Programmed	[redacted]
Mainland Orkney Shapinsay	SHEPD_73	3,080	[redacted]	Programmed	[redacted]
Mainland Orkney Hoy Centre (2)	SHEPD_34	4,730	[redacted]	Programmed	[redacted]
Mainland Orkney Hoy North (1)	SHEPD_21	4,700	[redacted]	Programmed	[redacted]
Sanday Eday	SHEPD_26	4,590	[redacted]	Programmed	[redacted]
Rousay Egilsay	SHEPD_29	2,020	[redacted]	Programmed	[redacted]
Sanday North Ronaldsay	SHEPD_36	10,700	[redacted]	Programmed	[redacted]
Shetland Whalsay	SHEPD_41	5,290	[redacted]	Programmed	[redacted]
Mull Coll	SHEPD_105	16,250	[redacted]	Programmed	[redacted]
Shetland West Linga	SHEPD_88	2,230	[redacted]	Programmed	[redacted]

8 RIIO-ED1 Subsea Cable Fault Strategy

There are 59 islands in the North of Scotland, that are connected to SHEPD's mainland electricity network via submarine electricity cables. The often remote location, and the physical marine environment makes fault location and repair more challenging than for conventional cables.

8.1 Alternative Supplies

Subsea cables are generally installed between islands or between the mainland and an island. Due to the nature of the distribution network this means that they either form part of an interconnected network or are radial feeds with no alternative supply.

The potential loss of a radial circuit requires local generation to maintain supplies to our customers. There is also sometimes a need to provide generation support to parts of the network to cover for the loss of a section of interconnected network. The provision of generation to support the local network in the event of a fault varies from small local generation sets at specific locations to 20 MW Power Stations on the larger islands.

When a subsea cable faults, the network configuration of that cable will determine the method required to restore supplies. These range from, back feeding using existing network infrastructure, using Fixed Diesel Generators or using mobile diesel generators. When a cable faults, the control room are alerted, and the regional staff restore supplies to customers as fast as possible. The fault investigation works start with diagnostic testing of each phase being carried out to locate how many metres from the shore end the failure has occurred. Then records are assessed to see if the failure is on a joint or a cable free span. Once the fault has been located the various options for the cable are considered. These will depend on many factors including the depth of the cable at the fault, the age of the cable, the availability of vessels, the sort of joint used and the availability of spares.

8.2 Repair

If the cable fault is at the shore end or accessible at low tide, then a repair may be considered. If the fault is at a depth where the cable could be winched onto a vessel and a new section of cable jointed in, then this would also be considered. If the joint has failed and this could be repaired on a vessel then this would also be considered. However, lifting cables from the sea bed, to joint on a vessel, places a large mechanical strain on them, and can lead to further faults, once the cable has been placed back on the sea bed. Therefore, for older cables in poor health, where it is determined that it is not practical or efficient to repair cables, a complete replacement is necessary. Going forward, as cables are more likely to have sections of additional protection due to the conditions of the Marine Licence, accessing the location of faults will be more difficult and doing piece in work and joint repair will be much less likely in the future.

8.3 Replacement

As a guide, an asset would be replaced, where the cost of repair and potential risk of further faults following disturbance would be greater than the cost of the replacement. Additional risks will also be taken into consideration e.g. the deeper the water, the more complex the repair. Greater strain is also put on the cable when jointing work is carried out on the vessel, increasing the risk of additional faults. Factors such as the age, and fault history of the cable would be taken into consideration when deciding whether to repair or replace.

8.4 Predicting Future Faults

In total there are 239km[27] of cable inspections planned for the rest of ED1. These include the two particularly long and critical cables that supply the Western Isles namely; SHEPD_65, Skye Harris 32.1km, and SHEPD_64, Skye South Uist, 46.1km. These cables were partially inspected in 2016. As there is no interconnection between the two, if there is a fault on one of the cables, then the diesel stations on the islands would have to be run to maintain supplies. There is no alternative way of supplying customers by closing open points on the network to enable the power to flow via another route. As such these cables are our next priority for end to end inspection in 2019/20.

Of the 239km of cable that is in the rest of our RIIO-ED1 programme, we estimate that 109km, including both Western Isles cables, may return a critical inspection rating leading to an HI5 health score in CNAIM. The mean length of all these cables is 3.17km[28]. This has been used to estimate the total length of cable that is likely to fault in RIIO-ED1 and require end to end replacement with protection.

To predict the number of faults that are likely to occur over the remainder of RIIO-ED1, data from the last 10 years has been analysed to determine an average fault rate of 3.6 faults per annum. On past performance this would equate to 14.4 faults for the rest of the price control period. Not all faults will result in a cable being replaced end to end; analysis suggests that 44% would require end to end replacement, 38% would be repairable, and 19% would be resolved with other engineering solutions such as replacement of the cable end box. This means, out of the 14.4 predicted faults, 6.3 are likely to result in end to end replacement over the remainder of the RIIO-ED1 period, and associated protection under the marine licensing regime.

8.4.1 Generator Costs

Where there is no alternative network connection, fixed or mobile generation is required to restore supplies in the event of a subsea cable fault. There is no interconnection between Harris and North Unst, so if one cable faults the other cable cannot supply the whole of the Western Isles. However, there is fixed diesel generation on the Western Isles capable of meeting any shortfall. There are similar arrangements on Orkney where a fault on one of the cables may require fixed generation to support demand.

Table 7 below provides an overview of the estimated diesel costs that would be incurred as part of a fault repair over RIIO-ED1. Based on a working assumption that the time required to replace a marine based fault could be 16 weeks, this may result in significant expenditure on diesel generation. If one of the critical subsea cables referenced above was to develop a marine fault and need to be replaced by diesel generation, this gives a forecast supply cost (associated with running diesel generation) of £2.40m.

In addition to standby generation costs above, based on actual fault costs incurred in RIIO-ED1 and DPCR5, the additional cost of repair is estimated at £2.1m in total.

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[27] 239km is made up of 200km which are to be inspected in the next 3 years plus circa 39km of cable inspected under the 2018/19 campaign that are awaiting completion.

[28] Fresh water cables are excluded from the analysis.

Table 7: Generation Costs for our Fixed Diesel Stations

Fixed Diesel Stations	[redacted]	[redacted]	[redacted]
Battery Point, Stornoway	[redacted]	[redacted]	[redacted]
Arnish, Stornoway	[redacted]	[redacted]	[redacted]
Loch Carnan, South Uist	[redacted]	[redacted]	[redacted]
Barra	[redacted]	[redacted]	[redacted]
Western Isles (all 4 stations above)	[redacted]	[redacted]	[redacted]
Tiree	[redacted]	[redacted]	[redacted]
Bowmore, Islay	[redacted]	[redacted]	[redacted]
Kirkwall, Orkney	[redacted]	[redacted]	[redacted]

9 Part 1 - Conclusion

In our RIIO-ED1 price control settlement Ofgem granted an allowance of **£36.9m** to replace circa **85.1km** of subsea cables (based on a unit rate of £0.43m/km). However, throughout RIIO-ED1, our asset data and risk management systems have improved, and we have implemented a more robust inspection regime as required under Scotland's National Marine Plan (NMP).

The new NMP and marine licensing regime described in sections 2, 3 and 4 above, has resulted in significant additional requirements in relation to inspection data and obligations to protect (and where relevant decommission and remove) subsea cables in RIIO-ED1. As a result, our asset inspections strategy (section 6) and campaign has also evolved significantly to provide more robust and higher quality data to discharge these responsibilities.

As set out in section 5, the industry has also moved to a common CBRM system and CNAIM for assessing asset health and criticality. Following this more robust approach to asset management, the projects that we now plan to take forward for replacement in RIIO-ED1 have changed. We have prioritised projects and plan to replace those cables with a health score of HI5 and impact of failure on our customers e.g. in terms of difficulty of restoring supply through other means and the cost of mobilising and running diesel or mobile generation. Full details of projects we plan to take forward are provided in Table 6 above.

In summary, we now plan to replace 16 cables, equivalent to 95.2km, at a cost of £39.8m (excluding burial and protection). 3 cables totalling 25km have been replaced to date, the remainder are planned for the rest of RIIO-ED1.

Furthermore, based on historical information over the last 10 years we also expect to experience 23 faults over the entire RIIO-ED1 period at a total cost of £15.9m (excluding burial and protection). We have experienced 9 faults to date. However, not all faults require end to end replacement. Again, based on historical information we forecast 6.6 faults will require end to end replacement and based on an average cable length of 3.16km, this equates to 19 km of end to end replacement over the entire price control period.

In line with our RII-ED1 business plan, this revised programme will allow us to deliver on commitments made in RIIO-ED1 to deliver:

- HI points of 1.2m; and
- A reduction in Customer Interruptions (CIs) and Customer Minutes Lost (CMLs) of 10,000 and 3,000,000 respectively.

Our programme for subsea cable replacement, as set out in Part 1 of this document (for planned replacement and fault replacement) underpins the protection activities and associated costs that SHEPD is now seeking to recover under the Subsea Cable Cost Reopener, as provided for in licence condition CRC3F. Full details are set out in Part 2 of this document.

Part 2 - Subsea Cable Protection Requirements for RIIO-ED1

10 Introduction

As set out above, in our RIIO-ED1 Business Plan we planned to replace 34 subsea cables (112km) at a cost of £41.8m (2012/13 prices). In its final determination Ofgem allowed £36.9m. While there was no fixed amount set for project numbers or cable length, using the unit rate referenced by Ofgem, this equates to circa 85.1km. In addition to the replacement allowance, Ofgem also provided £14.9m to cover subsea cable faults. This was based on circa 11 faults over the RIIO-ED1 period.

Under our RIIO-ED1 subsea cable planned replacement programme, we now plan to replace 16 cables at a total length of 95.2km (3 cables have been replaced at the time of submission and another 3 are being installed[29]. Our planned replacement costs for RIIO-ED1 are broadly in line with Ofgem's determination.

In relation to subsea cable faults, based on historic trends over the last 10 years, we are now forecasting 23 faults over the RIIO-ED1 period at a total cost of £15.9m (excluding burial and protection). These fault costs are also broadly in line with Ofgem's determination.

Against the RIIO-ED1 planned subsea cable replacement and fault programme, no allowance was made by Ofgem for associated protection costs for planned replacement and faults. Instead, Licence Condition CRC3F: Arrangements for the recovery of uncertain costs, provides a mechanism for adjusting opening levels of allowed expenditure to take account of "**Subsea Cable Costs**", defined in the license as:

"*costs incurred, or expected to be incurred, by the licensee in applying recognised and approved measures to protect cables ….. beyond laying the cable on the seabed ……… in accordance with the licensing requirements imposed by Marine Scotland*".

In this Part 2 of our reopener submission, we set out details of the **£58.9m** costs incurred and expected to be incurred in RIIO-ED1 to protect those cables we plan to replace under our planned replacement and fault programme, as set out in Part 1. We also set out details of actual costs incurred to date, assumptions made in relation to forecast protection costs, levels and methods of protection along with supporting justification and evidence.

[29]A further cable has been replaced following fault and another cable is currently in the process of being replaced following fault

11 RIIO-ED1 Protection Costs

Based on evidence of projects completed to date, we expect protection costs over the period to total **£58.9m**. This includes:

- £43.9m for planned replacement;
- £9.4m for faults;
- £5.0m for Indirects; and
- £0.6m for development of the CBA.

These costs include actual costs incurred to date and forecast costs for the remainder of the RIIO-ED1 period. Forecast costs have been informed by projects completed to date.

Protection costs included in this submission comprise the following:

- **Incremental Inspection Costs**
  As explained in section 6 above, our subsea cable inspection programme is an important part of our asset management process. It supports our risk-based approach to determining which subsea cables are at risk of failure and therefore need to be repaired or replaced. However, in RIIO-ED1 requirements for additional data and improved data quality have been driven by the introduction of the NMP in 2015 and associated marine licensing regime. Requirements include the need to ensure accurate records of all subsea cables and the need to justify the method and level of burial, protection and subsequent decommissioning and removal for any new or replaced subsea cables.

  As set out in section 6 above, we have inspected 78 subsea cables in RIIO-ED1 to date. This represents 70% of our total portfolio of 111 cables. Based on the total cost of inspections in RIIO-ED1 the average unit rate for inspections is [redacted] The incremental cost associated with the introduction of the NMP which we are seeking to recover under the Subsea Cable Cost Reopener is [redacted] This equates to £4.9m.

- **Incremental Survey, Design and Install Costs**
  Route survey, design and install activities are a fundamental part of the overall installation design and protection process. For instance, a key objective in the NMP for subsea cables (Chapter 14) is that route location should be determined (and accurately documented) for all cables to aid co-existence with other marine users. As a result, in RIIO-ED1 an element of survey, design and install activities for replacement and protection are now planned and managed as a combined activity to drive efficiency and a proportion of the total cost is allocated to protection as they are necessary to ensure compliance with the NMP and marine licensing requirements.

Detailed analysis of costs has been carried out for the 3 subsea cable projects completed and the 3 currently being installed[30], to determine an appropriate allocation method and basis for forecasting costs for future projects. This has allowed a bespoke unit rate to be created for different methods of protection in different marine environments. This has resulted in 4 rates:

- **100% Burial** – Our approach throughout has been to use unit rates derived from projects completed. As such a single unit rate of [redacted] has been applied to all future projects which require 100% end to end burial, based on Bute Cumbrae as this is the only project completed to date that required 100%. The length of the cable to be buried has not resulted in any further variation in this rate as the main cost factor is the cost associated with vessel hire.
- **Protection** – Based on evidence from projects completed to date a unit rate of [redacted] has been applied to all future projects to be undertaken which require an element of protection. This is based on recent evidence from marine licenses. The unit rate of [redacted] is based on the most common level of protection experienced to date of 20 rock bags per km.
- **A mix of Burial and Protection** – On projects which are to be undertaken where we have identified there is likely to be a need for an element of burial and protection we have used a blended rate. Based on projects with circa 2km of burial and a proportion of protection (20 – 30 rock bags per km) a unit rate of [redacted] has been used. Again, this unit rate will not vary significantly for most cables (which are under 20km) as the main cost driver is the cost of the vessel.
- **Surface Lay** – The cost associated with surface lay has been derived from analysis of projects completed to date in RIIO ED1, resulting in a unit rate of [redacted]. The cost of surface lay is outwith the scope of this reopener as it is associated with replacement activities and not protection, but it has been used to determine total subsea cable expenditure for RIIO-ED1.

- **Stakeholder Engagement and Consenting Costs**

  Due to the increased level of analysis and detailed evidence to be submitted in support of a marine licence (including the Pre-Application Consultation report, and insight and feedback from the Fishing Industry Representative (FIR)) the stakeholder engagement and consenting costs incurred in RIIO-ED1 include additional costs associated with engaging with all relevant stakeholders to ensure proportionate and efficient levels and methods of protection are identified and taken forward.

  Based on costs incurred to date of £0.4m, this results in a unit rate of £10.5k/km. Following analysis of incremental activities only (associated with the introduction of the NMP) a reduced unit rate of £6.8k/km has been applied projects under this reopener.

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[30] Cost analysis is based on the 3 completed projects – Rousay Westray, Shapinsay Stronsay and Bute Cumbrae. The 3 being installed are Mossbank Yell, Yell Unst 1 and 2.

- **Indirects**
  Under this reopener we have included the additional internal and external project management costs to support the determination of the correct level and method of protection and coordination of marine licence applications.

  - **Internal Project management**
    The subsea cable team play an essential part in the process which ensures ongoing compliance with the NMP and the level of protection required under marine licences for replacement projects in RIIO-ED1. Following analysis of incremental activities required under the NMP, we have included an additional [redacted] members of staff to the reopener for the first 4 years of RIIO-ED1. This rate increases to [redacted] in the second half of the price control period as we replace external resource with internal resource to improve efficiencies. This results in total Indirect costs for Internal Project Management in RIIO-ED1 of [redacted] under this reopener.

  - **External Project Management**
    The costs associated with external subsea project management roles (Offshore Client Representatives, Installation Project Manager, Subsea Cable Design Engineer) directly related to the introduction of the NMP have been derived based on the total cost to date for these roles. This results in a total cost [redacted] over the price control period, to be recovered under this reopener.

- **Decommissioning**
  This includes the additional costs to remove those subsea cables which we have or plan to replace in RIIO-ED1 to the extent they are required or likely to be required under the Marine Licence. Costs have been considered and included on a case by case basis, taking into account specific circumstances e.g. marine activity in the area and safety risk to other marine users. The unit rate has been derived from cable decommissioning works completed at Lerwick-Bressay, and from competitive tenders for Mossbank Yell and Yell Unst 1&2. Competitive tenders obtained for Bute Cumbrae have also been used. Rates were obtained as it was originally envisaged that we would have to remove the old cable following decommissioning, when this was replaced following fault. The decommissioning rate used in analysis includes costs for all mobilisation, demobilisation, weather risk, safe cable decommissioning and environmental disposal. The average rate for these five projects was [redacted]

Further detail of all the assumptions used to derive these unit rates can be found in Appendix C. All project descriptions setting out our proposed approach and assumptions, including CBA outputs and proposed marine licences can be found in Appendix A.

12 Survey, Design and Installation for Protection Activities

To ensure efficient and cost-effective delivery of burial and protection requirements under the marine licensing regime and absolute compliance with marine licences, our framework contractors will undertake the licensed activities in relation to all projects in compliance with the following specifications.

12.1 Survey Activities

Under the NMP, the approach to pre-lay inspections and surveys has changed significantly. For instance, the installation contractor must now verify installation data and assumptions before commencing work. They must also check that any design changes imposed by the Marine Licence are achievable and collect data for the optimisation of the cable routes. Pre-lay inspection and survey activities are undertaken in accordance with our internal specifications (**SP-NET-CAB-405 and SP-NET-CAB-406**[31]).

For example, the pre-lay survey must now complete the following to ensure burial and protection activities and obligations can be discharged and full marine licence compliance is achieved:

- Collect information on debris, obstructions and other irregularities along the installation routes;
- Locate and map in-service and abandoned cables or pipelines, and provide a detailed description of conditions in areas where cables or pipelines cross;
- Acquire all necessary data regarding sea currents and critical wave and wind directions in relevant areas; and
- Undertake any necessary Unexploded Ordnance (UXO) surveys and inspections

In extreme circumstances where cable protection requirements are found to present particular engineering difficulties or significant additional project costs (e.g. due to adverse seabed conditions such as moving sediment, steep slopes, difficult soil or seabed conditions, UXO[32]s, removal of out-of-service cables crossing the route and removal of boulders along the route), we may need to carry out further investigations (which will also require a licence), including high resolution bathymetry surveys, sub-bottom profiling and video inspections.

12.2 Design Activities

To support the design of the final cable route and burial and protection requirements, we have established a minimum set of criteria to ensure a robust, proportionate, transparent and consistent

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[31] See Appendix Q – SP-NET-CAB-406 - Minimum Requirements for Submarine Electricity Cable - Route Survey

[32] With the geographic location of our subsea cable assets, there are areas that are susceptible to a risk of Unexploded Ordnance (UXO). As part of the route planning and design phase, a desktop UXO threat and risk assessment study is carried out. Where the risk of potential UXOs is identified, more detailed site-based UXO surveys may be undertaken during the route surveys to identify significant or suspect targets along the route. If the route is within a UXO proximity alert, works are only undertaken after a clearance certificate is issued from the relevant authority. In most cases the preference would be to route the cable to avoid the area. If re-routing Is not possible, a UXO clearance specialist would be engaged for further identification, survey with the safe clearance, recovery and disposal from site. The Ministry of Defence would be notified in advance.

approach is taken for each project under the NMP and marine licensing regime. The relevant criteria are to:

- Keep cables within initial and or consented corridors, unless engineering constraints dictate otherwise;
- Comply with conditions set out in the Marine Works Licence;
- Comply with all relevant environmental regulations and legislation;
- Minimise total cable length and installation costs while not undermining cable properties/engineering or increasing risk to the subsea cable asset;
- Seek to achieve a low risk route;
- Seek to reduce lifetime system/ route maintenance;
- Seek to reduce or avoid environmental impact or disturbance;
- Seek to avoid areas of archaeological value and other sites of special interest;
- Seek to avoid unstable/steep slopes;
- Propose cable protection design and methodology with supporting risk analysis;

12.3 Installation

Following implementation of the NMP, we have developed installation specifications to ensure all activities (including burial, protection, decommissioning and removal) are managed in a safe, efficient, compliant and considerate way. The key areas covered in the specifications are:

- Design, development and qualification of proposed plans, systems and equipment;
- Vessel mobilisation, equipment and personnel plans, and operational procedures for all phases of the cable installation;
- Consideration of all environmental factors including water depth, wind, waves, currents and tides;
- Landing operations;
- Requirements for back-up equipment and spares;
- Contingency procedures and criteria for emergency actions;
- Cable marking; and accurate GPS coordinates for our and third-party records.

13 Decommissioning

Within our RIIO ED1 business plan we did not make any provision for the removal of our existing subsea cables at the end of their life. This is because, although, the NMP had introduced a requirement to decommission obsolete subsea cables, it had not been finalised at the time we submitted our RIIO-ED1 Business Plan. It was subsequently determined that additional costs for decommissioning would be considered under the Subsea Cable Costs provisions in licence condition CRC3F - Arrangements for the recovery of uncertain costs.

Based on experience to date under the marine licensing regime, there continues to be significant debate between stakeholders about the benefits of removing subsea cables once they have been replaced. On the one hand there is a strong argument that removal of subsea cables greatly enhances safety, by reducing them as a snagging hazard, within the marine environment but the counter argument is that subsea cables have been in the marine environment for a significant period of time, and pose limited additional risk and in some cases certain types of protection material (rock) can form an important part of the marine habitat. The research available to draw a strong conclusion for either argument remains limited at this time[33] and as a result, each cable requires assessment by Marine Scotland and ourselves on a case by case basis.

The enhanced information and quality of images provided under our RIIO-ED1 inspection; seabed sample information and mapping carried out in our survey regime have allowed us to evidence on a case by case basis where we see a risk to other marine users (Lerwick Bressay) and when we do not (Harris Scalpay, Shapinsay Stronsay). Our evidence then gives those responsible for determining the conditions of our marine licences the ability to make a more informed decision on whether there is a need to remove a subsea cable on a case by case basis, taking into consideration specific circumstances.

To date we have secured 5 marine licences under the NMP; none have required removal of the existing subsea cable following it being decommissioned from service. Currently Marine Scotland and other interested parties (Crown Estate and Fishing Associations) have allowed us to cap the ends of the subsea cable (Figure 6), secure them to the seabed and remove shore end yellow demarcation signs, if not required for the replacement cable.

Figure 6: Capped Subsea Cable

[33] Our CBA methodology now includes impact 12 which seeks to value the impact on the seabed and has been well received by policy bodies and non-profit organisations such as BEIS and non-profit organisations (Natural Capital Protocol) who are also undertaking research in this area.

The only exception has been the Lerwick Bressay subsea cable which was replaced using Horizontal Directional Drilling (HDD) to ensure full burial under the sea bed following repeated third-party damage. The Harbour Authorities planning consent process introduced the condition that the previous cable was decommissioned and removed from within the harbour limits, as part of the licence. The reason for mandating this condition was due to the volume of traffic using the harbour and the most recent incident being caused when a ship had to deploy its anchor in an emergency. This process was carried out 18 months after the successful installation and energisation of the new cable.

The full cost break-down for decommissioning and removal of the Lerwick Bressay subsea cable is [redacted] This has been used along with 2 other tendered unit rates submitted by framework contractors [redacted], for Bute Cumbrae and Yell Unst respectively) to forecast costs for Mainland Orkney Hoy (North), Mainland Orkney Hoy (Centre) and Mull Coll. Based on the individual project by project characteristics we forecast total costs to remove these 3 redundant cables (24.2km in length) would be [redacted] The licencing requirements for these 3 cables around removal after decommissioning will however not be known until the marine licences are submitted in 2021.

13.1 Change in Policy

Although the Marine Scotland policy considers decommissioning requirements on a cable by cable basis, for recent subsea cables installed, a new clause has been included in each marine licence requiring a detailed decommissioning and removal plan to be submitted 2 years prior to the new subsea cable reaching the end of its economic life. An extract from the marine licence for the Shapinsay Stronsay project is provided below by way of example. Full details are provided in Appendix R.

Point 65 "The licensee must, two years prior to the end of life of the licensed works, submit a decommissioning plan to the licensing authority for approval. The plan must be based on best practice at that time. The licensee shall be liable for all costs".

A second clause also requires a detailed decommissioning plan to be submitted if the cable is decommissioned before the end of the expected asset life.

Point 66 "Should the installation or use of the licensed works be halted before the proposed project end of life, the licensee must notify the licensing authority and within a timescale agreed by the licensing authority, submit a decommissioning plan to the licensing authority for approval. The plan must be based on best practice at that time. The licensee shall be liable for all costs.

While this is not an immediate consideration for this reopener or for RIIO-ED1, these additional obligations are relevant to future price controls. The exact requirements for a decommissioning plan are still to be determined because the level or cost is still unknown.

14 Our Approach to Procurement

As a regulated business we are required to comply with the Utilities Contracts (Scotland) Regulations 2016 (UCSR). To meet these requirements a new multi-vendor framework agreement was awarded in August 2017 for Subsea Cable Asset Replacement and Associated Services.

To ensure an economic and efficient approach to procurement of services a procurement strategy was developed, and detailed market analysis was undertaken prior to going to market. This analysis showed that due to the large volume of SHEPD's subsea cable assets and activities, and the requirement to replace / maintain and protect over a long-term period of time, there is market leverage which would allow the procurement and commercial strategy to develop a mid to long term agreement to assist the economic delivery of the programme.

There were a number of other wider factors that influenced our strategy. These included:

- Offshore wind; impacts in terms of recent planning consent announcements which have delayed the development of offshore windfarms potentially increasing the availability of competent contractors.
- Changes in Oil and Gas industry; the potential slowing in this sector should free resources in the market place. This potentially opens the market to a much wider degree and drives competition between companies with the relevant skill set. This may have a positive impact for SHEPD.
- There are also no other DNOs with such a high concentration of subsea cable assets within Great Britain, so this limits competition from within the industry.

Analysis of the market showed a general increase in the number of contractors over the last eight years, which is attributable, in part, to the growth in offshore wind. The analysis indicated that the existing supply chain view of our subsea cable programme is that it is of considerable value and attractive to maintain, going forward.

However, there are a number of wider market forces which could also impact economic and efficient delivery:

- Price volatility on commodities (fuel, metal costs) will have an impact on costs over time.
- The cable availability may reduce due to growth in offshore wind.
- Financial returns may not be sustainable for contractors resulting in an increase in cost in the long term for the same level of service.

For the reasons noted above, in terms of market conditions being uncertain it was also necessary to consider a Transactional[34] versus Strategic[35] approach to procurement. Details and explanations are outlined in Table 8 below.

[34] A Transactional procurement strategy is where each activity is individually tendered.
[35] A Strategic procurement strategy is where an overarching framework is created and then activities are called off as and when required.

Table 8: Transactional versus Strategic Procurement Considerations

Opportunity	Transactional	Strategic
Total Cost of ownership	Scheme by scheme tendering generally helps drive competition in the market place and thus ensure efficient costs. However, the frequency of tender returns required can have a negative impact (return fatigue) and higher preparation costs without a mechanism to reclaim unsuccessful tenders.	Offered costs may be slightly higher than transactional events due to uncertainty in long term market conditions and how these may change. This is offset over time as contractors become efficient due to consistency of approach and knowledge of client develops. This approach benefits the client and contractor from reduced overheads associated with tender returns.
Quality & Innovation	Driven only by the content of the contract. "We get what we paid for".	Allows learning and development to be shared between client and strategic partner thus quality and efficiency should increase over time.
Time	Introduces resource constraints for internal and external staff. More tenders can result in less efficiency in this area or a greater application of FTEs to a project	A single larger procurement event delivers long term benefits, more efficient use of time and establishes a relationship earlier in the process.
Safety	Each new contract / contractor requires induction and training to be repeated to ensure quality and safety standards are maintained and to ensure the contractor is educated into SSE SHE cultures and values.	SSE SHE values, standards and culture become ingrained.
Relationship	Contractor has a short-term focus. Only concerned with delivering the requirements of current contract.	A longer-term relationship is developed, which can drive efficiency, innovation and additional value-added activities or services.

The analysis in Table 8 indicated that in the longer-term, to the end of RIIO-ED1, a strategic approach was the most efficient and preferred arrangement for the successful delivery of the RIIO-ED1 subsea cable programme. A decision by SHEPD senior management was made to award a Strategic Procurement Contract, i.e. a Framework Contract[36].

Following a Pre-Qualification round in which [redacted] global suppliers were approached, [redacted] suppliers were invited to submit a tender in January 2017 [redacted] tenders were received. The contract conditions used as the basis of the framework contract are the 'New Engineering Contract 3 - Engineering and Construction Contract (NEC3 ECC), Option A with employer drafted amendments. Option A is a lump sum fixed price offer with activity schedule, subject to any Compensation Events. Any variation in costs are then down to the contractor to manage.

The tender was issued with an award criterion based on [redacted] with the following key assessments:

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[36] A Framework Contract is to establish terms governing contracts that may be awarded during the life of the programme and to award the agreement in full compliance with the EU Procurement Directive.

- Tenderers must hold a current Achilles UVDB Verify Certificate Level B2 or agree that they will obtain a valid Verify Certificate at Level B2 prior to award.
- Tenderers must pass the mandatory questions in Safety, Quality Management, Environmental Management and Design Management.
- Major Counter Party Review to ensure that the Tenderer is financially robust and can deliver the requirements of the Agreement, over its term. As such, several Financial Tests were undertaken using a variety of industry standard organisations.
- Terms and Conditions to ensure that any deviations that contractors were proposing to our standard conditions were acceptable.
- Commercial Evaluation based upon submitted tender returns.

Following this evaluation round and submission of Best and Final Offers in summer 2017, a decision was made by SHEPD senior management in summer 2017 and three framework agreements were awarded to Briggs Marine Contractors Limited, Global Marine Systems Limited and Boskalis in September 2017. Further information in relation to these companies is provided below.

Global Marine

Global Marine Services Ltd is a leading provider of engineering and underwater services, responding to the subsea cable installation, maintenance and burial requirements of customers around the world. The company has a legacy of 165 years in deep and shallow water operations and operates worldwide with main offices in Chelmsford, UK and Singapore.

Widely considered as subsea cable experts, Global Marine offers a comprehensive end-to-end solution for multiple offshore industries including oil & gas, telecoms, offshore renewables, power and deep-sea research.

Boskalis

Boskalis Subsea Cables & Flexibles (previously VBMS) specialises in subsea power cable installation, Balance of Plant maintenance for the renewable market, SURF installation for the oil & gas market and installation of interconnectors. The company delivers added value with its robust end-to-end project management and multi-disciplinary grid-to-grid solutions. In addition, Boskalis complies with strict European and international industry standards, reflected in a high QHSE ranking. Boskalis provides quality services balanced with cost effectiveness, with a portfolio including major offshore developments in Europe and beyond.

Briggs Marine and Environmental Services are based in Burntisland in Fife. The company supplies services across a range of industries working off shore in the marine sector with services ranging from vessel charter to diving projects to renewable energy, emergency response and salvage.

With the ability to create bespoke solutions for clients and end to end project planning, They also supply and train personnel, deal with pollution and oil spills, operate as an environmental consultancy and have many years of experience working with the oil and gas industry. Briggs offers "total solutions" to clients, whatever the project and have the experience to advise on multiple areas of operation.

14.1 Competitive Call off Procedure

The call off procedure from the framework requires each project to be competitively tendered on a project by project basis to leverage the best achievable commercial position based on the most economically advantageous tender. Having contracted on the lowest price from those tenders under the competitive call off procedure for replacement and protection activities undertaken to date, this ensures that we have achieved the best overall value for money for the projects. Furthermore, having derived the costs from 2 completed projects and 2 final tendered costs for an additional installation campaign (Mossbank Yell, Yell Unst 1 & 2) and the Bute Cumbrae replacement, following fault, means we have been able to determine a robust economic and efficient unit price for burial and protection for both completed and future projects in this submission.

Below is a summary of the 4 contracted cable replacement projects used, as highlighted above. These show how we have derived the best contractor price within the mini tender process under the framework contract.

Project Name: Rousay Westray
Project Status – Complete

Following the competitive call off procedure detailed in the framework, tenders were issued on 14th September 2017 to Briggs Marine, Global Marine and Boskalis.

Two tenders to carry out the required survey, design and installation (including protection) were received. The full project description of the Rousay Westray project is included in Appendix A. Costs are detailed below. For the avoidance of doubt, they are the direct costs associated with installation, including burial and protection. Relevant protection costs allocated to this reopener are set out in Table 14 below.

[redacted]

Following evaluation and negotiation on specific risk items (weather risk) together with a full programme review the contract was awarded to [redacted] on the basis of their updated and revised tender submission of [redacted] The final account was settled at [redacted]

Project Name: Shapinsay Stronsay
Project Status – Complete

The existing 33kV subsea electricity cable from the Bay of Crook in Shapinsay to Bay of Holland in Stronsay was proposed to be replaced as part of planned replacement works in 2018/19. In May 2018 the Shapinsay Stronsay cable faulted. Due to vessel availability and the critical nature of this cable the decision was made to award a full replacement project to [redacted]. Benchmarking was undertaken to demonstrate that the tendered prices were economic and efficient.

The contract award to [redacted] was valued at [redacted] The final account was settled at [redacted]

Project Name: Bute Cumbrae
Project Status – Under Contract and in progress

Following the competitive call off procedure prescribed in the framework Briggs Marine, Global Marine and Boskalis were invited to provide a tender based on their proposed methodology to achieve 100% burial. Tenders were submitted as follows:

[redacted]

Following extensive negotiations and discussions with all contractors and a best and final offer the contract was awarded to [redacted] for [redacted] The tenders submitted contained inclusions for cable decommissioning and removal, which were excluded from the contract award until further clarification was obtained regarding requirements under the Marine Licence. It has subsequently been clarified that removal of the old cable is not required.

Work is still ongoing and as such no final account value is available.

Mossbank Yell and Yell Unst 1 & 2
Project Status – Under Contract and in progress

Following the competitive call off procedure prescribed in the framework Briggs Marine, Global Marine and Boskalis were invited to provide a tender. The marine licence conditions prohibited works in the Shetland Harbour area between April and September to meet requirements of the Nature Conservation Master Plan as these areas are defined as Special Protection areas. Works therefore were required to be complete by 31 March 2019. Tenders received based on this Marine Works completion date were as follows:

[redacted]

[redacted] Following an evaluation of the known current risks and expert independent advice the contract was awarded to [redacted]

As works are ongoing the final account value has still to be determined.

14.1.1 Derivation of Survey, Design, Install (SDI) unit rates

The SDI unit rates used in this submission are derived by reference to 2 key mechanisms of the NEC3 ECC Option A Contracts, the contract programme and the activity schedule.

The critical path of each project is the shortest time possible to complete the works. Following submission by the Contractor, it is thoroughly reviewed by both the Project Managers and Planning Engineers before it is formally approved.

Figure 7 below is an extract from the Rousay Westray programme; it shows the timeline for the installation of the replacement cable and protection, and the separate elements on the critical path.

The NEC3 ECC contract relies on an up-to-date and realistic programme being maintained by the Contractor. The programme is a fundamental tool to monitor activity progress and to apportion costs across activities on the critical path. In the case of this reopener, it has also been used to perform activity-based costing for marine activities involved in surface lay, and / or burial and protection.

Figure 7: Extract from Rousay Westray Programme

[Redacted]

Figure 8 below provides an illustration of the analysis of each of the critical path activities undertaken to demonstrate that the additional time allocated for approved measures to protect subsea cables for the Rousay Westray project [redacted]

Figure 8: Activity Based Analysis for Surface Lay, Burial and Protection

[Redacted]

A similarly robust process has been undertaken for the other 4 advanced projects. The results of these analyses are shown in Table 9 below. This demonstrates the additional time applying recognised and approved measures to protect our subsea cables for each project.

Table 9: Additional time for burial and protection installation.

[Redacted]

14.1.2 Activity Schedule

An Activity Schedule is a list of activities prepared by the Contractor which he expects to carry out in completing the works. During the competitive call off procedure the Contractor provides a schedule and prices each one. Following any final negotiations this determines the Tendered Total and is the sum due to the Contractor on completion of the works, subject to any Compensation Events.

It is therefore reasonable to assess costs associated with protection of cables by reference to both the critical path programme and total costs identified from the Activity Schedule. To demonstrate how this has been applied we have used the Rousay Westray Project. A similar approach has been used for other completed and contracted projects to derive SDI unit rates. These unit rates are then used to determine costs incurred in applying recognised and approved measures to protect cables.

Table 10 below is a copy of the Activity Schedule for the Rousay Westray project. It includes commentary to evidence the reason for inclusion in the reopener, methodology of allocation and justification of cost.

Table 10: Activity Schedule Break Down

Activity Schedule Sub Group	Activity Description	Justification	Protection Cost	Allocation (%)
Inspections				
Inspection vessels and equipment	Inspection Survey (Pre-Lay and as laid Survey)	Pre-lay survey identifies any surface obstructions and mitigates risk of trencher snagging on debris on the route. Post laid surveys record as-built protection installed and areas of burial.	Yes	50%
Diver Swim and Landfall Inspection	Shore end Inspections	No cost attributed as these inform shore end works	Yes	Nil
Reporting Deliverables	Reporting as laid configuration	No cost attributed as these inform shore end works	Yes	Nil
Survey				
Reporting and Deliverables	Project Level UXO Desktop Study	No cost. In event that UXO removal works would be required for surface lay and burial & protection costs would be apportioned	No	Nil
Cable Replacement				
Cable Route Design	-Alongside Cable Transpooling Analysis - Cable Lay Dynamic Analysis - Shore End Pull Dynamic Analysis - Barge Stability Study	No cost attributed as these inform surface lay works	No	Nil
Cable Laying				
Mobilisation/Demobilisation	Main lay vessel	Percentage allocation as per the critical path analysis. Vessel costs and spread of equipment required to undertake burial and protection works must be within vessel costs and apportioned based on the additional time to complete the project	Yes	50%
Mobilisation/Demobilisation	Additional vessel		Yes	50%
Mobilisation/Demobilisation Barge	Barge		Yes	50%
Weather Risk - Payable on	Mobilisation of Cable Laying Vessel to site		Yes	50%
Cable Loading/unloading	Cable Loading/unloading		Yes	50%
Cable Loading/unloading	Barge Freighter		Yes	50%
Cable Loading/unloading	Additional vessel Loading Rock Bags and Mattresses		Yes	50%
Cable Laying	Transit Cable Installation Vessel		Yes	50%
Cable Laying	Transit additional vessel		Yes	50%
Cable Laying	Cable installation	No cost attributed as these inform shore end works	No	Nil

Cable Laying	Shore end works	No cost attributed as these inform shore end works	No	Nil
Cable Laying	Cable testing	No cost attributed as these inform shore end works	No	Nil
Cable Laying	2 x Transition Joint Pits (Provisional sum)	No cost attributed as these inform shore end works	No	Nil
Cable Protection				
Types of protection	92 x Rock bags	Cost relates only to protection	Yes	100%
Types of protection	8 x Mattresses	Cost relates only to protection	Yes	100%
Types of protection	Rock bag deployment	Cost relates only to protection	Yes	100%
Types of protection	Cable Trenching	Cost relates only to protection	Yes	100%
Types of protection	Crossing works	Cost relates only to protection	Yes	100%
Protection Design & Temporary Protection	Cable Stability Analysis	Cost relates only to protection	Yes	100%
Other Contractor				
Project Management	Project Management	Percentage allocation as per the critical path analysis. Vessel costs and spread of equipment required to undertake burial and protection works must be within vessel costs and apportioned based on the additional time to complete the project	Yes	50%

15 Approach to Determining Protection Costs

We have determined that the total protection costs sought in this reopener are **£58.9m**. This includes:

- £43.9m for planned replacement;
- £9.4m for faults;
- £5.0m for Indirects; and
- £0.6m for development of the CBA.

In determining forecast protection costs, we have taken account of the circumstances of each individual project and built up protection costs on a case by case basis. The cost base we have used is the actual costs for projects completed (as explained in Section 14) and detailed project designs for each new project still to be undertaken in RIIO-ED1. Detailed project designs including individual project analysis and specific details e.g. fishing activity in the area; the length of cable required; tidal flows; topography of the seabed; marine life; environmental considerations; and stakeholder views have all been considered in this approach and are explained in Appendix A. Table 11 below provides a summary of the outcome of this approach.

Table 11: Future Project Associated Cost Base

Subsea Cable Project Name	Identifier	Cost Base
Rousay Westray	SHEPD_149	Actual
Shapinsay Stronsay	SHEPD_153	Actual
Harris Scalpay East (2)	SHEPD_62	Actual
Yell Unst South (2)	SHEPD_61	Actual - contracted
Mossbank Yell South (2)	SHEPD_43	Actual - contracted
Yell Unst North (1)	SHEPD_44	Actual - contracted
Mainland Jura Post Protection	SHEPD_133	Actual
Carradale Arran Replacement	SHEPD_74	Bute Cumbrae
Orkney Shapinsay HDD	SHEPD_73	Shapinsay Stronsay
Mainland Orkney Hoy North	SHEPD_21	Rousay Westray
Mainland Orkney Hoy Centre	SHEPD_34	Rousay Westray
Sanday Eday	SHEPD_26	Rousay Westray
Rousay Egilsay	SHEPD_29	Mossbank Yell / Yell Unst
Sanday North Ronaldsay	SHEPD_36	Mossbank Yell / Yell Unst
Shetland Mainland Whalsay	SHEPD_41	Mossbank Yell / Yell Unst
Mull Coll Replacement	SHEPD_105	Bute Cumbrae
Shetland Mainland West Linga	SHEPD_88	Mossbank Yell / Yell Unst

To give further certainty in support of our cost calculations, we have completed indicative CBAs for projects planned for within the RIIO-ED1 period, but which have not yet started the marine licensing process. We strongly believe this provides greater clarity and certainty regarding expected marine licence requirements and therefore associated protection costs. Table 12 provides a summary of the analysis for each project.

Table 12: Updated RIIO ED1 Programme

Subsea Cable Project Name	CBRM Identifier	CBRM Length	Project Length	Inspected	CBA	Survey	Tendered	Licences	Install	Finanical Close	CBRM
Rousay Westray	SHEPD_149	10.45	**10.45**	✓	✓	✓	✓	✓	✓	✓	✓
Shapinsay Stronsay	SHEPD_153	14.77	**14.77**	✓	✓	✓	✓	✓	✓	✓	✓
Harris Scalpay East (2)	SHEPD_62	0.77	**0.77**	✓	✕	✓	✓	✕	✓	✓	✓
Yell Unst South (2)	SHEPD_61	1.77	2.6	✓	✓	✓	✓	✓			
Mossbank Yell South (2)	SHEPD_43	3.62	4.0	✓	✓	✓	✓	✓			
Yell Unst North (1)	SHEPD_44	2.13	2.6	✓	✓	✓	✓	✓			
Carradale Arran	SHEPD_74	6.07	6.4	✓	✓						
Mainland Orkney Shapinsay	SHEPD_73	2.90	3.1	✓	✓						
Mainland Orkney Hoy North	SHEPD_21	4.43	4.7	✓	✓						
Mainland Orkney Hoy Centre	SHEPD_34	4.46	4.7	✓	✓						
Sanday Eday	SHEPD_26	4.32	4.6	✓	✓						
Rousay Egilsay	SHEPD_29	1.90	2.0	✓	✓						
Sanday North Ronaldsay	SHEPD_36	10.08	10.7	✓	✓						
Shetland Mainland - Whalsay	SHEPD_41	4.98	5.3	✓	✓						
Mull Coll	SHEPD_105	15.31	16.3	✓	✓						
Shetland Mainland West Linga	SHEPD_88	2.10	2.2	✓	✓						
Totals		**90.06**	**95.2**								

Based on the CBA analysis in Appendix A, Table 13 provides an overview of the overall length of burial and type of protection required for each individual project to be completed in RIIO-ED1. Based on the most recent inspection, depth assessment indicates that elements of burial on 6 of the 10 projects can be achieved. On the remaining 4 projects, there is insufficient sediment to allow the required level of burial. Therefore, alternative protection is likely to be required to facilitate coexistence of marine stakeholders and comply with the NMP. In such cases costs are based on similar circumstances in projects such as Mossbank Yell and Yell Unst. Full details are set out in Appendix A.

Table 13: Future Projects - Length of Burial and Protection

Subsea Cable Project Name	CBRM Identifier	CBRM Length	Forecasted Burial (km)	Forecasted Protection (km)	No. Rock Bags
Carradale Arran	SHEPD_74	6.44	6.4	0.0	0
Mainland Orkney Shapinsay	SHEPD_73	3.08	1.0	2.1	30-40
Mainland Orkney Hoy North	SHEPD_21	4.70	2.6	2.1	40-50
Mainland Orkney Hoy Centre	SHEPD_34	4.73	2.7	2.1	40-50
Sanday Eday	SHEPD_26	4.59	1.5	3.1	40-50
Rousay Egilsay	SHEPD_29	2.02	0.0	2.0	15-20
Sanday North Ronaldsay	SHEPD_36	10.70	0.0	10.7	70-80
Shetland Mainland - Whalsay	SHEPD_41	5.29	0.0	5.3	100-120
Mull Coll	SHEPD_105	16.25	5.9	10.4	Rock placement
Shetland Mainland West Linga	SHEPD_88	2.23	0.0	2.2	40-50
Total		**60.03**	**20.09**		**375 - 460**

To further inform protection requirements for all projects still to be delivered under RIIO-ED1 under this reopener, views from interested parties in the geographical areas and Marine Scotland have been sought to justify the level and method of burial and protection proposed in our current designs.

Table 14 provides a breakdown of the £43.9m protection costs associated with proactive replacement of subsea cables in RIIO-ED1, on a project by project basis. In Appendix C we have provided more detail for each of these calculations, including the units and unit rates.

Table 14: Additional Protection and Burial Costs associated Proactive Replacement

Subsea Cable Project Name	CBRM Identifier	CBRM Length	Project Length	2012/13 Actual Protection Costs	2012/13 Forecast Protection Costs	Cost Base
Rousay Westray	SHEPD_149	10.45		[redacted]		Actual
Shapinsay Stronsay	SHEPD_153	14.77				Actual
Harris Scalpay East (2)	SHEPD_62	0.77				Actual
Islay Jura	SHEPD_133	0.00				Actual
Yell Unst South (2)	SHEPD_61		2.60			
Mossbank Yell South (2)	SHEPD_43		4.00			Actual - contracted
Yell Unst North (1)	SHEPD_44		2.60			
Inspections						Actual
Carradale Arran	SHEPD_74		6.44			Bute Cumbrae
Mainland Orkney Shapinsay	SHEPD_73		3.08			Rousay Westray
Mainland Orkney Hoy North	SHEPD_21		4.70			Rousay Westray
Mainland Orkney Hoy Centre	SHEPD_34		4.73			Rousay Westray
Sanday Eday	SHEPD_26		4.59			Rousay Westray
Rousay Egilsay	SHEPD_29		2.02			Mossbank Yell
Sanday North Ronaldsay	SHEPD_36		10.70			Mossbank Yell
Shetland Mainland - Whalsay	SHEPD_41		5.29			Mossbank Yell
Mull Coll	SHEPD_105		16.25			Bute Cumbrae
Shetland Mainland West Linga	SHEPD_88		2.23			Mossbank Yell
Totals		**26.0**	**69.2**	**11,944,312**	**31,959,018**	
					43,903,330	

Similarly, Table 15 below provides a breakdown of the £9.4m protection costs associated with faults. As explained in section 8, it is not possible to predict which cables will fault and therefore the specific level of protection or burial required. As a result, the unit rate for burial and protection in this reopener for the rest of RIIO-ED1 is a blended rate of [redacted] This is based on projects completed to date. SHEPD will manage any additional risk if the marine licences require additional protection.

Table 15: Additional Protection and Burial Costs associated with Faults

Subsea Cable Project Name	CBRM Identifier	CBRM Length	Project Length	2012/13 Actual Protection Costs	2012/13 Forecast Protection Costs	Cost Base
Lerwick Bressay North	SHEPD_118	0.44		[redacted]		Actual
Lerwick Bressay Cable Recovery	SHEPD_118	0.5				Actual
Bute Cumbrae Centre (2)	SHEPD_30	4.62				Actual
Fault 1 (2019/20)			3.16		[redacted]	Blended Unit Rate
Fault 2 (2020/21)			3.16			Blended Unit Rate
Fault 3 (2020/21)			3.16			Blended Unit Rate
Fault 4 (2021/22)			3.16			Blended Unit Rate
Fault 5 (2021/22)			3.16			Blended Unit Rate
Fault 6 (2022/23)			3.16			Blended Unit Rate
Total		**5.6**	**19.0**	**3,666,126**	**5,686,822**	
					9,352,947	

The CBA costs included in this reopener of £0.6m have been derived based on actual costs incurred for third party consultants, consultation events and materials and associated Indirect costs. Further detail is provided in Appendix C.

16 Cost Recovery Arrangements for the Reopener

SHEPD's licence contains provision for the recovery of the costs associated with the Subsea Cable reopener. Licence Condition CRC 3F sets out a mechanism:

'(a) to specify the basis on which the licensee's opening levels of allowed expenditure on uncertain cost activities, as specified in Table 1, can be revised; and

(b) to determine any appropriate revisions to PCFM Variable Values for the licensee relating to uncertain cost activities and the Regulatory Years to which they relate, for the purposes of the Annual Iteration Process for the ED1 Price Control Financial Model '

The Price Control Financial Model is already set up to allow the recovery of relevant subsea cable protection costs through the MOD value.

Table 16 shows the relevant protection cost incurred to date, in 2012/13 prices, and forecast costs for the remainder of the RIIO-ED1 period.

Table 16: Subsea Cable Cost Profile for RIIO ED1

	Actual Costs to Date				Forecast Cost for Remainder of RIIO ED1				
	2015/16	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**	**2022/23**	**Total**
Proactive Replacement	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Faults	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
CBA	[redacted]	[redacted]	[redacted]	[redacted]					[redacted]
Indirect	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Total Protection Costs	**1.8**	**7.0**	**4.9**	**10.7**	**4.2**	**4.5**	**12.3**	**13.5**	**58.9**

The established process of adjusting the MOD value each year, for future Regulatory Years, means that given the timescale for this reopener, we would expect an Ofgem determination towards the end of 2019 to feed into the 2020/21 Regulatory Year, but given the notice period for changes in charges costs would not be recovered until 2022/23. As with other reopeners, we would expect adjustments to be profiled in the final year of RIIO-ED1 and into RIIO-ED2 in line with the expenditure profile set out above.

As with other reopeners, appropriate adjustments will require to be made to take account of:

- The time value of money;
- SHEPD's RIIO-ED1 capitalisation rate; and
- Adjustments to SHEPD's opening RAV for RIIO-ED2.

17 Part 2 - Conclusion

As set out throughout this document, the introduction of Scotland's NMP imposed significant additional requirements on our business in RIIO-ED1, relative to DPCR5, to meet the new policies and objectives as set out in section 2 above.

In summary, we are now required to:

- Carry out a far greater level of engagement with all stakeholders for all marine licensable activities (inspections, surveys, installation, decommissioning and removal).
- Carry out significantly more detailed and rigorous inspection of all subsea cables to meet obligations in relation to coexistence with other marine users and marine licence applications.
- Develop a bespoke marine licensing CBA to evidence where burial and protection is required and the level and method to be deployed.
- Carry out greater levels of investment associated with burial and other forms of protection e.g. rock bag placement to protect the marine environment and users.
- Clearly evidence compliance with these additional requirements.

Costs set out in this submission for RIIO-ED1 have been determined on a project by project taking into account these requirements using evidence of projects completed to date and a rigorous activity-based cost approach. By drawing comparisons between projects completed and projects planned, to identify underlying requirements, we have significantly reduced the level of cost and cost uncertainty. Furthermore, our robust competitive tendering approach has ensured unit rates for burial and protection are competitive and efficient.

Full details of the rationale and approach to determine costs for each project are set out in Appendix A and C.

In summary, we set out in this document the basis on which we now forecast protection costs associated with protection activities for RIIO-ED1 to total **£58.9m.** This is broken down as follows:

- £43.9m for planned replacement;
- £9.4m for faults;
- £5.0m for Indirects; and
- £0.6m for development of the CBA.

Although this is an additional cost to customers, these protection activities are essential to ensure compliance with legal obligations under the Marine Scotland Act 2010 and associated requirements of the NMP. Following the measures, we have adopted in RIIO-ED1, particularly through our inspections programme and the introduction of the CBA, the additional subsea cable costs represent a significant saving to customers when compared to the protection costs of £260m initially anticipated at the beginning of RIIO-ED1.