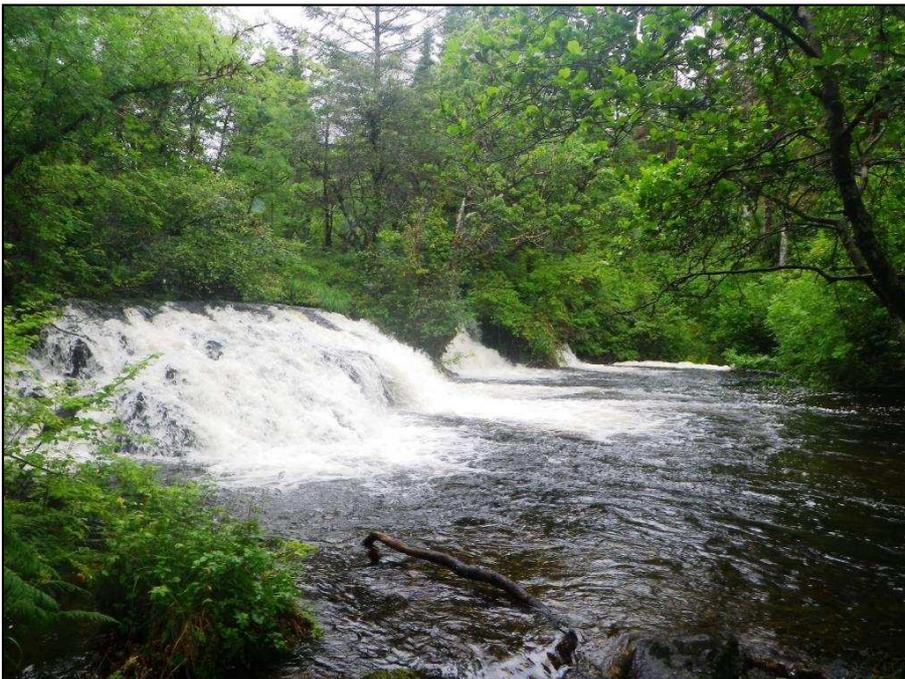


Dalavich Hydro-power Scheme Ecology Summary Report



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Table of Contents

| | | |
|-----------|--|----------|
| 1. | Introduction..... | 1 |
| 1.1 | Terms of Reference | 1 |
| 1.2 | Scope of Report and Methods | 1 |
| 1.3 | Site Location | 1 |
| 1.4 | Proposed scheme | 4 |
| 1.5 | Legislative Background..... | 4 |
| 2. | Baseline Conditions..... | 5 |
| 2.1 | Desk Study | 5 |
| 2.2 | Habitat Survey | 5 |
| 2.3 | Bryophyte Survey..... | 6 |
| 2.4 | Protected Species and Fish Habitat Survey..... | 7 |
| 3. | Evaluation..... | 8 |
| 3.1 | Evaluations of Valued Ecological Receptors | 8 |
| 3.2 | Potential Impacts of the Scheme | 8 |
| 3.3 | Species Licensing..... | 10 |

Appendices

Technical Appendix A: Geographical Evaluation Criteria

Technical Appendix B: Desk Study

Technical Appendix C: Habitat Survey

Technical Appendix D: Bryophyte Survey

Technical Appendix E: Protected Species and Fish Habitat Survey

List of Drawings

| | |
|------------------------------------|---|
| Figure 1: Site Location Plan | 3 |
|------------------------------------|---|

List of Tables

| | |
|--|---|
| Table 1: The status of NVC communities within the survey area..... | 6 |
| Table 2: Nationally scarce and oceanic species recorded on the River Avich | 7 |
| Table 2: Summary evaluations of Valued Ecological Receptors (VERs) within the site | 8 |

1. INTRODUCTION

1.1 Terms of Reference

EnviroCentre Ltd has been commissioned by Gregor Cameron Consultancy Ltd, on behalf of Dalavich Improvement Group, to provide ecological support to inform a planning application for the development of a run-of-river hydropower scheme on the River Avich, Argyll.

1.2 Scope of Report and Methods

An ecological appraisal has been carried out for the proposed development according to the guidelines prepared by the Chartered Institute of Ecology and Environmental Management (CIEEM)¹. Ecological appraisals, together with any ecological evaluation undertaken, are separate from the more formal Ecological Impact Assessment (EclA)² and may be prepared before undertaking a full EclA or may be stand alone documents where no EclA is required. No comprehensive up-to-date guidance exists for undertaking this type of baseline ecological assessment. The CIEEM document provides best practice guidance for those undertaking baseline ecological surveys and preliminary ecological appraisals. It sets out minimum standards and identifies basic requirements for these surveys and appraisals. It provides recommended terminology for consistency across baseline surveys and appraisals to aid developers and planning authorities. As no EclA is required for this development proposal, an ecological appraisal according to CIEEM guidance is deemed appropriate.

Under the guidance, the following were undertaken at Turnalt:

- Desk study to identify notable or protected habitats or species potentially impacted by the proposal;
- Habitat survey;
- Bryophyte survey;
- Protected species and fish habitat survey;
- Production of Target Notes for areas of interest or areas too small to map; and
- Evaluation of habitats on the site and in the immediate environs.

Ecological appraisals do not normally include impact assessments but a section is included in this report that sets out, in general terms, what the likely positive and negative ecological impacts of the hydro scheme at Turnalt would be. The geographical criteria for assessing the biodiversity value of designated sites, habitats and species in the UK (applicable to the hydro scheme on the River Avich) are set out in Technical Appendix A.

1.3 Site Location

The village of Dalavich is situated to the west of Loch Awe in Argyll & Bute, and the River Avich is situated around 500m to the north. The river drains from Loch Avich and flows eastwards for around 2.3km into Loch Awe, with a total drop in elevation of approximately 60m. The dominant land use in the area is coniferous plantation, although there is a narrow corridor of broadleaved woodland along much of the length of the River Avich.

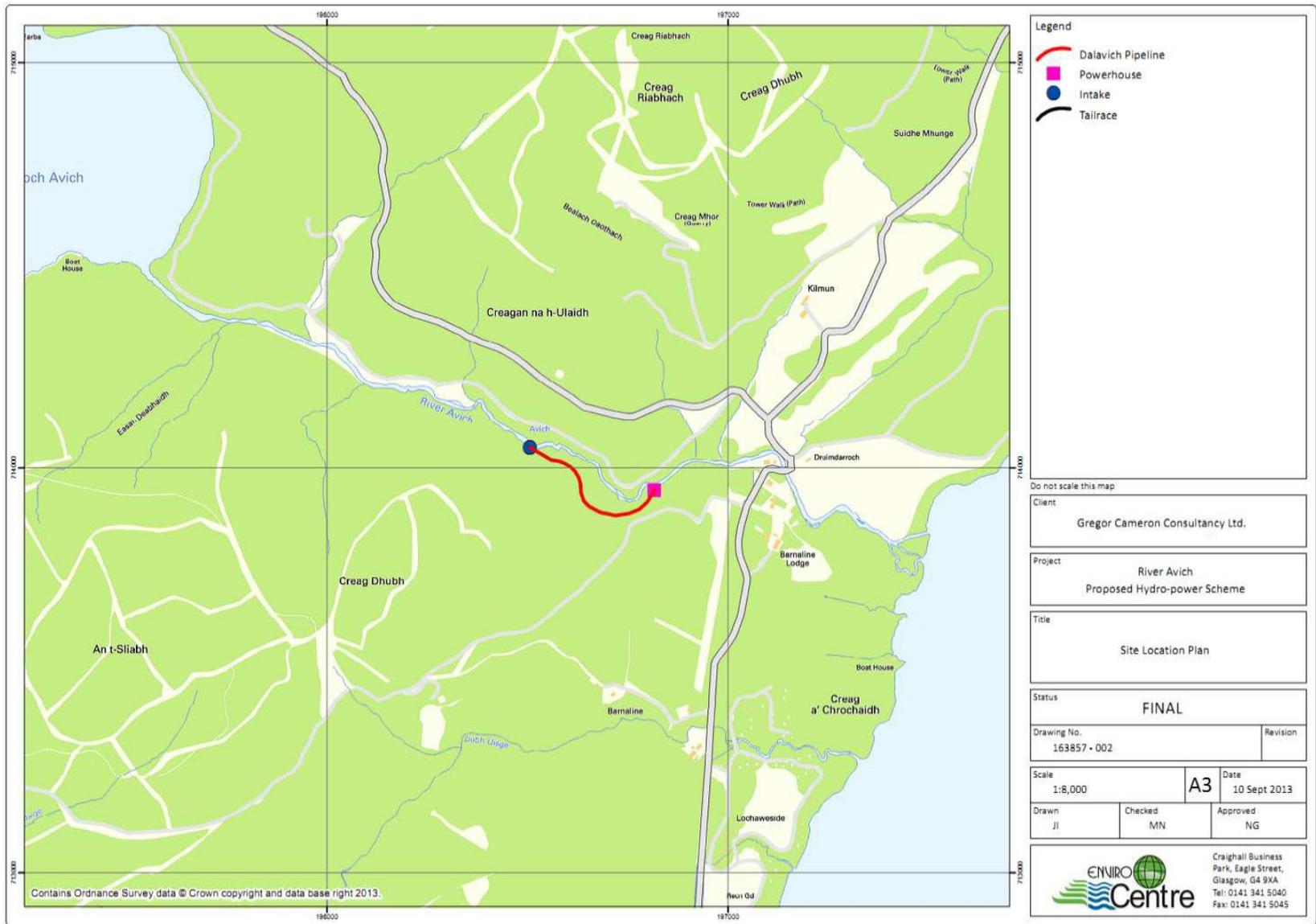
The River Avich is deeply incised at points with significant waterfalls along its length which would pose barriers to upstream fish migration. The first significant waterfall is located approximately 1km upstream from the watercourse's outfall to Loch Awe is approximately 10m in height. River morphology is assessed to be of SEPA River Type A (bedrock, cascade) with solid exposed rock on the channel and banks.

¹ CIEEM, 2011. Guidelines for Preliminary Ecological Appraisal.

² CIEEM, 2006. Guidelines for Ecological Impact Assessment in the United Kingdom.

A site location plan is presented in Figure 1 below.

Figure 1: Site Location Plan



1.4 Proposed scheme

The proposed scheme consists of an intake located at the former intake of a disused hydropower scheme, approximately half way down the River Avich. The proposed scheme would also share an outfall location with the former scheme. Full details of the proposed scheme are presented in Envirocentre report number 5385: *Dalavich Community Hydro- Hydrology Report*.

1.5 Legislative Background

The ecological appraisal has taken cognisance of the following legislation, conservation initiatives and general guidance:

- Council Directive 2000/60/EC establishing a framework for Community action in the field of water policy (The Water Framework Directive (WFD));
- The Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR);
- Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna (The Habitats Directive);
- The Conservation (Natural Habitats etc.) Regulations 1994 (as amended in Scotland) (The Habitats Regulations);
- The Wildlife and Countryside Act 1981 (as amended) (WCA);
- The Nature Conservation (Scotland) Act 2004 (NCA);
- The Wildlife and Natural Environment (Scotland) Act 2011 (WANE);
- The UK Biodiversity Action Plan (BAP);
- The Argyll and Bute Biodiversity Action Plan (ABBAP);
- The Scottish Biodiversity Strategy;
- Scottish Planning Policy (SPP);
- Planning Advice Note (PAN) 60: Planning for Natural Heritage;
- Guidance for Applicants on Supporting Information Requirements for Hydropower Applications. Scottish Environment Protection Agency (undated);
- Pollution Prevention Guidelines (PPGs) by the Scottish Environment Protection Agency (undated).

2. BASELINE CONDITIONS

2.1 Desk Study

In order to anticipate the potential ecological sensitivities at the site, a desk study was conducted in advance of the survey. This desk study included a review of:

- Information provided by Glasgow Museums and Resource Centre (GMRC)³ who currently hold records for the Argyll and Bute area (up to 2km from a central point within the site);
- Existing data on protected sites available through SNH's Sitelink website⁴ (up to 5km from the site);
- Argyll Local Development Plan (ALDP)⁵ (for non-statutory designated sites);
- Records of Ancient Woodlands available through Sketchmap⁶;
- Existing recent species data available through the National Biodiversity Network (NBN) Gateway website⁷ (up to 5km from the site);
- Consultation with SNH regarding locations of any known freshwater pearl mussel populations⁸ and the status of the river for bryophytes⁹;
- Information provided by the Botanical Society of Britain and Ireland (BSBI)¹⁰
- Information provided by the British Bryological Society (BBS)¹¹
- Argyll and Bute Biodiversity Action Plan (ABBAP)¹²; and the
- UK Biodiversity Action Plan¹³.

The results of the desk study are presented in Technical Appendix B.

2.2 Habitat Survey

The full results of the survey, comprising the habitat maps and target notes are provided in Technical Appendix C.

2.2.1 Phase 1 Habitat Survey

Excluding boundary features, five Phase 1 habitat types were identified on the site and in its immediate environs as follows:

- Broad-leaved woodland;
- Coniferous plantation woodland;

³ The GMRC website. Available at <http://www.glasgowlife.org.uk/museums/our-museums/glasgow-museum-resource-centre/Pages/default.aspx>

⁴ SNH Sitelink website. Available at <http://gateway.snh.gov.uk/sitelink/searchmap.jsp>

⁵ Local plan maps available at <http://www.argyll-bute.gov.uk/planning-and-environment/local-plan> (accessed 21/02/2013)

⁶ Sketchmap using Ancient Woodland layer. Available at <http://sketchmap.co.uk/>

⁷ NBN Gateway website. Available at <http://data.nbn.org.uk/> (search square NM91)

⁸ SNH local office contacted 22.01.2013

⁹ SNH Bryophyte Map: Available at <http://www.snh.gov.uk/planning-and-development/renewable-energy/hydro/sensitivities/>

¹⁰ Botanical Society of Britain and Ireland contact: Mr Carl Farmer contacted 23.01.2013

¹¹ British Bryological Society contact: Mr Gordon Rothero contacted 22.01.2013

¹² Argyll and Bute Biodiversity Action Plan available at <http://www.argyll-bute.gov.uk/sites/default/files/planning-and-environment/AandB%20BAP%20Draft.pdf> (accessed 21/01/2013)

¹³ UK Biodiversity Action Plan. Available at: <http://jncc.defra.gov.uk/page-5155>

- Recently felled coniferous plantation;
- Continuous bracken; and
- Acid flush.

Broadleaved woodland is the main habitat along the lower slopes on each side of, and immediately adjacent to, the main watercourse. The canopy is generally dominated by mature sessile oak whilst birch species become more prominent higher up towards the intake area. Wet woodland occurs on flatter or more gently sloping ground adjacent to the watercourse in the vicinity of the intake area and also the turbine house area.

The middle and upper slopes of the valley support large areas of dense coniferous plantation woodland dominated by Norway Spruce. Much of the plantation has now been felled in the lower part of the survey area. At present it has not yet been re-planted and it is reverting to more natural, though very open woodland, with oak and birch species.

Bracken is very frequent as part of the ground layer in the woodland areas and also in open gaps in the canopy and in areas of felled plantation. A single woodland flush was recorded on the bank by the footpath close to the intake area.

2.2.2 NVC Survey

Table 1 lists the NVC communities found on site which are considered to be groundwater dependent according SEPA LUPS4 guidance.

Table 1: The status of NVC communities within the survey area

| NVC community | Status in the survey area |
|--------------------|--|
| W4b | Wet woodland occurs on flat and gently sloping ground around the intake area and also by the turbine house location. Due to its close association with the riverside water table it is considered to be heavily groundwater dependent. |
| Unclassified flush | One single flush on bank next to footpath close to intake. It is considered heavily groundwater dependent. |

2.3 Bryophyte survey

Full details of the bryophyte survey are presented in Technical Appendix D. The results of the survey are summarised as follows:

- The River Avich is listed as a Nationally/Internationally important watercourse for bryophytes¹⁴.
- 129 bryophyte species were identified (50 liverwort species and 79 moss species) which is considered good for a site with limited rock exposure such as this;
- There are two nationally scarce species; *Radula volute* and *Leptoscyphus cuneifolius*, both of which are oceanic liverwort species with a very restricted distribution in Europe;
- 19 oceanic species were recorded (shown in Table 2 below) which is considered to be an average total for a ravine site in the Loch Awe area; and
- Of these, there are seven oceanic ravine indicator species giving the site a score of nine which is well above the threshold level of six points which indicates a site of national importance¹⁵.

¹⁴ SNH Bryophyte Map: Available at <http://www.snh.gov.uk/planning-and-development/renewable-energy/hydro/sensitivities/>

¹⁵ SNH Commissioned Report No.449b. Bryological Assessment for Hydroelectric Schemes in the West Highlands (2nd Edition) Available at: http://www.snh.org.uk/pdfs/publications/commissioned_reports/449b.pdf

- The significance of the medium amount of change due to the scheme on the high bryophyte sensitivity on the site is assessed as major.

Table 2: Nationally scarce and oceanic species recorded on the River Avich

| Nationally scarce species | |
|---|---------------------------------|
| <i>Radula voluta</i> | <i>Leptoscyphus cuneifolius</i> |
| Oceanic species (19 taxa) | |
| <i>Aphanolejeunea microscopica</i> (1) | <i>Plagiochila bifaria</i> |
| <i>Breutelia chrysocoma</i> | <i>Plagiochila exigua</i> (1) |
| <i>Campylopus atrovirens</i> | <i>Plagiochila punctata</i> |
| <i>Colura calyptrifolia</i> (1) | <i>Plagiochila spinulosa</i> |
| <i>Drepanolejeunea hamatifolia</i> I(1) | <i>Radula voluta</i> (3) |
| <i>Harpalejeunea molleri</i> (1) | <i>Saccogyna viticulosa</i> |
| <i>Hyocomium armoricum</i> | <i>Scapania gracilis</i> |
| <i>Lejeunea patens</i> | <i>Ulota phyllantha</i> |
| <i>Leptoscyphus cuneifolius</i> | <i>Zygodon conoideus</i> |
| <i>Metzgeria leptoneura</i> (1) | |

*Figures in () are oceanic ravine indicator species scores

2.4 Protected species and fish habitat survey

Full details of the protected species and fish habitat survey are presented in Technical Appendix E. The results of the survey are summarised as follows:

- A possible otter lay-up was identified on the banks of the River Avich;
- The broad-leaved trees in the immediate vicinity of the potential scheme pipeline route and powerhouse location are classified as category 1: trees with definite bat potential, supporting fewer features than category 1* trees or with potential for use by single bats;
- Although no evidence of red squirrel or pine marten was found during the survey, the conifer plantation provides optimal habitat for these species;
- No setts or any other evidence of badger activity was found during the survey;
- No den sites or any other evidence of wildcat activity was found during the survey;
- A variety of fish habitat classifications were made for the surveyed area of the River Avich. The falls located at NM 96733 13930 are assessed as being impassable to migratory fish species. Therefore, the proposed intake point is inaccessible to fish populations. A small number of trout fry were observed downstream of the outflow point, below the impassable falls; and
- No evidence of freshwater pearl mussels was found during the survey, although some areas of suitable substrates were noted.

3. EVALUATION

3.1 Evaluations of Valued Ecological Receptors

Ecological (or biodiversity) evaluations have been applied only to those habitats and species that have been scoped in to the assessment and those that are predicted to be affected by the construction or the operation of the hydro scheme. These are termed Valued Ecological Receptors (VERs) and are listed in Table 2 below. Economic value and social value have not been determined.

Table 3: Summary evaluations of Valued Ecological Receptors (VERs) within the site

| VER | Present on site | Biodiversity value | Overriding value of the site for the VER |
|-----------------------|---|---|---|
| Broad-leaved woodland | ✓ | UK BAP and ABBAP priority habitat. National biodiversity value. | Mature semi-natural woodland in good condition, therefore of national value. |
| Oceanic bryophytes | ✓ | Nineteen oceanic indicator species found on site. The site score for indicator species is 9 indicating a site of national importance. National biodiversity value, | The significance of the medium amount of change due to the scheme on the high bryophyte sensitivity on the site is assessed as major. Therefore the site is of national value. |
| Otter | ✓ | Annex IV of the Habitats Directive (European Protected Species (EPS)). UK BAP and ABBAP priority species. International biodiversity value. | Small amount of activity recorded on site. Local value. |
| Migratory fish | Present on the River Avich below the outfall location. | Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003, as amended by the Aquaculture and Fisheries Act (Scotland) 2007. UK BAP and ABBAP priority species. National biodiversity value. | Populations of migratory fish in the lower reaches of the River Avich, therefore the site is of Local value. |
| Non-migratory fish | Likely to be present in the River Avich | Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). | Populations are likely to be present in the River Avich, therefore the site is of local value. |

3.2 Potential impacts of the scheme

The main potential impacts of the scheme on ecology are set out below, along with suggested mitigation. This list is not exhaustive and the potential impacts have not been attached any level of magnitude or significance. Similarly, the mitigation measures have not been attached any level of success.

Potential negative construction impacts

- The route of the access track is not yet known. Once the detailed design of the scheme and access routes are known, any potential impacts can be assessed.
- All construction activities in or near water have the potential to cause water pollution to the River Avich. This should be managed under SEPA's PPGs and may need to be timed to avoid sensitive periods.
- It is considered unlikely that any bird species will be impacted by the proposed scheme. However as a precaution, it is recommended that a pre-construction nesting bird survey is undertaken for any vegetation that is to be removed.
- There will temporary vegetation disturbance from the construction of the penstock through broad-leaved woodland and conifer plantation. Mitigation would seek to keep the construction corridor to a minimum and to route the pipeline through patches of conifers where possible, and to re-instate all natural vegetation where possible.
- There will be permanent vegetation disturbance to broad-leaved woodland at the intake and powerhouse locations during construction. Mitigation should minimise felling of mature trees and restore ground flora vegetation where possible.
- There will be temporary disturbance to bryophytes around the intake location during construction including the loss of *Radula volute* (nationally scarce). Mitigation would seek to remove the Rhododendron on the site before it becomes established as this would benefit the bryophyte interest of the site in the long term.
- No resting sites were identified; however, otter passage along the watercourse should be facilitated at all times. It is recommended that a pre -construction survey for otter activity is undertaken.
- Although no evidence of bats, red squirrel or pine marten was found during the survey, the habitats found on site provide optimal habitat for these species. It is recommended that a pre-construction tree survey, conducted by experienced and licensed tree climbers, should be undertaken to check for evidence of bat roosts, red squirrel dreys and pine marten dens before vegetation removal.

Potential negative operation impacts

- The reduced flow along the water course will lead to a long-term shift of some centimetres by the riparian species towards the new base water level. It is unlikely that there will be any substantial change in the main species. However, is it possible that, as a result of a reduction in the frequency of scouring in the flow regime an increase in cover of larger species may lead to the loss of habitat for the small oceanic liverworts, in particular *Radula volute* (nationally scarce). It should be noted that the proposed development will be located in the same position as a former hydro-power scheme. As stands of *Radula volute* have persisted in the lower section of the river it is likely that populations are able to recover from changes to flow regimes. No mitigation is deemed necessary.
- Waterfalls along the Allt Dearg are natural barriers to fish passage but the intake structure should be screened to prevent access to the pipeline by migratory fish. The outfall structure should be suitably designed so that it does not attract fish.
- Sediment transport for normal and low flows in the depleted reach will reduce; this is likely to be directly proportional to the reduction in flow, but a higher proportion of fines will be transported downstream. However, the majority of the bedload material is typically transported during high flow/flood events and the impact of abstraction during these periods will be negligible. It is

considered that the proposed works will not cause a significant impact on the movement of sediment material or fish habitat.

Potential positive impacts

The proposed development is not expected to result in any positive impacts on the site.

3.3 Species Licensing

No European or national protected species licences are considered necessary for the planned construction works. Should a protected species be discovered on site the licensing position may need to be reviewed.

Technical Appendix A

Geographical Evaluation Criteria

| Geographical Value | Sites, habitats and species assessment criteria | | |
|--------------------|---|--|---|
| | Sites | Habitats | Species |
| International | <ul style="list-style-type: none"> Designated, candidate or proposed SACs, SPAs and Ramsar sites; Biosphere Reserves; Biogenetic Reserves; European Diploma Sites (Category A or C); or (Ecological) World Heritage Sites. | <ul style="list-style-type: none"> Any viable area of habitat included in Annex I of the EC Habitats Directive¹⁶; Any habitat area that is critical for a part of the life cycle of an internationally important species that is Critically Endangered to Vulnerable in the UK. | <ul style="list-style-type: none"> An internationally important population of a European Protected Species; An internationally important population of an internationally Vulnerable to Critically Endangered Red Data Book species. IUCN Data Deficient or Uncategorized species of global conservation concern. |
| National/ UK | <ul style="list-style-type: none"> SSSIs; National Nature Reserves. | <ul style="list-style-type: none"> A viable area of priority habitat listed in the UKBAP¹; An area of habitat fulfilling the criteria for designation as a SSSI. Any habitat area that is critical for a part of the life cycle of a nationally important species that is Critically Endangered to Vulnerable in the UK. | <ul style="list-style-type: none"> A nationally important population of any Red Data Book species that is Vulnerable to Critically Endangered in the UK. A nationally important population of any species that is Rare in the UK (<15 10 km grid squares); or that is included in the UK BAP; or that is classed as Data Deficient or Uncategorized in/by the Red Data Books/IUCN. A nationally important population of any Schedule 1 (bird), Schedule 5 (animal) and Schedule 8 (plant) species included in the Wildlife and Countryside Act 1981 (as amended). |
| Regional | <ul style="list-style-type: none"> Regional Parks; Areas of Great Landscape Value. | <ul style="list-style-type: none"> A viable area of priority habitat listed in the Argyll and Bute LBAP¹; Habitats with a significance greater than the county level but not sufficient for SSSI designation. | <ul style="list-style-type: none"> A regionally important population of a species that is 'Nationally Scarce' (present in 16-100 10km grid squares); or that is included in the Argyll and Bute LBAP. A significant assemblage of regionally scarce species. |
| County | <p>The following designations should be valued at the level of the criteria or the governing body that declared them (e.g. County, District or Local Council):</p> <ul style="list-style-type: none"> Areas of Natural History Interest (Biological); Biodiversity Alert Sites (BAS); Biological Heritage Sites; County Wildlife Sites; | <ul style="list-style-type: none"> County LBAP (if available) habitats noted as requiring protection; Semi-natural, ancient woodland >0.25ha in extent; A viable area of habitat included within the County LBAP (if available). | <ul style="list-style-type: none"> An important population of a species that is included within the County LBAP (if available); A significant assemblage of species that is scarce at the county level. |

¹⁶ Smaller areas should be considered at this level when they contribute to the viability of a larger area of similar or related habitat, such as by functioning as a corridor or stepping stone.

| | | | |
|-------------------------|--|---|--|
| District | <ul style="list-style-type: none"> • Heritage Sites; • Local Nature Reserves; • Local Wildlife Sites; • Natural Heritage Sites; • Sites of Biological Importance; • Sites of Ecological or Geological Importance; • Sites of Importance for Nature Conservation (SINCs); • Sites of Local Nature Conservation Importance (SLINCs); • Sites of Nature Conservation Importance (SNCIs); • Sites of Nature Conservation Value; • Sites of Scientific Importance; • Special Wildlife Sites; • Wildlife Heritage Sites; and • Wildlife Sites. | <ul style="list-style-type: none"> • Semi-natural, ancient woodland <0.25ha in extent; • Areas of viable habitat identified in the District LBAP (if available); • Diverse or ecologically valuable hedgerow network. | <ul style="list-style-type: none"> • An important population of a species that is included within the District LBAP (if available) or which occurs in 70-176 10km grid squares. |
| Local | <ul style="list-style-type: none"> • Sites of Nature Conservation Value; • Sites of Scientific Importance; • Special Wildlife Sites; • Wildlife Heritage Sites; and • Wildlife Sites. | <ul style="list-style-type: none"> • Habitats that are unique in or of some other significance in the local area; • Areas of habitat that contribute to the local ecological resource (e.g. species-rich hedgerows, verges, ponds, woodlands etc.). | <ul style="list-style-type: none"> • A locally important assemblage of species. |
| Zoi¹⁷ | <ul style="list-style-type: none"> • No designations. | <ul style="list-style-type: none"> • Common, often anthropogenic habitats. | <ul style="list-style-type: none"> • Common, frequently ruderal or alien species. |

¹⁷ ZOI: Within the Zone of Influence only (which might be the project site or a larger area).

Technical Appendix B

Desk Study

Technical Appendix B

Desk Study

| Source | Information Provided | | | |
|--------------------------------|---|--------------------------------|---------------------------------|--|
| GMRC ¹ | Species recorded | Latin name | | Comment |
| | Red squirrel | <i>Sciurus vulgaris</i> | | Recorded 720m south east of the site (2007). |
| SiteLink ² | Site name | Designation³ | Distance and orientation | Features |
| | Dalavich Oakwood | SSSI | 800m south | Mosaic of upland oak woodland and wet woodland. |
| Argyll Local Plan ⁴ | The land on which the site is situated is designated as Sensitive Countryside (south of the River Avich). | | | |
| Sketchmap ⁵ | Unnamed woodland in the River Avich riparian corridor. Extends from the south shore of Loch Avich, along the river to the west shore of Loch Awe. | | | |
| NBN Gateway ⁶ | Species occurring within the 10km OS grid square: NM91 | Latin name | | Comment |
| | European eel | <i>Anguilla anguilla</i> | | Found within 10km of the site (1983-2002). |
| | Arctic charr | <i>Salvelinus alpinus</i> | | Found within 10km of the site (1983-1997). |
| | Atlantic salmon | <i>Salmo salar</i> | | Found within 10km of the site (1793-2002). |
| | Brown trout | <i>Salmo trutta</i> | | Found within 10km of the site (1793-1998). |
| | Wildcat | <i>Felis silvestris</i> | | Found within 10km of the site (1960-2008) and in the 1km square NM9713 (2008). |

¹ The GMRC website. Available at <http://www.glasgowlife.org.uk/museums/our-museums/glasgow-museum-resource-centre/Pages/default.aspx>

² SNH SiteLink website. Available at <http://gateway.snh.gov.uk/sitelink/searchmap.jsp>

³ Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Area (SPA), Local Nature Reserve (LNR), Ramsar wetland designation (RAMSAR).

⁴ Local plan maps available at <http://www.argyll-bute.gov.uk/planning-and-environment/local-plan> (accessed 21/02/2013)

⁵ Sketchmap using Ancient Woodland layer. Available at <http://sketchmap.co.uk/>

⁶ NBN Gateway website. Available at <http://data.nbn.org.uk/> (search square NM80)

| Source | Information Provided | | |
|---------------------|---|----------------------------------|--|
| | Otter | <i>Lutra lutra</i> | Found within 10km of the site and at six specific locations, the nearest being 1km north west of the site (1973-1994). |
| | Pine marten | <i>Martes martes</i> | Found within 10km of the site (1736- 1959). |
| | Badger | <i>Meles meles</i> | Found within 10km of the site (1963-1973). |
| | Common pipistrelle | <i>Pipistrellus pipistrellus</i> | Found within 10km of the site and in the 1km square NM9612 (1972-2011). |
| | Red squirrel | <i>Sciurus vulgaris</i> | >40 records within 10km of the site (1990-2010). |
| SNH | <p>There is a record of freshwater pearl mussel in a tributary of the River Liever, approximately 3km south west of the site⁷.</p> <p>The River Avich is listed as a Nationally/Internationally important watercourse for bryophytes⁸.</p> | | |
| BSBI ⁹ | A number of protected plant species exist within the grid squares searched (NM 9514, 9614, 9613, 9714 and 9713). These are provided in Table 1 below. | | |
| BBS ¹⁰ | The local Bryophyte recorded has previously surveyed the area for a different client. | | |
| ABBAP ¹¹ | <p>The following species are listed in the ABBAP and are potentially relevant to the site. Those marked (N) are also listed on the UKBAP:</p> <ul style="list-style-type: none"> • Various birds; • Soprano pipistrelle bat (N); • Brown long-eared bat (N); • Noctule bat (N); • Red squirrel (N); • Otter (N); • Water vole (N); • Wildcat (N); • Great crested newt (N); • Allis shad (N); • Twaite shad (N); | | |

⁷ SNH local office contacted 22.01.2013

⁸ SNH Bryophyte Map: Available at <http://www.snh.gov.uk/planning-and-development/renewable-energy/hydro/sensitivities/>

⁹ Botanical Society of the British Isles contact: Mr Carl Farmer contacted 23.01.2013

¹⁰ British Bryological Society contact: Mr Grodon Rothero contacted 22.01.2013

¹¹ Argyll and Bute Biodiversity Action Plan available at <http://www.argyll-bute.gov.uk/sites/default/files/planning-and-environment/AandB%20BAP%20Draft.pdf> (accessed 21/01/2013)

| Source | Information Provided |
|--------|---|
| | <ul style="list-style-type: none"> • Atlantic salmon (N); • Sea lamprey (N); • River lamprey (N); • Fan mussel; and • Freshwater pearl mussel (N). |

Table 1: BSBI Records

| Taxon | Site | Gridref | Date | Recorder | Determiner |
|--|----------|---------|------------|-------------|-------------|
| <i>Dryopteris affinis</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Dryopteris dilatata</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Blechnum spicant</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Polystichum aculeatum</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Hymenophyllum wilsonii</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Polypodium vulgare</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Epilobium brunnescens</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Corylus avellana</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Hypericum pulchrum</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Quercus x rosacea</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Viola riviniana</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ranunculus repens</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Salix cinerea</i> subsp. <i>oleifolia</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Betula pubescens</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ranunculus acris</i> var. <i>acris</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Fagus sylvatica</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Alnus glutinosa</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Salix aurita</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rumex obtusifolius</i> var. <i>obtusifolius</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Stellaria uliginosa</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Quercus robur</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Urtica dioica</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |

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|---|----------|--------|------------|-------------|-------------|
| <i>Stellaria holostea</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Silene dioica</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Geranium robertianum</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Hedera helix</i> subsp. <i>helix</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Oxalis acetosella</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rubus fruticosus</i> agg. | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Filipendula ulmaria</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Prunus spinosa</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Primula vulgaris</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Angelica sylvestris</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Alchemilla glabra</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Chrysosplenium oppositifolium</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Vaccinium myrtillus</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Potentilla erecta</i> subsp. <i>erecta</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Calluna vulgaris</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rhododendron ponticum</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Fragaria vesca</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rubus idaeus</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Fraxinus excelsior</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Centaurea nigra</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Plantago lanceolata</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Prunella vulgaris</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Succisa pratensis</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Lonicera periclymenum</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Hypochaeris radicata</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Digitalis purpurea</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Scrophularia nodosa</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Senecio jacobaea</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Cirsium palustre</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Teucrium scorodonia</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Bellis perennis</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Luzula sylvatica</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |

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|--|----------|------------|------------|-------------|-------------|
| <i>Deschampsia cespitosa</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus tenuis</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus effusus</i> var. <i>effusus</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus articulatus</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus effusus</i> var. <i>subglomeratus</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Molinia caerulea</i> subsp. <i>caerulea</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Poa annua</i> | Dalavich | NM9614 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Galium odoratum</i> | Dalavich | NM96531406 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Stellaria holostea</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Mercurialis perennis</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Cerastium fontanum</i> subsp. <i>vulgare</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Alnus glutinosa</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Viola riviniana</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Silene dioica</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rumex acetosa</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Stellaria uliginosa</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Cardamine flexuosa</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rubus fruticosus</i> agg. | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rosa rugosa</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Filipendula ulmaria</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rhododendron ponticum</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Geranium robertianum</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Vaccinium myrtillus</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Potentilla erecta</i> subsp. <i>erecta</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Prunus spinosa</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Cytisus scoparius</i> subsp. <i>scoparius</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Calluna vulgaris</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Cotoneaster simonsii</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Plantago lanceolata</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Fraxinus excelsior</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Cirsium palustre</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Digitalis purpurea</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |

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|--|----------|------------|------------|---------------------------------------|-------------|
| <i>Scrophularia nodosa</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Centaurea nigra</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Plantago major</i> subsp. <i>major</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Lonicera periclymenum</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Succisa pratensis</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Teucrium scorodonia</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Bellis perennis</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Prunella vulgaris</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus effusus</i> var. <i>effusus</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Dactylis glomerata</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Deschampsia cespitosa</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus articulatus</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Pteridium aquilinum</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Athyrium filix-femina</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Dryopteris dilatata</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Blechnum spicant</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Polypodium vulgare</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Dryopteris affinis</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Equisetum sylvaticum</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ranunculus repens</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Urtica dioica</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ranunculus acris</i> var. <i>acris</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rumex obtusifolius</i> var. <i>obtusifolius</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Corylus avellana</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Quercus x rosacea</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Epilobium montanum</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Salix x multinervis</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Chamerion angustifolium</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Quercus robur</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ilex aquifolium</i> | Dalavich | NM9714 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ceratocarpus claviculata</i> | Dalavich | NM97151417 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Melampyrum pratense</i> | Dalavich | NM96451323 | 12/06/2010 | Carl Farmer & Seil Natural History | Carl Farmer |

| | | | | Group (SNHG) | |
|--|----------|------------|------------|--------------------|-------------|
| <i>Carex rostrata</i> | Dalavich | NM96731347 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Ranunculus flammula</i> subsp. <i>flammula</i> var. <i>flammula</i> | Dalavich | NM96731347 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Glyceria fluitans</i> | Dalavich | NM96741350 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Potamogeton natans</i> | Dalavich | NM96741350 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Eleocharis palustris</i> subsp. <i>vulgaris</i> | Dalavich | NM96741350 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Melampyrum pratense</i> | Dalavich | NM96821341 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Pteridium aquilinum</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Athyrium filix-femina</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Dryopteris dilatata</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Blechnum spicant</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Equisetum sylvaticum</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Ranunculus repens</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Rumex obtusifolius</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Ranunculus acris</i> var. <i>acris</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Rumex acetosa</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Urtica dioica</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Cerastium fontanum</i> subsp. <i>vulgare</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Stellaria uliginosa</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Chamerion angustifolium</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Cardamine pratensis</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Betula pubescens</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Viola palustris</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Stellaria holostea</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Corylus avellana</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Quercus robur</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Fagus sylvatica</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Salix cinerea</i> subsp. <i>oleifolia</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Anemone nemorosa</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Quercus x rosacea</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Salix aurita</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |

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|---|----------|--------|------------|--------------------|-------------|
| <i>Salix caprea</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Epilobium brunnescens</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Silene dioica</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Alnus glutinosa</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Viola riviniana</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Acer pseudoplatanus</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Ilex aquifolium</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Conopodium majus</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Lysimachia nemorum</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Rubus fruticosus</i> agg. | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Geranium robertianum</i> subsp. <i>robertianum</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Heracleum sphondylium</i> subsp. <i>sphondylium</i> var. <i>sphondylium</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Rubus idaeus</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Geum rivale</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Sorbus aucuparia</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Potentilla erecta</i> subsp. <i>erecta</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Vaccinium myrtillus</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Oxalis acetosella</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Trifolium repens</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Lotus pedunculatus</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Angelica sylvestris</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Calluna vulgaris</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Filipendula ulmaria</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Fragaria vesca</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Plantago major</i> subsp. <i>major</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Bellis perennis</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Ajuga reptans</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Veronica chamaedrys</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Taraxacum</i> agg. | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Plantago lanceolata</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Galium palustre</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |

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|---|----------|--------|------------|--------------------|-------------|
| <i>Euphrasia officinalis</i> agg. | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Digitalis purpurea</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Lonicera periclymenum</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Hypochaeris radicata</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Galium saxatile</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Luzula multiflora</i> subsp. <i>congesta</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Luzula pilosa</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Holcus mollis</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Poa annua</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Carex echinata</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Carex binervis</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Aira praecox</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Juncus effusus</i> var. <i>effusus</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Luzula sylvatica</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Carex ovalis</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Luzula multiflora</i> subsp. <i>multiflora</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Molinia caerulea</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Carex remota</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Carex pallescens</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Juncus tenuis</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Dactylis glomerata</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Poa pratensis</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Veronica officinalis</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Centaurea nigra</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Stachys palustris</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Valeriana officinalis</i> subsp. <i>sambucifolia</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Succisa pratensis</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Cirsium palustre</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Fraxinus excelsior</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Galium aparine</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Veronica serpyllifolia</i> subsp. <i>serpyllifolia</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Teucrium scorodonia</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |

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|--|----------|--------|------------|--------------------|-------------|
| <i>Crepis paludosa</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Myosotis laxa</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Myosotis secunda</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Scrophularia nodosa</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Hyacinthoides non-scripta</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Festuca rubra</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Holcus lanatus</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Juncus effusus</i> var. <i>subglomeratus</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Anthoxanthum odoratum</i> | Dalavich | NM9613 | 12/06/2010 | Carl Farmer & SNHG | Carl Farmer |
| <i>Polypodium vulgare</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Pteridium aquilinum</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Blechnum spicant</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Athyrium filix-femina</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Dryopteris affinis</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Dryopteris dilatata</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Picea sitchensis</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ranunculus repens</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Chamerion angustifolium</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Corylus avellana</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Quercus petraea</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ranunculus acris</i> var. <i>acris</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Quercus x rosacea</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ilex aquifolium</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Cardamine flexuosa</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Fagus sylvatica</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Salix cinerea</i> subsp. <i>oleifolia</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Montia fontana</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Salix x multinervis</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ranunculus flammula</i> subsp. <i>flammula</i> var. <i>flammula</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Stellaria uliginosa</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rumex obtusifolius</i> var. <i>obtusifolius</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |

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|---|----------|--------|------------|-------------|-------------|
| <i>Epilobium brunnescens</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Betula pubescens</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Salix caprea</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Salix aurita</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Stellaria holostea</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rubus fruticosus</i> agg. | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rhododendron ponticum</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Potentilla erecta</i> subsp. <i>erecta</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Fragaria vesca</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Sorbus aucuparia</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ulex europaeus</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Trifolium repens</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Vaccinium myrtillus</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Alchemilla mollis</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Oxalis acetosella</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Alchemilla glabra</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Hedera helix</i> subsp. <i>helix</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Filipendula ulmaria</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Chrysosplenium oppositifolium</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Galium saxatile</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Teucrium scorodonia</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus effusus</i> var. <i>effusus</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus effusus</i> var. <i>subglomeratus</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus tenuis</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Dactylis glomerata</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Luzula sylvatica</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Poa annua</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Deschampsia cespitosa</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus conglomeratus</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus articulatus</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Molinia caerulea</i> subsp. <i>caerulea</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Festuca ovina</i> agg. | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |

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|---|----------|--------|------------|--------------------|-------------|
| <i>Lotus pedunculatus</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Angelica sylvestris</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rubus idaeus</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Calluna vulgaris</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Prunella vulgaris</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Plantago lanceolata</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Fraxinus excelsior</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Hypochaeris radicata</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Succisa pratensis</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Veronica officinalis</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Digitalis purpurea</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Lonicera periclymenum</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Potamogeton polygonifolius</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Mentha aquatica</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Cirsium palustre</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Scrophularia nodosa</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Centaurea nigra</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Bellis perennis</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Valeriana officinalis</i> | Dalavich | NM9613 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Polypodium vulgare</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Dryopteris affinis</i> subsp. <i>borreri</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Oreopteris limbosperma</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Ceratocarpus claviculata</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Epilobium montanum</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Hypericum pulchrum</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Erica cinerea</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Trifolium pratense</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Trifolium dubium</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Prunella vulgaris</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Potamogeton polygonifolius</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Senecio aquaticus</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Deschampsia cespitosa</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |

| | | | | | |
|---|----------|------------|------------|--------------------|-------------|
| <i>Deschampsia flexuosa</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Juncus conglomeratus</i> var. <i>subuliflorus</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Juncus articulatus</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Agrostis capillaris</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Iris pseudacorus</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Juncus bufonius</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Agrostis canina</i> | Dalavich | NM9613 | 18/08/2012 | Carl Farmer & SNHG | Carl Farmer |
| <i>Glyceria fluitans</i> | Dalavich | NM96751349 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Asplenium trichomanes</i> subsp. <i>quadrivalens</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Dryopteris dilatata</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Cerastium fontanum</i> subsp. <i>vulgare</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Corylus avellana</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ilex aquifolium</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Quercus x rosacea</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Ranunculus repens</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Chamerion angustifolium</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Urtica dioica</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Rubus fruticosus</i> agg. | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Hedera helix</i> subsp. <i>helix</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Filipendula ulmaria</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Geranium robertianum</i> subsp. <i>robertianum</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Heracleum sphondylium</i> subsp. <i>sphondylium</i> var. <i>sphondylium</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Stachys palustris</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Senecio jacobaea</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Fraxinus excelsior</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Plantago major</i> subsp. <i>major</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Luzula sylvatica</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Dactylis glomerata</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus effusus</i> var. <i>subglomeratus</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Juncus effusus</i> var. <i>effusus</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| <i>Poa annua</i> | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |

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|--|--|----------|------------|----------------|---------------------|
| Juncus conglomeratus var. conglomeratus | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| Juncus articulatus | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| Lolium perenne | Dalavich | NM9713 | 05/11/2009 | Carl Farmer | Carl Farmer |
| Senecio sylvaticus | | NM963135 | 4/8/1987 | Thompson, B.H. | Thompson, B.H. |
| Geum rivale x urbanum (G. x intermedium) | River Avich,mouth of | NM9713 | 29/5/1992 | Thompson, B.H. | Thompson, B.H. |
| Hieracium strictiforme | Loch Awe,rd S of Barnaline Lodge | NM9713 | 8/1993 | Thompson, B.H. | Marshall, Rev. E.S. |
| Veronica filiformis | | NM971133 | 21/1/1988 | Thompson, B.H. | Thompson, B.H. |

Technical Appendix C

Habitat Survey

Dalavich Hydro-power Scheme Habitat Survey



September 2013



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Dalavich Hydro-power Scheme Habitats Survey

Table of Contents

| | | |
|-----------|---|----------|
| 1. | Introduction..... | 1 |
| 1.1 | Remit | 1 |
| 1.2 | Site Description | 1 |
| 1.3 | Proposed Development | 1 |
| 2. | Methods | 2 |
| 2.1 | Desk study | 2 |
| 2.2 | Phase 1 Habitat Survey | 2 |
| 2.3 | National Vegetation Classification Survey..... | 2 |
| 2.4 | Guidance..... | 3 |
| 2.5 | Legislation, policy and initiatives..... | 3 |
| 2.6 | Constraints..... | 3 |
| 3. | Results | 4 |
| 3.1 | Desk Study | 4 |
| 3.2 | Habitat Survey | 4 |
| 3.3 | Groundwater dependant terrestrial ecosystems..... | 5 |
| 4. | Conclusions and Recommendations..... | 6 |

Appendices

- Appendix A – Site Location Plan
- Appendix B – Phase 1 Habitat Map
- Appendix C – Target Notes
- Appendix D – NVC Map

List of Tables

| | |
|--|---|
| Table 1: The status of NVC communities within the survey area..... | 5 |
|--|---|

1. INTRODUCTION

1.1 Remit

EnviroCentre Ltd has been commissioned by Gregor Cameron Consultancy Ltd, on behalf of Dalavich Improvement Group, to provide support with respect to the proposed development of a run-of-river hydro-power scheme on the River Avich, Argyll.

The purpose of the survey is to provide habitat information to inform the development and identify sensitive areas and suitable mitigation as part of the Ecological Appraisal process.

1.2 Site Description

The village of Dalavich is situated to the west of Loch Awe in Argyll & Bute, and the River Avich is situated around 500m to the north. The river drains from Loch Avich and flows eastwards for around 2.3km into Loch Awe, with a total drop in elevation of approximately 60m. The dominant land use in the area is coniferous plantation, although there is a narrow corridor of broadleaved woodland along much of the length of the River Avich.

The River Avich is deeply incised at points with significant waterfalls along its length which would pose barriers to upstream fish migration. The first significant waterfall is located approximately 1km upstream from the watercourse's outfall to Loch Awe is approximately 10m in height.

A site location plan is provided in Appendix A.

1.3 Proposed Development

Full details of the proposed development are provided in Envirocentre document number 5385: *Dalavich Community Hydro- Hydrology Report*. The proposed intake is located at the former intake of a disused hydropower scheme, approximately half way down the River Avich. The proposed scheme would also share an outfall location with the former scheme.

2. METHODS

In order to ascertain the ecological baseline of the site in relation to the habitats, vegetation and plant species that are present, a desk-based study and field survey were undertaken to collate existing data and to derive up-to-date, site-specific information.

2.1 Desk study

A search was undertaken within a 10 km radius from the site, for existing information on:

- Statutory designated sites e.g. Special Protection Areas (SPA), Special Areas of Conservation (SAC) and Sites of Special Scientific Interest (SSSI)¹;
- Non-statutory designated sites e.g. Ancient Woodland Inventory (AWI)² sites or Local Nature Reserves (LNR); and
- Argyll and Bute Local Biodiversity Action Plan Priority Habitats and Species³.

2.2 Phase 1 Habitat Survey

A Phase 1 Habitat Survey was undertaken according to the standard, Joint Nature Conservation Committee (JNCC) method⁴ with the aim of identifying, describing and mapping the habitats and other features of ecological interest within the site boundary. The standard floras for each of the major plant groups are used within the report⁵.

The objectives of the field survey and subsequent reporting are to:

- Produce a map of habitats for the site;
- Obtain records of floral species (vascular plants. This does not comprehensively cover mosses and lichens and is not intended as an assessment of these groups);
- Evaluate the nature conservation value of the habitats on the site and suggest further detailed surveys where more information is required; and
- Identify any potential legal and policy constraints related to ecology that may affect the development.

2.3 National Vegetation Classification Survey

The National Vegetation Classification (NVC) is used to identify and map important habitats as identified and referenced to the European Habitats Directive and Water Framework Directive [in relation to Ground Water Dependant Terrestrial Ecosystems (GWDTEs)]. The NVC codes are also used to indicate species that are subject to legislation or included within, for example, Biodiversity Action Plans or Red Lists. The survey method follows Rodwell 1992⁶.

¹ SNH Sitelink website. Available at <http://gateway.snh.gov.uk/sitelink/searchmap.jsp>

² Sketchmap using Ancient Woodland layer. Available at <http://sketchmap.co.uk/>

³ Argyll and Bute Biodiversity Action Plan available at <http://www.argyll-bute.gov.uk/sites/default/files/planning-and-environment/AandB%20BAP%20Draft.pdf> (accessed 21/01/2013)

⁴ Joint Nature Conservation Committee. 2003. Handbook for Phase 1 habitat survey. Revised reprint. JNCC, Peterborough. Available online at: http://jncc.defra.gov.uk/PDF/pub10_handbookforphase1habitatsurvey.pdf. Accessed 30th April, 2012.

⁵ Stace, C.A. 2010 New Flora of the British Isles. 3rd edition. Cambridge University Press, for higher plants; Smith, A.J.E. 2004 The moss flora of Britain and Ireland. 2nd edition. Cambridge University Press, for mosses; and Paton, J..A. 1999 The liverwort flora of the British Isles. Harley Books, Colchester, for liverworts.

⁶ British Plant Communities Vols 1-5, J.S. Rodwell 1992, JNCC

2.4 Guidance

The surveys and assessment accord with the JNCC⁴ and CIEEM guidelines⁷.

2.5 Legislation, policy and initiatives

The following key elements of the legal, policy and initiative framework determine the types of data collected and its assessment within this report:

- The Conservation of Natural Habitats and of Wild Flora and Fauna EC Directive (92/43);
- The Conservation (Natural Habitats &c.) Regulations 1994 as amended;
- The Conservation (Natural Habitats, &c.) Amendments (Scotland) Regulations 2007;
- The Environmental Impact Assessment (Scotland) Regulations 1999;
- Guidelines for Ecological Impact Assessment in the United Kingdom. Institute of Ecology and Environmental Management 2006.
- The Nature Conservation (Scotland) Act 2004;
- Wildlife and Countryside Act (as amended) 1981;
- Water Framework Directive (GWDTE's)
- Scottish Planning Policy;
- UK Biodiversity Action Plan (UK BAP);
- Argyll and Bute Biodiversity Action Plan (LBAP); and
- The Scottish Biodiversity List.

2.6 Constraints

The survey was conducted within the appropriate season and under optimal conditions. There were no constraints to the habitat survey.

⁷ Institute of Ecology and Environmental Management Undated. General advice on surveys and methods. Available online at: <http://www.ieem.net/surveymethods.asp>.

3. RESULTS

3.1 Desk Study

The results of the desk study are presented in Technical Appendix B of Envirocentre report number 5685: *Dalavich Ecology Summary Report*.

3.2 Habitat Survey

The main habitat types are described below. The Phase 1 habitat map is presented in Appendix B and Phase 1 Target Notes (TN) in Appendix C. Further survey was undertaken of the Phase 1 habitats that were thought to be Annex 1 EU Habitat Directive habitats and UKBAP habitats to produce an NVC map, presented in Appendix D and this included GWDETs.

3.2.1 Broad-leaved woodland A1.1.1

Annex 1 91A0 Old sessile oak woods with Ilex and Blechnum in the British Isles

Annex 1 91D0 Bog woodland

W4b *Betula pubescens-Molinia caerulea* woodland, *Juncus effusus* sub-community

W7c *Alnus glutinosa-Fraxinus excelsior-Lysimachia nemorum* woodland, *Deschampsia cespitosa* sub-community

W11b *Quercus petraea- Betula pubescens-Oxalis acetosella* woodland *Blechnum spicant* sub-community

W17b *Quercus petraea-Betula pubescens-Dicranum majus* woodland typical sub-community

Broadleaved woodland, W17/W11, is the main habitat along the lower slopes on each side of, and immediately adjacent to, the main watercourse. The canopy is generally dominated by mature *Quercus petraea* up to 18m/80cm, especially lower down. *Betula pubescens* occurs through the canopy also and is more prominent higher up towards the intake area. There are frequent *Sorbus aucuparia* trees to 10m and also occasional *Fraxinus excelsior* to 18m/40cm and *Corylus avellana* to 4m. *Alnus glutinosa* to 12m may also occur where this woodland type becomes transitional to the wetter W4/W7 types on flatter less well drained ground adjacent to the watercourse. The W17b sub-community occurs on the steeper slopes, the ground flora of prominent *Vaccinium myrtillus* with *Blechnum spicant*, *Lonicera periclymenum*, *Pteridium aquilinum*, *Dryopteris affinis*, *Potentilla erecta* distinguishes it from the generally grassier W11b sub-community which lacks the heath species and has more *Holcus lanatus*, *Agrostis capillaris*, *Oxalis acetosella*, *Dryopteris affinis*, *Deschampsia flexuosa*, *Ajuga reptans*, *Hyacinthoides non-scripta* and the bryophytes *Thuidium tamariscinum*, *Hylocomium splendens* and *Plagiochila perelloides*.

Wet woodland, with *Betula pubescens* and *Alnus glutinosa* in the canopy, occurs on flatter or more gently sloping ground adjacent to the watercourse in the vicinity of the intake area and also the turbine house area. Most of this was recorded as W4b which has quite prominent *Molinia caerulea* in the ground flora along with a range of wet, marshy species such as *Filipendula ulmaria*, *Juncus effusus*, *Angelica sylvestris*, *Geum urbanum*, *Galium aparine*, *Holcus lanatus*, *Iris pseudacorus*, *Deschampsia cespitosa*, *Fraxinus excelsior* saplings, *Carex nigra*. *Salix cinerea* can be quite prominent as an understorey species here. By the outflow area there is a band of *Alnus glutinosa* dominated woodland, W7c, immediately alongside the watercourse. The alder are around 14m/100cm base and the ground flora here is composed of *Deschampsia cespitosa*, *Carex remota*, *Rubus fruticosus agg*, *Valeriana officinalis*. *Rhododendron ponticum* also grows here.

3.2.2 Coniferous plantation woodland A1.1.1

The middle and upper slopes of the valley support large areas of dense coniferous plantation woodland. The main species planted here seems to be *Picea abies*.

3.2.3 Recently felled coniferous woodland A4.2

Much of the plantation has now been felled in the lower part of the survey area. Currently it has not yet been re-planted and it is reverting to more natural, though very open woodland, with *Quercus petraea*, which was mixed in with the conifers, left standing and younger *Betula pubescens* now growing up and forming an understorey. The ground layer is composed of *Vaccinium myrtillus*, *Blechnum spicant*, *Dryopteris dilatata*, *Deschampsia flexuosa*, *Galium saxatile*, *Pteridium aquilinum*, *Rubus fruticosus* agg, *Betula pubescens* seedling and will succeed to W17b woodland if left unplanted. On flatter ground in the vicinity of the outflow/turbine house the felled woodland is reverting to the wetter W4b type with dense *Salix cinerea* and *Betula pubescens* over *Juncus effusus*, *Sphagnum fallax*, *aquilinum* and the moss *Polytrichum commune*.

3.2.4 Bracken C1.1

Pteridium aquilinum is very frequent as part of the ground layer in the woodland areas and also in open gaps in the canopy and in areas of felled plantation.

3.2.5 Acid flush E2.1

GWDTE

A single woodland flush was recorded on the bank by the footpath close to the intake area. This was not easily classified in NVC terms and consists of *Filipendula ulmaria* is prominent with *Juncus effusus*, *Succisa pratensis*, *Dicranella palustris*, *Geum urbanum*, *Holcus lanatus* and *Ranunculus repens*.

3.3 Groundwater dependant terrestrial ecosystems

The following table lists the NVC communities found on site which are considered to be groundwater dependent according SEPA LUPS4 guidance.

Table 1: The status of NVC communities within the survey area

| NVC community | Status in the survey area |
|--------------------|--|
| W4b | Wet woodland occurs on flat and gently sloping ground around the intake area and also by the turbine house location. Due to its close association with the riverside water table it is considered to be heavily groundwater dependent. |
| Unclassified flush | One single flush on bank next to footpath close to intake. It is considered heavily groundwater dependent. |

4. CONCLUSIONS AND RECOMMENDATIONS

Excluding boundary features, five Phase 1 habitat types were identified on the site and in its immediate environs as follows:

- Broad-leaved woodland;
- Coniferous plantation woodland;
- Recently felled coniferous plantation;
- Continuous bracken; and
- Acid flush.

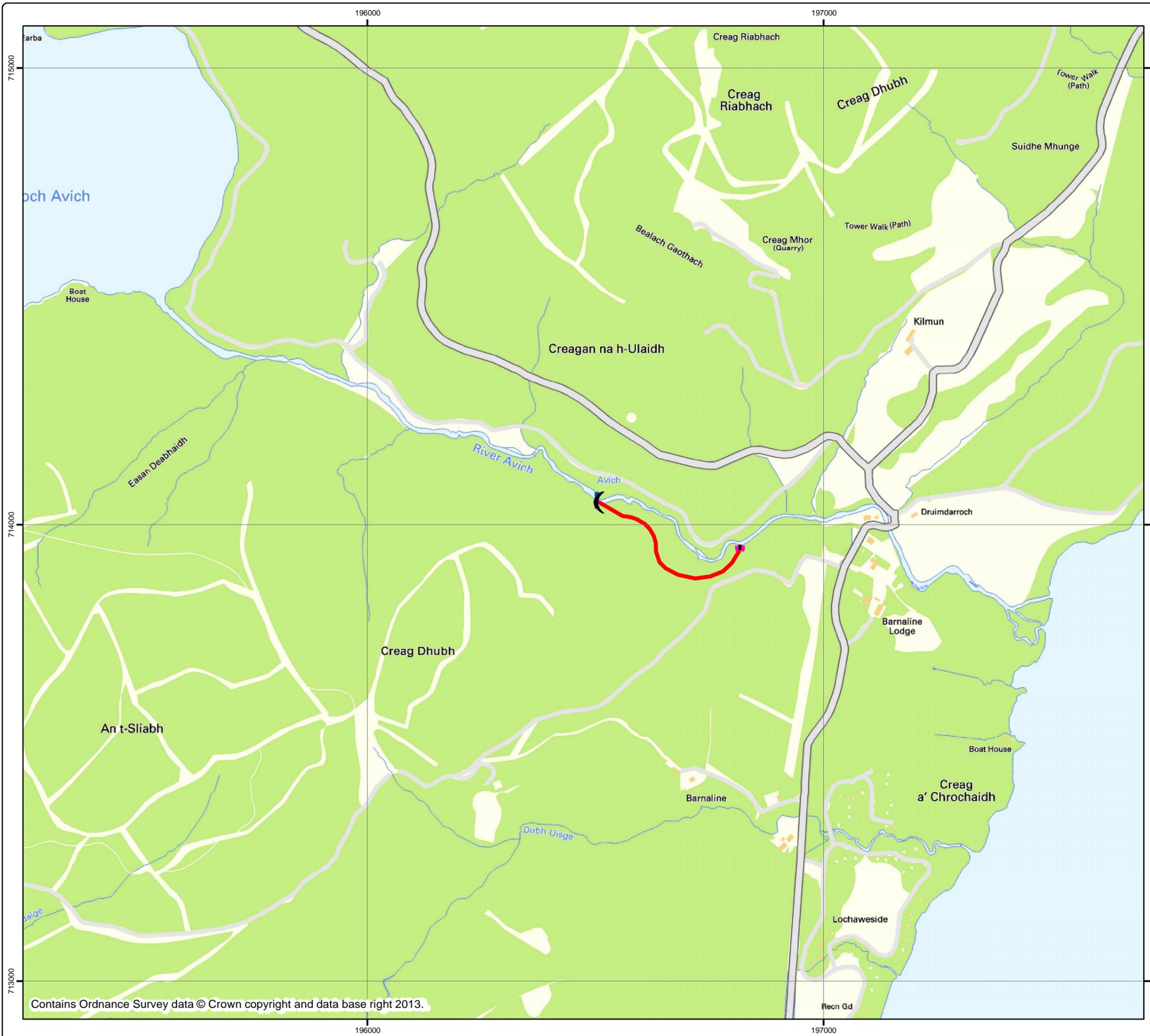
A total of two NVC communities were found on site which are considered to be groundwater dependent according to SEPA LUPS4 guidance.

The broad-leaved woodland habitat is likely to be impacted by the proposed development. However, these impacts are likely to be successfully avoided or reduced by micro-siting of the hydro-scheme development and replacement of vegetation where possible.

No further habitat survey is considered necessary.

Appendix A

Site Location Plan



Legend

- Dalavich Pipeline
- Powerhouse
- Intake
- Tailrace

Do not scale this map

| | | |
|-------------|--|--------------|
| Client | Gregor Cameron Consultancy Ltd. | |
| Project | River Avich Proposed Hydro-power Scheme | |
| Title | Site Location Plan | |
| Status | FINAL | |
| Drawing No. | 163857 - 002 | Revision |
| Scale | 1:8,000 | Date |
| | | A3 |
| | | 10 Sept 2013 |
| Drawn | Checked | Approved |
| Jl | MN | NG |



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Appendix B

Phase 1 Habitat Map



Legend

-  Dalavich Pipeline
-  Powerhouse
-  Intake
-  Tailrace
-  Target Note

Phase1

-  A1.1.1 semi-natural broad-leaved woodland
-  A1.2.2 coniferous plantation
-  A4.2 recently felled coniferous plantation

Do not scale this map

Client
Gregor Cameron Consultancy Ltd.

Project
Dalavich
Hydro-power Scheme

Title
Phase 1 Habitat Survey

Status
FINAL

| | |
|-----------------------------|----------|
| Drawing No. 163857 - 003 | Revision |
|-----------------------------|----------|

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Appendix C

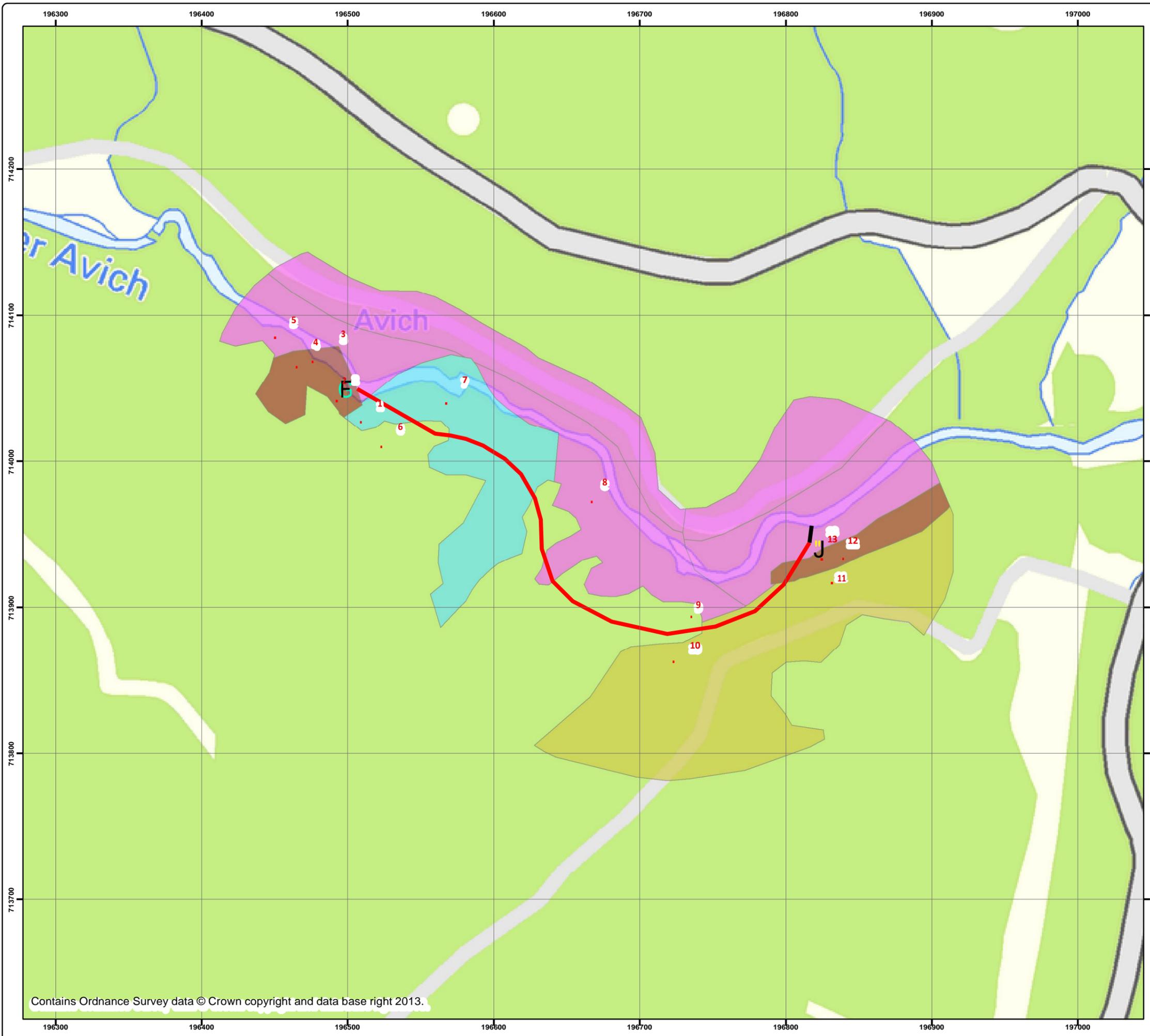
Target Notes

| Target Note | Comment | Location | |
|-------------|---|----------|--------|
| | | x | y |
| 1 | Woodland edge flush on bank. Not easy to NVC. <i>Filipendula ulmaria</i> is prominent with <i>Juncus effusus</i> , <i>Succisa pratensis</i> , <i>Dicranella palustris</i> , <i>Geum urbanum</i> , <i>Holcus lanatus</i> , <i>Ranunculus repens</i> . | 196513 | 714028 |
| 2 | Intake area broadleaved woodland W11b. <i>Salix cinerea</i> , <i>Betula pubescens</i> 16/80cm, <i>Alnus glutinosa</i> 6m/40cm, <i>Fraxinus excelsior</i> 6m, <i>Corylus avellana</i> and young <i>Betula pubescens</i> 3m. Ground flora <i>Holcus lanatus</i> , <i>Potentilla erecta</i> , <i>Agrostis capillaris</i> , <i>Hylocomium splendens</i> , <i>Dryopteris affinis</i> , <i>Oxalis acetosella</i> , <i>Thuidium tamariscinum</i> , <i>Dicranum scoparium</i> , and on damper ground some <i>Angelica sylvestris</i> , <i>Filipendula ulmaria</i> and <i>Caltha palustris</i> . | 196496 | 714046 |
| 3 | W4b wet woodland ground flora <i>Filipendula ulmaria</i> , <i>Juncus effusus</i> , <i>Angelica sylvestris</i> , <i>Geum urbanum</i> , <i>Galium aparine</i> , <i>Holcus lanatus</i> , <i>Iris pseudacorus</i> , <i>Deschampsia cespitosa</i> , <i>Salix cinerea</i> , <i>Betula pubescens</i> , <i>Fraxinus excelsior</i> saplings, <i>Carex nigra</i> . | 196488 | 714074 |
| 4 | Mainly W4b <i>Betula pubescens</i> , <i>Alnus glutinosa</i> , <i>Salix cinerea</i> over <i>Molinia caerulea</i> with <i>Filipendula ulmaria</i> , <i>Juncus effusus</i> , <i>Cirsium palustre</i> , <i>Potentilla erecta</i> , <i>Caltha palustris</i> , <i>Thuidium tamariscinum</i> , <i>Rubus</i> , <i>Holcus lanatus</i> , <i>Dryopteris affinis</i> . | 196469 | 714070 |
| 5 | On drier steeper bank dense W11b <i>Corylus avellana</i> understorey to 6m over <i>Dryopteris affinis</i> , <i>Rubus</i> , <i>Oxalis acetosella</i> , <i>Ajuga reptans</i> , <i>Hylocomium splendens</i> , <i>Holcus lanatus</i> , <i>Polytrichum commune</i> . | 196454 | 714085 |
| 6 | Plantation looks like mostly <i>Picea abies</i> , to over 20m/40cm. Ground flora very shaded with <i>Oxalis acetosella</i> and sparse <i>Blechnum spicant</i> , <i>Anemone nemorosa</i> , <i>Dryopteris dilatata</i> and the mosses <i>Thuidium tamariscinum</i> and <i>Polytrichum commune</i> . Occasional poor <i>Corylus avellana</i> or <i>Quercus petraea</i> . | 196527 | 714012 |
| 7 | Below intake is mainly W11b composed of <i>Quercus petraea</i> to 18m/60cm, <i>Betula pubescens</i> 14m/30cm, <i>Fraxinus excelsior</i> 18m/40cm, <i>Alnus glutinosa</i> 12m, <i>Corylus avellana</i> 4m. Ground flora <i>Holcus lanatus</i> , <i>Agrostis capillaris</i> , <i>Oxalis acetosella</i> , <i>Dryopteris affinis</i> , <i>Deschampsia flexuosa</i> , <i>Ajuga reptans</i> , <i>Hyacinthoides non-scripta</i> , <i>Thuidium tamariscinum</i> , <i>Hylocomium splendens</i> , <i>Plagiochila perelloides</i> . Wetter patches have <i>Filipendula ulmaria</i> , <i>Juncus effusus</i> , <i>Valeriana officinalis</i> , <i>Geum urbanum</i> (W4b). W17b over knolls with ground flora heathy - <i>Vaccinium myrtillus</i> , <i>Dryopteris dilatata</i> , <i>Blechnum spicant</i> , <i>Hylocomium splendens</i> . | 196571 | 714044 |
| 8 | Steeper W17b woodland here and downstream, composed of <i>Quercus petraea</i> to 20m/60cm with a sub-canopy of <i>Betula pubescens</i> 6m, <i>Corylus avellana</i> 4m, <i>Sorbus aucuparia</i> sapling. Ground flora <i>Vaccinium myrtillus</i> prominent with <i>Blechnum spicant</i> , <i>Lonicera periclymenum</i> , <i>Pteridium aquilinum</i> , <i>Dryopteris affinis</i> , <i>Potentilla erecta</i> . | 196667 | 713974 |
| 9 | <i>Picea abies</i> to over 20m/60cm. Ground flora shaded and reduced to <i>Oxalis acetosella</i> , <i>Vaccinium myrtillus</i> , <i>Lonicera periclymenum</i> and the mosses <i>Dicranum majus</i> , <i>Rhytidiadelphus loreus</i> and <i>Sphagnum fallax</i> . | 196731 | 713890 |
| 10 | Felled plantation, <i>Quercus petraea</i> 18m/70cm left standing, over <i>Betula pubescens</i> 3m, dense <i>Pteridium aquilinum</i> and mixed <i>Vaccinium myrtillus</i> , <i>Blechnum spicant</i> , <i>Rhytidiadelphus loreus</i> . Re-generating W17b woodland. | 196727 | 713862 |
| 11 | Felled plantation here. <i>Quercus petraea</i> left over a ground flora of <i>Vaccinium myrtillus</i> , <i>Blechnum spicant</i> , <i>Dryopteris dilatata</i> , <i>Deschampsia flexuosa</i> , <i>Galium saxatile</i> , <i>Pteridium aquilinum</i> , <i>Rubus fruticosus</i> agg, <i>Betula pubescens</i> seedling. Recovering W17b. | 196827 | 713921 |
| 12 | Recovering W4b wet woodland in felled area on linear flats. Dense <i>Salix cinerea</i> over <i>Juncus effusus</i> , <i>Sphagnum fallax</i> , <i>Betula pubescens</i> , <i>Pteridium aquilinum</i> , <i>Polytrichum commune</i> | 196835 | 713934 |
| 13 | Turbine/outflow area has an old hydro structure on raised bank, which is mainly W17b <i>Quercus petraea</i> 16m/60cm, <i>Sorbus aucuparia</i> 10m/15cm, over <i>Vaccinium myrtillus</i> , <i>Blechnum spicant</i> , <i>Dryopteris affinis</i> , <i>Lonicera periclymenum</i> , <i>Rubus fruticosus</i> agg. Area lower down by watercourse W7c with <i>Alnus glutinosa</i> | 196821 | 713942 |

| | | | |
|--|---|--|--|
| | 14m/100cm base, <i>Carex remota</i> , <i>Rubus fruticosus</i> agg, <i>Valeriana officinalis</i> , <i>Quercus petraea</i> 18m, <i>Fraxinus excelsior</i> 3m, <i>Deschampsia cespitosa</i> . <i>Rhododendron ponticum</i> . | | |
|--|---|--|--|

Appendix D

NVC Map



Legend

- Dalavich Pipeline
- Powerhouse
- Intake
- Tailrace
- Target Note

Dalavich habitats

NVC

- W11b/W17b
- W17b/W11b
- W17b/W4b
- W4b

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Project
Dalavich
Hydro-power Scheme

Title
Phase 2 NVC Vegetation Survey

Status
FINAL

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|-----------------------------|----------|
| Drawing No. 163857 - 004 | Revision |
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Technical Appendix D

Bryophyte Survey

River Avich Hydro-scheme

Survey of the bryophyte interest

Summary

A bryophyte survey of the site was carried out by Gordon Rothero (7-8th March, 2013), and the following points are taken from the full report.

The valley of the River Avich is an important bryophyte site. The site as surveyed has some 129 bryophyte species (50 liverworts, 79 mosses, listed in Annex 2), a good total for a site with limited rock exposures; this is probably due to the moderately base-rich andesite geology and the broadleaf tree cover. There are two nationally scarce species, *Radula voluta* and *Leptoscyphus cuneifolius*, both oceanic liverwort species with a very restricted distribution in Europe. There are 19 oceanic species, all listed in Table 3, an average total for a ravine site in the Loch Awe area and these give the site its main interest. Of these species, seven are oceanic ravine indicator species giving a site score of nine (see Table 3 for the scoring); well above the threshold level of six points indicating a site of national importance. The most notable features of the site are the well-spread population of *Radula voluta* on rocks in the inundation zone of the river and the very large population of *Leptoscyphus cuneifolius* on birches. The significance of the medium amount of change due to the scheme on the high bryophyte interest on the site, using the criteria set out in the matrix in Table 2, is classed as **major**.

* * * * *

1. Introduction

1.1. This report consists of a summary, a description of the survey methods, a report on the bryophyte communities and species on the site and their significance. Annex 1 has all the target notes with grid references and Annex 2 has full species list for the site as surveyed. In this report, nomenclature for the bryophytes follows Hill et al, 2008 (A checklist and census catalogue of British and Irish bryophytes, British Bryological Society). The definition of 'oceanic species' follows Hill & Preston (Hill MO & Preston CD, 1998. The geographical relationships of British and Irish bryophytes. Journal of Bryology, 20: 127-226). Definitions of nationally rare and scarce species are taken from lists published by the Biological Records Centre.

1.2. The proposal is for a run-of-the-river hydro scheme on the River Avich with intake options at the outflow from Loch Avich at c. NM9554.1448 (Intake option 1) and on the main river just above the Avich Falls at c. NM9650.1404 (Intake option 2). The powerhouse area is on the flatter ground by the old powerhouse building at c. NM9684.1395. The proposed pipeline route from Intake option 1 follows the river on the north side and then runs along the track before crossing the river about halfway to the proposed powerhouse. It then runs along the south bank to join the existing path and old pipeline route to the powerhouse. The pipeline from Intake option 2 follows the old pipeline route in its entirety.

1.3. The River Avich is a river draining Loch Avich which has an easy-angled upper section below the loch and then a section with small waterfalls and cascades before the gradient eases again towards the public road. The rock in the central section is andesite sandwiched between gritty Dalradian schist, both rock types giving a moderately base-rich substrate. Bedrock is often exposed as slabs at the sides of the river but the low crags only occur in the steeper central section around the falls but stones and boulder are frequent over much of the site. Again, the watercourse is only steeply incised in the central section which contains the waterfalls. The whole of the affected section of the burn has a variable cover of broadleaf trees, usually as a corridor between the ranks of conifer plantation. The abundant epiphytic

flora suggests that humidity levels are high but this may be due as much to the shelter of the conifers as to the watercourse and broadleaf tree canopy. Away from the watercourse corridor the ground is all production forest with consequent levels of habitat modification and disturbance.

1.4 The area involved in the proposed scheme has no sites designated for the conservation of the botanical interest.

2. Survey and evaluation methods

2.1. A standard Phase 1 walkover method was used to assess the bryophyte populations along the section of the burn that will have reduced flow ie. from the potential powerhouse and tailrace site, as indicated on the map supplied, to the intake area. Target notes were made along the burn and the banks on either side, describing the general bryophyte communities present and any species of interest. The very low water levels meant that the whole affected section was accessible and was surveyed.

2.2. The pipeline route as indicated on the map supplied was similarly surveyed as was the area around the proposed powerhouse.

2.3 The criteria used to assess the magnitude of the effects of the hydro scheme are based on the scale of the impact on the site, the sensitivity of the bryophyte populations and the duration of the effect.

Table 1. Scale for magnitude of ecological impact

| Magnitude of impact | Definition |
|---------------------|--|
| High | Wholesale change to most of a site or species population. |
| Medium | Substantial but partial change to a site or species population; or large change to small fraction of the site or species |
| Low | Minor change to part of a site or species population, or loss of a very small proportion of a site or population. |
| Negligible | Minimal change on a very small scale. |

2.4 The sensitivity of a bryophyte feature is broadly related to its ecological and conservation interest, with bryophytes of international and national significance having high sensitivity and those of more local significance having medium sensitivity. However, the local knowledge of the surveyor may lead to some variation in the use in these categories and this is explained in the text where necessary. The bryophyte interest in woodlands and ravines in the oceanic west of Scotland is normally assessed by reference to the number of oceanic species, as listed by Hill & Preston (1998), as well as to the presence of nationally rare or scarce species. The best of these wooded ravines are of international importance as the bryophyte communities they contain are rare in Europe and may contain some species which are globally rare. This conservation interest can be assessed by the occurrence on the site of a number of indicator species which are given a score according to rarity and threat level and this score aggregated for the site (Averis et al., 2012). This list of oceanic ravine indicator species also includes rare or scarce riparian species which may occur in sites away from the

oceanic west. The current threshold level for a nationally important site using this watercourse bryophyte assessment is a score of six. An evaluation of the bryophyte flora on this site is given in section 4 below.

2.5 The change in the pattern of discharge down the rivers will presumably continue indefinitely and so any impact on the bryophytes as a result of this change is likely to be permanent giving a medium impact as defined in Table 1. The matrix for determining the impact of the scheme on the bryophyte interest is given in Table 2.

Table 2. Matrix for determining the Significance of an Ecological Impact related to Sensitivity of the Feature and Magnitude of Change

| Sensitivity of bryophyte interest | Magnitude of Change | | | |
|-----------------------------------|---------------------|----------|----------|------------|
| | High | Medium | Low | Negligible |
| High | Major | Major | Moderate | Minor |
| Medium | Major | Moderate | Minor | Minor |
| Low | Moderate | Minor | Minor | Minor |
| Negligible | Minor | Minor | Minor | Minor |

*Shaded cells indicate a significant impact

3 Baseline conditions

3.1. A detailed and localised account of the bryophyte populations that will be affected by the proposed scheme is given in Annex 1 as target notes, and Annex 2 has a bryophyte species list for the main site on the River Avich.

3.2. Background to bryophytes in the Loch Awe area.

Loch Awe has an oceanic climate and the surrounding hills, woodlands and ravines have an extremely rich bryophyte flora. In particular, the area is rich in oceanic species, those bryophytes limited to the western fringes of Britain, many of which are rare in Europe. However, parts of the Loch Awe area are not particularly well-recorded and, in the area local to this scheme, much may well have been lost to extensive afforestation. Much of the rock in the area is acidic so that outcrops of more basic rock, as on the River Avich, are locally significant.

3.3 Description of the bryophyte interest in the areas affected by the scheme.

3.3.1 The riparian bryophytes in and by the burn are locally abundant, often covering most of the available rock surface, but the diversity is usually low. The most common species are *Platyhypnidium riparioides* which is overwhelmingly dominant on rocks in the burn and waterfalls and *Thamnobryum alopecurum* which is often dominant in the inundation zone. This combination is typical of burns with a catchment over moderately base-rich rocks. Other frequent riparian species in the inundation zone include, *Fontinalis antipyretica*, *Chiloscyphus polyanthos*, *Cinclidotus fontinaloides*, *Racomitrium aciculare*, *Sciuro-hypnum plumosum*, *Scapania undulata*, *Pellia epiphylla*, *Blindia acuta*, *Plagiochila porelloides*, *Fissidens taxifolius*, *Ctenidium molluscum* var *molluscum*, *Hygrohypnum eugyrium* and occasionally *Hyocomium armoricum*. The infrequent, sheltered, steep rock faces close to the burn have a limited development of the community of small oceanic liverworts with *Lejeunea patens* by

far the most common but *Harpalejeunea molleri* occasionally occurs here. The most significant population in this habitat is that of the nationally scarce, oceanic liverwort *Radula voluta* which has a number of stands, usually on slabby rocks and boulders in the lower part of the inundation zone.

3.3.2. The rocky banks have an abundance of common woodland floor species like *Thuidium tamariscinum*, *Rhytidiadelphus loreus*, *Dicranum majus*, *Hylocomium splendens*, *Loeskeobryum brevirostre*, *Rhytidiadelphus triquetrus*, *Mnium hornum*, *Breutelia chrysocoma* and more locally *Ptilium crista-castrensis*, *Bazzania trilobata*, *Dicranodontium denudatum*, *Kindbergia praelonga* and *Eurhynchium striatum*. On the steeper banks, particularly north-facing, rocky slopes, there are also stands of *Sphagnum quinquefarium*, with the oceanic species *Plagiochila spinulosa* and the filmy fern *Hymenophyllum wilsonii*. Where there is some seepage of water down the banks giving a wet soil, there is a large population of the liverwort *Trichocolea tomentella* usually accompanied by *Calliergonella cuspidata*, *Rhytidiadelphus triquetrus*, *Ctenidium molluscum* var *molluscum*, *Plagiochila asplenioides*, *Sphagnum girgensohnii* and more locally *Sphagnum palustre*, *Sphagnum fallax* and *Sphagnum squarrosum*.

3.3.3. There are only a small number of crags above the river on the site and, on the moderately base-rich rock, species include abundant *Saccogyna viticulosa*, *Isothecium myosuroides* var. *myosuroides*, *Diplophyllum albicans*, *Pellia endiviifolia*, *Dichodontium flavescens*, *Rhizomnium punctatum*, *Fissidens dubius*, *Palustriella commutata*, *Hookeria lucens*, *Plagiomnium undulatum*, *Fissidens taxifolius*, *Neckera crispa*, *Tortella tortuosa* and *Plagiochila spinulosa*. Some wetter crags have in addition species like *Anoetangium aestivum*, *Pohlia wahlenbergii* var. *wahlenbergii*, *Conocephalum conicum*, *Jungermannia atrovirens*, *Fissidens adianthoides*, *Amphidium mougeotii*, *Blindia acuta*, *Bryum pseudotriquetrum*, *Oxyrrhynchium hians*, *Aneura pinguis*, *Dichodontium pellucidum* and both *Leiocolea bantriensis* and *Leiocolea collaris*. On one crag there is a good population of the oceanic ravine indicator species *Metzgeria leptoneura*.

3.3.4. The woodland floor away from the river usually has just common pleurocarpous species like *Hylocomium splendens*, *Rhytidiadelphus loreus*, *Thuidium tamariscinum*, *Rhytidiadelphus triquetrus*, *Dicranum majus*, *Mnium hornum* and locally *Loeskeobryum brevirostre*. Where the ground is wetter *Sphagnum girgensohnii*, *Sphagnum capillifolium* and *Polytrichum commune* can be frequent. Under the conifers the ground is often completely covered by *Thuidium tamariscinum* with smaller amounts of *Polytrichum commune* and *Rhytidiadelphus triquetrus*.

3.3.5. the sheltered sites in the river corridor, the epiphytic flora is often luxuriant and contains a number of interesting species. On the oaks *Isothecium myosuroides* var. *myosuroides* is usually dominant with smaller amounts of *Frullania tamarisci*, *Hypnum cupressiforme*, *Dicranum scoparium* and locally *Scapania gracilis*, *Plagiochila punctata* and *Plagiochila spinulosa*. On birch and alder over much of the site the abundance of *Scapania gracilis*, *Plagiochila punctata* and the nationally scarce *Leptoscyphus cuneifolius* is notable, and this community even strays onto Sitka spruce, which is very unusual. The flora on ash is more diverse; locally there are festoons of *Neckera crispa* and much *Loeskeobryum brevirostre* around the bases of trees. Higher up there are usually stands of *Frullania tamarisci*, *Frullania dilatata*, *Metzgeria furcata*, *Metzgeria consanguinea*, *Plagiochila punctata*, *Zygodon conoideus* and more locally *Plagiochila exigua* and *Harpalejeunea molleri*. There is a similar flora on hazel in sheltered places by the river and in addition there are small populations of *Aphanolejeunea microscopica*, *Colura calyptrifolia* and *Drepanolejeunea hamatifolia*, all oceanic ravine indicator species.

Table 3. Nationally scarce and oceanic species recorded from the River Avich

| | |
|---|---------------------------------|
| Nationally scarce species | <i>Leptoscyphus cuneifolius</i> |
| <i>Radula voluta</i> | <i>Metzgeria leptoneura</i> (1) |
| <i>Leptoscyphus cuneifolius</i> | <i>Plagiochila bifaria</i> |
| | <i>Plagiochila exigua</i> (1) |
| Oceanic species (19 taxa) | <i>Plagiochila punctata</i> |
| <i>Aphanolejeunea microscopica</i> (1) | <i>Plagiochila spinulosa</i> |
| <i>Breutelia chrysocoma</i> | <i>Radula voluta</i> (3) |
| <i>Campylopus atrovirens</i> | <i>Saccogyna viticulosa</i> |
| <i>Colura calyptrifolia</i> (1) | <i>Scapania gracilis</i> |
| <i>Drepanolejeunea hamatifolia</i> l(1) | <i>Ulota phyllantha</i> |
| <i>Harpalejeunea molleri</i> (1) | <i>Zygodon conoideus</i> |
| <i>Hyocomium armoricum</i> | |
| <i>Lejeunea patens</i> | |

*Figures in () are oceanic ravine indicator species scores

4. Evaluation of the bryophyte flora

4.1. The site as surveyed has some 129 bryophyte species (50 liverworts, 79 mosses, listed in Annex 2), a good total for a site with limited rock exposures and which is probably due to the moderately base-rich andesite and the tree cover. There are two nationally scarce species, *Radula voluta* and *Leptoscyphus cuneifolius*, both oceanic liverwort species with a very restricted distribution in Europe. There are 19 oceanic species, all listed in Table 3, an average total for a ravine site in the Loch Awe area and these give the site its main interest. Of these species, seven are oceanic ravine indicator species giving a site score of nine (see Table 3 for the scoring); well above the threshold level of six points indicating a site of national importance. The most notable features of the site are the frequent patches of *Radula voluta* on rocks in the inundation zone of the river and the very large population of *Leptoscyphus cuneifolius* on birches.

4.2. This site has an important oceanic flora, particularly in an area which has been so altered by plantation woodland. With a score of nine for oceanic ravine indicator species and in the local context, the site is assessed as having high sensitivity for the bryophyte interest.

5. Potential impacts of the scheme

5.1 There are two main areas of impact of the scheme on the bryophytes. There will be the various effects of the reduced flow of water down the main watercourse and there will be the direct impact of the construction of the intakes, pipelines, powerhouse and access tracks. The effect of these changes will be different in each case.

5.2 In the burn, the ecology of the species concerned suggests that the reduced flow will lead to a long-term shift of some centimetres by the riparian species towards the new base water level. With *Platyhypnidium riparioides* and *Thamnobryum alopecurum* so dominant, it seems highly unlikely that there will be any substantial change in the main species. However it is possible that, as a result of a reduction in the frequency of scouring in the flow regime, an increase in cover of larger species may lead to the loss of some habitat for the small oceanic liverworts, and in particular this may affect the patches of *Radula voluta*. Apart from this possibility, it seems unlikely that the composition of the flora will change a great deal.

5.3. For the species on rocks and banks above the water channel, the reduction in flow in the burn will probably make little difference as most are not dependant on irrigation and humidity derived from the main burn. It is not easy to assess the impact of the proposed

scheme on the important epiphytic flora. While the humidity associated with the river corridor is important, the sheltering effect of the conifer plantations on either side clearly has a role and presumably these trees will be clear-felled at some point. It seems likely that the removal of the conifers will have at least as big an effect on the epiphytic bryophyte populations as any changes brought about by the proposed hydro scheme.

5.4 There will be some direct damage to the bryophyte interest from the construction of the intake as there are stands of *Radula voluta* at both of the intake site options. The initial part of the pipeline route from Intake option 1 also has trees with a good epiphytic flora as do other short stretches of the route. Much of the route along the existing tracks has only common bryophyte species and has already had much disturbance.

5.5. The significance of the medium amount of change due to the scheme on the high bryophyte interest on the site, using the criteria set out in the matrix in Table 2 above, is classed as **major**.

6 Mitigation.

6.1 It is presumed that some spate flows will continue down the burn and so the changes to the hydrology of the burn will be limited to that extent; this may be sufficient to give enough erosion to keep habitat open for *Radula voluta*.

6.2 The proposed intakes have stands of *Radula voluta* and care should be taken to cause minimum damage to these stands. In mitigation, removal of the small amount of Rhododendron on the site before it becomes established would benefit the bryophyte interest in the long term.

6.3. The scheme using intake option 2 is much the same as an old hydro scheme, parts of which are still visible. It is of interest to note that stands of *Radula voluta* have persisted in this lower section of the river below the intake, but nothing is known of the size of the old scheme or of the period over which it operated.

6.4. Management of the woodland along the river corridor to minimise the effect of clear-felling on the epiphytic flora would mitigate some of the effects of both changes in the discharge down the river and the felling.

6.5. The apart from short sections near the intakes and river crossing, the pipeline route and the powerhouse site have just common species that are abundant over the whole site and in the area in general and need no mitigation.

7 Residual impacts

7.1 The reduction in flow will have a residual impact in that the distribution of bryophyte populations on rocks in and by the burn is likely to change though given the dominance of a few species, it seems unlikely that species composition or diversity will be much altered. The main concern is that the open spaces on rock surfaces required by *Radula voluta* will be reduced but the continuation of occasional spates may moderate this process somewhat.

7.2 Whichever intake option is chosen, some stands of *Radula voluta* will almost certainly be lost during the construction process. The construction of the powerhouse and pipeline should have only a local residual impact on the bryophytes if every effort is made to avoid broadleaf trees where possible.

8 References

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Annex 1:- River Avich Hydro Scheme. Target notes

River Avich

- 1) NM9684.1395. Tailrace area. On rocks in the burn *Platyhypnidium riparioides* is very abundant as is *Thamnobryum alopecurum* in the inundation zone. *Chiloscyphus polyanthos* and *Cinclidotus fontinaloides* also occur on rocks in the water and *Hyocomium armoricum*, *Racomitrium aciculare* and *Ctenidium molluscum* var *molluscum* occur on bigger rocks and in the inundation zone at the sides. The bryophytes on the banks consist mostly of common pleurocarpous species like *Hylocomium splendens*, *Rhytidiadelphus loreus*, *Thuidium tamariscinum*, *Rhytidiadelphus triquetrus* and *Loeskeobryum brevirostre* with some *Hylocomiastrum umbratum* and *Plagiochila spinulosa*, and in wetter areas, more *Sphagnum girgensohnii*, *Calliergonella cuspidata* and *Trichocolea tomentella*. The trees have a good epiphytic flora with *Isothecium myosuroides* var. *myosuroides*, *Scapania gracilis*, *Plagiochila punctata*, *Plagiochila spinulosa*, *Frullania tamarisci*, *Harpalejeunea molleri*, *Neckera crispa* and *Ulota phyllantha*. There is very little change in this bryophyte flora for some 100m downstream.
- 2) NM9679.1394. A more incised section of the river on the bend. The very large boulders in the river here have *Ctenidium molluscum* var *molluscum*, *Hygrohypnum eugyrium*, *Racomitrium aciculare*, *Plagiochila porelloides*, *Lejeunea patens*, *Grimmia hartmanii*, *Hymenophyllum wilsonii* and a few patches of the nationally scarce oceanic liverwort *Radula voluta*. Low crags at the side have *Amphidium mougeotii*, *Isothecium myosuroides* var. *myosuroides*, *Diplophyllum albicans*, *Fissidens taxifolius*, *Lejeunea patens*, *Saccogyna viticulosa* and more *Radula voluta*. The riparian bryophyte flora and that on the banks is much as in Note 1.
- 3) NM9674.1392. Incised section to cascade. *Platyhypnidium riparioides* and *Thamnobryum alopecurum* remain abundant in the burn and inundation zone here with *Hyocomium armoricum*, *Brachythecium rivulare*, *Chiloscyphus polyanthos*, *Racomitrium aciculare* and *Fontinalis antipyretica*. The crags on the south side have a good flora with *Isothecium myosuroides* var. *myosuroides*, *Amphidium mougeotii*, abundant *Saccogyna viticulosa*, *Pellia endiviifolia*, *Dichodontium flavescens*, *Rhizomnium punctatum*, *Trichocolea tomentella*, frequent *Metzgeria leptoneura*, *Palustriella commutata*, *Hookeria lucens*, *Plagiomnium undulatum*, *Fissidens taxifolius*, *Neckera crispa*, *Tortella tortuosa* and *Plagiochila spinulosa*. The rocky banks have *Thuidium tamariscinum*, *Hylocomium splendens*, *Rhytidiadelphus loreus*, *Rhytidiadelphus triquetrus*, *Ctenidium molluscum* var *molluscum*, *Dicranum majus*, *Loeskeobryum brevirostre*, *Conocephalum conicum* and *Plagiochila spinulosa*. Rocks by the cascade have further patches of *Radula voluta* with *Hygrohypnum eugyrium*, *Plagiochila porelloides*, *Grimmia hartmanii*, *Ctenidium molluscum* var *molluscum* and *Amphidium mougeotii*. Above this the river is more open and easy-angled and has much the same flora as Note 1.
- 4) NM9699.1400. An open bouldery stretch of the river still with *Platyhypnidium riparioides* dominating in the burn and *Thamnobryum alopecurum* in the inundation zone. Other species here are *Chiloscyphus polyanthos*, *Racomitrium aciculare* and *Sciuro-hypnum plumosum*. On the low crags at the side, *Saccogyna viticulosa* is abundant and on the banks are *Rhytidiadelphus loreus*, *Thuidium tamariscinum*, *Loeskeobryum brevirostre*, *Plagiochila spinulosa*, *Dicranum majus*, *Hylocomium splendens* and large patches of *Trichocolea tomentella* where it is flushed. There is a well-developed epiphytic flora here with *Scapania gracilis*, *Plagiochila punctata*, *Plagiochila spinulosa* and the nationally scarce *Leptoscyphus cuneifolius* all frequent on birch and on ash and hazel, *Isothecium myosuroides* var. *myosuroides*, *Frullania tamarisci*, *Frullania dilatata*, *Lejeunea patens*, *Harpalejeunea molleri*, *Plagiochila exigua*, *Metzgeria consanguinea* and *Zygodon conoideus*. There are also large patches of *Neckera crispa* on ash. There is a similar flora to the next cascade.

5) NM9661.1403. In the cascade and the adjacent rocks *Platyhypnidium riparioides* and *Thamnobryum alopecurum* are again dominant with *Chiloscyphus polyanthos*, *Sciurohypnum plumosum*, *Racomitrium aciculare*, *Hyocomium armoricum*, *Ctenidium molluscum* var *molluscum*, *Rhizomnium punctatum*, *Lejeunea patens*, *Scapania undulata*, *Dichodontium flavescens*, *Pellia epiphylla*, *Trichostomum tenuirostre* and a few patches of *Radula voluta*. *Saccogyna viticulosa* is abundant on the wet banks and on wet soil are *Trichocolea tomentella*, *Hookeria lucens*, *Calliergonella cuspidata*, *Palustriella commutata* and *Plagiochila asplenioides*. *Plagiochila spinulosa* is locally abundant on the old oaks with *Hymenophyllum wilsonii* and *Plagiochila punctata* and *Leptoscyphus cuneifolius* frequent on birch. The river is braided and on the island are *Hylocomium splendens*, *Thuidium tamariscinum*, *Rhytidiadelphus loreus*, *Ptilium crista-castrensis*, *Breutelia chrysocoma*, *Sphagnum quinquefarium*, *Dicranodontium denudatum*, *Hylocomiastrum umbratum*, *Bazzania trilobata* and *Mylia taylori*.

6) NM9657.1404. Avich Falls. There is little change in the main riparian flora from Note 5 but there are good patches of *Fontinalis antipyretica* here and some *Hygrohypnum eugyrium* and *Cinclidotus fontinaloides*; *Radula voluta* is rare in the main fall but more frequent near the old weir. On rocks by the river are *Amphidium mougeotii*, *Bryum pseudotriquetrum*, *Fissidens taxifolius*, *Pellia endiviifolia*, *Dichodontium flavescens*, *Fissidens adianthoides*, *Saccogyna viticulosa* and *Diplophyllum albicans*. On the banks are *Hylocomium splendens*, *Thuidium tamariscinum*, *Rhytidiadelphus loreus*, *Ptilium crista-castrensis*, *Breutelia chrysocoma*, *Sphagnum quinquefarium*, *Hylocomiastrum umbratum*, *Bazzania trilobata* and *Sphagnum palustre* and *Calliergonella cuspidata* where it is wetter. The good epiphytic flora continues with *Plagiochila exigua*, *Harpalejeunea molleri*, *Zygodon conoideus* on ash and much *Plagiochila punctata* and *Leptoscyphus cuneifolius* on birch; *Loeskeobryum brevirostre* is frequent on the bases of the trees with *Isothecium myosuroides* var. *myosuroides* above.

7) NM9650.1403. Intake option 2 at the old weir. On and by the old weir are *Platyhypnidium riparioides*, *Thamnobryum alopecurum*, *Fontinalis antipyretica*, *Brachythecium rivulare*, *Dichodontium flavescens*, *Pellia epiphylla* and *Plagiochila porelloides*. On the S side the wet banks have *Thuidium tamariscinum*, *Calliergonella cuspidata*, *Rhytidiadelphus triquetrus*, *Plagiochila asplenioides*, *Loeskeobryum brevirostre*, *Plagiomnium undulatum* and *Brachythecium rivulare*. On the N side are *Rhytidiadelphus loreus*, *Rhytidiadelphus triquetrus*, *Thuidium tamariscinum*, *Dicranum majus*, *Ptilium crista-castrensis* and *Sphagnum quinquefarium*. On hazel are *Frullania tamarisci*, *Metzgeria consanguinea*, *Harpalejeunea molleri* and *Zygodon conoideus* and on birch *Plagiochila punctata*, *Scapania gracilis*, *Plagiochila spinulosa* and *Leptoscyphus cuneifolius*. There is a little *Radula voluta* on the rocks just below the weir on the N side. Above the weir there is a pool with very limited bryophyte interest but the same flora on the banks and trees.

8) NM9646.1411. An easy-angled section with a riparian flora limited to larger stones with *Platyhypnidium riparioides* and *Fontinalis antipyretica*. *Trichocolea tomentella* is abundant on the wet banks with some *Conocephalum conicum* and *Cirriphyllum piliferum*. On ash and hazel are *Plagiochila exigua*, *Harpalejeunea molleri*, *Drepanolejeunea hamatifolia* with large patches of *Neckera crispa* and on birch *Plagiochila punctata* and *Leptoscyphus cuneifolius* are locally abundant.

9) NM9638.1414. Cascades to the footbridge. On rocks in and by the river are *Platyhypnidium riparioides*, *Thamnobryum alopecurum*, *Lejeunea patens*, *Hygrohypnum eugyrium*, *Plagiochila porelloides*, *Radula voluta*, *Ctenidium molluscum* var *molluscum*, *Racomitrium aciculare*, *Pellia epiphylla*, *Scapania undulata*, *Hyocomium armoricum*, *Jungermannia atrovirens*, *Dichodontium flavescens* and *Fissidens taxifolius*. The good epiphytic flora continues with in addition *Aphanolejeunea microscopica* on hazel; *Isothecium*

myosuroides var. *myosuroides*, *Plagiochila spinulosa* and *Hymenophyllum wilsonii* festoon old oaks by the bridge.

10) NM9631.1414. A low cascade with no change in the riparian flora from Note 9 except for the addition of *Hygrohypnum ochraceum*, but no *Radula voluta* here. *Neckera crispa* is abundant on some ash trees with *Loeskeobryum brevirostre* and good patches of *Plagiochila exigua*. On the low crags additional species include *Fissidens dubius*, *Bartramia ithyphylla* and *Plagiochila bifaria*.

11) NM9624.1420. A low cascade with a large crag on the north side. There are several patches of *Radula voluta* on large rocks some 25m below the cascade. *Plagiochila exigua* is again frequent on the ash trees with *Harpalejeunea molleri*, *Zygodon conoideus* and *Homalothecium sericeum*. The wet banks have large stands of *Trichocolea tomentella* with *Calliergonella cuspidata* and *Rhytidiadelphus triquetrus*. On the crags are *Anoectangium aestivum*, *Pellia endiviifolia*, *Pohlia wahlenbergii* var. *wahlenbergii*, *Palustriella commutata*, *Conocephalum conicum*, *Jungermannia atrovirens*, *Dichodontium flavescens*, *Fissidens adianthoides*, *Amphidium mougeotii*, *Blindia acuta*, *Bryum pseudotriquetrum*, *Oxyrrhynchium hians*, *Aneura pinguis*, *Dichodontium pellucidum* and both *Leiocolea bantriensis* and *Leiocolea collaris*.

12) NM9620.1418. A similar cascade to Note 11 but with some 15 patches of *Radula voluta* on rocks on the south side with *Lejeunea patens*. A flat section above with a similar bryophyte flora on the banks and trees but limited interest in the burn.

13) NM9604.1426. A flat stretch with lots of trees down across the river and with conifers close by. The flora in the burn is limited to the larger rocks and the sides which have *Platyhypnidium riparioides*, *Fontinalis antipyretica*, *Plagiochila porelloides*, *Fissidens taxifolius*, *Thamnobryum alopecurum*, *Pellia epiphylla*, *Hycomium armoricum*, *Rhizomnium punctatum* and *Scapania undulata*. An addition to the epiphytic flora here is *Colura calyptrifolia* on a few hazels. On logs here are *Nowellia curvifolia*, *Riccardia palmata*, *Scapania gracilis*, *Plagiochila punctata*, *Dicranum scoparium* and *Isothecium myosuroides* var. *myosuroides* and there are good patches of *Hylocomiastrum umbratum* on the bank.

14) NM9588.1432. A quiet stretch with a similar riparian flora to note 13. There is a remarkable abundance of *Leptoscyphus cuneifolius* on the birch and alder here and lapun spreads onto some of the sitka. *Plagiochila spinulosa* is abundant on the old wall and also on one magnificent old oak. Above this the ground is disturbed by the construction of the new bridge.

15) NM9571.1436. A long, easy-angled stretch above the new bridge. The riparian flora is limited to *Fontinalis antipyretica* in the burn and *Chiloscyphus polyanthos*, *Pellia epiphylla* and *Fissidens taxifolius* on rocks at the side. On the wet banks are *Trichocolea tomentella*, *Calliergonella cuspidata*, *Sphagnum palustre* and *Sphagnum fallax* and better-drained ground has *Hylocomium splendens*, *Thuidium tamariscinum* and *Hypnum jutlandicum*. *Plagiochila punctata* and *Leptoscyphus cuneifolius* remain frequent on the birch and alder and *Microlejeunea ulicina* occurs on willows.

16) NM9562.1442. A riffle in the river with some rocks with *Platyhypnidium riparioides*, *Thamnobryum alopecurum*, *Fontinalis antipyretica* and low rocks at the side with *Lejeunea patens*, *Conocephalum conicum*, *Fissidens taxifolius*, *Rhizomnium punctatum*, *Sciurohypnum plumosum*, *Lejeunea cavifolia* and a few patches of *Radula voluta*. *Plagiochila exigua* and *Harpalejeunea molleri* are frequent on ash and *Plagiochila punctata* and *Leptoscyphus cuneifolius* locally abundant on birch.

17) NM9557.1443. Patches of *Radula voluta* occur on low rocks at tree roots from here right up to the outflow from Loch Avich.

18) NM9544.1447. Intake option 1 at the outflow from Loch Avich. Rocks in the outflow area have *Fontinalis antipyretica*, *Cinclidotus fontinaloides*, *Thamnobryum alopecurum*, *Calliergonella cuspidata* and are apparently 'eutrophicated' by birds. Rocks in the inundation zone on the south side have frequent patches of *Radula voluta* with *Calliergonella cuspidata*, *Ctenidium molluscum* var *molluscum*, *Rhizomnium punctatum*, *Fissidens taxifolius*, *Pellia epiphylla* and *Dichodontium pellucidum*. On the bank above are *Thuidium tamariscinum*, *Hylocomium splendens*, *Sphagnum girgensohnii*, *Sphagnum squarrosum*, *Ptilium crista-castrensis*, *Sphagnum capillifolium* and on birch *Plagiochila punctata*, *Scapania gracilis*, *Frullania tamarisci*, *Leptoscyphus cuneifolius* and *Isothecium myosuroides* var. *myosuroides*. There is no *Radula voluta* on the north side which has a similar riparian flora to that on the south side plus *Climacium dendroides*, *Plagiomnium undulatum* and *Scapania undulata*. On hazel here are *Frullania tamarisci*, *Frullania dilatata*, *Ulota phyllantha* and *Metzgeria furcata* and birch *Plagiochila punctata* and *Leptoscyphus cuneifolius*. On the bank are *Rhytidiadelphus loreus*, *Thuidium tamariscinum*, *Pleurozium schreberi*, *Plagiochila spinulosa*, *Isothecium myosuroides* var. *myosuroides* and *Hylocomium splendens*.

Pipeline route

19) The initial part of the route lies along the N bank of the river which is steep and has trees. On oaks are *Plagiochila punctata*, *Plagiochila spinulosa*, *Isothecium myosuroides* var. *myosuroides*, *Frullania tamarisci* and on hazel *Metzgeria consanguinea*, *Lejeunea patens*, *Frullania tamarisci* and *Frullania dilatata*. On the bank are *Rhytidiadelphus loreus*, *Thuidium tamariscinum*, *Pleurozium schreberi*, *Plagiochila spinulosa*, *Isothecium myosuroides* var. *myosuroides*, *Eurhynchium striatum* and *Hylocomium splendens* with *Trichocolea tomentella* in wetter parts.

20) NM9568.1438. A less steep and more open section just below the forest road to the new bridge. No change in the flora on the ground from Note 19 with the addition of *Loeskeobryum brevirostre* and in wetter areas *Sphagnum palustre*, *Sphagnum fallax* and *Sphagnum capillifolium*. *Leptoscyphus cuneifolius* is quite frequent on birch and *Harpalejeunea molleri* occurs on the ash trees.

21) Beyond the new bridge the route follows the forest road with little bryophyte interest; the flora consists mostly of common woodland pleurocarpous species.

22) NM9617.1422. The slope down to the point at which the pipeline route crosses to the south side of the river. *Rhytidiadelphus triquetrus* is common here with *Polytrichum commune*, *Loeskeobryum brevirostre*, *Rhytidiadelphus loreus*, *Calliergonella cuspidata* and *Thuidium tamariscinum*. Epiphytes include *Plagiochila punctata* and *Leptoscyphus cuneifolius* on birch and *Harpalejeunea molleri*, *Aphanolejeunea microscopica* and *Zygodon conoideus* on ash and hazel. For the river crossing see Note 12. The bank on the S side has *Thuidium tamariscinum*, *Calliergonella cuspidata*, *Trichocolea tomentella*, *Rhytidiadelphus triquetrus*, *Plagiochila asplenioides*, *Loeskeobryum brevirostre*, *Plagiomnium undulatum* and *Brachythecium rivulare*.

23) Below this the route runs through similar woodland and then into conifers with abundant *Thuidium tamariscinum* and some *Polytrichum commune* and *Rhytidiadelphus triquetrus*; *Plagiochila punctata* and *Scapania gracilis* on trees, including conifers and some rocks have *Plagiochila spinulosa*. In the conifers *Thuidium tamariscinum* becomes dominant with some *Polytrichum commune* and *Dicranum majus* and some of the trees have both *Plagiochila punctata* and *Leptoscyphus cuneifolius*.

24) NM9635.1414. Slopes above the footbridge. In the conifers are *Thuidium tamariscinum*, *Sphagnum girgensohnii*, *Plagiochila asplenioides*, *Cirriphyllum piliferum*, *Hookeria lucens* and *Calliergonella cuspidata* and *Plagiochila punctata* and *Scapania gracilis* on the trees. From this point the pipeline follows the path with limited bryophyte interest except for the epiphytes with *Leptoscyphus cuneifolius* still frequent on birches.

25) NM9653.1404. The section the pipeline from Intake option 2 to the main pipeline. The wet woodland floor has the wet banks have *Thuidium tamariscinum*, *Calliergonella cuspidata*, *Rhytidiadelphus triquetrus*, *Plagiochila asplenioides*, *Loeskeobryum brevirostre*, *Plagiomnium undulatum* and *Brachythecium rivulare*. The ash trees have a good epiphytic flora with *Plagiochila exigua*, *Plagiochila punctata*, *Harpalejeunea molleri* and *Zygodon conoideus* and *Plagiochila spinulosa*, *Plagiochila punctata* on oak alder and birch. The two pipeline options then merge to follow the existing path which also follows the old pipeline route.

26) NM9670.1390. The route runs through conifers and then out onto steep slopes with oaks, following the old pipeline route. Mostly common woodland floor species as above with good patches of *Sphagnum quinquefarium* and some *Anastrepta orcadensis*. *Plagiochila spinulosa* is locally abundant on the oaks and *Leptoscyphus cuneifolius* occurs on the birches. There is little change in this flora to the powerhouse site.

27) NM9684.1395. Powerhouse area. There area has been clear-felled in the past so there is some old brash and stumps and an old powerhouse (?) building. There are just common woodland floor species here including *Hylocomium splendens*, *Rhytidiadelphus loreus*, *Thuidium tamariscinum*, *Dicranum scoparium*, *Sphagnum capillifolium*, *Calliergonella cuspidata* and *Plagiochila spinulosa* on old stumps. On the trees are *Isothecium myosuroides* var. *myosuroides*, *Scapania gracilis*, *Plagiochila punctata*, *Plagiochila spinulosa*, *Frullania tamarisci*, *Harpalejeunea molleri*, *Neckera crispa* and *Ulota phyllantha*.

**Annex 2: River Avich Hydro Scheme
Bryophyte species list**

Mosses (79 taxa)

Amphidium mougeotii
Anoetangium aestivum
Atrichum undulatum
Bartramia ithyphylla
Blindia acuta
Brachythecium rivulare
Breutelia chrysocoma
Bryum capillare
Bryum pseudotriquetrum
Calliergonella cuspidata
Campylopus flexuosus
Cirriphyllum piliferum
Climacium dendroides
Cratoneuron filicinum
Ctenidium molluscum var. molluscum
Dichodontium flavescens
Dichodontium pellucidum
Dicranella heteromalla
Dicranodontium denudatum
Dicranum majus
Dicranum scoparium
Encalypta streptocarpa
Eurhynchium striatum
Fissidens adianthoides
Fissidens dubius
Fissidens taxifolius
Fontinalis antipyretica
Homalothecium sericeum
Hookeria lucens
Hygrohypnum eugyrium
Hygrohypnum ochraceum
Hylocomiastrum umbratum
Hylocomium splendens
Hyocomium armoricum
Hypnum andoi
Hypnum cupressiforme var. cupressiforme
Hypnum jutlandicum
Isothecium alopecuroides
Isothecium myosuroides var. myosuroides
Kindbergia praelonga
Loeskeobryum brevirostre
Mnium hornum
Neckera crispa
Oxyrrhynchium hians
Palustriella commutata s.str.
Plagiomnium undulatum
Plagiothecium undulatum
Platyhypnidium riparioides
Pleurozium schreberi
Pohlia wahlenbergii
Polytrichastrum formosum
Polytrichum commune
Polytrichum juniperinum
Pseudoscleropodium purum
Pseudotaxiphyllum elegans

Ptilium crista-castrensis
Racomitrium aciculare
Racomitrium aquaticum
Racomitrium fasciculare
Racomitrium lanuginosum
Rhizomnium punctatum
Rhytidiadelphus loreus
Rhytidiadelphus squarrosus
Rhytidiadelphus triquetrus
Sciuro-hypnum plumosum
Sphagnum capillifolium s.l.
Sphagnum fallax
Sphagnum girgensohnii
Sphagnum palustre
Sphagnum quinquefarium
Sphagnum squarrosum
Tetraphis pellucida
Thamnobryum alopecurum
Thuidium tamariscinum
Tortella tortuosa
Trichostomum tenuirostre
Ulota bruchii
Ulota phyllantha
Zygodon conoideus

Liverworts (50 taxa)

Anastrepta orcadensis
Aneura pinguis
Aphanolejeunea microscopica
Bazzania trilobata
Calypogeia muelleriana
Cephalozia bicuspidata
Chiloscyphus polyanthos s.l.
Colura calyptrifolia
Conocephalum conicum
Conocephalum salebrosum
Diplophyllum albicans
Drepanolejeunea hamatifolia
Frullania dilatata
Frullania fragilifolia
Frullania tamarisci
Harpalejeunea molleri
Jungermannia atrovirens
Leiocolea bantriensis
Leiocolea collaris
Lejeunea cavifolia
Lejeunea patens
Lepidozia reptans
Leptoscyphus cuneifolius
Lophocolea bidentata
Lophozia ventricosa
Metzgeria conjugata
Metzgeria consanguinea
Metzgeria furcata
Metzgeria leptoneura
Microlejeunea ulicina

River Avich hydro scheme - bryophyte survey

Mylia taylorii
Nardia scalaris
Nowellia curvifolia
Odontoschisma denudatum
Pellia endiviifolia
Pellia epiphylla
Plagiochila asplenioides
Plagiochila bifaria
Plagiochila exigua
Plagiochila porelloides
Plagiochila punctata
Plagiochila spinulosa
Radula complanata
Radula voluta
Riccardia palmata
Saccogyna viticulosa
Scapania gracilis
Scapania undulata
Trichocolea tomentella
Tritomaria quinquedentata

Technical Appendix E

Protected Species and Fish Habitat Survey

Dalavich Hydro-power Scheme Protected Species and Fish Habitat Survey



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Dalavich Hydro-power Scheme Protected Species and Fish Habitat Survey

Table of Contents

| | | |
|-----------|---|-----------|
| 1. | Introduction..... | 1 |
| 1.1 | Remit | 1 |
| 1.2 | Site Description | 1 |
| 1.3 | Proposed Development | 1 |
| 2. | Methodology | 2 |
| 2.1 | Desk Study | 2 |
| 2.2 | Protected Species Survey | 2 |
| 2.3 | Fish Habitat Survey | 6 |
| 2.4 | Constraints..... | 7 |
| 3. | Results | 8 |
| 3.1 | Desk Study | 8 |
| 3.2 | Protected Species Survey | 9 |
| 3.3 | Fish Habitat Survey | 14 |
| 4. | Conclusions and Recommendations..... | 19 |
| 4.1 | Further Survey | 19 |
| 4.2 | Species Licensing..... | 19 |

Appendices

- Appendix A – Site Location Plan
- Appendix B – Protected Species Legislation Summary
- Appendix C – Site Photographs
- Appendix D – Protected Species and Fish Habitat Survey Map

List of Tables

- Table 1: Suitable Bat Roosting Features in Buildings and Trees
- Table 2: Fish Habitat Classification for Walk-over Surveys
- Table 3: Desk Study Results
- Table 4: Freshwater Pearl Mussel Potential Survey Results
- Table 5: Fish Habitat Survey Results

1. INTRODUCTION

1.1 Remit

EnviroCentre Ltd has been commissioned by Gregor Cameron Consultancy Ltd, on behalf of Dalavich Improvement Group, to provide support with respect to the proposed development of a run-of-river hydro-power scheme on the River Avich, Argyll.

The aim of the survey was to assess the potential of the river's habitats to support protected faunal species. This included a search for suitable habitat and signs of:

- Otter (*Lutra lutra*);
- Bats (various species);
- Red squirrel (*Sciurus vulgaris*);
- Badger (*Meles meles*);
- Pine marten (*Martes martes*);
- Wildcat (*Felis silvestris*);
- Freshwater pearl mussel (*Margaritifera margaritifera*); and
- Likely migratory fish species (i.e. Atlantic salmon (*Salmo salar*), Sea trout (*Salmo trutta*), European eel (*Anguilla anguilla*), and also the potential for the presence of Lamprey species).

This report sets out the rationale for the survey, the methods employed, the results and an analysis of the findings. Recommendations for further survey and any licensing requirements are provided.

1.2 Site Description

The village of Dalavich is situated to the west of Loch Awe in Argyll & Bute, and the River Avich is situated around 500m to the north. The river drains from Loch Avich and flows eastwards for around 2.3km into Loch Awe, with a total drop in elevation of approximately 60m. The dominant land use in the area is coniferous plantation, although there is a narrow corridor of broadleaved woodland along much of the length of the River Avich.

The River Avich is deeply incised at points with significant waterfalls along its length which would pose barriers to upstream fish migration. The first significant waterfall is located approximately 1km upstream from the watercourse's outfall to Loch Awe is approximately 10m in height. River morphology is assessed to be of SEPA River Type A (bedrock, cascade) with solid exposed rock on the channel and banks.

A site location plan is provided in Appendix A.

1.3 Proposed Development

Full details of the proposed development are provided in Envirocentre document number 5385: *Dalavich Community Hydro- Hydrology Report*. The proposed intake is located at the former intake of a disused hydropower scheme, approximately half way down the River Avich. The proposed scheme would also share an outfall location with the former scheme.

2. METHODOLOGY

All survey work was undertaken and verified by experienced and competent ecologists, who are members of the Chartered Institute of Ecology and Environmental Management (CIEEM). The survey followed the standard method and guidelines endorsed by Scottish Natural Heritage (SNH) and CIEEM¹. This section provides a summary of the methods adopted during this project.

2.1 Desk Study

In order to anticipate the potential ecological sensitivities at the site, a desk study was conducted in advance of the survey. This desk study included a review of:

- Information provided by Glasgow Museums and Resource Centre (GMRC)² who currently hold records for the Argyll and Bute area (up to 2km from the site);
- Existing data on protected sites available through SNH's Sitelink website³ (up to 5km from the site);
- Argyll Local Development Plan (ALDP)⁴ (for non-statutory designated sites);
- Records of Ancient Woodlands available through Sketchmap⁵;
- Existing recent species data available through the National Biodiversity Network (NBN) Gateway website⁶ (up to 5km from the site);
- Consultation with SNH regarding locations of any known freshwater pearl mussel populations⁷
- Argyll and Bute Biodiversity Action Plan (ABBAP)⁸; and the
- UK Biodiversity Action Plan⁹.

2.2 Protected Species Survey

The protected species survey was undertaken on 21st August 2013 when conditions were still and mild (13°C) with occasional light rain and 100% cloud cover. The survey aimed to identify suitable habitat for protected species and, where possible, search for evidence of those species. Based on the outcomes of the desk study, searches for suitable habitat and direct evidence of the species listed in section 1.1 were undertaken.

A summary of protected species legislation is provided in Appendix B.

2.2.1 Otter

The otter survey extended along the banks of the River Avich within the site, plus 200m up and downstream from the intake and powerhouse locations, where access allowed. The survey followed best practice guidelines¹⁰. A search was made for suitable habitat along with field signs, including:

¹ CIEEM (2006) Guidance on Survey Methodology, Winchester.

² The GMRC website. Available at <http://www.glasgowlife.org.uk/museums/our-museums/glasgow-museum-resource-centre/Pages/default.aspx>

³ SNH Sitelink website. Available at <http://gateway.snh.gov.uk/sitelink/searchmap.jsp>

⁴ Local plan maps available at <http://www.argyll-bute.gov.uk/planning-and-environment/local-plan> (accessed 21/02/2013)

⁵ Sketchmap using Ancient Woodland layer. Available at <http://sketchmap.co.uk/>

⁶ NBN Gateway website. Available at <http://data.nbn.org.uk/> (search square NM91)

⁷ SNH local office contacted 22.01.2013

⁸ Argyll and Bute Biodiversity Action Plan available at <http://www.argyll-bute.gov.uk/sites/default/files/planning-and-environment/AandB%20BAP%20Draft.pdf> (accessed 21/01/2013)

⁹ UK Biodiversity Action Plan. Available at: <http://jncc.defra.gov.uk/page-5155>

¹⁰ Chanin, P (2003). Natura Life Series, Monitoring the European Otter. Natural England.

- Spraints (otter faeces/droppings used as territorial signposts. Often located in prominent positions and can be placed on deliberate piles of soil or sand);
- Footprints;
- Feeding remains (can often be a useful indication of otter presence);
- Paths/slides (otter can often leave a distinctive path from and into the watercourse);
- Holts: holts (underground shelters) are generally found:
 - Within trees roots at the edge of the bank of a river;
 - Within hollowed out trees;
 - In naturally formed holes in the river banks that can be easily extended;
 - Or preferably in ready-made holes created by other large mammals or humans such as badger setts, rabbit burrows or outlet pipes; and
- Couches/lay-ups (couches or lay-ups are places for lying up above ground are usually located near a watercourse, between rocks or boulders, under dense vegetation).

2.2.2 Bat Roost Potential Survey (BRP)

The BRP is designed to identify those structures and features present within a site that may provide suitable habitat for roosting bats and that may therefore require further survey work. Bats utilise a variety of roosts throughout the year, depending on their seasonal needs (e.g. breeding or hibernating etc.) and on the prevalent climatic conditions.

The BRP survey was conducted in accordance with the assessment criteria set out by the Bat Conservation Trust¹¹.

The survey consisted of visual inspections of external features of the trees in the survey area (there were no buildings within the survey area).

In general, it is accepted that mature, broad-leaved trees are preferred by bats, particularly oak (*Quercus* spp.) and beech (*Fagus sylvatica*). It is also known that for trees to be used by bats, they must be part of a wider habitat network that allows protected foraging, commuting and dispersal. The indicators used to assess the suitability of buildings and trees for roosts are provided in Table 1.

Table 1: Suitable Bat Roosting Features in Buildings and Trees

| Features of buildings used as bat roosts | Features of trees used as roosts | Signs indicating possible use by bats |
|---|----------------------------------|--|
| Gaps/cracks in wood barge boards, soffits and fascia boards | Cavities/loose bark | Tiny scratches around entry point |
| Gaps in end tiles, ridge tiles and eaves | Woodpecker holes | Staining around entry point |
| Gaps in lead flashing and roofing felt | Cracks/splits in major limbs | Bat droppings in/around/below entrance |
| Cavities in masonry | Behind thick ivy growth | Audible squeaking at dusk or during warm weather |
| Broken or hanging tiles | Within dense epicormic growth | Flies around entry point |
| Ventilation ducts, damaged drainage, overflow pipes | Existing bird and bat boxes | Smoothing of surfaces around cavity |

In addition, trees are categorised from 1-3 as follows:

¹¹ BatConservation Trust (2012). Bat Surveys – Good Practice Guidelines (Second Edition). Bat Conservation Trust, London.

- Category 1*: Trees with multiple, highly suitable features capable of supporting larger roosts.
- Category 1: Trees with definite bat potential, supporting fewer features than category 1* trees or with potential for use by single bats.
- Category 2: Trees with no obvious potential, although the tree is of a size and age that elevated surveys may result in cracks or crevices being found; or the tree supports some features which may have limited potential to support bats.
- Category 3: Trees with no potential to support bats.

2.2.3 Red Squirrel

The survey followed best practice guidance¹², which involves a search of suitable habitat (primarily coniferous woodland) for two distinct signs of squirrel activity. It should be noted that neither of these methods accurately distinguishes between red or grey squirrels (*Sciurus carolinensis*).

- Drey count – dreys are the nests made by both species of squirrel in trees. Dreys are distinguishable from birds' nests as they are normally 50cm in diameter and 30cm deep, comprise a ball shape and are usually densely constructed. The dreys are normally located close to the main stem of the tree at a height of 3m or more; and
- Feeding transects – where cone producing trees (conifers) are evident, a 50m x 1m transect is laid out through the woodland and evidence of squirrel feeding is searched for. Although the two species of squirrel cannot be distinguished from feeding remains, the manner in which squirrels break open seeds and nuts, which are then left on the forest floor, is diagnostic.

2.2.4 Badger

2.2.4.1 Habitat Suitability

The area was searched in its entirety to identify any potential habitat suitable for sheltering, foraging and commuting badgers.

Badgers require suitable ground conditions for sett creation (e.g. soil that is free draining and can easily be excavated). Continuous, well-connected, linear vegetation, such as tree lines and hedgerows, provide good foraging for their main food source earthworms, sheltering and commuting habitats for badgers and native berry producing trees and shrub species, offer a seasonal food resource.

2.2.4.2 Sett Survey

A badger sett is any structure or place that displays signs indicating current use by badger/located within an active badger territory. Setts comprise a series of underground tunnels and chambers, which form the home of a badger social group (clan). Although normally recorded in sloping, sandy soil in woodland habitats, it should be noted that badgers will excavate setts in a wide range of environments, including urban settings.

¹² Gurnell J, et al (2001). Forestry Commission Practice Note 11. Forestry Commission, Edinburgh. Available at: [http://www.forestry.gov.uk/pdf/fcpn011.pdf/\\$FILE/fcpn011.pdf](http://www.forestry.gov.uk/pdf/fcpn011.pdf/$FILE/fcpn011.pdf)

Setts can be located anywhere within the territory of the clan and more than one sett can often be in use. Within one territory, badgers may maintain a main sett with several annexe or satellite setts. Setts are identified by a number of characteristic features. These features include:

- A network of broad, concave entrances;
- Well-worn paths between entrances and foraging areas;
- Piles of excavated soil beside entrances (spoil heaps); and
- Piles of bedding materials beside entrances.

Diagnostic footprints and hair found around a sett can often confirm the presence of badgers and provide evidence of recent use. Fresh soil on spoil heaps can indicate recent use.

2.2.4.3 Field Signs

Badger field signs not only provide evidence of the species, but also give an indication of badger movements and how they utilise their territory. The following field signs were searched for:

- Guard hair;
- Footprints;
- Snuffling (badgers use their snout to turn over vegetation or soft soil to forage for bulbs and invertebrates);
- Scratching posts (marks on tree trunks/ fallen trees where badgers have left claw marks);
- Breach points (gaps in fences or crossing points over roads);
- Dung pit (single faeces deposit placed in a small excavation); and
- Latrines (collection of faecal deposits often used by badger clans to mark home range boundaries).

2.2.5 Pine Marten

The pine marten survey was conducted according to standard guidance¹³. A walkover survey was completed that searched for scats (e.g. on prominent features such as tree stumps, dead logs or stones), footprints and potential den sites.

An assessment of the habitat was also undertaken to identify likely prey resources, which include small mammals, birds and invertebrates, and potential resting sites and commuting opportunities.

2.2.6 Wildcat

A walkover survey was completed according to the standard wildcat survey guidance¹⁴ that searched for scats (e.g. on prominent features such as tree stumps, dead logs or stones) claw marks, paw prints and potential den sites (e.g. hollow trees, rock crevices, rabbit burrows, disused badger setts, under fallen debris or in old fox earths).

An assessment of the habitat was also undertaken to identify likely prey resources, which include small mammals and birds, potential resting sites and commuting resources.

¹³ NRA Survey Techniques for Pine Marten, Available at: <http://www.nra.ie/Publications/DownloadableDocumentation/Environment/file.16169,en.pdf>

¹⁴ FCS Guidance Note 35d: Forest operations and wildcats in Scotland. Available at: [http://www.forestry.gov.uk/pdf/EPWildcat.pdf/\\$FILE/EPWildcat.pdf](http://www.forestry.gov.uk/pdf/EPWildcat.pdf/$FILE/EPWildcat.pdf)

2.2.7 Freshwater Pearl Mussel Potential

The survey followed the protocols and methods outlined in the standard guidance for use in site specific projects¹⁵.

The survey design comprised the following treatment for the affected watercourses:

- A general visual assessment (from the bankside and by walking through shallow waters) of the substrate types over a distance comprising 100m upstream to 500m downstream, encompassing meanders, of proposed crossing point locations. Polarised glasses were used to reduce surface water glare.
- In order to assess the likelihood of mussels occurring in each unit, a visual evaluation of substrate characteristics was undertaken using the Wentworth scale¹⁶ for estimating percentage cover by eye of the following sediments:
 - B – Bedrock (solid)
 - Br – Boulder (>256mm)
 - C - Cobbles (64 -256mm)
 - P – Pebbles (4 – 64mm)
 - G – Gravel (2 – 4mm)
 - CS - Course sand (0.5 – 4mm)
 - FS – Fine sand (<0.5mm)
 - S – Silt (tiny)
- Substrate characterisation and a photographic record were made at the beginning and end of every survey reach; and at the intake and outflow locations.
- Any further information regarding key river features was noted along the survey reach including: adjacent land use and bankside vegetation, the presence of in-channel vegetation or algal growth, watercourse dimensions (approximate width and depth) and flow description, with any notes regarding the presence of runs, riffles, glides and pools, should they help describe the stream bed features.
- When favourable habitat was discovered a 50m transect along the length of the river was surveyed. A systematic in-stream search was undertaken along the transect using a glass-bottomed bucket to further reduce the glare of surface water. All parts of the watercourse were searched, the surveyor working in an upstream direction and moving any in-channel vegetation that would limit a view of the substrate.

2.3 Fish Habitat Survey

As a result of initial observations and with reference to the Scottish Fisheries Co-ordination Centre (SFCC) Habitat Surveys Training Course Manual¹⁷, a general walk-over survey was considered the most appropriate method to employ. Following the general principles of the Hendry & Cragg-Hine walk-over method¹⁸, the riverbank of the selected survey stretch was walked, entering the river when necessary. This method aims to collect both general and detailed information on the current status of the in-stream and bankside habitats and allows for as much ground to be covered in the least time.

A summary of the habitat type classification system used is given Table 2.1 below.

¹⁵ SNH publication 'Freshwater Pearl Mussel Survey Protocol for use in site-specific projects' (undated) available at: <http://www.snh.gov.uk/docs/A372955.pdf>

¹⁶ Wentworth CK (1922) A scale grade and class terms for clastic sediments. *Journal of Ecology* 30, 377-392.

¹⁷ SFCC Habitat Surveys Training Course Manual. Available at <http://www.scotland.gov.uk/Resource/Doc/295194/0096727.pdf>

¹⁸ Hendry, K. and Cragg-Hine, D. Restoration of Riverine Salmon Habitats: A Guidance Manual. *Environment Agency, Bristol*. (1997)

Table 2: Fish Habitat Classification for Walk-over Surveys¹⁹

| Habitat Type | Classification |
|--|--|
| Spawning habitat and silted spawning habitat | Stable gravel up to 30cm deep that is not compacted or contains excessive silt. Substrate size with a diameter of 1.3 to 10.2cm. |
| Fry (0+) habitat | Shallow (<20cm) and fast flowing water indicative of riffles and runs with a substrate dominated by gravel and cobbles. |
| Parr (1+) habitat | Riffle-run habitat that is generally faster and deeper than fry habitat (20-40cm). Substrate consists of boulder, cobbles and gravels. |
| Glides | Smooth laminar flow with little surface turbulence and generally greater than 30cm deep. |
| Pools | No perceptible flow and usually greater than 100m deep. Substrate with a high proportion of sand and silt. |
| Bankside/tunnel vegetation | Riparian vegetation ideally providing a mixture of open and closed canopy throughout the reach. Tunnel vegetation forms a complete closed canopy for extensive lengths (e.g. >200m). |
| Macrophyte beds | Submerged and emergent macrophytes providing localised hydraulic diversity. |
| Flow constrictions | Physical features providing a narrowing of the channel resulting in increased velocity and depth. |
| Obstructions to migration | Impassable falls, weirs, bridge sills etc. shallow braided river sections preventing upstream migration during low flows. |

Boundaries of different habitat features and types are assessed and recorded on a map. Positions of prominent or fixed features (such as bridges, pylons or trees) are recorded via GPS to provide accurate locations within the survey stretch.

A good representation of habitat types and features can be recorded as a mosaic of areas and/or points along the whole of the surveyed section(s). Other details, such as bank, riparian and substrate structure, are recorded along with photographs of individual stretches or specific features.

2.4 Constraints

The protected species and fish habitat surveys were undertaken within the appropriate season and under optimal conditions.

Several sections of the river run through gorges, some of which were difficult to access safely. Where access was not possible, the channel was viewed from above.

There were no further constraints to the protected species or fish habitat surveys.

3. RESULTS

3.1 Desk Study

The results of the desk study are provided in Table 3 below.

Table 3: Desk study results

| Source | Information Provided | | | | |
|-------------------|---|---------------------------|----------------------------------|---|--|
| GMRC | Species recorded | | Latin name | | Comment |
| | Red squirrel | | <i>Sciurus vulgaris</i> | | |
| SiteLink | Site name | Designation ¹⁹ | Distance and orientation | Features | |
| | Dalavich Oakwood | SSSI | 800m south | Mosaic of upland oak woodland and wet woodland. | |
| Argyll Local Plan | The land on which the site is situated is designated as Sensitive Countryside (south of the River Avich). | | | | |
| Sketchmap | The unnamed woodland in the River Avich riparian corridor is categorized as ancient woodland of semi-natural origin. Extends from the south shore of Loch Avich, along the river to the west shore of Loch Awe. | | | | |
| NBN Gateway | Species occurring within the 10km OS grid square: NM91 | | Latin name | | Comment |
| | European eel | | <i>Anguilla anguilla</i> | | Found within 10km of the site (1983-2002). |
| | Arctic charr | | <i>Salvelinus alpinus</i> | | Found within 10km of the site (1983-1997). |
| | Atlantic salmon | | <i>Salmo salar</i> | | Found within 10km of the site (1793-2002). |
| | Brown trout | | <i>Salmo trutta</i> | | Found within 10km of the site (1793-1998). |
| | Wildcat | | <i>Felis silvestris</i> | | Found within 10km of the site (1960-2008) and in the 1km square NM9713 (2008). |
| | Otter | | <i>Lutra lutra</i> | | Found within 10km of the site and at six specific locations, the nearest being 1km north west of the site (1973-1994). |
| | Pine marten | | <i>Martes martes</i> | | Found within 10km of the site (1736- 1959). |
| | Badger | | <i>Meles meles</i> | | Found within 10km of the site (1963-1973). |
| | Common pipistrelle | | <i>Pipistrellus pipistrellus</i> | | Found within 10km of the site and in the 1km square NM9612 (1972-2011). |

¹⁹ Site of Special Scientific Interest (SSSI), Special Area of Conservation (SAC), Special Protection Area (SPA), Local Nature Reserve (LNR), Ramsar wetland designation (RAMSAR).

| Source | Information Provided | | |
|--------|--|-------------------------|--|
| | Red squirrel | <i>Sciurus vulgaris</i> | >40 records within 10km of the site (1990-2010). |
| SNH | There is a record of freshwater pearl mussel in a tributary of the River Liever, approximately 3km south west of the site. | | |
| ABBAP | <p>The following species are listed in the ABBAP and are potentially relevant to the site. Those marked (N) are also listed on the UKBAP:</p> <ul style="list-style-type: none"> • Various birds; • Soprano pipistrelle bat (N); • Brown long-eared bat (N); • Noctule bat (N); • Red squirrel (N); • Otter (N); • Water vole (N); • Wildcat (N); • Great crested newt (N); • Allis shad (N); • Twaite shad (N); • Atlantic salmon (N); • Sea lamprey (N); • River lamprey (N); • Fan mussel; and • Freshwater pearl mussel (N). | | |

3.2 Protected Species Survey

A selection of site photographs is presented in Appendix C.

3.2.1 Otter

One possible otter lay-up was found at NM 96418 14113, approximately 120m upstream from the proposed intake location as shown on the map in Appendix D. No other evidence of otter activity was found during the survey.

Despite the dense overhanging vegetation along the banks of the River Avich, the banks are assessed as being sub-optimal for otter holt creation due to the high percentage of bedrock. As the falls at NM 96733 13930 are assessed as being impassable to fish, the foraging resources for otter greatly reduce upstream from this point.

3.2.2 BRP

The belt of ancient broad-leaved woodland along the banks of the river provides suitable habitat for roosting bats as several of the trees present the features described in Table 1 that may be exploited by bats. Therefore these trees are classified as category 1: trees with definite bat potential, supporting fewer features than category 1* trees or with potential for use by single bats. The areas of conifer plantation beyond the broad-leaved woodland

riparian corridor do not show any of the features that may be exploited by bats and as such are classified as category 3: trees with no potential to support bats.

The River Avich is a linear feature that provides connectivity between a range of habitats and may be used by commuting and foraging bats.

3.2.3 Red Squirrel

Suitable habitat for red squirrel is present in the conifer plantation woodland on both sides of the River Avich. No dreys were seen during the survey and no feeding evidence was found during the 50m x 1m feeding transect, which was undertaken adjacent to the route of the proposed pipeline.

3.2.4 Badger

No badger setts or other evidence of badger activity was found during the survey.

The habitats found on site including broad-leaved woodland provide optimal habitat for foraging and commuting badgers. However, the woodland floor is extremely wet and water-logged, reducing its suitability for badger sett creation.

3.2.5 Pine Marten and Wildcat

No resting sites or any other field signs were found for pine marten or wildcat.

The heavily wooded character of the site provides optimal habitat for commuting pine marten and will support foraging resources such as small mammals, invertebrates, nuts and amphibians.

3.2.6 Freshwater Pearl Mussel Potential

No freshwater pearl mussel presence was identified in the river - either live animals or shells. The substrate was generally characterised as unsuitable, although partially suitable fragmented habitat was noted in some survey reaches.

The results of the survey are provided in Table 4 below whilst the survey reaches (numbered 1-4) are shown on the map in Appendix D.

Table 4: Freshwater Pearl Mussel Potential Survey Results

| Survey reach | | Grid ref NM | Bedrock | Boulder | Cobble | Pebble | Gravel | Coarse sand | Fine sand | Silt | Width (m) | Depth (m) | Flow | Observations | FWPM Suitability | FWPM presence |
|--------------|--------|--|---------|---------|--------|--------|--------|-------------|-----------|------|-----------|-----------|----------|-----------------------|------------------|---------------|
| 1 | Start | 96520.14036 | - | - | 60 | 30 | 10 | - | - | - | 15 | 0.8 | Moderate | Oak riparian woodland | Partial | N |
| | Finish | 96402.14139 | | | | | | | | | | | | | | |
| | |  | | | | | | | | | | | | | | |
| 4 | Start | 96637.14014 | 40 | - | 20 | 35 | 5 | - | - | - | 8 | 0.6 | Fast | Oak riparian woodland | Partial | N |
| | Finish | 96610.14039 | | | | | | | | | | | | | | |



| | | | | | | | | | | | | | | | | |
|---|-----------------------------|-------------|----|----|----|----|---|---|---|---|----|-----|------------|-----------------------|------------|---|
| 3 | Upstream of outflow housing | | 40 | 20 | 30 | 10 | - | - | - | - | 15 | 0.7 | Torrential | Oak riparian woodland | Unsuitable | N |
| | Start | 96825.13949 | | | | | | | | | | | | | | |
| | Finish | 96793.13933 | | | | | | | | | | | | | | |



| | | | | | | | | | | | | | | | | |
|---|-------------------------------|-------------|---|----|----|----|----|---|---|---|----|-----|------|--|---------|---|
| 4 | Downstream of outflow housing | | | | | | | | | | | | | | | |
| | Start | 96825.13949 | - | 10 | 35 | 40 | 15 | - | - | - | 17 | 0.7 | Fast | Oak riparian woodland. Trout fry observed. | Partial | N |
| | Finish | 96989.13997 | | | | | | | | | | | | | | |
|  | | | | | | | | | | | | | | | | |

3.3 Fish Habitat Survey

The studied section of the river commenced at the footbridge that crosses the River Avich at NM 96369 14130, approximately 190m upstream of the intake point, to NM 96859 13976, 50m downstream from the outflow of the proposed scheme. The habitats identified during the survey show a variety of substrate compositions and flow rates.

The falls located at NM 96733 13930 are assessed as being impassable to migratory fish species. A small number of trout fry were observed downstream of the outflow point, below the impassable falls.

The full results of the fish habitat survey are presented in Table 5 below whilst the survey points (labelled A-F) are shown on the map in Appendix D.

Table 5: Fish habitat survey

| Survey point and Grid ref (NM) | Bedrock | Boulder | Cobble | Pebble | Gravel | Coarse sand | Fine sand | Silt | Width (m) | Depth (m) | Flow | Observations |
|--|--|---------|--------|--------|--------|-------------|-----------|------|-----------|-----------|----------|--|
| A 96369.14130 | 90 | 10 | - | - | - | - | - | - | 4 | 0.7 | Fast | Narrowing of channel has resulted in increased velocity and depth at this point. No habitat for spawning, fry or parr. No fish observed. |
| |  | | | | | | | | | | | |
| B 96462.14073 50m upstream of intake | - | - | 70 | 25 | 5 | - | - | - | 20 | 0.3 | Moderate | Fry habitat consisting of shallow and fast flowing water with substrate dominated by cobbles. No fish observed. |

| | | | | | | | | | | | | |
|---|---|---|--|---|---|---|---|---|----|---|------------|--|
| |  | |  | | | | | | | | | |
| <p>C 96529.14034 Intake point</p> | 100 | - | - | - | - | - | - | - | 10 | * | Torrential | Narrowing of channel has resulted in increased velocity and depth at this point. No habitat for spawning, fry or parr. No fish observed. |
| |  | |  | | | | | | | | | |
| <p>D 96733.13930</p> | 100 | - | - | - | - | - | - | - | 4 | * | Torrential | Impassable falls (approx. 10m high) preventing upstream migration. |

| | | | | | | | | | | | | |
|--|---|----|--|----|----|---|---|---|----|-----|------|--|
| |  | |  | | | | | | | | | |
| | - | 10 | 35 | 40 | 15 | - | - | - | 17 | 0.7 | Fast | Riffle-run habitat providing parr habitat which is generally faster and deeper than fry habitat. No fish observed. |
| <p>E 96817.13937 Location of outflow</p> |  | |  | | | | | | | | | |
| <p>F 96859.13976 50m downstream from outflow</p> | - | 20 | 70 | 5 | 5 | - | - | - | 10 | 1 | Fast | Riffle-run habitat providing parr habitat which is generally faster and deeper than fry habitat. Trout fry observed. |



* Depth of flow not assessed due to access restrictions

4. CONCLUSIONS AND RECOMMENDATIONS

4.1 Further Survey

Due to the presence of suitable habitat for otter along the River Avich, and the occurrence of a possible otter lay-up, it is recommended that a pre-construction survey for otter activity is undertaken.

The broad-leaved trees in the immediate vicinity of the potential scheme pipeline route and powerhouse location are assessed as having potential to support roosting bats. If any of these trees are to be removed during construction of the scheme, then further survey would be required to identify any roosting activity prior to works commencing.

Although no evidence of red squirrel or pine marten was found during the survey, the conifer plantation provides optimal habitat for these species. If any of the conifer trees are to be removed during construction of the scheme, then further survey would be required to identify any resting sites prior to works commencing.

In summary, it is recommended that a pre-construction tree survey, conducted by experienced and licensed tree climbers, should be undertaken to check for evidence of bat roosts, red squirrel dreys and pine marten dens.

No setts or any other evidence of badger activity was found during the survey. No further survey for badger is considered necessary.

No den sites or any other evidence of wildcat activity was found during the survey. No further survey for wildcat is considered necessary.

A variety of fish habitat classifications were made for the surveyed area of the River Avich. The falls located at NM 96733 13930 are assessed as being impassable to migratory fish species. Therefore, the proposed intake point is inaccessible to fish populations. A small number of trout fry were observed downstream of the outflow point, below the impassable falls. No further survey for fish is considered necessary.

No evidence of freshwater pearl mussels was found during the survey, although some areas of suitable substrates were noted. No further survey for freshwater pearl mussels is required.

4.2 Species Licensing

No European or national protected species licences are considered necessary for the planned construction works. Should a protected species be discovered on site the licensing position may need to be reviewed.

Appendix A

Site Location Plan

Appendix B

Protected Species Legislation Summary

European Protected Species (Wildcat, Bats and Otter)

A European Protected Species (EPS) is a species listed in the EC Directive (92/43) The Conservation of Natural Habitats and of Wild Flora and Fauna (the "Habitats Directive"), which is transposed into UK law through the Conservation (Natural Habitats &c.) Regulations 1994 (the "Habitat Regulations") as amended by The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007. Under this legislation an EPS (e.g. otter and all bat species) are protected from:

- (a) Deliberate or reckless capture, injuring or killing;
- (b) deliberate or reckless
 - (i) harassment of an animal or group of animals;
 - (ii) disturbance of such an animal while it is occupying a structure or place which it uses for shelter or protection;
 - (iii) disturbance of such an animal while it is rearing or otherwise caring for its young;
 - (iv) obstructing access to a breeding site or resting place of such an animal, or otherwise denying the animal use of the breeding site or resting place;
 - (v) disturbance of such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs; or
 - (vi) disturbing such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young;
- (c) deliberate or reckless taking or destroying the eggs of such an animal; or,
- (d) damaging or destroying a breeding site or resting place of such an animal.
- (e) any person:
 - (i) possessing or controlling;
 - (ii) transporting;
 - (iii) selling or exchanging; or
 - (iv) offering for sale or exchange,

any live or dead animal or part of an animal or anything derived from such an animal which has been taken from the wild and which is of a species or subspecies listed in Annex IV(a) to the Habitats Directive – unless the animal from which the part or the thing in question is derived, was lawfully taken from the wild (i.e. taken from the wild in the European Union without contravention of appropriate domestic legislation and before the implementation date of the Habitats Directive (in that Country e.g. 1994 in UK) or if it was taken from elsewhere).

European Protected Species Licensing

For a licence to be issued these three tests must be satisfied:

1. That the development is 'in the interests of public health and public safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment';
2. That there is 'no satisfactory alternative'; and
3. That the derogation (i.e. any permission/licence granted) is 'not detrimental to the maintenance of the populations of the species concerned at a favourable conservation status in their natural range'.

To obtain a licence a Method Statement is required that identifies the activities to be undertaken, the location of all resting sites (e.g. bat roosts), the potential effects and details of the proposed mitigation.

Badger

Under the Protection of Badgers Act (1992), as amended by the Nature Conservation (Scotland) Act 2004, it is an offence to:

- Kill, injure or take a badger;
- Have in possession a dead badger or any part of a badger;
- Cruelly ill treat a badger; and
- Damage, destroy, interfere or obstruct a badger sett or disturb a badger whilst it is occupying a sett.

Where an offence is committed the individual (as well as the body corporate, Scottish partnership or, as the case may be, unincorporated association) is guilty of the offence and is liable to be proceeded against and punished accordingly.

Red Squirrel and Pine Marten

Red squirrels and pine marten are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), as amended by the Nature Conservation (Scotland) Act, 2004.

Subject to certain exceptions, it is now an offence to 'intentionally or recklessly':

- Kill, injure or take (capture) a red squirrel or pine marten;
- Damage, destroy or obstruct access to any structure or place which they use for shelter or protection;
- Disturb a either species while it is occupying a structure or place which it uses for that purpose; or to
- Possess or control, sell, offer for sale or possess or transport for the purpose of sale any live or dead red squirrel or pine marten or any derivative of such an animal.

Knowingly causing or permitting any of the above acts to be carried out is also an offence.

Aquatic Species

The Atlantic salmon, river lamprey, allis and twaite shad, vendace and powan are listed on Schedule 3 of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) which make it an offence to use certain methods to catch or take them in freshwater.

The prohibited means of taking or killing fish are:

- Poison;
- Explosives.

The prohibited modes of transport are:

- Aircraft;
- Moving motor vehicles.

A person guilty of an offence under this regulation is liable on summary conviction to a fine not exceeding level 5 on the standard scale.

Freshwater pearl mussels are fully protected in the UK through Schedule 5 of the Wildlife and Countryside Act 1981 and amendments. It is an offence to intentionally or recklessly:

- Kill, injure or take a wild invertebrate listed on Schedule 5;

- Damage, destroy or obstruct access to any structure or place which such an animal uses for shelter or protection;
- Disturb such an animal when it is occupying a structure or place for that purpose.

It is also an offence to:

- Possess or control, sell, offer for sale or possess or transport for the purpose of sale any live or dead invertebrate listed on Schedule 5 or any derivative of such an animal.

Knowingly causing or permitting any of the above acts to be carried out is also an offence.

Appendix C

Site Photographs



Photograph 1: Conifer plantation south of the River Avich



Photograph 2: Remains of original hydro-scheme intake



Photograph 3: The route of the original pipeline through conifer plantation (shown in red)



Photograph 4: The site of the proposed powerhouse

Appendix D

Protected Species and Fish Habitat Survey Map