3 Physical Environment

3.2 Hydrology, Geology and Contaminated Land

3.2.1 Baseline Information

Introduction

3.2.1.1 This chapter of the ES describes and assesses the effects associated with the hydrology, geology and contaminated land aspects of the MORL modified Onshore Transmission Infrastructure (OnTI). It provides an assessment of the likely effects of the construction, operation and decommissioning of the modified OnTI development on the existing hydrological regime (i.e. flood risk, land drainage and effects on surface water bodies), underlying hydrogeological resources (i.e. groundwater, water supplies and aquifers), geological resources and any existing and arising land contamination within the route corridor.

3.2.1.2 The baseline study consisted of the following aspects:

- Detailed desk study to establish the baseline conditions within the OnTI area;
- Field surveys to inform the baseline assessment;
- Consideration of the relevant key legislative and planning information; and
- Consultation with relevant statutory and non-statutory bodies.

3.2.1.3 Supplementary details of these studies and assessments are detailed in the Technical Appendices.

3.2.1.4 The Study area is defined as a 500 m corridor, 250 m either side of the modified OnTI, extending 34 km from Inverboyndie on the coast, which is approximately 1.9 km to the west of Banff, to the proposed substation location approximately 5.4 km south west of New Deer.

3.2.1.5 Effects on hydrology and the quality and physical integrity of the water environment may result in secondary ecological effects on habitats or species. Effects on ecological receptors are considered in Chapter 4: Biological Environment.

3.2.1.6 A previous assessment of the potential effects of the OnTI was carried out in 2012. This is set out in the MORL Environmental Statement (2012). Since that time the location of the onshore substations has been changed from Peterhead to New Deer and the export cable landfall location has been modified from Fraserburgh to Inverboyndie. The export cable and onshore substations have been modified from Direct Current (DC)/Alternating Current (AC) infrastructure to AC infrastructure only. Accordingly, the impact assessment in this Chapter is a detailed assessment of the new locations and infrastructure now associated with the OnTI.

Consultations

3.2.1.7 A brief summary of the responses from the organisations consulted and the approach that is being adopted by MORL is set out in Table 3.2-1.

Table 3.2-1 Consultations

Organisation	Consultation Response	MORL Approach
Aberdeenshire Council (Private Water Supplies)	Records of private water supplies within 500 m of the cable route centreline and the substation were received 27th May 2014.	• Plot sites in project Geographical Information System (GIS); • Site surveys of private water supplies; • Conduct impact assessment; • Identification and incorporation of appropriate mitigation as set out in this report.
Aberdeenshire Council (Contaminated Land)	A GIS shape file with potentially contaminated land sites within the route was provided by the Council.	• Incorporate into project GIS; • Develop conceptual model and identify plausible pathways; • Identification and incorporation of appropriate mitigation as set out in this report.
AHVLA Scotland (Foot and Mouth Burial Sites)	AHVLA do not hold any records of Foot and Mouth burial sites in the area, although they stated that this does not mean that these do not exist.	Risk mitigation measures to be highlighted in the construction stage Environmental Management Plan (EMP).
Scottish Environment Protection Agency (SEPA) (Water Environment)	Four licensed abstractions are located within 1km of the route centreline. There are no groundwater monitoring sites for level or quality within the search area. SEPA's consultation response also gave advice with regard to disruption to wetland and peatlands, disturbance and re-use of excavated peat, groundwater abstractions, engineering activities in the water environment (meeting the objectives of the Water Framework Directive), water abstraction (CAR, 2011), pollution prevention and environmental management, borrow pits, flood risk (Indicative River and Coastal Flood Map) and regulatory advice.	• Licensed abstractions plotted in project GIS and included in impacts assessment; • Search conducted to identify wetlands/peatlands present; • Mitigation measures outlined in this report take SEPA best practice and regulatory advice into consideration.

Baseline Characteristics

3.2.1.8 Baseline information for the site has been collated through interrogation of the following publicly available information, and previous reports and field based studies, including:

- Previous Environmental Impact Assessment (EIA) Reports – MORL ES Chapters 3.7, 9.3, 13.3 and Technical Appendix 3.7 A (MORL, 2012);
- Scottish Environment Protection Agency (SEPA) – Flood Hazard Maps
- SEPA Water Framework Directive (WFD) classification –Data published for 2008 (cartographic format) and 2012 (report format);
- Ordnance Survey (OS) baseline mapping;
- Photographic evidence collected during site visit;
- British Geological Survey (BGS) UK Hydrogeology Viewer;
- SEPA River Basin Management Plan (RBMP) Interactive Map;
- SEPA Aquifer Productivity;
- BGS online viewer and publicly available downloadable data;

- BGS borehole records;
- Department for Environment, Food and Rural Affairs' (Defra) Magic website;
- Envirocheck Site Sensitivity Data;
- Historical Mapping – National Library of Scotland; and
- Scottish Natural Heritage (SNH) website;
- Macaulay Institute Web site.

3.2.1.9 The modified onshore export cable route corridor passes through a primarily agricultural area the majority of which drains northward to the Moray Firth via a number of rivers and watercourses, some of which are of high environmental value. The River Deveron in particular is an important salmon fishery.

3.2.1.10 The proposed substations are located approximately 5.4 km south west of New Deer. The surrounding area is rural and the dominant existing land use is also agricultural.

3.2.1.11 The drift and solid geology is characterised by superficial alluvial deposits overlying glacial deposits and there are minor aquifers in the area. Both the rivers and aquifers are potentially sensitive to the effects of pollution arising from disturbed areas of contaminated land or from general earthworks operations/spillages. Both the river and the local aquifers are also exploited locally for water supply. Sediment arising from construction works is of particular concern to the sports fishing community as this can negatively affect spawning grounds. These issues have implications for the Water Framework Directive status of water bodies in the study area, as currently defined in the River Basin Management Plan (RBMP).

3.2.1.12 Flood risk is an issue on some of the rivers in this area and the farming community is likely to be concerned about the effect of construction operations on land drainage systems.

3.2.1.13 Relatively few contaminative activities take place within this area, as shown on Figures 3.2.4(a through e). However, there are both historical and current mineral extraction activities along the route and there is a large operational quarry to the west of South Gorrachie.

Desktop Studies

Hydrology

3.2.1.14 A desk study of existing data was undertaken to establish:

- Location, type and distribution of surface water bodies, including peat bogs ;
- Existing flood risk data; and
- WFD and environmental classifications of water bodies along and nearby the modified export cable route.

Location and Distribution of Water Bodies

3.2.1.15 Water bodies potentially affected by the scheme are shown on Figures 3.2-5 (a through e) and listed below:

- Burn of Boyndie
- Burn of Bachlaw (trib. of R Deveron along Paddocklaw)
- River Deveron
- Den Burn (trib. of Burn of Montbletton)
- Burn of Montbletton (trib. of R. Deveron along Wester Keilhill)
- Burn of Fortrie

- Burn of Fishrie
- Craigston Burn
- Small stream next to Hill of Brackans (trib. Of Cot Burn)
- Aultan Burn
- Burn of Monquhitter (Idoch Water)
- Teuchar Stank
- Burn of Swanford
- Burn of Asleid
- Sea at Boyndie Bay

3.2.1.16 The watercourses listed above drain north towards the Moray Firth, apart from the Burn of Asleid and Burn of Swanford, which drain southwards. The River Deveron, with a catchment area at the proposed crossing of 1,232 km^2, is the largest watercourse by a considerable margin.

3.2.1.17 There are no natural lochs or statutorily protected peat bog wetland areas within the area of the modified OnTI apart from a minor open water body at Waggle Hill at the very edge of the onshore export cable route corridor near to the south of the corridor.

3.2.1.18 As productive agricultural land, the area is potentially sensitive to the effects of any activities that affect land drainage systems or which reduce infiltration as a result of soil or subsoil compaction. Details of any under-drainage systems that do exist are unlikely to be available in the form of plans or drawings but local farmers are likely to know of any historic or recently-installed under-drainage measures.

Existing Flood Risk Data

3.2.1.19 A number of the watercourses in the study area have been included in SEPA's National Flood Hazard Mapping work. This provides indicative measures of flood extents; high likelihood (10% annual probability; 1 in 10 years), medium likelihood (0.5% annual probability; 1 in 200 years) and low probability (0.1% annual probability; 1 in 1,000 years). The flood extents associated with the River Deveron are the most significant in the study area . There is a relatively wide floodplain in the vicinity of the modified onshore export cable corridor river crossing south of Bridge of Alvah. Flood extents associated with the remaining watercourses are relatively small. At the coast, the SEPA flood hazard maps show flooding is largely contained at the shoreline at Inverboyndie Bay, with minimal penetration inland. The only significant settlement at risk of tidal flooding is Banff, at the mouth of the River Deveron. However, there is a wide range of infrastructure and numerous minor settlements where flood risk is a potential issue.

3.2.1.20 The landfall point at Inverboyndie has a sandy beach, with the Boyndie Burn cutting through it. There are heavily-vegetated sand dunes at the back of the beach that provide a natural flood defence against tidal flooding. The lower reaches of Boyndie Burn are however affected by tidal effects.

Water Framework Directive Issues and Environmental Classification of Water Bodies

3.2.1.21 SEPA's WFD classifications for 2008 and 2012 were obtained from the RBMPs. The 2008 data can be viewed in cartographic form online, whereas the 2012 classification was consulted via the summary sheets, as no mapping was found. The WFD status/potential of each water body is presented in Table 3.2-2. See Figures 3.2-5 (a through e) for the location of each water body.

Table 3.2-2 SEPA WFD Classification of the Main Water Bodies in the Modified OnTI Corridor

Code (1)	Name	2012 (2)	2008 (3)	Adopted
WB005	Burn of Boyndie	Poor	Poor	Poor
WB008	Burn of Bachlaw (trib. of R Deveron along Paddocklaw)	n/a	n/a	n/a
WB009	River Deveron	Moderate	Moderate	Moderate
WB010	Den Burn (trib. of Burn of Montbletton)	Poor	n/a	Poor
WB011	Burn of Montbletton (trib. of R. Deveron along Wester Keilhill)	n/a	n/a	n/a
WB012	Burn of Fortrie	Bad	Bad	Bad
WB013	Burn of Fishrie	n/a	Moderate	Moderate
WB014	Craigston Burn	n/a	Moderate	Moderate
WB015	Small stream next to Hill of Brackans (trib. Of Cot Burn)	n/a	n/a	n/a
WB016	Aultan Burn	n/a	n/a	n/a
WB017	Burn of Monquhitter (Idoch Water)	Bad	Bad	Bad
WB018	Teuchar Stank	n/a	n/a	n/a
WB019	Burn of Swanford	n/a	n/a	n/a
WB020	Burn of Asleid	n/a	n/a	n/a
WB021	Sea at Boyndie Bay	Good	Good	Good

(1) Code used for this study

(2) http://www.sepa.org.uk/water/river_basin_planning/waterbody_data_sheets.aspx, see also

(3) http://gis.sepa.org.uk/rbmp

3.2.1.22 The issues affecting water body status include a range of factors such as physical modifications and biological/water quality issues associated primarily with agricultural activity. The River Deveron is a game fishery with a sustainable population of salmon, sea trout and brown trout. It has been identified by SEPA as a Diffuse Pollution Priority Catchment. Effects on salmon and trout are discussed in more detail in Chapter 4.2: Fish and Shellfish Ecology.

3.2.1.23 Arable cultivation, livestock farming and forestry are the main land use activities in areas affected by diffuse pollution on the River Deveron. It is a drinking water protected area (DWPA), providing drinking water for 60,000 people in the Aberdeenshire area. The river has also been designated as a Salmonid Water under the EC Water Framework Directive. Areas of the catchment are included in a Nitrate Vulnerable Zone and the entire catchment has been designated as an Urban Waste Water Treatment Directive Sensitive Area.

3.2.1.24 The modified OnTI area does not intersect any wetland RAMSAR, SAC or SSSI sites.The response by Aberdeenshire Council to the Scoping Report highlights the importance of the SSSI zones between Cullen and Stake Ness and Whitehills to Melrose, but these will not be impacted by the development which landfalls on the beach.

3.2.1.25 Whilst there are no peat bog wetlands, there are four areas within the modified OnTI area where the soils comprise peat (see Figure 3.2-3 (a through e)). Two of these are restricted to a narrow corridor along Teuchar Stank. There is an approximately 100 m² square area at Boghead Farm, south of Cuminestown (NGR 38000, 848821). The largest area of peat is the Moss of Sprottyneuk (NGR 381689, 846124), which comprises a shallow depression occupying approximately 1 km², as noted in the geology sections of this report. This area has been artificially drained in the past and appears to be currently used as rough grazing land.

Solid Geology

3.2.1.26 The 1:625,000 BGS mapping shows that the solid geology beneath the modified OnTI area comprises:

- The Southern Highland Group (SOHI);
- The Middle Old Red Sandstone (MOR);
- Lower Old Red Sandstone (LOR); and
- Igneous Intrusion.

3.2.1.27 SOHI comprises metamorphic rock and is found beneath the southern and northern-most ends of the modified OnTI area.

3.2.1.28 The Middle and Lower Old Red Sandstone are located in the central section of the modified OnTI area and comprise conglomerates, breccias, mudstones, sandstone and siltstones.

3.2.1.29 An igneous intrusion of quartz- microgabbro occurs directly beneath the indicative substations location. The intrusion lies in almost an east – west alignment and will be considered during foundation designs for the substations.

3.2.1.30 A large geological fault crosses the proposed cable alignment at three locations between Gorrachie Wood (NGR 374641, 856078) and to the south of Fintry (NGR 375597, 854257), and lies generally in a north –south alignment.

Superficial Geology

3.2.1.31 The superficial geology is complex and includes till, raised marine deposits, river terrace deposits, alluvium, glacio-fluvial deposits and some localised areas of blown sand and peat.

3.2.1.32 The majority of the superficial deposits along the route comprise Till, Devensian – Diamicton (TILLD). This has a variable composition, but generally comprises sandy, silty clay with pebbles.

3.2.1.33 Alluvium deposits outcrop along the route, following and adjacent to the surface watercourses. This is described by the BGS as clay, silt and sand. Alluvial deposits are mapped in two small isolated patches on the banks of the River Deveron at Inverichnie [NGR 369314,860645 and 369753, 860120] and here are described as gravel, sand, silt and clay. River Terrace Deposits (undifferentiated) occur in small isolated patches along the major surface water channels and are described as sand and gravel, with local lenses of silt, clay or peat.

3.2.1.34 Glaciofluvial Ice Contact deposits (GFIC) are extensively mapped in the northern section of the modified OnTI area and are described as sand and gravel, with localised lenses of silt, clay and organic material. Glaciofluvial Sheet Deposits (GFSD) are mapped along the River Deveron.

3.2.1.35 Head deposits occur at three locations along the route. The largest outcrop is located to the north of the Hill of Alvah (approximate NGR 366867, 860235). Head is

described as comprising gravel, sand and clay depending on upslope source (this being the SOHI) and distance from source. Poorly sorted and poorly stratified deposits formed mostly by solifluction and/or hillwash and soil creep.

3.2.1.36 Peat occurs in isolated patches towards the southern end of the route, the largest area of peat is situated at Moss of Sprottyneuk . Blown Sand is confined to a small outcrop near the remains of the church at Boyndie Bay and is described as pale brown, fine-grained, uncemented sand.

3.2.1.37 Raised Marine Deposits at Inverboyndie comprise a variable lithology of gravel (shingle), sand, silt and clay, and are commonly enriched with organic debris.

3.2.1.38 There is no made ground shown on the geological mapping.

Geological Designations

3.2.1.39 The Whitehills to Melrose Coast was designated as a geological Site of Special Scientific Interest (SSSI) in 1990 for the structural and metamorphic geology. The SSSI covers an area of 90.30 hectares extending from Whitehills, approximately 1.5 km to the west of Inverboyndie Bay, to Bowie Bate approximately 4.5 km to the east of the bay. Inverboyndie Bay itself does not fall within the SSSI designation. The designation applies to the exposed bedrock geology either side of the bay and the cable will not come ashore onto these areas.

BGS Borehole Records

3.2.1.40 There are no publicly available BGS borehole records that fall within the 1,000 m buffer of the modified OnTI area.

Aquifer Classification

3.2.1.41 The BGS online Hydrogeology Viewer for the UK provides a description and classification of the bedrock in terms of aquifer potential, whereas MacDonald et al. (2004) gives an indication of yields associated with this classification. A summary of these bedrock aquifers is presented below.

3.2.1.42 Southern Highland Group (MacDuff Formation and Knockhead Grit Member): Classified as a Low Productivity Aquifer with a yield of 0.1 to 1 l/s. This aquifer is capable of providing only small amounts of groundwater in the near surface weathered zone and secondary fractures. It is likely that these aquifers are only used for small domestic supplies.

3.2.1.43 Middle Old Red Sandstone (Gardenstown Conglomerate Formation): Classified as a Moderately Productive Aquifer with a yield of between 1 and 10 l/s. The aquifer is described as sandstones, in places flaggy, with siltstones, mudstones and conglomerates and interbedded lavas, locally yields small amounts of groundwater, which obtains its yield from both intergranular and fracture flow.

3.2.1.44 Lower Old Red Sandstone (Crovie Sandstone Formation): Classified as a Moderately Productive Aquifer with a yield of 1 to 10 l/s. The aquifer is described as a locally important multi-layered aquifer which obtains its yield from both intergranular and fracture flow.

3.2.1.45 The BGS UK Hydrogeology Viewer does not include superficial deposits. However, MacDonald et al. (2004) do present a map of superficial aquifer productivity, which also contains a classification table for superficial deposits. Based on this, the classification of the superficial deposits are as presented in Table 3.2-3 below.

Table 3.2-3 Superficial Deposit Classifications

Productivity Rating	**Superficial Deposits**
High (>10 l/s)	Glaciofluvial Sands and Gravels Alluvium River Terrace Deposits
Moderate (1-10 l/s)	Raised Marine Deposits
Low (0.1-1 l/s)	Sandy and gravelly Glacial Till

Groundwater Vulnerability

3.2.1.46 Groundwater vulnerability data has been obtained from Envirocheck and from the BGS/SEPA classification for Scotland.

3.2.1.47 The Envirocheck classification correlates to the superficial deposits. The Glacial Sand and Gravel, Alluvium and Raised Marine Deposits are classified as Minor or Moderately Permeable Aquifer, whereas the Glacial Till is classified as Non- or Weakly Permeable Aquifer.

3.2.1.48 The BGS/SEPA (O'Dochartaigh et al., 2011) groundwater vulnerability classification has been used in the impact assessment to derive the value/sensitivity of groundwater as a receptor. This indicates that the bedrock, in combination with the overlying superficial deposits along the onshore export cable route corridor and substation site are designated predominately as vulnerability class 4a-5 with some isolated areas classified as vulnerability class 2 or 3. The vulnerability classes are defined in Table 3.2-4 below.

Table 3.2-4 Groundwater Vulnerability Classifications and Their Interpretation (O'Dochartaigh *et al.*, 2011)

Vulnerability Class	Description		Frequency of activity	Travel time
5	Vulnerable to most pollutants, with rapid impact in many scenarios.		Vulnerable to individual events.	Rapid
4	Vulnerable to those pollutants not readily adsorbed or transformed.	4a May have low permeability soil; less likely to have clay present in superficial deposits.		
		4b More likely to have clay present in superficial deposits.		
3	Vulnerable to some pollutants; many others significantly attenuated.			
2	Vulnerable to some pollutants, but only when they are continuously discharged/leached.			
1	Only vulnerable to conservative pollutants in the long term when continuously and widely discharged/leached.		Vulnerable only to persistent activity.	Very slow
0	Not sufficient data to classify vulnerability: e.g. below lochs; in urban areas where geological and/or soils data are missing; where superficial deposits are mapped but not classified; or in mined (including opencast) and quarried areas.			

3.2.1.49 For the purposes of this assessment groundwater has been conservatively classified as a single receptor of vulnerability class 4a-5, rather than as individual receptors corresponding to the aquifers.

Groundwater Levels and Flow

3.2.1.50 A data request for groundwater level data has been submitted to SEPA as part of the consultation process detailed . The response from SEPA indicated that there is no monitoring data within 1km of the centreline of the cable route.

3.2.1.51 There are no BGS water wells or borehole records available on the online database within the modified OnTI area, but some data may be available in archive and will be requested for use in the design of the site investigation.

3.2.1.52 It is considered likely that the groundwater flow directions within the bedrock aquifers will follow the direction of the dip of the geology, unless modified locally by pumping. Groundwater within the superficial deposits will most likely correlate to topography with flow towards stream/ river channels.

Groundwater Quality

3.2.1.53 A data request for groundwater water quality data was submitted to SEPA as part of the consultation process. The response from SEPA indicated that there is no monitoring data within 1km of the centreline of the cable route. SEPA classify key water bodies as part of their River Basin Management Plans (RBMPs), which form part of the legislator requirements under the WFD. Along the cable route there are several groundwater bodies defined. These groundwater bodies, together with their water quality status in 2008, are presented in Table 3.2-5 below.

Table 3.2-5 Groundwater Bodies and Water Quality Status

ID	Groundwater Body	Location along route	Water Quality Status (2008)	Drinking Water Protection Zone?
150316	Banff coastal sand and gravel	Raised Marine Deposits along coastline adjacent to Banff	Good	Yes
150311	Buchie bedrock and localised sand and gravel aquifer	Knockhead Grit Member at Inverboyndie	Good	Yes
150312	Lower Devron Valley Sand and Gravel	Glaciofluvial Ice Contact Deposits immediately to the south of Banff and Inverboyndie	Good	Yes
150404	MacDuff	Corresponds to MacDuff Formation between Banff and Fintry	Good	Yes
150307	Turriff bedrock and localised sand and gravel aquifers	Corresponds to the Old Red Sandstone between Fintry and Cuminestown	Poor (diffuse pollution from nitrate use in arable farming)	Yes
150300	Ythan bedrock and localised sand and gravel aquifers	MacDuff formation south of Cuminestown to end of the route	Poor (diffuse pollution from nitrate use in arable farming)	Yes

3.2.1.54 The RBMP database also presents Drinking Water Protection Zones, as designated under the Drinking Water Directive. All the water bodies listed above are classified as Drinking Water Protection Zones.

Historical Mapping

3.2.1.55 Historical mapping for the modified OnTI area was reviewed via publicly available online resources from the National Library of Scotland. A summary of the key findings is given below.

- Historically, the area was and remains predominantly agricultural;
- There are a number of small local quarries shown on the historical mapping along the route, most of which are referred to as old gravel pits;
- The current distillery in Inverboyndie was first shown on the OS mapping dated 1904.
- The Banff Branch and Macduff Branch railways crossed the route in 1904 although are now both shown as disused/ dismantled.
- There is evidence of local smithies being present along the route in the past with a number of wind pumps and mills.

Envirocheck Sensitivity Data

3.2.1.56 An Envirocheck Report was commissioned for the modified OnTI area with a 500 m buffer either side, although the study area was subsequently reduced to 250 m either side (see Figure 3.2-1). The Envirocheck Report comprised site sensitivity data. A summary of the key findings is given below:

- There are four contemporary trade directory entries within the route corridor, of which three are active;
- There are no Control of Major Accident Hazards (COMAH) registered sites;
- There is one recorded petrol station, now obsolete (at Keilhill);
- There are eight BGS recorded mineral sites, all are completed opencast mines;
- There are five records for non-coal mining areas, located in the central section of the route. Identified as vein minerals classed as "Rare: Infrequent minor mining may have occurred but restricted in extent";
- There are two registered waste transfer sites for one site at Inverboyndie;
- There is one registered landfill at Foulzie. The license status is given as lapsed/ surrendered, i.e. is no longer operational; and
- The site falls within a Nitrate Vulnerable Zone.

Potentially Contaminated Land – Aberdeenshire Council

3.2.1.57 The Environmental Health Officer (EHO) at Aberdeenshire Council identified a number of potentially contaminated sites in the scoping response. The Council has provided a list of the contaminated sites of which 34 fall within the modified OnTI area (see Figure 3.2-4 (a through e)). These comprise:

- Eleven Quarries or gravel pits;
- One Smithy;
- Keilhill filling station (as listed in Envirocheck, now obsolete);
- Two sawmills and 14 unspecified mills;
- One fabricators (steel, aluminium and stainless steel welders);
- One store (Parkhill stores);
- One agricultural engineers;
- One commercial business (unspecified); and
- One unspecified activity (given as Inverboyndie).

3.2.1.58 Based on the information provided by the Council the sites have been screened using the Aberdeenshire Council Contaminated Land Strategy Land Use Risk Rating. All but two of the sites fall into the low risk category. The former petrol filling station and the fabricators are rated as medium risk sites.

Site Specific Surveys

3.2.1.59 Site visits took place between 2nd and 6th June 2014. The full length of the modified OnTI area was inspected including the location of the the substations. As the modified export cable route is 33 km long, the full route was driven, where possible, with walkover surveys at key locations.

3.2.1.60 Photographs were taken of relevant locations, such as proposed river crossings, structures, potential contaminated land sites, private water supply locations and geomorphological features as well as of the general landscape. The locations were determined from the desk based review. The information collected was used to

improve understanding of the sensitivity of the water bodies and receptors, respectively.

Survey of Surface Water Features

3.2.1.61 The landfall point and all surface watercourse crossings were surveyed. With the exception of the River Deveron, the majority of the watercourses – especially the smaller ones - have been modified, straightened or deepened to increase their capacity. Since the land is mainly dedicated to crop production and grazing, the channels are commonly straightened and productive agricultural land extends to the bank tops of the majority of watercourses. Low raised embankments commonly bound the channels. The channels are generally incised, with evidence of bank toe undercutting, and have very steep banks, which were covered in dense vegetation (high grass and bushes) at the time of the site visits (June 2014). The watercourse bed material is generally gravel, often covered by fine soil/sediment particles. These deposits are most common in the smaller watercourses and drains. These fines are also found attached to macrophites (e.g. algae) on the bed.

Survey of Water Supplies

3.2.1.62 Properties registered with Aberdeenshire Council as having a private water supply were visited within the modified OnTI area. Only water supplies falling within 500 m of the export cable corridor centreline or the area of the substations were visited. From the Council records, this included 58 private water supplies serving a total of 77 properties. The location and type of supply (well, surface water or spring) was recorded. From the site surveys of private water supplies, 21 properties were found to have switched to a mains supply and seven properties were derelict or empty.

3.2.1.63 Licensed abstraction data from SEPA identified 4 licensed/registered abstractions within 1 km of the cable route centreline. Aberdeenshire Council identified one abstraction, Fortrie Intake, within 500 m of the cable route centreline. The area where this intake is located was visited as part of the site survey. In addition Brackans Reservoir, a Scottish Water service reservoir, was briefly inspected. The source of water feeding this reservoir will be confirmed with Scottish Water, but it forms part of the distribution network and therefore has no natural catchment draining to it. The location of the private water supplies, licensed/ registered abstractions, Fortrie Intake and Brackans Reservoir, are presented on Figure 3.2-5 (a through e).

Legislative and Planning Framework

3.2.1.64 The specific supplementary legislation that was taken into account in the hydrology, geology and contaminated land baseline and assessment is outlined below:

- Water Framework Directive (WFD) 2000/60/EC (European Council, 2000). A framework for Community action in the field of water policy;
- Groundwater Daughter Directive to WFD 2006/118/EC (European Council, 2006). Daughter directive to WFD in order to prevent and control groundwater pollution;
- Freshwater Fish Directive 2006/44/EC (European Council, 2006). Directive on the quality of waters needing protection or improvement in order to support fish life;
- Water Environment and Water Services (Scotland) Act (Scottish Parliament, 2003). Act of the Scottish Parliament to make provision for the protection of the water environment;
- Water Environment (Controlled Activities) (Scotland) Regulations 2011(Scottish Ministers, 2011) and Amendment Regulations 2013. Regulations covering controlled activities which may affect the water environment;

- Environmental Protection Act 1990: Part IIA Contaminated Land (Parliament of the United Kingdom, 2000). Section of the Environmental Protection Act in relation to the use and remediation of contaminated Land;
- Contaminated Land (Scotland) Regulations 2000 (Scottish Minister, 2000) and Amendment Regulations 2005. Places duty on Local Authorities to identify and secure the remediation of contaminated land in their respective areas;
- Scottish Planning Policy (Scottish Government, 2010). A statement of Scottish Government Policy on land use planning, including subject policies on Flooding and Drainage. A revised version of the Scottish Planning Policy that was released on 23 June 2014 was also considered.;
- Flood Risk Management (Scotland) Act 2009 (Scottish Ministers, 2009). An Act to make provision about the assessment and sustainable management of flood risks;
- EU Groundwater Directive 80/68/EEC (European Council, 1979). This directive was largely replaced by the WFD in 2000;
- EU Drinking Water Directive 98/83/EC (European Council, 2003). Directive on the quality of water intended for human consumption;
- Groundwater Protection Policy for Scotland, Version 3 – Environmental Policy 19 (SEPA, 2009); and
- Private Water Supply (Scotland) Regulations 2006 (Scottish Ministers, 2006). Transpose the revised European Drinking Water Directive (Council Directive 98/83/EC), and update earlier Regulations. Their overriding objective is to ensure the provision of clean and wholesome drinking water and deliver significant health benefits to those using such supplies.

3.2.1.65 The relevant guidance that was considered when compiling the hydrology, geology and hydrogeology assessment is as follows:

- Aberdeenshire Local Development Plan (Aberdeenshire Council, 2012), including Policy 4 on Special Types of Rural Land, Policy 14 on Safeguarding of resources and Supplementary Guidance documents on development in the coastal zone, protection and conservation of the water environment, flooding and erosion and contaminated land;
- Development in the Coastal Zone, Policy 14 on Safeguarding of Resources and SPG Protection and conservation of the water environment;
- Aberdeenshire Council, Planning and Environmental Services (Revised 2011). Contaminated land strategy;
- Code of Practice for Earth Works (BS6031:1981)(British Standards Institute, 1981);
- Environmental Protection Act 1990: Part IIA Contaminated Land Statutory Guidance: Edition 2, Paper SE/2006/44 (Scottish Executive, 2006). Guidance on the interpretation and implementation of Part IIA;
- Planning Advice Note 33: Development of Contaminated Land (Scottish Executive, 2000). Guidance on the Development of Contaminated Land;
- Planning Advice Note (PAN) 61: Planning and Sustainable Urban Drainage Systems (Scottish Executive, 2001). Guidance on Sustainable urban Drainage Systems;
- Planning Advice Note 79: Water and Drainage (Scottish Executive, 2006). Guidance on the Planning and Delivery of new Water and Drainage infrastructure;
- PPG1: General guide to the prevention of pollution (SEPA, 2013);

- PPG2: Above ground oil storage tanks (SEPA, 2010);
- PPG5: Works and maintenance in or near water (SEPA, 2007);
- PPG6: Working at construction and demolition sites (SEPA, 2012);
- PPG8: Safe Storage and Disposal of Used Oils (SEPA, 2004);
- PPG18: Managing fire water and major spillages (SEPA, undated);
- PPG21: Pollution incident response planning (SEPA, 2009);
- PPG26: Safe storage - drums and intermediate bulk containers (SEPA, 2011);
- SEPA Controlled Activities Regulations: A Practical Guide (SEPA, March 2014);
- SEPA Good Practice Guide - Bank Protection (WAT-SG-23) April 2008;
- SEPA Good Practice Guide - River Crossings (WAT-SG-25) (SEPA, Nov 2010);
- SEPA Good Practice Guide - Sediment management (WAT-SG-26) (SEPA, June 2010);
- SEPA Good Practice Guide – Construction Methods (WAT-SG-29) (SEPA, March 2009);
- SEPA Good Practice Guide – Riparian Vegetation Management (WAT-SG-44) (SEPA, March 2009);
- SEPA Silt Control Guidance (SEPA, July 2013);
- An Introduction to Land Contamination and Development Management (SEPA and various Scottish Councils, 2010);
- SEPA (2006). Prevention of Pollution from Civil Engineering Contracts: Guidelines for the Special Requirements;
- Forestry Commission (2003). Forest and Water Guidelines. 4th edition;
- Scottish Executive (2000). River Crossings and Migratory Fish: Design Guidance. A Consultation Paper;
- Murnane, E., Heap, A. & Swain, A. 2006). Control of Water Pollution from Linear Construction Projects, Technical Guidance (C648). CIRIA;
- Murnane E. et al. (2002) Control of Water Pollution from Construction Sites – Guide to Good Practice (SP 156). CIRIA; and
- Connolly, S. & Charles, P. (2005) Environmental Good Practice on Site (C650). CIRIA.

3.2.2 *Impact Assessment*

Summary or Effects and Mitigation

3.2.2.1 This chapter considers the likely significant effects of the modified OnTI on the hydrology, geology and contaminated land. Further details on how individual effects have been assessed can be found in section 3.2.2.5.

Summary of Effects

3.2.2.2 The effects considered were as follows (see Table 3.2-6):

- Changes to surface runoff patterns and land drainage systems;
- Physical deterioration in water bodies (WFD);
- Water quality deterioration in water bodies (WFD);

- Increased flood risk due to loss of floodplain storage or conveyance capacity;
- Increased flood risk due to placing new receptors in flood zones or due to compromising existing flood and coastal erosion management measures;
- Soil/Subsoil compaction and reduced infiltration to groundwater;
- Release of sediment to the water environment (water supplies);
- Alteration of groundwater levels;
- Alteration of groundwater flow paths;
- Accidental release of contaminants;
- Disturbance and movement of contaminated materials.
- Human Health impacts from contaminated land;
- Damage to geological sites; and
- Sterilisation of mineral reserves.

Proposed Mitigation Measures and Residual Effects (Bold)

3.2.2.2 The primary mitigation technique is to route the cables and site the substations away from contaminated land and sensitive receptors. The corridor is sufficiently wide to provide some flexibility in this regard. Site investigations and consultation will be undertaken to inform the design process. Use of the guidance listed in Section 3.2.1.65 will be required to develop a construction stage Environmental Management Plan (EMP), together with emergency procedures for managing environmental incidents on site. All works affecting the water environment are likely to require a Controlled Activities Regulations (CAR) license from SEPA. Specific measures that will be used to ensure that the significance of the residual effects associated with hydrology, geology and contaminated land, are either of minor or negligible significance, include the following:

- Detailed consultation with the relevant stakeholders and key parties identified as potentially affected;
- Detailed site investigations to inform a design that avoids all unnecessary negative effects;
- Measures to prevent soil compaction and ensure that affected land drainage systems are reinstated;
- Use of best practice sustainable drainage and sediment management techniques;
- Where appropriate, use of horizontal directional drilling (HDD) beneath sensitive water bodies;
- Measures to ensure that no increases in local flood risk occur;
- Pollution risk reduction measures.

3.2.2.3 These measures are described in detail in Section 3.2.2.42 to 3.2.2.66.

3.2.2.4 A maintenance plan will be required for the operational phase, which ensures that the water environment will not be affected by maintenance and repair operations.

3.2.2.5 There are negligible residual effects upon the majority of all hydrology, geology and contaminated land receptors, as outlined in Table 3.2-6 below. The accidental spillage of pollutants during construction, and potential effects on water supplies, is assessed as being of minor significance following mitigation, as is the effects from contaminated land and ground gas. The disturbance and mobilisation of

contaminated material relating to aquifers and water supplies also has a residual effect of minor significance.

Table 3.2-6 Impact Assessment Summary

Effect	Receptor	Pre-mitigation effect	Mitigation	Post-Mitigation Effect
Construction and Decommissioning				
Temporary changes to surface runoff patterns and land drainage systems. **Permanent effects of substation and associated drainage infrastructure.**	Land and field drainage systems	Minor Significance (High Sensitvity water bodies) Negligible (Low sensitivity water bodies)	Construction stage Environmental Management Plan (EMP) to specify site best practices. All ground surfaces to be reinstated to pre-existing levels. Any affected field under-drainage systems fully reinstated. Substation drainage to be attenuated to greenfield rates and separated from any existing field drainage systems.	Negligible
Temporary physical deterioration in water bodies	Water bodies	Major significance (High Sensitvity water bodies) Minor significance (Low sensitivity Water Bodies)	Use below-ground horizontal directional drilling (HDD) techniques to avoid affecting high sensitivity water bodies. Adopt site best practices to minimise temporary impacts. Fully reinstate water bodies to pre-existing condition following construction.	Negligible
Temporary water quality deterioration in water bodies	Water bodies	Major significance (High sensitivity water bodies) Minor significance (Low sensitivity water bodies)	Adoption of site best practices to minimise pollution risk from construction plant and materials.	Negligible
Temporary soil erosion of working area and release of sediment into water environment	Water bodies	Major significance (Sensitive water bodies) Minor significance (Low sensitivity water bodies)	Adoption of site best practices. Construction on steep slopes will, where possible, be avoided. Best practice site sustainable drainage/sediment control practices will be adopted to ensure that this issue is tackled at source and there are no direct routes by which sediment-laden runoff can enter local water bodies.	Negligible

Effect	Receptor	Pre-mitigation effect	Mitigation	Post-Mitigation Effect
Temporary increased flood risk due to loss of floodplain storage or channel conveyance capacity	Water bodies	Major significance (High sensitivity water bodies) Minor significance (Low sensitivity water bodies)	No filling of floodplain areas. Temporary crossings of low sensitivity water bodies, where HDD techniques are not used, will be designed to ensure no increase in flood risk to local receptors. On completion, the physical alteration of the channel geometry will be reinstated to its pre-existing condition, with temporary erosion protection measures employed where necessary to ensure bank vegetation becomes fully re-established.	Negligible
Permanent increased flood risk by introducing new receptors into flood risk areas or due to existing flood and coastal erosion management measures being damaged or otherwise compromised.	Water bodies	Major significance (High sensitivity water bodies) Minor significance (Low sensitivity water bodies)	Location of the substation and other permanent assets and construction works in areas of low flood risk. Design and construction of new infrastructure to ensure that the integrity of existing flood defence assets is preserved.	Negligible
Changes to surface runoff and drainage	Water supplies/ abstractions	Minor significance (High and Very High sensitivity water supplies) Negligible (Low sensitivity water supplies)	Adoption of site best practices. Confirm source of supply from receptors and ensure water supply to these is not affected by development. Construction stage EMP to detail temporary diversions, downstream recharge etc.	Negligible
Release of sediment to the water environment (temporary)	Aquifers and water supplies	Minor significance (Medium- Very High sensitivity receptors) Negligible (Low sensitivity water supplies)	Adoption of site best practices as above.	Negligible
Subsoil compaction and reduced infiltration	Aquifers and water supplies	Minor significance (Medium- Very High sensitivity receptors) Negligible (Low sensitivity water supplies)	Limit area of compaction using same access route - detail in EMP.	Negligible
Alteration of groundwater levels, disruption to flow paths	Aquifers/ water supplies	Minor significance (Medium- Very High sensitivity receptors) Negligible (Low sensitivity water supplies)	No large scale abstraction proposed. Use sump pumps where necessary. Undertake ground investigation to determine the depth to groundwater. before undertaking detailed design.	Negligible

Effect	Receptor	Pre-mitigation effect	Mitigation	Post-Mitigation Effect
Accidental spillage of pollutants (eg fuel oils and lubricants)	Aquifers/ water supplies	Significant (Medium- Very High sensitivity receptors) Minor Significance (Low sensitivity water supplies)	EMP to include site best practices including PPG 21 Pollution Incidents Response Planning, including responding in a timely manner and planning for alternative water supply in event of pollution of a local water supply.	Minor significance (Medium- Very High sensitivity receptors) Negligible (Low sensitivity water supplies)
Effects from contaminated land and ground gas (e.g. inhalation, dermal inhalation, dermal contact, ingestion, direct ingestion, direct exposure) **Generation of contaminated waste.**	Human health	Major significance	Cable route alignment to avoid areas of contamination. Ground investigation at key locations to allow risks to be assessed and mitigated in detail. EMP to detail residual risk management measures; use of Personal Protective Equipment as last line of defence.	Minor significance
Damage to nearby geologically important sites	White hills to Melrose Coast SSSI Cullen to Whitehills Coast and Tarlair to Gardenstown Coast Local Nature conservation sites.	Significant	Consultation with key stakeholders; detailed and careful route alignment aided by a coastal geomorphological assessment; design construction and decommissioning techniques to avoid impacts. EMP to detail site Best Practice techniques and relevant PPGs.	Negligible
Sterilisation of mineral reserves	Mineral reserves	Minor significance	Consultation with key stakeholders and relevant parties.	Negligible
Disturbance and mobilisation of contaminated material	Surface water features	Minor significance	Ground investigation in areas identified as potential sources of significant contamination; EMP with contingency for encountering unexpected contamination such as Foot and Mouth burial sites; Method statement for drilling operations; and following best practice techniques and relevant PPGs.	Negligible
	Aquifers/ water supplies	Major Significance (Very High sensitivity receptors) Minor Significance (Low sensitivity receptors)		Minor significance (Medium- Very High sensitivity receptors) Negligible (Low sensitivity water supplies)
	Coastal environment	Minor significance		Negligible

Effect	Receptor	Pre-mitigation effect	Mitigation	Post-Mitigation Effect
Operation				
Changes to surface runoff patterns and land drainage systems.	Water bodies	Minor significance	Develop maintenance plan which uses designated routes and procedures designed to ensure maintenance operations do not affect local drainage systems.	Negligible
	Water supplies / abstractions	Minor significance (high and very high sensitivity water supplies) Insignificant (low sensitivity water supplies	Confirm source of supply from receptors and ensure water supply to these is not affected by development. Detailed design to minimise alterations to surface runoff and drainage. In line with PPG5 Work and maintenance in or near water.	Negligible
Soil compaction and reduced infiltration resulting in increases in localised overland flooding	Water bodies	Minor significance	Develop maintenance plan which uses designated routes and procedures designed to ensure maintenance operations do not result in compaction of agricultural soils.	Negligible
Physical deterioration in water bodies	Water bodies	Minor significance	Develop maintenance plan which uses designated routes and procedures designed to ensure maintenance operations do not result in physical deterioration of water bodies.	Negligible
Water quality deterioration in water bodies	Water bodies	Minor significance	Develop maintenance plan which uses designated routes and procedures designed to ensure maintenance operations do not result indeterioration in water quality within water bodies.	Negligible
Soil erosion and release of sediment into water environment	Water bodies	Minor significance	Develop maintenance plan which uses designated routes and procedures designed to mitigate the risk of maintenance operations resulting in sediment releases.	Negligble
Increased flood risk due to loss of floodplain storage or channel conveyance capacity	Water bodies	Minor significance	Develop maintenance plan which uses designated routes and procedures designed to mitigate the risk of maintenance operations affecting floodplain storage or conveyance.	Negligible

Effect	Receptor	Pre-mitigation effect	Mitigation	Post-Mitigation Effect
Increased flood risk by introducing new receptors into flood risk areas or due to existing flood and coastal erosion management measures being damaged or otherwise compromised	Water bodies	Minor significance	Where these cannot be avoided, develop maintenance plan which uses designated routes and procedures designed to mitigate the risk of maintenance operations affecting existing flood defences, including natural ones (e.g. sand dunes)	Negligible
Alteration of groundwater levels, disruption to flow paths	Aquifers/ water supplies	Minor significance (High - Very High sensitivity receptors) Insignificant (Medium - Low sensitivity water supplies)	No large scale abstraction proposed. Use sump pumps where necessary. Undertake ground investigation to determine the depth to groundwater and flow regime before undertaking detailed design.	Negligible
Accidental release of contaminants during substation operation	Aquifer (Class 4a)/Water supply well	Major Significance (Aquifer Class 4a) Significant (water supplies)	Regular inspections of site during operation to detect any release of contaminants. Confirm source of supply for PWS/N/0653. Detailed design to include the use of bunds around chemical/ fuel storage areas etc. (PPG8 Safe Storage and Disposal of used oils; PPG26 Safe storage - drums and intermediate bulk containers).	Minor Significance (Aquifer Class 4a) Minor Significance (water supplies)
Contaminated land and ground gas at Substations and along cable route	Human Health	Major significance	Environmental Monitoring and Management Plan, to include for example requirements for long term gas monitoring, PPE, health and safety issues and maintenance procedures and identifying sensitive land use areas or designations	Minor significance

Introduction to Impact Assessment

3.2.2.6 The assessment methodology is based on A Handbook on Environmental Impact Assessment (4th edition, 2013) by Scottish Natural Heritage (SNH). The significance of the likely effects of the modified OnTI has been defined by taking into account the sensitivity of the receptors and the potential magnitude and probability of the effect.

Details of Impact Assessment

3.2.2.7 Baseline desk studies were undertaken of the areas potentially affected by the proposals, as outlined in Figure 3.2-1 (Site Plan). These assessments included a review of relevant baseline information such as water quality data, historic land use, location of watercourses, site topography, designated areas, private water supplies, superficial and solid geology maps, groundwater maps, etc.

3.2.2.8 Initial findings were then verified using site surveys. The information collected during these surveys complemented the data collected and analysed during the desk study stage in order to:

a) Identify receptors and define their sensitivity;

b) Group the receptors according to their sensitivity;

c) Elaborate a list of potential effects and their significance; and

d) Correlate effects with receptors (pathways) and obtain the significance of the effect.

3.2.2.9 The above sequence also provided a series of mitigation measures to eliminate or reduce the impact of the effects.

3.2.2.10 The surface water receptors (water bodies) identified in the study area comprise the Moray Firth, rivers and minor watercourses (see Figure 3.2-5 (a through e)). No notable lochs or reservoirs were noted within the modified OnTI area, other than the service reservoir at Brackans. Whilst a few isolated areas of peat are present, most notably the Moss of Sprottynook, these have been artificially drained and are no longer associated with open water wetland features (Figure 3.2-3 (a through e)).

3.2.2.11 The definition of the sensitivity of surface water bodies was based on factors such as WFD classification, size of the channel, flood risk, environmental designation and water body use. The magnitude of the potential effect was judged in terms of the severity, size and duration of the effect. The parameters for defining sensitivity and magnitude are set out in detail Table 3.2-8.

3.2.2.12 Conceptual site models for key risk sites within the modified OnTI area have been developed, identifying existing or future potential source-pathway-receptor linkages and the plausibility of these in the context of each site setting (these are detailed in the technical appendix). Where appropriate, recommendations for intrusive site investigations prior to construction have been made. Consideration has been given to land that potentially contains contamination and/ or land that has special geological significance, either from a scientific, mining or mineral resources point of view including: geological sites of special scientific interest (SSSI), local geological sites (LGS), areas of current underground or opencast mining, and areas of designated mineral resources.

3.2.2.13 All baseline and survey data was captured within a Geographic Information System (GIS), together with the modified onshore export cable route and substation alignment. This information then informed the assessment of likely significant effects on various receptors within the study area. Appropriate mitigation measures were then determined.

Rochdale Envelope Parameters Considered in the Assessment

3.2.2.14 The range of parameters adopted within this assessment are summarised in Table 3.2-7 below. The parameters set out below define the "Rochdale Envelope" realistic worst case scenario for each likely significant effect. The actual requirements, in terms of dimensions, trench widths etc., may in reality be smaller.

Table 3.2-7 Rochdale Envelope Parameters

Potential Effect	Rochdale Envelope Scenario Assessed
Applicable to Construction, Operation and Decommissioning phases	
Changes to surface runoff patterns and land drainage systems	
Soil/subsoil compaction and reduced infiltration resulting in increases in localised overland flooding	
Physical deterioration in water bodies	

Potential Effect	Rochdale Envelope Scenario Assessed
Water quality deterioration in water bodies	Landfall: excavation and construction, possible permanent retaining wall and transitional pit. Onshore export cable route • Cable Trench width: up to four trenches, each 4 m wide assuming individual trenches. Alternatively two trenches with two cables in each, each 6 m in width • Depth (m): Target 1 m trench depth (although slightly deeper burial at 1.2 - 1.5 m may be required to achieve cover in some locations) • Maximum working width: 60 m. Depends on number of trenches, worst case assumes four separate trenches • Installation Method: A) Cable Plough; B) Horizontal Direction Drilling (HDD) (landfall and water crossings); and C) Open trench Substations • MORL Surface area: 36,450 m^2 • Transmission Owner (TO) Surface area: 45,900 m^2
Soil erosion of inclines and release into water environment	
Loss of floodplain storage or conveyance capacity	
Reduction in existing flood and coastal erosion management measures	
Effects on Water Supplies (quality and quantity)	
Effects on Aquifers (quality)	
Alteration of Groundwater Levels	
Alteration of Groundwater Flow	
Effects on geologically important sites	
Effects from Land contamination	
Sterilisation of mineral reserves	

3.2.2.15 The proposed cabling arrangement comprises a maximum of four cable trenches, with a maximum working width, worst case scenario, of 60 m. The modified export cable route from Inverboyndie to south-west New Deer is approximately 33 km in length.

EIA Methodology

3.2.2.16 The overall methodology involved defining the baseline scenario/conditions and considering the possible effects and their magnitudes and the receptors and their sensitivity, providing an overall assessment of the significance of each effect. Mitigation measures are also considered for each effect and the significance of the effect is reassessed after the mitigation measures are implemented. The methodology follows the Guidelines for Environmental Impact Assessment, produced by the Institute of Environmental Management and Assessment (IEMA).

3.2.2.17 For contaminated land the approach and methodologies used for the assessment are in accordance with the guidance contained within the Contaminated Land (Scotland) Regulations 2005 and the British Standard "Investigation of Potentially Contaminated Sites – Code of Practice", BS10175.

Determining the Sensitivity of the Resource/Receptor

3.2.2.18 Receptors and/or the receiving environment likely to be affected by the modified OnTI proposals have been identified within the defined study area. The sensitivity of the identified receptor/resource has been determined as follows:

Table 3.2-8 - Sensitivity of Potential Effects

Sensitivity	Definition of Examples
Very High Sensitivity	*Hydrology*
	Site of Special Scientific Interest (SSSI) or Special Area of Conservation (SAC); SEPA Water Quality defined as High; Designated salmonid fishery and / or salmonid spawning grounds present; Watercourse widely used for recreation, directly related to watercourse quality (e.g. salmon fishery) within 2 km downstream; Conveyance of flow and material, main river > 20 m wide; and/or Active floodplain area with known risks of widespread flooding (e.g. in relation to a flood prevention scheme).
	Hydrogeology (water supplies and groundwater)
	Surface water abstractions for public drinking water supply; Groundwater abstractions for public drinking water supply; Private Water Supplies - surface water abstractions within 0-200 m; Private Water Supplies - groundwater spring abstractions within 0-100 m of construction activities; Groundwater and surface water abstractions >1,000 m^3/d (within corridor); and/or Groundwater aquifer vulnerability classed between 4a-d and 5 in the SEPA vulnerability classification scheme.
	Geology and contaminated land
	Geology rare or of national importance as defined by SSSI or Regional Important Geological Site (RIGS); Human Health; Nationally important mineral reserves; and/or Groundwater aquifer vulnerability classed between 4d, 4c, 4b, 4a and 5 in the SEPA vulnerability classification scheme.
High sensitivity	*Hydrology*
	SEPA Water Quality defined as Good; Designated salmonid fishery and/or cyprinid fishery (Coarse Fish, including roach, carp, chubb, bream etc.); Watercourse used for recreation, directly related to watercourse quality (e.g. swimming, salmon fishery etc.); Conveyance of flow and material, main river 10-20 m wide; and/or Active floodplain area (Important in relation to flood defence).
	Hydrogeology

Sensitivity	Definition of Examples
	Large scale industrial surface water abstractions 500-100 m^3/d within 2 km downstream; Groundwater abstractions 500-1,000 m^3/d (within zone of influence of development); Private Water Supplies - surface water abstractions within 200-600 m; Private Water Supplies - groundwater spring abstractions within 100-400 m of construction activities; Private Water Supplies - groundwater borehole abstractions within 0-200 m of construction activities; Groundwater private water supply >10 m^3/d or serves >50 people; and/or Groundwater aquifer vulnerability classed as 3 in the SEPA vulnerability classification scheme.
	Geology and contaminated land
	Groundwater aquifer vulnerability classed as 3 in the SEPA vulnerability classification scheme.
Medium sensitivity	*Hydrology*
	SEPA Water Quality defined as Moderate; Occasional or local recreation (e.g. local angling clubs); Conveyance of flow and material, main river <10 m wide or ordinary watercourse >5 m wide; Existing flood defences; May be subject to improvement plans by SEPA; Designated cyprinid fishery, salmonid species may be present and catchment locally important for fisheries; and/or Watercourse not widely used for recreation, or recreation use not directly related to watercourse quality..
	Hydrogeology
	Industrial/ agricultural surface water abstractions 50-499 m^3/d within 2 km downstream; Groundwater abstractions 50-499 m^3/d; Private Water Supplies - surface water abstractions within 600->800 m; Private Water Supplies - groundwater spring abstractions within 400-800 m of construction activities; Private Water Supplies - groundwater borehole abstractions within 200-600 m of construction activities; and/or Groundwater aquifer vulnerability classed as 2 in the SEPA vulnerability classification scheme.
	Geology and contaminated land
	Locally important mineral reserves; Geological Conservation sites and LGS; and/or Groundwater aquifer vulnerability classed as 2 in the SEPA vulnerability classification scheme.

Sensitivity	Definition of Examples
Low sensitivity	*Hydrology*
	SEPA water quality defined as Poor or Bad; Fish sporadically present or restricted, no designated features; Receptors not used for recreation (e.g. no clubs or access route associated with watercourse); Watercourse <5 m wide – flow conveyance capacity of watercourse low – very limited floodplain as defined by topography, historical information and SEPA flood map; and/or Receptor heavily engineered or artificially modified and may dry up during summer months.
	Hydrogeology
	Industrial/ agricultural surface water abstractions <50 m^3/d within 2 km downstream; Groundwater abstractions <50 m^3/d; Private Water Supplies - groundwater spring abstractions within >800 m of construction activities; Private Water Supplies - groundwater borehole abstractions within 600->800 m of construction activities; and Groundwater aquifer vulnerability classed as 1 in the SEPA vulnerability classification scheme.
	Geology and contaminated land
	Geology not designated under a SSSI or RIGS or protected by specific guidance.

3.2.2.19 Derelict or uninhabited houses have been assigned a low sensitivity as they are not currently using water but may still have a private supply that could be used in the future. Uninhabited houses were those with empty rooms (no furniture, doors etc.) or those confirmed as being uninhabited by neighbours/owners of the property. Properties for which there was no response, i.e. no one in when the surveys were carried out, have been assigned a sensitivity based on their proximity to the centreline.

3.2.2.20 Where the point of abstraction (well, spring intake etc.) is unknown, the proximity of the abstraction to the centreline of the OnTI route has been taken as the distance between the centreline and the property served by the private water supply.

Determining the Magnitude of the Effect

3.2.2.21 The magnitude of the effect has been determined using the criteria in Table 3.2-9 below:

Table 3.2-9 Magnitude of Potential Impacts

Magnitude	Criteria	Description	Example
Major	Results in loss of attribute	Fundamental (long term or permanent) changes to geology, hydrology, water quality and hydrogeology Severe or irreversible moderate detrimental effect to human health. Irreversible detrimental effect to building structure.	Detrimental effect to nationally important geological feature. Loss of designated Salmonid Fishery. Loss of national level designated species / habitats. Changes in WFD water quality status of river reach. Significant loss flood storage/ increased flood risk. Pollution of potable source of abstraction compared to pre-development conditions. Loss of life, permanent disability, terminal illness. Building collapse or demolition.
Moderate	Results in a negative effect on integrity of attribute or loss of part of attribute	Material but non-fundamental and short to medium term changes to the geology, hydrology, water quality and hydrogeology Long-term minor or short-term moderate detrimental effect to human health.	Loss in productivity of a fishery. Contribution of a significant proportion of the discharges in the receiving water, but insignificant enough to change its water quality status. Reversible damage to nationally important geological feature. Temporary illness (months) following exposure to contaminant or gases. No increase in flood risk.
Minor	Results in minor negative effect on attribute	Detectable but non-material and transitory changes to the geology, hydrology, water quality and hydrogeology Short-term minor detrimental effect to human health.	Changes are of limited size and/or proportion. No increase in flood risk. Short-term temporary (days) illness following exposure to contaminant or gases.
Negligible	Results in a negative effect on attribute but of insufficient magnitude to affect the use/ integrity	No perceptible changes to the geology, hydrology, water quality and hydrogeology No appreciable impact on human health	Discharges to watercourse but no loss in quality, fishery productivity or biodiversity. No significant effect on the economic value of the receptor. No increase in flood risk. No change to human health.
Minor positive	Results in minor positive effect on attribute.	Minor reduction in risk to human health. Slight, local-scale improvement to the quality of potable groundwater or surface water resources.	Contamination linkages removed, or interrupted.

Magnitude	Criteria	Description	Example
Moderate Positive	Results in a positive effect on integrity of attribute or loss of part of attribute	Moderate reduction in risk to human health. Moderate local-scale improvement to the quality of groundwater or surface water resources.	Remediation of local small scale contaminated site. Contamination sources removed. Improvement for sensitive receptors.
Major positive	Results in positive improvements to attribute	Major reduction in risk to human health. Significant local-scale/ moderate to significant regional scale improvement to the quality of groundwater or surface water resources.	Remediation of large scale contaminated site. Contamination sources removed. Improvement to previously significantly contaminated areas. Improvement for sensitive receptors.

Significance of the Effect

3.2.2.22 The assessment of significance is based on the characteristics of the effect and the sensitivity of the receptor. By establishing the sensitivity of the resource/receptor and the magnitude of the effect the matrix shown in Table 3.2-10 below will be used to determine the significance level. For the purposes of this assessment effects of 'significant' or above are significant in terms of the EIA Regulations.

Table 3.2-10 Significance of the Effects

Receptor Sensitivity	Magnitude of Effect			
	Major	**Moderate**	**Minor**	**Negligible**
Very High	Major significance	Major significance	Minor significance	Minor significance
High	Major significance	Significant	Minor significance	Negligible
Medium	Significant	Significant	Minor significance	Negligible
Low	Minor significance	Minor significance	Negligible	Negligible

Assessment of Sensitivity of Receptors

3.2.2.23 The basis on which the sensitivity of receptors within the study area has been classified is shown in Table 3.2-11 below.

Table 3.2-11 Sensitivity of Receptors in Study Area

Receptor type	Description/Justification	Receptors Included	Sensitivity
Water body of high regional importance	Large water bodies with at least Moderate WFD classification	River Deveron, Boyndie Bay	Very high
Water body of local importance	Smaller water bodies with WFD classification	Burn of Boyndie, Burn of Fortrie, Burn of Fishrie, Craigston Burn, Burn of Monquhitter (Idoch Water)	High

Receptor type	Description/Justification	Receptors Included	Sensitivity
Minor water bodies	Small watercourses with no WFD classification	Burn of Bachlaw, Den Burn, Burn of Montbletton, Cot Burn, Aultan Burn, Burn of Swanford, Burn of Asleid	Moderate
Small land drainage channels	Small land drainage channels	Unnamed watercourses	Low
Private water supplies	Unknown source. Sensitivity assigned is worst case based on distance from centreline and proximity to mapped surface water course.	[PWS/N/2240]	Very high
	Unknown source. Sensitivity assigned is worst case based on distance from centreline.	[PWS/N/1060, PWS/N/2644, PWS/N/2163, PWS/N/0217, PWS/N/0653]	High
	Derelict/ uninhabited properties with no current active water supply.	[PWS/N/2505, PWS/N/0869, PWS/N/1113, PWS/N/2162, PWS/N/2132, PWS/N/2164, PWS/N/2225]	Low
	Private water supply: from spring between 100-400 m of centreline.	[PWS/N/0041, PWS/N/0032, PWS/N/0038]	High
	Private water supply: from spring between 400-800 m of centreline.	[PWS/N/0761]	Medium
	Private water supply from well between 0-200 m of centreline or substation.	[PWS/N/0063, PWS/N/2470, PWS/N/0763, PWS/N/1121, PWS/N/1065, PWS/N/1888, PWS/N/2165, PWS/N/2233, PWS/N/2129, PWS/N/1893]	High
	Private water supply: from well between 200-600m from centreline.	[PWS/N/0834, PWS/N/1045 and PWS-5951, PWS/N/1123, PWS/N/1100, PWS/N/0340, PWS/N/2475, PWS/N/2676, PWS/N/0347, PWS-5772, PWS/N/0422, PWS/N/2212, PWS/N/1896]	Medium
SEPA CAR Abstractions	Registered groundwater abstraction (10-50m^3/d)	Gellyhill Farm	Low
	Complex Licence to abstract groundwater (>2,000m^3/d)	MacDuff Distillery	Very high
	Complex Licences to abstract surface water (>2,000m^3/d)	Slackadale House Garniestone Farm	Very high
Public water supplies	Public water supply storage facility within 500m of centreline.	Scottish Water Brackans Reservoir	Very high
	Public/Industrial Water Supply	Fortrie Intake	Medium
Aquifers	Aquifers all assumed to be vulnerability classification 4a or 5.	All aquifers	High

Receptor type	Description/Justification	Receptors Included	Sensitivity
Statutorily protected sites	Geology of national importance as defined by SSSI	Whitehills to Melrose Coast SSSI	Very high
Non-statutorily protected sites	Locally important geological conservation sites	Cullen to Whitehills Coast and Tarlair to Gardenstown Coast Local Nature conservation sites.	Medium
Mineral reserves, including peat bogs	Locally important mineral reserves	Infrequent mineral veins in central section of the route, sand and gravel resources, peat bogs	Medium
Human health	Human Health	Construction workers, site users, site neighbours	Very high

Impact Assessment

3.2.2.24 The potential effects caused by the proposed works, pre-mitigation, identified in this section were considered the same for the three phases of development (Construction, Operation/Maintenance and Decommissioning) as the effect to the water body may occur at any of these stages.

3.2.2.25 The potential effects have been grouped into categories as follows:

- Changes to surface runoff patterns and land drainage systems;
- Physical deterioration in water bodies;
- Water quality deterioration in water bodies;
- Increased flood risk due to loss of floodplain storage or watercourse conveyance capacity;
- Increased flood risk due to placing new receptors in flood zones or due to compromising existing flood and coastal erosion management measures;
- Soil/subsoil compaction and reduced infiltration to aquifers/water supplies;
- Releases of sediment affecting water supplies;
- Alteration of groundwater levels;
- Alteration of groundwater flow paths;
- Accidental release of polluting materials affecting water supplies;
- Disturbance and movement of contaminated materials;
- Human health effects from contaminated land;
- Damage to geological sites;
- Sterilisation of mineral reserves.

3.2.2.26 These are discussed below. A summary of the detailed assessment made of the likely significance of each effect, if mitigation measures are not adopted, is provided in Table 3.2-12 at the end of this section. The following effects were considered for the construction, operation decommissioning phases:

Changes to Surface Runoff Patterns and Land Drainage Systems

3.2.2.27 The construction and decommissioning phases could affect local runoff patterns as a result of earth-moving operations, with potential for existing land drains and under-drainage systems to be damaged. This would likely cause localised flooding and contribute to soil erosion problems – an effect discussed in more detail below. It

would also affect agricultural productivity, but at a localised level, depending on the areas drained by the specific field drains affected. During operation, poorly-maintained access routes have potential to have similar impacts. Similarly, unless the substations are provided with well-designed sustainable drainage systems, this could negatively impact on local land drainage systems. These effects are assessed as being of minor significance, even for water bodies of high sensitivity, because the impacts will be localised. For low sensitivity water bodies these effects are assessed to be negligible. This issue is assessed as being of minor significance for high sensitivity water supplies and negligible significance for low sensitivity water supplies.

Physical Deterioration in Water Bodies

3.2.2.28 If measures are not taken to safeguard existing water bodies, the construction, operation and decommissioning activities may damage river/watercourse banks leading to further bank and bed erosion with consequent deposition downstream. Whilst the effects are likely to be minor and localised in the context of water body as a whole, the WFD status of many of these watercourses is already compromised by physical modifications and such effects could contribute to a failure to meet WFD targets. These effects are likely to be temporary and localised, but could have longer-term impacts if not adequately mitigated. Pre-mitigation, these issues are assessed as being potentially of major significance for high sensitivity water bodies such as the River Deveron and of minor significance for low sensitivity water bodies.

Water Quality Deterioration in Water Bodies (WFD)

3.2.2.29 If specific measures are not taken to control sediment-laden runoff and or polluting matter from entering the watercourses at all phases of the scheme's lifetime, this is likely to contribute to existing diffuse pollution problems, which may affect the watercourse achieving good status by the WFD target dates. This effect is assessed as being potentially of major significance for high sensitivity water bodies such as the River Deveron, unless mitigation is implemented. For low sensitivity water bodies this issue is assessed as being of minor significance pre-mitigation.

Increased Flood Risk Due to Loss of Floodplain Storage or Conveyance Capacity

3.2.2.30 Filling of floodplain areas, for example with temporary stockpiles, bunds or mounds, displaces floodwater, which may increase flood risk elsewhere. Similarly, if temporary or permanent watercourse crossings are badly-designed or maintained, this may increase flood levels, impacting local properties. This issue applies to all phases of the scheme, but the construction and decommissioning phases have most potential to cause problems. This issue is assessed as being of minor significance pre-mitigation, because of the limited scale of the likely impacts.

Increased Flood Risk Due to Placing New Receptors in Flood Zones or Due to Compromising Existing Flood and Coastal Erosion Management Measures

3.2.2.31 If no measures are taken to make sure that construction of vulnerable receptors in flood zones is avoided, then flood risk may be increased. Similarly, if existing flood defences, including the sand dunes, are not protected during construction, operation and decommissioning phases, then receptor exposure to the flood hazard may increase. This issue is assessed as potentially being of major significance for sensitive water bodies – for example if the sand dune natural flood defences were negatively affected. For low sensitivity water bodies the effects are assessed as being of minor significance, pre-mitigation.

Release of Sediment Affecting Water Supplies

3.2.2.32 The construction of temporary access tracks and excavation of cable trench and substation foundations, if not carefully managed, could lead to the release of sediment to surface watercourses or fines into aquifers (turbidity). This can have implications for water quality, especially public and private water supplies. This

would apply to the decommissioning phase as well. In the context of this development the effect is assumed to be localised and minor in scale, due to the smaller watercourses that are impacted. These effects are assessed as being of minor significance to medium-high sensitivity water supplies and of negligible significance for low sensitivity water supplies, pre-mitigation.

Subsoil Compaction and Reduced Infiltration

3.2.2.33 During construction and decommissioning, the operation of heavy plant along the alignment of the OnTI and temporary access routes, and clearance of the area on which the two substations are to be located, may lead to compaction of superficial deposits which may reduce the infiltration capacity of the subsoil. This would reduce the amount of recharge able to reach the superficial and bedrock aquifers locally, which will have a knock on effect on any abstractions from these aquifers. In the context of the proposed development, the effect is assumed to be localised given the trench widths and relatively small substation footprint. This issue applies to a lesser extent to the operational phase, when the route will need to be accessed for inspection and maintenance purposes. These effects are assessed as being of minor significance to medium-high sensitivity water supplies; of negligible significance for low sensitivity water supplies, pre-mitigation.

Alteration of Groundwater Levels and Groundwater Flow Paths

3.2.2.34 The proposed development may affect groundwater levels and flows on a very local scale as a result of temporary dewatering (likely to be very shallow). This may however have an effect on groundwater abstractions close to the works. The excavation depth for both cable trench and substation foundations are likely to be shallow (<1.5m) and as a result are unlikely to have a great effect on either groundwater levels or flow patterns. In the context of the proposed development, the effect is assessed as being of minor significance to medium-high sensitivity water supplies; of negligible significance for low sensitivity water supplies, pre-mitigation.

Accidental Release of Contaminants to the Water Environment

3.2.2.35 During construction chemicals, concrete, bentonite and fuels are likely to be used and stored on site. This poses the risks of accidental spillage of contaminants during use or re-fuelling, and of leakage from storage tanks and containers. These contaminants therefore pose a risk to water quality in surface and groundwater bodies which are used for water supply. In addition, heavy rainfall could lead to further pollution incidents if spillages and leakages are not detected or cleared up. Contaminants thought to be contained on areas of hardstanding may be mobilised in surface runoff. The substation will include transformers that are likely to be oil-filled. Replacement and maintenance of the transformers will be associated with an attendant risk of oil spillages occurring. In the context of the modified OnTI, it is considered that these pollutants will not be present in large quantities. The effect is assessed as being of major significance for medium-high sensitivity water supplies and of minor significance for low sensitivity water supplies, pre-mitigation.

Disturbance and Movement of Contaminated Materials

3.2.2.36 A number of potentially contaminated sites have been identified during the desk study and site walkover. Such sites may contain contaminated soils and groundwater which may be mobilised during excavation of the cable trench and substation foundations, leading to pollution of surface and groundwater bodies, some of which are used for water supply. In the context of the modified OnTI development, the effects are considered to be localised and dependant on a sensitive receptor being located close to a contaminant source. These issues are assessed as having pre-mitigation effects of minor significance for all but very high

sensitivity aquifers, for which the effects are assessed as being of major significance, pre-mitigation.

Human Health Impacts from Contaminated Land and Ground Gas

3.2.2.37 During the desk study and site walkover a number of potentially contaminated sites were identified within the study area. Such sites may contain contaminated soils, groundwater and ground gas. Construction workers could be exposed to contaminated soils and /or groundwater through inhalation, dermal contact, ingestion, or direct exposure during excavations works. Construction activities in contaminated ground may generate dust which could mobilise contaminants into the atmosphere and subsequently be inhaled by construction workers and nearby land users. There are areas of former peat bog which may be a source of ground gas. There is also risk of accumulating gases in confined spaces, such as trenches. Hazardous gases are also potentially explosive.

3.2.2.38 Human health is considered as a receptor of very high sensitivity. The pre-mitigation magnitude ranges from major adverse, direct, long term, permanent effect to a minor adverse, temporary, short term effect. The worst case scenario applies to loss of life for example due to accumulation of ground gases in confined spaces such as open trenches. The short term temporary effect may be a minor illness due to limited exposure to gases or contamination. This effect is therefore considered to be of major significance pre-mitigation.

Damage to Geologically Important Sites

3.2.2.39 The modified offshore export cable landfall site is bound on either side of Inverboyndie bay by a SSSI, Whitehills to Melrose Coast. Inverboyndie Bay itself does not fall within the SSSI designation. However, the landfall design and exact location on the beach and foreshore area has the potential to cause damage to the geological SSSI through excavation and movement of construction traffic. The SSSI as a designated site is considered as a receptor of very high sensitivity. Pre-mitigation effect have been assessed as significant.

Sterilisation of Mineral Reserves

3.2.2.40 A detailed assessment of the location of economically viable mineral reserves, other than a review of the findings from the Envirocheck report, has been made of the modified OnTI area. The BGS records identify rare mineral veins, with restricted extent, together with and evidence of historical and current open cast quarries. The construction of the cable trench and substation will have limited impact on the future exploitation of any potential mineral reserves at depth. The mineral reserves are locally important and assessed as a receptor of medium sensitivity. The pre mitigation magnitude is considered as a minor adverse direct, long term, permanent effect of minor significance.

3.2.2.41 The above impacts are summarised in Table 3.2-12 below. Each receptor is potentially impacted by a range of effects. For simplicity, Table 3.2-12 uses the data for the effect with the highest impact and which is of highest significance, pre-mitigation at the construction / decommissioning and operational phases.

Table 3.2-12 shows the assessment of the magnitude of the effect with the highest impact considered for each receptor and their significance pre-mitigation.

Receptor	Sensitivity	Pre-Mitigation Impacts Magnitude	Pre-Mitigation Significance
Construction and Decommissioning Phases			
Water body of high regional importance (River Deveron, Boyndie Bay)	Very high	Moderate	Major Significance
Water body of local importance (Burn of Boyndie, Burn of Fortrie, Burn of Fishrie, Craigston Burn, Burn of Monquhitter (Idoch Water)	High	Moderate	Significant
Minor water bodies (Burn of Bachlaw, Den Burn, Burn of Montbletton, Cot Burn, Aultan Burn, Burn of Swanford, Burn of Asleid)	Moderate	Minor	Minor significance
Small land drainage channels	Low	Negligible	Negligible
Brackan Service reservoir	Very high	Moderate	Major Significance
CAR Registered Abstraction (Gellyhill Farm)	Low	Moderate	Minor Significance
CAR Complex Licensed Abstractions (MacDuff Distillery, Slackadale House and Garniestone Farm)	Very High	Moderate	Major Significance
Private Water Supply [PWS/N/2240] **Unknown source. Sensitivity assigned is worst case based on distance from centreline and proximity to mapped surface water course.**	Very high	Moderate	Major Significance
PWS/N/1060, PWS/N/2644, PWS/N/2163, PWS/N/0217, PWS/N/0653] **Unknown sources. Sensitivity assigned is worst case based on distance from centreline.**	High	Moderate	Significant

Receptor	Sensitivity	Pre-Mitigation Impacts Magnitude	Pre-Mitigation Significance
[PWS/N/2505, PWS/N/0869, PWS/N/1113, PWS/N/2162, PWS/N/2132, PWS/N/2164, PWS/N/2225] **Derelict/ uninhabited properties with no current active water supply.**	Low	Moderate	Minor Significance
Private water supplies [PWS/N/0041, PWS/N/0032, PWS/N/0038] **from springs between 100-400 m of centreline.**	High	Moderate	Significant
Private water supply: [PWS/N/0761] from spring between 400-800 m of centreline.	Medium	Moderate	Significant
Private water supplies **[PWS/N/0063, PWS/N/2470, PWS/N/0763, PWS/N/1121, PWS/N/1065, PWS/N/1888, PWS/N/2165, PWS/N/2233, PWS/N/2129, PWS/N/1893] from wells between 0-200 m of centreline or substation.**	High	Moderate	Significant
Private water supplies **[PWS/N/0834, PWS/N/1045 and PWS-5951, PWS/N/1123, PWS/N/1100, PWS/N/0340, PWS/N/2475, PWS/N/2676, PWS/N/0347, PWS-5772, PWS/N/0422, PWS/N/2212, PWS/N/1896] from wells between 200-600m from centreline.**	Medium	Moderate	Significant
Public/Industrial Water Supply	Medium	Moderate	Significant
Aquifers all assumed to be vulnerability classification 4a or 5.	Very High	Moderate	Major Significance
White hills to Melrose Coast SSSI	Very high	Moderate	Significant
Cullen to Whitehills Coast and Tarlair to Gardenstown Coast Local Nature conservation sites.	High	Major	Significant
Mineral reserves	Low	Minor	Minor significance
Human health	Very high	Major	Major Significance
Operational phases			
Water body of high regional importance (River Deveron, Boyndie Bay)	Very high	Minor	Minor significance

Receptor	Sensitivity	Pre-Mitigation Impacts Magnitude	Pre-Mitigation Significance
Water body of local importance (Burn of Boyndie, Burn of Fortrie, Burn of Fishrie, Craigston Burn, Burn of Monquhitter (Idoch Water)	High	Minor	Minor significance
Minor water bodies (Burn of Bachlaw, Den Burn, Burn of Montbletton, Cot Burn, Aultan Burn, Burn of Swanford, Burn of Asleid)	Medium	Minor	Minor significance
Small land drainage channels	Low	Minor	Negligible
Brackan Service reservoir	Very high	Negligible	Minor Significance
CAR Registered Abstraction (Gellyhill Farm)	Low	Negligible	Insignificant
CAR Complex Licensed Abstractions (MacDuff Distillery, Slackadale House and Garniestone Farm)	Very High	Negligible	Minor Significance
Private Water Supply [PWS/N/2240] **Unknown source. Sensitivity assigned is worst case based on distance from centreline and proximity to mapped surface water course.**	Very high	Negligible	Minor Significance
PWS/N/1060, PWS/N/2644, PWS/N/2163, PWS/N/0217, PWS/N/0653] **Unknown sources. Sensitivity assigned is worst case based on distance from centreline.**	High	Moderate	Significant
[PWS/N/2505, PWS/N/0869, PWS/N/1113, PWS/N/2162, PWS/N/2132, PWS/N/2164, PWS/N/2225] **Derelict/ uninhabited properties with no current active water supply.**	Low	Negligible	Insignificant
Private water supplies [PWS/N/0041, PWS/N/0032, PWS/N/0038] **from springs between 100-400 m of centreline.**	High	Negligible	Insignificant
Private water supply: [PWS/N/0761] from spring between 400-800 m of centreline.	Medium	Negligible	Insignificant

Receptor	Sensitivity	Pre-Mitigation Impacts Magnitude	Pre-Mitigation Significance
Private water supplies [PWS/N/0063, PWS/N/2470, PWS/N/0763, PWS/N/1121, PWS/N/1065, PWS/N/1888, PWS/N/2165, PWS/N/2233, PWS/N/2129, PWS/N/1893] from wells between 0-200 m of centreline or substation.	High	Moderate	Significant
Private water supplies [PWS/N/0834, PWS/N/1045 and PWS-5951, PWS/N/1123, PWS/N/1100, PWS/N/0340, PWS/N/2475, PWS/N/2676, PWS/N/0347, PWS-5772, PWS/N/0422, PWS/N/2212, PWS/N/1896] from wells between 200-600m from centreline.	Medium	Negligible	Insignificant
Public/Industrial Water Supply	Medium	Negligible	Insignificant

Proposed Monitoring and Mitigation

3.2.2.42 The proposed monitoring and mitigation measures to address the pre-mitigation impacts described above are outlined below. All works affecting the water environment are likely to require a Controlled Activities Regulations (CAR) licence from SEPA. This process will involve providing the necessary evidence that the water environment will be adequately safeguarded by the design and construction process. The mitigation below is assessed as rendering all effects associated with geology, hydrology and contamination to being of negligible significance, with two exceptions. The accidental spillage of pollutants during construction, and potential effects on water supplies, is assessed as being of minor significance following mitigation, as is the effects from contaminated land and ground gas. The disturbance and mobilisation of contaminated material relating to aquifers and water supplies also has a residual impact of minor significance.

Avoidance of Sensitive Receptors

3.2.2.43 The primary mitigation technique is to route the cable and site the substations away from sensitive receptors. Many of the potential construction effects will be fully or partially mitigated by consultation with land and asset owners, site investigations and careful routing of the proposed OnTI/substation. Based on findings from the environmental baseline assessment, the following areas will be avoided for the final cable route where possible:

- Designated areas including geological and geomorphological SSSIs;
- Deep peat bogs. Peat is known to exist within the study area as detailed on geological maps. Where peat cannot be avoided, detailed peat depths surveys will be undertaken and the cable route will be designed such that the effect on the peat hydrology and carbon losses are minimised. The width of the cable trench will be minimised and peat will be extracted in such a manner to enable re-use for peat restoration;
- Private water supplies and abstractions. It may not be feasible to avoid all private water supplies and abstractions along the entire route, in particular in areas with many private water supplies clustered together. In such cases, a

more detailed investigation and risk assessment will be carried out to identify the exact location and potential zone of influence;

- Floodplains as shown in the SEPA Indicative River & Coastal Flood Map. Although avoidance of watercourses and floodplains is not entirely possible, the cable route will not run close to the river banks or over great distances parallel to rivers within the floodplain;
- Contaminated land as identified following detailed site investigations.

3.2.2.44 In general, the cable trenches will not be wider than strictly necessary and construction methods will be adopted to minimise additional (temporary) land take.

Detailed Site Investigations

3.2.2.45 Once the exact route selection is made within the wider study area, detailed site investigation will be carried out to assess risks from the potential existing land contamination identified. A site investigation strategy together with any additional research to further augment the conceptual site model will be developed for each individual site of potential existing land contamination along the route. The strategy for each will also be discussed with the Contaminated Land Officer at Aberdeenshire Council to give them an early opportunity to comment on the investigations proposed.

3.2.2.46 After implementation of the site investigation, detailed risk assessments will be carried out to understand the hazards posed by subsurface contamination, if present. In some instances, the hazards may be such that remedial works may be necessary to address the hazards prior to construction.

3.2.2.47 Geotechnical site investigations will be carried out to characterise the ground and groundwater conditions in relation to the design of the engineering works, de-watering requirements, foundation design and design of directional drilling for crossing of sensitive watercourses. These will be designed in conjunction with a specialist directional drilling contractor to reduce the risks as much as possible in relation to break out of bentonite.

3.2.2.48 The unknown sources of private water supply will be investigated further to confirm the source. This is particularly important for those located close to the substations, which may also be at risk during the operational phase.

3.2.2.49 The location of the abstraction licences within 500 m of the onshore export cable route centreline and substation locations also need to be ascertained and assessed. The potential presence of large abstractions for public consumption is a key uncertainty and risk.

3.2.2.50 A geomorphological study shall be carried out in Inverboyndie Bay to identify the most suitable location for the landfall infrastructure. Geo-environmental ground investigations shall be carried out at locations identified as potentially significantly contaminated, this should also include gas monitoring in areas of peat bogs. Gas protection measure may be required beneath the substation building if elevated ground gas is identified.

Environmental Design

3.2.2.51 The detailed design of the scheme will be developed for the cable route and sub-station using the data from the site investigations and risk assessments and EIA, in consultation with affected parties. The design will play a key role in reducing the scope for negative effects, as follows:

- The landfall design and exact location on the beach and foreshore area will be designed to minimise potential impacts on the SSSI;

- The design of crossings of sensitive water bodies will detail the cable passing a safe distance beneath the water body in question. Where HDD is used, drilling through the underlying rock or under granular deposits beneath water bodies will include sufficient cover to avoid leaching of lubricant or other polluting substances into the water bodies concerned;
- Where the infrastructure unavoidably passes adjacent to existing public or private water supplies, measures will be incorporated to ensure that the permanent works will pose no threat to these potable water sources;
- The design will ensure that, where the alignment unavoidably results in flood defence features being encountered – be these local riparian bunds or the sand dunes at Inverboyndie Bay – these defences are in no way compromised by the permanent works;
- Wherever there is a residual risk of flooding associated with the permanent works, that cannot be mitigated by the avoidance strategy, flood resistance or resilience measures, and attendant mitigation of off site impacts, will be used to ensure the permanent works is safe from flooding and will not increase flood risk elsewhere;
- Use of sustainable drainage systems for any permanent access roads and the substation compound to attenuate runoff to existing rates and prevent deterioration in the water quality of downstream watercourses. The drainage system will adopt sustainable drainage system (SUDS) principles as set out in best-practice guidance documents (Masters-Williams et al., 2001; Murnane et al., 2006; Water Research Centre et al., 2007; Woods Ballard 2007). All drainage measures will be designed to take account of existing land drainage systems;
- The risk of pollution occurring as result of operation and maintenance of the transformers will be mitigated by incorporation of sumps and, if necessary, secondary containment and/or bunding;
- Sterilisation of mineral reserves will be mitigated by undertaking consultation with the relevant stakeholders and key parties. Where mineral reserve sites cannot be avoided, and where there is potential for future extraction or possible sterilisation of these reserves, a design will be developed that minimises the sterilising effects.

Construction

Environmental Management Plan (EMP)

3.2.2.52 Use of the guidance listed in Section 3.2.1.65 will be made to develop a detailed Environmental Management Plan (EMP) in consultation with SEPA. This will be developed in conjunction with the contractor undertaking the engineering activities and monitoring. The EMP will also consider the actions to be taken in the event of encountering unexpected contamination and hazardous gases and how to deal with accidental pollution incidents, such as fuel spills.

3.2.2.53 Specific measures that are likely to be used to ensure that the significance of the residual effects are either of minor significance or insignificant, include the following:

- Any soils affected by construction activity will be protected from compaction. The default technique is likely to be for topsoil in the working area to be stripped, stored in a manner to prevent its deterioration/compaction and reinstated to the same levels as currently exist. Other techniques, such as temporary raft structures, may also be used;
- Dedicated site access routes and compound areas will be drained using drainage measures designed to ensure runoff is attenuated to existing levels and there are no routes for sediment or other pollutants to directly enter

watercourses. The system will be implemented prior and during the construction activities. Construction on steep slopes will, where possible, be avoided. The drainage system will adopt sustainable drainage system (SUDS) principles as set out in best-practice guidance documents (Masters-Williams et al., 2001; Murnane et al., 2006; Water Research Centre et al., 2007; Woods Ballard 2007). It will also provide measures to reduce erosion and prevent sediment laden runoff entering surface water. For example: adequately sized settlement lagoons could be constructed to allow settlement of sediments prior to discharge to groundwater or surface water. It is envisaged that the drainage system will incorporate some or all of the following components:

  - Diversion or cut-off drains to direct nearby runoff away from the construction area;
  - Drainage ditches, swales, infiltration areas etc. to capture runoff;
  - Distribute discharge points and drainage outfalls (surface water or groundwater) to reduce flow rates and volumes;
  - Check dams at regular intervals along ditches on a gradient to prevent high flow rates;
  - Settlement lagoons and sediment traps to prevent water pollution and act as a buffer area in case of pollution incidents; and
  - Temporary access track drainage to prevent surface water flooding.

- Any field under-drainage systems that are encountered on site will be reinstated to the same line and level to ensure that these systems continue to operate after the new infrastructure has been installed;
- Appropriate construction methods will be used for floodplain and watercourse crossings, with horizontal directional drilling (HDD) techniques used for larger watercourses such as the River Deveron. Where other techniques are used for crossing minor watercourses, such as temporary bridging structures or culverts, the physical alteration of the channel geometry will be reinstated to their pre-existing condition, with temporary erosion protection measures employed where necessary to ensure bank vegetation becomes fully re-established. To mitigate the disturbance to small watercourses as part of the construction of crossings, the following working methods will be adopted:
  - Minimise the duration over which watercourses are dammed to prevent backing up of flows and drying up of downstream channels;
  - Overpump flow where construction requires more than one day or where flows are significant;
  - Excavate cable trenches as narrow as possible across the river bed;
  - Restore river beds and banks using original soils and gravels where possible;
  - Provide additional scour and erosion protection to mitigate the risk of bare soils, and;
  - Develop site specific crossing methods take into account local issues and risks.
- Best practice construction site management will be adopted to minimise pollution risk from construction plant and materials including regular inspection of plant, storage of materials away from water bodies in spillage-proof containment areas and location of welfare and toilet facilities away from water bodies;

- The integrity of existing flood defences will be maintained throughout construction by ensuring these issues are captured in the construction stage EMP;
- Human health effects will be mitigated using the findings of the ground investigations and the personal protection equipment (PPE) provided where necessary. The EMP will include health and safety information of this kind. Confined space training will be given to construction workers potentially at risk from accumulating natural gases in open trenches and confined spaces, wherever such working methods cannot be avoided.
- Mitigation measures and best practice techniques shall be adopted to prevent unnecessary damage to the SSSI. Consideration shall be given to the plant traffic movements creating potential damage to the foreshore geology and to the potential for fuels / oil spills and leaks from machinery. A detailed method statement for foreshore construction shall be produced.

3.2.2.54 A site waste management plan will be developed to minimise waste (e.g. peat and soils, contaminated materials), reuse materials were possible (i.e. re-use agricultural and clean soils from trench excavation for backfill), segregate wastes (e.g. keep potentially contaminated soils separate from others) and ensure storage does not pose a risk of pollution from runoff / spillage.

3.2.2.55 A maintenance plan will be required for the operational phase which ensures that the water environment will not be affected by maintenance and repair operations. With the above measures in place, the residual effects of the scheme on the water environment will be either insignificant or of minor significance.

Environmental Monitoring

3.2.2.56 A groundwater and surface water monitoring programme will be carried out to obtain baseline data, as well as data during construction works for identified sensitive water environment receptors (e.g. water supplies, major watercourses).

3.2.2.57 These will be dependent on the final route alignment. The scope of this will be agreed with SEPA prior to implementation.

3.2.2.58 Once the final route alignment is determined detailed site investigations and review of water supplies in proximity to the route will be completed. If this identifies a potential effect on groundwater levels / flow regimes particularly in the vicinity of water supplies, a monitoring plan to review effects on groundwater levels / quality will be developed.

3.2.2.59 A surface water monitoring network for sensitive watercourses in relation to the final route alignment will be established six months prior to construction works. The monitoring network will consist of control monitoring points upstream of construction works as well as monitoring points downstream.

3.2.2.60 In addition to surface water monitoring, regular visual inspection of surface water management features such as field drainage outfalls and receiving watercourses will be carried out in order to establish whether there are increased levels of suspended sediment, erosion or deposition. It is likely that there will be an on-going need to maintain these structures (for example: by the removal of debris) to ensure they continue to function as designed.

3.2.2.61 Regular visual inspection of watercourses will be carried out during construction, particularly during periods of high rainfall but also during low flow conditions, in order to establish that levels of suspended solids have not been significantly increased by on-site activities.

3.2.2.62 Monitoring may also be required as a condition of any discharge consents, abstraction licences or other environmental regulations.

3.2.2.63 Following construction, earthworks reinstatement and, where appropriate, vegetation will be monitored to ensure stable ground surfaces become fully re-established. Similarly, areas where land drainage systems have to be reinstated during construction, following their inevitable disruption when the cable is installed, will be monitored to ensure that these systems are working satisfactorily.

Operation

3.2.2.64 The measures implemented during the construction phase will also address the operational phase effects to sensitive receptors. An Environmental Management Plan including health and safety information shall be kept with details of locations where contaminated materials and ground gases are known to occur along the route, so that maintenance works can be planned accordingly and PPE worn if necessary. Details of the SSSI will also be included to avoid any unnecessary damage during maintenance.

3.2.2.65 Regular inspections of the substations will be undertaken to ensure timely detection of any release of contaminants. The detailed design of the substations will include the use of bunds around chemical/ fuel storage areas and interceptor drains for any contaminants spilt in line with pollution prevention and design guidelines.

Decommissioning

3.2.2.66 As previously discussed, there is no specific schedule for the scope of activities for the decommissioning phase at present and as such it is not possible to identify detailed mitigation measures. However, as many of the potential effects could be similar and certainly no worse than that identified for the construction phase, the mitigation measures would be similar to those proposed for the construction phase.

3.2.3 Cumulative Impact Assessment

Summary

3.2.3.1 This section presents the results of assessment of the potential cumulative effects upon hydrology, geology and contaminated land arising from the modified OnTI as a whole in conjunction with other existing or reasonably foreseeable onshore developments and activities. MORL's approach to the assessment of cumulative effects is described in Chapter 1.3: Environmental Impact Assessment.

3.2.3.2 The other developments proposed in the area are, almost without exception, relatively minor, localised developments. For example, the windframs comprise installation of between one and three realtively small turbines and the anemometer masts are single masts. The largest proposal is for a 9.8 hectare solar farm.

3.2.3.3 A summary of the likely significant cumulative effects, assuming other developments in the area proceed at the same time as MORL's development, is provided in Table 3.2-13 below. In general, following mitigation, the cumulative effect on the hydrology, geology and hydrogeology is still assessed assessed to be negligible or of minor significance.

3.2.3.4 None of the individual effects were considered to increase due to potential cumulative effects, and hence no additional mitigation is required. In general terms it is considered that there is limited potential for cumulative effects to occur. Provided that each development is carried out with appropriate mitigation, adopting the best practices outlined in this report, the cumulative effect of the overall project, including these other developments, is assessed as being the same.

3.2.3.5 A key effect considered as part of all cumulative sites is water pollution due to construction activities. Although this could lead to a cumulative effect, the spatial distribution and the timing of the projects assessed makes it highly unlikely that there will be a significant cumulative effect on any surface water or groundwater body.

Table 3.2-13 Significant Cumulative Effects Summary

Effect	Residual Significance Level for Modified OnTI	Whole Project Assessment: Modified TI +Telford, Stevenson and MacColl	Mitigation Method
Construction			
All effects related to geology/contaminated land	Minor / negligible	Minor / negligible	None required beyond standard best practice
	Total Cumulative Impact Assessment	*If all of these developments proceed at the same time, the risk of contamination being encountered and waste being generated will be very slightly increased, but overall the cumulative impact is still considered to be of minor / negligible significance provided appropriate mitigation is implemented in accordance with the best practices outlined in this report.*	
All effects related to aquifers/water supplies	Minor / negligible	Minor / negligible	None required beyond standard best practice
	Total Cumulative Impact Assessment	*If all of these developments proceeded at the same time, the risk of aquifers and water supplies being affected by pollution will be slightly increased, but this is still only considered to be of minor / negligible significance, provided appropriate mitigation is implemented in accordance with the best practices outlined in this report.*	
All effects related to flood risk/surface water environment	Negligible	Negligible	None required beyond standard best practice.
	Total Cumulative Impact Assessment	*If all of these developments proceeded at the same time, the risk of surface water bodies being affected will be slightly increased, as will be the risks associated with localised land drainage and flood risk effects. However, overall, given the scale of these developments, the cumulative impact, with mitigation, is considered to be of negligible significance.*	
Operation / Maintenance			
All effects related to geology/contaminated land	Minor	Minor	None required beyond standard best practice
	Total Cumulative Impact Assessment	*The residual effects of minor significance – risk of pollution incidents occurring – remains of minor significance.*	
All effects related to aquifers/water supplies	Minor / Negligible	Negligible	None required beyond standard best practice
	Total Cumulative Impact Assessment	*Provided that each development is carried out with appropriate mitigation, the cumulative effect of all the development is considered negligible.*	
All effects related to flood risk/surface water environment	Negligible	Negligible	None required beyond standard best practice
	Total Cumulative Impact Assessment	*Provided that each development is carried out with appropriate mitigation, the cumulative effect of all the development is considered negligible.*	

Assessment of Cumulative Effects

Methodology

3.2.3.6 This section presents the results of assessment of the potential cumulative effects upon geology, hydrology and contaminated land arising from the modified OnTI in conjunction with other existing or reasonably foreseeable developments and activities. A whole project assessment has also been undertaken for the likely significant cumulative effects of the modified TI in conjunction with the three consented wind farms.

3.2.3.7 The scope of cumulative effects assessment considered planned developments which match the following criteria:

- Within 5 km of the onshore cable route;
- Those which are current (expired applications were excluded); and
- Those which are live (withdrawn or refused applications were excluded).

3.2.3.8 The scope of cumulative effects assessment highlighted that no planned developments were required to be considered for potential cumulative effects on the VERs identified within Table 3.2-13. The developments and activities considered at the scoping stage of the cumulative impact assessment are listed in Table 3.2-14 below for clarity.

3.2.3.9 There are eleven developments which are approved or pending planning permission within or in the close vicinity of the modified onshore export cable route corridor and substation site (Table 3.2-14 below).

Table 3.2-14. Developments and activities considered in detail in the cumulative impact assessment.

Name	Details	Evidence	Planning Status	Construction Timescale
Cairnhill Farm (Turriff, Aberdeenshire, AB53 5TN)	Erecton of 3 no Wind Turbines and Infrastructure Application received 2007.	No significant impacts during the operational phase on relevant receptors.	Operational	N/A
Gairnieston Farm (Turriff, AB53 5RP)	Erection of Wind Turbine and Associated Infrastructure (1 turbine). Application received 2007.	No significant impacts on any relevant receptors.	Operational	N/A
Backhill of Yonderton (Craigston, Turriff AB53 5PT)	Erection of 2 no. Enercon E70 2.3MY (4.6MW) Wind Turbines on 64 metre masts (Total Height 99.5 meters) and associated infrastructure. Application received 2010.	No significant impacts on any other relevant receptors.	Approved	Duration 3 – 5 Months. No start date confirmed.
South Colleonard (Banff, AB45 3TP)	Full Planning Permission for Erection of 1 no. Wind Turbine, Hub Height 55.6 metres (Total Height 79.6 metres) and Associated Infrastructure. Application Received 2012.	No significant impacts on any relevant receptors.	Pending	No information available.

Name	Details	Evidence	Planning Status	Construction Timescale
Knock Thunder Farm (Fiskaidly, Banff AB45 3AB)	Erection of 1 no. turbine of 77 m height and substation plus associated infrastructure. Application submitted 2013.	No significant impacts on any relevant receptors.	Pending	No information available.
Overhead Line Deviation (Upper Mains of Asleid Turriff)	Overhead line deviation. Application submitted 2004	No impact assessment prepared – insufficient information.	Approved	No information available.
Overhead Line (Sprottyneuk, New Deer, Turriff, Aberdeenshire, AB53 6XX)	Erection of 11kV Overhead Line (Retrospective). Application submitted 2006.	No impact assessment prepared – insufficient information.	Approved	N/A
33,000 Volt Line (Land at Strath of Brydock, Banff)	Installation of 33 kV Line. Application Granted 2008.	No impact assessment prepared – insufficient information.	Approved	No information available.
Reinforcement and Reinsulation of Existing Overhead Electricity Transmission Line (Land Rothienorman T Junction to Peterhead 275kV Electricity Sub Station) – near Millbrex.	Notification under Electricity Act 1989 for Section 37 Notification for Reinforcement and Reinsulation of Existing Overhead Electricity Transmission Line to Upgrade Voltage from 275kV to 400kV. Application granted 2013.	No significant impacts on any relevant receptors.	Approved	Works anticipated to commence 2016-2018.
Cairnhill Farm (Turiff, AB53 5TN)	Installation of 2.4MW Solar Farm comprising 10000 PV Panels and Associated Infrastructure. Footprint 9.8 hecatres. Application granted 2013.	No significant impacts on any relevant receptors.	Approved	Duration: 2-3 weeks. No start date confirmed.

3.2.3.10 It can be concluded that these all comprise localised developments that will have no effects of significance to receptors potentially affected by the OnTI.

3.2.3.11 The solar farm at Cairnhill is situated within the study area and is the largest of the proposed developments. Its construction concurrently with the OnTI and substation could contribute to cumulative effects if the two developments are not coordinated. However, provided each party is made aware of the other's intentions, and incorporates appropriate mitigation into their proposals, as outlined in this assessment, the assessment of the significance of the cumulative impacts remains unaffected.

3.2.3.12 No further consideration of cumulative effects is given within this chapter.

3.2.4 References

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All guidance listed in Sections 3.2.1.63 and 3.2.1.64 of this report