Introduction

5.1 This chapter has been prepared by BSG Ecology and examines the likely significant ecological effects of the proposed extension of the Crystal Rig Substation and the creation of temporary compound areas. The ecological impact assessment (EcIA) has been carried out with reference to the guidance produced by the Chartered Institute of Ecology and Environmental Management[18] (CIEEM, 2016), which is recognised nationally as current best practice.

5.2 The approach adopted in this Chapter follows the EcIA process from baseline data gathering through to the assessment of residual impacts. It starts by describing the results of the desk study and field survey, which have been carried out to gather data on flora and fauna, the habitats present within the site and to identify any statutory and non-statutory designated sites of nature conservation interest in the area. Collectively these data establish the baseline conditions.

5.3 The collated baseline information has then been evaluated to identify which ecological receptors (i.e. sites, habitats and species) may potentially be impacted by the proposed development. The potential impacts on the key receptors are then outlined and an assessment is made of their ecological significance. The assessment has been based upon the avoid-mitigate-compensate hierarchy. In the final stages, the potential for measures to mitigate significant adverse impacts is investigated and, where this is not possible, the need for compensatory measures is identified. The likely post-mitigation / post-compensation residual impacts are discussed and the implications of these residual impacts are examined with regard to planning policy.

Scope and Methodology

Desk Study

5.4 A data search was previously undertaken by Wild Surveys Ltd in October 2016 (Wild Surveys Limited, 2016) and this involved consulting publicly available databases, local wildlife groups and other sources of data for records of protected species, habitats and sites within 2 km (5 km for bats) of the site.

Field Survey

5.5 A number of ecological surveys have been carried out at the site, which collectively, provide a comprehensive overview of the ecological features that are present. The ecological baseline for the site has been derived with reference to the following surveys:

- Extended Phase 1 habitat survey in October 2011 (Enviro Centre, 2011).
- Extended Phase 1 habitat survey in April 2013 (MWH, 2013).
- Site walkover survey in February 2016 (Wild Surveys Limited, 2016).
- Extended Phase 1 habitat survey in March 2016 (BSG Ecology, 2016).
- Site walkover survey in August 2016 (Wild Surveys Limited, 2016).

5.6 A previous Phase 1 habitat survey of the Substation and surrounding area was undertaken as part of the Environmental Statement for Crystal Rig Windfarm Phase II by Natural Power in April 2004.

[18] Now the Chartered Institute of Ecology and Environmental Management

5.7 All of the surveys involved a walkover assessment of the habitats present and consideration of habitat suitability for a range of protected species including badger *Meles meles*, otter *Lutra lutra*, water vole *Arvicola amphibius*, bats, red squirrel *Sciurus vulgaris*, breeding birds, great crested newt *Triturus cristatus* and reptiles.

5.8 A copy of the extended Phase 1 habitat survey undertaken in March 2016 by BSG Ecology has been placed in Technical Appendix 4.0.

Assessment of Effects

5.9 In order to determine the potential for ecological impacts and the significance of the resultant ecological effects, a standard process has been used to assess each ecological receptor. This process consists of the following steps:

1. Evaluate receptors to the geographical scale.
2. Identify ecological impacts and effects.
3. Determine confidence in ecological effects.
4. Determine significance of effects.
5. Identify mitigation and compensation measures.
6. Determine residual effects and their significance.

5.10 The predicted impacts may be direct or indirect in nature, and may occur in one or more of the construction, operation or decommissioning phases of the scheme. The impacts identified to be acting on each ecological receptor are assessed in terms of the factors listed below:

- Direction (positive, negative or neutral impact).
- Magnitude (the amount or level of impact).
- Extent (area in hectares, linear metres, etc).
- Duration (in time or related to species life-cycles).
- Reversibility (i.e. is the impact permanent or temporary).
- Timing and frequency (e.g. related to breeding seasons).
- Cumulative effects (between impacts from a number of sources).

5.11 IEEM guidance states that impacts should be determined as being significant when they have an adverse or positive effect “on the integrity of a defined site or ecosystem and/or the conservation status of habitats or species within a given geographical area”.

5.12 Using the information gathered, together with professional judgement, it is determined whether the effects will be significant or not for the integrity (of a site / ecosystem) or conservation status (of a habitat / species) for each ecological receptor. The impact significance is determined at the appropriate geographical scale.

5.13 Following the application of the mitigation hierarchy (i.e. avoidance, mitigation or compensation) the residual impacts are identified. The residual impacts are then assessed to determine whether they comply with the prevailing policy, guidance and legislation. A decision is then made whether the identified impact is contrary to certain policies and hence whether the development is significant in planning terms.

5.14 The relative significance of effects has been assessed using the following terms:

- Major - a fundamental change to the environment.

- Moderate - a material but non-fundamental change to the environment.
- Minor - a detectable but non-material change to the environment.
- None- no detectable change to the environment.

Policy Context

5.15 This chapter has regard to the requirements of and advice given in the following documents:

- European Commission (EC) Habitats Directive (Directive 92/43/EEC) as translated into UK law by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) (The Habitats Regulations);
- EC Fisheries Directive (78/659/EEC);
- EC Water Framework Directive (Directive 2000/60/EC) with regard to Groundwater Dependent Terrestrial Ecosystems (GWDTEs);
- Surface Waters (Fishlife) (Classification) (Scotland) Regulations 1997 (as amended);
- Wildlife and Countryside Act 1981 (as amended) (WCA);
- The Protection of Badgers Act 1992 (PBA);
- Nature Conservation (Scotland) Act 2004 (NCA);
- The Wildlife and Natural Environment (Scotland) Act 2011 (WANE Act);
- Scottish Planning Policy (SPP) (2014);
- Planning Advice Note (PAN) 60: Planning for Natural Heritage;
- Scottish Executive Guidance on Protected Species (Scottish Executive, 2001);
- The adopted East Lothian Local Plan 2008 (ELLP), in particular Policy NH1a: Internationally Protected Areas; Policy NH1b: Sites of Special Scientific Interest; Policy NH2: Wildlife and Geological Areas; Policy NH3: Important Local Biodiversity Sites; Policy NH6: Watercourses and Wetlands.
- The UK Biodiversity Action Plan (UK BAP);
- East Lothian Biodiversity Action Plan (ELBAP)
- The Scottish Biodiversity List (SBL);

5.16 The following Table provides an overview of the key policy and legislation taking into account the ecological features present within the site.

Table 5.1: Relevant Planning Policy

Planning Policy	Summary
Paragraph 195 of the SPP	Planning authorities, and all public bodies, have a duty under the Nature Conservation (Scotland) Act 2004 to further the conservation of biodiversity.
Paragraph 202 of the SPP	Developers should seek to minimise adverse impacts through careful planning and design, considering the services which the natural environment is providing and maximising the potential for enhancement.
Paragraph 203 of the SPP	Direct or indirect effects on statutorily protected sites will be an important consideration, but designation does not impose an automatic prohibition on development.
Paragraph 214 of the SPP	The presence (or potential presence) of a legally protected species is an important consideration in planning application decisions.
ELLP Policy NH1a	Policy protection for internationally protected areas.
ELLP Policy NH1b	Policy protection for Sites of Special Scientific Interest.
ELLP Policy NH2	Policy protection for wildlife and geological areas.
ELLP Policy NH3	Policy protection for important local biodiversity sites

ELLP Policy NH6	Policy protection for watercourses and wetlands
WCA	All nesting birds are protected from intentional killing, injury or taking of any wild bird or taking, damaging or destroying its nest whilst in use or being built, or taking or destroying its eggs. In addition, it is an offence to disturb any wild bird listed on Schedule 1 of WCA.
WCA	Animals listed on Schedule 5 of the WCA are protected from intentional or reckless killing, injury or taking, or damaging, destroying or obstructing access to any structure or place which such an animal uses for shelter or protection or to disturb such an animal when it is occupying a structure or place for that purpose.

Baseline Conditions

5.17 The following section describes the baseline conditions within the site at the time of the most recent site visit (Wild Surveys Ltd, August 2016). With the exception of the existing Substation site and associated infrastructure where there has already been extensive habitat loss or disturbance, there has been little change in the ecological baseline since surveys were first carried out in 2011 (Enviro Centre, 2011).

Habitats

5.18 Marshy grassland and heath/acid grassland mosaic are the two dominant habitats within the site. Marshy grassland is extensive and it consists of a limited range of commonly occurring species. Areas of heath are limited to a few small discrete areas in parts of the site. The surveys have found evidence that the area is grazed by livestock at certain times of the year.

5.19 The access tracks pass through a variety of habitats including woodland, scrub, improved grassland and arable land at lower elevations, and upland habitats such as acid grassland, continuous bracken and wet heath at higher elevations leading up to the Substation.

5.20 No invasive non-native species were recorded during the course of any of the surveys.

5.21 The habitats present within the site and the wider study area are generally of low ecological importance and are common and widespread in the surrounding area. Some of the identified habitats have characteristics that overlap with the following habitat types that are included on the Scottish Biodiversity List: ‘Upland flushes, fens and swamps’; ‘Upland heathland’; ‘Lowland mixed deciduous woodland’.

5.22 In all cases the areas of these habitats are limited in their extent, particularly where they occur as part of a mosaic. Whilst there is some overlap with the priority habitat ‘Upland flushes, fens and swamps’ (with regard to plant species recorded on site), none of the identify habitats correspond with the priority habitat descriptions of flush, fen or swamp habitats. Similarly the low abundance of dwarf shrubs means that the habitats present do not correspond with the priority habitat description of ‘Upland heathland’.

5.23 The priority habitat ‘Lowland mixed deciduous woodland’ is only present adjacent to some sections of the access track.

5.24 Overall, the habitats within the site are evaluated as only being of importance at the Site level.

Breeding Bird Habitat

5.25 The dominance of marshy grassland and dry heath/acid grassland mosaic is likely to reduce the suitability of the site for many bird species, but these habitats may be utilised by some ground-nesting species. Displaying skylark *Alauda arvensis* have previously been noted within the site, and meadow pipit *Anthus pratensis* was also present in the area (BSG Ecology, 2016). Other species recorded in the area included, goldfinch *Carduelis carduelis*, kestrel *Falco tinnunculus* and buzzard *Buteo buteo* (Wild Surveys Ltd, 2016).

5.26 No wader species were noted within the site but a pair of snipe *Gallinago gallinago* was previously recorded from marshy grassland by the Tay Burn to the south-east of the site (BSG Ecology, 2016). Lapwing *Vanellus vanellus* and curlew *Numenius arquata* have previously been recorded in the wider area (MWH, 2013).

5.27 Overall, the site is considered to be poor for nesting birds and is only likely to support a limited range of commonly occurring species and a small number of territories. The birds that have been recorded during site visits are mostly commonly occurring farmland and moorland species, but skylark, lapwing and curlew are included on the Birds of Conservation Concern (BoCC) Red List (Eaton *et al*, 2015). Meadow pipit, kestrel and snipe are included on the BoCC Amber List.

5.28 Overall, the bird assemblage within the site is evaluated as only being of importance at the Site level.

Bat Habitat Suitability Assessment

5.29 There are no features suitable for roosting bats within or adjacent to the site. The open moorland habitats may provide some foraging opportunities for bats, however the site is open and exposed and this is likely to render conditions less favourable for foraging bats (see Ekman & De Jong, 1996; Altringham, 2003; Downs & Racey, 2006; Brandt et al, 2007; Walsh & Harris, 1996a,b).

5.30 Overall, the site has been evaluated as only being of importance at the Site level for bats, as it is only likely to be used on an occasional basis by small numbers of foraging / commuting bats.

Badger

5.31 No badger setts or field signs were identified during the walkover survey. The habitat present is considered to be poor for sett establishment due to the marshy ground conditions. Overall, the site has been evaluated as having no importance for badger.

Otter

5.32 No suitable watercourses or water features are present within the site or within at least 100 m of the proposed Substation Extension site. The nearest watercourse is the Tay Burn which is located to the east of the existing Substation and is separated from the site by a track. The watercourse crossing at Thurston Mains Burn (NT 70975 72866) was found to have suitability for commuting and foraging otter (Wild Surveys Ltd, 2016).

5.33 Overall, the site has been evaluated as having no importance for otter, although it is possible that this species occasionally uses watercourses in the area.

Water Vole

5.34 No suitable watercourses or water features are present within the site or within at least 100 m of the works area. The nearest watercourse is the Tay Burn which is located to the east of the existing Substation and is separated from the site by a track. Suitable habitat exists for this species within the marshy grassland habitat adjacent to the Substation, however no signs of water vole presence have been detected during any of the surveys (Wild Surveys Ltd, 2016).

5.35 Overall, the site has been evaluated as having no importance for water vole as no evidence has been found to indicate that this species is present.

Red Squirrel

5.36 The habitat within and adjacent to the site is not suitable for red squirrel and has been evaluated as having no importance for this species.

Reptiles

5.37 The heath/acid grassland mosaic may provide suitable common lizard *Zootoca vivpara* habitat as it is quite tussocky in places, however the damp ground conditions that predominate are likely to reduce the overall importance of the habitat for this species. Adder *Vipera berus* and slow worm *Anguis fragilis* may also be present in drier areas. No field signs for reptiles were recorded during the course of any of the surveys.

5.38 Overall, the reptile population within the site has been evaluated as only being of importance at the Site level. Although no evidence has been found to indicate that reptiles are present, the nature of the habitats present has led to the conclusion that the presence of a small residual population is possible.

Table 5.2: Summary of Evaluation of Ecological Receptors

Receptor	Evaluation	Rationale
Marshy grassland	Site level	Habitat does not conform to a priority habitat description.
Heath / acid grassland mosaic	Site level	Habitat mosaic does not conform to a priority habitat description.
Watercourses	Site level	The nearest watercourse is more than 100 m from the extension site.
Broadleaf woodland	Site level	Small areas of broadleaf woodland are present adjacent to the access track.
Badger	Not present	There is no evidence that badger is present within the site.
Bats	Site level	There are no roosting opportunities within the site and the habitat is poor for foraging bats.
Otter	Not present	There is no evidence that otter is present within the site.
Water vole	Not present	There is no evidence that water vole is present within the site.
Red squirrel	Not present	There is no evidence that red squirrel is present within the site.
Breeding birds	Site level	The habitats present are only likely to support a limited range of ground-nesting species.
Great crested newt	Not present	There is no evidence that great crested newt is present within the site.
Reptiles	Site level	No reptiles have been observed but there are scattered areas of suitable habitat.

Potential Effects of Proposed Development

Effects on Habitats

5.39 The site does not support any habitats that are considered to be of ecological importance: marshy grassland and heath / acid grassland mosaic are common and widespread in the surrounding area and the habitats present are not considered to correspond to any priority habitat descriptions[19]. The loss or disturbance of these habitats is therefore not likely to be significant in ecological terms and is not likely to conflict with any policy protection or legislative considerations.

5.40 The proposed construction work will result in the loss of vegetation within the footprint of the development site. It is also possible that the movement of heavy plant and other construction traffic could result in the temporary disturbance of adjacent habitats, for example resulting in ground compaction.

5.41 Where possible habitat loss and disturbance will be limited by clearly defining the extent of the construction footprint and the areas that can be accessed by construction vehicles. This will be achieved using appropriate fencing to demarcate the construction area.

5.42 Construction activities will result in the exposure of bare ground, which increases the risk of silt run-off particularly during periods of high rainfall. In the absence of mitigation this could result in siltation impacts on adjacent watercourses, which may affect sensitive aquatic invertebrate and fish species.

5.43 To minimise pollution related impacts the construction contractors will adhere to the appropriate Pollution Prevention Guidelines published by SEPA.

Effects on Species

5.44 The walkover survey did not reveal any evidence of the presence of protected species although the presence of small numbers of reptiles cannot be ruled out. Ground-nesting birds, in particular skylark and meadow pipit, may be present.

5.45 In the absence of mitigation, the vegetation clearance, soil stripping and earthworks that will take place during the construction of the Substation Extension has the potential to impact on reptiles and nesting birds. This may result in the death or injury of animals and the loss of habitat that supports those animals.

5.46 Vegetation clearance, soil stripping and earthworks during the construction of the Substation Extension should ideally be undertaken outside of the main breeding bird season, i.e. March to August. If this is not possible a pre-construction bird survey will be required to ensure that any active nest sites are identified and protected from disturbance and damage to help ensure that the works proceed lawfully.

5.47 Measures will be adopted to minimise impacts on reptiles. These are described in detail in the report prepared by Wild Surveys Ltd, 2016.

[19] http://www.biodiversityscotland.gov.uk/advice-and-resources/habitat-definitions/priority/

5.48 Although no evidence has been found to indicate that species such as badger and otter are present within the site, their presence in the future cannot be ruled out as they are highly mobile. It is therefore proposed that the following best practice mitigation measures will be adopted: a temporary ramp to be placed in trenches over 0.5 m deep in order to allow potentially trapped animals to exit the trench; any open pipes will be capped to prevent animals gaining access; all excavations and pipe systems will be checked at the start of each working day; site construction fencing will not interfere with the passage of animals along watercourses.

5.49 It is also proposed that lighting will be directed away from watercourses to avoid impacts on otter and commuting / foraging bats. If this is not possible then lighting should be designed with reference to current guidance on mitigating impacts on bats (Bat Conservation Trust and Institute of Lighting Engineers, 2009).

5.50 As some mobile species may potentially use the site in the future, all site staff will be made aware of the potential presence of otter, badger, water vole, reptiles and breeding birds on site and the legal protection afforded them. Should any sightings or signs of these species be noted on site, all works in the vicinity will stop and the project ecologist contacted for advice.

Table 5.3: Significance of Effects

Receptor	Effect	Significance
Marshy grassland	Loss / disturbance of habitat of low ecological importance within the development footprint.	**Minor**
Heath / acid grassland mosaic	Loss / disturbance of habitat of low ecological importance within the development footprint.	**Minor**
Watercourses	Mobilisation of silt via surface water run-off and drainage into watercourses.	**Minor**
Badger	No evidence that badger is present.	**None**
Bats	Roosting bats are unlikely to be present; Small numbers of foraging and commuting bats may be present.	**Minor**
Otter	No evidence that otter is present, but occasional presence is possible.	**Minor**
Water vole	No evidence that water vole is present.	**Minor**
Breeding birds	Small numbers of ground nesting birds may be present.	**Minor**
Great crested newt	No evidence that great crested newt is present.	**None**
Reptiles	Small numbers of reptiles may be present in areas of suitable habitat.	**Minor**

Residual and Cumulative Effects

5.51 The proposed development will result in the loss or disturbance of habitats that are considered to be of low ecological importance and which commonly occur in the wider area. The loss of habitat to accommodate the proposed development is not likely to have a significant effect on the conservation status of any of the affected habitats.

5.52 The construction work that has taken place to date to accommodate the existing Substation will have resulted in similar impacts on the same types of habitats. The cumulative effect of the proposed Substation Extension will be the loss of a larger area of habitat that has been evaluated as being of low ecological importance. Overall, the same conclusion is reached, i.e.

that the losses are not likely to have a significant effect on the conservation status of any of the affected habitats, which are commonly occurring and widespread in the local area.

5.53 The predicted habitat loss is not considered to be contrary to the following policies in the adopted East Lothian Local Plan 2008: Policy NH1a: Internationally Protected Areas; Policy NH1b: Sites of Special Scientific Interest; Policy NH2: Wildlife and Geological Areas; Policy NH3: Important Local Biodiversity Sites; or Policy NH6: Watercourses and Wetlands.

5.54 The proposed development may result in the displacement of small numbers of breeding birds and reptiles; however, similar habitat is available in the wider area and it is likely that these species will relocate into these areas without affecting the overall conservation status of the species.

Table 5.4: Residual Effects following Adoption of Mitigation Measures

Receptor	Effect following mitigation	Significance
Marshy	Loss / disturbance of habitat of low ecological importance within the development footprint	**Minor**
Heath / acid grassland	Loss / disturbance of habitat of low ecological importance within the development footprint	**Minor**
Watercourses	Risk of silt pollution is minimised through the adoption of appropriate PPGs	**Minor**
Badger & otter	Providing ramps in deep excavations and capping pipes will reduce risk of entrapment	**None**
Bats	Minimising light spillage onto sensitive habitats will minimise impacts on foraging / commuting bats	**None**
Water vole	Pre-development checking survey will minimise risk of impacts occurring	**None**
Breeding birds	Pre-development checking survey will minimise risk of impacts occurring	**None**
Reptiles	Pre-development checking survey will minimise risk of impacts occurring	**None**

Conclusion

5.55 The proposed development will result in the loss or disturbance of habitats that are considered to be of low ecological importance and which commonly occur in the wider area.

5.56 The proposed work may result in the displacement of a small number of ground-nesting birds and a small reptile population (if present on site), however suitable alternative bird nesting habitat and reptile habitat is present in the wider area.

5.57 Measures will be adopted that will ensure that significant impacts on other species are not likely. This includes precautionary mitigation that recognises that some mobile species may use the site in the future.

5.58 In accordance with the significance criteria that have been adopted within this chapter, the ecological assessment of the proposed development indicates that the residual effects will only

be **Minor** for marshy grassland, heath / acid grassland mosaic and watercourses. No residual effects are anticipated for any other ecological receptors.

5.59 Taking into account the proposed mitigation measures, the residual impacts are considered to be **Not Significant** in planning terms. The proposed work is not contrary to any planning policy, the objective of which is to protect biodiversity.

Introduction

6.1 A desk-based assessment and walk over field survey were conducted to identify the cultural heritage interests within a study area centred on the location of the proposed extension to the 400kV grid Substation at Crystal Rig wind farm (as shown on Figure 6.1). The following assessment considers the likely impacts of the proposals on cultural heritage interests.

6.2 The cultural heritage assessment was informed by comments and information provided by Historic Environment Scotland (HES)[20], East Lothian Council Archaeology Service (ELCAS) and Scottish Borders Council Archaeology Service (SBCAS).

Scope and Methodology

6.3 The assessment considers the following potential impacts:

- Direct impacts on recorded cultural heritage assets and on as yet undiscovered assets within the Inner Study Area;
- Indirect impacts on the setting of designated cultural heritage assets present within the Outer Study Area.

6.4 As the routes proposed for construction traffic, and for operational traffic, are existing roadways[21], there is no potential for direct effects upon cultural heritage assets resulting from their use to arise. The routes for construction and operational traffic have therefore been scoped out of this assessment.

Consultation

6.5 Consultation letters were sent to ELCAS and SBCAS on 24th April 2013, to introduce the project, to provide details of the proposed approach to appraisal, and to obtain opinion on the likely effects on historic environment interests of the proposed development. A letter was sent to Historic Scotland on 5th June 2013, providing details of cultural heritage sites and features identified within the proposed development area, and details of the mitigation measures which were proposed to be adopted for the scheme.

6.6 Table 6.1 below details the responses to these consultations.

[20] Historic Scotland (HS), as an organisation, was superseded in 2015 under the terms of the Historic Environment Scotland Bill by a new organisation known as Historic Environment Scotland (HES). This new body combines and sustains the roles previously performed by Historic Scotland and the Royal Commission on the Ancient and Historic Monuments of Scotland. For an earlier application for this proposed development, Historic Scotland was consulted and correspondence received in response was from that organisation. For convenience and simplicity reference is made (except in relation to this correspondence) only to the latter organisation: Historic Environment Scotland (HES).

[21] The existing Aikengall Windfarm Access Road would be used for all construction traffic. The existing Crystal Rig Windfarm Access Road would be used for all operational traffic.

Table 6.1: Consultation Responses

Consultee	Issue	How/ where this is addressed
East Lothian Council Archaeologist (Received 8th May 2013)	Stated that they were content with the proposed methodology for the assessment.	Noted
	Noted the potential for impacts upon the remains of the farmstead and enclosures at Boonslie. These remains are currently under assessment to potentially be designated as a scheduled monument, and should therefore be considered in the assessments as being of schedulable quality.	An assessment of the indirect effects (effects on the setting) of Boonslie farmstead and enclosures is set out in Paragraph 1.58 of this document.
Scottish Borders Council Archaeologist (Received 26th April 2013)	Stated that they were content with the proposed assessment methodology, and that there were no specific cultural heritage issues which they wished to highlight.	Noted.
Historic Scotland (Received 18th June 2013)	Confirmed that the proposed would not impact on the location or settings of any cultural heritage assets with statutory designations.	Noted.
East Lothian Historic Environment Record Officer (Received 23rd February 2017)	Confirmed that there have been no additions to their records within the study area for the proposed development.	Noted.
Scottish Borders Council Historic Environment Record Officer (Received 23rd February 2017)	Noted that the results of an archaeological watching brief between Westerdod Substation and Crystal Rig Substation, and an archaeological evaluation close to the Crystal Rig Substation have recently been added to the HER. Both investigations found no archaeological finds or features.	Noted.

Study Areas

6.7 The cultural heritage study area was divided into two zones – an Inner Study Area and an Outer Study area, as illustrated on Figures 6.1 and 6.2.

6.8 The Inner Study Area consists of the proposed development area plus a 200 m buffer. This area was considered sufficient to identify cultural heritage assets close to, or within, the development footprint, and to provide additional background information on the archaeological potential of the proposed development area. A field survey was carried out within the Inner Study Area. Figure 6.1 depicts the proposed development area and the 200 m buffer, together with the locations of cultural heritage assets identified by the cultural heritage study within the Inner Study Area. A gazetteer of cultural heritage assets located within the Inner Study Area, detailing the current baseline condition and an assessment of the cultural heritage importance of each asset, is provided in Technical Appendix 5.0.

6.9 The Outer Study Area consists of a 4 km buffer centred on the proposed development area, and is the area in which the potential impacts of the proposals on the setting of cultural heritage assets have been assessed. This study area was defined taking into account the findings of the LVIA assessment which states that there is unlikely to be any significant impact at distances of more than 4 km from the proposed Substation Extension. Figure 6.2 shows the Outer Study Area, together with the Zone of Theoretical Visibility (ZTV) and the locations of key

cultural heritage assets. An assessment of the likely indirect impacts upon the heritage assets within the Outer Study Area, resulting from the construction and operation of the proposed development, is presented in paragraphs 6.57-6.58 below.

Data Collection

6.10 A desk-based study and reconnaissance walk over field survey were undertaken in order to identify cultural heritage constraints and to assess the archaeological potential of the site of the proposed Crystal Rig Substation Extension.

6.11 No intrusive archaeological investigations have been carried out as a part of this appraisal.

Desk-based Study

6.12 Up-to-date information was obtained from appropriate sources on the locations, and extents where known, of cultural heritage assets with statutory protection and non-statutory designations within both the Inner and Outer Study Areas.

- Details of the locations and extents of Scheduled Monuments, Listed Buildings, Inventory Gardens and Designed Landscapes, Inventory Historic Battlefields and Conservation Areas were downloaded in GIS from the Historic Environment Scotland Data Warehouse (Historic Environment Scotland 2017a).
- Information on known cultural heritage assets within the Inner Study Area was obtained from the East Lothian Historic Environment Record (HER) and Scottish Borders Historic Environment Record (HER).
- Additional information on the character and condition of known archaeological sites and features within the Inner Study Area was obtained from Canmore, the HES database, via the online Pastmap resource (HES 2017b).
- Historic Ordnance Survey maps (including 1st and 2nd Edition maps and subsequent map editions), and other published historic maps held in the Map Library of the National Library of Scotland were examined for the Inner Study Area.
- An assessment was made of vertical aerial photographs held by HES (Sorties from 1959 were examined) and modern aerial photography (Google Earth ^{TM}) for the Inner Study Area.
- Reports concerning previous archaeological work in the area with regard to the Crystal Rig wind farm (Jones 2008), the existing Crystal Rig wind farm Substation (Hill & Suddaby 2007), and the proposed onshore works for the NNG Wind farm (CFA 2012) provided information on previous work which had occurred within the Inner Study Area.
- The Historic Land-Use Assessment Data for Scotland (HLA Map) (HES 2017c) was consulted for information on the historic land use character of the Inner Study Area.
- The Scottish Palaeoecological Archive Database (SPAD) (Coles et al. 1998) which records the distribution of known palaeoenvironmental sites across Scotland, was consulted for information on such sites within or adjacent to the proposed grid connection route. There were no such sites recorded within or in the vicinity of the Inner Study Area.

Reconnaissance Field Survey

6.13 A walk over reconnaissance field survey was undertaken within the Inner Study Area (the proposed development area plus a 200 m buffer), in order to:

- Assess the baseline condition of the known cultural heritage assets which had been identified through the desk-based assessment;
- Identify any further sites or features of cultural heritage interest which were not detected by the desk-based assessment; and

- Identify areas with the potential to contain currently unrecorded buried archaeological remains.

6.14 The reconnaissance field survey of the Inner Study Area was carried out in 2013.

6.15 Identified cultural heritage assets were recorded on proforma monument recording forms and by digital photography. Their positions (and where appropriate their extents) were logged using a Global Positioning System (GPS) accurate to +/- 1-2m.

Impact Assessment Methodology

Assessment of Effects

6.16 The types of impact on cultural heritage interests which might result from the proposed development have been assessed in the following categories:

- Direct, where there may be a physical impact on an asset caused by the construction of the proposed development. Direct effects tend to have permanent and irreversible adverse impacts upon cultural heritage remains.
- Indirect, where elements of the development affect the setting of cultural heritage features present in the vicinity.

6.17 Effects have been assessed in terms of their magnitude (Table 6.3), permanence (permanent / temporary), reversibility, and nature (adverse / neutral / beneficial).

6.18 Beneficial effects are those that contribute to the value of an asset through enhancement of desirable characteristics or the introduction of new, positive attributes. Neutral effects occur where the development can be accommodated comfortably by the receiving environment while neither contributing to nor detracting from the value of the asset. Adverse effects are those that detract from the value of an asset through a reduction in or disruption of valuable characteristics, or the introduction of new inappropriate characteristics.

Assessing Significance of Impact on Cultural Heritage Assets

6.19 The significance of an impact depends upon the importance of a cultural heritage asset (Table 6.2), combined with the magnitude of the predicted impact (Table 6.3).

6.20 Cultural heritage assets represent a non-renewable resource that are often fragile and suffer from constant attrition, from both natural and human causes. The assessment of importance of archaeological and heritage assets reflects the relative weight given to them in SHEP and SPP. Table 6.2 summarises the relative importance of those types of cultural heritage asset relevant to this study.

Table 6.2: Importance of Cultural Heritage Assets

Cultural Heritage Importance	Site Types
National / International	Sites of national or international importance, including: ▪ Scheduled Monuments and sites proposed for scheduling.
Regional	Sites of regional importance, including: ▪ Archaeological sites and areas of distinctive regional importance.
Local	Sites of local importance, including: ▪ Archaeological sites and areas of local importance.
Lesser	Sites of little or no importance including: ▪ Artefact find-spots; and ▪ Poorly preserved examples of particular types of feature.

6.21 Criteria for assessing the magnitude of an impact, which measures the degree of change to the baseline condition of the heritage asset that could result from the construction of the proposed Substation Extension, are presented in Table 6.3.

Table 6.3: Magnitude of Impacts

Magnitude	Definition
High	A fundamental material change to the baseline condition of the asset, leading to total loss or major alteration of its character or setting.
Medium	A material, partial loss or alteration of character or setting.
Low	A slight, detectable, alteration of the baseline condition or setting of the asset.
Imperceptible	A barely distinguishable change from baseline conditions.

6.22 The importance of the asset defined in Table 6.2 and the magnitude of the predicted impact in Table 6.3 are used to inform the professional judgement of the likely significance of the effect. Table 6.4 summarises the criteria for assessing the significance of an effect, following the standard terminology utilised throughout the ER. Major and moderate effects are considered to be significant.

Table 6.4: Significance of Effects

Magnitude of Impact ▼	Importance of Asset ►			
	National / International	Regional	Local	Lesser
High	Major	Major	Moderate	Minor
Medium	Major	Moderate	Minor	None
Low	Moderate	Minor	None	None
Imperceptible	Minor	None	None	None

6.23 The terms used to define the relative significance of effects are defined in Table 6.5 below.

Table 6.5: Significance of Effects

Term	Definition
Major	A fundamental change to the environment.
Moderate	A material but non-fundamental change to the environment.
Minor	A detectable but non-material change to the environment.
None	No detectable change to the environment.

Policy Context

6.24 The primary legislation and planning guidance at the national level comprises:

- National Planning Framework for Scotland 3 (NPF3) (The Scottish Government 2014a);
- Historic Environment Scotland Policy Statement (HESPS) (Historic Environment Scotland 2016)
- Scottish Planning Policy (SPP) (The Scottish Government 2014b); and
- Planning Advice Note 2/2011 (PAN 2) (The Scottish Government 2011).

6.25 Planning policy at the local and regional level comprises:

- The Strategic Development Plan for Edinburgh and South East Scotland (SESplan) (2013);
- East Lothian Local Plan (2008); and
- The Scottish Borders Local Development Plan (LDP) (2016)

National Planning Framework for Scotland 3 (NPF3) (The Scottish Government 2014)

6.26 NPF3 is government policy on how nationally important land use planning matters should be addressed across the country (Para 1). The Framework provides the strategic spatial policy context for decisions and actions by the Government and its agencies, and brings together the Scottish Government's plans and strategies in economic development, regeneration, energy, environment, climate change, transport and digital infrastructure to provide a coherent vision of how Scotland should evolve over the next 20 to 30 years.

6.27 One of the main elements of the spatial strategy set out in NPF3 is the intention to respect, enhance and make responsible use of Scotland's cultural assets (Section 4: A natural resilient place) and the framework recognises the contribution made by our cultural heritage to our economy, cultural identify and quality of life. Planning authorities are required to consider the Framework when preparing development plans, and it is a material consideration in the determination of planning applications.

Historic Environment Policy Statement (HESPS) (Historic Environment Scotland 2016)

6.28 This sets out the principles under which Historic Environment Scotland (HES) operates and provides a framework that informs the day to day work of a range of organisations that have a role and interest in managing the historic environment. The policy statement complements and is to be read alongside the Scottish Planning Policy and other relevant documents, including 'Our Place in Time: the Historic Environment Strategy for Scotland' (2014).

Scottish Planning Policy (SPP) (The Scottish Government 2014)

6.29 In SPP (Para 136) the historic environment is recognised as a key cultural and economic asset and a source of inspiration that should be seen as integral to creating successful places. Culture-led regeneration can have a profound impact on the well-being of a

community in terms of the physical look and feel of a place and can also attract visitors, which in turn can bolster the local economy and sense of pride or ownership.

6.30 Key policy principles set out in SPP are to:

- Promote the care and protection of the designated and non-designated historic environment (including individual assets, related settings and the wider cultural landscape) and its contribution to sense of place, cultural identity, social well-being, economic growth, civic participation and lifelong learning; and
- Enable positive change in the historic environment which is informed by a clear understanding of the importance of the heritage assets affected and ensure their future use. Change should be sensitively managed to avoid or minimise adverse impacts on the fabric and setting of the asset, and ensure that its special characteristics are protected, conserved or enhanced.

Planning Advice Note 2/2011; Planning and Archaeology

6.31 Planning Advice Note 2/2011 (PAN 2) advises that, in determining planning applications, planning authorities should take into account the relative importance of archaeological sites (para 5). It also notes that in determining planning applications that may impact on archaeological features or their setting, planning authorities may on occasion have to balance the benefits of development against the importance of archaeological features (para 6). The desirability of preserving a monument (whether scheduled or not) is a material consideration and the objective should be to assure the protection and enhancement of monuments by preservation in situ, in an appropriate setting. When preservation in situ is not possible, recording and/or excavation followed by analysis and publication of the results may be an acceptable alternative (para 14).

The Strategic Development Plan for Edinburgh and South East Scotland (SESplan)

6.32 The SES Plan notes that Local Development Plans will "ensure that there are no significant adverse impacts on the integrity of international and national built or cultural heritage sites in particular World Heritage Sites, Scheduled Ancient Monuments, Listed Buildings, Royal Parks and Sites listed in the Inventory of Gardens and Designed Landscapes.

6.33 The SES Plan contains no policies with specific reference to cultural heritage matters.

East Lothian Local Plan (2008)

6.34 The East Lothian Local Plan contains the following policies of relevance to the assessment:

6.35 Policy Env7: Scheduled Monuments and Archaeological Sites

(1) Where a proposed development might affect any site or area included in the East Lothian Sites and Monuments Record (of known or suspected archaeological interest), the developer must first undertake and make available to the Planning Authority a professional archaeological assessment and, if necessary, a field evaluation.

(2) Development that would harm a site of archaeological interest or its setting, particularly a Scheduled Monument, will not be permitted. The only exception to this will be situations where archaeological advice concludes that the significance of the remains is not sufficient to justify their physical preservation in situ when weighed against other material considerations, including the benefits of the proposed development. In such situations, the developer must make proper provision for the excavation, recording, and analysis of the archaeological

remains in advance of the commencement of development, any subsequent post-excavation work and the publication of the results. Appropriate conditions may be applied to any planning permission to achieve this.

(3) Where it is feasible within a proposed development to accommodate, preserve and enhance archaeological features or their setting, public access to and interpretation of these features will be expected.

The Scottish Borders Local Development Plan (LDP) (2016)

6.36 The Scottish Borders Local Development Plan contains the following policies of relevance to the assessment:

6.37 Policy EP8: Archaeology

(A) National Archaeological Sites

Development proposals which would destroy or adversely affect the appearance, fabric or setting or Scheduled Monuments or other nationally important sites will not be permitted unless:

a) The development offers substantial benefits, including those of a social or economic nature, that clearly outweigh the national value of the site, and
b) There are no reasonable alternative means of meeting the development need.
c) Regional or Local Archaeological Assets

Development proposals which will adversely affect an archaeological asset of regional or local significance will only be permitted if it can be demonstrated that the benefits of the proposal will clearly outweigh the heritage value of the asset.

In all of the above cases, where development proposals impact on a Scheduled Monument, other nationally important sites, or any other archaeological or historical asset, developers may be required to carry out detailed investigations.

Any proposal that will adversely affect a historic environment asset or its appropriate setting must include a mitigation strategy acceptable to the Council.

Baseline Conditions

General

6.38 Four cultural heritage assets have been identified within the Inner Study Area. The locations and extents of these assets are shown on Figure 6.1, and Technical Appendix 5.0 provides detailed gazetteer information on their character and baseline condition, together with an assessment of the relative cultural heritage importance of each.

6.39 Numbers in brackets refer to site numbers provided on Figure 6.1 and in Technical Appendix 6.0.

Cultural Heritage Assets within the Inner Study Area

6.40 There are no Scheduled Monuments or Listed Buildings within the Inner Study Area, and no part of the Inner Study Area would intersect with a Conservation Area, Inventory Historic Battlefield or Inventory Garden and Designed Landscape.

6.41 The East Lothian HER and / or Canmore database holds records for three sites within the Inner Study Area. Records of three archaeological events (EEL 497, EEL 589 & EEL 591)

which relate to field survey and evaluation works carried out prior to the construction of the existing Substation, reconnaissance field survey prior to the construction of Crystal Rig wind farm, and a watching brief at Crystal Rig II wind farm, are held by the HER. The findings from these works are recorded under other HER Nos. and these event records are therefore not mentioned further in this report. In their consultation response, SBC noted an archaeological watching brief between the Westerdod Substation and the Crystal Rig Substation, and an archaeological evaluation which had recently been carried out close to the Crystal Rig Substation. Neither of these investigations found any archaeological finds or features, and they are not mentioned further in this assessment.

6.42 Examination of historic maps identified one further site within the Inner Study Area.

6.43 Field survey provided further information on the baseline condition of the sites and features which had been identified through the desk-based assessment.

6.44 The four cultural heritage sites and features recorded within the Inner Study Area all relate to the medieval or later agricultural exploitation of the land.

6.45 An area of drainage ditches (**1**) has previously been investigated through an archaeological evaluation, which formed part of the archaeological mitigation works for the construction of the existing Substation. The area has also since been disturbed by the construction of the Substation, and the use of the adjacent area as a construction compound. Field bank (**2**) was recorded by field survey (Jones 2008), but was not recorded by the current (2013) field survey. As the bank lies within the outer fence enclosing the existing Substation, it is assumed that the bank has been destroyed by construction activities in the area. Both the area of drainage ditches (**1**) and the former location of the field bank (**2**) are considered to be of lesser cultural heritage importance.

6.46 The remains of a trackway (**3**) are visible to the west of the proposed Substation Extension, as a hollow-way running on a roughly north-south orientation with a slight bank visible on the eastern side. The trackway is depicted on the First Edition Ordnance Survey map (Haddingtonshire, Sheet XVI, 1855, 6" to 1 mile) and is considered to be of local cultural heritage importance as it forms part of a wider system of trackways which connect with The Herring Road, which lies further to the west, and which was used in the 18th and 19th centuries to transport herring from Dunbar to the markets in Lauder, and to carry home salted herring for use over the winter months.

6.47 The remains of a sub-square enclosure (**4**) measuring 8m x 7m were identified by a field survey in 2008. The enclosure was defined by a low bank 0.4m high and 1m wide. The remains of the enclosure are considered by this assessment to be of local cultural heritage importance.

Assessment of the Archaeological Potential of the Inner Study Area

6.48 The HLA map (HES 2017c) notes the Boonslie area, to the north of the proposed development area, as an area of medieval / post medieval settlement and agriculture. The area to the south of the existing Substation is marked as 17th – 18th century rectilinear fields and farms. The current land use character of the development area is moorland and rough pasture, with the majority of the area having been disturbed by construction activities for the existing Substation and the Crystal Rig wind farm.

6.49 There is no evidence for prehistoric activity within the proposed development area, and evidence for prehistoric settlement is generally confined to the lowland areas further to the north and east. Settlement in the area is first depicted on Roy's Military Survey map (1747-55), with farmsteads such as Boonslie, to the north of the proposed Substation, being shown.

6.50 The archaeological trial trench evaluation prior to the construction of the existing Substation provided evidence that the land in this area had not been subject to significant or extensive development, but that it had been progressively enclosed and partially improved. Taking these results, and the lack of substantial recorded remains in the vicinity of the proposed Substation Extension into account, it is considered that there is a low potential for previously undetected, buried remains to survive within the proposed development area.

Assessment of the Archaeological Potential of the Inner Study Area

6.51 There is one cultural heritage asset located within 4km of the proposed Substation Extension from which the Substation Extension would theoretically be visible (Figure A18). This asset is:

- Enclosures and farmstead at Boonslie (Site of Schedulable Quality, HER No. MEL 1682).

Potential Effects of Proposed Development

Direct Effects

6.52 The potential for direct effects was assessed using the criteria detailed in Tables 6.3 and 6.4. All direct effects are considered to be permanent, irreversible and adverse, unless otherwise stated.

6.53 Part of track (**3**) lies within the temporary construction area, and would therefore likely be disturbed by vehicle movements, temporary storage of construction materials and by other construction activities. The track extends to the north and south of the Inner Study Area, and it is therefore only a part of the track which would be directly affected by the proposed development. The direct effect would likely be of medium magnitude. The effect is assessed to be **Minor** and therefore **Not Significant.**

6.54 **No Effect** is predicted for an area of drainage ditches (**1**) although this lies within the proposed development area. This site has been disturbed by the archaeological trial trenching which formed part of the archaeological mitigation for the construction of the existing Substation, and was then effectively destroyed by construction activities during the construction of the Substation. The effect upon the area of drainage ditches is therefore assessed to be **Not Significant.**

6.55 **No Effect** is predicted for bank (**2**) although it lies within the proposed development area, because this site no longer survives. The effect upon bank (**2**) is assessed to be **Not Significant.**

6.56 **No Effect** is predicted for enclosure (**4**) which lies outside the proposed development area, and the temporary construction areas. The enclosure is separated from the proposed development area by a modern post and wire fence.

Indirect Effects

6.57 Enclosures and farmstead at Boonslie (HER No.MEL1682), a site considered by East Lothian Council to be of schedulable quality, is predicted by the ZTV to have theoretical visibility of the proposed Substation Extension.

6.58 Boonslie enclosures and farmstead comprises an extensive area of earthworks which are visible on aerial photographs, and which include the remains of buildings, enclosures and rig and furrow cultivation remains which are believed to date to the late medieval period. The site is located on unimproved ground which slopes down towards the burn to the east, and which is largely overgrown with heather vegetation. From the majority of the site both the existing Substation and the proposed extension would be visible. In very limited areas the new Substation Extension only would be visible; these areas lie in close proximity to the line of the burn. For some parts of the site, along the line of the burn, and at the northern end of the site either no part of the existing or proposed extension to the Substation would be visible, or for other parts, only the existing substation would theoretically be visible. The setting of the enclosures and farmstead remains is its location within the more sheltered land of the burn valley, and this would not be affected by the proposed development. The wider landscape around Boonslie already includes the existing Substation and the Crystal Rig wind farm. The proposed Substation Extension would lead to a barely distinguishable change from the existing baseline conditions, causing a permanent, irreversible impact of imperceptible magnitude. The effect is assessed to be **Minor**, neutral and therefore **Not Significant.**

Mitigation

6.59 The emphasis in planning policy is for preservation in situ of important remains. Where that is not possible, the excavation and recording of any affected sites would be required in advance of construction, at the developer's expense.

6.60 Taking into account that an earlier planning consent, for an extension to the Substation granted by East Lothian Council (Application No. 13/00756/PM), did not require mitigation for trackway (**3**), it is considered that no mitigation would be required for the potential impact on a short part of this trackway resulting from the proposed development.

6.61 The area of drainage ditches (**1**) has already been the subject of archaeological mitigation, and along with the former location of a field bank (**2**) then suffered disturbance during the construction of the existing Substation. These sites have been effectively destroyed, and therefore no mitigation is proposed.

6.62 Written guidelines would be issued for use by all construction contractors, outlining the need to avoid causing unnecessary damage to known sites. That document would contain arrangements for calling upon retained professional support in the event that buried archaeological remains of potential archaeological interest (such as building remains, human remains, artefacts etc.) are discovered during construction works. The guidance would make clear the legal responsibilities placed upon those who disturb artefacts or human remains.

6.63 Any archaeological mitigation works requested by ELC or SBC before or during construction works would be included in a Written Scheme of Investigation (WSI) produced for approval prior to the commencement of construction works. Provision would be made for the excavation and recording of any archaeological remains identified as a result of any

mitigation works and that could not be preserved in situ. This provision would include the consequent production of written reports on the findings of the archaeological work conducted, with post-excavation analyses, publication and archiving of the results of the work, where appropriate.

6.64 No mitigation measures are proposed in relation to the predicted indirect effects.

Table 6.6: Summary of Mitigation Measures

Issue	Mitigation Measure	Input
Potential direct impact on Trackway (**3**). Impact would affect only a small part of the trackway resulting in an effect of no more than minor significance.	None	N/A
Low potential for direct impact on previously unrecorded archaeology, resulting in a potential effect of no more than minor significance.	Requirements for mitigation to be agreed with East Lothian Council and Scottish Borders Council	Work to be carried out in advance of / during construction works.

Residual Effects

6.65 The assessment of the residual effects has been carried out with reference to the proposed development layout as shown on Figure 6.1.

Residual Direct (Construction) Effects

6.66 The completion of the programme of archaeological mitigation works which are set out above would minimise the loss of the archaeological resource which would occur as a result of the construction of the proposed Substation Extension. Following the implementation of the proposed mitigation measures, the residual effect is assessed to be **Not Significant.**

Residual Indirect (Operational) Effects

6.67 No mitigation is proposed, and therefore the predicted residual impacts remain as predicted above. The residual effect is assessed to be **Minor** and therefore **Not Significant.**

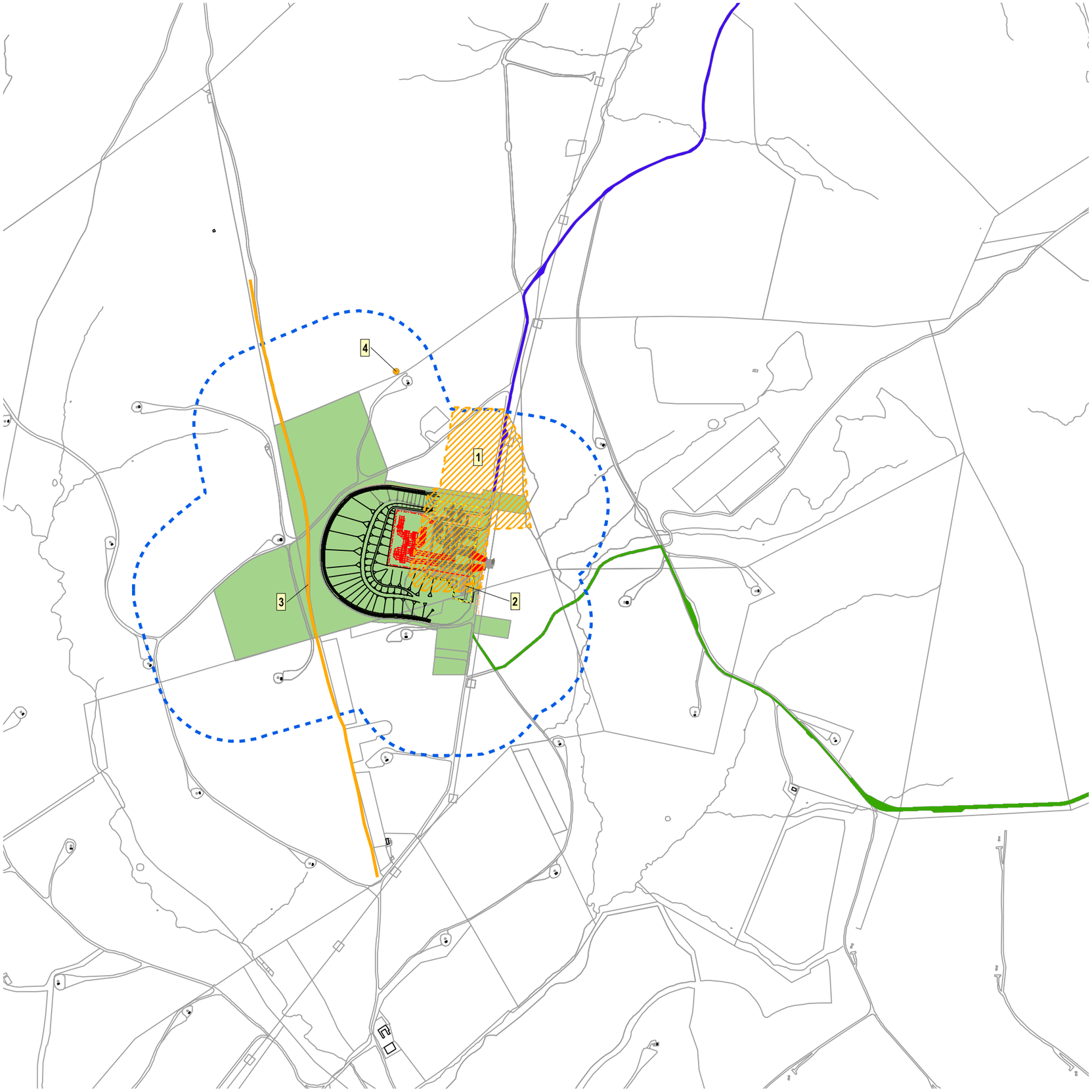
Archaeology and Cultural Heritage Summary

6.68 Up-to-date information on the locations and extents of cultural heritage assets were obtained for an Inner Study Area, consisting of the proposed development area plus a 200 m buffer. Detailed desk-based assessment and reconnaissance field survey were also carried out for this area.

6.69 This work identified four assets of cultural heritage interest within the Inner Study Area, which are of either local or lesser cultural heritage importance. A **Minor Effect** (**Not Significant**) upon the trackway (**3**) is predicted, due to construction activities. The area of drainage ditches (**1**) and the field bank (**2**) have been effectively destroyed, and therefore no mitigation is proposed. Enclosure (**4**) is separated from the proposed development area by a modern post and wire fence, and this is considered sufficient mitigation to ensure the preservation in situ of the enclosure.

6.70 The potential for the proposed development area to contain previously unrecorded remains of archaeological significance is considered to be low.

6.71 One indirect (operational) impact of **Minor** significance is predicted for the site of Boonslie, enclosures and farmstead (MEL 1682), a site considered by East Lothian Council to be of schedulable quality. The residual indirect effect is assessed to be **Not Significant**.



Key:

- Proposed Development Area including Temporary Construction Compound Areas
- Construction Access Route
- Operational Access Route
- Inner Study Area
- Cultural Heritage Site (point)
- Cultural Heritage Site (line)
- Cultural Heritage Site (area)

0 250 500m

figure 6.1

Title:

Cultural Heritage: Constraints

Project:

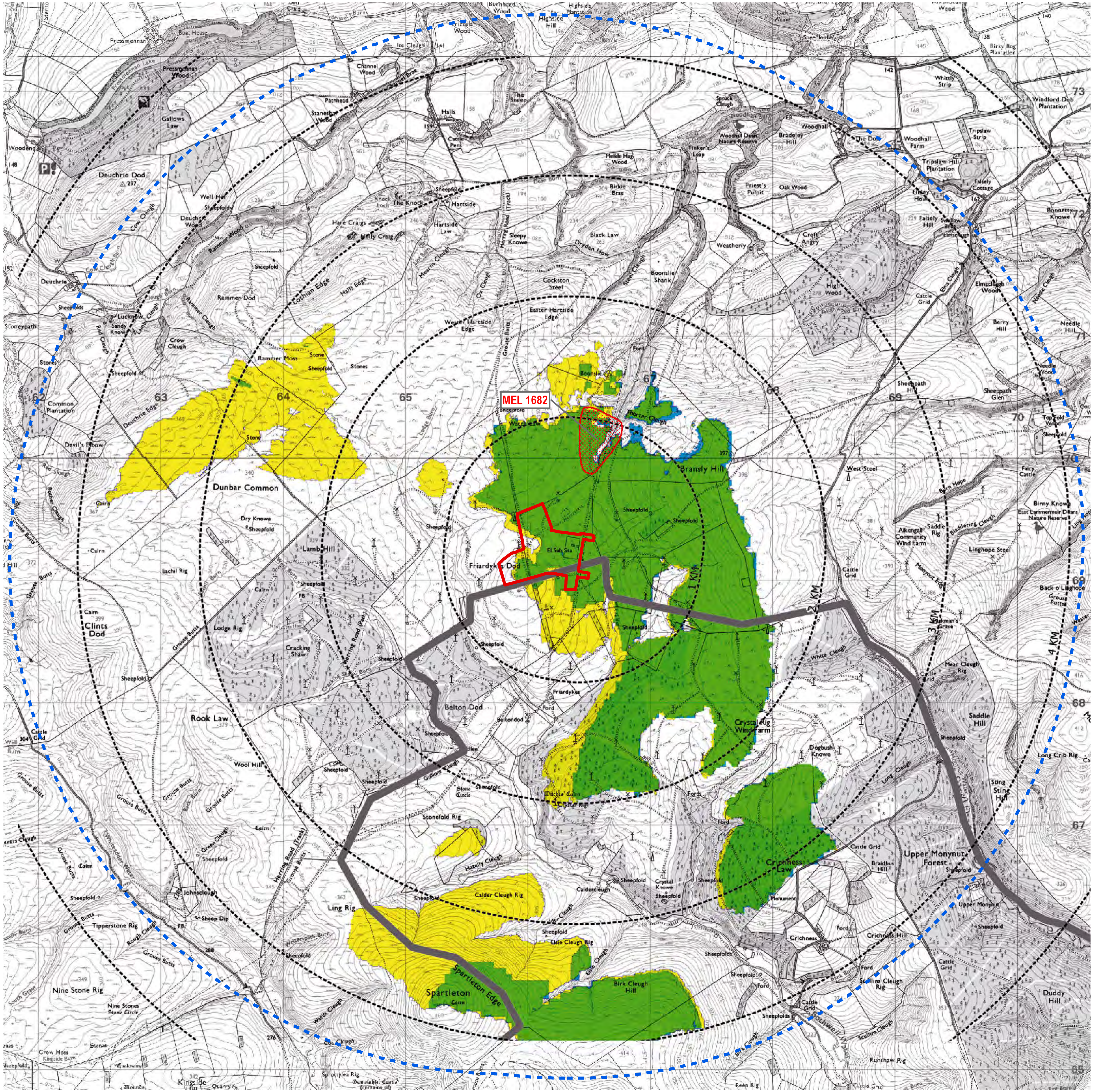
Crystal Rig Substation Extension

Scale: 1:10,000 at A3

Date: Mar 2017

SP EnergyNetworks

Environmental Designworks
Landscape Architecture + Planning



Key:

- Proposed Development Area including Temporary Construction Compound Areas
- Outer Study Area
- Site of schedulable quality
- Administration Boundary
- Theoretical Visibility of existing Crystal Rig Substation
- Theoretical Visibility of proposed Crystal Rig Substation Extension
- Combined Theoretical Visibility

Ordnance Survey Key:

Contours	Mast	Parking/Park & ride
Landfill site	Wind turbine	Picnic site
Woodland	Youth Hostel	Tourist interest
Forestry Commission	Place of worship	Telephone, public
Visitor centre	Camp site/Caravan	Viewpoint
Nature reserve	Golf course	Walks/Trails

0 1 2km

figure 6.2

Title:

Cultural Heritage: External Receptors and ZTV

Project:

Crystal Rig Substation Extension

Scale: 1:33,000 at A3

Date: Mar 2017

SP EnergyNetworks

Environmental Designworks
Landscape Architecture + Planning

Introduction

7.1 This chapter presents a summary of baseline conditions at the proposed Substation Extension and the qualitative technical assessment of potential effects the proposed development will have on catchment hydrology. The full baseline, supporting flood risk statement and drainage strategy are presented in Technical Appendix 7.

7.2 For the purposes of this Chapter, 'the proposed development' jointly refers to the proposed extension to the existing Substation at Crystal Rig and the proposed temporary construction compounds. When each element is referred to separately they are referred to as the 'proposed Substation Extension' and the 'proposed Temporary Compounds'. The existing Substation at Crystal Rig is referred to as 'the existing Substation'.

Scope and Methodology

Scoping Consultation Responses

7.3 As part of the 2013 planning application, pre-application consultation was undertaken and a summary of the responses relevant to the water environment are presented in Table 7.1.

Table 7.1: 2013 Consultation Responses Relating to the Water Environment

Consultee	Issue	How / where this is addressed
Scottish Environment Protection Agency (SEPA) (letter response 9 August 2013)	The response confirmed that, from the information submitted for consultation in 2013, the proposal to extend the Substation was satisfactory and did not require authorisation from SEPA.	No response/action required.
Scottish Natural Heritage (SNH) (response received 8 July 2013)	SNH noted that the initial environmental appraisal on which the scope of work was based appeared comprehensive and, at that stage, SNH was not aware of any environmental issues in relation to their remit that had been overlooked. SNH highlighted the importance of the River Tweed SAC (Special Area of Conservation) into which the Tay Burn and Mossy Burn flow. SNH specifically mentioned that the qualifying interests of the SAC would be sensitive to disturbance to the river habitat, including silt and sediment entering the watercourse and smothering gravel beds, suspended solids in the water column, pollution events, and changes in water	Watercourses (including the River Tweed SAC) are identified in the baseline summary and are considered as receptors in the qualitative assessment of the potential effects the proposed development will have on catchment hydrology in this chapter.

	quality and chemistry. SNH stated that such effects could be avoided through a combination of good design and use of effective mitigation methods (particularly during construction) and that reference should be made to SNH guidance 'Good practice during windfarm construction'.	

7.4 These responses informed the scope of the 2013 assessment work (MWH, 2013) and have also been considered in the preparation of this report. No additional scoping consultations have been undertaken as part of this assessment.

Technical Scope

7.5 The technical scope of this Chapter is to present an assessment of the potential effects of the proposed development on the hydrology of the study area.

Geographical Scope

7.6 The study area for the assessment of effects on catchment hydrology covers the proposed development itself and an area with a radius of 1 km from the proposed development boundary. Water features located downstream of the study area that have the potential to be hydraulically connected to the study area are also identified as part of the baseline and considered in the assessment. The study area is shown in Technical Appendix 6.0 - Drawing 1.

Temporal Scope

7.7 The assessment of effects on catchment hydrology covers the construction, operation (including inspection and maintenance) and decommissioning periods.

Sources of Baseline Information

7.8 This baseline section has been collated from the previous Environmental Report (MWH, 2013) and the 2016 Environmental Report Addendum (Environmental Designworks, 2016) submitted for the original proposed Crystal Rig Substation Extension.

7.9 It is understood that there have been no notable changes to the proposed development area since the previous work. The baseline for this assessment is, therefore, largely compiled using the information presented in the 2013 Environmental Report and the 2016 Addendum where no other source of information is referenced. Where additional information has been required, or the currency of existing information has been checked, the additional sources have been referenced.

7.10 No additional site visits, ground investigation or consultation has been undertaken as part of this assessment.

Assessment Method and Significance Criteria

7.11 Using the baseline conditions identified from the sources outlined in the previous sections, and the description of the proposed development presented in Chapter 3, the potential changes upon the hydrological environment resulting from the proposed development are

described in this section. A qualitative assessment methodology is then used to assess the magnitude of the potential changes and the significance of the effects.

7.12 Two factors have been considered in using this approach: 1) the sensitivity of the receiving environment (in this case a watercourse, surface water body or surface water abstraction); and 2) the magnitude of the change should it occur. This approach provides a mechanism for identifying the areas where mitigation measures are required, and for identifying mitigation measures appropriate to the significance of the effects presented to the hydrological environment by the proposed development.

7.13 The sensitivity classification of the receiving environment is defined in Table 7.2. Criteria for determining the magnitude of the change are provided in Table 7.3. The sensitivity of the receiving environment together with the magnitude of the change defines the significance of the effect, as identified within Table 7.4.

Table 7.2: Sensitivity Criteria for Receptor

Sensitivity	Definition
Very High	• International importance. • Receptor with a high quality and rarity, regional or national scale and limited potential for substitution/replacement.
High	• National importance. • Human Health. • Receptor with a high quality, local scale and limited potential for substitution / replacement; or • Receptor with a medium quality and rarity, regional or national scale and limited potential for substitution / replacement.
Medium	• Regional importance. • Receptor with a medium quality and rarity, local scale and limited potential for substitution / replacement; or • Receptor with a low quality and rarity, regional or national scale and limited potential for substitution / replacement.
Low	• Local importance. • Receptor with a low quality and rarity, local scale. • Environmental equilibrium is stable and is resilient to changes that are greater than natural fluctuations, without detriment to its present character.

Table 7.3: Magnitude of Change Criteria and Definitions

Magnitude	Description of Criteria	
	Adverse	Beneficial
High	Loss of resource/receptor, loss of quality and integrity of the resource/receptor, severe damage to key characteristics, features or elements.	Large scale or major improvement to resource/receptor quality, extensive restoration or enhancement.
Medium	Partial loss of resource/receptor, partial loss of quality and integrity of the resource/receptor, damage to key characteristics, features or elements.	Improvement to resource/receptor quality, some restoration or enhancement, addition of key characteristics, features or elements.

Low	Some measureable change in/damage to attributes, quality or vulnerability. Minor loss of, or alteration to, key characteristics, features or elements.	Minor benefit to, or addition of, one or more key characteristics, features or elements. Some beneficial impact on the attribute or reduction in the negative impact.
Very Low	Very minor (immeasurable) change to one or more characteristics, features or elements.	Very minor (immeasurable) benefit to, or positive addition of, one or more characteristics, features or elements.
Negligible	No change to characteristics, features or elements.	

Table 7.4: Significance of Effect

Receptor Sensitivity	Magnitude of Change				
	Negligible	Very Low	Low	Medium	High
Low	None	None	Slight	Slight	Minor
Medium	None	Slight	Slight	Minor	**Moderate**
High	None	Slight	Minor	**Moderate**	**Major**
Very High	None	Minor	**Moderate**	**Major**	**Major**

7.14 The relative significance of effects presented in Table 7.4 can be described in the following terms:

- Major - a fundamental change to the environment.
- Moderate - a material but non-fundamental change to the environment.
- Minor - a detectable but non-material change to the environment.
- None - no detectable change to the environment.

7.15 Effects of 'major' and 'moderate' significance (bold in Table 7.4) are considered to be 'significant' in terms of this assessment and in terms of the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011.

Policy Context

7.16 This section presents an overview of the main policies (see Table 7.5) and guidance relevant to this assessment. The main policies are presented fully in Technical Appendix 6.0.

Table 7.5: Summary of Relevant Policies

Planning Policy	Summary
National Planning Framework 3 (2014)	*We will respect, enhance and make responsible use of our natural and cultural assets*". This includes water resources which "*contribute to the quality and distinctiveness of our environment*" (para. 4.3) "*All of our resources…..require sustainable management to deliver on our climate change commitments and realise opportunities for business and employment*" (para. 4.8), which acknowledges the

	need to balance development with resources and climate change commitments. NPF paragraph 4.25 specifically highlights the importance of managing flood risk in rural areas in response to changing weather patterns. The targets for the future presented within the NPF state that "*90% of water bodies [will be] at good ecological status by 2027", and good ecology is dependent on good water quality and quantity*.
Scottish Planning Policy (2014)	States planning plays an important role in protecting and enhancing the natural environment and that the planning system should "*promote protection and improvement of the water environment, including rivers, lochs, estuaries, wetlands, coastal waters and groundwater, in a sustainable and co-ordinated way*" (para.194) "*Development management decisions should take account of potential effects on landscapes and the natural and water environment, including cumulative effects*" (para. 202) Highlights that the planning system should promote *"a precautionary approach to flood risk from all sources.....taking account of the predicted effects of climate change*", locate development "*away from functional flood plains and medium to high risk areas*" and avoid "*increased surface water flooding through requirements for Sustainable Drainage Systems (SuDS) and minimising the area of impermeable surface*" (para. 255) Flood Risk Assessment will generally be required for applications within areas identified at high or medium likelihood of flooding/flood risk in SEPA's flood maps (para. 266)
East Lothian Local Plan (2008)	Policy NH1a (Internationally Protected Areas) Policy NH1b (Sites of Special Scientific Interest) Policy NH6 (Watercourses and Wetlands) Policy DP15 (Sustainable Urban Drainage Systems) Policy DP16 (Flooding)
Scottish Borders Local Development Plan (adopted May 2016)	Policy EP1 (International Nature Conservation Sites and Protected Species) Policy EP2 (National Nature Conservation Sites and Protected Species) Policy EP15 (Development Affecting the Water Environment) Policy IS8 (Flooding) Policy IS9 (Sustainable Urban Drainage Systems)

7.17 Guidance relevant to this assessment includes the following:

- The Scottish Government Flood Risk Planning Advice, June 2015 (which supersedes Planning Advice Note 69 on Flood Risk).

- Scottish Natural Heritage guidance entitled 'Good practice during windfarm construction', version 3 dated September 2015.
- Scottish Environment Protection Agency Pollution Prevention Guidelines (PPGs).

Baseline Conditions

7.18 This section presents a summary of the full baseline (see Technical Appendix 6.0).

Ground Conditions

7.19 The proposed development is located in an area dominated by undulating hills. The topography of the area slopes downwards from west to east. The ground at the proposed development extension site will have an elevation of approximately 302 m AOD and the existing Substation is at an elevation of approximately 298 m AOD.

7.20 The ground cover/vegetation largely comprises rough and marshy grassland with localised man-made features associated with the Crystal Rig wind farm and existing Substation. There are very few trees at the proposed development site or in the immediate area. There are patches of woodland within 0.5 km and areas of plantation within 1 km.

7.21 The soils mapped in the proposed Substation Extension and temporary compound areas (Scotland's Soils, 2017) comprise Brown Soils and Blanket Peat, which are both of the Ettrick Association. The blanket peats are mapped in the northern parts of the proposed Substation Extension area and the northern part of the proposed temporary compound areas. The presence of peat was noted also as part of the ecology survey undertaken in May 2013 (MWH, 2013). Blanket Bog was only mapped in a small area to the north and west of the proposed temporary compound areas (i.e. not in an area of proposed development)

7.22 The superficial geology mapped in the area (BGS, 2017) comprises alluvial deposits and Glacial Till. The Alluvial material is mapped as being confined to the routes of the surface watercourses. The Glacial Till is mapped as being located in the lows (valleys and saddles between hills). There are no superficial deposits mapped on the areas of higher ground away from the watercourses. In relation to the proposed development itself, there are Till deposits mapped in the northern part around the temporary compounds and there are no superficial deposits mapped to the west or south of the existing Substation where the proposed Substation Extension and proposed southern temporary compound are proposed.

7.23 The bedrock geology beneath the proposed Substation Extension and compound areas is mapped (BGS, 2017) as comprising wacke deposits that are part of the Gala Group.

7.24 The land around the proposed development drains poorly and there are commonly areas of wet/saturated ground in the area, particularly following precipitation.

Hydrogeology

7.25 The bedrock geology is part of the 'Lammermuir bedrock and localised sand and gravel drift aquifer' groundwater body within the Solway Tweed River Basin District. The groundwater body was classified in 2008 as having good status for both quantity and chemistry. The targets for this water body under the Water Framework Directive are to maintain the good status and that "no deterioration in status occurs, unless caused by a

new activity providing significant specified benefits to society or the wider environment"[22]. The water body is described by SEPA as having an area of 271.66 km^2 and is associated with Bothwell Water and Whiteadder Water. The 'Lammermuir bedrock and localised sand and gravel drift aquifer' is also a drinking water protected area.

7.26 The British Geology Society (BGS, 2107) classifies the Gala Group bedrock aquifer as low productivity. Groundwater storage and flow occurs in the near surface weathered zone and through secondary fractures.

7.27 There are no investigation results to provide site-specific information on groundwater levels. Groundwater may be encountered within the Glacial Till in localised lenses of the more silty and sandy parts of the Till, but lateral and vertical flows are likely to be limited where clay dominates. It is likely that water will be encountered within the soils and fractured upper horizons of the bedrock aquifer. Flow will most likely follow topography and, therefore, groundwater flow beneath the proposed development will be generally towards the east and the Tay Burn.

7.28 There is likely to be a hydraulic connection between groundwater and surface water in the catchments. Near surface groundwater is likely to provide baseflow to the burns and feed springs/seeps in the area.

Surface Water Features

7.29 There are no surface watercourses or water bodies on the proposed development. The nearest watercourse is a tributary of the Tay Burn, which at its closest passes approximately 0.25 km east of the proposed development. A tributary of the Mossy Burn is located approximately 0.75 km to the west. These watercourses are shown in Technical Appendix 6.0 - Drawing 1.

7.30 The tributary of the Tay Burn originates approximately 0.5 km north of the proposed development and flows parallel on the western side of the existing access track before passing under the tack through a culvert approximately 0.3 km north of the proposed development. It then flows towards the southeast (passing the proposed development), south then southwest where it converges with the Mossy Burn approximately 1.4 km south of the proposed development and continues to flow southeast as the Bothwell Water. The Bothwell Water is part of the Whiteadder Water Catchment, which ultimately discharges into the River Tweed.

Catchment Characteristics

7.31 The proposed development is located between the Tay Burn and the Mossy Burn, which converge to the south of the site and become Bothwell Water. Information on the characteristics of the catchments of these two burns was presented in the 2013 assessment and is reproduced in detail in Technical Appendix 6.0 as no changes are known to have occurred since that report was submitted.

Flood Risk Mapping

7.32 The SEPA flood map (SEPA, 2017) indicates that there is no risk of flooding at the sites of the proposed Substation Extension or the proposed temporary compounds. There are localised areas of flood risk from rivers or surface water associated with the routes of the

[22] RBMP Water body information sheet for water body 150141 (Lammermuir bedrock and localised sand and gravel aquifers), dated 15 March 2010

Tay Burn and the Mossy Burn, but the areas that are likely to flood are constrained to the watercourse channels and the immediate surrounds. There are no areas mapped as being at risk from groundwater flooding.

7.33 The proposed development is located just upstream of the area covered by the Flood Risk Management Strategy for the Tweed Local Plan District (SEPA, 2016). The watercourses downstream of the proposed development are within the Tweed catchment and the Scottish Borders Council area covered by the Tweed Plan. The Whiteadder Water (of which the Tay Burn is a tributary) flows into the potentially vulnerable area 13/02 (Preston), which is identified as being at risk from river flooding.

Historical Flooding

7.34 A significant flood recorded within the Preston potentially vulnerable area was in 1948 and was caused by a third of expected annual rainfall falling over a six day period, which caused flooding in the rivers Tweed, Blackadder, Whiteadder, Till and Eye Water (SEPA, 2016).

Surface Water Quality

7.35 Bothwell Water (into which the Tay and Mossy burns flow) is a classified surface water body under the Water Framework Directive. In 2008, it was classified as having 'good' overall status ('good' ecological status and a chemical status of 'pass'). The targets for this water body under the Water Framework Directive are to maintain the good status and to "ensure that no derogation from good status occurs unless caused by a new activity providing significant specified benefits to society or the wider environment"[23]. Bothwell Water surface water body is associated with the Whiteadder Water and River Tweed Protected Areas and groundwater in the 'Lammermuir bedrock and localised sand and gravel drift aquifers'.

Abstractions and Water Supplies

7.36 No springs, private or public water supplies or licensed abstractions from surface water or groundwater were identified in this area as part of the 2013 study (MWH, 2013).

Designated Sites

7.37 There are no designated sites on the proposed development or within the study area (SNH, 2017). The nearest designated sites are Sites of Special Scientific Interest (SSSI) located approximately 1.5 km to the north-northeast and approximately 2 km to the north-northwest (see Figure 4.1). The SSSI to the north-northeast is Woodhall Dean, which is an area of upland oak woodland. The SSSI to the north-northwest is Rammer Cleugh, which is designated for its upland oak woodland and example of Quaternary geology. There is a third SSSI located approximately 2.5 km to the east; Lammermuir Deans. This SSSI is designated for its valley fen wetlands, upland mixed ash woodland, subalpine calcareous grassland habitat and its examples of fluvial geomorphology.

7.38 The River Tweed, into which Bothwell Water ultimately discharges, is designated as a SSSI and a Special Area of Conservation (SAC). It is designated for fish species, Otter and its freshwater habitats. Many of these are listed as being under pressure from water quality and flows. At its closest, the River Tweed SAC is approximately 3 km south-

[23] RBMP Water body information sheet for water body 5120 (Bothwell Water), dated 15 March 2010.

southeast of the proposed development. The SSSI is designated for the same species and habitats, as well as beetle, fly and vascular plant assemblages.

Drainage at the Existing Substation

7.39 The proposed Substation Extension lies downstream of a hill slope catchment with around 10 ha draining towards the western boundary of the proposed development.

7.40 The existing development is bounded by an earth bund that extends around its western boundary. A swale is located around the outside base of the bund to intercept water that runs off from the west. The swale is approximately 4.8 m wide from the top of its banks, 0.7 m deep and 500 m in length. Water from this swale is conveyed around the outer edge of the bund and discharged to ground to the east through culverts that run under the existing access track near the northern and southern extents of the existing Substation.

7.41 A filter trench is located on the inside of the bund at its base and runs around the perimeter of the existing Substation footprint. This is approximately 1 m wide and intercepts flows from inside the bund. Water intercepted by this is also discharged to ground to the east through culverts that run under the existing access track near the northern and southern extents of the existing Substation.

7.42 Surface water that originates from within the Substation footprint (i.e. on the flattened ground inside the filter trench) is managed by a series of pipes within the gravel base that direct water to a catch pit on the eastern side of the existing Substation compound. This catch pit discharges to ground to the east via a culvert that runs under the existing access track near the middle point of the north-south eastern boundary of the existing substation.

7.43 Discharges of the intercepted water to the land east of the existing Substation mimic the original direction of surface water runoff, which would naturally have followed the gradient from west to east. The land onto which the discharges occur is marshy grassland on soils that are commonly saturated; therefore, surface water flow continues overland predominantly, before reporting to the Tay Burn and its tributaries.

7.44 Foul drainage at the existing Substation is managed via a mound soakaway located on the eastern boundary of the existing Substation compound. The soakaway has a mound filter system for the treatment of domestic waste with a sand filter. Topsoil covers the soakaway. The soakaway discharges treated effluent to ground under SEPA CAR licence CAR/R/R/1027767)

Identification of Receptors and Sensitivity

7.45 Using the baseline information presented in this Chapter and the classification in Table 7.2, the key receptors and the selected sensitivities are:

- **The Tay Burn** feeds into the River Tweed SAC and SSSI - High Sensitivity.
- **Groundwater in the Gala Group** is a potential drinking water resource with good chemical status, but likely low productivity aquifer, that provides baseflow to the Tay Burn - Medium Sensitivity.
- **The proposed development** itself from flood risk and changes in flood risk and will provide regional distribution of electricity - Medium Sensitivity.

Summary of Flood Risk Statement

7.46 The full Flood Risk Statement is included in Technical Appendix 6.0 and is based on the 2013 Flood Risk Statement (MWH, 2013), the updated baseline presented above, and the updated drainage strategy (also presented in Technical Appendix 6.0- Appendix A).

7.47 The sources of flood risk considered included groundwater and surface water. The proposed development is not located in an area at risk from flooding from the coast or reservoirs and is not located near the coast or any reservoirs, so such source of risk were not considered.

7.48 The Flood Risk Statement concluded that the risk to the proposed development from groundwater and surface water flooding is considered to be low. The risk of the Proposed Development changing the current level of flood risk is also considered to be low.

Potential Effects of Proposed Development

7.49 This assessment of effects comprises an initial assessment that takes into account design mitigation and good practice that is inherent to standard construction practices. These include the proposed drainage strategy, good practice construction methods that will be included in the Construction Environment Management Plan (CEMP) and SEPA pollution prevention guidelines. Full details of the design mitigation considered in the initial assessment is presented in Technical Appendix 6.0.

Construction Effects

7.50 The activities that are considered in this stage are as follows:

- The construction and use of the proposed temporary compounds;
- The construction of perimeter bunding;
- The extension of the existing SUDS (Sustainable Urban Drainage Systems) (including the addition of new culverts); and
- The construction of the proposed Substation Extension (including earthworks, fencing, installation of the electrical equipment, and the construction of the surfaced internal access road).

7.51 In relation to the hydrological environment, the following changes are considered possible as a result of these activities:

- **Changes in quality of the runoff towards the Tay Burn** – increased suspended solids or input of other pollutants (e.g. oils, lubricants and chemicals from machinery and construction activities) could disturb the river habitat by introducing silt and sediment and smothering gravel beds, changing erosion/deposition processes, increasing the suspended solids in the water column, and introducing pollution. The design mitigation includes silt traps, settlement ponds and pollution prevention measures. Taking these measures into account, the magnitude of change is predicted to be very low adverse. The associated effect on the very high sensitivity receptor is determined as **Minor** adverse, temporary and reversible.

- **Changes in the quality of water infiltrating to groundwater** – oils, lubricants and chemicals from machinery and construction activities could introduce pollution to water recharging to ground. The design mitigation includes pollution prevention measures and the CEMP will include details regarding how machinery will be inspected and

maintained, and how to deal with accidental leaks/spills. Taking these measures into account, the magnitude of change is predicted to be very low adverse. The associated effect on the medium sensitivity receptor is determined as **Slight** adverse, temporary and reversible.

- **Changes to runoff quantity (specifically changes to runoff towards the Tay Burn)** – increased areas of compacted ground could increase and the temporary features could divert flow away from its natural path. Runoff from proposed temporary compound areas will be captured using temporary features (and potentially the existing SUDS) that will then discharge to ground to the east of the proposed development where it will have the chance to infiltrate to ground or flow over ground and ultimately to the Tay Burn. Discharge of intercepted runoff will be managed to greenfield rates. Taking these measures into account, the magnitude of change is predicted to be negligible. The associated effect on the very high sensitivity receptor is determined as **None.**

- **Changes in flood risk due to changes in runoff** (**Secondary effect)** - increased runoff into the Tay Burn and changes in sediment deposition during construction could result in changes in flood risk at the Tay Burn. Discharge of intercepted runoff will be managed to greenfield rates, so there will be no change to flood risk at the Tay Burn. There is currently no flood risk at the site and it is unlikely that such changes would alter that. Taking these findings and measures into account, the magnitude of change is predicted to be negligible. The associated effect on the very high sensitivity receptor is determined as **None.**

7.52 All of the above changes have been assessed as resulting in either slight or minor effects. Therefore, **None** of the above predicted construction effects are considered **Significant** in terms of this assessment.

Operational Effects

7.53 The only activities that will take place during operation related to ongoing inspection and maintenance of the proposed Substation. It is assumed for this stage that the proposed temporary compounds have been decommissioned already. In relation to the hydrological environment, the following changes are considered possible as a result of the operational activities:

- **Changes in recharge to groundwater** – recharge to groundwater could be reduced by an increase in hardstanding. The potential for this reduction will be limited by the design incorporating a high proportion of permeable surfacing. Taking these measures into account, the magnitude of change is predicted to be negligible. The associated effect on the medium sensitivity receptor is determined as **None.**

- **Changes to surface water quantity (specifically changes to runoff towards the Tay Burn)** – The drainage strategy will result in either diverting water from upgradient around the site before discharging it to the east, or managing precipitation falling within the development and subsequently discharging it to the east. There is no proposed consumptive intervening use of that water. Multiple points of discharge to land to the east helps reduce the effect of a point discharge of water collected though the SUDS. Hardstanding is limited and most of the developed area will have a permeable surface

to reduce the potential for increases in surface run-off. Discharge of intercepted runoff will be managed to greenfield rates. Taking these measures into account, the magnitude of change is predicted to be negligible. The associated effect on the very high sensitivity receptor is determined as **None.**

- **Changes to surface water quality due to accidental leaks/spills** – operational management of the site will include regular inspection routines (to limit the potential for accidental releases from Substation equipment and maintenance vehicles) and pollution prevention measures (to address any accidental releases that might occur). Such mitigation is predicted to result in a negligible change to surface water quality. The associated effect on the very high sensitivity receptor is determined as **None.**

- **Changes to groundwater quality due to accidental leaks/spills** – operational management of the site will include regular inspection routines (to limit the potential for accidental releases from Substation equipment and maintenance vehicles) and pollution prevention measures (to address any accidental releases that might occur). Such mitigation is predicted to result in a negligible change to groundwater quality. The associated effect on the medium sensitivity receptor is determined as **None.**

- **Changes in flood risk due to changes in runoff** (**Secondary effect)** - increased runoff into the Tay Burn and changes in sediment deposition due to the ongoing presence of the development and its drainage system could result in change in flood risk at the Tay Burn. Discharge of intercepted runoff will be managed to greenfield rates, so there should be no change to flood risk at the Tay Burn. There is currently no flood risk at the site and it is unlikely that such changes would alter that. Taking these findings and measures into account, the magnitude of change is predicted to be negligible. The associated effect on the very high sensitivity receptor is determined as **None.**

7.54 All of the above changes have been assessed as resulting in an effect significance categorised as **None.** Therefore, none of the above predicted construction effects are considered **Significant** in terms of this assessment.

Decommissioning Effects

7.55 It is assumed decommissioning will take place in phases as elements of the proposed development are progressively no longer required. There will be some decommissioning of the proposed temporary compounds after construction is complete. It is not known when decommissioning of the proposed Substation will occur, but it is assumed it will take place at some time in the future.

7.56 In relation to the hydrological environment, the following changes are considered possible as a result of any of the decommissioning activities:

- **Changes in quality of the runoff towards the Tay Burn** – increased suspended solids or input of other pollutants (e.g. oils, lubricants and chemicals from machinery and construction activities) during decommissioning activities could (as with construction) disturb the river habitat by introducing silt and sediment and smothering gravel beds, changing erosion/deposition processes, increasing the suspended solids in the water column, and introducing pollution. The mitigation included in the decommissioning plan will be similar to those adopted during construction (e.g. silt

traps, settlement ponds and pollution prevention measures). Taking these measures into account, the magnitude of change is predicted to be very low adverse. The associated effect on the very high sensitivity receptor is determined as **Minor** adverse, temporary and reversible.

- **Changes in the quality of water infiltrating to groundwater** – as with construction activities, there is the potential that oils, lubricants and chemicals from machinery and decommissioning activities could introduce pollution to water recharging to ground. The mitigation included in the decommissioning plan will be similar to those adopted during construction (e.g. pollution prevention measures, details regarding how machinery will be inspected and maintained, and how to deal with accidental leaks/spills). Taking these measures into account, the magnitude of change is predicted to be very low adverse. The associated effect on the medium sensitivity receptor is determined as **Slight** adverse, temporary and reversible.

- **Changes to surface water quantity (specifically changes to runoff towards the Tay Burn)** – during decommissioning, the above ground infrastructure, impermeable hardstanding and drainage systems will be removed. The area will then be reinstated to as close to pre-development conditions as possible. Therefore, the intention is that runoff will return to near natural conditions and the changes are, therefore, classified as negligible when compared to baseline conditions. The associated effect on the very high sensitivity receptor is determined as **None.**

- **Changes in recharge to groundwater** – during decommissioning, the above ground infrastructure and impermeable hardstanding will be removed. The area will then be reinstated to as close to pre-development conditions as possible. Therefore, the intention is that recharge rates will return to near natural conditions and the changes are, therefore, classified as negligible when compared to baseline conditions. The associated effect on the medium sensitivity receptor is determined as **None.**

- **Changes in flood risk due to changes in runoff** (**Secondary effect)** – changes in runoff into the Tay Burn and changes in sediment deposition due to decommissioning activities could result in change in flood risk at the Tay Burn. During decommissioning, the above ground infrastructure, impermeable hardstanding and drainage systems will be removed. The area will then be reinstated to as close to pre-development conditions as possible. There is currently no flood risk at the site and it is unlikely that such changes would alter that. Therefore, the intention is that runoff will return to near natural conditions. Therefore, the change is classified as negligible when compared to baseline conditions. The associated effect on the very high sensitivity receptor is determined as **None.**

7.57 All of the above changes have been assessed as resulting in an effect significance categorised as **None, Slight** or **Minor.** Therefore, **None** of the above predicted construction effects are considered **Significant** in terms of this assessment.

Additional Mitigation Measures

7.58 The initial assessment of potential changes indicates that the initial effects are not classified as significant. No additional mitigation is advised to reduce these effects further.

The following additional details in relation to the mitigation are recommended to support the results of the initial assessment, but do not change the findings:

- Methods for appropriate storage and reuse of soils should be agreed in advance with SNH – this may include covering stockpiles to limit erosion.
- Appropriate long-term maintenance arrangements and plans should be put in place to make sure the SUDS and drainage systems at the development are managed in a way that means the interception and discharge of run-off and precipitation occurs in the intended way.
- Methods for the reinstatement of near-original ground conditions should be discussed and agreed with the appropriate statutory body (e.g. SNH, SEPA) as part of the preparation of decommissioning plans.

Residual and Cumulative Effects

7.59 No additional mitigation is required to reduce the initial effects, so no further assessment has been made. The results of the assessment of initial effects remain valid.

7.60 No assessment of cumulative effects was undertaken in relation to hydrology in the 2013 assessment. Through design, good practice construction methods and appropriate mitigation, all of the potential effects as a result of the proposed development have been assessed as not being significant. Therefore, no assessment of cumulative effects has been included within this assessment.

7.61 A Summary of the predicted changes to the hydrological environment and significance of effects is presented in Table 7.6

Table 7.6: Summary of Predicted Changes to the Hydrological Environment and Significance of Effects

Receptor (sensitivity)	Potential Change	Mitigation	Magnitude of Change	Effect Significance
Construction Phase				
Tay Burn (Very High)	Changes in quality of the runoff due to increased suspended solids or input of other pollutants	Design mitigation, plus methods for appropriate storage and reuse of soils agreed with SNH.	Very Low	**Minor**
	Changes to runoff quantity due to changes in the drainage regime	Design mitigation only	Negligible	**None**
	Changes in flood risk due to changes in runoff	Design mitigation only	Negligible	**None**
Groundwater (Medium)	Changes in quality of recharge due to pollutants from machinery and construction activities	Design mitigation only	Very Low	**Slight**
Operational Phase				
Tay Burn (VeryHigh)	Changes to runoff quantity due to changes in the drainage regime	Design mitigation, plus long-term maintenance of drainage systems	Negligible	**None**
	Changes to surface water quality due to accidental leaks/spills	Design mitigation only	Negligible	**None**
	Changes in flood risk due to changes in runoff	Design mitigation, plus long-term maintenance of drainage systems	Negligible	**None**
Groundwater (Medium)	Changes in recharge rates due to increased hardstanding	Design mitigation only	Negligible	**None**
	Changes to water quality due to accidental leaks/spills	Design mitigation only	Negligible	**None**
Decommissioning Phase				
Tay Burn (Very High)	Changes in quality of the runoff due to increased suspended solids or input of other pollutants	Design mitigation only	Very Low	**Minor**
	Changes in runoff rates due to changes in hardstanding and drainage arrangements	Design mitigation, plus, methods for reinstatement of ground conditions agreed as part of the preparation of decommissioning plans	Negligible	**None**
	Changes in flood risk due to changes in runoff	Design mitigation, plus, methods for reinstatement of ground conditions agreed as part of the preparation of decommissioning plans	Negligible	**None**
Groundwater (Medium)	Changes in quality of recharge due to pollutants from machinery and construction activities	Design mitigation only	Very Low	**Slight**
	Changes in recharge rates due to changes in hardstanding	Design mitigation, plus, methods for reinstatement of ground conditions agreed as part of the preparation of decommissioning plans	Negligible	**None**

Environmental Report

8.1 The applications for the approved Crystal Rig Substation Extension were accompanied by an Environmental Report prepared by MWH UK Ltd (2013). The environmental assessment of the proposed development identified **No Significant** environmental effects.

8.2 Since the grant of the Planning Permissions in 2013, new electrical engineering safety clearance standards have been introduced which requires the electrical compound to be increased in size from 95m x 137m to 100m x 144m (5m x 7m). In addition, the temporary construction compound requires to be increased in size to accommodate storage of material and surface water management. It is also proposed that the construction access will now follow the existing construction route established for Crystal Rig Substation Aikengall II Extension. This development is currently under construction.

8.3 This Environmental Report has been prepared to accompany the two new planning applications[24] for the proposed development being submitted to East Lothian and Scottish Borders Councils. The site has been revisited and an assessment of the environmental effects of the current proposals undertaken by specialists.

8.4 From the outset, SPEN has focused on reducing the environmental impact of the proposed development, whilst remaining technically and economically viable. Measures proposed by SPEN to mitigate identified and potential environmental effects have been placed in Technical Appendix 7.0.

8.5 On review, **No Significant** environmental effects are predicted by the proposed Substation Extension development.

[24] Applications were submitted to East Lothian and Scottish Borders Councils for Non Material Variations of the planning permissions in April 2016. East Lothian have requested the submission of a new Planning Application and Scottish Borders approved the application for the Non Material Variation. An updated Environmental Report has therefore been prepared to accompany the new planning applications.

A Pre-Application Consultation Report, and Design and Access Statement will also accompany the applications.

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Transmission Equipment

The following are general definitions of terms used in relation to transmission equipment.

Term	Explanation
IEC	Iberdrola Engineering & Construction is the Iberdrola Group Company that carries out engineering and construction work.
kV	Kilovolt (one thousand (1000) volts)
MW	Megawatt (one million watts or one thousand kilowatts)
Overhead Line	An electric line installed above ground, usually supported by lattice steel towers or wooden poles.
SPT	Scottish Power Transmission Ltd. Licence holder under the Electricity Act 1989.
Substations	Controls the flow and voltage of electricity by means of transformers and switchgear, with facilities for control, fault protection and communications.
Switchgear	Combination of electrical disconnect switches, fuses or circuit breakers used to control, protect and isolate electrical equipment.
Transformer	Substation components used to increase or decrease the voltage of electricity.

Landscape and Visual Assessment

The following are terms as defined by the Landscape Institute and Institute of Environmental Management and Assessment, in the Guidelines for Landscape and Visual Assessment (2013).

Term	Explanation
Baseline Studies	Work done to determine and describe the environmental conditions against which future changes can be measured or predicted and assessed.
Enhancement	Proposals that seek to improve the landscape resource and visual amenity of the proposed development site and its wider setting, over and above its baseline condition.
Landscape Character	A distinct recognisable and consistent pattern of elements in the landscape that makes one landscape different from another, rather than better or worse.
Landscape Effects	Effects on the landscape as a resource in its own right.
Landscape Receptors	Defined aspects of the landscape resource that have the potential to be affected by the proposal.
Landscape Quality (Condition)	A measure of the physical state of the landscape. It may include the extent to which typical character is represented in individual areas, the intactness of the landscape and the condition of individual elements
Landscape Value	The relative value that is attached to different landscapes by society. A landscape may be valued by different stakeholders for a whole variety of reasons.

Magnitude (of effect)	A term that combines judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short or long term in duration.
Photomontage	A visualisation which superimposes an image of a proposed development upon a photograph or series of photographs.
Sensitivity (of receptor)	A term applied to specific receptors, combining judgements of the susceptibility of the receptor to the specific type of change or development proposed and the value related to that receptor.
Significance	A measure of the importance or gravity of the environmental effect, defined by significance criteria specific to the environmental topic.
Visual Amenity	The overall pleasantness of the views people enjoy of their surroundings, which provides an attractive visual setting or backdrop to the enjoyment of activities of the people living, working, recreating, visiting or travelling through an area.
Visual Effects	Effects on specific views and on the general visual amenity experienced by people.
Visual Receptors	Individuals and/ or defined groups of people who have the potential to be affected by a proposal.
Zone of Theoretical Visibility (ZTV)	A map, usually digitally produced, showing areas of land within which a development is theoretically visible.

Cultural Heritage

The following are general definitions of terms used in relation to Cultural Heritage.

Term	Explanation
ELCAS	East Lothian Council Archaeology Service
GDL	Garden and Designed Landscape
HER	Historic Environment Record
HLA	Historic Land-use Assessment
HES	Historic Environment Scotland
SBCAS	Scottish Borders Council Archaeology Service
WSI	Written Scheme of Investigation

Hydrology

The following are general definitions of terms used in relation to Hydrology.

Term	Explanation
Attenuation	to reduce the effect of something.
Aquifer	a body rock that contains or transmits groundwater and releases it in sufficient quantities for use.
Baseflow	the portion of flow in a surface watercourse that comes from the input from deep subsurface flow and delayed shallow subsurface flow.
Bedrock	Bedrock Geology (formally known as solid geology) is the solid rock that is either exposed at the surface or located beneath superficial material such as soils and gravels.
Bund	an embankment typically constructed from earth or stone.

Catchment	the area of land, usually delineated by topography, over which all precipitation that falls ends up in specific waterbody. Also referred to as a drainage basin.
CEMP (Construction Environment Management Plan)	document that defines how a project will be managed to meet environmental objectives. Details the targets, objectives and procedures that will be adopted.
Gley	widespread throughout Scotland, a gley is a sticky soil that developed under conditions of intermittent or permanent waterlogging. They tend to be greyish or bluey-grey in colour with orange mottling. The colour is a result of the low levels of oxygen present during their formation.
Greenfield	denoting the state prior to development.
Precipitation	rain, snow, sleet, or hail that falls to or condenses on the ground.
Receptor	something that could be adversely affected by a change to its environment.
Settlement Pond	also commonly referred to as a settling basin. An open feature used to manage pollution and runoff from earth works. Used to allow settlement of suspended solids before slowly releasing discharge at the desired rate.
Silt Fence	a temporary sediment management device made of a porous fabric attached to posts in the ground and used on construction sites to protect water quality in nearby watercourses/waterbodies.
Soakaway	a pit, typically filled with permeable material, into which waste water is piped so that it drains slowly out into the surrounding soil.
SUDS (Sustainable Urban Drainage System)	provide a natural approach to managing drainage in and around developments and aim to prevent water pollution and flooding. Techniques include green roofs, permeable surfaces, infiltration trenches, swales, wetlands and water detention basins.
Superficial Deposits	Superficial deposits (formerly known as 'drift') are the youngest geological deposits formed during the most recent period of geological time (the Quaternary). Most superficial deposits are unconsolidated (loose, not cemented) sediments such as gravel, sand, silt and clay.
Swale	a shallow drainage channels in the ground where water running off a site can be channelled to another location or collect and soak away.
Topsoil	the top layer of soil; commonly fertile and dark coloured surface soil where plants root themselves.
Wacke	an impure sandstone comprising poorly sorted mineral and rock fragments in a finer silt and clay matrix.
Water assets	Scottish Water's assets, including pipelines, treatment works and reservoirs.

SP ENERGY NETWORKS