

Pant-y-Turnor Hydro Scheme

Ecology Report

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1. SUMMARY

- A micro hydro scheme is proposed for the Nant Ffynnon-wen, close to Llangadog, Carmarthenshire. Consultation had taken place with Natural Resources Wales. Recommendations were made to carry out a protected species survey of the site. This was to cover in particular, the potential presence of otter, dormouse and the moss *Hamatocaulis vernicosus*. Other protected species surveys were to be carried out as appropriate. In line with best practice, an extended Phase I habitat survey was also carried out. In order to pre-empt any requirement for lower plants survey (to address any effects on humidity-demanding species), a bryophyte survey was also carried out. In addition, an appraisal of the site for sensitive lichen species was carried out (i.e. not a full survey but an assessment of the site's potential to support sensitive lichens).
- Phase 1 Habitat survey concentrated primarily on the penstock route and the proposed locations of infrastructure (intakes, powerhouse) (since these were the areas that were most likely to be directly impacted). The narrow band of woodland either side of the Nant Ffynnon-wen (in its lower stretches on the site) was also categorised in terms of its Phase I habitats. Phase I Habitat survey revealed that all of the vegetation communities likely to be impacted were widespread upland communities of mid Wales. In terms of sensitivity, the route and infrastructure avoids all vegetation/habitats of ecological value. It is worth noting however, that more sensitive, species-rich vegetation, is found near the penstock route. The penstock route has been deliberately re-routed to avoid this vegetation.
- The woodland areas are not considered suitable for dormouse. The moss *Hamatocaulis vernicosus* was not recorded and the on-site habitats were considered unsuitable for this species. Survey and assessment for protected species did not reveal any evidence of otter holts or resting places (the intake points and outfall point/powerhouse location were systematically checked for this species). It is considered that the proposed works will have a negligible impact on this species. No trees close to infrastructure locations were considered suitable as bat roosts, however these were all at some distance from infrastructure and will not be impacted. No active badger setts were recorded along any of the proposed penstock route or close to any proposed infrastructure. In addition, there is no suitable habitat for water vole.
- The breeding bird assemblage of the proposed route and infrastructure areas was also taken into consideration during the survey. This was found to be entirely typical for the locality and contained no species protected under Schedule 1 of the Wildlife and Countryside Act.
- A bryophyte survey was carried out which focused particularly on humidity-demanding species, representative of the Section 7 (Environment (Wales) Act 2016) oceanic ravine community. Bryophyte

survey also focused on the potential presence of *Hamatocaulis vernicosus*, a geographically restricted species that is particularly prevalent in this area of Carmarthenshire. The site was also assessed for the presence of 'old forest' lichens and any indicators of important areas for riparian lichens. The lower plants assemblage was found to be relatively poor, with few species of the Section 7 community, no 'old forest' lichens and little potential for significant riparian lichens. In addition, the habitat along the penstock route was unsuitable for *Hamatocaulis vernicosus*. A small, base-rich flush area was present, downstream of the main intake point. This supported a range of bryophytes of relatively restricted distribution, suited to these conditions.

- The overall conclusion of the ecological surveys was that the proposed penstock route, intake point and powerhouse will have very little ecological impact. There will be no significant impact on any protected species or important ecological receptor.
- Formal mitigation and protection measures are outlined for the potential presence of bat roosts. No measures are stipulated for otter, badger, dormouse or water vole, as it is considered that these species are not present (apart from otter which is likely to be sporadically present along this watercourse).

2. INTRODUCTION

2.1. Background and Survey Objectives

A micro hydro scheme is proposed on the Nant Ffynnon-wen, Llangadog, Carmarthenshire.

Chris F. Brown MCIEEM surveyed the site to establish if there were any ecological constraints or likely impacts on, or of, the proposed development.

The survey consisted of the following elements:

- A habitat survey of the route and infrastructure areas to a Phase 1 level;
- A site survey that identified the potential for protected species on the proposed route and infrastructure locations;
- A bryophyte survey of the proposed penstock route and associated with the stream itself (to ascertain the presence and sensitivity of humidity-demanding species as well as *Hamatocaulis vernicosus*);
- A desk study comprising recorded ecological interests within 2km of the proposed development. Information relating to the location of key sites and species of nature conservation interest within the search area

was obtained from Aderyn (LERC Wales' Biodiversity Information and Reporting Database).

- This report, which details the results of the above together with species protection measures and suggestions for ecological enhancement.

2.2. Site Description

The proposed penstock, for its whole route, is close to the Nant Ffynnon-wen. This forms a narrow upland river, with open grassland banks for much of its length (Photo 1, Appendix 3). Further downstream, the banks become more wooded. Much of the wooded bank area appears relatively heavily grazed and supports a flora typical of acid woodland. The penstock route runs through a small variety of habitat/vegetation types. These include semi-improved acid grassland, scattered bracken, acid dry heath (Western gorse) and semi-natural broadleaved woodland. The area immediately adjacent to the two potential intake locations (Photos 2 and 3, Appendix 3) largely consists of damp acid grassland vegetation. The powerhouse location features similar vegetation though is adjacent to semi-natural broadleaved woodland. In its lower reaches, the penstock route runs adjacent to high quality marshy grassland and wet heath. The cable route largely runs through poor semi-improved grassland or improved grassland.

2.3. Proposed Works

The project involves the construction of a new intake weir (across the full width of the watercourse, a building to house the turbine and generator (power house) and a pipe (penstock) buried in a trench from the intake weir to the power house location (Photo 4, Appendix 3). The locations of the two potential intake points are shown in photos 2 and 3 (Appendix 3).

A screen will be used on the intake weir and the screen size (3mm) has been stipulated by Natural Resources Wales to eliminate the risk of fish being drawn into the penstock. Where the water is discharged back into the watercourse, the tailrace pipe will be above the water level preventing fish from entering the turbine even during flood levels.

The trench depth required for the penstock will be a minimum of 900mm to provide at least 500mm of cover over the penstock. In a few locations along the route, due to undulations in the land, deeper trenches will be required up to a maximum of 1,600mm to ensure a gradual fall in the penstock of at least 0.9%. The trench width will be dictated by the bucket on the digger, but will be approximately 600 to 700mm wide. The working width required for the penstock installation, including the temporary pile of spoil, will be about 4,000mm.

2.4. Correspondence with consultees

TGV, working on behalf of the developer, approached Natural Resources Wales (NRW) to discuss any concerns they may have with the proposal in relation to ecology. NRW requested that survey or assessment take place for

the European Protected Species (EPS) otter and dormouse. In addition, they raised the possibility of the moss *Hamatocaulis vernicosus* being present on the site (it is prevalent in this area of Carmarthenshire). Whilst not specifically asked for, in line with best practice, an extended Phase I Habitat survey, with relevant recorder details, was carried out for the proposed development. This included an assessment for protected species. In addition, a desk study was carried out, with biological records for a 2km search area obtained from the Biological Records Centre.

3. METHODOLOGY

3.1. Vegetation Survey and Assessment

The penstock route (including the power house and intake weir sections), was surveyed in terms of its vegetation communities, and these were categorized according to Phase I habitat survey categories. The woodland close to the stream was also surveyed in terms of its vegetation communities. Brief species lists were compiled for these areas. Habitat survey was based on the procedures in JNCC (2010).

The site was surveyed on 25th August 2018. The weather was generally bright, with some overcast periods and a very short period of rain. There was a slight westerly (F. 2/3) breeze. Chris F. Brown, a qualified ecologist, ornithologist and bryologist, carried out the survey. He has carried out many similar surveys previously and is highly familiar with their aims and requirements.

3.2. Protected Species Surveys

Surveys for protected species were undertaken on the same date as the vegetation survey. The presence or potential presence of protected species was noted on a survey field map.

3.1.1. Dormouse

The potential for dormouse *Muscardinus avellanarius* was assessed through habitat appraisal. This included reviewing the site for the following features, considered favourable for dormice (Natural England/Forestry Commission interim guidance, 2007):

- Woods that are connected to other areas of suitable woodland;
- Wide range of broadleaved species and ages present, in patches, scattered throughout, or around the edge;
- Shrub layer present, especially with hazel, honeysuckle or bramble;
- Species-rich scrub on woodland margins, ride sides or in patches;

- Canopy connections across tracks or thick, wide hedgerow connections to other nearby suitable habitat;
- Conifer/broadleaved mixtures or conifer plantations colonised by native broadleaves; and
- Fruiting hazel or sweet chestnut – ideally as managed coppice.

3.1.2. Otter

A standard otter *Lutra lutra* survey was undertaken, following the methodology detailed by Chanin (2003). The stream was searched for signs of otter at suitable locations and in particular at the intake and power house locations. Otter signs include spraints (faeces), tracks, paths, food remains and shelters (holts and couches). This last (i.e. the presence of holts and/or couches) is a particularly important survey requirement, in that breeding sites and resting places are specifically mentioned in the European legislation covering this species. Conditions were optimal for finding spraints on exposed rocks, as water levels were so low, due to recent dry conditions.

3.1.3. Bats

The potential for bats was assessed through the identification of suitable habitat and roost structures. This included assessing any large trees close to the pipeline route, intake points and powerhouse location. There were no buildings that will be impacted by the proposed scheme. Guidance was taken from the Bat Conservation Trust guidelines (Collins, 2016). In particular, large trees with split limbs, dense epicormic growth, covering of ivy and/or woodpecker and other holes were noted. Potential signs of bat use were also noted, including droppings, feeding remains, urine splats, bat carcasses, grease staining and polishing suggestive of bat entry.

3.1.4. Badger

Badger *Meles meles* survey was undertaken through looking for signs such as setts, foraging signs, dung pits or tracks. Active setts in particular were searched for, as these may constrain the location of any development (i.e. no development within 30m of an active sett).

3.1.5. Birds

An assessment of the site for breeding birds was conducted whilst walking the route of the penstock. Particular attention was paid to species associated with the intake and powerhouse locations, the woodland areas and with the Nant Ffynnon-wen.

3.3. Lower Plants Survey and Assessment

Suitable micro-habitats were searched in detail for mosses and liverworts. These included steep damp rock faces, rock niches, woodland flushes and

tree bases, trunks and branches. Drier areas of rock faces were also examined, as was the floor of the semi-natural broadleaved woodland and rocks/boulders within the stream itself. All species from the proposed site were identified. Wherever possible, material was identified on site using x10 and x20 hand lenses. In cases where identification was not possible with a hand lens, a sample of material was obtained and packaged, for microscopic identification later. The survey also encompassed 'old forest' lichen species i.e. lichens associated with long-established woodland conditions. This included a search for species typical of more humid woodland conditions e.g. species of *Sticta*, *Lobaria virens*, etc.

A number of lower plant species (in particular some of the bryophytes) are dependent on high levels of humidity. They are therefore principally associated with areas of fast-flowing water, often exacerbated by topographical features such as waterfalls, incised ravines and gorges. The importance of these ravine communities of bryophytes is underlined by their inclusion as an assemblage under Section 7 of the Environment (Wales) Act 2016 (i.e. of principal importance for conservation of biological diversity in Wales). The Section 7 'oceanic ravine community' list of species is reproduced in Appendix 2.

4. RESULTS

4.1. Desk Study

A large number of species records (1475) were returned from Aderyn. In particular, large numbers of records were returned for birds, vascular plants and bryophytes. Fewer records were evident for mammals, amphibians and reptiles. By far the majority of these records derived from three specific locations – Pant y Turnor (SN759223), Gellygron (SN766225) and Cae Llwynroser (SN758225). These result from previous intensive vegetation surveys in these locations e.g. NRW Phase II surveys. A number of Locally Important Species of vascular plant were recorded. These form a similar suite of species to those recorded during the current survey. However, they are recorded from different locations. The Gellygron location is approximately 300m north of the feeding intake point. The Cae Llwynroser location is immediately (150m) west of the farmhouse at Pant y Turnor. The Pant y Turnor location is to the north-west of the powerhouse, and appears to be an extension of the good quality habitat recorded in the current survey. Several records were evident for *Hamatocaulis vernicosus* though the closest one was approximately 300m east of the feeding intake point. There were few records of Priority Species within 1km. Merlin *Falco columbarius* and red kite *Milvus milvus* were recorded within 1km, though still at some distance from the proposal. There were no records of bats within 1km. The closest otter record was approximately 1.5km distant from the scheme while the closest dormouse record was 1.6km distant. All other records were also at some distance from the proposal.

Two SSSIs lie within 2km of the site. The first is Mynydd Du and the second is Pen-y-graig-goch. No information seemed to be readily available for these

sites (i.e. through the internet). However, they lie at least 1km from the proposal and there can be no likelihood of ecological connection between them and the proposal.

4.2. Vegetation Survey and Assessment

4.2.1. Vegetation Descriptions

In terms of vegetation communities, the penstock route can be divided into three Phase I habitat types:

- acid grassland;
- acid dry heath;
- marshy grassland;
- semi-natural broadleaved woodland;

These habitats are detailed further below. A plan showing the location of these communities at the site is provided in Appendix 1.

Acid grassland

This mainly comprises relatively impoverished examples of the NVC community U4 *Festuca ovina* - *Agrostis capillaris* - *Galium saxatile* grassland. Most of the U4 community recorded was of the commonest sub-community, U4a the Typical sub-community. This is a species-poor sub-community, which tends to be rather dominated by mosses e.g. *Hylocomium splendens* and *Pleurozium schreberi*. The commonest grass is sheep's-fescue *Festuca ovina*. Much of the area was heavily grazed as indicated by the presence of abundant mat-grass *Nardus stricta* (inedible to sheep and therefore becomes predominant in heavily grazed situations). The grassland is also rather damp, as indicated by occasional or frequent purple moor-grass *Molinia caerulea* and patchy soft rush *Juncus effusus*. Western gorse *Ulex gallii* is scattered and occasional. In more sheltered situations close to the watercourse, was male-fern *Dryopteris filix-mas*. In some of the more damp areas, the grassland grades into acid flush-type vegetation, with very occasional patches of the bog-mosses *Sphagnum palustre* and *S. tenellum*. Deer-grass *Trichophorum cespitosum* and the moss *Campylopus atrovirens* are also found in some of the wetter areas. Few herbs were present in the acid grassland, indicating its relative impoverishment. U4a is a very widespread sub-community in the Welsh uplands and in-by-land. This community was found close to both of the intake points and in much of the surrounding moorland. The first 600m of the penstock route from the main intake point comprises acid grassland (U4a) (Photo 5, Appendix 3).

Acid dry heath

In drier locations and bordering the Nant Ffynnon-wen for the first 250m downstream of the main intake was acid dry heath. In this instance, it

comprises Western gorse. This forms a narrow band along the top of each bank, thickening in places. In NVC terms, this is H8 *Calluna vulgaris* – *Ulex gallii* heath. The example at the site is impoverished, in that some key species, including heather *Calluna vulgaris*, are largely absent. It is likely that heavy grazing has removed this species. Photo 6 (Appendix 3) shows this narrow band of gorse.

Marshy grassland

Three fields close to the powerhouse location comprise marshy grassland. They are categorised as this Phase I habitat due to the frequency of purple moor-grass. These fields are very species-rich, especially in sections close to runnels that run through the fields. In NVC terms, they are closest to M24 *Molinia caerulea* – *Cirsium dissectum* fen-meadow, though parts of the fields are more heathy and are then more akin to M15 *Trichophorum cespitosum* – *Erica tetralix* wet heath. Frequent species in these fields include great burnet *Sanguisorba officinalis* (locally), sneezewort *Achillea ptarmica*, star sedge *Carex echinata*, saw-wort *Serratula tinctoria*, whorled caraway *Carum verticillatum*, quaking grass *Briza media* and devil's-bit scabious *Succisa pratensis*. Purple moor-grass *Molinia caerulea* is the dominant grass species. Meadow thistle *Cirsium dissectum* is particularly frequent in places, typifying classic M24 vegetation. Other areas have a higher frequency of cross-leaved heath *Erica tetralix* indicating wet heath conditions. Runnels through the fields tend to be dominated by bog asphodel *Narthecium ossifragum* and small sedge species. Much of the vegetation had 'gone over' and no doubt there were other species (e.g. flea sedge *Carex pulicaris*) that were missed due to the time of year. A single plant of petty whin *Genista anglica* was recorded, though again this is likely to be more visible earlier in the year. Photos of this vegetation are provided as photos 7 and 8 (Appendix 3).

Originally, the lower sections of the penstock route and part of the cable route, were planned as running through some of this vegetation. The importance of it was highlighted to the developer and the position of infrastructure altered so that it will not now impact on this vegetation.

Semi-natural broadleaved woodland

Bordering the watercourse for the lower part of its length and found close to the powerhouse location, is semi-natural broadleaved woodland (BW). This woodland is largely neutral in character. The most prevalent canopy species are ash *Fraxinus excelsior* and hazel *Corylus avellana*. There is also smaller amounts of sessile oak *Quercus petraea*. At the confluence of the Nant Ffynnon-wen and the streams to the east, the woodland becomes distinctly scrubby in nature, with young downy birch *Betula pubescens*, willow *Salix* and gorse *Ulex europaeus* (Photo 9, Appendix 3). Much of the woodland appears heavily grazed and there are few species in the field layer. Greater stitchwort *Stellaria holostea* is frequent in places and bluebell *Hyacinthoides non-scripta* occasional. The main ferns are male-fern and lady-fern *Athyrium filix-femina*. The penstock route will run along the top edge of this woodland, to avoid impacts on the high quality marshy grassland vegetation described above.

No other vegetation communities were present.

4.2.2. Flora

The majority of plant species recorded were widespread and typical of the habitats they were found in. The only exception to this is the suite of species associated with the marshy grassland and wet heath vegetation described above (NVC communities M24 and M15). This comprises a very good example of 'rhos pasture', a community that is characteristic of more species-rich purple moor-grass vegetation in Wales. A number of species recorded in this example are local in Wales (and further afield) and some have suffered considerable declines (e.g. petty whin). No vascular (i.e. higher) plant species were found that are protected, apart from bluebell, which is protected under Schedule 8 of the Wildlife and Countryside Act (1981). This was found sparsely through the broadleaved woodland areas, though not in the area of the powerhouse location.

4.3. Lower Plants Survey and Assessment

Almost all bryophytes recorded were common and widespread species. The commonest species within the woodland areas were *Thuidium tamariscinum*, *Mnium hornum* and *Eurhynchium striatum*. The watercourse was generally poor for bryophytes, with few species and little cover. The most frequent species recorded were occasional *Racomitrium aciculare* and *Platyhypnidium riparioides*. In addition, *Dichodontium pellucidum* was found on gritty banks. The presence of relatively frequent patches of *Jungermannia exsertifolia* ssp. *cordifolia* indicates slightly base-enriched conditions. A small flushed area is found close to a small tributary that joins the Nant Ffynnon-wen, just to the south of the more easterly sheepfold. This supports a small number of bryophytes indicative of base-rich conditions. These include *Palustriella falcata*, *Scorpidium scorpioides* and *Scorpidium cossonii*. The vascular plants bog pimpernel *Anagallis tenella*, marsh pennywort *Hydrocotyle vulgaris*, tawny sedge *Carex hostiana* and round-leaved sundew *Drosera rotundifolia* also occur here. This small area is species-rich and should be avoided. It is highlighted on the plan at Appendix 1. A photo is provided as photo 10 (Appendix 3). No 'old forest' lichens were recorded and the stream did not appear suitable for important riverine species.

4.4. Protected Species Surveys

4.4.1. Bats

No buildings lay close to the proposed pipeline or infrastructure locations and therefore there was no potential for such structures to support bat roosts. A small number of trees in the woodland close to the lower part of the penstock route were considered to have features potentially suitable for roosting bats. However, these trees will not be impacted by the penstock and are therefore not considered further. No other trees are close to infrastructure locations (the intake and powerhouse locations are treeless). Therefore, no other tree

roosts could be potentially affected by the construction of the intake, powerhouse or pipeline.

4.4.2. Dormouse

The woodland was considered unsuitable for supporting dormouse. There was a comparative lack of food plants for this species (food plant species such as honeysuckle were sparse). There was also a lack of a suitable understorey.

4.4.3. Badger

No badger setts were found on the proposed route. No evidence of badgers was found within the woodland. The majority of the penstock route appears too damp for optimum conditions for badger setts.

4.4.4. Otter

No signs of otter were recorded. Otter undoubtedly use the Nant Ffynno-wen from time to time, but this section does not appear to be regularly used, as no spraints were found. Conditions were also optimal for finding spraints on exposed rocks, as water levels were low.

4.4.5. Birds

Few birds were recorded on the site. A number of species are likely to be associated with the woodland areas, as well as the stream itself. All species recorded were common and widespread. A single red kite (Schedule 1 species) was recorded overhead. However, there is no possibility of impacts on this species from the proposal.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Evaluation

This section provides an evaluation of the potential impact of the proposed development on habitats and species identified within the report above.

5.2. Possible Impacts of Proposed Works on Vegetation

The proposed intake point, powerhouse and penstock route are anticipated as having negligible impacts on their respective surrounding habitats. The potential removal of small trees for the intake and powerhouse construction is not considered significant from an ecological perspective. The high quality habitat in three fields to the north of the powerhouse location has been avoided with the re-routing of the penstock and cable route.

5.3. Possible Impacts of Proposed works on Lower Plant Species

There will be negligible impact from the proposed works on lower plant species. No individual species of conservation significance were recorded

and the site also fails to meet the criteria for the Section 7 oceanic ravine community. The flush vegetation highlighted in 4.3 should be avoided with the penstock route (see plan in Appendix 1).

5.4. Possible Impacts of Proposed works on Protected Species

5.4.1. Bats

There will be no impact from the scheme on bats, as all suitable bat roost trees are at some distance from the proposed route and infrastructure. General mitigation and protection measures are outlined for bats.

5.4.2. Dormouse

There will be negligible impact from the scheme on dormouse as there is no suitable habitat for this species.

5.4.3. Badger

No signs of badger were recorded and no active setts will be impacted by the proposal. There will therefore be no impacts on this species and no mitigation or species protection measures are considered necessary.

5.4.4. Otter

No signs of otter were recorded, and usage of the Nant Ffynnon-wen is likely to be low. No resting places or holts were found. No impacts are predicted for this species and no mitigation or species protection measures are considered necessary.

5.4.5. Birds

No impacts are predicted from the scheme on birds, subject to the mitigation and species protection measures outlined below.

5.5. Mitigation and Species Protection Measures

No mitigation measures are considered necessary for lower plants (aside from avoidance of area highlighted in 4.3), dormouse, badger and otter.

5.5.1. Vegetation

No mitigation measures for vegetation are considered necessary, as the penstock route and other infrastructure lie in vegetation of low ecological value. The penstock route has also been altered to avoid vegetation of higher value.

5.5.2. Bats

Although it is not anticipated that any large trees with potential bat roosts are likely to be felled (based on the information and route provided), the developer should notify the ecologist prior to the works commencing if it is likely that any

large trees will be impacted. An initial roost assessment (in line with the BCT Guidelines) can then be carried out on the impacted tree, and from this, decisions can be made with regard to emergence surveys and further assessment. In general, felling should take place in the winter when roosts are least likely to be present. It is possible however that hibernation roosts may be present at this time of year, and the ecologist should be notified of any large trees that could potentially be felled

5.5.3. Birds

A number of species of bird may be breeding close to the penstock route, intake point or power house area (e.g. open moorland nesting species such as meadow pipit *Anthus pratensis* and skylark *Aluuda arvensis*). It is recommended that a pre-construction survey take place for any active nests that may be disturbed by construction, if carried out during the breeding season (March to August inclusive). This would take the form of a check immediately ahead of the works for the presence of nesting or nest-building birds. If found, then they should be left undisturbed with at least 5m of cover around the nest, until the young have fledged and the nest is no longer in use.

5.6. Recommendations and Ecological Enhancement Measures

The lack of ecological impact from the scheme means that no ecological enhancement measures are considered necessary.

6. REFERENCES

Chanin (2003). Ecology of the European otter *Lutra lutra*. Conserving Natura 2000 Rivers Ecology Series No 10. English Nature. Peterborough, UK.

Collins, J. (ed.) (2016) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.

JNCC, (2010), Handbook for Phase 1 habitat survey - a technique for environmental audit

Appendix 1: Phase I Habitat survey map of site (see next page)

Key:

SI Poor semi-improved grassland

AG Acid grassland

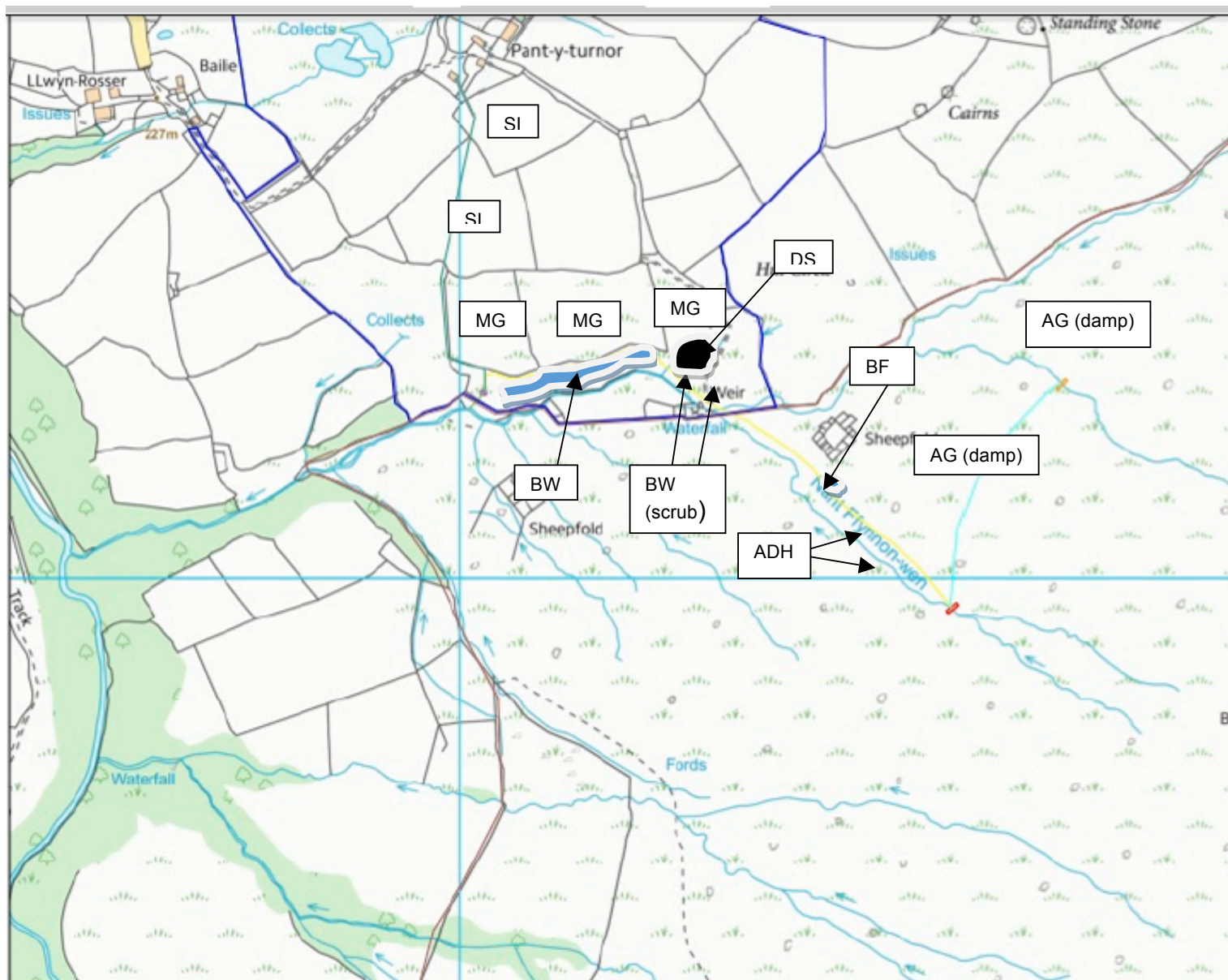
MG Marshy grassland – high quality

ADH Acid dry heath

BF Base-rich flush

BW Semi-natural broadleaved woodland

DS Dense scrub



Appendix 2: Section 42 Oceanic Ravine Bryophytes.

Bryophytes included under Section 42 of the Natural Environment and Rural Communities (NERC) Act 2006 have recently been revised and now include 52 species plus an assemblage named 'Oceanic Ravine Bryophytes'.

Important sites for the latter are identified by the following indicator species:

1. Presence of any one of the following species: *Aphanolejeunea microscopica*, *Campylopus setifolius*, *Daltonia splachnoides*, *Drepanolejeunea hamatifolia*, *Hageniella micans*, *Harpalejeunea molleri*, *Leptoscyphus cuneifolius*, *Metzgeria leptoneura*, *Paraleptodontium recurvifolium*, *Plagiochila exigua*, *Plagiochila heterophylla*, *Radula voluta* or *Sematophyllum demissum*; OR
2. Presence of three or more of the following species: *Adelanthus decipiens*, *Andreaea megistospora*, *Dicranum scottianum*, *Fissidens polyphyllus*, *Jubula hutchinsiae*, *Lepidozia cupressina*, *Lepidozia pearsonii* or *Radula aquilegia*; OR
3. Presence of five or more of the following species: *Anastrepta orcadensis*, *Colura calyptrifolia*, *Douinia ovata*, *Heterocladium wulfsbergii*, *Hygrobiella laxifolia*, *Hygrohypnum eugyrium*, *Isothecium holtii*, *Marchesia mackaii*, *Plagiochila bifaria*, *Plagiochila punctata*, *Platyhypnidium lusitanicum*, *Porella pinnata*, *Rhabdoweisia crenulata* or *Sphenolobopsis pearsonii*; OR
4. Presence of eight or more of the following species: *Bazzania trilobata*, *Fissidens bryoides* var. *caespitans*, *Hyocomium armoricum*, *Lejeunea lamacerina*, *Lejeunea patens*, *Lophocolea fragrans*, *Plagiochila spinulosa*, *Saccogyna viticulosa*, *Scapania gracilis*, *Solenostoma paroicum* or *Sphagnum quinquefarium*.

Appendix 3: Photographs



Photo 1: Representative photo of Nant Ffynnon-wen showing open grassland banks.



Photo 2: Feeding Intake; damp acid grassland



Photo 3: Main intake; damp acid grassland, patchy Western gorse

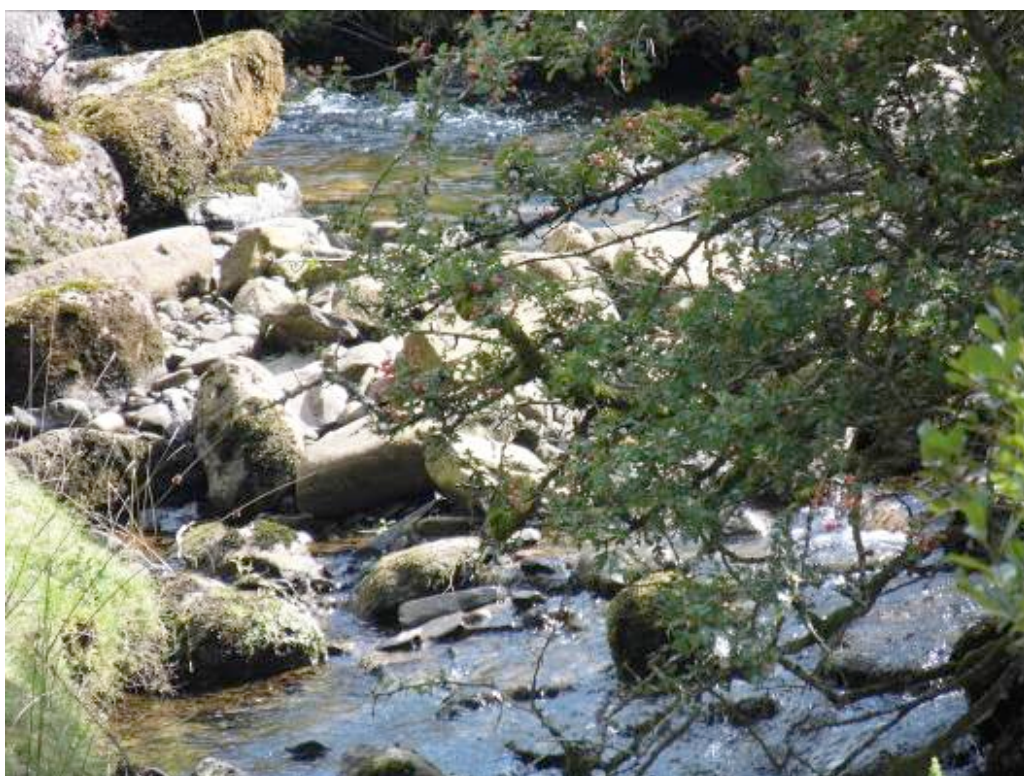


Photo 4: Powerhouse location



Photo 5: Representative photo of damp acid grassland, along much of penstock route



Photo 6: Narrow band of Western gorse either side of watercourse



Photo 7: Species-rich marshy grassland (M24/M15); 'rhos pasture'



Photo 8: Species-rich marshy grassland (M24/M15); 'rhos pasture'