Loch Kemp Storage
A STATERA COMPANY

LOCH KEMP STORAGE

Shadow Habitats Regulations Appraisal (HRA) Report (Stage 1 & 2)

November 2023

LOCH KEMP STORAGE

Habitats Regulations Appraisal Report

(Stage 1 & 2)

Prepared for: ASH design + Assessment

SLR Ref: 428.V04707.00036
Version No: 9
November 2023

Document Control	
Document Properties	
Organisation	ASH Design and Assessment (on behalf of Statera Energy)
Project Name	Loch Kemp Storage
Report Title	Habitat Regulations Appraisal Report
Author(s)	Hazel Douglas and Pawel Gullett (SLR Consulting), Rowan Smith and Donald Morrison (Gavia Environmental Ltd.)
Draft version/final	Final
Document reference	428.V04707.00036

Date	Revision No	Prepared By	Reviewed By	Approved By	Status	Comments
17.02.23	1	Hazel Douglas, Pawel Gullet, Rowan Smith, Donald Morrison	Duncan Watson	Duncan Watson	Draft	First draft – all disciplines combined
17.07.23	2	Hazel Douglas	Duncan Watson	Duncan Watson	Draft	Second draft following NatureScot comments and revised scheme
10.08.23	3	Hazel Douglas	Duncan Watson	Duncan Watson	Draft	Third draft following client comments and further scheme revision
14.08.23	4	Hazel Douglas	Duncan Watson	Duncan Watson	Draft	Fourth draft following client comments
22.09.23	5	Rowan Smith	Donald Morrison, Matthew Hopkins	Donald Morrison, Matthew Hopkins	Draft	Fifth draft following legal review (non-River Moriston) and River Moriston update
26.10.23	6	Hazel Douglas	Duncan Watson	Duncan Watson	Draft	Revision to Ness Woods SAC woodland sections following NatureScot comments
01.11.23	7	Rowan Smith	Donald Morrison, Matthew Hopkins	Donald Morrison, Matthew Hopkins	Draft	Revision following River Moriston legal review and update
08.11.23	8	Hazel Douglas	Rachel McHale	Hazel Douglas	Draft	Minor update to traffic assessment / air quality data for Ness Woods SAC, and update to otter prey sections.
16.11.23	9	Hazel Douglas	Duncan Watson	Duncan Watson	Final	Final issue.

BASIS OF REPORT

This document has been prepared by SLR with reasonable skill, care and diligence, and taking account of the timescales and resources devoted to it by agreement with ASH design + Assessment (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.

CONTENTS

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

1.0 Introduction

SLR Consulting Ltd (SLR) and Gavia Environmental Ltd were commissioned by ASH Design + Assessment Ltd, on behalf of Statera Energy Limited, to prepare a Habitats Regulations Appraisal (HRA) for the Proposed Development of Loch Kemp Storage (approximate central OS grid reference NH 46967 16157), illustrated in Figure 1.

Consent for the Proposed Development is being sought under Section 36 of the Electricity Act 1989, as it falls under the category of electricity generating stations with capacity in excess of 50 megawatts. The Proposed Development is situated within The Highland Council (THC) administration area. The Planning Application is administered by the Energy Consents Unit (ECU) and will be determined by Scottish Ministers.

The location of the Proposed Development, the red line planning boundary (herein referred to as the 'Site'), and the scheme layout is illustrated in Figure 1. A full description of the Proposed Development is provided in Volume 1, Chapter 3 of the Environmental Impact Assessment (EIA) Report that forms part of the Planning Application, and within Section 4.0 of this report.

The switching station and associated access track, the underground cable between the cable shaft and switching station, and the cable itself through the cable tunnel between the powerhouse and the cable shaft (as shown under 'Associated Works' in Figure 1), does not form part of the Project, as it will be subject to a separate planning application. It has therefore been assessed under the in combination assessment within this HRA Report. The cable tunnel and cable shaft does form part of the Proposed Development.

This HRA report includes both a Stage 1 screening assessment, and a Stage 2 Statement to Inform the Appropriate Assessment (SIAA) (see Section 1.2 for a description of HRA stages). This HRA report does not include a Stage 3 assessment of alternative solutions, or Stage 4 imperative reasons of overriding public interest (IROPI) assessment, which are instead provided separately in the Derogation Report[1]. Similarly this report does not include the proposed package of compensatory measures, which is provided separately in the Derogation Report, and should be read in conjunction with this report.

1.1 Purpose of the Report

This report serves to identify any aspects of the Proposed Development that would be likely to lead to significant effects upon any sites afforded protection under the Conservation (Natural Habitats, &c.) Regulations 1994 (the Habitats Regulations). Such sites are referred to as European Sites, which is a collective term that describes Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSACs), Special Protection Areas (SPAs) and potential Special Protection Areas (pSPAs). Where the absence of likely significant effects on European Sites cannot be concluded from Stage 1 assessment, further assessment has been undertaken to provide the information to inform the competent authority's determination of the need for Stage 2 Appropriate Assessment, and to serve as the basis of that assessment. This information is referred to as a Stage 2 Statement to Inform the Appropriate Assessment (SIAA).

The Proposed Development falls partially within Ness Woods SAC, which is considered within this report. This report also considers the potential for likely significant effects beyond direct proximity. The Site is located 0.75 km from Loch Knockie and nearby Lochs SPA; 2.07 km from River Moriston SAC; 11 km from North Inverness Lochs SPA; 13.4 km from Urquhart Bay Wood SAC; 16 km from Loch Ruthven SPA; and 22 km from Loch Ashie SPA; all of which are also considered within this report. Information on the process and criteria used to determine which European sites are included within the HRA process are detailed in Sections 3.2.2 and 5.3 of this report.

[1] Royal Haskoning DHV (2023) Loch Kemp Storage: Derogation Report.

The Stage 2 SIAA within this report provides evidence of examination of adverse effects on the integrity of these European sites, to provide the competent authority with all relevant information required to inform the Appropriate Assessment where deemed necessary.

1.2 Objectives of Habitats Regulations Appraisal

The Habitats Directive promotes a hierarchy of avoidance, mitigation and compensatory measures to be addressed.

The stages of the HRA process are:

- Stage 1: Screening: the process which identifies whether effects upon European Sites of a plan or project are possible, either alone or in combination with other plans or projects and considers whether these effects are likely to be significant. This is broken down into:
    - Confirm whether the project or plan is connected with site management;
    - Examine the nature of the proposed works – are they a project or plan;
    - Identify whether there are potential effects on European Sites based on proximity criteria / potential effect pathways; and
    - Assess the likely significant effects, including in-combination effects.
- Stage 2: Appropriate Assessment: the detailed consideration of the effect on the integrity of the European site(s) of the plan or project, either alone or in combination with other plans or projects, with respect to the site's conservation objectives and its structure and function.
- Stage 3: Assessment of alternative solutions: the process which examines alternative ways of achieving the objectives of the plan or project that avoid adverse effects on the integrity of the European site(s).
- Stage 4: Assessment where no alternative solutions exist and where adverse effects remain: an assessment of whether the development is necessary for imperative reasons of overriding public interest (IROPI) and, if so, of the compensatory measures needed to maintain the overall coherence of the European network.

The HRA process is further described in Sections 3.1 – 3.3.

1.3 Consultation

1.3.1 Ness Woods SAC

As part of the scoping process, THC has indicated that it considers that a HRA should accompany the application, given the proposal's potential impact on European Sites (as set out in the EIA Scoping Opinion dated 11th March 2022).

NatureScot were consulted on the key interests in Ness Woods SAC to be considered, specifically in relation to the woodland designations ['*Old sessile oak woods with Ilex and Blechnum in the British Isles*' (common name: western acidic oak woodland) and '*Tilio-Acerion forests of slopes, screes and ravines*' (common name: mixed woodland on base-rich soils associated with rocky slopes)] and what would be required to ensure that sufficient surveys are undertaken to cover the designated site and enable an Appropriate Assessment to be prepared. NatureScot highlighted that the mixed woodland qualifying habitat is the primary reason for site selection and confirmed that both qualifying woodland interests include all aspects of the woodland structure, including understorey / ground flora, epiphytes, and terrestrial / saxicolous bryophytes and lichens. NatureScot advised that bryophyte-rich ravines are an integral part of the typical species of both woodland habitats and are amongst the reasons why these habitats are of international interest and why Ness Woods SAC was selected. NatureScot

also recommended that its sitelink facility[2] be used for the most up to date information, and that the Conservation Advice Package contained therein provides the most up to date information on the importance of Ness Woods SAC and the conservation objectives against which the proposal will be assessed in a HRA.

NatureScot also stated in its scoping response: "*NatureScot note that an underground grid connection has been agreed, but the route has yet to be decided. Based on the location of the powerhouse, this has the potential to further impact on the woodland features of the SAC. This needs to be taken into account and included in a cumulative impact assessment and included in the EIA Report*." The Proposed Development, and this HRA assessment, includes an underground cable connection, via a cable tunnel, between the powerhouse (within Ness Woods SAC on the Loch Ness shoreline), and a cable shaft located to the south-east of the powerhouse, outwith Ness Woods SAC (see Figure 1), such that no additional land-take within Ness Woods SAC would occur. The switching station (located in close proximity to Dell Farm, over 1 km from Ness Woods SAC), and associated access track, and cable connection between the cable shaft and switching station (which will follow access track routes and cross over Dam 1) (see 'Associated Works' in Figure 1), form a separate planning application, and are subject to an in combination assessment within this report.

A site visit conducted by NatureScot, was undertaken on 27th April 2022. Feedback was provided via a memorandum dated 10th May 2022, which in summary included:

- Confirmation that the majority of the woodland within the Ness Woods SAC project area corresponds to [Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles]. The main areas of [*Tilio-Acerion* forests of slopes, screes and ravines] were identified in the immediate vicinity of the ravines, especially the Allt an t'Sluichd, and also the unnamed burn draining Lochan a' Choin Uire;
- Comments and notes were provided for specific areas of interest, and a request made for detailing features of interest within the bryophyte and lichen reports.
- Notes on potential impacts of the development were provided, including: temporarily affected areas within the working corridor, for which restoration will not necessarily be possible; the access track would result in woodland fragmentation; increased disturbance could have major impacts to fauna; loss of important bryophytes and lichens would be irreplaceable; and confirmation that survey of bryophytes and lichens of the Allt an t-Sluichd and information on any flow restrictions is required.

Detailed bryophyte and lichen surveys have been undertaken, and the assessment within this HRA Report includes full details of potential impacts highlighted by NatureScot.

An early draft of the sections of this HRA report specifically relating to Ness Woods SAC was shared with NatureScot for comment, and feedback relating to evaluating the impacts on qualifying woodland habitats was given by NatureScot, in a meeting held on 13th April 2023, and follow-up informal notes provided by email on 17th April 2023.

The draft HRA was updated to address the comments raised by NatureScot. As set out in the 13th April meeting minutes (updated by NatureScot in an email dated 2nd May), the main comments from NatureScot specific to the Ness Woods SAC sections of the early draft HRA are summarised as:

- Provide further detail on bryophytes and their value as typical species of the qualifying habitats;
- Provide further detail of fragmentation effects between the lower section of proposed access track and Loch Ness shoreline within Ness Woods SAC;
- Provide clarification on how the natural flow regime of the Allt an t'Sluichd would be maintained, and provide an assessment of impact on the bryophytes / lichens in the Allt an t-Sluichd gorge;
- Provide further detail of whether the proposed access track through Ness Woods SAC would affect hydrological flows, resulting in any effects upon sensitive habitat such as flush vegetation;

[2] https://sitelink.nature.scot/site/8337 [Accessed in November 2022]

- Provide justification that land-take calculations associated with the access track on the slopes are deliverable; and
- It was agreed that lichen translocation could not be counted as mitigation or compensation, due to the likelihood of success not being sufficiently high enough.

NatureScot provided additional comments to an updated HRA draft, in an email dated 27th September 2023, specifically in relation to Ness Woods SAC, which are summarised as follows:

- Conservation Objective 2a (woodland qualifying features): NatureScot advise that the impact of fragmentation is likely to be underestimated. NatureScot comment that further areas of woodland (additional to the areas between the two tightest hairpin bends, which were already identified in the draft being reviewed) will become isolated along the access track corridor, which is more sinuous than the existing track. They state that as a general rule edge effects can extend 30m into the surrounding woodland, and so an area of less than 60m across contains no woodland interior habitat. There may be scope for discussion over the applicability of this figure to the woodland on this site, but it indicates the likely scale of the issue.
- Conservation Objective 2c (woodland qualifying features): NatureScot advise that the assessment of loss of viability seems likely to underestimate the potential impact of fragmentation (edge effects), and that there is likely to be a further loss of viability of typical species as a result of micro-climate edge effects, in relation to the lichens within the second lowest hairpin bend of the proposed access track, where the canopy is less open. NatureScot recommend a discussion between Andy Acton (the project lichenologist) and NatureScot's Woodland and Lichen/Bryophyte Advisors to confirm the likely susceptibility of the specific lichens in this hairpin, to microclimate edge effects and the distance over which they may be affected.
- Conservation Objective 2c (otter qualifying feature): NatureScot query how the fish mitigation measures would mitigate impacts on availability of food for otter, and that they would have a likely significant effect on the River Moriston SAC, for which they should be assessed against conservation objectives of River Moriston SAC in an HRA before being included as mitigation. They advise that it may not be possible to conclude no adverse effects on site integrity, and are seeking further internal advice on the likely magnitude of impacts on prey availability and whether they think there is in fact a need for mitigation.

This final HRA document has been updated to address NatureScot comments. The updates have been undertaken without further consultation with NatureScot, due to submission time constraints, but have been undertaken following further consultation with Andy Acton (project lichenologist). A more precautionary assessment of fragmentation and edge effects has been provided, which incorporates additional wider hairpin bends where the canopy is more closed. A more precautionary assessment of microclimatic edge effects upon lichens within the second lowest hairpin bend has also been included. Fish mitigation has been updated and is included in the HRA assessment for River Moriston SAC.

1.3.2 River Moriston SAC

NatureScot were consulted on the status of Freshwater Pearl Mussel *Margaritifera margaritifera* in the River Moriston and a licence to release historical data was signed. Historical survey efforts were conducted in 2003 and 2013, NatureScot stated that an additional survey effort would be required to inform updated population status within the river. It was proposed that three surveys would be conducted, two above the falls at Invermoriston and one at the mouth at Loch Ness, to place the population at the mouth into context to that of the entire population; NatureScot agreed this was an appropriate survey effort to inform the HRA. Survey

methodologies followed the approved NatureScot method[3] with the scope of works approved by NatureScot prior to conducting field surveys.

1.3.3 Urquhart Bay SAC

A draft of the report provided in Appendix 1, 'Eco-hydrological assessment of the impacts of Loch Kemp Storage on Urquhart Bay Wood SAC,' used to inform this HRA, was provided to NatureScot for initial comment on 4th May 2023. The version provided in Appendix 1 to this HRA draft has been updated to address comments provided by NatureScot, in a meeting held on 20th June 2023, and follow-up meeting minutes provided by email on 22nd June 2023. NatureScot recommended the following areas be added / expanded, in order to ensure a robust basis for the HRA:

- Using an appropriately long data series of water levels in Loch Ness to allow understanding of the patterns of variation, extremes, and identification of any trends;
- Explanation of how all current / consented / proposed pumped storage hydro (PSH) and the Ness canal are, or will be, regulated under the Controlled Activity Regulations (CAR) in relation to the loch levels below which they cannot abstract, and how these effect loch levels at present and if the Proposed Development is built;
- Explanation and ideally a diagram to show how the mean, minimum and maximum loch levels relate to the level at which Foyers has to stop abstracting;
- Explanation of how the effects of abstraction via Ness canal are addressed in the modelling;
- Explanation of how climate change will or will not affect the modelled loch level variations;
- Justification / evidence to support the position that PSH schemes are likely to increase water level fluctuations at a diurnal level, but not over substantially longer durations;
- Justification for selecting variations from the mean loch level as the basis for the reasonable worst case scenario, or if more appropriate changing it e.g. to the minimum loch level in relation to the effects of maximum abstraction, and the maximum loch level in relation to the effects of maximum discharge; and
- A cross-section across the Loch at Urquhart Bay Wood, showing the minimum, mean and maximum water levels, and the Foyers 'stop level'.

This final point has not been included in the report provided in Appendix 1, as a full cross section across the loch is not possible due to the large variation in depth across the loch. Figure 8-7 in the report models the manner in which the flood levels recorded from 2014 – 2023 inundate different extents of Urquhart Bay Wood but this figure only reflects levels above 16 m AOD due to a lack of topographic data for levels below 16 m AOD. All other comments raised by NatureScot have been addressed in Appendix 1.

NatureScot confirmed (via email dated 15th August 2023) that its advisors agree with the conclusion in the updated eco-hydrological assessment, that there will be no adverse effect on site integrity on Urquhart Bay Woods SAC from Loch Kemp Storage.

1.4 Evidence of Technical Competence and Experience

The assessment of sites designated for (non-avian) terrestrial ecology features has been completed by Hazel Douglas MCIEEM MBiolSci, Associate Ecologist with SLR Consulting. Hazel has over nine years' experience within ecological consultancy, and is a competent and experienced terrestrial ecologist, who specialises in Ecological Impact Assessment. Hazel has completed a number of HRA assessments within the UK and Republic of Ireland.

The assessment of sites designated for avian features has been completed by Pawel Gullett, Associate Ecologist with SLR Consulting. Pawel is an ecological consultant and ornithologist; he joined SLR in autumn of 2022 with over ten years of environmental consulting experience, mainly in the Scottish renewable sector. He is

[3] https://www.nature.scot/sites/default/files/2018-04/Freshwater-pearl-mussel-survey-protocol-for-use-in-site-specific-projects.pdf [Accessed March 2023].

experienced in the design, implementation and management of ecological assessments, production and review of ornithology EIA chapters and HRA documentation and technical reports.

The assessment of sites designated for aquatic features has been compiled by Rowan Smith, Environmental Consultant and Donald Morrison of Gavia Environmental Ltd. Rowan is a consultant specialising in aquatic ecology experienced in ecological design, implementation and application of aquatic technical reports and EIA documentation. Donald is a Principal Consultant at Gavia Environmental with over eight years' experience in fisheries and ecology and a member of the Institute of Fisheries Management (MIFM). Matthew Hopkins aided with technical review. Matthew is a Director at Gavia Environmental with over 25 years' freshwater ecology experience and EIA technical direction.

This report has been technically reviewed by Duncan Watson MCIEEM CEnv, Technical Director with SLR Consulting. Duncan is an Ecologist with over 25 years' professional experience, much of which relates to projects in the renewable energy sector. Duncan has a particular interest in Ecological Impact Assessment and Habitats Regulations Assessment and was a member of the technical review group responsible for revising and updating the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK (published in 2018 and recently updated). He has also led CIEEM workshops on Ecological Impact Assessment and Habitats Regulations Assessment.

2.0 Relevant Legislation and Policy

The relevant legislation is the Conservation (Natural Habitats, &c.) Regulations 1994. Regulation 48 sets out the steps for assessing plans and projects which may affect European sites (in the National Network). Although this legislation derives from the EC Habitats Directive, the Regulations continue to apply following the UK's exit from the EU. The Regulations have been subject to further minor technical amendments to deal with the UK's exit from the EU however the process for assessment remains largely unaltered. Case law made prior to the UK exit from the EU also still applies and is relevant. This includes the People over Wind Judgement[4] which made clear that mitigation measures cannot be considered at screening stage (Stage 1) and therefore any project requiring mitigation to avoid significant effects, or to make certain that there are no such effects, needs to be assessed under Stage 2 Appropriate Assessment.

Where reserved matters (within the meaning of Schedule 5 of the Scotland Act 1998)[5] are concerned, certain provisions of the Conservations of Habitats and Species Regulations 2017 apply instead. Both sets of regulations require an equivalent process in relation to the assessment of plans and projects with the potential to affect European sites.

The need for HRA is re-iterated in national and local planning policies in Scotland. In terms of national policy, Policy 4(b) of the National Planning Framework 4 (NPF4), adopted in February 2023, states: "*Development proposals that are likely to have a significant effect on an existing or proposed European site (Special Area of Conservation or Special Protection Areas) and are not directly connected with or necessary to their conservation management are required to be subject to an "appropriate assessment" of the implications for the conservation objectives.*" In terms of local policy, the need for HRA is stated in, e.g., Policy 2 of the Proposed Inner Moray Firth Development Plan 2022[6], and Policy 57 of the Highland-wide Local Development Plan 2012[7].

Policy 4(c) of NPF4 states that: "All Ramsar sites are also European sites and/or Sites of Special Scientific Interest and are extended protection under the relevant statutory regimes." Scottish Government guidance on how it expects its policy on the protection of Ramsar sites to be implemented[8] states that: "*where Ramsar interests coincide with Natura qualifying interests protected under an SPA or an SAC, as the case may be, the interests are thereby given the same level of (legal) protection as Natura sites. Where Ramsar interests are not the same as Natura qualifying interests but instead match SSSI features, these receive protection under the SSSI regime.*"

---

[4] People Over Wind and Peter Sweetman vs Coillte Teoranta CJEU C-323/17

[5] Reserved matters include: activities consented under sections 36 or 37 of the Electricity Act 1989; activities consented under the Pipelines Act 1962; matters related to the exploration for, and exploitation of, deposits of oil and natural gas; and matters related to defence of the realm.

[6] The Highland Council (2022) *Inner Moray Firth Proposed Local Development Plan 2* [online] Available at: https://www.highland.gov.uk/info/178/local_and_statutory_development_plans/202/inner_moray_firth_local_development_plan [Accessed in November 2022]

[7] The Highland Council (2012) *Highland Wide Local Development Plan April 2012* [online] Available at: https://www.highland.gov.uk/download/downloads/id/1505/highland-wide_local_development_plan.pdf [Accessed in November 2022]

[8] Scottish Government (2019) Implementation of Scottish Government policy on protecting Ramsar sites [online] Available at: https://www.gov.scot/publications/implementation-of-scottish-government-policy-on-protecting-ramsar-sites/ [Accessed in October 2023]

3.0 Methodology

3.1 General Approach

The methodology used in this report is based on Regulation 48 of the Conservation (Natural Habitats, &c.) Regulations 1994, NatureScot guidance[9] and European Commission (EC) Guidance[10,11] on the application of the Habitats Directive. The 2021 EC guidance describes a series of stages and steps which should be completed when carrying out the assessment and these are followed here with minor modifications. The assessment applies only to European sites (SPAs and SACs) by law. More specifically, it only applies to the qualifying interest features of such sites, i.e. the features which are the reason that the site was designated. Ramsar sites, where the interest features coincide with the qualifying interests of overlapping SPAs or SACs, would also be considered in the assessment. However, in this case there are no Ramsar sites within the potential Zone of Influence of the Proposed Development and Ramsar sites are therefore not considered further.

3.2 Stage One Screening

3.2.1 Process Outline

Stage One is a screening assessment, the purpose of which is to determine whether a plan or project requires more detailed assessment. There are two principal tests:

- The first test considers whether the plan or project is needed for the management of a European site for the purpose of maintaining or restoring its conservation interest. Any such plans or projects can usually be screened out of further assessment.
- The second test considers whether the plan or project, without specific mitigation measures, would be likely to have a significant effect on any European Site. This requires consideration of the project on its own and in combination with other plans or projects.

A project can only be screened out of further assessment if it is certain (beyond reasonable scientific doubt) that there would be no significant effects on any European site without mitigation designed specifically to address potential impacts on the qualifying interest of such sites. The process is also used to determine which European Sites should be included in the later stages of the assessment.

The HRA screening stage has been characterised by the 2021 EC guidance as a four-step process. These steps are:

- Step 1: Ascertain whether the project or plan is directly connected with, or necessary to, the management of the European site;
- Step 2: Describe the plan or project and its impact factors;
- Step 3: Identify which European sites may be affected by the plan or project; and
- Step 4: Assess whether likely significant effects can be ruled out in view of the site's conservation objectives.

When each of these steps has been worked through there are two potential outcomes:

[9] https://www.nature.scot/professional-advice/planning-and-development/environmental-assessment/habitats-regulations-appraisal-hra [Accessed in February 2022]

[10] EC (2021) Assessment of plans and projects in relation to Natura 2000 sites - Methodological guidance on Article 6(3) and (4) of the Habitats Directive 92/43/EEC

[11] EC (2018) Managing Natura 2000 sites: The provisions of Article 6 of the 'Habitats' Directive 92/43/EEC

1. One or more likely significant effects on designated features of European sites are identified, or there is uncertainty about the absence of likely significant effects, and the project requires an Appropriate Assessment (Stage 2); or
2. There is an absence of likely significant effects on designated features of European sites as there is no pathway by which such effects could occur and therefore there is no requirement for an Appropriate Assessment. This is also known as 'screening out' the need for further assessment.

The person applying for permission for a plan or project where there are likely significant effects on European sites, must provide sufficient information to the competent authority to enable the competent authority to assess whether an Appropriate Assessment is required.

3.2.2 Identification of the European sites that could be affected by a project

The European sites that should be considered within the screening process are those where there is the potential, on a precautionary basis, for a likely significant effect to be identified for the project alone and in combination with other plans and projects.

Key to determining which European sites are included within this consideration is an understanding of the activities associated with a project, the geographical scale over which changes due to the different activities may be detectable and the types of receptors (in other words designated features) susceptible to them[12]. Through the use of this *activity – change – effect* concept, it is possible to identify potential European sites (and their qualifying features) that may be subject to likely significant effects.

The 'zone of influence' for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities. This is likely to extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries. The zone of influence will vary for different ecological features depending on their sensitivity to an environmental change[13].

3.2.3 Identifying in combination effects and other plans or projects for inclusion

Effects on European sites may result from a proposed development alone and/or in combination with other plans or projects; these potential cumulative effects are described as 'in combination effects' in the Habitats Regulations.

The identification of plans and projects to include within the in-combination assessment follows the same methodology as that outlined in Section 3.2.2 for the identification of European sites relevant to a project. Key to the inclusion of other plans and projects within the assessment are the spatial and temporal overlaps that may occur due to the scale of potential changes (for example overlaps in the zones of disturbance caused by simultaneous construction activity) or the areas over which potential receptors may travel (for example a bird may pass through several areas where development is proposed when moving between roosting and feeding grounds in or between designated sites).

Following the identification of plans and projects, an initial screening is then undertaken to filter out minor proposals (for example extensions to existing dwellings, minor street works, changes of use etc.) with no potential to cause likely significant effects in combination and those with no potential to overlap with a project due to differing timescales. Those that are to be included within the in-combination assessment are then considered with regard to the identified potential effects. The list of plans and projects identified has also been used to inform Stage 2 of the HRA process.

---

[12] This includes habitats and species that are not designated features but help underpin the conservation objectives of a European site (for example habitats supporting designated features). This is in line with recent case law – Case C-461/17 Holohan v An Bord Pleanala.

[13] Chartered Institute of Ecology and Environmental Management (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal.

3.2.4 Determining Likely Significant Effects

The HRA screening process uses the threshold of likely significant effects to determine whether effects on European sites should be the subject of further assessment. The Habitats Regulations do not define the term 'likely significant effect'. However, in the Waddenzee case (Case C-127/02) the European Court of Justice found that a likely significant effect exists if it cannot be excluded on the basis of objective information that the plan or project will have significant effects on the conservation objectives of the site concerned, whether alone or in combination with any other project. The Advocate General's opinion in the Sweetman case (Case C-258/11) further clarifies the position by noting that, for a conclusion of a likely significant effect to be made, "*there is no need to establish such an effect...it is merely necessary to determine that there may be such an effect*".

Under the Habitat Regulations an effect is likely if:

1) it cannot be excluded, in that it is capable of having an effect, on the basis of objective information; and
2) it is likely to undermine the site's conservation objectives, after all aspects of the plan or project have been considered alone and in combination with other plans and projects.

A precautionary approach has been taken to the screening process (Stage 1). Only those designated features and European sites where it can be demonstrated that there is no likelihood of a significant effect occurring (based on the criteria and approach outlined above) have been screened out. This screening assessment does not consider any mitigation measures that are necessary to reduce or avoid likely significant effects on European sites. This follows the judgement of the Court of Justice of the European Union in People over Wind[14] where it was concluded that the need for measures to avoid or reduce harmful effects presupposes that there is a likely significant effect, and consequently consideration at Stage 2 is required.

Within the screening assessment, each potential effect is considered using information from surveys undertaken to inform the HRA process, published literature (where available), other available baseline data, modelling outputs, the project design and professional judgement (informed by CIEEM, 2018[15]). Where a potential effect has been identified, but no likely significant effect is predicted, the evidence and reason for reaching this conclusion is provided.

3.3 Stage Two: Appropriate Assessment

Stage Two is a more detailed assessment, known as an Appropriate Assessment in the legislation. This considers the potential for likely significant effects in more detail and considering mitigation measures before reaching a conclusion. At this stage, the test is whether the project or plan will have an adverse effect on the integrity of any European site. This must be considered in the light of the conservation objectives for the qualifying interest features. Any effect which is found to undermine the conservation objectives is considered an adverse effect on the integrity of the site.

The steps involved in the HRA Stage Two: Appropriate Assessment, as defined in the 2021 EC guidance, are summarised below:

- Step 1: Collect information on the project and on the European sites concerned;
- Step 2: Assess the implications of the plan or project in view of the site's conservation objectives, individually or in combination with other plans or projects. This step involves:
    - Part 1: identifying the conservation objectives of the European sites affected by the plan or project;
    - Part 2: identifying and assessing the impacts of the plan or project against the site's conservation objectives; and

[14]Case C-323/17 People Over Wind v Coillte Teoranta.

[15] Chartered Institute of Ecology and Environmental Management (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal.

- Part 3: considering cumulative effects with other plans or projects.
- Step 3: Ascertain the effects of the plan or project on the integrity of the European site; and
- Step 4: Mitigation Measures. This step involves providing a detailed description of mitigation measures, an assessment of the effectiveness of these measures, monitoring where required, and an assessment of effects after the mitigation has been applied.

3.4 Baseline Data Collation

3.4.1 Desk Review

Baseline information was gathered through a desk-based study considering previous data, reports and survey work in the area as summarised below:

- Desk study of protected and notable species records and non-statutory designated sites within 2 km of the Site supplied by Highland Biological Recording Group (HBRG) (data obtained in November 2022, and summarised within Volume 1, Chapter 10: Terrestrial Ecology of the EIA Report);
- Terrestrial Ecology Report[16], which provides baseline information on terrestrial habitats and protected species within the Site, including within Ness Woods SAC (see Section 3.4.2 below);
- Bryophyte Survey Report[17], which includes detailed baseline information on the bryophyte interest within the Site, including within Ness Woods SAC (see Section 3.4.2 below);
- Lichen Survey Report[18], which includes detailed baseline information on the terrestrial lichen interest within the Site, including within Ness Woods SAC (see Section 3.4.2 below);
- Freshwater Lichen Survey Report[19], which includes detailed baseline information on the freshwater lichen interest within the Site and surrounding area, including within Ness Woods SAC (see Section 3.4.2 below);
- The following chapters from Volume 1 of the EIA Report, where methods of data collection and results are described in full: Chapter 7: Water Management; Chapter 10: Terrestrial Ecology; Chapter 11: Ornithology; Chapter 12: Aquatic Ecology; Chapter 13: Fish; Chapter 14: Geology, Soils and Water; Chapter 17: Noise and Vibration; and Chapter 18: Air Quality;
- Detailed project information has been derived from Volume 1, Chapter 3: Description of Development of the EIA;
- NatureScot sitelink facility and document links therein for Ness Woods SAC[20], comprising: Qualifying Interest List; Conservation Advice Package; SAC Map; Scotland's Environment – Feature Condition[21]; JNCC SAC Site Details; and JNCC SAC Data Form;
- NatureScot sitelink facility and document links therein for River Moriston SAC[22], comprising: Qualifying Interest List; Conservation Advice Package; SAC Map; Scotland's Environment – Feature Condition; JNCC SAC Site Details; and JNCC SAC Data Form;
- NatureScot sitelink facility and document links therein for Loch Knockie and nearby Lochs SPA[23], North Inverness Lochs SPA[24], Loch Ruthven SPA[25], and Loch Ashie SPA[26], comprising: SPA Citation, Conservation

[16] Blairbeg Consulting (2022) Loch Kemp Pumped Storage Scheme. Terrestrial Ecology Report.
[17] Nick Hodgetts Botanical Services (2022) Bryophyte Survey at the Proposed Loch Kemp Pumped Storage Scheme – Final Report.
[18] Acton, A. (2022) Lichen survey at the proposed Loch Kemp pump storage scheme. Report to ASH. Design + Assessment.
[19] Douglass, J. R. (2023) Freshwater Lichen Survey at the Proposed Loch Kemp Pumped Storage Scheme.
[20] https://sitelink.nature.scot/site/8337 [Accessed in November 2022]
[21] https://informatics.sepa.org.uk/ProtectedNatureSites/ [Accessed in November 2022]
[22] https://sitelink.nature.scot/site/8361 [Accessed in November 2022]
[23] https://sitelink.nature.scot/site/8529 [Accessed in February 2023]
[24] https://sitelink.nature.scot/site/8557 [Accessed in February 2023]
[25] https://sitelink.nature.scot/site/8538 [Accessed in February 2023]
[26] https://sitelink.nature.scot/site/8525 [Accessed in February 2023]

Objectives, SPA Map, Scotland's Environment – Feature Condition; JNCC SPA Site Details; and JNCC SPA Data Form;

- NatureScot sitelink facility and document links therein for Urquhart Bay Wood SAC[27], comprising: Qualifying Interest List; Conservation Advice Package; SAC Map; Scotland's Environment – Feature Condition; JNCC SAC Site Details; and JNCC SAC Data Form;
- Eco-hydrological assessment of the impacts of Loch Kemp Storage on Urquhart Bay Wood SAC, which is appended in full to this HRA report (Appendix 1), and referred to as appropriate throughout this report;
- Desk study of Slavonian grebe (*Podiceps auritus*) breeding records within the Zone of Influence (15 km radius of the Proposed Development, as well as Loch Ruthven and Loch Ashie) supplied by the RSPB on 14th February 2023 and Scottish Ornithologist' Club (SOC)[28];
- Pre-works otter survey report[29], which provides updated baseline information on otter within 250 m of proposed Ground Investigation (GI) works, which includes the proposed powerhouse area on the Loch Ness shoreline and Dam 1 area on the Allt an t-Sluichd within Ness Woods SAC; and
- Consultation and receipt of NatureScot data on Freshwater Pearl Mussel records from survey work undertaken in 2003 and 2013.

The source of information for the plans and projects for the 'in combination' assessment was the Highland Council planning portal[30], the Highland-wide Local Development Plan 2012[31], and the Proposed Inner Moray Firth Local Development Plan 2022[32].

3.4.2 Site Surveys

To support this HRA (and the EIA process), a series of baseline surveys have been undertaken from 2021 – 2023, as reported in the baseline reports detailed in Section 3.4.1 above. Full survey methodologies and results are provided in the associated baseline reports and EIA Report, and are summarised below:

- Phase 1 habitat survey using standard JNCC methodology[33] in June and August 2021, and June 2023, covering land within 250 m of proposed infrastructure[34];
- National Vegetation Classification (NVC) survey using standard methodology[35] in June and August 2021, and June 2023, covering land within 250 m of proposed infrastructure;
- Protected Species walkover surveys comprising otter (*Lutra lutra*), Scottish wildcat (*Felis sylvestris*), badger (*Meles meles*), water vole (*Arvicola amphibius*), red squirrel (*Sciurus vulgaris*), pine marten

[27] https://sitelink.nature.scot/site/8406 [Accessed in February 2023]

[28] https://www.the-soc.org.uk/about-us/online-scottish-bird-report [Accessed in February 2023]

[29] SLR Consulting (2023) Loch Kemp Pumped Storage Scheme: GI Works. Otter survey. 428.V04707.00036

[30] https://www.highland.gov.uk/info/180/planning_-_applications_warrants_and_certificates/143/planning_permission/4 [Accessed in November 2022]

[31] The Highland Council (2012) *Highland Wide Local Development Plan April 2012* [online] Available at: https://www.highland.gov.uk/download/downloads/id/1505/highland-wide_local_development_plan.pdf [Accessed in November 2022]

[32] The Highland Council (2022) *Inner Moray Firth Proposed Local Development Plan 2* [online] Available at: https://www.highland.gov.uk/info/178/local_and_statutory_development_plans/202/inner_moray_firth_local_development_plan [Accessed in November 2022]

[33] JNCC (2010), Handbook for Phase 1 Habitat Survey – a technique for environmental audit. Joint Nature Conservation Committee: Peterborough.

[34] With the exception of an area south of Whitebridge Plantation beyond the Site boundary, land east of the B682 beyond the Site boundary, and a north-east section of Whitebridge Plantation. These areas lie well beyond the boundary of Ness Woods SAC and beyond the proposed infrastructure footprint.

[35] Rodwell, J.S. (2006) NVC Users' Handbook, JNCC, Peterborough.

(*Martes martes*) and bats, using standard methodologies[36,37,38,39,40,41], in June and August 2021, and June 2023. Bat survey comprised a ground-level inspection of trees to assess their suitability for roosting bats[42]. Protected species surveys covered suitable habitat within a 100 m buffer from proposed infrastructure, extended to 200 m for otter, Scottish wildcat and water vole;

- Detailed bryophyte survey, comprising woodland and watercourse habitat within Ness Woods SAC within the Site boundary, undertaken in September 2021, April and June 2022;
- Detailed lichen surveys, comprising terrestrial lichens within Ness Woods SAC (including within the Site boundary as well as outwith the Site boundary within the Dell estate) and around Loch Kemp; and freshwater lichens along watercourses Allt à Chinn Mhonaich, an unnamed stream which drains from the Lochan a Choin Uire, and Allt an t-Sluichd, in April, May and July 2022; along with freshwater lichens on the rocky shore of Loch Kemp and surrounding moorland lichens in December 2022, and freshwater lichens in surrounding lochs and lochans in February and March 2023;
- Detailed tree tagging for trees within Ness Woods SAC that lie within close proximity to the proposed infrastructure footprint and works areas in summer 2022 and spring 2023;
- Baseline data has been collated on the River Moriston and Loch Ness from previous studies in 2003 and 2013. Mussel surveys were conducted at three locations on the River Moriston to provide updated information on population status in March 2023 and comprised of a single survey visit undertaken under optimal survey conditions;
- Loch and riverine macroinvertebrate surveys of Loch Kemp, Loch Ness, Loch Cluanie, Lochan a Choin Uire, Allt Leachd Gowerie, Allt Loch Paiteag, Allt an t-Sluichd and Allt a Chinn Mhonaich, undertaken in July and September 2022;
- Waterbird surveys using a combination of walkover surveys around waterbodies within proximity of the Proposed Development (1 km), and short vantage point watches over waterbodies with suitable habitat for breeding waterfowl. Waterbird surveys comprised four visits between April and July 2021 and 2022;
- Aspect Land & Hydrographic Surveys Ltd were commissioned to undertake a current monitoring survey within Loch Ness, at the confluence of the River Moriston which was conducted on 01 June 2023; and
- Otter pre-GI works survey within a 250 m buffer of proposed GI works areas, which includes the proposed powerhouse area and Dam 1 area within Ness Woods SAC, as well as areas around Loch Kemp, undertaken on 24th – 26th May and 14th June 2023.

---

[36] Bang, P. and Dahlstrøm, P. (2001) Animal Tracks and Signs. Oxford University Press

[37] Sargent, G. and Morris, P. (2003) How to find and identify mammals. The Mammal Society, London

[38] Davis, A. R. & Gray, D. (2010) The distribution of Scottish wildcats (Felis silvestris) in Scotland (2006-2008). Scottish Natural Heritage Commissioned Report No. 360

[39] Scottish Natural Heritage (2011) Scottish Wild Cat Naturally Scottish Series. SNH Battleby. http://www.snh.org.uk/pdfs/publications/naturallyscottish/wildcats.pdf

[40] Neal, E. and Cheesman, C. (2006) Badgers. Poyser Natural History, Cambridge, UK

[41] Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). Eds Fiona Matthews and Paul Chanin. The Mammal Society, London

[42] Collins, J. (2016) Bat Surveys for Professional Ecologists. Good Practice Guidelines. Third edition. Bat Conservation Trust, London

4.0 Detailed Project Description

A full description of the Proposed Development is given in Volume 1, Chapter 3: Description of Development of the EIA Report. The proposed layout is shown in Figure 1.

The proposal is to build and operate a pumped storage scheme up to 600 Megawatt (MW) with an energy storage capacity of up to 9 Gigawatt hours (GWh), utilising the existing Loch Kemp as the upper storage reservoir and Loch Ness as the lower storage reservoir. To allow drawdown for storage, Loch Kemp would be raised by approximately 28 m from the existing elevation. Four new saddle dams and four minor cut off dams would be constructed around Loch Kemp to form the upper reservoir.

4.1.1 Development Site Baseline

The Proposed Development Site is situated on Dell Estate approximately 13 km to the north-east of Fort Augustus, occupying the area of land between Whitebridge to the east and the shore of Loch Ness to the west / north-west. The north-western part of the Proposed Development Site comprises a section of Ness Woods SAC and Easter Ness Forest Site of Special Scientific Interest (SSSI), on uneven ground that slopes down to the Loch Ness shoreline. Further details of the baseline habitat within Ness Woods SAC are provided in Section 5.4.1.

The central areas of the Proposed Development Site comprise Loch Kemp along with several smaller surrounding Lochans, surrounded by a mosaic of moorland habitats. The Allt an t'Sluichd watercourse drains from Loch Kemp into Loch Ness through Ness Woods SAC.

In the central areas of the Proposed Development Site, dense bracken and dry dwarf shrub heath are the dominant habitat types, with dry heath generally in a species-poor condition due to muirburn management. Several pockets of blanket bog are also present, along with pockets of wet modified bog, and smaller pockets of wet dwarf shrub heath, unimproved acid grassland, acid flushes, and semi-improved neutral grassland. There are also several areas of native birch-dominated woodland, predominantly around the shores of Loch Kemp.

Whitebridge Plantation, a conifer plantation, covers the eastern and north-eastern parts of the Proposed Development Site.

Further ecological information from Site survey work is provided in Section 5.4.1.

4.1.2 Timeline

It is anticipated that the construction period would last four to five years, with four years of civil engineering and one to two years of reinstatement / restoration, testing and commissioning, subject to consents and the successful contractor's approach.

4.1.3 Construction Stage

The construction stage includes the following activities:

- Site establishment, including felling of trees and construction of access tracks: Years 1 – 2;
- Form platform at lower reservoir works: Years 1 – 2;
- Tunnel excavation and underground works (including turbine shafts): Years 1 – 4;
- Construction of dams and upper reservoir works: Years 1 – 4;
- Construction of powerhouse building, substation and above ground lower reservoir works: Years 2 – 4;
- Site reinstatement / restoration: Years 4 – 5; and
- Testing and commissioning: Years 4 – 5.

The following components will comprise the project and will require construction or installation:

- **Dams and Upper Reservoir**: Four new saddle dams would be constructed measuring 16 – 34 m high, and four minor cut-off dams would be constructed around Loch Kemp to enable the storage of water by increasing the size of the existing Loch Kemp to form the upper reservoir. The loch level would be raised by approximately 28 m from the existing level of 177 m AOD elevation to 205 m AOD. The northernmost dam (Dam 1) is located within Ness Woods SAC at the upstream end of the Allt an t-Sluichd watercourse, and would be a roller compacted concrete (RCC) dam. A compensation flow discharge would be released to the Allt an t-Sluichd, and the dams would have a spillway for emergency drawdown. It is anticipated Dam 4 would also be a RCC dam, whereas Dam 5 would be a hybrid RCC and rockfill dam. The remainder of the dams would be constructed of rock. Rock construction materials would be sourced on-site from tunnel and shaft excavations and borrow pits. An inlet / outlet structure would also be constructed below the western edge of Loch Kemp, which would be connected to the underground waterway system. This will feature diffusers to discharge or abstract water from Loch Kemp, a trash rack screen to prevent debris that may damage the pump / turbines, and a gate structure to allow the waterways to be isolated from the loch when maintenance is required. A temporary cofferdam would be constructed between the inlet / outlet and Loch Kemp during construction. Dams 1 and 4, and the inlet / outlet structure would require small control kiosks housing control system equipment and emergency power supplies in the form of diesel generators.

- **Underground Waterway System**: The underground waterway system would consist of two headrace tunnels carrying water between the upper reservoir and lower reservoir. These tunnels would be approximately 1.2 km in length. Furthermore, each turbine would have a short tailrace tunnel section, approximately 50 m in length, to connect the turbine to the outlet area and lower control works at Loch Ness. All underground works are likely to be constructed using drill, blast, muck and haul techniques.
- **Powerhouse Platform Area and Access Tunnels** - The onshore elements of the outlet area and the Powerhouse Building would be located on a large area of hardstanding over two levels, referred to as the Powerhouse Platform Area. The upper and lower level would be connected by an access track to the rear (east) of the powerhouse building. Access tunnels would be constructed from the powerhouse platform (via a tunnel adit) to facilitate access to the underground waterway system. These tunnels would be accessed from the lower platform works.
- **Powerhouse Building**: A series of shafts with a surface building located on the shore of Loch Ness would contain reversible pump turbines and motor generators together with associated equipment such as transformers. The powerhouse building would also house administration and visitor facilities. Also located within the powerhouse building would be a 275 kV gas insulated switchgear (GIS) substation, firefighting equipment and an emergency diesel generator.

- **Outlet Area:** A tailrace structure would be located on the shore of Loch Ness, integral with the Powerhouse Building. The lower control works would comprise up to four concrete inlet / outlet structures positioned at the end of the tailrace tunnels. These would house the screen arrangements and be shaped to smoothly channel the water in and out of Loch Ness at low velocities. Temporary cofferdams would be used within Loch Ness during construction.

- **Quayside and Pier**: A quayside and pier would be constructed adjacent to the Powerhouse Building and outlet area. This would allow the delivery of larger items by boat during construction, such as the electrical and mechanical (E&M) kit, as well as access to the powerhouse from the loch during the operating phase (including access by members of the public to the visitor centre). The pier would be approximately 50 m long by 8 m wide and would have a gentle gradient ramping down from the basement level of the Powerhouse Building to the Loch Ness waterline. The pier is anticipated to extend approximately 40 m into Loch Ness (from low water level). The quayside would be constructed parallel to the shoreline of Loch Ness for approximately 100 m. Following construction, the quayside and pier

would be left in place to enable boats to dock, so that boat users in Loch Ness can access the visitor centre and viewing platform within the Powerhouse Building, as well as for delivery and maintenance purposes.

- **Surge Shafts**: The underground waterway system would require up to two surge shafts located on a local high point between Loch Kemp and Loch Ness. It is likely that the surge shafts would be constructed using the raised bore tunnelling technique.

- **Cable Tunnel and Vertical Cable Shaft** – A short cable tunnel would extend from the access tunnel connecting to a vertical cable shaft to facilitate the grid connection from the powerhouse. The electricity cable (the subject of a separate consenting process), would be housed within this section of tunnel and would resurface outside the Ness Woods SAC, to connect by buried underground cable to a new switching station near Loch Kemp (which is also the subject of a separate consenting process).

- **Access Roads and Security Compound**: A series of temporary and permanent access roads would be provided for construction of the Proposed Development, and for operational and emergency access. Existing estate access and forestry tracks would be upgraded where feasible but new access tracks would also be required, partly due to many of the existing tracks around Loch Kemp being lost within the inundation area. Tracks used for construction would generally be 8 m in width but would be reinstated to 4 m post construction for operation and emergency access. Operational tracks would be constructed to a width of 4 m. A new junction would be created with the B862 public road at Whitebridge, for Site access, where a security compound would be located. A new access track would also be required to access the lower reservoir area, through Ness Woods SAC. To minimise land-take, the section through Ness Woods SAC would be 6 m wide (increased to 7m at bends, with additional cut-and-fill, as detailed further in Section 5.4.1, and shown in Figure 3)[43]. Site access tracks would typically be constructed with rock from on-site construction activities. Where necessary, geotextiles would be used with the surface course comprising a durable unbound graded rock surfacing material. Depending on local ground conditions, access tracks around the upper reservoir works would be constructed using a combination of 'floating track' or 'cut track' designs.

Most of the rock from the excavated tunnels and shafts would be removed via the shafts and tunnel portals near the powerhouse on the shore at Loch Ness. The excavated rock from the underground works would be reused in a positive manner in the dams, powerhouse platform, powerhouse building, and localised areas of construction works wherever feasible.

The existing fishing lodge on the shore of Loch Kemp would be replaced by a new fishing lodge outwith the upper reservoir inundation area. A new water supply would be provided to Dell Lodge to ensure continuity of supply during construction.

During construction, there would be a requirement for temporary Site establishment and laydown areas in the vicinity of Whitebridge Plantation, the upper reservoir, the lower reservoir works, and the surge shaft. Borrow pits would be required to provide aggregate to construct suitable access tracks and site establishment areas, in advance of tunnel spoil being available for use.

There would be approximately 200 – 250 workers on average working on Site, but this would vary throughout the construction period. It is anticipated that construction workers would be accommodated in a temporary workers camp on site, within Whitebridge Plantation.

[43] The track would feature a 4 m running surface with a 1 m drainage trench and 1 m safety barrier on opposing sides of the running surface, leading to a total width of 6 m. At tight cornering radii within the access track, the running surface width would be widened to 5 m to allow the safe operation of both fixed axle and articulated HGVs for construction and tunnel spoil transportation, increasing the total width to 7 m.

It is anticipated that surface works would generally be undertaken between 07.00 and 19.00 hours, and that underground operations and continuous pouring of concrete would need to continue 24 hours a day, seven days a week. In the event of surface work being required outwith these hours, e.g. abnormal load deliveries, commissioning works or emergency mitigation works, the Planning Authority would be notified prior to these works taking place, wherever possible.

Any surface blasting would take place between the hours of 09.00 to 17.00 on Monday to Friday inclusive and 10.00 to 14.00 on Saturdays, Sundays and on National Public Holidays, unless otherwise approved in advance in writing by the Planning Authority.

During the winter, all work areas across the Site would have temporary construction lighting at the start and end of the working day for surface works, with the exception of the tunnel portals, which would require temporary lighting when vehicle access is required to the underground operations. Vehicle access into / out of the tunnel portal outside of surface working hours would be minimised to limit the use of lighting during these hours and appropriate mitigation would be implemented to minimise illumination, glare or light spillage from these lights to nearby receptors. The appointed contractor may wish to work 24 hours a day in other areas of the Site, in which case temporary lighting would also be required in these areas. Any lighting required outside of the surface working hours, would be agreed with the Planning Authority in advance.

4.1.4 Operational Stage

During operation, the Proposed Development would be manned from the administration area inside the powerhouse, 24 hours a day (although some night-time work may be workers on call rather than based onsite). It is anticipated that the Proposed Development would require 15 operational staff members to operate the site. Regular maintenance visits would be made to inspect and maintain structures and components of the Proposed Development.

Once operational, external lighting, with the exception of the Powerhouse Building including at the dams and upper reservoir inlet/outlet structure, would only be used during essential operational and maintenance activities. This would be subject to detailed design to be approved by the Planning Authority. Internal lighting would be required in the Powerhouse Building, predominantly during working hours, unless essential operational and maintenance activities were required outwith these hours. Any external lighting required at the powerhouse building would be designed to be discrete and minimise light pollution.

4.1.5 Decommissioning Stage

With proper maintenance, it is anticipated that the Proposed Development would remain functional indefinitely. However, if the Proposed Development ceases operation, decommissioning would take place and would involve sealing underground tunnels; removing generation plant; leaving in-situ infrastructure where removal would result in more damage than leaving in place; and reinstating disturbed ground.

If the project were to be decommissioned, it is anticipated that the potential effects on European Sites would be equal to or less than the construction impacts. As such, a separate assessment of potential decommissioning effects is not included in this report.

4.1.6 Design Evolution

The final scheme layout and infrastructure has been through the following design evolution which has reduced the land-take footprint within Ness Woods SAC compared to earlier design iterations:

- The width of the proposed access track through the Ness Woods SAC has been reduced from 8 m to 6 m (7m on bends).
- Multiple access track route options have been considered to try to reduce land-take within the woodland qualifying interest habitat, as well as to reduce the level of impact on bryophyte and lichen communities

of conservation value and minimise tree loss as far as possible. Feasible route options are constrained by the steep topography of the land in this area, and the requirement for a maximum 10% gradient limit (with the exception of a short section of track at 12% gradient, permissible only by having 6% relief either side; all other lengths of the proposed track do not exceed 10% gradient). The proposed route largely follows an existing track and partially passes through non-qualifying interest habitat (primarily acid grassland) in the upper stretch, however it deviates from the existing track and passes through woodland qualifying interest habitat in the middle and lower stretch, with several tight hairpin bends, which is deemed unavoidable in the design due to the gradient. Whilst effort has been made to avoid the trees and areas with the highest lichen and bryophyte interest where possible, this has not always been feasible due to the gradient constraints. The route largely follows the route of the existing track as far as practical / feasible, within the gradient constraints, to minimise additional habitat land-take. The access track has also been microsited to ensure it is at least 10 m away from the top of the banks of the Allt a'Chinn Mhonaich watercourse for the entirety of the route, following advice from SEPA as a pollution prevention measure. No storage of material would be permitted in this buffer area.

- The powerhouse location has been sited on a flat area close to Loch Ness shore, which is dominated by bracken, and whilst this area is still classified as part of the woodland qualifying interest habitat, construction in this area will reduce tree loss compared to more densely wooded areas. The land-take of the powerhouse and associated infrastructure (powerhouse platform and tunnel adit) has been designed to be as compact as possible to reduce the land-take in this area, and to reduce the loss of the more restricted '*Tilio-Acerion* forests of slopes, screes and ravines' qualifying interest woodland habitat where possible.
- Earlier causeway or pontoon designs were considered on the margin of Loch Ness for construction laydown, however these have been removed from the design, as it has been concluded that sufficient construction laydown can be accommodated within the proposed powerhouse platform area, without any additional land-take required. This reduces the length of loch shore habitat being disturbed.
- The infrastructure footprint, and working corridor (i.e. land used for construction), has been reduced as far as is practically feasible.
- No construction compounds, laydown areas, or welfare compounds are proposed within Ness Woods SAC outside of the powerhouse platform area.
- The grid connection would be routed through the cable tunnel within Ness Woods SAC, to avoid additional SAC land-take.
- An option previously being considered of a conveyer belt through Ness Woods SAC to transport some construction materials has been removed from the scheme. This is because a 4 m operational access track would still have been required, and therefore a conveyer belt would not have reduced overall land-take within Ness Woods SAC.
- The design of Dam 1 has been altered, to use a concrete design, which reduces the land-take of the dam within Ness Woods SAC by approximately 50%.
- Access to and from the visitor centre by the public would be via the quayside on Loch Ness only. The jetty would have a walled path on the lower level that would take visitors directly to the visitor entrance, with no other areas available for visitors to access.

The predicted direct loss of qualifying habitat within Ness Woods SAC (via direct land take from infrastructure and the working corridor) has been reduced from an initial estimate of 12-13 ha, down to (up to) 5.52 ha, with the assessment based on the worst case. Further details on the consideration of alternatives with respect to Ness Woods SAC are provided in Volume 1, Chapter 2: Design Evolution and Alternatives of the EIA Report, and the Loch Kemp Storage Derogation Report[1].

5.0 Stage One: Screening

5.1 Step One: Management of the Site

The project is not directly connected with or necessary to the management, for the purposes of maintaining or restoring the conservation interest, of any European Site of the National Network. The project cannot therefore be screened out of further assessment on that basis.

5.2 Step Two: Project Description

A detailed project description is provided in Section 4.0. The project impact factors are detailed in Sections 5.3 and 5.4 below.

5.3 Step Three: Designated sites which may be affected by the project

All European sites within the potential Zone of Influence of the Proposed Development have been detailed within Table 5-1. Table 5-1 provides a description of each European site, and details the qualifying interest features, conservation objectives, and vulnerabilities, using information obtained from NatureScot's sitelink facility (as detailed in Section 3.4.1).

Table 5-1 details all European sites within a 15 km radius of the Proposed Development, and also includes European sites beyond 15 km if they are hydrologically linked to the Proposed Development, or where a qualifying interest of the site includes a more mobile species which has the potential to be impacted beyond 15 km, which in this instance relates to birds only (as described further below). Effects beyond 15 km are not likely in the absence of hydrological connection or more mobile qualifying features. The locations of the European sites within the potential Zone of Influence of the Proposed Development are shown in Figure 2.

For the ornithological component of the HRA process, Screening should largely consider three important aspects of the Proposed Development and the qualifying features of the European site:

1. Connectivity between the Proposed Development and the European site;
2. Route to impact between the Proposed Development and the European site; and
3. Numbers of qualifying features (birds) available for impact (trivial or non-trivial).

NatureScot guidance[44] helps identify connectivity between development proposals and SPAs, and therefore identification of European sites which may be affected by the project. It provides a method for removing from consideration those European Sites which clearly have no connectivity to a proposed development, or those where it is obvious that the conservation objectives for the site's qualifying interests will not be undermined despite a connection. The process is based on consideration of the distances that some species may regularly travel beyond the boundary of their SPAs for dispersal and foraging. Slavonian grebe is not included in the NatureScot guidance, therefore the lack of connectivity cannot be clearly demonstrated for two SPAs extending beyond a 15 km radius of the Proposed Development. Not much is known about the movements of Slavonian grebe during the breeding season, however ringing data from Scotland indicate that following the breeding failure, the grebes can move between the breeding sites, and attempt to breed elsewhere. There is evidence of one individual moving 30 km between breeding sites, after a breeding failure[45]. As such, a precautionary approach has been adopted whereby SPAs for which breeding and / or moulting Slavonian grebe is a qualifying feature have been considered within a 30 km radius of the Proposed Development.

[44] SNH (2016) Assessing Connectivity with Special Protection Areas (SPAs). Scottish Natural Heritage.
[45] Benn, S. (2003) Conserving Scotland's Slavonian Grebes. British Wildlife 15: 25-30.

On the basis of the above, there are seven European sites which require consideration at the screening stage and are therefore included in Table 5-1:

- Ness Woods SAC;
- Loch Knockie and nearby Lochs SPA;
- River Moriston SAC;
- North Inverness Lochs SPA;
- Urquhart Bay Wood SAC;
- Loch Ruthven SPA; and
- Loch Ashie SPA.

Table 5-1: European Sites within the potential Zone of Influence of the Project

Site Name & Ref	Distance from Site	Qualifying Interest	Description	Conservation Objectives	Vulnerability
Ness Woods SAC (UK0030223)	Within Site	Primary reason for selection: *Tilio-Acerion* forests of slopes, screes and ravines (common name: mixed woodland on base-rich soils associated with rocky slopes). Other qualifying features: Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles (common name: western acidic oak woodland). Otter (*Lutra lutra*).	Ness Woods SAC is composed of three areas of woodland running alongside and to the south of Loch Ness. It contains a mixture of woodland habitats and these, together with several watercourses that run through the site, provide suitable habitat for otters. This complex of sites includes one of the best and most extensive examples of a ravine woodland in Scotland at Glen Tarff; further examples occur along the north-facing shores of Loch Ness. The canopy is a mixture of alder (*Alnus glutinosa)*, ash (*Fraxinus excelsior*) and wych elm (*Ulmus glabra*) with a locally abundant hazel (*Corylus avellana*) shrub layer. The ground flora is rich in ferns, mosses and herbaceous plants, and the woods have a luxuriant epiphytic flora of lichens, liverworts and mosses with Atlantic affinities. The site supports 25 ha of mixed woodland on base-rich soils associated with rocky slopes; and 538 ha of western acidic oak woodland. Both qualifying woodland features are in an unfavourable condition (no change) (last updated in 2008). Otter is in an unfavourable condition (declining) (last updated in 2011), although the Conservation Advice Package identifies that the level of confidence in the otter survey results are low due to difficult survey conditions and no access to one of the areas where otter signs were previously found. The Conservation Advice Package states that management of 'Tilio-Acerion forests of slopes, screes and ravines' should have priority over the other features of the site given its status as a Habitats Directive priority habitat.	1. To ensure that the qualifying features of Ness Woods SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status. 2. To ensure that the integrity of Ness Woods SAC is restored by meeting objectives 2a, 2b and 2c for each qualifying feature: *Tilio-Acerion* forests of slopes, screes and ravines: 2a. Restore the extent and distribution of the habitat within the site. 2b. Restore the structure, function and supporting processes of the habitat. 2c. Restore the distribution and viability of typical species of the habitat. Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles: 2a. Maintain the extent and distribution of the habitat within the site. 2b. Restore the structure, function and supporting processes of the habitat. 2c. Restore the distribution and viability of typical species of the habitat. Otter: 2a. Maintain the population of the species as a viable component of the site. 2b. Maintain the distribution of the species throughout the site. 2c. Maintain the habitats supporting the species within the site and availability of food.	High negative impacts are listed in the JNCC Data Form as: Grazing in forest woodlands (B06); invasive non-native species (I01); air pollution, air-borne pollutants (H04); human induced changes in hydraulic conditions (J02); and roads, paths and railways (D01). The Conservation Advice Package identifies grazing pressure, poorly developed under-storey and canopy cover, and limited woodland regeneration to be the cause of both woodland qualifying features to be in unfavourable condition.

Site Name & Ref	Distance from Site	Qualifying Interest	Description	Conservation Objectives	Vulnerability
Loch Knockie and nearby Lochs SPA (UK9001552)	0.75 km (south of Great Glen)	This site qualifies under Article 4.1 by regularly supporting a population of European Importance of the Annex 1 species: Slavonian grebe (up to 6 pairs, up to 10% of the GB population).	Loch Knockie and Nearby Lochs SPA comprises a group of lochs at the south-east end of the Great Glen. The undisturbed aquatic plant communities on the SPA include extensive sedge beds. The lochs are surrounded by mire, heath, mixed woodland and agricultural land. The boundaries of the SPA follow those of Knockie Lochs SSSI (0.75 km from the Proposed Development) and Glendoe Lochans SSSI (11 km from the Proposed Development). Knockie Lochs SSSI consists of two deep lochs of moderate nutrient status, Loch nan Lann and Loch Knockie. These lie at an altitude of 200 m. Loch Knockie contains a number of small-wooded islands. Knockie Lochs supported one pair of Slavonian grebes during most years, including the last decade (2012 – 2022). Glendoe Lochans SSSI consists of a number of small lochans of moderate nutrient status on a plateau at 700 m. The average breeding population of Slavonian grebe over the period 2005 to 2008 within the site was 1.25 pairs, but it has been declining within the last decade (a pair or an individual was recorded there every year between 2012 and 2016, and successful breeding was recorded in 2019). The site condition was assessed as Unfavourable (on 31 Jul 2002).	1.To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained. 2.To ensure for the qualifying species that the following are maintained in the long term: 2a. Population of the species as a viable component of the site; 2b. Distribution of the species within site; 2c. Distribution and extent of habitats supporting the species; 2d. Structure, function and supporting processes of habitats supporting the species; 2e. No significant disturbance of the species.	High negative impacts are listed in the JNCC Data Form as: invasive non-native species (I01), inundation (L08) and interspecific faunal relations (K03).
River Moriston SAC [UK0030259]	2.07 km	Primary reason for selection: freshwater pearl mussel *(Margaritifera margritifera*).	River Moriston SAC covers the entirety of the River Moriston from the source at the outfall of Loch Cluanie Dam into Loch Ness. The site covers an area of 194.38 ha over a length of 31.98 km.	1. To ensure that the qualifying features of the River Moriston SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status.	The Conservation Advice Package identifies water quality, hydrological alterations (including engineering and abstractions), habitat

Site Name & Ref	Distance from Site	Qualifying Interest	Description	Conservation Objectives	Vulnerability
		Other qualifying feature: Atlantic salmon *(Salmo salar*).	The site supports a functional freshwater pearl mussel population with high juvenile composition (at 40% of total population). Salmon play an important role within earlier life stages of freshwater pearl mussels acting as a host species for larval glochidia that attach to gills. The freshwater pearl mussel population is considered in an unfavourable condition (no change) (last updated in 2018). Salmon are in an unfavourable condition (no change) (last updated in 2011).	2. To ensure that the integrity of the River Moriston SAC is restored by meeting objectives 2a, 2b, 2c for each qualifying feature (and 2d for freshwater pearl mussel). Freshwater pearl mussel: 2a. (i) Restore the population of freshwater pearl mussel as a viable component of the site. 2b. (i) Restore the distribution of freshwater pearl mussel throughout the site. 2c. (i) Restore the habitats supporting the freshwater pearl mussel within the site and the availability of food. 2d. (i) Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats. Atlantic salmon: 2a. (ii) Restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site. 2b. (ii) Restore the distribution of Atlantic salmon throughout the site. 2c. (ii) Restore the habitats supporting Atlantic salmon within the site and availability of food.	degradation, illegal pearl fishing and lack of availability of host species as key factors affecting the qualifying features determining freshwater pearl mussels to be in an unfavourable condition. The Conservation Advice Package identifies lack of sediment/ gravel transport (due to presence of dams) and non-native invasive species as the primary pressures with agriculture, grazing, water management, water quality and forestry pressures also identified.
North Inverness Lochs SPA (UK9001553)	10.7 km (north of Great Glen)	This site qualifies under Article 4.1 by regularly supporting a population of European Importance of the Annex 1 species: Slavonian grebe (1991 to 1995, 7 pairs, 12% of the GB population).	North Inverness Lochs SPA is located northwest of the Great Glen. The SPA contains five lochans which support extensive sedge beds and are surrounded by mire, moorland and semi-natural broadleaved woodland dominated by birch. The boundaries of the SPA follow those of Balnagrantach SSSI (16 km from the Proposed Development) and the Dubh Lochs SSSI (11 km from the Proposed Development). The current breeding	As per Loch Knockie and nearby Lochs SPA	High negative impacts are listed in the JNCC Data Form as: invasive non-native species (I01), inundation (L08) and interspecific faunal relations (K03).

Site Name & Ref	Distance from Site	Qualifying Interest	Description	Conservation Objectives	Vulnerability
			population of Slavonian grebe stands at one to two pairs (based on data from 2012-2022). The site condition was assessed as Favourable maintained (on 15 May 2009).		
Urquhart Bay Wood SAC [UK0030298]	13.0 km	Primary reason for selection: Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*) (common name: Alder woodland on floodplains)	Urquhart Bay Wood SAC is located on the opposite shore of Loch Ness from the Site. It has developed on an alluvial delta at the confluence of the Rivers Enrick and Coiltie as they flow into Loch Ness, and covers an area of 46.39 ha. It comprises predominantly broad-leaved deciduous woodland (94%) along with inland water bodies (4%) and bogs, marshes, water fringed vegetation and fens (2%). There are extensive stands of alluvial forests on the wetter ground associated with the river channels, with transitions on gradually rising land to stands of lowland broad-leaved woodland containing ash, alder, wild cherry (*Prunus avium*), rowan (*Sorbus aucuparia*), wych elm, white willow (*Salix alba*) and bird cherry (*Prunus padus*). There are also characteristic transitions to swamp and open freshwater.	1. To ensure that the qualifying feature of Urquhart Bay Wood is in favourable condition and makes an appropriate contribution to achieving favourable conservation status. 2. To ensure that the integrity of Urquhart Bay Wood is restored by meeting objectives 2a, 2b and 2c for the qualifying feature: 2a. Maintain the extent and distribution of the habitat within the site. 2b. Restore the structure, function and supporting processes of the habitat. 2c. Restore the distribution and viability of typical species of the habitat.	The Conservation Advice Package lists the woodland qualifying interest as in unfavourable condition (no change) (last assessed in 2010), with over grazing and invasive non-native species preventing the site from being in favourable condition. It also states that any changes in local and catchment hydrology could also have significant effects on the site.
Loch Ruthven SPA (UK9001551)	15.6 km (south of Great Glen)	This site qualifies under Article 4.1 by regularly supporting a population of European importance of the Annex 1 species: Slavonian grebe with a breeding population of up to 14 pairs (18.9% of the GB population, 5-year mean, 1989-1993).	Loch Ruthven SPA is a freshwater loch of moderate nutrient status located southeast of the Great Glen. A marshy zone is found at the west end of the loch where there is a transition from open water, through swamp and fen, to sedge-rich acidic grassland. The size of breeding population of Slavonian grebe has been fluctuating over the last ten years, with a maximum of 15 pairs recorded there in 2016, however lowest numbers were recorded recently (nine pairs in 2021 and six pairs in 2022). The site condition was assessed as Favourable maintained (on 15 May 2009).	As per Loch Knockie and nearby Lochs SPA	High negative impacts are listed in the JNCC Data Form as: invasive non-native species (I01), inundation (L08) and interspecific faunal relations (K03).

Site Name & Ref	Distance from Site	Qualifying Interest	Description	Conservation Objectives	Vulnerability
Loch Ashie SPA (UK9001554)	21.6 km (south of Great Glen)	This site qualifies under Article 4.1 by regularly supporting a population of European importance of the Annex 1 species: Slavonian grebe, with an autumn gathering of up to 60 individuals.	Loch Ashie SPA is a large, open, mesotrophic loch located southeast of the Great Glen. Most of the shore is stony and exposed with only small pockets of emergent vegetation. Where the shore is more sheltered, small beds of bottle sedge have developed. Loch Ashie does not currently hold any breeding Slavonian grebes (the last breeding pair was recorded there in 2015). There are no current data on the number of birds using the site for moulting, however in the early 90's up to 46 individuals were recorded there. The site condition was assessed as Favourable maintained (on 31 July 2002).	As per Loch Knockie and nearby Lochs SPA	High negative impacts are listed in the JNCC Data Form as: invasive non-native species (I01), inundation (L08) and interspecific faunal relations (K03).

5.4 Step Four: Assessment of "Likely Significant Effects"

At this stage assessment as to whether likely significant effects on the relevant European sites can be ruled out is undertaken. This must be done in the view of the Conservation Objectives for the identified European Sites (see Table 5-1). Information relating to species presence and the potential for indirect impacts is also included.

At the screening stage, 'a likely effect' is one which cannot be excluded (or ruled out) without further assessment or mitigation, and a 'significant effect' is one which could undermine the conservation objectives of one of the qualifying interest features.

The primary purpose of this stage is to determine whether the project requires a Stage 2 Appropriate Assessment, and which European sites should be considered at Stage 2. Stage 1 can also be used to screen out those aspects of the project that can be considered not likely to have an effect, as well as those qualifying features of European sites that are not likely to be affected from the exposure to a potential impact and/ or pathway. If significant effects cannot be excluded because further assessment is required or the effects will require mitigation, the next stage of HRA will be required: Stage 2: Appropriate Assessment.

5.4.1 Ness Woods SAC

Relevant Ecological Information

Habitats

The habitat survey recorded the presence of both woodland qualifying interest habitats within the part of Ness Woods SAC that falls within the Site boundary, on steep ground along the Loch Ness shoreline, as shown in Figure 3.

'Old Sessile Oak Woods with *Ilex* and *Blechnum* in the British Isles' is the predominant habitat type, reflecting National Vegetation Classification (NVC) types W11a and W17, as described below, and shown in Figures 3 and 5. This corresponds to areas dominated by downy birch (*Betula pubescens*), but there are significant stands of hazel (*Corylus avellana*). Uphill from Loch Ness shoreline, the ground flora becomes dominated by bracken (*Pteridium aquilinum*) with a few small areas of grassy understorey. Bracken forms an almost continuous layer beneath generally widely spaced tree cover, but on occasion stands of common bent (*Agrostis capillaris*), creeping soft-grass (*Holcus mollis*) and sweet vernal-grass (*Anthoxanthum odoratum*) form beneath canopy cover and at the fringes of bracken stands. Wood sorrel (*Oxalis acetosella*), tormentil (*Potentilla erecta*), bramble (*Rubus fruticosus* agg.), dog violet (*Viola riviniana*) and wood sage (*Teucrium scorodonia*) are scattered throughout. This woodland component reflects National Vegetation Classification (NVC) community W11a *Quercus petraea-Betula pubescens-Oxalis acetosella* woodland *Dryopteris dilatata* sub-community. On steeper ground, and rockier outcrops within the woodland, the ground flora is heathier and heather (*Calluna vulgaris*), mosses *Hylocomium splendens*, *Rhytidiadelphus loreous, Dicranum majus* and *Pleurozium schreberi* are more frequent in the sward beneath bracken and on ledges. The understorey is generally species-poor however, and the canopy almost entirely dominated by downy birch. Occasional holly (*Ilex aquifolium*), rowan (*Sorbus aucuparia*) and hazel are present in gullies and on crags. This woodland type reflects W17 *Quercus petraea-Betula pubescens-Dicranum majus* woodland and is more typical of more acidic or peaty soil substrates.

'*Tilio-Acerion* Forests of Slopes, Screes and Ravines' is much more restricted in distribution, recorded mostly along Loch Ness shoreline, and small fragments in mosaic with 'Old Sessile Oak Woods with *Ilex* and *Blechnum* in the British Isles' on the lower slopes, and along the unnamed water course draining from Lochan a' Choin Uire, and the Allt an t-Sluichd draining from Loch Kemp. Ash (*Fraxinus excelsior*), alder (*Alnus glutinosa*) and goat willow (*Salix caprea*) are more prevalent in the canopy. These areas also have a diverse ground flora, with wood sorrel (*Oxalis acetosella*), dog violet (*Viola riviniana*), primrose (*Primula vulgaris*), tufted hair-grass (*Deschampsia cespitosa* agg.), false brome (*Brachypodium sylvaticum*), common nettle (*Urtica dioica*) and yellow pimpernel (*Lysimachia nemorum*) frequent in the sward. Commonly there are stands of ferns including lady fern (*Athyrium filix-femina*), scaly male-fern (*Dryopteris affinis* agg.) and broad buckler-fern (*Dryopteris dilatata*). Occasionally

wood avens (*Geum urbanum*), globeflower (*Trollius europaeus*) and marsh hawk's-beard (*Crepis paludosa*) are present, particularly in damper, sheltered areas below crags and rock overhangs. This woodland type reflects W9 *Fraxinus excelsior-Sorbus aucuparia-Mercurialis perennis* woodland.

Areas of broadleaved woodland are considered to be in poor condition, with the canopy dominated by mature trees and negligible cover of young or regenerating saplings. Bracken is almost universally dominant across large areas in the understorey and is considered to limit the potential for tree regeneration. Moderate to high levels of tree browsing are also evident, particularly on hazel trees, likely impacted by deer and goat populations present within the woodlands.

The higher slopes of Ness Woods SAC also support smaller areas of unimproved acid grassland, wet dwarf shrub heath and dry dwarf shrub heath. Whilst the wet dwarf shrub heath (NVC community M15) represents habitat that has moderate potential to be a groundwater dependent terrestrial ecosystem (GWDTE) according to SEPA guidelines[46], a hydrogeological assessment concludes this habitat to be sustained by rainfall, surface water and waterlogging of the soils, rather than groundwater (as detailed in Volume 1, Chapter 14: Geology, Soils and Water of the EIA Report). Specifically, these habitats are typically located on sloped ground which is underlain by low permeability deposits, and the distribution is not typical of that attributable to a dominant groundwater discharge and is not consistent with changing geological units which underlie the area. Similarly, all other habitats across the Proposed Development Site are also concluded to not be sustained by groundwater. The baseline assessment contained in Chapter 14 of the EIA Report has determined that the deposits which underlie the Proposed Development are unlikely to contain significant amounts of groundwater.

A total of 161 bryophyte taxa were recorded during the bryophyte survey, although no Nationally Rare or Nationally Scarce species[47] were recorded. The area of the proposed powerhouse platform was found to be mostly of limited bryological interest, however areas of interest were identified within / in close proximity to the proposed infrastructure areas, within sheltered areas within Ness Woods SAC, and the watercourses running through Ness Woods SAC (see Figure 7). Specifically, the Allt a' Chinn Mhonaich and the unnamed watercourse draining from Lochan a' Choin Uire support abundant bryophyte communities and are moderately rich in oceanic species (Target Notes 1 and 8 respectively, Figure 7), with the latter also supporting basicolous species, including *Metzgeria pubescens* growing with *Neckera complanata* on an old hazel (Target Note 6, Figure 7). The upstream section of the Allt an t-Sluichd within the proposed dam footprint area is of little bryological interest, however downstream of the proposed dam location, beyond the Site boundary, the watercourse is notable for its variety and abundance of bryophytes, including a reasonably rich oceanic flora considering the Site is close to the eastern extreme of the distribution of many of these oceanic species (including *Radula aquilegia*, *Lejeunea cavifolia*, *Lejeunea lamacerina* and *Lejeunea patens*), and large stands of *Bazzania tricrenata*, *Plagiochila spinulosa* and *Ptilium crista-castrensis* (Target Note 11, Figure 7).

The woodland along the line of the proposed access track is mainly of little bryological interest, however there are stands of hazel with some bryophyte interest in this area (Target Note 2, Figure 7), including *Antitrichia curtipendula*, *Neckera complanata*, *Neckera pumila*, *Orthotrichum striatum* and *Ulota intermedia*. Hazels east of the proposed powerhouse area (Target Note 7, Figure 7) also have some interest. Further bryological interest was recorded on ash trees, specifically on the Loch Ness shoreline in close proximity to the powerhouse, where *Frullania dilatata* and *Orthotrichum striatum* were recorded (Target Note 5 in Figure 7), and an old ash tree by the unnamed watercourse draining from Lochan a' Choin Uire, with characteristic flora including *Zygodon conoideus* (Target Note 9, Figure 7).

As well as the epiphyte interest, bryological interest was also recorded in some rock and scree areas, specifically on Loch Ness shore boulders, rocks and low rock faces, and the vertical low rock faces above the shoreline beach, where extensive stands of the oceanic *Plagiochila spinulosa* were recorded (Target Note 3 in Figure 7). The north-

[46] SEPA (2014) *Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems. Land Use Planning System SEPA Guidance Note 31 (LUPS – GN31)*. Version 3 Issued 11th September 2017

[47] Pescott, O. (2016) Revised lists of nationally rare and scarce bryophytes for Britain. *Field Bryology* 115: 22-30

west facing scree slopes in the area on the eastern edge of the proposed powerhouse platform support the liverworts *Bazzania trilobata*, *Plagiochila punctata*, *Plagiochila spinulosa* and *Scapania gracilis,* and the moss *Hylocomiastrum umbratum* (Target Note 4 in Figure 7). An area of scree by the unnamed watercourse draining from Lochan a' Choin Uire is rich with *Bazzania trilobata* and *Dicranum fuscescens* (Target Note 10 in Figure 7).

Using the guidelines for the selection of Sites of Special Scientific Interest (SSSI)[48], the Site as a whole scores 8 on the basis of oceanic species present, not reaching the 12 point 'threshold' suggested for consideration for notification. The methodology within Averis *et al*. (2012)[49] was used to assess the bryological importance of the three watercourses within Ness Woods SAC surveyed; this methodology was developed to assess the bryological importance or potential importance of ravines, using 29 'target species' of nationally uncommon humidity-demanding bryophytes to classify sites to one of five levels of bryological importance. Eight or nine oceanic or hyperoceanic (=Atlantic) species were recorded on each watercourse surveyed, however only one 'target species' per watercourse was recorded, placing them in 'Category C', meaning the watercourses are of '*low to medium bryological importance and hydroelectric development is unlikely to have a significant national / international impact on humidity-demanding oceanic bryophyte assemblages*.' However, the bryophyte assemblage still has value in the context of Ness Woods SAC, as it is an important component of the qualifying woodland habitats, and is therefore important to favourable condition of the qualifying woodland features.

The terrestrial lichen survey recorded a large number of lichen taxa within Ness Woods SAC that are rare / threatened in a UK and / or European context. Most of the taxa are strongly associated with veteran hazel but several were recorded on other veteran trees / shrub species including birch, ash, aspen (*Populus tremuloides*), oak and alder (see Figure 6).

The woodland habitats for lichens have been assessed using the Boreal Woodland Index (BWI), the Sub-oceanic Woodland Index (SWI) and the 'Pinhead' Index of Sanderson *et al*. (2018)[50]. The Site exceeds the threshold for SSSI quality based on its BWI score, with 31 BWI species recorded, exceeding the 15 BWI species threshold. Three Upland Rainforest Index species were also recorded, indicating the importance of the boreal woods. Thirty-two SWI species were recorded, which exceeds the SSSI quality threshold of 20 species. The Site falls just below the 10 species SSSI threshold for the 'Pinhead' Index, with nine species recorded. To put the Site into context of more western woods in the Scottish temperate rainforest zone, the Site supports 23 species on the Lowland Rainforest Index (the threshold for SSSI status is 25). The Site therefore meets SSSI quality for lichens of birchwoods and hazel stands, based on multiple criteria. The Site is particularly important because it supports old woodland species that are scarce and threatened in this region of Scotland especially oceanic / hyperoceanic species at the edge of their range, and the best hazel stands support viable populations of a number of them, including *Pachyphiale fagicola*, *Arthonia sampaianae*, *Nevesia sampaiana* and *Parmeliella testacea*; the outstanding populations of the latter two species also meet the requirements to qualify the Site for SSSI status.

The freshwater lichen survey found that all three watercourses surveyed within Ness Woods SAC meet or exceed the threshold score for being considered for SSSI designation, using the Acid Watercourses Quality Index (AQUI)[50]. The highest scoring watercourse is Allt a' Chinn Mhonaich with an AQUI score of 15 (the threshold for SSSI quality is 11); this watercourse supports four Near Threatened, two Data Deficient and two Nationally Rare species. Allt an t-Sluichd has an AQUI score of 11, and supports one Vulnerable, one Schedule 8 (Wildlife and

---

[48] Bosanquet, S., Genney, D. & Cox, J. (2018) *Guidelines for the selection of biological SSSIs. Part 2: detailed guidelines for habitats and species groups. Chapter 12. Bryophytes*. Peterborough, Joint Nature Conservation Committee.

[49] Averis, A.B.G., Genney, D.R., Hodgetts, N.G., Rothero, G.P. & Bainbridge, I.P. (2012) *Bryological assessment for hydroelectric schemes in the west Highlands – 2nd edition*. Scottish Natural Heritage Commissioned Report No. 449b. (Available online at https://www.nature.scot/sites/default/files/2017-07/Publication%202012%20-%20SNH%20Commissioned%20Report%20449b%20-%20Bryological%20assessment%20for%20hydroelectric%20schemes%20in%20the%20West%20Highlands%20(2nd%20edition).pdf)

[50] Sanderson, N.A., Wilkins, T.C., Bosanquet, S.D.S and Genney, R. (2018) *Guidelines for the Selection of Biological SSSIs Part 2: Detailed Guidelines for Habitats and Species Groups*. Chapter 13 Lichens and associated microfungi. Joint Nature Conservation Committee, Peterborough

Countryside Act 1981 (as amended in Scotland)), two Data Deficient and three Nationally Rare species[51,52]. The Schedule 8 species comprises *Fuscopannaria ignobilis*, recorded on an ash tree on an island within the watercourse, downstream of Proposed Dam 1 and beyond the working corridor (as well as at a further location on a veteran hazel close to the proposed access track route but beyond the working corridor or fragmentation area, and on an aspen well away from construction works). The unnamed watercourse draining from Lochan a Choin Uire also scores 11 on the AQUI, and supports one Data Deficient species. These species assemblages are assessed as being of high or very high conservation value at the study-Site based scale.

The lichen assemblages are an important component of the qualifying woodland habitats, and are therefore important to favourable condition of the qualifying woodland features.

Otter

Surveys undertaken in summer 2021 confirmed the presence of otter on the Site (locations of field signs are provided in Figure 8). A total of four couches / lay-ups were identified. Three of these are located close to Loch Ness shore within Ness Woods SAC, each located under tree roots and with flattened vegetation, evidence of feeding remains or fresh / old spraint present. One further couch / lay-up was recorded along the Allt an t-Sluichd, in close proximity to the proposed location of Dam 1. Three spraints were recorded within Ness Woods SAC close to the Loch Ness shoreline. No natal holts were recorded.

An update survey in May – June 2023, for proposed GI works, confirmed the continued presence of otter on the Site, with a further six otter resting places identified. Three lay-ups and one potential holt were identified within Ness Woods SAC close to the Loch Ness shoreline. Otter spraint was only recorded at one of these resting places (TN 5, Figure 8). The potential holt (TN 6, Figure 8) comprises a well-sheltered gap between boulders which extends for approximately 0.5 m underground, and may provide seasonal use as a holt, but is not considered sufficiently extensive enough to be suitable for breeding. Outside of Ness Woods SAC, one potential holt was identified to the east of Loch Kemp and Loch Cluanie on the margin of Torr Cluanie plantation (TN 10, Figure 8), under an exposed root system of a tree stump, with a well-sheltered internal space which may provide temporary shelter for commuting otter, but which is considered unsuitable for a breeding site. A potential lay-up (likely to be ephemeral due to being prone to flooding) was also recorded to the south of Loch Kemp close to the Allt Leachd Gowrie watercourse (TN 11, Figure 8). A spraint was recorded on the north-western shore of Loch Kemp. The four couches / lay-ups identified in 2021 were reinspected and no fresh field evidence was recorded in these locations. One further holt was recorded incidentally during a site visit in September 2023, on the Loch Ness shoreline to the south-west of the proposed Development Area (TN 12, Figure 8). This holt comprises a large cavity between boulders, with an additional higher exit point above the high water line, and contained some old bedding material within, along with several fresh spraints. This holt is considered suitable for breeding, although breeding has not been confirmed. Given the location of the holt, over 200 m from proposed works, and therefore beyond a potential disturbance distance, additional survey work has not been undertaken to determine whether it is in use as a natal holt. For the purposes of assessment, it is assumed that this holt could be used for breeding.

The distribution of field evidence recorded during the surveys indicates that the most important habitat for otter within the Site is within the broadleaved woodland cover of Ness Woods SAC, particularly close to the Loch Ness shoreline. The surveys confirm that otters are also using Loch Kemp, and the connecting watercourses the Allt an t-Sluichd, and Allt Leacht Gowrie. No otter field evidence was recorded within Whitebridge Plantation, nor within the more open heath and bog areas away from waterbodies and watercourses.

[51] IUCN Red List. Available at: https://www.iucnredlist.org/

[52] Woods, R.G. & Coppins, B.J. (2012) *A Conservation Evaluation of British Lichens and Lichenicolous fungi*. Species Status 13. Joint Nature Conservation Committee, Peterborough.

Other fauna

Surveys undertaken in summer 2021 and 2023 also recorded the presence of red squirrel, badger, pine marten and roosting bats within the SAC. Red squirrel is specifically referred to in the Conservation Advice Package for the SAC.

Macroinvertebrate surveys undertaken in 2022 did not identify any species of nature conservation interest, and of the species recorded, they were common and widespread taxa, typical of a range of habitat types. No invasive non-native macroinvertebrate species were recorded during surveys. The Site does not feature any habitat suitable for freshwater pearl mussel *Margaritifera margaritifera*.

Potential Effects for the project alone

Habitat loss

Construction of the powerhouse and related infrastructure on the Loch Ness shoreline, the access track leading to the powerhouse, the construction of a dam at the upstream end of the Allt an t-Sluichd (Dam 1) and associated inundation area would result in habitat loss within Ness Woods SAC as detailed in Table 5-2 and illustrated in Figure 3.

Habitat loss assumptions

The habitat loss assessment has been undertaken using the following assumptions and parameters, with the rationale provided where appropriate:

- The habitat loss calculations include all areas to be lost from direct infrastructure land-take (i.e. access track running width, inundation area, dam and powerhouse infrastructure).
- The habitat loss calculations also include the construction working corridor (with some exceptions, as detailed further below). Although habitat restoration would be undertaken in the working corridors beyond the infrastructure footprint (in locations where cut and fill is not required), these areas have been included in the permanent habitat loss calculations, on the basis that they represent irreplaceable ancient woodland habitat.
- The running surface of the access track through the SAC is predominantly 6 m, widened to 7m on bends[53]. However, due to the cut and fill requirements of the track continually changing with the slope gradient, track routing and bend radius, the working corridor is not a consistent distance from the centreline of the access track. The access track footprint includes indicative cut and fill requirements informed by topographical data available during the basis of design. An additional 3 m working corridor buffer has been applied as a precautionary measure. Cross-sections showing the likely range of access track working widths are shown in Diagrams 5-1 and 5-2. At hairpin bends on a steep slope, the fill requirement for structural stability is clearly visible extending on the downhill edge of the access track. Whilst these areas are still incorporated within the 3m working corridor buffer area, should poor conditions be discovered during ground investigations and the detailed design, the fill areas on corners are most likely to increase in size, thus, permanently occupying areas within the working corridor that would otherwise be reinstated post construction. Meanwhile, straighter sections of the access track, or areas on gentler slope gradients, would be unlikely to require cut and fill beyond that already considered within the working corridor. As such, it is not anticipated that the built footprint of the access track post construction would occupy 100% of the 3 m working corridor buffer area. Based on this, on a precautionary basis, it has been assumed that up to 70% of the 3m buffer would be permanently lost from the SAC, although it is envisioned that the build percentage would be lower than this. This area is included in the habitat loss calculations. Due to the uncertainty of which sections of the access track 3 m working corridor buffer

[53] The track would feature a 4 m running surface with a 1 m drainage trench and 1 m safety barrier on opposing sides of the running surface resulting in a total width of 6 m. At tight cornering radii within the access track, the running surface width would be widened to 5 m to the allow safe operation of both fixed axle and articulated HGVs for construction and tunnel spoil transportation, increasing the total width to 7 m.

would be utilised, habitat loss has been presented as a range for each habitat type, representing the maximum and minimum that could be lost for each habitat type, and the assessment is based on a worst-case scenario for loss of qualifying interest woodland habitat.

- The habitat loss figures include a 0.12 ha area of land to the north-east of the powerhouse, on the Loch Ness shoreline, which may be required for siting of the tailrace structure. This micro-siting flexibility for the tailrace structure is required, due to the uncertainty in geological conditions. Although land-take may not be required in this area, it has been included in the habitat loss calculations on a precautionary basis.
- Although much of the '*Tilio-Acerion* forests of slopes, screes and ravines' in mosaic is located along the unnamed watercourse draining from Lochan a Choin Uire (which is beyond the working corridor), on a precautionary basis the habitat loss calculation assumes that the two woodland types are distributed evenly within the habitat polygons that contain mosaics of the two woodland types (see Figure 3), to ensure that the potential loss of the more restricted '*Tilio-Acerion* forests of slopes, screes and ravines' priority habitat type is not underestimated.
- On a similarly precautionary basis, the habitat loss calculation for 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles' includes bracken stands within the SAC with the same soil type as this habitat type, due to the possibility that a suitable seed bank has persisted and could be restored.

Table 5-2: Summary of Habitat Loss within Ness Woods SAC[54]

Habitat Type	Habitat Loss from Permanent Infrastructure (ha)			Habitat Loss from Working Corridor (including 70% of 3 m buffer along access track)[55] (ha)	Total Loss (ha)[56]	Loss as % of total qualifying interest habitat in SAC
	Access Track Running Width	Inundation Area and Dam	Powerhouse Infrastructure			
Qualifying Interest Habitat						
Tilio-Acerion forests of slopes, screes and ravines	0.04	0.00	0.28	0.23 – 0.27	0.56 – 0.60	2.22 – 2.38%
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	0.71	0.44	1.84	1.87 – 1.97	4.86 – 4.96	0.90 – 0.92%
TOTAL (Qualifying Interest Habitat)	0.75	0.44	2.12	2.10 – 2.20[57]	5.42 – 5.52[52]	N / A
Non-Qualifying Interest Habitat						
Acid Grassland (U4)	0.00	0.00	0.00	0.01 -0.02	0.01 – 0.02	N / A

[54] The mapped boundary of Ness Woods SAC overlaps with a slither of the open water of Loch Ness, due to a mapping discrepancy of the precise location of Loch Ness shoreline. The SAC boundary follows the shoreline from Ordnance Survey (OS) mapping, whereas the habitat loss calculations follow more detailed and accurate mapping of the shoreline undertaken by project engineers (as shown in Figure 3).

[55] Loss per habitat type has been presented as a range (representing the maximum and minimum per habitat type), due to uncertainty in which areas of the 3 m working corridor buffer along the access track would be lost.

[56] Some of the figures in the total loss column differ from the sum of the previous four columns by 0.01 ha; this is due to the figures presented being rounded to two decimal places.

[57] These ranges differ slightly from adding the above habitat types together, as adding the maximum amounts would exceed 70% of the 3m access track working corridor buffer.

Habitat Type	Habitat Loss from Permanent Infrastructure (ha)			Habitat Loss from Working Corridor (including 70% of 3 m buffer along access track)[55] (ha)	Total Loss (ha)[56]	Loss as % of total qualifying interest habitat in SAC
	Access Track Running Width	Inundation Area and Dam	Powerhouse Infrastructure			
Bare Ground (Existing access track)	0.09	0.00	0.00	0.08 – 0.12	0.17 – 0.21	N / A
Dry dwarf shrub heath	0.00	0.00	0.00	0.01 – 0.02	0.01 – 0.02	N/A
TOTAL (all habitats)	0.84	0.44	2.12	2.29	5.68	N / A

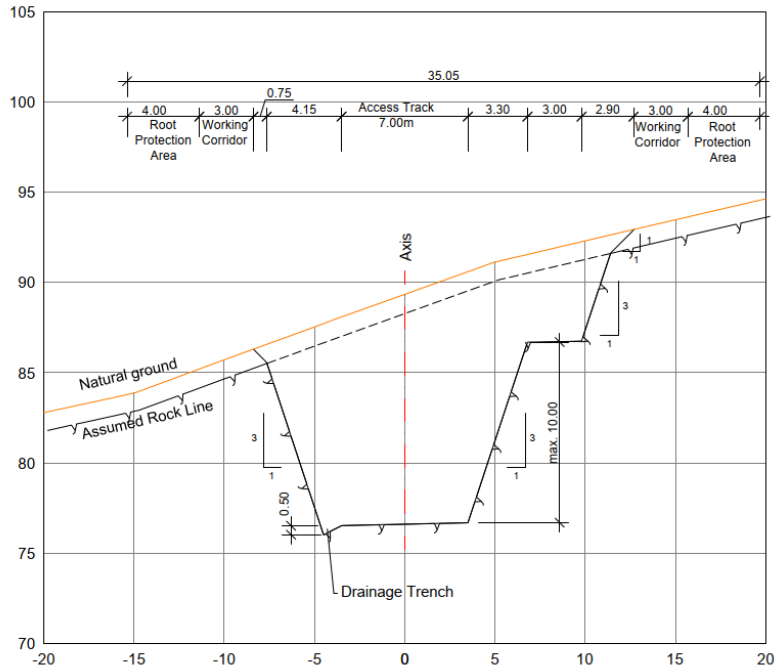


Diagram 5-1: Cross-section of SAC Access Track Working Width for the Widest Section

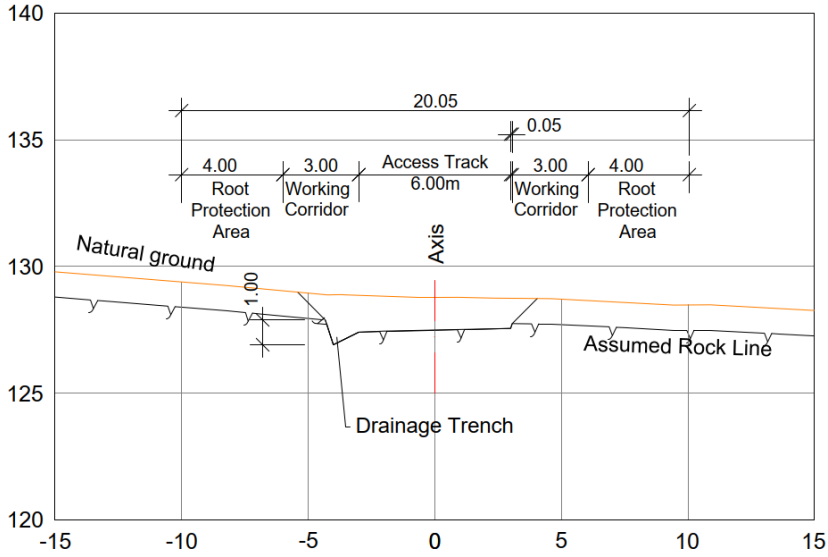


Diagram 5-2: Cross-section of SAC Access Track Working Width for the Narrowest Section

Tree loss assumptions

The specific number of trees to be lost (per species), based on the habitat loss assumptions and rationale described above, is provided in Table 5-3 and illustrated in Figure 4.

The tree loss calculations include all trees located within areas of direct infrastructure land-take (i.e. access track, inundation area, dam and powerhouse infrastructure).

On a precautionary basis, it has been assumed that all trees within the access track 3 m working corridor buffer would be lost. In practice, some trees within the 30% of the 3 m working corridor not being utilised for construction, may be retained, but a worst-case scenario has been used for assessment purposes, as works would almost certainly be required within the relevant Root Protection Areas (RPAs).

In addition, it is acknowledged that there is also the risk of trees being damaged beyond the working corridor, due to the possible damage to roots for any works within the working corridor where it is not feasible to avoid RPAs. Trees within a 4 m buffer of the working corridor are shown in Table 5-3. A 4 m buffer has been applied for assessment purposes, as this represents the average (both mean and median) RPA radius of trees within close proximity to the working corridor, assessed using a sample of 30 trees along the proposed working corridor, measured in May 2023. The average RPA is deemed to represent a suitable buffer for calculating the overall number of trees whose roots could be affected. This is because whilst some trees beyond this average buffer could have RPAs extending into the working corridor (due to their positioning and / or larger than average RPAs), this is likely to be balanced by a broadly similar proportion of trees within this buffer having RPAs that do not extend into the working corridor (due to their positioning within the buffer and / or smaller than average RPAs).

As set out in relation to habitat loss not all of the 3 m working corridor buffer along the access track would be utilised and a precautionary assumption that up to 70% of the 3 m buffer would be permanently lost has been utilised. It is also unlikely that more than 70% of the trees within the 4 m buffer outside of the working corridor, along the access track, would be affected from possible root damage. Given that it is not known which sections of the access track 3 m working corridor buffer would be utilised, it is not known which of the trees within the 4 m buffer beyond the working corridor along the access track would be affected from possible root damage. As such, Table 5-3 provides details of all trees within a 4 m buffer, along with the total number of trees that would be affected on the basis of 70% of trees being affected along the access track. For the 4 m buffer around other infrastructure it is assumed that 100% of trees would be affected by possible root damage.

A precautionary assumption of 70% of trees within the 4 m buffer along the access track being affected by possible root damage has been applied for the same reasons as the 70% habitat loss assumption being applied within the 3 m working corridor buffer. Specifically, as work will not be required along the full length of the working corridor buffer along the access track, RPAs of trees would also not be affected along the full length of the 4 m buffer beyond the working corridor. An assumption of 70% is precautionary, as cut-and-fill is likely not needed in a lot of these RPA areas, smaller trees at a distance from the works would not be affected, and micro-siting of the access road works would be undertaken where possible to minimise encroachment into RPAs, as directed by the ECoW who would mark out RPAs. Effort would be made to try and protect all of the trees outside of the working corridor, and RPAs would only be affected where the access track cannot be built in any other way (i.e. where cut-and-fill right up to it cannot be avoided).

Table 5-3: Individual tree loss, and trees at risk of root damage, within Ness Woods SAC

Tree Species	Number of trees to be lost (loss from permanent infrastructure and working corridor)	Number of trees (per species) within 4 m of working corridor, at risk of root damage	Number of trees at risk of root damage, assuming 70% of trees within 4 m access track buffer are affected[58]
Birch	711	94	
Hazel	90	20	
Alder	20	7	
Ash	5	3	
Oak	1	3	
Rowan	13	3	
Standing deadwood	4	0	
Unidentified / Cherry	6	2	
TOTAL	**850**	**132**	**107**

[58] Numbers cannot be provided for individual tree species, as it is not known which sections of the 70% of the 3m buffer working corridor along the access track would be utilised, and therefore which individual tree species could be affected.

Construction would result in the direct loss of up to 0.60 ha of '*Tilio-Acerion* forests of slopes, screes and ravines' qualifying interest habitat, comprising a small area on the shores of Loch Ness at the northern edge of the powerhouse site, and small pockets in mosaic with 'old sessile oak woods with Ilex and Blechnum in the British Isles' in the powerhouse and access track locations. This represents a loss of up to 2.38% of the total habitat type within Ness Woods SAC.

Construction would result in the direct loss of up to 4.96 ha of 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles' qualifying interest habitat, comprising the majority of the habitat at the powerhouse and associated infrastructure location, the proposed access track, and the location of Dam 1 and adjacent inundation area. This habitat loss represents up to 0.92% of the total habitat type within Ness Woods SAC.

Construction would result in the direct loss of a range of individual bryophytes and lichens and associated microfungi, primarily via the felling of trees (specifically veteran trees (including birch, rowan and ash) and veteran hazels), and to a lesser extent the removal / disturbance of rocks, within the construction areas for the powerhouse and associated infrastructure, the access track and Dam 1. These bryophyte and lichen communities form an important component of the qualifying interest woodland habitats.

Specifically, with respect to the direct loss of bryophytes, construction of the access track would result in the direct loss of part of an old-growth hazel stand with a rich epiphytic bryophyte flora, dominated by the common epiphytes *Isothecium myosuroides*, *Isothecium alopecuroides*, *Frullania tamarisci*, *Homalothecium sericeum*, *Hypnum* spp. and *Ulota* spp. More interesting species recorded in this area included *Antitrichia curtipendula*, *Neckera complanata*, *Neckera pumila*, *Orthotrichum striatum* and *Ulota intermedia* (Target Note 2, Figure 7), all of which are of Least Concern[59], with the exception of *Ulota intermedia* which is Not Evaluated (which is new to East Inverness-shire, as it is a recently-described segregate of the *Ulota crispa* complex[60], rather than being a rare species). Two ash trees (southern edge of Target Note 5, Figure 7) to the north of the powerhouse would also be lost, which support common species such as *Frullania dilatata* and *Orthotrichum striatum*. Direct loss of a rich bryophyte flora would also occur on rocks on the loch shore where the powerhouse platform and tailrace structures are to be constructed (Target Note 3, Figure 7), on a low rock face (Target Note 3, Figure 7) in the powerhouse construction area, and on the lower section of a scree slope in the powerhouse construction area (Target Note 4, Figure 7). *Fontinalis antipyretica*, *Hygrohypnum luridum*, *Racomitrium aciculare*, *Sciuro-hypnum plumosum*, *Thamnobryum alopecurum*, *Grimmia hartmanii*, *Nogopterium (Pterogonium) gracile*, *Lejeuneca cavifolia*, *Dicranum scoparium, Frullania tamarisci, Amphidium mougeotii, Anoectangium aestivum, Hylocomiadelphus* (*Rhytidiadelphus*) *triquetrus, Bazzania trilobata*, *Plagiochila punctata*, *Plagiochila spinulosa*, *Bartramia pomiformis*, *Blepharostoma trichophyllum*, *Neckera crispa*, *Tortella tortuosa, Scapania gracilis*, and *Hylocomiastrum umbratum* were recorded in these areas. None of these bryophytes within the infrastructure footprint or working corridor are rare, however they comprise typical species of the qualifying woodland habitats.

Direct loss of lichens and associated lichenicolous fungi is mostly associated with the proposed access track and powerhouse infrastructure area. Specifically, those of very high[61] value where some loss would occur comprise *Arthonia sampaianae* (NR, UK Red Listed NT[62]) (four of nine locations lost (on hazel)), *Bactrospora homalotropa*

---

[59] Hodgetts, N., et al. (2019) *A miniature world in decline: European Red List of Mosses, Liverworts and Hornworts*. Brussels, Belgium: IUCN. Available at: https://portals.iucn.org/library/sites/library/files/documents/RL-4-027-En.pdf [Accessed in July 2023]

[60] Blockeel, T.L. 2017. The *Ulota crispa* group in Britain and Ireland, with notes on other species of the genus. *Field Bryology* 117: 8-19.

[61] The value of lichens are assessed at the Site-based scale within the baseline terrestrial lichen report (Acton, 2022), In summary, lichens assessed as having 'very high value' are generally old growth species, including species that are Red-listed in the UK and / or Europe, rare or absent in most other areas of Britain outwith their strongholds in Argyll / Lochaber, and rare at the Site-based scale. 'High value' species are notable species that are generally scarce on Site, whereas 'medium value' species are more common species.

[62] Lichen conservation status key: LC = Least Concern (IUCN Red List Category); IUCN Red-Listed species are: CR = Critically Endangered; EN = Endangered; VU = Vulnerable or NT = Near Threatened. Sc = Scottish Biodiversity List species. IR = species for which the UK has International Responsibility, as it supports a significant proportion of the European and / or global populations; L = *Lobarion* community species; NS = Nationally Scarce; NR = Nationally Rare: Conservation status follows: Woods, R. G. and Coppins, B. J. (2012) A Conservation Evaluation of British Lichens and Lichenicolous Fungi. Species Status 13. Joint Nature Conservation Committee, Peterborough.

(NS, Sc, IR, Lowland Rainforest Indicator (LRI) species[63]) (one of seven lost (on hazel)), *Fuscopannaria mediterranea* (LC, NS, L, SWI) (one of two lost (on hazel)), *Leptogium burgessii* (Sc, IR) (four of 26 lost (on hazel)), *Pectenia plumbea* (LC, L, IR) (two of six lost (on hazel and rowan)) and *Phlyctis agelaea* (NT, NS, Sc) (one of five lost (on hazel)) ,all of which are old growth species.

High value species *Nevesia sampaiana* (UK Red Listed NT, NS, L, Sc, IR, BWI, LRI) (16 of 183 lost) and *Parmeliella testacea* (NT, NS, L, Sc, IR, LRI) (32 of 169 lost) would also experience some direct loss, primarily on hazel; these two species are widespread across the Site, but given that the proposed access track passes through a core population in an old growth hazel stand, the resilience of these species could be reduced. High value old growth species *Crutarndina petractoides* (Sc, IR) (three of 49 lost) and *Pannaria rubiginosa* (LC, Sc, L, IR, BWI) (five of 48 lost) would also experience some direct loss, on hazel. A single patch (out of ten) of high value *Bunodophoron melanocarpum* (LC) would also be lost to the inundation zone, although this lies outside of Ness Woods SAC. A veteran hazel supporting *Scutula circumspecta* (VU, NS, Sc) and *Pachyphiale fagicola* (NT, NR) lies immediately beyond the working corridor and RPA, and therefore would be retained, although particular care would be required during construction to ensure protection (see Step Four, Mitigation Measures).

Lichens on the watercourses surveyed would predominantly be retained, with the exception of the upper stretch of the Allt an t-Sluichd at the location of Dam 1, where several lichens of medium value, a single lichen of high value on a birch tree, *Lopadium disciforme* (LC, BWI, SWI) (one of five on the Site), and a single lichen of very high value on a birch tree, *Bactrospora corticola* (NS) (one of two on the Site), would be lost within the woodland surrounding the watercourse.

In total, 10 trees with lichens of very high value, 34 of high value, and 68 of medium value at the Site-based scale, would be lost from within Ness Woods SAC (within the infrastructure footprint and working corridor). Beyond the working corridor, a further two trees with lichens of very high value, eight with lichens of high value, and seven of medium value at the Site-based scale would be at risk of loss or damage, due to potential effects upon roots of the trees, within 4 m of the working corridor.

The loss of up to 0.60 ha of '*Tilio-Acerion* forests of slopes, screes and ravines' and up to 4.96 ha of 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles', including 850 trees and the associated bryophyte and lichen interest, along with the possible damage to roots of a further 107 retained trees, is assessed as constituting a likely significant effect. Habitat loss as a result of construction, along with damage to roots of retained trees, is therefore included in the SIAA.

Habitat Fragmentation

Beyond the working corridor and 4m possible tree impact buffer, there is the potential for the qualifying woodland habitats, including the associated bryophyte and lichen communities, to be indirectly affected by fragmentation, along the proposed access track corridor.

Fragmentation can have a negative effect on plant species richness and diversity, with smaller patch sizes and greater distances between patches negatively affecting species richness and diversity; although not all plant species have been found to respond in the same way, with woodland specialist species such as ferns most affected[64]. More generalist species are not so affected by spatial isolation as they tend to be more evenly distributed across the landscape matrix and therefore they tend to dominate once woodland species become locally extinct[65]. Within Ness Woods SAC, the distance between woodland patches (i.e. the width of the access track corridor) is small, and the woodland patches (i.e. woodland either side of the access track corridor) are large, as they have immediate connectivity with extensive areas of woodland to the north and south of the

[63] Coppins, A. M. and Coppins, B. J. (2002) Indices of Ecological Continuity for Woodland Epiphytic Lichen Habitats in the British Isles. British Lichen Society, London.

[64] Rodriguez-Loinaz, G. Amezaga, I. and Onaindia, M. (2012) Does forest fragmentation affect the same way all growth-forms? *Journal of Environmental Management*, 94, Issue 1, Pages 125-131

[65] Ryan, L. (2012) *Impacts of nearby development on ancient woodland – addendum*. The Woodland Trust, Grantham

project area. Therefore, a widespread reduction in woodland plant species richness and diversity as a result of fragmentation is not expected in retained woodland habitat areas distant from the proposed access track corridor.

Fragmentation can also result in increased edge effects. Edges are associated with higher temperatures and wind speeds, greater disturbance, increased water loss, and the presence of non-woodland species, which can impact upon the ecology of woodland[65]. Increased solar radiation at woodland edges decreases soil moisture, which leads to decreased decomposition of leaf litter, and reduced nutrient cycling[66].

Herbst *et al*. (2007)[67] showed that evapotranspiration from trees was significantly higher at edges than in the interior of the woodland. This edge effect can dominate the water use of small woods because the higher the amount of transpiration the lower the rate of groundwater recharge. Therefore, the smaller the wood (and therefore the greater the edge to interior ratio) the lower the soil water recharge rate is expected to be. Changes to transpiration rates are not equal across all tree species with ash being more affected than oak, field maple (*Acer campestre*) and hawthorn (*Crataegus monogyna*). However, the effect of increased water loss was found to become negligible for woods greater than 100 hectares, which is applicable at Ness Woods SAC.

Edge effects can penetrate as far as 30m into a woodland, but this is greatly reduced for closed edges[68]. Gonzalez *et al*. (2010)[69] found that the greater the proportion of edge to the interior the more likely the interior was to be colonised by light demanding species; therefore, the amount of edge to interior, as well as the structure may be impacting on the species composition of the woodland.

The proposed access track route is sinuous, due to the technical constraints associated with gradients, and as such comprises several hairpin bends, where retained woodland in the interior of the hairpin bends has the potential to become fragmented.

For assessment purposes, it has been assumed that areas of retained relatively dense woodland habitat within the hairpin bends, which measure 60m or less across, comprise woodland habitat that could become more isolated as a result of construction, and therefore has the potential to result in vegetation changes. These areas are shown in Figures 3 - 8, and the corresponding qualifying habitat areas are detailed in Table 5-4. These areas have been included on the basis of becoming isolated from woodland interior habitat. Hairpin bends that transect existing edge habitat with open and scattered woodland, or open bracken patches (e.g. at the upper stretch of the proposed access track), are excluded from this calculation. This is on the basis that edge habitat already exists in these areas, and therefore is not at risk of becoming further fragmented from woodland interior habitat.

Table 5-4: Areas of Habitat Change from Fragmentation Effects

Habitat Type[70]	Habitat Change from Fragmentation Effects (ha)
Tilio-Acerion forests of slopes, screes and ravines	0.13
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	1.04

[66] Riutta, T., Slade, E. M., Bebber, D. P., Taylor, M. E., Malhi, Y., Riordan, P., MacDonald, D. W. and Morecroft, M. D. (2012) Experimental evidence for the interacting effects of forest edge, moisture and soil macrofauna on leaf litter decomposition, *Soil Biology and Biochemistry*, 49, pages 124 - 131

[67] Herbst, M., Roberts, J. M., Rosier, P. T. W., Taylor, M. E. and Gowing, D. J. (2007) Edge effects and forest water use: A field study in a mixed deciduous woodland, *Forest Ecology and Management*, 250, pages 176 - 186

[68] Hamburg, L., Lehvavirta, S. and Kotze, D. J. (2009) Forest edge structure as a shaping factor of understorey vegetation in urban forests in Finland, *Forest Ecology and Management*, 257, Issue 2, Pages 712 - 722

[69] Gonzalez, M., Ladet, S., Deconchat, M., Cabanettes, A., Alard, D. and Balent, G. (2010) Relative contribution of edge and interior zones to patch size effect on species richness: An example for woody plants, *Forest Ecology and Management*, 259, Issue 3, Pages 266 - 274

[70] Qualifying habitat areas shown are based on the same assumptions regarding composition of the mosaic habitats that have been used for the direct habitat loss calculations

Habitat Type[70]	Habitat Change from Fragmentation Effects (ha)
Total	1.17

Habitat fragmentation as a result of construction is assessed as constituting a likely significant effect, and is therefore included in the SIAA. Potential effects of fragmentation are discussed in further detail within the SIAA, including a detailed assessment of fragmentation effects upon lichen species.

During the operational phase, no significant effects on retained habitats are likely, beyond those already identified under the construction phase impacts, and this element is therefore scoped out of the SIAA. Infrastructure would already be in place and no further habitat loss would be required. Staff vehicles for manning of the powerhouse and routine operational and maintenance purposes would be present on the Site, on existing access tracks and in the powerhouse area. The potential for incidents and spillages affecting sensitive habitats is considered to be very low.

Dust deposition

Dust deposition can impact vegetation by affecting photosynthesis, respiration, transpiration and allowing the penetration of phytotoxic gaseous pollutants, generally resulting in decreased productivity. Epiphytic lichens are particularly sensitive to dust deposition[71].

An air quality assessment has been undertaken and is presented in full in Volume 1, Chapter 18: Air Quality of the EIA Report; a summary is provided below.

The activities with the potential to generate dust within close proximity (i.e. within the Institute of Air Quality Management (IAQM) adopted 400 m screening distance[72]) to Ness Woods SAC are: construction of the powerhouse building; site clearance and preparation; construction of a platform at the lower reservoir works and tunnel portal; excavation of access tunnel and drop shaft; processing (concrete batching plant, crusher and screener); construction of on-site tracks; excavations and surfacing; on-site transportation (material transfer); excavation and operation of borrow pits 7 and 8; blasting and excavation; stockpiling; the construction of Dams 1 and 8; construction of works with rockfill (Dam 8); central processing area; crushing and screening; and concrete batching plant (for upper reservoir works).

The air quality assessment for dust deposition has calculated the magnitude of effect using the residual source emissions magnitudes, the pathway effectiveness for the habitats in Ness Woods SAC, the receptor sensitivity, and dust impact risk. Table 5-5 presents a summary of the magnitude of effect in the absence of mitigation.

Table 5-5: IAQM Dust Impact & Magnitude of Effect (without mitigation) – Disamenity Dust, Ecological Receptors

Receptor		Pathway Effectiveness	Residual Source Emission	Dust Impact Risk	Magnitude of Effect
Powerhouse Area / On-site Transportation					
Woodland <20m		Highly Effective	Large	High Risk	Substantial Adverse
Woodland <50m		Moderately Effective		Medium Risk	Moderate Averse
Woodland >50m		Ineffective		Low Risk	Slight Adverse
Acid Grassland /	<50m	Highly Effective		High Risk	Substantial Adverse
	<100m downwind	Highly Effective		High Risk	Substantial Adverse
	<100m upwind	Moderately Effective		Medium Risk	Moderate Adverse

[71] Farmer, A. (1993) The effects of dust on vegetation – a review. *Environmental Pollution* 79: 63-75

[72] Institute of Air Quality Management (2016) Guidance on the Assessment of Mineral Dust Impacts for Planning

Receptor		Pathway Effectiveness	Residual Source Emission	Dust Impact Risk	Magnitude of Effect
Bracken / Dry Heath	>100m downwind	Moderately Effective		Medium Risk	Moderate Adverse
	>100m upwind	Ineffective		Low Risk	Slight Adverse
Construction of On-site Tracks / Dams					
Woodland <20m		Highly Effective	Medium	Medium Risk	Moderate Adverse
Woodland <50m		Moderately Effective		Low Risk	Slight Adverse
Woodland >50m		Ineffective		Negligible	Negligible
Acid Grassland / Bracken / Dry Heath	<50m	Highly Effective		Medium Risk	Moderate Adverse
	<100m downwind	Highly Effective		Medium Risk	Moderate Adverse
	<100m upwind	Moderately Effective		Low Risk	Slight Adverse
	>100m downwind	Moderately Effective		Low Risk	Slight Adverse
	>100m upwind	Ineffective		Negligible	Negligible
Borrow Pits					
Woodland <20m		Highly Effective	Small	Low Risk	Slight Adverse
Woodland <50m		Moderately Effective		Negligible	Negligible
Woodland >50m		Ineffective		Negligible	Negligible
Acid Grassland / Bracken / Dry Heath	<50m	Highly Effective		Low Risk	Slight Adverse
	<100m downwind	Highly Effective		Low Risk	Slight Adverse
	<100m upwind	Moderately Effective		Negligible	Negligible
	>100m downwind	Moderately Effective		Negligible	Negligible
	>100m upwind	Ineffective		Negligible	Negligible

In an unmitigated scenario, the air quality assessment concludes that dust deposition would have a predicted range of effects from negligible to substantial adverse, depending on the distance and direction from the dust generating activity. Dust deposition during construction is therefore assessed as constituting a likely significant effect and is included in the SIAA.

Emissions generated from road traffic, and non-road mobile machinery

An air quality assessment for exhaust emissions generated from road traffic and Non-Road Mobile Machinery (NRMM), for Ness Woods SAC, is detailed in Volume 1, Chapter 18: Air Quality of the EIA Report, and is summarised here.

A review of the ecological effects of diffuse air pollution arising from road traffic on semi-natural habitats[73] found that lichen diversity declined with increasing concentrations of pollutants emitted from vehicle exhausts.

An increase in vehicle emissions can result from off-site vehicles, on-site vehicles and on-site plant during construction. The sources of emissions increase during construction are identified as: additional road vehicle movements generated during construction (from importation of material for concrete / shotcrete and access creation, importation of fuel, servicing and occasional deliveries of larger items of plant); dump trucks for material transfer using internal haul routes (primarily between the powerhouse and the upper reservoir); and remaining NRMM used at the powerhouse and associated infrastructure and Dam 1.

Critical Levels are a quantitative estimate of exposure to one or more airborne pollutants in gaseous forms, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Critical Levels for the protection of vegetation and ecosystems are specified within relevant UK and

[73] Smithers, R., Harris, R. and Hitchcock, G. (2016) *The ecological effects of air pollution from road transport: an updated review*. Natural England Commissioned Report NECR199

air quality legislation. For Nitrous Oxides (NOx) emissions, the relevant Critical Levels are 30 µg/m3 (annual mean) and 200 µg/m3 (daily mean) for all ecosystems[74].

Critical Loads are a quantitative estimate of exposure to deposition of one or more pollutants, below which significant harmful effects on sensitive elements of the environment do not occur, according to present knowledge. Critical Loads for eutrophication are habitat / species specific (derived from a range of experimental studies), whereas Critical Loads for acidification are dependent on soil chemistry, as well as habitat type.

The Air Pollution Information System (APIS) website[75], a support tool for assessment of potential effects of air pollutants on habitats and species developed in partnership by the UK conservation agencies and regulatory agencies and the Centre for Ecology and Hydrology, has been used to provide information on background pollutant concentrations, current deposition rates, Critical Loads for nutrient nitrogen (N) (Table 5-6) and Critical Loads for functions for acidity (Table 5-7) for Ness Woods SAC.

Table 5-6: Nitrogen Critical Levels and Critical Loads

Site	APIS Critical Load Class (most sensitive)	NOx Annual Mean (µg / m^3)	Critical Load Range (kg N / ha / yr)	Current Load (kg N / ha / yr)
Ness Woods SAC	Acidophilous *Quercus*-dominated woodland	1.65	10-15	6.3

Table 5-7: Acid Critical Load Functions and Current Loads

Site	APIS Critical Load Class (most sensitive)	Critical Load Function[76] (keq / ha / yr)			Current Load (keq / ha / yr)	
		CLmaxS	CLminN	CLmaxN	Nitrogen Deposition	Sulphur Deposition
Ness Woods SAC	Broadleaved, mixed and yew woodland	0.591	0.142	0.876	0.5	0.1

For off-site road traffic, designated sites within 200 m of the affected road network (i.e. roads which are expected to experience an increase in traffic volume as a result of the proposed construction activities) are considered in accordance with established criteria[74,77]. In this instance, the affected road network is the A9 (T), B861 and B862. There are no ecological designations present within 200 m of the affected road network. Furthermore, the 24-hour Annual Average Daily Traffic (AADT) road traffic flows generated during the construction phase are well below the Institute of Air Quality Management (IAQM) prescribed screening criteria of 1,000 AADT (and/or 200 Heavy Duty Vehicles (HDVs) as AADT). As such, no further assessment is required, and road traffic impacts associated with construction activities on air quality are assessed as having a neutral effect on Ness Woods SAC which is not significant.

[74] IAQM (2020) *A Guide to the Assessment of Air Quality Impacts on Designated Nature Conservation Sites*, v 1.1

[75] http://www.apis.ac.uk/ [accessed in November 2022]

[76] Critical Load functions for acidity are defined in APIS using three quantities, to account for both sulphur and nitrogen inputs: CLmaxS (maximum critical load for sulphur), CLminN (minimum critical load for nitrogen) and CLmaxN (maximum critical load for nitrogen).

[77] Highways England et al. (2019) *Design Manual for Roads and Bridges* (DMRB) LA 105

For on-site NRMM, land within 50 m of NRMM emissions is considered[78]. According to the IAQM[79], experience of assessing exhaust emissions from NRMM suggests that they are unlikely to make a significant impact on local air quality. According to Defra's TG22 guidance[80], experience of assessing the exhaust emissions from on-site plant (NRMM) and Site traffic suggests that, with suitable controls and Site management, they are unlikely to make a significant impact on local air quality.

On-site vehicle generation through Ness Woods SAC during construction is summarised in Table 5-8 (provided by the appointed transport consultant for the Proposed Development).

Table 5-8: Construction Phase Vehicle Generation (on-Site, within Ness Woods SAC)

Time Period	HDVs (as AADT)	LDVs (as AADT)
2025 (Jul – Dec)	122	13
2026	96	98
2027	185	149
2028	183	143
2029	45	70
2030 (Jan – Jun)	0	5

The 24-hour AADT traffic flows generated on the designated track running through Ness Woods SAC are well below the screening criteria of 1,000 AADT (and / or 200 HDVs). As such, the air quality assessment concludes that the impact of on-site vehicle movements on air quality can be considered as having a neutral and non-significant effect on Ness Woods SAC. A likely significant effect can therefore be ruled out and no further assessment is required.

NRMM emissions are controlled through European Directives (e.g. Regulation EU 2016/1628) in terms of maximum operable emission limits. Emissions standards are applied to NRMM engines at the point of placing on the market – and typically become stricter following the introduction and availability of cleaner technologies and fuels. The most recent stringent emission standards, Stage V, were effective from 2019 for engines below 56 kW and above 130 kW, and from 2020 for engines of 56-130 kW. By the time construction activities are expected to commence (2025), all NRMM will comply with Stage V emissions, as a minimum – or a later emission standard introduced in the interim period.

Whilst taking into account the extent of NRMM proposed to be used (type, quantum and emission standards), associated control measures and the transient / phased nature of the construction works, the likelihood of NRMM emissions comprising a significant concern for Ness Woods SAC is low.

Construction works associated with Dam 1 would take a total of 24 months, with the extent and use of NRMM constantly changing as works progress. There is approximately 1.9 ha of the SAC within the 50 m screening distance threshold of the Dam working corridor, representing <0.5% of the total area of the SAC.

Construction works associated with the powerhouse platform would be greatest in intensity for the initial 12 months of work when plant is required for excavation, blasting and on-site processing. Following this period however the number of NRMM and intensity of use will significantly reduce as construction activities are limited

[78] Following a review of approaches adopted for Nationally Significant Infrastructure Projects (NSIP) where extensive onshore construction activities are proposed, a 50 m distance screening threshold in relation to NRMM emissions has been accepted by statutory consultees and the Planning Inspectorate (England) (Northampton Gateway, 2019 The Northampton Gateway Rail Freight Interchange Order 201X. Applicants' Response to Secretary of State's Request for Comments).

[79] Holman *et al* (2014) *IAQM Guidance on the Assessment of Dust from Demolition and Construction*, Institute of Air Quality Management, London

[80] DEFRA (2022) *Local Air Quality Management*. Technical Guidance (TG22). DEFRA, London

to handling of material and on-site transportation (which has been assessed separately, above). There is approximately 5.1 ha of the SAC within the 50 m screening distance threshold of the powerhouse area, representing approximately 0.6% of the total area of the SAC.

The existing levels of NOx, Nitrogen deposition and Nitrogen and Sulphur loads associated with the most sensitive woodland habitats are below the site-specific Critical Levels / Loads, as presented in Tables 5-5 and 5-6. The current NOx concentration is 5.5% of the annual AQO (Air Quality Objectives) for ecological habitats, the current nitrogen deposition load is between 42% and 63% of the Critical Load range, and there is headroom of 43% and 83% between the current and maximum critical loads for Nitrogen and Sulphur-derived acid, respectively.

Based on the above, emissions are assessed to be insignificant, and effects of emissions from NRMM upon Ness Woods SAC habitats during construction are assessed to be not significant.

As such, likely significant effects from emissions generated from road traffic and NRMM are ruled out, and are therefore screened out of the SIAA.

Impacts of water quality or a change in flow regime of watercourses

In an unmitigated scenario, the Allt an t-Sluichd watercourse, which flows from Loch Kemp into Loch Ness, has the potential to be adversely affected if there are changes in water quality as a result of the construction of Dam 1, via inadvertent pollution events via fuel spills, changes in water chemistry from contamination with concrete, dust, or from an increased sediment load / construction run off. Specifically, the watercourse downstream of Dam 1 supports assemblages of regionally important bryophytes and nationally important lichens on rocks close to or within the watercourse, which could be adversely affected by changes in water quality. Areas of the Allt an t-Sluichd downstream of Dam 1 (beyond the working corridor) also support '*Tilio-Acerion* forests of slopes, screes and ravines' habitat. Similarly, construction of the access track in close proximity to Allt a' Chinn Mhonaich (which also supports regionally and nationally important bryophytes and lichens) also has the potential to affect water quality in an unmitigated scenario.

The aquatic, amphibious and splash zone lichen assemblages on the Allt an t-Sluichd occupy highly restricted and specialised niches, as they require either constant, frequent or occasional inundation or wetting provided by the natural flow regime[81,82,83]. Therefore, a change in flow rate could negatively affect these lichens due to altering the available niches. In an unmitigated scenario, the flow rate of the Allt an t-Sluichd would change, and therefore the bryophyte and lichen assemblage could be adversely affected.

A decrease in water quality, change in flow regime, or construction of dam 1 could also adversely affect riverine macroinvertebrates within the watercourses running through Ness Woods SAC, although the significance of effects upon macro-invertebrates prior to mitigation is considered to be non-significant, given that the macroinvertebrate communities are widespread within the local area and no species of high conservation interest were recorded during surveys.

A decrease in water quality within the watercourses running through Ness Woods SAC could also adversely affect otter prey, such as European eel (*Anguilla anguilla*) and brown trout (*Salmo trutta*), as discussed further in the following sections. Impacts of water quality or a change in flow regime of watercourses are therefore assessed as constituting a likely significant effect and are included in the SIAA.

Access track construction and maintenance of groundwater and surface water flows

In the absence of sensitive track construction design and implementation of appropriate drainage design, the construction of the permanent infrastructure within Ness Woods SAC, and in particular construction of the access

---

[81] Orange, A. (2017) The Importance of Watercourses for Lichens in Eryri SSSI. NRW Evidence Report No. 224, 159 pp

[82] Demars, B.O.L & Britton, A. (2011) *Assessing the impacts of small-scale hydroelectric schemes on rare bryophytes and lichens*. SNH & Macaulay Land Use Institute Funded Report. SNH Commissioned Report No. 412

[83] Douglass, J.R & Coppins, B.J. (in prep) *Monitoring of Collema dichotomum on the River Devon, before and after the instillation of a hydro-electric scheme*

track on sloping ground down to the powerhouse area, has the potential to cause localised hydrological changes to groundwater or surface water flows. Specifically, if natural flows are disrupted, there is the potential for localised drying out of some areas and increased wetting to other areas, such as downslope of the track where water could become concentrated from run-off.

Flush vegetation would be vulnerable to such effects. However, no such flush vegetation was identified within the baseline surveys, within Ness Woods SAC, either within close proximity to the working corridor, or downslope of the working corridor. Several habitats with moderate potential GWDTE were identified across the wider Site or in areas of Ness Woods SAC away from impact areas, however these were all concluded not to be maintained by groundwater, but instead by rainwater and surface water flow paths (as detailed in Volume 1, Chapter 14: Geology, Soils and Water of the EIA Report).

Although no sensitive flush vegetation has been identified, and no access track watercourse crossings are proposed within Ness Woods SAC, this potential pathway for effect is scoped into the SIAA on a precautionary basis, due to the potential for localised small-scale changes to vegetation communities which comprise typical species of the woodland qualifying habitats, in the absence of mitigation.

Spread of access track material

The material used for the SAC access track would be stone sourced from on-site construction works, along with an asphalt / tarmac topcoat. Habitat loss calculations account for a working corridor along the proposed access track, and it is considered unlikely that material would spread beyond this footprint, such that there would be no likely significant effect of the spread of access track material beyond the working corridor, and this impact pathway is therefore screened out from the SIAA.

Inadvertent introduction of invasive non-native species

Although no invasive non-native plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981 were identified within the construction areas, and no invasive non-native aquatic macroinvertebrates were recorded within the aquatic habitat sampled, in an unmitigated scenario, construction activities have the potential to introduce such species into Ness Woods SAC, via contaminated soil tracked in from machinery or brought in from footwear, or in the case of aquatic habitat via importing of construction materials. Invasive non-native aquatic macroinvertebrate species also have the potential to be spread through the transfer of water between Loch Ness and Loch Kemp, notably freshwater amphipod *Crangonyx pseudogracilis* and flatworm *Phagocata woodworthi* which are known to be present within Loch Ness.

Invasive species are listed as a threat for Ness Woods SAC in the Conservation Advice Package, and non-native invasive plants can out-compete native flora. Therefore, in the absence of mitigation, the inadvertent introduction of invasive non-native species is assessed as constituting a likely significant effect and is included in the SIAA.

Loss of otter resting places

Construction would result in the loss of three otter lay-ups (TN 5, TN 7 and TN 8 in Figure 8) and one potential holt (non-breeding) (TN 6 in Figure 8), within Ness Woods SAC, located close to the shore of Loch Ness within the proposed powerhouse platform footprint. (see Figure 8). Outside of Ness Woods SAC, construction of the dams would result in the loss of a further potential holt (TN 10, Figure 8) and potential (ephemeral) lay-up (TN 11, Figure 8). No natal holts would be affected.

In the absence of mitigation, construction works would result in contravention of wildlife legislation, via the destruction of six otter resting places.

The loss of six otter resting places during construction is therefore assessed as constituting a likely significant effect and is further considered in the SIAA.

Disturbance of otter via human presence, construction noise and vibration including blasting, and lighting

Construction activities have the potential to cause temporary disturbance to otters that use the waterbodies, watercourses and surrounding sheltered habitats on and around the Site for foraging, commuting and resting. Four further couches / lay-ups are located beyond the working corridor, to the north and south of the working corridor close to Loch Ness shoreline, and to the north of Dam 1, along the Allt an t-Sluichd.

Potential sources of disturbance relate to human and vehicular presence, construction noise and vibration including blasting, and temporary construction lighting.

In the absence of mitigation, it is possible that otter resting places could be disturbed, either through site personnel or machinery entering areas close to resting places or in the event of new resting places becoming established in close proximity to working corridors. The possible disturbance of otter resting places is therefore assessed as constituting a likely significant effect and is included in the SIAA.

Due to the requirement for temporary construction lighting and some night-time work, localised disturbance due to night-time human / machinery presence and construction lighting is predicted, which could temporarily displace commuting and hunting otter from the immediate area of the construction works.

Operational lighting would be restricted to the powerhouse area only, which could also result in a small-scale localised disturbance effect at the powerhouse location.

During operation, daily human presence would be required on the Site. This would be restricted to manning of the powerhouse, and a relatively low number of daily staff vehicle movements along the access track. It is estimated that an average of five staff would require daily access to the Site. Additional human presence would also occur at the powerhouse building and adjacent quayside and pier on the shore of Loch Ness, via tourist trips to the powerhouse building by boat. Human presence would be low level and localised in extent, and human presence would mostly occur during daylight hours when otters are less active, therefore disturbance impacts to otter from human presence during operation would be small-scale and localised. However, there is the potential for disturbance levels to become less localised in an unmitigated scenario, for example if visitor access from tourist boats was unrestricted and affected surrounding habitat in Ness Woods SAC.

To allow for a more detailed assessment and the application of mitigation measures, disturbance to otter from lighting and human presence is assessed as constituting a likely significant effect and is included in the SIAA.

Injury or killing of otter from traffic collisions, becoming trapped in excavations, or accessing turbines

The death or injury of an otter could affect the conservation status of this species locally and could represent an offence under relevant legislation.

Otter activity recorded during baseline surveys was most heavily concentrated in Ness Woods SAC, particularly towards the Loch Ness shoreline, although a spraint and potential lay-up was also recorded on Loch Kemp shoreline and on the Allt Leacht Gowrie to the south of Loch Kemp, and one potential holt to the east of Loch Kemp. The nearest public road is the B862, located to the east of Whitebridge Plantation. Given that the majority of construction works are located in the open areas between Ness Woods SAC and Whitebridge Plantation, and given that works would not result in the restriction of access to Loch Ness and other good quality otter habitat around the Loch Ness shoreline, it is considered unlikely that construction works would displace otter towards the B862 public road, such that an increase in collision risk along the B862 public road is not predicted.

In the absence of mitigation, there is the potential for increased traffic collision risk on the on-site access tracks. A risk of traffic collision from on-site access tracks applies to both the construction and operation phases, although the risk is much smaller during the operation phase, given that on-site vehicle movement will be minimal, with an estimated average of five staff requiring daily access to the Site. There is also a risk of injury or death to otter from becoming trapped in excavations during construction, or accessing turbines via the intake / outfall structures, during the operational phase, in an unmitigated scenario.

In the absence of mitigation, a likely significant effect from the injury or killing of otter cannot be ruled out, both during construction and operation, and this effect pathway is therefore included in the SIAA.

Fragmentation of otter habitat from dam construction

Otter evidence has been recorded on the Allt an t-Sluichd, however the relative lack of field evidence during the surveys at Loch Kemp indicates that otter are likely to use Loch Kemp on an occasional basis only. The construction of Dam 1 at the upstream end of the Allt an t-Sluichd is not anticipated to cause significant fragmentation effects to otter, as there would be no obstruction to otter movement on either side of the dam, and therefore it is expected that otters occasionally travelling between the watercourse and Loch Kemp will travel either side of the dam. Similarly, the construction of Dam 4 on the Allt Leachd Gowrie would not cause significant fragmentation effects to otter, as there would also be no obstruction to otter movement on either side of the dam, and therefore it is expected that otters occasionally travelling along the Allt Leachd Gowrie will travel either side of the dam. This is also the case for Dam 3. All other dams are situated away from major watercourses or areas where otter activity has been recorded, and also have no obstruction to movement either side of the dams. As such, likely significant effects from fragmentation of otter habitat from dam construction can be ruled out, and are screened out of the SIAA.

Impacts to otter prey and aquatic habitat

In freshwater, otters feed mainly on fish such as trout, salmon and eels; on spawning frogs and toads in spring; and occasionally on mammals and birds.

Loch Ness and the wider catchment supports Atlantic salmon (*Salmo salar*), brown trout, ferox brown trout (*Salmo trutta*), sea trout (*Salmo trutta*), European eel, Arctic charr (*Salvelinus alpinus*), brook lamprey (*Lampetra planeri*), sea lamprey (*Petromyzon marinus*) and river lamprey (*Lampetra fluviatilus*) (as detailed in Volume 1, Chapter 13: Fish of the EIA Report), and represents optimal hunting habitat for otter. The concentration of otter field evidence recorded during the baseline surveys, with the highest density recorded along Loch Ness shoreline, supports the conclusion that Loch Ness represents the most important hunting area for otter within the Proposed Development area.

Loch Kemp supports a population of resident brown trout, and European eel has been detected within the Allt a Chinn Mhonaich (see Volume 1, Chapter 13: Fish of the EIA Report).

The otter baseline surveys indicate that Loch Kemp is used less frequently than Loch Ness.

In the absence of mitigation, the Chapter 13 of the EIA Report concludes that there would be a likely significant effect upon Arctic charr, ferox brown trout, Atlantic salmon, sea trout, European eel, river and sea lamprey within Loch Ness, as a result of underwater noise during construction, from piling and blasting operations.

During the operational phase, in the absence of mitigation, Chapter 13 of the EIA Report predicts a likely significant effect upon Atlantic salmon within Loch Ness, from attraction of adult fish to the outlet during generation, as well as a likely significant cumulative effect of attraction to multiple sources of water generation within Loch Ness. A likely significant effect upon Atlantic salmon and sea trout within Loch Ness, from attraction of downstream migrating smolts to the intake during generation, is also predicted, as well as a likely significant cumulative effect of attraction to multiple sources of water abstraction within Loch Ness.

European eel within Loch Ness could also be significantly adversely affected during the operational phase, via impingement / entrainment / loss of upstream migrating elvers to the outlet during generation, and impingement / entrainment / loss of downstream migrating silver eels at the intake during abstraction. A significant adverse effect upon river / sea lamprey within Loch Ness is also predicted during the operational phase, in an unmitigated scenario, due to attraction of upstream migrating adults to the outlet during generation, and attraction of downstream migrating lamprey to the outlet during abstraction.

During construction, in an unmitigated scenario, minor, non-significant adverse effects are also predicted upon Arctic charr, juvenile lamprey and Loch Ness salmonid spawning habitat (via instream works during construction),

brown trout in Loch Kemp (via the dam and access track construction and footprint), brook lamprey and brown trout (via noise and vibration during cofferdam construction in Loch Ness), brook and sea / river lamprey and Loch Salmonid spawning habitat (via loss of nursery / spawning habitat within temporary works footprint in Loch Ness), riverine fish habitat on Allt Leachd Gowerie, Allt an t-Sluichd and Allt a Chinn Mhonaich (via the dam construction footprint and / or dust and run off from construction works), and on all fish species studied (via temporary construction lighting, and / or dust and run off from construction works).

During the operational phase, in an unmitigated scenario, minor, non-significant adverse effects are also predicted upon brown trout at Loch Kemp (due to fish strandings from water level fluctuations, migratory barriers due to dams, loss of spawning habitat and riverine habitat due to inundation / infrastructure, and displacement / mortality / loss of habitat due to Allt Leachd Gowerie watercourse crossing). Other non-significant adverse effects include: temporary displacement from operational noise and vibration / lighting, and thermal stress of from localised temperature changes, of all fish species studied; the loss of Arctic charr, brown trout and lamprey habitat at Loch Ness due to permanent infrastructure, localised sediment erosion and / or fluctuating water levels; fluctuations in water levels in Loch Ness causing issues with downstream smolt migration and upstream adult migration of Atlantic salmon, and migrating eel and sea trout; impingement to intake and / or attraction to outfall of eel, lamprey, ferox brown trout and sea trout at Loch Ness; and minor loss of loch salmonid spawning habitat and riverine fish habitat.

There would also be a permanent reduction in the quality of available amphibian habitat within the inundation area, due to the fluctuating water levels. However, given the extensive areas of suitable amphibian habitat that would be unaffected within the Site and surrounding landscape, including further lochs, lochans, smaller ponds and watercourses, the potential effect upon amphibians is considered minimal.

Due to the likely significant effects upon otter prey species in an unmitigated scenario, this effect pathway is included in the SIAA.

Potential Effects for the project in combination with other projects and plans

Given that significant effects upon Ness Woods SAC are likely, there is the potential for in combination effects with other projects or plans, if there are other projects and projects that could also adversely affect Ness Woods SAC. In combination effects upon Ness Woods SAC have been assessed by considering other developments and plans within Ness Woods SAC; adjacent to Ness Woods SAC; within 5 km of the development Site; and other planned and operational pumped hydro schemes on Loch Ness that could potentially affect Ness Woods SAC. Due to the need for detailed assessment, potential in combination effects are not assessed further in the Stage 1 screening, but are instead included in the SIAA.

5.4.2 Loch Knockie and nearby Lochs SPA

Relevant Ecological Information

Slavonian grebe, the reason for designation of Loch Knockie and nearby Lochs SPA, is an Annex I (of the Birds Directive) and Schedule 1 (of the Wildlife & Countryside Act 1981 species of high conservation concern in the UK. It is a Scottish Biodiversity List (SBL) priority species and is on the UK Birds of Conservation Concern (BoCC) Red-list due to severe breeding population decline over 25 years / longer term[84].

Slavonian grebe is one of the UK's rarest nesting birds – the size of the British breeding population is currently estimated at only 28 pairs[85]. Its breeding range is almost entirely restricted to the Highland and Grampian regions, specifically to freshwater lochs surrounding the Great Glen and Aviemore. In winter, Slavonian grebes

[84] Stanbury, A., Eaton, M., Aebischer, N., Balmer, D., Brown, A., Douse, A., Lindley, P., McCulloch, N., Noble, D., and Win I. (2021) The status of our bird populations: the fifth Birds of Conservation Concern in the United Kingdom, Channel Islands and Isle of Man and second IUCN Red List assessment of extinction risk for Great Britain. British Birds 114: 723-747.

[85] Woodward, I., Aebischer, N., Burnell, D., Eaton, M., Frost, T., Hall, C., Stroud, D.A. & Noble, D. (2020) Population estimates of birds in Great Britain and the United Kingdom. British Birds 113: 69–104.

move to the coast, joining immigrants from other breeding areas from farther afield. The numbers recorded across the wintering range in the UK oscillate around a thousand individuals (995 in 2011-2015)[85]. The Scottish winter population is estimated at 300-500 individuals[86].

Habitat requirements

In Scotland, Slavonian grebe breeds on a variety of lochs with emergent vegetation, from eutrophic lochs in the lowlands to oligotrophic lochs located at higher altitudes (up to 740 m). The loch size can vary from 0.3 ha to 376 ha (average 4 ha)[87]. The grebes feed entirely on the breeding lochs during the breeding season, therefore their movements during the breeding season are restricted to within their breeding sites.

Their diet consists of small fish such as sticklebacks and minnows, and a wide variety of aquatic invertebrates, captured by pursuit diving, and sometimes from the surface of the water or from vegetation. Chironomid (non-biting) midges are an important food source for the grebe chicks (grebe breeding success is positively correlated with chironomid abundance[88]). After the breeding season, Slavonian grebes move to sheltered shallow coastal waters, where their diet consists mainly of fish and crustaceans.

Slavonian grebes usually nest in sedge beds but also use other loch-side vegetation. The floating nest is made of part rotted and fresh water weed and is anchored by surrounding vegetation. Bottle sedge is the main plant amongst which the nest is made, however common reeds or trailing branches of willows can be also used. It is not the size of the loch, but the food supply, clarity of water, presence of suitable nesting habitat (beds of dense bottle sedge), and level of human disturbance that are the main variables determining the selection of breeding sites by Slavonian grebes[89]. In general, Slavonian grebes prefer lochs with small fish (presence of the main food), clear water (ability to hunt) and shoreline trees (cover reducing predation).

Breeding population distribution and trends

The European population of Slavonian grebe is estimated at 14,200-19,200 mature individuals, which equates to 6,400-9,200 pairs[90] (Europe holds <10% of the global population). The European population is estimated to be decreasing at a rate approaching 30% over three generations (21.3 years).

The first UK breeding record of a Slavonian grebe was in 1909 when a pair nested in Inverness-shire[91]. It has since become established within northern Scotland as a rare, localized breeding bird. Inverness-shire remains the population stronghold, however Slavonian grebes were also recorded breeding in Caithness, Strathspey, Moray and Nairn, and even in Perth and Kinross.

Regular counts have been conducted in Scotland since 1971 when the breeding population was estimated at 49 pairs and increasing, reaching the maximum population size of 80 pairs in the 1980s. The beginning of the 1990s saw the population decline across the Scottish range, reaching 31 pairs in 2000. Since then, the population size has fluctuated between years, however the downward trend remained. In 2021, the number of breeding pairs counted in the Highlands was only 19 – the lowest total in the last 10 years[92]. Low productivity is regarded as a major cause of the Slavonian grebe population's decline in Scotland. This decline is mostly associated with a low number of pairs at most sites, making the grebe very vulnerable to site extinction.

---

[86] Forrester, R.W., Andrews, I.J., McInerny, C.J., Murray, R.D., McGowan, R.Y., Zonfrillo, B., Betts, M.W., Jardine, D.C. and Grundy, D.S. eds. 2012. The digital birds of Scotland. The Scottish Ornithologists' Club, Aberlady.

[87] Summers, R., W. & Mavor, R., A. (1995) Occupation patterns of lochs by Slavonian Grebes in Scotland. Scottish Birds 18:65-70.

[88] Brooks, S.J., Jones, V.J., Telford, R.J. et al. Population trends in the Slavonian grebe Podiceps auritus (L.) and Chironomidae (Diptera) at a Scottish loch. J Paleolimnol 47, 631–644 (2012).

[89] Ron W. Summers , Roddy A. Mavor , Sandra Hogg & Ron Harriman (2011) Lake characteristics and their selection by breeding Slavonian Grebes Podiceps auritus in Scotland, Bird Study, 58:3, 349-356.

[90] BirdLife International (2021) European Red List of Birds. Luxembourg: Publications Office of the European Union.

[91] McGhie, H.A. (1994) Discovery of the first British clutch of Slavonian Grebe eggs in a museum collection. Scot. Birds17:166–167.

[92] Highland Bird Report 2021. Scottish Ornithologists' Club, Highland Branch.

Correlates of breeding success

Breeding success of Slavonian grebes in Scotland is low – the mean clutch size is 3.9 eggs, nest survival around 40%, and productivity 0.58 chicks per pair (as recorded between 1971 and 2004)[93]. The recent breeding data from the Highlands (2010-2021)[92] show a similar picture (0.69 young per pair). This is in contrast to higher productivity recorded in other European countries (0.37-1 in Norway, 0.84-1.26 in Iceland and 1.8 in Finland)[94].

The causes behind the low productivity of Slavonian grebe in Scotland are varied, and often difficult to investigate. A study investigating whether weather variation has any effects on a declining population of Slavonian grebes found no clear evidence linking climate change to the Slavonian grebe's decline[95]. However, the authors concluded that grebe population parameters were strongly associated with weather conditions during the breeding season, with a positive effect of temperature during the chick rearing period on breeding success and a negative effect of breeding season rainfall on population growth rates.

Another study investigating the causes of low breeding success found that predation (by crows, pike and mustelids), variability in water levels as well as disturbance by anglers can all contribute to the breeding failure[94]. Clutch survival was negatively correlated with crow frequency and variability in water levels. Brood survival was lower where the introduced fish species (pike) was present and higher where the water was clearer. These factors may have affected predation rates and foraging efficiency, respectively. Overall, productivity was negatively related to the frequency of crows and number of bank anglers, who can disturb grebes.

Other sources also point to afforestation as a cause leading to hydrological changes that reduce the availability of invertebrate prey to the grebe[96]. Moreover, pollution (agricultural run-off) can degrade the nutritional quality of the prey base and nutrient status of the water which has been related to breeding success of Slavonian grebes in Scotland[89].

Movements

Slavonian grebe is a migratory species throughout its range. In winter birds leave their breeding lochs and are found around UK coasts with the Moray Firth, the Firth of Forth and the Clyde Estuary hosting important numbers. Within the context of the Proposed Development, risks to the species, and therefore SPA populations, exist during the breeding season only when birds may be present in the wider area. The breeding season here is defined as late March, when birds arrive to their breeding lochs, to mid-September, when they leave to winter at the coastal areas (the actual breeding cycle, i.e. presence of grebes on breeding sites, is usually shorter, with birds laying eggs in mid-May and departing the lochs in mid-August[87]).

Slavonian grebes are sedentary during the breeding season (if they breed), meaning that they stay on their breeding sites (lochs) without the need for any foraging or commuting flights elsewhere. However, occasionally, after a breeding failure Slavonian grebes can move between breeding sites. The movements will also occur between the breeding and moult sites after the breeding is concluded (however, some birds undergo the moulting on their breeding sites).

Baseline conditions

Baseline information was gathered through a desk-based study considering previous data (information on Slavonian grebe was obtained from RSPB who provided a copy of their dataset on breeding locations within 15

[93] Crooke C, Dennis R, Harvey M, Summers RW (1993) Population size and breeding success of Slavonian Grebes in Scotland. In: Andrews J, Carter SP (eds) Britain's Birds in 1990-91: the conservation and monitoring review. BTO, Thetford and JNCC, Peterborough.

[94] Ron W. Summers, Roddy A. Mavor, and Mark H. Hancock (2009) Correlates of breeding success of Horned Grebes in Scotland, Waterbirds 32(2), 265-275.

[95] Ewing, S.R., Benn, S., Cowie, N. et al. (2013) Effects of weather variation on a declining population of Slavonian Grebes Podiceps auritus. J Ornithol 154, 995–1006.

[96] BirdLife International (2023) Species factsheet: Podiceps auritus. Downloaded from http://www.birdlife.org on 01/02/2023.

km of the Proposed Development, within the last ten years), local breeding bird reports[92] and baseline survey work in the area.

In 2021, the lowest total of breeding pairs was recorded in Highland – only 19 pairs[92]. In the area around the Great Glen, there were four breeding pairs (on four lochs) north of the Great Glen and 11 breeding pairs on three lochs south of the Great Glen. This big decline in breeding pairs that year was somewhat offset by the best productivity (1.2 young per pair) and number of young fledged (23) since 2014.

The nearest record of breeding Slavonian grebe to the Proposed Development is from Loch Knockie; a single pair has been regularly recorded breeding there in the last 10 years. This record is *circa* 2 km distant from the nearest infrastructure within the Proposed Development. A probable breeding pair was also recorded on Loch nan Lann in 2012 (which is also part of the Loch Knockie and nearby Lochs SPA) – this record is 3.4 km distant from the Proposed Development. This location has been regularly monitored for Slavonian grebe since, but no presence has been recorded there since 2012.

Another regular breeding site of Slavonian grebe is approximately 4 km to the north of the Proposed Development (on the northern side of Loch Ness). Up to two pairs regularly breed there, almost every year. This site is not part of any of the SPAs designated for Slavonian grebe. Further breeding records of Slavonian grebe come from Loch Ruthven SPA (up to nine pairs were recorded there in 2021) and various locations on the northeast part of Loch Ness.

During baseline surveys in 2021 and 2022 no Slavonian grebes were recorded on any suitable lochs and lochans within 1 km of the Proposed Development. These included Loch Kemp, Lochan a' Choin Uire, Loch Cluanie, Loch Paiteag, and unnamed ponds near Dell Lodge.

Potential Effects for the project alone

Given the distance between Loch Knockie and nearby Lochs SPA and the Proposed Development (0.75 km), there is a requirement to assess the potential for impacts on some of the Conservation Objectives (see Table 5-1). Specifically, whether the construction of the Proposed Development could cause disturbance to Slavonian grebe - Conservation Objectives 1 and 2(e), and also affect the structure, function and supporting processes of habitats supporting that designated feature - Conservation Objective 2(d). It is also necessary to assess whether it is possible that construction work has the potential to significantly affect a qualifying ornithological feature (Slavonian grebe) when outside of the designated site, which could lead to an adverse effect on the population of the ornithological feature within the designated site - Conservation Objective 2(a). The construction works would not affect the distribution of Slavonian grebe within the SPA - Conservation Objective 2(b) or the distribution and extent of habitats supporting this species - Conservation Objective 2(c). It can also be concluded that during the operational phase of the Proposed Development there will be no potential for adverse impacts on any of the Conservation Objectives.

In the view of the Conservation Objectives, the following have been identified as pressures from the Proposed Development that may impact the integrity of Loch Knockie and nearby Lochs SPA, and as such are subject to a Likely Significant Effects test.

Displacement effect - Conservation Objective 2(a)

The construction of the Proposed Development may result in avoidance of habitats, potentially leading to restricting or displacing birds from potential breeding sites, leading indirectly to population level impacts. Apart from Loch Knockie and Loch nan Lann (which form the northern component of the SPA), there are other waterbodies around the Proposed Development that are potentially suitable for breeding Slavonian grebes (Loch Kemp in itself is partly suitable). Slavonian grebes were recorded on some of them in the past (Lochan Scristan and Dearg Lochain, which lie *circa* 1 km to the north of the Proposed Development), however not in the last ten years. It is therefore possible that some of the neighbouring lochs to the Proposed Development could be utilised by Slavonian grebe, if not for breeding then temporarily in the period preceding it when grebes return from the wintering grounds.

There are several factors influencing the selection of breeding sites by Slavonian grebes (namely, food resource, quality of water and breeding habitat). Based solely on the habitat requirements, there are many potential breeding sites in the vicinity of the Proposed Development that Slavonian grebe could utilise for breeding (within and outside of Loch Knockie and nearby Lochs SPA). However, Slavonian grebe exhibit some degree of breeding site persistence (site fidelity)[97], therefore the likelihood of grebes selecting those sites where they bred (successfully) in the past is higher. Site and habitat occupancy may vary temporally and spatially, with occupancy at range edges especially prone to change over time, as the ecological conditions change or may be suboptimal[98]. Lochs with small breeding populations, and to some extent poor environmental conditions, tend to have lower site persistence[99].

The nearest breeding Slavonian grebe site is on Loch Knockie - 2 km from the Proposed Development. Loch Knockie, together with Loch nan Lann, forms the northern component of Loch Knockie and nearby Lochs SPA. The last probable breeding pair on Loch nan Lann was recorded in 2012 (3.4 km from the Proposed Development), therefore the breeding population of Slavonian grebe on the northern part of Loch Knockie and nearby Lochs SPA consists of a maximum one pair. Several other lochs belonging to Loch Knockie and nearby Lochs SPA (Glendoe Lochans) are located 9 km further to the south. A pair was observed there in suitable nesting habitat in 2012 and 2013, and an individual was recorded there in 2014, 2015, 2016 and 2019 (breeding was only confirmed in 2019). Owing to the distance between Loch Knockie and Loch nan Lann (the northern component of the SPA) and Glendoe Lochans (the southern component of the SPA) it can be assumed that any pressures resulting from the Proposed Development, which could be potentially impacting the northern part of the SPA, would be undetectable to the grebes breeding in the southern component of this SPA.

Baseline surveys carried out in 2021 and 2022 did not record any Slavonian grebes on the lochs nearest to the Proposed Development (also, there are no recent records of Slavonian grebes from within 1 km of the Proposed Development). Given the low population size of Loch Knockie and nearby Lochs SPA (one to two pairs), the scarcity of breeding records within in the proximity of the Proposed Development and the overall Scottish population decline, it is increasingly likely that the Slavonian grebe population of Loch Knockie and nearby Lochs SPA is now functionally extinct, therefore the number of individuals available for impact is trivial, even if Slavonian grebes were to be temporarily present on some of the other lochs in the proximity of the Proposed Development. As such, no likely significant effect will result for the overall Loch Knockie and nearby Lochs SPA population, therefore the displacement effect impact can be screened out from the SIAA.

Changes to hydrological conditions (water quantity and pollution) - Conservation Objective 2(d)

The aquatic environment of the SPA is supporting habitat for Slavonian grebe. Slavonian grebes require low nutrient, clear lochs where they can hunt for invertebrates and small fish such as stickleback and minnow. These requirements are sensitive to aquatic pollution and dust pollution via surface water run-off. Moreover, variability in water levels can lead to breeding failure (through nest destruction). Although grebe nests can float to a degree and the adults can build up in response to rising water, nests eventually become flooded by rising water or disintegrate, especially if there is wave action. However, given that there is no hydrological link between the works associated with the Proposed Development and Loch Knockie and nearby Lochs SPA, there will be no realistic impact pathway and no likely significant effect will result. As such, this impact pathway is screened out from the SIAA.

Invasive non-native species (INNS) - Conservation Objective 2(d)

[97] Ferguson RS (1981) Territorial attachment and mate fidelity by horned grebes. Wilson Bulletin 93:560–561.

[98] White TCR (2008) The role of food, weather and climate in limiting the abundance of animals. Biol Rev 83:227–248.

[99] Stien, J., Strann, K.B., Jepsen, J.U. et al. (2016) Breeding persistence of Slavonian Grebe (Podiceps auritus) at long-term monitoring sites: predictors of a steep decline at the northern European range limit. J Ornithol 157, 75–84. https://doi.org/10.1007/s10336-015-1249-7

In the absence of mitigation, water and vegetation material transfer between Loch Kemp and Loch Ness may facilitate invasive non-native species transfer outside of the Proposed Development Site. This in turn can lead to deterioration of the aquatic habitats used by Slavonian grebe and foods which they rely upon during breeding. For example, fish, such as pike, could compete with grebes for invertebrate food and small fish. However, given that there is no hydrological link between the works associated with the Proposed Development and Loch Knockie and nearby Lochs SPA, the risk of cross-catchment contamination will be negligible, and there will be no realistic impact pathway that could result in a likely significant effect. As such, this impact pathway is screened out from the SIAA.

Disturbance to breeding Slavonian grebe: construction phase - Conservation Objective 1 and 2(e)

Due to proximity of the Proposed Development (750 m), construction activities have the potential to disturb breeding population of Slavonian grebe of Loch Knockie and nearby Lochs SPA via visual disturbance and noise. These two potential impact pathways are considered separately below.

Visual disturbance

Slavonian grebes can be relatively tolerant of human presence (the species is assessed to have a medium sensitivity to human disturbance)[100]. Predation at nests and nest damage by flooding and wave action present more of a threat, however, loch selection may be influenced by human disturbance; in particular bank-anglers, whose presence may keep grebes off eggs for extended periods[101]. Summers *et al.*[102] note that Slavonian grebe breeding lochs tend to be located hundreds of metres from roads and houses which they suggest is an indication of human disturbance. There is not much evidence to be able to determine at what distance Slavonian grebes may be subject to displacement from nest sites due to visual stimuli or presence of infrastructure, but based on the estimated upper limit of human disturbance distances given by Goodship & Furness[100] being 350 m, and Summers *et al.*[102] recording a mean distance of occupied lochs from houses and roads of 450 m and 375 m respectively, it can be reasonably concluded that no breeding Slavonian grebes would be affected by the construction work activity given that the closest loch is *circa* 750 m distant (and the closest known nest site is *circa* 2 km from the nearest infrastructure).

Slavonian grebe is known to have a very high sensitivity to boat disturbance; this species is very likely to respond to a passing ferry at a distance of 200-300 m by flying away[103]. As a result, Slavonian grebes can be absent from areas where regular boat activity takes place; the evasive flights of Slavonian grebes can be longer / further than for other species. However, boat disturbance is not considered a realistic impact here, given no line of sight between Loch Ness and breeding lochs within the SPA, and given that any boat activity would be restricted to Loch Ness, which is located over 700 m from lochs within the SPA.

As such, it can be considered that visual disturbance will be no realistic impact pathway that could result in a likely significant effect.

Noise

Different species of bird have different tolerance thresholds to noise disturbance and therefore construction works and other operations impact upon different species in differing ways. General construction noise is unlikely to have a significant effect, with noise disturbance most likely during activities involving loud, irregular noise such as the occasional use of loud machinery and piling. Furthermore, birds are liable to habituation (e.g. they usually

[100] Goodship, N.M. and Furness, R.W. 2022. Disturbance Distances Review: An updated literature review of disturbance distances of selected bird species. A report from MacArthur Green to NatureScot.

[101] Thom, V.M. 1986. The Birds of Scotland. T and AD Poyser Ltd, London.

[102] Summers, R.W., Mavor, R.A., Hogg, S. & Harriman, R. (2011) Lake characteristics and their selection by breeding Slavonian Grebes Podiceps auritus in Scotland, Bird Study, 58:3, 349-356, DOI: 10.1080/00063657.2011.585630

[103] Jarrett, D., Cook, A.S.C.P., Woodward, I., Ross, K., Horswill, C., Dadam, D. and Humphreys, E.M. (2018) Short-term behavioural responses of wintering waterbirds to marine activity. Scottish Marine and Freshwater Science 9 (7).

become more tolerant with increased exposure time to regular activities)[104]. Generic guidelines based on research on waterbirds[105] are precautionary for consenting requirements and suggest an approach distance to 300 m and a low noise threshold figure of 55dB. A 70dB noise threshold has, however, been developed over a period of years, based on published data as well as findings from primary observations[106] (these however don't include research on Slavonian grebe). The research indicates that when ambient construction noise levels is restricted to below 70dB (at the bird); birds will habituate to regular noise below this level[107]. Based on standard distance decay rates for noise, blasting operations or pile driving (120dB at the source) would be below the impact threshold at *circa* 350 m. Given that the distance between the SPA and the nearest areas where construction activities will take place is a minimum of 750 m meters (in reality, the distance between the known Slavonian grebe breeding site and the nearest infrastructure – a dam, is *circa* 2 km), the construction activities would not have any effect on breeding Slavonian grebe within Loch Knockie and nearby Lochs SPA. Noise modelling has been undertaken, as detailed in Volume 1, Chapter 17: Noise and Vibration of the EIA Report, which confirms that construction and operational noise would be well below the impact threshold within the SPA (see modelled noise contour maps in Plates 17.2 – 17.6, in Chapter 17 of the EIA Report, which show that noise levels from construction and operational activities would be below 45dB at the closest part of the SPA, and therefore even lower at the closest known Slavonian grebe breeding site. It is, therefore, considered that noise will be no realistic impact pathway that could result in a likely significant effect. As such, disturbance is screened out from the SIAA.

Potential Effects for the project in combination with other projects and plans

As all impacts could be screened out from resulting in likely significant effects, there are no impact pathways that could interact with the European sites in combination with other projects and plans.

5.4.3 North Inverness Lochs SPA, Loch Ruthven SPA and Loch Ashie SPA

Given the distances between these three SPAs (all designated for Slavonian grebe) and the Proposed Development (a minimum of 10.7 km), and based on the relevant ecological information provided in Section 5.4.2, it can be concluded that there is no potential for adverse impacts on most of the Conservation Objectives for these three SPAs. Specifically, the construction and operation of the Proposed Development would not affect the distribution of Slavonian grebe within a SPA - Conservation Objective 2(b), or the distribution and extent of habitats supporting this species - Conservation Objective 2(c), or to affect the structure, function and supporting processes of habitats supporting that designated feature - Conservation Objective 2(d). Given the distance, it is also concluded that construction and operation of the Proposed Development would not cause significant disturbance to Slavonian grebe - Conservation Objective 2(e). However, the Proposed Development is considered to have the potential to significantly affect a qualifying ornithological feature (Slavonian grebe) when outside the designated site, which could lead to an adverse effect on the population of the ornithological feature within the designated site - Conservation Objective 2(a). This impact pathway will be the same for all three SPAs, therefore the rationale for assessment is applicable to all three SPAs and is given collectively for all three SPAs in the following sections.

Potential Effects for the project alone

Displacement - Conservation Objective 2(a)

[104] Smit, C.J. & Visser, G.J.M. (1993) Effects of disturbance on shorebirds: a summary of existing knowledge from the Dutch Wadden Sea and Delta area. Wader Study Group Bull. 68: 6-19.

[105] Wintermans, G.J.M. (1991) De uitstralingseffecten van militaire geluidsproductie in de Marnewaard op het gedrag en de ecologie van wadvogels. RIN report 91/3, Texel: 60 pp.

[106] Cutts N & Allan J. (1999) Avifaunal Disturbance Assessment. Flood Defence Works: Saltend. Report to Environment Agency.

[107] Cutts, N., Phelps, A. and Burdon, D. (2009) Construction and waterfowl: Defining Sensitivity, Response, Impacts and Guidance. Report to Humber INCA, Institute of Estuarine and Coastal Studies, University of Hull.

The construction of the Proposed Development may result in avoidance of habitats, potentially preventing dispersal movements of individuals between breeding and moult sites, leading indirectly to population level impacts. During breeding season, Slavonian grebes fly relatively infrequently, and at night, and it is very difficult to accurately determine the level of flight activity across any given area. It is known however that Slavonian grebes can move between lochs in March / April before they settle down on one to breed. It is also possible that birds may undertake more substantial movements from lochs after breeding has ceased. Although very subtly, the barrier effect could potentially increase the duration of individuals' flights between lochs and impact on fitness, thus affecting productivity and survival rates.

Of all three SPAs considered here, Loch Ruthven SPA holds the highest number of breeding Slavonian grebes. At designation up to 14 pairs were nesting there, which in 1989-1993 constituted almost 20% of the total Scottish breeding population. The recent breeding records (up to nine pairs recorded in 2021) show a decline in the number of breeding pairs, however, Loch Ruthven SPA is still a national stronghold for Slavonian grebe. The number of Slavonian grebes breeding at North Inverness Lochs SPA is much lower (one to two pairs). Loch Ashie SPA is not designated for breeding Slavonian grebes but as a moult site where grebe congregate after the breeding season. As the most important known moult site in Scotland (up to 46 individuals were recorded there in the early 90's), it was the reason for SPA designation.

As mentioned earlier, during the breeding season Slavonian grebe are mainly sedentary, and major dispersal flight activity is expected after the breeding season. These flights are undertaken from individual breeding sites towards the established moult sites and the coastal areas to the northeast. As such, the predominant flight direction from Loch Ruthven SPA would be expected towards the nearest moult site to the north (Loch Ashie SPA). Similarly, grebes from North Inverness Lochs SPA would disperse northeast reaching Loch Ashie SPA or the coastal areas in the Moray, Beauly and Cromarty Firths. Given that the Proposed Development is located southwest of the three SPAs considered here, and at considerable distance from each of them (11-22 km), the likelihood of autumnal dispersing flights associated with these SPAs across the Proposed Development is negligible. Similarly, any migratory movements in spring (birds moving from the coastal areas southwest towards the breeding sites) are likely to concern a very small number of Slavonian grebes, with the majority of them settling down at Loch Ruthven SPA and to the north of Loch Ness, and not reaching the Proposed Development. Also, given the current population size of Slavonian grebes in the Great Glen area, the number of individuals available for impact will be negligible. In the light of the above, displacement is not considered a realistic impact pathway that could result in a likely significant effect, therefore it is screened out from the SIAA for Loch Ruthven SPA, North Inverness Lochs SPA and Loch Ashie SPA.

Potential Effects for the project in combination with other projects and plans

In relation to the Proposed Development, the information presented above on displacement suggests that the Proposed Development would contribute no impact on the Slavonian grebe populations within Loch Ruthven SPA, North Inverness Lochs SPA and Loch Ashie SPA. There is therefore no potential for Likely Significant Effects in combination with other projects and in combination effects are screened out of the SIAA.

5.4.4 River Moriston SAC

Relevant Ecological Information

Freshwater pearl mussels (hereafter referred to as 'mussels') are the primary qualifying feature, have a complex life cycle that in the initial larval (glochidial) stage requires the presence of a salmonid host species, trout or salmon, onto which they attach and remain on gills for approximately nine months. Juvenile mussels then drop off and reside in gravel within rivers. A healthy population of salmonids is critical in allowing population growth and sustaining a juvenile population of mussels. Mussels are unlikely to be impacted by changes in water flow regimes caused by the outlet or intake flow associated with the development due to distance and existing flows in the River Moriston, however, salmonid host species required to fulfil specific life stage requirements may be.

Atlantic salmon (hereafter salmon) have a complex life cycle that involves moving between freshwater and saltwater. The juvenile stage varies between one to four years in freshwater during which salmon play an important role as a host for larval glochidia. Salmon then undergo 'smoltifcation', a series of physiological adaptations, in preparation for the saltwater of marine environments during their migration in early spring. Salmon grow to maturity within marine environments before migrating back to their natal rivers to spawn, fish that survive return to marine environments as 'kelts'. Although adult life stages are not critical to mussels as hosts, they are critical in maintaining a healthy host population of juvenile fish for mussels. Consequently, to ensure a healthy host population, protection of salmon at all life stages is critical.

The impact pathway for salmon is considered the same for mussels due to the dependencies of mussels on salmon as a host species. The impacts on mussels are thus considered under the potential impacts to salmon, and not considered separately unless direct effects may also affect mussels other than through host availability. It is also recognised that salmon comprise one of two potential salmonid host species for mussels in Loch Ness, with trout (*Salmo trutta*) also widely abundant in Loch Ness and the River Moriston. Consequently, a complete absence of salmon as a host species is not indicative of a total lack of host species for mussels.

At its nearest point the mouth of the River Moriston is 1.8 km from the shoreline of the Development.

Potential Effects for the project alone

Decrease in Loch Ness water level during periods of water abstraction may lower water levels in the mouth of the River Moriston placing mussels outwith preferential habitats

Rapid water level decreases may leave mussels at the extent of their preferential depth range of 0.1 – 2 m (optimal 0.3 - 0.4 m) and at risk of desiccation induced mortalities if aerial exposure is maintained or increased predation risk if mussels are partially or wholly exposed. Limited evidence[108] suggests mussels are able to adopt behavioural strategies to track receding water levels (horizontal movement) or by burrowing into the substrate (vertical movement), however, such traits are population specific and are unknown for those residing in the SAC, this effect is therefore **screened into the SIAA**.

Increase in Loch Ness water level during periods of electricity generation may cause 'water back up' in the mouth of the River Moriston placing mussels outwith preferential habitats

Rapid water level increases may submerge mussels outwith optimal habitats of 0.3 - 0.4 m. This is unlikely to severely impact mussels that are potentially capable of vertical and / or horizontal movement to reach optimal depths. Similar to the above, due to the lack of population specific behavioural traits, behavioural responses are unknown and consequently this has been **screened into the SIAA**.

Increase in Loch Ness water level may cause periods of slack water in the mouth of the River Moriston

At the mouth of the River Morison the impact of changing flow regimes may result in slack water periods during rapid water level rise in Loch Ness with the potential to place mussels outwith their optimum habitat preferences of flow: 0.1 - 2.0 ms^{-1}. Due to mussels being able to tolerate extremely low velocity the change is unlikely to impact mussels significantly. Additionally, populations of mussels elsewhere, such as those present on the River Tay, Perthshire, are known to tolerate tidal areas of the river where river water becomes slack on a regular occurrence [109] or in primarily slack loch margins[110], consequently this has been screened out of the SIAA.

Nutrient Enrichment resulting from construction works

---

[108] Curley, E. A. M., Thomas, R., Adams, C. E. and Stephen, A. (2021). Adaptive responses of freshwater pearl mussels, *Margaritifera margaritifera,* to managed drawdowns. Aquatic Conservation 32(3).

[109] Gavia Environmental. (2020). Stormontfield Lade Freshwater Pearl Mussel & Lamprey Survey. Report no: GEL20195.

[110] NatureScot. (2023). Freshwater pearl mussels discovered in Scottish Lochs. [Online].

Mussels are known to be acutely sensitive to elevations in soluble reactive phosphorous in water with tolerance thresholds of 0.03 mg/l[111]. Construction related activities, such as the erosion of rocks, fertilisers for compensation vegetation may be transported into Loch Kemp and transferred to Loch Ness via tributaries and/or pumps that have the potential to effect mussels in the mouth of the River Moriston. Due to the dilution factor of Loch Ness and the distance between source and receptor, this is not likely to impact mussels and has been screened out of the SIAA.

Salmon may become impinged on intake screen during periods of abstraction

Mortalities are unlikely to occur due to maximum intake draw velocities being limited to escapable velocities (<0.3 m/s at 100 m) to prevent impingement. Mortalities associated with impingement, or associated mortalities from increased energy burdens escaping draw, go against natural selection processes and may remove genetic traits favourable in other parts of the life cycle. Migrating smolts are the most vulnerable life stage to this potential effect due to smaller body size and weakened swimming ability in comparison to adults. Kelts, weakened from spawning / migrating may be additionally vulnerable. It is possible that prior weakened / injured individuals may be unable to escape the water draw, however, the ability of such fish to migrate to the sea without predation / mortality is extremely low and therefore loss to the population is unlikely to be greater than currently experienced. Due to the potential impact on salmon at multiple life stages this has been **screened into the SIAA.**

Intake flow attracting downstream migrating salmonid smolts

Salmon and sea trout smolts passively migrate downstream during a period of 'smoltification', whereby freshwater salmonid smolts undergo the physiological and behavioural changes to adapt to saltwater environments following the current of rivers. There is a potential impact that smolts migrating from the River Moriston SAC to the marine environment may be attracted to the intake during periods of water abstraction. In the absence of comprehensive smolt tracking studies within Loch Ness, it is unknown which route smolts currently take through the loch. Smolt tracking studies in similarly large Scottish Lochs and European lakes have shown high diversity in migration pathway (including the regular crossing of waterbodies)[112,113]; it is uncertain as to how many smolts migrating downstream may be attracted in an unmitigated scenario, however the whole smolt population is unlikely to be attracted *en masse*, due to the aforementioned diversity of pathways and timing of migrations, however those which migrate past the intake and could potentially be affected.

For the purposes of assessment, using the precautionary principle, it is assumed that a large proportion of the River Moriston SAC smolts pass the Proposed Development. Movement is associated with a potential increased energy burden due to additional distance covered before reaching the marine environment and an increased predation risk with additional time spent in the loch and at the inlet point. Post-disturbance mortality at sea due to cumulative energy burdens may additionally occur. The maximum intake velocity across the screen will be <0.3 m/s. The sustained swimming speed of salmon with a minimum body length of 0.15 m is 0.54 m/s, faster than the predicted maximum velocity[114]. Consequently, salmon at all life stages are predicted to have the ability to overcome the velocity of the draw preventing potential mortalities or associated injuries with impingement on the screens. Entrainment of fish is unlikely to cause significant mortalities due to the inclusion of fine mesh (12.5 mm) screens over the intake in initial designs. Screens of 12.5 mm have observed deflection efficiencies of

[111] Scottish Natural Heritage (now NatureScot). (2011). River South Esk Special Area of Conservation (SAC) Advice to planning applicants.

[112] Lilly, J., Honkanen, H. M., McCallum, J. M., Newton, M., Bailey, D. M. and Adams, C. E. (2022). Combining acoustic telemetry with a mechanistic model to investigate characteristics unique to successful Atlantic salmon smolt migrants through a standing body of water. *Environmental Biology of Fishes.* 105. pp. 2045-2063.

[113] Hanssen, E. M., Vollset, K. W., Salvanes, A. G. V., Barlup, B., Whoriskey, K., Isaksen, T. E. N., Hulbak, M. and Lennox, R. J. (2021). Acoustic telemetry predation sensors reveal the tribulations of Atlantic Salmon (*Salmo salar*) smolts migrating through lakes. *Ecology of Freshwater.* 31(2): 424-437.

[114] Tang, J. and Wardle, C. S. (1992). Power Output of Two Sizes of Atlantic Salmon (*Salmo salar*) at their Maximum Sustained Swimming Speeds. Journal of Experimental Biology 166.

89%[115]. Due to the potentially significant impacts on migrating salmon stages this has been **screened into the SIAA.**

Outlet flow attracting adult migrating salmonids

Adult salmon actively migrate upstream to spawn against water currents where they illustrate rheotaxis responses (turning to face oncoming currents). The presence of an additional flowing water source may attract upstream migrating salmon to the water outlet instead of the River Moriston during periods of power generation. This has the potential effect of delaying migration, increasing energy burdens and predation risks. Fish may be delayed for the duration of a generation cycle (up to 15 hrs). A reduction in adult salmon reaching the River Moriston reduces eggs fertilised with knock-on effects on juvenile populations in the following years reducing host availability for mussels. Embedded mitigation within construction design includes the use of vanes at the end of the intake / outlet point to dissipate flow prior to release into Loch Ness to reduce the attractiveness of outflows. As the potential impact without embedded mitigation is considered high, this has been **screened into the SIAA.**

Rapidly changing temperature regimes in the immediate vicinity of the water outlet

Considering the placement of the tailrace in Loch Ness, the capacity of Loch Ness to buffer incoming water changes is high due to the high volume of receptive water, consequently water changes in the scale of Loch Ness are considered minimal and are unlikely to influence water temperatures in the River Moriston and therefore mussels in the SAC.

During periods of electricity generation, the water outlet may rapidly increase the water temperature by several degrees with the potential to cause thermal shock to salmon host species that may utilise the outlet area as a migration route including salmon smolts, spawning adults and kelts. As a result of potential presence of salmon in this area, the effect of rapidly changing temperature regimes have been **screened into the SIAA.**

Water transfer between Loch Kemp and Loch Ness may introduce foreign pathogens

During periods of abstraction and generation, water is exchanged between Loch Kemp and Loch Ness creating a potential risk that any pathogens present in Loch Kemp (but not in Loch Ness) may be introduced into Loch Ness. This may introduce diseases or harmful bacteria that may affect both mussels and salmon. Whilst there is a pathogen pathway, the potential new impact is extremely low considering Loch Kemp has existing tributaries discharging into Loch Ness, therefore this has been screened out of the SIAA.

Water transfer between Loch Kemp and Loch Ness may facilitate and / or increase invasive non-native species transfer

During periods of abstraction and generation water is exchanged between Loch Kemp and Loch Ness creating a potential risk that invasive non-native species (INNS) may be transferred to Loch Ness where they may affect mussels and / or salmon.

Pump storage hydro schemes have the potential to transfer INNS via water exchange between lochs, however, given no INNS species were recorded within Loch Kemp (in comparison to Loch Ness) (see Volume 1, Chapter 12: Aquatic Ecology of the EIA Report) it is highly unlikely any additional species will be introduced.

It is acknowledged that the risk to Loch Ness is lower than the risk to Loch Kemp due to the greater abundance of species and INNS present within the River Ness catchment, however, the risk to Loch Kemp is outwith the scope of the HRA and is therefore screened out of the SIAA.

Importing materials may facilitate invasive non-native species transfer in Loch Ness during construction phase

Importing of materials during the construction phase creates a potential risk that invasive non-native species (INNS) may be transferred to Loch Ness where they may affect mussels and / or salmon. Given the distance

[115] Environment Agency. (2016). Testing the effectiveness of fish screens for hydropower intakes.

between the SAC, approximately 1.8 km, and the construction site, it is unlikely that spread of most types of INNS would reach the SAC and impact qualifying interests directly. During the construction phase the risk of spread of INNS is reduced, through Biosecurity measures incorporated into the Construction Environmental Management Plan (CEMP) and this effect is consequently screen out of the SIAA.

Increased sedimentation / turbidity (non-toxic) in areas adjacent to the SAC during construction phase

Increased sedimentation (as a result of dust and track run off) in water in Loch Ness during construction may impact salmon host species through impaired respiration via effects on gill function. Given the distance between the SAC, approximately 1.8 km, and the construction site, it is unlikely that sedimentation will reach the SAC and impact mussels directly but may indirectly affect future recruitment success due to lack of available host species. The impact to host species is likely insignificant as the dilution effect of suspended sediment will be quick given the volume of water in Loch Ness resulting in quick settling of material. Salmon also have the ability to move out of the way of any instances of localised pollution within the loch. Consequently, this risk is short-lived. Limited potential for risk is given to salmon in the immediate vicinity of construction where sedimentation and / or increased turbidity is likely to occur, moreover salmon are able to actively avoid such areas consequently this is screened out of the SIAA.

Risk of contamination (toxic) from fuel / chemical leakages / and concrete spills (construction phase)

A deterioration of water quality could adversely affect salmon interests, which could in turn affect mussels due to a reduction in available host species. Given the distance between the SAC, approximately 1.8 km, and the construction site, it is unlikely that contaminants will reach the SAC and impact mussels directly but may indirectly affect future recruitment success due to lack of available host species. Fuel / chemical leaks high in concentration may directly kill salmon host species in the direct vicinity. Fuel / chemical leaks in low concentration may have sub-lethal effects on salmon affecting health and ability to complete migration. During the construction phase the risk of pollution is reduced, through a pollution prevention plan (PPP) incorporated into the Construction Environmental Management Plan (CEMP) and a water quality monitoring programme and is consequently screen out of the SIAA.

Risk of noise disturbance from heavy machinery, sediment movement, temporary cofferdam

Noise has the potential for behavioural, sub-lethal and lethal effects dependent on the distance between noise and receptor, extent and duration of noise. The impact of noise on mussels is currently unknown but predicted to be of potentially low risk due to increased distance between source and receptor (1.8 km).

Noise disturbances are likely to involve loud and irregular noise with the use of loud machinery/piling; constant high noise disturbance is not predicted. Salmon are known sensitive noise receptors with enhanced auditory senses capable of detecting low frequency acoustic stimuli below 380 Hz, on par with the dominant frequencies associated with piling during construction periods[116]. Exposure to such was not linked to observed differences in marine stage salmon behaviour or 'startle responses' to sudden noises suggesting construction noise is not likely to impact behaviour or migration routes.

Currently literature on the impact of smolts (in freshwater) in response to noise is not available, they are known, however, to have more acute auditory receptors enhancing hearing sensitivity than adult salmon[117].

Operational noises are predicted to be significantly reduced compared to construction noises with potential impacts minimised. Additionally, the noise from the immediate falls in the River Moriston should provide some

[116] Hawkins, A. D. and Johnstone, A. D. F. (1978). The hearing of the Atlantic salmon, *Salmo salar*. Journal of fish biological 13.
[117] Marine Scotland. (2016). Measurement of Hearing in the Atlantic salmon (*Salmo salar*).

background noise of which fish will either be accustomed to or provide background noise to mask construction noises when in the River Moriston. Resultingly noise is screened out of the SIAA.

Fish aggregation effect from aquatic infrastructure

Many fish species are attracted to anthropogenic structures. Structures are considered to serve as new habitat and provide cover for fish instream or in lochs. However, given the strong migratory urges of salmon and the dismissal of other anthropogenic structures such as piers and pipe outlets, it is unlikely to result in the direct aggregation of salmon in Loch Ness. Any delay in migration has the potential to incur increased predation risk, if fish are consistently attracted to the infrastructure, predators may favour outlet areas for 'hunting' resulting in inflated predation beyond average Loch levels. Predators within Loch Ness include, but are not limited to, otter (*Lutra lutra)*, pike (*Esox lucius*), various species of fish eating birds and American mink (*Neovision vison*). Given the extensive range of anthropogenic infrastructure in Loch Ness, including fish farms, piers and large power stations (e.g. Foyers Power Station) and their distribution throughout the length of Loch Ness, the addition of further structures is unlikely to cause strong aggregation effect and resultingly is screened out of the SIAA.

Reduction of water levels in Loch Ness impeding migration

Although Foyers PSH is operational and considered part of the baseline, there could be a situation where the Proposed Development would be operational when Foyers PSH is not. This section of the assessment therefore considers potential impacts on water levels in Loch Ness under a scenario where the Proposed Development is operating in isolation. An assessment of the likely significant effects on salmon migration at the Ness Weir in combination with Foyers PSH and other consented schemes in Loch Ness is provided separately.

The proposed operational regime of the Proposed Development would operate largely within the current maximum and minimum range of loch levels in Loch Ness, due to the implementation of stop pumping (or 'hands off') and stop generating levels enforced through the CAR Licence (see **Volume 1, Chapter 7: Water Management** of the EIA Report for further details). These levels would be agreed with SEPA, but the stop pumping level of the Proposed Development would be above the stop pumping level assigned to the operational Foyers PSH to ensure it does not restrict the operation of the existing PSH. Foyers PSH in turn has a stop pumping level applied to ensure it does not draw water down below the minimum levels required for the operation of the Caledonian Canal and to maintain a compensation flow over the Ness Weir (see **Volume 2, Figure 7.3: Historic Loch Ness Levels with Pumped Hydro Curtailment Levels** of the EIA Report).

The maximum operational drawdown within the lower reservoir (Loch Ness) during a pumping cycle (i.e. when water is pumped up to and stored in the upper reservoir) would be approximately 0.37 m if the Proposed Development was operating in isolation, including during periods when smolts are migrating. However, this represents an absolute worst-case scenario, where the upper reservoir would be filled from the minimum to maximum level. Current trends in other operational PSH schemes indicate an average dispatch time of 4 hours. If this scenario is assumed as the reasonable worst-case scenario, water levels in Loch Ness would reduce by 0.08 m during four hours of pumping operation. During generation cycle (when water is released from the upper reservoirs) within the same scenario, water levels in Loch Ness would increase on average by 0.10 m during four hours of generation (see **Volume 1, Chapter 7: Water Management** of the EIA Report for further details). However if either the stop pumping or the stop generating level in Loch Ness were reached during a cycle, operation of the Proposed Development would cease and it would enter standby mode.

As the stop pumping level applied to the Proposed Development (through the CAR Licence) would be above the stop pumping level of the Foyers PSH, the impact on smolt migration at the Ness Weir would be less for the Proposed Development in isolation (i.e., if the Proposed Development were to abstract water from Loch Ness without Foyers PSH abstracting) than the existing baseline scenario, where Foyers PSH is abstracting water from Loch Ness in isolation. A reduction of water levels in Loch Ness impeding migration has therefore been **screened out of the SIAA** for the Proposed Development in isolation. An assessment of the likely significant effects on salmon migration at the Ness Weir in combination with Foyers PSH and other consented schemes in Loch Ness is provided separately.

Potential Effects for the project in combination with other projects and plans

Given that there is the potential for significant effects upon the River Moriston SAC, there is the potential for in combination effects with other proposed projects and plans, and those existing, that could also adversely affect the River Moriston SAC. In combination effects upon the River Moriston SAC have been assessed by considering other developments and plans within the River Moriston SAC, and those connected by aquatic features that may relay effects regardless of distance from the development Site. Other consented and operational pumped hydro schemes on Loch Ness that could potentially impact the River Moriston SAC have been considered in the assessment of potential effects. Due to the need for detailed assessment, all potential in combination effects considered in the Stage 1 screening are included in the SIAA.

Increase in frequency of maximum and minimum water levels if multiple hydropower schemes abstract / release water during the same period

Multiple hydropower schemes releasing (generating) water at the same time has the potential to increase the rate at which maximum water levels are achieved and the frequency that they are reached in Loch Ness. Consequently mussels at the deeper extent of preferential depth range, at 2 m, may be placed outwith preferential depths more frequently.

Multiple hydropower schemes (inc. operational and consented) abstracting (pumping) water at the same time has the potential to increase the frequency that minimum water levels are reached in Loch Ness. The increased frequency of water level decrease may leave mussels unable to trail falling water levels more frequently with a potential increase in predation and risk of desiccation. Due to the presence of mussels within the River Moriston only and not the shoreline of Loch Ness, the existing flow of the River Moriston should buffer water level fluctuation. Combined with the presence of mussels outwith established depth preferences this is unlikely to further affect mussels and as such has been screened out of the SIAA.

Increased sedimentation in the lower reaches / mouth of the watercourse due to decreased bank stabilisation resulting from frequently changing water flow regimes deteriorating water quality, detrimental for mussels, may additionally become exacerbated due to increase in rise / fall in water level when multiple pumped storage hydro schemes are operational. However, due to the gradual increase / decrease of water levels this is unlikely to increase erosion in these areas and has consequently been screened out of the SIAA.

Reduction of water levels in Loch Ness impeding migration

The Proposed Development, Foyers PSH and Red John PSH would all operate within their respective stop pumping (or 'hands off') and stop generating levels. For the Proposed Development and Red John, these levels would be / have been agreed with SEPA through their respective CAR Licences, but the stop pumping level of both these developments would be above the stop pumping level assigned to the operational Foyers PSH, which the Applicant understands is dictated by the agreement between British Waterways (BWB, now Scottish Canals) and North of Scotland Hydro-Electric Board (NoSHEB, now SSEN Renewables) (1970)[118]. Due to the implementation of these stop / stop generating levels, even under a scenario where all three PSH schemes were operating simultaneously, variation in water levels would continue to operate largely within the current maximum and minimum range of levels in Loch Ness, but it is likely that there would be more variation in water level between these limits with multiple PHS schemes operating on the loch. Further details are provided in **Chapter 7: Water Management** of the EIA Report.

If all three PSHs were to undergo a pumping cycle (i.e. when water is pumped up to and stored in the upper reservoirs) simultaneously, the maximum operational drawdown within the lower reservoir (Loch Ness) would be approximately 0.73 m. However, this represents an absolute worst-case scenario, where the upper reservoirs

[118] Notwithstanding this, the stop pumping level that would be allocated to the Proposed Development through the CAR Licence process would not be below the stop pumping level of Foyers PSH.

would all be filled from the minimum to maximum level simultaneously. Current trends in other operational PSH schemes indicate an average dispatch time of 4 hours. If this scenario is assumed as the reasonable worst-case scenario, water levels in Loch Ness would reduce by 0.15 m over a four-hour period of pumping. During generation cycle (when water is released from the upper reservoirs) within the same scenario, water levels in Loch Ness would increase on average by 0.21 m during four hours of generation. However, if loch levels breached the allocated stop pumping or stop generating level of any of the PSH schemes, operation would cease and the PSH would enter standby mode. When loch levels are low, both the Proposed Development and Red John PSH would reach their stop pumping level and need to cease operation before Foyers PSH. Foyers PSH would therefore remain the primary driver of the minimum loch level during these drier periods.

The level of the main fish pass crest at Ness Weir is at a level of 14.93 m AOD, which is well below the stop pumping level of the Foyers PSH and therefore also below the stop pumping level that would be applied to both Red John PSH and the Proposed Development. The operation of the Proposed Development in combination with other projects would therefore not restrict or impede the use of the main Ness Weir fish pass by salmon, including smolts, and other migratory fish species.

The stop pumping level of the Foyers PSH (i.e. the baseline scenario) is below that of the smolt pass level (15.48 m AOD) at Ness Weir. It is anticipated that this would also be the case with proposed operational limits of the Red John PSH and the Proposed Development, albeit the 'stop pumping' levels of these developments would be higher than the existing Foyers PSH scheme, so Foyers PSH would remain the primary driver of the minimum loch levels during periods of abstraction. Periodic reductions in Loch Ness water levels by up to 73 cm as a result of abstraction cycles of multiple PSH schemes simultaneously may result in water levels falling below the smolt pass level at Ness Weir more frequently, including during periods when smolts are migrating. Resultingly, smolts which migrate into the Caledonian Canal (a known hotspot of smolt mortality in the River Ness Catchment) may be further delayed on their migration compared to the existing scenario, where only Foyers PSH is abstracting water from Loch Ness at any time. Due to the potential increased mortality of smolts this effect has been **screened into the SIAA**.

Increased energy burden associated with navigating anthropogenic structures and / or barriers to migration

Anadromous fish species require unimpeded migration routes between marine and freshwater environments. Abstraction of water from the development and / or other hydropower developments in the River Ness catchment may reduce flow into the River Ness preventing the movement of fish and / or trapping fish in holding pools. The Caledonian Canal runs parallel to the River Ness at the outlet of Loch Ness (Loch Dochfour). This can present an impact on downstream migrating fish as they follow the water draw of the canal rather than following the natural river course at Ness Weir and become lost or delayed on their migration. This can then result in losses due to predation and energy expenditure. The initial results of the Ness 'Missing Salmon Project' (a tracking study) detected salmon smolts (3 individuals) entering the Caledonian Canal at Dochfour and not subsequently detected versus smolts which went down the River Ness (11 individuals, 9 of which were detected on the final receiver)[119]. These effects on upstream adult migration and downstream smolt migration have the potential to increase overall migration times with associated energy burdens, increased predation risk and poaching risk whilst stationary (adult salmon). Stress burdens have additionally been known to cause disease outbreaks in populations[120]. The influence of navigating multiple anthropogenic barriers, including impassable flow conditions, due to changing flow regimes in the River Ness increases the overall burden on fish. Resultingly, this has been **screened into the SIAA.**

[119] Scottish Centre for Ecology and the Natural Environment. (2019). Ness 'Missing Salmon Project' 2019. [Online].

[120] Mateus, A. P., Power, D. M. and Canário, A. V. M. (2017). Stress and Disease in Fish. *Fish Diseases Prevention and Control Strategies.* pp. 187-220.

Combined abstraction of water has the potential to reduce water flow in the River Ness

Migrating salmon access the River Moriston SAC via the River Ness and Loch Ness, therefore hindrance or disruption to upstream migration at any stage may prevent adult salmon from reaching spawning grounds. A delay in adult salmon migration may result in increased energy and stress burdens as previously discussed. The main fish pass at Ness Weir is at a level of 14.93 m AOD, which is well below the stop pumping level of the Foyers PSH and therefore also below the stop pumping level that would be applied to Red John PSH and the Proposed Development. The operation of the Proposed Development in combination with other projects would therefore not restrict or impede the use of the main Ness Weir fish pass by salmon, including smolts, and other migratory fish species. Resultingly, this has been screened out of the SIAA.

Combined noise effect

Cumulative noise effects from multiple Developments in overlapping operation periods may result in excessive noise production. Noise of existing hydro schemes, notably in Loch Ness, have not been linked to damage and/or injury of salmon at multiple life stages. As Developments are spaced out within Loch Ness noise will likely dissipate and not result in overlapping areas where higher noise exposure may result. Resultingly, this has not been screened into the SIAA.

5.4.5 Urquhart Bay Wood SAC

Relevant Ecological Information

A detailed ecological-hydrological assessment of the potential impact of the project on Urquhart Bay Wood SAC is provided in Appendix 1 of this report and has been summarised within the relevant sections of this HRA report as appropriate[121].

Urquhart Bay Wood SAC is representative of Residual Alluvial Forests (listed under Annex 1 of the EU Habitats Directive), and two NVC vegetation types are represented in the SAC according to the Conservation Advice Package, namely *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland (W7) and *Fraxinus excelsior - Sorbus aucuparia - Mercurialis perennis* woodland (W9b). The woodland system is characterised by frequent inundation by floods, changes in channels and accumulation of woody debris during flood events.

Residual Alluvial Forests typically comprise fast-growing, early successional canopy tree species (e.g. willow, alder, birch) that rely on periodic disturbances for the creation of suitable recruitment sites for seedlings. The canopy trees often do not survive more than 60-80 years and thus, medium to high-magnitude floods are needed at least every 50 years for the forest renewal. The magnitude and frequency of flood events are crucial aspects of maintaining the structure and species composition of Residual Alluvial Forests, with the most important flood events being low-frequency high-magnitude floods and intermediate-frequency medium-magnitude floods[122]. Low-frequency high magnitude floods have significant impacts on the floodplain landscape and allow for extensive regeneration of riparian communities. Intermediate-frequency medium-magnitude floods have more of a maintenance function, particularly in clearing dead vegetation and maintaining historical levels of riparian vegetation, but also contribute fine sediments that create additional sites for seedling recruitment. High-

[121] The hydrological modelling data have been updated since the eco-hydrological report within Appendix 1 was completed. Whilst the hydrological modelling has changed, the principal of the loch level varying within existing limits remains the same. The hydrological modelling update does not have a material effect on the eco-hydrological report contained in Appendix 1, and does not change the conclusions of the report. The hydrological modelling of levels in Loch Ness, upon which the report is based, was originally based upon observed level information from the SEPA gauge at Foyers. This original dataset had just under 5 years of observations, based on the availability of information at the time. To improve the accuracy of the analysis a longer-term dataset was identified at the SEPA gauge at Ness-side. This dates back to September 1972 providing 50 years of historic flow information which was manipulated to estimate loch levels within Loch Ness over the period. The project engineers consider the longer duration dataset a more robust basis for evaluation of the impact of pumped hydro on Loch Ness levels.

[122] Barsoum, N., Anderson, R., Broadmeadow, S., Bishop, H. and Nisbet, T. (2005). Eco-hydrological guidelines for wet woodland - Phase I. English Nature Research Report No. 619.

frequency low-magnitude floods do not play an important role in habitat creation, but do contribute to recharging underground water resources, depositing sediment and maintaining sites where pioneers have established. High frequency flooding is also likely to play a role in preventing the establishment of terrestrial invasive species that cannot tolerate frequently inundated conditions.

The SAC is underlain by superficial deposits of alluvium which are characterised by a poorly sorted matrix of sand, silt and clay. The lower-lying reaches of the SAC are dominated by fine sediments such as clay, resulting in waterlogged conditions, and this will retain water even when water levels decrease (i.e. have low permeability). The high-lying reaches have coarser alluvial soils that have deposited in flood events on top of the fine sediments and thus drain more easily (i.e. these soils have higher permeability).

Potential Effects for the project alone

Fluctuations in water levels of Loch Ness from operation of Loch Kemp Storage

Loch Ness has a drainage area of approximately 1,800 km^2 and is roughly 40 km long with a surface area of 55 km^2. The Loch is fed by numerous rivers such as the Oich, Morriston, Foyers, Enrich and Coiltie, each of which makes a contribution to the loch water level. However, Loch Ness responds relatively slowly to inputs from these rivers as a result of its large size and capacity to temporarily store water and there is a lag in changes to the loch water level as a result of inflows. Loch Ness also forms part of the Caledonian Canal which joins the loch at Dochfour and Fort Augustus locks. The level of Loch Ness and the adjoining canal network is controlled by the Dochfour Weir structure (Ness Weir) which includes the SSE Renewables operated sluice gates that provide river flows downstream when the loch levels are lower than the weir.

Operation of the Proposed Development is expected to result in more frequent variation in Loch Ness water levels, within likely daily and weekly cycles during pumping and generation cycles.

The lowest level of Loch Ness is governed by the existing operational Foyers Pumped Storage Scheme, which has the potential to draw down lower than Kemp or Red John (a consented Pumped Storage Scheme on Loch Ness), and Kemp would always operate above these levels, and therefore the lowest current minimum level of the Loch would not be exceeded by the Proposed Development, although the minimum level in Loch Ness may be approached more often. It is the Applicant's understanding that the 'stop pumping' level of Foyers PSH is dictated by the agreement between British Waterways (BWB, now Scottish Canals) and North of Scotland Hydro-Electric Board (NoSHEB, now SSEN Renewables) (1970) and is given as 15.27 mAOD in Volume 1, Chapter 7: Water Management[123]. It is expected that future schemes will be subject to regulation by SEPA and that stop pumping levels would be defined in CAR licenses. The preliminary CAR licence application for the Kemp project proposed a stop-pumping level of 15.33 mAOD for the Proposed Development, although a slightly higher value was used in modelling undertaken by Mott MacDonald for Gilkes Energy, with an intermediate level assumed for Red John. Setting higher thresholds for future schemes is intended to protect the existing scheme. Application of the Foyers threshold of 15.27 mAOD essentially means that the loch level should not drop below that value. In an extreme drought, compensation releases to the River Ness could result in a slightly lower level, but at this level no PSH schemes would be abstracting water from Loch Ness, and the size of the Loch Ness catchment means that inflows are nearly always greater than the required release.

The maximum current flood level of Loch Ness is unlikely to be exceeded for any significant period of time, as a result of the "stop generating" level which would stop operation of the scheme when the Loch Ness level exceeds the 1-in-10 year flood risk level (see Figure 8.5 in Appendix 1).

Data on the current water levels within Loch Ness have been collected (for April 2014 – present from Foyers, and September 1972 – present from Ness-side, on the River Ness downstream of Loch Ness); full details and a comparison between gauge locations is provided in Appendix 1. In summary, Loch Ness currently experiences

[123] Notwithstanding this, the stop pumping level that would be allocated to the Proposed Development through the CAR Licence process would not be below the stop pumping level of Foyers PSH.

significant spikes in water level at certain times of the year, however these are brief in duration and would not result in prolonged inundation of the shores of Loch Ness.

Graphs showing the daily mean water levels at Foyers, the average diurnal pattern of Loch Ness levels, and the historic water levels in Loch Ness in relation to the Foyers stop pumping threshold, for the period April 2014 to April 2023, are provided in Appendix 1. The extreme daily mean loch levels are 3.555 m on 8 March 2015 and 1.162 m on 28 May 2023; these equate to 17.72 and 15.32 mAOD respectively. The 15-minute data show a minimum of just over 15.25 mAOD, marginally below the Foyers stop-pumping level. With a wet year at the start and a couple of dry years towards the end of the dataset, there is a suggestion of a downward trend in water levels, but the data set is too short for drawing conclusions.

The data have been used to model the manner in which historic flood levels inundate different extents of Urquhart Bay Wood. This concludes that a small proportion of the woodland vegetation was inundated for 1% of the time during the period used for modelling (April 2014 to April 2023), and significant areas were inundated only during large flood events (1:10 year or greater), such as in March 2015 (see Appendix 1 for limitations of the modelling).

Appendix 1 provides an assessment of the effect that the operation of the Caledonian Canal system has on current loch level fluctuations, based on data provided by Scottish Canals for the nearest lock, Dochgarroch Lock. It is concluded that the contribution of locking is negligible in the consideration of current water level variations in Loch Ness.

When operating at full capacity and generating at up to 600 MW of power, the Proposed Development would transfer a maximum of 22 Mm^3 between the upper (Loch Kemp) and lower (Loch Ness) reservoirs, which would result in a rate of change of 0.025 – 0.03 m/hr.

Modelling has been undertaken to predict water level fluctuations when the Proposed Development is in operation, using approximately five years of Foyers data, which is considered to give a reasonable representation of the loch level regime (see Appendix 1 for full details and justification).

Current trends indicate an average pumped storage dispatch time of four hours. This would mean a rise in Loch Ness of 105 mm over four hours during a Generation Cycle. Pumping for the same duration would lead to a drop in Loch Ness of 74 mm.

Urquhart Bay Wood SAC is on an alluvial delta at the confluence of the Rivers Enrick and Coiltie as they flow into Loch Ness, and meets the shoreline of Loch Ness along the eastern SAC boundary, and is therefore hydrologically connected to Loch Ness. There is therefore a pathway for potential effects as a result of water level fluctuations within Loch Ness. Given the presence of the potential pathway for effect, and due to the requirement for detailed assessment, it is screened into the SIAA.

Potential Effects for the project in combination with other projects and plans

Fluctuations in water levels of Loch Ness from combined operation of Kemp, Foyers and Red John PSS

Modelling has been undertaken to predict the water level fluctuations within Loch Ness when existing and consented pumped storage schemes are operating in combination with the Proposed Development (see Appendix 1). This includes the operational Foyers and consented Red John.

The average dispatch time of four hours has been used to model a Sensible Worst Case Scenario, i.e. with all schemes operating simultaneously but not necessarily at full capacity in terms of flow rate and duration. Given the difference in storage volumes and catchment of each, this scenario is unlikely to happen regularly. If all three pumped storage schemes are operating simultaneously, the water level in Loch Ness would rise by 205 mm over four hours, and pumping for the same duration would lead to a drop in Loch Ness water levels of 143 mm. Under the scenario of all three pumped storage schemes operating, the level exceeded on average for 1% of the time (i.e. 3-4 days per year) may increase by around 100 mm and there would be a small reduction in the average loch level of around 50 mm.

Under an Absolute Worst Case Scenario of all three PSS schemes operating simultaneously at full capacity (i.e. total drawdown), the maximum water level of Loch Ness would be 660 mm above the current average water level and minimum water level would be 537 mm lower than the current average.

The potential impacts of climate change on Loch Ness water levels were not assessed as part of this assessment. Broad climate change predictions for Scotland predict drier summers and wetter winters. Summers may contain frequent or longer periods of low loch water levels, which could result in curtailment of pumped storage operation. Nonetheless, climate change should not result in any fundamental change to how pumped storage would impact loch levels, such as diurnal variation in water levels, slightly higher maximum levels and slightly lower average levels. There is also some potential for pumped storage schemes to mitigate extreme levels by pumping during flood events and generating in dry periods.

Similarly to the Proposed Development operating alone, there is also a pathway for potential effects as a result of water level fluctuations within Loch Ness when all pumped storage schemes are operating simultaneously. Given the presence of the potential pathway for effect, and due to the requirement for detailed assessment, in combination effects upon Urquhart Bay Wood SAC are screened into the SIAA.

5.5 Stage One: Conclusions and Recommendations

Stage 1 highlighted that likely significant effects cannot yet be ruled out without further assessment and / or mitigation. Therefore, Stage 2 Appropriate Assessment is required for the following European sites and qualifying interests:

- Ness Woods SAC;
  - *Tilio-Acerion* forests of slopes, screes and ravines;
  - Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles; and
  - Otter.

- River Moriston SAC:
  - Freshwater pearl mussel; and
  - Atlantic salmon.

- Urquhart Bay Wood SAC:
  - Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior.*

In the absence of mitigation, the following potential pathways for effects have been included in the SIAA:

Ness Woods SAC:

- Direct habitat loss during construction;
- Habitat change due to fragmentation;
- Damage or degradation to surrounding retained habitats due to:
  - Damage to tree roots during construction;
  - Air quality impacts from dust deposition during construction;
  - Water quality impacts or a change in flow regimes of watercourses flowing through Ness Woods SAC during construction and operation;
  - Access track construction and maintenance of groundwater and surface water flows; and
  - Inadvertent introduction of invasive non-native species during construction.
- Loss of otter laying up sites during construction;
- Disturbance of otter via human presence, construction noise and vibration, and lighting during construction and operation;
- Injury or killing of otter from traffic collisions, becoming trapped in excavations, or accessing turbines during construction and operation; and

- Impacts to otter prey and aquatic habitat during construction and operation.

River Moriston SAC:

- Increase in frequency of Loch Ness water level fluctuations resulting in:
    - Water quality impacts or a change in water level regimes of watercourses during operation periods;
    - Mussels being placed out with preferential habitats;
    - Reduction in water levels in Loch Ness impeding migration;
    - Increased energy burden associated with navigating anthropogenic structures and / or barriers to migration
    - Combined abstraction of water has the potential to reduce water flow in the River Ness and
    - Reduction in salmon host population.
- Disturbance of salmon from normal migrations pathways at multiple life stages during operation periods resulting in a decreased capacity as a host species for mussels:
    - Salmon smolt impingement on intake screens during abstraction;
    - Attraction of salmon smolts to intake screens during abstraction;
    - Attraction of adult salmon to outlet flow;
- Rapidly changing temperature regimes in the immediate vicinity of the water outlet

Urquhart Bay Wood SAC:

- Increase in frequency of Loch Ness water level fluctuations.

In combination effects are also assessed for all of the above.

All other European sites, qualifying features and potential pathways for effects have been screened out due to the lack of potential for Likely Significant Effects.

6.0 Stage Two: Statement to Inform Appropriate Assessment

6.1 Step One: Information on the Project and European Sites Concerned

The project is described in detail in Section 4.0.

Information on the European Sites is provided in Table 5-1.

6.2 Steps Two to Four

6.2.1 Ness Woods SAC

Step Two, Part One: Identifying Conservation Objectives

Ness Woods SAC conservation objectives are provided in Table 5-1, and listed below in Step Two, Part Two.

Step Two, Part Two: Effects of the Project on Conservation Objectives

Overarching Conservation Objectives for all habitat features:

1. ***To ensure that the qualifying features of Ness Woods SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status***

Under this Conservation Objective, Ness Woods SAC Conservation Advice Package states that "*Favourable Conservation Status (FCS) is considered at a European biogeographic level… When carrying out appraisals of plans and projects against these conservation objectives, it is not necessary to understand the status of the feature in other SACs in this biogeographic region. The purpose of the appraisal should be to understand whether the integrity of the site (see objective 2) would be maintained. If this is the case then its contribution to FCS across the Atlantic Biogeographic Region will continue to be met*."

The assessment of FCS of qualifying features is determined via objectives 2a - c, as discussed further below. As such, it follows that if the project undermines any of the conservation objectives 2a – 2c, it also undermines conservation objective 1. Therefore, for the reasons given under objectives 2a – c (below), in the absence of mitigation **the project is concluded to undermine conservation objective 1 for both qualifying habitat features**.

2. ***To ensure that the integrity of Ness Woods SAC is restored by meeting objectives 2a, 2b and 2c for each qualifying feature***

Under this Conservation Objective, Ness Woods SAC Conservation Advice Package states that "*The aim at this SAC is to restore the qualifying features to a favourable condition as a contribution to their wider conservation status. Therefore any impacts to the objectives shown in 2a, 2b, or 2c below must not persist so that they prevent the achievement of this overall aim. When carrying out appraisals of plans or projects the focus should be on restoring site integrity, specifically by meeting the objectives outlined in 2a, 2b and 2c. If these are met then site integrity will be restored…Temporary impacts on these objectives resulting from plans or projects can only be permitted where they do not prevent the ability of a feature to recover and there is certainty that the features will be able to quickly recover...*"

Objectives 2a, 2b and 2c are discussed individually below for each qualifying habitat feature.

Tilio-Acerion forests of slopes, screes and ravines:

2a. Restore the extent and distribution of the habitat within the site

The Conservation Advice Package states "*...The SAC includes three areas; all three comprise mosaics of the two woodland types for which the SAC is designated. However, the [Tilio-Acerion forests of slopes, screes and ravines] feature dominates at Glen Tarff and Inverfarigaig, whereas Easter Ness Forest supports both types.*

…there should be no measurable net reduction in the extent of the habitat and its distribution throughout the site...In particular, there should be no habitat loss from within or at the edge of the woodland and no habitat fragmentation…"

As detailed in Section 5.4.1, the project would result in the permanent direct loss (via permanent infrastructure, and via the working corridor) of up to 0.60 ha of this qualifying woodland feature during construction, and indirect habitat change (via fragmentation within hairpin bends) of a further 0.13 ha. Areas beyond the permanent infrastructure but within the working corridor have been included in the permanent habitat loss calculations, given the irreplaceable ancient woodland status, and uncertainty around the significant length of time that the habitat within the working corridor would take to recover.

The loss and fragmentation relates to a small area on the shores of Loch Ness in the footprint of the powerhouse infrastructure, along with small areas in a habitat mosaic with 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles' along the proposed access track corridor and in the powerhouse infrastructure area, as illustrated in Figure 3. The direct habitat loss represents up to 2.38% of the total habitat type within Ness Woods SAC. The direct habitat loss combined with the indirect effects of habitat fragmentation represents up to 2.90% of the total habitat type within Ness Woods SAC. A further assessment of possible fragmentation effects upon typical species of the habitat is provided under Conservation Objective 2c.

Given that the loss would result in reducing the extent and distribution of '*Tilio-Acerion* forests of slopes, screes and ravines,' the project is assessed as **undermining conservation objective 2a for this qualifying feature**.

2b. Restore the structure, function and supporting processes of the habitat

The Conservation Advice Package states: "*This habitat depends on nutrient-rich and base-rich soils and shady micro-climates found towards the bases of slopes, coarse scree, cliffs, steep rocky slopes and ravines. It is characterised by tree cover that:*

- *Has a mixed forest structure including young, mature, dying and dead trees in dense thickets and open glades with a range of shade cast on the woodland floor.*
- *Is made up of diverse broadleaved tree and shrub species, but most consistently and abundantly by species with the characteristics (shade, leaf decay, structure, bark pH and obligate / associated dependent species) of ash, hazel and wych elm.*
- *The slopes on which this woodland type develops are often unstable, leading to an element of dynamism in their structure. Whilst this adds to the diversity of the communities present, it also makes the woodland vulnerable to disturbance from human activities. If disturbance is too frequent, or present over too large an area, it may lead to loss of woodland area and typical species, and recovery might be slow.*

The ground flora associated with the habitat is linked to variations in moisture and shade, or 'disturbance communities' associated with scree and cliff-bases.

These characteristics can be achieved by maintaining an abundance of key tree species, particularly ash, hazel and wych elm, an absence of invasive species which compromise the critical characteristics of the habitat, and grazing levels that allow all species of trees, shrubs and ground flora to develop naturally and flower, fruit etc.

Grazing pressures mean the ground flora, shrub layer and canopy cover all need to be restored so that the woodland has a more natural structure. Measures are also needed to ensure mixed age classes of trees are present."

Within retained habitat areas, beyond the habitat loss area as described in Section 5.4.1 and under Conservation Objective 2a, in the absence of mitigation there is the possibility that further key tree species and their associated bryophyte and lichen interest could be lost or damaged, due to damage to tree roots. This area of potential further loss or damage would be localised to the margins of the working corridor areas only, specifically within 4 m of the working corridor, as described in Section 5.4.1, and detailed in Table 5-3. Due to the complex habitat mosaics, it is not possible to separate out the number of trees beyond the working corridor that could be subject

to root damage per habitat type. It is also not possible to determine which trees (and therefore which species) would be affected within this buffer, due to the uncertainty over which parts of the access track working corridor would be affected. However, the estimated maximum total number of trees that could be damaged beyond the working corridor, for all habitat types, is 107 (see Table 5-3).

Beyond the immediate margins of the working corridor, the project is not expected to contribute to a change in the abundance of key tree species. Specifically, whilst there may be some temporary localised displacement of grazing animals (i.e. wild deer and feral goats) within the immediate areas of construction during the construction period, from disturbance from construction activities, the project is not anticipated to influence the overall number of grazing animals (i.e. wild deer and feral goats) in the local area, and consequently grazing levels are expected to remain largely unchanged.

No invasive non-native plant species listed on Schedule 9 of the Wildlife and Countryside Act 1981 were recorded within the Site during the habitat surveys, although it is recognised that invasive species, especially Rhododendron (*Rhododendron ponticum*), are present in the wider Ness Woods SAC boundary (i.e. beyond the Site boundary). In an unmitigated scenario, there is a risk that construction activities could introduce such plant species into Ness Woods SAC where activities are proposed, via contaminated soil tracked in from machinery or brought in from footwear, which could outcompete native species and key species of the habitat type, within retained areas, thereby having the potential to adversely change the woodland structure.

There is also the potential for the introduction of invasive non-native aquatic macroinvertebrates into Loch Kemp and its tributaries, during construction via the importation of construction materials for dam construction, or during operation via water transfer from Loch Ness to Loch Kemp, which could alter the native aquatic macroinvertebrate species assemblage. However, such species were not recorded during the survey work and are therefore not likely to be present in the project area. Transfer of invertebrate species can also occur via natural vectors such as by birds. The significance of the potential effect of spread of invasive non-native aquatic macroinvertebrate species is considered to be not significant (see Volume 1, Chapter 12: Aquatic Ecology of the EIA Report).

In an unmitigated scenario, dust deposition within retained habitat surrounding the working corridors has the potential to adversely affect the function and species composition of flora making up a component part of the qualifying feature. Dust deposition can impact vegetation by affecting photosynthesis, respiration, transpiration and allowing the penetration of phytotoxic gaseous pollutants, generally resulting in decreased productivity. Epiphytic lichens are particularly sensitive to dust deposition[124]. As detailed in Table 5-5 (with further details provided in Volume 1, Chapter 18: Air Quality of the EIA Report), the air quality assessment concluded the magnitude of effect upon woodland to be: 'substantial adverse' within 20 m of the powerhouse area and on-site transportation; 'moderate adverse' within 20 m of construction of the access track and dam, and within 50 m of the powerhouse area and on-site transportation; 'slight adverse' within 20 m of borrow pits, 50 m of construction of the access track and dam, and beyond 50 m of the powerhouse area and on-site transportation; and 'negligible' beyond these areas. Although dust deposition would be temporary only, during the four to five year construction period, it is possible that adverse effects upon the flora, and a change in habitat structure and species composition, could occur within this timeframe. Given that there are areas of '*Tilio-Acerion* forests of slopes, screes and ravines' habitat within the zones in which adverse dust deposition effects are predicted, this habitat type could be negatively affected beyond the working corridor.

Construction of Dam 1 has the potential to adversely affect water quality within the Allt an t-Sluichd watercourse, from inadvertent pollution events via fuel spills, changes in water chemistry from contamination with concrete, or from an increased sediment load. Similarly, construction of the access track in close proximity to Allt a' Chinn Mhonaich also has the potential to affect water quality.

[124] Farmer, A. (1993) The effects of dust on vegetation – a review. *Environmental Pollution* 79: 63-75

In the absence of mitigation, construction of Dam 1 at the upstream end of the Allt an t-Sluichd would also change the flow rate within the watercourse. Areas of the Allt an t-Sluichd downstream of Dam 1 (beyond the working corridor) support '*Tilio-Acerion* forests of slopes, screes and ravines' habitat, including high value assemblages of bryophytes and lichens close to or within the watercourse. The hydrological regime of the watercourse and associated water quality is a supporting process of the qualifying habitat, as it affects humidity levels and provides highly restricted specialised niches for aquatic, amphibious and splash zone lichen assemblages, which require either constant, frequent or occasional inundation or wetting provided by the natural flow regime. As such, a change in water quality or flow regime in these watercourses could adversely affect specialised lichens and bryophytes beyond the working corridor, in the immediate vicinity of the watercourse, by altering the available niches, which could lead to a change in species composition over time.

In an unmitigated scenario, the construction of the access track on sloping ground, which passes through a habitat mosaic which supports a component of '*Tilio-Acerion* forests of slopes, screes and ravines' qualifying habitat, has the potential to disrupt natural groundwater or surface water flows, which could cause localised drying out or increased wetting of localised areas adjacent to the access track, particularly downslope. No flushes or other habitat maintained by groundwater have been identified in these areas, and the route of the access track is generally dominated by dry open woodland with a bracken-dominated ground flora. Nevertheless, variations in moisture create important habitat niches for ground flora, and water flows are an important supporting process for '*Tilio-Acerion* forests of slopes, screes and ravines', therefore changes to water flows have the potential to cause localised changes to the vegetation structure adjacent to the access track beyond the working area.

Overall, in the absence of mitigation, it is concluded that the project has the potential to **undermine conservation objective 2b for this qualifying feature,** by adversely affecting the structure, function or supporting processes of the feature within retained habitat beyond the habitat loss footprint, and within and beyond the habitat fragmentation areas, via the following effect pathways: damage to tree roots in close proximity to the working corridor during construction; risk of introducing invasive species during construction and operation; dust deposition during construction; deterioration in water quality of watercourses during construction; a change in flow regime on the Allt an t-Sluichd during construction and operation; and localised water flow disruption in the vicinity of the access track during construction and operation.

2c. Restore the distribution and viability of typical species of the habitat

The Conservation Advice Package states:

"The key tree species for this habitat are ash (Fraxinus excelsior), hazel (Corylus avellana), and wych elm (Ulmus glabra).

The ground flora is very varied, but the following elements are especially characteristic: fern banks (including beech fern (Phegopteris connectilis), oak fern (Gymnocarpium dryopteris), hard shield fern (Polystichum aculeatum), lady fern (Athyrium,felix-femina), brittle bladder fern (Cystopteris fragilis), mountain fern (Oreopteris limbosperma) and buckler-ferns (Dryopteris species)); stands of ramsons (Allium ursinum) in the moister zones; dog's mercury (Mercurialis perennis) and enchanter's-nightshade Circaea species on drier but still base-rich soils, the grasses mountain melick (Melica nutans) and wood fescue (Festuca altissima); wood avens (Geum urbanum), and natural 'disturbance communities' comprising common nettle (Urtica dioica), herb-Robert (Geranium robertianum) and cleavers (Galium aparine) associated with scree and cliff-bases. The bryophyte and lichen communities are also rich, and includes the nationally scarce lichen Fuscopannaria ignobilis at Inverfarigaig. Species associated with F. ignobilis at Inverfarigaig include Degelia plumbea, Lobaria pulmonaria, L. scrobiculata, L. virens, Nephroma laevigatum, Normandina pulchella, Pannaria rubiginosa and Peltigera collina.

False-brome (Brachypodium sylvaticum), bugle (Ajuga repens), woodruff (Galium odoratum), wild strawberry (Fragaria vesca) and common valerian (Valeriana officinalis) are also found at this site and Glen Tarff supports locally important plants such as wood crane's-bill (Geranium sylvaticum).

The rivers Farigaig and Tarff and several small streams run through the woodland into Loch Ness and these areas, together with the rocky ground and tree roots, provide excellent habitat for otters. Red squirrel are also present.

Grazing levels can impact the typical species of this site. The ground flora, shrub layer and canopy cover all need to be restored and measures put in place to ensure mixed age classes of trees are present…"

Due to the direct loss of up to 0.60 ha of '*Tilio-Acerion* forests of slopes, screes and ravines' within the habitat loss area, there would be a loss of key tree species and typical ground flora and shrub layer species within this (up to) 0.60 ha area. Tree species and numbers to be lost are detailed in Table 5-3, and ground flora, including bryophyte and lichen loss, is detailed in Section 5.4.1. Due to the complex mosaic nature of the qualifying woodland features, it has not been possible to separate tree loss figures per qualifying feature habitat type, and therefore tree loss figures as a whole are provided. From Table 5-3, it can be seen that five ash trees and 90 hazel trees, defined as key tree species for this habitat type, would be lost.

Beyond the (up to) 0.60 ha habitat loss area, in the absence of mitigation there is the potential for the distribution of typical canopy, shrub layer and ground flora species to be adversely affected surrounding the working corridors, via: dust deposition during construction; damage to tree roots in close proximity to the working corridor during construction; risk of introducing invasive species during construction; deterioration in water quality of watercourses during construction; a change in flow regime on the Allt an t-Sluichd during construction and operation; and localised water flow disruption in the vicinity of the access track during construction and operation, as described under conservation objective 2b (above). No change in the distribution or viability of typical species as a result of grazing levels is expected as a result of the project, as described under conservation objective 2b.

As detailed in Section 5.4.1, a further 0.13 ha of retained habitat within hairpin bends, could be indirectly affected via fragmentation effects, resulting in possible habitat change, specifically a possible change in vegetation composition of woodland species, due to isolation from interior habitat.

As detailed in Section 5.4.1, direct loss of lichens and associated lichenicolous fungi is mostly associated with the proposed access track and powerhouse infrastructure area, including six very high value old growth species, primarily on hazel (see Section 5.4.1 for a breakdown of loss per species). The information provided on lichens in this section relates to both qualifying woodland habitats, not just '*Tilio-Acerion* forests of slopes, screes and ravines'.

High value species *Nevesia sampaiana* and *Parmeliella testacea* would also experience some direct loss; these two species are widespread across the Site, but given that the proposed access track passes through a core population in an old growth hazel stand, the resilience of these species could be reduced, which could in turn affect their viability. High value old growth species *Crutarndina petractoides, Pannaria rubiginosa* and *Lopadium disciforme* would also experience some direct loss.

Whilst numerous individual lichens / lichenicolous fungi of medium, high and very high value would be lost, construction works are not anticipated to lead to the extinction of any lichen species at the Site level, as all species within the working corridor also occur within other areas of the Site. However, fragmentation effects can reduce the long-term viability / resilience of sub-populations through increasing distances between colonisation sources and thus reducing the chances of colonisation events. This makes species that appear to rely exclusively / almost exclusively on dispersal via vegetative propagules sensitive to fragmentation impacts, as these tend to be short range dispersal mechanisms (and most effective within a stand where veteran trees suitable for colonisation are nearby). This includes a number of *Lobarion* species recorded on the Site. Specifically, *Fuscopannaria ignobilis* is non-fertile and has been recorded at three locations during the lichen surveys: on an ash tree on an island within the Allt an t-Sluichd watercourse, downstream of Proposed Dam 1 and beyond the working corridor; on a veteran hazel close to the proposed access track route but beyond the working corridor; and on an aspen well away from construction works. Although the *F. ignobilis* on the ash within the Allt an t-Sluichd watercourse would not be directly lost, in an unmitigated scenario its viability is likely to be threatened, due to the drying out of the watercourse and resultant reduction in humidity levels in the immediate vicinity of

the watercourse, and due to a lack of nearby colonisation sources. The *F. ignobilis* on the veteran hazel close to the proposed access track (beyond the working corridor and RPAs) is less likely to be threatened from humidity changes, given its location within an open canopy area with only sparse tree cover, where changes in humidity and light levels are expected to be negligible. *Leptogium burgessii* is scarce and local on the Site with few patches with well-developed fruits. *Parmeliella testacea* and *Nevesia sampaiana* are also sensitive to fragmentation impacts, as they are very rarely or never recorded fertile on the Site. Stands of hazel with good, healthy sub-populations of frequent *Nevesia sampaiana* are likely to be especially important to support its fungal parasite *Arthonia sampaianae*.

The retained habitat within the tightest hairpin bends are considered to have the most adverse effects with respect to fragmentation causing a significant decrease in colonisation events, and therefore a potential decrease in viability of these species at the localised scale. Beyond the tightest hairpin bends, colonisation events are unlikely to be significantly reduced, given that available habitat and colonisation sources are available on both sides of the proposed infrastructure areas for most species, although it is acknowledged that the reduction in available habitat for some of the most scarce lichen species at the Site (i.e. high value species *Arthonia sampaiana, Bactrospora homaloptropa, Fuscopannaria mediterranea, Leptogium burgessii, Pectenia plumbea, Phlyctis agelaea* and *Bactrospora corticola*), could lower the resilience and long-term viability of these populations at the Site scale in the long term.

Potential fragmentation effects also include a change in micro-climatic conditions. Regionally, nationally and internationally important bryophytes and lichens that occur on the Site are sensitive to changes in micro-climatic conditions (humidity, shelter and light levels), particularly old-growth epiphytic floras. Oceanic species are also particularly vulnerable to a reduction in shelter / humidity as they are on the eastern edge of their range. The *Lobarion* community is vulnerable to fragmentation due to increased dispersal distances and changes in micro-climate / reduced humidity, which is evidenced at the Site from observations of fragmentation of hazel stands elsewhere in the Survey Area, where the *Lobarion* community is in poor condition. This includes many of the lichen species of medium value, including *Sticta sylvatica* (Sc L IR), *Pannaria conoplea* (Sc L IR), *Degelia atlantica*, and *Dictyonema* sp.

For bryophytes and lichens, the drying out of the Allt an t-Sluichd has the potential to reduce the viability of the communities along the watercourse, due to a change in the humidity levels. Beyond the watercourse, within retained habitat areas surrounding the working corridor, an adverse effect upon the distribution and viability of bryophytes is not expected within areas where the canopy cover of the woodland is scattered and open with bracken areas. This is because microclimatic conditions are not expected to appreciably change in retained habitat beyond the working footprint within such areas, and given that bryophyte species recorded are generally common and widespread, with no Nationally Rare or Scarce bryophyte species recorded[47]. The exception to this is where the working corridor passes through more dense closed canopy woodland and old-growth hazel and birch stands, most notably the second lowest hairpin bend of the proposed access track (the area of which is included in the calculation for indirect effects of fragmentation, see Table 5-4). In this location, construction of the access track would pass through an old-growth hazel stand which would increase exposure and lead to reduced availability of niches for bryophyte species reliant on more sheltered humid conditions, as well as epiphytic lichen species reliant on such conditions. The below assessment focuses on this hairpin bend, as NatureScot have specifically raised a concern relating to further loss of viability of typical species as a result of micro-climatic edge effects within this area, and given that this area has the highest concentration of lichens of value. There are also a small number of records of bryophytes and lichens of value within the adjacent hairpin bend fragmentation areas, where similar effects are also possible on a smaller scale.

Seven very high value or high value lichen species occur within the fragmentation area of this hairpin bend, as further described individually below:

- There are two trees supporting very high value *Bactrospora homalotropa;* given that this is a sheltered oceanic woodland species, adopting a precautionary principle these two lichens are assessed as being threatened by reduced humidity in this area.
- Four trees supporting very high value *Leptogium burgessii*. This is an oceanic species of sheltered moist woods, and therefore it is concluded that these would be heavily impacted by fragmentation. This is a core area for this species in the site, and the fragmentation would reduce the suitability of this area overall and reduce long term population viability. This species is most often found fertile on better developed thalli when conditions are optimum[125]; the majority of the best fertile patches (four of eight) are along the proposed access track corridor or hairpin area;
- Fourteen trees supporting high value *Nevesia sampaiana*. The *Nevesia* within the survey area at Kemp appears to survive on remaining hazels despite fragmentation[126], and therefore this species may survive the reduction in humidity due to fragmentation within this area, although the conditions may become less suitable for its fungal parasite *Arthonia sampaiana* (see further below);
- *Arthonia sampaiana*, a high value fungal parasite of *Nevesia sampaiana*. Although there are no trees within the hairpin bend fragmentation areas that support this species (additional to those that would be directly lost within the working corridor, which passes through a core population), the conditions within the fragmentation areas are likely to become less suitable for this species, thus resulting in a reduction in available habitat, and reducing the viability of the species;
- One tree supporting very high value *Microcalicium disseminatum*, beyond the working corridor and RPA buffer, but within close proximity. A species of veteran trees in humid localities. The main effect for this species would be the reduction of available habitat (rather than microclimatic fragmentation effects), relating to the loss of gnarly veteran birches with bare lignum patches and hollows, of which there are several suitable veteran birches within this area;
- Twenty-two trees supporting high value *Parmeliella testacea*. This is an oceanic species of sheltered moist woods, and it is concluded that all of these locations within the hairpin bend would be potentially affected by the Proposed Development. This is a core area for this species within the study site, and fragmentation would make this area less suitable overall for this species, and reduce viability;
- One tree within the first hairpin bend and one within the second hairpin bend supporting high value *Crutarndina petractoides*. This is a species of sheltered woods therefore could potentially be impacted by fragmentation, but is not likely to be as vulnerable as other species requiring high humidity. However, adopting a precautionary approach these two locations are assessed as being potentially threatened by micro-climatic fragmentation effects; and
- One tree supporting high value *Pannaria rubiginosa* within this second hairpin bend, and two further trees within the adjacent hairpin bends. This is a species of humid sheltered oceanic woods, therefore on a precautionary basis it is assumed that these three locations are potentially threatened by micro-climatic fragmentation effects.

Felling of trees at the location of Dam 1 could also reduce humidity levels for old-growth lichen species *Felipes leucopellaea*, *Lopadium disciforme* and *Protoparmelia ochrococca* in this area (although it is noted that *Felipes leucopellaea* is not confined to sheltered woods but often appears to be most abundant in more sheltered woods). However, the canopy cover of the woodland in and adjacent to the construction areas is generally scattered and open with open bracken areas, with limited areas of dense and sheltered tree coverage, due to extensive over-browsing. Therefore, beyond the watercourse, significant changes in micro-climatic conditions are unlikely to extend beyond the immediate edge of the construction area itself, in the vicinity of Dam 1.

The lowest part of the proposed access track extends for approximately 250 m across the slope above the Loch Ness shoreline, set back from the shoreline by between approximately 30 m and 100 m, before curving up the hillside in a series of hair-pin bends. The woodland area between the lower section of the proposed access track

[125] Pers. obs. of Andy Acton, project lichenologist, is that in poor habitat conditions thalli are more scrappy and without fruits
[126] Pers. obs, Andy Acton, project lichenologist

and the Loch Ness shoreline primarily comprises of a habitat mosaic of 60% '*Tilio-Acerion* forests of slopes, screes and ravines,' and 40% 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles,' made up of NVC communities W9b, W11a, W17b and U20 (see Figures 3 and 5). Ground flora species including oak fern (*Gymnocarpoium droyopteris*), globeflower (*Trollius europaea*), scaly male fern (*Dryopteris dilatate*), wood anemone (*Anemone nemorosa*), wood sorrel (*Oxalis acetosella*), wood sage (*Teucrium scorodonia*), chickweed wintergreen (*Trientalis europaea*) and yellow pimpernel (*Lysimachia nemorum*) were recorded here at low cover, and tree species include birch, alder, ash, hazel and rowan. This habitat type continues south beyond the infrastructure area, and is connected with large areas of woodland habitat to the south, where Ness Woods SAC continues. Due to the width of habitat and connection to further similar woodland habitat, and the fact that the shoreline already represents woodland edge habitat, further significant fragmentation effects for this area of habitat are not considered likely, with nearby plant seed and colonisation sources available. Mammal species would be able to continue to move between this area of habitat, and habitat to the south, with all species also expected to be able to cross the proposed access track, to move between this area and further habitat to the north and east (see further information on otter and red squirrel below). Similarly, invertebrates would be able to move between this habitat area and adjoining habitat to the south, or cross the proposed access track to access further habitat to the north and east. This assessment applies to both woodland qualifying habitat types.

The Conservation Advice Package mentions two faunal species, otter and red squirrel. Otter is present within Ness Woods SAC, and is assessed separately under the conservation objectives for otter. In summary, although otter habitat would be lost at a localised scale, given the abundance of retained, connected and undisturbed high quality habitat for otter resting, breeding and feeding that is available, including rocky ground and tree roots, the viability of the otter population within Ness Woods SAC would not be threatened, although there would be a risk of otter mortality, disturbance or injury in an unmitigated scenario.

Red squirrel presence is confirmed within Ness Woods SAC within the Site, as well as in Whitebridge Plantation and Torr Cluanie plantation. The hazel within the broadleaved woodland within the Site provides good quality foraging habitat for red squirrel. No squirrel dreys were identified within the proposed working corridors within Ness Woods SAC, although one squirrel drey was identified within the working corridor in Torr Cluanie plantation, located 0.9 km from Ness Woods SAC. A localised loss of up to 5.52 ha of red squirrel woodland habitat within Ness Woods SAC would occur (including both woodland types together). The average home range of red squirrel is estimated between 9 – 30 ha and overlap between the home ranges of different individuals can be small[127]. Given that the loss is less than the estimated home range of one individual, and given the abundance of suitable and well connected habitat in the surrounding areas, the Proposed Development is not predicted to significantly adversely affect the viability of the red squirrel population within Ness Woods SAC. Similarly, the loss of one red squirrel drey, outwith Ness Woods SAC, is not predicted to significantly adversely affect the viability of the red squirrel population within Ness Woods SAC, given the local context of abundant available habitat for drey building, and the distance from Ness Woods SAC.

Overall, it is concluded that the project has the potential to **undermine conservation objective 2c for this qualifying feature,** by: reducing the distribution of typical canopy, shrub layer and ground flora species of the habitat within the (up to) 0.60 ha direct habitat loss area; by resulting in possible habitat change within the 0.13 ha fragmentation areas within hairpin bends; by affecting bryophytes and lichen species that are humidity sensitive within the second hairpin bend fragmentation area via micro-climatic edge effects; by reducing the resilience and therefore potentially affecting the long-term viability of lichen species that are rare at the site-based scale; and reducing the distribution of key canopy, shrub layer and ground flora species within retained habitat beyond the habitat loss / fragmentation area. In the absence of mitigation this could occur via the following effect pathways: habitat removal during construction to facilitate scheme infrastructure; damage to tree roots in close proximity to the working corridor during construction; risk of introducing invasive species during construction; dust deposition during construction; deterioration in water quality of watercourses during

[127] Harris, S. and Yalden, D.W. (2008) Mammals of the British Isles: Handbook (4th Edition). The Mammal Society, Southampton

construction; a change in flow regime on the Allt an t-Sluichd during construction and operation; and localised water flow disruption in the vicinity of the access track during construction and operation.

Old sessile oak woods with Ilex and Blechnum in the British Isles:

2a. Maintain the extent and distribution of the habitat within the site

As detailed in Section 5.4.1, the project would result in the permanent direct loss (via permanent infrastructure, and via the working corridor) of up to 4.96 ha, and the indirect effect ofhabitat change from fragmentation effects (within hair pin bends) of a further 1.04 ha of this qualifying woodland feature during construction. Areas beyond the permanent infrastructure but within the working corridor have been included in the permanent direct habitat loss calculations, given the irreplaceable ancient woodland status, and uncertainty around the significant length of time that the habitat within the working corridor would take to recover.

The loss and fragmentation relates to the powerhouse infrastructure area, access track corridor including hair pin bends, and Dam 1 and associated inundation area immediately to the north of Loch Kemp, at the upstream end of the Allt an t-Sluichd, as illustrated in Figure 3. The habitat loss calculation includes bracken stands within the SAC with the same soil type as this habitat type, due to the possibility that a suitable seed bank has persisted and could be restored. The direct habitat loss represents up to 0.92% of the total habitat type within Ness Woods SAC. The direct habitat loss combined with the indirect effects of habitat fragmentation represents up to 1.12% of the total habitat type within Ness Woods SAC.

Given that the loss would result in reducing the extent and distribution of 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles,' the project is assessed as **undermining conservation objective 2a for this qualifying feature**.

2b. Restore the structure, function and supporting processes of the habitat

The Conservation Advice Package states: "*This habitat type comprises a range of woodland types dominated by mixtures of oak. It is found in areas of base-poor soils with at least moderately high rainfall, and the key elements that should be in place include:*

- *Mixed age classes of trees, canopy cover, deadwood / fallen trees, understorey, ground flora & epiphytic plants. At this site there are low levels of native tree species regeneration. A more natural ground flora, shrub layer and canopy cover should also be allowed to regenerate.*
- *Large, long lived trees with the characteristics of existing species, especially the defining species of oak (bark chemistry and structure, shade, leaf litter, fruiting, senescence and deadwood development).*
- *Low levels of herbivore impacts, to allow all species of trees and shrubs to regenerate, and healthy growth of ground flora, including flowering and fruiting. At this site grazing is contributing to the lack of regeneration by native tree species and affecting the composition of ground flora, shrub layer and canopy cover within the site.*
- *Levels of humidity capable of supporting characteristic bryophyte and lichen assemblages.*
- *Absence of invasive non-native species, especially Rhododendron.*
- *Prevention of pathogen arrival, establishment and spread.*

The vascular plant community is generally species-poor, characterised by ericoid shrubs, bracken and grasses. However, the communities of ferns, and particularly lichens and bryophytes, are luxuriant and species rich."

The potential effects upon the structure, function and supporting processes of the habitat are very similar to those described under Conservation Objective 2b for '*Tilio-Acerion* forests of slopes, screes and ravines.'

Within retained habitat areas, beyond the habitat loss and fragmentation areas as described under Conservation Objective 2a, in the absence of mitigation there is the potential for adverse effects on the structure, function or supporting processes of the woodland habitat via the following impact pathways (as described in further detail under Conservation Objective 2b for '*Tilio-Acerion* forests of slopes, screes and ravines'):

- Loss or damage of further key tree species and their associated bryophyte and lichen interest along the margins of the working corridor, due to damage of tree roots during construction;
- Construction activities could introduce invasive plant species into Ness Woods SAC where activities are proposed, via contaminated soil tracked in from machinery or brought in from footwear, which could outcompete native species and key species of the habitat type, within retained areas, thereby having the potential to adversely change the woodland structure. This same pathway has the potential to increase the risk of pathogen arrival and spread. There is also the potential for the introduction of invasive non-native aquatic macroinvertebrates into Loch Kemp and its tributaries, during construction via the importation of construction materials, or during operation via water transfer, however the significance of the potential effect of spread of invasive non-native macroinvertebrate species is considered to be non-significant (as detailed in Volume 1, Chapter 12: Aquatic Ecology of the EIA Report);
- Dust deposition can impact vegetation by affecting photosynthesis, respiration, transpiration and allowing the penetration of phytotoxic gaseous pollutants, generally resulting in decreased productivity. Given that areas of 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles' occur within areas identified in the air quality assessment as having 'slight adverse' to 'substantial adverse' dust deposition effects upon woodland, as detailed in Table 5-5, dust deposition has the potential to adversely affect the function and species composition of flora making up a component part of the qualifying feature in these areas, during the four to five year construction period.
- Construction activities have the potential to adversely affect water quality within the Allt an t-Sluichd and Allt a' Chinn Mhonaich watercourses, both of which support mosaics of 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles,' which has the potential to adversely affect the species composition of aquatic species along the watercourses.
- A change in flow rate of the Allt an t-Sluichd as a result of dam construction would also adversely affect ground flora species composition along the watercourse corridor, by reducing humidity levels and changing the hydrological regime of narrow niches (aquatic, amphibious and splash zone) for which specialised lichen and bryophyte species rely on.
- Construction of the access track has the potential to cause localised changes to ground flora composition outside of the working corridor, within the vicinity of the access track, from localised drying out and wetting caused by disruption to water flows.

As detailed under Conservation Objective 2b for '*Tilio-Acerion* forests of slopes, screes and ravines', the project is not expected to contribute to a change in the abundance of grazing animals (i.e. wild deer and feral goats), and consequently grazing levels are expected to remain largely unchanged, and therefore no effects upon tree age class structure, tree or shrub regeneration, or ground flora as a result of grazing changes are predicted.

Overall, in the absence of mitigation, it is concluded that the project has the potential to **undermine conservation objective 2b for this qualifying feature,** by adversely affecting the structure, function or supporting processes of the feature within retained habitat beyond the habitat loss footprint, and within and beyond the habitat fragmentation areas, via the following effect pathways: damage to tree roots in close proximity to the working corridor during construction; risk of introducing invasive species and pathogens during construction and operation; dust deposition during construction; deterioration in water quality of watercourses during construction; a change in the flow regime on the Allt an t-Sluichd during construction and operation; and localised water flow disruption in the vicinity of the access track during construction and operation.

2c. Restore the distribution and viability of typical species of the habitat

The Conservation Advice Package states: "The key tree species found in this habitat are oak (Quercus robur and / or Q. petraea) and birch (Betula pendula and / or B. pubescens). There is significant variation between individual stands of the habitat in domination by either oak or birch. Holly and hazel are also important components of the habitat.

The ground flora consists of blaeberry (Vaccinium myrtillus) and wavy hair-grass (Deschampsia flexuosa) with bell heather (Erica cinerea) and cow-wheat (Melampyrum pratense).

Western acidic oak woodland supports an important component of Britain's oceanic bryophyte flora and lichen mycota. The distribution and viability of these assemblages should be maintained with particular focus on nationally rare, scarce and / or threatened species and on assemblages that indicate a long period of ecological continuity. Whilst the mixed woodland on base-rich soils associated with rocky slopes feature at Ness Woods SAC supports rich lichen communities, the bryophyte flora is richer in the western acidic oak woodland.

The rivers Farigaig and Tarff and several small streams run through the woodland into Loch Ness and these areas, together with the rocky ground and tree roots, provide excellent habitat for otters. Red squirrel are also present.

The site is also important for the rare beetle, Bolitophagus reticulatus, which in the UK is found only in the highlands of Scotland. The beetle larvae feed on the bracket fungus Fomes fomentarius which colonises old birch trees.

Grazing levels can impact the typical species of this site. The ground flora, shrub layer and canopy cover all need to be restored and measures put in place to ensure mixed age classes of trees are present."

Due to the direct loss of up to 4.96 ha of 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles' within the habitat loss area, there would be a loss of key tree species and typical ground flora species within this 4.96 ha area. Tree species and numbers to be lost are detailed in Table 5-3. Due to the complex mosaic nature of the qualifying woodland features, it has not been possible to separate tree loss figures per qualifying feature habitat type, and therefore tree loss figures as a whole are provided. From Table 5-3, it can be seen that 711 birch, 90 hazel, and one oak trees, defined as key or important tree species for this habitat type, would be lost.

Beyond the (up to) 4.96 ha direct habitat loss area, in the absence of mitigation there is the potential for the distribution of typical canopy, shrub layer and ground flora species to be adversely affected surrounding the working corridors, via the same effect pathways as stated under Conservation Objective 2c for '*Tilio-Acerion* forests of slopes, screes and ravines' habitat. These are dust deposition during construction; damage to tree roots in close proximity to the working corridor during construction; risk of introducing invasive species during construction; deterioration in water quality of watercourses during construction; a change in flow regime on the Allt an t-Sluichd during construction and operation; and localised water flow disruption in the vicinity of the access track during construction and operation.

There would also be the potential for vegetation changes within the 1.04 ha fragmentation areas within hair pin bends, resulting from isolation from woodland interior habitat, as described in Section 5.4.1. The assessment of microclimatic fragmentation effects upon bryophytes and lichens provided under Conservation Objective 2c for '*Tilio-Acerion* forests of slopes, screes and ravines' also applies to 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles', as does the assessment of effects upon the viability of bryophyte and lichen communities, along with otter and red squirrel, and fragmentation along Loch Ness shoreline.

The beetle *Bolitophagus reticulatus* could be associated with some of the 711 birch trees that would be lost. Birch is the dominant species within the majority of woodland areas surveyed, and is widespread in the local area. Given the abundance of suitable and well connected birch-dominated woodland habitat in the surrounding areas, the Proposed Development is not predicted to significantly adversely affect the viability of the *Bolitophagus reticulatus* population within Ness Woods SAC.

Overall, it is concluded that the project has the potential to **undermine conservation objective 2c for this qualifying feature,** by: reducing the distribution of typical canopy, shrub layer and ground flora species of the habitat within the (up to) 4.96 ha direct habitat loss area; by resulting in possible habitat change within the 1.04 ha fragmentation areas within hairpin bends; by affecting bryophyte and lichen species that are humidity sensitive within the second hairpin bend fragmentation area via micro-climatic edge effects; by reducing the resilience and therefore potentially affecting the long-term viability of lichen species that are rare at the site-based scale; and reducing the distribution of key canopy, shrub layer and ground flora species within retained habitat beyond the habitat loss / fragmentation area. In the absence of mitigation this could occur via the following effect pathways: habitat removal during construction to facilitate scheme infrastructure; damage to tree roots in close proximity to the working corridor during construction; risk of introducing invasive species and

pathogens during construction and operation; dust deposition during construction; deterioration in water quality of watercourses during construction; a change in flow regime on the Allt an t-Sluichd during construction and operation; and localised water flow disruption in the vicinity of the access track during construction and operation.

Otter:

1. To ensure that the qualifying features of Ness Woods SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status

Under Objective 1, the Conservation Advice Package details the same information for otter as it does for the woodland qualifying features.

Similarly to the woodland habitats, the assessment of FCS of otter is determined via objectives 2a - c, as discussed further below. As such, it follows that if the project undermines any of the conservation objectives 2a – 2c, it also undermines conservation objective 1. Therefore, for the reasons given under objectives 2a – c, in the absence of mitigation, the project is concluded to **undermine conservation objective 1 for otter.**

2.To ensure that the integrity of Ness Woods SAC is restored by meeting objectives 2a, 2b and 2c for the qualifying feature:

Under Objective 2, the Conservation Advice Package details the same information for otter as it does for the woodland qualifying features.

Conservation Objectives 2a, 2b and 2c for otter are discussed individually below.

2a. Maintain the population of the species as a viable component of the site.

The Conservation Advice Package states: "*The conditions for the long-term existence of the otter population at Ness Woods SAC should be maintained.*

An estimate of the number of otters occupying the site is not available and therefore there is no numerical baseline that can be given for the site. A survey was carried out for site condition monitoring purposes in 2011 however this just involved a sample of the site. Difficult survey conditions also meant that otter detectability (through field signs) may have been compromised.

This conservation objective is considered to be met if the conditions for the species' long-term existence are in place. This includes:

- *Avoiding effects that could lead to a permanent reduction in the otter population through mortality, injury, or impacts caused by disturbance or displacement. This includes for example the effects caused by development, river engineering, water pollution, roads without adequate crossing provision for otters or suitable culverts, or entanglement in fishing gear;*
- *Maintaining the species' ability to use all areas of importance within the site (to be considered under conservation objective 2b);*
- *Maintaining access to, and availability of, undisturbed resting places; and*
- *Maintaining access to, and availability of, supporting habitats and prey (to be considered under conservation objective 2c).*

Otters are wide-ranging and highly mobile. The population at Ness Woods SAC is reliant on suitable habitat in the surrounding wider countryside. The home range of an otter will vary depending on their sex, habitat quality and food availability. It will also vary between freshwater and coastal environments. Males living in rivers and streams can have a linear home range size of around 40 km and females living in the same habitat can have a linear home range of around 20 km. Males have been known to range as far as 80 km. When assessing the effects of any plan or project consideration should be given to whether impacts outwith the SAC could affect achievement of this conservation objective.

Otters are a European protected species (EPS) and it is an offence to deliberately or recklessly capture, injure, kill, harass or disturb them in certain circumstances, or to damage or destroy their breeding or resting places anywhere in Scotland unless a licence has been issued to do so. A licence can only be issued for particular purposes which the law allows. Further, there must be no satisfactory alternative and no detrimental impact on the contribution to the maintenance of otter at a favourable conservation status for a licence to be issued. This assessment considers impacts on the otter population at a local and regional level. The licensing requirement is in addition to considering whether a plan or project will result in any impacts (including incidental impacts) to the otter population within the SAC."

The conditions listed as required for the species' long-term existence are discussed individually below ('*Maintaining the species' ability to use all areas of importance within the site'* and '*Maintaining access to, and availability of, supporting habitats and prey*' are discussed separately under Conservation Objectives 2b and 2c respectively below):

Avoiding effects that could lead to a permanent reduction in the otter population through mortality, injury, or impacts caused by disturbance or displacement

The death or injury of an otter could affect the conservation status of this species locally, and could represent an offence under relevant legislation. As detailed in Section 5.4.1, in the absence of mitigation, the following potential effect pathways would increase the risk of mortality or injury to otter, and therefore would result in this condition not being met:

- Traffic collisions along on-site access tracks during construction or operation;
- Otter becoming trapped in excavations during construction;
- Otter accessing turbines via the intake / outfall structures during the operational phase.

As detailed in Section 5.4.1, in the absence of mitigation, the following potential effect pathways could cause disturbance or displacement:

- Displacement of otter from the permanent infrastructure footprint, including loss of three lay-ups and one possible (non-breeding) holt within Ness Woods SAC, and a further possible (non-breeding) holt and lay-up outside of Ness Woods SAC;
- Disturbance of otter via human and vehicular presence during construction;
- Disturbance of otter via noise and vibration during construction;
- Disturbance of otter during construction and operation via lighting; and
- Disturbance of otter during operation via human presence from tourist trips.

Construction would result in the loss of (up to) 5.52 ha of woodland habitat within Ness Woods SAC which provides suitable cover and resting habitat for otter, including the loss of otter resting sites within the working corridor, located close to the shore of Loch Ness within the proposed powerhouse footprint, within Ness Woods SAC (see Figure 8). No natal holts would be affected. The assumption that all 5.52 ha of the woodland habitat is suitable for otter is precautionary, as areas away from the shoreline or watercourses are less likely to be regularly used by otter. In the absence of mitigation, construction works would result in contravention of wildlife legislation, via the destruction of otter resting places.

Otters that live in freshwater habitats occupy very large home ranges which may contain up to 30 resting sites[128]. There is a large abundance of undisturbed, sheltered, connected habitat suitable for otter resting places (including lie-ups and holts), both within the Site itself, as well as surrounding the Site. Habitat surrounding the site includes further areas of woodland along the shores of Loch Ness to the north and south of the Site, on the far side of Loch Ness to the west, and within sheltered habitat close to waterbodies and watercourses in the wider landscape such as the River Fechlin corridor to the east, and Loch Knockie and surrounding woodland to

[128] Environment Agency (1999) *Otters and River Habitat Management*. Environment Agency, Bristol.

the south. It is concluded that there is sufficient availability of connected and undisturbed habitat in the surrounding areas to provide an abundance of suitable alternative opportunities for shelter.

Otter is widespread locally and nationally, with the Scottish population estimated to be 8,000[129]. Given their local and national status, their large home range sizes and use of a large number of resting sites, and the fact that there is an abundance of good quality habitat suitable for shelter on-site and within the wider area, including within the remainder of Ness Woods SAC, it is concluded that the loss of up to 5.52 ha of woodland, including three lay-ups and one possible (non-breeding) holt within Ness Woods SAC, and a further possible (non-breeding) holt and lay-up outside of Ness Woods SAC, would not lead to a permanent reduction in the otter population, and does not constitute a significant effect.

Otters are able to adapt to a certain level of human disturbance[130]. NatureScot advise exclusion zones of 200 m around breeding holts, and 30 m around non-breeding resting places, with a development licence required if such exclusion zones are not possible[131]. Four (non-breeding) lay-ups have been identified beyond the working corridor (see Figure 8). Three of these are located further than 30 m from the working corridor. One holt (with suitability to be used for breeding) has also been identified beyond the working corridor, and is situated over 200 m from the working corridor, on the Loch Ness shoreline. Given that there is woodland between the working corridor and these lay-ups / holt, offering natural screening, likely disturbance effects to the lay-ups and holt are considered to be minimal. One lay-up on the Loch Ness shoreline (TN 4 in Figure 8) lies within 30 m of the proposed access track working corridor, and as such a development licence for this lay-up would be required, due to disturbance. A development licence for the remaining lay-ups and holt is unlikely to be required. The construction works would not result in creating any obstructions between the lay-ups / holt, and the Loch Ness hunting habitat.

In the absence of mitigation, it is possible that further otter resting places could be disturbed, either through site personnel or machinery entering areas close to resting places in the absence of exclusion zones being set up, or in the event of new resting places becoming established in close proximity to working corridors.

Otters occupying freshwater areas are primarily nocturnal[132]. The majority of the construction works will be undertaken during daylight hours. However night-time working and the use of temporary construction lighting is proposed for the tunnel portals (located in the area by the powerhouse infrastructure on the shore of Loch Ness within Ness Woods SAC, and the western shore of Loch Kemp outwith Ness Woods SAC). There is also a requirement for some temporary construction lighting at the start and end of the day during winter. Some localised disturbance due to night-time human / machinery presence and construction lighting is therefore predicted, which could temporarily displace commuting and hunting otter from the immediate area of the construction works, primarily at the tunnel portal / powerhouse infrastructure location.

Operational lighting would be restricted to the powerhouse area only, which would be low level, which could also result in a small-scale localised disturbance effect at the powerhouse location.

These areas are limited in extent. Construction activity and lighting is also temporary in nature, with extensive unlit and undisturbed areas across the Site and wider area. When considering this in the context of the large home ranges of otter, it is concluded that human / machinery disturbance and artificial lighting during

[129] NatureScot (2022) Information on otter [online]. Available at: https://www.nature.scot/plants-animals-and-fungi/mammals/land-mammals/otter#:~:text=Today%2C%20the%20species%20is%20flourishing,lochs%2C%20rivers%20or%20the%20sea. [Accessed in November 2022]

[130] Chanin, P. (2003) Monitoring the Otter *Lutra lutra*. Conserving Natura 2000 Rivers Monitoring Series No. 10, English Nature, Peterborough

[131] https://www.nature.scot/sites/default/files/2018-09/Species%20Planning%20Advice%20-%20otter.pdf [accessed in January 2023]

[132] https://www.nature.scot/plants-animals-and-fungi/mammals/land-mammals/otter#:~:text=Otters%20that%20live%20in%20freshwater,including%20man%2Dmade%20ones [accessed in January 2023]

construction would not lead to a permanent reduction in the otter population, and does not constitute a significant effect.

During operation, as detailed in Section 5.4.1, daily human presence on the Site would be low level and localised in extent, and human presence would mostly occur during daylight hours when otters are less active. Disturbance effects to otter from human presence during operation would be small-scale and localised. However, there is the potential for disturbance levels to become less localised in an unmitigated scenario, for example if visitor access from tourist boats was not restricted to surrounding habitat in Ness Woods SAC, which could in turn result in disturbance to otter using surrounding resting places.

Maintaining access to, and availability of, undisturbed resting places

As described in the previous section, three lay-ups and one possible (non-breeding) holt within Ness Woods SAC, and a further possible (non-breeding) holt and lay-up outside of Ness Woods SAC would be lost to the permanent infrastructure. One additional lay-up is located outside of the working corridor but within the 30 m disturbance distance buffer defined by NatureScot[131]. Three further lay-ups are located outside of the working corridor beyond 30 m disturbance buffers, and one further holt (suitable for breeding) is located outside of the working corridor beyond a 200 m disturbance buffer. However, disturbance to the remaining otter lay-ups / holt is still possible in an unmitigated scenario, due to site personnel or machinery entering areas close to resting places in the absence of exclusion zones being set up. Additionally, in the event of new resting places becoming established in close proximity to working corridors, disturbance to new resting places could occur. However, as described in the previous section, otter use a large number of resting places within their territories, and there is an abundance of connected and undisturbed habitat highly suitable for cover and resting places within the areas surrounding the working corridor, and in the wider area, both within and outwith Ness Woods SAC. As such, it is concluded that the local otter population would continue to have access to, and availability of, sufficient undisturbed resting places within the surrounding areas, such that their long-term existence would not be compromised.

Overall, it is concluded that in the absence of mitigation, not all conditions for the species' long-term existence would be met, and the project therefore has the potential to **undermine Conservation Objective 2a for otter**.

2b. Maintain the distribution of the species throughout the site

The Conservation Advice Package states: *"Otters should be able to use and access all areas of importance within the SAC and their distribution throughout the site should be maintained.*

Distribution of otters within the site can be affected by disturbance originating both within and outwith the site. Plans and projects that cause displacement and barrier effects to the species can also affect species distribution. Examples include road and bridge construction works and general disturbance from human activity (and dogs) by watercourses especially at dusk / night-time."

Otter field evidence has been recorded within all wooded areas of Ness Woods SAC within the Development Site boundary, and particularly along the Loch Ness shoreline, and these areas provide habitat suitable for resting.

The project would not result in restricting access to Loch Ness, which constitutes an important hunting area. Specifically, otters that use the wooded areas of Ness Woods in close proximity to the project area for cover and resting would continue to be able to access Loch Ness both to the north and south of the project area. Similarly, otter would be able to continue to access Loch Kemp and smaller Lochans to the east of Ness Woods SAC, by commuting along the Allt an t-Sluichd watercourse and around either side of Dam 1 at the upstream end of the watercourse, or by travelling along other watercourses passing through the area such as the Allt a' Chinn Mhonaich and the unnamed watercourse draining from Lochan a' Choin Uire. As such, it is concluded that there would be no significant barrier effects, and access to important hunting habitat, and wooded areas suitable for cover, would be maintained.

As described under Conservation Objective 2a, there would be a loss of (up to) 5.52 ha of woodland habitat suitable for cover, including otter resting sites. Beyond the working corridor, there is the potential for disturbance

as a result of human and vehicular presence, noise, vibration and lighting during construction, and lighting and human presence during operation. For the reasons already discussed in the previous section, the disturbance effects are assessed as being minimal and localised, and in the context of the large home ranges of otter, and abundance of connected habitat in the surrounding areas, would not result in a significant reduction in the distribution of the species throughout the site.

Overall, it is concluded that the project **would not undermine Conservation Objective 2b for otter.**

2c. Maintain the habitats supporting the species within the site and availability of food

The Conservation Advice Package states: "*The distribution and extent of otter habitat within the site should be maintained, together with the structure, function and supporting processes of the habitat.*

Otters require suitable habitat for foraging, breeding and resting. In freshwater environments abundant boulders, crevices and / or peat, or other cavity-forming features such as tree root systems are needed to provide secure holt sites above high water. Dense scrub is also valuable for providing lie-ups and couches. Suitable areas supporting a healthy fish population within a nearby watercourse or still water body are required within each otter's home range, to enable foraging for key prey species such as salmonids and eels. Access to ponds, ditches, reedbeds and wetlands where amphibians may breed is also important.

Changes to water flow and water quality can adversely affect otter habitat and prey on which they depend. Otters' food supply is normally associated with good water quality and therefore the water quality standards set out under the Water Framework Directive (2000/60/EC) should be met."

As already discussed under the Conservation Objectives for the woodland qualifying features, in the absence of mitigation, construction of Dam 1 and the access track has the potential to adversely affect water quality within the Allt an t-Sluichd and Allt a' Chinn Mhonaich watercourses, from inadvertent pollution events via fuel spills, changes in water chemistry from contamination with concrete, or from an increased sediment load. In the absence of mitigation, construction of Dam 1 would also affect the flow rate within the Allt an t-Sluichd. Any of these changes could adversely affect otter via prey abundance.

As detailed in Section 5.4.1, in an unmitigated scenario, the project has the potential to significantly adversely affect Arctic charr, ferox brown trout, Atlantic salmon, sea trout, European eel, river and sea lamprey within Loch Ness during construction. Atlantic salmon, sea trout, European eel, river and sea lamprey within Loch Ness are also predicted to be significantly adversely affected during the operational phase. Pathways for these significant effects comprise: underwater noise during construction from piling and blasting operations; attraction to the outlet and intake; and impingement / entrainment to the intake / outlet during the operational phase. Other potential effects upon fish are assessed as being minor and non-significant (see Volume 1, Chapter 13: Fish of the EIA Report). Therefore in an unmitigated scenario, the Proposed Development could adversely affect otter via a reduced prey abundance. The potential reduced prey abundance is expected to be minor in the context of the high quality and abundant food resource of Loch Ness and the wider catchment however.

As discussed in the previous sections, although there would be a loss of up to 5.52 ha of wooded habitat suitable for otter cover, including the loss and disturbance of otter resting sites, given the abundance of surrounding wooded habitat for cover and resting (including abundant crevices, boulders and tree roots), and considering the loss in the context of large otter home ranges and the large number of resting places used within home ranges, it is considered that sufficient breeding and resting habitat will be maintained such that the otter population would not be significantly adversely affected.

Overall, it is concluded that in the absence of mitigation, the project has the potential to **undermine Conservation Objective 2c for otter**, by reducing the availability of key prey species.

Step Two, Part Three: In Combination Effects of the Project with other Plans or Projects

In combination effects upon Ness Woods SAC have been assessed by considering other developments within Ness Woods SAC, and other developments adjacent to Ness Woods SAC that could potentially affect it. The in

combination assessment also includes a consideration of developments within 5 km of the Proposed Development Site boundary, to allow for consideration of effects on otter beyond the boundary of Ness Woods SAC, where disturbance effects within overlapping home ranges have the potential to occur. In combination effects resulting from proposed, consented and operational pumped storage hydro schemes at Loch Ness are also considered.

The assessment includes operational projects; projects under construction; consented projects which are not yet under construction and projects for which planning or scoping applications have been submitted. Minor developments such as individual dwellings, extensions and driveways have been excluded. The Loch Kemp Storage 'Associated Works', comprising the switching station, associated access track, and underground cable between the powerhouse and switching station, has also been included. The onward grid connection, from the switching station to the existing Foyers Substation, which would be subject to a separate consenting process to be completed by Scottish Hydro Electric Transmission plc, operating and known as Scottish and Southern Electricity Networks Transmission (SSEN Transmission), has not been included because there is insufficient information about the route at this stage. However, the route is not expected to pass through Ness Woods SAC.

There are no consented or proposed operations that require assessment for in combination effects of dust emissions of vehicle movements, as detailed further in Volume 1, Chapter 18: Air Quality of the EIA Report.

A total of 11 other developments were identified within the in combination effects search parameters, which have been assessed for their potential to lead to in combination effects upon Ness Woods SAC with the Proposed Development. The results of the in combination assessment are presented in Table 6-1.

No likely significant in combination effects were identified from the Highland-wide Local Development Plan 2012 or the Proposed Inner Moray Firth Local Development Plan 2022.

Table 6-1: In Combination Effects Assessment for Ness Woods SAC

Name	Details of Development	Status	Distance and Direction from Site	Cumulative effects
Loch Kemp Storage Associated Works	Switching station, underground cable, and access track	Subject to separate planning application (not submitted at time of writing)	Within Site, and partially within Ness Woods SAC	**No significant in combination effects** predicted. The location of the proposed 'Associated Works', to be subject to a separate planning application, are shown in Figure 3 (subject to micro-siting). The proposed switching station and access track is located over 1 km east of Ness Woods SAC. The proposed underground cable route between the cable shaft and the switching station would follow the route of access tracks already proposed for the Proposed Development. The cable route would pass through Ness Woods SAC at two locations. Specifically, the cable would pass over Dam 1 at Loch Kemp outflow, over the Allt an t-Sluichd. The cable would also pass underground through the cable tunnel, between the powerhouse on the shore of Loch Ness, and the cable shaft to the east of Ness Woods SAC. Due to the cable being passed through an underground tunnel, or being sited on infrastructure already proposed for the Proposed Development (i.e. Dam 1 and access tracks), these Associated Works would not result in any further loss, damage or fragmentation of habitat within Ness Woods SAC, beyond that already occurring as a result of the Proposed Development. As such, no significant in combination effects upon the qualifying woodland habitats are predicted as a result of these works. The switching station and access track are located a sufficient distance away, in differing habitats for those which Ness Woods SAC is designated for, with no hydrological connectivity, such that they are not predicted to result in significant effects upon Ness Woods SAC woodland qualifying habitat. No significant in combination effects are therefore predicted for the woodland qualifying habitat, either during construction or operation. The Associated Works do not lie within habitat expected to be of high value to otter (beyond areas already being affected by the Proposed Development), and are not expected to result in any additional impacts to watercourses or waterbodies. The Associated Works are not proposed within disturbance buffers of any identified otter resting places. With standard best practice working measures in place, the Associated Works would not be expected to result in a significant increased risk of mortality or injury to otter during construction or operation. The works could result in additional disturbance to fauna (otter, as well as other typical faunal species of the qualifying habitats such as red squirrel) during construction, as a result of human and machinery presence. However, the areas of value for these species would already be disturbed as a result of construction of the Proposed Development, such that significant additional disturbance beyond that which would already occur as a result of the Proposed Development, is not anticipated, based on the assumption that construction works would be undertaken concurrently with the Proposed Development. Therefore, no significant in combination effects upon Ness Woods SAC otter qualifying feature, nor any other qualifying features, are predicted.

Name	Details of Development	Status	Distance and Direction from Site	Cumulative effects
				As such, this development would not undermine any of the Conservation Objectives of Ness Woods SAC in combination with the Proposed Development.
Land at Allt Luaidhe	500 kW run-of-river hydro-electric power scheme	Operational	c. 3 km southwest, partially within Ness Woods SAC	**No significant in combination effects** predicted. A powerhouse and 500 m of penstock falls within Ness Woods SAC boundary, located on the shore of Loch Ness approximately 3 km southwest of the Site. The scheme has already been constructed, and tree loss was minimal (maximum of 120 trees, with compensatory planting incorporated) within an area of the SAC assessed to be of low quality. With scheme alterations and mitigation in place, NatureScot confirmed that no likely significant effects on Ness Woods SAC were predicted, and no Appropriate Assessment was required. Similarly, no significant effects were predicted on any other ecological features. Considering the nature of the development and the fact that construction has already been completed, no in combination effects are predicted as a result of disturbance or mortality / injury risk to otter or typical species of the woodland qualifying features, nor as a result of water quality impacts. Given that habitat loss was small and non-significant, and that no otter resting places were affected, no significant in combination effects are predicted upon Ness Woods SAC, in relation to habitat loss or fragmentation of woodland or otter qualifying features. As such, this development would not undermine any of the Conservation Objectives of Ness Woods SAC in combination with the Proposed Development.
Culachy Estate Land	10 turbine wind farm	Scoping	c. 12 km southwest, partially within Ness Woods SAC	**No significant in combination effects** predicted. Although the application boundary falls partially within Ness Woods SAC, the proposed turbine locations and associated infrastructure are set back well away from the SAC, on moorland, such that direct effects upon Ness Woods SAC are unlikely. There is hydrological connectivity with Ness Woods SAC. However, with good practice pollution prevention measures in place, water quality impacts would likely be negligible. The two projects are in different parts of Ness Woods SAC, within different catchments, and therefore an in combination effect on any one part of Ness Woods SAC would not occur. It is possible that individual otter could roam between the Site and this development, and therefore otter have the potential to experience multiple sources of disturbance within their home range if construction periods were to overlap. However, due to the distance between the disturbance sources, and when considering disturbance levels in the context of very large otter home range sizes, with an abundance of high quality otter habitat within the Loch Ness catchment, in combination effects of disturbance upon otter are considered to be minimal and non-significant. Given the separation distance of 12 km from the Proposed Development Site, no further pathways for potential in combination effects have been identified. As such, this development would not undermine any of the Conservation Objectives of Ness Woods SAC in combination with the Proposed Development.

Name	Details of Development	Status	Distance and Direction from Site	Cumulative effects
Dell Wind Farm	10 turbine wind farm (re-design from original 14 turbine consented scheme)	Scoping	c. 1.3 km south (nearest turbine is c. 8 km south)	**No significant in combination effects** predicted. The development would not affect the habitat types that Ness Woods SAC is designated for. No significant effects upon otter were predicted for the original consented scheme, and no significant in combination effects upon otter are predicted. Specifically, even if the construction periods were to overlap, given the suboptimal habitat for otter in much of the construction zone, the separation distance from the Site, and considering in the context of large otter home ranges with good quality habitat in the Loch Ness catchment, in combination effects of disturbance upon otter are considered to be minimal and non-significant. The project is located over 2.5km from Ness Woods SAC with no hydrological connection, such that no in combination effects upon Ness Woods SAC are predicted. As such, this development would not undermine any of the Conservation Objectives of Ness Woods SAC in combination with the Proposed Development.
Corriegarth Wind Farm	23 turbine wind farm	Operational	c. 2.7 km east (nearest turbine c. 7 km southeast)	**No significant in combination effects** predicted. Construction is already complete. No significant effects upon otter were predicted, and no significant in combination effects upon otter are predicted. The development would not affect the habitat types that Ness Woods SAC is designated for. The project is located over 3.5km from Ness Woods SAC with no hydrological connection, such that no in combination effects upon Ness Woods SAC are predicted. As such, this development would not undermine any of the Conservation Objectives of Ness Woods SAC in combination with the Proposed Development.
Corriegarth 2 Wind Farm	16 turbine wind farm	Appeal	c. 2.7 km east (nearest turbine c. 7 km southeast)	**No significant in combination effects** predicted. No significant effects upon otter were predicted, and no significant in combination effects upon otter are predicted. Specifically, even if the construction periods were to overlap, given the suboptimal habitat for otter in much of the construction zone, the separation distance from the Site, and considering in the context of large otter home ranges with good quality habitat in the Loch Ness catchment, in combination effects of disturbance upon otter are considered to be minimal and non-significant. The development would not affect the habitat types that Ness Woods SAC is designated for. The project is located over 3.5km from Ness Woods SAC with no hydrological connection, such that no in combination effects upon Ness Woods SAC are predicted. As such, this development would not undermine any of the Conservation Objectives of Ness Woods SAC in combination with the Proposed Development.
Bhlaraidh Wind Farm	36 turbine wind farm	Operational	c. 3 km west (nearest turbine c. 8 km west)	**No significant in combination effects** predicted. Construction is already complete. No significant effects upon otter were predicted, and no significant in combination effects upon otter are predicted. The development is on the far side of Loch Ness with a low level of ecological connectivity. The development would not affect the habitat types that Ness Woods SAC is designated for. The project is located 3km from Ness Woods SAC with no hydrological connection, such that no in combination effects upon Ness

Name	Details of Development	Status	Distance and Direction from Site	Cumulative effects
				Woods SAC are predicted. As such, this development would not undermine any of the Conservation Objectives of Ness Woods SAC in combination with the Proposed Development.
Bhlaraidh Wind Farm Extension	15 turbine wind farm	Operational	c. 3 km west (nearest turbine c. 6.5 km west)	**No significant in combination effects** predicted. Construction is already complete. No significant effects upon otter were predicted, and no significant in combination effects upon otter are predicted. The development is on the far side of Loch Ness with a low level of ecological connectivity. The development would not affect the habitat types that Ness Woods SAC is designated for. The project is located a sufficient distance from Ness Woods SAC with no hydrological connection, such that no in combination effects upon Ness Woods SAC are predicted. As such, this development would not undermine any of the Conservation Objectives of Ness Woods SAC in combination with the Proposed Development.
Loch Liath Wind Farm	26 turbine wind farm	Scoping	4 km west (nearest turbine c. 8 km west)	**No significant in combination effects** predicted. No significant in combination effects upon otter are predicted, given the separation distance from the Site, lack of hydrological connectivity, and suboptimal habitat for otter within the proposed wind farm footprint. Specifically, even if the construction periods were to overlap, given the separation distance from the Site, and considering in the context of large otter home ranges with good quality habitat in the Loch Ness catchment, in combination effects of disturbance upon otter are considered to be minimal and non-significant. The development has no strong ecological connectivity with the Site, being located on the far side of Loch Ness with most construction works located at least 8 km from the Site. The development would not affect the habitat types that Ness Woods SAC is designated for. The project is located a sufficient distance from Ness Woods SAC with no hydrological connection, such that no in combination effects upon Ness Woods SAC are predicted. As such, this development would not undermine any of the Conservation Objectives of Ness Woods SAC in combination with the Proposed Development.
Red John Pumped Storage Scheme	Pumped Storage Scheme	Consented	c. 19 km northeast	**No significant in combination effects** predicted. Operation of Red John and Foyers pumped storage schemes together with the Proposed Development would increase the frequency at which the water levels of Loch Ness would fluctuate between the existing minimum and maximum water levels. Ness Woods SAC boundary extends to the shoreline of Loch Ness. Whilst the woodland qualifying feature habitats extend to the shoreline, the shoreline itself is rocky and the terrain is steep, and the woodland qualifying habitat does not extend into the littoral zone. No in combination effects upon Ness Woods SAC are therefore predicted.
Foyers Pumped Storage Scheme	Pumped Storage Scheme	Operational	c. 6 km northeast	

Step Three: Effects on Integrity

Without mitigation and considering in combination effects, the project has the potential to undermine the following conservation objectives for Ness Woods SAC, and therefore represent an adverse effect on the integrity of the SAC:

- All habitat features:
  - 1. To ensure that the qualifying features of Ness Woods SAC are in favourable conservation status.
  - 2. To ensure that the integrity of Ness Woods SAC is restored by meeting objectives 2a, 2b and 2c for each qualifying feature:
- *Tilio-Acerion* forests of slopes, screes and ravines:
  - 2a. Restore the extent and distribution of the habitat within the site;
  - 2b. Restore the structure, function and supporting processes of the habitat;
  - 2c. Restore the distribution and viability of typical species of the habitat;
- Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles:
  - 2a. Maintain the extent and distribution of the habitat within the site;
  - 2b. Restore the structure, function and supporting processes of the habitat; and
  - 2c. Restore the distribution and viability of typical species of the habitat.
- Otter:
  - 1. To ensure that the qualifying features of Ness Woods SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status.
  - 2.To ensure that the integrity of Ness Woods SAC is restored by meeting objectives 2a, 2b and 2c for the qualifying feature:
  - 2a. Maintain the population of the species as a viable component of the site; and
  - 2c. Maintain the habitats supporting the species within the site and availability of food.

Step Four: Mitigation Measures

For the potential effect pathways undermining Conservation Objectives identified in Step Three, proposed mitigation measures, and the predicted effects following the application of the proposed measures, are presented below. The mitigation measures detailed include good practice measures that would reduce or remove effects upon the qualifying features, as well as more tailored mitigation measures and embedded mitigation that would reduce or remove effects.

Construction Phase

General measures

- A detailed Construction Environmental Management Plan (CEMP) will be required for the Proposed Development, which will contain full details of construction mitigation measures. An Outline CEMP is included in Volume 4, Appendix 3.3 of the EIA Report.
- Toolbox talks will be delivered prior to the start of works to all construction personnel. This will include information on the relevant European Site interest features, their location, legislative protection and mitigation measures;
- A suitably qualified Ecological / Environmental Clerk of Works (ECoW) or ECoW team would be employed for the duration of the construction and reinstatement periods, to ensure natural heritage interests are safeguarded, including all ecological and hydrological matters; The powerhouse and associated processing plant would have hard paved surfaces to control air quality risk; and
- On-site tracks would be constructed from unbound stone with regular maintenance and grading.

Reduced water quality – mitigation measures

Good practice measures in relation to pollution risk and sediment management that would be adopted during the construction and operation phases are set out in Volume 1, Chapter 7: Water Management and Chapter 14:

Geology, Soils and Water of the EIA Report. Mitigation will be required in the form of a rigorous CEMP and Pollution Prevention Plan (PPP), this will require adherence to Scottish Environment Protection Agency (SEPA) Guidance for Pollution Prevention (GPP) and Pollution Prevention Guidance Notes (PPG)[133] specifically: GPP 1, 2, 5, 8, 13, 21 and 22, and PPG 3, 6 and 7. Good practice measures detailed in Construction Industry Research and Information Association (CIRIA) publications C532, C741 and C753[134]; and SEPA publications 'Engineering in the Water Environment: Good Practice Guide – Sediment Management'[135]; 'Groundwater Protection Policy for Scotland'[136]; and 'Guide to Hydropower Construction Good Practice'[137] would also be adhered to. The mitigation would be detailed by the client in the CEMP and PPP documents and signed off by the Local Planning Authority (LPA). The mitigation would be implemented by the client and once in place would require regular monitoring to ensure all aspects are compliant. In summary, the mitigation to be set out in the CEMP / PPP would include:

- Areas would be designated for production of concrete or washout of vehicles which are a minimum distance of 50 m from a watercourse;
- Washout water would also be stored in the washout area before being treated and disposed of, or re-used in concrete production;
- A 10 m buffer has been applied to watercourses and, with the exception of the Dam 1 works at the upper end of the Allt an t-Sluichd within Ness Woods SAC, where practical any proposed construction activities or infrastructure has been located outside of this buffer. Within Ness Woods SAC, this relates to the Allt a Chinn Mhonaich, the unnamed watercourse draining from Lochan a' Choin Uire, and the length of Allt an t-Sluichd downstream of Dam 1;
- Refuelling would take place at least 50 m from watercourses;
- Any above ground on-site fuel and chemical storage would be bunded, and procedures would be adhered to for storage of fuels and other potentially contaminative materials in line with the Controlled Activity Regulations, to minimise the potential for accidental spillage;
- Emergency spill response kits would be maintained during the construction works;
- A vehicle management system would be put in place wherever possible to reduce the potential conflicts between vehicles and thereby reduce the risk of collision;
- A speed limit would be used to reduce the likelihood and significance of any collisions;
- Drip trays will be placed under vehicles which could potentially leak fuel / oils;
- Any water contaminated with silt or chemicals would not be discharged, nor would runoff be allowed to enter, directly or indirectly, a watercourse without prior treatment;
- Water for temporary site welfare facilities would be brought to site, and foul water would be collected in a tank and collected for off-site disposal at an appropriately licensed facility, and would be managed in accordance with PPG4;
- A plan for dealing with spillage incidents would be designed prior to construction, and this would be adhered to should any incident occur, reducing the effect as far as practicable. This would be included in the final CEMP for the Proposed Development;
- A wet weather protocol would be developed. This would detail the procedures to be adopted by all staff during periods of heavy rainfall. Tool box talks would be given to engineering / construction / supervising personnel. Roles would be assigned and the inspection and maintenance regimes of sediment and runoff

133 https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/

134 CIRIA (2001) *C532 Control of Water Pollution from Construction Sites*; CIRIA (2015) *C741 Environmental Good Practice on Site*; CIRIA (2015) *C753 The SUDS Manual*. Available at: https://www.ciria.org/

135 SEPA (2010) *Engineering in the water environment: good practice guide. Sediment Management*. First edition. Available online at: https://www.sepa.org.uk/media/151049/wat-sg-26.pdf

136 SEPA (2009) *Groundwater protection policy for Scotland*. Version 3. Available online at: https://www.sepa.org.uk/media/60033/policy-19_groundwaternov09.pdf

137 SNH, SEPA and Scottish Renewables (2019) *Guide to Hydropower Construction Good Practice*. Version 3. Available online at: https://www.sepa.org.uk/media/34332/guide-to-hydropower-construction-phase-good-practice-guidance.pdf

control measures would be adopted during these periods. In extreme cases, the above protocol would dictate that work on-site may have to be temporarily suspended until weather / ground conditions allow;

- Good practice measures for the management of erosion and sedimentation would include the following:
  - All stockpiled materials would be located outwith a 50 m buffer from watercourses;
  - Water would be prevented, as far as possible, from entering excavations such as trenches and foundations through the use of appropriate cut-off drainage;
  - Where the above is not possible, water would pass through silt / sediment traps to remove silt prior to discharge into the surrounding drainage system. Silt / sediment traps and flow attenuation measures would remain in place immediately post-construction, to slow runoff velocities and prevent erosion until vegetation around infrastructure becomes re-established;
  - Clean and dirty water on-site would be separated, and dirty water would be filtered before entering the water environment;
  - Silt fences would be deployed as required to reduce sediment transport;
  - The amount of ground exposed, and time period during which it is exposed, would be kept to a minimum;
  - Silt / sediment traps, single size aggregate, geotextiles or straw bales would be used to filter any coarse material and prevent increased levels of sediment. Further to this, activities involving the movement or use of fine sediment would avoid periods of heavy rainfall where possible; and
  - The ECoW and the Principal Contractor would carry out regular visual inspections of watercourses to check for suspended solids in watercourses downstream of work areas.
- The following measures would be implemented for dam construction:
  - Where excavations for foundations encounter localised limited quantities of groundwater or become flooded due to surface water runoff or heavy rainfall, appropriate treatment of dewatering would be instigated under direction of the site ECoW;
  - No dewatering discharge would be permitted directly adjacent to watercourses;
  - Unless directed otherwise by the site ECoW, dewatering discharge would drain across buffer areas of vegetation (e.g. grassland, heather) of at least 20 m width, which would provide for natural attenuation and dispersal of the flow and removal of silt;
  - Where no suitable vegetation is available for natural treatment of dewatering, the discharge would be passed through on-site settling tanks / lagoons prior to discharge by soakaway or to watercourse;
  - The requirement for dewatering would be minimised in all locations by timely and efficient excavation of the foundation void and subsequent concrete pouring and backfilling;
  - All procedures for dewatering would be agreed by the Principal Contractor with SEPA, THC and NatureScot, and detailed in the CEMP;
  - As much of the concrete as possible used in the installation of Dam 1 would be pre-weathered to reduce the risk of alkaline shock on the aquatic ecosystem downstream from Dam 1; and
  - The Principal Contractor would develop a method statement to address the transport, transfer, handling and pouring of liquid concrete at foundation sites.
- In relation to works involving concrete batching, transport and pouring, the following mitigation would be adopted:
  - Where concrete transfers are required, measures would be adopted at the point of concrete transfer to prevent accidental spillage of liquid concrete and no transfers would be undertaken in proximity to watercourses or areas of standing water;
  - There would be no wash-out of concrete carrying vehicles at foundation sites (except the concrete chute) with wash-out undertaken at the nearest compounds where suitably bunded / protected facilities would be provided. Chutes would be washed out to a suitable container, allowed to settle and disposed at suitably licensed facilities or reused in concrete production;

- Excess concrete or wash-out liquid would not be discharged to drains or watercourses. Drainage from washout facilities would be collected and treated or removed to an appropriate treatment point / licensed disposal site; and
- Vehicles and plant working at foundations would be confined to the area required for safe working only to prevent compaction, rutting and habitat damage to adjacent areas of land.

A Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by a Freshwater Ecologist or Aquatic Clerk of Works (ACoW) with experience of working with aquatic ecosystems. Water quality monitoring during the construction phase would be undertaken for the surface water catchments that drain from the Site to ensure that none of the tributaries of the main channels are carrying pollutants or suspended solids. Monitoring would be carried out at a specified frequency (depending upon the construction phase) on these catchments. Monitoring would continue throughout the construction phase and immediately post construction. Monitoring would be used to allow a rapid response to any pollution incident as well as assess the efficacy of good practice or remedial measures. Monitoring frequency would increase during the construction phase if remedial measures to improve water quality are implemented. Detailed water quality monitoring plans would be developed during detailed design. THC, SEPA, Ness and Beauly Fisheries Trust (NBFT) and Ness District Salmon Fisheries Board (NDSFB) would be consulted on the plans, which would be contained within the final CEMP. The performance of the good practice measures would be kept under constant review by the Water Quality Monitoring Programme, based on a comparison of data taken during construction with a baseline data set, sampled prior to the construction period.

With these precautions being adhered to there is negligible risk of watercourse contamination impacting Ness Woods SAC qualifying features.

Flow regime changes to Allt an t-Sluichd watercourse – mitigation measures

The natural flow regime of the Allt an t-Sluichd watercourse, which drains from Loch Kemp shall be maintained through construction and operation via an outfall at Dam 1, to maintain the hydrological regime.

Dam 1 would feature a compensation release at the foot of the dam. The pipe running through the dam for this environmental release would be positioned below the minimum water level in the upper reservoir to ensure availability of water. The release would be controlled by a valve on the pipe which would allow adjustment of the compensation flow rate by the plant's control system. A flow gauge has been in place to measure the water flow in the Allt an t-Sluichd between January 2022 and February 2023, recording over one year of data. Flow data has also been obtained from SEPA from permanent flow gauging stations in nearby river catchments. By comparing 2022-2023 flow data in the Allt an t-Sluichd with the permanent gauging stations, a long duration characteristic for the Allt an t-Sluichd has been established using several decades' worth of data[138]. The compensation flow through Dam 1 would be at a rate to be agreed with SEPA and NatureScot such as to mimic the natural flow of the Allt an t-Sluichd prior to scheme construction.

During construction of Dam 1, the natural flow in the Allt an t-Sluichd would be maintained through a phased construction approach. One side of the dam would be constructed behind a cofferdam while the watercourse flows around the cofferdam. The first phase of dam construction would include a drain pipe at the base of the dam. Watercourse flow would be maintained through the drain while the second phase of the dam is constructed. Once the dam is completed natural flow in the watercourse shall be maintained by the dedicated compensation flow pipe as described in the paragraph above.

With this measure in place, the hydrological regime of the Allt an t-Sluichd watercourse would be maintained, and humidity levels downstream on the watercourse would not be affected. The highly restricted niches for bryophytes and aquatic, amphibious and splash zone lichen assemblages would therefore be maintained. As

[138] MNV Consulting (2023) Loch Kemp outflow river monitoring station. Flow monitoring: Final report.

such, no residual effect upon the bryophyte and lichen assemblage, nor any other component of the woodland qualifying habitat downstream of Dam 1, would occur.

Dust deposition – mitigation measures

Dust mitigation measures are detailed in Volume 1, Chapter 18: Air Quality of the EIA Report. A Dust Management Plan (DMP) would be produced which would be signed off by the LPA. A monitoring scheme would be implemented as part of the DMP.

The following good practice dust control measures would be employed across the whole Site:

- Locating dust generating activities away from high and medium sensitive receptors (where possible);
- Provision for water supply for dampening;
- Provision of wheel wash and paved parking;
- Provide training on dust mitigation;
- Monitoring of dust deposition;
- Maintaining good communication;
- Management of on- and off-site vehicle movements including inspections, spill control, speed limits and cleaning;
- Soil and overburden handling;
- Using hydraulic excavators and fitting dust extraction systems;
- Appropriate use of processing plant;
- Dampening of materials in dry weather; and
- Management of stockpiles.

The following additional dust control measures specific to Ness Woods SAC would be adopted:

- Plan dust generating activities within 100 m of Ness Woods SAC during favourable weather conditions only, where practicable;
- Locate the central processing area in the upper reservoir area at least 200 m from Ness Woods SAC, where practicable;
- Application of water suppression in dry conditions and a speed limit of 15 mph for vehicle movements through Ness Woods SAC;
- Cover and dampen short-term stockpiles within 100 m of Ness Woods SAC;
- For long-term stockpiles within 200 m of Ness Woods SAC where seeding is not possible, use netting screens / side walls / semi permeable fences / misting sprays;
- Management measures for conveyers used within 100 m of Ness Woods SAC;
- Crushing and screening to take place in a fully enclosed structure if within 200 m of Ness Woods SAC or a sheltered area as far away from the SAC as possible and fitted with water spray suppression bars;
- Avoid stripping and overburden handling operations within 200 m of Ness Woods SAC during dry and windy conditions, where practicable; and
- Implement monitoring of dust deposition within Ness Woods SAC including baseline survey.

With these mitigation measures being adhered to, it is considered that the Residual Source Emission Magnitude and the Pathway Effectiveness for dust emissions would reduce substantially, for the residual effects upon Ness Woods SAC to be considered non-significant in Volume 1, Chapter 18 of the EIA Report.

Protection of tree roots and retained habitat – mitigation measures

Good practice measures to protect retained habitats outside of the working corridors during the construction phase would be implemented, including the erection of temporary protective fencing demarcating the working corridor, to be overseen and policed by the ECoW. Vehicular access would not be permitted outside of the working corridor.

To minimise damage to bryophyte interest, care would be taken during construction to minimise the disturbance to the rocks close to the Loch Ness shoreline in the proposed powerhouse area, the boulder scree above the proposed powerhouse, and the low northwest-facing rocks above the beach in the proposed powerhouse area, as far as possible. Disturbance to sheltered rotten logs and rock outcrops would also be avoided or minimised wherever possible.

An ECoW would supervise all works in the vicinity of veteran hazels and birch trees. Appropriate barriers would be used to define working corridors and all trees to be retained. Appropriate buffer zones would be implemented when erecting barriers to avoid inadvertent damage from heavy machinery / plant manoeuvring. This shall incorporate Root Protection Zones for retained trees wherever possible (to avoid damage to the root plates of retained trees near the working corridor) and would also incorporate collapsed / leaning and / or 'phoenix' trees (as the lichen interest is often best developed on leaning stems). Cutting leaning stems on hazels to be retained shall be avoided where possible, and where unavoidable a lichenologist would be consulted.

With these mitigation measures in place, damage to retained trees and associated bryophyte and lichen communities, as well as other vegetation, beyond the working corridor, would be minimised as far as possible, and RPAs of trees beyond the working corridor would only be affected where construction works cannot be undertaken in any other way (e.g. where track cut-and-fill right up to the RPA cannot be avoided). Up to 107 trees outside of the working corridor could still potentially be damaged, however this figure is precautionary, and would be further reduced by the mitigation measures proposed here, although some damage would be unavoidable.

Lighting – mitigation measures

Temporary construction lighting would be restricted to the minimum required. Construction lighting details would be provided in the final CEMP. Operational lighting would also be restricted to the minimum required for operational and security purposes, and would comprise discrete lighting located at the powerhouse infrastructure only. Lighting would be directed away from the most sensitive habitats including woodland and waterbodies, wherever possible, to minimise light spill to adjacent habitats. Lighting would avoid specifications with a high UV component.

Whilst the adoption of sensitive lighting would reduce potential light disturbance effects upon otter, some lighting disturbance effects would remain. As discussed under Conservation Objective 2a for otter, lighting areas are limited in extent. Construction activity and lighting is also temporary in nature, with extensive unlit and undisturbed areas across the Site and wider area. When considering this in the context of the large home ranges of otter, it is concluded that artificial lighting would not lead to a permanent reduction in the otter population, and does not constitute a significant effect.

Track construction and maintaining groundwater and surface water flows – mitigation measures

The access track proposed through Ness Woods SAC shall be of a permeable construction that will allow infiltration of rainwater and lateral movement of surface water flows.

The access track shall have frequent cross drains to maintain existing surface water flow paths. The precise locations of the cross drains would be determined by the ECoW.

The access track would be constructed with rock and aggregate won onsite and therefore would have the same geochemical properties as the existing rock.

With these mitigation measures in places, the creation of areas of concentrated flow would be avoided, and the over / under-saturation of retained habitats would be avoided. These measures would safeguard any existing water flow paths and maintain existing water quality. Therefore no appreciable change in the retained vegetation communities comprising typical species of the qualifying woodland habitats, as a result of drainage impacts, is predicted. Therefore residual potential hydrological effects upon existing habitats surrounding the access track would be negligible.

Inadvertent introduction of invasive non-native species – mitigation measures

A pre-construction survey for invasive non-native plant species shall be undertaken. A Biosecurity Management Plan (BMP) would be produced, which would be informed by the results of the pre-construction survey, and would be adhered to for the duration of construction. The BMP would detail measures to prevent the spread of invasive non-native species during construction, including the checking and cleaning of site personnel footwear and machinery tracks and tyres.

The CEMP, PPP and Water Quality Monitoring Programme, overseen by an ACoW, would include Biosecurity measures which would protect against the spread of aquatic invasive non-native macroinvertebrate species during the construction phase. Annual monitoring of aquatic macroinvertebrates would be undertaken to monitor the spread of such species during the construction phase.

With the biosecurity measures being adhered to, the risk of introducing or spreading invasive non-native species would be negligible.

Protection of otter resting places and licensing

Due to the time that will have elapsed since the last surveys and the possibility that otter activity could have changed in the intervening period, a pre-construction otter survey would be undertaken prior to construction taking place. This would cover all watercourses and other suitable habitat within 250 m of proposed infrastructure and working corridors. Pre-construction surveys would also include red squirrel.

Due to the presence of otter lay-ups and potential (non-breeding) holts within the working corridor, and outside of the working corridor but within a 30 m buffer, a licence would be obtained from NatureScot prior to the commencement of works within 30 m of the otter resting sites. The licence application would include up to date survey information and an otter protection plan, detailing measures to protect and reduce disturbance to otter. For the two potential (non-breeding) holts which would be lost, two artificial holts would be created within retained undisturbed habitat, which would be agreed with NatureScot under licence.

An exclusion zone of a minimum of 30 m would be implemented for the retained otter lay-ups, and 200 m for the retained holt (suitable for breeding), demarcated by the ECoW, to prevent disturbance to the retained lay-ups / holt, and to ensure legislative compliance. No site personnel or machinery would be permitted within the exclusion zones.

With the above mitigation measures in place, disturbance would be reduced, no disturbance of the three retained otter lay-ups beyond 30 m of the working corridor and one retained holt beyond 200 m of the working corridor would occur, and relevant legislation would be adhered to.

Risk of mortality or injury of otter from traffic collisions or becoming trapped in excavations – mitigation measures

During construction, site speed limits of 15 mph would reduce the likelihood of accidental injury / killing of otter by construction traffic. A site speed limit of 15 mph would also be in place during operation.

All potentially dangerous substances or materials within construction compounds or used during maintenance activities during operation, would be carefully stored to prevent them causing any harm to otters which may enter the compounds at night.

During construction, all excavations greater than 1 m depth would either be covered at night or designed to include a ramp to allow otters a means of escape should they fall in.

With the above mitigation measures in place, the risk of otter mortality from traffic collisions during construction and operation, or becoming trapped in excavations during construction, is considered minimal and non-significant. These measures also apply to protecting red squirrel.

Fish impacts – mitigation measures

For the construction of Dams 1 and 4 which require instream works on the Allt an t-Sluichd and Allt Leachd Gowerie watercourses, and the installation of the culvert on the Allt Leachd Gowerie watercourse, fish rescue and relocation would be undertaken prior to the damming / dewatering of watercourses. This would protect resident trout populations in the vicinity of the works from harm.

For the installation of the cofferdams, a fish rescue would be undertaken within the enclosed cofferdam areas prior to dewatering.

For the installation of the cofferdam at Loch Ness and construction of the lower control works on the Loch Ness shoreline, a fish rescue and relocation would be undertaken around any soft sediment areas, suitable for juvenile lamprey in the immediate vicinity of the works prior to piling.

Any piling operations would adopt a 'soft start' approach to allow adult fish within the immediate vicinity of the cofferdam works area to disperse unharmed. Noise reducing devices shall be fitted to equipment, including baffles and silencers, to reduce noise during construction. Noise emissions would be additionally reduced through the implementation of acoustic barriers around piling and blasting operations such as through the use of air bubble or solid barriers or baffles. For any piling or blasting operations, a temporary bubble curtain will be deployed around the works to attenuate noise effects and deter fish from the area. Barriers will both additionally prevent dispersion of silt pollution into Loch Ness. These have been successfully implemented on previous construction projects and would reduce and / or negate noise impacts when deployed correctly. Noise levels will be monitored in Loch Ness via the installation of hydrophones and monitoring equipment. The ACoW would monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.

Any lighting used during construction would be directed away from the loch edges and watercourses to prevent the risk of displacement and increased predation of fish during the hours of darkness.

With the above mitigation measures in place, the residual effect upon Arctic charr, Atlantic salmon, ferox brown trout, river and sea lamprey, brown and sea trout in Loch Ness (i.e. otter prey species) during construction would be minor, and does not constitute a significant effect. All other effects upon fish during construction would also remain non-significant. Given the lack of significant effects on fish potential effects on otter in terms of prey availability would be avoided.

Operational phase

Intake / Outlet Screens

Intake / outlet and tailrace structures at Loch Ness and Loch Kemp, and the outflow at Dam 1, shall be fitted with screens, comprising a 12.5 mm mesh aperture. This will prevent the risk of fish impingement and entrainment, as detailed under the mitigation for River Moriston SAC, but shall also prevent otter from entering the intake / outlet pipes, which shall protect otter from becoming trapped or injured / killed, or accessing the turbines. The screens will require regular inspection and maintenance or a self-cleaning mechanism to prevent blockage / damage from foliage and debris.

The proposed screens are industry standard specifications and accord with NatureScot guidance[139] to protect otter.

With the screens in place, the risk of mortality or injury to otter by accessing turbines is removed.

The screens would also prevent the risk of fish entrapment, injury and mortality or translocation. It is possible that smaller fish (e.g. elvers) may be able to pass through a 12.5 mm screen however using a recommended mesh size for elver of 2 mm would result in continual foliage / debris build up and increase velocities across the

[139] SNH (2015) Hydroelectric schemes and the natural heritage. Available at: https://www.nature.scot/sites/default/files/2018-05/A1521095%20-%20Hydroelectric%20schemes%20and%20the%20natural%20heritage%20-%20Dec%202015.pdf [Accessed in January 2023]

screen, likely increasing overall impacts on fish. Elvers are weaker swimmers so are unlikely to be able to overcome the outflow velocity during generation and swim through the screens.

Intake / Outlet Water Velocity

The approach velocity of water across the intake screen during abstraction / pumping mode would be <0.3 m/s. This would ensure that most fish species would be able to overcome the effect of entrainment towards the screens.

Outflow would be diffused using vane structures on the outlets to spread the flow over a wider area. This would reduce the potential for attraction / entrainment / impingement of upstream migrating fish.

Culvert design

The culvert to be installed on the Allt Leachd Gowerie for construction and operational access would conform to the SEPA good practice guide on river crossings. This would allow fish passage through the culvert.

Further fish mitigation measures

An appropriately designed fish deterrent system will be installed which will deter fish from the draw of water from the intake, preventing entrainment / impingement at the screens and reducing predation impacts. Fish deterrent systems work best when multiple fish deterrent types are working in tandem and could include bubble curtains, acoustic fish deterrents (AFD) or intensive flashing light. The deterrent system will be deployed around the intake to deter fish during sensitive periods (Mid-March – end June for salmon and sea trout smolts and May – end July for elvers).

Strobe lighting surrounding the outlet / intake area during night and crepuscular periods would act as a deterrent for salmon utilising the immediate area as a migration route. This may have additional benefits in encouraging adult fish to move within the immediate vicinity of the mouth of the River Moriston reducing migration times and associated energy burden and predation risk. Additionally, night time marks peak smolt migration periods (for early migrators) when light deterrent is most effective. Lighting would be less efficient as a deterrent during daylight hours.

CCTV would be in operation at the outlet area to deter and monitor instances of poaching.

In the first year of the operational phase, an ACoW would monitor problem areas within the inundated section of Loch Kemp and seek to introduce dug channels allowing passage back to natural loch / river channels at minimum inundation.

A Fish Monitoring Plan (FMP) would be implemented to monitor the impacts of the operational scheme on fish.

With the above mitigation measures in place, the residual effect upon Atlantic salmon, European eel, river and sea lamprey, and sea trout in Loch Ness (i.e. otter prey species) during operation would be minor, and does not constitute a significant effect. All other effects upon fish during operation would also remain non-significant. Given the lack of significant effects on fish potential effects on otter in terms of prey availability would be avoided.

Restriction of access to Ness Woods SAC habitat

For tourists visiting the powerhouse building by boat during operation, measures to prevent visitors from accessing adjacent areas of habitat within Ness Woods SAC would be put in place, such that visitors can access the powerhouse building and quayside only, with details to be agreed post-consent.

With this measure in place, human disturbance effects during operation would be minimised and would be restricted to the infrastructure areas only, primarily the powerhouse building and quayside.

Impact of the mitigation measures

The residual effects on the conservation objectives, with mitigation in place, for Ness Woods SAC are assessed in Table 6-2.

Table 6-2: Assessment of residual effects on the Conservation Objectives, with mitigation applied, for Ness Woods SAC

Qualifying feature	Conservation Objective	Relevant mitigation	Residual Effect – Alone	Residual effect – In Combination	Objective Undermined?
All habitat features:					
1. To ensure that the qualifying features of Ness Woods SAC are in favourable conservation status		As below, under 2a – c for woodland qualifying features.	As below, under 2a – c for woodland qualifying features.	No additional.	Yes – by undermining 2a – c
Tilio-Acerion forests of slopes, screes and ravines					
2. To ensure that the integrity of Ness Woods SAC is restored by meeting objectives 2a, 2b and 2c for each qualifying feature:	2a. Restore the extent and distribution of the habitat within the site	-	Permanent direct loss of up to 0.60 ha, and habitat change from fragmentation of 0.13 ha of qualifying feature woodland habitat, including associated tree, bryophyte, lichen and ground flora; and possible root damage of trees beyond the working corridor (see Table 5-3 and Section 5.4.1 for a full breakdown).	No additional.	Yes
	2b. Restore the structure, function and supporting processes of the habitat	Implement rigorous CEMP and PPP, including adherence to relevant SEPA pollution prevention guidelines. Toolbox talks. Demarcate retained habitat areas with protective fencing including Root Protection Zones, and prohibit vehicle / machinery access. ECoW and ACoW supervision, and implementation of Water Quality Monitoring Programme. Pre-construction invasive non-native species survey and implementation of BMP. Implement dust control mitigation measures delivered via DMP.	Permanent direct loss of up to 0.60 ha, and habitat change from fragmentation of 0.13 ha of qualifying feature woodland habitat, including associated tree, bryophyte, lichen and ground flora; and possible root damage of trees beyond the working corridor (see Table 5-3 and Section 5.4.1 for a full breakdown). With mitigation measures in place, the structure, function or supporting processes of the feature within retained habitat beyond the 0.73 ha habitat loss and fragmentation areas would not be adversely affected.	No additional.	Yes
	2c. Restore the distribution and viability of typical species of the habitat		Permanent direct loss of up to 0.60 ha, and habitat change from fragmentation of 0.13 ha of qualifying feature woodland habitat, including associated tree, bryophyte, lichen and ground flora; and possible root damage of trees beyond the working	In combination disturbance effects upon fauna comprising	Yes

Qualifying feature	Conservation Objective	Relevant mitigation	Residual Effect – Alone	Residual effect – In Combination	Objective Undermined?
		Include outfall on Dam 1 to maintain natural flow regime on Allt an t-Sluichd watercourse. Pre-weathered concrete used in construction of Dam 1 where possible. Implement track construction and drainage measures to maintain groundwater and surface water flows.	corridor (see Table 5-3 and Section 5.4.1 for a full breakdown). Adversely affecting humidity sensitive bryophyte and lichen species within the second hairpin bend fragmentation area, via microclimatic edge effects. Reducing the resilience and therefore potentially affecting the long-term viability of lichen species that are rare at the site-based scale, via fragmentation effects. With mitigation measures in place, the distribution of typical canopy, shrub layer and ground flora species within retained habitat beyond the 0.73 ha habitat loss and fragmentation areas would not be adversely affected.	typical species of the habitat, from the Associated Works, or from other developments with overlapping construction periods, are minor and non-significant.	
Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles					
2. To ensure that the integrity of Ness Woods SAC is restored by meeting objectives 2a, 2b and 2c for each qualifying feature:	2a. Maintain the extent and distribution of the habitat within the site	-	Permanent direct loss of up to 4.96 ha, and habitat change from fragmentation of 1.04 ha of qualifying feature woodland habitat, including associated tree, bryophyte, lichen and ground flora; and possible root damage of trees beyond the working corridor (see Table 5-3 and Section 5.4.1 for a full breakdown).	No additional.	Yes
	2b. Restore the structure, function and supporting processes of the habitat	Implement rigorous CEMP and PPP, including adherence to relevant SEPA pollution prevention guidelines. Toolbox talks. Demarcate retained habitat areas with protective fencing including Root Protection	Permanent direct loss of up to 4.96 ha, and habitat change from fragmentation of 1.04 ha of qualifying feature woodland habitat, including associated tree, bryophyte, lichen and ground flora; and possible root damage of trees beyond the working corridor (see Table 5-3 and Section 5.4.1 for a full breakdown). With mitigation measures in place, the structure, function or supporting processes of the feature	No additional.	Yes

Qualifying feature	Conservation Objective	Relevant mitigation	Residual Effect – Alone	Residual effect – In Combination	Objective Undermined?
		Zones, and prohibit vehicle / machinery access. ECoW and ACoW supervision, and implementation of Water Quality Monitoring Programme. Pre-construction invasive non-native species survey and implementation of BMP. Implement dust control mitigation measures delivered via DMP. Include outfall on Dam 1 to maintain natural flow regime on Allt an t-Sluichd watercourse. Pre-weathered concrete used in construction of Dam 1 where possible. Implement track construction and drainage measures to maintain groundwater and surface water flows.	within retained habitat beyond the 6.00 ha habitat loss and fragmentation areas would not be adversely affected.		
	2c. Restore the distribution and viability of typical species of the habitat		Permanent direct loss of up to 4.96 ha, and habitat change from fragmentation of 1.04 ha of qualifying feature woodland habitat, including associated tree, bryophyte, lichen and ground flora; and possible root damage of trees beyond the working corridor (see Table 5-3 and Section 5.4.1 for a full breakdown). Adversely affecting humidity sensitive bryophyte and lichen species within the second hairpin bend fragmentation area, via microclimatic edge effects. Reducing the resilience and therefore potentially affecting the long-term viability of lichen species that are rare at the site-based scale, via fragmentation effects. With mitigation measures in place, the distribution of typical canopy, shrub layer and ground flora species within retained habitat beyond the 6.00 ha habitat loss and fragmentation areas would not be adversely affected.	In combination disturbance effects upon fauna comprising typical species of the habitat, from the Associated Works, or from other developments with overlapping construction periods, are minor and non-significant.	Yes
Otter					
1. To ensure that the qualifying features of Ness Woods SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status		As below, under 2a – c.	As below, under 2a – c.	As below, under 2a – c.	No
2.To ensure that the integrity of Ness Woods	2a. Maintain the population of the species as a viable component of the site	Install intake / outlet screens. Site speed limit of 15 mph during construction and operation.	Displacement of otter from permanent infrastructure footprint, including three lay-ups and one possible (non-breeding) holt within Ness Woods SAC, along with a further possible (non-	In combination disturbance effects upon otter from	No

Qualifying feature	Conservation Objective	Relevant mitigation	Residual Effect – Alone	Residual effect – In Combination	Objective Undermined?
SAC is restored by meeting objectives 2a, 2b and 2c for the qualifying feature		Cover or ramp excavations, safe storage of chemicals. Toolbox talks. ECoW and ACoW supervision, and implementation of Water Quality Monitoring Programme. Implement rigorous CEMP and PPP, including adherence to relevant SEPA pollution prevention guidelines. Pre-construction otter surveys. Implement buffer zones around retained otter resting places.	breeding) holt and ephemeral lay-up outside of Ness Woods SAC, but would not lead to a permanent reduction in the otter population, and does not constitute a significant effect. Localised otter disturbance from human and vehicular presence and lighting, including one retained lay-up, but would not lead to a permanent reduction in the otter population, and does not constitute a significant effect. With mitigation in place, no appreciable increase in risk of otter mortality or injury is predicted, and disturbance to three retained otter resting places would be avoided.	developments with overlapping construction periods are minor and non-significant.	
	2b. Maintain the distribution of the species throughout the site	Obtain licence for lost and disturbed otter resting places, including implementation of an Otter Protection Plan, and creation of two artificial otter holts. Implement sensitive lighting. Restrict public access to habitat areas during operation.	No significant barrier effects, and access to important hunting habitat, and wooded areas suitable for cover, would be maintained. Displacement of otter from permanent infrastructure footprint, including otter resting places, and localised otter disturbance from human and vehicular presence and lighting, but would not result in a significant reduction in the distribution of the species throughout the site.	In combination disturbance effects upon otter from other developments with overlapping construction periods are minor and non-significant.	No
	2c. Maintain the habitats supporting the species within the site and availability of food	Toolbox talks. ECoW and ACoW supervision, and implementation of Water Quality Monitoring Programme. Implement rigorous CEMP and PPP, including adherence to relevant SEPA pollution prevention guidelines.	No residual significant effects upon otter prey species are predicted, and therefore otter food availability will be maintained. Loss of up to 5.52 ha of wooded habitat suitable for otter cover (although areas away from the shoreline and watercourses are unlikely to be used by otter regularly), including the loss and disturbance of otter resting sites, however sufficient breeding and resting habitat will be	In combination disturbance effects upon otter from other developments with overlapping construction periods are	No

Qualifying feature	Conservation Objective	Relevant mitigation	Residual Effect – Alone	Residual effect – In Combination	Objective Undermined?
		Include outfall on Dam 1 to maintain natural flow regime on Allt an t-Sluichd watercourse. Pre-weathered concrete used in construction of Dam 1 where possible. Implement buffer zones around retained otter resting places. Fish mitigation, including: fish rescue and relocation for instream works and cofferdam installation; 'soft start' approach to piling operations; temporary bubble curtain for piling / blasting operations; noise abatement measures fitted to equipment; monitoring of noise levels with hydrophones during construction; construction lighting directed away from Loch edge; intake / outlet screens; control of intake approach velocity of water; use of vane structures to diffuse outflow; culvert to conform to SEPA guidance; diversion from intake / outlet using an appropriately designed fish deterrent system (bubble curtain / strobe lighting / AFD); CCTV monitoring at outlet; ACoW supervision of dug channels for rescue in Loch Kemp; implementation of FMP.	maintained such that the otter population would not be significantly adversely affected.	minor and non-significant. With fish mitigation in place, the Proposed Development would have limited input to the overall cumulative effects of other schemes upon fish.	

6.2.2 River Moriston SAC

Step Two, Part One: Identifying Conservation Objectives

River Moriston SAC conservation objectives are provided in Table 5-1 and listed below in Step Two Part Two.

Step Two, Part Two: Effects of the Project on Conservation Objectives

1. To ensure that the qualifying features of the River Moriston SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status.

The assessment of FCS for qualifying features is determined via objectives 2a-d (i) for mussels and 2a-c (ii) for salmon in their role as a host species and separate qualifying feature.

2. To ensure that the integrity of the River Moriston SAC is restored by meeting objectives 2a, 2b, 2c for each qualifying feature (and 2d for freshwater pearl mussel).

Objectives 2a (i) and (ii), 2b (i) and (ii), 2c (i) and (ii) and 2d (i) are discussed individually.

Freshwater Pearl Mussel

2a. (i) Restore the population of freshwater pearl mussel as a viable component of the site.

The role of salmon in providing a host species contributing to mussel population status is discussed within 2a - 2c (ii) below. Surveys undertaken by Gavia Environmental observed mussel populations to have increased between 2013 – 2023 at two historically monitored NatureScot transect locations (upstream of falls at Invermoriston). Evidence of recent recruitment, as shown by high juvenile composition in the population (22.01% and 7.4%), suggests recovery and expansion of the population (at abundance levels A and B) in these areas.

Two transect locations were conducted below the falls at Invermoriston, and within the area of potential impact from water level fluctuations resulting from the Proposed Development and found mussel populations at abundance levels D and C. Juveniles were not identified suggesting recent recruitment has not taken place. Additionally, all mussels present were large adult individuals with average sizes of 94.3 and 87.5 mm in length, suggesting ages of around 20 years (mature adults). Overall, mussel populations were indicative of preferential habitat above the falls at Invermoriston, and outwith the area of potential impact from water level fluctuations and slack water creation. Therefore, the proposed Development alone is unlikely to impact breeding populations or juveniles through water level fluctuations. Loss of any mussels below the falls at Invermoriston is unlikely to be detrimental to the wider population, as evidenced by the absence of juvenile mussels, suggesting environmental conditions and/or presence of host species is insufficient for recruitment. Moreover, the wider upstream population has demonstrated growth irrespective of the limited downstream population. Resultingly, it is concluded that the Proposed Development **will not undermine conservation objective 2a. (i) for restoring the population of mussels as a viable component of the site** when the wider population is taken into consideration.

Mussels have existing population pressures outwith the Proposed Development and the cumulative impact of existing developments within the area, as well as illegal poaching. Resultingly, mussel population growth may decline or plateau irrespective of the development, and declining populations during the construction and/or operational phases are not necessarily indicative that the development has caused an impact, notably in the area impacted by water level fluctuations below the falls at Invermoriston. Four species have been recorded as known predators of mussels including: European otter (*Lutra lutra)*; oystercatcher (*Haematopus ostralegus)*; hooded crow (*Corvus cornix)*; and American mink (*Mustela vison)*. Predation is considered opportunistic in nature and a rare occurrence and is therefore unlikely to significantly impact the population or inhibit population recovery[140].

[140] Cosgrove, P., Hastie, L., and Sime, I. (2007). Recorded Natural Predation of Freshwater Pearl Mussels *Margaritifera margaritifera* (L.) in Scotland. *Journal of Conchology.* 39 (4).

2b. (i) **Restore the distribution of freshwater pearl mussel throughout the site.**

Distribution of mussels within the River Moriston is currently hindered by anthropogenic development preventing the upstream movement of salmonids. Consequently, barriers (both natural and anthropogenic) serve to limit salmon accessibility irrespective of the Proposed Development. Consequently, mussels are limited in their spatial distribution within the River Moriston irrespective of additional development in the River Ness catchment, this is discussed in 2a -2c (ii) below.

The current mussel distribution, informed by surveys undertaken by Gavia Environmental, indicated the highest population densities were located in upstream locations on the River Moriston. These sites were located 750 m and 2500 m above the falls. Such populations indicated recent recruitment, through juvenile presence, and population growth between 2003 and 2023; these were considered to be in Favourable Condition. Mussel populations in downstream locations of the river, near the mouth of Loch Ness, observed no juvenile presence, and therefore no recent recruitment, and were of consequent lower population abundance level (Level D and C). Historical data is not present for transects in such locations therefore population growth/decline cannot be ascertained. Low population status is indicative of limitations in the environment (e.g. unsuitable habitat, insufficient flow regimes or water quality limitations). Presence of adult mussels in this area is potentially indicative of washed-out mussels from upstream locations during periods of heavy flow and would in part provide explanation for unsuccessful recruitment. In such cases habitat is suitable to support adult survival but not successful recruitment.

Given this current distribution of mussels, it suggests that irrespective of the Proposed Development the downstream population of mussels is unlikely to recover to an extent that the population is considered restored, as observed in upstream locations without intervention.

Additionally, distribution is heavily limited by habitat availability within the River Moriston. The presence of hydro schemes upstream of Loch Ness contributes to reduced finer substrate availability instream and sediment fluctuations limiting both the density of the population and distribution expansion within the river. As a result, existing factors undermine the restoration of mussels throughout the River Moriston SAC. Resultingly, it is concluded that the Proposed Development **will not undermine conservation objective 2b. (i) for restoring the distribution of mussels throughout the site.**

2c. (i) **Restore the habitats supporting the freshwater pearl mussel within the site and the availability of food.**

The Proposed Development is unlikely to contribute significantly to deterioration, improvement or plateau in habitat quality due to the distance between the SAC and the Proposed Development. Additionally, considering that the Proposed Development is situated downstream of the River Moriston in Loch Ness, and separated by a large waterfall, the area of potential impact is small in the context of the entire river. In the unlikely event of any potential effects, notably pollution events, these could only affect the first 630 m of the SAC in any case due to the presence of significant falls. Extent of impact of 630 m is considered highly unlikely due to an existing flow in this area of river and the distance across Loch Ness, approximately 1.6 km. Resultingly any habitat deterioration above the falls and area immediately below will not be due to the Proposed Development.

Habitat changes through altered rate of water level fluctuations, and changes to flow regimes through the creation of slack water during generation periods may affect mussels located at the mouth of the River Moriston. The presence of deep stretches of heavily silted river near the mouth at Loch Ness, >2 m in depth, currently provide unsuitable habitat for mussels. Given mussels were found in such water depths considerably outwith optimal depth ranges of 0.3 - 0.4 m and substrate types, mussels have shown preference and/or the ability to inhabit areas of deeper water. Mussels are therefore unlikely to experience further effects related to the increased rate of water level change in Loch Ness. Mussels present in the river near the mouth of Loch Ness in water >2m in depth are likely the only mussels at risk of aerial exposure and/or desiccation as a result of changing water levels in Loch Ness. At minimum water levels as a result of the Proposed Development, mussels will likely still be covered by water and therefore not impacted.

Resultingly, it is concluded that the Proposed Development **will not undermine conservation objective 2c. (i) for restoring the habitat of mussels throughout the site.**

It is highlighted that deterioration in habitat quality has been previously identified within the SAC due to extensive development on the River Moriston and its catchment for a hydropower scheme. Therefore it is likely that, irrespective of the Proposed Development, deterioration will occur without outside intervention.

Juvenile mussels are known to consume a range of organic matter (including detritus and algae)[141], however, the diet of adults is largely unknown. The presence of healthy, growing mussel populations at all life stages in upstream locations is indicative of a food source adequate in sustaining population growth. As these populations are beyond the influence of the Proposed Development, when excluding impacts to host species populations, it is unlikely food sources in upstream locations will be impacted resultingly it is concluded the Proposed Development **will not undermine conservation objective 2c. (i).**

2d. (i) **Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats.**

Effects on Atlantic salmon as a host species, are discussed below (2a. (ii), 2b. (ii) and -2c. (ii)). Resident brown trout within the River Moriston, an additional recognised and viable host species, are unlikely to be affected by the Proposed Development as they are non-migratory and reside only within the river. Brown trout are known to occur widely throughout the River Moriston and Loch Ness, therefore a viable population of salmonid host species is present outwith salmon population densities. Studies in Norway and Scotland have indicated strong host specificity indicating certain populations of mussels exclusively use trout over salmon as a host species (and salmon exclusively over trout)[142,143]. Similarly, studies conducted on encystment success of mussels on trout observed higher success in migratory trout vs resident trout, indicative of no single preference of host in the species. Therefore, without studies conducted specific to the River Moriston there is no evidence to suggest the River Moriston population favour salmon over trout as a host species, or *vice versa*. Existing studies indicate there is currently no evidence to suggest a change in density or age structure of host species populations (in this case brown trout) has contributed to the decline of mussels[144].

Atlantic Salmon

2a. (ii) **Restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site.**

Salmon populations are declining globally and currently considered in an 'unfavourable' condition within the River Moriston due to a variety of environmental and anthropogenic factors. There is no evidence that the presence of the operational Foyers PSH since 1974 has had an adverse effect on the salmon population.

Salmon may be affected by the following impacts included within Stage Two:

[141] Eybe, T., Thielen, F., Bohn, T. and Sures, B. (2013). The first millimetre – rearing juvenile freshwater pearl mussels (*Margaritifera margaritifera L.*) in plastic boxes. *Aquatic Conservation: Marine and Freshwater Ecosystems*. 23(6). pp. 964-975.

[142] Karlsson, S., Larsen, B. M. and Hindar, K. (2014). Host-dependent genetic variation in freshwater pearl mussel (*Margaritifera margaritifera* L.). *Hydrobiologia.* 735. pp. 179-190.

[143] NatureScot. (2018). Host salmonid specificity of selected pearl mussel populations. Research Report No. 972.

[144] Bauer, G. (1988). Threats to the freshwater pearl mussel *Margaritifera Margaritifera* L. in Central Europe. *Biological Conservation.* 45(4). pp. 239-253.

1. Salmon may become impinged on intake screens during periods of abstraction;
2. Intake flow attracting downstream migrating salmonid smolts;
3. Outlet flow attracting adult migrating salmonids; and
4. Changing temperature regimes in the immediate vicinity of the water outlet.

Migration routes of salmon from the River Moriston SAC are currently unknown within the River Ness Catchment. Similar salmon telemetry studies in Scottish Lochs have shown a wide variation of potential migration pathways, consequently knowledge from existing literature cannot be applied to predict potential migratory pathways. Resultingly, application of the precautionary principle dictates that a proportion of the salmon on migration will be present within the vicinity of the intake screens during periods of abstraction and generation[145].

Adult salmon and smolts in the vicinity of screens during periods of abstraction will not result in mortalities due to impingement, as maximum draw velocities are limited to escapable velocities for salmon at smolt and adult live stages at <0.3 m/s at 100 m to prevent impingement on the screens. Screens will also be 12.5mm mesh aperture to prevent entrainment of salmonids within the infrastructure. The sustained swimming speed of salmon with a minimum body length of 0.15 m is 0.54 m/s, which is faster than the predicted maximum velocity of the intake, consequently salmon at all life stages are predicted to overcome this[146].

Salmon smolts undergoing smoltification have the potential to be attracted to the intake flow during periods of water abstraction. Deterrence from migration route is associated with a potential increased energy burden due to additional distance covered before reaching the marine environment and an increased predation and mortality risk with additional time spent in the loch and at the intake point. Mortality may not occur immediately however post-disturbance mortality at sea due to cumulative energy burdens could in theory occur. Mussel glochidia are unlikely to be present on smolt gills during this stage, however, a reduction in outward migration of smolts would impact population growth capabilities when adult fish return to spawn.

Considering the mortality risks to salmon smolts under the precautionary principle, the Proposed Development is concluded (without mitigation) as being **likely to undermine conservation objective 2a. (ii) for restoring the population of Atlantic salmon, including range of genetic types, as a viable component of the site.**

Adult salmon actively migrate upstream to spawn against water currents where they illustrate rheotaxis (i.e. face in the direction of flow) responses. The presence of an additional flowing water source may attract upstream migrating salmon to the water outlet instead of the River Moriston during periods of generation. This has the potential effect of delaying migration, increasing energy burdens and predation risks, and reducing spawning success by delayed arrival at spawning grounds. Fish may be delayed for the duration of a generation cycle. Delay and/or disruption in migration at any stage may prevent adult salmon from reaching spawning grounds and impact the number of viable offspring produced. Low juvenile numbers may contribute to a decline in overall population reducing the number of host-species available for mussel glochidia encystment. Reduced water flow in the River Ness during periods of water abstraction is unlikely to hinder migrating salmon from accessing Loch Ness, and therefore the River Moriston SAC due to operational limits on water abstraction imposed on the Proposed Development agreed as part of the CAR licence which will allow fish passage at Ness Weir. The scale of the delay is de minimis in relation to the obstacles and anthropogenic disruption salmon face in reaching their spawning grounds.

[145] Lilly, J., Honkanen, H. M., McCallum, J. M., Newton, M., Bailey, D. M. and Adams, C. E. (2021). Combining acoustic telemetry with a mechanistic model to investigate characteristics unique to successful Atlantic salmon smolt migrants through a standing body of water. *Environmental Biology of Fishes.* 105. pp. 2045-2063.

[146] Tang, J. and Wardle, C. S. (1992). Power Output of Two Sizes of Atlantic Salmon (*Salmo salar*) at their Maximum Sustained Swimming Speeds. Journal of Experimental Biology 166.

Regarding temperature change an extremely conservative assumption, whereby discharges from Loch Kemp into Loch Ness would reach 20°C whilst Loch Ness remains at 6°C has been modelled by Ramboll using TUFLOW-FV, an industry-standard advection-dispersion model. The area experiencing temperatures greater than 15°C is limited to 140 m to the southwest of the plume location, 360 m to the northeast and up to 65 m away from the shoreline, covering a maximum surface area of 32,500 m². In the extremely unlikely event that temperatures did approach 20°C, based on Ramboll's modelling, potential impacts are limited to <0.0004% of the volume of Loch Ness being impacted. Temperatures will rapidly return to background levels at the end of discharges[147]. Modelled temperatures are far below the temperatures capable of causing behavioural responses associated with pain including jumps from the water, collisions and sudden swimming bursts (associated with increased energy expenditure).

Considering the effects of the outlet flow attracting adult salmon and changing temperature regimes, it has been concluded the Proposed Development **will not further undermine conservation objective 2a. (ii) for restoring the population of Atlantic salmon, including range of genetic types, as a viable component of the site.**

2b. (ii) **Restore the distribution of Atlantic salmon throughout the site.**

Salmon within the River Moriston are currently unable to access the full catchment due to two anthropogenic impassable barriers present but are present throughout their accessible range. The Proposed Development is unlikely to exacerbate this providing no additional barriers to fish distribution throughout the catchment. Consequently, it is concluded that **conservation objective 2b. (ii) Restore the distribution of Atlantic salmon throughout the site will not be undermined.**

2c. (ii) **Restore the habitats supporting Atlantic salmon within the site and availability of food.**

No salmon habitat will be lost or compromised due to the Proposed Development.

The habitat for juvenile salmon, the only life stage actively inhabiting freshwater areas, was poor in the stretch of the River Moriston likely to be impacted by the Proposed Development. Areas above the falls at Invermoriston are unlikely to be impacted by the Proposed Development and house the largest area of fry and parr habitat. It is therefore unlikely that the habitat supporting juvenile salmon will be impacted. Spawning habitat at the mouth of the River Moriston was determined to be not-suitable (due to stagnant water and finer sediments, e.g., sand and silt) and sub-optimal in areas (due to stagnant water), consequently no spawning habitat is likely to be compromised.

Resultingly, it is concluded that the Proposed Development **will not undermine conservation objective 2c. (ii) for restoring the distribution of Atlantic salmon throughout the site given the relevant spawning habitat is unsuitable and there is no impact on food availability.**

Food availability for juvenile salmon, the only life stage actively feeding in freshwater, is likely to be unaffected by the Proposed Development due to the distance between the Proposed Development and the mouth of the River Moriston. It is possible, however, that increased water fluctuations may impact prey species vulnerable to the changing water regimes. Areas impacted would be limited to Loch Ness and the section of the River Moriston below the falls at Invermoriston, noted for containing poor juvenile habitat. Additionally, smolts and adult salmon are known not to actively feed during migration periods, i.e. they are not actively seeking out food and eating only opportunistically. Resultingly, it is concluded that the Proposed Development **will not undermine conservation objective 2c. (ii) for restoring the availability of food within the site.**

Step Two, Part Three: In Combination Effects of the Project with other Plans or Projects

1. To ensure that the qualifying features of the River Moriston SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status.

[147] Otton, H. and Gaskell, S. (2023) Technical Note: Thermal Plume Modelling Loch Ness.

The in-combination impact of multiple developments within Loch Ness is unlikely to present additional impacts outwith those potentially introduced via the Proposed Development as a standalone project. The assessment of qualifying features is determined via objectives 2a-d (i) for mussels and 2a-c (ii) for salmon in their role as a host species and separate qualifying feature.

2. To ensure that the integrity of the River Moriston SAC is restored by meeting objectives 2a, 2b, 2c for each qualifying feature (and 2d for freshwater pearl mussel).

Objectives 2a (i) and (ii), 2b (i) and (ii), 2c (i) and (ii) and 2d (i) are discussed individually.

Freshwater Pearl Mussel:

2a. (i) Restore the population of freshwater pearl mussel as a viable component of the site.

As described in step two, part two above, no direct or indirect impacts on freshwater pearl mussel populations were anticipated in relation to the Proposed Development. The in-combination effects of multiple developments within Loch Ness is unlikely to present additional impacts outwith those potentially introduced via the Proposed Development alone,. It is concluded that the addition of the Proposed Development **will not undermine conservation objective 2a. (i) restoring the population of freshwater pearl mussel as a viable component of the site.**

2b. (i) Restore the distribution of freshwater pearl mussel throughout the site.

Current distribution of mussels in the River Moriston is heavily limited by habitat availability. The presence of the three hydro power stations: Dundreggan; Loyne; and Cluanie limits the availability of finer substrates downstream, favoured by mussels, and water flow. Consequently, mussel distribution is limited to that with suitable habitat, without intervention or compensation mussel distribution is unlikely to change and/or expand. The Proposed Development in combination with other pumped storage schemes is unlikely to contribute further impact to this, positively or negatively, due to the impacted area being located below significant falls and **will therefore not undermine conservation objective 2b. (i) Restore distribution of freshwater pearl mussel throughout the site.**

2c. (i) Restore the habitats supporting the freshwater pearl mussel within the site and the availability of food

The in combination impact of multiple developments within Loch Ness is unlikely to present additional impacts outwith those potentially introduced via the Proposed Development alone. As the Proposed Development occupies the highest stop pumping water level, at 17.44 m (Red John stop level is 17.1 m), it will not add a cumulative impact to minimum water levels, therefore it **will not undermine conservation objective 2c. (i) Restore the habitats supporting the freshwater pearl mussel within the site and the availability of food.**

2d. (i) Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats

Impacts on primary host species; Atlantic salmon are discussed below (2b and 2c). Resident brown trout within the River Moriston are **not** likely to be affected by in combination effects of the Proposed Development with other projects / plans as they are non-migratory and reside only within the river.

Atlantic Salmon:

2a. (ii) Restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site

Migration routes of salmon from the River Moriston SAC are currently unknown within the River Ness Catchment. Similar salmon telemetry studies in Scottish Lochs have shown a wide variation of potential migration pathways, consequently knowledge from existing literature cannot be applied to predict potential migratory pathways. Resultingly, application of the precautionary principle dictates that a proportion of the salmon on migration will

be present within the vicinity of the intake screens of multiple PSH developments during periods of abstraction and generation[148].

Salmon smolts undergoing smoltification have the potential to be attracted to multiple intake flows from multiple PSH developments during periods of water abstraction. Deterrence from migration route is associated with a potential increased energy burden due to additional distance covered before reaching the marine environment and an increased predation and mortality risk with additional time spent in the loch and at the intake points. Mortality may not occur immediately however post-disturbance mortality at sea due to cumulative energy burdens could in theory occur. Mussel glochidia are unlikely to be present on smolt gills during this stage, however, a reduction in outward migration of smolts would impact population growth capabilities when adult fish return to spawn.

Considering the mortality risks to salmon smolts under the precautionary principle, the Proposed Development (without mitigation) in combination with other PSH developments is concluded as being **likely to undermine conservation objective 2a. (ii) for restoring the population of Atlantic salmon, including range of genetic types, as a viable component of the site.**

Due to operational limits implemented through the relevant CAR Licences for each PSH scheme on Loch Ness, the combination of the Proposed Development, the consented Red John PSH and the existing Foyers PSH would not cause loch levels to reduce below the existing Foyers PSH stop pumping level (i.e. the baseline scenario), as both the consented Red John PSH and the Proposed Development would have a higher 'stop pumping' level applied than the existing Foyers PSH scheme (15.27 m AOD) (see **Volume 1, Chapter 7: Water Management** of the EIA Report for further details). A higher stop pumping level than the Foyers PSH level would also be applied to any future PSH on Loch Ness.

The main fish pass at Ness Weir is at a level of 14.93 m AOD, which is well below the stop pumping level of the Foyers PSH and therefore also below the stop pumping level that would be applied to Red John PSH and the Proposed Development. The operation of the Proposed Development in combination with other projects would therefore not restrict or impede the use of the main Ness Weir fish pass by salmon, including smolts, and other migratory fish species compared to the existing baseline scenario.

The stop pumping level of the existing Foyers PSH scheme is below the smolt pass (also referred to as the 'smolt chute') level at Ness Weir (15.48 m AOD), which acts as a potential bypass channel for any smolts which bypass the main fish pass outlet at Ness Weir and enter the canal. This highlights a potential existing problem for smolt passage in this area. There is also a second smolt pass in the form of a sluice gate which Scottish Canals operate at Dochfour and this is opened during the smolt run to provide a further outlet back to the River Ness for smolts.

Although the stop pumping level agreed for both the Proposed Development and the consented Red John PSH scheme (via their relevant CAR Licences) would be above that of the existing Foyers PSH, it is anticipated that these schemes would also have a 'stop pumping' level below the level of the smolt pass at Ness Weir. Periodic reduction in Loch Ness water levels as a result of the abstraction cycles of multiple PSH schemes occurring simultaneously, may therefore result in water levels falling below the smolt pass level at Ness Weir more frequently compared to the existing scenario where Foyers PSH would operate in isolation, reducing availability for smolt escapement from the canal. There is uncertainty however about the effectiveness of the smolt pass within the canal in its current state, especially at lower water levels where there is less attraction towards its inlet (Plate 1). The Ness District Salmon Fisheries Board consider it to be *'an ineffective design'*[149]. It is unlikely that the smolt pass provides effective mitigation, with limited attraction for downstream migrating smolts

[148] Lilly, J., Honkanen, H. M., McCallum, J. M., Newton, M., Bailey, D. M. and Adams, C. E. (2021). Combining acoustic telemetry with a mechanistic model to investigate characteristics unique to successful Atlantic salmon smolt migrants through a standing body of water. *Environmental Biology of Fishes.* 105. pp. 2045-2063.

[149] Ness District Salmon Fisheries Board (2023) Pers Comm Brian Shaw 12th October 2023.

compared with the main fish pass. Smolt which enter the canal when the water level is below the level of the smolt pass would also still be able to re-enter the River Ness through the smolt sluice operated by Scottish Canals at the Dochfour lock gates.

Plate 1: Smolt Pass (chute) entrance from the Caledonian Canal during low loch levels. Limited attraction for smolts to enter the bypass. Loch Level was 1.26 m on Foyers Gauge, well below typical mean low level 1.39 m). The chute had limited attraction for downstream migrating smolts with very little flow and water depth

Plate 2: Smolt Pass (chute) flowing towards the River Ness with minimal flow and water depth across the waste weir during low loch levels.

Although water levels may fall below the smolt pass level at Ness Weir more frequently if multiple PSH schemes are abstracting water from Loch Ness simultaneously, the opposite effect would be true for the generating cycles of these schemes. This would mean that water level would also increase above the smolt pass level more frequently and more rapidly if multiple PSH schemes are pumping water into Loch Ness simultaneously. During periods of higher water levels associated with multiple PSH pumping water into Loch Ness, there would also be a greater attraction for smolts to descend the main fish pass, increasing escapement from the loch. This could have a beneficial impact on smolts, by reducing delays on migration compared to the existing situation where only Foyers PSH would be pumping water back into Loch Ness at any given time and would help to counteract the effect of more frequent lower loch levels due to fluctuation.

It should also be noted that this assessment assumes a worst-case scenario where Foyers PSH, Red John PSH and the Proposed Development would be abstracting water from Loch Ness simultaneously and the loch levels would be low enough that the combined abstraction cycle of the three schemes would bring the water levels below the level of the smolt pass at Ness Weir. In reality, this scenario would not occur every time the Proposed Development undergoes an abstraction / pumping cycle.

Consequently, effects of water level fluctuation **will not further undermine conservation objective 2a. (ii) Restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site.**

2b. (ii) Restore the distribution of Atlantic salmon throughout the site.

Salmon within the River Moriston are currently unable to access the full catchment due to two anthropogenic impassable barriers present but are present throughout their accessible range. The in combination influence of developments is unlikely to exacerbate this providing no additional barriers to fish distribution throughout the catchment. Consequently, it is concluded that **conservation objective 2b. (ii) Restore the distribution of Atlantic salmon throughout the site will not be undermined.**

2c. (ii) Restore the habitats supporting Atlantic salmon within the site and availability of food.

Spawning salmon have the potential to be impacted by increasing / decreasing water levels encouraging spawning in usually unsuitable locations reducing egg viability and success. Due to existing and consented

pumped storage hydro schemes present within Loch Ness, such as Red John downstream in the River Ness catchment, there is a potential risk that combined abstraction or generation periods will cause extreme elevations and decreases in water levels exacerbating impacts on egg success.

High variation in water levels, and rate of water level change, is likely to occur as hydro schemes will abstract water and generate during similar periods to meet electricity demands. These abstractions are limited / regulated by a consented operational regime (CAR licence), consequently minimum and maximum water levels will not change only the frequency of water level change. A stop generating level within the operational regime is proposed to protect against adverse impacts in terms of flooding when the Loch Ness level exceeds the estimated 1-in-10 year flood. Consequently, this **will not further undermine conservation objective 2c. (ii) Restore the habitats supporting Atlantic salmon within the site and availability of food.**

Step Three: Effects on Integrity

Mussels are unlikely to be directly impacted by the Proposed Development or in-combination influence of multiple developments due to their current distribution with highest densities above the falls near the mouth of the River Moriston and water level minimum and maximums not being exceeded.

The presence of the falls is likely to prevent pollution, both toxic and non-toxic, from entering the majority of the SAC and affecting water quality, a key component of mussel habitat requirements. Additionally, water level changes are unlikely to impact mussels due to the presence of large falls at Invermoriston even when in combination with generating/pumping of multiple hydro schemes.

The only present impact to mussels is a reduction of salmon as a host population, however, given the extensive presence of resident brown trout in Loch Ness and the River Moriston, reduction of the salmon host population does not necessarily reduce viable host populations available for mussels. It is acknowledged that mussels have been in decline throughout their natural range in Scotland[150]. The presence of the Proposed Development is unlikely to alter this trend, and is additionally unlikely to exacerbate decline, habitat deterioration or distribution within the River Moriston SAC.

The extent of impact on salmon smolts can currently not be determined due to the lack of River Moriston / Loch Ness specific salmon tracking studies. Migrating salmon smolts and adults all have a potential risk in that migration routes may be in close proximity to the Proposed Development resulting in adverse effects on the species during construction and operational periods. Equally, if migration routes do not pass the Proposed Development potential impacts will be greatly minimised. The effects (if present) on salmon are likely to occur for the lifetime of the development, however, appropriate mitigation measures (discussed in Step Four) will reduce these effects significantly.

In worst case circumstances , in the absence of mitigation (see Step Four below), the following objectives of the River Moriston SAC could be compromised:

- 2d. (i) Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats and
- 2a. (ii) Restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site.

The objectives for salmon within the River Moriston SAC have the potential to be compromised if a large percentage of the population migrate within close proximity to the Proposed Development, without mitigation measures (see Step Four below)

It is anticipated that following a worst-case-scenario hypothesis the following objectives of the River Moriston SAC will **not** be compromised:

[150] NatureScot (2023) Freshwater Pearl Mussel. Available: Freshwater pearl mussel | NatureScot Last Accessed: 29.09.2023

Freshwater Pearl Mussel:

- 2a. (i) Restore the population of freshwater pearl mussel as a viable component of the site.;
- 2b. (i) Restore the distribution of freshwater pearl mussel throughout the site; and
- 2c. (i) Restore the habitats supporting the freshwater pearl mussel within the site and the availability of food.

Atlantic Salmon:

- 2b. (ii) Restore the distribution of Atlantic salmon throughout the site; and
- 2c. (ii) Restore the habitats supporting Atlantic salmon within the site and availability of food.

Step Four: Mitigation Measures

For the potential effect pathways undermining Conservation Objectives identified in Step Three, proposed mitigation measures, and the predicted effects following the application of the proposed measures, are presented below.

Construction Phase

Construction Run Off and Pollution

A Construction Environmental Management Plan (CEMP), including Biosecurity Plan and Water Quality Monitoring Programme would be implemented by the Principal Contractor and overseen by a freshwater Ecologist or Aquatic Clerk of Works (ACoW) with experience of working with aquatic ecosystems. The CEMP would take into account existing forestry drainage on Site, and Site specific drainage/pollution issues. SEPA pollution prevention guidelines would be adhered to.

Water Quality Monitoring

The ACoW would implement a suitable water quality monitoring regime, particularly of parameters with concentrations known to be relevant to salmon. The monitoring regime shall cover the construction period and a suitable period after to monitor ongoing (potential) pollution on Site and ensure silt mitigation measures are working effectively. Placement of *in-situ* automatic water quality data loggers for pH, conductivity, temperature, dissolved oxygen, and turbidity would allow real time data to be collected and by using telemetry viewed remotely, thus providing an early warning system for potential pollution events on site allowing emergency anti-pollution measures to be quickly mobilised, in accordance with those stated in the CEMP. This would be accompanied by a regular *in-situ* and *ex-situ* (laboratory tested) sampling suite at monthly intervals. *Ex-situ* monitoring allows a wider sampling suite of parameters specific to salmon to be assessed and monitored.

Construction Noise

Specific noise abatement measures shall be implemented where possible. Noise reducing devices shall be fitted to equipment, including baffles and silencers, to reduce noise during construction.

Soft start piling is an established mitigation measure recommended. Soft start involves the gradual increase of piling impact over a prolonged period, in such cases fish (and aquatic mammals) are exposed to noise below the threshold to induce mortality or injury, to encourage movement away from the area and reduce the risk of injury. This method has shown positive avoidance results for aquatic mammals[151].

Noise emissions can additionally be reduced through the implementation of acoustic barriers around piling and blasting operations such as through the use of air bubble or solid barriers or baffles. For any piling or blasting

[151] Weir, C. R. (2008). Short-finned pilot whales (*Globicephala macrorhynchus*) respond to an airgun ramp-up procedure off Gabon. *Aquatic Mammals.* **34**. pp. 349-354.

operations, a temporary bubble curtain will be deployed around the works to attenuate noise effects and deter fish from the area. Barriers will both additionally prevent dispersion of silt pollution into Loch Ness.

These have been successfully implemented on previous construction projects and should reduce and / or negate noise impacts on salmon when deployed correctly. Noise levels will be monitored in Loch Ness via the installation of hydrophones and monitoring equipment. The ACoW would monitor loch areas in the vicinity of the works for any fish kills in relation to works producing underwater noise.

Lighting

Any lighting used during construction would be directed away from the loch edges and watercourses to prevent the risk of displacement and increased predation of fish during the hours of darkness. This additionally prevents potential attraction or deterrence of fish (dependent on light intensity) that may deter fish from migration route[152].

Operational Phase

Fitting screens to intake / outlet

The fitting of a 12.5 mm mesh aperture screen across the intake / outlet will prevent entrainment of adult salmon / smolts and associated mortalities during generation / abstraction periods. This will prevent the risks of fish entrapment, injury and mortality or translocation. The screens will require regular inspection and maintenance or a self-cleaning mechanism to prevent blockage / damage from foliage and debris.

Reducing velocity of abstraction to escapable velocities for salmon

The water intake velocity will not exceed 0.3 m/s, this is a recognised escapable velocity for a range of salmon life stages. Additionally, the outflow will be diffused using a vane structure to disperse flow over a wider area to reduce the potential attractiveness of migrating adult salmon.

Diversion of salmon (all life stages) from migration pathways

An appropriately designed fish deterrent system will be installed which will deter fish from the draw of water from the intake, preventing entrainment / impingement at the screens and reducing predation impacts. Fish deterrent systems work best when multiple fish deterrent types are working in tandem[153] and could include bubble curtains, acoustic fish deterrents (AFD) or intensive flashing light. Bubble curtains alone have been shown to divert salmon smolts with high efficiency under natural conditions[154]. The deterrent system will be deployed around the intake to deter fish during sensitive periods (Mid-March – end June) for salmon. Strobe lighting surrounding the outlet / intake area during night and crepuscular periods would act as a deterrent for salmon utilising the immediate area as a migration route. This may have additional benefits in encouraging adult fish to move within the immediate vicinity of the mouth of the River Moriston reducing migration times and associated energy burden and predation risk. Additionally, night time marks peak smolt migration periods (for early migrators) when light deterrent is most effective. Lighting would be less efficient as a deterrent during daylight hours. Residual impacts after implementation of mitigation for the Proposed Development alone and in combination are summarised in Table 6-3.

---

[152] Wright, D. W., Glaropoulos, A., Solstorn, D., Stein, L. H. and Oppedal, F. (2015). Atlantic salmon *Salmo salar* instantaneously follow vertical light movements in sea cages. *Aquaculture Environment Interactions.* ***7*** *(1). pp. 61-65.*

[153] A.W.H.Turnpenny & N. O'Keeffe (2005) Bubble screens in combination with other behavioural stimuli, Screening for Intake and Outfalls: a best practice guide. Available: Microsoft Word - W6_103_TR_amended_1.doc (publishing.service.gov.uk) Last Accessed: 13/09/2023

[154] J. Leander a, J. Klaminder a, G. Hellström b, M. Jonsson (2021) Bubble barriers to guide downstream migrating Atlantic salmon (*Salmo salar*): An evaluation using acoustic telemetry

Table 6-3: Assessment of residual effects on the Conservation Objectives, with mitigation applied, for River Moriston SAC

Qualifying feature	Conservation Objective	Relevant mitigation	Residual Effect – Alone	Residual effect – In Combination	Objective Undermined?
All designated features:					
2. To ensure that the qualifying features of the River Moriston SAC are in favourable condition and make an appropriate contribution to achieving favourable conservation status.		As below, under 2a – d for freshwater pearl mussel qualifying features.	As below, under 2a – d for freshwater pearl mussel qualifying features.	No	No
Freshwater Pearl Mussel, Margaritifera margaritifera					
2. To ensure that the integrity of the River Moriston SAC is restored by meeting objectives 2a, 2b, 2c for each qualifying feature (and 2d for freshwater pearl mussel).	2a. (i) Restore the population of freshwater pearl mussel as a viable component of the site.	Mitigation for mussel host species is considered within Objectives 2a. (ii) – 2c. (ii).	Residual effect for mussel host species is considered within Objectives 2a. (ii) – 2c. (ii).	No additional	No
	2b. (i) Restore the distribution of freshwater pearl mussel throughout the site.	N/A	No additional	No additional	No
	2c. (i) Restore the habitats supporting the freshwater pearl mussel within the site and the availability of food.	N/A	No additional	No additional	No
	2d. (i) Restore the distribution and viability of freshwater pearl mussel host species and their supporting habitats.	Mitigation for mussel host species is considered within Objectives 2a. (ii) – 2c. (ii).	Residual effect for mussel host species is considered within Objectives 2a. (ii) – 2c. (ii).	No	No

Qualifying feature	Conservation Objective	Relevant mitigation	Residual Effect – Alone	Residual effect – In Combination	Objective Undermined?
Atlantic salmon, *Salmo salar*					
2. To ensure that the integrity of the River Moriston SAC is restored by meeting objectives 2a, 2b, 2c for each qualifying feature (and 2d for freshwater pearl mussel).	2a. (ii) Restore the population of Atlantic salmon, including range of genetic types, as a viable component of the site.	Implement rigorous CEMP, including adherence to relevant SEPA pollution prevention guidelines. Aquatic Clerk of Works (ACoW) supervision. Implement suitable water quality monitoring regime. For any piling or blasting operations, a temporary bubble curtain would be deployed around the works to attenuate noise effects and deter fish from the area. Noise abatement measures fitted to equipment. Monitoring of noise levels with hydrophones during construction. Re-direct lighting away from watercourses. Fitting screens 12.5mm aperture size to intake / outlet. Reducing velocity of abstraction to escapable velocities. Diversion of salmon from intake / outlet using an appropriately designed fish deterrent system (bubble curtain / strobe lighting / AFD).	No residual significant effects upon salmon populations are predicted, therefore the population will be maintained. Diversion of salmon from intake / outlet should reduce the attraction to changing water flows. Sustaining high habitat quality through water quality monitoring and ACoW supervision will help restore the population of salmon.	No residual significant effects upon population are predicted following mitigation measures during the operational phase.	No
	2b. (ii) Restore the distribution of Atlantic salmon throughout the site.		Displacement associated with aversion to noise and light in the area around the intake / outlet and shoreline infrastructure will be averted.	No additional	No
	2c. (ii) Restore the habitats supporting Atlantic salmon within the site and availability of food.		No residual significant effects upon habitats are predicted, therefore habitat will be maintained. With mitigation measures in place, water quality should be maintained at a suitable standard to support salmon migrating within Loch Ness.	No additional	No

It is noted that in the 'Statement to inform an Appropriate Assessment'[155] prepared for the Red John it was concluded that '*following the assessment of mitigation and avoidance provisions for the Development, it could be concluded that the Development would not result in an adverse effect of integrity on the River Moriston SAC, either alone or in combination'*. In the Red John PSH consent (granted in 2021), and following the completion of the Appropriate Assessment, Scottish Ministers concluded that subject to the mitigation measures identified in the HRA statements and the imposition of conditions attached to the planning permission, Red John PSH would not adversely affect the integrity of the qualifying interests of the River Moriston SAC. It is submitted that the same conclusion is appropriate here given that this is the same category of development also on Loch Ness affecting the same SAC.

[155] Red John Pumped Storage Hydro Scheme Habitats Regulations Appraisal: Statement to Inform Appropriate Assessment. Available at: https://www.redjohnpsh.co.uk/Standalone%20Documents/Statement%20to%20Inform%20an%20Appropriate%20Assessment.pdf [Last Accessed 08/11/2023]

6.2.3 Urquhart Bay Wood SAC

Step Two, Part One: Identifying Conservation Objectives

Urquhart Bay Wood SAC conservation objectives are provided in Table 5-1 and listed below in Step Two Part Two.

Step Two, Part Two: Effects of the Project on Conservation Objectives

1. ***To ensure that the qualifying feature of Urquhart Bay Wood SAC is in favourable condition and makes an appropriate contribution to achieving favourable conservation status***

Under this Conservation Objective, the Urquhart Bay Wood SAC Conservation Advice Package states that "*Favourable Conservation Status (FCS) is considered at a European biogeographic level… When carrying out appraisals of plans and projects against these conservation objectives, it is not necessary to understand the status of the feature in other SACs in this biogeographic region. The purpose of the appraisal should be to understand whether the integrity of the site (see objective 2) would be maintained. If this is the case then its contribution to FCS across the Atlantic Biogeographic Region will continue to be met*."

The assessment of FCS of qualifying features is determined via objective 2 (including parts a, b and c), as discussed further below. As such, it follows that if the project undermines any of the conservation objectives 2a – 2c, it also undermines conservation objective 1. Therefore, for the reasons given under objectives 2a – c (below), **the project is concluded not to undermine conservation objective 1**.

2. ***To ensure that the integrity of Urquhart Bay Wood is restored by meeting objectives 2a, 2b and 2c for the qualifying feature.***

Under this Conservation Objective, the Urquhart Bay Wood SAC Conservation Advice Package states that "*The aim at this SAC is to maintain, or where appropriate restore, the protected habitats in a favourable condition as a contribution to their wider conservation status. Therefore any impacts to the objectives shown in 2a, 2b, or 2c below must not persist so that they prevent the achievement of this overall aim. When carrying out appraisals of plans or projects the focus should be on restoring site integrity, specifically by meeting the objectives outlined in 2a, 2b and 2c. If these are met then site integrity will be restored…Temporary impacts on these objectives resulting from plans or projects can only be permitted where they do not prevent the ability of a feature to recover and there is certainty that the features will be able to quickly recover...*"

Objectives 2a, 2b and 2c are discussed individually below.

2a. Maintain the extent and distribution of the habitat within the site

The Conservation Advice Package states: *"The extent of the Alder woodland on floodplains feature, taken from the Standard Data Form, has been estimated at 36.18ha and represents the amount of complex, yet limited, mosaic of several individual stands of habitat. This should be maintained or allowed to increase through natural regeneration or restoration; there should be no measurable net reduction in the extent of the habitat and its distribution throughout the site.*

This will include the avoidance of effects that could lead to a permanent reduction in the extent or distribution of the habitat such as further agricultural reclamation, minimising the risk of fire and preventing the dumping of waste.

This Conservation Objective is considered to be met if the conditions to ensure the habitats' long-term existence are in place."

The project is situated 13.0 km away from Urquhart Bay Wood SAC, on the opposite side of Loch Ness. Therefore there would be no habitat loss, and no direct adverse effect upon the extent and distribution of the qualifying habitat within the site, as a result of the Proposed Development.

The potential eco-hydrological effects of the fluctuation in water levels within Loch Ness are assessed below under Conservation Objective 2b, as the hydrological regime constitutes a supporting process of the qualifying habitat.

Given the above, and given the assessment provided under Conservation Objective 2b, it is concluded that **the project would not undermine Conservation Objective 2a.**

2b. Restore, the structure, function and supporting processes of the habitat

The Conservation Advice Package states: "*This habitat depends on hydrological conditions that lead to a high water table, wet conditions and sufficient variation to allow channel dynamics and vegetation succession to occur. This should allow for an abundance of key tree species that:*

- *Can colonise the floodplain substrate (wet, unstable) and thrive (tolerance of high water table) pioneer species recolonising riparian habitats after disturbances*
- *Can create important habitat structure for freshwater invertebrates and fish*
- *Can support a wide variety of terrestrial invertebrates, whilst overhanging the water surface (providing food for fish and other aquatic predators)*
- *Can provide leaf litter with a rapid decomposition rate, high levels of nitrogen, moderate levels of phosphorus and low levels of refractory carbon*
- *Provide moderate shade, especially over the water surface*
- *Can capture or fix nitrogen and make it accessible to other parts of the ecosystem.*

Restoring the original flow of the river where possible e.g. through reinstating back channels will help ensure the natural processes continue to shape the site.

A key measure that will restore the structure, function and supporting processes of the habitat at this site is addressing the widespread colonisation by non-native tree species and invasive species such as Himalayn balsam, Japanese knotweed and white butterbur which are prevalent on the site. Given the ongoing impacts of 'chalara' ash dieback an active removal of non-native tree species, such as sycamore, should be assessed against the future composition of woods.

Maintaining grazing levels that allow trees, shrubs and ground flora to develop naturally to flower and fruit (which is particularly important on drier margins) is also important. In the long term, the site should have a low level of grazing by red and roe deer (or other native herbivores), which allows trees to regenerate and which helps to prevent too many trees of a single age from dominating the wood in dense stands in future decades."

Soils of wet bottomland forests or woodlands are characterised by low oxygen levels as a result of a high water table and frequent flooding. Saturated soils can become anaerobic within hours to days of waterlogging, resulting in altered plant metabolism, closure of leaf stomata, reduced photosynthesis, nutrient uptake and water absorption. Depending on how long these conditions persist, mortality in species that have not evolved low-oxygen stress avoidance measures can occur. Flooding is a particularly important disturbance feature, affecting physical vegetation structure and floristic composition. The magnitude, frequency and timing of flood events is crucial to maintaining species composition and rejuvenation of vegetation in these forests[156].

The eco-hydrological assessment (Appendix 1) provides an assessment of potential effects of changes to water levels in Loch Ness on keystone species, and the structure and floristic composition of the qualifying habitat in Urquhart Bay Wood SAC. Two well-researched tree species with different hydrological requirements were selected for the analysis of ecological-hydrological requirements, namely common alder (*Alnus glutinosa*) and European ash (*Fraxinus excelsior*). These keystone species are prominently represented in the Residual Alluvial Forest ecosystem in the SAC, and were selected to act as suitable surrogates for the ecosystems as a whole, for the lower-lying, waterlogged areas (where alder is dominant) and higher-lying, better drained areas (where ash

[156] Barsoum, N., Anderson, R., Broadmeadow, S., Bishop, H. and Nisbet, T. (2005). Eco-hydrological guidelines for wet woodland - Phase I. English Nature Research Report No. 619

is a prominent canopy species). They are also the defining species of the vegetation communities represented in the SAC, namely NVC communities W7 and W9b. This approach of using relevant and appropriate surrogate species has been applied successfully in other Ecological Flow Assessments, and is an approach used in accepted methodologies such as the Riparian Vegetation Response Assessment Index[157] and Downstream Response to Imposed Flow Transformation (DRIFT)[158] method.

Alder grows on permanently and seasonally wet soils within a wide pH range (3.4-7), growing mostly along streams, wet depressions or swamps. It is mostly restricted to recent alluvial sediments along stream and lake margins as well as mineral soils in areas of impeded drainage or seasonally wet hill slopes. Young trees (5-8 years old) appear to grow best in continually wet soils, whereas older trees (28+ years old) grow best in free-draining alluvial sediment since they have roots that have permanent access to the high water table and thus can grow in a well-aerated substrate. Alder is able to grow well in frequently inundated soils having evolved mechanisms such as aerenchymatous root tissues, which increase oxygen conductivity of roots, and pressurized gas transport, which improves oxygen transport into roots, particularly if the ambient air temperature is lower than that of the tree stem[159]. Another highly effective adaptation that alder has for coping with flooding induced anoxia and post-anoxic stress is accumulation of the enzyme superoxide dismutase (SOD) in root tissues during inundation. This enables the plant to survive long-term flooding and post-anoxic injury when plant tissues are not protected against oxygen damage on return to air[160]. Drought stress is a significant threat to a bottomland species such as alder. It can disrupt the necessary supply of photoassimilates in the root nodules and disrupts the strict regulation of oxygen levels in these nodules, all of which has significant impacts on plant growth. Drought-stressed alder seedlings also are notably vulnerable to infestation by a fungal parasite (*Phomopsis alnea*), which causes stem cankers and die-back.

European ash is widespread throughout Britain and much of mainland Europe, growing on a wide range of soils but is most common on nutrient-rich soils with a high base status (pH > 4.2), and is often dominant on dry calcareous soils[161,162]. It is usually absent on acidic soils where the pH of the surface soil is lower than 4.2. In Britain ash grows best on moist soils where the winter water-table is between 40 and 100 cm below the surface[163], but in situations such as Urquhart Bay Wood SAC, where the water table is higher, it will grow well on wet, periodically inundated soils along brooks and springs[164] provided there is a shallow layer of seasonally well-drained soil for establishment[165]. This explains some of the species distribution dynamics at the Urquhart Bay Wood SAC site, where alder dominates in the lower-lying, more permanently wet areas and ash is more prominent on higher-lying, better-drained areas. Seedlings are shade tolerant, but adults are not so it tends to be an intermediate successional species, invading gaps in mixed stands rather than forming extensive pure stands.

---

[157] Kleynhans CJ, Mackenzie J, Louw MD. (2007) Module F: Riparian Vegetation Response Assessment Index in River Eco Classification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report

[158] King, J., C. Brown, and H. Sabet. (2003) A scenario-based holistic approach to environmental flow assessments for rivers. Riv. Res. Appl. 19: 619-639.

[159] Frye, J. & Grosse, W. (1992). Growth Responses to Flooding and Recovery of Deciduous Trees. Zeitschrift für Naturforschung 47c, 683-689

[160] Monk, L.S., Fagerstedt, K.V., & Crawford, R.M.M. (1987). Superoxide-Dismutase as an anaerobic polypeptide - a key factor in recovery from oxygen deprivation in Iris pseudacorus. Plant Physiol. 85: 1016-1020

[161] Thomas, P.A. (2016) Biological Flora of the British Isles: Fraxinus excelsior. Journal of Ecology 2016, 104, 1158–1209.

[162] Dobrowolska, D., Hein, S., Oosterbaan, A., Wagner, S., Clark, J. and Skovsgaard, J.P. (2011) A review of European ash (Fraxinus excelsior L.): implications for silviculture. Forestry 84 (2): 133-148

[163] Kerr, G., & Cahalan, C. (2004). A review of site factors affecting the early growth of ash (Fraxinus excelsior L.). Forest Ecology and Management, 188: 225-234

[164] Diekmann, M. (1996) Ecological behaviour of deciduous hardwood trees in Boreo-nemoral Sweden in relation to light and soil conditions. Forest Ecology and Management 6: l–14

[165] Wardle, P. (1961) Biological Flora of the British Isles: Fraxinus excelsior L. Journal of Ecology 49: 739-751

As detailed in Section 5.4.5, modelling has been undertaken to predict Loch Ness water level fluctuations when the Proposed Development is in operation, as well as when existing and consented pumped storage schemes are in operation together, specifically with the operational Foyers, and consented Red John. The assessment of potential effects upon Urquhart Bay Wood SAC has focussed on water level fluctuations as a result of the three schemes working in operation together. This is because this is considered to be the most relevant modelling scenario to assess, as it reflects the most likely background operating conditions under which the Proposed Development would operate, and it also represents a suitable worst-case scenario for assessment. It follows that if no significant adverse effects are identified for the three pumped storage schemes operating together, then there would also be no significant adverse effects for the Proposed Development operating in isolation.

The natural level of Loch Ness varies relatively slowly because of its size and ability to temporarily store water, which provides a lag on the variations in inflow. During operation of the pumped storage schemes short-term water level fluctuations will be superimposed on the natural variation over a number of hours. The minimum level in Loch Ness will be approached more often, but the absolute minimum level will not change as a result of the operation of the Proposed Development. The overall range of levels will increase slightly as a result of releases during a Generation Cycle, which would cause a temporary increase in level before the resulting increase in flow over the weir brings the level back down.

The projected increase in water levels of Loch Ness under the Sensible Worst Case Scenario (when all three schemes are operating) is likely to result in daily incremental periods of inundation during a Generation Cycle, and increased wetting of the soils in the lower-lying areas of the Urquhart Bay Wood SAC. In most scenarios, the operation of the Proposed Development would not result in the maximum flood level being exceeded. The only scenario where this is possible would be if the pumped storage schemes entered a Generation Cycle when the loch was in flood, effectively drowning the weir, resulting in additional inflow above the maximum flood level for a limited period of time.

The magnitude of water level decrease during a Pumping Cycle is projected to be slightly less than the increase during a Generation Cycle and it is unlikely that soils would desiccate for long enough to have any detrimental impact on the species that are dependent on wet soils, such as alder. This is because the low permeability of the fine sediments in lower lying areas in the SAC means that these areas will have a lag in responding to short term changes (particularly decreases) in water levels, and the likelihood that groundwater level will not be solely dependent on contributions from Loch Ness, but will also be supplemented by subsurface flows from the Enrick and Coiltie Rivers (depending on the differential between river surface levels and the groundwater table), and thus a daily pumping cycle is unlikely to result in marked changes in soil inundation levels. The current minimum flow levels of Loch Ness are determined by the operation of the Ness Weir and will not be affected by the Project, and it is unlikely that areas currently dominated by common alder will become desiccated as a result of the Project operation.

Any increases in inundation are most likely to affect the low-lying areas, which are dominated by species adapted to waterlogged soils, such as common alder. The minor increase in frequency of inundation may cause soils to be wetter for longer and may even decrease the risk of soil desiccation during drought periods, although this is an untested assumption. Such a scenario could potentially create a slightly more favourable environment for alder seedling establishment and maintenance of the established alder woodland, and a less favourable seedling establishment base for most of the invasive species present, which generally cannot tolerate the same extent and frequency of waterlogging as species such as alder. Exceptions to this would be Himalayan balsam and white butterbur, both of which can tolerate waterlogged conditions.

The more diverse, higher-lying areas with well-drained soils are less likely to be impacted by the projected increases and decreases in water level, particularly as this plant community relies less on waterlogged conditions than the alder-dominated community. It is unlikely that the decreases in water level of the Loch during Pumping Cycles will result in any significant drawdown of the ground-water table, since water levels are likely to rise soon afterwards during the following generation cycle and the low permeability of the alluvial soils means a lag in these responding to desiccation. Mature ash trees prefer a winter water-table depth of 40 – 100 cm below

ground level. In the unlikely event that there is a minor drawdown in the ground-water table, the large range in preference of water table depth makes it unlikely that ash will be negatively impacted by this during Pumping Cycles.

In addition, the average Loch Ness water level is only likely to undergo a minor change, with the main change being the magnitude of daily fluctuations. Thus, areas that are currently dry and above or near to this elevation are unlikely to change from the current state.

In summary, as long as diurnal fluctuations created by pumped storage scheme operation do not exceed the current maximum and minimum water levels of Loch Ness for any significant period of time then these are not predicted to have a long-term negative impact on Urquhart Bay Wood SAC.

Overall, the water dynamics that currently shape the structure and floristic composition of Urquhart Bay Wood SAC, namely periodicity, magnitude and extent of flooding, are unlikely to change enough to have an impact on vegetation structure and floristic composition. Therefore, the project is unlikely to have any long-term detrimental effects on the key tree and shrub species at Urquhart Bay Woods SAC.

It is therefore concluded that a high water table, wet conditions and sufficient variation to allow channel dynamics and vegetation succession to occur, shall persist. It would therefore continue to allow for an abundance of key tree species that provide the structure and range of functions and supporting processes as set out in the Conservation Advice Package; namely colonising and thriving in the floodplain substrate; creating habitat structure for freshwater invertebrates and fish; supporting a wide variety of terrestrial invertebrates whilst overhanging the water surface; providing leaf litter with optimal properties; providing moderate shade; and capturing / fixing nitrogen. The project would have no impact on the grazing levels within Urquhart Bay Wood SAC and would have no negative impacts on the frequency and distribution of invasive non-native species.

It is therefore concluded that **the project would not undermine Conservation Objective 2b. This is the case both in combination with other plans and projects (i.e. with all three pumped storage schemes operating together), and for the project alone.**

2c. Restore, the distribution and viability of typical species of the habitat

The Conservation Advice Package states: *"Many Alder woods on floodplains are dynamic, being part of a successional series of habitats. At this site the following NVC types are dominant:*

W7 Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum woodland and,

W9(b) Fraxinus excelsior – Sorbus aucuparia – Mercurialis perennis woodland.

The key tree species found at this site are alder (Alnus glutinosa), dominant on the wetter areas, and diverse broadleaved woodland of white willow (Salix alba), ash (Fraxinus excelsior), gean (Prunus avium), bird cherry (Prunus padus), rowan (Sorbus aucuparia), wych elm (Ulmus glabra) and blackthorn (Prunus spinosa) occurring on drier ground.

These transitions from wet to drier woodland and from open to more closed communities provide important ecological variation. The ground flora is correspondingly varied. Some stands are dominated by tall herbs, reeds and sedges, for example common nettle Urtica dioica, dog's mercury Mercurialis perennis, cleavers Galium aparine, hedge-woundwort Stachys sylvatica, common bluebell Hyacinthoides non-scripta, great wood-rush Luzula sylvatica, ground elder Aegopodium podagraria and creeping buttercup Ranunculus repens.

Non-plant typical species supported by this habitat include a rich collection of over 150 lichen species. Blackcap Sylvia atricapilla, willow warbler Phylloscopus trochilus, wood warbler Phylloscopus sibilatrix, spotted flycatcher Muscicapa striata and pied flycatcher Ficedula hypoleuca are all present at the site as well as mammals including roe deer Capreolus capreolus, otter Lutra lutra and bat species."

The eco-hydrological assessment summarised above for Conservation Objective 2b, and contained in Appendix 1, is also relevant to Conservation Objective 2c. Specifically, for the reasons already set out, key tree and shrub

species would not have any long-term detrimental effects, and it is concluded that the vegetation structure and floristic composition of the qualifying habitat would not be adversely affected. Important ecological variation and diversity is therefore expected to be maintained.

Regarding non-plant species, the Conservation Advice Package specifically mentions five bird species. These are all summer migrant woodland / scrub specialists[166]. Blackcap and willow warbler have a diet of a range of insects, and berries / fruit, and nest in shrubs / scrub. Wood warblers have a diet of insects, flies and spiders, and also nest in shrubs / scrub, and require woodland with mature trees. Spotted flycatchers have a diet of flying insects and nest in sheltered crevices, including holes in trees. Pied flycatchers have a diet of flying insects, caterpillars and other invertebrates, and nest in holes in mature trees. Given that adverse effects are not predicted upon the floristic composition of the qualifying woodland habitat, including tree and shrub species, significant adverse effects are not predicted upon these bird species. The woodland habitat for which these species rely on in summer for feeding, nesting and cover, would continue to provide these resources. Therefore, the distribution or viability of these species would not be affected.

Similarly, given that the structure and floristic composition would not be adversely affected, the viability and distribution of roe deer would not be adversely affected, as the species would continue to have a woodland resource for food and shelter. This is also the case for otter, which would continue to have a woodland resource for cover and shelter, including tree roots and boulders providing suitable resting habitat, and would continue to have access to a high quality and abundant food resource in Loch Ness and the surrounding catchment. Bats would also not be adversely affected, given that their roosting resource would remain unaffected, and the quality and connectivity of foraging habitat would not be adversely affected.

The woodland also supports a wide variety of lichen species, which grow on trees and rock. There would be the potential for lichen species which have highly restricted niches, to be adversely affected, if there was a change in humidity or light levels, that altered restricted niches. However, for the reasons detailed above for Conservation Objective 2b, changes in humidity and light levels are not predicted to occur. This is because tree and shrub species would not have long-term detrimental effects, and therefore would be expected to retain existing light levels within the woodland, and continue to provide habitat for epiphytic lichens. Due to the retention of the existing structure and floristic composition, and due to the lag in response of the lower-lying soils to short-term fluctuations in water levels within Loch Ness, with a resultant low risk of soil desiccation, the humidity levels within the qualifying woodland habitat are expected to remain unchanged. As such, the distribution and viability of lichens within the woodland qualifying habitat would not be adversely affected.

It is therefore concluded that **the project would not undermine Conservation Objective 2c. This is the case both in combination with other plans and projects (i.e. with all three pumped storage schemes operating together), and for the project alone.**

Step Two, Part Three: Cumulative Effects of the Project with other Plans or Projects

Step Two, Part two above, incorporates an assessment of the potential effects of the project operating in combination with Foyers and Red John pumped storage schemes, as this is considered to be the most relevant assessment for the project. Beyond these schemes, no further plans or projects have been identified that could give rise to in combination effects.

As detailed in Section Two, Part Two above, the project would not undermine any of the Conservation Objectives, in combination with other plans and projects.

[166] https://www.woodlandtrust.org.uk/trees-woods-and-wildlife/animals/birds/

Step Three: Effects on Integrity

As detailed in Step Two, Parts Two and Three, the project would not undermine any of the Conservation Objectives, either alone, or in combination with other plans and projects. As such, it can be concluded that there would be no effect upon the integrity of Urquhart Bay Wood SAC.

Step Four: Mitigation Measures

It has been concluded that there would be no effect upon the integrity of Urquhart Bay Wood SAC, and therefore no mitigation measures are required.

7.0 Conclusion

7.1 Ness Woods SAC

The majority of impact pathways on features of Ness Woods SAC were screened in for assessment. In the absence of mitigation measures, all Conservation Objectives for all qualifying features of Ness Woods SAC have the potential to be undermined.

Mitigation measures have been applied as follows:

- to protect retained habitats via: dust control, pollution prevention, protection of retained tree roots where possible, maintaining the natural flow rate on the Allt an t-Sluichd watercourse, implementing track construction and drainage measures to maintain groundwater and surface water flows, use of pre-weathered concrete in construction of Dam 1 where possible, EcoW and AcoW supervision, provision of toolbox talks, and implementing a CEMP, PPP, BMP, and Water Quality Monitoring Programme;
- to control the risk of mortality or injury to otter via: fitting screens, implementing a 15 mph speed limit, capping or ramping excavations and storing chemicals safely;
- to reduce otter disturbance, provide mitigation for lost resting places, and protect food availability via: implementing sensitive lighting, undertaking pre-construction surveys, implementing buffer zones around retained otter resting places, obtaining licence for lost and disturbed otter resting places including implementation of an Otter Protection Plan and creation of two artificial holts, providing fish mitigation and pollution control, and controlling public access to retained habitats.

Once mitigation has been applied, a significant residual effect remains for: the direct loss of up to 0.60 ha, and indirect habitat change via fragmentation of 0.13 ha, of '*Tilio-Acerion* forests of slopes, screes and ravines'; and the direct loss of up to 4.96 ha, and indirect habitat change via fragmentation of 1.04 ha, of 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles.' This includes the direct loss of associated trees (850 in total, including 90 hazels), bryophytes, lichens and ground flora within the direct habitat loss areas, as well as the potential to damage roots of up to 107 further trees, beyond these areas. Additionally, vegetation changes could occur within the fragmentation areas from becoming isolated from woodland interior habitat, and bryophytes and lichens which are humidity sensitive could be adversely affected within the second hairpin bend fragmentation area, via microclimatic edge effects. Overall, there is the potential for the resilience and therefore long-term viability of lichen species that are rare at the site-based scale to be reduced. The residual effects would result in undermining conservation objectives 1, 2, 2a, 2b and 2c for the '*Tilio-Acerion* forests of slopes, screes and ravines' and 'Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles' qualifying features. With mitigation measures in place, no Conservation Objectives for otter would be undermined.

It is therefore concluded that the project alone would result in an adverse effect on the integrity of Ness Woods SAC. The HRA therefore requires progression to Stage 3 and Stage 4 for Ness Woods SAC.

7.2 Loch Knockie and nearby Lochs SPA, North Inverness Lochs SPA, Loch Ruthven SPA and Loch Ashie SPA

The assessment undertook a test of Likely Significant Effects of impact pathways relating to displacement, changes to hydrological conditions, invasive non-native species and disturbance impacts on breeding Slavonian grebes at Loch Knockie and nearby Lochs SPA. Moreover, displacement effect was assessed for a further three SPAs: North Inverness Lochs SPA, Loch Ruthven SPA and Loch Ashie SPA.

Likely Significant Effects could be screened out for all impact pathways, for all four SPAs considered.

Based on the information provided above, it can be reasonably concluded that within the context of potential impacts on Slavonian grebe, no SPA conservation objectives would be compromised due to the Proposed

Development, and no adverse effect on integrity of any SPA would result, either alone or in-combination with other projects.

7.3 River Moriston SAC

The majority of impact pathways on features of the River Moriston SAC were screened in for assessment. In the absence of mitigation measures a likely significant effect was predicted undermining Conservation Objectives for both mussels (2d. (i)) and salmon (2a. (ii)).

Mitigation applied for salmon significantly reduced residual effects for the Proposed Development alone and for in-combination effects from other plans and projects. Although an absence of information exists regarding migration pathways of salmon, at all life stages, originating from the River Moriston SAC applying precautionary mitigation through fish deterrent systems around the intake will have a neutral effect on salmon populations under worst case scenario with no net change to salmon population. Fish deterrent systems will depreciate effects of increased energy burden, risk of injury and increased risk of predation through attraction to inlet/outlet. No in-combination residual effects were predicted after mitigation was applied.

It has therefore concluded that no Conservation Objectives would be undermined for mussels with adoption of mitigation measures. Loch Ness, and the distance between source and receptor, acts as a buffer for mussels in most instances. Conservation Objectives pertaining to the population of salmon will not be compromised following adoption and strict enforcement of mitigation measures presented within this HRA and in the CEMP.

Both of these conclusions are consistent with the grant of the Red John PSH consent in 2021, as already noted.

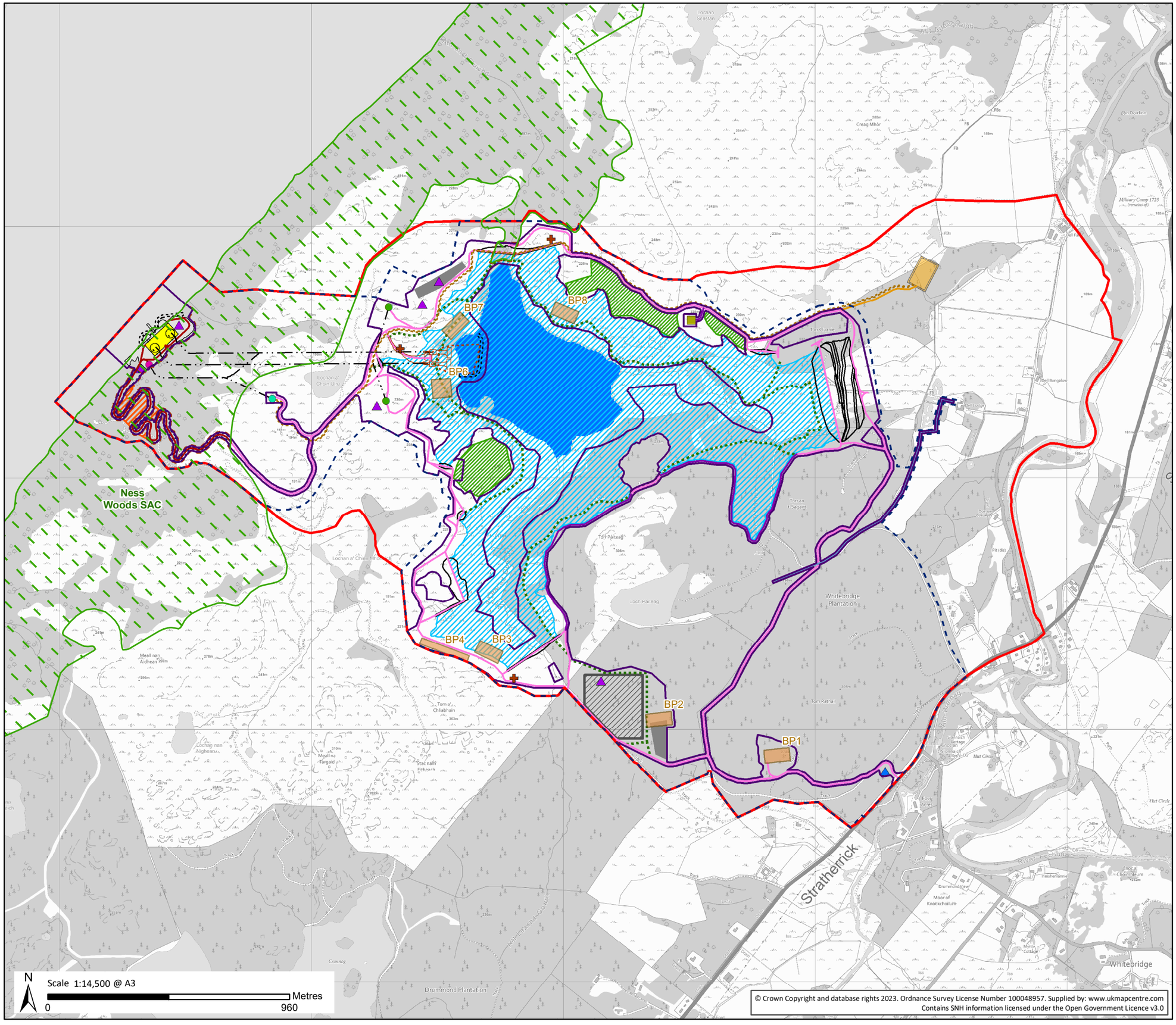
7.4 Urquhart Bay Wood SAC

The effect of fluctuation in water levels within Loch Ness was screened in for assessment. An eco-hydrological assessment was completed (see Appendix 1), to assess potential effects upon the structure and floristic composition of the qualifying woodland habitat.

It has been concluded that no Conservation Objectives would be undermined, and no adverse effect on site integrity would occur, as a result of the project alone, or in-combination with other plans and projects. As such, no mitigation measures are required.

FIGURE 1

Project Location and Layout



Key

- Site Boundary
- Development Area
- Working Corridor
- Control Kiosk
- Cable Shaft
- Temporary Site Compound
- Security Compound
- Access Tunnel
- Surge Shaft
- Relocated Estate Fishing Lodge
- Inlet/Outlet Excavation
- Intake
- Underground Tunnel
- Temporary Cofferdam
- New Estate Water Supply
- Construction and Operational Access Track Within SAC
- Construction and Operational Access Track (4m Wide Running Surface)
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Indicative Borrow Pit Excavation
- Temporary Laydown Area
- Main Welfare Compound
- Powerhouse Building
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- Powerhouse Platform, Quayside and Pier
- 3 m Access Track Working Corridor
- 4 m Buffer beyond Working Corridor
- Woodland Fragmentation Area
- Ness Woods SAC

Advanced Works

- Fenced Native Woodland Natural Regeneration Areas (Pre-Construction)

Associated Works

- 275 kV Cable Trench*
- Switching Station Access*
- 275 kV Switching Station*

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 1

Project Location & Layout

Drawn by: ME **Date:** 13/11/2023

Drawing: 04707.00036.00018.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR

FIGURE 2

Locations of European Sites within the potential Zone of Influence

Loch Ashie SPA

Urquhart Bay Wood SAC

North Inverness Lochs SPA

Loch Ruthven SPA

Ness Woods SAC

River Moriston SAC

Ness Woods SAC

Loch Knockie & Nearby Lochs SPA

Ness Woods SAC

Loch Knockie and nearby Lochs SPA

N

Scale 1:150,000@ A3

0 5 Km

Key

- Site Boundary
- Planning Boundary 15 km Buffer
- Special Area of Conservation (SAC)
- Special Protection Area (SPA)

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 2
Locations of European Sites within the Potential Zone of Influence

Drawn by: ME **Date:** 13/11/2023

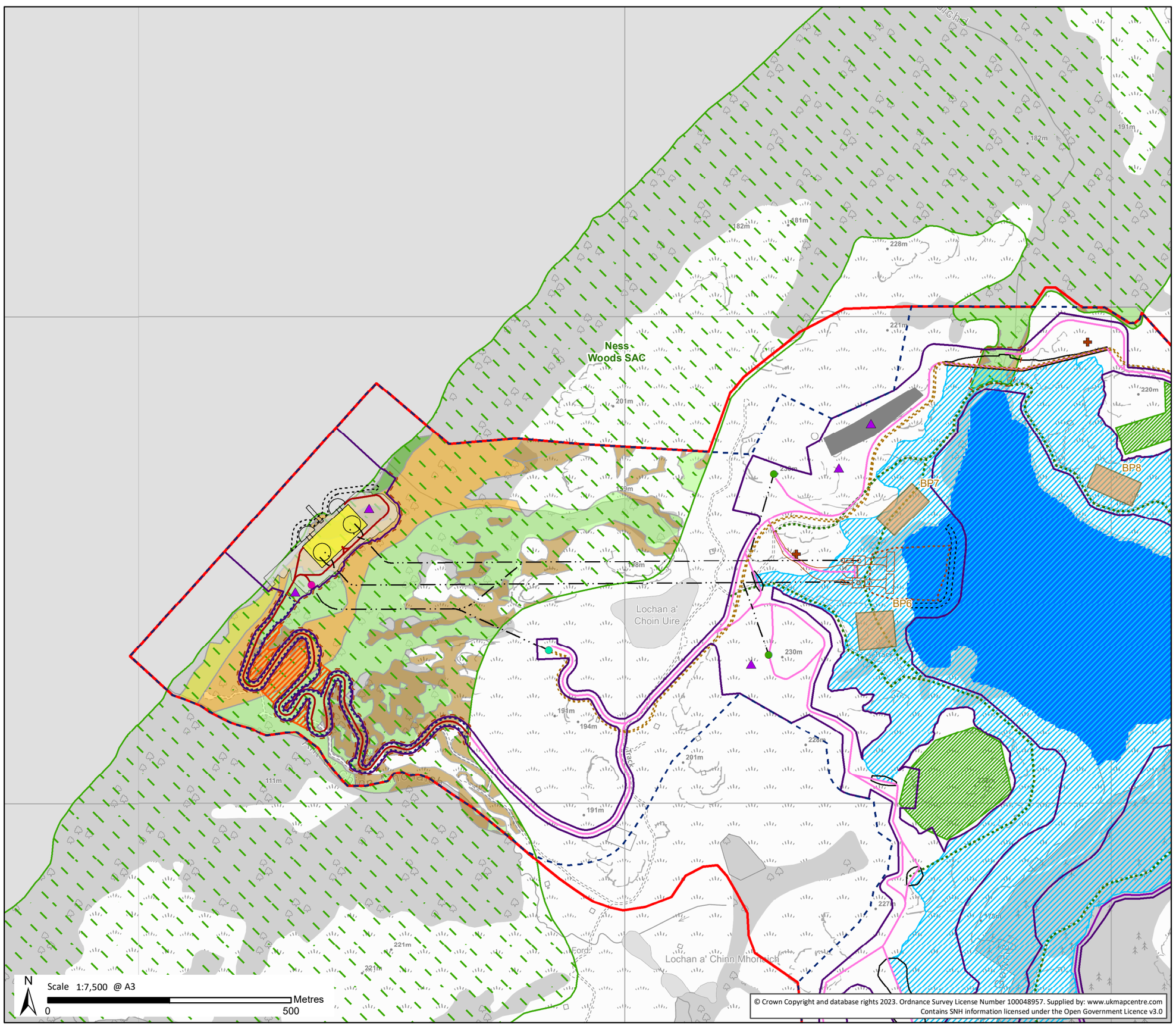
Drawing: 04707.00036.00013.2

Loch Kemp Storage
A STATERA COMPANY

ash SLR

FIGURE 3

Ness Woods SAC Qualifying Interest Habitat with Proposed Infrastructure Overlain



Key

- Site Boundary
- Development Area
- Working Corridor
- Control Kiosk
- Cable Shaft
- Temporary Site Compound
- Access Tunnel Adit
- Surge Shaft
- Inlet/Outlet Excavation
- Intake
- Underground Tunnel
- Temporary Cofferdam
- Construction and Operational Access Track Within SAC
- Construction and Operational Access Track (4m Wide Running Surface)
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Indicative Borrow Pit Excavation
- Temporary Laydown Area
- Powerhouse Building
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- Powerhouse Platform, Quayside and Pier
- 3 m Access Track Working Corridor
- 4 m Buffer beyond Working Corridor
- Woodland Fragmentation Area
- Ness Woods SAC

Advanced Works

- Fenced Native Woodland Natural Regeneration Areas (Pre-Construction)

Associated Works

- 275 kV Cable Trench*

SAC Qualifying Habitat

- Tilio-Acerion Forests of Slopes, Screes and Ravines
- Old Sessile Oak Woods with Ilex and Blechnum in the British Isles
- Bracken Stands – Included as Old Sessile Oak Woods with Ilex and Blechnum in the British Isles
- Habitat Mosaic: 80% Old Sessile Oak Woods with Ilex and Blechnum in the British Isles, 20% Tilio-Acerion Forests of Slopes, Screes and Ravines
- Habitat Mosaic: 60% Tilio-Acerion Forests of Slopes, Screes and Ravines, 40% Old Sessile Oak Woods with Ilex and Blechnum in the British Isles

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 3

Ness Woods SAC Qualifying Interest Habitat with Proposed Infrastructure Overlain

Drawn by: ME **Date:** 13/11/2023

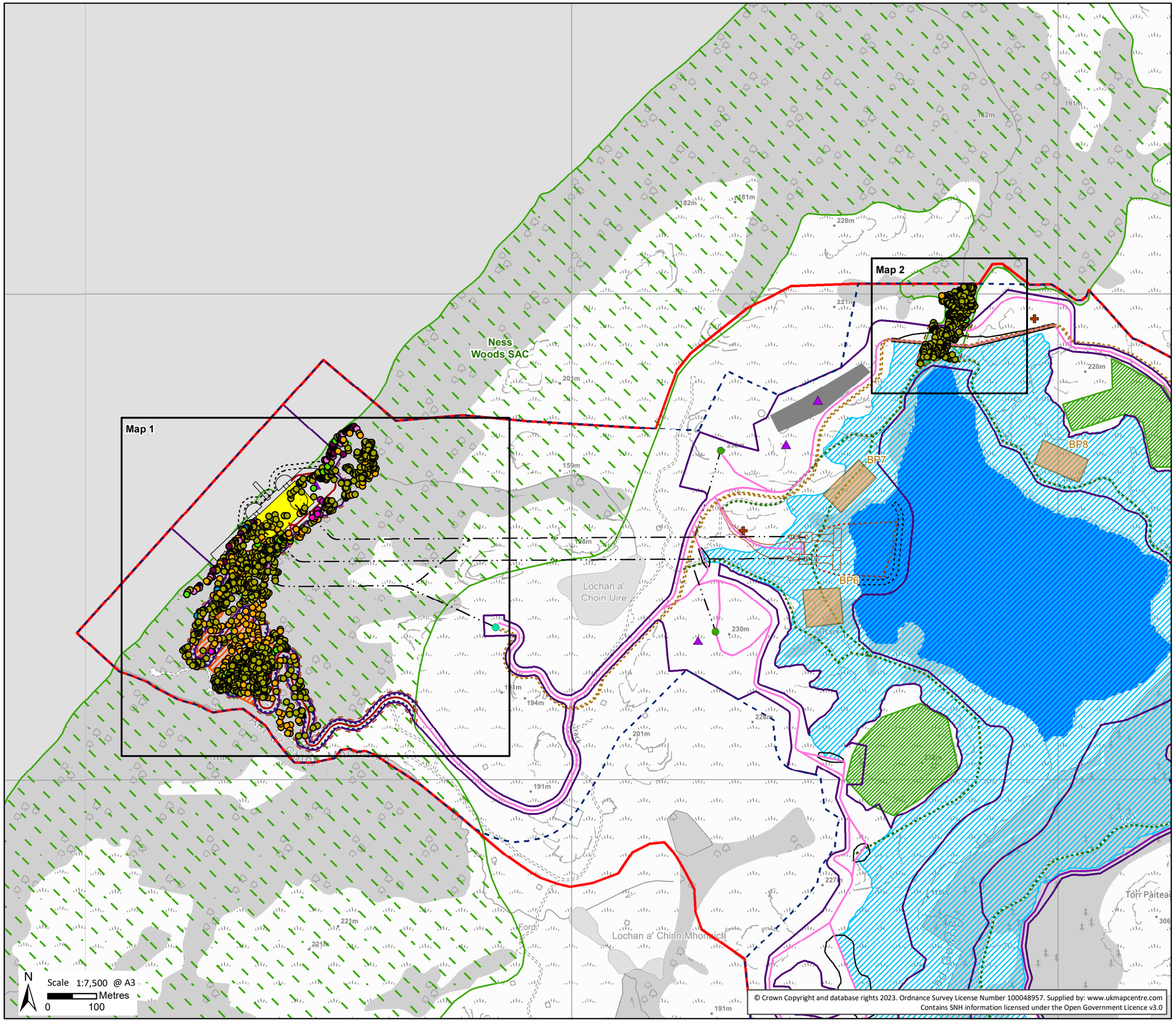
Drawing: 04707.00036.00015.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR

FIGURE 4

Ness Woods SAC Individual Tree Species with Proposed Infrastructure Overlain



Key

- Site Boundary
- Development Area
- Working Corridor
- Control Kiosk
- Cable Shaft
- Temporary Site Compound
- Access Tunnel Adit
- Surge Shaft
- Inlet/Outlet Excavation
- Intake
- Underground Tunnel
- Temporary Cofferdam
- Construction and Operational Access Track Within SAC
- Construction and Operational Access Track (4m Wide Running Surface)
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Indicative Borrow Pit Excavation
- Temporary Laydown Area
- Powerhouse Building
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- Powerhouse Platform, Quayside and Pier
- 3 m Access Track Working Corridor
- 4 m Buffer beyond Working Corridor
- Woodland Fragmentation Area
- Ness Woods SAC

Advanced Works

- Fenced Native Woodland Natural Regeneration Areas (Pre-Construction)

Associated Works

- 275 kV Cable Trench*

Tree Species

- Alder
- Ash
- Birch
- Hazel
- Oak
- Rowan
- Silver Birch
- Standing Deadwood
- Unidentified/Cherry

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

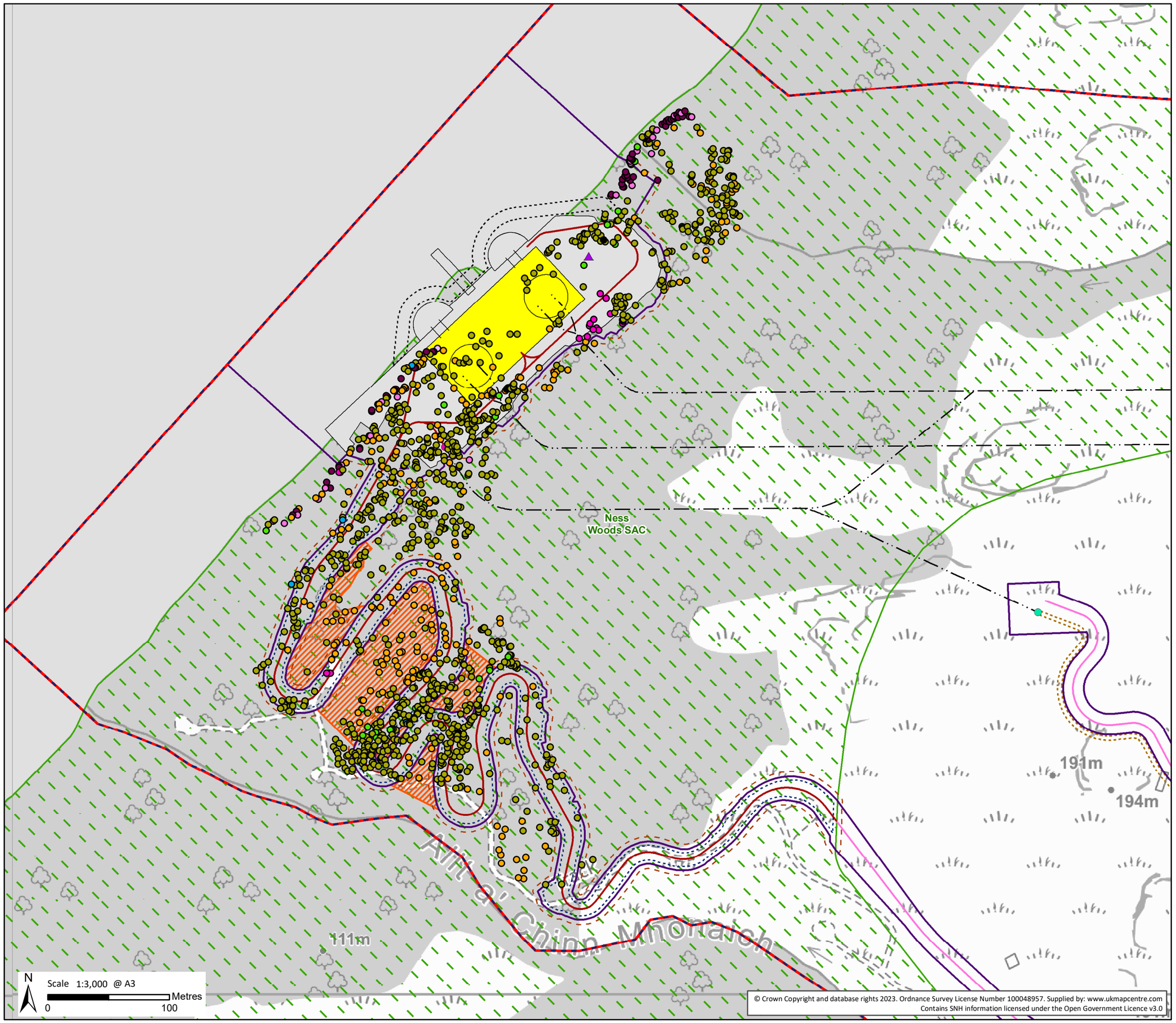
Figure 4
Ness Woods SAC Individual Tree Species with Proposed Infrastructure Overlain
Overview

Drawn by: ME **Date:** 13/11/2023

Drawing: 04707.00036.00016.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR



Key

- Site Boundary
- Development Area
- Working Corridor
- Cable Shaft
- Temporary Site Compound
- Access Tunnel Adit
- Underground Tunnel
- Construction and Operational Access Track Within SAC
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Powerhouse Building
- Powerhouse Platform, Quayside and Pier
- 3 m Access Track Working Corridor
- 4 m Buffer beyond Working Corridor
- Woodland Fragmentation Area
- Ness Woods SAC

Associated Works

- 275 kV Cable Trench*

Tree Species

- Alder
- Ash
- Birch
- Hazel
- Oak
- Rowan
- Silver Birch
- Standing Deadwood
- Unidentified/Cherry

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

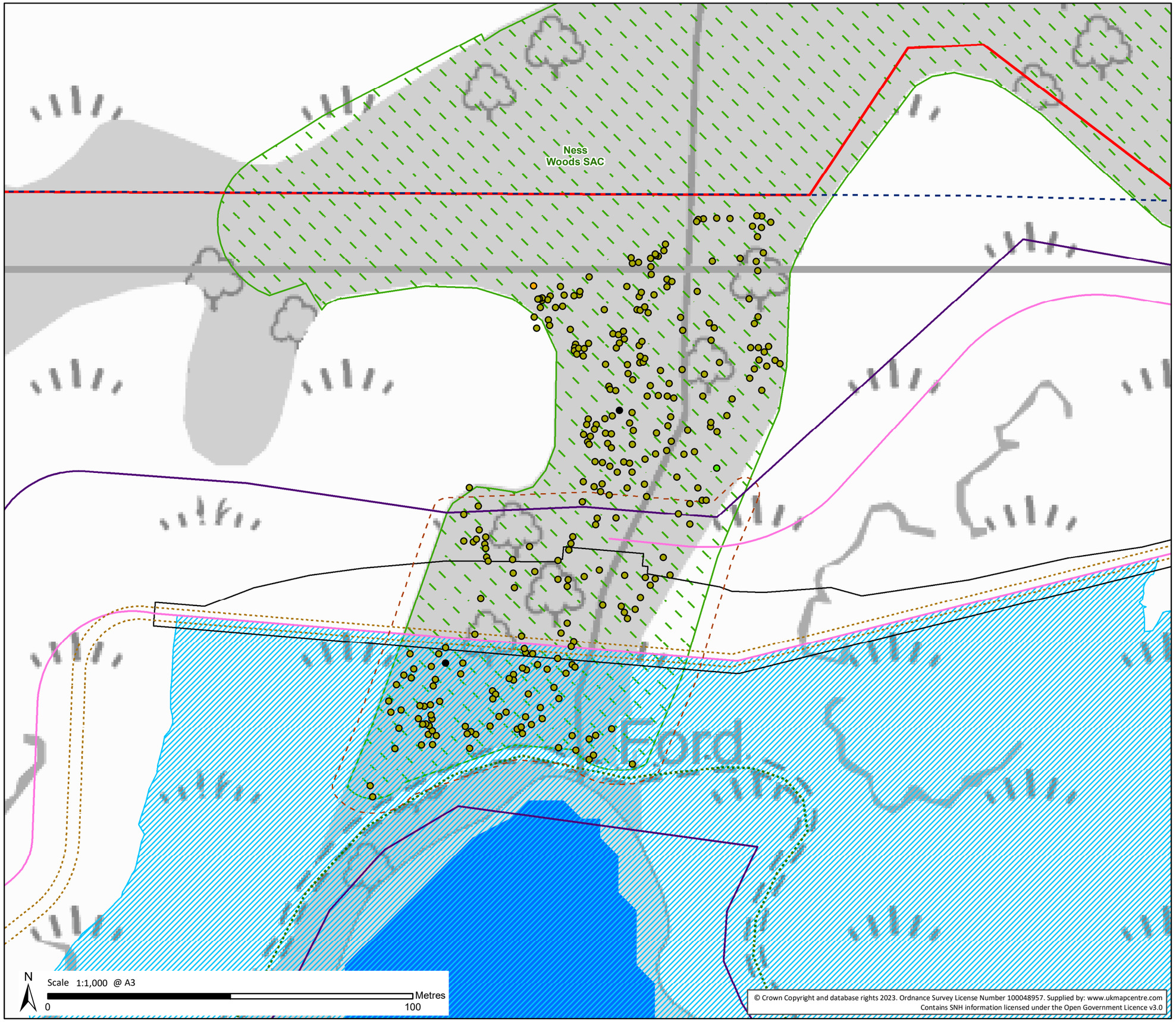
Figure 4
Ness Woods SAC Individual Tree Species with Proposed Infrastructure Overlain
Map 1

Drawn by: ME **Date:** 13/11/2023

Drawing: 04707.00036.00016.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR



Key

- Site Boundary
- Development Area
- Working Corridor
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- 4 m Buffer beyond Working Corridor
- Ness Woods SAC

Associated Works

- 275 kV Cable Trench*

Tree Species

- Alder
- Ash
- Birch
- Hazel
- Oak
- Rowan
- Silver Birch
- Standing Deadwood
- Unidentified/Cherry

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 4
Ness Woods SAC Individual Tree Species with Proposed Infrastructure Overlain
Map 2

Drawn by: ME **Date:** 13/11/2023

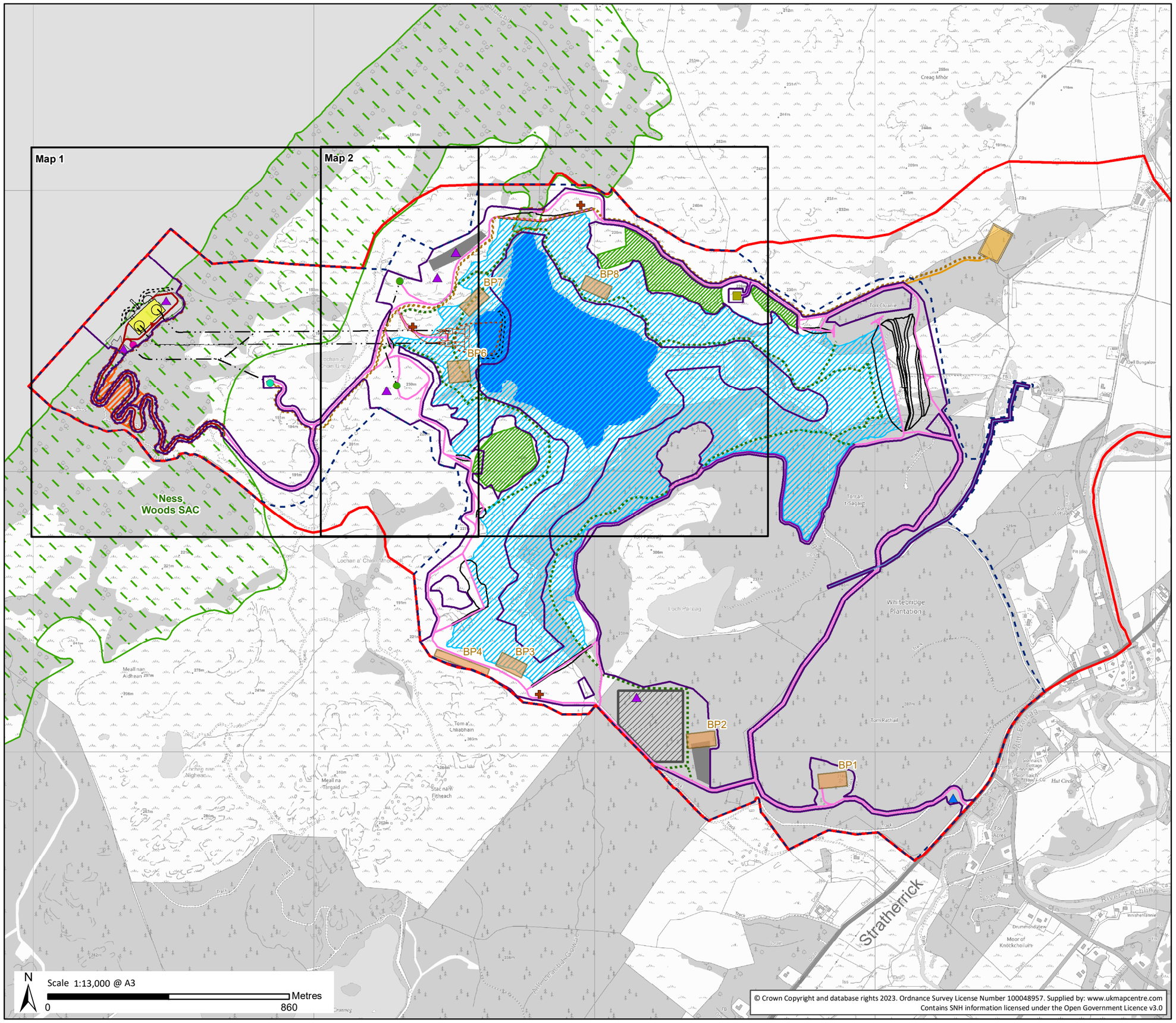
Drawing: 04707.00036.00016.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR

FIGURE 5

NVC Survey with Proposed Infrastructure Overlain



Key

- Site Boundary
- Development Area
- Working Corridor
- Control Kiosk
- Cable Shaft
- Temporary Site Compound
- Security Compound
- Access Tunnel Adit
- Surge Shaft
- Relocated Estate Fishing Lodge
- Inlet/Outlet Excavation
- Intake
- Underground Tunnel
- Temporary Cofferdam
- New Estate Water Supply
- Construction and Operational Access Track Within SAC
- Construction and Operational Access Track (4m Wide Running Surface)
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Indicative Borrow Pit Excavation
- Temporary Laydown Area
- Main Welfare Compound
- Powerhouse Building
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- Powerhouse Platform, Quayside and Pier
- 3 m Access Track Working Corridor
- 4 m Buffer beyond Working Corridor
- Woodland Fragmentation Area
- Ness Woods SAC

Advanced Works

- Fenced Native Woodland Natural Regeneration Areas (Pre-Construction)

Associated Works

- 275 kV Cable Trench*
- Switching Station Access*
- 275 kV Switching Station*

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 5

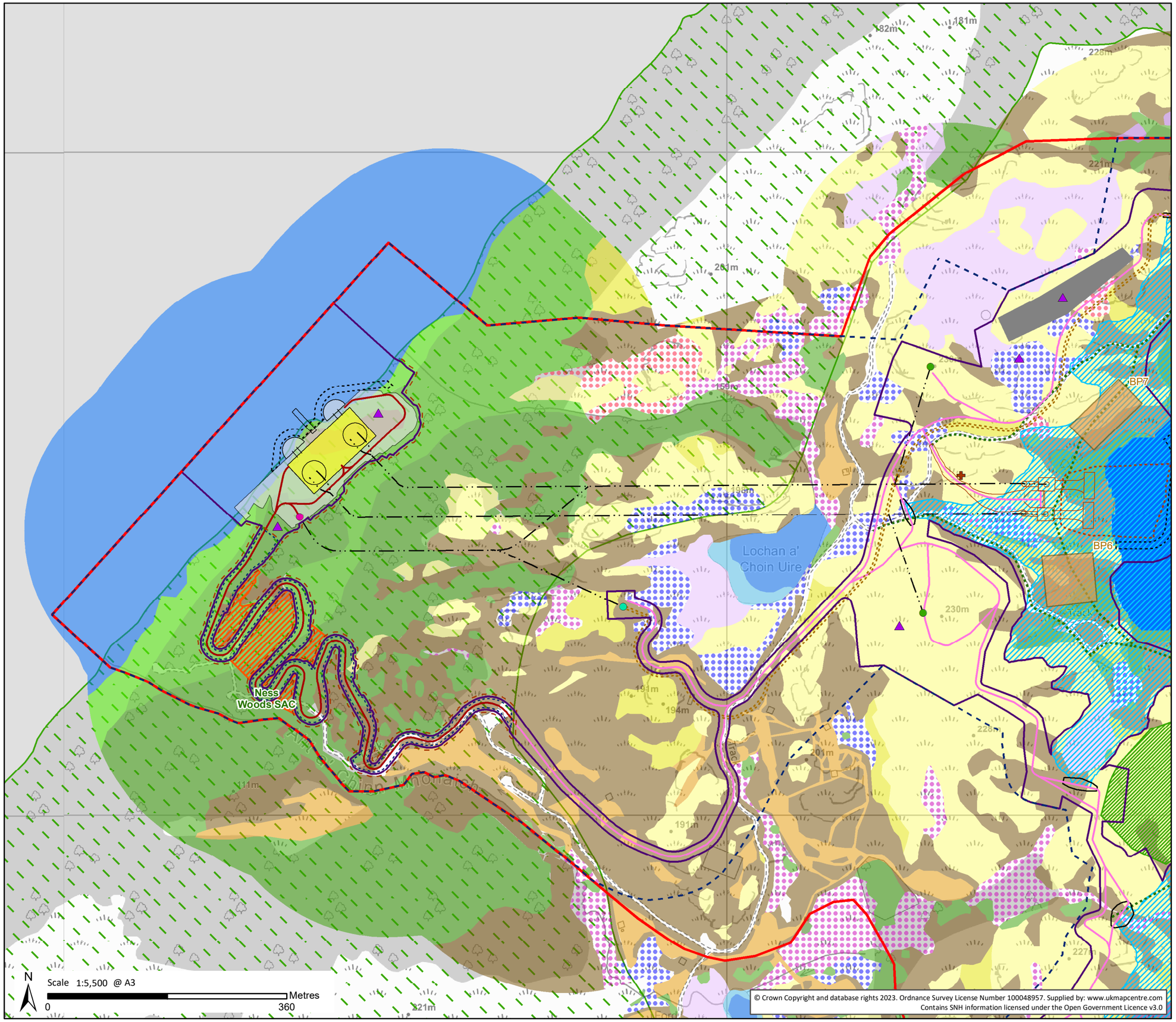
NVC Survey with Proposed Infrastructure Overlain Overview

Drawn by: ME **Date:** 13/11/2023

Drawing: 04707.00036.00034.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR



Key

- Site Boundary
- Development Area
- Working Corridor
- Control Kiosk
- Cable Shaft
- Temporary Site Compound
- Access Tunnel Adit
- Surge Shaft
- Inlet/Outlet Excavation
- Intake
- Underground Tunnel
- Temporary Cofferdam
- Construction and Operational Access Track Within SAC
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Indicative Borrow Pit Excavation
- Temporary Laydown Area
- Powerhouse Building
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- Powerhouse Platform, Quayside and Pier
- 3 m Access Track Working Corridor
- 4 m Buffer beyond Working Corridor
- Woodland Fragmentation Area
- Ness Woods SAC

Advanced Works

- Fenced Native Woodland Natural Regeneration Areas (Pre-Construction)

Associated Works

- 275 kV Cable Trench*

Dominant NVC Category

- G1 Standing Water
- H10 Dry Heath
- H10/U20 Dry Heath/Bracken
- M15/U20 Wet Heath/Scattered Bracken
- M15/U4 Wet Heath/Acid Grassland
- M15a Wet Heath
- M15b Wet Heath
- M17 Blanket Bog
- M17-20 Modified Bog
- M25a Wet Modified Bog
- S9 Marginal Vegetation
- U4 Acid Grassland
- U20 Bracken
- W9 Upland Mixed Broadleaved Woodland
- W11a Upland Oak-Birch Woodland
- W17 Upland Oak-Birch Woodland
- W1x Willow Scrub

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 5

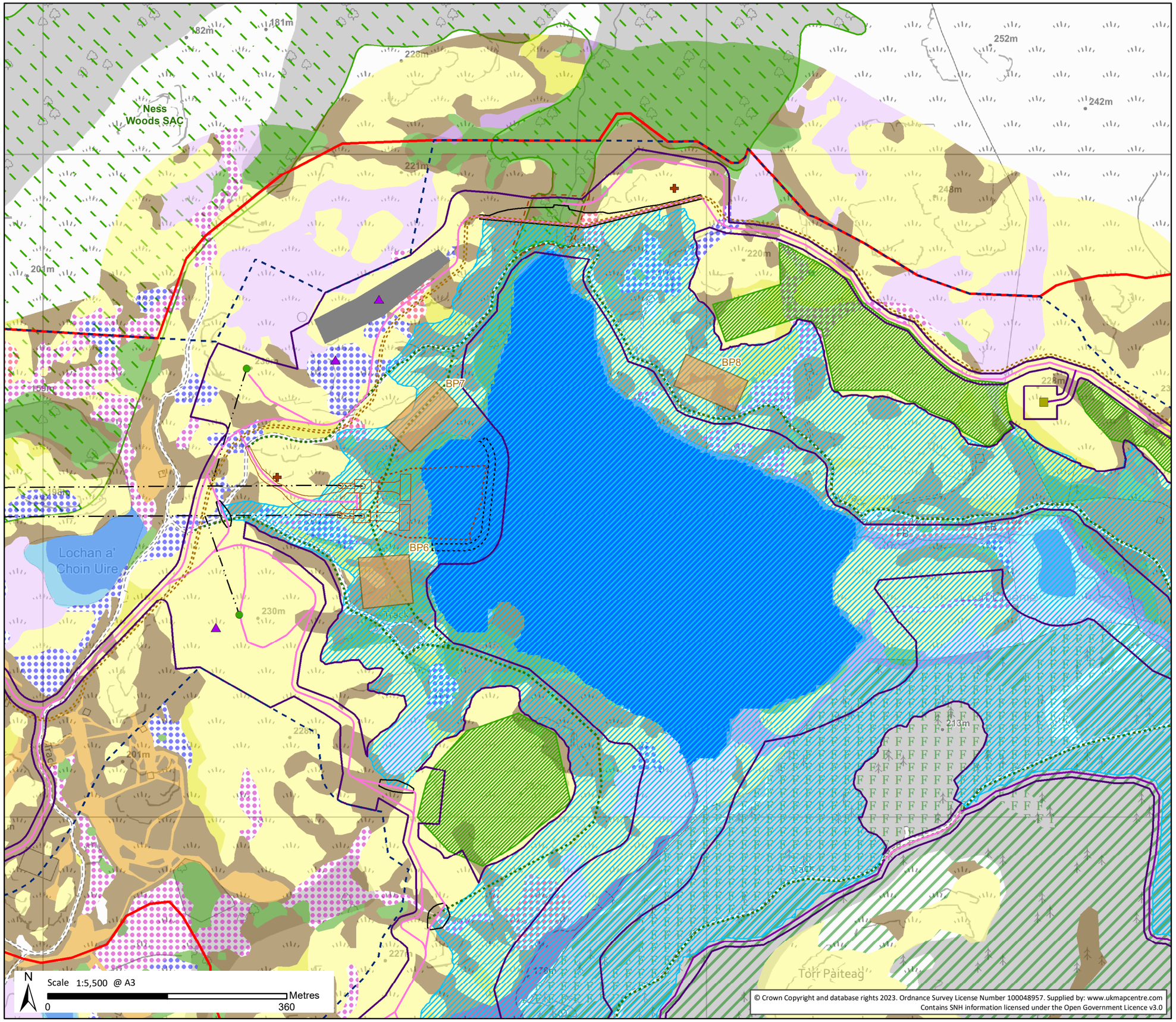
NVC Survey with Proposed Infrastructure Overlain Map 1

Drawn by: ME **Date:** 13/11/2023

Drawing: 04707.00036.00034.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR



Key

- Site Boundary
- Development Area
- Working Corridor
- Control Kiosk
- Temporary Site Compound
- Surge Shaft
- Relocated Estate Fishing Lodge
- Inlet/Outlet Excavation
- Intake
- Underground Tunnel
- Temporary Cofferdam
- Construction and Operational Access Track (4m Wide Running Surface)
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Indicative Borrow Pit Excavation
- Temporary Laydown Area
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- 4 m Buffer beyond Working Corridor
- Ness Woods SAC

Advanced Works

- Fenced Native Woodland Natural Regeneration Areas (Pre-Construction)

Associated Works

- 275 kV Cable Trench*

Dominant NVC Category

- A1.2.2 Coniferous Plantation Woodland
- A1.4.2 Felled Coniferous Plantation Woodland
- A8 Aquatic Community
- G1 Standing Water
- H10 Dry Heath
- H10/U20 Dry Heath/Bracken
- M15/U20 Wet Heath/Scattered Bracken
- M15/U4 Wet Heath/Acid Grassland
- M15a Wet Heath
- M15b Wet Heath
- M17 Blanket Bog
- M17-20 Modified Bog
- M20 Modified Bog
- M25a Wet Modified Bog
- S4a Aquatic Vegetation
- S9 Marginal Vegetation
- S10 Marginal Vegetation
- U4 Acid Grassland
- U20 Bracken
- W17 Upland Oak-Birch Woodland
- W1x Willow Scrub

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 5

NVC Survey with Proposed Infrastructure Overlain Map 2

Drawn by: ME **Date:** 13/11/2023

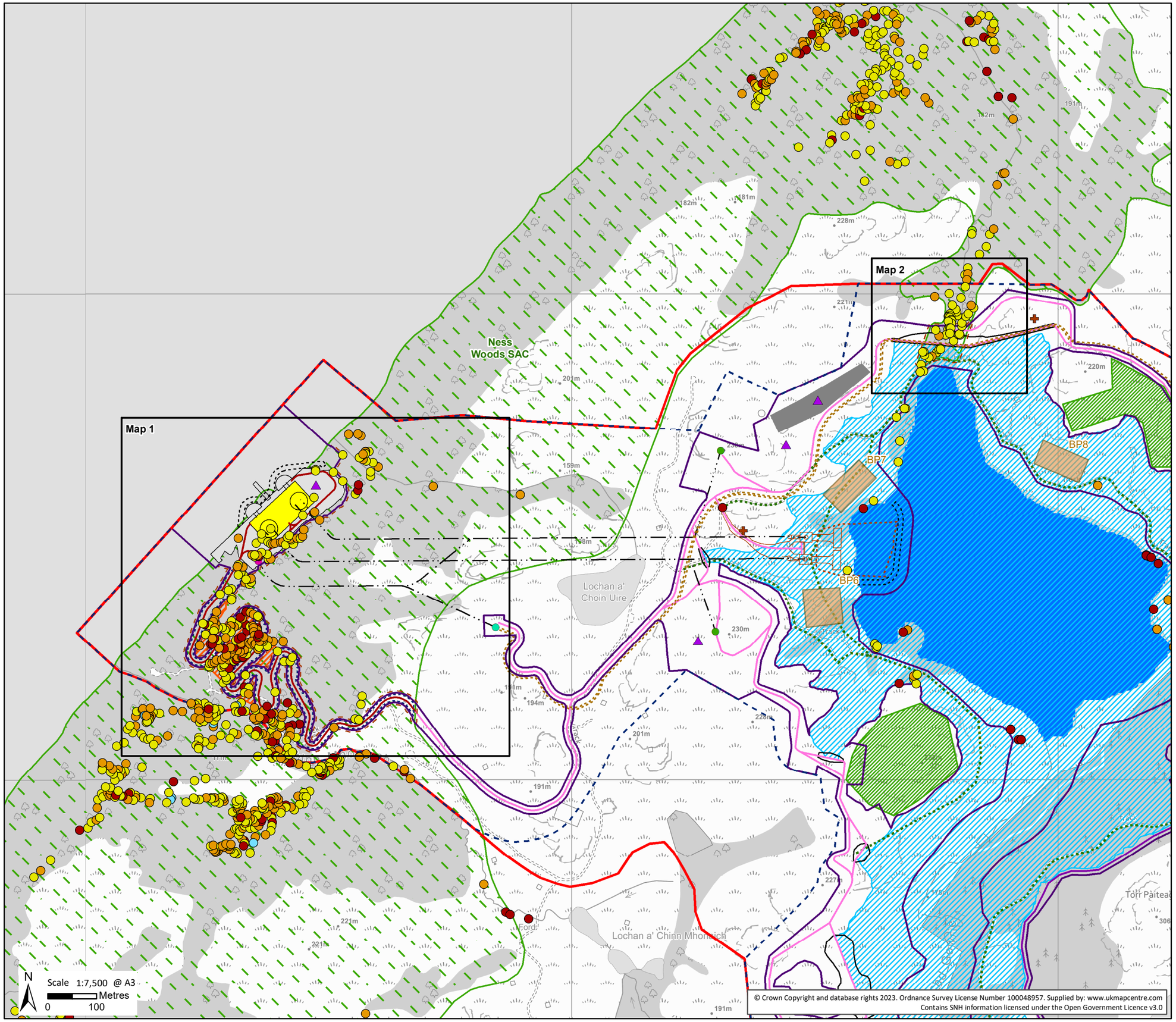
Drawing: 04707.00036.00034.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR

FIGURE 6

Lichens with Proposed Infrastructure Locations Overlain



Key

- Site Boundary
- Development Area
- Working Corridor
- Control Kiosk
- Cable Shaft
- Temporary Site Compound
- Access Tunnel Adit
- Surge Shaft
- Inlet/Outlet Excavation
- Intake
- Underground Tunnel
- Temporary Cofferdam
- Construction and Operational Access Track Within SAC
- Construction and Operational Access Track (4m Wide Running Surface)
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Indicative Borrow Pit Excavation
- Temporary Laydown Area
- Powerhouse Building
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- Powerhouse Platform, Quayside and Pier
- 3 m Access Track Working Corridor
- 4 m Buffer beyond Working Corridor
- Woodland Fragmentation Area
- Ness Woods SAC

Advanced Works

- Fenced Native Woodland Natural Regeneration Areas (Pre-Construction)

Associated Works

- 275 kV Cable Trench*

Lichens

- Very High Interest
- High Interest
- Medium Interest
- Medium/Low Interest
- Low Interest

*Associated works subject to separate consent. Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 6

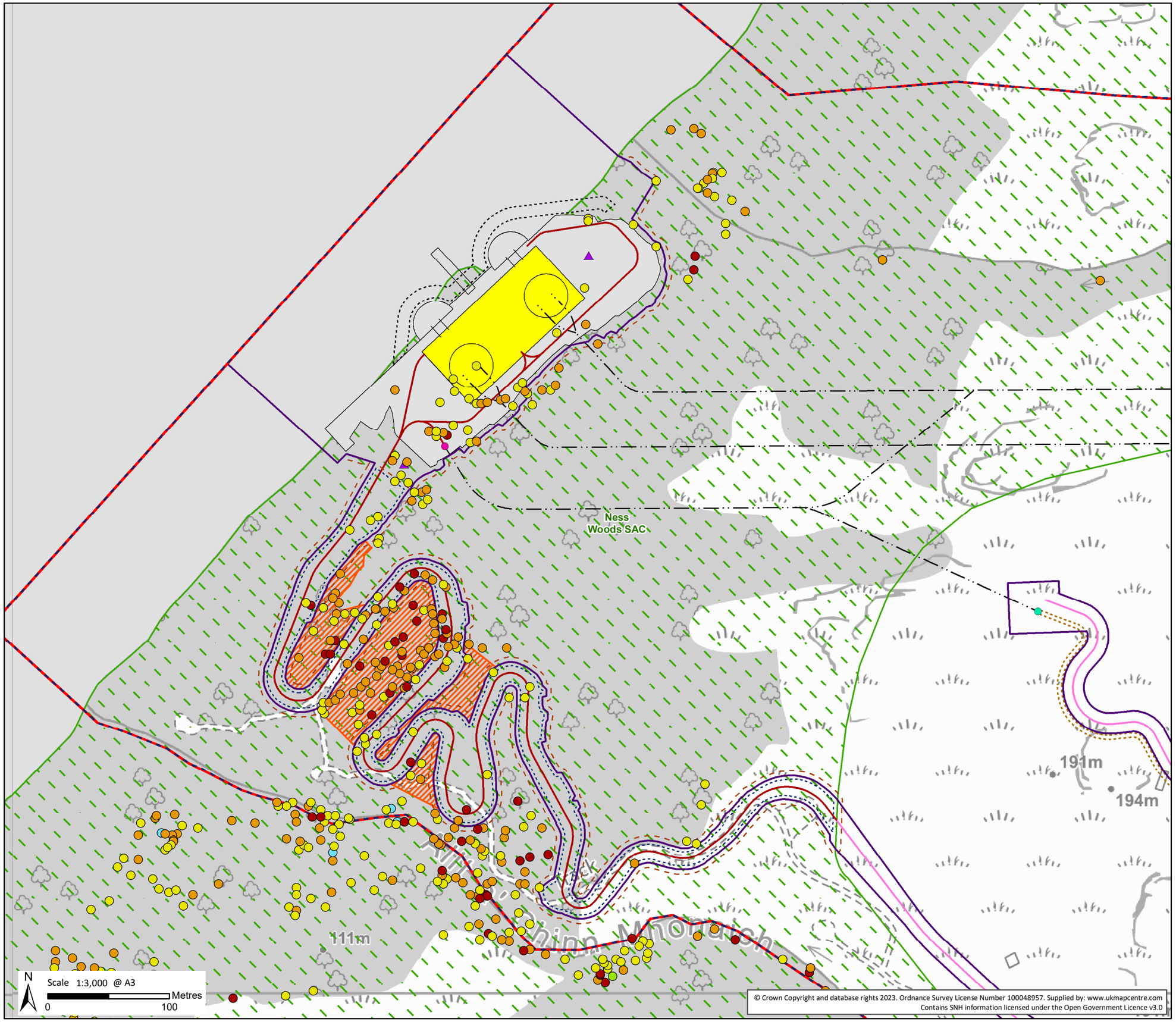
Lichens with Proposed Works Overlain Overview

Drawn by: ME **Date:** 13/11/2023

Drawing: 04707.00036.00032.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR



Key

- Site Boundary
- Development Area
- Working Corridor
- Cable Shaft
- Temporary Site Compound
- Access Tunnel Adit
- Underground Tunnel
- Construction and Operational Access Track Within SAC
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Powerhouse Building
- Powerhouse Platform, Quayside and Pier
- 3 m Access Track Working Corridor
- 4 m Buffer beyond Working Corridor
- Woodland Fragmentation Area
- Ness Woods SAC

Associated Works

- 275 kV Cable Trench*

Lichens

- Very High Interest
- High Interest
- Medium Interest
- Medium/Low Interest
- Low Interest

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 6

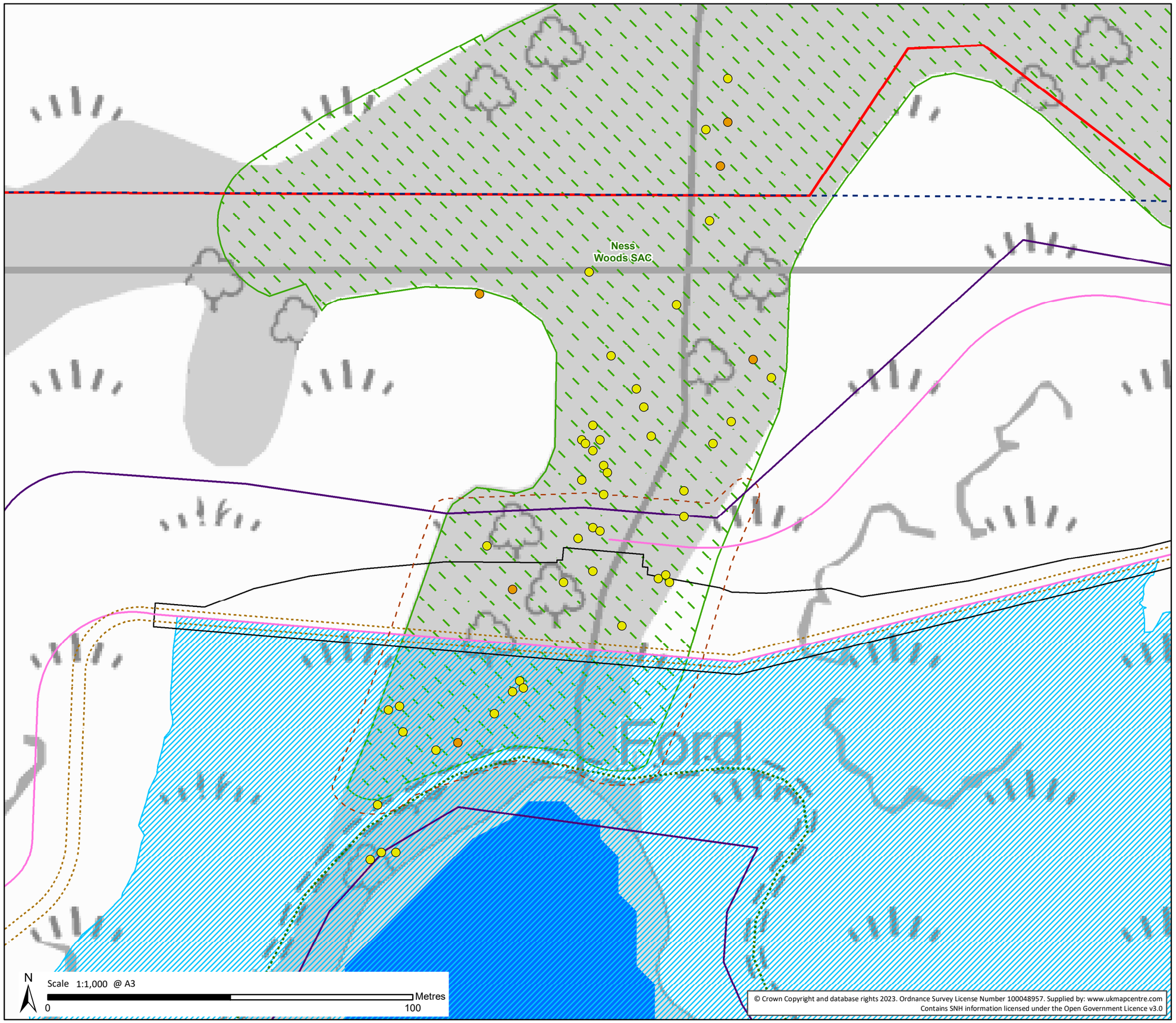
Lichens with Proposed Works Overlain Map 1

Drawn by: ME **Date:** 13/11/2023

Drawing: 04707.00036.00032.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR



Key

- Site Boundary
- Development Area
- Working Corridor
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- 4 m Buffer beyond Working Corridor
- Ness Woods SAC

Associated Works

- 275 kV Cable Trench*

Lichens

- High Interest
- Medium Interest

*Associated works subject to separate consent.
Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 6

Lichens with Proposed Works Overlain Map 2

Drawn by: ME **Date:** 13/11/2023

Drawing: 04707.00036.00032.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR

FIGURE 7

Bryophytes with Proposed Infrastructure Overlain

1 - Allt a'Chinn Mhonaich Burn – this watercourse supports abundant bryophyte communities and is moderately rich in oceanic species. No Nationally Rare or Nationally Scarce species were identified.

2 - Stands of hazel supporting a rich bryophyte flora. No rare bryophyte species were identified but these hazel groves do contain bryophytes of interest.

3 – Loch shore boulders, rocks and low rock faces have a variety of common and widespread bryophyte sp. Most are mosses but the liverwort *Lejeunea cavifolia* is also present. The trees by the loch shore have abundant common epiphytes, including bryophytes. Vertical low rock faces above beach which a wide variety of bryophytes, including basicolous sp. and extensive stands of the oceanic *Plagiochila spinulosa*.

4 – North-west facing scree slopes dominated by bryophyte sp. The rocks support a variety of species, including the liverworts *Bazzania trilobata, Plagiochila punctata, P. spinulosa and Scapania gracilis* and the moss *Hylocomiastrum umbratum*.

5– Ash trees located near powerhouse site with rich flora. No rare bryophyte sp. identified but *Frullania dilatata* and *Orthotrichum striatum* are both present.

6- *Metzgeria pubescens* growing with *Neckera complanata* on an old hazel tree.

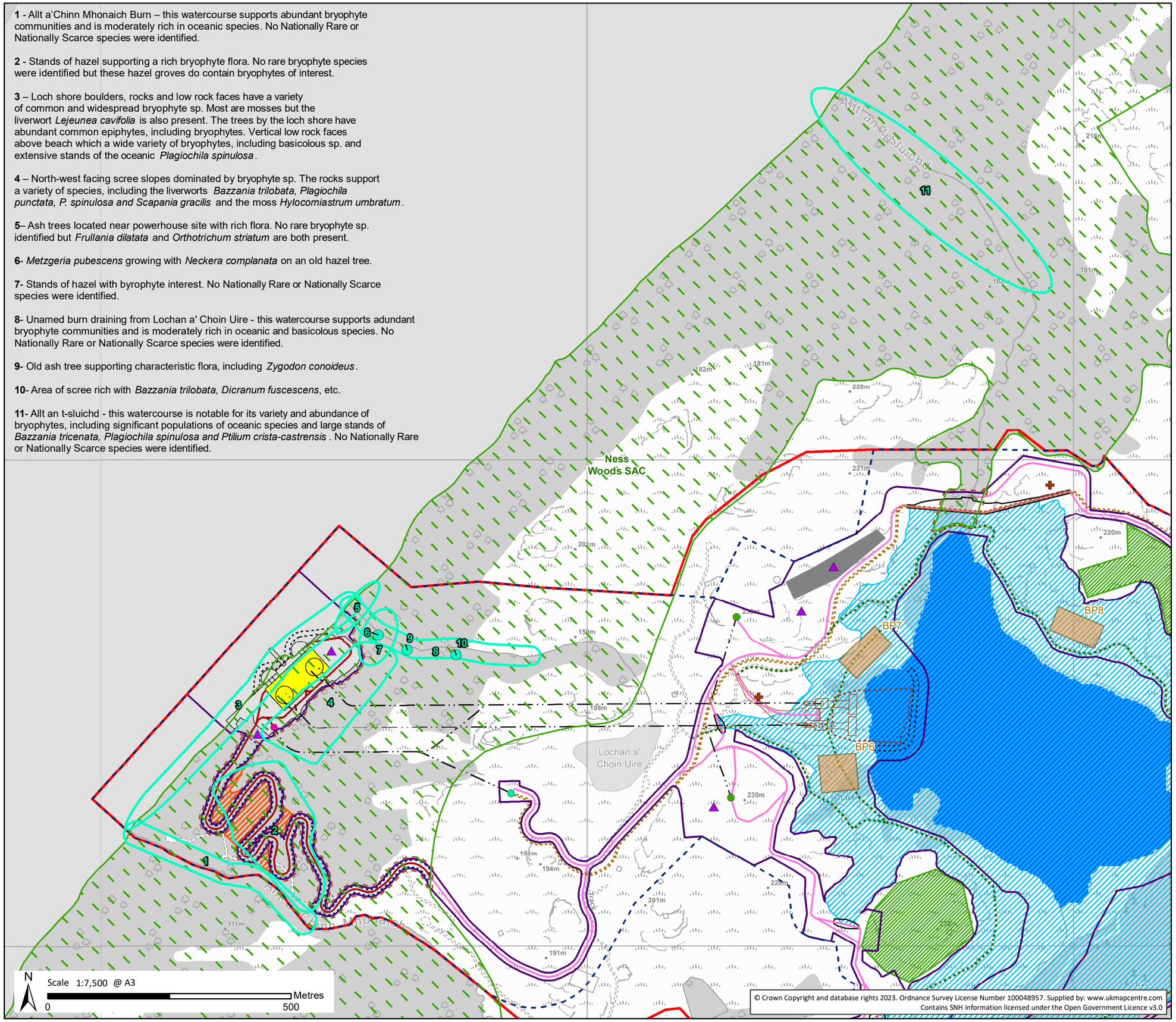
7- Stands of hazel with byrophyte interest. No Nationally Rare or Nationally Scarce species were identified.

8- Unamed burn draining from Lochan a' Choin Uire - this watercourse supports adundant bryophyte communities and is moderately rich in oceanic and basicolous species. No Nationally Rare or Nationally Scarce species were identified.

9- Old ash tree supporting characteristic flora, including *Zygodon conoideus*.

10- Area of scree rich with *Bazzania trilobata, Dicranum fuscescens*, etc.

11- Allt an t-sluichd - this watercourse is notable for its variety and abundance of bryophytes, including significant populations of oceanic species and large stands of *Bazzania tricenata, Plagiochila spinulosa and Ptilium crista-castrensis* . No Nationally Rare or Nationally Scarce species were identified.



Key

- Site Boundary
- Development Area
- Working Corridor
- Control Kiosk
- Cable Shaft
- Inlet/Outlet Structure
- Temporary Site Compound
- Access Tunnel
- Surge Shaft
- Inlet/Outlet Excavation
- Intake
- Underground Tunnel
- Temporary Cofferdam
- Construction and Operational Access Track Within SAC
- Construction and Operational Access Track (4m Wide Running Surface)
- Construction and Operational Access Track (8m Wide Running Surface, Reinstated to 4m Where Feasible)
- Dam
- Temporary Construction Access Track (8m Wide Running Surface)
- Indicative Borrow Pit Excavation
- Temporary Laydown Area
- Powerhouse Building
- Maximum Inundation Area (Upper Reservoir)
- Loch Kemp Surface Area (Existing)
- Powerhouse Platform, Quayside and Pier
- 3 m Access Track Working Corridor
- 4 m Buffer beyond Working Corridor
- Woodland Fragmentation Area
- Ness Woods SAC

Advanced Works

- Fenced Native Woodland Natural Regeneration Areas (Pre-Construction)

Associated Works

- 275 kV Cable Trench*

Bryophytes

- Bryophyte Location (Point)
- Bryophyte Location (Area)

*Associated works subject to separate consent. Footprints show indicative locations / routes only.

Loch Kemp Storage

Habitat Regulations Appraisal Report

Figure 7
Bryophytes with Proposed Works Overlain

Drawn by: ME **Date:** 13/11/2023

Drawing: 04707.00036.00033.4

Loch Kemp Storage
A STATERA COMPANY

ash SLR

FIGURE 8

Otter Field Signs with Proposed Infrastructure Overlain

APPENDIX 1

Eco-hydrological assessment of the impacts of Loch Kemp Storage on Urquhart Bay Wood SAC

LOCH KEMP PUMPED STORAGE SCHEME

Eco-hydrological assessment of the impacts of the Loch Kemp Pumped Storage Scheme on Urquhart Bay Wood SAC

Prepared for: ASH design + Assessment

SLR Ref: 428.V04707.00036
Version No: 3
November 2023

Document Control	
Document Properties	
Organisation	ASH Design and Assessment (on behalf of Statera Energy)
Project Name	Loch Kemp Pumped Storage Scheme
Report Title	Eco-hydrological assessment of the impacts of the Loch Kemp Pumped Storage Scheme on Urquhart Bay Wood SAC
Author(s)	Warren McCleland
Draft version/final	Rev 3
Document reference	428.V04707.00036

Date	Revision No	Prepared By	Reviewed By	Approved By	Status	Comments
26.04.23	0	Warren McCleland	Hazel Douglas, Duncan Watson, Gordon Robb	Duncan Watson	Draft	Draft for client comment
04.05.23	1	Warren McCleland	Hazel Douglas, Duncan Watson, Gordon Robb	Duncan Watson	Final	Final
13.07.23	2	Warren McCleland	Duncan Watson	Duncan Watson	Draft	Updated to reflect NatureScot comments (hydrology)
07.11.23	3	Hazel Douglas	Warren McCleland	Warren McCleland	Final	Figure 8-5 updated. Disclaimer added relating to hydrological modelling

DISCLAIMER

The hydrological modelling data have been updated since this report was completed. Whilst the hydrological modelling has changed, the principal of the loch level varying within existing limits remains the same. The hydrological modelling update does not have a material effect on this report, and does not change the conclusions of this report.

The hydrological modelling of levels in Loch Ness, upon which this report is based, was originally based upon observed level information from the SEPA gauge at Foyers. This original dataset had just under 5 years of observations, based on the availability of information at the time. To improve the accuracy of the analysis a longer-term dataset was identified at the SEPA gauge at Ness-side. This dates back to September 1972 providing 50 years of historic flow information which was manipulated to estimate loch levels within Loch Ness over the period. The project engineers consider the longer duration dataset a more robust basis for evaluation of the impact of pumped hydro on Loch Ness levels.

BASIS OF REPORT

This document has been prepared by SLR with reasonable skill, care and diligence, and taking account of the timescales and resources devoted to it by agreement with ASH design + Assessment (the Client) as part or all of the services it has been appointed by the Client to carry out. It is subject to the terms and conditions of that appointment.

SLR shall not be liable for the use of or reliance on any information, advice, recommendations and opinions in this document for any purpose by any person other than the Client. Reliance may be granted to a third party only in the event that SLR and the third party have executed a reliance agreement or collateral warranty.

Information reported herein may be based on the interpretation of public domain data collected by SLR, and/or information supplied by the Client and/or its other advisors and associates. These data have been accepted in good faith as being accurate and valid.

The copyright and intellectual property in all drawings, reports, specifications, bills of quantities, calculations and other information set out in this report remain vested in SLR unless the terms of appointment state otherwise.

This document may contain information of a specialised and/or highly technical nature and the Client is advised to seek clarification on any elements which may be unclear to it.

Information, advice, recommendations and opinions in this document should only be relied upon in the context of the whole document and any documents referenced explicitly herein and should then only be used within the context of the appointment.

CONTENTS

DOCUMENT REFERENCES

FIGURES

APPENDICES

1.0 Introduction

1.1 Background

Statera Energy Ltd is planning to develop a new 600 MW Pumped Storage Scheme (PSS) between Loch Kemp and Loch Ness, approximately 13km to the north-east of Fort Augustus, in the Scottish Highlands (hereafter referred to as the "Project" or "Kemp PSS"). The Project plans to utilise Loch Kemp as an upper storage reservoir and Loch Ness as a lower reservoir. Loch Kemp will be raised by approximately 28 m from its existing elevation to allow drawdown for storage. Four new saddle dams between 15 – 30 m high and four minor cut off dams would be constructed around Loch Kemp to form the upper reservoir. An Environmental Impact Assessment (EIA) is currently being conducted for the project. One PSS already exists in Loch Ness (Foyers) and has been operational for more than 50 years. Another PSS has been given consent but not yet constructed (Red John).

Potential effects on Urquhart Bay Wood Special Area of Conservation (SAC) have been raised as a concern by NatureScot. The SAC is located on the shores of Loch Ness and is one of the best examples of ancient wet woodland remaining in Britain. SACs are protected in Scotland under the Conservation (Natural Habitats, &c.) Regulations 1994, as amended in Scotland, also referred to as the Habitats Regulations. Under Regulation 48 of the Habitats Regulations, a competent authority, before deciding to undertake, or give any consent, permission or other authorisation for, a plan or project which is likely to have a significant effect on a European site (either alone or in combination with other plans or projects) must make an appropriate assessment of the implications for the site in view of that site's conservation objectives. This assessment must demonstrate beyond reasonable scientific doubt that the integrity of the SAC would not be affected.

SLR Consulting Limited (SLR) has been commissioned by Ash Design + Assessment Ltd, on behalf of Statera Energy Ltd, to undertake an ecological-hydrological assessment of the potential impact of the Project on the integrity of the Urquhart Bay Wood SAC. This is a stand-alone report that presents the findings of the assessment. It is intended that this report will be appended to a wider Habitats Regulations Appraisal (HRA) Report (Stage 1 and 2) for the Kemp PSS project, particularly the Stage Two Appropriate Assessment in respect of Urquhart Bay Wood SAC. This version of the report incorporates comments from NatureScot on a first draft, received by email on June 22nd 2023. It also incorporates points discussed at a meeting with NatureScot on 20th June 2023.

1.2 Staff

The assessment has been undertaken by Warren McCleland. Warren is a Principal Ecologist at SLR and is primarily involved in biodiversity assessments for projects in Africa. He has 18 years' experience conducting biodiversity assessments in Africa (over 100 field trips to 19 countries). He has extensive experience in implementation of lender performance standards, particularly compilation of Critical Habitat Assessments. Warren has frequently been part of multidisciplinary teams as the botanical specialist in assessment of ecological flow requirements of riverine systems for hydropower projects. Examples of projects in which ecological flow requirements for riparian vegetation have been calculated are:

- Mulungushi HPP (38 MW project on the Mulungushi River, Central Province, Zambia) - 2013;
- Ngonye Falls HPP (180 MW project on the Zambezi River, Western Province, Zambia) - 2015;
- Kalungwishi HPP (247 MW project on the Kalungwishi River, Luapula Province, Zambia) – 2018;
- Kakono HPP (87 MW project along the Kagera River, Kagera Region, Tanzania) – 2020; and
- Ruzizi III HPP (206 MW project along the Ruzizi River, on the Rwanda / DRC border) - 2022.

In all of the above projects, the particular life histories and ecological requirements of dominant riparian tree species were linked to their eco-hydrological requirements and applied to integrated Ecological Flow Requirements, including data from aquatic invertebrate and fish specialists.

Input into this assessment and a technical review has been provided by Duncan Watson MCIEEM CEnv, Technical Director with SLR Consulting, and Hazel Douglas MCIEEM MBiolSci, Associate Ecologist with SLR Consulting, both based in the UK.

Duncan is an Ecologist with over 25 years' professional experience, much of which relates to projects in the renewable energy sector. Duncan has a particular interest in Ecological Impact Assessment and Habitats Regulations Assessment (HRA) and was a member of the technical review group responsible for revising and updating the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK (published in 2018 and recently updated). He has also led CIEEM workshops on Ecological Impact Assessment and Habitats Regulations Assessment.

Hazel has over nine years' experience within ecological consultancy, and is a competent and experienced terrestrial ecologist, who specialises in Ecological Impact Assessment. Hazel has completed a number of HRA assessments within the UK and Republic of Ireland.

Both Duncan and Hazel have extensive experience and knowledge of ecological consultancy work in Scotland, and have an in-depth understanding of the Kemp PSS project and its local setting. Duncan and Hazel have both visited the proposed development site, and are currently undertaking the (non-avian) terrestrial ecology assessments for the project.

This report has also been reviewed by Gordon Robb BSc (Hons), MSc, MBA, FCIWEM, C.WEM, Technical Director with SLR Consulting. Gordon is responsible for undertaking and managing hydrological and hydrogeological assessments in support of renewables projects including hydro power, wind, solar and hydrogen projects. Gordon has over 30 years' experience as a consulting hydrologist within the renewables and electrical infrastructure sector. He is based locally, in SLR's Stirling office, has practised widely in Scotland, and has both recent Public Hearing and Inquiry experience. He has prepared assessments for more than 100 renewable developments and was a contributing author to SRF's/SEPA's peat reuse guidance and NatureScot's wind farm decommissioning guidance.

Peter Ede BSc (Hons) FCIWEM C.WEM C Eng, a hydrologist with Mott MacDonald and a Past President of the British Hydrological Society, who was involved in the hydrological modelling for this project, provided extensive inputs into Sections 8 and 9 of this report. Peter has nearly 40 years' experience in hydrology throughout the UK and in 30 countries worldwide, including review and analysis of many hydropower projects.

1.3 Objectives

The primary objective of this study was to assess whether the proposed Kemp PSS is likely to impact the integrity of the Urquhart Bay Wood SAC or not. This provided the basis for the Scope of Work discussed in Section 2.

2.0 Scope of Work

The following actions form the Scope of Work (SoW) for this study:

- Review relevant literature pertaining to the Urquhart Bay Wood SAC and similar wet woodland types;
- Review relevant literature pertaining to life histories and hydrological requirements of key tree / shrub species in the wet woodland habitat present within Urquhart Bay Wood SAC;
- Assess the potential effects of the Project on key tree / shrub species in wet woodland habitat represented at Urquhart Bay Wood, based on the modelling of likely variation in water level and inundation changes that the project hydrological team provide;
- Provide recommendations for management measures that could reduce the residual effect of the Project on wet woodland habitat, if required; and
- Provide an assessment of whether the residual effect significance of the project could potentially affect the integrity of the SAC or not.

3.0 Approach and Methods

The study was entirely desktop-based and relied on an extensive literature search, as well as hydrological data for Loch Ness provided by the client's engineers (Appendix 1). The rationale underpinning the approach was that if, during the construction and operation of the Kemp PSS, the current floristic composition and vegetation structure of the woodland vegetation of the SAC were maintained, then the ecological integrity would not be negatively affected. The approach followed was as follows:

- Establish the type of woodland / forest represented at Urquhart Bay Wood SAC and its current ecological state;
- Provide an overview of keystone species present in Urquhart Bay Wood SAC and their eco-hydrological requirements;
- Establish the current state of variations in water level in Loch Ness, given that one pumped storage hydro-electric scheme is already in operation and consent has been given for another;
- Provide an overview of projected changes to the Loch Ness variations in water level if the Kemp PSS is also in operation;
- Predict the potential effects of changes to water levels in Loch Ness on keystone species in the SAC; and
- Provide a statement regarding the effect of the Kemp PSS project on the integrity of Urquhart Bay Wood SAC.

The primary resources for understanding the type of vegetation represented in the SAC were:

1) Conservation Advice Package for the Urquhart Bay Wood SAC (NatureScot, 2020); and
2) Eco-hydrological guidelines for wet woodland - Phase I. English Nature Research Report No. 619 (Barsoum *et al*., 2005).

The Conservation Advice Package indicates which vegetation associations are present in the wet woodland habitat and the descriptions of these associations indicate which species are dominant. A number of references were consulted to establish the eco-hydrological requirements of the key species present. The data collected were then interpreted in the context of the SAC on the basis of the following ecological and hydrological assumptions:

- The lower-lying reaches of the SAC are dominated by fine sediments such as clay, and thus will retain water even when water levels decrease (i.e. have low permeability), whereas the high-lying reaches which have coarser alluvial soils that have been deposited in flood events on top of the fine sediments and thus drain more easily (i.e. these soils have higher permeability).
- The recharge of groundwater in the SAC is not solely dependent on input from water levels in the Loch but also dependent on the inputs from the Enrick and Coiltie Rivers and their network of minor tributaries. In fact, it is possible that soil inundation in lower lying areas is maintained more by inputs from these rivers than the Loch itself, although this will depend on how frequently the surface water level of the rivers is above the groundwater table.
- The two dominant woodland tree species in the SAC, common alder (*Alnus glutinosa*) and European ash (*Fraxinus excelsior*), are suitable surrogates for the two woodland types represented in the SAD (*Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland, and *Fraxinus excelsior - Sorbus aucuparia - Mercurialis perennis* woodland). Both species are currently prominent in the SAC, with common alder being dominant in lower-lying waterlogged areas in the SAC and European ash being a prominent canopy species in drier, higher lying parts of the SAC. Both species are also the defining species of the woodland types represented in the SAC. Far less information was available for some of the other species known to occur there and thus statements regarding eco-hydrological requirements of

those species could not be made with a reasonable measure of confidence. This approach of using relevant and appropriate surrogate species has been applied successfully in other Ecological Flow Assessments, and is an approach used in accepted methodologies such as the Riparian Vegetation Response Assessment Index (Kleynhans *et al*., 2007) and Downstream Response to Imposed Flow Transformation (DRIFT) method (King *et al*., 2003).

- The duration, frequency and timing of current minimum and maximum water levels in Loch Ness are favourable for the maintenance of the wet woodland that is currently prevalent at the SAC.
- It is not intended to manage Loch Ness water levels beyond their existing level range, although variation in water levels within these limits is expected to be more frequent within likely daily and weekly cycles; operation of the PSS may also lead to a small, temporary increase in the highest loch levels, and to more frequent instances of levels approaching the current minimum (the Foyers stop pumping level).
- The lowest level of Loch Ness would be governed by Foyers PSS, which has the potential to draw down lower than Red John or Kemp, and Kemp would always operate above these levels, and therefore the lowest current minimum level of the Loch would not be exceeded by the Project, although the minimum level in Loch Ness may be approached more often.
- The maximum current flood level of Loch Ness is unlikely to be exceeded for any significant period of time, as a result of the operation of the weir at Dochfour (Ness Weir). However, it is understood that water flow over the weir is dependent on water levels in the loch and immediate downstream reaches, meaning that during periods of high water levels in the loch the weir has no effect on controlling flow levels and the downstream channel becomes the control mechanism. Thus, any PSS releases during a flood event would increase the Loch Ness level, and even if releases are not made at that time any prior releases may mean that if a flood occurs the peak level may be higher than if there had been no PSS operation. However, these periods of maximum level exceedance would be brief and the level would subside as the flood water exits the loch over the weir and moves through the downstream channel.

4.0 Assumptions and Limitations

- This study was undertaken at desktop level only and no site visit was undertaken; this is not seen as a significant limitation given that there is a large body of literature available on the key dominant species, as well as wet woodland / forest types in the U.K.
- The author has relied on the extensive literature available for British wet woodlands and the two key species assessed to conduct the desktop assessment, which included extensive inputs from two ecologists and one hydrologist in the SLR UK team (Hazel Douglas, Duncan Watson, Gordon Robb); and
- The author is a botanist with experience in determining flow requirements of riparian tree species, but has no formal hydrological training and has relied on inputs from Peter Ede (hydrologist at Mott MacDonald), the SLR hydrology team and the Statera engineers to interpret hydrological data provided by the Project engineers.

5.0 Overview of Urquhart Bay Wood SAC

Urquhart Bay Wood is a Site of Special Scientific Interest (SSSI) that has also been designated as an SAC on the basis of the important representation of ancient Alder woodland on floodplain habitat (SNH, 2009; NatureScot, 2020). The SAC covers 46 ha, of which 36.18 represents alder woodland on floodplains, and is located at the confluence of the Enrick and Coiltie Rivers on the western shore of Loch Ness (Figure 5-1). The site comprises Alder forest on swampy ground formed by the confluence of the two rivers and is one of the few intact floodplain wet woodlands remaining in the UK, which is also considered a rare habitat in Europe (SNH, 2009).

The Urquhart Bay Wood SAC is underlain by superficial deposits of alluvium which are characterised by a poorly sorted matrix of sand, silt and clay[1]. There is most likely an accumulation of fine sediments (clay, silt) in lower lying areas, resulting in waterlogged conditions, while higher-lying areas have a higher proportion of coarse sediments (sand, gravel) that are better drained and less waterlogged. Deposits of fine sediments within alluvium usually produce low permeability and soils will thus be less responsive to rapid changes in water levels in the loch, i.e. if levels of the loch drop the soils are likely to remain saturated for a period of time. Water levels in alluvium will fluctuate naturally in response to seasonal changes in rainfall and changes in water level of adjacent watercourses, although there will be a lag in the change in water level in alluvium as a result of poor permeability of the fine sediments.

In contrast, the higher-lying coarser sands and gravels are free-draining (i.e. have higher permeability) and are thus likely to be more responsive to changes in water level. These deposits of coarser sediments on top of the alluvial delta probably indicate historic large flood events. Soil inundation in lower lying areas is most likely maintained by inputs from the Enrick and Coiltie Rivers and their network of minor tributaries in the SAC, with less inputs from level variations in the Loch itself.

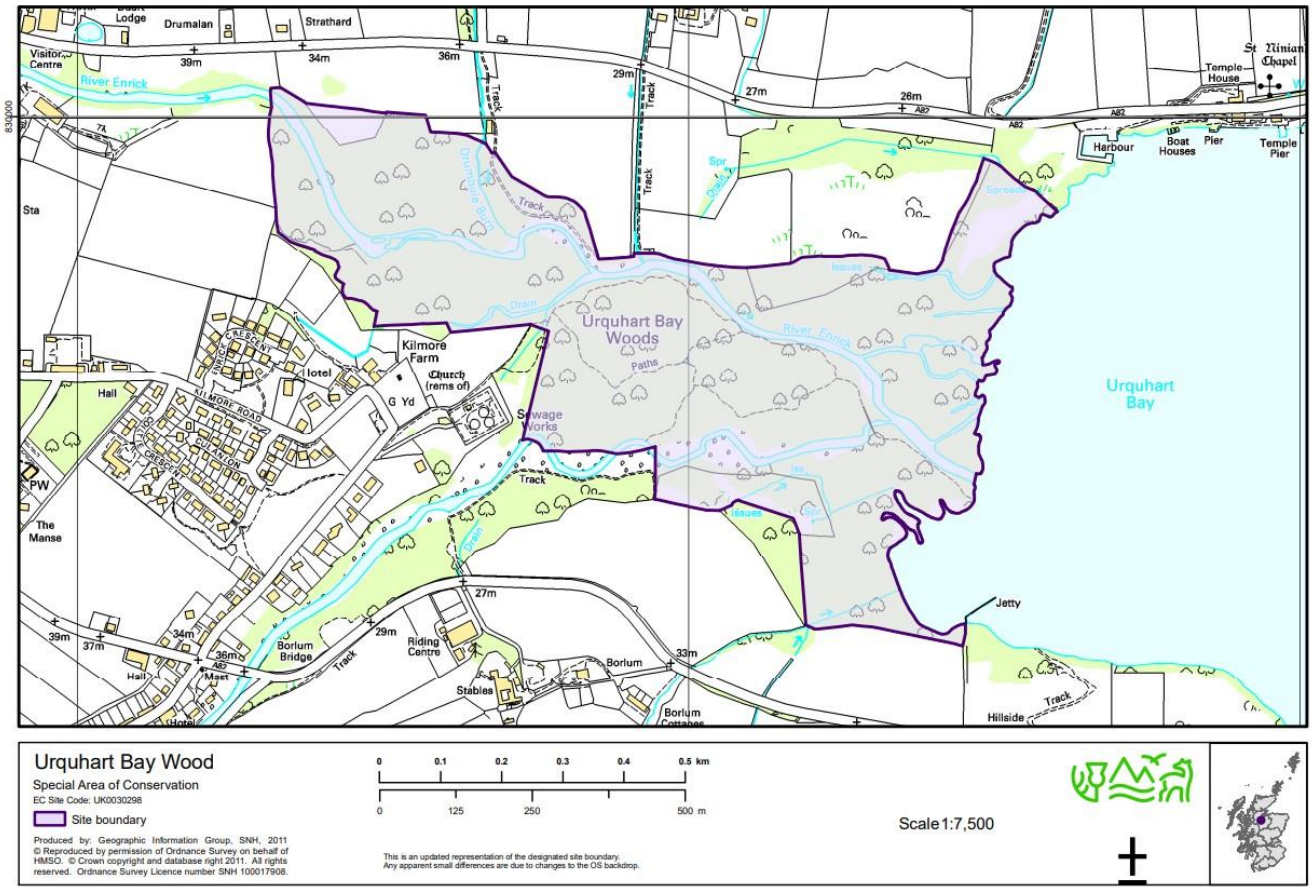
Common alder dominates the low-lying wetter ground, with a greater diversity of trees and shrubs being present on gradually rising, drier ground, including European ash, wild cherry (*Prunus avium*), bird cherry (*Prunus padus*), rowan (*Sorbus aucuparia*), wych elm (*Ulmus glabra*) and white willow (*Salix alba*), while understory shrubs include hazel (*Corylus avellana*) and blackthorn (*Prunus spinosa*) (NatureScot, 2020).

Species composition of the herbaceous ground cover is typical of wet mixed broadleaved woodlands and includes common nettle (U*rtica dioica*), dog's mercury (*Mercurialis perennis*), cleavers (*Galium aparine*), hedge-woundwort (*Stachys sylvatica*), common bluebell (*Hyacinthoides non-scripta*), great wood-rush (*Luzula sylvatica*), ground elder (*Aegopodium podagraria*) and creeping buttercup (*Ranunculus repens*). Two National Vegetation Classification vegetation types are represented in the SAC according to the Conservation Advice Package (NatureScot, 2020), namely *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland (W7) and *Fraxinus excelsior - Sorbus aucuparia - Mercurialis perennis* woodland (W9b). The woodland system is characterised by frequent inundation by floods, changes in channels and accumulation of woody debris during flood events (NatureScot, 2020).

The woodland was assessed as being in unfavourable condition in 2002 as a result of heavy browsing pressure by cattle and roe deer and abundance of non-native plant species such as sycamore (*Platanus* sp.), Himalayan balsam (*Impatiens glandulifera*), Japanese knotweed (*Reynoutria japonica*), snowberry (*Symphoricarpos albus*) and white butterbur (*Petasites albus*) (SNH, 2009). Conservation management is being undertaken in most of the site supported by NatureScot management agreements. While the woodland has generally not been intensively managed, removal and / or control of invasive exotic species has taken place (NatureScot, 2020).

[1] British Geological Survey (BGS) mapping (https://www.bgs.ac.uk/geological-data/opengeoscience/map-data-downloads/)

Figure 5-1. Location of Urquhart Bay Wood Special Area of Conservation[2]



[2] Taken from the official SAC Map produced by Geographic Information Group, SNH, 2020 (https://sitelink.nature.scot/site/8406)

6.0 Overview of Residual Alluvial Forests

Many of Britain's river systems were covered by vast floodplain forests, but much of this habitat has been cleared since prehistoric times for settlement and agriculture (Peterken, 1996). Only an estimated 4,500 – 8,000 ha of Residual Alluvial Forests survive in the UK, either as parts of drier woodland communities, or as isolated stands within herbaceous wetland vegetation. Most of the remaining Residual Alluvial Forests are located in the wetter parts of the country, such as Scotland. Many have been identified as a priority habitat requiring protection in the UK and many have been selected as SACs, such as the Urquhart Bay Wood SAC.

Two wet woodland habitats are recognised within Annex 1 of the EU Habitats Directive, namely Residual Alluvial Forests and Bog Woodland (Barsoum *et al*., 2005). Urquhart Bay Wood SAC is representative of Residual Alluvial Forests and has two National Vegetation Classification vegetation communities represented, namely *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland (W7) and *Fraxinus excelsior - Sorbus aucuparia - Mercurialis perennis* woodland (W9b). These forests typically comprise fast-growing, early successional canopy tree species (e.g. willow, alder, birch) that rely on periodic disturbances for the creation of suitable recruitment sites for seedlings. The canopy trees often do not survive more than 60-80 years and thus, medium to high-magnitude floods are needed at least every 50 years for the forest renewal.

The magnitude and frequency of flood events are crucial aspects of maintaining the structure and species composition of Residual Alluvial Forests, with the most important flood events being low-frequency high-magnitude floods and intermediate-frequency medium-magnitude floods (Barsoum *et al.,* 2005). Low-frequency high magnitude floods have significant impacts on the floodplain landscape, including creation of new habitat such as oxbow lakes, and allow for extensive regeneration of riparian communities. Intermediate-frequency medium-magnitude floods have more of a maintenance function, particularly in clearing dead vegetation and maintaining historical levels of riparian vegetation, but also contribute fine sediments that create additional sites for seedling recruitment. High-frequency low-magnitude floods do not play an important role in habitat creation, but do contribute to recharging underground water resources, depositing sediment and maintaining sites where pioneers have established. High frequency flooding is also likely to play a role in preventing the establishment of terrestrial invasive species that cannot tolerate frequently inundated conditions.

7.0 Eco-hydrological characteristics of Wet Woodland species

Soils of wet bottomland forests or woodlands are characterised by low oxygen levels as a result of a high water table and frequent flooding. Saturated soils can become anaerobic within hours to days of waterlogging, resulting in altered plant metabolism, closure of leaf stomata, reduced photosynthesis, nutrient uptake and water absorption. Depending on how long these conditions persist, mortality in species that have not evolved low-oxygen stress avoidance measures can occur. Flooding is a particularly important disturbance feature, affecting physical vegetation structure and floristic composition. The magnitude, frequency and timing of flood events is crucial to maintaining species composition and rejuvenation of vegetation in these forests (Barsoum *et al*., 2005). Two species have been selected for analysis of eco-hydrological requirements, both of which are important canopy species in different parts of the SAC, namely common alder and European ash. Both are well-researched tree species with different hydrological requirements and should be suitable surrogates for the lower-lying, waterlogged areas (common alder) and high-lying, better drained areas (European ash) represented in the Residual Alluvial Forest ecosystem in Urquhart Bay Wood. Both species are currently prominent in the SAC, with common alder being dominant in lower-lying waterlogged areas, and European ash being a prominent canopy species in drier, higher lying parts of the SAC. Both species are also the defining species of the vegetation communities represented in the SAC, namely *Alnus glutinosa – Fraxinus excelsior – Lysimachia nemorum* woodland (W7) and *Fraxinus excelsior - Sorbus aucuparia - Mercurialis perennis* woodland (W9b). Far less information was available for some of the other species known to occur there and thus statements regarding eco-hydrological requirements of those species could not be made with a reasonable measure of confidence.

7.1 Common Alder (*Alnus glutinosa*)

Alder grows throughout Britain on permanently and seasonally wet soils within a wide pH range (3.4-7), growing mostly along streams, wet depressions or swamps. It is mostly restricted to recent alluvial sediments along stream and lake margins as well as mineral soils in areas of impeded drainage or seasonally wet hill slopes. Young trees (5-8 years old) appear to grow best in continually wet soils, whereas older trees (28+ years old) grow best in free-draining alluvial sediment since they have roots that have permanent access to the high water table and thus can grow in a well-aerated substrate. Alder is able to grow well in frequently inundated soils having evolved mechanisms such as aerenchymatous root tissues, which increase oxygen conductivity of roots, and pressurized gas transport, which improves oxygen transport into roots, particularly if the ambient air temperature is lower than that of the tree stem (Frye & Grosse, 1992). Another highly effective adaptation that alder has for coping with flooding induced anoxia and post-anoxic stress is accumulation of the enzyme superoxide dismutase (SOD) in root tissues during inundation. This enables the plant to survive long-term flooding and post-anoxic injury when plant tissues are not protected against oxygen damage on return to air (Monk *et al*., 1987).

Drought stress is a significant threat to a bottomland species such as alder. It can disrupt the necessary supply of photoassimilates in the root nodules and disrupts the strict regulation of oxygen levels in these nodules, all of which has significant impacts on plant growth. Drought-stressed alder seedlings also are notably vulnerable to infestation by a fungal parasite (*Phomopsis alnea*), which causes stem cankers and die-back.

7.2 European Ash (*Fraxinus excelsior*)

European ash is widespread throughout Britain and much of mainland Europe, growing on a wide range of soils but is most common on nutrient-rich soils with a high base status (pH > 4.2), and is often dominant on dry calcareous soils (Thomas, 2016; Dobrowolska *et al*., 2011). It is usually absent on acidic soils where the pH of the surface soil is lower than 4.2.

Within Britain, ash is the second most abundant tree in small woodland patches and the third most abundant tree in large areas of high forest, although it is generally a lowland species in Britain (Maskell *et al.,* 2013). In Britain it grows best on moist soils where the winter water-table is between 40 and 100 cm below the surface

(Kerr & Cahalan, 2004), but in situations such as Urquhart Bay Wood SAC, where the water table is higher, it will grow well on wet, periodically inundated soils along brooks and springs (Diekmann, 1996) provided there is a shallow layer of seasonally well-drained soil for establishment (Wardle, 1961). This explains some of the species distribution dynamics at the Urquhart Bay Wood SAC site, where alder dominates in the lower-lying, more permanently wet areas and ash is more prominent on higher-lying, better-drained areas.

Seedlings are shade tolerant, but adults are not so it tends to be an intermediate successional species, invading gaps in mixed stands rather than forming extensive pure stands.

8.0 Current State of Water Levels in Loch Ness[3]

8.1 Patterns of variation and trends in water levels in Loch Ness

Loch Ness has a drainage area of approximately 1,800km^2 and is roughly 40km long with a surface area of 55km^2. The Loch is fed by numerous rivers such as the Oich, Morriston, Foyers, Enrich and Coiltie, each of which makes a contribution to the loch water level. However, Loch Ness responds relatively slowly to inputs from these rivers as a result of its large size and capacity to temporarily store water and there is a lag in changes to the loch water level as a result of inflows. Loch Ness also forms part of the Caledonian Canal which joins the loch at Dochfour and Fort Augustus locks. The level of Loch Ness and the adjoining canal network is controlled by the Dochfour Weir structure (Ness Weir) which includes the SSE operated sluice gates that provide river flows downstream when the loch levels are lower than the weir.

At the time that modelling was undertaken (spring 2022) loch level data was limited to a period of just under 5 years from March 2017 because of problems associated with the cyber-attack on SEPA. More data are now available, with the record at Foyers running from April 2014 to date. The SEPA gauge at Ness-side, on the River Ness downstream of Loch Ness, provides a longer-term perspective with records from September 1972 to date[4]. Conditions at Ness-side are closely related to those at Foyers because a rise in the loch level leads to increased outflow over Ness weir which means higher levels and flow at Ness-side. The relationship is illustrated in Figure 8-1 which compares average monthly water levels (referenced to each site's local datum). There is a broadly linear relationship, but with deviation at lower levels where the operation of the SSE sluice at Ness Weir significantly affects the outflow from Loch Ness and hence the water level at Ness-side. The graph shows the Foyers level in June 2023 to be much lower than in April 2023, but at Ness-side the June level was only marginally lower, almost certainly because of greater sluice releases. The last two months have shown the lowest loch levels in the period of record, in line with recent media reports. The next lowest were in 2021 which was another notable dry summer. No documentary evidence has been seen about the operation of the sluice. The modelling was done based on an understanding that there was a compensation requirement of 28.3m^3/s, though it was noted that there were some periods with River Ness flows significantly lower than this. Any change in the compensation assumption would have an impact on the frequency of occurrence of low loch levels but would have negligible impact on average or high levels.

The Ness-side data show a clear increase in the 1970s and 1980s, which follows the pattern for many sites in western Scotland, reflecting a widespread increase in rainfall. Since about 1990 there is no obvious trend, and the period used for analysis/modelling appears broadly representative of that longer period. The Foyers data shows a smaller range of levels than at Ness-side, reflecting the very large surface area of Loch Ness compared to the small river cross-section.

[3] The text in section 8 and portions of section 9 have been provided by Peter Ede, hydrologist at Mott MacDonald

[4] NRFA Station Data for 6007 - Ness at Ness-side (ceh.ac.uk)

Figure 8-1. Comparison of monthly average water levels at Foyers and Ness-side

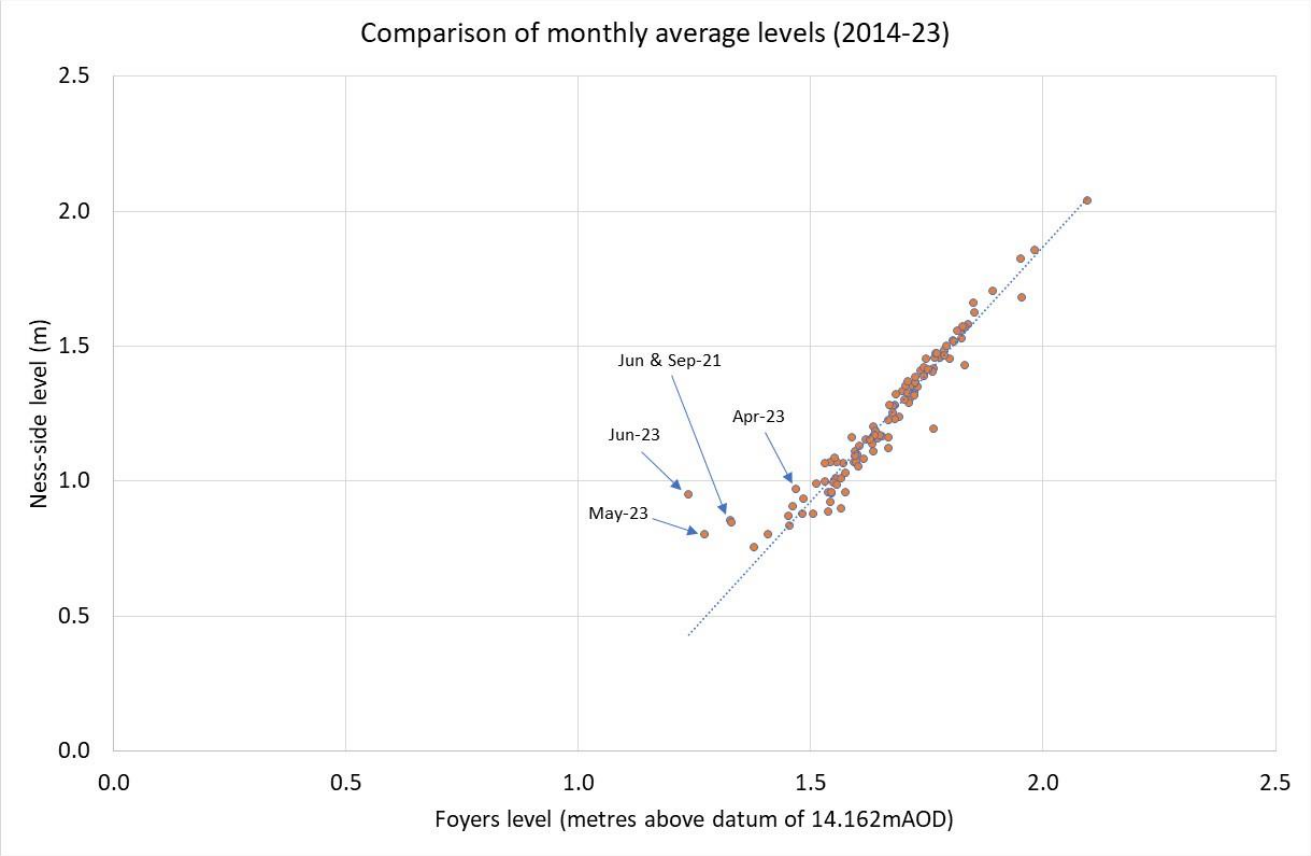
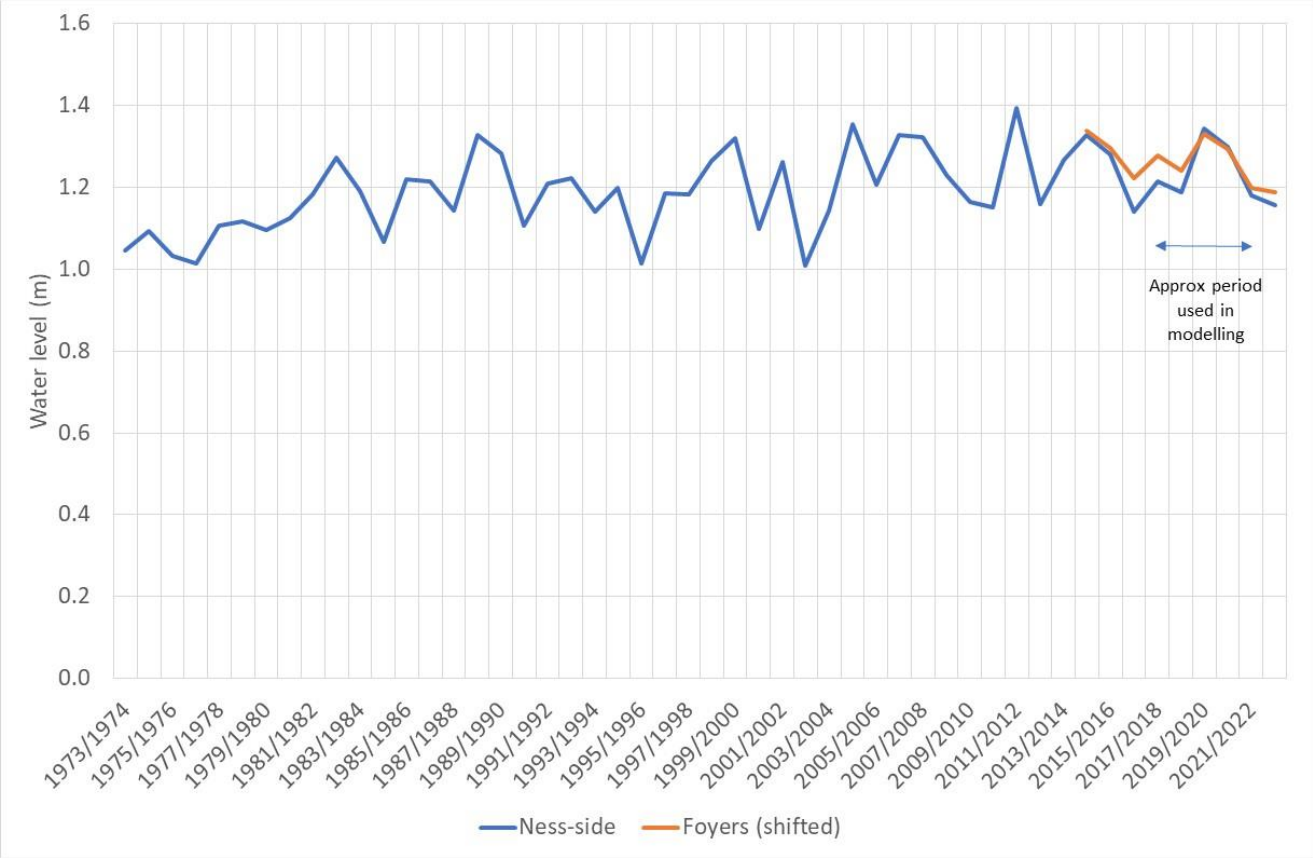


Figure 8-2 compares the annual mean levels and places the recent period in context by showing the full period of Ness-side data. In order to maximise the number of years of Foyers data the averages are for years from 1st June to 31st May. The Ness-side data shows a clear increase in the 1970s and 1980s; increases over this period have been seen at many sites in the west of Scotland, reflecting a widespread increase in rainfall. Since about 1990 there is no obvious trend, and the period used for analysis/modelling appears broadly representative of that longer period. The Foyers data shows a smaller range of levels than at Ness-side, reflecting the very large surface area of Loch Ness compared to the small river cross-section. In the light of the above level comparisons it is considered that the period of Foyers data should give a reasonable representation of the loch level regime.

Figure 8-2: Comparison of annual average water levels at Foyers and Ness-side[5]



The variation in daily mean level over the period April 2014 to April 2023 is shown in Figure 8-3. Raw data are provided in Appendix 01. The extreme levels in the period are 3.555 m on 8 March 2015 and 1.162 m on 28 May 2023; these equate to 17.72 and 15.32 mAOD respectively. The 15-minute data shows a minimum of just over 15.25 mAOD, marginally below the Foyers stop-pumping level. With a wet year at the start and a couple of dry years towards the end the graph has a suggestion of a downward trend, but the data set is too short for drawing conclusions.

The variations in level reflect the historic operation of Foyers as well as rainfall, loch inflows and the operation of the SSE sluice. No data on Foyers operation are available, but the operation can be inferred from the level data. The average level through the day, from the full period of data, is shown in Figure 8-4; this shows a decline from about 2300 to 0600 (reflecting typical pumping up during the night when demand is low and electricity prices usually below average) with rises through the day (when there are releases to generate power to meet demand), excepting a period of slight decline between about 1230 and 1530. However, it should be noted that future operation will not necessarily follow a similar pattern, as this may be driven by changes in availability of power from other sources (e.g. wind) as well as changes in overall demand for electricity.

Figure 8-5 indicates the frequency at which different levels have been exceeded between April 2014 and April 2023, as well as the minimum water level that is determined by the Foyers stop-pumping threshold. It is understood that Foyers is obliged to stop pumping at this threshold, which means that the loch level should not drop below that value, except during periods of extreme drought when compensation releases would be required to maintain a minimum flow of 28.3 m^3/s in the River Ness.

[5] Water levels are in metres above datum, with each gauge having its own datum.

Figure 8-3: Daily mean water levels at Foyers

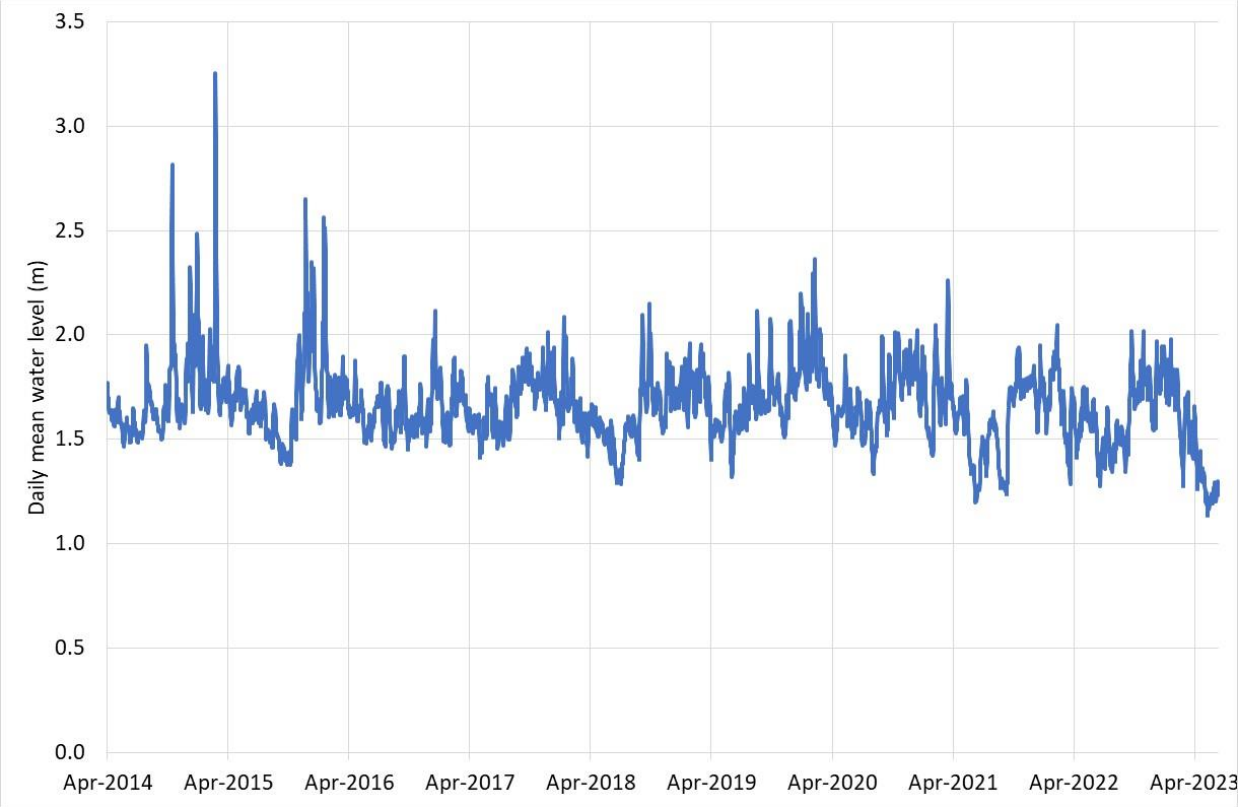


Figure 8-4: Average diurnal pattern of Loch Ness levels

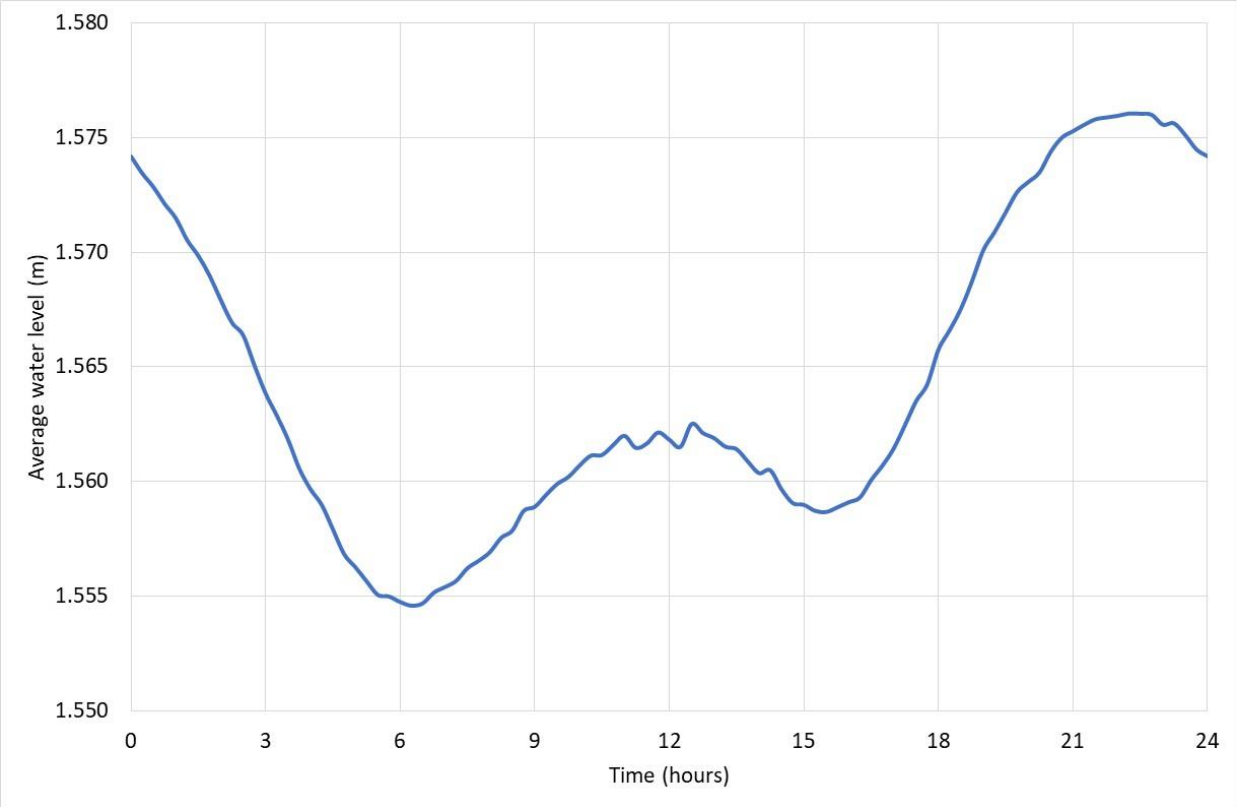


Figure 8-5: Historic water levels in Loch Ness (April 2014 to April 2023) in relation to the Foyers stop pumping threshold

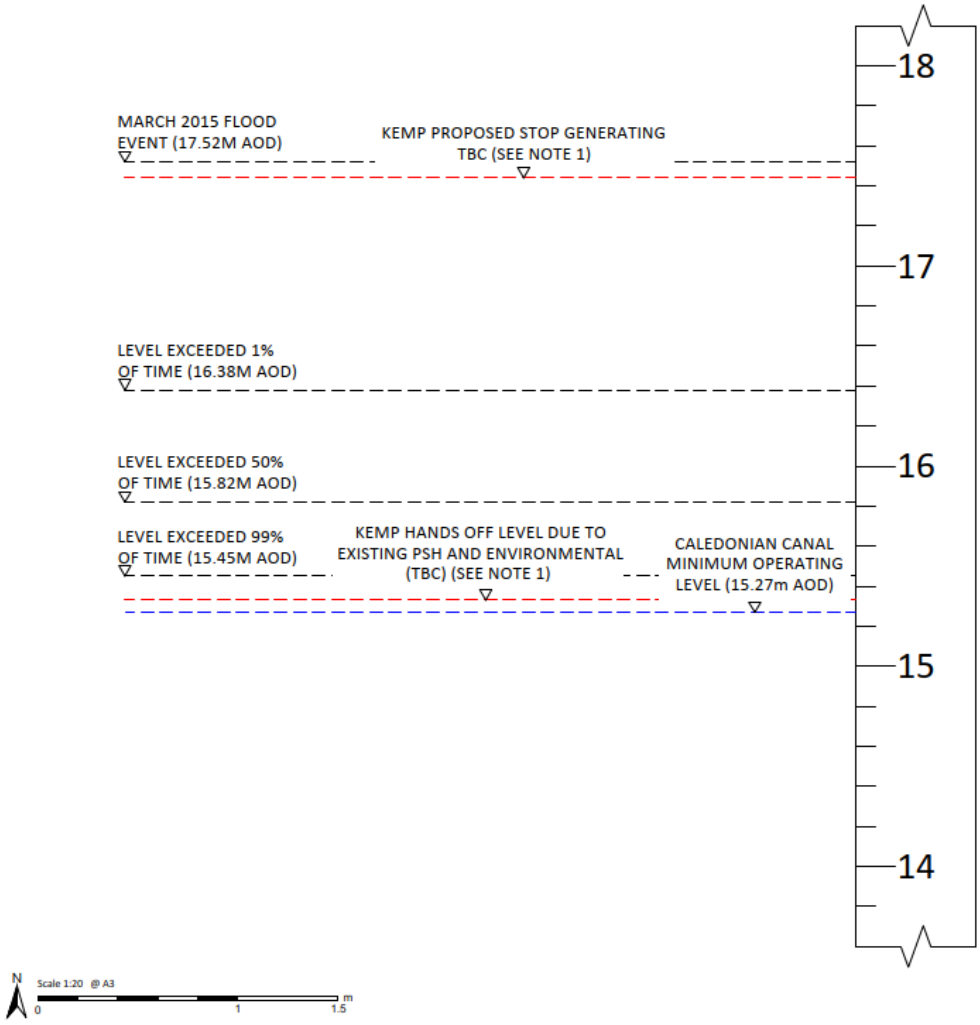


Figure 8-6 shows the daily maximum water levels at Foyers between April 2014 and April 2023. The average annual maximum level during this period was 16.58 mAOD, with the highest level being 17.52 mAOD. Figure 8-5 indicates the frequency at which different water levels were exceeded at Foyers between April 2014 and April 2023. The manner in which these flood levels inundate different extents of Urquhart Bay Wood is modelled in Figure 8-7.[6] A small portion of the woodland vegetation was inundated for 1% of the time during the period used for modelling (Apr 2014 to Apr 2023) and significant areas were inundated only during large flood events (1:10 year or greater), such as in March 2015.

[6] This figure currently reflects levels above 16 mAOD. It should be updated if suitable topographic data can be acquired for levels below 16 mAOD, indicating the predicted levels under different operational scenarios (such as all three PSS operating simultaneously)

Figure 8-6: Maximum water levels in Loch Ness from April 2014 to April 2023

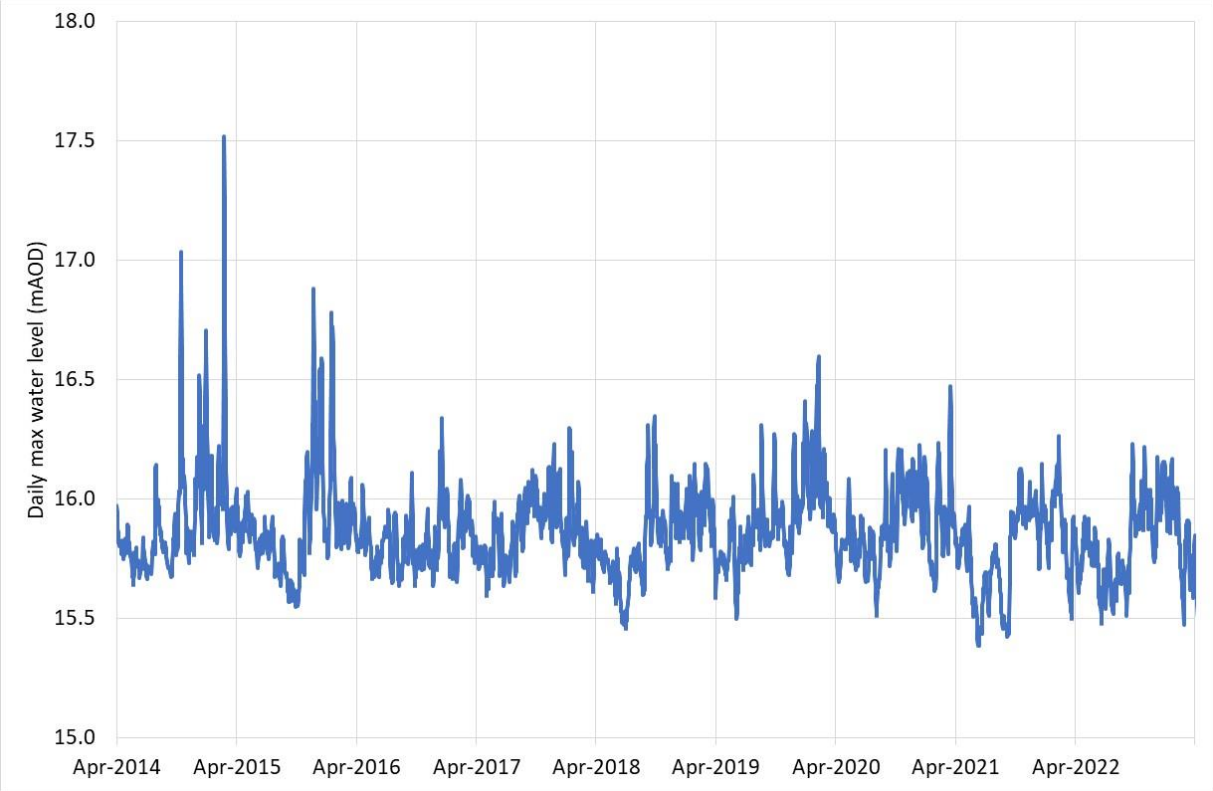
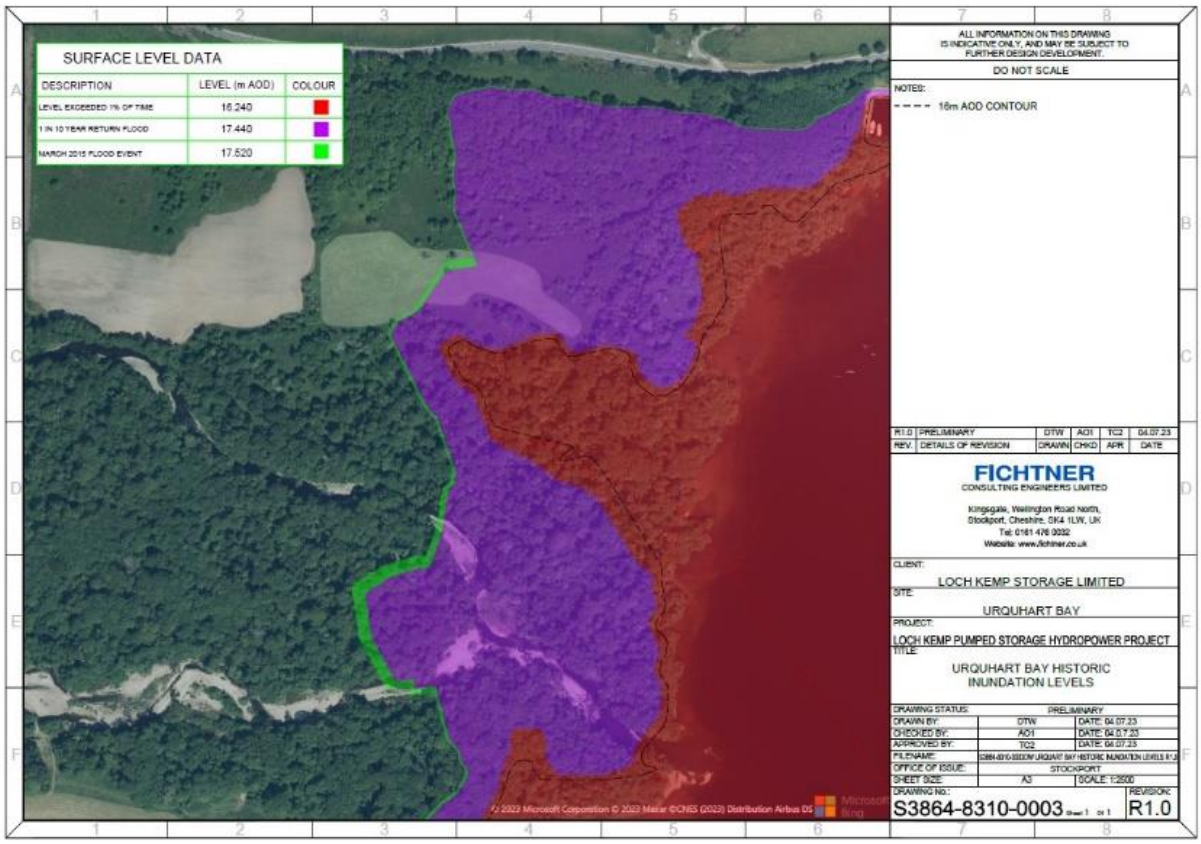


Figure 8-7: Historic inundation levels at Urquhart Bay Wood

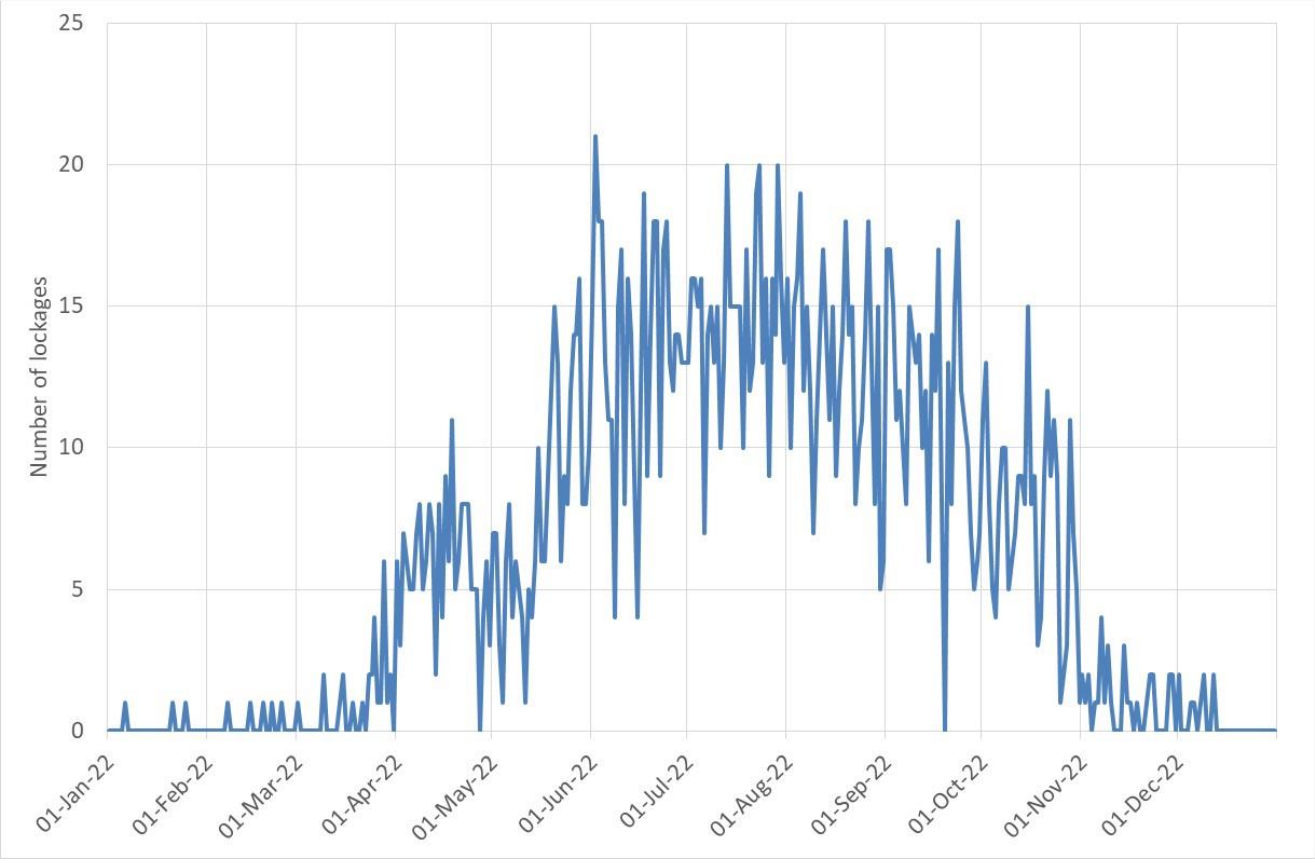


8.2 Operation of the Caledonian Canal

The Caledonian Canal is a system of natural lochs and man-made canals that connects the Scottish east coast at Inverness with the west coast at Fort William. Movement of vessels along the Canal is regulated by 29 locks, which allow movement of vessels along an altitudinal gradient through temporarily storing and releasing water. In theory, operation of the locks could thus have short-term impacts on water levels in the loch, which would be determined by the number of lock activations per day and the lock dimensions.

The closest relevant lock to the Kemp PSS is Dochgarroch Lock, which is located downstream of Loch Ness. The licence for lock operation states a maximum of 37 uses of the lock per day, although data provided to Fichtner by Scottish Canals for 2022 indicate a maximum daily usage of 21 and a summer average of around 15 lockages (Figure 8-8). Given the dimensions of Dochgarroch Lock, this represents average flows over a day of 0.37 m^3/s and 0.26 m^3/s respectively. Even if the maximum number of permitted lockages were to take place, representing a volume of about 56 Ml, or an average over the day of about 0.65 m^3/s, this would be insignificant compared to the modelled compensation flow of 28.3 m^3/s or the average annual minimum flow in the River Ness of 18 m^3/s. The contribution of locking is thus considered to be negligible in the consideration of current water level variations in Loch Ness.

Figure 8-8: Usage of Dochgarroch Lock



9.0 Projected changes to Loch Ness water levels and predicted impacts on Urquhart Bay Wood SAC

9.1 Projected changes to water levels

9.1.1 Operational scenarios

When operating at full capacity and generating 600 MW of power, the Kemp PSS will transfer a maximum of 22 Mm^3 between the upper (Loch Kemp) and lower (Loch Ness) reservoirs, which will result in a rate of change in water level of 0.025 – 0.03 m/hr.

The changes to water levels in Loch Ness as a result of the existing and proposed PSS being in operation have been modelled within a Sensible Worst Case scenario, which is when Foyers, Red John and Kemp schemes are operating simultaneously but not necessarily at full capacity in terms of flow rate and duration. Given the difference in storage volumes and catchment of each, this scenario is unlikely to happen regularly. The Sensible Worst Case scenario involved a profile of pumping and releases on an hourly basis through the year, developed by the leading energy market advisers, LCP for Statera. An even less likely scenario is all three PSS schemes operating simultaneously at full capacity, i.e. an Absolute Worst Case scenario.

Current trends in other operational PSS projects indicate an average dispatch time of 4 hours. Under the Sensible Worst Case Scenario during a Pumping Cycle, i.e. when water is pumped up to and stored in the upper reservoirs, water levels in Loch Ness would reduce on average by 143 mm during four hours of operation (Table 9-1). During a Generation Cycle (when water is released from the upper reservoirs) within the same scenario, water levels in Loch Ness would increase on average by 205 mm during four hours of generation (see Chapter 7: Water Management of the Kemp PSS EIA Report). Under an Absolute Worst Case Scenario, the maximum water level of Loch Ness would be 660 mm above the current average water level during generation (Generation Cycle) and the minimum water level would be 537 mm lower than the current average during pumping (Pumping Cycle).

Figure 9-1 indicates the projected rate of reduction in level in Loch Ness during a pumping cycle (i.e. when water is being stored) and Figure 9-2 shows the projected increase in level in Loch Ness during a generation cycle (i.e. when water is being released from the upper reservoirs). It needs to be noted that these figures do not refer to changes in flow based on Kemp PSS only, but when Foyers, Red John and Kemp schemes are operating simultaneously, a worse case scenario than Kemp operating in isolation.

Table 9-1: Average fluctuation in Loch Ness water level under the Sensible Worst Case Scenario

	Rate of level reduction in Loch Ness with all sites pumping (mm)	Rate of level increase in Loch Ness with all sites generating (mm)
Level change in mm with all three PSH operating for 4 hrs	143	205
Average Level change in mm per hr with all three PSH operating	36	51

Figure 9-1. Projected Water Level Reduction during a Pumping Cycle in a Sensible Worst Case Scenario

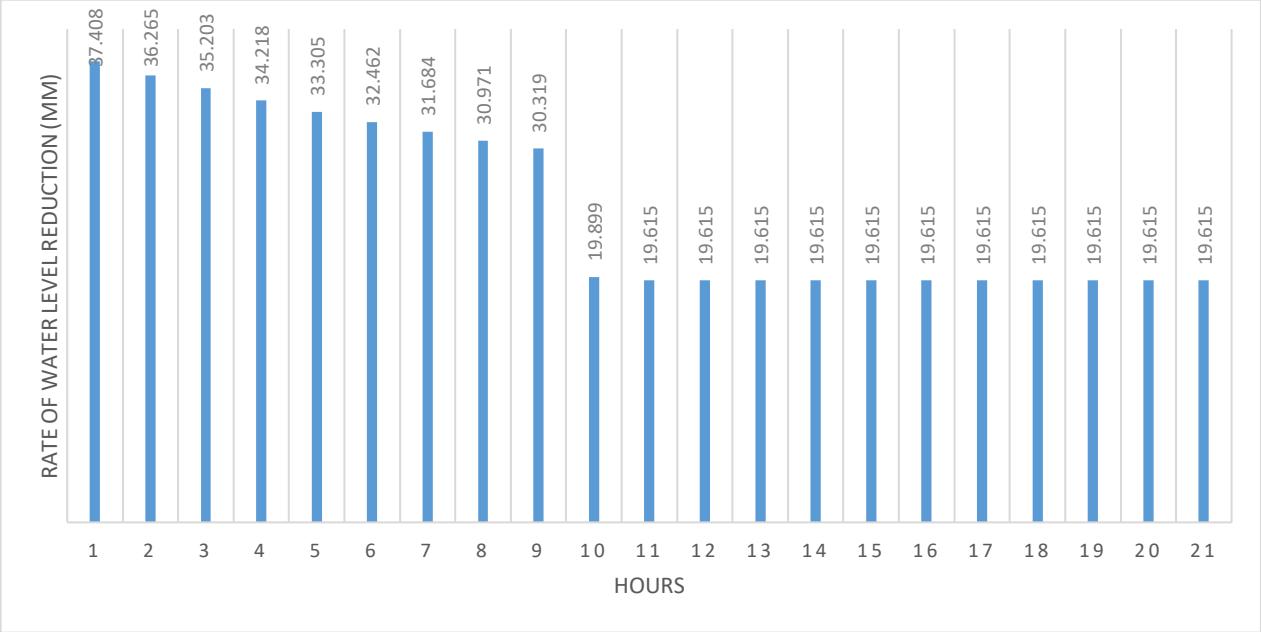
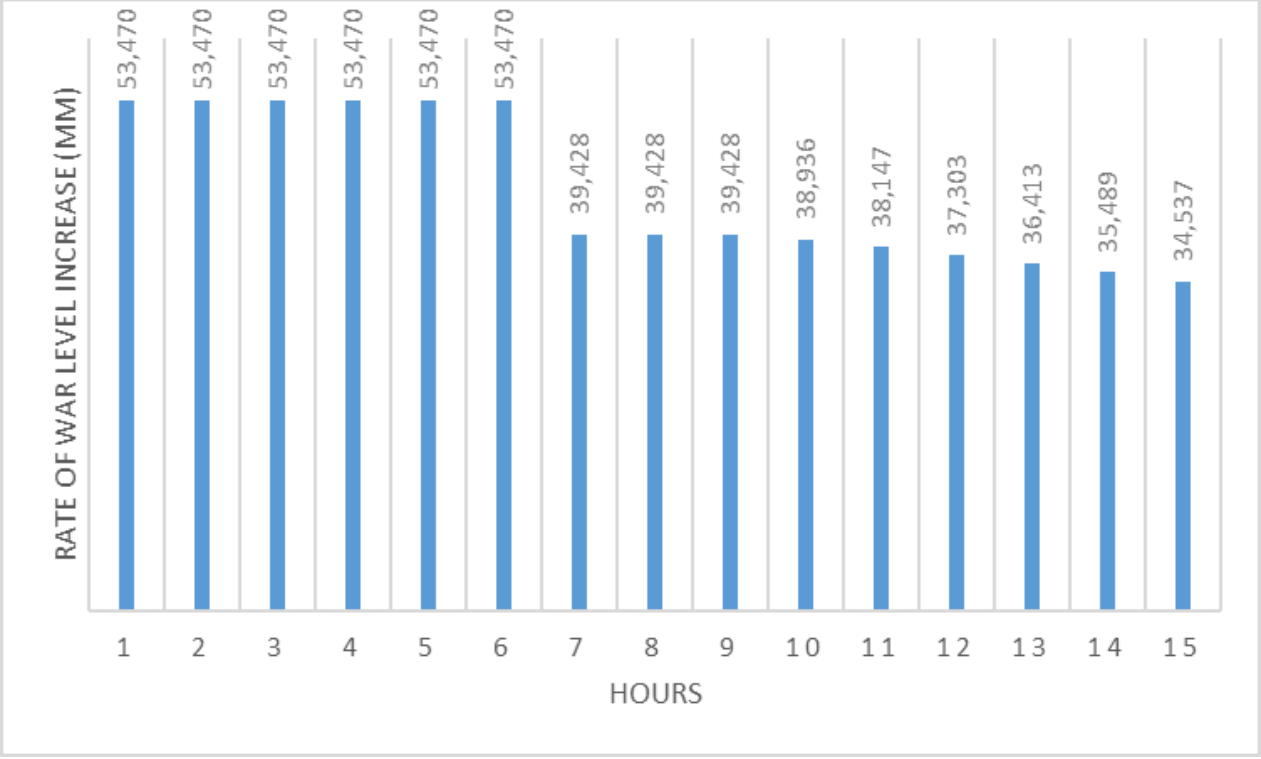


Figure 9-2. Projected Water Level Increase during a Generation Cycle in a Sensible Worst Case Scenario

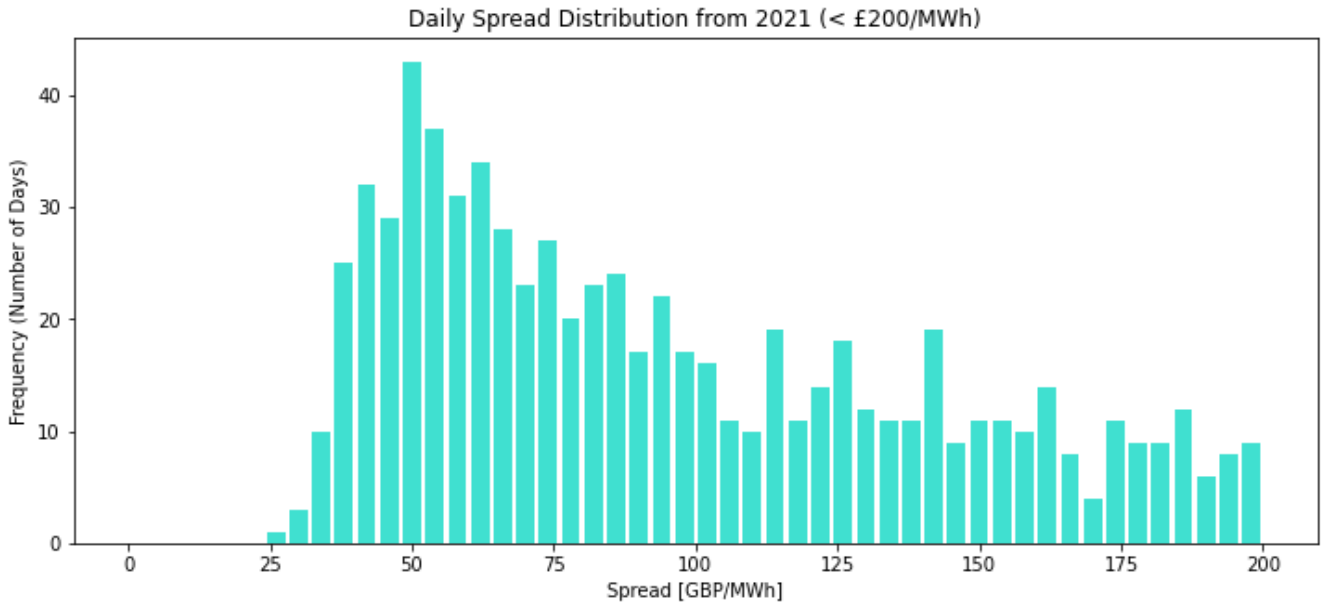


9.1.2 Storage between Pumping and Generation Cycles

Once a Pumping Cycle is complete there is the possibility that water could be stored in the upper reservoirs for a period of time before beginning a Generation Cycle. During this period of storage the Loch Ness water level would be slightly lower than prior to the Pumping Cycle. However, the likelihood of water remaining in the upper reservoir for even as long as 12 hours before being released is low, even though the decision to generate power would be driven to some extent by market prices. Daily movement in price can be extreme, up to as much as

£2000/MWh during the winter of 2022 and decreasing to as little as £30-40/MWh during sunny periods in May and June 2023[7]. Figure 9-3 indicates this high variation in daily spread of market prices over a year from January 2021. However, even at a very low market price of £20/MWh there is sufficient profit to justify releasing stored water for a Generation Cycle[8]. It is therefore highly unlikely that water would be held in the upper reservoir for longer periods since the PSS would not be profitable if not generating power. Given the daily distribution spread in Figure 9-3, the market price will almost always be sufficient for PSS assets to be generating power on a daily basis and thus not storing water in the upper reservoirs.

Figure 9-3: Daily Spread Distribution of Market Prices



9.2 Pumped Storage Scheme Operational Assumptions

9.2.1 Regulation of water levels through PSS operating rules

It is understood that there was an agreement between SSE and the then British Waterways that SSE should maintain a minimum level in Loch Ness of 15.27mAOD; this is therefore the level at which Foyers must stop pumping water from Loch Ness to its upper reservoir. It is expected that future schemes will be subject to regulation by SEPA and that stop-pumping levels will be defined in CAR licences. SEPA regulation might apply to Foyers in future. The preliminary CAR licence application for the Kemp project proposed a stop-pumping level of 15.33 mAOD for the PSS, although a slightly higher value was used in modelling undertaken by Mott MacDonald for Gilkes Energy, with an intermediate level assumed for Red John. Setting higher thresholds for future schemes is intended to protect the existing scheme. The extent of curtailment of PSS operation would be affected by any change to threshold levels, but there would be no fundamental change to the impact on the water level regime of the loch. Application of the Foyers threshold of 15.27 mAOD essentially means that the loch level should not drop below that value. (In an extreme drought, compensation releases to the River Ness could result in a slightly lower level, but the size of the Loch Ness catchment means that inflows are nearly always greater than the required release.)

[7] Andrew Troup, Statera Energy (*pers.comm.*)
[8] Andrew Troup, Statera Energy (*pers.comm.*)

The natural level of Loch Ness varies relatively slowly because its size and ability to temporarily store water provides a lag on variations in inflow. With the operation of a PSS, short-term fluctuation in level is superimposed on the natural variation, usually over a number of hours. Kemp PSS could generate at its maximum rate for about 15 hours, but shorter cycles are more likely, in which the upper reservoir is only partly emptied before being filled again. The modelling has assumed a scenario of all schemes operating in sync.

Operation of the Kemp PSS would mean that the minimum level in Loch Ness would be approached more often, but the absolute minimum level would not change. The overall range of levels will slightly increase because releases for generation cause a temporary increase in level before the resulting increase in flow over the weir brings the level back down. Under the scenario of all three PSS operating, the level exceeded on average for 1% of the time (i.e. 3-4 days per year) may increase by around 100 mm and there would be a small reduction in the average loch level of around 50 mm.

It is expected that future CAR licences would have a "stop-generation" threshold when releases from upper reservoirs would have to stop in order to avoid worsening flood conditions downstream. The preliminary CAR licence application for Kemp proposed a stop-generation level of 17.44 mAOD, based on the expected level in a 1-in-10 year flood event. Curtailment of operation due to this threshold would be limited as it would only occur once every ten years on average, and for a limited period. Even in a 100-year event the level would only exceed the threshold for about 48 hours.

9.2.2 Scenario variations in loch level

One of the key means of illustrating the changes in loch levels due to operation of a PSS is the level duration curve (LDC), which plots the level against the percentage of time that the level is exceeded (Figure 9-4). Table 9-2 provides estimated levels for selected points of exceedance on the LDC for various operational options under a Sensible Worst Case Scenario[9]. Under the more likely scenario that PSS do not operate together, the impacts would be reduced. The data in Table 9-2 indicate that L1 (the level exceeded 1% of the time) will only occur on average 3-4 days a year and will vary from 16.28 mAOD if just Foyers is generating power, to 16.39 mAOD if all three PSS are operating simultaneously. Other key points on the LDC are L50 (the median level) and L99 (the level exceeded 99% of the time).

It should be noted that the values and graph are from the period of data used for modelling (2017-22). The full recorded data show a higher L1 of 16.38m (due to the influence of the major flood event in 2015), with marginal differences to the L50 and L99. The occurrence of levels marginally below the Foyers stop-pumping threshold may be due to the hourly time step used in the model, as Foyers pumping for an hour would lower the loch level by about 10 mm. The high assumed compensation also has an influence. Furthermore, the assumed compensation explains the reduction in L99 between the recorded data and the "simulated natural", as actual outflows at certain times were much lower than the 28.3m^3/s assumed in the modelling.

[9] The scenario was based on a reasonable pattern of operation (subject to the constraint of stop-pumping thresholds) across a range of water levels, not just the mean level.

Figure 9-4: Level Duration Curves for Foyers under various scenarios

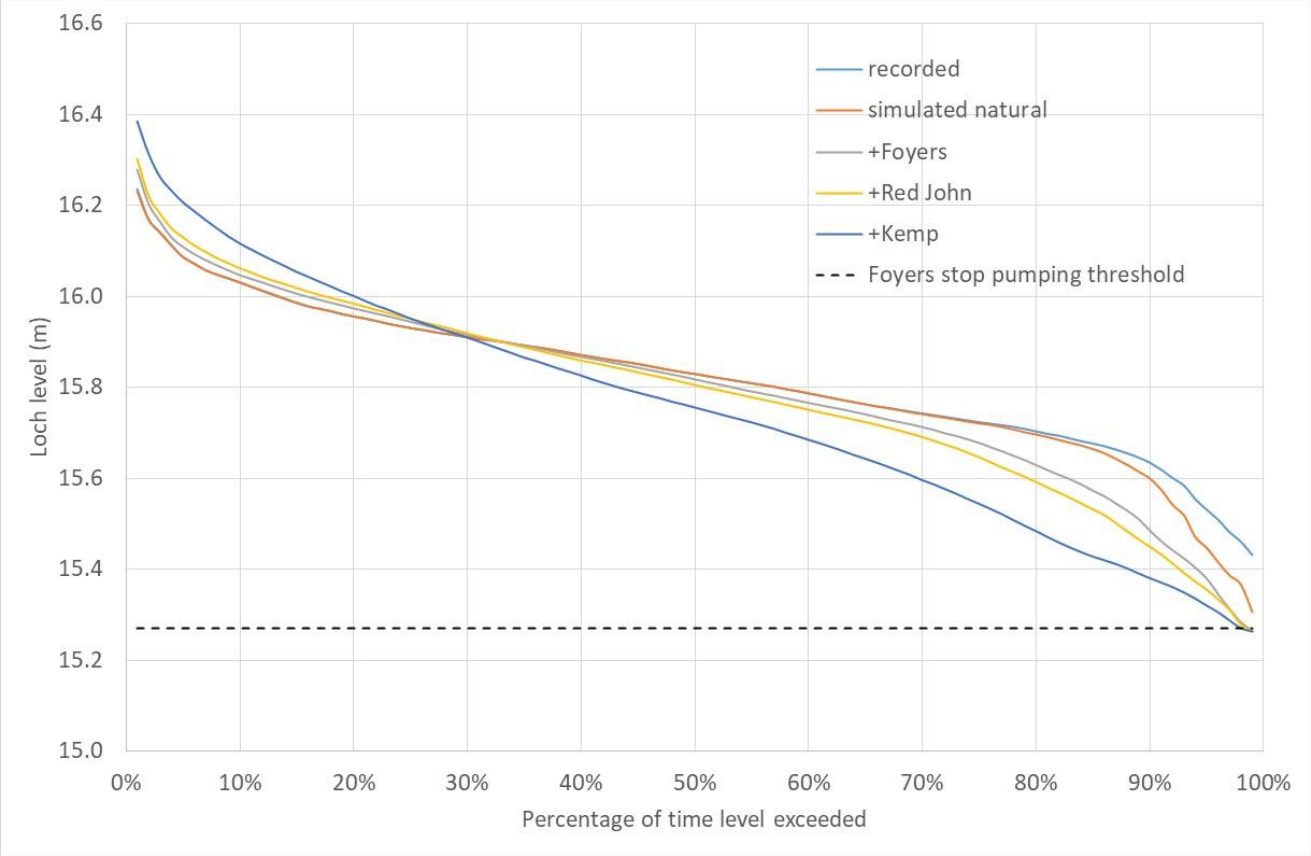


Table 9-2: Estimated levels for selected points on the LDC for various PSH scenarios

	Exceedance	Recorded	Simulated natural	+Foyers	+Red John	+Kemp
L1	1%	16.24	16.23	16.28	16.30	16.39
L50	50%	15.83	15.83	15.82	15.81	15.76
L99	99%	15.43	15.31	15.27	15.26	15.26

Note: Based on model period 2017-22.

9.2.3 Impacts of Climate Change

The potential impacts of climate change on Loch Ness water levels were not assessed as part of this assessment. Broad climate change predictions for Scotland predict drier summers and wetter winters. Summers may contain frequent or longer periods of low loch water levels, which could result in curtailment of PSS operation. Nonetheless, climate change should not result in any fundamental change to how PSS impact loch levels, such as diurnal variation in water levels, slightly higher maximum levels and slightly lower average levels. There is also some potential for PSS to mitigate extreme levels by pumping during flood events and generating in dry periods.

9.3 Predicted Impacts on Urquhart Bay Wood SAC

The potential effects that have been considered in this study are effects on the structure and floristic composition of the Riparian Alluvial Forest vegetation at Urquhart Bay Wood SAC. This is the basis for defining whether the Kemp PSS will affect the integrity of the SAC. The effects have been assessed using the known eco-hydrological requirements of two keystone tree species as a surrogate for the ecosystem as a whole, namely common alder and European ash.

The natural level of Loch Ness varies relatively slowly because of its size and ability to temporarily store water, which provides a lag on the variations in inflow. During operation of the PSS short-term water level fluctuations will be superimposed on the natural variation over a number of hours. The minimum level in Loch Ness will be approached more often, but the absolute minimum level will not change as a result of the operation of Kemp PSS. The overall range of levels will increase slightly as a result of releases during a Generation Cycle, which would cause a temporary increase in level before the resulting increase in flow over the weir brings the level back down (see below).

The projected increase in water levels of Loch Ness under the Sensible Worst Case Scenario (when all three schemes are operating) is likely to result in daily incremental periods of inundation during a Generation Cycle, and increased wetting of the soils in the lower-lying areas of the Urquhart Bay Wood SAC. In most scenarios, the operation of the Kemp PSS would not result in the maximum flood level being exceeded. The only scenario where this is possible would be if the PSS entered a Generation Cycle when the loch was in flood, effectively drowning the weir, resulting in additional inflow above the maximum flood level for a limited period of time.

The magnitude of water level decrease during a Pumping Cycle is projected to be slightly less than the increase during a Generation Cycle and it is unlikely that soils would desiccate for long enough to have any detrimental impact on the species that are dependent on wet soils, such as alder. This is because the low permeability of the fine sediments in lower lying areas in the SAC means that these areas will have a lag in responding to short term changes (particularly decreases) in water levels, and the likelihood that groundwater level will not be solely dependent on contributions from Loch Ness, but will also be supplemented by subsurface flows from the Enrick and Coiltie Rivers (depending on the differential between river surface levels and the groundwater table), and thus a daily pumping cycle is unlikely to result in marked changes in soil inundation levels. The current minimum flow levels of Loch Ness are determined by the operation of the Ness Weir and will not be affected by the Project, and it is unlikely that areas currently dominated by common alder will become desiccated as a result of the Project operation.

Any increases in inundation are most likely to affect the low-lying areas, which are dominated by species adapted to waterlogged soils, such as common alder. The distribution of these areas corresponds to the zones of inundation during flood events depicted in Figure 8-7. The minor increase in frequency of inundation may cause soils to be wetter for longer and may even decrease the risk of soil desiccation during drought periods, although this is an untested assumption. Such a scenario could potentially create a slightly more favourable environment for alder seedling establishment and maintenance of the established alder woodland, and a less favourable seedling establishment base for most of the invasive species present, which generally cannot tolerate the same extent and frequency of waterlogging as species such as alder. Exceptions to this would be Himalayan balsam and white butterbur, both of which can tolerate waterlogged conditions.

The more diverse, higher-lying areas with well-drained soils are less likely to be impacted by the projected increases and decreases in water level, particularly as this plant community relies less on waterlogged conditions than the alder-dominated community. It is unlikely that the decreases in water level of the Loch during Pumping Cycles will result in any significant drawdown of the ground-water table, since water levels are likely to rise soon afterwards during the following generation cycle and the low permeability of the alluvial soils means a lag in these responding to desiccation. Mature ash trees prefer a winter water-table depth of 40 - 100 cm below ground level. In the unlikely event that there is a minor drawdown in the ground-water table, the large range in preference of water table depth makes it unlikely that ash will be negatively impacted by this during Pumping

Cycles. In addition, the average Loch Ness water level is only likely to undergo a minor change of approximately 50 mm, with the main change being the magnitude of daily fluctuations. Thus, areas that are currently dry and above or near to this elevation are unlikely to change from the current state.

In summary, as long as diurnal fluctuations created by PSS operation do not exceed the current maximum and minimum water levels of Loch Ness for any significant period of time then these are not predicted to have a long-term negative impact on Urquhart Bay Wood SAC.

10.0 Conclusion

The Kemp PSS will contribute daily fluctuations in the water levels of Loch Ness, even if all three pumped storage schemes are in operation (Sensible Worst Case scenario), which is an unlikely scenario. However, even under the Sensible Worst Case Scenario, the operation of the Project will only have a negligible effect on the average water level of Loch Ness. Under this scenario, there will be projected water level reductions of 143 mm during a 4-hour Pumping Cycle and increases in water level of up to 205 mm during a 4-hour Generation Cycle in Loch Ness (see Chapter 7: Water Management of the Kemp PSS EIA Report). The fine alluvial sediments (clays, silts) of lower-lying areas in the SAC are likely to have low permeability and thus would respond slowly to changes in surrounding water levels in the loch and adjacent rivers. The changes in loch water levels as a result of operation of the three PSS schemes will be relatively short in duration and are thus unlikely to result in any increase in overall waterlogging of lower-lying soils or desiccation of higher-lying free draining sediments. The water dynamics that currently shape the structure and floristic composition of Urquhart Bay Wood SAC, namely periodicity, magnitude and extent of flooding, are unlikely to change enough to have an impact on vegetation structure and floristic composition, hence retaining the ecological integrity of the woodlands.

The dominant species in low-lying more permanently wet areas of the SAC (alder) is unlikely to be negatively impacted during periods of water storage (when water levels at Loch Ness will decrease), since this will be offset by the small increases in inundation during periods of generation. Soil desiccation would be one of the more significant risks facing common alder if water levels in Loch Ness drop too low for lengthy periods, given its preference for and adaptation to very wet or waterlogged soils. However, the alluvial sediments on which alder grows have low permeability and are likely to dry out much slower than the rate at which water levels are fluctuating, i.e. there will be a lag in response from the alluvial sediments and the risk of soil desiccation is as a result of the Project is low. It is possible that the Project will lower the overall risk of soil desiccation as a result of the small but consistent incremental increases in water levels during Generation Cycles, particularly during periods of natural drought. The other dominant tree species in Urquhart Bay Wood SAC is European ash, which occupies more well-drained, higher-lying areas. It is unlikely to be negatively impacted by slight water level increases, particularly since it is not prominent in the lower-lying parts of the SAC. It is a species that can tolerate some desiccation of soil and thus the brief periods of water level dropping are unlikely to have a negative impact.

In summary, the development of the Kemp PSS is unlikely to have any long-term detrimental effects on the key tree and shrub species at Urquhart Bay Wood SAC and thus is unlikely to affect the integrity of the SAC.

11.0 References

Barsoum, N., Anderson, R., Broadmeadow, S., Bishop, H. and Nisbet, T. (2005). Eco-hydrological guidelines for wet woodland - Phase I. English Nature Research Report No. 619.

Diekmann, M. (1996) Ecological behaviour of deciduous hardwood trees in Boreo-nemoral Sweden in relation to light and soil conditions. *Forest Ecology and Management* 6: l–14.

Dobrowolska, D., Hein, S., Oosterbaan, A., Wagner, S., Clark, J. and Skovsgaard, J.P. (2011) A review of European ash (*Fraxinus excelsior* L.): implications for silviculture. *Forestry* 84 (2): 133-148.

Frye, J. & Grosse, W. (1992). Growth Responses to Flooding and Recovery of Deciduous Trees. *Zeitschrift für Naturforschung* 47c, 683-689.

Kerr, G., & Cahalan, C. (2004). A review of site factors affecting the early growth of ash (*Fraxinus excelsior* L.). *Forest Ecology and Management*, 188: 225-234.

King, J., C. Brown, and H. Sabet. 2003. A scenario-based holistic approach to environmental flow assessments for rivers. *Riv. Res. Appl*. 19: 619-639.

Kleynhans CJ, Mackenzie J, Louw MD. 2007. Module F: Riparian Vegetation Response Assessment Index in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint Water Research Commission and Department of Water Affairs and Forestry report. Maskell, L., Henrys, P., Norton, L., Smart, S. & Wood, C. (2013) Distribution of ash Trees (*Fraxinus excelsior*) in Countryside Survey Data. Centre for Ecology and Hydrology, Wallingford, UK.

Monk, L.S., Fagerstedt, K.V., & Crawford, R.M.M. (1987). Superoxide-Dismutase as an anaerobic polypeptide - a key factor in recovery from oxygen deprivation in *Iris pseudacorus*. *Plant Physiol*. 85: 1016-1020.

Peterken, G.F. (1996). *Natural woodland ecology and conservation in northern temperate regions*. Cambridge: Cambridge University Press.

SNH (2009). Urquhart Bay Wood Site of Special Scientific Interest - Site Management Statement. Public statement prepared by Scottish Natural Heritage for owners and occupiers of the SSSI.

SNH (2020). Urquhart Bay Wood Special Area of Conservation – Conservation Advice Package. Document produced by Nature Scot for owners and occupiers of the SAC.

Thomas, P.A. (2016) Biological Flora of the British Isles: *Fraxinus excelsior*. *Journal of Ecology* 2016, 104, 1158–1209.

Wardle, P. (1961). Biological Flora of the British Isles: *Fraxinus excelsior* L. Journal of Ecology 49: 739-751.

APPENDIX 01

Hydrological data (water level variation) for Loch Ness (April 2014 to June 2023)

Foyers daily water levels

		1.661			datum	14.162						
Min	1.092	1.138	1.178	0.008					Min	-0.117	-0.08	-0.154
Max	3.073	3.255	3.355	0.903					Max	0.166	0.168	0.165
											-	
mAOD		15.823							Mean	-0.007	0.001	-0.007
Min	15.254	15.300	15.340									

	Full period		Apr-14 to Apr-23	
	gauge	mAOD	gauge	mAOD
0%	3.26	17.42	3.26	17.42
1%	2.22	16.38	2.22	16.38
50%	1.65	15.81	1.65	15.82
99%	1.24	15.40	1.29	15.45
100%	1.14	15.30	1.20	15.36

								15.841	15.875				
Date	Min	Mean	Max	Range	Max AOD		date	min_level	avg_level	max_level		min	mean	max
15/04/2014	1.751	1.771	1.810	0.059	15.972									
16/04/2014	1.717	1.758	1.779	0.062	15.941									
17/04/2014	1.684	1.709	1.727	0.043	15.889									
18/04/2014	1.678	1.696	1.711	0.033	15.873									
19/04/2014	1.648	1.682	1.698	0.050	15.860									
20/04/2014	1.621	1.645	1.655	0.034	15.817									
21/04/2014	1.597	1.626	1.650	0.053	15.812									
22/04/2014	1.608	1.645	1.663	0.055	15.825									
23/04/2014	1.627	1.643	1.655	0.028	15.817									

24/04/2014	1.621	1.631	1.640	0.019	15.802
25/04/2014	1.609	1.641	1.661	0.052	15.823
26/04/2014	1.614	1.641	1.651	0.037	15.813
27/04/2014	1.611	1.639	1.658	0.047	15.820
28/04/2014	1.593	1.619	1.641	0.048	15.803
29/04/2014	1.566	1.592	1.605	0.039	15.767
30/04/2014	1.567	1.588	1.612	0.045	15.774
01/05/2014	1.584	1.616	1.631	0.047	15.793
02/05/2014	1.613	1.639	1.664	0.051	15.826
03/05/2014	1.584	1.610	1.625	0.041	15.787
04/05/2014	1.566	1.586	1.604	0.038	15.766
05/05/2014	1.542	1.569	1.585	0.043	15.747
06/05/2014	1.541	1.562	1.591	0.050	15.753
07/05/2014	1.549	1.579	1.600	0.051	15.762
08/05/2014	1.582	1.604	1.627	0.045	15.789
09/05/2014	1.584	1.615	1.646	0.062	15.808
10/05/2014	1.597	1.615	1.631	0.034	15.793
11/05/2014	1.599	1.640	1.664	0.065	15.826
12/05/2014	1.613	1.647	1.671	0.058	15.833
13/05/2014	1.602	1.618	1.630	0.028	15.792
14/05/2014	1.590	1.605	1.620	0.030	15.782
15/05/2014	1.586	1.606	1.631	0.045	15.793
16/05/2014	1.535	1.581	1.627	0.092	15.789
17/05/2014	1.539	1.580	1.612	0.073	15.774
18/05/2014	1.604	1.680	1.731	0.127	15.893
19/05/2014	1.658	1.702	1.721	0.063	15.883
20/05/2014	1.632	1.659	1.683	0.051	15.845
21/05/2014	1.614	1.646	1.666	0.052	15.828
22/05/2014	1.618	1.631	1.648	0.030	15.810
23/05/2014	1.604	1.635	1.655	0.051	15.817
24/05/2014	1.581	1.617	1.634	0.053	15.796
25/05/2014	1.556	1.573	1.592	0.036	15.754
26/05/2014	1.556	1.579	1.611	0.055	15.773
27/05/2014	1.550	1.580	1.604	0.054	15.766
28/05/2014	1.557	1.578	1.609	0.052	15.771
29/05/2014	1.522	1.554	1.577	0.055	15.739
30/05/2014	1.522	1.556	1.578	0.056	15.740

31/05/2014	1.495	1.522	1.539	0.044	15.701
01/06/2014	1.467	1.494	1.514	0.047	15.676
02/06/2014	1.465	1.485	1.508	0.043	15.670
03/06/2014	1.457	1.492	1.512	0.055	15.674
04/06/2014	1.441	1.464	1.482	0.041	15.644
05/06/2014	1.442	1.475	1.500	0.058	15.662
06/06/2014	1.495	1.505	1.524	0.029	15.686
07/06/2014	1.502	1.536	1.559	0.057	15.721
08/06/2014	1.507	1.552	1.615	0.108	15.777
09/06/2014	1.553	1.575	1.600	0.047	15.762
10/06/2014	1.529	1.560	1.578	0.049	15.740
11/06/2014	1.533	1.545	1.553	0.020	15.715
12/06/2014	1.537	1.554	1.570	0.033	15.732
13/06/2014	1.565	1.604	1.633	0.068	15.795
14/06/2014	1.538	1.572	1.588	0.050	15.750
15/06/2014	1.526	1.547	1.568	0.042	15.730
16/06/2014	1.539	1.563	1.582	0.043	15.744
17/06/2014	1.547	1.563	1.581	0.034	15.743
18/06/2014	1.528	1.561	1.578	0.050	15.740
19/06/2014	1.525	1.553	1.581	0.056	15.743
20/06/2014	1.507	1.538	1.574	0.067	15.736
21/06/2014	1.486	1.513	1.532	0.046	15.694
22/06/2014	1.482	1.494	1.506	0.024	15.668
23/06/2014	1.475	1.491	1.509	0.034	15.671
24/06/2014	1.492	1.512	1.534	0.042	15.696
25/06/2014	1.479	1.500	1.521	0.042	15.683
26/06/2014	1.467	1.496	1.532	0.065	15.694
27/06/2014	1.502	1.541	1.562	0.060	15.724
28/06/2014	1.510	1.543	1.563	0.053	15.725
29/06/2014	1.504	1.542	1.566	0.062	15.728
30/06/2014	1.533	1.554	1.577	0.044	15.739
01/07/2014	1.481	1.518	1.548	0.067	15.710
02/07/2014	1.505	1.541	1.575	0.070	15.737
03/07/2014	1.575	1.650	1.677	0.102	15.839
04/07/2014	1.600	1.635	1.667	0.067	15.829
05/07/2014	1.578	1.601	1.630	0.052	15.792
06/07/2014	1.560	1.588	1.612	0.052	15.774

07/07/2014	1.565	1.578	1.594	0.029	15.756
08/07/2014	1.550	1.579	1.601	0.051	15.763
09/07/2014	1.497	1.550	1.575	0.078	15.737
10/07/2014	1.483	1.520	1.552	0.069	15.714
11/07/2014	1.517	1.541	1.566	0.049	15.728
12/07/2014	1.517	1.547	1.565	0.048	15.727
13/07/2014	1.493	1.528	1.546	0.053	15.708
14/07/2014	1.474	1.503	1.524	0.050	15.686
15/07/2014	1.427	1.491	1.512	0.085	15.674
16/07/2014	1.464	1.485	1.502	0.038	15.664
17/07/2014	1.451	1.500	1.525	0.074	15.687
18/07/2014	1.487	1.506	1.518	0.031	15.680
19/07/2014	1.496	1.515	1.541	0.045	15.703
20/07/2014	1.496	1.527	1.555	0.059	15.717
21/07/2014	1.499	1.527	1.549	0.050	15.711
22/07/2014	1.501	1.526	1.537	0.036	15.699
23/07/2014	1.497	1.527	1.547	0.050	15.709
24/07/2014	1.512	1.535	1.550	0.038	15.712
25/07/2014	1.509	1.533	1.551	0.042	15.713
26/07/2014	1.494	1.525	1.542	0.048	15.704
27/07/2014	1.494	1.525	1.548	0.054	15.710
28/07/2014	1.494	1.520	1.531	0.037	15.693
29/07/2014	1.482	1.504	1.533	0.051	15.695
30/07/2014	1.490	1.507	1.521	0.031	15.683
31/07/2014	1.490	1.539	1.594	0.104	15.756
01/08/2014	1.545	1.572	1.600	0.055	15.762
02/08/2014	1.523	1.577	1.620	0.097	15.782
03/08/2014	1.605	1.632	1.648	0.043	15.810
04/08/2014	1.604	1.640	1.660	0.056	15.822
05/08/2014	1.595	1.615	1.643	0.048	15.805
06/08/2014	1.588	1.605	1.622	0.034	15.784
07/08/2014	1.580	1.597	1.623	0.043	15.785
08/08/2014	1.580	1.596	1.615	0.035	15.777
09/08/2014	1.567	1.580	1.605	0.038	15.767
10/08/2014	1.570	1.654	1.808	0.238	15.970
11/08/2014	1.779	1.868	1.968	0.189	16.130
12/08/2014	1.920	1.949	1.980	0.060	16.142

13/08/2014	1.821	1.896	1.954	0.133	16.116
14/08/2014	1.774	1.825	1.856	0.082	16.018
15/08/2014	1.720	1.775	1.815	0.095	15.977
16/08/2014	1.606	1.683	1.740	0.134	15.902
17/08/2014	1.633	1.704	1.800	0.167	15.962
18/08/2014	1.744	1.766	1.834	0.090	15.996
19/08/2014	1.733	1.754	1.788	0.055	15.950
20/08/2014	1.675	1.720	1.793	0.118	15.955
21/08/2014	1.649	1.743	1.806	0.157	15.968
22/08/2014	1.677	1.728	1.781	0.104	15.943
23/08/2014	1.643	1.692	1.725	0.082	15.887
24/08/2014	1.653	1.684	1.709	0.056	15.871
25/08/2014	1.639	1.666	1.694	0.055	15.856
26/08/2014	1.644	1.684	1.706	0.062	15.868
27/08/2014	1.661	1.683	1.703	0.042	15.865
28/08/2014	1.647	1.663	1.686	0.039	15.848
29/08/2014	1.622	1.639	1.659	0.037	15.821
30/08/2014	1.615	1.632	1.664	0.049	15.826
31/08/2014	1.605	1.623	1.645	0.040	15.807
01/09/2014	1.585	1.608	1.630	0.045	15.792
02/09/2014	1.577	1.595	1.622	0.045	15.784
03/09/2014	1.564	1.594	1.630	0.066	15.792
04/09/2014	1.580	1.596	1.615	0.035	15.777
05/09/2014	1.579	1.595	1.622	0.043	15.784
06/09/2014	1.585	1.603	1.619	0.034	15.781
07/09/2014	1.619	1.638	1.650	0.031	15.812
08/09/2014	1.635	1.644	1.655	0.020	15.817
09/09/2014	1.635	1.644	1.654	0.019	15.816
10/09/2014	1.620	1.636	1.644	0.024	15.806
11/09/2014	1.605	1.619	1.629	0.024	15.791
12/09/2014	1.582	1.599	1.607	0.025	15.769
13/09/2014	1.572	1.582	1.591	0.019	15.753
14/09/2014	1.560	1.571	1.576	0.016	15.738
15/09/2014	1.556	1.566	1.575	0.019	15.737
16/09/2014	1.546	1.555	1.566	0.020	15.728
17/09/2014	1.527	1.539	1.550	0.023	15.712
18/09/2014	1.528	1.537	1.546	0.018	15.708

19/09/2014	1.535	1.546	1.556	0.021	15.718
20/09/2014	1.541	1.547	1.552	0.011	15.714
21/09/2014	1.530	1.538	1.545	0.015	15.707
22/09/2014	1.525	1.536	1.550	0.025	15.712
23/09/2014	1.525	1.534	1.540	0.015	15.702
24/09/2014	1.527	1.535	1.542	0.015	15.704
25/09/2014	1.500	1.516	1.532	0.032	15.694
26/09/2014	1.485	1.497	1.511	0.026	15.673
27/09/2014	1.486	1.498	1.508	0.022	15.670
28/09/2014	1.500	1.505	1.513	0.013	15.675
29/09/2014	1.506	1.509	1.515	0.009	15.677
30/09/2014	1.505	1.517	1.530	0.025	15.692
01/10/2014	1.525	1.551	1.576	0.051	15.738
02/10/2014	1.574	1.595	1.621	0.047	15.783
03/10/2014	1.612	1.639	1.662	0.050	15.824
04/10/2014	1.640	1.661	1.671	0.031	15.833
05/10/2014	1.624	1.645	1.658	0.034	15.820
06/10/2014	1.622	1.643	1.656	0.034	15.818
07/10/2014	1.641	1.677	1.731	0.090	15.893
08/10/2014	1.730	1.760	1.777	0.047	15.939
09/10/2014	1.702	1.733	1.751	0.049	15.913
10/10/2014	1.667	1.688	1.704	0.037	15.866
11/10/2014	1.622	1.648	1.670	0.048	15.832
12/10/2014	1.594	1.610	1.625	0.031	15.787
13/10/2014	1.578	1.591	1.603	0.025	15.765
14/10/2014	1.572	1.593	1.610	0.038	15.772
15/10/2014	1.573	1.602	1.626	0.053	15.788
16/10/2014	1.576	1.599	1.627	0.051	15.789
17/10/2014	1.569	1.593	1.621	0.052	15.783
18/10/2014	1.573	1.607	1.637	0.064	15.799
19/10/2014	1.633	1.720	1.752	0.119	15.914
20/10/2014	1.749	1.787	1.815	0.066	15.977
21/10/2014	1.802	1.835	1.863	0.061	16.025
22/10/2014	1.811	1.846	1.874	0.063	16.036
23/10/2014	1.818	1.834	1.852	0.034	16.014
24/10/2014	1.796	1.842	1.863	0.067	16.025
25/10/2014	1.797	1.858	1.971	0.174	16.133

26/10/2014	1.968	2.275	2.440	0.472	16.602
27/10/2014	2.437	2.533	2.740	0.303	16.902
28/10/2014	2.727	2.819	2.874	0.147	17.036
29/10/2014	2.447	2.614	2.730	0.283	16.892
30/10/2014	2.205	2.338	2.447	0.242	16.609
31/10/2014	1.991	2.091	2.207	0.216	16.369
01/11/2014	1.913	1.966	2.002	0.089	16.164
02/11/2014	1.918	1.965	2.004	0.086	16.166
03/11/2014	1.919	1.951	1.972	0.053	16.134
04/11/2014	1.883	1.913	1.925	0.042	16.087
05/11/2014	1.878	1.901	1.935	0.057	16.097
06/11/2014	1.817	1.851	1.891	0.074	16.053
07/11/2014	1.854	1.907	1.928	0.074	16.090
08/11/2014	1.852	1.877	1.886	0.034	16.048
09/11/2014	1.814	1.840	1.855	0.041	16.017
10/11/2014	1.730	1.786	1.814	0.084	15.976
11/11/2014	1.643	1.718	1.758	0.115	15.920
12/11/2014	1.599	1.640	1.659	0.060	15.821
13/11/2014	1.560	1.584	1.610	0.050	15.772
14/11/2014	1.554	1.626	1.669	0.115	15.831
15/11/2014	1.666	1.699	1.718	0.052	15.880
16/11/2014	1.659	1.694	1.715	0.056	15.877
17/11/2014	1.657	1.678	1.704	0.047	15.866
18/11/2014	1.608	1.660	1.689	0.081	15.851
19/11/2014	1.540	1.591	1.611	0.071	15.773
20/11/2014	1.537	1.552	1.569	0.032	15.731
21/11/2014	1.519	1.558	1.586	0.067	15.748
22/11/2014	1.536	1.600	1.637	0.101	15.799
23/11/2014	1.588	1.624	1.646	0.058	15.808
24/11/2014	1.595	1.622	1.648	0.053	15.810
25/11/2014	1.601	1.635	1.663	0.062	15.825
26/11/2014	1.625	1.667	1.702	0.077	15.864
27/11/2014	1.627	1.644	1.660	0.033	15.822
28/11/2014	1.636	1.653	1.672	0.036	15.834
29/11/2014	1.639	1.659	1.683	0.044	15.845
30/11/2014	1.601	1.633	1.655	0.054	15.817
01/12/2014	1.597	1.622	1.645	0.048	15.807

02/12/2014	1.580	1.617	1.637	0.057	15.799
03/12/2014	1.580	1.605	1.629	0.049	15.791
04/12/2014	1.571	1.597	1.619	0.048	15.781
05/12/2014	1.553	1.592	1.614	0.061	15.776
06/12/2014	1.552	1.577	1.605	0.053	15.767
07/12/2014	1.582	1.640	1.681	0.099	15.843
08/12/2014	1.669	1.708	1.747	0.078	15.909
09/12/2014	1.698	1.819	1.893	0.195	16.055
10/12/2014	1.852	1.886	1.923	0.071	16.085
11/12/2014	1.812	1.856	1.887	0.075	16.049
12/12/2014	1.794	1.828	1.870	0.076	16.032
13/12/2014	1.753	1.777	1.795	0.042	15.957
14/12/2014	1.775	1.937	2.002	0.227	16.164
15/12/2014	1.872	1.961	2.015	0.143	16.177
16/12/2014	1.848	1.864	1.886	0.038	16.048
17/12/2014	1.869	1.907	1.953	0.084	16.115
18/12/2014	1.870	1.936	1.989	0.119	16.151
19/12/2014	1.852	1.914	1.942	0.090	16.104
20/12/2014	1.838	1.874	1.910	0.072	16.072
21/12/2014	1.859	2.124	2.310	0.451	16.472
22/12/2014	2.272	2.327	2.357	0.085	16.519
23/12/2014	2.105	2.231	2.286	0.181	16.448
24/12/2014	1.972	2.031	2.105	0.133	16.267
25/12/2014	1.890	1.959	1.993	0.103	16.155
26/12/2014	1.806	1.856	1.890	0.084	16.052
27/12/2014	1.746	1.811	1.847	0.101	16.009
28/12/2014	1.675	1.739	1.772	0.097	15.934
29/12/2014	1.620	1.672	1.705	0.085	15.867
30/12/2014	1.616	1.634	1.656	0.040	15.818
31/12/2014	1.611	1.683	1.758	0.147	15.920
01/01/2015	1.757	1.986	2.127	0.370	16.289
02/01/2015	2.032	2.095	2.145	0.113	16.307
03/01/2015	1.917	1.995	2.033	0.116	16.195
04/01/2015	1.863	1.896	1.922	0.059	16.084
05/01/2015	1.807	1.852	1.876	0.069	16.038
06/01/2015	1.813	1.851	1.880	0.067	16.042
07/01/2015	1.837	1.939	2.020	0.183	16.182

08/01/2015	1.965	2.025	2.065	0.100	16.227
09/01/2015	1.987	2.042	2.194	0.207	16.356
10/01/2015	2.150	2.226	2.272	0.122	16.434
11/01/2015	2.126	2.205	2.423	0.297	16.585
12/01/2015	2.409	2.488	2.543	0.134	16.705
13/01/2015	2.242	2.365	2.459	0.217	16.621
14/01/2015	2.026	2.143	2.244	0.218	16.406
15/01/2015	2.041	2.089	2.122	0.081	16.284
16/01/2015	2.001	2.057	2.100	0.099	16.262
17/01/2015	1.868	1.945	2.001	0.133	16.163
18/01/2015	1.806	1.854	1.883	0.077	16.045
19/01/2015	1.768	1.815	1.852	0.084	16.014
20/01/2015	1.677	1.742	1.774	0.097	15.936
21/01/2015	1.634	1.663	1.681	0.047	15.843
22/01/2015	1.613	1.645	1.676	0.063	15.838
23/01/2015	1.607	1.661	1.706	0.099	15.868
24/01/2015	1.705	1.733	1.755	0.050	15.917
25/01/2015	1.747	1.838	1.919	0.172	16.081
26/01/2015	1.901	1.918	1.937	0.036	16.099
27/01/2015	1.885	1.902	1.953	0.068	16.115
28/01/2015	1.950	1.996	2.018	0.068	16.180
29/01/2015	1.900	1.976	2.020	0.120	16.182
30/01/2015	1.753	1.857	1.910	0.157	16.072
31/01/2015	1.717	1.744	1.764	0.047	15.926
01/02/2015	1.718	1.755	1.770	0.052	15.932
02/02/2015	1.712	1.752	1.766	0.054	15.928
03/02/2015	1.707	1.723	1.734	0.027	15.896
04/02/2015	1.656	1.694	1.708	0.052	15.870
05/02/2015	1.635	1.661	1.678	0.043	15.840
06/02/2015	1.641	1.664	1.695	0.054	15.857
07/02/2015	1.643	1.666	1.686	0.043	15.848
08/02/2015	1.621	1.644	1.668	0.047	15.830
09/02/2015	1.622	1.667	1.713	0.091	15.875
10/02/2015	1.711	1.763	1.785	0.074	15.947
11/02/2015	1.769	1.788	1.803	0.034	15.965
12/02/2015	1.723	1.771	1.800	0.077	15.962
13/02/2015	1.714	1.748	1.763	0.049	15.925

14/02/2015	1.644	1.699	1.725	0.081	15.887
15/02/2015	1.614	1.624	1.650	0.036	15.812
16/02/2015	1.634	1.670	1.692	0.058	15.854
17/02/2015	1.678	1.706	1.735	0.057	15.897
18/02/2015	1.719	1.830	1.985	0.266	16.147
19/02/2015	1.976	2.030	2.062	0.086	16.224
20/02/2015	1.940	2.008	2.043	0.103	16.205
21/02/2015	1.853	1.904	1.940	0.087	16.102
22/02/2015	1.808	1.843	1.877	0.069	16.039
23/02/2015	1.740	1.804	1.847	0.107	16.009
24/02/2015	1.749	1.786	1.815	0.066	15.977
25/02/2015	1.788	1.812	1.837	0.049	15.999
26/02/2015	1.837	1.932	1.973	0.136	16.135
27/02/2015	1.883	1.937	1.963	0.080	16.125
28/02/2015	1.890	1.905	1.918	0.028	16.080
01/03/2015	1.912	1.937	1.955	0.043	16.117
02/03/2015	1.888	1.948	1.980	0.092	16.142
03/03/2015	1.785	1.860	1.916	0.131	16.078
04/03/2015	1.752	1.780	1.796	0.044	15.958
05/03/2015	1.764	1.871	1.959	0.195	16.121
06/03/2015	1.937	2.091	2.417	0.480	16.579
07/03/2015	2.417	2.926	3.320	0.903	17.482
08/03/2015	3.073	3.255	3.355	0.282	17.517
09/03/2015	2.811	2.930	3.073	0.262	17.235
10/03/2015	2.509	2.673	2.811	0.302	16.973
11/03/2015	2.215	2.363	2.509	0.294	16.671
12/03/2015	2.073	2.134	2.231	0.158	16.393
13/03/2015	1.951	2.019	2.073	0.122	16.235
14/03/2015	1.858	1.908	1.951	0.093	16.113
15/03/2015	1.798	1.843	1.873	0.075	16.035
16/03/2015	1.737	1.804	1.852	0.115	16.014
17/03/2015	1.665	1.714	1.742	0.077	15.904
18/03/2015	1.635	1.660	1.673	0.038	15.835
19/03/2015	1.636	1.651	1.669	0.033	15.831
20/03/2015	1.603	1.637	1.651	0.048	15.813
21/03/2015	1.599	1.613	1.628	0.029	15.790
22/03/2015	1.611	1.620	1.629	0.018	15.791

23/03/2015	1.618	1.641	1.671	0.053	15.833
24/03/2015	1.669	1.697	1.718	0.049	15.880
25/03/2015	1.692	1.708	1.721	0.029	15.883
26/03/2015	1.674	1.697	1.713	0.039	15.875
27/03/2015	1.643	1.673	1.690	0.047	15.852
28/03/2015	1.636	1.697	1.773	0.137	15.935
29/03/2015	1.718	1.763	1.797	0.079	15.959
30/03/2015	1.726	1.741	1.761	0.035	15.923
31/03/2015	1.743	1.770	1.790	0.047	15.952
01/04/2015	1.758	1.791	1.803	0.045	15.965
02/04/2015	1.765	1.784	1.801	0.036	15.963
03/04/2015	1.772	1.795	1.804	0.032	15.966
04/04/2015	1.780	1.789	1.799	0.019	15.961
05/04/2015	1.760	1.777	1.792	0.032	15.954
06/04/2015	1.737	1.747	1.764	0.027	15.926
07/04/2015	1.740	1.751	1.772	0.032	15.934
08/04/2015	1.736	1.748	1.763	0.027	15.925
09/04/2015	1.717	1.745	1.772	0.055	15.934
10/04/2015	1.673	1.731	1.768	0.095	15.930
11/04/2015	1.640	1.680	1.702	0.062	15.864
12/04/2015	1.641	1.687	1.732	0.091	15.894
13/04/2015	1.715	1.733	1.750	0.035	15.912
14/04/2015	1.739	1.802	1.845	0.106	16.007
15/04/2015	1.836	1.854	1.881	0.045	16.043
16/04/2015	1.787	1.822	1.847	0.060	16.009
17/04/2015	1.772	1.792	1.818	0.046	15.980
18/04/2015	1.741	1.769	1.793	0.052	15.955
19/04/2015	1.736	1.763	1.804	0.068	15.966
20/04/2015	1.651	1.700	1.749	0.098	15.911
21/04/2015	1.610	1.634	1.666	0.056	15.828
22/04/2015	1.583	1.609	1.623	0.040	15.785
23/04/2015	1.596	1.609	1.619	0.023	15.781
24/04/2015	1.538	1.587	1.605	0.067	15.767
25/04/2015	1.540	1.565	1.596	0.056	15.758
26/04/2015	1.553	1.575	1.600	0.047	15.762
27/04/2015	1.571	1.601	1.621	0.050	15.783
28/04/2015	1.607	1.634	1.652	0.045	15.814

29/04/2015	1.639	1.652	1.673	0.034	15.835
30/04/2015	1.656	1.673	1.683	0.027	15.845
01/05/2015	1.672	1.682	1.694	0.022	15.856
02/05/2015	1.649	1.712	1.740	0.091	15.902
03/05/2015	1.622	1.640	1.654	0.032	15.816
04/05/2015	1.628	1.647	1.674	0.046	15.836
05/05/2015	1.657	1.682	1.711	0.054	15.873
06/05/2015	1.686	1.725	1.751	0.065	15.913
07/05/2015	1.660	1.710	1.731	0.071	15.893
08/05/2015	1.654	1.710	1.733	0.079	15.895
09/05/2015	1.666	1.705	1.739	0.073	15.901
10/05/2015	1.654	1.682	1.705	0.051	15.867
11/05/2015	1.685	1.745	1.786	0.101	15.948
12/05/2015	1.764	1.794	1.808	0.044	15.970
13/05/2015	1.807	1.829	1.850	0.043	16.012
14/05/2015	1.797	1.817	1.831	0.034	15.993
15/05/2015	1.718	1.785	1.827	0.109	15.989
16/05/2015	1.672	1.721	1.751	0.079	15.913
17/05/2015	1.679	1.751	1.828	0.149	15.990
18/05/2015	1.828	1.851	1.868	0.040	16.030
19/05/2015	1.797	1.823	1.844	0.047	16.006
20/05/2015	1.773	1.808	1.841	0.068	16.003
21/05/2015	1.709	1.750	1.773	0.064	15.935
22/05/2015	1.671	1.694	1.715	0.044	15.877
23/05/2015	1.643	1.671	1.688	0.045	15.850
24/05/2015	1.616	1.641	1.654	0.038	15.816
25/05/2015	1.617	1.667	1.709	0.092	15.871
26/05/2015	1.639	1.667	1.686	0.047	15.848
27/05/2015	1.642	1.682	1.721	0.079	15.883
28/05/2015	1.648	1.673	1.706	0.058	15.868
29/05/2015	1.706	1.734	1.764	0.058	15.926
30/05/2015	1.699	1.740	1.772	0.073	15.934
31/05/2015	1.664	1.689	1.716	0.052	15.878
01/06/2015	1.665	1.679	1.690	0.025	15.852
02/06/2015	1.677	1.703	1.719	0.042	15.881
03/06/2015	1.712	1.733	1.747	0.035	15.909
04/06/2015	1.720	1.730	1.742	0.022	15.904

05/06/2015	1.699	1.734	1.753	0.054	15.915
06/06/2015	1.696	1.712	1.724	0.028	15.886
07/06/2015	1.713	1.738	1.757	0.044	15.919
08/06/2015	1.681	1.720	1.743	0.062	15.905
09/06/2015	1.642	1.673	1.686	0.044	15.848
10/06/2015	1.603	1.643	1.662	0.059	15.824
11/06/2015	1.601	1.608	1.624	0.023	15.786
12/06/2015	1.608	1.632	1.652	0.044	15.814
13/06/2015	1.608	1.626	1.644	0.036	15.806
14/06/2015	1.594	1.627	1.656	0.062	15.818
15/06/2015	1.589	1.610	1.626	0.037	15.788
16/06/2015	1.540	1.582	1.601	0.061	15.763
17/06/2015	1.502	1.530	1.548	0.046	15.710
18/06/2015	1.502	1.530	1.553	0.051	15.715
19/06/2015	1.522	1.544	1.563	0.041	15.725
20/06/2015	1.531	1.571	1.595	0.064	15.757
21/06/2015	1.550	1.584	1.621	0.071	15.783
22/06/2015	1.569	1.580	1.592	0.023	15.754
23/06/2015	1.584	1.631	1.664	0.080	15.826
24/06/2015	1.592	1.620	1.637	0.045	15.799
25/06/2015	1.618	1.644	1.672	0.054	15.834
26/06/2015	1.611	1.640	1.658	0.047	15.820
27/06/2015	1.548	1.608	1.635	0.087	15.797
28/06/2015	1.548	1.576	1.605	0.057	15.767
29/06/2015	1.579	1.600	1.628	0.049	15.790
30/06/2015	1.587	1.609	1.626	0.039	15.788
01/07/2015	1.610	1.653	1.683	0.073	15.845
02/07/2015	1.632	1.668	1.689	0.057	15.851
03/07/2015	1.563	1.629	1.651	0.088	15.813
04/07/2015	1.551	1.589	1.608	0.057	15.770
05/07/2015	1.599	1.638	1.667	0.068	15.829
06/07/2015	1.608	1.632	1.651	0.043	15.813
07/07/2015	1.608	1.629	1.645	0.037	15.807
08/07/2015	1.637	1.670	1.693	0.056	15.855
09/07/2015	1.666	1.696	1.716	0.050	15.878
10/07/2015	1.699	1.731	1.764	0.065	15.926
11/07/2015	1.662	1.712	1.734	0.072	15.896

12/07/2015	1.630	1.664	1.685	0.055	15.847
13/07/2015	1.616	1.662	1.693	0.077	15.855
14/07/2015	1.617	1.635	1.647	0.030	15.809
15/07/2015	1.632	1.656	1.677	0.045	15.839
16/07/2015	1.576	1.644	1.671	0.095	15.833
17/07/2015	1.559	1.605	1.640	0.081	15.802
18/07/2015	1.556	1.576	1.606	0.050	15.768
19/07/2015	1.606	1.649	1.685	0.079	15.847
20/07/2015	1.627	1.676	1.701	0.074	15.863
21/07/2015	1.616	1.625	1.639	0.023	15.801
22/07/2015	1.581	1.631	1.653	0.072	15.815
23/07/2015	1.555	1.568	1.584	0.029	15.746
24/07/2015	1.575	1.627	1.650	0.075	15.812
25/07/2015	1.599	1.626	1.652	0.053	15.814
26/07/2015	1.548	1.594	1.614	0.066	15.776
27/07/2015	1.550	1.605	1.638	0.088	15.800
28/07/2015	1.615	1.645	1.674	0.059	15.836
29/07/2015	1.640	1.660	1.681	0.041	15.843
30/07/2015	1.643	1.685	1.708	0.065	15.870
31/07/2015	1.676	1.701	1.720	0.044	15.882
01/08/2015	1.677	1.697	1.731	0.054	15.893
02/08/2015	1.665	1.729	1.763	0.098	15.925
03/08/2015	1.646	1.677	1.695	0.049	15.857
04/08/2015	1.644	1.659	1.671	0.027	15.833
05/08/2015	1.644	1.682	1.712	0.068	15.874
06/08/2015	1.628	1.686	1.712	0.084	15.874
07/08/2015	1.581	1.603	1.638	0.057	15.800
08/08/2015	1.502	1.561	1.587	0.085	15.749
09/08/2015	1.482	1.498	1.509	0.027	15.671
10/08/2015	1.491	1.506	1.526	0.035	15.688
11/08/2015	1.508	1.532	1.552	0.044	15.714
12/08/2015	1.474	1.504	1.516	0.042	15.678
13/08/2015	1.487	1.515	1.539	0.052	15.701
14/08/2015	1.526	1.546	1.565	0.039	15.727
15/08/2015	1.508	1.536	1.559	0.051	15.721
16/08/2015	1.488	1.512	1.523	0.035	15.685
17/08/2015	1.491	1.513	1.536	0.045	15.698

18/08/2015	1.498	1.508	1.521	0.023	15.683
19/08/2015	1.499	1.511	1.519	0.020	15.681
20/08/2015	1.471	1.513	1.538	0.067	15.700
21/08/2015	1.453	1.485	1.517	0.064	15.679
22/08/2015	1.493	1.540	1.570	0.077	15.732
23/08/2015	1.493	1.501	1.512	0.019	15.674
24/08/2015	1.478	1.499	1.510	0.032	15.672
25/08/2015	1.470	1.488	1.500	0.030	15.662
26/08/2015	1.446	1.476	1.493	0.047	15.655
27/08/2015	1.448	1.460	1.471	0.023	15.633
28/08/2015	1.438	1.460	1.471	0.033	15.633
29/08/2015	1.452	1.523	1.575	0.123	15.737
30/08/2015	1.573	1.616	1.635	0.062	15.797
31/08/2015	1.631	1.645	1.662	0.031	15.824
01/09/2015	1.627	1.654	1.679	0.052	15.841
02/09/2015	1.649	1.669	1.681	0.032	15.843
03/09/2015	1.622	1.636	1.652	0.030	15.814
04/09/2015	1.619	1.643	1.661	0.042	15.823
05/09/2015	1.622	1.646	1.668	0.046	15.830
06/09/2015	1.563	1.596	1.624	0.061	15.786
07/09/2015	1.532	1.552	1.565	0.033	15.727
08/09/2015	1.526	1.532	1.542	0.016	15.704
09/09/2015	1.518	1.526	1.535	0.017	15.697
10/09/2015	1.509	1.519	1.531	0.022	15.693
11/09/2015	1.508	1.515	1.524	0.016	15.686
12/09/2015	1.504	1.514	1.526	0.022	15.688
13/09/2015	1.497	1.504	1.512	0.015	15.674
14/09/2015	1.481	1.510	1.526	0.045	15.688
15/09/2015	1.477	1.493	1.505	0.028	15.667
16/09/2015	1.459	1.485	1.500	0.041	15.662
17/09/2015	1.432	1.454	1.465	0.033	15.627
18/09/2015	1.414	1.434	1.446	0.032	15.608
19/09/2015	1.421	1.436	1.448	0.027	15.610
20/09/2015	1.396	1.418	1.432	0.036	15.594
21/09/2015	1.370	1.392	1.404	0.034	15.566
22/09/2015	1.370	1.384	1.404	0.034	15.566
23/09/2015	1.399	1.415	1.435	0.036	15.597

24/09/2015	1.410	1.433	1.456	0.046	15.618
25/09/2015	1.439	1.460	1.474	0.035	15.636
26/09/2015	1.455	1.479	1.499	0.044	15.661
27/09/2015	1.450	1.478	1.498	0.048	15.660
28/09/2015	1.441	1.470	1.487	0.046	15.649
29/09/2015	1.443	1.455	1.467	0.024	15.629
30/09/2015	1.443	1.460	1.488	0.045	15.650
01/10/2015	1.440	1.462	1.479	0.039	15.641
02/10/2015	1.429	1.451	1.465	0.036	15.627
03/10/2015	1.419	1.448	1.467	0.048	15.629
04/10/2015	1.392	1.428	1.460	0.068	15.622
05/10/2015	1.387	1.397	1.412	0.025	15.574
06/10/2015	1.399	1.415	1.442	0.043	15.604
07/10/2015	1.410	1.422	1.442	0.032	15.604
08/10/2015	1.415	1.436	1.449	0.034	15.611
09/10/2015	1.386	1.405	1.421	0.035	15.583
10/10/2015	1.378	1.397	1.409	0.031	15.571
11/10/2015	1.370	1.385	1.403	0.033	15.565
12/10/2015	1.361	1.376	1.386	0.025	15.548
13/10/2015	1.364	1.388	1.403	0.039	15.565
14/10/2015	1.380	1.395	1.408	0.028	15.570
15/10/2015	1.386	1.403	1.421	0.035	15.583
16/10/2015	1.405	1.442	1.453	0.048	15.615
17/10/2015	1.377	1.406	1.431	0.054	15.593
18/10/2015	1.357	1.381	1.394	0.037	15.556
19/10/2015	1.363	1.376	1.388	0.025	15.550
20/10/2015	1.375	1.391	1.414	0.039	15.576
21/10/2015	1.358	1.393	1.421	0.063	15.583
22/10/2015	1.372	1.392	1.441	0.069	15.603
23/10/2015	1.434	1.455	1.474	0.040	15.636
24/10/2015	1.470	1.574	1.628	0.158	15.790
25/10/2015	1.622	1.644	1.670	0.048	15.832
26/10/2015	1.623	1.638	1.651	0.028	15.813
27/10/2015	1.608	1.643	1.663	0.055	15.825
28/10/2015	1.508	1.589	1.617	0.109	15.779
29/10/2015	1.505	1.526	1.552	0.047	15.714
30/10/2015	1.468	1.510	1.534	0.066	15.696

31/10/2015	1.474	1.544	1.577	0.103	15.739
01/11/2015	1.528	1.558	1.577	0.049	15.739
02/11/2015	1.527	1.548	1.561	0.034	15.723
03/11/2015	1.501	1.543	1.565	0.064	15.727
04/11/2015	1.504	1.522	1.543	0.039	15.705
05/11/2015	1.482	1.519	1.533	0.051	15.695
06/11/2015	1.468	1.510	1.541	0.073	15.703
07/11/2015	1.454	1.497	1.518	0.064	15.680
08/11/2015	1.459	1.521	1.586	0.127	15.748
09/11/2015	1.584	1.725	1.787	0.203	15.949
10/11/2015	1.787	1.848	1.890	0.103	16.052
11/11/2015	1.863	1.878	1.891	0.028	16.053
12/11/2015	1.795	1.873	1.913	0.118	16.075
13/11/2015	1.894	1.914	1.928	0.034	16.090
14/11/2015	1.907	1.956	1.995	0.088	16.157
15/11/2015	1.923	1.952	2.013	0.090	16.175
16/11/2015	1.977	2.001	2.037	0.060	16.199
17/11/2015	1.946	1.992	2.021	0.075	16.183
18/11/2015	1.898	1.960	2.010	0.112	16.172
19/11/2015	1.834	1.901	1.931	0.097	16.093
20/11/2015	1.762	1.819	1.852	0.090	16.014
21/11/2015	1.695	1.750	1.779	0.084	15.941
22/11/2015	1.609	1.661	1.695	0.086	15.857
23/11/2015	1.588	1.600	1.613	0.025	15.775
24/11/2015	1.605	1.625	1.645	0.040	15.807
25/11/2015	1.609	1.642	1.673	0.064	15.835
26/11/2015	1.643	1.662	1.686	0.043	15.848
27/11/2015	1.680	1.740	1.775	0.095	15.937
28/11/2015	1.749	1.800	1.843	0.094	16.005
29/11/2015	1.795	1.819	1.850	0.055	16.012
30/11/2015	1.766	1.806	1.837	0.071	15.999
01/12/2015	1.761	1.858	2.007	0.246	16.169
02/12/2015	2.007	2.106	2.158	0.151	16.320
03/12/2015	1.941	2.014	2.069	0.128	16.231
04/12/2015	1.916	2.121	2.502	0.586	16.664
05/12/2015	2.495	2.651	2.720	0.225	16.882
06/12/2015	2.444	2.555	2.654	0.210	16.816

07/12/2015	2.191	2.323	2.457	0.266	16.619
08/12/2015	2.074	2.150	2.209	0.135	16.371
09/12/2015	2.072	2.142	2.216	0.144	16.378
10/12/2015	2.106	2.203	2.247	0.141	16.409
11/12/2015	2.002	2.074	2.130	0.128	16.292
12/12/2015	1.910	1.958	2.002	0.092	16.164
13/12/2015	1.825	1.882	1.919	0.094	16.081
14/12/2015	1.754	1.807	1.836	0.082	15.998
15/12/2015	1.756	1.778	1.795	0.039	15.957
16/12/2015	1.791	1.878	1.920	0.129	16.082
17/12/2015	1.919	1.963	1.998	0.079	16.160
18/12/2015	1.927	1.942	1.963	0.036	16.125
19/12/2015	1.960	2.005	2.044	0.084	16.206
20/12/2015	1.970	2.004	2.024	0.054	16.186
21/12/2015	1.984	2.017	2.051	0.067	16.213
22/12/2015	1.999	2.063	2.102	0.103	16.264
23/12/2015	2.060	2.128	2.297	0.237	16.459
24/12/2015	2.297	2.349	2.376	0.079	16.538
25/12/2015	2.207	2.321	2.386	0.179	16.548
26/12/2015	2.044	2.140	2.221	0.177	16.383
27/12/2015	1.929	2.015	2.058	0.129	16.220
28/12/2015	1.883	1.921	1.945	0.062	16.107
29/12/2015	1.899	1.944	2.082	0.183	16.244
30/12/2015	2.082	2.322	2.428	0.346	16.590
31/12/2015	2.209	2.312	2.403	0.194	16.565
01/01/2016	1.984	2.130	2.209	0.225	16.371
02/01/2016	1.856	1.943	1.984	0.128	16.146
03/01/2016	1.794	1.839	1.861	0.067	16.023
04/01/2016	1.740	1.786	1.814	0.074	15.976
05/01/2016	1.735	1.768	1.797	0.062	15.959
06/01/2016	1.687	1.744	1.780	0.093	15.942
07/01/2016	1.696	1.725	1.746	0.050	15.908
08/01/2016	1.655	1.699	1.718	0.063	15.880
09/01/2016	1.596	1.640	1.660	0.064	15.822
10/01/2016	1.603	1.637	1.661	0.058	15.823
11/01/2016	1.640	1.654	1.666	0.026	15.828
12/01/2016	1.641	1.668	1.685	0.044	15.847

13/01/2016	1.675	1.692	1.710	0.035	15.872
14/01/2016	1.671	1.684	1.698	0.027	15.860
15/01/2016	1.654	1.684	1.700	0.046	15.862
16/01/2016	1.617	1.669	1.690	0.073	15.852
17/01/2016	1.575	1.633	1.663	0.088	15.825
18/01/2016	1.558	1.576	1.588	0.030	15.750
19/01/2016	1.560	1.582	1.603	0.043	15.765
20/01/2016	1.568	1.597	1.612	0.044	15.774
21/01/2016	1.563	1.581	1.626	0.063	15.788
22/01/2016	1.613	1.714	1.786	0.173	15.948
23/01/2016	1.773	1.813	1.838	0.065	16.000
24/01/2016	1.805	1.825	1.840	0.035	16.002
25/01/2016	1.809	1.851	1.883	0.074	16.045
26/01/2016	1.875	2.031	2.103	0.228	16.265
27/01/2016	1.999	2.061	2.098	0.099	16.260
28/01/2016	1.988	2.070	2.363	0.375	16.525
29/01/2016	2.363	2.563	2.617	0.254	16.779
30/01/2016	2.342	2.460	2.560	0.218	16.722
31/01/2016	2.120	2.246	2.342	0.222	16.504
01/02/2016	2.148	2.391	2.486	0.338	16.648
02/02/2016	2.473	2.517	2.562	0.089	16.724
03/02/2016	2.243	2.401	2.484	0.241	16.646
04/02/2016	2.048	2.149	2.243	0.195	16.405
05/02/2016	2.039	2.064	2.094	0.055	16.256
06/02/2016	1.881	1.982	2.040	0.159	16.202
07/02/2016	1.852	1.890	1.923	0.071	16.085
08/02/2016	1.837	1.908	1.946	0.109	16.108
09/02/2016	1.818	1.829	1.841	0.023	16.003
10/02/2016	1.762	1.811	1.837	0.075	15.999
11/02/2016	1.712	1.758	1.778	0.066	15.940
12/02/2016	1.648	1.692	1.713	0.065	15.875
13/02/2016	1.620	1.647	1.657	0.037	15.819
14/02/2016	1.605	1.616	1.635	0.030	15.797
15/02/2016	1.556	1.606	1.645	0.089	15.807
16/02/2016	1.535	1.618	1.724	0.189	15.886
17/02/2016	1.721	1.752	1.794	0.073	15.956
18/02/2016	1.781	1.802	1.824	0.043	15.986

19/02/2016	1.764	1.780	1.795	0.031	15.957
20/02/2016	1.751	1.775	1.792	0.041	15.954
21/02/2016	1.752	1.772	1.788	0.036	15.950
22/02/2016	1.754	1.772	1.787	0.033	15.949
23/02/2016	1.737	1.761	1.785	0.048	15.947
24/02/2016	1.677	1.719	1.742	0.065	15.904
25/02/2016	1.652	1.673	1.685	0.033	15.847
26/02/2016	1.667	1.694	1.721	0.054	15.883
27/02/2016	1.654	1.692	1.721	0.067	15.883
28/02/2016	1.616	1.646	1.667	0.051	15.829
29/02/2016	1.594	1.615	1.628	0.034	15.790
01/03/2016	1.624	1.725	1.775	0.151	15.937
02/03/2016	1.774	1.810	1.832	0.058	15.994
03/03/2016	1.778	1.787	1.804	0.026	15.966
04/03/2016	1.732	1.771	1.795	0.063	15.957
05/03/2016	1.730	1.745	1.759	0.029	15.921
06/03/2016	1.629	1.698	1.744	0.115	15.906
07/03/2016	1.611	1.634	1.653	0.042	15.815
08/03/2016	1.611	1.647	1.667	0.056	15.829
09/03/2016	1.641	1.668	1.693	0.052	15.855
10/03/2016	1.672	1.693	1.712	0.040	15.874
11/03/2016	1.678	1.698	1.717	0.039	15.879
12/03/2016	1.682	1.745	1.786	0.104	15.948
13/03/2016	1.780	1.796	1.818	0.038	15.980
14/03/2016	1.779	1.797	1.813	0.034	15.975
15/03/2016	1.768	1.791	1.807	0.039	15.969
16/03/2016	1.689	1.741	1.785	0.096	15.947
17/03/2016	1.633	1.675	1.700	0.067	15.862
18/03/2016	1.621	1.653	1.673	0.052	15.835
19/03/2016	1.605	1.633	1.658	0.053	15.820
20/03/2016	1.592	1.613	1.645	0.053	15.807
21/03/2016	1.592	1.613	1.629	0.037	15.791
22/03/2016	1.611	1.635	1.651	0.040	15.813
23/03/2016	1.642	1.652	1.662	0.020	15.824
24/03/2016	1.648	1.667	1.681	0.033	15.843
25/03/2016	1.670	1.684	1.708	0.038	15.870
26/03/2016	1.708	1.781	1.851	0.143	16.013

27/03/2016	1.850	1.888	1.908	0.058	16.070
28/03/2016	1.859	1.896	1.928	0.069	16.090
29/03/2016	1.756	1.821	1.859	0.103	16.021
30/03/2016	1.743	1.753	1.774	0.031	15.936
31/03/2016	1.700	1.754	1.782	0.082	15.944
01/04/2016	1.683	1.694	1.735	0.052	15.897
02/04/2016	1.735	1.751	1.764	0.029	15.926
03/04/2016	1.734	1.753	1.777	0.043	15.939
04/04/2016	1.768	1.801	1.817	0.049	15.979
05/04/2016	1.765	1.789	1.803	0.038	15.965
06/04/2016	1.738	1.764	1.783	0.045	15.945
07/04/2016	1.741	1.758	1.780	0.039	15.942
08/04/2016	1.761	1.779	1.789	0.028	15.951
09/04/2016	1.764	1.785	1.802	0.038	15.964
10/04/2016	1.724	1.740	1.773	0.049	15.935
11/04/2016	1.697	1.729	1.759	0.062	15.921
12/04/2016	1.651	1.689	1.716	0.065	15.878
13/04/2016	1.638	1.646	1.660	0.022	15.822
14/04/2016	1.638	1.660	1.690	0.052	15.852
15/04/2016	1.615	1.665	1.689	0.074	15.851
16/04/2016	1.608	1.622	1.634	0.026	15.796
17/04/2016	1.592	1.612	1.624	0.032	15.786
18/04/2016	1.587	1.606	1.617	0.030	15.779
19/04/2016	1.610	1.615	1.622	0.012	15.784
20/04/2016	1.605	1.611	1.616	0.011	15.778
21/04/2016	1.607	1.621	1.629	0.022	15.791
22/04/2016	1.628	1.650	1.668	0.040	15.830
23/04/2016	1.632	1.646	1.655	0.023	15.817
24/04/2016	1.610	1.630	1.646	0.036	15.808
25/04/2016	1.618	1.636	1.659	0.041	15.821
26/04/2016	1.617	1.641	1.667	0.050	15.829
27/04/2016	1.605	1.631	1.658	0.053	15.820
28/04/2016	1.592	1.616	1.633	0.041	15.795
29/04/2016	1.592	1.623	1.647	0.055	15.809
30/04/2016	1.632	1.669	1.703	0.071	15.865
01/05/2016	1.632	1.679	1.752	0.120	15.914
02/05/2016	1.752	1.827	1.864	0.112	16.026

03/05/2016	1.859	1.876	1.899	0.040	16.061
04/05/2016	1.812	1.833	1.873	0.061	16.035
05/05/2016	1.793	1.817	1.847	0.054	16.009
06/05/2016	1.739	1.780	1.809	0.070	15.971
07/05/2016	1.693	1.725	1.754	0.061	15.916
08/05/2016	1.635	1.673	1.694	0.059	15.856
09/05/2016	1.617	1.644	1.670	0.053	15.832
10/05/2016	1.581	1.630	1.655	0.074	15.817
11/05/2016	1.554	1.585	1.602	0.048	15.764
12/05/2016	1.556	1.585	1.610	0.054	15.772
13/05/2016	1.597	1.613	1.624	0.027	15.786
14/05/2016	1.610	1.626	1.647	0.037	15.809
15/05/2016	1.608	1.629	1.648	0.040	15.810
16/05/2016	1.610	1.637	1.663	0.053	15.825
17/05/2016	1.645	1.658	1.674	0.029	15.836
18/05/2016	1.648	1.656	1.663	0.015	15.825
19/05/2016	1.646	1.665	1.692	0.046	15.854
20/05/2016	1.594	1.656	1.685	0.091	15.847
21/05/2016	1.600	1.676	1.738	0.138	15.900
22/05/2016	1.705	1.736	1.759	0.054	15.921
23/05/2016	1.687	1.702	1.713	0.026	15.875
24/05/2016	1.627	1.674	1.703	0.076	15.865
25/05/2016	1.624	1.641	1.651	0.027	15.813
26/05/2016	1.632	1.645	1.660	0.028	15.822
27/05/2016	1.632	1.643	1.649	0.017	15.811
28/05/2016	1.584	1.604	1.634	0.050	15.796
29/05/2016	1.531	1.574	1.592	0.061	15.754
30/05/2016	1.470	1.520	1.547	0.077	15.709
31/05/2016	1.473	1.502	1.531	0.058	15.693
01/06/2016	1.460	1.486	1.504	0.044	15.666
02/06/2016	1.471	1.502	1.527	0.056	15.689
03/06/2016	1.516	1.527	1.540	0.024	15.702
04/06/2016	1.519	1.545	1.558	0.039	15.720
05/06/2016	1.469	1.495	1.520	0.051	15.682
06/06/2016	1.460	1.481	1.509	0.049	15.671
07/06/2016	1.454	1.501	1.537	0.083	15.699
08/06/2016	1.518	1.540	1.576	0.058	15.738

09/06/2016	1.502	1.517	1.529	0.027	15.691
10/06/2016	1.509	1.531	1.553	0.044	15.715
11/06/2016	1.524	1.552	1.573	0.049	15.735
12/06/2016	1.532	1.567	1.599	0.067	15.761
13/06/2016	1.507	1.540	1.562	0.055	15.724
14/06/2016	1.510	1.521	1.542	0.032	15.704
15/06/2016	1.528	1.568	1.597	0.069	15.759
16/06/2016	1.596	1.622	1.640	0.044	15.802
17/06/2016	1.591	1.613	1.623	0.032	15.785
18/06/2016	1.555	1.598	1.624	0.069	15.786
19/06/2016	1.480	1.529	1.564	0.084	15.726
20/06/2016	1.487	1.506	1.515	0.028	15.677
21/06/2016	1.474	1.494	1.510	0.036	15.672
22/06/2016	1.478	1.504	1.515	0.037	15.677
23/06/2016	1.507	1.522	1.537	0.030	15.699
24/06/2016	1.537	1.563	1.586	0.049	15.748
25/06/2016	1.582	1.592	1.598	0.016	15.760
26/06/2016	1.560	1.587	1.605	0.045	15.767
27/06/2016	1.550	1.558	1.567	0.017	15.729
28/06/2016	1.543	1.557	1.574	0.031	15.736
29/06/2016	1.566	1.575	1.583	0.017	15.745
30/06/2016	1.567	1.582	1.591	0.024	15.753
01/07/2016	1.581	1.611	1.628	0.047	15.790
02/07/2016	1.616	1.643	1.662	0.046	15.824
03/07/2016	1.647	1.656	1.664	0.017	15.826
04/07/2016	1.644	1.655	1.664	0.020	15.826
05/07/2016	1.651	1.656	1.661	0.010	15.823
06/07/2016	1.649	1.656	1.666	0.017	15.828
07/07/2016	1.656	1.669	1.679	0.023	15.841
08/07/2016	1.672	1.680	1.689	0.017	15.851
09/07/2016	1.668	1.684	1.699	0.031	15.861
10/07/2016	1.689	1.701	1.711	0.022	15.873
11/07/2016	1.702	1.709	1.716	0.014	15.878
12/07/2016	1.685	1.707	1.722	0.037	15.884
13/07/2016	1.637	1.661	1.686	0.049	15.848
14/07/2016	1.637	1.653	1.681	0.044	15.843
15/07/2016	1.654	1.692	1.710	0.056	15.872

16/07/2016	1.667	1.686	1.699	0.032	15.861
17/07/2016	1.658	1.674	1.684	0.026	15.846
18/07/2016	1.661	1.686	1.708	0.047	15.870
19/07/2016	1.692	1.716	1.730	0.038	15.892
20/07/2016	1.713	1.770	1.794	0.081	15.956
21/07/2016	1.752	1.769	1.784	0.032	15.946
22/07/2016	1.716	1.747	1.763	0.047	15.925
23/07/2016	1.699	1.716	1.727	0.028	15.889
24/07/2016	1.684	1.700	1.711	0.027	15.873
25/07/2016	1.620	1.657	1.688	0.068	15.850
26/07/2016	1.548	1.588	1.621	0.073	15.783
27/07/2016	1.513	1.544	1.561	0.048	15.723
28/07/2016	1.476	1.495	1.515	0.039	15.677
29/07/2016	1.480	1.500	1.511	0.031	15.673
30/07/2016	1.480	1.493	1.504	0.024	15.666
31/07/2016	1.423	1.473	1.498	0.075	15.660
01/08/2016	1.425	1.485	1.522	0.097	15.684
02/08/2016	1.451	1.467	1.485	0.034	15.647
03/08/2016	1.454	1.472	1.493	0.039	15.655
04/08/2016	1.471	1.522	1.554	0.083	15.716
05/08/2016	1.535	1.576	1.593	0.058	15.755
06/08/2016	1.566	1.610	1.649	0.083	15.811
07/08/2016	1.565	1.637	1.699	0.134	15.861
08/08/2016	1.698	1.739	1.768	0.070	15.930
09/08/2016	1.728	1.758	1.782	0.054	15.944
10/08/2016	1.719	1.739	1.750	0.031	15.912
11/08/2016	1.729	1.745	1.759	0.030	15.921
12/08/2016	1.718	1.740	1.753	0.035	15.915
13/08/2016	1.713	1.734	1.774	0.061	15.936
14/08/2016	1.648	1.710	1.742	0.094	15.904
15/08/2016	1.617	1.635	1.648	0.031	15.810
16/08/2016	1.591	1.609	1.623	0.032	15.785
17/08/2016	1.554	1.577	1.592	0.038	15.754
18/08/2016	1.505	1.536	1.554	0.049	15.716
19/08/2016	1.486	1.499	1.513	0.027	15.675
20/08/2016	1.459	1.485	1.499	0.040	15.661
21/08/2016	1.459	1.488	1.518	0.059	15.680

22/08/2016	1.439	1.467	1.484	0.045	15.646
23/08/2016	1.442	1.455	1.471	0.029	15.633
24/08/2016	1.452	1.500	1.553	0.101	15.715
25/08/2016	1.481	1.527	1.560	0.079	15.722
26/08/2016	1.493	1.518	1.533	0.040	15.695
27/08/2016	1.477	1.497	1.517	0.040	15.679
28/08/2016	1.468	1.487	1.505	0.037	15.667
29/08/2016	1.468	1.482	1.497	0.029	15.659
30/08/2016	1.486	1.495	1.503	0.017	15.665
31/08/2016	1.491	1.504	1.518	0.027	15.680
01/09/2016	1.511	1.521	1.537	0.026	15.699
02/09/2016	1.525	1.550	1.575	0.050	15.737
03/09/2016	1.572	1.606	1.629	0.057	15.791
04/09/2016	1.593	1.641	1.674	0.081	15.836
05/09/2016	1.564	1.617	1.645	0.081	15.807
06/09/2016	1.542	1.565	1.576	0.034	15.738
07/09/2016	1.557	1.598	1.640	0.083	15.802
08/09/2016	1.589	1.610	1.627	0.038	15.789
09/09/2016	1.593	1.615	1.634	0.041	15.796
10/09/2016	1.627	1.659	1.685	0.058	15.847
11/09/2016	1.612	1.634	1.686	0.074	15.848
12/09/2016	1.624	1.663	1.692	0.068	15.854
13/09/2016	1.678	1.731	1.769	0.091	15.931
14/09/2016	1.655	1.690	1.720	0.065	15.882
15/09/2016	1.657	1.694	1.733	0.076	15.895
16/09/2016	1.619	1.666	1.694	0.075	15.856
17/09/2016	1.578	1.612	1.633	0.055	15.795
18/09/2016	1.511	1.560	1.596	0.085	15.758
19/09/2016	1.499	1.536	1.565	0.066	15.727
20/09/2016	1.545	1.569	1.599	0.054	15.761
21/09/2016	1.545	1.574	1.601	0.056	15.763
22/09/2016	1.539	1.570	1.629	0.090	15.791
23/09/2016	1.626	1.641	1.656	0.030	15.818
24/09/2016	1.652	1.687	1.715	0.063	15.877
25/09/2016	1.700	1.719	1.730	0.030	15.892
26/09/2016	1.724	1.741	1.758	0.034	15.920
27/09/2016	1.682	1.705	1.741	0.059	15.903

28/09/2016	1.689	1.725	1.768	0.079	15.930
29/09/2016	1.762	1.897	1.947	0.185	16.109
30/09/2016	1.838	1.896	1.940	0.102	16.102
01/10/2016	1.754	1.826	1.861	0.107	16.023
02/10/2016	1.689	1.735	1.758	0.069	15.920
03/10/2016	1.605	1.643	1.690	0.085	15.852
04/10/2016	1.559	1.573	1.609	0.050	15.771
05/10/2016	1.532	1.546	1.564	0.032	15.726
06/10/2016	1.523	1.554	1.587	0.064	15.749
07/10/2016	1.554	1.598	1.625	0.071	15.787
08/10/2016	1.500	1.537	1.563	0.063	15.725
09/10/2016	1.420	1.471	1.501	0.081	15.663
10/10/2016	1.434	1.457	1.477	0.043	15.639
11/10/2016	1.467	1.485	1.513	0.046	15.675
12/10/2016	1.475	1.496	1.520	0.045	15.682
13/10/2016	1.477	1.492	1.512	0.035	15.674
14/10/2016	1.475	1.544	1.574	0.099	15.736
15/10/2016	1.541	1.579	1.616	0.075	15.778
16/10/2016	1.471	1.511	1.541	0.070	15.703
17/10/2016	1.471	1.512	1.547	0.076	15.709
18/10/2016	1.533	1.563	1.584	0.051	15.746
19/10/2016	1.561	1.585	1.609	0.048	15.771
20/10/2016	1.567	1.598	1.626	0.059	15.788
21/10/2016	1.577	1.588	1.598	0.021	15.760
22/10/2016	1.583	1.611	1.629	0.046	15.791
23/10/2016	1.566	1.598	1.612	0.046	15.774
24/10/2016	1.566	1.604	1.641	0.075	15.803
25/10/2016	1.569	1.592	1.619	0.050	15.781
26/10/2016	1.525	1.566	1.586	0.061	15.748
27/10/2016	1.470	1.508	1.542	0.072	15.704
28/10/2016	1.481	1.519	1.548	0.067	15.710
29/10/2016	1.526	1.535	1.545	0.019	15.707
30/10/2016	1.518	1.530	1.540	0.022	15.702
31/10/2016	1.529	1.573	1.608	0.079	15.770
01/11/2016	1.569	1.587	1.597	0.028	15.759
02/11/2016	1.569	1.590	1.605	0.036	15.767
03/11/2016	1.597	1.621	1.648	0.051	15.810

04/11/2016	1.594	1.607	1.621	0.027	15.783
05/11/2016	1.565	1.589	1.611	0.046	15.773
06/11/2016	1.517	1.539	1.565	0.048	15.727
07/11/2016	1.503	1.520	1.543	0.040	15.705
08/11/2016	1.523	1.580	1.625	0.102	15.787
09/11/2016	1.539	1.562	1.584	0.045	15.746
10/11/2016	1.540	1.564	1.590	0.050	15.752
11/11/2016	1.575	1.591	1.611	0.036	15.773
12/11/2016	1.608	1.639	1.656	0.048	15.818
13/11/2016	1.598	1.654	1.695	0.097	15.857
14/11/2016	1.602	1.640	1.678	0.076	15.840
15/11/2016	1.644	1.685	1.720	0.076	15.882
16/11/2016	1.689	1.715	1.739	0.050	15.901
17/11/2016	1.734	1.766	1.796	0.062	15.958
18/11/2016	1.696	1.736	1.766	0.070	15.928
19/11/2016	1.632	1.677	1.700	0.068	15.862
20/11/2016	1.572	1.631	1.661	0.089	15.823
21/11/2016	1.516	1.560	1.580	0.064	15.742
22/11/2016	1.520	1.536	1.559	0.039	15.721
23/11/2016	1.513	1.530	1.552	0.039	15.714
24/11/2016	1.522	1.560	1.595	0.073	15.757
25/11/2016	1.518	1.543	1.565	0.047	15.727
26/11/2016	1.507	1.547	1.583	0.076	15.745
27/11/2016	1.506	1.531	1.552	0.046	15.714
28/11/2016	1.523	1.561	1.591	0.068	15.753
29/11/2016	1.583	1.603	1.624	0.041	15.786
30/11/2016	1.532	1.575	1.597	0.065	15.759
01/12/2016	1.533	1.550	1.570	0.037	15.732
02/12/2016	1.541	1.577	1.593	0.052	15.755
03/12/2016	1.471	1.518	1.544	0.073	15.706
04/12/2016	1.442	1.463	1.473	0.031	15.635
05/12/2016	1.439	1.473	1.498	0.059	15.660
06/12/2016	1.495	1.535	1.569	0.074	15.731
07/12/2016	1.518	1.564	1.600	0.082	15.762
08/12/2016	1.592	1.627	1.657	0.065	15.819
09/12/2016	1.652	1.692	1.721	0.069	15.883
10/12/2016	1.609	1.676	1.705	0.096	15.867

11/12/2016	1.605	1.641	1.675	0.070	15.837
12/12/2016	1.620	1.652	1.682	0.062	15.844
13/12/2016	1.544	1.609	1.635	0.091	15.797
14/12/2016	1.535	1.547	1.559	0.024	15.721
15/12/2016	1.524	1.536	1.544	0.020	15.706
16/12/2016	1.523	1.554	1.580	0.057	15.742
17/12/2016	1.557	1.584	1.613	0.056	15.775
18/12/2016	1.556	1.581	1.613	0.057	15.775
19/12/2016	1.556	1.572	1.588	0.032	15.750
20/12/2016	1.572	1.599	1.629	0.057	15.791
21/12/2016	1.601	1.679	1.726	0.125	15.888
22/12/2016	1.674	1.732	1.773	0.099	15.935
23/12/2016	1.719	1.834	1.905	0.186	16.067
24/12/2016	1.850	1.877	1.903	0.053	16.065
25/12/2016	1.871	1.979	2.039	0.168	16.201
26/12/2016	1.905	1.944	1.973	0.068	16.135
27/12/2016	1.864	1.916	1.956	0.092	16.118
28/12/2016	1.791	1.841	1.874	0.083	16.036
29/12/2016	1.772	1.804	1.831	0.059	15.993
30/12/2016	1.780	1.860	1.975	0.195	16.137
31/12/2016	1.975	2.117	2.177	0.202	16.339
01/01/2017	1.967	2.045	2.116	0.149	16.278
02/01/2017	1.836	1.912	1.967	0.131	16.129
03/01/2017	1.739	1.784	1.837	0.098	15.999
04/01/2017	1.712	1.741	1.753	0.041	15.915
05/01/2017	1.736	1.747	1.762	0.026	15.924
06/01/2017	1.736	1.767	1.792	0.056	15.954
07/01/2017	1.701	1.745	1.774	0.073	15.936
08/01/2017	1.660	1.693	1.720	0.060	15.882
09/01/2017	1.670	1.714	1.739	0.069	15.901
10/01/2017	1.732	1.779	1.827	0.095	15.989
11/01/2017	1.766	1.796	1.828	0.062	15.990
12/01/2017	1.786	1.830	1.866	0.080	16.028
13/01/2017	1.760	1.802	1.826	0.066	15.988
14/01/2017	1.721	1.750	1.766	0.045	15.928
15/01/2017	1.723	1.788	1.834	0.111	15.996
16/01/2017	1.811	1.844	1.881	0.070	16.043

17/01/2017	1.773	1.824	1.851	0.078	16.013
18/01/2017	1.738	1.764	1.781	0.043	15.943
19/01/2017	1.705	1.738	1.757	0.052	15.919
20/01/2017	1.629	1.695	1.723	0.094	15.885
21/01/2017	1.610	1.648	1.674	0.064	15.836
22/01/2017	1.550	1.589	1.615	0.065	15.777
23/01/2017	1.543	1.571	1.608	0.065	15.770
24/01/2017	1.481	1.537	1.576	0.095	15.738
25/01/2017	1.474	1.489	1.508	0.034	15.670
26/01/2017	1.474	1.508	1.528	0.054	15.690
27/01/2017	1.495	1.518	1.545	0.050	15.707
28/01/2017	1.490	1.512	1.534	0.044	15.696
29/01/2017	1.482	1.506	1.530	0.048	15.692
30/01/2017	1.466	1.491	1.511	0.045	15.673
31/01/2017	1.455	1.494	1.527	0.072	15.689
01/02/2017	1.474	1.496	1.513	0.039	15.675
02/02/2017	1.463	1.482	1.504	0.041	15.666
03/02/2017	1.470	1.508	1.541	0.071	15.703
04/02/2017	1.524	1.577	1.609	0.085	15.771
05/02/2017	1.592	1.622	1.643	0.051	15.805
06/02/2017	1.613	1.631	1.645	0.032	15.807
07/02/2017	1.595	1.623	1.652	0.057	15.814
08/02/2017	1.566	1.602	1.625	0.059	15.787
09/02/2017	1.539	1.580	1.614	0.075	15.776
10/02/2017	1.526	1.571	1.591	0.065	15.753
11/02/2017	1.513	1.536	1.545	0.032	15.707
12/02/2017	1.473	1.507	1.529	0.056	15.691
13/02/2017	1.450	1.470	1.488	0.038	15.650
14/02/2017	1.451	1.473	1.494	0.043	15.656
15/02/2017	1.456	1.474	1.489	0.033	15.651
16/02/2017	1.466	1.516	1.555	0.089	15.717
17/02/2017	1.555	1.583	1.614	0.059	15.776
18/02/2017	1.591	1.624	1.663	0.072	15.825
19/02/2017	1.616	1.696	1.747	0.131	15.909
20/02/2017	1.653	1.663	1.676	0.023	15.838
21/02/2017	1.676	1.715	1.742	0.066	15.904
22/02/2017	1.719	1.751	1.779	0.060	15.941

23/02/2017	1.759	1.808	1.831	0.072	15.993							
24/02/2017	1.773	1.788	1.806	0.033	15.968							
25/02/2017	1.776	1.882	1.920	0.144	16.082							
26/02/2017	1.863	1.874	1.891	0.028	16.053							
27/02/2017	1.847	1.891	1.915	0.068	16.077							
28/02/2017	1.774	1.825	1.850	0.076	16.012							
01/03/2017	1.696	1.743	1.794	0.098	15.956							
02/03/2017	1.630	1.650	1.696	0.066	15.858							
03/03/2017	1.581	1.631	1.655	0.074	15.817							
04/03/2017	1.573	1.611	1.632	0.059	15.794							
05/03/2017	1.614	1.628	1.641	0.027	15.803							
06/03/2017	1.589	1.618	1.633	0.044	15.795							
07/03/2017	1.623	1.645	1.675	0.052	15.837							
08/03/2017	1.668	1.703	1.739	0.071	15.901							
09/03/2017	1.703	1.750	1.786	0.083	15.948							
10/03/2017	1.749	1.768	1.778	0.029	15.940							
11/03/2017	1.739	1.755	1.762	0.023	15.924							
12/03/2017	1.722	1.734	1.745	0.023	15.907							
13/03/2017	1.657	1.707	1.734	0.077	15.896							
14/03/2017	1.659	1.682	1.702	0.043	15.864							
15/03/2017	1.697	1.716	1.735	0.038	15.897							
16/03/2017	1.708	1.719	1.741	0.033	15.903							
17/03/2017	1.741	1.789	1.821	0.080	15.983							
18/03/2017	1.804	1.828	1.853	0.049	16.015							
19/03/2017	1.794	1.803	1.811	0.017	15.973							
20/03/2017	1.780	1.807	1.834	0.054	15.996							
21/03/2017	1.807	1.823	1.840	0.033	16.002							
22/03/2017	1.743	1.790	1.821	0.078	15.983							
23/03/2017	1.742	1.760	1.784	0.042	15.946							
24/03/2017	1.762	1.793	1.826	0.064	15.988							
25/03/2017	1.708	1.737	1.766	0.058	15.928							
26/03/2017	1.666	1.687	1.712	0.046	15.874							
27/03/2017	1.684	1.712	1.733	0.049	15.895							
28/03/2017	1.673	1.685	1.700	0.027	15.862							
29/03/2017	1.651	1.670	1.684	0.033	15.846							
30/03/2017	1.644	1.681	1.705	0.061	15.867							
31/03/2017	1.645	1.667	1.704	0.059	15.866	31/03/2017	1.645	1.654	1.670	0.000	0.013	0.034

01/04/2017	1.670	1.691	1.708	0.038	15.870	01/04/2017	1.658	1.683	1.708	0.012	0.008	0.000
02/04/2017	1.673	1.714	1.748	0.075	15.910	02/04/2017	1.670	1.704	1.748	0.003	0.010	0.000
03/04/2017	1.643	1.682	1.708	0.065	15.870	03/04/2017	1.679	1.700	1.735	-0.036	-0.018	-0.027
04/04/2017	1.575	1.631	1.660	0.085	15.822	04/04/2017	1.639	1.655	1.680	-0.064	-0.024	-0.020
05/04/2017	1.575	1.588	1.599	0.024	15.761	05/04/2017	1.575	1.593	1.638	0.000	-0.005	-0.039
06/04/2017	1.577	1.586	1.599	0.022	15.761	06/04/2017	1.575	1.584	1.599	-0.002	-0.002	0.000
07/04/2017	1.583	1.593	1.600	0.017	15.762	07/04/2017	1.585	1.594	1.600	-0.002	-0.001	0.000
08/04/2017	1.589	1.606	1.626	0.037	15.788	08/04/2017	1.583	1.596	1.611	-0.006	-0.010	-0.015
09/04/2017	1.558	1.589	1.634	0.076	15.796	09/04/2017	1.581	1.608	1.634	-0.023	-0.019	-0.000
10/04/2017	1.547	1.559	1.569	0.022	15.731	10/04/2017	1.553	1.563	1.580	-0.006	-0.004	-0.011
11/04/2017	1.508	1.538	1.568	0.060	15.730	11/04/2017	1.508	1.541	1.569	0.000	-0.003	-0.001
12/04/2017	1.560	1.594	1.620	0.060	15.782	12/04/2017	1.527	1.567	1.615	0.033	0.027	0.005
13/04/2017	1.613	1.648	1.682	0.069	15.844	13/04/2017	1.607	1.639	1.682	0.006	0.009	0.000
14/04/2017	1.613	1.645	1.678	0.065	15.840	14/04/2017	1.613	1.644	1.678	0.000	-0.001	-0.000
15/04/2017	1.578	1.600	1.624	0.046	15.786	15/04/2017	1.578	1.616	1.673	0.000	-0.016	-0.049
16/04/2017	1.551	1.591	1.615	0.064	15.777	16/04/2017	1.578	1.597	1.614	-0.027	-0.006	-0.001
17/04/2017	1.556	1.608	1.643	0.087	15.805	17/04/2017	1.551	1.596	1.643	0.005	-0.012	-0.000
18/04/2017	1.581	1.592	1.602	0.021	15.764	18/04/2017	1.581	1.595	1.638	0.000	-0.003	-0.036
19/04/2017	1.585	1.599	1.607	0.022	15.769	19/04/2017	1.585	1.597	1.607	0.000	-0.002	-0.000
20/04/2017	1.566	1.590	1.599	0.033	15.761	20/04/2017	1.585	1.596	1.607	-0.019	-0.006	-0.008
21/04/2017	1.547	1.561	1.574	0.027	15.736	21/04/2017	1.550	1.572	1.598	-0.003	-0.011	-0.024
22/04/2017	1.534	1.550	1.568	0.034	15.730	22/04/2017	1.541	1.553	1.569	-0.007	-0.003	-0.001
23/04/2017	1.519	1.530	1.542	0.023	15.704	23/04/2017	1.519	1.537	1.566	0.000	-0.007	-0.024
24/04/2017	1.510	1.536	1.555	0.045	15.717	24/04/2017	1.510	1.533	1.555	0.000	-0.003	-0.000
25/04/2017	1.505	1.537	1.557	0.052	15.719	25/04/2017	1.505	1.533	1.555	0.000	-0.004	-0.002

26/04/2017	1.548	1.570	1.587	0.039	15.749	26/04/2017	1.527	1.560	1.586	0.021	0.010	0.001
27/04/2017	1.557	1.576	1.600	0.043	15.762	27/04/2017	1.548	1.571	1.600	0.009	0.005	0.000
28/04/2017	1.586	1.613	1.641	0.055	15.803	28/04/2017	1.564	1.597	1.641	0.022	0.016	0.000
29/04/2017	1.594	1.613	1.630	0.036	15.792	29/04/2017	1.594	1.611	1.639	0.000	0.002	-0.009
30/04/2017	1.574	1.591	1.612	0.038	15.774	30/04/2017	1.585	1.607	1.630	-0.011	-0.016	-0.018
01/05/2017	1.542	1.568	1.597	0.055	15.759	01/05/2017	1.562	1.577	1.597	-0.020	-0.009	0.000
02/05/2017	1.543	1.566	1.579	0.036	15.741	02/05/2017	1.542	1.565	1.579	0.001	0.001	0.000
03/05/2017	1.548	1.559	1.570	0.022	15.732	03/05/2017	1.543	1.559	1.577	0.005	0.000	-0.007
04/05/2017	1.535	1.557	1.578	0.043	15.740	04/05/2017	1.535	1.559	1.578	0.000	-0.002	0.000
05/05/2017	1.537	1.558	1.574	0.037	15.736	05/05/2017	1.535	1.557	1.573	0.002	0.001	0.001
06/05/2017	1.540	1.578	1.600	0.060	15.762	06/05/2017	1.538	1.563	1.598	0.002	-0.015	-0.002
07/05/2017	1.525	1.558	1.581	0.056	15.743	07/05/2017	1.549	1.576	1.600	-0.024	-0.018	-0.019
08/05/2017	1.527	1.564	1.601	0.074	15.763	08/05/2017	1.525	1.551	1.601	0.002	0.013	0.000
09/05/2017	1.574	1.607	1.626	0.052	15.788	09/05/2017	1.562	1.595	1.625	0.012	-0.012	-0.001
10/05/2017	1.584	1.594	1.607	0.023	15.769	10/05/2017	1.584	1.596	1.624	0.000	0.002	0.017
11/05/2017	1.596	1.616	1.642	0.046	15.804	11/05/2017	1.595	1.610	1.642	0.001	-0.006	0.000
12/05/2017	1.587	1.618	1.634	0.047	15.796	12/05/2017	1.596	1.619	1.634	-0.009	-0.001	-0.000
13/05/2017	1.546	1.581	1.611	0.065	15.773	13/05/2017	1.573	1.599	1.634	-0.027	-0.018	-0.023
14/05/2017	1.490	1.526	1.554	0.064	15.716	14/05/2017	1.519	1.546	1.588	-0.029	-0.020	-0.034
15/05/2017	1.410	1.473	1.508	0.098	15.670	15/05/2017	1.484	1.502	1.537	-0.074	-0.029	-0.029
16/05/2017	1.390	1.416	1.434	0.044	15.596	16/05/2017	1.410	1.427	1.477	-0.020	-0.011	0.043
17/05/2017	1.411	1.469	1.504	0.093	15.666	17/05/2017	1.390	1.447	1.504	0.021	-0.022	-0.000
18/05/2017	1.441	1.456	1.465	0.024	15.627	18/05/2017	1.452	1.461	1.483	-0.011	-0.005	0.018
19/05/2017	1.444	1.459	1.475	0.031	15.637	19/05/2017	1.441	1.458	1.475	0.003	0.001	0.000
20/05/2017	1.448	1.465	1.474	0.026	15.636	20/05/2017	1.444	1.461	1.474	0.004	0.004	0.000

										-	-	-
21/05/2017	1.402	1.434	1.458	0.056	15.620	21/05/2017	1.432	1.450	1.474	0.030	0.016	0.016
22/05/2017	1.417	1.440	1.463	0.046	15.625	22/05/2017	1.402	1.425	1.449	0.015	0.015	0.014
23/05/2017	1.454	1.483	1.514	0.060	15.676	23/05/2017	1.446	1.466	1.497	0.008	0.017	0.017
24/05/2017	1.508	1.534	1.563	0.055	15.725	24/05/2017	1.484	1.503	1.517	0.024	0.031	0.046
25/05/2017	1.559	1.579	1.600	0.041	15.762							
26/05/2017	1.571	1.589	1.608	0.037	15.770							
										-	-	
27/05/2017	1.556	1.604	1.631	0.075	15.793	27/05/2017	1.604	1.611	1.621	0.048	0.007	0.010
											-	-
28/05/2017	1.556	1.578	1.593	0.037	15.755	28/05/2017	1.556	1.581	1.618	0.000	0.003	0.025
29/05/2017	1.564	1.598	1.620	0.056	15.782	29/05/2017	1.560	1.593	1.620	0.004	0.005	0.000
										-	-	-
30/05/2017	1.525	1.546	1.576	0.051	15.738	30/05/2017	1.533	1.568	1.614	0.008	0.022	0.038
										-	-	-
31/05/2017	1.506	1.524	1.529	0.023	15.691	31/05/2017	1.524	1.528	1.538	0.018	0.004	0.009
										-	-	-
01/06/2017	1.485	1.505	1.515	0.030	15.677	01/06/2017	1.500	1.510	1.529	0.015	0.005	0.014
												-
02/06/2017	1.495	1.505	1.512	0.017	15.674	02/06/2017	1.485	1.505	1.515	0.010	0.000	0.003
03/06/2017	1.494	1.509	1.533	0.039	15.695	03/06/2017	1.494	1.505	1.532	0.000	0.004	0.001
04/06/2017	1.498	1.519	1.533	0.035	15.695	04/06/2017	1.498	1.516	1.533	0.000	0.003	0.000
05/06/2017	1.508	1.517	1.542	0.034	15.704	05/06/2017	1.507	1.515	1.530	0.001	0.002	0.012
06/06/2017	1.542	1.674	1.754	0.212	15.916	06/06/2017	1.508	1.587	1.720	0.034	0.087	0.034
07/06/2017	1.738	1.765	1.780	0.042	15.942	07/06/2017	1.730	1.757	1.780	0.008	0.008	0.000
											-	-
08/06/2017	1.731	1.746	1.768	0.037	15.930	08/06/2017	1.731	1.748	1.778	0.000	0.002	0.010
09/06/2017	1.768	1.802	1.826	0.058	15.988	09/06/2017	1.748	1.783	1.826	0.020	0.019	0.000
										-	-	-
10/06/2017	1.687	1.755	1.785	0.098	15.947	10/06/2017	1.765	1.786	1.821	0.078	0.031	0.036
										-	-	-
11/06/2017	1.652	1.680	1.706	0.054	15.868	11/06/2017	1.679	1.701	1.772	0.027	0.021	0.066
12/06/2017	1.656	1.685	1.713	0.057	15.875	12/06/2017	1.652	1.672	1.713	0.004	0.013	0.000
										-	-	
13/06/2017	1.684	1.695	1.713	0.029	15.875	13/06/2017	1.686	1.697	1.713	0.002	0.002	0.000
										-	-	
14/06/2017	1.653	1.689	1.710	0.057	15.872	14/06/2017	1.684	1.695	1.710	0.031	0.006	0.000
15/06/2017	1.673	1.701	1.722	0.049	15.884	15/06/2017	1.653	1.693	1.722	0.020	0.008	0.000

16/06/2017	1.671	1.705	1.725	0.054	15.887	16/06/2017	1.673	1.706	1.725	-0.002	-0.001	0.000
17/06/2017	1.653	1.670	1.693	0.040	15.855	17/06/2017	1.654	1.679	1.717	-0.001	-0.009	-0.024
18/06/2017	1.647	1.679	1.718	0.071	15.880	18/06/2017	1.653	1.674	1.706	-0.006	-0.005	0.012
19/06/2017	1.675	1.719	1.757	0.082	15.919	19/06/2017	1.647	1.708	1.757	0.028	-0.011	0.000
20/06/2017	1.631	1.661	1.682	0.051	15.844	20/06/2017	1.662	1.684	1.746	-0.031	-0.023	-0.064
21/06/2017	1.639	1.665	1.707	0.068	15.869	21/06/2017	1.631	1.657	1.707	0.008	-0.008	0.000
22/06/2017	1.562	1.623	1.650	0.088	15.812	22/06/2017	1.635	1.650	1.689	-0.073	-0.027	-0.039
23/06/2017	1.510	1.542	1.563	0.053	15.725	23/06/2017	1.540	1.567	1.638	-0.030	-0.025	-0.075
24/06/2017	1.499	1.516	1.529	0.030	15.691	24/06/2017	1.507	1.522	1.540	-0.008	-0.006	-0.011
25/06/2017	1.496	1.506	1.515	0.019	15.677	25/06/2017	1.499	1.510	1.525	-0.003	-0.004	-0.010
26/06/2017	1.490	1.518	1.540	0.050	15.702	26/06/2017	1.490	1.505	1.534	0.000	-0.013	-0.006
27/06/2017	1.528	1.559	1.591	0.063	15.753	27/06/2017	1.522	1.532	1.540	0.006	-0.027	0.051
28/06/2017	1.558	1.594	1.626	0.068	15.788	28/06/2017	1.547	1.590	1.626	0.011	-0.004	0.000
29/06/2017	1.556	1.599	1.672	0.116	15.834	29/06/2017	1.556	1.579	1.619	0.000	-0.020	-0.053
30/06/2017	1.672	1.744	1.777	0.105	15.939	30/06/2017	1.618	1.688	1.770	-0.054	-0.056	-0.007
01/07/2017	1.696	1.746	1.773	0.077	15.935	01/07/2017	1.747	1.766	1.777	-0.051	-0.020	-0.004
02/07/2017	1.667	1.680	1.700	0.033	15.862	02/07/2017	1.677	1.699	1.750	-0.010	-0.019	-0.050
03/07/2017	1.598	1.643	1.671	0.073	15.833	03/07/2017	1.651	1.666	1.683	-0.053	-0.023	-0.012
04/07/2017	1.543	1.578	1.606	0.063	15.768	04/07/2017	1.586	1.601	1.644	-0.043	-0.023	-0.038
05/07/2017	1.492	1.546	1.589	0.097	15.751	05/07/2017	1.543	1.561	1.589	-0.051	-0.015	0.000
06/07/2017	1.474	1.496	1.516	0.042	15.678	06/07/2017	1.487	1.507	1.560	-0.013	-0.011	-0.044
07/07/2017	1.444	1.476	1.496	0.052	15.658	07/07/2017	1.474	1.489	1.514	-0.030	-0.013	-0.018
08/07/2017	1.441	1.457	1.471	0.030	15.633	08/07/2017	1.441	1.457	1.480	0.000	0.000	-0.009
09/07/2017	1.459	1.474	1.493	0.034	15.655	09/07/2017	1.451	1.464	1.481	0.008	0.010	0.012

10/07/2017	1.493	1.520	1.543	0.050	15.705	10/07/2017	1.478	1.506	1.543	0.015	0.014	0.000
11/07/2017	1.505	1.524	1.533	0.028	15.695	11/07/2017	1.502	1.518	1.537	0.003	0.006	-0.004
12/07/2017	1.518	1.537	1.558	0.040	15.720	12/07/2017	1.518	1.530	1.547	0.000	0.007	0.011
13/07/2017	1.549	1.571	1.595	0.046	15.757	13/07/2017	1.542	1.563	1.595	0.007	0.008	0.000
14/07/2017	1.552	1.586	1.603	0.051	15.765	14/07/2017	1.549	1.583	1.603	0.003	0.003	0.000
15/07/2017	1.541	1.573	1.595	0.054	15.757	15/07/2017	1.541	1.569	1.601	0.000	0.004	-0.006
16/07/2017	1.530	1.569	1.596	0.066	15.758	16/07/2017	1.569	1.582	1.596	-0.039	-0.013	0.000
17/07/2017	1.528	1.555	1.570	0.042	15.732	17/07/2017	1.528	1.548	1.573	0.000	0.007	-0.003
18/07/2017	1.502	1.555	1.577	0.075	15.739	18/07/2017	1.555	1.565	1.577	-0.053	-0.010	0.000
19/07/2017	1.496	1.538	1.581	0.085	15.743	19/07/2017	1.496	1.526	1.571	0.000	0.012	0.010
20/07/2017	1.575	1.583	1.592	0.017	15.754	20/07/2017	1.556	1.576	1.591	-0.019	-0.007	-0.001
21/07/2017	1.520	1.555	1.579	0.059	15.741	21/07/2017	1.557	1.573	1.592	-0.037	-0.018	-0.013
22/07/2017	1.505	1.530	1.546	0.041	15.708	22/07/2017	1.520	1.533	1.557	-0.015	-0.003	-0.011
23/07/2017	1.464	1.497	1.518	0.054	15.680	23/07/2017	1.501	1.517	1.543	-0.037	-0.020	-0.025
24/07/2017	1.438	1.471	1.489	0.051	15.651	24/07/2017	1.464	1.480	1.501	-0.026	-0.009	-0.012
25/07/2017	1.456	1.487	1.499	0.043	15.661	25/07/2017	1.438	1.473	1.499	-0.018	-0.014	0.000
26/07/2017	1.446	1.484	1.511	0.065	15.673	26/07/2017	1.466	1.491	1.511	-0.020	-0.007	0.000
27/07/2017	1.468	1.519	1.558	0.090	15.720	27/07/2017	1.446	1.498	1.557	0.022	0.021	0.001
28/07/2017	1.502	1.553	1.591	0.089	15.753	28/07/2017	1.496	1.535	1.589	0.006	0.018	0.002
29/07/2017	1.524	1.572	1.618	0.094	15.780	29/07/2017	1.524	1.552	1.605	0.000	0.020	-0.013
30/07/2017	1.577	1.600	1.632	0.055	15.794	30/07/2017	1.577	1.601	1.631	0.000	-0.001	-0.001
31/07/2017	1.584	1.598	1.611	0.027	15.773	31/07/2017	1.582	1.600	1.628	0.002	0.002	0.017
01/08/2017	1.610	1.625	1.643	0.033	15.805	01/08/2017	1.584	1.611	1.635	0.026	0.014	0.008
02/08/2017	1.621	1.646	1.662	0.041	15.824	02/08/2017	1.620	1.639	1.662	0.001	0.007	0.000
03/08/2017	1.653	1.686	1.722	0.069	15.884	03/08/2017	1.641	1.671	1.719	0.012	0.015	0.003
04/08/2017	1.649	1.696	1.743	0.094	15.905	04/08/2017	1.649	1.683	1.743	0.000	0.013	0.000

05/08/2017	1.678	1.709	1.726	0.048	15.888	05/08/2017	1.690	1.714	1.741	-0.012	-0.005	-0.015
06/08/2017	1.590	1.646	1.682	0.092	15.844	06/08/2017	1.678	1.700	1.723	-0.088	-0.054	-0.041
07/08/2017	1.598	1.614	1.628	0.030	15.790	07/08/2017	1.590	1.618	1.649	-0.008	-0.004	-0.021
08/08/2017	1.590	1.602	1.611	0.021	15.773	08/08/2017	1.590	1.602	1.617	0.000	0.000	-0.006
09/08/2017	1.563	1.586	1.604	0.041	15.766	09/08/2017	1.581	1.597	1.610	-0.018	-0.011	-0.006
10/08/2017	1.495	1.554	1.596	0.101	15.758	10/08/2017	1.550	1.570	1.596	-0.055	-0.016	0.000
11/08/2017	1.479	1.501	1.515	0.036	15.677	11/08/2017	1.479	1.510	1.580	0.000	-0.009	-0.065
12/08/2017	1.483	1.507	1.528	0.045	15.690	12/08/2017	1.501	1.510	1.528	-0.018	-0.003	0.000
13/08/2017	1.480	1.500	1.522	0.042	15.684	13/08/2017	1.480	1.500	1.522	0.000	0.000	0.000
14/08/2017	1.468	1.503	1.534	0.066	15.696	14/08/2017	1.468	1.491	1.522	0.000	0.012	0.012
15/08/2017	1.522	1.544	1.570	0.048	15.732	15/08/2017	1.516	1.532	1.561	0.006	0.012	0.009
16/08/2017	1.561	1.586	1.660	0.099	15.822	16/08/2017	1.542	1.564	1.587	0.019	0.022	0.073
17/08/2017	1.658	1.679	1.706	0.048	15.868	17/08/2017	1.581	1.650	1.699	0.077	0.029	0.007
18/08/2017	1.679	1.728	1.778	0.099	15.940	18/08/2017	1.669	1.711	1.778	0.010	0.017	0.000
19/08/2017	1.672	1.688	1.712	0.040	15.874	19/08/2017	1.682	1.703	1.764	-0.010	-0.015	-0.052
20/08/2017	1.712	1.757	1.787	0.075	15.949	20/08/2017	1.672	1.734	1.787	0.040	0.023	0.000
21/08/2017	1.724	1.755	1.776	0.052	15.938	21/08/2017	1.724	1.744	1.782	0.000	-0.011	-0.006
22/08/2017	1.764	1.800	1.822	0.058	15.984	22/08/2017	1.766	1.794	1.822	-0.002	-0.006	0.000
23/08/2017	1.803	1.834	1.852	0.049	16.014	23/08/2017	1.764	1.813	1.852	0.039	0.021	0.000
24/08/2017	1.770	1.811	1.836	0.066	15.998	24/08/2017	1.818	1.830	1.847	-0.048	-0.019	-0.011
25/08/2017	1.783	1.806	1.821	0.038	15.983	25/08/2017	1.770	1.795	1.820	0.013	0.011	0.001
26/08/2017	1.784	1.813	1.828	0.044	15.990	26/08/2017	1.805	1.816	1.828	-0.021	-0.003	0.000
27/08/2017	1.724	1.771	1.802	0.078	15.964	27/08/2017	1.757	1.786	1.819	-0.033	-0.015	-0.017
28/08/2017	1.711	1.746	1.796	0.085	15.958	28/08/2017	1.711	1.750	1.801	0.000	-0.004	-0.005

29/08/2017	1.647	1.695	1.724	0.077	15.886	29/08/2017	1.694	1.725	1.788	-0.047	-0.030	-0.064
30/08/2017	1.634	1.652	1.667	0.033	15.829	30/08/2017	1.645	1.661	1.705	-0.011	-0.009	-0.038
31/08/2017	1.631	1.663	1.695	0.064	15.857	31/08/2017	1.631	1.652	1.692	0.000	-0.011	-0.003
01/09/2017	1.656	1.676	1.706	0.050	15.868	01/09/2017	1.654	1.675	1.706	-0.002	-0.001	0.000
02/09/2017	1.599	1.665	1.694	0.095	15.856	02/09/2017	1.656	1.673	1.694	-0.057	-0.008	0.000
03/09/2017	1.595	1.605	1.619	0.024	15.781	03/09/2017	1.595	1.621	1.693	0.000	-0.016	-0.074
04/09/2017	1.578	1.616	1.643	0.065	15.805	04/09/2017	1.595	1.616	1.643	-0.017	0.000	0.000
05/09/2017	1.583	1.614	1.637	0.054	15.799	05/09/2017	1.578	1.614	1.637	-0.005	0.000	0.000
06/09/2017	1.587	1.632	1.684	0.097	15.846	06/09/2017	1.583	1.609	1.649	-0.004	-0.023	-0.035
07/09/2017	1.682	1.714	1.746	0.064	15.908	07/09/2017	1.650	1.690	1.745	-0.032	-0.024	-0.001
08/09/2017	1.721	1.769	1.796	0.075	15.958	08/09/2017	1.699	1.741	1.787	-0.022	-0.028	-0.009
09/09/2017	1.796	1.828	1.854	0.058	16.016	09/09/2017	1.787	1.806	1.854	-0.009	-0.022	0.000
10/09/2017	1.822	1.850	1.886	0.064	16.048	10/09/2017	1.836	1.851	1.886	-0.014	-0.001	0.000
11/09/2017	1.755	1.813	1.838	0.083	16.000	11/09/2017	1.822	1.835	1.876	-0.067	-0.022	-0.038
12/09/2017	1.773	1.811	1.840	0.067	16.002	12/09/2017	1.755	1.795	1.840	-0.018	-0.016	0.000
13/09/2017	1.795	1.819	1.846	0.051	16.008	13/09/2017	1.802	1.822	1.846	-0.007	-0.003	0.000
14/09/2017	1.734	1.771	1.798	0.064	15.960	14/09/2017	1.763	1.795	1.842	-0.029	-0.024	-0.044
15/09/2017	1.688	1.734	1.768	0.080	15.930	15/09/2017	1.734	1.752	1.781	-0.046	-0.018	-0.013
16/09/2017	1.696	1.720	1.736	0.040	15.898	16/09/2017	1.688	1.712	1.736	-0.008	-0.008	0.000
17/09/2017	1.727	1.755	1.785	0.058	15.947	17/09/2017	1.720	1.748	1.785	-0.007	-0.007	0.000
18/09/2017	1.737	1.765	1.796	0.059	15.958	18/09/2017	1.727	1.760	1.796	-0.010	-0.005	0.000
19/09/2017	1.731	1.748	1.779	0.048	15.941	19/09/2017	1.731	1.746	1.790	0.000	-0.002	-0.011
20/09/2017	1.773	1.793	1.831	0.058	15.993	20/09/2017	1.750	1.774	1.807	-0.023	-0.019	-0.024
21/09/2017	1.830	1.875	1.909	0.079	16.071	21/09/2017	1.788	1.837	1.908	-0.042	-0.038	-0.001
22/09/2017	1.880	1.894	1.907	0.027	16.069	22/09/2017	1.882	1.896	1.908	-0.002	-0.002	-0.001
23/09/2017	1.794	1.849	1.882	0.088	16.044	23/09/2017	1.855	1.877	1.903	-0.061	-0.028	-0.021

24/09/2017	1.782	1.816	1.853	0.071	16.015	24/09/2017	1.792	1.820	1.856	-0.010	-0.004	-0.003
25/09/2017	1.797	1.814	1.837	0.040	15.999	25/09/2017	1.782	1.811	1.841	-0.015	-0.003	-0.004
26/09/2017	1.775	1.803	1.825	0.050	15.987	26/09/2017	1.797	1.812	1.834	-0.022	-0.009	-0.009
27/09/2017	1.746	1.776	1.808	0.062	15.970	27/09/2017	1.766	1.787	1.813	-0.020	-0.011	-0.005
28/09/2017	1.753	1.779	1.813	0.060	15.975	28/09/2017	1.746	1.771	1.813	-0.007	-0.008	-0.000
29/09/2017	1.779	1.797	1.821	0.042	15.983	29/09/2017	1.753	1.791	1.821	-0.026	-0.006	-0.000
30/09/2017	1.809	1.849	1.868	0.059	16.030	30/09/2017	1.779	1.821	1.868	-0.030	-0.028	-0.000
01/10/2017	1.808	1.829	1.872	0.064	16.034	01/10/2017	1.815	1.845	1.872	-0.007	-0.016	-0.000
02/10/2017	1.833	1.873	1.899	0.066	16.061	02/10/2017	1.808	1.848	1.881	-0.025	-0.025	-0.018
03/10/2017	1.899	1.935	1.958	0.059	16.120	03/10/2017	1.877	1.912	1.953	-0.022	-0.023	-0.005
04/10/2017	1.879	1.918	1.946	0.067	16.108	04/10/2017	1.921	1.935	1.951	-0.042	-0.017	-0.005
05/10/2017	1.878	1.894	1.918	0.040	16.080	05/10/2017	1.878	1.893	1.924	-0.000	-0.001	-0.006
06/10/2017	1.835	1.887	1.919	0.084	16.081	06/10/2017	1.882	1.900	1.919	-0.047	-0.013	-0.000
07/10/2017	1.790	1.814	1.835	0.045	15.997	07/10/2017	1.814	1.839	1.889	-0.024	-0.025	-0.054
08/10/2017	1.760	1.774	1.792	0.032	15.954	08/10/2017	1.772	1.787	1.812	-0.012	-0.013	-0.020
09/10/2017	1.752	1.759	1.770	0.018	15.932	09/10/2017	1.754	1.761	1.771	-0.002	-0.002	-0.001
10/10/2017	1.760	1.774	1.814	0.054	15.976	10/10/2017	1.752	1.766	1.781	0.008	0.008	0.033
11/10/2017	1.814	1.830	1.838	0.024	16.000	11/10/2017	1.764	1.811	1.838	0.050	0.019	0.000
12/10/2017	1.819	1.833	1.864	0.045	16.026	12/10/2017	1.819	1.831	1.844	0.000	0.002	0.020
13/10/2017	1.858	1.912	1.937	0.079	16.099	13/10/2017	1.822	1.883	1.937	0.036	0.029	0.000
14/10/2017	1.829	1.871	1.915	0.086	16.077	14/10/2017	1.860	1.890	1.919	-0.031	-0.019	-0.004
15/10/2017	1.792	1.815	1.844	0.052	16.006	15/10/2017	1.799	1.835	1.915	-0.007	-0.020	-0.071
16/10/2017	1.802	1.822	1.849	0.047	16.011	16/10/2017	1.795	1.814	1.832	0.007	0.008	0.017
17/10/2017	1.838	1.850	1.862	0.024	16.024	17/10/2017	1.812	1.840	1.862	-0.026	-0.010	-0.000
18/10/2017	1.815	1.850	1.878	0.063	16.040	18/10/2017	1.843	1.859	1.878	-0.028	-0.009	0.000

19/10/2017	1.764	1.797	1.820	0.056	15.982	19/10/2017	1.799	1.816	1.861	-0.035	-0.019	-0.041
20/10/2017	1.747	1.783	1.801	0.054	15.963	20/10/2017	1.764	1.787	1.804	-0.017	-0.004	-0.003
21/10/2017	1.735	1.757	1.774	0.039	15.936	21/10/2017	1.747	1.765	1.798	-0.012	-0.008	-0.024
22/10/2017	1.711	1.731	1.746	0.035	15.908	22/10/2017	1.724	1.739	1.762	-0.013	-0.008	-0.016
23/10/2017	1.693	1.736	1.778	0.085	15.940	23/10/2017	1.711	1.737	1.778	-0.018	-0.001	0.000
24/10/2017	1.698	1.734	1.775	0.077	15.937	24/10/2017	1.693	1.721	1.762	0.005	0.013	0.013
25/10/2017	1.747	1.772	1.789	0.042	15.951	25/10/2017	1.740	1.769	1.789	0.007	0.003	0.000
26/10/2017	1.761	1.787	1.802	0.041	15.964	26/10/2017	1.747	1.776	1.802	0.014	0.011	0.000
27/10/2017	1.720	1.759	1.784	0.064	15.946	27/10/2017	1.759	1.778	1.797	-0.039	-0.019	-0.013
28/10/2017	1.610	1.683	1.733	0.123	15.895	28/10/2017	1.697	1.722	1.765	-0.087	-0.039	-0.032
29/10/2017	1.606	1.645	1.672	0.066	15.834	29/10/2017	1.606	1.634	1.691	0.000	0.011	-0.019
30/10/2017	1.660	1.689	1.710	0.050	15.872	30/10/2017	1.660	1.678	1.708	0.000	0.011	0.002
31/10/2017	1.652	1.690	1.718	0.066	15.880	31/10/2017	1.680	1.697	1.718	-0.028	-0.007	0.000
01/11/2017	1.664	1.705	1.732	0.068	15.894	01/11/2017	1.652	1.692	1.732	0.012	0.013	0.000
02/11/2017	1.704	1.730	1.756	0.052	15.918	02/11/2017	1.699	1.724	1.756	0.005	0.006	0.000
03/11/2017	1.671	1.696	1.712	0.041	15.874	03/11/2017	1.685	1.709	1.754	-0.014	-0.013	-0.042
04/11/2017	1.675	1.712	1.733	0.058	15.895	04/11/2017	1.671	1.697	1.724	0.004	0.015	0.009
05/11/2017	1.721	1.738	1.750	0.029	15.912	05/11/2017	1.721	1.733	1.750	0.000	0.005	0.000
06/11/2017	1.726	1.741	1.789	0.063	15.951	06/11/2017	1.731	1.741	1.753	-0.005	0.000	0.036
07/11/2017	1.789	1.820	1.836	0.047	15.998	07/11/2017	1.726	1.788	1.836	0.063	0.032	0.000
08/11/2017	1.748	1.801	1.860	0.112	16.022	08/11/2017	1.788	1.823	1.860	-0.040	-0.022	0.000
09/11/2017	1.735	1.757	1.780	0.045	15.942	09/11/2017	1.746	1.763	1.785	-0.011	-0.006	-0.005
10/11/2017	1.738	1.791	1.817	0.079	15.979	10/11/2017	1.735	1.769	1.814	0.003	0.022	0.003
11/11/2017	1.744	1.795	1.823	0.079	15.985	11/11/2017	1.783	1.801	1.823	-0.039	-0.006	0.000

											-	-
12/11/2017	1.724	1.737	1.748	0.024	15.910	12/11/2017	1.724	1.758	1.819	0.000	0.021	0.071
13/11/2017	1.725	1.747	1.765	0.040	15.927	13/11/2017	1.725	1.738	1.757	0.000	0.009	0.008
										-	-	
14/11/2017	1.740	1.757	1.768	0.028	15.930	14/11/2017	1.748	1.760	1.768	0.008	0.003	0.000
										-	-	
15/11/2017	1.710	1.750	1.776	0.066	15.938	15/11/2017	1.740	1.755	1.776	0.030	0.005	0.000
16/11/2017	1.712	1.771	1.810	0.098	15.972	16/11/2017	1.710	1.749	1.810	0.002	0.022	0.000
											-	-
17/11/2017	1.765	1.780	1.795	0.030	15.957	17/11/2017	1.765	1.788	1.810	0.000	0.008	0.015
										-	-	
18/11/2017	1.740	1.774	1.809	0.069	15.971	18/11/2017	1.765	1.780	1.809	0.025	0.006	0.000
												-
19/11/2017	1.736	1.759	1.777	0.041	15.939	19/11/2017	1.736	1.756	1.790	0.000	0.003	0.013
20/11/2017	1.757	1.797	1.821	0.064	15.983	20/11/2017	1.754	1.780	1.821	0.003	0.017	0.000
21/11/2017	1.806	1.892	1.969	0.163	16.131	21/11/2017	1.802	1.832	1.930	0.004	0.060	0.039
										-	-	
22/11/2017	1.898	1.940	1.971	0.073	16.133	22/11/2017	1.937	1.955	1.971	0.039	0.015	0.000
										-	-	-
23/11/2017	1.830	1.881	1.916	0.086	16.078	23/11/2017	1.881	1.904	1.944	0.051	0.023	0.028
										-	-	-
24/11/2017	1.763	1.810	1.844	0.081	16.006	24/11/2017	1.807	1.837	1.891	0.044	0.027	0.047
										-	-	-
25/11/2017	1.693	1.738	1.767	0.074	15.929	25/11/2017	1.734	1.762	1.809	0.041	0.024	0.042
										-	-	-
26/11/2017	1.680	1.704	1.718	0.038	15.880	26/11/2017	1.693	1.712	1.750	0.013	0.008	0.032
27/11/2017	1.693	1.736	1.792	0.099	15.954	27/11/2017	1.680	1.713	1.753	0.013	0.023	0.039
										-	-	
28/11/2017	1.690	1.761	1.802	0.112	15.964	28/11/2017	1.747	1.778	1.802	0.057	0.017	0.000
										-	-	-
29/11/2017	1.660	1.682	1.692	0.032	15.854	29/11/2017	1.679	1.698	1.763	0.019	0.016	0.071
										-	-	-
30/11/2017	1.655	1.663	1.668	0.013	15.830	30/11/2017	1.658	1.668	1.687	0.003	0.005	0.019
										-	-	-
01/12/2017	1.634	1.647	1.656	0.022	15.818	01/12/2017	1.646	1.654	1.668	0.012	0.007	0.012
02/12/2017	1.641	1.669	1.701	0.060	15.863	02/12/2017	1.634	1.651	1.688	0.007	0.018	0.013
03/12/2017	1.698	1.731	1.743	0.045	15.905	03/12/2017	1.681	1.713	1.743	0.017	0.018	0.000
04/12/2017	1.727	1.772	1.801	0.074	15.963	04/12/2017	1.727	1.750	1.801	0.000	0.022	0.000
05/12/2017	1.791	1.809	1.843	0.052	16.005	05/12/2017	1.785	1.797	1.810	0.006	0.012	0.033

06/12/2017	1.830	1.876	1.994	0.164	16.156	06/12/2017	1.805	1.835	1.868	0.025	0.041	0.126
07/12/2017	1.960	2.015	2.068	0.108	16.230	07/12/2017	1.866	1.985	2.068	0.094	0.030	0.000
08/12/2017	1.887	1.944	1.991	0.104	16.153	08/12/2017	1.947	1.980	2.030	-0.060	-0.036	-0.039
09/12/2017	1.787	1.860	1.911	0.124	16.073	09/12/2017	1.853	1.896	1.946	-0.066	-0.036	-0.035
10/12/2017	1.722	1.771	1.797	0.075	15.959	10/12/2017	1.774	1.799	1.853	-0.052	-0.028	-0.056
11/12/2017	1.701	1.725	1.739	0.038	15.901	11/12/2017	1.722	1.743	1.782	-0.021	-0.018	-0.043
12/12/2017	1.704	1.720	1.729	0.025	15.891	12/12/2017	1.701	1.720	1.729	0.003	0.000	0.000
13/12/2017	1.705	1.732	1.757	0.052	15.919	13/12/2017	1.704	1.724	1.756	0.001	0.008	0.001
14/12/2017	1.704	1.718	1.731	0.027	15.893	14/12/2017	1.709	1.725	1.757	-0.005	-0.007	-0.026
15/12/2017	1.682	1.706	1.717	0.035	15.879	15/12/2017	1.704	1.712	1.731	-0.022	-0.006	-0.014
16/12/2017	1.676	1.700	1.721	0.045	15.883	16/12/2017	1.676	1.697	1.720	0.000	0.003	0.001
17/12/2017	1.699	1.762	1.816	0.117	15.978	17/12/2017	1.699	1.729	1.792	0.000	0.033	0.024
18/12/2017	1.805	1.819	1.834	0.029	15.996	18/12/2017	1.784	1.809	1.830	0.021	0.010	0.004
19/12/2017	1.832	1.865	1.893	0.061	16.055	19/12/2017	1.812	1.846	1.893	0.020	0.019	0.000
20/12/2017	1.880	1.919	1.946	0.066	16.108	20/12/2017	1.866	1.902	1.946	0.014	0.017	0.000
21/12/2017	1.840	1.875	1.904	0.064	16.066	21/12/2017	1.869	1.897	1.937	-0.029	-0.022	-0.033
22/12/2017	1.724	1.810	1.849	0.125	16.011	22/12/2017	1.820	1.843	1.871	-0.096	-0.033	-0.022
23/12/2017	1.707	1.726	1.745	0.038	15.907	23/12/2017	1.715	1.743	1.825	-0.008	-0.017	-0.080
24/12/2017	1.743	1.891	1.939	0.196	16.101	24/12/2017	1.707	1.812	1.939	0.036	-0.079	0.000
25/12/2017	1.910	1.940	1.965	0.055	16.127	25/12/2017	1.918	1.942	1.965	-0.008	-0.002	-0.000
26/12/2017	1.806	1.878	1.912	0.106	16.074	26/12/2017	1.878	1.907	1.945	-0.072	-0.029	-0.033
27/12/2017	1.737	1.793	1.822	0.085	15.984	27/12/2017	1.796	1.823	1.889	-0.059	-0.030	-0.067
28/12/2017	1.709	1.738	1.767	0.058	15.929	28/12/2017	1.710	1.748	1.798	-0.001	-0.010	-0.031
29/12/2017	1.671	1.706	1.732	0.061	15.894	29/12/2017	1.696	1.726	1.761	-0.025	-0.020	-0.029

30/12/2017	1.635	1.672	1.696	0.061	15.858	30/12/2017	1.663	1.681	1.702	-0.028	-0.009	-0.006
31/12/2017	1.621	1.670	1.701	0.080	15.863	31/12/2017	1.621	1.661	1.697	0.000	-0.009	-0.004
01/01/2018	1.652	1.680	1.693	0.041	15.855	01/01/2018	1.679	1.689	1.701	-0.027	-0.009	-0.008
02/01/2018	1.647	1.657	1.670	0.023	15.832	02/01/2018	1.647	1.659	1.689	0.000	-0.002	-0.019
03/01/2018	1.626	1.636	1.658	0.032	15.820	03/01/2018	1.626	1.648	1.670	0.000	-0.012	-0.012
04/01/2018	1.594	1.616	1.635	0.041	15.797	04/01/2018	1.594	1.622	1.640	0.000	-0.006	-0.005
05/01/2018	1.613	1.652	1.697	0.084	15.859	05/01/2018	1.611	1.629	1.664	0.002	0.023	0.033
06/01/2018	1.668	1.686	1.701	0.033	15.863	06/01/2018	1.663	1.682	1.697	0.005	0.004	0.004
07/01/2018	1.640	1.657	1.673	0.033	15.835	07/01/2018	1.650	1.670	1.701	-0.010	-0.013	-0.028
08/01/2018	1.590	1.633	1.661	0.071	15.823	08/01/2018	1.633	1.648	1.662	-0.043	-0.015	-0.001
09/01/2018	1.495	1.556	1.597	0.102	15.759	09/01/2018	1.557	1.590	1.644	-0.062	-0.034	-0.047
10/01/2018	1.499	1.507	1.516	0.017	15.678	10/01/2018	1.495	1.512	1.563	0.004	-0.005	-0.047
11/01/2018	1.499	1.536	1.561	0.062	15.723	11/01/2018	1.501	1.521	1.562	-0.002	-0.015	-0.001
12/01/2018	1.548	1.567	1.585	0.037	15.747	12/01/2018	1.553	1.569	1.592	-0.005	-0.002	-0.007
13/01/2018	1.549	1.571	1.586	0.037	15.748	13/01/2018	1.563	1.579	1.595	-0.014	-0.008	-0.009
14/01/2018	1.531	1.580	1.680	0.149	15.842	14/01/2018	1.546	1.571	1.595	-0.015	-0.009	-0.085
15/01/2018	1.677	1.724	1.756	0.079	15.918	15/01/2018	1.593	1.695	1.764	-0.084	-0.029	-0.008
16/01/2018	1.684	1.729	1.760	0.076	15.922	16/01/2018	1.721	1.746	1.770	-0.037	-0.017	-0.010
17/01/2018	1.666	1.693	1.712	0.046	15.874	17/01/2018	1.676	1.706	1.761	-0.010	-0.013	-0.049
18/01/2018	1.628	1.664	1.692	0.064	15.854	18/01/2018	1.662	1.690	1.716	-0.034	-0.026	-0.024
19/01/2018	1.614	1.633	1.655	0.041	15.817	19/01/2018	1.625	1.646	1.679	-0.011	-0.013	-0.024

20/01/2018	1.578	1.622	1.637	0.059	15.799	20/01/2018	1.621	1.638	1.663	-0.043	-0.016	-0.026
21/01/2018	1.545	1.570	1.596	0.051	15.758	21/01/2018	1.564	1.594	1.636	-0.019	-0.024	-0.040
22/01/2018	1.551	1.607	1.688	0.137	15.850	22/01/2018	1.555	1.584	1.641	-0.004	0.023	0.047
23/01/2018	1.688	1.888	2.009	0.321	16.171	23/01/2018	1.633	1.767	1.964	0.055	0.121	0.045
24/01/2018	1.987	2.087	2.136	0.149	16.298	24/01/2018	1.964	2.045	2.152	-0.023	-0.042	-0.016
25/01/2018	1.995	2.082	2.127	0.132	16.289	25/01/2018	2.096	2.124	2.147	-0.101	-0.042	-0.020
26/01/2018	1.824	1.928	1.995	0.171	16.157	26/01/2018	1.941	1.991	2.089	-0.117	-0.063	-0.094
27/01/2018	1.801	1.837	1.866	0.065	16.028	27/01/2018	1.824	1.860	1.942	-0.023	-0.023	-0.076
28/01/2018	1.832	1.917	2.026	0.194	16.188	28/01/2018	1.845	1.873	1.937	-0.013	-0.044	-0.089
29/01/2018	1.951	2.001	2.032	0.081	16.194	29/01/2018	1.940	2.010	2.038	-0.011	-0.009	-0.006
30/01/2018	1.937	1.965	2.008	0.071	16.170	30/01/2018	1.952	1.972	2.003	-0.015	-0.007	-0.005
31/01/2018	1.908	1.989	2.033	0.125	16.195	31/01/2018	1.974	2.008	2.042	-0.066	-0.019	-0.009
01/02/2018	1.825	1.872	1.918	0.093	16.080	01/02/2018	1.875	1.919	2.024	-0.050	-0.047	-0.106
02/02/2018	1.792	1.839	1.869	0.077	16.031	02/02/2018	1.831	1.852	1.886	-0.039	-0.013	-0.017
03/02/2018	1.709	1.762	1.792	0.083	15.954	03/02/2018	1.769	1.803	1.867	-0.060	-0.041	-0.075
04/02/2018	1.659	1.698	1.718	0.059	15.880	04/02/2018	1.692	1.723	1.774	-0.033	-0.025	-0.056
05/02/2018	1.637	1.650	1.664	0.027	15.826	05/02/2018	1.659	1.674	1.710	-0.022	-0.024	-0.046
06/02/2018	1.621	1.634	1.645	0.024	15.807	06/02/2018	1.632	1.645	1.663	-0.011	-0.011	-0.018
07/02/2018	1.621	1.641	1.662	0.041	15.824	07/02/2018	1.634	1.648	1.671	-0.013	-0.007	-0.009
08/02/2018	1.624	1.639	1.662	0.038	15.824	08/02/2018	1.630	1.647	1.671	-0.006	-0.008	-0.009

09/02/2018	1.595	1.649	1.682	0.087	15.844	09/02/2018	1.641	1.657	1.687	-0.046	-0.008	-0.005
10/02/2018	1.599	1.674	1.726	0.127	15.888	10/02/2018	1.606	1.658	1.731	-0.007	-0.016	-0.005
11/02/2018	1.677	1.697	1.721	0.044	15.883	11/02/2018	1.678	1.705	1.731	-0.001	-0.008	-0.010
12/02/2018	1.634	1.685	1.714	0.080	15.876	12/02/2018	1.684	1.708	1.731	-0.050	-0.023	-0.017
13/02/2018	1.634	1.675	1.703	0.069	15.865	13/02/2018	1.638	1.680	1.725	-0.004	-0.005	-0.022
14/02/2018	1.621	1.665	1.691	0.070	15.853	14/02/2018	1.645	1.675	1.708	-0.024	-0.010	-0.017
15/02/2018	1.663	1.730	1.776	0.113	15.938	15/02/2018	1.665	1.707	1.768	-0.002	-0.023	-0.008
16/02/2018	1.766	1.778	1.789	0.023	15.951	16/02/2018	1.750	1.778	1.802	-0.016	-0.000	-0.013
17/02/2018	1.774	1.797	1.819	0.045	15.981	17/02/2018	1.771	1.795	1.818	-0.003	-0.002	-0.001
18/02/2018	1.748	1.771	1.788	0.040	15.950	18/02/2018	1.750	1.784	1.818	-0.002	-0.013	-0.030
19/02/2018	1.785	1.835	1.875	0.090	16.037	19/02/2018	1.778	1.806	1.860	-0.007	-0.029	-0.015
20/02/2018	1.866	1.887	1.910	0.044	16.072	20/02/2018	1.858	1.886	1.909	-0.008	-0.001	-0.001
21/02/2018	1.768	1.841	1.876	0.108	16.038	21/02/2018	1.852	1.870	1.889	-0.084	-0.029	-0.013
22/02/2018	1.697	1.732	1.768	0.071	15.930	22/02/2018	1.740	1.778	1.856	-0.043	-0.046	-0.088
23/02/2018	1.672	1.695	1.712	0.040	15.874	23/02/2018	1.694	1.710	1.736	-0.022	-0.015	-0.024
24/02/2018	1.641	1.665	1.681	0.040	15.843	24/02/2018	1.652	1.679	1.703	-0.011	-0.014	-0.022
25/02/2018	1.594	1.618	1.642	0.048	15.804	25/02/2018	1.614	1.643	1.684	-0.020	-0.025	-0.042
26/02/2018	1.565	1.583	1.600	0.035	15.762	26/02/2018	1.580	1.600	1.634	-0.015	-0.017	-0.034
27/02/2018	1.561	1.580	1.595	0.034	15.757	27/02/2018	1.569	1.583	1.598	-0.008	-0.003	-0.003
28/02/2018	1.570	1.591	1.614	0.044	15.776	28/02/2018	1.582	1.599	1.620	-0.012	-0.008	-0.006
01/03/2018	1.569	1.629	1.665	0.096	15.827	01/03/2018	1.576	1.624	1.672	-0.007	-0.005	-0.007

02/03/2018	1.616	1.684	1.719	0.103	15.881	02/03/2018	1.616	1.670	1.730	0.000	0.014	-0.011
03/03/2018	1.604	1.666	1.699	0.095	15.861	03/03/2018	1.675	1.696	1.739	-0.071	-0.030	-0.040
04/03/2018	1.531	1.587	1.630	0.099	15.792	04/03/2018	1.596	1.628	1.692	-0.065	-0.041	-0.062
05/03/2018	1.496	1.536	1.550	0.054	15.712	05/03/2018	1.533	1.558	1.612	-0.037	-0.022	-0.062
06/03/2018	1.496	1.584	1.615	0.119	15.777	06/03/2018	1.522	1.570	1.620	-0.026	-0.014	-0.005
07/03/2018	1.610	1.628	1.647	0.037	15.809	07/03/2018	1.616	1.626	1.651	-0.006	-0.002	-0.004
08/03/2018	1.588	1.621	1.646	0.058	15.808	08/03/2018	1.630	1.641	1.653	-0.042	-0.020	-0.007
09/03/2018	1.541	1.583	1.596	0.055	15.758	09/03/2018	1.588	1.603	1.639	-0.047	-0.020	-0.043
10/03/2018	1.532	1.557	1.574	0.042	15.736	10/03/2018	1.545	1.573	1.604	-0.013	-0.016	-0.030
11/03/2018	1.532	1.552	1.571	0.039	15.733	11/03/2018	1.549	1.566	1.581	-0.017	-0.014	-0.010
12/03/2018	1.531	1.543	1.553	0.022	15.715	12/03/2018	1.534	1.554	1.574	-0.003	-0.011	-0.021
13/03/2018	1.529	1.550	1.572	0.043	15.734	13/03/2018	1.538	1.554	1.577	-0.009	-0.004	-0.005
14/03/2018	1.525	1.545	1.558	0.033	15.720	14/03/2018	1.542	1.557	1.580	-0.017	-0.012	-0.022
15/03/2018	1.542	1.604	1.664	0.122	15.826	15/03/2018	1.542	1.576	1.642	0.000	0.028	-0.022
16/03/2018	1.652	1.697	1.745	0.093	15.907	16/03/2018	1.635	1.688	1.750	-0.017	-0.009	-0.005
17/03/2018	1.612	1.642	1.665	0.053	15.827	17/03/2018	1.642	1.671	1.739	-0.030	-0.029	-0.074
18/03/2018	1.577	1.604	1.625	0.048	15.787	18/03/2018	1.604	1.630	1.669	-0.027	-0.026	-0.044
19/03/2018	1.535	1.565	1.588	0.053	15.750	19/03/2018	1.566	1.588	1.622	-0.031	-0.023	-0.034
20/03/2018	1.491	1.513	1.540	0.049	15.702	20/03/2018	1.515	1.540	1.586	-0.024	-0.027	-0.046
21/03/2018	1.447	1.482	1.499	0.052	15.661	21/03/2018	1.471	1.500	1.527	-0.024	-0.018	-0.028

22/03/2018	1.484	1.543	1.585	0.101	15.747	22/03/2018	1.494	1.523	1.582	-0.010	0.020	0.003
23/03/2018	1.558	1.599	1.628	0.070	15.790	23/03/2018	1.564	1.589	1.627	-0.006	0.010	0.001
24/03/2018	1.604	1.627	1.648	0.044	15.810	24/03/2018	1.616	1.630	1.651	-0.012	-0.003	-0.003
25/03/2018	1.597	1.618	1.636	0.039	15.798	25/03/2018	1.606	1.631	1.649	-0.009	-0.013	-0.013
26/03/2018	1.570	1.599	1.620	0.050	15.782	26/03/2018	1.607	1.619	1.639	-0.037	-0.020	-0.019
27/03/2018	1.561	1.574	1.586	0.025	15.748	27/03/2018	1.577	1.590	1.612	-0.016	-0.016	-0.026
28/03/2018	1.567	1.586	1.609	0.042	15.771	28/03/2018	1.572	1.588	1.602	-0.005	-0.002	0.007
29/03/2018	1.607	1.621	1.643	0.036	15.805	29/03/2018	1.584	1.614	1.640	-0.023	-0.007	-0.003
30/03/2018	1.585	1.627	1.651	0.066	15.813	30/03/2018	1.619	1.643	1.659	-0.034	-0.016	-0.008
31/03/2018	1.598	1.627	1.662	0.064	15.824	31/03/2018	1.598	1.628	1.673	0.000	-0.001	-0.011
01/04/2018	1.534	1.578	1.613	0.079	15.775	01/04/2018	1.587	1.611	1.659	-0.053	-0.033	-0.046
02/04/2018	1.474	1.522	1.553	0.079	15.715	02/04/2018	1.526	1.556	1.584	-0.052	-0.034	-0.031
03/04/2018	1.481	1.495	1.510	0.029	15.672	03/04/2018	1.496	1.512	1.532	-0.015	-0.017	-0.022
04/04/2018	1.471	1.480	1.490	0.019	15.652	04/04/2018	1.476	1.495	1.511	-0.005	-0.015	-0.021
05/04/2018	1.442	1.458	1.476	0.034	15.638	05/04/2018	1.454	1.476	1.493	-0.012	-0.018	-0.017
06/04/2018	1.393	1.417	1.452	0.059	15.614	06/04/2018	1.407	1.439	1.475	-0.014	-0.022	-0.023
07/04/2018	1.410	1.455	1.482	0.072	15.644	07/04/2018	1.412	1.438	1.475	-0.002	-0.017	-0.007
08/04/2018	1.479	1.494	1.509	0.030	15.671	08/04/2018	1.475	1.492	1.519	-0.004	-0.002	-0.010
09/04/2018	1.509	1.535	1.553	0.044	15.715	09/04/2018	1.502	1.529	1.562	-0.007	-0.006	-0.009
10/04/2018	1.522	1.560	1.594	0.072	15.756	10/04/2018	1.530	1.557	1.583	-0.008	-0.003	-0.011

11/04/2018	1.587	1.628	1.665	0.078	15.827	11/04/2018	1.565	1.611	1.668	-0.022	-0.017	-0.003
12/04/2018	1.546	1.599	1.630	0.084	15.792	12/04/2018	1.613	1.632	1.660	-0.067	-0.033	-0.030
13/04/2018	1.559	1.604	1.625	0.066	15.787	13/04/2018	1.554	1.599	1.633	-0.005	-0.005	-0.008
14/04/2018	1.575	1.589	1.596	0.021	15.758	14/04/2018	1.589	1.606	1.631	-0.014	-0.017	-0.035
15/04/2018	1.575	1.591	1.608	0.033	15.770	15/04/2018	1.587	1.597	1.613	-0.012	-0.006	-0.005
16/04/2018	1.533	1.582	1.607	0.074	15.769	16/04/2018	1.594	1.609	1.619	-0.061	-0.027	-0.012
17/04/2018	1.542	1.572	1.645	0.103	15.807	17/04/2018	1.543	1.571	1.600	-0.001	-0.001	-0.045
18/04/2018	1.615	1.643	1.662	0.047	15.824	18/04/2018	1.580	1.637	1.673	-0.035	-0.006	-0.011
19/04/2018	1.642	1.669	1.691	0.049	15.853	19/04/2018	1.639	1.664	1.703	-0.003	-0.005	-0.012
20/04/2018	1.642	1.657	1.670	0.028	15.832	20/04/2018	1.656	1.676	1.693	-0.014	-0.019	-0.023
21/04/2018	1.619	1.639	1.652	0.033	15.814	21/04/2018	1.640	1.654	1.671	-0.021	-0.015	-0.019
22/04/2018	1.576	1.616	1.647	0.071	15.809	22/04/2018	1.621	1.638	1.664	-0.045	-0.022	-0.017
23/04/2018	1.544	1.596	1.634	0.090	15.796	23/04/2018	1.594	1.619	1.642	-0.050	-0.023	-0.008
24/04/2018	1.532	1.576	1.609	0.077	15.771	24/04/2018	1.542	1.580	1.615	-0.010	-0.004	-0.006
25/04/2018	1.528	1.562	1.584	0.056	15.746	25/04/2018	1.572	1.585	1.609	-0.044	-0.023	-0.025
26/04/2018	1.534	1.579	1.622	0.088	15.784	26/04/2018	1.534	1.564	1.606	0.000	-0.015	-0.016
27/04/2018	1.613	1.631	1.648	0.035	15.810	27/04/2018	1.606	1.626	1.647	-0.007	-0.005	-0.001
28/04/2018	1.634	1.646	1.655	0.021	15.817	28/04/2018	1.632	1.644	1.661	-0.002	-0.002	-0.006
29/04/2018	1.637	1.656	1.670	0.033	15.832	29/04/2018	1.654	1.654	1.654	-0.017	-0.002	-0.016
30/04/2018	1.604	1.620	1.637	0.033	15.799	30/04/2018	1.623	1.639	1.667	-0.019	-0.019	-0.030
01/05/2018	1.540	1.569	1.607	0.067	15.769	01/05/2018	1.564	1.597	1.626	-0.024	-0.028	-0.019

											-	-	-
02/05/2018	1.535	1.546	1.559	0.024	15.721		02/05/2018	1.537	1.547	1.560	0.002	0.001	0.001
03/05/2018	1.544	1.556	1.570	0.026	15.732		03/05/2018	1.535	1.551	1.570	0.009	0.005	0.000
04/05/2018	1.547	1.562	1.577	0.030	15.739		04/05/2018	1.547	1.558	1.577	0.000	0.004	0.000
												-	-
05/05/2018	1.519	1.532	1.550	0.031	15.712		05/05/2018	1.519	1.544	1.573	0.000	0.012	0.023
06/05/2018	1.515	1.536	1.545	0.030	15.707		06/05/2018	1.515	1.533	1.544	0.000	0.003	0.001
											-	-	
07/05/2018	1.512	1.529	1.553	0.041	15.715		07/05/2018	1.519	1.537	1.553	0.007	0.008	0.000
												-	-
08/05/2018	1.466	1.515	1.530	0.064	15.692		08/05/2018	1.466	1.518	1.532	0.000	0.003	0.002
09/05/2018	1.501	1.513	1.531	0.030	15.693		09/05/2018	1.501	1.511	1.527	0.000	0.002	0.004
10/05/2018	1.518	1.544	1.563	0.045	15.725		10/05/2018	1.505	1.527	1.554	0.013	0.017	0.009
												-	
11/05/2018	1.503	1.537	1.574	0.071	15.736		11/05/2018	1.503	1.538	1.563	0.000	0.001	0.011
12/05/2018	1.568	1.599	1.618	0.050	15.780		12/05/2018	1.540	1.576	1.612	0.028	0.023	0.006
											-	-	-
13/05/2018	1.599	1.605	1.615	0.016	15.777		13/05/2018	1.600	1.608	1.618	0.001	0.003	0.003
											-	-	-
14/05/2018	1.589	1.596	1.602	0.013	15.764		14/05/2018	1.592	1.600	1.609	0.003	0.004	0.007
													-
15/05/2018	1.581	1.589	1.598	0.017	15.760		15/05/2018	1.587	1.593	1.602	-0.006	0.004	-0.004
													-
16/05/2018	1.572	1.580	1.585	0.013	15.747		16/05/2018	1.578	1.584	1.592	-0.006	0.004	-0.007
17/05/2018	1.569	1.577	1.583	0.014	15.745		17/05/2018	1.569	1.576	1.585	0.000	0.001	-0.002
18/05/2018	1.577	1.581	1.585	0.008	15.747		18/05/2018	1.577	1.581	1.585	0.000	0.000	0.000
													-
19/05/2018	1.566	1.578	1.585	0.019	15.747		19/05/2018	1.571	1.579	1.584	-0.005	0.001	0.001
													-
20/05/2018	1.566	1.571	1.581	0.015	15.743		20/05/2018	1.566	1.574	1.585	0.000	0.003	-0.004
21/05/2018	1.564	1.573	1.585	0.021	15.747		21/05/2018	1.565	1.573	1.585	-0.001	0.000	0.000
													-
22/05/2018	1.514	1.534	1.570	0.056	15.732		22/05/2018	1.525	1.552	1.581	-0.011	0.018	-0.011
23/05/2018	1.512	1.527	1.538	0.026	15.700		23/05/2018	1.514	1.527	1.540	-0.002	0.000	-0.002
24/05/2018	1.515	1.534	1.550	0.035	15.712		24/05/2018	1.512	1.532	1.550	0.003	0.002	0.000
													-
25/05/2018	1.504	1.521	1.541	0.037	15.703		25/05/2018	1.509	1.526	1.545	-0.005	0.005	-0.004
													-
26/05/2018	1.460	1.488	1.512	0.052	15.674		26/05/2018	1.479	1.502	1.522	-0.019	0.014	-0.010

27/05/2018	1.462	1.476	1.487	0.025	15.649	27/05/2018	1.460	1.475	1.493	0.002	0.001	-0.006
28/05/2018	1.477	1.497	1.512	0.035	15.674	28/05/2018	1.475	1.488	1.509	0.002	0.009	0.003
29/05/2018	1.498	1.514	1.527	0.029	15.689	29/05/2018	1.489	1.511	1.525	0.009	0.003	0.002
30/05/2018	1.500	1.519	1.538	0.038	15.700	30/05/2018	1.498	1.509	1.527	0.002	0.010	0.011
31/05/2018	1.513	1.528	1.541	0.028	15.703	31/05/2018	1.509	1.526	1.539	0.004	0.002	0.002
01/06/2018	1.493	1.518	1.532	0.039	15.694	01/06/2018	1.513	1.523	1.541	-0.020	-0.005	-0.009
02/06/2018	1.474	1.488	1.497	0.023	15.659	02/06/2018	1.474	1.496	1.522	0.000	-0.008	-0.025
03/06/2018	1.474	1.511	1.538	0.064	15.700	03/06/2018	1.474	1.492	1.525	0.000	0.019	0.013
04/06/2018	1.533	1.549	1.576	0.043	15.738	04/06/2018	1.528	1.546	1.576	0.005	0.003	0.000
05/06/2018	1.517	1.541	1.559	0.042	15.721	05/06/2018	1.533	1.547	1.559	-0.016	-0.006	0.000
06/06/2018	1.516	1.532	1.561	0.045	15.723	06/06/2018	1.516	1.530	1.561	0.000	0.002	0.000
07/06/2018	1.525	1.551	1.569	0.044	15.731	07/06/2018	1.520	1.547	1.569	0.005	0.004	0.000
08/06/2018	1.489	1.526	1.553	0.064	15.715	08/06/2018	1.525	1.541	1.562	-0.036	-0.015	-0.009
09/06/2018	1.461	1.489	1.505	0.044	15.667	09/06/2018	1.475	1.498	1.529	-0.014	-0.009	-0.024
10/06/2018	1.423	1.455	1.479	0.056	15.641	10/06/2018	1.449	1.471	1.502	-0.026	-0.016	-0.023
11/06/2018	1.401	1.420	1.429	0.028	15.591	11/06/2018	1.421	1.430	1.465	-0.020	-0.010	-0.036
12/06/2018	1.404	1.412	1.436	0.032	15.598	12/06/2018	1.401	1.409	1.428	0.003	0.003	0.008
13/06/2018	1.351	1.413	1.443	0.092	15.605	13/06/2018	1.409	1.428	1.443	-0.058	-0.015	0.000
14/06/2018	1.343	1.383	1.403	0.060	15.565	14/06/2018	1.343	1.378	1.417	0.000	0.005	-0.014
15/06/2018	1.380	1.434	1.492	0.112	15.654	15/06/2018	1.380	1.400	1.457	0.000	0.034	0.035
16/06/2018	1.491	1.529	1.588	0.097	15.750	16/06/2018	1.463	1.496	1.543	0.028	0.033	0.045
17/06/2018	1.529	1.593	1.631	0.102	15.793	17/06/2018	1.545	1.594	1.631	-0.016	-0.001	0.000
18/06/2018	1.488	1.514	1.542	0.054	15.704	18/06/2018	1.512	1.534	1.597	-0.024	-0.020	-0.055
19/06/2018	1.500	1.560	1.590	0.090	15.752	19/06/2018	1.488	1.531	1.590	0.012	-0.029	0.000
20/06/2018	1.509	1.561	1.584	0.075	15.746	20/06/2018	1.561	1.572	1.584	-0.052	-0.011	0.000
21/06/2018	1.462	1.478	1.511	0.049	15.673	21/06/2018	1.466	1.506	1.581	-0.004	-0.028	-0.070
22/06/2018	1.475	1.494	1.514	0.039	15.676	22/06/2018	1.462	1.484	1.514	0.013	0.010	0.000

23/06/2018	1.484	1.499	1.518	0.034	15.680	23/06/2018	1.484	1.500	1.518	0.000	-0.001	0.000
24/06/2018	1.485	1.504	1.531	0.046	15.693	24/06/2018	1.485	1.500	1.531	0.000	-0.004	0.000
25/06/2018	1.452	1.481	1.504	0.052	15.666	25/06/2018	1.469	1.494	1.528	-0.017	-0.013	-0.024
26/06/2018	1.442	1.458	1.480	0.038	15.642	26/06/2018	1.442	1.464	1.493	0.000	-0.006	-0.013
27/06/2018	1.401	1.436	1.454	0.053	15.616	27/06/2018	1.443	1.450	1.476	-0.042	-0.014	-0.022
28/06/2018	1.385	1.409	1.423	0.038	15.585	28/06/2018	1.401	1.415	1.443	-0.016	-0.006	-0.020
29/06/2018	1.345	1.379	1.400	0.055	15.562	29/06/2018	1.380	1.393	1.423	-0.035	-0.014	-0.023
30/06/2018	1.328	1.351	1.366	0.038	15.528	30/06/2018	1.344	1.355	1.384	-0.016	-0.004	-0.018
01/07/2018	1.340	1.355	1.364	0.024	15.526	01/07/2018	1.328	1.355	1.366	0.012	0.000	-0.002
02/07/2018	1.292	1.334	1.358	0.066	15.520	02/07/2018	1.332	1.350	1.360	-0.040	-0.016	-0.002
03/07/2018	1.283	1.301	1.317	0.034	15.479	03/07/2018	1.283	1.306	1.332	0.000	-0.005	-0.015
04/07/2018	1.270	1.296	1.320	0.050	15.482	04/07/2018	1.291	1.302	1.320	-0.021	-0.006	0.000
05/07/2018	1.280	1.308	1.321	0.041	15.483	05/07/2018	1.270	1.298	1.320	0.010	0.010	0.001
06/07/2018	1.294	1.319	1.347	0.053	15.509	06/07/2018	1.293	1.320	1.347	0.001	-0.001	0.000
07/07/2018	1.277	1.298	1.318	0.041	15.480	07/07/2018	1.277	1.300	1.324	0.000	-0.002	-0.006
08/07/2018	1.286	1.297	1.310	0.024	15.472	08/07/2018	1.283	1.298	1.316	0.003	-0.001	-0.006
09/07/2018	1.295	1.319	1.339	0.044	15.501	09/07/2018	1.286	1.314	1.339	0.009	0.005	0.000
10/07/2018	1.308	1.326	1.340	0.032	15.502	10/07/2018	1.303	1.322	1.336	0.005	0.004	0.004
11/07/2018	1.306	1.328	1.350	0.044	15.512	11/07/2018	1.306	1.327	1.350	0.000	-0.001	0.000
12/07/2018	1.327	1.346	1.360	0.033	15.522	12/07/2018	1.317	1.341	1.360	0.010	0.005	0.000
13/07/2018	1.336	1.357	1.366	0.030	15.528	13/07/2018	1.327	1.352	1.366	0.009	0.005	0.000
14/07/2018	1.289	1.314	1.343	0.054	15.505	14/07/2018	1.309	1.333	1.363	-0.020	-0.019	-0.020
15/07/2018	1.269	1.285	1.297	0.028	15.459	15/07/2018	1.269	1.291	1.319	0.000	-0.006	-0.022
16/07/2018	1.296	1.323	1.342	0.046	15.504	16/07/2018	1.279	1.310	1.342	0.017	0.013	0.000

17/07/2018	1.308	1.318	1.328	0.020	15.490	17/07/2018	1.309	1.321	1.339	-0.001	0.003	-0.011
18/07/2018	1.311	1.319	1.350	0.039	15.512	18/07/2018	1.308	1.316	1.326	0.003	0.003	0.024
19/07/2018	1.335	1.356	1.375	0.040	15.537	19/07/2018	1.315	1.341	1.375	0.020	0.015	0.000
20/07/2018	1.369	1.387	1.398	0.029	15.560	20/07/2018	1.355	1.377	1.398	0.014	0.010	0.000
21/07/2018	1.365	1.383	1.391	0.026	15.553	21/07/2018	1.377	1.387	1.398	-0.012	0.004	-0.007
22/07/2018	1.369	1.392	1.409	0.040	15.571	22/07/2018	1.365	1.383	1.404	0.004	0.009	0.005
23/07/2018	1.402	1.425	1.438	0.036	15.600	23/07/2018	1.395	1.413	1.435	0.007	0.012	0.003
24/07/2018	1.426	1.441	1.455	0.029	15.617	24/07/2018	1.426	1.439	1.455	0.000	0.002	0.000
25/07/2018	1.431	1.460	1.490	0.059	15.652	25/07/2018	1.431	1.446	1.473	0.000	0.014	0.017
26/07/2018	1.474	1.492	1.500	0.026	15.662	26/07/2018	1.465	1.486	1.500	0.009	0.006	0.000
27/07/2018	1.470	1.493	1.504	0.034	15.666	27/07/2018	1.474	1.492	1.504	-0.004	0.001	0.000
28/07/2018	1.450	1.507	1.551	0.101	15.713	28/07/2018	1.450	1.493	1.547	0.000	0.014	0.004
29/07/2018	1.491	1.560	1.589	0.098	15.751	29/07/2018	1.491	1.539	1.584	0.000	0.021	0.005
30/07/2018	1.540	1.576	1.597	0.057	15.759	30/07/2018	1.577	1.585	1.597	-0.037	0.009	0.000
31/07/2018	1.528	1.547	1.561	0.033	15.723	31/07/2018	1.540	1.554	1.584	-0.012	0.007	-0.023
01/08/2018	1.530	1.558	1.578	0.048	15.740	01/08/2018	1.528	1.552	1.578	0.002	0.006	0.000
02/08/2018	1.518	1.543	1.559	0.041	15.721	02/08/2018	1.542	1.552	1.578	-0.024	0.009	-0.019
03/08/2018	1.543	1.561	1.580	0.037	15.742	03/08/2018	1.518	1.550	1.577	0.025	0.011	0.003
04/08/2018	1.532	1.549	1.564	0.032	15.726	04/08/2018	1.532	1.553	1.580	0.000	0.004	-0.016
05/08/2018	1.546	1.563	1.580	0.034	15.742	05/08/2018	1.538	1.558	1.580	0.008	0.005	0.000
06/08/2018	1.557	1.577	1.602	0.045	15.764	06/08/2018	1.553	1.570	1.602	0.004	0.007	0.000
07/08/2018	1.585	1.609	1.632	0.047	15.794	07/08/2018	1.574	1.602	1.632	0.011	0.007	0.000
08/08/2018	1.539	1.573	1.599	0.060	15.761	08/08/2018	1.574	1.590	1.627	-0.035	0.017	-0.028
09/08/2018	1.545	1.564	1.580	0.035	15.742	09/08/2018	1.539	1.559	1.581	0.006	0.005	-0.001
10/08/2018	1.548	1.571	1.594	0.046	15.756	10/08/2018	1.558	1.569	1.593	-0.010	0.002	0.001
11/08/2018	1.507	1.546	1.560	0.053	15.722	11/08/2018	1.547	1.561	1.594	-0.040	0.015	-0.034
12/08/2018	1.508	1.522	1.538	0.030	15.700	12/08/2018	1.507	1.524	1.559	0.001	0.002	-0.021
13/08/2018	1.536	1.557	1.578	0.042	15.740	13/08/2018	1.519	1.546	1.578	0.017	0.011	0.000
14/08/2018	1.507	1.542	1.568	0.061	15.730	14/08/2018	1.539	1.553	1.574	-0.032	0.011	-0.006

15/08/2018	1.501	1.515	1.532	0.031	15.694	15/08/2018	1.507	1.521	1.542	-0.006	0.006	-0.010
16/08/2018	1.500	1.518	1.548	0.048	15.710	16/08/2018	1.500	1.512	1.545	0.000	0.006	0.003
17/08/2018	1.505	1.550	1.573	0.068	15.735	17/08/2018	1.512	1.547	1.573	-0.007	0.003	0.000
18/08/2018	1.479	1.511	1.537	0.058	15.699	18/08/2018	1.479	1.517	1.564	0.000	0.006	-0.027
19/08/2018	1.504	1.529	1.561	0.057	15.723	19/08/2018	1.504	1.521	1.546	0.000	0.008	0.015
20/08/2018	1.553	1.608	1.641	0.088	15.803	20/08/2018	1.531	1.583	1.641	0.022	0.025	0.000
21/08/2018	1.548	1.591	1.612	0.064	15.774	21/08/2018	1.589	1.605	1.634	-0.041	0.014	-0.022
22/08/2018	1.564	1.584	1.621	0.057	15.783	22/08/2018	1.548	1.577	1.606	0.016	0.007	0.015
23/08/2018	1.572	1.613	1.650	0.078	15.812	23/08/2018	1.579	1.614	1.650	-0.007	0.001	0.000
24/08/2018	1.574	1.591	1.618	0.044	15.780	24/08/2018	1.572	1.590	1.629	0.002	0.001	-0.011
25/08/2018	1.570	1.583	1.591	0.021	15.753	25/08/2018	1.579	1.588	1.614	-0.009	0.005	-0.023
26/08/2018	1.541	1.577	1.596	0.055	15.758	26/08/2018	1.570	1.583	1.596	-0.029	0.006	0.000
27/08/2018	1.544	1.559	1.576	0.032	15.738	27/08/2018	1.541	1.559	1.596	0.003	0.000	-0.020
28/08/2018	1.538	1.557	1.572	0.034	15.734	28/08/2018	1.553	1.564	1.576	-0.015	0.007	-0.004
29/08/2018	1.507	1.537	1.553	0.046	15.715	29/08/2018	1.538	1.547	1.568	-0.031	0.010	-0.015
30/08/2018	1.495	1.506	1.516	0.021	15.678	30/08/2018	1.503	1.512	1.544	-0.008	0.006	-0.028
31/08/2018	1.474	1.490	1.503	0.029	15.665	31/08/2018	1.485	1.499	1.515	-0.011	0.009	-0.012
01/09/2018	1.474	1.487	1.502	0.028	15.664	01/09/2018	1.474	1.484	1.502	0.000	0.003	0.000
02/09/2018	1.451	1.466	1.480	0.029	15.642	02/09/2018	1.451	1.474	1.498	0.000	0.008	-0.018
03/09/2018	1.434	1.452	1.466	0.032	15.628	03/09/2018	1.452	1.461	1.476	-0.018	0.009	-0.010
04/09/2018	1.419	1.436	1.450	0.031	15.612	04/09/2018	1.433	1.441	1.458	-0.014	0.005	-0.008
05/09/2018	1.417	1.423	1.433	0.016	15.595	05/09/2018	1.417	1.426	1.450	0.000	0.003	-0.017
06/09/2018	1.418	1.428	1.437	0.019	15.599	06/09/2018	1.418	1.425	1.433	0.000	0.003	0.004
07/09/2018	1.426	1.437	1.450	0.024	15.612	07/09/2018	1.429	1.437	1.450	-0.003	0.000	0.000
08/09/2018	1.419	1.441	1.459	0.040	15.621	08/09/2018	1.426	1.441	1.459	-0.007	0.000	0.000

09/09/2018	1.378	1.408	1.454	0.076	15.616	09/09/2018	1.378	1.414	1.459	0.000	-0.006	-0.005
10/09/2018	1.452	1.573	1.641	0.189	15.803	10/09/2018	1.400	1.502	1.641	0.052	0.071	0.000
11/09/2018	1.605	1.642	1.674	0.069	15.836	11/09/2018	1.590	1.620	1.659	0.015	0.022	0.015
12/09/2018	1.668	1.711	1.743	0.075	15.905	12/09/2018	1.650	1.687	1.739	0.018	0.024	0.004
13/09/2018	1.727	1.744	1.764	0.037	15.926	13/09/2018	1.712	1.738	1.764	0.015	0.006	0.000
14/09/2018	1.730	1.750	1.763	0.033	15.925	14/09/2018	1.727	1.745	1.763	0.003	0.005	0.000
15/09/2018	1.685	1.749	1.777	0.092	15.939	15/09/2018	1.744	1.762	1.777	-0.059	0.013	0.000
16/09/2018	1.684	1.732	1.772	0.088	15.934	16/09/2018	1.684	1.721	1.768	0.000	0.011	0.004
17/09/2018	1.764	1.827	1.981	0.217	16.143	17/09/2018	1.730	1.771	1.829	0.034	0.056	0.152
18/09/2018	1.931	1.978	2.016	0.085	16.178	18/09/2018	1.819	1.956	2.016	0.112	0.022	0.000
19/09/2018	1.938	2.040	2.118	0.180	16.280	19/09/2018	1.931	1.984	2.081	0.007	0.056	0.037
20/09/2018	2.004	2.098	2.146	0.142	16.308	20/09/2018	2.079	2.113	2.146	-0.075	0.015	0.000
21/09/2018	1.883	1.950	2.005	0.122	16.167	21/09/2018	1.949	2.006	2.128	-0.066	0.056	-0.123
22/09/2018	1.845	1.886	1.920	0.075	16.082	22/09/2018	1.882	1.905	1.951	-0.037	0.019	-0.031
23/09/2018	1.746	1.793	1.854	0.108	16.016	23/09/2018	1.781	1.832	1.893	-0.035	0.039	-0.039
24/09/2018	1.732	1.748	1.762	0.030	15.924	24/09/2018	1.732	1.753	1.783	0.000	0.005	-0.021
25/09/2018	1.688	1.718	1.756	0.068	15.918	25/09/2018	1.712	1.736	1.757	-0.024	0.018	-0.001
26/09/2018	1.707	1.744	1.779	0.072	15.941	26/09/2018	1.688	1.722	1.778	0.019	0.022	0.001
27/09/2018	1.744	1.761	1.780	0.036	15.942	27/09/2018	1.744	1.759	1.779	0.000	0.002	0.001
28/09/2018	1.708	1.757	1.782	0.074	15.944	28/09/2018	1.753	1.768	1.782	-0.045	0.011	0.000
29/09/2018	1.626	1.692	1.722	0.096	15.884	29/09/2018	1.699	1.719	1.767	-0.073	0.027	-0.045
30/09/2018	1.617	1.629	1.645	0.028	15.807	30/09/2018	1.621	1.643	1.699	-0.004	0.014	-0.054
01/10/2018	1.614	1.655	1.679	0.065	15.841	01/10/2018	1.617	1.646	1.679	-0.003	0.009	0.000
02/10/2018	1.606	1.636	1.655	0.049	15.817	02/10/2018	1.606	1.638	1.670	0.000	0.002	-0.015
03/10/2018	1.641	1.663	1.687	0.046	15.849	03/10/2018	1.641	1.656	1.687	0.000	0.007	0.000
04/10/2018	1.663	1.712	1.753	0.090	15.915	04/10/2018	1.655	1.685	1.728	0.008	0.027	0.025
05/10/2018	1.748	1.770	1.794	0.046	15.956	05/10/2018	1.725	1.756	1.794	0.023	0.014	0.000

06/10/2018	1.751	1.769	1.785	0.034	15.947	06/10/2018	1.759	1.773	1.787	-0.008	0.004	-0.002
07/10/2018	1.720	1.766	1.821	0.101	15.983	07/10/2018	1.720	1.750	1.779	0.000	0.016	0.042
08/10/2018	1.805	1.845	1.965	0.160	16.127	08/10/2018	1.777	1.815	1.844	0.028	0.030	0.121
09/10/2018	1.965	2.087	2.139	0.174	16.301	09/10/2018	1.836	1.994	2.124	0.129	0.093	0.015
10/10/2018	2.106	2.149	2.184	0.078	16.346	10/10/2018	2.121	2.150	2.184	-0.015	0.001	0.000
11/10/2018	1.911	2.016	2.110	0.199	16.272	11/10/2018	2.000	2.078	2.158	-0.089	0.062	-0.048
12/10/2018	1.853	1.885	1.978	0.125	16.140	12/10/2018	1.868	1.924	2.007	-0.015	0.039	-0.029
13/10/2018	1.869	1.931	1.997	0.128	16.159	13/10/2018	1.853	1.888	1.950	0.016	0.043	0.047
14/10/2018	1.937	2.010	2.064	0.127	16.226	14/10/2018	1.950	2.013	2.064	-0.013	0.003	0.000
15/10/2018	1.836	1.893	1.938	0.102	16.100	15/10/2018	1.898	1.933	2.007	-0.062	0.040	-0.069
16/10/2018	1.746	1.791	1.856	0.110	16.018	16/10/2018	1.791	1.830	1.901	-0.045	0.039	-0.045
17/10/2018	1.741	1.756	1.770	0.029	15.932	17/10/2018	1.746	1.759	1.788	-0.005	0.003	-0.018
18/10/2018	1.720	1.745	1.761	0.041	15.923	18/10/2018	1.741	1.752	1.761	-0.021	0.007	0.000
19/10/2018	1.701	1.725	1.754	0.053	15.916	19/10/2018	1.705	1.729	1.754	-0.004	0.004	0.000
20/10/2018	1.672	1.689	1.701	0.029	15.863	20/10/2018	1.672	1.701	1.747	0.000	0.012	-0.046
21/10/2018	1.628	1.661	1.698	0.070	15.860	21/10/2018	1.645	1.678	1.699	-0.017	0.017	-0.001
22/10/2018	1.584	1.626	1.650	0.066	15.812	22/10/2018	1.618	1.639	1.657	-0.034	0.013	-0.007
23/10/2018	1.595	1.617	1.653	0.058	15.815	23/10/2018	1.584	1.613	1.634	0.011	0.004	0.019
24/10/2018	1.628	1.645	1.662	0.034	15.824	24/10/2018	1.603	1.637	1.658	0.025	0.008	0.004
25/10/2018	1.659	1.695	1.742	0.083	15.904	25/10/2018	1.633	1.669	1.718	0.026	0.026	0.024
26/10/2018	1.728	1.742	1.754	0.026	15.916	26/10/2018	1.696	1.731	1.754	0.032	0.011	0.000
27/10/2018	1.682	1.713	1.745	0.063	15.907	27/10/2018	1.698	1.729	1.754	-0.016	0.016	-0.009
28/10/2018	1.632	1.664	1.682	0.050	15.844	28/10/2018	1.656	1.680	1.714	-0.024	0.016	-0.032
29/10/2018	1.609	1.631	1.645	0.036	15.807	29/10/2018	1.630	1.643	1.671	-0.021	0.012	-0.026

30/10/2018	1.621	1.655	1.682	0.061	15.844	30/10/2018	1.609	1.640	1.680	0.012	0.015	0.002
31/10/2018	1.628	1.642	1.655	0.027	15.817	31/10/2018	1.639	1.651	1.682	-0.011	0.009	-0.027
01/11/2018	1.622	1.642	1.658	0.036	15.820	01/11/2018	1.622	1.639	1.655	0.000	0.003	0.003
02/11/2018	1.658	1.693	1.724	0.066	15.886	02/11/2018	1.639	1.671	1.713	0.019	0.022	0.011
03/11/2018	1.722	1.760	1.784	0.062	15.946	03/11/2018	1.699	1.737	1.782	0.023	0.023	0.002
04/11/2018	1.749	1.773	1.790	0.041	15.952	04/11/2018	1.749	1.768	1.790	0.000	0.005	0.000
05/11/2018	1.741	1.771	1.790	0.049	15.952	05/11/2018	1.762	1.779	1.790	-0.021	0.008	0.000
06/11/2018	1.692	1.724	1.749	0.057	15.911	06/11/2018	1.723	1.747	1.782	-0.031	0.023	-0.033
07/11/2018	1.683	1.696	1.710	0.027	15.872	07/11/2018	1.686	1.699	1.726	-0.003	0.003	-0.016
08/11/2018	1.683	1.711	1.732	0.049	15.894	08/11/2018	1.683	1.707	1.732	0.000	0.004	0.000
09/11/2018	1.653	1.679	1.697	0.044	15.859	09/11/2018	1.671	1.691	1.721	-0.018	0.012	-0.024
10/11/2018	1.667	1.711	1.741	0.074	15.903	10/11/2018	1.653	1.688	1.731	0.014	0.023	0.010
11/11/2018	1.703	1.732	1.749	0.046	15.911	11/11/2018	1.721	1.734	1.749	-0.018	0.002	0.000
12/11/2018	1.649	1.689	1.707	0.058	15.869	12/11/2018	1.690	1.710	1.747	-0.041	0.021	-0.040
13/11/2018	1.570	1.624	1.658	0.088	15.820	13/11/2018	1.628	1.653	1.691	-0.058	0.029	-0.033
14/11/2018	1.580	1.592	1.610	0.030	15.772	14/11/2018	1.570	1.594	1.635	0.010	0.002	-0.025
15/11/2018	1.571	1.587	1.623	0.052	15.785	15/11/2018	1.571	1.590	1.623	0.000	0.003	0.000
16/11/2018	1.578	1.602	1.633	0.055	15.795	16/11/2018	1.573	1.596	1.633	0.005	0.006	0.000
17/11/2018	1.540	1.566	1.585	0.045	15.747	17/11/2018	1.564	1.582	1.627	-0.024	0.016	-0.042
18/11/2018	1.518	1.542	1.557	0.039	15.719	18/11/2018	1.533	1.549	1.576	-0.015	0.007	-0.019
19/11/2018	1.517	1.530	1.546	0.029	15.708	19/11/2018	1.517	1.532	1.557	0.000	0.002	-0.011
20/11/2018	1.487	1.536	1.573	0.086	15.735	20/11/2018	1.509	1.535	1.565	-0.022	0.001	0.008
21/11/2018	1.503	1.540	1.562	0.059	15.724	21/11/2018	1.487	1.537	1.573	0.016	0.003	-0.011
22/11/2018	1.548	1.589	1.624	0.076	15.786	22/11/2018	1.529	1.565	1.619	0.019	0.024	0.005
23/11/2018	1.572	1.597	1.616	0.044	15.778	23/11/2018	1.586	1.603	1.624	-0.014	0.006	-0.008

24/11/2018	1.572	1.579	1.587	0.015	15.749	24/11/2018	1.572	1.583	1.614	0.000	-0.004	-0.027
25/11/2018	1.546	1.575	1.595	0.049	15.757	25/11/2018	1.572	1.582	1.595	-0.026	-0.007	0.000
26/11/2018	1.571	1.610	1.627	0.056	15.789	26/11/2018	1.546	1.589	1.627	0.025	0.021	0.000
27/11/2018	1.538	1.599	1.620	0.082	15.782	27/11/2018	1.599	1.612	1.623	-0.061	-0.013	-0.003
28/11/2018	1.534	1.562	1.581	0.047	15.743	28/11/2018	1.534	1.566	1.603	0.000	-0.004	-0.022
29/11/2018	1.571	1.624	1.703	0.132	15.865	29/11/2018	1.561	1.591	1.626	0.010	0.033	0.077
30/11/2018	1.703	1.801	1.880	0.177	16.042	30/11/2018	1.617	1.726	1.817	0.086	0.075	0.063
01/12/2018	1.880	1.910	1.937	0.057	16.099	01/12/2018	1.817	1.889	1.935	0.063	0.021	0.002
02/12/2018	1.776	1.843	1.884	0.108	16.046	02/12/2018	1.847	1.882	1.937	-0.071	-0.039	-0.053
03/12/2018	1.765	1.781	1.799	0.034	15.961	03/12/2018	1.767	1.790	1.847	-0.002	-0.009	-0.048
04/12/2018	1.702	1.740	1.765	0.063	15.927	04/12/2018	1.739	1.763	1.792	-0.037	-0.023	-0.027
05/12/2018	1.695	1.725	1.752	0.057	15.914	05/12/2018	1.695	1.719	1.749	0.000	-0.006	0.003
06/12/2018	1.696	1.719	1.742	0.046	15.904	06/12/2018	1.709	1.726	1.752	-0.013	-0.007	-0.010
07/12/2018	1.705	1.765	1.819	0.114	15.981	07/12/2018	1.696	1.732	1.807	0.009	0.033	0.012
08/12/2018	1.818	1.872	1.902	0.084	16.064	08/12/2018	1.792	1.842	1.902	0.026	-0.030	0.000
09/12/2018	1.823	1.866	1.900	0.077	16.062	09/12/2018	1.858	1.879	1.900	-0.035	-0.013	0.000
10/12/2018	1.766	1.810	1.835	0.069	15.997	10/12/2018	1.813	1.833	1.891	-0.047	-0.023	-0.056
11/12/2018	1.749	1.771	1.785	0.036	15.947	11/12/2018	1.766	1.781	1.820	-0.017	-0.010	-0.035
12/12/2018	1.659	1.718	1.753	0.094	15.915	12/12/2018	1.723	1.745	1.774	-0.064	-0.027	-0.021
13/12/2018	1.632	1.656	1.673	0.041	15.835	13/12/2018	1.640	1.672	1.721	-0.008	-0.016	-0.048
14/12/2018	1.604	1.655	1.688	0.084	15.850	14/12/2018	1.632	1.660	1.688	-0.028	-0.005	0.000
15/12/2018	1.570	1.635	1.671	0.101	15.833	15/12/2018	1.570	1.625	1.665	0.000	-0.010	0.006
16/12/2018	1.659	1.698	1.726	0.067	15.888	16/12/2018	1.640	1.676	1.711	0.019	-0.022	0.015
17/12/2018	1.725	1.747	1.766	0.041	15.928	17/12/2018	1.709	1.735	1.765	0.016	-0.012	0.001
18/12/2018	1.746	1.845	1.902	0.156	16.064	18/12/2018	1.727	1.794	1.902	0.019	-0.051	0.000

19/12/2018	1.803	1.842	1.871	0.068	16.033	19/12/2018	1.840	1.865	1.900	-0.037	-0.023	-0.029
20/12/2018	1.731	1.785	1.817	0.086	15.979	20/12/2018	1.783	1.812	1.842	-0.052	-0.027	-0.025
21/12/2018	1.712	1.738	1.750	0.038	15.912	21/12/2018	1.729	1.745	1.781	-0.017	-0.007	-0.031
22/12/2018	1.703	1.713	1.721	0.018	15.883	22/12/2018	1.703	1.719	1.742	0.000	-0.006	-0.021
23/12/2018	1.706	1.716	1.728	0.022	15.890	23/12/2018	1.709	1.717	1.728	-0.003	-0.001	0.000
24/12/2018	1.667	1.702	1.719	0.052	15.881	24/12/2018	1.700	1.711	1.726	-0.033	-0.009	-0.007
25/12/2018	1.654	1.682	1.707	0.053	15.869	25/12/2018	1.664	1.689	1.713	-0.010	-0.007	-0.006
26/12/2018	1.627	1.643	1.659	0.032	15.821	26/12/2018	1.637	1.661	1.704	-0.010	-0.018	-0.045
27/12/2018	1.630	1.663	1.697	0.067	15.859							
28/12/2018	1.652	1.694	1.726	0.074	15.888							
29/12/2018	1.687	1.745	1.785	0.098	15.947							
30/12/2018	1.700	1.734	1.749	0.049	15.911	30/12/2018	1.739	1.744	1.749	-0.039	-0.010	0.000
31/12/2018	1.687	1.699	1.713	0.026	15.875	31/12/2018	1.692	1.709	1.740	-0.005	-0.010	-0.027
01/01/2019	1.691	1.710	1.731	0.040	15.893	01/01/2019	1.687	1.702	1.728	0.004	-0.008	0.003
02/01/2019	1.699	1.715	1.737	0.038	15.899	02/01/2019	1.701	1.716	1.737	-0.002	-0.001	0.000
03/01/2019	1.690	1.719	1.750	0.060	15.912	03/01/2019	1.695	1.719	1.750	-0.005	0.000	0.000
04/01/2019	1.639	1.676	1.693	0.054	15.855	04/01/2019	1.676	1.694	1.742	-0.037	-0.018	-0.049
05/01/2019	1.636	1.673	1.697	0.061	15.859	05/01/2019	1.636	1.666	1.693	0.000	-0.007	0.004
06/01/2019	1.643	1.678	1.712	0.069	15.874	06/01/2019	1.654	1.681	1.712	-0.011	-0.003	0.000
07/01/2019	1.632	1.653	1.678	0.046	15.840	07/01/2019	1.632	1.660	1.704	0.000	-0.007	-0.026
08/01/2019	1.650	1.688	1.721	0.071	15.883	08/01/2019	1.636	1.670	1.718	0.014	0.018	0.003
09/01/2019	1.690	1.716	1.737	0.047	15.899	09/01/2019	1.687	1.707	1.728	0.003	0.009	0.009
10/01/2019	1.727	1.763	1.780	0.053	15.942	10/01/2019	1.723	1.755	1.780	0.004	-0.008	0.000
11/01/2019	1.680	1.727	1.750	0.070	15.912	11/01/2019	1.727	1.741	1.776	-0.047	-0.014	-0.026

12/01/2019	1.652	1.686	1.722	0.070	15.884	12/01/2019	1.670	1.696	1.742	-0.018	0.010	-0.020
13/01/2019	1.654	1.694	1.737	0.083	15.899	13/01/2019	1.652	1.682	1.722	0.002	0.012	0.015
14/01/2019	1.736	1.781	1.805	0.069	15.967	14/01/2019	1.704	1.752	1.805	0.032	0.029	0.000
15/01/2019	1.804	1.832	1.849	0.045	16.011	15/01/2019	1.787	1.817	1.847	0.017	0.015	0.002
16/01/2019	1.810	1.847	1.881	0.071	16.043	16/01/2019	1.821	1.848	1.881	-0.011	0.001	0.000
17/01/2019	1.776	1.803	1.818	0.042	15.980	17/01/2019	1.802	1.818	1.852	-0.026	0.015	-0.034
18/01/2019	1.740	1.763	1.779	0.039	15.941	18/01/2019	1.761	1.778	1.809	-0.021	0.015	-0.030
19/01/2019	1.717	1.751	1.777	0.060	15.939	19/01/2019	1.740	1.755	1.777	-0.023	0.004	0.000
20/01/2019	1.684	1.702	1.717	0.033	15.879	20/01/2019	1.696	1.720	1.771	-0.012	0.018	-0.054
21/01/2019	1.618	1.642	1.692	0.074	15.854	21/01/2019	1.625	1.669	1.705	-0.007	0.027	-0.013
22/01/2019	1.616	1.642	1.672	0.056	15.834	22/01/2019	1.616	1.634	1.672	0.000	0.008	0.000
23/01/2019	1.627	1.651	1.681	0.054	15.843	23/01/2019	1.626	1.649	1.681	0.001	0.002	0.000
24/01/2019	1.632	1.660	1.682	0.050	15.844	24/01/2019	1.630	1.659	1.682	0.002	0.001	0.000
25/01/2019	1.641	1.684	1.772	0.131	15.934	25/01/2019	1.641	1.658	1.699	0.000	0.026	0.073
26/01/2019	1.772	1.887	1.934	0.162	16.096	26/01/2019	1.698	1.817	1.932	0.074	0.070	0.002
27/01/2019	1.848	1.865	1.880	0.032	16.042	27/01/2019	1.855	1.883	1.934	-0.007	0.018	-0.054
28/01/2019	1.794	1.834	1.863	0.069	16.025	28/01/2019	1.829	1.851	1.873	-0.035	0.017	-0.010
29/01/2019	1.724	1.779	1.801	0.077	15.963	29/01/2019	1.787	1.803	1.840	-0.063	0.024	-0.039
30/01/2019	1.690	1.715	1.728	0.038	15.890	30/01/2019	1.714	1.732	1.792	-0.024	0.017	-0.064
31/01/2019	1.639	1.677	1.694	0.055	15.856	31/01/2019	1.684	1.696	1.722	-0.045	0.019	-0.028
01/02/2019	1.614	1.639	1.653	0.039	15.815	01/02/2019	1.627	1.647	1.684	-0.013	0.008	-0.031
02/02/2019	1.580	1.621	1.646	0.066	15.808	02/02/2019	1.608	1.627	1.652	-0.028	0.006	-0.006
03/02/2019	1.534	1.555	1.584	0.050	15.746	03/02/2019	1.545	1.581	1.644	-0.011	0.026	-0.060
04/02/2019	1.535	1.559	1.580	0.045	15.742	04/02/2019	1.534	1.549	1.573	0.001	0.010	0.007

05/02/2019	1.574	1.602	1.641	0.067	15.803	05/02/2019	1.565	1.585	1.611	0.009	0.017	0.030
06/02/2019	1.636	1.723	1.786	0.150	15.948	06/02/2019	1.599	1.668	1.759	0.037	0.055	0.027
07/02/2019	1.776	1.806	1.832	0.056	15.994	07/02/2019	1.756	1.791	1.832	0.020	0.015	0.000
08/02/2019	1.761	1.871	1.979	0.218	16.141	08/02/2019	1.761	1.816	1.910	0.000	0.055	0.069
09/02/2019	1.929	1.961	1.984	0.055	16.146	09/02/2019	1.912	1.963	1.984	0.017	-0.002	0.000
10/02/2019	1.860	1.898	1.933	0.073	16.095	10/02/2019	1.894	1.924	1.962	-0.034	-0.026	-0.029
11/02/2019	1.789	1.842	1.890	0.101	16.052	11/02/2019	1.841	1.867	1.896	-0.052	-0.025	-0.006
12/02/2019	1.754	1.778	1.794	0.040	15.956	12/02/2019	1.765	1.793	1.837	-0.011	-0.015	-0.043
13/02/2019	1.701	1.747	1.782	0.081	15.944	13/02/2019	1.749	1.766	1.787	-0.048	-0.019	-0.005
14/02/2019	1.731	1.752	1.770	0.039	15.932	14/02/2019	1.701	1.741	1.770	0.030	-0.011	0.000
15/02/2019	1.720	1.746	1.773	0.053	15.935	15/02/2019	1.720	1.749	1.765	0.000	-0.003	0.008
16/02/2019	1.773	1.823	1.855	0.082	16.017	16/02/2019	1.730	1.798	1.855	0.043	-0.025	0.000
17/02/2019	1.732	1.768	1.794	0.062	15.956	17/02/2019	1.761	1.791	1.847	-0.029	-0.023	-0.053
18/02/2019	1.742	1.784	1.813	0.071	15.975	18/02/2019	1.732	1.762	1.810	0.010	-0.022	0.003
19/02/2019	1.763	1.818	1.855	0.092	16.017	19/02/2019	1.806	1.819	1.855	-0.043	-0.001	0.000
20/02/2019	1.766	1.786	1.805	0.039	15.967	20/02/2019	1.763	1.792	1.845	0.003	-0.006	-0.040
21/02/2019	1.677	1.771	1.807	0.130	15.969	21/02/2019	1.778	1.791	1.807	-0.101	-0.020	0.000
22/02/2019	1.616	1.664	1.696	0.080	15.858	22/02/2019	1.662	1.701	1.798	-0.046	-0.037	-0.102
23/02/2019	1.595	1.624	1.649	0.054	15.811	23/02/2019	1.595	1.626	1.674	0.000	-0.002	-0.025
24/02/2019	1.615	1.631	1.643	0.028	15.805	24/02/2019	1.615	1.632	1.648	0.000	-0.001	-0.005
25/02/2019	1.599	1.626	1.641	0.042	15.803	25/02/2019	1.621	1.633	1.641	-0.022	-0.007	0.000
26/02/2019	1.584	1.607	1.622	0.038	15.784	26/02/2019	1.584	1.608	1.636	0.000	-0.001	-0.014
27/02/2019	1.602	1.629	1.648	0.046	15.810	27/02/2019	1.602	1.617	1.647	0.000	0.012	0.001
28/02/2019	1.638	1.666	1.689	0.051	15.851	28/02/2019	1.635	1.653	1.689	0.003	0.013	0.000

01/03/2019	1.662	1.674	1.689	0.027	15.851	01/03/2019	1.662	1.671	1.686	0.000	0.003	0.003
02/03/2019	1.662	1.682	1.724	0.062	15.886	02/03/2019	1.662	1.675	1.689	0.000	0.007	0.035
03/03/2019	1.724	1.822	1.870	0.146	16.032	03/03/2019	1.666	1.762	1.870	0.058	0.060	0.000
04/03/2019	1.807	1.832	1.846	0.039	16.008	04/03/2019	1.826	1.844	1.869	-0.019	0.012	-0.023
05/03/2019	1.744	1.789	1.808	0.064	15.970	05/03/2019	1.787	1.808	1.839	-0.043	0.019	-0.031
06/03/2019	1.739	1.763	1.783	0.044	15.945	06/03/2019	1.739	1.763	1.799	0.000	0.000	-0.016
07/03/2019	1.745	1.784	1.859	0.114	16.021	07/03/2019	1.745	1.769	1.783	0.000	0.015	0.076
08/03/2019	1.707	1.808	1.868	0.161	16.030	08/03/2019	1.770	1.830	1.868	-0.063	0.022	0.000
09/03/2019	1.689	1.727	1.773	0.084	15.935	09/03/2019	1.689	1.724	1.799	0.000	0.003	-0.026
10/03/2019	1.665	1.734	1.777	0.112	15.939	10/03/2019	1.737	1.760	1.777	-0.072	0.026	0.000
11/03/2019	1.651	1.678	1.729	0.078	15.891	11/03/2019	1.651	1.677	1.738	0.000	0.001	-0.009
12/03/2019	1.729	1.814	1.897	0.168	16.059	12/03/2019	1.668	1.745	1.852	0.061	0.069	0.045
13/03/2019	1.884	1.901	1.929	0.045	16.091	13/03/2019	1.850	1.886	1.898	0.034	0.015	0.031
14/03/2019	1.925	1.958	1.986	0.061	16.148	14/03/2019	1.893	1.936	1.986	0.032	0.022	0.000
15/03/2019	1.934	1.954	1.976	0.042	16.138	15/03/2019	1.934	1.957	1.984	0.000	0.003	-0.008
16/03/2019	1.852	1.932	1.976	0.124	16.138	16/03/2019	1.935	1.958	1.976	-0.083	0.026	0.000
17/03/2019	1.831	1.864	1.906	0.075	16.068	17/03/2019	1.831	1.868	1.954	0.000	0.004	-0.048
18/03/2019	1.845	1.895	1.918	0.073	16.080	18/03/2019	1.871	1.898	1.918	-0.026	0.003	0.000
19/03/2019	1.838	1.846	1.869	0.031	16.031	19/03/2019	1.838	1.857	1.903	0.000	0.011	-0.034
20/03/2019	1.857	1.872	1.890	0.033	16.052	20/03/2019	1.841	1.866	1.890	0.016	0.006	0.000
21/03/2019	1.854	1.913	1.963	0.109	16.125	21/03/2019	1.857	1.900	1.963	-0.003	0.013	0.000
22/03/2019	1.834	1.855	1.873	0.039	16.035	22/03/2019	1.845	1.874	1.933	-0.011	0.019	-0.060
23/03/2019	1.794	1.839	1.869	0.075	16.031	23/03/2019	1.816	1.845	1.869	-0.022	0.006	0.000
24/03/2019	1.776	1.795	1.805	0.029	15.967	24/03/2019	1.776	1.809	1.856	0.000	0.014	-0.051
25/03/2019	1.787	1.821	1.862	0.075	16.024	25/03/2019	1.787	1.804	1.862	0.000	0.017	0.000
26/03/2019	1.784	1.801	1.821	0.037	15.983	26/03/2019	1.794	1.818	1.861	-0.010	0.017	-0.040

27/03/2019	1.760	1.790	1.811	0.051	15.973	27/03/2019	1.783	1.794	1.811	-0.023	-0.004	0.000
28/03/2019	1.726	1.750	1.770	0.044	15.932	28/03/2019	1.742	1.764	1.807	-0.016	-0.014	-0.037
29/03/2019	1.673	1.698	1.729	0.056	15.891	29/03/2019	1.673	1.715	1.760	0.000	-0.017	-0.031
30/03/2019	1.688	1.705	1.722	0.034	15.884	30/03/2019	1.688	1.701	1.721	0.000	0.004	0.001
31/03/2019	1.679	1.692	1.702	0.023	15.864	31/03/2019	1.687	1.700	1.722	-0.008	-0.008	-0.020
01/04/2019	1.629	1.654	1.691	0.062	15.853	01/04/2019	1.649	1.674	1.696	-0.020	-0.020	-0.005
02/04/2019	1.569	1.614	1.643	0.074	15.805	02/04/2019	1.614	1.632	1.646	-0.045	-0.018	-0.003
03/04/2019	1.580	1.731	1.798	0.218	15.960	03/04/2019	1.569	1.652	1.791	0.011	-0.079	0.007
04/04/2019	1.718	1.777	1.812	0.094	15.974	04/04/2019	1.785	1.797	1.812	-0.067	-0.020	0.000
05/04/2019	1.725	1.761	1.802	0.077	15.964	05/04/2019	1.718	1.751	1.802	0.007	-0.010	0.000
06/04/2019	1.771	1.802	1.834	0.063	15.996	06/04/2019	1.759	1.796	1.834	0.012	-0.006	0.000
07/04/2019	1.753	1.779	1.806	0.053	15.968	07/04/2019	1.753	1.781	1.820	0.000	-0.002	-0.014
08/04/2019	1.719	1.750	1.774	0.055	15.936	08/04/2019	1.751	1.769	1.800	-0.032	-0.019	-0.026
09/04/2019	1.671	1.699	1.724	0.053	15.886	09/04/2019	1.698	1.718	1.749	-0.027	-0.019	-0.025
10/04/2019	1.669	1.685	1.709	0.040	15.871	10/04/2019	1.669	1.684	1.709	0.000	-0.001	0.000
11/04/2019	1.622	1.656	1.675	0.053	15.837	11/04/2019	1.622	1.671	1.701	0.000	-0.015	-0.026
12/04/2019	1.530	1.604	1.640	0.110	15.802	12/04/2019	1.614	1.636	1.660	-0.084	-0.032	-0.020
13/04/2019	1.420	1.492	1.536	0.116	15.698	13/04/2019	1.499	1.535	1.613	-0.079	-0.043	-0.077
14/04/2019	1.393	1.413	1.427	0.034	15.589	14/04/2019	1.407	1.430	1.500	-0.014	-0.017	-0.073
15/04/2019	1.391	1.408	1.449	0.058	15.611	15/04/2019	1.391	1.404	1.422	0.000	0.004	0.027
16/04/2019	1.449	1.491	1.509	0.060	15.671	16/04/2019	1.407	1.463	1.509	0.042	0.028	0.000
17/04/2019	1.499	1.524	1.541	0.042	15.703	17/04/2019	1.481	1.507	1.539	0.018	-0.017	0.002
18/04/2019	1.511	1.532	1.543	0.032	15.705	18/04/2019	1.531	1.538	1.543	-0.020	-0.006	0.000
19/04/2019	1.537	1.545	1.556	0.019	15.718	19/04/2019	1.511	1.537	1.556	0.026	-0.008	0.000

20/04/2019	1.544	1.563	1.578	0.034	15.740	20/04/2019	1.537	1.553	1.578	0.007	0.010	0.000
21/04/2019	1.514	1.542	1.573	0.059	15.735	21/04/2019	1.534	1.559	1.577	-0.020	0.017	-0.004
22/04/2019	1.484	1.512	1.532	0.048	15.694	22/04/2019	1.484	1.512	1.541	0.000	0.000	-0.009
23/04/2019	1.475	1.514	1.547	0.072	15.709	23/04/2019	1.513	1.527	1.547	-0.038	0.013	0.000
24/04/2019	1.464	1.528	1.583	0.119	15.745	24/04/2019	1.464	1.501	1.560	0.000	0.027	0.023
25/04/2019	1.555	1.572	1.584	0.029	15.746	25/04/2019	1.549	1.566	1.583	0.006	0.006	0.001
26/04/2019	1.506	1.535	1.577	0.071	15.739	26/04/2019	1.529	1.558	1.584	-0.023	0.023	-0.007
27/04/2019	1.523	1.547	1.563	0.040	15.725	27/04/2019	1.506	1.531	1.563	0.017	0.016	0.000
28/04/2019	1.563	1.594	1.617	0.054	15.779	28/04/2019	1.551	1.581	1.617	0.012	0.013	0.000
29/04/2019	1.551	1.575	1.589	0.038	15.751	29/04/2019	1.579	1.586	1.606	-0.028	0.011	-0.017
30/04/2019	1.542	1.559	1.579	0.037	15.741	30/04/2019	1.551	1.561	1.579	-0.009	0.002	0.000
01/05/2019	1.546	1.555	1.568	0.022	15.730	01/05/2019	1.542	1.554	1.574	0.004	0.001	-0.006
02/05/2019	1.548	1.567	1.589	0.041	15.751	02/05/2019	1.550	1.566	1.587	-0.002	0.001	0.002
03/05/2019	1.568	1.590	1.612	0.044	15.774	03/05/2019	1.548	1.580	1.612	0.020	0.010	0.000
04/05/2019	1.566	1.579	1.593	0.027	15.755	04/05/2019	1.566	1.580	1.612	0.000	0.001	-0.019
05/05/2019	1.562	1.581	1.595	0.033	15.757	05/05/2019	1.576	1.585	1.595	-0.014	0.004	0.000
06/05/2019	1.543	1.564	1.579	0.036	15.741	06/05/2019	1.561	1.572	1.594	-0.018	0.008	-0.015
07/05/2019	1.536	1.548	1.557	0.021	15.719	07/05/2019	1.536	1.550	1.570	0.000	0.002	-0.013
08/05/2019	1.542	1.571	1.605	0.063	15.767	08/05/2019	1.539	1.565	1.605	0.003	0.006	0.000
09/05/2019	1.556	1.582	1.604	0.048	15.766	09/05/2019	1.543	1.579	1.604	0.013	0.003	0.000
10/05/2019	1.541	1.565	1.585	0.044	15.747	10/05/2019	1.556	1.570	1.589	-0.015	0.005	-0.004
11/05/2019	1.530	1.546	1.562	0.032	15.724	11/05/2019	1.530	1.550	1.582	0.000	0.004	-0.020
12/05/2019	1.513	1.524	1.543	0.030	15.705	12/05/2019	1.513	1.534	1.562	0.000	0.010	-0.019
13/05/2019	1.502	1.521	1.540	0.038	15.702	13/05/2019	1.513	1.524	1.540	-0.011	0.003	0.000
14/05/2019	1.492	1.510	1.519	0.027	15.681	14/05/2019	1.492	1.509	1.530	0.000	0.001	-0.011
15/05/2019	1.511	1.519	1.526	0.015	15.688	15/05/2019	1.510	1.518	1.526	0.001	0.001	0.000

16/05/2019	1.464	1.488	1.523	0.059	15.685	16/05/2019	1.485	1.504	1.523	-0.021	0.016	0.000
17/05/2019	1.473	1.490	1.503	0.030	15.665	17/05/2019	1.464	1.487	1.503	0.009	0.003	0.000
18/05/2019	1.484	1.516	1.531	0.047	15.693	18/05/2019	1.473	1.503	1.531	0.011	0.013	0.000
19/05/2019	1.505	1.527	1.543	0.038	15.705	19/05/2019	1.505	1.527	1.543	0.000	0.000	0.000
20/05/2019	1.514	1.527	1.541	0.027	15.703	20/05/2019	1.508	1.523	1.541	0.006	0.004	0.000
21/05/2019	1.541	1.556	1.575	0.034	15.737	21/05/2019	1.525	1.543	1.563	0.016	0.013	0.012
22/05/2019	1.557	1.567	1.579	0.022	15.741	22/05/2019	1.557	1.566	1.576	0.000	0.001	0.003
23/05/2019	1.537	1.556	1.581	0.044	15.743	23/05/2019	1.537	1.563	1.581	0.000	0.007	0.000
24/05/2019	1.554	1.561	1.575	0.021	15.737	24/05/2019	1.543	1.556	1.565	0.011	0.005	0.010
25/05/2019	1.575	1.602	1.636	0.061	15.798	25/05/2019	1.558	1.581	1.608	0.017	0.021	0.028
26/05/2019	1.623	1.680	1.723	0.100	15.885	26/05/2019	1.602	1.648	1.707	0.021	0.032	0.016
27/05/2019	1.716	1.737	1.749	0.033	15.911	27/05/2019	1.696	1.727	1.749	0.020	0.010	0.000
28/05/2019	1.690	1.711	1.726	0.036	15.888	28/05/2019	1.710	1.722	1.741	-0.020	0.011	-0.015
29/05/2019	1.609	1.659	1.693	0.084	15.855	29/05/2019	1.660	1.685	1.712	-0.051	0.026	-0.019
30/05/2019	1.605	1.636	1.659	0.054	15.821	30/05/2019	1.605	1.630	1.664	0.000	0.006	-0.005
31/05/2019	1.655	1.690	1.752	0.097	15.914	31/05/2019	1.641	1.663	1.703	0.014	0.027	0.049
01/06/2019	1.718	1.766	1.798	0.080	15.960	01/06/2019	1.702	1.752	1.798	0.016	0.014	0.000
02/06/2019	1.666	1.689	1.719	0.053	15.881	02/06/2019	1.685	1.720	1.783	-0.019	0.031	-0.064
03/06/2019	1.677	1.699	1.729	0.052	15.891	03/06/2019	1.666	1.688	1.729	0.011	0.011	0.000
04/06/2019	1.688	1.709	1.725	0.037	15.887	04/06/2019	1.692	1.710	1.725	-0.004	0.001	0.000
05/06/2019	1.686	1.744	1.771	0.085	15.933	05/06/2019	1.686	1.720	1.771	0.000	0.024	0.000
06/06/2019	1.761	1.805	1.835	0.074	15.997	06/06/2019	1.761	1.783	1.835	0.000	0.022	0.000
07/06/2019	1.781	1.819	1.846	0.065	16.008	07/06/2019	1.809	1.827	1.846	-0.028	0.008	0.000
08/06/2019	1.721	1.754	1.781	0.060	15.943	08/06/2019	1.755	1.779	1.824	-0.034	0.025	-0.043
09/06/2019	1.606	1.668	1.722	0.116	15.884	09/06/2019	1.666	1.710	1.756	-0.060	0.042	-0.034
10/06/2019	1.535	1.575	1.611	0.076	15.773	10/06/2019	1.567	1.605	1.665	-0.032	0.030	-0.054
11/06/2019	1.462	1.528	1.564	0.102	15.726	11/06/2019	1.535	1.548	1.568	-0.073	0.020	-0.004

12/06/2019	1.364	1.423	1.471	0.107	15.633	12/06/2019	1.398	1.470	1.537	-0.034	-0.047	-0.066
13/06/2019	1.373	1.391	1.407	0.034	15.569	13/06/2019	1.364	1.382	1.405	0.009	0.009	0.002
14/06/2019	1.372	1.385	1.407	0.035	15.569	14/06/2019	1.380	1.393	1.407	-0.008	-0.008	0.000
15/06/2019	1.363	1.372	1.378	0.015	15.540	15/06/2019	1.370	1.376	1.383	-0.007	-0.004	-0.005
16/06/2019	1.309	1.347	1.373	0.064	15.535	16/06/2019	1.354	1.363	1.374	-0.045	-0.016	-0.001
17/06/2019	1.305	1.321	1.334	0.029	15.496	17/06/2019	1.305	1.320	1.354	0.000	-0.001	-0.020
18/06/2019	1.315	1.341	1.359	0.044	15.521	18/06/2019	1.315	1.330	1.356	0.000	-0.011	0.003
19/06/2019	1.357	1.383	1.423	0.066	15.585	19/06/2019	1.352	1.369	1.398	0.005	-0.014	0.025
20/06/2019	1.403	1.430	1.454	0.051	15.616	20/06/2019	1.382	1.420	1.454	0.021	-0.010	0.000
21/06/2019	1.412	1.432	1.444	0.032	15.606	21/06/2019	1.403	1.425	1.445	0.009	-0.007	-0.001
22/06/2019	1.437	1.463	1.485	0.048	15.647	22/06/2019	1.432	1.448	1.468	0.005	-0.015	0.017
23/06/2019	1.478	1.495	1.513	0.035	15.675	23/06/2019	1.470	1.489	1.513	0.008	-0.006	0.000
24/06/2019	1.505	1.551	1.579	0.074	15.741	24/06/2019	1.481	1.523	1.579	0.024	-0.028	0.000
25/06/2019	1.557	1.590	1.609	0.052	15.771	25/06/2019	1.557	1.575	1.603	0.000	-0.015	0.006
26/06/2019	1.593	1.617	1.635	0.042	15.797	26/06/2019	1.597	1.609	1.623	-0.004	-0.008	0.012
27/06/2019	1.593	1.602	1.609	0.016	15.771	27/06/2019	1.593	1.605	1.630	0.000	-0.003	-0.021
28/06/2019	1.602	1.610	1.625	0.023	15.787	28/06/2019	1.597	1.606	1.618	0.005	-0.004	0.007
29/06/2019	1.569	1.635	1.723	0.154	15.885	29/06/2019	1.569	1.624	1.703	0.000	-0.011	0.020
30/06/2019	1.495	1.550	1.602	0.107	15.764	30/06/2019	1.526	1.593	1.723	-0.031	-0.043	-0.121
01/07/2019	1.502	1.550	1.571	0.069	15.733	01/07/2019	1.495	1.536	1.566	0.007	-0.014	0.005
02/07/2019	1.557	1.590	1.607	0.050	15.769	02/07/2019	1.557	1.579	1.602	0.000	-0.011	0.005
03/07/2019	1.587	1.605	1.629	0.042	15.791	03/07/2019	1.586	1.602	1.629	0.001	-0.003	0.000
04/07/2019	1.581	1.600	1.614	0.033	15.776	04/07/2019	1.594	1.606	1.617	-0.013	-0.006	-0.003
05/07/2019	1.535	1.572	1.590	0.055	15.752	05/07/2019	1.580	1.587	1.606	-0.045	-0.015	-0.016
06/07/2019	1.538	1.561	1.573	0.035	15.735	06/07/2019	1.535	1.557	1.578	0.003	-0.004	-0.005
07/07/2019	1.507	1.542	1.565	0.058	15.727	07/07/2019	1.543	1.556	1.570	-0.036	-0.014	-0.005
08/07/2019	1.507	1.527	1.542	0.035	15.704	08/07/2019	1.507	1.527	1.552	0.000	0.000	-0.010
09/07/2019	1.524	1.545	1.579	0.055	15.741	09/07/2019	1.513	1.532	1.548	0.011	-0.013	0.031
10/07/2019	1.577	1.609	1.641	0.064	15.803	10/07/2019	1.546	1.584	1.624	0.031	-0.025	0.017

11/07/2019	1.641	1.666	1.683	0.042	15.845	11/07/2019	1.622	1.653	1.683	0.019	0.013	0.000
12/07/2019	1.623	1.659	1.679	0.056	15.841	12/07/2019	1.649	1.664	1.681	-0.026	0.005	-0.002
13/07/2019	1.589	1.611	1.632	0.043	15.794	13/07/2019	1.602	1.629	1.679	-0.013	0.018	-0.047
14/07/2019	1.542	1.575	1.592	0.050	15.754	14/07/2019	1.579	1.593	1.613	-0.037	0.018	-0.021
15/07/2019	1.537	1.546	1.566	0.029	15.728	15/07/2019	1.537	1.548	1.580	0.000	0.002	-0.014
16/07/2019	1.558	1.565	1.574	0.016	15.736	16/07/2019	1.542	1.558	1.567	0.016	0.007	0.007
17/07/2019	1.548	1.565	1.576	0.028	15.738	17/07/2019	1.558	1.569	1.576	-0.010	0.004	0.000
18/07/2019	1.549	1.559	1.579	0.030	15.741	18/07/2019	1.548	1.556	1.571	0.001	0.003	0.008
19/07/2019	1.576	1.603	1.629	0.053	15.791	19/07/2019	1.559	1.583	1.608	0.017	0.020	0.021
20/07/2019	1.624	1.641	1.666	0.042	15.828	20/07/2019	1.607	1.627	1.651	0.017	0.014	0.015
21/07/2019	1.625	1.677	1.707	0.082	15.869	21/07/2019	1.650	1.676	1.707	-0.025	0.001	0.000
22/07/2019	1.626	1.693	1.745	0.119	15.907	22/07/2019	1.625	1.665	1.725	0.001	0.028	0.020
23/07/2019	1.716	1.747	1.765	0.049	15.927	23/07/2019	1.724	1.743	1.765	-0.008	0.004	0.000
24/07/2019	1.680	1.716	1.748	0.068	15.910	24/07/2019	1.713	1.736	1.758	-0.033	0.020	-0.010
25/07/2019	1.668	1.686	1.712	0.044	15.874	25/07/2019	1.670	1.691	1.722	-0.002	0.005	-0.010
26/07/2019	1.617	1.661	1.693	0.076	15.855	26/07/2019	1.662	1.679	1.703	-0.045	0.018	-0.010
27/07/2019	1.562	1.605	1.628	0.066	15.790	27/07/2019	1.606	1.624	1.660	-0.044	0.019	-0.032
28/07/2019	1.555	1.571	1.587	0.032	15.749	28/07/2019	1.555	1.577	1.611	0.000	0.006	-0.024
29/07/2019	1.549	1.567	1.583	0.034	15.745	29/07/2019	1.561	1.570	1.586	-0.012	0.003	-0.003
30/07/2019	1.533	1.554	1.570	0.037	15.732	30/07/2019	1.546	1.560	1.583	-0.013	0.006	-0.013
31/07/2019	1.528	1.542	1.560	0.032	15.722	31/07/2019	-0.001	1.509	1.567			-0.007
01/08/2019	1.556	1.579	1.600	0.044	15.762	01/08/2019	1.546	1.565	1.597	0.010	0.014	0.003
02/08/2019	1.599	1.629	1.658	0.059	15.820	02/08/2019	1.576	1.610	1.657	0.023	0.019	0.001
03/08/2019	1.624	1.642	1.658	0.034	15.820	03/08/2019	1.614	1.636	1.658	0.010	0.006	0.000
04/08/2019	1.632	1.662	1.684	0.052	15.846	04/08/2019	1.647	1.662	1.684	-0.015	0.000	0.000
05/08/2019	1.582	1.620	1.646	0.064	15.808	05/08/2019	1.625	1.640	1.682	-0.043	0.020	-0.036

06/08/2019	1.581	1.598	1.642	0.061	15.804	06/08/2019	1.581	1.594	1.627	0.000	0.004	0.015
07/08/2019	1.642	1.792	1.915	0.273	16.077	07/08/2019	1.596	1.690	1.840	0.046	0.102	0.075
08/08/2019	1.835	1.906	1.939	0.104	16.101	08/08/2019	1.843	1.906	1.939	-0.008	0.000	0.000
09/08/2019	1.805	1.839	1.883	0.078	16.045	09/08/2019	1.814	1.857	1.914	-0.009	0.018	-0.031
10/08/2019	1.773	1.834	1.867	0.094	16.029	10/08/2019	1.805	1.842	1.876	-0.032	0.008	-0.009
11/08/2019	1.754	1.771	1.797	0.043	15.959	11/08/2019	1.759	1.786	1.844	-0.005	0.015	-0.047
12/08/2019	1.714	1.749	1.767	0.053	15.929	12/08/2019	1.752	1.764	1.793	-0.038	0.015	-0.026
13/08/2019	1.656	1.702	1.725	0.069	15.887	13/08/2019	1.709	1.722	1.761	-0.053	0.020	-0.036
14/08/2019	1.655	1.690	1.735	0.080	15.897	14/08/2019	1.655	1.682	1.735	0.000	0.008	0.000
15/08/2019	1.681	1.734	1.776	0.095	15.938	15/08/2019	1.677	1.714	1.776	0.004	0.020	0.000
16/08/2019	1.677	1.708	1.743	0.066	15.905	16/08/2019	1.704	1.730	1.767	-0.027	0.022	-0.024
17/08/2019	1.646	1.676	1.718	0.072	15.880	17/08/2019	1.654	1.685	1.718	-0.008	0.009	0.000
18/08/2019	1.646	1.714	1.754	0.108	15.916	18/08/2019	1.646	1.684	1.751	0.000	0.030	0.003
19/08/2019	1.738	1.753	1.769	0.031	15.931	19/08/2019	1.738	1.753	1.769	0.000	0.000	0.000
20/08/2019	1.743	1.757	1.786	0.043	15.948	20/08/2019	1.738	1.752	1.770	0.005	0.005	0.016
21/08/2019	1.714	1.746	1.794	0.080	15.956	21/08/2019	1.714	1.758	1.794	0.000	0.012	0.000
22/08/2019	1.716	1.734	1.758	0.042	15.920	22/08/2019	1.725	1.738	1.758	-0.009	0.004	0.000
23/08/2019	1.691	1.726	1.753	0.062	15.915	23/08/2019	1.716	1.729	1.753	-0.025	0.003	0.000
24/08/2019	1.665	1.683	1.704	0.039	15.866	24/08/2019	1.671	1.697	1.740	-0.006	0.014	-0.036
25/08/2019	1.658	1.675	1.690	0.032	15.852	25/08/2019	1.665	1.678	1.690	-0.007	0.003	0.000
26/08/2019	1.623	1.647	1.662	0.039	15.824	26/08/2019	1.643	1.658	1.674	-0.020	0.011	-0.012
27/08/2019	1.598	1.637	1.660	0.062	15.822	27/08/2019	1.623	1.645	1.660	-0.025	0.008	0.000
28/08/2019	1.596	1.610	1.622	0.026	15.784	28/08/2019	1.598	1.612	1.644	-0.002	0.002	-0.022
29/08/2019	1.546	1.598	1.627	0.081	15.789	29/08/2019	1.607	1.616	1.627	-0.061	0.018	0.000

30/08/2019	1.569	1.629	1.747	0.178	15.909	30/08/2019	1.546	1.589	1.633	0.023	0.040	0.114
31/08/2019	1.747	2.036	2.126	0.379	16.288	31/08/2019	1.632	1.868	2.124	0.115	0.168	0.002
01/09/2019	2.071	2.115	2.148	0.077	16.310	01/09/2019	2.102	2.124	2.148	-0.031	-0.009	0.000
02/09/2019	1.914	1.996	2.071	0.157	16.233	02/09/2019	1.985	2.054	2.118	-0.071	-0.058	-0.047
03/09/2019	1.884	1.938	1.983	0.099	16.145	03/09/2019	1.914	1.951	1.983	-0.030	-0.013	0.000
04/09/2019	1.790	1.839	1.885	0.095	16.047	04/09/2019	1.818	1.876	1.927	-0.028	-0.037	-0.042
05/09/2019	1.738	1.791	1.820	0.082	15.982	05/09/2019	1.790	1.809	1.820	-0.052	-0.018	0.000
06/09/2019	1.734	1.749	1.773	0.039	15.935	06/09/2019	1.734	1.750	1.788	0.000	-0.001	-0.015
07/09/2019	1.701	1.769	1.815	0.114	15.977	07/09/2019	0.254	1.755	1.815			0.000
08/09/2019	1.672	1.703	1.720	0.048	15.882	08/09/2019	1.701	1.719	1.762	-0.029	-0.016	-0.042
09/09/2019	1.677	1.694	1.713	0.036	15.875	09/09/2019	1.672	1.690	1.713	0.005	0.004	0.000
10/09/2019	1.623	1.672	1.706	0.083	15.868	10/09/2019	1.676	1.693	1.706	-0.053	-0.021	0.000
11/09/2019	1.609	1.620	1.640	0.031	15.802	11/09/2019	1.609	1.630	1.681	0.000	-0.010	-0.041
12/09/2019	1.620	1.636	1.665	0.045	15.827	12/09/2019	1.610	1.626	1.640	0.010	0.010	0.025
13/09/2019	1.614	1.657	1.681	0.067	15.843	13/09/2019	1.633	1.654	1.681	-0.019	-0.003	0.000
14/09/2019	1.593	1.628	1.666	0.073	15.828	14/09/2019	1.593	1.630	1.678	0.000	-0.002	-0.012
15/09/2019	1.649	1.701	1.740	0.091	15.902	15/09/2019	1.630	1.670	1.730	0.019	0.031	0.010
16/09/2019	1.709	1.728	1.753	0.044	15.915	16/09/2019	1.720	1.732	1.753	-0.011	-0.004	0.000
17/09/2019	1.705	1.723	1.740	0.035	15.902	17/09/2019	1.705	1.719	1.740	0.000	0.004	0.000
18/09/2019	1.715	1.731	1.752	0.037	15.914	18/09/2019	1.715	1.729	1.752	0.000	0.002	0.000
19/09/2019	1.700	1.720	1.729	0.029	15.891	19/09/2019	1.715	1.727	1.745	-0.015	-0.007	-0.016
20/09/2019	1.663	1.687	1.711	0.048	15.873	20/09/2019	1.688	1.703	1.727	-0.025	-0.016	-0.016
21/09/2019	1.625	1.646	1.673	0.048	15.835	21/09/2019	1.625	1.653	1.686	0.000	-0.007	-0.013
22/09/2019	1.650	1.665	1.680	0.030	15.842	22/09/2019	1.644	1.660	1.680	0.006	0.005	0.000
23/09/2019	1.660	1.674	1.695	0.035	15.857	23/09/2019	1.655	1.671	1.695	0.005	0.003	0.000

24/09/2019	1.655	1.670	1.685	0.030	15.847	24/09/2019	1.661	1.672	1.684	-0.006	-0.002	0.001
25/09/2019	1.614	1.645	1.665	0.051	15.827	25/09/2019	1.642	1.659	1.685	-0.028	0.014	-0.020
26/09/2019	1.615	1.627	1.639	0.024	15.801	26/09/2019	1.614	1.626	1.659	0.001	0.001	-0.020
27/09/2019	1.624	1.645	1.664	0.040	15.826	27/09/2019	1.623	1.641	1.664	0.001	0.004	0.000
28/09/2019	1.628	1.654	1.673	0.045	15.835	28/09/2019	1.627	1.647	1.671	0.001	0.007	0.002
29/09/2019	1.643	1.664	1.684	0.041	15.846	29/09/2019	1.643	1.657	1.676	0.000	0.007	0.008
30/09/2019	1.676	1.687	1.697	0.021	15.859	30/09/2019	1.668	1.683	1.697	0.008	0.004	0.000
01/10/2019	1.665	1.678	1.684	0.019	15.846	01/10/2019	1.672	1.683	1.697	-0.007	-0.005	-0.013
02/10/2019	1.659	1.670	1.676	0.017	15.838	02/10/2019	1.665	1.672	1.684	-0.006	-0.002	-0.008
03/10/2019	1.630	1.666	1.691	0.061	15.853	03/10/2019	1.659	1.675	1.691	-0.029	-0.009	0.000
04/10/2019	1.655	1.678	1.700	0.045	15.862	04/10/2019	1.630	1.667	1.700	-0.025	-0.011	-0.000
05/10/2019	1.583	1.633	1.673	0.090	15.835	05/10/2019	1.638	1.660	1.698	-0.055	-0.027	-0.025
06/10/2019	1.592	1.642	1.675	0.083	15.837	06/10/2019	1.583	1.622	1.675	-0.009	-0.020	0.000
07/10/2019	1.661	1.707	1.735	0.074	15.897	07/10/2019	1.640	1.680	1.733	-0.021	-0.027	-0.002
08/10/2019	1.722	1.806	1.882	0.160	16.044	08/10/2019	1.721	1.757	1.838	-0.001	-0.049	-0.044
09/10/2019	1.877	1.916	1.977	0.100	16.139	09/10/2019	1.837	1.880	1.926	-0.040	-0.036	-0.051
10/10/2019	1.961	1.992	2.057	0.096	16.219	10/10/2019	1.924	1.967	1.997	-0.037	-0.025	-0.060
11/10/2019	2.050	2.077	2.110	0.060	16.272	11/10/2019	1.988	2.057	2.110	-0.062	-0.020	-0.000
12/10/2019	1.986	2.035	2.075	0.089	16.237	12/10/2019	2.035	2.059	2.091	-0.049	-0.024	-0.016
13/10/2019	1.857	1.916	1.988	0.131	16.150	13/10/2019	1.901	1.968	2.032	-0.044	-0.052	-0.044
14/10/2019	1.800	1.842	1.875	0.075	16.037	14/10/2019	1.839	1.864	1.899	-0.039	-0.022	-0.024
15/10/2019	1.761	1.791	1.817	0.056	15.979	15/10/2019	1.791	1.807	1.840	-0.030	-0.016	-0.023
16/10/2019	1.734	1.748	1.762	0.028	15.924	16/10/2019	1.744	1.760	1.796	-0.010	-0.012	-0.034
17/10/2019	1.724	1.730	1.736	0.012	15.898	17/10/2019	1.726	1.734	1.753	-0.002	-0.004	-0.017
18/10/2019	1.697	1.718	1.730	0.033	15.892	18/10/2019	1.717	1.725	1.733	-0.020	-0.007	-0.003
19/10/2019	1.696	1.727	1.755	0.059	15.917	19/10/2019	1.696	1.716	1.753	-0.000	-0.011	-0.002

20/10/2019	1.732	1.746	1.755	0.023	15.917	20/10/2019	1.730	1.745	1.755	0.002	0.001	0.000
21/10/2019	1.655	1.709	1.737	0.082	15.899	21/10/2019	1.708	1.733	1.751	0.053	0.024	0.014
22/10/2019	1.653	1.665	1.674	0.021	15.836	22/10/2019	1.653	1.670	1.713	0.000	0.005	0.039
23/10/2019	1.661	1.674	1.702	0.041	15.864	23/10/2019	1.661	1.669	1.675	0.000	0.005	0.027
24/10/2019	1.695	1.729	1.744	0.049	15.906	24/10/2019	1.673	1.710	1.742	0.022	0.019	0.002
25/10/2019	1.710	1.744	1.779	0.069	15.941	25/10/2019	1.710	1.732	1.752	0.000	0.012	0.027
26/10/2019	1.672	1.734	1.768	0.096	15.930	26/10/2019	1.730	1.759	1.779	0.058	0.025	0.011
27/10/2019	1.671	1.698	1.722	0.051	15.884	27/10/2019	1.671	1.695	1.730	0.000	0.003	0.008
28/10/2019	1.721	1.742	1.760	0.039	15.922	28/10/2019	1.695	1.725	1.760	0.026	0.017	0.000
29/10/2019	1.724	1.754	1.793	0.069	15.955	29/10/2019	1.740	1.757	1.793	0.016	0.003	0.000
30/10/2019	1.723	1.753	1.789	0.066	15.951	30/10/2019	1.724	1.740	1.771	0.001	0.013	0.018
31/10/2019	1.736	1.760	1.776	0.040	15.938	31/10/2019	1.723	1.758	1.780	0.013	0.002	0.004
01/11/2019	1.720	1.733	1.748	0.028	15.910	01/11/2019	1.720	1.737	1.769	0.000	0.004	0.021
02/11/2019	1.746	1.786	1.813	0.067	15.975	02/11/2019	1.736	1.762	1.800	0.010	0.024	0.013
03/11/2019	1.794	1.817	1.825	0.031	15.987	03/11/2019	1.798	1.813	1.825	0.004	0.004	0.000
04/11/2019	1.792	1.804	1.821	0.029	15.983	04/11/2019	1.794	1.810	1.823	0.002	0.006	0.002
05/11/2019	1.759	1.779	1.799	0.040	15.961	05/11/2019	1.780	1.791	1.810	0.021	0.012	0.011
06/11/2019	1.728	1.743	1.759	0.031	15.921	06/11/2019	1.740	1.755	1.780	0.012	0.012	0.021
07/11/2019	1.688	1.707	1.729	0.041	15.891	07/11/2019	1.703	1.723	1.744	0.015	0.016	0.015
08/11/2019	1.669	1.681	1.690	0.021	15.852	08/11/2019	1.679	1.689	1.705	0.010	0.008	0.015
09/11/2019	1.637	1.659	1.673	0.036	15.835	09/11/2019	1.657	1.669	1.683	0.020	0.010	0.010
10/11/2019	1.616	1.630	1.642	0.026	15.804	10/11/2019	1.624	1.640	1.658	0.008	0.010	0.016
11/11/2019	1.603	1.615	1.633	0.030	15.795	11/11/2019	1.603	1.617	1.640	0.000	0.002	0.007

12/11/2019	1.617	1.641	1.654	0.037	15.816	12/11/2019	1.612	1.628	1.652	-0.005	0.013	0.002
13/11/2019	1.647	1.656	1.662	0.015	15.824	13/11/2019	1.652	1.656	1.662	-0.005	-0.000	-0.000
14/11/2019	1.635	1.644	1.655	0.020	15.817	14/11/2019	1.639	1.649	1.661	-0.004	-0.005	-0.006
15/11/2019	1.602	1.616	1.636	0.034	15.798	15/11/2019	1.613	1.628	1.647	-0.011	-0.012	-0.011
16/11/2019	1.574	1.588	1.605	0.031	15.767	16/11/2019	1.585	1.600	1.618	-0.011	-0.012	-0.013
17/11/2019	1.550	1.562	1.575	0.025	15.737	17/11/2019	1.559	1.571	1.586	-0.009	-0.009	-0.011
18/11/2019	1.538	1.545	1.551	0.013	15.713	18/11/2019	1.539	1.549	1.559	-0.001	-0.004	-0.008
19/11/2019	1.519	1.534	1.544	0.025	15.706	19/11/2019	1.526	1.539	1.550	-0.007	-0.005	-0.006
20/11/2019	1.513	1.525	1.536	0.023	15.698	20/11/2019	1.514	1.528	1.544	-0.001	-0.003	-0.008
21/11/2019	1.509	1.518	1.534	0.025	15.696	21/11/2019	1.512	1.521	1.536	-0.003	-0.003	0.002
22/11/2019	1.501	1.510	1.521	0.020	15.683	22/11/2019	1.503	1.513	1.521	-0.002	0.003	0.000
23/11/2019	1.499	1.511	1.518	0.019	15.680	23/11/2019	1.499	1.508	1.516	0.000	0.003	0.002
24/11/2019	1.515	1.525	1.533	0.018	15.695	24/11/2019	1.507	1.519	1.528	0.008	0.006	0.005
25/11/2019	1.527	1.533	1.536	0.009	15.698	25/11/2019	1.527	1.532	1.536	0.000	0.001	0.000
26/11/2019	1.531	1.542	1.560	0.029	15.722	26/11/2019	1.528	1.537	1.548	0.003	0.005	0.012
27/11/2019	1.558	1.620	1.686	0.128	15.848	27/11/2019	1.540	1.577	1.634	0.018	0.043	0.052
28/11/2019	1.685	1.711	1.722	0.037	15.884	28/11/2019	1.635	1.692	1.722	-0.050	-0.019	-0.000
29/11/2019	1.665	1.684	1.707	0.042	15.869	29/11/2019	1.683	1.700	1.720	-0.018	-0.016	-0.013
30/11/2019	1.626	1.647	1.666	0.040	15.828	30/11/2019	1.648	1.660	1.682	-0.022	-0.013	-0.016
01/12/2019	1.605	1.620	1.629	0.024	15.791	01/12/2019	1.617	1.629	1.650	-0.012	-0.009	-0.021
02/12/2019	1.601	1.609	1.619	0.018	15.781	02/12/2019	1.602	1.611	1.626	-0.001	-0.002	-0.007
03/12/2019	1.590	1.600	1.610	0.020	15.772	03/12/2019	1.590	1.603	1.614	0.000	-0.003	-0.004
04/12/2019	1.596	1.617	1.643	0.047	15.805	04/12/2019	1.591	1.605	1.625	0.005	0.012	0.018
05/12/2019	1.627	1.711	1.804	0.177	15.966	05/12/2019	1.615	1.652	1.750	0.012	0.059	0.054

06/12/2019	1.800	1.814	1.827	0.027	15.989	06/12/2019	1.756	1.805	1.827	0.044	0.009	0.000
07/12/2019	1.795	1.871	2.029	0.234	16.191	07/12/2019	1.795	1.812	1.864	0.000	0.059	0.165
08/12/2019	2.022	2.058	2.084	0.062	16.246	08/12/2019	1.869	2.019	2.073	0.153	0.039	0.011
09/12/2019	1.932	1.996	2.046	0.114	16.208	09/12/2019	1.984	2.038	2.084	-0.052	-0.042	-0.038
10/12/2019	1.931	2.046	2.112	0.181	16.274	10/12/2019	1.931	1.990	2.111	0.000	0.056	0.001
11/12/2019	2.027	2.069	2.103	0.076	16.265	11/12/2019	2.057	2.091	2.112	-0.030	-0.022	-0.009
12/12/2019	1.921	1.977	2.027	0.106	16.189	12/12/2019	1.971	2.015	2.060	-0.050	-0.038	-0.033
13/12/2019	1.845	1.885	1.924	0.079	16.086	13/12/2019	1.881	1.916	1.968	-0.036	-0.031	-0.044
14/12/2019	1.770	1.812	1.845	0.075	16.007	14/12/2019	1.809	1.839	1.880	-0.039	-0.027	-0.035
15/12/2019	1.725	1.747	1.770	0.045	15.932	15/12/2019	1.748	1.768	1.808	-0.023	-0.021	-0.038
16/12/2019	1.718	1.727	1.738	0.020	15.900	16/12/2019	1.718	1.730	1.750	0.000	-0.003	-0.012
17/12/2019	1.715	1.724	1.733	0.018	15.895	17/12/2019	1.715	1.724	1.736	0.000	0.000	-0.003
18/12/2019	1.708	1.726	1.746	0.038	15.908	18/12/2019	1.716	1.727	1.746	-0.008	-0.001	0.000
19/12/2019	1.728	1.769	1.823	0.095	15.985	19/12/2019	1.708	1.742	1.786	0.020	0.027	0.037
20/12/2019	1.813	1.837	1.850	0.037	16.012	20/12/2019	1.771	1.823	1.850	-0.042	-0.014	0.000
21/12/2019	1.763	1.796	1.813	0.050	15.975	21/12/2019	1.800	1.815	1.846	-0.037	-0.019	-0.033
22/12/2019	1.715	1.743	1.763	0.048	15.925	22/12/2019	1.745	1.763	1.798	-0.030	-0.020	-0.035
23/12/2019	1.697	1.711	1.718	0.021	15.880	23/12/2019	1.711	1.720	1.746	-0.014	-0.009	-0.028
24/12/2019	1.685	1.699	1.710	0.025	15.872	24/12/2019	1.693	1.702	1.718	-0.008	-0.003	-0.008
25/12/2019	1.681	1.688	1.695	0.014	15.857	25/12/2019	1.681	1.692	1.708	0.000	-0.004	-0.013
26/12/2019	1.679	1.689	1.709	0.030	15.871	26/12/2019	1.679	1.687	1.695	0.000	-0.002	-0.014
27/12/2019	1.683	1.711	1.744	0.061	15.906	27/12/2019	1.683	1.699	1.723	0.000	-0.012	-0.021
28/12/2019	1.708	1.769	1.832	0.124	15.994	28/12/2019	1.708	1.739	1.789	0.000	-0.030	-0.043
29/12/2019	1.802	1.814	1.826	0.024	15.988	29/12/2019	1.785	1.811	1.832	-0.017	-0.003	-0.006

30/12/2019	1.802	1.817	1.826	0.024	15.988	30/12/2019	1.802	1.815	1.823	0.000	-0.002	-0.003
31/12/2019	1.777	1.803	1.816	0.039	15.978	31/12/2019	1.802	1.812	1.826	-0.025	-0.009	-0.010
01/01/2020	1.721	1.757	1.781	0.060	15.943	01/01/2020	1.752	1.777	1.805	-0.031	-0.020	-0.024
02/01/2020	1.716	1.759	1.812	0.096	15.974	02/01/2020	1.716	1.737	1.772	0.000	-0.022	-0.040
03/01/2020	1.785	1.802	1.816	0.031	15.978	03/01/2020	1.777	1.804	1.816	-0.008	-0.002	0.000
04/01/2020	1.781	1.789	1.799	0.018	15.961	04/01/2020	1.781	1.791	1.808	0.000	-0.002	-0.009
05/01/2020	1.773	1.790	1.820	0.047	15.982	05/01/2020	1.773	1.786	1.797	0.000	-0.004	-0.023
06/01/2020	1.794	1.816	1.837	0.043	15.999	06/01/2020	1.791	1.806	1.834	-0.003	-0.010	-0.003
07/01/2020	1.808	1.957	2.071	0.263	16.233	07/01/2020	1.808	1.868	2.051	0.000	-0.089	-0.020
08/01/2020	1.977	2.018	2.064	0.087	16.226	08/01/2020	2.008	2.047	2.071	-0.031	-0.029	-0.007
09/01/2020	1.890	1.926	1.977	0.087	16.139	09/01/2020	1.914	1.959	2.007	-0.024	-0.033	-0.030
10/01/2020	1.835	1.875	2.001	0.166	16.163	10/01/2020	1.836	1.876	1.914	-0.001	-0.001	-0.087
11/01/2020	2.001	2.199	2.249	0.248	16.411	11/01/2020	1.835	2.070	2.249	-0.166	-0.129	-0.000
12/01/2020	2.041	2.135	2.222	0.181	16.384	12/01/2020	2.110	2.196	2.246	-0.069	-0.061	-0.024
13/01/2020	1.958	1.995	2.045	0.087	16.207	13/01/2020	1.958	2.033	2.113	0.000	-0.038	-0.068
14/01/2020	1.903	1.951	1.990	0.087	16.152	14/01/2020	1.947	1.971	1.996	-0.044	-0.020	-0.006
15/01/2020	1.903	2.035	2.148	0.245	16.310	15/01/2020	1.903	1.958	2.100	0.000	-0.077	-0.048
16/01/2020	2.104	2.131	2.157	0.053	16.319	16/01/2020	2.103	2.136	2.157	-0.001	-0.005	-0.000
17/01/2020	2.001	2.056	2.114	0.113	16.276	17/01/2020	2.046	2.093	2.137	-0.045	-0.037	-0.023
18/01/2020	1.896	1.947	2.003	0.107	16.165	18/01/2020	1.935	1.987	2.047	-0.039	-0.040	-0.044
19/01/2020	1.833	1.863	1.897	0.064	16.059	19/01/2020	1.849	1.891	1.936	-0.016	-0.028	-0.039
20/01/2020	1.825	1.836	1.848	0.023	16.010	20/01/2020	1.825	1.839	1.859	0.000	-0.003	-0.011
21/01/2020	1.841	1.856	1.868	0.027	16.030	21/01/2020	1.832	1.837	1.843	-0.009	-0.019	-0.025
22/01/2020	1.835	1.851	1.863	0.028	16.025	22/01/2020	1.849	1.856	1.868	-0.014	-0.005	-0.005

23/01/2020	1.803	1.820	1.845	0.042	16.007	23/01/2020	1.817	1.834	1.856	-0.014	-0.014	-0.011
24/01/2020	1.780	1.796	1.806	0.026	15.968	24/01/2020	1.794	1.802	1.817	-0.014	-0.006	-0.011
25/01/2020	1.756	1.776	1.798	0.042	15.960	25/01/2020	1.773	1.785	1.802	-0.017	-0.009	-0.004
26/01/2020	1.753	1.768	1.783	0.030	15.945	26/01/2020	1.753	1.765	1.781	0.000	-0.003	-0.002
27/01/2020	1.749	1.773	1.784	0.035	15.946	27/01/2020	1.769	1.776	1.784	-0.020	-0.003	0.000
28/01/2020	1.724	1.739	1.750	0.026	15.912	28/01/2020	1.736	1.752	1.775	-0.012	-0.013	-0.025
29/01/2020	1.723	1.761	1.827	0.104	15.989	29/01/2020	1.723	1.732	1.743	0.000	-0.029	-0.084
30/01/2020	1.813	1.926	1.981	0.168	16.143	30/01/2020	1.767	1.857	1.978	-0.046	-0.069	-0.003
31/01/2020	1.954	1.991	2.076	0.122	16.238	31/01/2020	1.954	1.969	1.990	0.000	-0.022	-0.086
01/02/2020	2.074	2.104	2.121	0.047	16.283	01/02/2020	1.989	2.080	2.121	-0.085	-0.024	0.000
02/02/2020	1.978	2.022	2.077	0.099	16.239	02/02/2020	2.006	2.061	2.114	-0.028	-0.039	-0.037
03/02/2020	1.941	1.971	2.000	0.059	16.162	03/02/2020	1.962	1.985	2.006	-0.021	-0.014	-0.006
04/02/2020	1.878	1.914	1.943	0.065	16.105	04/02/2020	1.908	1.938	1.966	-0.030	-0.024	-0.023
05/02/2020	1.822	1.850	1.878	0.056	16.040	05/02/2020	1.843	1.873	1.908	-0.021	-0.023	-0.030
06/02/2020	1.788	1.803	1.824	0.036	15.986	06/02/2020	1.800	1.817	1.847	-0.012	-0.014	-0.023
07/02/2020	1.748	1.776	1.797	0.049	15.959	07/02/2020	1.767	1.789	1.803	-0.019	-0.013	-0.006
08/02/2020	1.741	1.779	1.859	0.118	16.021	08/02/2020	1.741	1.758	1.784	0.000	-0.021	-0.075
09/02/2020	1.849	1.983	2.042	0.193	16.204	09/02/2020	1.785	1.901	2.041	-0.064	-0.082	-0.001
10/02/2020	1.925	1.976	2.036	0.111	16.198	10/02/2020	1.957	2.010	2.042	-0.032	-0.034	-0.006
11/02/2020	1.868	1.899	1.931	0.063	16.093	11/02/2020	1.885	1.922	1.963	-0.017	-0.023	-0.032
12/02/2020	1.834	1.856	1.875	0.041	16.037	12/02/2020	1.854	1.871	1.900	-0.020	-0.015	-0.025
13/02/2020	1.807	1.829	1.846	0.039	16.008	13/02/2020	1.826	1.839	1.857	-0.019	-0.010	-0.011
14/02/2020	1.801	1.852	1.902	0.101	16.064	14/02/2020	1.801	1.826	1.867	0.000	-0.026	-0.035
15/02/2020	1.878	2.023	2.142	0.264	16.304	15/02/2020	1.863	1.934	2.087	-0.015	-0.089	-0.055

16/02/2020	2.113	2.171	2.278	0.165	16.440	16/02/2020	2.091	2.132	2.178	0.022	0.039	0.100
17/02/2020	2.272	2.296	2.313	0.041	16.475	17/02/2020	2.179	2.269	2.313	0.093	0.027	0.000
18/02/2020	2.150	2.217	2.281	0.131	16.443	18/02/2020	2.200	2.262	2.309	-0.050	-0.045	-0.028
19/02/2020	2.082	2.108	2.152	0.070	16.314	19/02/2020	2.082	2.138	2.201	0.000	-0.030	-0.049
20/02/2020	2.033	2.075	2.115	0.082	16.277	20/02/2020	2.064	2.094	2.115	-0.031	-0.019	0.000
21/02/2020	2.048	2.267	2.400	0.352	16.562	21/02/2020	2.033	2.145	2.332	0.015	0.122	0.068
22/02/2020	2.291	2.366	2.434	0.143	16.596	22/02/2020	2.318	2.386	2.434	-0.027	-0.020	0.000
23/02/2020	2.106	2.195	2.291	0.185	16.453	23/02/2020	2.176	2.264	2.344	-0.070	-0.069	-0.053
24/02/2020	1.969	2.032	2.107	0.138	16.269	24/02/2020	2.017	2.088	2.173	-0.048	-0.056	-0.066
25/02/2020	1.882	1.924	1.969	0.087	16.131	25/02/2020	1.916	1.960	2.016	-0.034	-0.036	-0.047
26/02/2020	1.816	1.851	1.884	0.068	16.046	26/02/2020	1.845	1.875	1.915	-0.029	-0.024	-0.031
27/02/2020	1.775	1.795	1.816	0.041	15.978	27/02/2020	1.785	1.812	1.844	-0.010	-0.017	-0.028
28/02/2020	1.774	1.787	1.802	0.028	15.964	28/02/2020	1.774	1.788	1.802	0.000	-0.001	0.000
29/02/2020	1.783	1.805	1.817	0.034	15.979	29/02/2020	1.776	1.796	1.817	0.007	0.009	0.000
01/03/2020	1.799	1.806	1.816	0.017	15.978	01/03/2020	1.799	1.808	1.817	0.000	-0.002	-0.001
02/03/2020	1.802	1.810	1.819	0.017	15.981	02/03/2020	1.802	1.809	1.819	0.000	0.001	0.000
03/03/2020	1.803	1.812	1.817	0.014	15.979	03/03/2020	1.804	1.812	1.817	-0.001	0.000	0.000
04/03/2020	1.789	1.798	1.810	0.021	15.972	04/03/2020	1.801	1.808	1.814	-0.012	-0.010	-0.004
05/03/2020	1.751	1.767	1.789	0.038	15.951							
06/03/2020	1.744	1.754	1.762	0.018	15.924							
07/03/2020	1.746	1.847	2.016	0.270	16.178							
08/03/2020	2.013	2.028	2.046	0.033	16.208							
09/03/2020	1.959	1.984	2.015	0.056	16.177							
10/03/2020	1.971	2.003	2.028	0.057	16.190	10/03/2020	1.996	2.006	2.018	-0.025	-0.003	0.010

11/03/2020	1.967	1.994	2.026	0.059	16.188	11/03/2020	1.989	2.008	2.028	-0.022	-0.014	-0.002
12/03/2020	1.902	1.925	1.971	0.069	16.133	12/03/2020	1.913	1.951	1.992	-0.011	-0.026	-0.021
13/03/2020	1.838	1.866	1.902	0.064	16.064	13/03/2020	1.855	1.890	1.916	-0.017	-0.024	-0.014
14/03/2020	1.813	1.832	1.851	0.038	16.013	14/03/2020	1.813	1.834	1.856	0.000	-0.002	-0.005
15/03/2020	1.845	1.861	1.871	0.026	16.033	15/03/2020	1.823	1.852	1.870	0.022	-0.009	-0.001
16/03/2020	1.837	1.856	1.893	0.056	16.055	16/03/2020	1.837	1.855	1.871	0.000	-0.001	-0.022
17/03/2020	1.871	1.890	1.906	0.035	16.068	17/03/2020	1.857	1.881	1.906	0.014	-0.009	-0.000
18/03/2020	1.859	1.877	1.899	0.040	16.061	18/03/2020	1.869	1.886	1.901	-0.010	-0.009	-0.002
19/03/2020	1.836	1.851	1.863	0.027	16.025	19/03/2020	1.851	1.860	1.877	-0.015	-0.009	-0.014
20/03/2020	1.798	1.817	1.836	0.038	15.998	20/03/2020	1.811	1.831	1.852	-0.013	-0.014	-0.016
21/03/2020	1.758	1.782	1.805	0.047	15.967	21/03/2020	1.777	1.797	1.815	-0.019	-0.015	-0.010
22/03/2020	1.710	1.736	1.759	0.049	15.921	22/03/2020	1.738	1.754	1.778	-0.028	-0.018	-0.019
23/03/2020	1.676	1.692	1.723	0.047	15.885	23/03/2020	1.688	1.707	1.737	-0.012	-0.015	-0.014
24/03/2020	1.676	1.718	1.755	0.079	15.917	24/03/2020	1.676	1.695	1.731	0.000	-0.023	-0.024
25/03/2020	1.755	1.813	1.845	0.090	16.007	25/03/2020	1.725	1.776	1.834	0.030	-0.037	-0.011
26/03/2020	1.833	1.840	1.843	0.010	16.005	26/03/2020	1.833	1.840	1.845	0.000	-0.000	-0.002
27/03/2020	1.808	1.831	1.841	0.033	16.003	27/03/2020	1.831	1.838	1.842	-0.023	-0.007	-0.001
28/03/2020	1.768	1.791	1.826	0.058	15.988	28/03/2020	1.772	1.808	1.831	-0.004	-0.017	-0.005
29/03/2020	1.746	1.762	1.771	0.025	15.933	29/03/2020	1.762	1.771	1.791	-0.016	-0.009	-0.020
30/03/2020	1.734	1.742	1.755	0.021	15.917	30/03/2020	1.735	1.748	1.764	-0.001	-0.006	-0.009
31/03/2020	1.707	1.721	1.737	0.030	15.899	31/03/2020	1.719	1.731	1.745	-0.012	-0.010	-0.008
01/04/2020	1.683	1.693	1.712	0.029	15.874	01/04/2020	1.687	1.703	1.724	-0.004	-0.010	-0.012
02/04/2020	1.684	1.700	1.707	0.023	15.869	02/04/2020	1.683	1.694	1.706	-0.001	-0.006	-0.001

03/04/2020	1.693	1.698	1.708	0.015	15.870	03/04/2020	1.693	1.701	1.708	0.000	-0.003	0.000
04/04/2020	1.667	1.684	1.701	0.034	15.863	04/04/2020	1.673	1.691	1.701	-0.006	-0.007	0.000
05/04/2020	1.647	1.666	1.698	0.051	15.860	05/04/2020	1.650	1.669	1.682	-0.003	-0.003	0.016
06/04/2020	1.689	1.743	1.774	0.085	15.936	06/04/2020	0.247	1.684	1.759			0.015
07/04/2020	1.744	1.757	1.774	0.030	15.936	07/04/2020	1.748	1.763	1.774	-0.004	-0.006	0.000
08/04/2020	1.745	1.756	1.774	0.029	15.936	08/04/2020	1.744	1.752	1.759	-0.001	-0.004	0.015
09/04/2020	1.761	1.768	1.774	0.013	15.936	09/04/2020	1.754	1.766	1.774	-0.007	-0.002	0.000
10/04/2020	1.739	1.745	1.762	0.023	15.924	10/04/2020	1.739	1.753	1.773	-0.000	-0.008	-0.011
11/04/2020	1.720	1.729	1.748	0.028	15.910	11/04/2020	1.720	1.735	1.750	-0.000	-0.006	-0.002
12/04/2020	1.701	1.720	1.742	0.041	15.904	12/04/2020	1.708	1.727	1.742	-0.007	-0.007	0.000
13/04/2020	1.681	1.691	1.703	0.022	15.865	13/04/2020	1.689	1.701	1.723	-0.008	-0.010	-0.020
14/04/2020	1.659	1.671	1.692	0.033	15.854	14/04/2020	1.663	1.679	1.692	-0.004	-0.008	0.000
15/04/2020	1.621	1.639	1.670	0.049	15.832	15/04/2020	1.633	1.653	1.670	-0.012	-0.014	0.000
16/04/2020	1.596	1.608	1.625	0.029	15.787	16/04/2020	1.597	1.619	1.633	-0.001	-0.011	-0.008
17/04/2020	1.571	1.581	1.600	0.029	15.762	17/04/2020	1.577	1.591	1.605	-0.006	-0.010	-0.005
18/04/2020	1.555	1.563	1.576	0.021	15.738	18/04/2020	1.555	1.569	1.578	-0.000	-0.006	-0.002
19/04/2020	1.534	1.543	1.558	0.024	15.720	19/04/2020	1.538	1.551	1.563	-0.004	-0.008	-0.005
20/04/2020	1.508	1.519	1.537	0.029	15.699	20/04/2020	1.511	1.528	1.542	-0.003	-0.009	-0.005
21/04/2020	1.493	1.515	1.521	0.028	15.683	21/04/2020	1.493	1.513	1.520	0.000	-0.002	-0.001
22/04/2020	1.470	1.493	1.521	0.051	15.683	22/04/2020	1.476	1.509	1.521	-0.006	-0.016	0.000
23/04/2020	1.455	1.471	1.487	0.032	15.649	23/04/2020	1.455	1.475	1.487	0.000	-0.004	0.000
24/04/2020	1.452	1.475	1.488	0.036	15.650	24/04/2020	1.452	1.469	1.485	0.000	-0.006	0.003
25/04/2020	1.484	1.497	1.503	0.019	15.665	25/04/2020	1.474	1.491	1.503	0.010	-0.006	0.000

										-	-	
26/04/2020	1.491	1.497	1.504	0.013	15.666	26/04/2020	1.492	1.498	1.504	0.001	0.001	0.000
27/04/2020	1.494	1.507	1.514	0.020	15.676	27/04/2020	1.491	1.502	1.512	0.003	0.005	0.002
28/04/2020	1.507	1.529	1.539	0.032	15.701	28/04/2020	1.506	1.520	1.537	0.001	0.009	0.002
29/04/2020	1.530	1.547	1.566	0.036	15.728	29/04/2020	1.530	1.539	1.558	0.000	0.008	0.008
30/04/2020	1.557	1.588	1.611	0.054	15.773	30/04/2020	1.545	1.568	1.594	0.012	0.020	0.017
01/05/2020	1.608	1.616	1.624	0.016	15.786	01/05/2020	1.596	1.611	1.619	0.012	0.005	0.005
02/05/2020	1.614	1.637	1.649	0.035	15.811	02/05/2020	1.614	1.627	1.649	0.000	0.010	0.000
03/05/2020	1.636	1.661	1.670	0.034	15.832	03/05/2020	1.636	1.654	1.670	0.000	0.007	0.000
										-	-	-
04/05/2020	1.605	1.633	1.657	0.052	15.819	04/05/2020	1.629	1.650	1.670	0.024	0.017	0.013
												-
05/05/2020	1.609	1.620	1.632	0.023	15.794	05/05/2020	1.605	1.616	1.636	0.004	0.004	0.004
06/05/2020	1.615	1.634	1.643	0.028	15.805	06/05/2020	1.615	1.630	1.643	0.000	0.004	0.000
07/05/2020	1.624	1.635	1.645	0.021	15.807	07/05/2020	1.624	1.634	1.642	0.000	0.001	0.003
08/05/2020	1.632	1.644	1.655	0.023	15.817	08/05/2020	1.632	1.640	1.648	0.000	0.004	0.007
										-	-	
09/05/2020	1.611	1.640	1.663	0.052	15.825	09/05/2020	1.631	1.646	1.663	0.020	0.006	0.000
											-	-
10/05/2020	1.596	1.621	1.635	0.039	15.797	10/05/2020	1.596	1.625	1.656	0.000	0.004	0.021
												-
11/05/2020	1.608	1.622	1.629	0.021	15.791	11/05/2020	1.608	1.621	1.635	0.000	0.001	0.006
											-	
12/05/2020	1.598	1.610	1.629	0.031	15.791	12/05/2020	1.598	1.616	1.629	0.000	0.006	0.000
13/05/2020	1.598	1.611	1.625	0.027	15.787	13/05/2020	1.598	1.609	1.621	0.000	0.002	0.004
14/05/2020	1.608	1.627	1.641	0.033	15.803	14/05/2020	1.606	1.620	1.635	0.002	0.007	0.006
											-	-
15/05/2020	1.610	1.621	1.630	0.020	15.792	15/05/2020	1.610	1.625	1.641	0.000	0.004	0.011
16/05/2020	1.607	1.626	1.652	0.045	15.814	16/05/2020	1.607	1.618	1.630	0.000	0.008	0.022
										-	-	-
17/05/2020	1.597	1.628	1.647	0.050	15.809	17/05/2020	1.623	1.637	1.652	0.026	0.009	0.005
18/05/2020	1.595	1.632	1.654	0.059	15.816	18/05/2020	1.595	1.620	1.643	0.000	0.012	0.011
19/05/2020	1.644	1.659	1.671	0.027	15.833	19/05/2020	1.642	1.652	1.667	0.002	0.007	0.004
										-		
20/05/2020	1.659	1.668	1.672	0.013	15.834	20/05/2020	1.660	1.668	1.672	0.001	0.000	0.000
										-		
21/05/2020	1.655	1.684	1.719	0.064	15.881	21/05/2020	1.659	1.679	1.719	0.004	0.005	0.000
22/05/2020	1.611	1.672	1.784	0.173	15.946	22/05/2020	1.611	1.655	1.708	0.000	0.017	0.076
23/05/2020	1.775	1.875	1.920	0.145	16.082	23/05/2020	1.676	1.805	1.919	0.099	0.070	0.001

24/05/2020	1.881	1.903	1.921	0.040	16.083	24/05/2020	1.881	1.902	1.920	0.000	-0.001	-0.001
25/05/2020	1.805	1.849	1.908	0.103	16.070	25/05/2020	1.838	1.884	1.921	-0.033	-0.035	-0.013
26/05/2020	1.774	1.796	1.809	0.035	15.971	26/05/2020	1.793	1.807	1.840	-0.019	-0.011	-0.031
27/05/2020	1.728	1.760	1.776	0.048	15.938	27/05/2020	1.765	1.777	1.804	-0.037	-0.017	-0.028
28/05/2020	1.703	1.721	1.733	0.030	15.895	28/05/2020	1.721	1.733	1.769	-0.018	-0.012	-0.036
29/05/2020	1.628	1.670	1.711	0.083	15.873	29/05/2020	1.667	1.697	1.731	-0.039	-0.027	-0.020
30/05/2020	1.558	1.589	1.629	0.071	15.791	30/05/2020	1.587	1.617	1.667	-0.029	-0.028	-0.038
31/05/2020	1.542	1.562	1.576	0.034	15.738	31/05/2020	1.542	1.562	1.585	0.000	0.000	0.009
01/06/2020	1.567	1.578	1.590	0.023	15.752	01/06/2020	1.566	1.573	1.585	0.001	0.005	0.005
02/06/2020	1.580	1.597	1.617	0.037	15.779	02/06/2020	1.577	1.591	1.616	0.003	-0.006	-0.001
03/06/2020	1.580	1.592	1.607	0.027	15.769	03/06/2020	1.580	1.593	1.617	0.000	0.001	0.010
04/06/2020	1.598	1.632	1.649	0.051	15.811	04/06/2020	1.588	1.621	1.649	0.010	0.011	0.000
05/06/2020	1.588	1.611	1.670	0.082	15.832	05/06/2020	1.588	1.610	1.645	0.000	0.001	0.025
06/06/2020	1.670	1.740	1.765	0.095	15.927	06/06/2020	1.599	1.693	1.765	0.071	-0.047	-0.000
07/06/2020	1.722	1.742	1.758	0.036	15.920	07/06/2020	1.734	1.749	1.765	-0.012	-0.007	-0.007
08/06/2020	1.703	1.720	1.739	0.036	15.901	08/06/2020	1.711	1.729	1.748	-0.008	-0.009	-0.009
09/06/2020	1.691	1.703	1.717	0.026	15.879	09/06/2020	1.700	1.709	1.723	-0.009	-0.006	-0.006
10/06/2020	1.583	1.646	1.693	0.110	15.855	10/06/2020	1.630	1.681	1.704	-0.047	-0.035	-0.011
11/06/2020	1.557	1.594	1.623	0.066	15.785	11/06/2020	1.581	1.604	1.631	-0.024	-0.010	-0.008
12/06/2020	1.538	1.555	1.563	0.025	15.725	12/06/2020	1.538	1.562	1.598	0.000	-0.007	-0.035
13/06/2020	1.534	1.549	1.560	0.026	15.722	13/06/2020	1.534	1.552	1.560	0.000	-0.003	-0.000
14/06/2020	1.521	1.539	1.552	0.031	15.714	14/06/2020	1.521	1.542	1.555	0.000	-0.003	-0.003
15/06/2020	1.489	1.513	1.540	0.051	15.702	15/06/2020	1.512	1.529	1.543	-0.023	-0.016	-0.003

16/06/2020	1.498	1.538	1.567	0.069	15.729	16/06/2020	1.489	1.516	1.551	0.009	0.022	0.016
17/06/2020	1.567	1.582	1.600	0.033	15.762	17/06/2020	1.550	1.572	1.600	0.017	0.010	0.000
18/06/2020	1.590	1.608	1.627	0.037	15.789	18/06/2020	1.573	1.600	1.627	0.017	0.008	0.000
19/06/2020	1.595	1.614	1.630	0.035	15.792	19/06/2020	1.590	1.606	1.625	0.005	0.008	0.005
										-	-	-
20/06/2020	1.559	1.608	1.627	0.068	15.789	20/06/2020	1.611	1.622	1.630	0.052	0.014	0.003
											-	-
21/06/2020	1.523	1.548	1.564	0.041	15.726	21/06/2020	1.523	1.561	1.609	0.000	0.013	0.045
											-	-
22/06/2020	1.501	1.529	1.554	0.053	15.716	22/06/2020	1.501	1.539	1.563	0.000	0.010	0.009
23/06/2020	1.546	1.601	1.640	0.094	15.802	23/06/2020	1.501	1.564	1.629	0.045	0.037	0.011
24/06/2020	1.613	1.648	1.663	0.050	15.825	24/06/2020	1.606	1.636	1.663	0.007	0.012	0.000
										-	-	
25/06/2020	1.645	1.656	1.670	0.025	15.832	25/06/2020	1.647	1.657	1.670	0.002	0.001	0.000
										-	-	
26/06/2020	1.620	1.650	1.666	0.046	15.828	26/06/2020	1.645	1.655	1.666	0.025	0.005	0.000
										-	-	-
27/06/2020	1.546	1.600	1.633	0.087	15.795	27/06/2020	1.604	1.627	1.663	0.058	0.027	0.030
												-
28/06/2020	1.542	1.565	1.594	0.052	15.756	28/06/2020	1.542	1.563	1.605	0.000	0.002	0.011
29/06/2020	1.594	1.652	1.691	0.097	15.853	29/06/2020	1.564	1.616	1.664	0.030	0.036	0.027
30/06/2020	1.691	1.715	1.735	0.044	15.897	30/06/2020	1.661	1.695	1.735	0.030	0.020	0.000
01/07/2020	1.722	1.747	1.767	0.045	15.929	01/07/2020	1.714	1.739	1.767	0.008	0.008	0.000
										-	-	-
02/07/2020	1.663	1.699	1.724	0.061	15.886	02/07/2020	1.687	1.721	1.761	0.024	0.022	0.037
											-	-
03/07/2020	1.663	1.680	1.699	0.036	15.861	03/07/2020	1.663	1.682	1.710	0.000	0.002	0.011
											-	
04/07/2020	1.641	1.664	1.713	0.072	15.875	04/07/2020	1.641	1.665	1.696	0.000	0.001	0.017
05/07/2020	1.701	1.729	1.757	0.056	15.919	05/07/2020	1.653	1.710	1.757	0.048	0.019	0.000
										-	-	-
06/07/2020	1.692	1.713	1.732	0.040	15.894	06/07/2020	1.693	1.720	1.739	0.001	0.007	0.007
											-	-
07/07/2020	1.671	1.683	1.697	0.026	15.859	07/07/2020	1.671	1.693	1.728	0.000	0.010	0.031
											-	-
08/07/2020	1.655	1.677	1.693	0.038	15.855	08/07/2020	1.655	1.678	1.697	0.000	0.001	0.004
											-	-
09/07/2020	1.634	1.662	1.682	0.048	15.844	09/07/2020	1.634	1.666	1.693	0.000	0.004	0.011

10/07/2020	1.625	1.652	1.674	0.049	15.836	10/07/2020	1.645	1.664	1.678	-0.020	-0.012	-0.004
11/07/2020	1.588	1.605	1.632	0.044	15.794	11/07/2020	1.588	1.622	1.658	0.000	-0.017	-0.026
12/07/2020	1.510	1.541	1.589	0.079	15.751	12/07/2020	1.532	1.568	1.607	-0.022	-0.027	-0.018
13/07/2020	1.480	1.501	1.514	0.034	15.676	13/07/2020	1.491	1.513	1.545	-0.011	-0.012	-0.031
14/07/2020	1.456	1.471	1.487	0.031	15.649	14/07/2020	1.456	1.479	1.510	0.000	-0.008	-0.023
15/07/2020	1.455	1.475	1.496	0.041	15.658	15/07/2020	1.455	1.473	1.496	0.000	0.002	0.000
16/07/2020	1.452	1.491	1.516	0.064	15.678	16/07/2020	1.452	1.480	1.514	0.000	0.011	0.002
17/07/2020	1.485	1.508	1.530	0.045	15.692	17/07/2020	1.485	1.504	1.530	0.000	0.004	0.000
18/07/2020	1.488	1.514	1.529	0.041	15.691	18/07/2020	1.488	1.513	1.528	0.000	0.001	0.001
19/07/2020	1.491	1.515	1.524	0.033	15.686	19/07/2020	1.491	1.516	1.529	0.000	-0.001	-0.005
20/07/2020	1.496	1.517	1.535	0.039	15.697	20/07/2020	1.496	1.518	1.535	0.000	-0.001	0.000
21/07/2020	1.464	1.493	1.523	0.059	15.685	21/07/2020	1.480	1.506	1.534	-0.016	-0.013	-0.011
22/07/2020	1.459	1.479	1.492	0.033	15.654	22/07/2020	1.459	1.479	1.515	0.000	0.000	-0.023
23/07/2020	1.476	1.516	1.543	0.067	15.705	23/07/2020	1.475	1.495	1.538	0.001	0.021	0.005
24/07/2020	1.528	1.554	1.590	0.062	15.752	24/07/2020	1.528	1.551	1.590	0.000	0.003	0.000
25/07/2020	1.530	1.588	1.619	0.089	15.781	25/07/2020	1.530	1.564	1.614	0.000	0.024	0.005
26/07/2020	1.548	1.574	1.594	0.046	15.756	26/07/2020	1.548	1.587	1.619	0.000	-0.013	-0.025
27/07/2020	1.568	1.620	1.655	0.087	15.817	27/07/2020	1.567	1.593	1.649	0.001	0.027	0.006
28/07/2020	1.639	1.687	1.717	0.078	15.879	28/07/2020	1.634	1.663	1.710	0.005	0.024	0.007
29/07/2020	1.656	1.684	1.711	0.055	15.873	29/07/2020	1.670	1.695	1.717	-0.014	-0.011	-0.006
30/07/2020	1.615	1.650	1.679	0.064	15.841	30/07/2020	1.646	1.666	1.692	-0.031	-0.016	-0.013
31/07/2020	1.598	1.623	1.650	0.052	15.812	31/07/2020	1.603	1.629	1.657	-0.005	-0.006	-0.007
01/08/2020	1.583	1.594	1.602	0.019	15.764	01/08/2020	1.583	1.603	1.643	0.000	-0.009	-0.041
02/08/2020	1.527	1.554	1.588	0.061	15.750	02/08/2020	1.536	1.574	1.601	-0.009	-0.020	-0.013

03/08/2020	1.524	1.579	1.630	0.106	15.792	03/08/2020	1.524	1.554	1.621	0.000	0.025	0.009
04/08/2020	1.583	1.609	1.632	0.049	15.794	04/08/2020	1.583	1.604	1.630	0.000	0.005	0.002
05/08/2020	1.628	1.658	1.676	0.048	15.838	05/08/2020	1.612	1.642	1.675	0.016	0.016	0.001
06/08/2020	1.646	1.680	1.701	0.055	15.863	06/08/2020	1.646	1.670	1.701	0.000	0.010	0.000
07/08/2020	1.632	1.657	1.684	0.052	15.846	07/08/2020	1.644	1.671	1.694	-0.012	-0.014	-0.010
08/08/2020	1.597	1.626	1.657	0.060	15.819	08/08/2020	1.602	1.635	1.666	-0.005	-0.009	-0.009
09/08/2020	1.561	1.583	1.608	0.047	15.770	09/08/2020	1.569	1.603	1.653	-0.008	-0.020	-0.045
10/08/2020	1.533	1.562	1.590	0.057	15.752	10/08/2020	1.546	1.571	1.599	-0.013	-0.009	-0.009
11/08/2020	1.490	1.535	1.571	0.081	15.733	11/08/2020	1.525	1.548	1.575	-0.035	-0.013	-0.004
12/08/2020	1.460	1.490	1.513	0.053	15.675	12/08/2020	1.480	1.504	1.557	-0.020	-0.014	-0.044
13/08/2020	1.418	1.451	1.477	0.059	15.639	13/08/2020	1.438	1.467	1.499	-0.020	-0.016	-0.022
14/08/2020	1.403	1.424	1.446	0.043	15.608	14/08/2020	1.410	1.430	1.464	-0.007	-0.006	-0.018
15/08/2020	1.361	1.390	1.410	0.049	15.572	15/08/2020	1.362	1.403	1.440	-0.001	-0.013	-0.030
16/08/2020	1.318	1.343	1.367	0.049	15.529	16/08/2020	1.326	1.362	1.410	-0.008	-0.019	-0.043
17/08/2020	1.311	1.333	1.350	0.039	15.512	17/08/2020	1.318	1.337	1.353	-0.007	-0.004	-0.003
18/08/2020	1.318	1.359	1.391	0.073	15.553	18/08/2020	1.311	1.337	1.369	0.007	0.022	0.022
19/08/2020	1.355	1.395	1.447	0.092	15.609	19/08/2020	1.355	1.394	1.447	0.000	0.001	0.000
20/08/2020	1.359	1.430	1.473	0.114	15.635	20/08/2020	1.359	1.408	1.473	0.000	0.022	0.000
21/08/2020	1.419	1.447	1.467	0.048	15.629	21/08/2020	1.419	1.446	1.468	0.000	-0.001	-0.001
22/08/2020	1.427	1.446	1.475	0.048	15.637	22/08/2020	1.427	1.450	1.475	0.000	-0.004	0.000
23/08/2020	1.421	1.438	1.471	0.050	15.633	23/08/2020	1.421	1.439	1.471	0.000	0.001	0.000
24/08/2020	1.396	1.445	1.486	0.090	15.648	24/08/2020	1.396	1.439	1.486	0.000	0.006	0.000
25/08/2020	1.425	1.475	1.523	0.098	15.685	25/08/2020	1.425	1.465	1.523	0.000	0.010	0.000
26/08/2020	1.437	1.477	1.501	0.064	15.663	26/08/2020	1.465	1.477	1.494	-0.028	0.000	0.007

27/08/2020	1.431	1.470	1.520	0.089	15.682	27/08/2020	1.431	1.458	1.501	0.000	0.012	0.019
28/08/2020	1.502	1.561	1.599	0.097	15.761	28/08/2020	1.486	1.531	1.590	0.016	0.030	0.009
29/08/2020	1.585	1.628	1.675	0.090	15.837	29/08/2020	1.577	1.611	1.675	0.008	0.017	0.000
30/08/2020	1.597	1.622	1.656	0.059	15.818	30/08/2020	1.597	1.622	1.671	0.000	0.000	-0.015
31/08/2020	1.611	1.632	1.651	0.040	15.813	31/08/2020	1.611	1.630	1.654	0.000	0.002	0.003
01/09/2020	1.579	1.626	1.649	0.070	15.811	01/09/2020	1.631	1.640	1.649	-0.052	-0.014	0.000
02/09/2020	1.591	1.656	1.722	0.131	15.884	02/09/2020	1.579	1.628	1.722	0.012	0.028	0.000
03/09/2020	1.623	1.655	1.676	0.053	15.838	03/09/2020	1.644	1.669	1.721	-0.021	-0.014	-0.045
04/09/2020	1.602	1.636	1.677	0.075	15.839	04/09/2020	1.602	1.640	1.677	0.000	-0.004	0.000
05/09/2020	1.636	1.686	1.706	0.070	15.868	05/09/2020	1.616	1.662	1.700	0.020	0.024	0.006
06/09/2020	1.648	1.686	1.722	0.074	15.884	06/09/2020	1.663	1.693	1.722	-0.015	-0.007	0.000
07/09/2020	1.637	1.677	1.729	0.092	15.891	07/09/2020	1.648	1.683	1.729	-0.011	-0.006	0.000
08/09/2020	1.608	1.646	1.697	0.089	15.859	08/09/2020	1.608	1.649	1.720	0.000	-0.003	-0.023
09/09/2020	1.640	1.667	1.702	0.062	15.864	09/09/2020	1.631	1.660	1.702	-0.009	-0.007	0.000
10/09/2020	1.605	1.643	1.672	0.067	15.834	10/09/2020	1.638	1.659	1.693	-0.033	-0.016	-0.021
11/09/2020	1.648	1.692	1.720	0.072	15.882	11/09/2020	1.605	1.665	1.720	0.043	0.027	0.000
12/09/2020	1.677	1.767	1.874	0.197	16.036	12/09/2020	1.665	1.721	1.799	0.012	0.046	0.075
13/09/2020	1.874	1.994	2.042	0.168	16.204	13/09/2020	1.791	1.910	2.038	-0.083	-0.084	-0.004
14/09/2020	1.921	1.987	2.045	0.124	16.207	14/09/2020	1.985	2.022	2.045	-0.064	-0.035	0.000
15/09/2020	1.865	1.894	1.927	0.062	16.089	15/09/2020	1.887	1.919	1.996	-0.022	-0.025	-0.069
16/09/2020	1.774	1.818	1.868	0.094	16.030	16/09/2020	1.815	1.849	1.894	-0.041	-0.031	-0.026
17/09/2020	1.725	1.749	1.783	0.058	15.945	17/09/2020	1.725	1.768	1.821	0.000	-0.019	-0.038
18/09/2020	1.665	1.698	1.748	0.083	15.910	18/09/2020	1.665	1.718	1.768	0.000	-0.020	-0.020
19/09/2020	1.586	1.640	1.676	0.090	15.838	19/09/2020	1.586	1.658	1.726	0.000	0.018	0.050

										-	-	-
20/09/2020	1.556	1.588	1.626	0.070	15.788	20/09/2020	1.580	1.616	1.665	0.024	0.028	0.039
21/09/2020	1.541	1.579	1.618	0.077	15.780	21/09/2020	1.541	1.570	1.600	0.000	0.009	0.018
22/09/2020	1.565	1.618	1.667	0.102	15.829	22/09/2020	1.565	1.598	1.667	0.000	0.020	0.000
										-	-	
23/09/2020	1.584	1.622	1.663	0.079	15.825	23/09/2020	1.610	1.639	1.663	0.026	0.017	0.000
24/09/2020	1.617	1.679	1.721	0.104	15.883	24/09/2020	1.584	1.650	1.721	0.033	0.029	0.000
										-	-	-
25/09/2020	1.596	1.645	1.673	0.077	15.835	25/09/2020	1.641	1.665	1.718	0.045	0.020	0.045
										-	-	-
26/09/2020	1.516	1.588	1.634	0.118	15.796	26/09/2020	1.585	1.616	1.657	0.069	0.028	0.023
										-	-	-
27/09/2020	1.501	1.524	1.556	0.055	15.718	27/09/2020	1.507	1.540	1.607	0.006	0.016	0.051
28/09/2020	1.519	1.570	1.608	0.089	15.770	28/09/2020	1.501	1.544	1.608	0.018	0.026	0.000
										-	-	
29/09/2020	1.511	1.571	1.611	0.100	15.773	29/09/2020	1.556	1.582	1.611	0.045	0.011	0.000
												-
30/09/2020	1.506	1.553	1.584	0.078	15.746	30/09/2020	1.506	1.549	1.598	0.000	0.004	0.014
01/10/2020	1.568	1.655	1.748	0.180	15.910	01/10/2020	1.548	1.600	1.694	0.020	0.055	0.054
02/10/2020	1.748	1.787	1.816	0.068	15.978	02/10/2020	1.689	1.754	1.816	0.059	0.033	0.000
03/10/2020	1.795	1.817	1.852	0.057	16.014	03/10/2020	1.775	1.801	1.816	0.020	0.016	0.036
04/10/2020	1.832	1.908	1.943	0.111	16.105	04/10/2020	1.807	1.875	1.943	0.025	0.033	0.000
										-	-	
05/10/2020	1.851	1.894	1.941	0.090	16.103	05/10/2020	1.880	1.917	1.941	0.029	0.023	0.000
										-	-	-
06/10/2020	1.769	1.834	1.877	0.108	16.039	06/10/2020	1.833	1.857	1.879	0.064	0.023	0.002
										-	-	-
07/10/2020	1.762	1.778	1.803	0.041	15.965	07/10/2020	1.768	1.790	1.850	0.006	0.012	0.047
										-	-	
08/10/2020	1.749	1.772	1.804	0.055	15.966	08/10/2020	1.752	1.775	1.804	0.003	0.003	0.000
										-	-	-
09/10/2020	1.707	1.744	1.770	0.063	15.932	09/10/2020	1.740	1.758	1.782	0.033	0.014	0.012
											-	-
10/10/2020	1.692	1.714	1.740	0.048	15.902	10/10/2020	1.692	1.717	1.749	0.000	0.003	0.009
										-	-	-
11/10/2020	1.649	1.669	1.702	0.053	15.864	11/10/2020	1.657	1.692	1.740	0.008	0.023	0.038
										-	-	-
12/10/2020	1.609	1.643	1.661	0.052	15.823	12/10/2020	1.634	1.657	1.681	0.025	0.014	0.020
										-	-	-
13/10/2020	1.632	1.662	1.686	0.054	15.848	13/10/2020	1.639	1.701	1.796	0.007	0.039	0.110

14/10/2020	1.654	1.671	1.683	0.029	15.845	14/10/2020	1.662	1.751	1.837	-0.008	-0.080	-0.154
15/10/2020	1.651	1.662	1.673	0.022	15.835	15/10/2020	1.654	1.665	1.679	-0.003	-0.003	-0.006
16/10/2020	1.619	1.647	1.660	0.041	15.822	16/10/2020	1.628	1.656	1.670	-0.009	-0.009	-0.010
17/10/2020	1.588	1.610	1.619	0.031	15.781	17/10/2020	1.608	1.622	1.654	-0.020	-0.012	-0.035
18/10/2020	1.588	1.607	1.628	0.040	15.790	18/10/2020	1.588	1.606	1.628	0.000	-0.001	0.000
19/10/2020	1.604	1.691	1.770	0.166	15.932	19/10/2020	1.592	1.640	1.720	0.012	-0.051	-0.050
20/10/2020	1.766	1.827	1.886	0.120	16.048	20/10/2020	1.719	1.784	1.850	0.047	-0.043	-0.036
21/10/2020	1.886	1.961	1.985	0.099	16.147	21/10/2020	1.834	1.914	1.982	0.052	-0.047	-0.003
22/10/2020	1.978	2.014	2.048	0.070	16.210	22/10/2020	1.966	2.005	2.048	0.012	-0.009	0.000
23/10/2020	1.857	1.951	1.990	0.133	16.152	23/10/2020	1.958	1.984	2.029	-0.101	-0.033	-0.039
24/10/2020	1.874	1.935	1.972	0.098	16.134	24/10/2020	1.857	1.930	1.972	-0.017	-0.005	0.000
25/10/2020	1.851	1.885	1.915	0.064	16.077	25/10/2020	1.851	1.902	1.960	0.000	-0.017	-0.045
26/10/2020	1.877	1.886	1.897	0.020	16.059	26/10/2020	1.869	1.884	1.902	-0.008	-0.002	-0.005
27/10/2020	1.833	1.879	1.907	0.074	16.069	27/10/2020	1.880	1.893	1.907	-0.047	-0.014	0.000
28/10/2020	1.819	1.848	1.877	0.058	16.039	28/10/2020	1.833	1.853	1.883	-0.014	-0.005	-0.006
29/10/2020	1.821	1.847	1.869	0.048	16.031	29/10/2020	1.819	1.847	1.869	-0.002	-0.000	0.000
30/10/2020	1.819	1.875	1.925	0.106	16.087	30/10/2020	1.821	1.865	1.925	-0.002	-0.010	0.000
31/10/2020	1.825	1.931	2.012	0.187	16.174	31/10/2020	1.819	1.887	1.997	0.006	-0.044	-0.015
01/11/2020	1.961	2.008	2.044	0.083	16.206	01/11/2020	1.951	1.996	2.044	0.010	-0.012	0.000
02/11/2020	1.900	1.967	2.009	0.109	16.171	02/11/2020	1.978	2.001	2.042	-0.078	-0.034	-0.033
03/11/2020	1.853	1.899	1.927	0.074	16.089	03/11/2020	1.900	1.920	1.976	-0.047	-0.021	-0.049
04/11/2020	1.801	1.825	1.864	0.063	16.026	04/11/2020	1.816	1.848	1.908	-0.015	-0.023	-0.044
05/11/2020	1.781	1.797	1.836	0.055	15.998	05/11/2020	1.786	1.806	1.836	-0.005	-0.009	0.000
06/11/2020	1.777	1.789	1.805	0.028	15.967	06/11/2020	1.778	1.790	1.805	-0.001	-0.001	0.000

07/11/2020	1.771	1.786	1.807	0.036	15.969	07/11/2020	1.777	1.787	1.807	-0.006	-0.001	0.000
08/11/2020	1.735	1.756	1.773	0.038	15.935	08/11/2020	1.754	1.770	1.794	-0.019	-0.014	-0.021
09/11/2020	1.725	1.740	1.760	0.035	15.922	09/11/2020	1.731	1.745	1.760	-0.006	-0.005	0.000
10/11/2020	1.645	1.707	1.729	0.084	15.891	10/11/2020	1.716	1.728	1.751	-0.071	-0.021	-0.022
11/11/2020	1.646	1.690	1.733	0.087	15.895	11/11/2020	1.645	1.684	1.733	0.001	0.006	0.000
12/11/2020	1.694	1.747	1.792	0.098	15.954	12/11/2020	1.677	1.729	1.792	0.017	0.018	0.000
13/11/2020	1.718	1.752	1.795	0.077	15.957	13/11/2020	1.719	1.753	1.795	-0.001	-0.001	0.000
14/11/2020	1.726	1.761	1.790	0.064	15.952	14/11/2020	1.718	1.757	1.790	0.008	0.004	0.000
15/11/2020	1.727	1.780	1.845	0.118	16.007	15/11/2020	1.737	1.780	1.845	-0.010	0.000	0.000
16/11/2020	1.738	1.776	1.809	0.071	15.971	16/11/2020	1.727	1.764	1.798	0.011	0.012	0.011
17/11/2020	1.807	1.891	1.924	0.117	16.086	17/11/2020	1.774	1.846	1.923	0.033	0.045	0.001
18/11/2020	1.888	1.921	1.947	0.059	16.109	18/11/2020	1.885	1.914	1.947	0.003	0.007	0.000
19/11/2020	1.870	1.897	1.937	0.067	16.099	19/11/2020	1.881	1.914	1.937	-0.011	-0.017	0.000
20/11/2020	1.825	1.860	1.885	0.060	16.047	20/11/2020	1.851	1.872	1.885	-0.026	-0.012	0.000
21/11/2020	1.812	1.854	1.896	0.084	16.058	21/11/2020	1.825	1.860	1.896	-0.013	-0.006	0.000
22/11/2020	1.821	1.855	1.875	0.054	16.037	22/11/2020	1.812	1.848	1.878	-0.009	-0.007	-0.003
23/11/2020	1.833	1.868	1.922	0.089	16.084	23/11/2020	1.833	1.848	1.880	0.000	0.020	0.042
24/11/2020	1.912	1.930	1.956	0.044	16.118	24/11/2020	1.881	1.918	1.956	-0.031	-0.012	0.000
25/11/2020	1.876	1.909	1.934	0.058	16.096	25/11/2020	1.905	1.925	1.944	-0.029	-0.016	-0.010
26/11/2020	1.807	1.868	1.900	0.093	16.062	26/11/2020	1.876	1.889	1.905	-0.069	-0.021	-0.005
27/11/2020	1.791	1.822	1.844	0.053	16.006	27/11/2020	1.807	1.831	1.883	-0.016	-0.009	-0.039
28/11/2020	1.782	1.792	1.801	0.019	15.963	28/11/2020	1.782	1.799	1.837	-0.000	-0.007	-0.036
29/11/2020	1.756	1.786	1.807	0.051	15.969	29/11/2020	1.782	1.793	1.807	-0.026	-0.007	0.000
30/11/2020	1.759	1.768	1.783	0.024	15.945	30/11/2020	1.756	1.769	1.797	-0.003	-0.001	-0.014

01/12/2020	1.731	1.764	1.793	0.062	15.955	01/12/2020	1.764	1.774	1.793	-0.033	-0.010	0.000
02/12/2020	1.732	1.748	1.765	0.033	15.927	02/12/2020	1.731	1.749	1.775	-0.001	-0.001	-0.010
03/12/2020	1.669	1.724	1.745	0.076	15.907	03/12/2020	1.729	1.739	1.759	-0.060	-0.015	-0.014
04/12/2020	1.679	1.771	1.892	0.213	16.054	04/12/2020	1.669	1.720	1.805	-0.010	-0.051	-0.087
05/12/2020	1.892	1.975	2.004	0.112	16.166	05/12/2020	1.803	1.918	2.004	-0.089	-0.057	-0.000
06/12/2020	1.913	1.960	1.993	0.080	16.155	06/12/2020	1.949	1.976	2.003	-0.036	-0.016	-0.010
07/12/2020	1.841	1.900	1.942	0.101	16.104	07/12/2020	1.898	1.933	1.977	-0.057	-0.033	-0.035
08/12/2020	1.857	1.871	1.885	0.028	16.047	08/12/2020	1.841	1.867	1.892	-0.016	-0.004	-0.007
09/12/2020	1.841	1.878	1.908	0.067	16.070	09/12/2020	1.858	1.881	1.908	-0.017	-0.003	-0.000
10/12/2020	1.769	1.820	1.856	0.087	16.018	10/12/2020	1.679	1.845	1.891	-0.090	-0.025	-0.035
11/12/2020	1.775	1.797	1.815	0.040	15.977	11/12/2020	1.769	1.795	1.815	-0.006	-0.002	-0.000
12/12/2020	1.757	1.781	1.798	0.041	15.960	12/12/2020	1.767	1.783	1.804	-0.010	-0.002	-0.006
13/12/2020	1.748	1.765	1.795	0.047	15.957	13/12/2020	1.748	1.768	1.796	-0.000	-0.003	-0.001
14/12/2020	1.795	1.872	1.902	0.107	16.064	14/12/2020	1.763	1.831	1.902	-0.032	-0.041	-0.000
15/12/2020	1.836	1.898	1.929	0.093	16.091	15/12/2020	1.865	1.903	1.929	-0.029	-0.005	-0.000
16/12/2020	1.821	1.852	1.882	0.061	16.044	16/12/2020	1.834	1.863	1.907	-0.013	-0.011	-0.025
17/12/2020	1.829	1.862	1.892	0.063	16.054	17/12/2020	1.821	1.860	1.892	-0.008	-0.002	-0.000
18/12/2020	1.836	1.888	1.953	0.117	16.115	18/12/2020	1.829	1.865	1.953	-0.007	-0.023	-0.000
19/12/2020	1.833	1.877	1.909	0.076	16.071	19/12/2020	1.874	1.898	1.933	-0.041	-0.021	-0.024
20/12/2020	1.849	1.903	1.941	0.092	16.103	20/12/2020	1.833	1.872	1.932	-0.016	-0.031	-0.009
21/12/2020	1.900	1.923	1.944	0.044	16.106	21/12/2020	1.912	1.930	1.944	-0.012	-0.007	-0.000
22/12/2020	1.876	1.898	1.918	0.042	16.080	22/12/2020	1.892	1.908	1.934	-0.016	-0.010	-0.016
23/12/2020	1.798	1.857	1.879	0.081	16.041	23/12/2020	1.865	1.880	1.900	-0.067	-0.023	-0.021
24/12/2020	1.775	1.793	1.807	0.032	15.969							

25/12/2020	1.759	1.792	1.821	0.062	15.983
26/12/2020	1.755	1.927	2.047	0.292	16.209
27/12/2020	1.970	2.026	2.065	0.095	16.227
28/12/2020	1.891	1.939	1.970	0.079	16.132
29/12/2020	1.803	1.854	1.892	0.089	16.054
30/12/2020	1.738	1.784	1.805	0.067	15.967
31/12/2020	1.704	1.725	1.741	0.037	15.903
01/01/2021	1.679	1.692	1.704	0.025	15.866
02/01/2021	1.662	1.681	1.697	0.035	15.859
03/01/2021	1.641	1.658	1.667	0.026	15.829
04/01/2021	1.626	1.635	1.641	0.015	15.803
05/01/2021	1.556	1.610	1.631	0.075	15.793
06/01/2021	1.558	1.610	1.646	0.088	15.808
07/01/2021	1.646	1.691	1.733	0.087	15.895
08/01/2021	1.643	1.663	1.685	0.042	15.847
09/01/2021	1.645	1.664	1.689	0.044	15.851
10/01/2021	1.685	1.712	1.772	0.087	15.934
11/01/2021	1.772	1.945	2.015	0.243	16.177
12/01/2021	1.856	1.929	1.972	0.116	16.134
13/01/2021	1.852	1.880	1.903	0.051	16.065
14/01/2021	1.810	1.850	1.874	0.064	16.036
15/01/2021	1.792	1.854	1.903	0.111	16.065
16/01/2021	1.794	1.860	1.906	0.112	16.068
17/01/2021	1.866	1.897	1.925	0.059	16.087
18/01/2021	1.859	1.891	1.902	0.043	16.064
19/01/2021	1.792	1.835	1.860	0.068	16.022
20/01/2021	1.776	1.812	1.837	0.061	15.999
21/01/2021	1.699	1.741	1.778	0.079	15.940
22/01/2021	1.649	1.689	1.703	0.054	15.865
23/01/2021	1.626	1.647	1.662	0.036	15.824
24/01/2021	1.594	1.619	1.639	0.045	15.801
25/01/2021	1.557	1.585	1.597	0.040	15.759
26/01/2021	1.538	1.556	1.577	0.039	15.739
27/01/2021	1.517	1.542	1.562	0.045	15.724
28/01/2021	1.511	1.543	1.577	0.066	15.739
29/01/2021	1.503	1.547	1.571	0.068	15.733
30/01/2021	1.495	1.509	1.520	0.025	15.682

31/01/2021	1.496	1.522	1.559	0.063	15.721
01/02/2021	1.540	1.556	1.576	0.036	15.738
02/02/2021	1.472	1.524	1.563	0.091	15.725
03/02/2021	1.466	1.499	1.534	0.068	15.696
04/02/2021	1.474	1.507	1.544	0.070	15.706
05/02/2021	1.450	1.493	1.512	0.062	15.674
06/02/2021	1.438	1.484	1.512	0.074	15.674
07/02/2021	1.432	1.464	1.503	0.071	15.665
08/02/2021	1.438	1.469	1.487	0.049	15.649
09/02/2021	1.399	1.431	1.452	0.053	15.614
10/02/2021	1.412	1.439	1.458	0.046	15.620
11/02/2021	1.423	1.448	1.460	0.037	15.622
12/02/2021	1.381	1.441	1.478	0.097	15.640
13/02/2021	1.388	1.422	1.460	0.072	15.622
14/02/2021	1.406	1.452	1.512	0.106	15.674
15/02/2021	1.512	1.580	1.643	0.131	15.805
16/02/2021	1.635	1.754	1.804	0.169	15.966
17/02/2021	1.782	1.834	1.882	0.100	16.044
18/02/2021	1.849	1.886	1.921	0.072	16.083
19/02/2021	1.856	1.906	1.970	0.114	16.132
20/02/2021	1.960	1.990	2.028	0.068	16.190
21/02/2021	2.018	2.048	2.074	0.056	16.236
22/02/2021	1.871	1.967	2.033	0.162	16.195
23/02/2021	1.847	1.900	1.954	0.107	16.116
24/02/2021	1.942	1.982	2.029	0.087	16.191
25/02/2021	1.865	1.910	1.954	0.089	16.116
26/02/2021	1.802	1.831	1.865	0.063	16.027
27/02/2021	1.771	1.791	1.805	0.034	15.967
28/02/2021	1.751	1.763	1.773	0.022	15.935
01/03/2021	1.738	1.769	1.795	0.057	15.957
02/03/2021	1.698	1.764	1.805	0.107	15.967
03/03/2021	1.683	1.723	1.749	0.066	15.911
04/03/2021	1.586	1.647	1.687	0.101	15.849
05/03/2021	1.563	1.588	1.608	0.045	15.770
06/03/2021	1.559	1.581	1.602	0.043	15.764
07/03/2021	1.539	1.566	1.599	0.060	15.761
08/03/2021	1.540	1.566	1.597	0.057	15.759

09/03/2021	1.583	1.620	1.680	0.097	15.842
10/03/2021	1.679	1.725	1.793	0.114	15.955
11/03/2021	1.766	1.786	1.801	0.035	15.963
12/03/2021	1.781	1.793	1.804	0.023	15.966
13/03/2021	1.716	1.774	1.797	0.081	15.959
14/03/2021	1.702	1.712	1.721	0.019	15.883
15/03/2021	1.706	1.736	1.757	0.051	15.919
16/03/2021	1.729	1.742	1.754	0.025	15.916
17/03/2021	1.707	1.732	1.757	0.050	15.919
18/03/2021	1.639	1.682	1.728	0.089	15.890
19/03/2021	1.623	1.639	1.655	0.032	15.817
20/03/2021	1.623	1.643	1.663	0.040	15.825
21/03/2021	1.622	1.641	1.658	0.036	15.820
22/03/2021	1.599	1.625	1.642	0.043	15.804
23/03/2021	1.552	1.582	1.607	0.055	15.769
24/03/2021	1.532	1.570	1.610	0.078	15.772
25/03/2021	1.608	1.648	1.717	0.109	15.879
26/03/2021	1.714	1.777	1.806	0.092	15.968
27/03/2021	1.790	1.813	1.848	0.058	16.010
28/03/2021	1.846	1.940	2.120	0.274	16.282
29/03/2021	2.120	2.215	2.260	0.140	16.422
30/03/2021	2.205	2.222	2.259	0.054	16.421
31/03/2021	2.206	2.263	2.309	0.103	16.471
01/04/2021	2.051	2.135	2.211	0.160	16.373
02/04/2021	1.928	1.982	2.051	0.123	16.213
03/04/2021	1.860	1.908	1.937	0.077	16.099
04/04/2021	1.758	1.810	1.867	0.109	16.029
05/04/2021	1.722	1.743	1.765	0.043	15.927
06/04/2021	1.659	1.700	1.727	0.068	15.889
07/04/2021	1.649	1.691	1.718	0.069	15.880
08/04/2021	1.641	1.713	1.775	0.134	15.937
09/04/2021	1.763	1.773	1.782	0.019	15.944
10/04/2021	1.728	1.758	1.768	0.040	15.930
11/04/2021	1.712	1.720	1.728	0.016	15.890
12/04/2021	1.682	1.715	1.754	0.072	15.916
13/04/2021	1.651	1.674	1.694	0.043	15.856
14/04/2021	1.632	1.644	1.655	0.023	15.817

15/04/2021	1.629	1.644	1.667	0.038	15.829
16/04/2021	1.639	1.657	1.675	0.036	15.837
17/04/2021	1.614	1.645	1.672	0.058	15.834
18/04/2021	1.596	1.617	1.639	0.043	15.801
19/04/2021	1.555	1.586	1.625	0.070	15.787
20/04/2021	1.541	1.549	1.563	0.022	15.725
21/04/2021	1.525	1.544	1.551	0.026	15.713
22/04/2021	1.536	1.548	1.561	0.025	15.723
23/04/2021	1.506	1.529	1.550	0.044	15.712
24/04/2021	1.519	1.532	1.548	0.029	15.710
25/04/2021	1.532	1.545	1.567	0.035	15.729
26/04/2021	1.537	1.556	1.583	0.046	15.745
27/04/2021	1.535	1.565	1.586	0.051	15.748
28/04/2021	1.567	1.579	1.604	0.037	15.766
29/04/2021	1.598	1.617	1.644	0.046	15.806
30/04/2021	1.603	1.623	1.646	0.043	15.808
01/05/2021	1.618	1.629	1.648	0.030	15.810
02/05/2021	1.610	1.632	1.652	0.042	15.814
03/05/2021	1.577	1.628	1.676	0.099	15.838
04/05/2021	1.585	1.621	1.643	0.058	15.805
05/05/2021	1.626	1.656	1.679	0.053	15.841
06/05/2021	1.661	1.687	1.711	0.050	15.873
07/05/2021	1.677	1.700	1.712	0.035	15.874
08/05/2021	1.661	1.684	1.705	0.044	15.867
09/05/2021	1.657	1.680	1.716	0.059	15.878
10/05/2021	1.675	1.701	1.718	0.043	15.880
11/05/2021	1.664	1.677	1.688	0.024	15.850
12/05/2021	1.667	1.681	1.700	0.033	15.862
13/05/2021	1.673	1.695	1.710	0.037	15.872
14/05/2021	1.671	1.710	1.731	0.060	15.893
15/05/2021	1.644	1.662	1.674	0.030	15.836
16/05/2021	1.601	1.617	1.644	0.043	15.806
17/05/2021	1.549	1.583	1.605	0.056	15.767
18/05/2021	1.525	1.552	1.576	0.051	15.738
19/05/2021	1.503	1.521	1.534	0.031	15.696
20/05/2021	1.507	1.527	1.551	0.044	15.713
21/05/2021	1.531	1.557	1.585	0.054	15.747

22/05/2021	1.542	1.556	1.565	0.023	15.727
23/05/2021	1.542	1.556	1.565	0.023	15.727
24/05/2021	1.559	1.656	1.748	0.189	15.910
25/05/2021	1.748	1.786	1.805	0.057	15.967
26/05/2021	1.710	1.753	1.780	0.070	15.942
27/05/2021	1.645	1.686	1.714	0.069	15.876
28/05/2021	1.629	1.644	1.660	0.031	15.822
29/05/2021	1.599	1.617	1.631	0.032	15.793
30/05/2021	1.562	1.581	1.601	0.039	15.763
31/05/2021	1.507	1.548	1.587	0.080	15.749
01/06/2021	1.474	1.493	1.517	0.043	15.679
02/06/2021	1.448	1.472	1.490	0.042	15.652
03/06/2021	1.396	1.420	1.453	0.057	15.615
04/06/2021	1.383	1.396	1.405	0.022	15.567
05/06/2021	1.378	1.386	1.398	0.020	15.560
06/06/2021	1.370	1.383	1.391	0.021	15.553
07/06/2021	1.339	1.361	1.375	0.036	15.537
08/06/2021	1.330	1.339	1.344	0.014	15.506
09/06/2021	1.337	1.368	1.397	0.060	15.559
10/06/2021	1.351	1.376	1.394	0.043	15.556
11/06/2021	1.343	1.357	1.371	0.028	15.533
12/06/2021	1.353	1.377	1.408	0.055	15.570
13/06/2021	1.334	1.368	1.396	0.062	15.558
14/06/2021	1.334	1.378	1.419	0.085	15.581
15/06/2021	1.314	1.369	1.424	0.110	15.586
16/06/2021	1.322	1.339	1.355	0.033	15.517
17/06/2021	1.351	1.370	1.388	0.037	15.550
18/06/2021	1.322	1.355	1.372	0.050	15.534
19/06/2021	1.238	1.304	1.339	0.101	15.501
20/06/2021	1.235	1.259	1.276	0.041	15.438
21/06/2021	1.196	1.226	1.245	0.049	15.407
22/06/2021	1.184	1.199	1.221	0.037	15.383
23/06/2021	1.210	1.235	1.255	0.045	15.417
24/06/2021	1.177	1.216	1.239	0.062	15.401
25/06/2021	1.176	1.201	1.224	0.048	15.386
26/06/2021	1.219	1.230	1.237	0.018	15.399
27/06/2021	1.232	1.249	1.269	0.037	15.431

28/06/2021	1.250	1.273	1.292	0.042	15.454
29/06/2021	1.237	1.272	1.300	0.063	15.462
30/06/2021	1.236	1.261	1.274	0.038	15.436
01/07/2021	1.236	1.259	1.287	0.051	15.449
02/07/2021	1.269	1.284	1.301	0.032	15.463
03/07/2021	1.247	1.264	1.276	0.029	15.438
04/07/2021	1.240	1.254	1.272	0.032	15.434
05/07/2021	1.249	1.301	1.342	0.093	15.504
06/07/2021	1.341	1.370	1.391	0.050	15.553
07/07/2021	1.381	1.396	1.412	0.031	15.574
08/07/2021	1.395	1.428	1.462	0.067	15.624
09/07/2021	1.411	1.424	1.438	0.027	15.600
10/07/2021	1.404	1.446	1.476	0.072	15.638
11/07/2021	1.469	1.489	1.516	0.047	15.678
12/07/2021	1.470	1.490	1.507	0.037	15.669
13/07/2021	1.502	1.515	1.530	0.028	15.692
14/07/2021	1.453	1.481	1.505	0.052	15.667
15/07/2021	1.467	1.501	1.526	0.059	15.688
16/07/2021	1.469	1.500	1.530	0.061	15.692
17/07/2021	1.409	1.425	1.469	0.060	15.631
18/07/2021	1.427	1.441	1.462	0.035	15.624
19/07/2021	1.407	1.432	1.451	0.044	15.613
20/07/2021	1.401	1.420	1.441	0.040	15.603
21/07/2021	1.385	1.421	1.444	0.059	15.606
22/07/2021	1.359	1.384	1.400	0.041	15.562
23/07/2021	1.356	1.389	1.410	0.054	15.572
24/07/2021	1.322	1.346	1.363	0.041	15.525
25/07/2021	1.321	1.329	1.349	0.028	15.511
26/07/2021	1.330	1.354	1.376	0.046	15.538
27/07/2021	1.352	1.390	1.409	0.057	15.571
28/07/2021	1.399	1.422	1.456	0.057	15.618
29/07/2021	1.450	1.494	1.528	0.078	15.690
30/07/2021	1.507	1.524	1.535	0.028	15.697
31/07/2021	1.503	1.513	1.523	0.020	15.685
01/08/2021	1.513	1.520	1.532	0.019	15.694
02/08/2021	1.514	1.524	1.533	0.019	15.695
03/08/2021	1.513	1.539	1.557	0.044	15.719

04/08/2021	1.557	1.580	1.597	0.040	15.759
05/08/2021	1.565	1.577	1.584	0.019	15.746
06/08/2021	1.564	1.590	1.615	0.051	15.777
07/08/2021	1.557	1.595	1.612	0.055	15.774
08/08/2021	1.540	1.556	1.568	0.028	15.730
09/08/2021	1.555	1.567	1.580	0.025	15.742
10/08/2021	1.557	1.569	1.587	0.030	15.749
11/08/2021	1.559	1.580	1.602	0.043	15.764
12/08/2021	1.594	1.603	1.613	0.019	15.775
13/08/2021	1.580	1.592	1.608	0.028	15.770
14/08/2021	1.608	1.635	1.649	0.041	15.811
15/08/2021	1.594	1.627	1.648	0.054	15.810
16/08/2021	1.586	1.604	1.614	0.028	15.776
17/08/2021	1.542	1.584	1.608	0.066	15.770
18/08/2021	1.518	1.542	1.566	0.048	15.728
19/08/2021	1.526	1.543	1.557	0.031	15.719
20/08/2021	1.555	1.577	1.586	0.031	15.748
21/08/2021	1.566	1.575	1.583	0.017	15.745
22/08/2021	1.559	1.571	1.585	0.026	15.747
23/08/2021	1.535	1.548	1.561	0.026	15.723
24/08/2021	1.522	1.532	1.540	0.018	15.702
25/08/2021	1.504	1.515	1.526	0.022	15.688
26/08/2021	1.492	1.498	1.509	0.017	15.671
27/08/2021	1.485	1.491	1.501	0.016	15.663
28/08/2021	1.449	1.467	1.488	0.039	15.650
29/08/2021	1.423	1.435	1.452	0.029	15.614
30/08/2021	1.364	1.406	1.433	0.069	15.595
31/08/2021	1.340	1.361	1.382	0.042	15.544
01/09/2021	1.321	1.346	1.358	0.037	15.520
02/09/2021	1.305	1.330	1.350	0.045	15.512
03/09/2021	1.301	1.326	1.341	0.040	15.503
04/09/2021	1.277	1.298	1.312	0.035	15.474
05/09/2021	1.241	1.270	1.291	0.050	15.453
06/09/2021	1.258	1.283	1.305	0.047	15.467
07/09/2021	1.287	1.305	1.329	0.042	15.491
08/09/2021	1.276	1.301	1.324	0.048	15.486
09/09/2021	1.283	1.314	1.347	0.064	15.509

10/09/2021	1.306	1.316	1.324	0.018	15.486
11/09/2021	1.291	1.298	1.316	0.025	15.478
12/09/2021	1.285	1.300	1.315	0.030	15.477
13/09/2021	1.256	1.282	1.295	0.039	15.457
14/09/2021	1.268	1.286	1.309	0.041	15.471
15/09/2021	1.264	1.284	1.308	0.044	15.470
16/09/2021	1.261	1.287	1.309	0.048	15.471
17/09/2021	1.280	1.295	1.307	0.027	15.469
18/09/2021	1.251	1.292	1.313	0.062	15.475
19/09/2021	1.248	1.262	1.278	0.030	15.440
20/09/2021	1.240	1.249	1.260	0.020	15.422
21/09/2021	1.238	1.251	1.267	0.029	15.429
22/09/2021	1.250	1.284	1.309	0.059	15.471
23/09/2021	1.249	1.275	1.297	0.048	15.459
24/09/2021	1.221	1.243	1.272	0.051	15.434
25/09/2021	1.261	1.287	1.317	0.056	15.479
26/09/2021	1.260	1.291	1.346	0.086	15.508
27/09/2021	1.344	1.434	1.494	0.150	15.656
28/09/2021	1.494	1.568	1.626	0.132	15.788
29/09/2021	1.625	1.656	1.680	0.055	15.842
30/09/2021	1.648	1.666	1.685	0.037	15.847
01/10/2021	1.622	1.672	1.723	0.101	15.885
02/10/2021	1.719	1.748	1.784	0.065	15.946
03/10/2021	1.696	1.710	1.742	0.046	15.904
04/10/2021	1.703	1.726	1.746	0.043	15.908
05/10/2021	1.685	1.719	1.743	0.058	15.905
06/10/2021	1.729	1.751	1.765	0.036	15.927
07/10/2021	1.715	1.731	1.758	0.043	15.920
08/10/2021	1.718	1.748	1.780	0.062	15.942
09/10/2021	1.719	1.730	1.743	0.024	15.905
10/10/2021	1.670	1.687	1.724	0.054	15.886
11/10/2021	1.687	1.699	1.716	0.029	15.878
12/10/2021	1.688	1.713	1.744	0.056	15.906
13/10/2021	1.657	1.696	1.713	0.056	15.875
14/10/2021	1.644	1.657	1.672	0.028	15.834
15/10/2021	1.661	1.683	1.704	0.043	15.866
16/10/2021	1.670	1.689	1.704	0.034	15.866

17/10/2021	1.682	1.714	1.736	0.054	15.898
18/10/2021	1.725	1.742	1.762	0.037	15.924
19/10/2021	1.713	1.742	1.768	0.055	15.930
20/10/2021	1.711	1.729	1.744	0.033	15.906
21/10/2021	1.704	1.734	1.750	0.046	15.912
22/10/2021	1.710	1.771	1.801	0.091	15.963
23/10/2021	1.717	1.748	1.772	0.055	15.934
24/10/2021	1.724	1.749	1.775	0.051	15.937
25/10/2021	1.775	1.802	1.850	0.075	16.012
26/10/2021	1.843	1.887	1.949	0.106	16.111
27/10/2021	1.895	1.933	1.964	0.069	16.126
28/10/2021	1.834	1.869	1.899	0.065	16.061
29/10/2021	1.811	1.822	1.837	0.026	15.999
30/10/2021	1.791	1.826	1.844	0.053	16.006
31/10/2021	1.779	1.817	1.900	0.121	16.062
01/11/2021	1.900	1.942	1.964	0.064	16.126
02/11/2021	1.842	1.902	1.934	0.092	16.096
03/11/2021	1.779	1.816	1.847	0.068	16.009
04/11/2021	1.747	1.765	1.779	0.032	15.941
05/11/2021	1.752	1.766	1.779	0.027	15.941
06/11/2021	1.664	1.731	1.762	0.098	15.924
07/11/2021	1.653	1.691	1.729	0.076	15.891
08/11/2021	1.728	1.748	1.763	0.035	15.925
09/11/2021	1.734	1.750	1.766	0.032	15.928
10/11/2021	1.738	1.756	1.782	0.044	15.944
11/11/2021	1.759	1.784	1.801	0.042	15.963
12/11/2021	1.759	1.788	1.807	0.048	15.969
13/11/2021	1.709	1.768	1.791	0.082	15.953
14/11/2021	1.697	1.705	1.712	0.015	15.874
15/11/2021	1.709	1.740	1.759	0.050	15.921
16/11/2021	1.733	1.771	1.798	0.065	15.960
17/11/2021	1.764	1.783	1.801	0.037	15.963
18/11/2021	1.744	1.759	1.780	0.036	15.942
19/11/2021	1.750	1.764	1.774	0.024	15.936
20/11/2021	1.764	1.789	1.804	0.040	15.966
21/11/2021	1.706	1.760	1.785	0.079	15.947
22/11/2021	1.706	1.731	1.751	0.045	15.913

23/11/2021	1.739	1.772	1.804	0.065	15.966
24/11/2021	1.710	1.736	1.752	0.042	15.914
25/11/2021	1.718	1.752	1.794	0.076	15.956
26/11/2021	1.758	1.796	1.910	0.152	16.072
27/11/2021	1.747	1.761	1.780	0.033	15.942
28/11/2021	1.710	1.740	1.757	0.047	15.919
29/11/2021	1.713	1.747	1.773	0.060	15.935
30/11/2021	1.749	1.771	1.786	0.037	15.948
01/12/2021	1.720	1.759	1.775	0.055	15.937
02/12/2021	1.714	1.745	1.764	0.050	15.926
03/12/2021	1.710	1.748	1.793	0.083	15.955
04/12/2021	1.788	1.799	1.808	0.020	15.970
05/12/2021	1.766	1.786	1.797	0.031	15.959
06/12/2021	1.764	1.804	1.834	0.070	15.996
07/12/2021	1.754	1.783	1.810	0.056	15.972
08/12/2021	1.741	1.756	1.768	0.027	15.930
09/12/2021	1.742	1.772	1.792	0.050	15.954
10/12/2021	1.747	1.762	1.788	0.041	15.950
11/12/2021	1.742	1.758	1.774	0.032	15.936
12/12/2021	1.763	1.782	1.816	0.053	15.978
13/12/2021	1.791	1.802	1.813	0.022	15.975
14/12/2021	1.780	1.806	1.840	0.060	16.002
15/12/2021	1.836	1.853	1.874	0.038	16.036
16/12/2021	1.794	1.815	1.841	0.047	16.003
17/12/2021	1.759	1.804	1.830	0.071	15.992
18/12/2021	1.749	1.767	1.784	0.035	15.946
19/12/2021	1.710	1.741	1.757	0.047	15.919
20/12/2021	1.682	1.726	1.751	0.069	15.913
21/12/2021	1.677	1.692	1.702	0.025	15.864
22/12/2021	1.663	1.690	1.711	0.048	15.873
23/12/2021	1.630	1.651	1.667	0.037	15.829
24/12/2021	1.573	1.637	1.664	0.091	15.826
25/12/2021	1.530	1.554	1.576	0.046	15.738
26/12/2021	1.523	1.532	1.545	0.022	15.707
27/12/2021	1.529	1.538	1.548	0.019	15.710
28/12/2021	1.544	1.572	1.597	0.053	15.759
29/12/2021	1.561	1.615	1.655	0.094	15.817

30/12/2021	1.633	1.705	1.766	0.133	15.928
31/12/2021	1.637	1.739	1.779	0.142	15.941
01/01/2022	1.642	1.676	1.709	0.067	15.871
02/01/2022	1.666	1.760	1.899	0.233	16.061
03/01/2022	1.899	1.951	1.985	0.086	16.147
04/01/2022	1.820	1.895	1.936	0.116	16.098
05/01/2022	1.783	1.813	1.832	0.049	15.994
06/01/2022	1.705	1.759	1.803	0.098	15.965
07/01/2022	1.724	1.753	1.775	0.051	15.937
08/01/2022	1.668	1.718	1.744	0.076	15.906
09/01/2022	1.667	1.712	1.752	0.085	15.914
10/01/2022	1.704	1.748	1.793	0.089	15.955
11/01/2022	1.779	1.788	1.803	0.024	15.965
12/01/2022	1.784	1.797	1.811	0.027	15.973
13/01/2022	1.722	1.755	1.784	0.062	15.946
14/01/2022	1.731	1.763	1.791	0.060	15.953
15/01/2022	1.732	1.770	1.794	0.062	15.956
16/01/2022	1.642	1.694	1.736	0.094	15.898
17/01/2022	1.638	1.655	1.678	0.040	15.840
18/01/2022	1.618	1.634	1.654	0.036	15.816
19/01/2022	1.626	1.654	1.681	0.055	15.843
20/01/2022	1.620	1.666	1.703	0.083	15.865
21/01/2022	1.582	1.615	1.635	0.053	15.797
22/01/2022	1.530	1.571	1.594	0.064	15.756
23/01/2022	1.501	1.526	1.547	0.046	15.709
24/01/2022	1.512	1.601	1.660	0.148	15.822
25/01/2022	1.586	1.620	1.649	0.063	15.811
26/01/2022	1.627	1.650	1.668	0.041	15.830
27/01/2022	1.649	1.690	1.733	0.084	15.895
28/01/2022	1.623	1.696	1.737	0.114	15.899
29/01/2022	1.645	1.691	1.715	0.070	15.877
30/01/2022	1.676	1.709	1.738	0.062	15.900
31/01/2022	1.620	1.687	1.736	0.116	15.898
01/02/2022	1.620	1.639	1.662	0.042	15.824
02/02/2022	1.626	1.667	1.717	0.091	15.879
03/02/2022	1.717	1.780	1.832	0.115	15.994
04/02/2022	1.785	1.828	1.861	0.076	16.023

05/02/2022	1.790	1.834	1.874	0.084	16.036
06/02/2022	1.785	1.802	1.826	0.041	15.988
07/02/2022	1.764	1.788	1.815	0.051	15.977
08/02/2022	1.793	1.814	1.832	0.039	15.994
09/02/2022	1.796	1.829	1.874	0.078	16.036
10/02/2022	1.791	1.804	1.819	0.028	15.981
11/02/2022	1.750	1.787	1.811	0.061	15.973
12/02/2022	1.760	1.818	1.869	0.109	16.031
13/02/2022	1.863	1.897	1.918	0.055	16.080
14/02/2022	1.867	1.886	1.902	0.035	16.064
15/02/2022	1.813	1.850	1.876	0.063	16.038
16/02/2022	1.814	1.920	1.977	0.163	16.139
17/02/2022	1.873	1.912	1.946	0.073	16.108
18/02/2022	1.838	1.874	1.900	0.062	16.062
19/02/2022	1.801	1.833	1.856	0.055	16.018
20/02/2022	1.808	1.893	1.943	0.135	16.105
21/02/2022	1.923	1.947	1.980	0.057	16.142
22/02/2022	1.933	1.966	1.998	0.065	16.160
23/02/2022	1.976	2.050	2.102	0.126	16.264
24/02/2022	1.885	1.969	2.047	0.162	16.209
25/02/2022	1.863	1.879	1.899	0.036	16.061
26/02/2022	1.851	1.884	1.929	0.078	16.091
27/02/2022	1.819	1.838	1.856	0.037	16.018
28/02/2022	1.812	1.838	1.857	0.045	16.019
01/03/2022	1.811	1.837	1.857	0.046	16.019
02/03/2022	1.716	1.776	1.818	0.102	15.980
03/03/2022	1.702	1.732	1.754	0.052	15.916
04/03/2022	1.720	1.737	1.747	0.027	15.909
05/03/2022	1.690	1.715	1.728	0.038	15.890
06/03/2022	1.669	1.687	1.704	0.035	15.866
07/03/2022	1.599	1.652	1.686	0.087	15.848
08/03/2022	1.562	1.578	1.614	0.052	15.776
09/03/2022	1.552	1.593	1.626	0.074	15.788
10/03/2022	1.613	1.627	1.649	0.036	15.811
11/03/2022	1.616	1.626	1.633	0.017	15.795
12/03/2022	1.618	1.651	1.681	0.063	15.843
13/03/2022	1.659	1.711	1.750	0.091	15.912

14/03/2022	1.714	1.730	1.743	0.029	15.905
15/03/2022	1.697	1.712	1.728	0.031	15.890
16/03/2022	1.690	1.714	1.735	0.045	15.897
17/03/2022	1.610	1.639	1.694	0.084	15.856
18/03/2022	1.542	1.581	1.624	0.082	15.786
19/03/2022	1.490	1.516	1.557	0.067	15.719
20/03/2022	1.475	1.498	1.519	0.044	15.681
21/03/2022	1.473	1.489	1.507	0.034	15.669
22/03/2022	1.473	1.504	1.539	0.066	15.701
23/03/2022	1.512	1.530	1.549	0.037	15.711
24/03/2022	1.485	1.521	1.546	0.061	15.708
25/03/2022	1.464	1.478	1.492	0.028	15.654
26/03/2022	1.432	1.446	1.470	0.038	15.632
27/03/2022	1.398	1.423	1.447	0.049	15.609
28/03/2022	1.371	1.389	1.415	0.044	15.577
29/03/2022	1.380	1.407	1.435	0.055	15.597
30/03/2022	1.362	1.390	1.411	0.049	15.573
31/03/2022	1.347	1.373	1.395	0.048	15.557
01/04/2022	1.363	1.379	1.395	0.032	15.557
02/04/2022	1.346	1.353	1.364	0.018	15.526
03/04/2022	1.267	1.328	1.355	0.088	15.517
04/04/2022	1.261	1.285	1.337	0.076	15.499
05/04/2022	1.335	1.423	1.530	0.195	15.692
06/04/2022	1.529	1.631	1.687	0.158	15.849
07/04/2022	1.677	1.711	1.751	0.074	15.913
08/04/2022	1.715	1.737	1.750	0.035	15.912
09/04/2022	1.736	1.749	1.763	0.027	15.925
10/04/2022	1.694	1.710	1.743	0.049	15.905
11/04/2022	1.594	1.637	1.700	0.106	15.862
12/04/2022	1.588	1.612	1.634	0.046	15.796
13/04/2022	1.634	1.653	1.672	0.038	15.834
14/04/2022	1.651	1.683	1.707	0.056	15.869
15/04/2022	1.689	1.703	1.715	0.026	15.877
16/04/2022	1.646	1.667	1.692	0.046	15.854
17/04/2022	1.576	1.603	1.652	0.076	15.814
18/04/2022	1.521	1.557	1.608	0.087	15.770
19/04/2022	1.523	1.538	1.563	0.040	15.725

20/04/2022	1.537	1.548	1.563	0.026	15.725
21/04/2022	1.507	1.529	1.555	0.048	15.717
22/04/2022	1.473	1.503	1.523	0.050	15.685
23/04/2022	1.404	1.452	1.490	0.086	15.652
24/04/2022	1.391	1.418	1.441	0.050	15.603
25/04/2022	1.432	1.452	1.471	0.039	15.633
26/04/2022	1.433	1.450	1.473	0.040	15.635
27/04/2022	1.443	1.459	1.483	0.040	15.645
28/04/2022	1.460	1.484	1.520	0.060	15.682
29/04/2022	1.512	1.530	1.550	0.038	15.712
30/04/2022	1.475	1.512	1.532	0.057	15.694
01/05/2022	1.474	1.488	1.505	0.031	15.667
02/05/2022	1.497	1.532	1.569	0.072	15.731
03/05/2022	1.556	1.578	1.603	0.047	15.765
04/05/2022	1.502	1.535	1.565	0.063	15.727
05/05/2022	1.486	1.512	1.534	0.048	15.696
06/05/2022	1.495	1.551	1.593	0.098	15.755
07/05/2022	1.593	1.624	1.661	0.068	15.823
08/05/2022	1.619	1.655	1.669	0.050	15.831
09/05/2022	1.519	1.548	1.619	0.100	15.781
10/05/2022	1.540	1.583	1.672	0.132	15.834
11/05/2022	1.672	1.710	1.739	0.067	15.901
12/05/2022	1.716	1.733	1.743	0.027	15.905
13/05/2022	1.716	1.740	1.758	0.042	15.920
14/05/2022	1.734	1.750	1.766	0.032	15.928
15/05/2022	1.627	1.698	1.735	0.108	15.897
16/05/2022	1.596	1.629	1.650	0.054	15.812
17/05/2022	1.611	1.647	1.665	0.054	15.827
18/05/2022	1.564	1.599	1.631	0.067	15.793
19/05/2022	1.600	1.648	1.686	0.086	15.848
20/05/2022	1.642	1.668	1.690	0.048	15.852
21/05/2022	1.647	1.660	1.676	0.029	15.838
22/05/2022	1.646	1.667	1.692	0.046	15.854
23/05/2022	1.667	1.715	1.742	0.075	15.904
24/05/2022	1.722	1.741	1.754	0.032	15.916
25/05/2022	1.645	1.684	1.735	0.090	15.897
26/05/2022	1.554	1.622	1.660	0.106	15.822

27/05/2022	1.564	1.585	1.596	0.032	15.758
28/05/2022	1.579	1.588	1.601	0.022	15.763
29/05/2022	1.576	1.592	1.610	0.034	15.772
30/05/2022	1.574	1.591	1.606	0.032	15.768
31/05/2022	1.582	1.599	1.617	0.035	15.779
01/06/2022	1.596	1.627	1.654	0.058	15.816
02/06/2022	1.589	1.601	1.627	0.038	15.789
03/06/2022	1.545	1.573	1.597	0.052	15.759
04/06/2022	1.520	1.536	1.558	0.038	15.720
05/06/2022	1.523	1.554	1.570	0.047	15.732
06/06/2022	1.565	1.578	1.598	0.033	15.760
07/06/2022	1.581	1.603	1.626	0.045	15.788
08/06/2022	1.606	1.622	1.632	0.026	15.794
09/06/2022	1.529	1.585	1.635	0.106	15.797
10/06/2022	1.521	1.537	1.559	0.038	15.721
11/06/2022	1.530	1.565	1.600	0.070	15.762
12/06/2022	1.594	1.620	1.656	0.062	15.818
13/06/2022	1.656	1.682	1.700	0.044	15.862
14/06/2022	1.659	1.691	1.720	0.061	15.882
15/06/2022	1.658	1.679	1.698	0.040	15.860
16/06/2022	1.609	1.634	1.664	0.055	15.826
17/06/2022	1.525	1.569	1.617	0.092	15.779
18/06/2022	1.531	1.544	1.557	0.026	15.719
19/06/2022	1.552	1.568	1.592	0.040	15.754
20/06/2022	1.590	1.600	1.608	0.018	15.770
21/06/2022	1.602	1.626	1.661	0.059	15.823
22/06/2022	1.518	1.571	1.622	0.104	15.784
23/06/2022	1.527	1.537	1.551	0.024	15.713
24/06/2022	1.482	1.534	1.565	0.083	15.727
25/06/2022	1.408	1.433	1.491	0.083	15.653
26/06/2022	1.366	1.386	1.423	0.057	15.585
27/06/2022	1.409	1.436	1.458	0.049	15.620
28/06/2022	1.292	1.325	1.416	0.124	15.578
29/06/2022	1.320	1.357	1.392	0.072	15.554
30/06/2022	1.383	1.414	1.436	0.053	15.598
01/07/2022	1.379	1.414	1.432	0.053	15.594
02/07/2022	1.352	1.360	1.380	0.028	15.542

03/07/2022	1.261	1.311	1.353	0.092	15.515
04/07/2022	1.260	1.276	1.319	0.059	15.481
05/07/2022	1.318	1.405	1.468	0.150	15.630
06/07/2022	1.348	1.371	1.397	0.049	15.559
07/07/2022	1.395	1.421	1.461	0.066	15.623
08/07/2022	1.432	1.442	1.464	0.032	15.626
09/07/2022	1.432	1.442	1.451	0.019	15.613
10/07/2022	1.412	1.446	1.487	0.075	15.649
11/07/2022	1.470	1.509	1.543	0.073	15.705
12/07/2022	1.442	1.487	1.517	0.075	15.679
13/07/2022	1.403	1.418	1.450	0.047	15.612
14/07/2022	1.395	1.403	1.417	0.022	15.579
15/07/2022	1.371	1.388	1.416	0.045	15.578
16/07/2022	1.357	1.370	1.391	0.034	15.553
17/07/2022	1.333	1.357	1.375	0.042	15.537
18/07/2022	1.370	1.428	1.483	0.113	15.645
19/07/2022	1.462	1.507	1.548	0.086	15.710
20/07/2022	1.420	1.439	1.462	0.042	15.624
21/07/2022	1.417	1.456	1.497	0.080	15.659
22/07/2022	1.497	1.552	1.589	0.092	15.751
23/07/2022	1.506	1.540	1.590	0.084	15.752
24/07/2022	1.498	1.571	1.627	0.129	15.789
25/07/2022	1.611	1.620	1.649	0.038	15.811
26/07/2022	1.627	1.653	1.669	0.042	15.831
27/07/2022	1.617	1.635	1.649	0.032	15.811
28/07/2022	1.561	1.583	1.618	0.057	15.780
29/07/2022	1.487	1.558	1.608	0.121	15.770
30/07/2022	1.483	1.505	1.527	0.044	15.689
31/07/2022	1.446	1.462	1.489	0.043	15.651
01/08/2022	1.383	1.464	1.492	0.109	15.654
02/08/2022	1.346	1.372	1.389	0.043	15.551
03/08/2022	1.359	1.401	1.440	0.081	15.602
04/08/2022	1.423	1.442	1.460	0.037	15.622
05/08/2022	1.422	1.432	1.446	0.024	15.608
06/08/2022	1.365	1.389	1.428	0.063	15.590
07/08/2022	1.334	1.358	1.369	0.035	15.531
08/08/2022	1.336	1.346	1.355	0.019	15.517

09/08/2022	1.337	1.345	1.355	0.018	15.517
10/08/2022	1.313	1.347	1.387	0.074	15.549
11/08/2022	1.385	1.415	1.442	0.057	15.604
12/08/2022	1.413	1.441	1.455	0.042	15.617
13/08/2022	1.423	1.459	1.484	0.061	15.646
14/08/2022	1.456	1.478	1.503	0.047	15.665
15/08/2022	1.444	1.460	1.476	0.032	15.638
16/08/2022	1.438	1.454	1.473	0.035	15.635
17/08/2022	1.414	1.444	1.470	0.056	15.632
18/08/2022	1.380	1.398	1.415	0.035	15.577
19/08/2022	1.406	1.447	1.491	0.085	15.653
20/08/2022	1.437	1.456	1.482	0.045	15.644
21/08/2022	1.454	1.507	1.556	0.102	15.718
22/08/2022	1.553	1.570	1.598	0.045	15.760
23/08/2022	1.569	1.589	1.610	0.041	15.772
24/08/2022	1.528	1.556	1.580	0.052	15.742
25/08/2022	1.495	1.512	1.529	0.034	15.691
26/08/2022	1.486	1.496	1.500	0.014	15.662
27/08/2022	1.486	1.495	1.502	0.016	15.664
28/08/2022	1.490	1.498	1.502	0.012	15.664
29/08/2022	1.482	1.491	1.495	0.013	15.657
30/08/2022	1.469	1.481	1.489	0.020	15.651
31/08/2022	1.472	1.479	1.486	0.014	15.648
01/09/2022	1.466	1.475	1.482	0.016	15.644
02/09/2022	1.478	1.490	1.509	0.031	15.671
03/09/2022	1.470	1.479	1.488	0.018	15.650
04/09/2022	1.468	1.495	1.522	0.054	15.684
05/09/2022	1.482	1.518	1.555	0.073	15.717
06/09/2022	1.542	1.560	1.579	0.037	15.741
07/09/2022	1.517	1.541	1.563	0.046	15.725
08/09/2022	1.495	1.526	1.551	0.056	15.713
09/09/2022	1.495	1.510	1.521	0.026	15.683
10/09/2022	1.502	1.511	1.522	0.020	15.684
11/09/2022	1.507	1.514	1.520	0.013	15.682
12/09/2022	1.433	1.473	1.519	0.086	15.681
13/09/2022	1.438	1.463	1.490	0.052	15.652
14/09/2022	1.471	1.490	1.503	0.032	15.665

15/09/2022	1.435	1.469	1.484	0.049	15.646
16/09/2022	1.404	1.431	1.454	0.050	15.616
17/09/2022	1.336	1.367	1.407	0.071	15.569
18/09/2022	1.334	1.342	1.348	0.014	15.510
19/09/2022	1.346	1.353	1.364	0.018	15.526
20/09/2022	1.363	1.414	1.447	0.084	15.609
21/09/2022	1.430	1.445	1.457	0.027	15.619
22/09/2022	1.428	1.496	1.535	0.107	15.697
23/09/2022	1.520	1.542	1.561	0.041	15.723
24/09/2022	1.531	1.539	1.544	0.013	15.706
25/09/2022	1.408	1.460	1.534	0.126	15.696
26/09/2022	1.402	1.426	1.442	0.040	15.604
27/09/2022	1.409	1.489	1.558	0.149	15.720
28/09/2022	1.530	1.557	1.587	0.057	15.749
29/09/2022	1.542	1.592	1.633	0.091	15.795
30/09/2022	1.532	1.613	1.670	0.138	15.832
01/10/2022	1.664	1.691	1.714	0.050	15.876
02/10/2022	1.698	1.735	1.795	0.097	15.957
03/10/2022	1.708	1.748	1.804	0.096	15.966
04/10/2022	1.734	1.861	1.933	0.199	16.095
05/10/2022	1.856	1.906	1.957	0.101	16.119
06/10/2022	1.856	1.910	2.002	0.146	16.164
07/10/2022	1.982	2.020	2.069	0.087	16.231
08/10/2022	1.869	1.926	1.985	0.116	16.147
09/10/2022	1.833	1.859	1.888	0.055	16.050
10/10/2022	1.801	1.823	1.844	0.043	16.006
11/10/2022	1.759	1.796	1.828	0.069	15.990
12/10/2022	1.741	1.762	1.804	0.063	15.966
13/10/2022	1.680	1.710	1.751	0.071	15.913
14/10/2022	1.708	1.740	1.770	0.062	15.932
15/10/2022	1.619	1.661	1.719	0.100	15.881
16/10/2022	1.606	1.644	1.681	0.075	15.843
17/10/2022	1.632	1.662	1.692	0.060	15.854
18/10/2022	1.692	1.738	1.767	0.075	15.929
19/10/2022	1.656	1.719	1.752	0.096	15.914
20/10/2022	1.643	1.671	1.715	0.072	15.877
21/10/2022	1.702	1.729	1.754	0.052	15.916

22/10/2022	1.693	1.711	1.725	0.032	15.887
23/10/2022	1.682	1.707	1.725	0.043	15.887
24/10/2022	1.654	1.688	1.709	0.055	15.871
25/10/2022	1.691	1.718	1.744	0.053	15.906
26/10/2022	1.642	1.672	1.708	0.066	15.870
27/10/2022	1.665	1.700	1.737	0.072	15.899
28/10/2022	1.684	1.710	1.789	0.105	15.951
29/10/2022	1.690	1.774	1.819	0.129	15.981
30/10/2022	1.668	1.700	1.723	0.055	15.885
31/10/2022	1.661	1.689	1.741	0.080	15.903
01/11/2022	1.687	1.715	1.763	0.076	15.925
02/11/2022	1.670	1.731	1.828	0.158	15.990
03/11/2022	1.828	1.878	1.916	0.088	16.078
04/11/2022	1.805	1.843	1.873	0.068	16.035
05/11/2022	1.805	1.857	1.883	0.078	16.045
06/11/2022	1.751	1.793	1.817	0.066	15.979
07/11/2022	1.663	1.726	1.764	0.101	15.926
08/11/2022	1.670	1.692	1.710	0.040	15.872
09/11/2022	1.698	1.739	1.806	0.108	15.968
10/11/2022	1.794	1.851	1.979	0.185	16.141
11/11/2022	1.966	2.008	2.040	0.074	16.202
12/11/2022	1.946	2.021	2.055	0.109	16.217
13/11/2022	1.803	1.884	1.946	0.143	16.108
14/11/2022	1.742	1.763	1.804	0.062	15.966
15/11/2022	1.742	1.767	1.797	0.055	15.959
16/11/2022	1.795	1.829	1.854	0.059	16.016
17/11/2022	1.750	1.780	1.796	0.046	15.958
18/11/2022	1.754	1.790	1.816	0.062	15.978
19/11/2022	1.785	1.795	1.803	0.018	15.965
20/11/2022	1.786	1.814	1.838	0.052	16.000
21/11/2022	1.796	1.841	1.876	0.080	16.038
22/11/2022	1.803	1.834	1.861	0.058	16.023
23/11/2022	1.669	1.730	1.815	0.146	15.977
24/11/2022	1.670	1.691	1.709	0.039	15.871
25/11/2022	1.692	1.780	1.832	0.140	15.994
26/11/2022	1.807	1.825	1.841	0.034	16.003
27/11/2022	1.813	1.835	1.853	0.040	16.015

28/11/2022	1.818	1.849	1.872	0.054	16.034
29/11/2022	1.788	1.838	1.875	0.087	16.037
30/11/2022	1.737	1.768	1.803	0.066	15.965
01/12/2022	1.755	1.808	1.837	0.082	15.999
02/12/2022	1.710	1.749	1.786	0.076	15.948
03/12/2022	1.680	1.697	1.711	0.031	15.873
04/12/2022	1.669	1.698	1.722	0.053	15.884
05/12/2022	1.629	1.670	1.690	0.061	15.852
06/12/2022	1.624	1.653	1.677	0.053	15.839
07/12/2022	1.581	1.637	1.676	0.095	15.838
08/12/2022	1.547	1.586	1.608	0.061	15.770
09/12/2022	1.564	1.592	1.624	0.060	15.786
10/12/2022	1.557	1.581	1.599	0.042	15.761
11/12/2022	1.516	1.549	1.574	0.058	15.736
12/12/2022	1.535	1.583	1.629	0.094	15.791
13/12/2022	1.570	1.602	1.636	0.066	15.798
14/12/2022	1.525	1.544	1.589	0.064	15.751
15/12/2022	1.548	1.612	1.643	0.095	15.805
16/12/2022	1.625	1.689	1.723	0.098	15.885
17/12/2022	1.632	1.664	1.682	0.050	15.844
18/12/2022	1.483	1.554	1.642	0.159	15.804
19/12/2022	1.503	1.628	1.732	0.229	15.894
20/12/2022	1.732	1.797	1.838	0.106	16.000
21/12/2022	1.834	1.907	1.947	0.113	16.109
22/12/2022	1.924	1.972	2.014	0.090	16.176
23/12/2022	1.766	1.873	1.925	0.159	16.087
24/12/2022	1.726	1.805	1.861	0.135	16.023
25/12/2022	1.709	1.787	1.851	0.142	16.013
26/12/2022	1.693	1.734	1.770	0.077	15.932
27/12/2022	1.721	1.755	1.782	0.061	15.944
28/12/2022	1.714	1.771	1.823	0.109	15.985
29/12/2022	1.716	1.771	1.824	0.108	15.986
30/12/2022	1.682	1.717	1.753	0.071	15.915
31/12/2022	1.716	1.768	1.802	0.086	15.964
01/01/2023	1.713	1.754	1.800	0.087	15.962
02/01/2023	1.708	1.762	1.801	0.093	15.963
03/01/2023	1.691	1.740	1.775	0.084	15.937

04/01/2023	1.775	1.845	1.889	0.114	16.051
05/01/2023	1.836	1.871	1.888	0.052	16.050
06/01/2023	1.862	1.930	1.981	0.119	16.143
07/01/2023	1.858	1.947	1.993	0.135	16.155
08/01/2023	1.840	1.858	1.884	0.044	16.046
09/01/2023	1.863	1.895	1.924	0.061	16.086
10/01/2023	1.760	1.809	1.892	0.132	16.054
11/01/2023	1.772	1.868	1.921	0.149	16.083
12/01/2023	1.912	1.948	1.995	0.083	16.157
13/01/2023	1.855	1.935	1.974	0.119	16.136
14/01/2023	1.805	1.856	1.890	0.085	16.052
15/01/2023	1.809	1.833	1.858	0.049	16.020
16/01/2023	1.792	1.808	1.824	0.032	15.986
17/01/2023	1.743	1.779	1.805	0.062	15.967
18/01/2023	1.722	1.773	1.814	0.092	15.976
19/01/2023	1.683	1.701	1.726	0.043	15.888
20/01/2023	1.699	1.736	1.761	0.062	15.923
21/01/2023	1.664	1.678	1.703	0.039	15.865
22/01/2023	1.677	1.765	1.816	0.139	15.978
23/01/2023	1.809	1.838	1.870	0.061	16.032
24/01/2023	1.812	1.851	1.889	0.077	16.051
25/01/2023	1.811	1.861	1.895	0.084	16.057
26/01/2023	1.842	1.883	1.925	0.083	16.087
27/01/2023	1.745	1.797	1.850	0.105	16.012
28/01/2023	1.672	1.753	1.787	0.115	15.949
29/01/2023	1.636	1.665	1.697	0.061	15.859
30/01/2023	1.693	1.798	1.850	0.157	16.012
31/01/2023	1.731	1.757	1.795	0.064	15.957
01/02/2023	1.772	1.826	1.874	0.102	16.036
02/02/2023	1.872	1.948	1.980	0.108	16.142
03/02/2023	1.929	1.979	2.005	0.076	16.167
04/02/2023	1.814	1.862	1.930	0.116	16.092
05/02/2023	1.790	1.814	1.844	0.054	16.006
06/02/2023	1.775	1.797	1.827	0.052	15.989
07/02/2023	1.751	1.836	1.889	0.138	16.051
08/02/2023	1.688	1.715	1.756	0.068	15.918
09/02/2023	1.697	1.733	1.783	0.086	15.945

10/02/2023	1.721	1.754	1.791	0.070	15.953
11/02/2023	1.790	1.808	1.831	0.041	15.993
12/02/2023	1.792	1.808	1.832	0.040	15.994
13/02/2023	1.804	1.834	1.862	0.058	16.024
14/02/2023	1.687	1.773	1.822	0.135	15.984
15/02/2023	1.625	1.647	1.688	0.063	15.850
16/02/2023	1.684	1.733	1.773	0.089	15.935
17/02/2023	1.676	1.743	1.797	0.121	15.959
18/02/2023	1.752	1.832	1.885	0.133	16.047
19/02/2023	1.738	1.778	1.817	0.079	15.979
20/02/2023	1.758	1.795	1.818	0.060	15.980
21/02/2023	1.807	1.833	1.846	0.039	16.008
22/02/2023	1.779	1.829	1.862	0.083	16.024
23/02/2023	1.657	1.763	1.847	0.190	16.009
24/02/2023	1.645	1.659	1.671	0.026	15.833
25/02/2023	1.637	1.654	1.676	0.039	15.838
26/02/2023	1.606	1.632	1.647	0.041	15.809
27/02/2023	1.614	1.625	1.644	0.030	15.806
28/02/2023	1.535	1.608	1.646	0.111	15.808
01/03/2023	1.507	1.529	1.546	0.039	15.708
02/03/2023	1.488	1.521	1.539	0.051	15.701
03/03/2023	1.476	1.513	1.530	0.054	15.692
04/03/2023	1.463	1.493	1.510	0.047	15.672
05/03/2023	1.444	1.464	1.483	0.039	15.645
06/03/2023	1.392	1.429	1.450	0.058	15.612
07/03/2023	1.380	1.401	1.422	0.042	15.584
08/03/2023	1.387	1.405	1.425	0.038	15.587
09/03/2023	1.353	1.388	1.411	0.058	15.573
10/03/2023	1.355	1.376	1.393	0.038	15.555
11/03/2023	1.263	1.341	1.386	0.123	15.548
12/03/2023	1.255	1.280	1.309	0.054	15.471
13/03/2023	1.264	1.354	1.458	0.194	15.620
14/03/2023	1.450	1.485	1.520	0.070	15.682
15/03/2023	1.500	1.520	1.550	0.050	15.712
16/03/2023	1.494	1.541	1.601	0.107	15.763
17/03/2023	1.601	1.641	1.665	0.064	15.827
18/03/2023	1.632	1.654	1.671	0.039	15.833

19/03/2023	1.649	1.700	1.732	0.083	15.894
20/03/2023	1.652	1.692	1.722	0.070	15.884
21/03/2023	1.498	1.611	1.668	0.170	15.830
22/03/2023	1.497	1.575	1.626	0.129	15.788
23/03/2023	1.623	1.701	1.747	0.124	15.909
24/03/2023	1.659	1.698	1.735	0.076	15.897
25/03/2023	1.662	1.713	1.749	0.087	15.911
26/03/2023	1.695	1.726	1.747	0.052	15.909
27/03/2023	1.646	1.696	1.733	0.087	15.895
28/03/2023	1.600	1.626	1.648	0.048	15.810
29/03/2023	1.418	1.494	1.601	0.183	15.763
30/03/2023	1.420	1.441	1.457	0.037	15.619
31/03/2023	1.443	1.476	1.498	0.055	15.660
01/04/2023	1.466	1.499	1.516	0.050	15.678
02/04/2023	1.511	1.541	1.569	0.058	15.731
03/04/2023	1.496	1.534	1.570	0.074	15.732
04/04/2023	1.432	1.468	1.517	0.085	15.679
05/04/2023	1.439	1.509	1.553	0.114	15.715
06/04/2023	1.469	1.516	1.561	0.092	15.723
07/04/2023	1.556	1.586	1.602	0.046	15.764
08/04/2023	1.489	1.570	1.597	0.108	15.759
09/04/2023	1.397	1.426	1.489	0.092	15.651
10/04/2023	1.396	1.404	1.423	0.027	15.585
11/04/2023	1.420	1.447	1.478	0.058	15.640
12/04/2023	1.450	1.492	1.521	0.071	15.683
13/04/2023	1.515	1.577	1.648	0.133	15.810
14/04/2023	1.642	1.660	1.683	0.041	15.845
15/04/2023	1.566	1.635	1.666	0.100	15.828
16/04/2023	1.570	1.602	1.621	0.051	15.783
17/04/2023	1.554	1.591	1.620	0.066	15.782
18/04/2023	1.473	1.518	1.572	0.099	15.734
19/04/2023	1.432	1.460	1.508	0.076	15.670
20/04/2023	1.418	1.447	1.467	0.049	15.629
21/04/2023	1.347	1.390	1.459	0.112	15.621
22/04/2023	1.328	1.367	1.393	0.065	15.555
23/04/2023	1.254	1.276	1.330	0.076	15.492
24/04/2023	1.240	1.266	1.286	0.046	15.448

25/04/2023	1.261	1.289	1.319	0.058	15.481
26/04/2023	1.315	1.357	1.396	0.081	15.558
27/04/2023	1.353	1.376	1.409	0.056	15.571
28/04/2023	1.409	1.436	1.447	0.038	15.609
29/04/2023	1.402	1.421	1.442	0.040	15.604
30/04/2023	1.389	1.409	1.422	0.033	15.584
01/05/2023	1.364	1.404	1.433	0.069	15.595
02/05/2023	1.410	1.443	1.467	0.057	15.629
03/05/2023	1.363	1.442	1.473	0.110	15.635
04/05/2023	1.292	1.313	1.363	0.071	15.525
05/05/2023	1.277	1.298	1.323	0.046	15.485
06/05/2023	1.310	1.327	1.344	0.034	15.506
07/05/2023	1.261	1.322	1.364	0.103	15.526
08/05/2023	1.252	1.293	1.339	0.087	15.501
09/05/2023	1.332	1.363	1.383	0.051	15.545
10/05/2023	1.309	1.334	1.362	0.053	15.524
11/05/2023	1.289	1.316	1.339	0.050	15.501
12/05/2023	1.308	1.334	1.347	0.039	15.509
13/05/2023	1.330	1.342	1.352	0.022	15.514
14/05/2023	1.304	1.319	1.341	0.037	15.503
15/05/2023	1.269	1.297	1.318	0.049	15.480
16/05/2023	1.255	1.275	1.295	0.040	15.457
17/05/2023	1.204	1.249	1.291	0.087	15.453
18/05/2023	1.178	1.208	1.250	0.072	15.412
19/05/2023	1.234	1.249	1.263	0.029	15.425
20/05/2023	1.134	1.188	1.239	0.105	15.401
21/05/2023	1.142	1.199	1.263	0.121	15.425
22/05/2023	1.228	1.246	1.271	0.043	15.433
23/05/2023	1.097	1.165	1.236	0.139	15.398
24/05/2023	1.092	1.138	1.179	0.087	15.341
25/05/2023	1.170	1.203	1.235	0.065	15.397
26/05/2023	1.197	1.221	1.241	0.044	15.403
27/05/2023	1.163	1.182	1.213	0.050	15.375
28/05/2023	1.153	1.162	1.178	0.025	15.340
29/05/2023	1.158	1.182	1.206	0.048	15.368
30/05/2023	1.203	1.220	1.234	0.031	15.396
31/05/2023	1.207	1.216	1.224	0.017	15.386

01/06/2023	1.192	1.210	1.234	0.042	15.396
02/06/2023	1.177	1.206	1.219	0.042	15.381
03/06/2023	1.204	1.223	1.236	0.032	15.398
04/06/2023	1.195	1.224	1.237	0.042	15.399
05/06/2023	1.225	1.242	1.257	0.032	15.419
06/06/2023	1.205	1.225	1.247	0.042	15.409
07/06/2023	1.178	1.199	1.224	0.046	15.386
08/06/2023	1.162	1.193	1.212	0.050	15.374
09/06/2023	1.191	1.208	1.225	0.034	15.387
10/06/2023	1.196	1.212	1.227	0.031	15.389
11/06/2023	1.200	1.219	1.233	0.033	15.395
12/06/2023	1.191	1.235	1.267	0.076	15.429
13/06/2023	1.250	1.271	1.289	0.039	15.451
14/06/2023	1.251	1.271	1.284	0.033	15.446
15/06/2023	1.267	1.293	1.309	0.042	15.471
16/06/2023	1.229	1.261	1.306	0.077	15.468
17/06/2023	1.207	1.230	1.247	0.040	15.409
18/06/2023	1.193	1.218	1.241	0.048	15.403
19/06/2023	1.172	1.204	1.234	0.062	15.396
20/06/2023	1.212	1.236	1.261	0.049	15.423
21/06/2023	1.206	1.239	1.261	0.055	15.423
22/06/2023	1.259	1.279	1.295	0.036	15.457
23/06/2023	1.267	1.280	1.293	0.026	15.455
24/06/2023	1.241	1.297	1.330	0.089	15.492
25/06/2023	1.190	1.233	1.277	0.087	15.439
26/06/2023	1.246	1.260	1.280	0.034	15.442

Averages for 1 Jan to 26 Jun	
2015	1.80
2016	1.72
2017	1.64
2018	1.61
2019	1.67
2020	1.77

2021	1.64
2022	1.65
2023	1.52

APPENDIX 02

Project changes in flow in Loch Ness under a Sensible Worst Case Scenario

Foyers, Red John & Kemp on Sensible Worst Case Cycle with average Ness Level

PSH	Generation Flow (m3/s)	Pumping Flow (m3/s)
Foyers	200	140
Red John	220	154
Kemp	416	289

	Pumping Cycle			PSH Pumping Flow (m3/s)					
Hour	Level (m AoD)	Inflow to LN (m3/s)	Outflow at Ness Weir (m3/s)	Foyers	RJ	Kemp	Total	Rate of level reduction in Loch Ness (m)	Rate of level reduction in Loch Ness (mm)
1	16,000	150	153,05	140	154	289	586,0525	0,037	37,408
2	15,963	150	135,15	140	154	289	568,1487	0,036	36,265
3	15,926	150	118,52	140	154	289	551,5155	0,035	35,203
4	15,891	150	103,08	140	154	289	536,0811	0,034	34,218
5	15,857	150	88,78	140	154	289	521,7828	0,033	33,305
6	15,824	150	75,57	140	154	289	508,5667	0,032	32,462
7	15,791	150	63,39	140	154	289	496,3873	0,032	31,684
8	15,759	150	52,21	140	154	289	485,2084	0,031	30,971
9	15,728	150	42,00	140	154	289	475,0033	0,030	30,319
10	15,698	150	32,76	140		289	311,7565	0,020	19,899
11	15,678	150	28,30	140		289	307,3	0,020	19,615
12	15,659	150	28,30	140		289	307,3	0,020	19,615
13	15,639	150	28,30	140		289	307,3	0,020	19,615
14	15,619	150	28,30	140		289	307,3	0,020	19,615
15	15,600	150	28,30	140		289	307,3	0,020	19,615
16	15,580	150	28,30	140		289	307,3	0,020	19,615
17	15,561	150	28,30	140		289	307,3	0,020	19,615
18	15,541	150	28,30	140		289	307,3	0,020	19,615
19	15,521	150	28,30	140		289	307,3	0,020	19,615

20	15,502	150	28,30	140		289	307,3	0,020	19,615
21	15,482	150	28,30	140		289	307,3	0,020	19,615
22	15,463								

Total **0,53749805** **0,537**

	Generation Cycle			PSH Generation Flow (m3/s)					Rate of level increase in Loch Ness (mm)
Hour	Level (m AoD)	Inflow to LN (m3/s)	Outflow at Ness Weir (m3/s)	Foyers	RJ	Kemp	Total	Rate of level increase in Loch Ness (m)	
1	15,270	30	28,30	200	220	416	837,7	0,053	53,470
2	15,323	30	28,30	200	220	416	837,7	0,053	53,470
3	15,377	30	28,30	200	220	416	837,7	0,053	53,470
4	15,430	30	28,30	200	220	416	837,7	0,053	53,470
5	15,484	30	28,30	200	220	416	837,7	0,053	53,470
6	15,537	30	28,30	200	220	416	837,7	0,053	53,470
7	15,591	30	28,30	200		416	617,7	0,039	39,428
8	15,630	30	28,30	200		416	617,7	0,039	39,428
9	15,670	30	28,30	200		416	617,7	0,039	39,428
10	15,709	30	36,00	200		416	609,9959	0,039	38,936
11	15,748	30	48,36	200		416	597,6387	0,038	38,147
12	15,786	30	61,59	200		416	584,4072	0,037	37,303
13	15,823	30	75,52	200		416	570,4763	0,036	36,413
14	15,860	30	90,01	200		416	555,9936	0,035	35,489
15	15,895	30	104,91	200		416	541,0862	0,035	34,537
16	15,930								

Total **0,660** **0,660**

EUROPEAN OFFICES

AYLESBURY
T: +44 (0)1844 337380

BELFAST
belfast@slrconsulting.com

BIRMINGHAM
T: +44 (0)121 2895610

BONN
T: +49 (0)176 60374618

BRADFORD-ON-AVON
T: +44 (0)1225 309400

BRISTOL
T: +44 (0)117 9064280

CARDIFF
T: +44 (0)2920 491010

CHELMSFORD
T: +44 (0)1245 801630

CORK
T: +(021) 240 9000

DUBLIN
T: +353 (0)1 296 4667

EDINBURGH
T: +44 (0)131 335 6830

EXETER
T: +44 (0)1392 490152

FRANKFURT
frankfurt@slrconsulting.com

GLASGOW
glasgow@slrconsulting.com

GRENOBLE
T: +33 (0)6 23 37 14 14

KILKENNY
kilkenny@slrconsulting.com

LEEDS
T: +44 (0)113 5120293

LONDON
T: +44 (0)203 8056418

MAIDSTONE
T: +44 (0)1622 609242

MANCHESTER
T: +44 (0)161 8727564

NETHERLANDS
T: +31 6 28 02 18 80

NEWCASTLE UPON TYNE
T: +44 (0)1844 337380

NOTTINGHAM
T: +44 (0)115 9647280

SHEFFIELD
T: +44 (0)114 2455153

SHREWSBURY
T: +44 (0)1743 239250

SPAIN
T: +34 6 82 04 83 01

STIRLING
T: +44 (0)1786 239900

WORCESTER
T: +44 (0)1905 751310

EUROPEAN OFFICES

AYLESBURY
T: +44 (0)1844 337380

BELFAST
belfast@slrconsulting.com

BIRMINGHAM
T: +44 (0)121 2895610

BONN
T: +49 (0)176 60374618

BRADFORD-ON-AVON
T: +44 (0)1225 309400

BRISTOL
T: +44 (0)117 9064280

CARDIFF
T: +44 (0)2920 491010

CHELMSFORD
T: +44 (0)1245 801630

CORK
T: ++353 (0) 21 240 9000

DUBLIN
T: +353 (0)1 296 4667

EDINBURGH
T: +44 (0)131 335 6830

EXETER
T: +44 (0)1392 490152

FRANKFURT
frankfurt@slrconsulting.com

GLASGOW
glasgow@slrconsulting.com

GRENOBLE
T: +33 (0)6 23 37 14 14

KILKENNY
kilkenny@slrconsulting.com

LEEDS
T: +44 (0)113 5120293

LONDON
T: +44 (0)203 8056418

MAIDSTONE
T: +44 (0)1622 609242

MANCHESTER
T: +44 (0)161 8727564

NEWCASTLE UPON TYNE
T: +44 (0)1844 337380

NOTTINGHAM
T: +44 (0)115 9647280

SHEFFIELD
T: +44 (0)114 2455153

SHREWSBURY
T: +44 (0)1743 239250

STIRLING
T: +44 (0)1786 239900

WORCESTER
T: +44 (0)1905 751310