

Appendix D – Environment

D1 NOISE AND VIBRATION

D1.1 INTRODUCTION

STAG recommends that the noise appraisal follows the approach set out in WebTAG Unit 3.3.2¹. The STAG appraisal considers operational noise only, and is based on changes in traffic flows. The appraisal aims to estimate the change in the population annoyed by noise for a do-minimum strategy compared with the proposed options. The approach is to estimate the total number of people exposed to different noise levels and, using the annoyance response relationship data provided in WebTAG, calculate the change in the number of people likely to be 'annoyed'.

A method for assessing vibration is not included within either WebTAG or STAG.

D1.2 KEY ISSUES

A number of properties and communities lie adjacent to the routes of the road network tie ins leading to the options. These include residential and other sensitive properties. However, it is noted that a number of properties located close to the northern and southern bridgeheads of the existing Forth Road Bridge will already experience significant impacts from noise generated by north and south-bound traffic on the bridge.

The majority of new road network connections proposed south of the Firth Forth are located away from communities however there are individual properties close to the proposed roads that may be affected by traffic generated noise. On the southern shore the road network tie ins run primarily through agricultural land to the south east and south west of South Queensferry.

On the northern shore in Fife, the road network connections could impact on a number of communities:

- The network connection for Option C tunnel runs to the north of Rosyth;
- The network connection for Option D tunnel runs through an area of land sandwiched between the north eastern fringes of Rosyth and north western fringes of Inverkeithing;
- The network connection for Option D bridge joins the existing carriageway north of the existing northern bridgehead; and
- The network connection for Option E tunnel crosses agricultural land to the north east of Dalgety Bay.

¹ WebTag 'Transport Analysis Guidance' Website: <http://www.webtag.org.uk/> . Department for Transport. Update February 2007.

Closure of the existing Forth road bridge may also have the potential to affect a greater number of receptors in sub-urban and urban districts of Edinburgh and Dunfermline.

D1.3 APPRAISAL OUTCOME

Potential Impacts

Construction noise varies considerably during any building project. Properties within 50 to 100m of such works can be disturbed. The character of construction noise varies during the project depending on the activities being undertaken. For changes to existing road infrastructure and construction of new overground roads, initial phases can involve road breaking, earth moving followed by planing. These activities can produce high levels of noise and vibration but would be of limited duration. Rolling and compaction can also be noisy but finishing phases of paving and signage erection tend to be low noise operations. Predicted construction noise is likely to exceed 75 LAeq,12hr. Major negative short term impacts are therefore predicted to occur at locations in close proximity to construction works.

Typical road construction activities have the potential to generate perceptible vibration within 10m of works and could result in Moderate adverse impacts for short periods, meaning that vibration may be perceptible but there would be no effect on the structure of properties. The potential impact would be dependant on the method of working, local ground conditions and receptor sensitivity.

There is also potential for vibration impacts resulting from tunnel boring operations. It is generally accepted that, without highly detailed understanding of the media, waveform, and frequency distribution, ground-borne vibration prediction methods are “beset with complexities and uncertainties”². It is therefore considered best practice to measure ground-borne vibrations where there is “concern that damage may occur”³. Implemented through the application of the Construction Environmental Management Plan (CEMP), where significant vibration impacts are likely it is recommended that a detailed assessment be conducted if tunnelling are required.

Traffic modelling indicates that once operational, all the options would experience a significant increase in road traffic and consequently traffic related noise. Increases and decreases in traffic flows are predicted to occur across a large area and consequently a large number of receptors are likely to be affected, both positively where traffic flows are predicted to be reduced and negatively where traffic flows are predicted to increase.

² Thornley-Taylor, R.M., ‘Ground Vibration Prediction and Assessment’.

³ BRE Digest 403, March 1995 ‘Damage to structures from ground-borne vibration. Building Research Establishment 1995.

Mitigation

As well as providing a calculation methodology, BS5228:1997 “Noise and vibration control on construction and open sites”⁴ also gives detailed advice on methods of minimising nuisance from construction noise. This can take the form of reduction at source, control of noise spread and in areas of very high noise levels, insulation at receptors. It should be a requirement of any construction contract for the contractors to comply with the recommendations in this standard in order to achieve specific noise limit criteria for each site. A code of construction practice or environmental management plan would be prepared by the contractor and this would include the following provisions at locations where noise is likely to be a problem:

- Proper use of plant with respect to minimising noise emissions and regular maintenance. All vehicles and mechanical plant used for the purpose of the works would be fitted with effective exhaust silencers and would be maintained in good efficient working order;
- Selection of inherently quiet plant where appropriate. All major compressors would be ‘sound reduced’ models fitted with properly lined and sealed acoustic covers which would be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools would be fitted with mufflers or silencers of the type recommended by the manufacturers;
- Machines in intermittent use would be shut down in the intervening periods between work or throttled down to a minimum;
- All ancillary plant such as generators, compressors and pumps would be positioned so as to cause minimum noise disturbance. If necessary, acoustic barriers or enclosures would be provided. A well constructed 3m high barrier of 10mm softwood can reduce noise levels by 5 – 10 dB; and
- Adherence to the codes of practice for construction working and piling given in British Standard BS 5228:1997 and the guidance given therein minimising noise emissions from the site.
- Night time working would be kept to an absolute minimum and the normal working day would be used wherever possible.
- In order to minimise the likelihood of complaints, the local authorities and affected residents would be kept informed of the works to be carried out and of any proposed work outside normal hours. Residents would be provided with a point of contact for any queries or complaints. In general,

⁴ British Standard BS 5228: 1997 ‘Noise and Vibration control on construction and open sites. Part 1. Code of practice for basic information and procedures for noise and vibration control’ . British Standards Institution, 1997. ISBN 0 580 26845 4.

good public relations and extensive consultation with local authorities would be necessary to help to minimise the impact of construction work.

Mitigation of operational noise would take the form of acoustic barriers located as close as possible to affected sensitive properties.

D1.4 SUMMARY

The traffic predictions indicate that operation of all the options has the potential to cause significant changes in road traffic noise, not only on local routes, but also much further afield. From the traffic predictions, a number of existing roads in West Lothian, Falkirk, City of Edinburgh and Fife have been identified that will experience a change in traffic flow of:

- Less than -20%; and
- Greater than +25%.

In some areas reductions in traffic flows are predicted resulting in reduced noise levels however, overall, all options are considered to have significant negative impacts. Operational noise impacts would be experienced across a wide area for all the options. The magnitude of the impact is dependent on the proximity of the receptor to the source of noise i.e. the closer the receptor to the source of noise, the greater the impact magnitude. Table D1.1 below summarises this assessment.

Table D1.1 - Summary of Assessment

Proposal			Overall Effects	Temporary	Overall Effects	Permanent
Corridor Tunnel	C -		Minor Negative	to Major	Minor Negative	to Major
Corridor Bridge	D -		Minor Negative	to Major	Minor Negative	to Major
Corridor Tunnel	D -		Minor Negative	to Major	Minor Negative	to Major
Corridor Tunnel	E -		Minor Negative	to Major	Minor Negative	to Major

D2 LOCAL AND GLOBAL AIR QUALITY

D2.1 INTRODUCTION

The global and local air quality assessment consists of two parts, a strategic level assessment and a local level assessment. The strategic level assessment considers emissions of pollutants over the whole study area and the local level assessment considers the impact of the scheme on concentrations of pollutants at a local level. The strategic level assessment, presented below, considers emissions of carbon dioxide, a greenhouse gas, which may impact on a global scale. Carbon dioxide has been singled out as the most important transport induced greenhouse gas having a direct impact on global warming.

A local level assessment which considers the impact of pollutant concentrations on people's health has not been undertaken. The local assessment considers locations which are sensitive to local air quality such as residential properties, schools and hospitals. A scheme that relieves congestion in a highly populated area will have a beneficial impact on local air quality, whereas a scheme that introduces more vehicles to a populated area will have a detrimental impact on local air quality.

D2.2 STRATEGIC LEVEL ASSESSMENT

Total annual emissions of nitrogen dioxide (NO₂) (as total nitrogen oxides (NO_x)), fine particulate matter (PM₁₀) and carbon dioxide (CO₂) have been calculated for five scenarios; a do-minimum scenario and do-something scenarios for each corridor, all for 2017. The methodology detailed in DMRB 11.3.1 was followed.

Due to the wide area that could be affected by changes in traffic flow, and therefore changes in emissions, all road links within an area of 1200 km², approximately centred on the existing crossing, have been assessed. The area stretched from Falkirk and Kincardine in the west to Edinburgh and Kirkcaldy in the east; and from Kinross in the north to Livingston in the south.

D2.3 KEY ISSUES

The results, in terms of total annual emissions of NO₂, PM₁₀ and CO₂ are presented in Table D2.1 below. The percentage impact of each corridor when compared to the do-minimum is shown in brackets.

Table D2.1 - Annual Emissions of NO₂, PM₁₀ and CO₂, 2017

Pollutant	Do-Minimum	C Tunnel	D Bridge	D Tunnel	E Tunnel
NO ₂ (as NO _x) (T/yr)	2,945	2,881 (-2.1%)	2,850 (-3.2%)	2,887 (-2.0%)	2,938 (-0.2%)
PM ₁₀ (kg/yr)	80,634	80,287 (-0.4%)	80,342 (-0.4%)	81,281 (0.8%)	82,685 (2.5%)
CO ₂ (kT/yr)	1,043	1,026 (-1.6%)	1,020 (-2.2%)	1,031 (-1.1%)	1,056 (1.2%)

D2.4 APPRAISAL OUTCOME

A reduction in total annual emissions of all three pollutants was predicted for the C Tunnel and D Bridge Corridors. For D Tunnel, reductions in NO₂ and CO₂ were predicted, but an increase in emissions of PM₁₀ was predicted. For E Tunnel, increases in emissions of CO₂ and PM₁₀ were predicted, and a small decrease in NO₂.

The greatest decrease in CO₂ emissions, and hence beneficial impact, was predicted for D Bridge. A 2.2% decrease was predicted (22,721 tonnes/year). For E Tunnel a 1.2% increase in CO₂ emissions was predicted (12,922 tonnes/year).

These increase/decreases may be put into a greater context by considering estimated total emissions, by Local Authority area, from all sources. In 2004 a total of 8,499 kilotonnes of CO₂ were emitted from all sources from the following Councils; City of Edinburgh, Falkirk and West Lothian (a total area of 1000 km²). The percentage increases/decreases for each corridor option when compared to this figure are: -0.17% (C Tunnel), -0.23% (D Bridge), -0.12% (D Tunnel) and 0.13% (E Tunnel).

D2.4 SUMMARY

The Strategic level assessment predicts overall beneficial (or positive) impacts for C Tunnel, D Bridge and D Tunnel, and overall detrimental (or negative) impacts for E Tunnel however it should be noted that these results have not been informed by a local level assessment.

D3 WATER QUALITY, DRAINAGE, FLOOD DEFENCE

D3.1 INTRODUCTION

This section of the STAG appraisal considers the potential effects of the replacement crossing proposals and associated road infrastructure on the water environment. For the purpose of this study water environment includes water quality, drainage and flooding.

A baseline desk study has been undertaken and surface waterbodies located within a 500 metres wide corridor around each proposal have been identified.

Where such information has been available, the desk study has incorporated the following:

- Identification of the locations and characteristics of principal water bodies in the area;
- Details of river classifications from the Scottish Environment Protection Agency (SEPA) for relevant waterbodies. Classifications reflect the status of the watercourse in terms of chemical and biological properties, aesthetic quality and toxicity assessment; and
- Details of the reporting categories assigned to the surface waterbodies within each corridor; as determined by the Characterisation and Impact Analysis undertaken by SEPA required by Article 5 of the Water Framework Directive;

It should be noted that no water quality monitoring was undertaken as part of this assessment.

D3.2 KEY ISSUES

Water Framework Directive

The Water Framework Directive was transposed into Scottish law by the Water Environment and Water Services Act (Scotland) 2003 (WEWS) and Water Environment (Controlled Activities) (Scotland) Regulations 2005 (CAR).

The overall objective of the Water Framework Directive (WFD) is the 'protection of the water environment' which is transposed into s.1(2) a) of the WEWS Act) as meaning preventing further deterioration of, and protecting and enhancing, the 'status' of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on those aquatic ecosystems'. The WFD goes on to define "Surface water status" as the general expression of the status of a body of surface water, determined by the poorer of its ecological status and its chemical status, Article 2(17).

The ongoing implementation of the WFD has resulted in the identification and characterisation of River Basin Districts (RBDs); the Firth of Forth being located in the Scotland RBD. A key consideration in the characterisation is assessing if the waterbody is at risk of not achieving the WFD target of “good status” by 2015. A risk based approach, rather than the qualitative approach used for water quality classifications, is used to determine WFD characterisations. The risk status is determined taking into account pressures and impacts including; point source and diffuse pollution, abstractions, impoundments and hydromorphological change. Four reporting categories are used to describe all types of surface waterbodies:

- 1a definitely at risk of not achieving “good status” by 2015;
- 1b probably at risk of not achieving “good status” by 2015;
- 2a probably not at risk of not achieving “good status” by 2015; and
- 2b definitely not at risk of not achieving “good status” by 2015.

It should be noted that the characterisation takes into account factors not previously considered in the assessment of river quality. This coupled with the more stringent quality objectives of the WFD mean that the many surface waterbodies are deemed to be in categories 1a or 1b, at risk of not achieving “good status” when they may have higher quality rating under water quality classification regime.

The Controlled Activities Regulations (CAR) have also resulted from the implementation of the WFD. CAR covers engineering works in or adjacent to waterbodies and aims to control the impacts of development on the water environment. There are three levels of CAR, General Binding Rules (GBRs), Registration and Licence. The control and authorisation conditions applied under these levels would be dependent on the risks a particular development poses to the water environment.

Water Quality Classification

Water quality classifications have been determined taking into account biological, chemical and aesthetic elements of surface waters and a single classification has resulted. Class ranges are:

- A1 Excellent;
- A2 Good;
- B Moderate;
- C Poor; and
- D Seriously polluted

It is the intention of SEPA that the above classifications will continue to be used for reporting until at least 2007 when they will be replaced by the WFD reporting categories. Where such information on water quality exists, this assessment has taken into account both the water quality classification, based on the sampling year 2005, and the results of the WFD characterisation.

D3.3 MITIGATION

With regards to the protection of the water environment, mitigation is generic and results from legislation and best practice. To avoid repetition temporary mitigation to be employed during the construction phase and permanent mitigation incorporated into the final design is described below:

Temporary mitigation would include:

- Construction activities would be undertaken in accordance with the relevant legislation including WEWS and CAR and best practice such as the technical guidance set out in the “Design Manual for Roads and Bridges: Vol. 10 – Environmental Design and Management” published by the Highways Agency, SEPA Pollution Prevention Guidelines (PPGs) and a rigorous Code of Construction Practice (CoCP) and/or Environmental Management Plan (EMP);
- Temporary site drainage and treatment procedures, based on Sustainable Urban Drainage Systems (SUDS), would be put in place to manage surface water runoff and accidental spills of fuel, etc.;
- Measures would be put in place to prevent pollutants and/or suspended sediments entering surface watercourses;
- At the detailed design stage a flood risk assessment would be undertaken in accordance with Scottish Planning Policy 7 (SPP7 Planning and Flooding). The flood risk assessment would be carried out in accordance with criteria set out in SEPA Policy 41 (Development at Risk of Flooding) and would address the effects of development on watercourses within the corridor;
- At the detailed design phase, temporary works required during the construction process would be designed to minimise disruption to flows and disturbance to the bed, channel and banks of the affected surface waters and associated ecosystems; and
- Temporary and permanent works, in particular culverts, would be designed such that they minimise the disruptions to flow and do not increase the risk of flooding. Temporary culverts would be regularly inspected during construction to ensure blockages do not occur.

Permanent mitigation would include:

- An appropriately designed drainage system that would collect and treat surface runoff from the carriageway;
- The discharge of polluted surface water runoff into receiving watercourses could be mitigated by minimising the number of discharge points along the scheme length and using existing surface water drainage where possible;
- Maintenance of bridge structures would follow protection measures described in the SEPA guidance PPG23 “Maintenance of Structures over Water” would be followed when maintaining the bridge and associated infrastructure;
- Adequate pollution control would be incorporated into the drainage system of all new and upgraded road linkages in order to prevent deterioration of the quality of the water environment and would include the installation of oil/petrol interceptors where necessary;
- Culverts would be designed such that they do not affect the hydraulic capacity of a watercourse, reduce the risk of flooding, minimise the effects on the morphology of watercourse and allow passage of migratory fish and other species;
- The drainage system would be designed such that they do not affect the hydraulic capacity of a watercourse and reduce the risk of flooding;
- Potential enhancement, where appropriate, of stretches of watercourses affected by culverting or re-alignment to offset negative effects;
- Opportunities for habitat enhancement would also be maximised through the drainage design and the preferred route in general to compensate for the land-take element of the scheme.

D3.4 APPRAISAL OUTCOMES

This section considers the potential effects of the construction and operation of a replacement Forth crossing. It should be noted that all impacts have been assessed taking into account the mitigation described in section D3.3.

Construction and operation activities are broadly similar for each proposal. Consequently the majority of effects, whether temporary (construction) or permanent (operation), are common to all of the proposals. Construction activities would include:

- Site clearance and demolition activities
- Earthworks, including the construction of embankments and cuttings;
- Road upgrades including widening, re-profiling and junction alterations;

- Construction of new roads linking the crossing to the existing network;
- Construction of the toll plaza (if required) and associated facilities; and
- Tunnel or bridge construction.

To avoid repetition potential impacts are set out below. Where potential effects are specific to a particular proposal this is highlighted. Temporary and permanent impacts include:

- Potential mobilisation of pollutants or sediments by surface runoff during construction, particularly where works take place within the vicinity of surface waters;
- Where construction activities take place on or close to areas of contaminated ground, surface runoff could form a pathway allowing contaminants to enter nearby watercourses;
- Re-alignment or culverting of watercourses leading to reductions in water quality;
- Culvert construction could damage the banks or beds of the watercourses and have secondary indirect impacts on riparian or aquatic ecosystems;
- Tunnelling in Corridors C and D, and bridge construction in Corridor D would have a negligible effect on the hydrology of the Firth of Forth;
- Tunnelling in Corridor E would have a significant negative impact on the hydrology of the Firth of Forth as a result of displaced sediments and increased turbidity;
- Contaminated surface runoff containing, fuels, oils, lubricants, salt or grit could enter carriageway drainage systems and then be discharged to watercourses.
- Increase in the volume of surface runoff due to the introduction of impermeable surfaces;
- Poorly designed or blocked culverts could lead to localised flooding.
- Culverted watercourses could experience a reduction in water quality meaning those watercourses identified as being at risk of not achieving the objectives of the WFD may not achieve “good status” by 2015.

The impacts of the Do Minimum are associated with other committed schemes projects such as upgrading the A985 to dual carriageway and constructing Park and Choose Sites however, the precise location of these schemes in relation to surface waterbodies is unknown. It is assumed that the

other committed schemes will incorporate mitigation to prevent, reduce or offset negative environmental impacts.

The surface waters potentially affected by all corridors are described, north to south, in Table D3.1 below:

Table D3.1 - Potentially Affected Surface Waters

Potentially Affected Surface Water Name	Proposal	WFD Reporting Category	Water Quality Classification	Comments
Brankholm Burn	C, tunnel	1a	C, poor	Construction activities would take place within 400 metres of the burn however water quality is already poor due to the urban surroundings. New and upgraded roads cross or are close to these waters. Crossings may necessitate culverts or re-alignment of watercourses.
	D, bridge			
	D, tunnel			
	E, tunnel			
Keithing Burn	C, tunnel	1a	C, poor	New and upgraded roads cross or are close to these waters. Crossings may necessitate culverts or re-alignment of watercourses leading to negative effects on water quality, watercourse banks and bed. In the long term, culverting would cause secondary indirect impacts on riparian and aquatic ecosystems.
	D, bridge			
	D, tunnel			
	E, tunnel			
The Cast	D, bridge	Not monitored	Not monitored	
	D, tunnel			
	E, tunnel			
Pinkerton Burn	D, bridge	Not monitored	Not monitored	
	D, tunnel			
	E, tunnel			

Firth of Forth	C, tunnel	1a	n/a	Water quality is historically poor due to the number of domestic and industrial discharges the Firth of Forth receives however Proposals C and D tunnel, and D bridge are unlikely to exacerbate existing problems. Construction of tunnel could displace large volumes of sediment and hugely increase turbidity within the Firth of Forth.
	D, bridge			
	D, tunnel			
	E, tunnel			
Midhope Burn	C, tunnel	1b	B, moderate	Construction works associated with the shaft for the tunnel occur within 300 metres of the burn. There is the potential for site drainage to pollute the burn if not adequately treated and handled.

Linn Mill Burn	D, bridge	Not monitored	Not monitored	Construction works, the southern bridgehead or a shaft for tunnel works, would be located within 300 metres of this watercourse. Site drainage would need to be adequately treated and dealt with to prevent potential contamination of the burn.
	D, tunnel			
Hopetoun Fishery	C, tunnel	Not monitored	Not monitored	Construction works associated with roads linking the M9 to toll plazas (if required) take place in the vicinity of the Fishery. Although water quality is not monitored its function implies a good standard of water quality.
	D, bridge			
	D, tunnel			
Humbie Reservoir	D, tunnel	Not monitored	Not monitored	A bridge would be required to cross the reservoir in order to link the toll plaza (if required) to the new spur roads from the M9. Temporary and permanent impacts could include a reduction in water quality.
Swine Burn	C, tunnel	1a	A2, good	New roads from the M9 would impact on the burn, it is likely to require to be culverted or re-aligned. The burn has already been culverted by a section of the M9.
	D, bridge			
	D, tunnel			
	E, tunnel			

Dolphinton Burn	E, tunnel	1a	C, poor	Construction sites for both tunnel portals on the southern shore are bisected by the burn. Polluted surface runoff could further reduce water quality.
Union Canal	C, tunnel	1a	C, poor	Construction works associated with the toll plaza (if required) take place within 300 metres of the Canal. An appropriate system would be required to treat and discharge surface runoff to prevent impacting on the canal.
Niddry Burn	D, tunnel	1b	Not monitored	Construction works would take place within the vicinity of these surface waters.
Field drains	C, tunnel	Not monitored	Not monitored	Unnamed field drains are present throughout all of corridors. Within these water quality is likely to be of a low standard. Where roads cross these they may require to be re-aligned where they could be incorporated into the carriageway drainage system, or they may be culverted.
	D, bridge			
	D, tunnel			
	E, tunnel			

The most significant negative effects of Corridor C Tunnel are associated with the culverting or re-aligning of surface waters which could prevent

waterbodies achieving the objectives of WFD. As well as potential damage to the banks and/or bed of affected watercourses during the construction of culverts, in the long term there would be reductions in water quality and secondary indirect impacts on the riparian or aquatic ecosystems. Where appropriate, potential compensatory mitigation, such as ecological improvements of other sections of the affected surface water could offset negative impacts. All other temporary and permanent impacts, in particular those related to the potential contamination of surface runoff, handling site drainage and potential for flooding could be adequately mitigated through the adoption of the mitigation outlined in section D3.3. On this basis the overall temporary and permanent effects of Corridor C Tunnel are assessed to be minor negative to neutral.

The impacts of new and upgraded roads on watercourses are likely to be the most significant effects of Corridor D Bridge. Culverting of surface waters could prevent them from achieving the objectives of the WFD by 2015. Mitigation could include measures to offset this impact by improvements to other stretches of the affected surface waters. Impacts relating to drainage and flooding can be adequately mitigated by adoption of the mitigation measures outlined in section D3.3. On this basis the overall temporary and permanent effects of Corridor D Bridge are assessed to be minor negative to neutral.

The impacts of Corridor D Tunnel on drainage and flooding can be adequately mitigated by the measures described in section D3.3 however, the construction of a bridge over Humber Reservoir and culverts associated with new roads could have negative effects on water quality. The cumulative effects of the bridge and culverts is such that the overall temporary effects of this proposal have been assessed as minor to moderate negative and permanent effects minor negative to neutral.

The most significant negative effects of Corridor E Tunnel relate to the displacement of sediments on the bed of the Firth of Forth and the resultant increase in turbidity as well as the potential culverting of surface waters on the northern shore. The majority of impacts can be mitigated through the adoption of mitigation measures described in section D3.3 however, as a result of the significant negative effects on water quality within the Firth of Forth the overall temporary effects have been assessed as minor to moderate negative and the permanent effects as minor negative to neutral.

D3.5 SUMMARY

The overall temporary and permanent effects of Corridors C tunnel and D bridge can be effectively mitigated by adherence to legislation and the adoption of best practice such as SUDS and SEPA PPGs such that impacts are neutral. Effects resulting from culverting or re-alignment of watercourses may require, if appropriate, compensatory mitigation to offset potential negative impacts on water quality however, it is noted that under the WFD

surface waters take the overall quality of the poorest stretch within them meaning that affected watercourses may not achieve the Directive’s targets by 2015.

The overall temporary effects of Corridors D and E tunnel have been assessed as minor to moderate negative and permanent effects as minor negative to neutral.

Within Corridor D the road network linkages and upgrades require a greater number of surface waters to be culverted or re-aligned and in the case of the Humber Reservoir bridged. On this basis temporary effects have been assessed as minor to moderate negative. Construction of the immersion tube tunnel in Corridor E would have a significant negative impact on the Firth of Forth. Dredging, drilling and blasting would displace large volumes of sediment on the bed of the Firth of Forth and cause increased turbidity. The permanent effects of both Corridors D and E tunnel has been assessed as minor negative to neutral.

Table D3.2 below summarises the findings of the assessment.

Table D3.2 - Summary of Assessment

Proposal	Overall Effects	Temporary	Overall Effects	Permanent
Corridor C - Tunnel	Minor Negative to Neutral	to	Minor Negative to Neutral	to
Corridor D - Bridge	Minor Negative to Neutral	to	Minor Negative to Neutral	to
Corridor D - Tunnel	Minor to Moderate Negative		Minor Negative to Neutral	to
Corridor E - Tunnel	Minor to Moderate Negative		Minor Negative to Neutral	to

D4 GEOLOGY

D4.1 INTRODUCTION

Baseline geological and groundwater information was obtained by means of a desk study review of currently available information. No fieldwork was carried out to confirm the findings of the desk study. An appraisal of contaminated land issues is included in D8, Agriculture and Soils.

The local geology and groundwater regime was determined from geological and hydrogeological maps published by the British Geological Survey (BGS), borehole records held by the BGS, previously published reports, and relevant Geological Memoirs. Information on the presence of any SSSIs of geological interest was obtained from SNH, while Fife Council and the Edinburgh Geology Society were consulted on the presence of any Regionally Important Geological Sites (RIGS) on each side of the Firth.

Potential impacts relating to geology include damage to areas designated for their geological interest, effects on active or potential mineral extraction activities including sterilisation of reserves, and loss of deposits of limited extent or of ecological or other value, e.g significant areas of peat. Impacts on groundwater quality or flow regime which affect the resource potential, for human use, ecology or river baseflows would be of concern.

D4.2 KEY ISSUES

Superficial deposits across the area are predominantly Glacial Till on either side of the Firth of Forth, with alluvial sediments within the Firth of Forth channel and on its shores, including under much of Rosyth Naval Base. Small deposits of “undifferentiated soils” are recorded around surface water drainage near the C Tunnel option, the tank farm by D Tunnel, at Ferry Craig near D Tunnel and around North Queensferry. To the north and south of the Firth of Forth, pockets of made ground are present associated with roads, quarries and other industrial activities. The contamination issues associated with made ground are discussed in Section D8, as is the impact of disturbing sediment at the base of the Firth of Forth especially for the immersed tube method proposal for E Tunnel.

Each of the crossing proposals cross a variety of Carboniferous strata on either side and below the Firth of Forth. Sections of the strata contain worked oil shales and the potential environmental effects of any required mine stabilisation is covered with contaminated land in Section D8. Although highly unlikely that underground oil shale extraction will be considered in the future, each crossing proposal has the potential to sterilise some reserves. Around North Queensferry each proposal crosses part of a large quartz dolerite intrusion, while to the south of the Firth of Forth, small sections of the D Bridge, D Tunnel and E Tunnel access roads are on Teschenite (another dolerite-type rock).

No SSSIs relating to geology, or RIGS, are present on or immediately adjacent to any of the crossing proposals. Sections of the Firth of Forth SPA identified as being of geological interest are all to the east of C and D proposals and although the line of E Tunnel crosses the Forth Bridge to Granton geological section, it would pass well under the coastal exposures involved. In addition, each of the strata affected by the crossing proposals are extensive in the area and therefore no significant impact is predicted with respect to geological deposits.

In relation to groundwater, the Carboniferous strata in the area is defined by the BGS as a Highly Productive Aquifer (not extensive). Borehole yields are typically moderate, not greater than 10 litres/second. The dolerites and other igneous rocks in the area are defined as impermeable rocks, with groundwater flow generally limited to shallow cracks and joints. Local groundwater quality is often impacted by historic mining with elevated levels of iron, sulphide and other pollutants. This is evidenced by the number of discharges of mine-polluted groundwater into local watercourses including Midhope Burn around three kilometres west of C Tunnel. The development of a tunnel beneath the Firth of Forth may have a localised effect on the groundwater flow regime particularly if a substantial area of mine workings require to be stabilised by grouting. However given the extent and thickness of similar strata around the proposals, which will typically have a network of fractures especially in mined areas, any localised changes in groundwater levels and flows would dissipate quickly away from the tunnel.

Shallow groundwater in the superficial deposits, being predominantly glacial till, is not considered to represent a significant resource. The limited extent of other types of superficial deposits, away from the Firth of Forth, limits their groundwater resource potential, and in the case of made ground the water will often be poor quality. Changes to the shallow groundwater regime can impact on wetland habitats that are supported by groundwater. However, the only designated wetland site in the vicinity of the crossings proposals is St Margaret's Marsh and this is a tidal salt marsh in hydraulic connection with the Firth of Forth. Great Crested Newts have been identified at ponds near Dundas Castle. It is not known whether these ponds are dependant on groundwater, but in any case the distance of over one kilometre from any of the crossing proposal developments rules out the possibility of an impact on groundwater supply to the ponds. The temporary presence of a construction compound near the ponds is not predicted to have a discernible effect on local groundwater.

D4.3 APPRAISAL OUTCOMES

The potential impact on the local geology and groundwater regime has been considered for each crossing option. No designated or non-designated sites of geological interest are predicted to be affected by any of the options and the types of bedrock and superficial strata affected by each option are widespread in the area. No specific geological deposits with ecological or

other value, e.g. significant peat deposits, are identified in the vicinity of the options. Tunnel C is likely to sterilise more oil shale reserves than the other options, but it is unlikely that oil shale working will become economically viable in the future. It is therefore considered that there are no discernible differences between the options with respect to geology.

Shallow groundwater in the vicinity of each option is not considered to have significant resource potential or sustain sites of ecological interest or surface water baseflows and it is therefore not a consideration in comparing the options. Deeper groundwater in the bedrock strata is not predicted to be significantly affected by any of the crossing options, although each tunnel option, especially if mine stabilisation is required, may create very localised changes in the groundwater regime. Tunnel C has the greatest potential for such a change, being in an area of more extensive mine workings.

D4.4 SUMMARY

The appraisal has shown that no significant impacts on the local geology and groundwater regime are predicted and therefore these aspects are not an important consideration in option selection. The bridge option is very slightly advantageous in this regard as it has lower potential for locally altering the deep groundwater regime.

D5 BIODIVERSITY

D5.1 INTRODUCTION

The following section discusses the over-riding biodiversity issues associated with the four crossing proposals of the Firth of Forth, followed by a discussion of potential impacts and broad mitigation measures. The Appraisal Summary Tables (ASTs) in ##### present an assessment of impacts after consideration of mitigation. The key issues are set out in a hierarchical order, dealing with protected sites in the first instance, followed by protected species. In both cases, the hierarchy is descending from European (international) importance - UK (national) – local/regional.

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The baseline information has been collated from many sources, stated in the text, and aims to present an overview of the main issues to inform the decision making process for route selection.

D5.2 KEY ISSUES

The international importance of the Forth's intertidal and coastal habitat to birds affords one of the highest levels of designation possible in the UK, under the Birds Directive (Council Directive 79/409/EEC) of two Special Protection Areas (SPAs); the Firth of Forth SPA and the Forth Islands SPA. These designations are illustrated in Volume 2 Drawings. It should be noted that these designations may be geographically extended to include the open water habitat of the Firth of Forth within the timescale of the project. A third international site, the River Teith, is designated under the Habitats Directive (Council Directive 92/43/EEC) as a Special Area of Conservation (SAC), which also requires consideration as it may be vulnerable to indirect impacts. The Firth of Forth is also designated as a Ramsar site under the Ramsar convention, and together these designated sites contribute to the European network of protected sites known as Natura 2000 sites which are protected by the Conservation (Natural Habitats, &c.) Regulations 1994 as amended.

These sites are afforded additional protection through designation as Sites of Special Scientific Interest under the Wildlife and Countryside Act (1981) as amended.

If the preferred route has potential for a significant effect on the integrity of any of these European sites, an appropriate assessment would be required which is a detailed analysis all potential impacts and how they would be mitigated to avoid adverse impact on the integrity of the site. If residual impact cannot be avoided, the lack of an alternative plan has to be demonstrated. If there is no alternative to the development there must be imperative reasons of over riding public interest (IROPI) (which may be of a social or economic nature) for the plan/project to proceed and compensatory measures would be required to ensure that the overall coherence of the Natura 2000 resource is protected. These measures maybe inclusion of other areas out with the Natura site to be

included within the designation or habitat creation which in time, can be included within the Natura site.

Any assessment of impact on Natura 2000 sites has to consider effects out with the Natura 2000 sites boundaries, as the qualifying species also depend upon related habitats and/or the broader landscape for their survival, as well as the habitats contained within the designated area. This is most relevant to the open water of the Forth which provides fundamental habitat for birds in both SPA's.

In addition to the Natura 2000 sites there is a Site of Special Scientific Interest in the study area which is protected by the Wildlife and Countryside Act 1981, as amended.

Table D5.1 summarises the international and national designations, please refer to Annex D5.1 for a full account of the designated features and conservation objectives for these sites.

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Please note that in the following text, the international sites are referred to only by their Natura 2000 designation, as this is the over riding legislation.

Table D5.1: Internationally and Nationally Protected Sites

Site	International Designations	National Designation
Firth of Forth	Special Protection Area (SPA) Ramsar site	Site of Special Scientific Interest
Forth Islands	SPA	Site of Special Scientific Interest
River Teith	Special Area for Conservation (SAC)	Site of Special Scientific Interest
St Margaret's Marsh		Site of Special Scientific Interest

The protection of species mirrors the hierarchy of importance as that for protected sites. Species protected by the Conservation (Natural Habitats, &c.) Regulations 1994, as amended have the highest level of protection and are referred to as European Protected Species. The Wildlife and Countryside Act (1981) as amended, protects species important in a UK context under Schedule 5 of the Act. Badgers are afforded protection from harm and persecution under The Protection of Badgers Act (1992) and are considered ubiquitous over all of the corridors. Their common conservation status does not make their distribution contribute to any assessment; however the developer's legal responsibilities would raise their importance in any following EIA.

At this level of assessment, there is a lack of comprehensive information available for species to provide a 'level playing field' for route selection. Data searches were carried out to assess if there are any documented pertinent protected species issues that should be considered, and these are discussed within the corridor proposals.

All species of British bats are European Protected Species. Within all of the corridors, there are infrequent records of individual bats, the most pertinent record being a long eared bat roost, common to the Corridors of Tunnels D and E and Bridge D. The frequent shelterbelts and parcels of ancient woodland in all the corridors offers potential roost habitat for bats, particularly when coupled with open water.

Water voles are on Schedule 5 of the Wildlife and Countryside Act (1981) as amended and may be present in one or all of the zones of impact. There are no records of water voles within data searches carried out or in the National Water Vole Survey within any of the proposed development corridors.

The potential impacts on international and national sites are the primary biodiversity considerations informing route selection and the consideration of European Protected Species is also of importance. However, general diversity has to be considered under the Nature Conservation (Scotland) Act 2004 which places a duty on every public body and office holder to further the conservation of biodiversity.

This duty is fulfilled in this report as:

- Undesignated local sites with notable biodiversity, listed in local plans;
- Ancient woodland listed on the Ancient Woodland inventory(REF), and;
- Habitats in the route corridor.

D5.3 GENERIC IMPACTS

Many impacts would be shared between two or more corridors and hence are of limited value to discriminate between options however, it should be noted that the assessment scoring in the AST's is not a comparative method, it judges the impact of each proposal individually.

The bored tunnels of C, D and E share impacts from activities associated with the tunnelling, disposal of the spoil and provision of tunnel shafts and construction entrances. The generic effects are indirect, related to noise, visual disturbance, dust, water run off and increased sediment loads into water courses. The mitigation of these impacts would be uniform, following SEPAs Pollution Prevention Guidelines and following of a code of construction practice. However, the ecological receptors present and their sensitivity varies between options. This is discussed further in the text for each option, as are the impacts of the immersed tube construction method in tunnel E.

D5.4 APPRAISAL OUTCOMES

For the purpose of this route appraisal, the zones of influence for potential terrestrial and intertidal impacts is defined as 500 metres to either side of the likely route, and 500 metres from the edge of the cut and fill for the tunnel exits. In the terrestrial corridor, impacts would decrease with increasing distance, however wetland habitats are likely to be more vulnerable to impact. The zone of influence for the estuary is more difficult to define at this stage, so the study considers the broader context of the mid Firth for the estuarine environment.

Access to land was not possible to facilitate detailed surveys. A walk over survey was carried out from roads and paths to update the Phase 1 Assessment and an otter survey of the shore lines was undertaken together with some sampling of watercourses for otter signs when possible from land with public access.

TUNNEL C

INTERNATIONAL AND NATIONAL ISSUES

The tunnel would pass beneath the Firth of Forth SPA, avoiding direct impact. However, the proposed shaft and site entrance on the northern shore is adjacent to the SPA, and there would be potential for indirect impacts, particularly disturbance to feeding birds and impacts related to changes in the intertidal and estuarine environment. The proposed location for the shaft and site entrance for the southern shore is screened from the SPA by linear belts of woodland but the scale and duration of the works may still lead to disturbance issues. Indirect effects as for the northern shore also have potential for impact on the southern shore. The birds of the SPA may become habituated to the general construction activities, and mitigation measures may be possible to limit specific disturbance events by seasonal timing of certain construction activities and having an enforced buffer zone and screening structures for the SPA in the north. Adherence to the generic mitigation measures may avoid significant indirect impacts on the SPA.

The intertidal habitat for feeding and roosting is relatively extensive on both shores. WeBS low tide data for the winter of 03/04 indicates that redshank, curlew and wigeon all occur in significant numbers in this corridor (above one per cent of SPA designated threshold level).

European Protected Species

Otters are present on the Grand Union Canal, which lies within 200 metres to the south of the toll plaza area (if required) and proposed road infrastructure. The railway line sits between the canal and the proposed new toll plaza (if required) and roads, but there are many ponds present to the south of Hopetoun Estate that may be used for feeding, particularly in spring when amphibians are spawning. It is likely that otters would move along ditches and

small burns to access these ponds. Sensitive design of all water course crossings would avoid fragmentation of habitat and otter fencing may be appropriate to reduce/avoid road mortalities.

Local Sites

Thirteen areas of woodland listed on the Ancient Woodland Inventory occur within the corridor, however only two woodlands would have any direct impacts:

- Swine Burn Wood AWI and unnamed AWI pockets, which are Immediately adjacent to proposal new spur road from the M9. Both sites are on established of plantation origin, and;
- Unnamed woodland which is immediately south of the M9. A long established woodland of plantation origin. The northern part of the wood would be lost to the proposal junction alignment

BRIDGE D

International and National Issues

The bridge crossing has the potential for negative impact on the three Natura 2000 sites. The construction of the bridge is likely to cause disturbance to the wintering bird assemblages of the Firth of Forth SPA, causing disturbance within the SPA boundary to birds feeding at low tide, birds roosting at high tide, disturbance to open water species. WeBS low tide data for the winter of 03/04 indicates redshank, cormorant, curlew and red breasted merganser all occur in significant numbers in this corridor (above one per cent of SPA designated threshold level). The Setting Forth project looked at the use of inland fields by wintering SPA birds during the winter of 1993. The main areas noted for inland use were fields west of South Queensferry, Kirkliston to Turnhouse and St Margaret's Marsh. Large flocks of curlew were observed to the west of Hillend in the winter of 06/07 during a walk over survey to inform this assessment. It is likely that the birds move around according to availability of agricultural habitat and disturbance, and that habitat loss would not be a significant issue.

Information on open water birds is not comprehensive enough to establish if there would be any disturbance impacts.

The Forth Islands SPA is designated for its breeding common, roseate, sandwich and arctic tern colonies and breeding seabird assemblages. Most of this composite SPA is located in the outer Firth of Forth, however Long Craig Island is situated beneath the Forth Road Bridge and supports important tern colonies. Breeding common terns have only been found on four of the thirteen Islands surveyed on the Firth of Forth by the Forth Sea Bird Group (Table D5.2). The Forth Islands SPA is designated for 334 pairs accounting for three per cent of the Great British Population. The number of breeding

common terns has fluctuated in the last 10 years, but the importance of Long Craig Island in terms of the total breeding common tern population of the SPA can be seen in Table D5.2, with Long Craig frequently supporting over 50 per cent of the SPA population in recent years.

Leith Docks SPA holds the largest breeding common tern colony on the Forth and is designated for 558 pairs, which is five per cent of the British population. Terns are very mobile, and would readily move between colonies and birds are unlikely to breed only in one colony or another. There is therefore an ecological link between these two SPAs.

The terns of the Forth use undesignated habitats such as open water and congregate in areas such as Port Edgar for loafing/roosting after breeding and pre migration.

Table D5.2: Numbers of Common Tern Breeding Pairs on Forth Islands

Year	Inch-mickery + Cow & Calves	Inch Garvie / Forth Bridge	Long Craig	May Isle	Total
2006	No data available				
2005	0	10	120	65	195
2004	0	5	171	62	238
2003	0	4	157	60	221
2002	0	12	55	2	69
2001	0	7	24	132	163
2000	0	0	75	303	378
1999	0	10	118	415	543
1998	9	10	63	127	209
1997	0	0	70	338	408
1996	15	0	80	248	343

Long Craig Island is approximately 400 metres from the proposed bridge alignment; the impacts of construction on the shore and open water have potential for disturbance to feeding and flight lines to foraging areas and construction activities such as pile driving may cause disturbance to breeding birds. Mitigation may be possible to avoid invasive construction techniques such as pile driving at the most sensitive time of year, but this may conflict with the wintering bird interest of the Firth of Forth.

The River Teith SAC relies upon the successful migration through the Forth of salmon, sea lamprey and river lamprey. There is potential for this migration to be interrupted by indirect impacts of construction such as increased turbidity. The acoustic impact of pile driving, in particular can create a barrier for migrating fish. It is not known at this stage whether construction can be timed to avoid such impact.

St Margaret's Marsh SSSI is a 26.4ha area designated for its coastland habitat, particularly its reed bed which represents approximately three per cent of the Scottish coastal reed bed resource. A small area of salt marsh showing transitions from lower to mid/upper salt marsh is also present. Breeding birds are important with water rail, sedge warbler and reed bunting and there is scattered scrub supporting breeding whitethroat, willow warbler, linnet and green woodpecker. Wintering snipe, redshank, curlew and oystercatcher use the site and so there is a direct ecological relationship with the Firth of Forth SPA. The proposed junctions to link the bridge to the motorway will result in loss of habitat in the east of the SSSI and other indirect impacts are also indicated such as modification of remaining habitat through disturbance, shading and dust, disturbance to birds from construction and operation, alterations to ground water conditions. The potential for mitigation of the direct impacts is limited, and creation of compensatory habitats may be more appropriate. The SSSI is made on reclaimed land and it may be possible to artificially extend the reed bed westwards, however the neighbouring area is elevated and this may not be possible.

European Protected Species

Cetaceans are regularly recorded in the mid Forth and further upstream. Studies have shown that the use of pile driving can mask communication between animals causing confusion and distress. A Cetacean watching brief would go some way to avoiding this impact, ceasing such operations if Cetaceans are present, but this obviously has limitations.

Otters are common in the Lothians, however the proposed connecting roads avoid main and most smaller water courses. A sampling survey in January 07 found evidence of otters at the mouth of the Linn Mill Burn, which strongly implies use of the foreshore for feeding and/or travelling between rivers to good food sources such as ponds in the upper reaches of these small tributaries of the Forth. The Linn Mill Burn is approximately 100 metres from the route. Avoiding fragmentation by, appropriate design of crossing water courses and construction considerations would facilitate commuting otters.

Local Sites

There are sixteen areas of ancient woodland, one wildlife site and two SINC's within the corridor, however the following four sites are likely to be impacted directly: Swine Burn Wood AWI and unnamed AWI pockets, which are immediately adjacent to optional new spur road from the M9. Both sites are long established of plantation origin

Ross's plantation AWI, Long established of plantation origin. South of M9 where additional lane is proposed.

SINC, coastal site. No other details provided, Southern landfall crosses over the site

Unnamed pocket of AWI/SNAWI, Northern landfall of the bridge directly crosses over the top of the woodland. Long established of plantation origin.

TUNNEL D

International and National Issues

This tunnel would also pass beneath the Firth of Forth SPA, avoiding direct impact, but the proposed location of the northern shaft may have indirect impacts on the Firth of Forth SPA and also St Margaret's Marsh SSSI, both which lie adjacent to this shaft site. The potential impacts on both of these sites relate to disturbance of birds, and also indirect effects of construction such as dust and contaminated run off. The site is currently scattered scrub, and bird communities will be using this for breeding in conjunction with St Margaret's Marsh. St Margaret's Marsh, being a coastal water reed bed, is also vulnerable to changes in ground water conditions. Mitigating disturbance is difficult here, as the shaft site would be enclosed on two sides by protected sites, and meaningful buffer areas may reduce the construction site area to a point of non viability. Equally, the bird communities of St Margaret's Marsh are important all year round, while the SPA holds importance only in winter. Resolving disturbance issues for both sites simultaneously, using seasonal windows of opportunity for certain operations may not be possible, although screening structures may limit general disturbance and habituation to general construction activities may occur.

European Protected Species

The proposed construction site for the portal lies approximately 400 metres from a pond with an extant great crested newt population. The distribution of great crested newts in other ponds in this area has not fully been studied, although many ponds in the area were surveyed in 1996 and no further ponds were found to be positive for great crested newt. The accepted radius to assess probability of use of terrestrial habitat from breeding ponds is 500 metres, although most are found within 50 metres. The proposed road linkages into the existing road infrastructure may result in increased isolation of this population when the scheme is in operation, but a broader analysis of the status of great crested newt in this area would be required to assess this.

Otters are common in the Lothians. The connecting infrastructure to the M9, the southern connections to the A90 and the linking road to Hillend indicate potential for impacts to otters, particularly in terms of fragmentation as many small burns are crossed. Otter signs were found at Parsgillis Bridge indicating use of these small burns. To the west of Kirkliston, there are several reservoirs surrounded by woodland providing good habitat that is part of the River Almond catchment, which supports a good otter population. The new link road would pass over the Swine Burn, the Humber Reservoir and the Dolphington Burn. Mitigating the potential impacts of increased otter mortality on the new roads and junctions frequently includes measures such as otter

fencing and habitat creation. Avoiding fragmentation by excluding culvert in crossing watercourses, appropriate bridge design and construction considerations would facilitate commuting otters.

Local Sites

Nineteen areas listed as ancient woodland (AWI), one wildlife site and two Sites of Importance for Nature Conservation lie within the corridor. Of these the following four sites maybe impacted directly:

- Unnamed AWI/Semi natural AWI, which lies North of St Margaret's Marsh. Long established of plantation origin. Minor road approx 100 metres to the east of site and northern tunnel portal 500 metres north of site. Area would be immediately south of portal construction site.
- SINC, Pikes Pool, On the northern side of the M9, adjacent to proposed new road from the M9
- Ross's Plantation AWI, Long established of plantation origin. South of M9 where additional lane is proposed.
- Carmelhill Wood AWI Immediately south of toll plaza (if required), link road is routed directly through the site. Long established of plantation origin.

TUNNEL E

International and National Issues

This tunnel would also pass beneath the Firth of Forth SPA avoiding direct impact, however the construction method would include a 1700 metres length of immersed tube. Placement of the immersed tube involves excavation through the silt deposits within the Forth, connecting the submerged tube sections in with the bored tunnel sections and then subsequent placement of imported infill material. It is likely to involve a considerable number of barge movements to dispose of spoil, blasting sections of dolerite, and barge movements for the import of fill material. These operations would entail significant disturbance to the natural sediment deposits and processes, and indirect impacts of increased turbidity, movements of sediments, smothering and release of stored contaminants. The construction of this section is likely to take between three to four years. These operations all have potential for impacting the ecology of the mid Forth. Relating this to the European sites, there are potential impacts for:

- Interruption of migrating fish to and from the North Sea, notably salmon, sea lamprey and river lamprey which are qualifying species of the River Teith SAC;

- Loss of feeding habitat, and disturbance to open water species of wintering water fowl that are qualifying species of the Firth of Forth SPA. In particular to Slavonian grebe, goldeneye and red breasted merganser;
- Impact through increased sediment deposition on beds of eelgrass (*Zostera* spp.), which are feeding grounds for several bird species;
- Disturbance to flight lines of terns commuting to and from the Forth Islands SPA, and;
- Disturbance to feeding terns.

Mitigation may be able to minimise impacts by the seasonal timing of some of these operations, such as blasting, however there are conflicting seasonal interests.

The proposed shaft area on the northern shore and the proposed location of the fabrication yard at Rosyth are both in proximity to the Firth of Forth SPA, and issues of disturbance and indirect construction impacts may arise.

European Protected Species

Otters are common in the Lothians however, the toll plaza area (if required) and proposed road links into the existing road infrastructure avoid main rivers likely to be core areas of any otters home ranges. Smaller burns and ditches would be crossed that are likely to be used by otters for commuting to ponds and moving between rivers, however construction impacts can be managed to minimise impact, and careful bridge design and otter fencing can be used to minimise the risk of increased road mortality when the roads are operational, and retain the commutability of the smaller burns thus avoiding fragmentation of habitat.

Cetaceans are European Protected Species, and regularly occur throughout the Forth with historical accounts dating back to the late 1600's. Over the last 10 years Cetacean records are more frequent. The most common sighting over the past 10 years has been of smaller cetaceans, particularly harbour porpoises, *Phocaena phocaena* which is considered the only resident species. Striped dolphin, *Stenella coeruleoalba*, minke whale, *Balaenoptera acutorostrata* and humpback whale, *Megaptera novaeangliae* are seen regularly but infrequently in the mid or upper firth. Killer whales, *Orcinus orca* were recorded in the mid firth in 2007, but there are no others records of this species in the last 10 years.

The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007, makes it an offence to “deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean).” Blasting within the Forth would constitute disturbance. A cetacean watching brief would go some way to avoiding this impact, ceasing such operations if Cetaceans are present, but this obviously has limitations.

Local sites

There are fifteen local sites within the corridor, of these three may be impacted directly:

- Dundas Estate SINC and AWI within the estate, new roads from the M9 to the toll plaza (if required) directly cross the southern end of the sites.
- Unnamed AWI, north west of Craig Brae Farm, this is long established of plantation origin. The toll plaza (if required) is located within woodland and portal construction site immediately adjacent to it.
- Letham Hill Wood AWI, this is the largest AWI in area – 0.3 square kilometres. It is of long established of plantation origin. The shaft construction site is immediately adjacent to the southern tip of the forest and the portal construction site is within 500 metres of site.

D5.5 SUMMARY

Tunnel options C and D have the potential for indirect impacts on the Firth of Forth Special Protection Area (SPA). Impacts associated with portals and construction sites adjacent to the SPA could cause disturbance and possibly affect the estuarine environment, although the latter can be controlled by good construction practices.

Tunnel E has potential for a greater impact on the SPAs within the Firth of Forth. The immersed tube method that is necessary to overcome geological formations and to ensure that the tunnel conforms to gradient constraints would cause considerable disruption to the natural sedimentation processes by dredging and blasting. This has potential implications for open water birds and shore birds of the Firth of Forth SPA, the breeding terns of the Forth Islands SPA and migrating salmon and lamprey associated with the River Teith Special Area of Conservation (SAC). Additionally, cetaceans and other protected species (such as basking sharks and seals) may be disturbed and there may be far reaching impacts from disturbed sediments smothering eelgrass beds, which are an important habitat feature of the Firth of Forth. It is worth noting that a number of these species are specifically protected by the Nature Conservation (Scotland) Act 2004, particularly from “reckless” harm. Therefore, as with the SPAs, mitigation comprising seasonal constraints may be imposed during construction works, including blasting and movement of sediments in order to avoid such harm occurring.

Bridge D also has potential for construction disturbance and other indirect impacts on the Firth of Forth SPA, the migrating salmon and lamprey associated with the River Teith SAC, and the breeding tern populations of the Forth Islands SPA. The latter is particularly notable due to the importance of Long Craig Island, situated some 400 metres from the proposed bridge and which in some years holds over 50 per cent of the Forth islands SPA breeding common tern population. The requirement to avoid disturbing wintering birds

associated with the Firth of Forth SPA, whilst at other times of the year avoiding disturbance to breeding and feeding terns associated with the Forth Islands SPA, may require onerous seasonal constraints that could significantly affect the construction programme for the bridge. In addition, the potential impacts on and interaction with the common tern colony of the Leith Docks SPA may also need to be considered.

Bridge D would also have a direct impact on the eastern end of St Margaret's Marsh SSSI and has implications for the water-levels affecting the remainder of the site. However, this is effectively a man made habitat, and it may be possible to create compensatory habitat to the west.

The scale and duration of the options indicating most potential impact on Natura 2000 sites, i.e. the SPAs and SAC, (Corridor E Tunnel and D Bridge) give limited scope for seasonal timing of construction operations. This difficulty, as discussed above, is further compounded by the opposing seasonal interests of all of the sites. All routes would require an Appropriate Assessment⁵ with regard to these Natura sites.

Other issues are more difficult to evaluate due to the patchiness of data. However, all corridors would impact on protected species such as badger, bat and otter. Non designated sites would also be affected by all options, in most cases this would lead to a loss of ancient woodland.

⁵ Where a project/plan is likely to have a significant effect on Natura 2000 sites (eg SPA/SAC) in Great Britain, Regulation 48 of the Habitats Regulations requires that an Appropriate Assessment (AA) be undertaken prior to the giving of any consent or permission. The AA assesses the implications of the project/plan for the site, in view of that site's particular designated features and conservation objectives. Note the need for AA's extends to projects/plans outwith the boundary of the site in order to determine their implications for the interest(s) protected within the site.

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ANNEX D5.1 - DETAILS OF DESIGNATED SITES

FIRTH OF FORTH Special Protection Area (SPA)

Article 4.1 - Qualifying Features

Wintering		Percentage of GB Population*%
<i>Gavia stellata</i> (North west Europe-wintering)	Red throated diver	2
<i>Haematopus ostralegus</i> (East & north/west Africa)	Oystercatcher	2
<i>Limosa lapponica</i> (Western Palearctic-wintering)	Bar tailed godwit	4
<i>Pluvialis apricaria</i> (North west Europe-breeding)	Golden plover	1
<i>Podiceps auritus</i> (North west Europe)	Slavonian grebe	21
Passage		
<i>Sternus sandvicensis</i> (West East/West Africa)	Sandwich Tern	6

* Based upon the 5 year peak mean of 93/94-97/98

Article 4.2 Qualifying Features

Wintering		Percentage of GB Population*%
<i>Anser brachyrynychus</i> (East Greenland/Iceland/UK)	Pink footed goose	6
<i>Arenaria interpres</i> (North west-wintering)	Turnstone	1
<i>Caladris canutus</i> (North, east Canada/Greenland/Iceland/NW Europe)	Knot	3
<i>Tadorna tadorna</i> (North west Europe)	Shelduck	2
<i>Tringa totanus</i> (Eastern atlantic)	Redshank	3
An internationally important assemblage of birds with 95000 individuals including <i>Melanitta nigra</i> (common scoter), <i>Phalacrocorax carbo</i> (cormorant), <i>Numenius arquatica</i> (curlew), <i>Calidris alpina alpina</i> (dunlin), <i>Somateria mollissima</i> (eider), <i>Bucephala alngula</i> (goldeneye), <i>Podiceps cristatus</i> (great crested grebe), <i>Pluvialis squatarola</i> (grey plover), <i>Vanellus vanellus</i> (lapwing), <i>Clangula hyemalis</i> (long tailed duck), <i>Anas platyrhynchos</i> (mallard), <i>Haematopus ostralegus</i> (oystercatcher), <i>Mergus serrator</i> (red breasted merganser), <i>Charadrius hiaticula</i> (ringed plover), <i>Aythya marita</i> (scaup), <i>Melanitta fusca</i> (velvet scoter) and <i>Anas penelope</i> (wigeon).		

The Firth of Forth Conservation Objectives are: “ To avoid deterioration of the habitats of the qualifying species or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and

- To ensure for the qualifying species that the following are maintained in the long-term:
- Population of the species as a viable component of the site
- Distribution of the species within the site
- Distribution and extent of habitats supporting the species

- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species”

FORTH ISLANDS Special Protection Area (SPA)

ARTICLE 4.1 QUALIFICATION (79/409/EEC)

Breeding		Percentage of GB Population* %
<i>Sterna dougallii</i>	Roseate tern	12.5
<i>Sterna hirundo</i>	Common tern	2.7
<i>Sterna sandvicensis</i>	Sandwich tern	No count

ARTICLE 4.2 QUALIFICATION (79/409/EEC)

During the breeding season the area regularly supports; Razorbill (*Alca torda*), Puffin (*Fratercula arctica*), Lesser Black-backed Gull (*Larus fuscus*), Gannet (*Morus bassanus*) Shag (*Phalacrocorax aristotelis*) Cormorant (*Phalacrocorax carbo*) Kittiwake (*Rissa tridactyla*) Guillemot (*Uria aalge*)

Conservation Objectives

To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained; and

To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

RIVER TEITH Special Area of Conservation (SAC)

Qualifying Interests For Which The Site Is Designated:

<i>Lampetra fluviatilis</i>	River lamprey
<i>Lampetra planeri</i>	Brook lamprey
<i>Petromyzon marinus</i>	Sea lamprey
<i>Salmo salar</i>	Atlantic salmon

Conservation Objectives

The River Teith's Conservation objectives are: "To avoid deterioration of the habitats of the qualifying species (listed below) or significant disturbance to the qualifying species, thus ensuring that the integrity of the site is maintained and the site makes an appropriate contribution to achieving favourable conservation status for each of the qualifying features; and

To ensure for the qualifying species that the following are maintained in the long term:

- Population of the species, including range of genetic types for salmon, as a viable component of the site
- Distribution of the species within site
- Distribution and extent of habitats supporting the species
- Structure, function and supporting processes of habitats supporting the species
- No significant disturbance of the species

ST MARGARET'S MARSH Site of Special Scientific Interest (SSSI)

Fife

Midas Reference: 1659

PLANNING AUTHORITY:	Fife Council
DATE NOTIFIED UNDER 1981 ACT:	9 October 1996
NATIONAL GRID REFERENCE:	NT 116816
OS 1:50,000 SHEET NO:	65
1:25,000 SHEET NO:	NT 08/18
AREA:	26.4 ha.

DESCRIPTION:

Biological: Habitat: Coastland

St Margaret's Marsh is situated on the north bank of the Firth of Forth, west of Rosyth and directly to the north of the Forth Road Bridge. It supports an extensive area of coastal reedbed, saltmarsh, tall herb vegetation and scrub.

There are two main areas of reedbed separated by a grassy bund which together comprise one of the largest expanses of reedbed in Fife. It is the largest unit in the Firth of Forth and represents around three per cent of the Scottish coastal reedbed resource. The reedbeds comprise almost pure stands of common reed *Phragmites australis* with only occasional nettle *Urtica dioica*, great willowherb *Epilobium hirsutum* and cleavers *Galium aparine* around the outer margins.

An area of salt marsh extends from a small inlet in the east of the site along a linear strip below the sea wall. The salt marsh shows succession from transitional lower marsh zones dominated by common saltmarsh grass *Puccinellia maritima* and glasswort *Salicornia europaea*, through mid to upper marsh red fescue – salt marsh rush *Festuca rubra-Juncus gerardii* communities, to upper or drift line stands of common couch grass *Elymus repens*. This latter community marks the transition between the salt marsh vegetation and the reedbed and grassland.

The reedbeds provide important habitat for breeding birds such as water rail, sedge warbler and reed bunting. Wintering birds include snipe, redshank, curlew, and oystercatcher.

The reedbeds are surrounded by a broad band of tall herb grassland. The grassy bund separating the two main areas of reedbed supports a more diverse herb rich grassland and includes locally uncommon species such as northern marsh-orchid *Dactylorhiza purpurella*.

Shrub species such as hawthorn *Crataegus monogyna*, gorse *Ulex europaeus*, bramble *Rubus fruticosus* agg, and goat willow *Salix caprea* are scattered throughout the tall herb and grassland areas and contribute to the overall diversity of the site.

The scrub and grassland area supports a good breeding bird community including species such as whitethroat, willow warbler, linnets and green woodpecker.

REMARKS

This is a new site.

ANNEX D5.2- DETAILS OF NON STATUTORY SITES WITHIN ZONE OF IMPACT

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Sites in bold are directly on or adjacent to the proposed route, other sites may be subject to indirect impacts.

The sites are ordered from North to south.

AWI On ancient woodland inventory
SNAWI On semi natural ancient woodland inventory
In italics A Wildlife Site, source Scottish Wildlife Trust
SINC A Site of Importance for Nature Conservation

Tunnel C Non-Statutory Sites

Site Name	Comments
Unnamed AWI/SNAWI at Pitreavie, Dunfermline	180 metres north of existing A823. Long established of plantation origin.
Unnamed AWI/SNAWI south of Pitreavie, Dunfermline	200 metres south of existing A823. Long established of plantation origin.
Bellknowes AWI/SNAWI	Long established of plantation origin. Within approx. 150 metres of tunnel alignment. Portal construction site is approx. 400 metres east of the site.
Fossackie Hill Plantation AWI/SNAWI	Long established of plantation origin. Tunnel alignment passes under the eastern extent of the woodland. Optional new road linking to Admiralty Road directly crosses through the woodland.
Windylaw Strip AWI/SNAWI	Long established of plantation origin. Tunnel alignment passes under the woodland.
Wester Shore Wood AWI	Ancient of semi-natural origin. Tunnel alignment passes below the woodland.
Unnamed AWI/SNAW within Abercorn Parish	Ancient of semi-natural origin. Tunnel alignment passes below the woodland. Midhope Burn flows through the woodland.
Unnamed AWI	Long established of plantation origin. Wood is north of the M9. Tunnel alignment passes below motorway and woodland.

Unnamed AWI on both banks of the Union Canal.	Toll plaza (if required) and southern portal construction site are approx. 300 metres north of the site.
Unnamed AWI at Duntarvie Castle	300 metres north of new M9 junction. Long established of plantation origin
Swine Burn Wood AWI and unnamed AWI pockets	Immediately adjacent to optional new spur road from the M9. Both sites are Long established of plantation origin
Unnamed AWI	Immediately south of the M9. Long established of plantation origin. The northern part of the wood would be lost to the optional junction alignment.
Beatlie Wood AWI/SNAWI	400 metres south of new road junction on the M9 and minor road. Long established of plantation origin

Bridge D Non-Statutory Sites

Site Name	Comments
Fordell Castle Woods AWI	Long established of plantation origin, 290 metres east of where M90 would be widened.
Unnamed AWI	260 metres east and 360 metres west of widened M90. Long established of plantation origin
Unnamed pocket of AWI/SNAWI	Immediately adjacent to M90/B981. Long established of plantation origin
Unnamed pocket of AWI/SNAWI	North of A823, Long established of plantation origin.
Unnamed pocket of AWI/SNAWI	270 metres south of A823. Long established of plantation origin.
<i>Jamestown Pond, Inverleith. Wildlife Site</i>	<i>Approx. 150-200 metres east of upgraded roads on north shore where they join the M90.</i>
Unnamed pocket of AWI/SNAWI	North of St Margaret's Marsh, approx. 200 metres west of proposed flyover. Long established of plantation origin.

Unnamed pocket of AWI/SNAWI	Northern landfall of the bridge directly crosses over the top of the woodland. Long established of plantation origin.
SINC, coastal site. No other details provided.	Southern landfall crosses over the site.
East Shore Wood AWI	300 metres west of Southern landfall site. Ancient of semi natural origin.
Unnamed AWI	Approx. 190 metres east of toll plaza (if required) Long established of plantation origin.
SINC, Dundas Estate	New roads on average within 350 metres of the site.
Duddingston Wood	190 metres west of the road leading to the toll plaza (if required)s. Long established of plantation origin.
Swine Burn Wood AWI and unnamed AWI pockets	Immediately adjacent to new spur road from the M9. Both sites are Long established of plantation origin
Ross's plantation AWI	Long established of plantation origin. South of M9 where additional lane is proposed.
SINC, Lindsays Crag and Niddry Burn	Roughly 400 metres south west where new roads start on the M9 (westbound)
Unnamed AWI at Duntarvie Castle	300 metres north of new eastbound junction. Long established of plantation origin
Unnamed AWI	Immediately south of M9, Long established of plantation origin
Beatlie Wood AWI/SNAWI	390 metres south of new road junction on the M9. Long established of plantation origin
Hawk Hill Wood AWI	400 metres south of new M9 junction, Long established of plantation origin

Tunnel D Non-Statutory Sites

Site Name	Comments
Calais Muir Wood Wildlife Site/AWI/SNAWI	No other details on wildlife site provided. AWI is long established of plantation origin. Site is roughly 300

	metres west of widened M90.
Fordell Castle Woods AWI	Long established of plantation origin, 290 metres east of where M90 would be widened.
Unnamed AWI within Inverkeithing Parish	Long established of plantation origin, 200 metres east of new road linking B981 and the M90.
Unnamed pocket of AWI at Duloch within Inverkeithing Parish	420 metres west of new and existing roads. Long established of plantation origin.
Unnamed AWI/SNAWI	Sandwiched between M90 on the west and new road from the B981 on the east. Long established of plantation origin.
Unnamed AWI/SNAWI at Pitreavie, Dunfermline	180 metres north of existing A823. Long established of plantation origin.
Unnamed AWI/SNAWI south of Pitreavie, Dunfermline	200 metres south of existing A823. Long established of plantation origin.
Letham Hill Wood AWI	250 metres east of new and upgraded minor roads, larges. Largest AWI in area – 0.3 square kilometres. Long established of plantation origin.
<i>Jamestown Pond, Inverleith. Wildlife Site</i>	<i>Approx. 200 metres east of new and existing roads at the Forth Road Bridge.</i>
Unnamed AWI/SNAWI	North of St Margaret’s Marsh. Long established of plantation origin. Minor road approx 100 metres to the east of site and northern tunnel portal 500 metres north of site. Area would be immediately south of portal construction site.
SINC, coastal site stretches from this location (Port Edgar) to Dalmeny Park SINC in the east.	120 metres east of tunnel alignment.
East Shore Wood AWI and unnamed AWI	Tunnel alignment directly below both sites. Ancient of semi natural origin.
Dundas Estate SINC	370 metres east of southern tunnel portal. Portal construction site would be at this location.
BarrenCraig Wood AWI	Long established of plantation origin. 370 metres east of southern tunnel

	portal. Portal construction site would be at this location.
Duddingston Wood AWI	360 metres west of tunnel alignment. Long established of plantation origin.
Swineburn Wood AWI	300 metres west of minor road below the toll plaza (if required). Long established of plantation origin.
Carmelhill Wood AWI	Immediately south of toll plaza (if required), link road is routed directly through the site. Long established of plantation origin.
Unnamed pockets of AWI	390 metres south west of new road/toll plaza (if required). Long established of plantation origin.
Unnamed AWI north of Niddry Mains	At places within 100 metres of new road from the M9. Long established of plantation origin.
Ross's Plantation AWI	Long established of plantation origin. South of M9 where additional lane is proposed.
SINC, Lindsays Crag and Niddry Burn	50 metres south of Junction 1a of the M9
SINC, Pikes Pool	On the northern side of the M9, adjacent to proposed new road from the M9 to
Two unnamed pockets of AWI	Within 200 metres of northern side of road under construction linking the M9 to the A90.

Tunnel E Non-Statutory Sites

Site Name	Comments
<i>Calais Muir Wood Wildlife Site/AWI/SNAWI</i>	<i>No other details on wildlife site provided. AWI is long established of plantation origin. Site is roughly 300 metres west of widened M90.</i>
Fordell Castle Woods AWI	Long established of plantation origin, 290 metres east of where M90 would be widened.
Unnamed AWI at Balbougie	Long established of plantation origin, 150 metres east of new road linking the northern portal with the M90.
Unnamed pocket of AWI at Duloch	Approx. 240 metres west of new

within Inverkeithing Parish	junction on the M90. Long established of plantation origin.
Unnamed AWI/SNAWI	Sandwiched between M90 on the west and new road from the B981 on the east. Long established of plantation origin.
Unnamed AWI/SNAWI at Pitreavie, Dunfermline	180 metres north of existing A823. Long established of plantation origin.
Unnamed AWI/SNAWI south of Pitreavie, Dunfermline	200 metres south of existing A823. Long established of plantation origin.
Letham Hill Wood AWI	Largest AWI in area – 0.3 square kilometres. Long established of plantation origin. Shaft construction site is immediately adjacent to the southern tip of the forest. Portal construction site within 500 metres of site.
SINC at Dalmeny Park/Leuchold Wood AWI/SNAWI	Tunnel alignment passes directly under these sites.
SINC and AWI at Dalmeny Park. Some unnamed/named AWI inc. Burnshot Wood and Mansion Hill Wood.	Optional tunnel portal and access road (on eastern side linking to A90) are within 200 metres of SINC/AWI. AWI is long established of plantation origin.
Unnamed SINC/AWI/SNAW	190 metres south of A90/optional tunnel portal and portal construction site.
SINC, located along railway	Western tunnel alignment passes under railway and SINC. Existing A90 and new junction (part of link with M9) all immediately adjacent to the SINC.
Unnamed AWI, north west of Craig Brae Farm	Long established of plantation origin. Toll plaza (if required) located within woodland and portal construction site immediately adjacent to it.
Dundas Estate SINC and AWI within the estate.	New roads from the M9 to the toll plaza (if required) directly cross the southern end of the sites.
SINC, Pikes Pool	On the northern side of the M9, adjacent to junction from the M9 to A90.
SINC, Lindsays Crag and Niddry Burn, unnamed AWI.	AWI is ancient of semi natural origin. 50 metres south of Junction 1a of the M9

ANNEX D5.3 – PHASE 1 HABITAT SURVEY TARGET NOTES

The following notes should be read in conjunction with the Phase 1 Habitat drawings contained within Volume 2.

Lothian Phase 1 Habitat Surveys (2001/2) Target Notes

Target Note (TN)	Grid Reference	Description
S11 TN1	NT 11914 76819	Introduced Shrub. Dense Rhododendron Rhododendron spp. and Cherry Laurel Prunus laurocerasus to 7m with scattered mature trees of Sycamore Acer pseudoplatanus, Sessile Oak Quercus petraea, Yew Taxus baccata, Larch Larix sp. and Pine Pinus sp. The ground is shaded and bare, any small gaps are dominated by Nettle Urtica dioica.
S11 TN10	NT 12101 75843	Broad-leaved Plantation. Open canopy to 25m, with abundant Sycamore Acer pseudoplatanus, Beech Fagus sylvatica and Wych Elm Ulmus glabra regeneration, plus occasional Yew Taxus baccata. The shrub layer is sparse with locally frequent Rhododendron Rhododendron ponticum and occasional Elder Sambucus nigra. The ground flora has frequent to locally dominant Nettle Urtica dioica and Common Bent Agrostis capillaris, frequent Foxglove Digitalis purpurea, Ground Ivy Glechoma hederacea, Common Mouse-ear Cerastium fontanum, Wood Sage Teucrium scorodonia and Common Dog-violet Viola riviniana.
S11 TN11	NT 12150 75850	Pond. Small pond in garden of Craigend House. Dominated by Common Reedmace Typha latifolia with little open water, thick with algae. Abrupt steep low banks no marginal vegetation as such.
S11 TN12	NT 12124 75943	Broad-leaved Plantation. Open canopy to 25m, with abundant Yew Taxus baccata and Beech Fagus sylvatica, and occasional Sycamore Acer pseudoplatanus, Silver Birch Betula pendula and Sessile Oak Quercus petraea. Shrub layer sparse with much Rhododendron Rhododendron ponticum having been recently cleared, now occasional with Elder Sambucus nigra. Sparse ground flora, just frequent Nettle Urtica dioica and Foxglove Digitalis purpurea, with Blinks Montia fontana along a track. Rarities Present: Blinks Montia fontana Frequent/Uncommon in Vice County.

Target Note (TN)	Grid Reference	Description
S11 TN13	NT 12147 75785	Semi-improved Neutral Grassland. A disturbed vehicle turning area with an open sward of Red Fescue <i>Festuca rubra</i> and Common Bent <i>Agrostis capillaris</i> , with abundant Ragwort <i>Senecio jacobaea</i> , Selfheal <i>Prunella vulgaris</i> and Creeping Buttercup <i>Ranunculus repens</i> , also frequent Germander Speedwell <i>Veronica chamaedrys</i> , Field Forget-me-not <i>Myosotis arvensis</i> , Common Mouse-ear <i>Cerastium fontanum</i> , Ground Ivy <i>Glechoma hederacea</i> and Creeping Thistle <i>Cirsium arvense</i> . Common Figwort <i>Scrophularia nodosa</i> occurs rarely. The adjoining ruderal area is dominated by Nettle <i>Urtica dioica</i> and Creeping Thistle <i>Cirsium arvense</i> .
S11 TN14	NT 12077 76096	Poor Semi-improved Grassland. Low diversity pasture dominated by Common Bent <i>Agrostis capillaris</i> with abundant Rough Meadow-grass <i>Poa trivialis</i> , with frequent Yorkshire Fog <i>Holcus lanatus</i> , Creeping Buttercup <i>Ranunculus repens</i> and White Clover <i>Trifolium repens</i> , plus occasional Sweet Vernal Grass <i>Anthoxanthum odoratum</i> , Perennial Rye-grass <i>Lolium perenne</i> , Germander Speedwell <i>Veronica chamaedrys</i> and Creeping Thistle <i>Cirsium arvense</i> .
S11 TN15	NT 11934 76197	Poor Semi-improved Grassland. Low diversity pasture dominated by Common Bent <i>Agrostis capillaris</i> with abundant Rough Meadow-grass <i>Poa trivialis</i> , White Clover <i>Trifolium repens</i> , Germander Speedwell <i>Veronica chamaedrys</i> and Creeping Thistle <i>Cirsium arvense</i> . Around margins Nettle <i>Urtica dioica</i> and Ground Ivy <i>Glechoma hederacea</i> is abundant.
S11 TN16	NT 11940 76308	Broad-leaved Plantation. Closed canopy 20 - 25m, with abundant Sycamore <i>Acer pseudoplatanus</i> and Beech <i>Fagus sylvatica</i> , frequent Yew <i>Taxus baccata</i> , and occasional Sessile Oak <i>Quercus petraea</i> , Scots Pine <i>Pinus sylvestris</i> and European Lime <i>Tilia X europaea</i> . Shrub layer sparse with locally frequent Rhododendron <i>Rhododendron ponticum</i> . There is no ground flora in the deep shade.

Target Note (TN)	Grid Reference	Description
S11 TN17	NT 12088 76291	Semi-improved Neutral Grassland. Mown golf fairway dominated by Common Bent <i>Agrostis capillaris</i> with frequent to locally abundant Red Fescue <i>Festuca rubra</i> , White Clover <i>Trifolium repens</i> and Annual Meadow-grass <i>Poa annua</i> , frequent Creeping Buttercup <i>Ranunculus repens</i> , Yorkshire Fog <i>Holcus lanatus</i> and Perennial Rye-grass <i>Lolium perenne</i> , locally frequent Sweet Vernal Grass <i>Anthoxanthum odoratum</i> , Meadow Foxtail <i>Alopecurus pratensis</i> and Common Sorrel <i>Rumex acetosa</i> , plus occasional Yarrow <i>Achillea millefolium</i> , Germander Speedwell <i>Veronica chamaedrys</i> , Field Wood-rush <i>Luzula campestre</i> , Meadow Buttercup <i>Ranunculus acris</i> , Ragwort <i>Senecio jacobaea</i> and Greater Bird's-foot-trefoil <i>Lotus uliginosus</i> . Mature broadleaved trees are scattered across the golf course.
S11 TN18	NT 12206 70566	Amenity Grassland (Poor Semi-improved Grassland). Mown golf fairway sward of Common Bent <i>Agrostis capillaris</i> , Red Fescue <i>Festuca rubra</i> , Yorkshire Fog <i>Holcus lanatus</i> , Annual Meadow-grass <i>Poa annua</i> , and Perennial Rye-grass <i>Lolium perenne</i> , with very locally frequent Sweet Vernal Grass <i>Anthoxanthum odoratum</i> . No herbs.
S11 TN19	NT 11917 76627	Amenity Grassland (Semi-improved Neutral Grassland). Mown amenity grassland dominated by Common Bent <i>Agrostis capillaris</i> with frequent Red Fescue <i>Festuca rubra</i> , and Perennial Rye-grass <i>Lolium perenne</i> , White Clover <i>Trifolium repens</i> , Creeping Buttercup <i>Ranunculus repens</i> , Sweet Vernal Grass <i>Anthoxanthum odoratum</i> , plus occasional Common Sorrel <i>Rumex acetosa</i> , Field Wood-rush <i>Luzula campestre</i> and Germander Speedwell <i>Veronica chamaedrys</i> . Mature broadleaved trees are scattered across the area.

Target Note (TN)	Grid Reference	Description
S11 TN2	NT 12178 76931	Broad-leaved Plantation. Actively managed plantation with an open even aged canopy to 30m, of mature c. 60 yrs trees. Some disturbance where logs extracted, areas of new underplanting of broadleaved species. Sycamore <i>Acer pseudoplatanus</i> dominates with frequent Beech <i>Fagus sylvatica</i> , Lime <i>Tilia x europaea</i> and occasional Horse Chestnut <i>Aesculus hippocastanum</i> , Yew <i>Taxus baccata</i> , Silver Birch <i>Betula pendula</i> , Norway Spruce <i>Picea abies</i> and Scots Pine <i>Pinus sylvestris</i> . Shrub layer has frequent to locally abundant Rhododendron <i>Rhododendron</i> spp., occasional Cherry Laurel <i>Prunus laurocerasus</i> , with Hawthorn <i>Crataegus monogyna</i> frequent along the track. The ground flora is patchy with much bare ground and species-poor with very abundant Nettle <i>Urtica dioica</i> , plus frequent Creeping Buttercup <i>Ranunculus repens</i> , Male Fern <i>Dryopteris felix-mas</i> , and Broad Buckler Fern <i>Dryopteris dilatata</i> .
S11 TN20	NT 12049 76395	Mixed Plantation. Open canopy to 25m of abundant Sycamore <i>Acer pseudoplatanus</i> and Scots Pine <i>Pinus sylvestris</i> , frequent Sessile Oak <i>Quercus petraea</i> and Beech <i>Fagus sylvatica</i> , plus occasional Yew <i>Taxus baccata</i> and Norway Spruce <i>Picea abies</i> . Shrub layer consists of abundant Rhododendron <i>Rhododendron ponticum</i> and occasional Scattered Elder <i>Sambucus nigra</i> . The ground is predominantly bare with scattered Broad Buckler Fern <i>Dryopteris dilatata</i> and Nettle <i>Urtica dioica</i> . Some recent logging and Rhododendron clearance has taken place.

Target Note (TN)	Grid Reference	Description
S11 TN21	NT 12028 75910	Semi-improved Neutral Grassland. Small area of grassland partially shaded by trees on top of a rock exposure. Rabbit grazed sward dominated by Common Bent <i>Agrostis capillaris</i> with abundant moss <i>Rhytidiadelphous squarrosus</i> , frequent Red Fescue <i>Festuca rubra</i> , Yorkshire Fog <i>Holcus lanatus</i> , Perennial Rye-grass <i>Lolium perenne</i> , Common Dog Violet <i>Viola riviniana</i> , Wood Sage <i>Teucrium scorodonia</i> , Germander <i>Speedwell Veronica chamaedrys</i> , plus occasional Field Forget-me-not <i>Myosotis arvensis</i> , Common Mouse-ear <i>Cerastium fontanum</i> , Yarrow <i>Achillea millifolium</i> , Ragwort <i>Senecio jacobea</i> , Cleavers <i>Galium aparine</i> , Lady's Bedstraw <i>Galium verum</i> , Male Fern <i>Dryopteris filix-mas</i> and Wood Speedwell <i>Veronica montana</i> . Also scattered Broom <i>Cytisus scoparius</i> and <i>Rhododendron ponticum</i> . Rarities Present: Wood Speedwell <i>Veronica montana</i> Frequent/Uncommon in Vice County.
S11 TN22	NT 12009 76026	Broad-leaved Plantation. Recorded as 'long established plantation' in ancient woodland inventory. Closed canopy to 25m with abundant Sycamore <i>Acer pseudoplatanus</i> frequent Beech <i>Fagus sylvatica</i> , Yew <i>Taxus baccata</i> , Silver Birch <i>Betula pendula</i> , Horse Chestnut <i>Aesculus hippocastanum</i> , European Lime <i>Tilia X europaea</i> , plus occasional Scots Pine <i>Pinus sylvestris</i> , and Sitka Spruce <i>Picea sitchensis</i> . <i>Rhododendron ponticum</i> dominates the shrub layer. The ground flora is largely ruderal dominated by Nettle <i>Urtica dioica</i> with abundant Cleavers <i>Galium aparine</i> and Ground Ivy <i>Glechoma hederacea</i> , plus frequent Foxglove <i>Digitalis purpurea</i> and occasional Broad Buckler Fern <i>Dryopteris dilatata</i> .
S11 TN23	NT 11946 76129	Ruderal Vegetation. Nettle <i>Urtica dioica</i> dominates with abundant Cleavers <i>Galium aparine</i> , Crosswort <i>Cruciata laevipes</i> , Field Forget-me-not <i>Myosotis arvensis</i> and Lesser Celandine <i>Ranunculus ficaria</i> , frequent Bracken <i>Pteridium aquilinum</i> , Male Fern <i>Dryopteris filix-mas</i> , Creeping Thistle <i>Cirsium arvense</i> , locally frequent Ground Ivy <i>Glechoma hederacea</i> , Lesser Burdock <i>Arctium minus</i> , and rarely Common Figwort <i>Scrophularia nodosa</i> . Also scattered <i>Rhododendron ponticum</i> .

Target Note (TN)	Grid Reference	Description
S11 TN24	NT 11773 76408	Scrub. Scattered Elder <i>Sambucus nigra</i> , <i>Rhododendron ponticum</i> and Common Gorse <i>Ulex europaeus</i> over Nettle <i>Urtica dioica</i> , Common Bent <i>Agrostis capillaris</i> , Yorkshire Fog <i>Holcus lanatus</i> and Germander Speedwell <i>Veronica chamaedrys</i> .
S11 TN25	NT 11572 76632	Mixed Plantation. Closed canopy to 25m of abundant Sycamore <i>Acer pseudoplatanus</i> , Scots Pine <i>Pinus sylvestris</i> , Beech <i>Fagus sylvatica</i> , frequent Lime <i>Tilia X europaea</i> and Yew <i>Taxus baccata</i> over a shrub layer of abundant <i>Rhododendron ponticum</i> . The ground is predominantly bare with local patches of Common Bent <i>Agrostis capillaris</i> and Wood Sage <i>Teucrium scorodonia</i> .
S11 TN26	NT 11396 76775	Semi-improved Acid Grassland. Neglected grassland over north-facing slope dominated by Yorkshire Fog <i>Holcus lanatus</i> with abundant Common Bent <i>Agrostis capillaris</i> and Red Fescue <i>Festuca rubra</i> , frequent Germander Speedwell <i>Veronica chamaedrys</i> , Heath Speedwell <i>Veronica officinalis</i> , Heath Bedstraw <i>Galium saxatile</i> , Foxglove <i>Digitalis purpurea</i> and Broad Buckler Fern <i>Dryopteris dilatata</i> , plus occasional Ragwort <i>Senecio jacobaea</i> , Selfheal <i>Prunella vulgaris</i> and Smooth Meadow-grass <i>Poa pratensis</i> .
S11 TN27	NT 11911 77170	Poor Semi-improved Grassland. Neglected field of rank grassland with abundant False Oat-grass <i>Arrhenatherum elatius</i> , Cock's-foot <i>Dactylis glomerata</i> , Common Bent <i>Agrostis capillaris</i> and Red Fescue <i>Festuca rubra</i> , frequent Common Hogweed <i>Heracleum spondylium</i> , Broadleaved Dock <i>Rumex obtusifolius</i> , White Clover <i>Trifolium repens</i> , Creeping Thistle <i>Cirsium arvense</i> , Nettle <i>Urtica dioica</i> and Bush Vetch <i>Vicia cracca</i> .

Target Note (TN)	Grid Reference	Description
S11 TN28	NT 11715 77271	Broad-leaved Plantation. Echline Strip. Closed canopy to 30m with abundant Sycamore <i>Acer pseudoplatanus</i> frequent Horse Chestnut <i>Aesculus hippocastanum</i> , European Lime <i>Tilia X europaea</i> , Yew <i>Taxus baccata</i> and Scots Pine <i>Pinus sylvestris</i> , occasional Wild Cherry <i>Prunus avium</i> , Sessile Oak <i>Quercus petraea</i> and Norway Maple <i>Acer platanoides</i> . Shrub layer has locally abundant Blackthorn <i>Prunus spinosa</i> and occasional <i>Rhododendron ponticum</i> . The ground flora is largely ruderal dominated by Nettle <i>Urtica dioica</i> with abundant Cleavers <i>Galium aparine</i> , Creeping Buttercup <i>Ranunculus repens</i> , Chickweed <i>Stellaria media</i> and Wavy Bitter-cress <i>Cardamines flexuosa</i> , plus frequent Enchanter's Nightshade <i>Circaea lutetiana</i> and Male Fern <i>Dryopteris filix-mas</i> .
S11 TN29	NT 11454 77032	Broad-leaved Plantation. Immature woodland very open canopy to 15m. Abundant Sycamore <i>Acer pseudoplatanus</i> with frequent Horse Chestnut <i>Aesculus hippocastanum</i> and European Lime <i>Tilia X europaea</i> , plus scattered <i>Rhododendron ponticum</i> . Rank grassland between trees with False Oat-grass <i>Arrhenatherum elatius</i> , Cock's-foot <i>Dactylis glomerata</i> , Common Hogweed <i>Heracleum spondylium</i> and Nettle <i>Urtica dioica</i> .
S11 TN3	NT 12454 76590	Broad-leaved Plantation. An open even aged canopy to 30m, of mature c. 60 yrs trees, with very abundant Yew <i>Taxus baccata</i> , frequent Sycamore <i>Acer pseudoplatanus</i> , and Lime <i>Tilia x europaea</i> , occasional Beech <i>Fagus sylvatica</i> , Silver Birch <i>Betula pendula</i> , occasional Horse Chestnut <i>Aesculus hippocastanum</i> , Ash <i>Fraxinus excelsior</i> and Wych Elm <i>Ulmus glabra</i> regeneration. The shrub layer consists of abundant <i>Rhododendron ponticum</i> , frequent Elder <i>Sambucus nigra</i> and locally frequent Bramble <i>Rubus fruticosus</i> . The ground flora is patchy with bare patches in deep shade and ruderal patches in the light dominated by Nettle <i>Urtica dioica</i> with frequent Male Fern <i>Dryopteris felix-mas</i> , Creeping Buttercup <i>Ranunculus repens</i> , Common Bent <i>Agrostis capillaris</i> and Selfheal <i>Prunella vulgaris</i> .

Target Note (TN)	Grid Reference	Description
S11 TN30	NT 11256 77084	Broad-leaved Plantation. Circa 30 years old with an open canopy to 25m dominated by Sycamore <i>Acer pseudoplatanus</i> with occasional Horse Chestnut <i>Aesculus hippocastanum</i> , Scots Pine <i>Pinus sylvestris</i> , Beech <i>Fagus sylvatica</i> and Ash <i>Fraxinus excelsior</i> . Also some very recent broadleaved planting. The ground flora is dominated by grasses Common Bent <i>Agrostis capillaris</i> and Yorkshire Fog <i>Holcus lanatus</i> with abundant Nettle <i>Urtica dioica</i> , Cleavers <i>Galium aparine</i> and Lesser Celandine <i>Ranunculus ficaria</i> , plus locally frequent Enchanter's Nightshade <i>Circaea lutetiana</i> , Gooseberry <i>Ribes uva-crispa</i> , Black Currant <i>Ribes nigrum</i> and Wood Meadow-grass <i>Poa nemoralis</i> .
S11 TN31	NT 11171 76658	Broad-leaved Plantation. Closed canopy to 30m with abundant Sycamore <i>Acer pseudoplatanus</i> frequent Beech <i>Fagus sylvatica</i> , Yew <i>Taxus baccata</i> , Silver Birch <i>Betula pendula</i> , Horse Chestnut <i>Aesculus hippocastanum</i> , European Lime <i>Tilia X europaea</i> , plus occasional Scots Pine <i>Pinus sylvestris</i> . <i>Rhododendron ponticum</i> dominates the shrub layer. The ground flora is grassy with Common Bent <i>Agrostis capillaris</i> and Yorkshire Fog <i>Holcus lanatus</i> with abundant Nettle <i>Urtica dioica</i> , Cleavers <i>Galium aparine</i> and occasional Broad Buckler Fern <i>Dryopteris dilatata</i> .
S11 TN32	NT 11072 76280	Marshy Grassland. Dominated by tussocks of Soft Rush <i>Juncus effusus</i> with abundant mosses and scattered Marsh Willowherb <i>Epilobium palustre</i> , Water Mint <i>Mentha aquatica</i> and Common Marsh-bedstraw <i>Galium palustre</i> and Narrow Buckler fern <i>Dryopteris carthusiana</i> . A few Downy Birch <i>Betula pubescens</i> occur within the rush dominated area. Tufted Hair-grass <i>Deschampsia cespitosa</i> and Marsh Thistle <i>Cirsium palustre</i> are frequent around the drier fringes.
S11 TN33	NT 11208 76264	Pond. Stone-built rectangular water storage tank with vertical sides. A few Yellow Flag Iris <i>pseudacorus</i> plants, otherwise no other vegetation, waters thick with algae. Wildfowl present.

Target Note (TN)	Grid Reference	Description
S11 TN34	NT 11288 76305	Poor Semi-improved Grassland. Moderately shaded strip of rough unmanaged grassland with abundant Common Bent <i>Agrostis capillaris</i> , Yorkshire Fog <i>Holcus lanatus</i> and Creeping Buttercup <i>Ranunculus repens</i> , frequent Germander Speedwell <i>Veronica chamaedrys</i> , Ragwort <i>Senecio jacobaea</i> , Creeping Thistle <i>Cirsium arvense</i> and Tufted Hair-grass <i>Deschampsia cespitosa</i> plus very locally frequent Bluebell <i>Hyacinthoides non-scripta</i> .
S11 TN35	NT 11849 75975	Broad-leaved Plantation. Open canopy to 25m dominated by Sycamore <i>Acer pseudoplatanus</i> with frequent Beech <i>Fagus sylvatica</i> , Yew <i>Taxus baccata</i> , Horse Chestnut <i>Aesculus hippocastanum</i> , European Lime <i>Tilia X europaea</i> and Scots Pine <i>Pinus sylvestris</i> . Occasional Wild Cherry <i>Prunus avium</i> and Sessile Oak <i>Quercus petraea</i> . Shrub layer of scattered <i>Rhododendron ponticum</i> . The ground flora is grassy with abundant Common Bent <i>Agrostis capillaris</i> , Cock's-foot <i>Dactylis glomerata</i> , Creeping Buttercup <i>Ranunculus repens</i> and Yorkshire Fog <i>Holcus lanatus</i> plus frequent Nettle <i>Urtica dioica</i> , and occasional Common Dog Violet <i>Viola riviniana</i> .
S11 TN36	NT 11593 76000	Improved Pasture. Large pasture field with herb-poor sward of abundant to locally dominant Perennial Ryegrass <i>Lolium perenne</i> , abundant Common Bent <i>Agrostis capillaris</i> , Yorkshire Fog <i>Holcus lanatus</i> , Rough Meadow-grass <i>Poa trivialis</i> , Creeping Buttercup <i>Ranunculus repens</i> , frequent White Clover <i>Trifolium repens</i> , Annual Meadow-grass <i>Poa annua</i> , Creeping Thistle <i>Cirsium arvense</i> and Sweet Vernal Grass <i>Anthoxanthum odoratum</i> .

Target Note (TN)	Grid Reference	Description
S11 TN37	NT 11882 76045	Dundas Loch. Boating Loch with steep rock-built banks, largely overhung and shaded by trees and Rhododendron <i>Rhododendron ponticum</i> , thus very little marginal vegetation except small scattered clumps of Yellow Flag <i>Iris pseudacorus</i> . At the northern end the profile is shelving with marginal vegetation dominated by Soft Rush <i>Juncus effusus</i> with frequent Yellow Flag <i>Iris pseudacorus</i> , Great Willowherb <i>Epilobium hirsutum</i> , Marsh Willowherb <i>Epilobium palustre</i> and occasional Common Reedmace <i>Typha latifolia</i> . Rarities Present: Common Reedmace <i>Typha latifolia</i> Scarce/Local in Vice County.
S11 TN38	NT 11699 76198	Semi-improved Neutral Grassland. Damp area at northern end of Dundas Loch dominated by Yorkshire Fog <i>Holcus lanatus</i> with abundant Common Bent <i>Agrostis capillaris</i> and Red Fescue <i>Festuca rubra</i> , frequent Marsh Thistle <i>Cirsium palustre</i> , locally frequent Silverweed <i>Potentilla anserina</i> and Germander Speedwell <i>Veronica chamaedrys</i> plus very locally frequent Greater Bird's-foot-trefoil <i>Lotus uliginosus</i> .
S11 TN39	NT 11469 76472	Ruderal Vegetation. Steep talus slopes at base of crags supporting a dense vegetation of abundant Yorkshire Fog <i>Holcus lanatus</i> , Nettle <i>Urtica dioica</i> and Green Alkanet <i>Pentaglottis sempervirens</i> .
S11 TN4	NT 12402 76312	Broad-leaved Plantation. Very open canopy to 20m with even age structure, with abundant Sycamore <i>Acer pseudoplatanus</i> and Yew <i>Taxus baccata</i> , frequent European Lime <i>Tilia X europaea</i> , Beech <i>Fagus sylvatica</i> and Silver Birch <i>Betula pendula</i> over a shrub layer of abundant Rhododendron <i>Rhododendron ponticum</i> and occasional other <i>Rhododendron</i> spp. The ground flora is dominated by Nettle <i>Urtica dioica</i> . Some recent broadleaved underplanting.

Target Note (TN)	Grid Reference	Description
S11 TN40	NT 11503 76504	Semi-improved Acid Grassland. Short sward over thin rocky soils above crags. Abundant Yorkshire Fog <i>Holcus lanatus</i> , Common Bent <i>Agrostis capillaris</i> , Creeping Buttercup <i>Ranunculus repens</i> and the moss <i>Rhytidiadelphus squarrosus</i> , locally abundant Germander Speedwell <i>Veronica chamaedrys</i> , frequent White Clover <i>Trifolium repens</i> , Heath Speedwell <i>Veronica officinalis</i> , locally frequent Heath Bedstraw <i>Galium saxatile</i> and Ragwort <i>Senecio jacobaea</i> . Around the rock outcrops Red Fescue <i>Festuca rubra</i> is abundant with very locally frequent Early Hair-grass <i>Aira praecox</i> , Sheep's Sorrel <i>Rumex acetosella</i> , Ground Ivy <i>Glechoma hederacea</i> and Wood Sage <i>Teucrium scorodonia</i> . Also scattered Sycamore <i>Acer pseudoplatanus</i> and Silver Birch <i>Betula pendula</i> .
S11 TN41	NT 11592 76334	Poor Semi-improved Grassland. Moderately shaded strip of rough unmanaged grassland with abundant Red Fescue <i>Festuca rubra</i> , Common Bent <i>Agrostis capillaris</i> , Yorkshire Fog <i>Holcus lanatus</i> and Creeping Buttercup <i>Ranunculus repens</i> , frequent Creeping Thistle <i>Cirsium arvense</i> , Ground Ivy <i>Glechoma hederacea</i> , locally frequent Sweet Vernal Grass <i>Anthoxanthum odoratum</i> and Nettle <i>Urtica dioica</i> , with very locally abundant Bracken <i>Pteridium aquilinum</i> . The area had recently been sprayed with herbicide to kill thistles.
S11 TN5	NT 12340 76090	Broad-leaved Plantation. Open canopy to 30m with even age structure, with abundant Sycamore <i>Acer pseudoplatanus</i> and Lime <i>Tilia X europaea</i> , frequent Yew <i>Taxus baccata</i> , and occasional Wild Cherry <i>Prunus avium</i> and Scots Pine <i>Pinus sylvestris</i> over a shrub layer of frequent Rhododendron <i>Rhododendron ponticum</i> . The ground flora is dominated by Nettle <i>Urtica dioica</i> with abundant Cleavers <i>Galium aparine</i> , frequent Male Fern <i>Dryopteris filix-mas</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> plus common grasses. Some recent broadleaved underplanting.

Target Note (TN)	Grid Reference	Description
S11 TN6	NT 12345 75840	Pond. Recently created for duck. Abrupt steep low banks, c. 40cm deep, thick with algae. Common Reedmace <i>Typha latifolia</i> dominates with abundant Mare's-tail <i>Hippuris vulgaris</i> , and some open water. Area around pond dominated by ruderal vegetation of Creeping Buttercup <i>Ranunculus repens</i> , Nettle <i>Urtica dioica</i> , Creeping Thistle <i>Cirsium arvense</i> and Soft Rush <i>Juncus effusus</i> with scattered <i>Rhododendron ponticum</i> . Rarities Present: Mare's-tail <i>Hippuris vulgaris</i> Rare in Vice County.
S11 TN7	NT 12476 75766	Broad-leaved Plantation. Open canopy to 25m, with scrubby patches. Abundant Sycamore <i>Acer pseudoplatanus</i> and Yew <i>Taxus baccata</i> , frequent Horse Chestnut <i>Aesculus hippocastanum</i> plus occasional Lime <i>Tilia X europaea</i> and Silver Birch <i>Betula pendula</i> over a shrub layer of scattered <i>Rhododendron ponticum</i> . The ground flora is dominated by Nettle <i>Urtica dioica</i> with abundant Cleavers <i>Galium aparine</i> , Creeping Buttercup <i>Ranunculus repens</i> and Foxglove <i>Digitalis purpurea</i> .
S11 TN8	NT 12255 75724	Broad-leaved Plantation. Very open canopy to 25m, with abundant Sycamore <i>Acer pseudoplatanus</i> and Yew <i>Taxus baccata</i> , and occasional Horse Chestnut <i>Aesculus hippocastanum</i> , European Lime <i>Tilia X europaea</i> , Scots Pine <i>Pinus sylvestris</i> , Wild Cherry <i>Prunus avium</i> and Silver Birch <i>Betula pendula</i> over a shrub layer of scattered <i>Rhododendron ponticum</i> . The ground flora is dominated by Nettle <i>Urtica dioica</i> with abundant Cleavers <i>Galium aparine</i> , Creeping Buttercup <i>Ranunculus repens</i> and Rough Meadow-grass <i>Poa trivialis</i> , frequent Foxglove <i>Digitalis purpurea</i> and Ground Ivy <i>Glechoma hederacea</i> ; Common Figwort <i>Scrophularia nodosa</i> occurs rarely.

Target Note (TN)	Grid Reference	Description
S11 TN9	NT 12077 75806	Semi-improved Neutral Grassland. Slope below rock outcrop, 30o west facing. Unmanaged sward dominated by Common Bent <i>Agrostis capillaris</i> , with frequent Yorkshire Fog <i>Holcus lanatus</i> , Red Fescue <i>Festuca rubra</i> , Germander Speedwell <i>Veronica chamaedrys</i> , Selfheal <i>Prunella vulgaris</i> , Field Forget-me-not <i>Myosotis arvensis</i> , Foxglove <i>Digitalis purpurea</i> , Common Mouse-ear <i>Cerastium fontanum</i> , Ragwort <i>Senecio jacobaea</i> , plus occasional Wood Speedwell <i>Veronica montana</i> and Thyme-leaved Speedwell <i>Veronica serpyllifolia</i> . Rarities Present: Wood Speedwell <i>Veronica montana</i> Frequent/Uncommon in Vice County.
S15 TN1	NT 12528 78513	Scrub. Dense scrub with abundant Hawthorn <i>Crataegus monogyna</i> , Broom <i>Cytisus scoparius</i> , Bramble <i>Rubus fruticosus</i> , frequent Elder <i>Sambucus nigra</i> , Dog Rose <i>Rosa canina</i> , Goat Willow <i>Salix caprea</i> , Sycamore <i>Acer pseudoplatanus</i> , and occasional Common Gorse <i>Ulex europaeus</i> . Ruderal herbs in gaps.
S15 TN2	NT 12581 78446	Unimproved Neutral Grassland. Unmanaged but trampled and rabbit grazed sward dominated by Common Bent <i>Agrostis capillaris</i> , with frequent Red Fescue <i>Festuca rubra</i> , Cock's-foot <i>Dactylis glomerata</i> , Rough Meadow-grass <i>Poa trivialis</i> , White Clover <i>Trifolium repens</i> , Perennial Rye-grass <i>Lolium perenne</i> , Ribwort <i>Plantago lanceolata</i> , Oxeye Daisy <i>Leucanthemum vulgare</i> , Meadow vetchling <i>Lathyrus pratensis</i> , Common Bird's-foot-trefoil <i>Lotus corniculatus</i> , Tufted Vetch <i>Vicia cracca</i> , plus occasional Sweet Vernal Grass <i>Anthoxanthum odoratum</i> , Ragwort <i>Senecio jacobaea</i> , Common Mouse-ear <i>Cerastium fontanum</i> , Creeping Thistle <i>Cirsium arvense</i> , Hard Rush <i>Juncus inflexus</i> , Common Spotted Orchid <i>Dactylorhiza fuchsii</i> and Lady's-mantle <i>Alchemilla vulgaris</i> agg.

Target Note (TN)	Grid Reference	Description
S15 TN3	NT 12508 78411	Broad-leaved Woodland. Scrubby secondary woodland with an open canopy to 10m. Sycamore <i>Acer pseudoplatanus</i> dominates with abundant Hawthorn <i>Crataegus monogyna</i> , Elder <i>Sambucus nigra</i> , Bramble <i>Rubus fruticosus</i> , frequent Common Gorse <i>Ulex europaeus</i> and occasional Ash <i>Fraxinus excelsior</i> and Snowberry <i>Symphoricarpos albus</i> . The herb layer is ruderal with abundant Nettle <i>Urtica dioica</i> , Cleavers <i>Galium aparine</i> and Creeping Thistle <i>Cirsium arvense</i> , plus frequent Cow Parsley <i>Anthriscus sylvestris</i> , Wood Avens <i>Geum urbanum</i> , Ivy <i>Hedera helix</i> and Japanese Knotweed <i>Fallopia japonica</i> .
S15 TN4	NT 12438 78512	Broad-leaved Woodland. Early successional woodland with a closed canopy to 8m of abundant Goat Willow <i>Salix caprea</i> , Sycamore <i>Acer pseudoplatanus</i> , Hawthorn <i>Crataegus monogyna</i> , Bramble <i>Rubus fruticosus</i> , and frequent Ash <i>Fraxinus excelsior</i> saplings. Beneath Male Fern <i>Dryopteris felix-mas</i> is locally abundant and Rosebay Willowherb <i>Chamerion angustifolium</i> is frequent.
S15 TN5	NT 12374 78524	Semi-improved Neutral Grassland. Unmanaged but trampled and rabbit grazed sward dominated by Common Bent <i>Agrostis capillaris</i> , with abundant Red Fescue <i>Festuca rubra</i> , Cock's-foot <i>Dactylis glomerata</i> , White Clover <i>Trifolium repens</i> , Oxeye Daisy <i>Leucanthemum vulgare</i> , frequent Sweet Vernal Grass <i>Anthoxanthum odoratum</i> , Common Mouse-ear <i>Cerastium fontanum</i> , and occasional Ribwort Plantain <i>Plantago lanceolata</i> , Red Bartsia <i>Odontites verna</i> , Perforate St John's-wort <i>Hypericum perforatum</i> , Ragwort <i>Senecio jacobaea</i> , Strawberry <i>Fragaria vesca</i> and Common Vetch <i>Vicia sativa</i> .

Target Note (TN)	Grid Reference	Description
S15 TN6	NT 12242 78555	Broad-leaved Woodland. Early successional woodland with a closed canopy to 15m dominated by Sycamore <i>Acer pseudoplatanus</i> with frequent Goat Willow <i>Salix caprea</i> , occasional Ash <i>Fraxinus excelsior</i> and Birch hybrids <i>Betula x aurata</i> . The shrub layer is of abundant Hawthorn <i>Crataegus monogyna</i> and regeneration of Wych Elm <i>Ulmus glabra</i> , plus frequent saplings of Beech <i>Fagus sylvatica</i> and Ash <i>Fraxinus excelsior</i> . The herb layer has very abundant Ivy <i>Hedera helix</i> , abundant Bramble <i>Rubus fruticosus</i> , Male Fern <i>Dryopteris felix-mas</i> , locally abundant Wood Meadow-grass <i>Poa nemoralis</i> , Raspberry <i>Rubus idaeus</i> , Nettle <i>Urtica dioica</i> , Cleavers <i>Galium aparine</i> , Lesser Celandine <i>Ranunculus ficaria</i> , frequent Red Campion <i>Silene dioica</i> , Cow Parsley <i>Anthriscus sylvestris</i> , plus occasional Red Current <i>Ribes sylvestre</i> and rare Bluebell <i>Hyacinthoides non-scripta</i> .
S15 TN7	NT 12090 78489	Amenity Grassland. Regularly mown recreation ground with a sward dominated by Common Bent <i>Agrostis capillaris</i> , with abundant Yorkshire Fog <i>Holcus lanatus</i> , Cock's-foot <i>Dactylis glomerata</i> , Germander Speedwell <i>Veronica chamaedrys</i> , White Clover <i>Trifolium repens</i> , Ribwort Plantain <i>Plantago lanceolata</i> and Daisy <i>Bellis perennis</i> .
S15 TN8	NT 12131 78526	Broad-leaved Woodland. Secondary woodland within and up the sides of the cutting of the disused railway line. A closed, low canopy of abundant Sycamore <i>Acer pseudoplatanus</i> (a few to 25m in height) and Wych Elm <i>Ulmus glabra</i> , plus a few Hornbeam <i>Carpinus betula</i> along the edge of the recreation ground. The shrub layer consists of abundant Hawthorn <i>Crataegus monogyna</i> and Elder <i>Sambucus nigra</i> . The ground flora is generally dominated by Ivy <i>Hedera helix</i> in the deep shade with frequent Wood Meadow-grass <i>Poa nemoralis</i> , Wood Avens <i>Geum urbanum</i> and Male Fern <i>Dryopteris felix-mas</i> , locally frequent Herb Robert <i>Geranium robertianum</i> , plus occasional Pignut <i>Conopodium majus</i> . In better lit areas ruderal species predominate with locally abundant Nettle <i>Urtica dioica</i> , Cleavers <i>Galium aparine</i> , locally frequent Cow Parsley <i>Anthriscus sylvestris</i> and occasional Wood Dock <i>Rumex sanguineus</i> .

Target Note (TN)	Grid Reference	Description
S15 TN9	NT 11984 78522	Ruderal. Giant Hogweed <i>Heracleum mantegazzianum</i> locally frequent along woodland edge
S16 TN1	NT 11085 74268	Scrub. Stand of scrub in a grazed field, co-dominated by Common Gorse <i>Ulex europaeus</i> and Hawthorn <i>Crataegus monogyna</i> with frequent Elder <i>Sambucus nigra</i> and occasional Broom <i>Cytisus scoparius</i> . Between the shrubs is abundant Nettle <i>Urtica dioica</i> , Yorkshire Fog <i>Holcus lanatus</i> , Cock's-foot <i>Dactylis glomerata</i> , Creeping Buttercup <i>Ranunculus repens</i> and frequent Creeping Thistle <i>Cirsium arvense</i> . Around a small old quarry are also scattered Sycamore <i>Acer pseudoplatanus</i> , wild Cherry <i>Prunus laurocerasus</i> , Ash <i>Fraxinus excelsior</i> and beneath them Herb Robert <i>Geranium robertianum</i> , common Dog-violet <i>Viola riviniana</i> , Germander <i>Speedwell Veronica chamaedrys</i> , Wood Speedwell <i>Veronica montana</i> . Rarities Recorded: Frequent/uncommon in Vice County: Wood Speedwell <i>Veronica montana</i> .
S16 TN2	NT 11334 74259	Improved Grassland. Grazed field with abundant Perennial Rye-grass <i>Lolium perenne</i> , Yorkshire Fog <i>Holcus lanatus</i> , Common Bent <i>Agrostis capillaris</i> , Rough Meadow-grass <i>Poa trivialis</i> , frequent Smooth Meadow-grass <i>Poa pratense</i> , Red Fescue <i>Festuca rubra</i> , Creeping Buttercup <i>Ranunculus repens</i> , White Clover <i>Trifolium repens</i> , occasional Cock's-foot <i>Dactylis glomerata</i> , Crested Dog's-tail <i>Cynosurus cristatus</i> , Meadow Foxtail <i>Alopecurus pratensis</i> , Marsh Foxtail <i>Alopecurus geniculatus</i> , Annual Meadow-grass <i>Poa annua</i> and Daisy <i>Bellis perennis</i> .

Target Note (TN)	Grid Reference	Description
S16 TN3	NT 11545 74183	Mixed Plantation. Closed canopy of poles to 25-30m with a few mature trees around the edge. Dominated by Sycamore <i>Acer pseudoplatanus</i> with locally abundant Larch <i>Larix</i> sp., frequent Scots Pine <i>Pinus sylvestris</i> , occasional Ash <i>Fraxinus excelsior</i> , Aspen <i>Populus tremula</i> plus, rarely, Yew <i>Taxus baccata</i> and Sweet Chestnut <i>Castanea sativa</i> . The shrub layer has abundant Snowberry <i>Symphoricarpos albus</i> , frequent Elder <i>Sambucus nigra</i> , occasional Hawthorn <i>Crataegus monogyna</i> , <i>Rhododendron ponticum</i> and, rarely, Holly <i>Ilex aquifolium</i> . The ground flora has abundant Nettle <i>Urtica dioica</i> and Sycamore <i>Acer pseudoplatanus</i> seedlings, locally abundant Male Fern <i>Dryopteris filix-mas</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> , frequent Foxglove <i>Digitalis purpurea</i> , Cleavers <i>Galium aparine</i> , locally frequent Common Dog-violet <i>Viola riviniana</i> , occasional Bramble <i>Rubus fruticosus</i> agg. and rarely Common Figwort <i>Scrophularia nodosa</i> .
S16 TN4	NT 11440 74066	Running Water. Niddrie Burn. Stony bottom, grazed to edges. Scattered marginal vegetation with abundant Reed Canary-grass <i>Phalaris arundinacea</i> , occasional Water Forget-me-not <i>Myosotis scorpioides</i> and Great Willowherb <i>Epilobium hirsutum</i> .
S16 TN5	NT 11083 74188	Mixed Plantation. Closed canopy of poles to 25-30m with a few mature trees around the edge. Dominated by Sycamore <i>Acer pseudoplatanus</i> with frequent Scots Pine <i>Pinus sylvestris</i> and Wych Elm <i>Ulmus glabra</i> regeneration, occasional Ash <i>Fraxinus excelsior</i> , European Lime <i>Tilia x europaea</i> plus one large Wellingtonia <i>Sequoiadendron giganteum</i> . The shrub layer has abundant Snowberry <i>Symphoricarpos albus</i> , frequent Elder <i>Sambucus nigra</i> and occasional Hawthorn <i>Crataegus monogyna</i> . The ground flora has frequent Wood Meadow-grass <i>Poa nemoralis</i> , Bluebell <i>Hyacinthoides non-scripta</i> , occasional Wild Garlic <i>Allium ursinum</i> and Red Campion <i>Silene dioica</i> .

Target Note (TN)	Grid Reference	Description
S17 TN1	NT 11364 78605	Broad-leaved Woodland. Open secondary woodland to 20m over a steep rock exposure. Sycamore <i>Acer pseudoplatanus</i> dominates with frequent Wych Elm <i>Ulmus glabra</i> and Elder <i>Sambucus nigra</i> over a ground flora of Ivy <i>Hedera helix</i> in shaded parts, with Nettles <i>Urtica dioica</i> around the margins and dominating gaps.
S17 TN2	NT 11367 78703	Semi-improved Neutral Grassland. Unmanaged rank sward with Common Bent <i>Agrostis capillaris</i> and False Oat-grass <i>Arrhenatherum elatius</i> both locally dominant, abundant Yorkshire Fog <i>Holcus lanatus</i> , Rough Meadow-grass <i>Poa trivialis</i> , Creeping Buttercup <i>Ranunculus repens</i> and Germander <i>Thymus praecox</i> Speedwell <i>Veronica chamaedrys</i> , with frequent Common Mouse-ear <i>Cerastium fontanum</i> , Creeping Thistle <i>Cirsium arvense</i> , Cock's-foot <i>Dactylis glomerata</i> , Crosswort <i>Cruciata laevipes</i> , Common Hogweed <i>Heracleum sphondylium</i> and Nettle <i>Urtica dioica</i> , plus occasional Primrose <i>Primula vulgaris</i> . Also scattered Common Gorse <i>Ulex europaeus</i> and Sycamore <i>Acer pseudoplatanus</i> .
S17 TN3	NT 11378 78665	Marginal Vegetation. Through the grassland (TN2) the stream has marginal vegetation which includes abundant Water Forget-me-not <i>Myosotis scorpioides</i> and Great Willowherb <i>Epilobium hirsutum</i> , frequent Angelica <i>Angelica sylvestre</i> , Marsh Marigold <i>Caltha palustris</i> , Water Mint <i>Mentha aquatica</i> , plus occasional Hard Rush <i>Juncus inflexus</i> , Garlic Mustard <i>Alliaria petiolata</i> , Brooklime <i>Veronica beccabunga</i> and Japanese Knotweed <i>Fallopia japonica</i> .
S17 TN4	NT 11301 78575	Ruderal Vegetation. Ruderal vegetation along woodland edge and along a section of the Linn Mill Burn, with Nettle <i>Urtica dioica</i> , abundant Cleavers <i>Galium aparine</i> , Cow Parsley <i>Anthriscus sylvestris</i> , Bramble <i>Rubus fruticosus</i> , Common Hogweed <i>Heracleum sphondylium</i> , Broad-leaved Dock <i>Rumex obtusifolius</i> , Creeping Buttercup <i>Ranunculus repens</i> , Common Sorrel <i>Rumex acetosa</i> and Creeping Thistle <i>Cirsium arvense</i>

Target Note (TN)	Grid Reference	Description
S17 TN5	NT 10896 78345	Broad-leaved Woodland. Woodland of planted origin with some large trees, plus later regeneration and naturalisation to give a closed canopy to 25m dominated by Sycamore <i>Acer pseudoplatanus</i> , with frequent European Lime <i>Tilia x europaea</i> , Sessile Oak <i>Quercus petraea</i> and Wych Elm <i>Ulmus glabra</i> regeneration, plus occasional Yew <i>Taxus baccata</i> , Beech <i>Fagus sylvatica</i> and Ash <i>Fraxinus excelsior</i> . The shrub layer has frequent Holly <i>Ilex aquifolium</i> and Hawthorn <i>Crataegus monogyna</i> , with occasional Rhododendron <i>Rhododendron ponticum</i> . The herb layer has abundant Nettle <i>Urtica dioica</i> and Cleavers <i>Galium aparine</i> , frequent Broad Buckler Fern <i>Dryopteris dilatata</i> , Creeping Buttercup <i>Ranunculus repens</i> , locally frequent Enchanter's Nightshade <i>Circaea lutetiana</i> , and there is much bare ground in deep shade. Occurring occasionally to rarely are Common Figwort <i>Scrophularia nodosa</i> , Common Dog-violet <i>Viola riviniana</i> , Sanicle <i>Sanicula europaea</i> , Lady Fern <i>Athyrium filix-femina</i> , Pignut <i>Conopodium majus</i> , Wood Sorrel <i>Oxalis acetosella</i> , Leopard's-bane <i>Doronicum pardalianches</i> , Three-veined Sandwort <i>Moehringia trinervia</i> and Bluebell <i>Hyacinthoides non-scripta</i> .
S17 TN6	NT 10773 78234	Ruderal Vegetation. The Linn Mill Burn flows between low but steep banks with ruderal and rank vegetation of Nettle <i>Urtica dioica</i> and False Oat-grass <i>Arrhenatherum elatius</i> , and a fragmentary marginal vegetation of Water Forget-me-not <i>Myosotis scorpioides</i> and Great Willowherb <i>Epilobium hirsutum</i> . Along the Burn are scattered , Sessile Oak <i>Quercus petraea</i> , Alder <i>Alnus glutinosa</i> and Hawthorn <i>Crataegus monogyna</i> . The latter section runs through a pasture field where the banks are of grazed improved pasture, before the Burn disappears into a culvert.

Target Note (TN)	Grid Reference	Description
S18 TN1	NT 12998 78191	Broad-leaved Woodland. Tarmac footpath along disused railway line with immature secondary woodland on the slopes of the cutting. Closed low canopy of abundant Ash <i>Fraxinus excelsior</i> and Sycamore <i>Acer pseudoplatanus</i> , with occasional Wych Elm <i>Ulmus glabra</i> and Silver Birch <i>Betula pendula</i> . The shrub layer has abundant Hawthorn <i>Crataegus monogyna</i> , with frequent Elder <i>Sambucus nigra</i> and saplings of Ash and Sycamore, plus occasional Goat Willow <i>Salix caprea</i> . The ground flora varies with shade intensity with woodland herbs, grassy areas and ruderal patches. Ivy <i>Hedera helix</i> is abundant with frequent Broad Buckler Fern <i>Dryopteris dilatata</i> and Wood Avens <i>Geum urbanum</i> , plus occasional Bluebell <i>Hyacinthoides non-scripta</i> , in shaded parts; with abundant Nettles <i>Urtica dioica</i> , Cleavers <i>Galium aparine</i> , Bramble <i>Rubus fruticosus</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> and frequent Garlic Mustard <i>Alliaria petiolata</i> around the margins and in gaps. There are also grassy stretches of Common Bent <i>Agrostis capillaris</i> and Yorkshire Fog <i>Holcus lanatus</i> , grassland with abundant Smooth Meadow-grass <i>Poa pratensis</i> and Cow Parsley <i>Anthriscus sylvestris</i> .
S18 TN11	NT 13011 74717	Scrub. Cutting slopes dominated by Hawthorn <i>Crataegus monogyna</i> with frequent Bramble <i>Rubus fruticosus</i> and occasional small Ash <i>Fraxinus excelsior</i> , Wild Cherry <i>Prunus avium</i> and Goat Willow <i>Salix caprea</i> trees, and occasional Elder <i>Sambucus nigra</i> . Between the shrubs and trees are ruderal patches of Nettle <i>Urtica dioica</i> , Great Willowherb <i>Epilobium hirsutum</i> and Rosebay Willowherb <i>Chamerion angustifolium</i> , plus fragments of species-poor neutral grassland.

Target Note (TN)	Grid Reference	Description
S18 TN12	NT 13883 75325	Mixed Plantation. Closed canopy to 25m with abundant Scots Pine <i>Pinus sylvestre</i> , Corsican Pine <i>Pinus nigra</i> plus frequent Sycamore <i>Acer pseudoplatanus</i> and Ash <i>Fraxinus excelsior</i> , and occasional Larch <i>Larix decidua</i> . The shrub layer is dominated by Snowberry <i>Symphoricarpos alba</i> with locally frequent Hawthorn <i>Crataegus monogyna</i> and occasional Hazel <i>Corylus avellana</i> . The ground flora has patches of Nettle <i>Urtica dioica</i> and Rosebay Willowherb <i>Chamerion angustifolium</i> plus Wood Avens <i>Geum urbanum</i> , Herb Robert <i>Geranium robertianum</i> , Garlic Mustard <i>Alliaria petiolata</i> and Few-flowered Leek <i>Allium paradoxum</i> .
S18 TN16	NT 12643 74153	Ruderal Vegetation. Nettle <i>Urtica dioica</i> dominates a section of cutting with frequent False Oat-grass <i>Arrhenatherum elatius</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> , Creeping Thistle <i>Cirsium arvense</i> and scattered Hawthorn <i>Crataegus monogyna</i> .
S18 TN2	NT 13228 78252	Semi-improved Neutral Grassland. Unmanaged rank sward on steep slope. Abundant Meadow Foxtail <i>Alopecurus pratense</i> , Cock's-foot <i>Dactylis glomerata</i> , False Oat-grass <i>Arrhenatherum elatius</i> , Nettle <i>Urtica dioica</i> , plus frequent Cow Parsley <i>Anthriscus sylvestris</i> , Common Hogweed <i>Heracleum sphondylium</i> and Cleavers <i>Galium aparine</i> .
S18 TN3	NT 13393 78154	Broad-leaved Woodland. Jock's Hole. Closed 20-30m canopy of self-sown woodland over very steep Burn valley. Sycamore <i>Acer pseudoplatanus</i> dominant, abundant Wych Elm <i>Ulmus glabra</i> and Ash <i>Fraxinus excelsior</i> , very locally abundant Scots Pine <i>Pinus sylvestris</i> , and occasional Silver Birch <i>Betula pendula</i> . Amongst abundant lying dead wood is a ground flora with abundant Ivy <i>Hedera helix</i> , Nettle <i>Urtica dioica</i> , Cleavers <i>Galium aparine</i> , Bramble <i>Rubus fruticosus</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> and Lesser Celandine <i>Ranunculus ficaria</i> , plus locally frequent Red Currant <i>Ribes sylvestre</i> , Hart's-tongue Fern <i>Phyllitis scolopendrium</i> , Gooseberry <i>Ribes uva-crispa</i> , Male Fern <i>Dryopteris filix-mas</i> and Sanicle <i>Sanicula europaea</i> .

Target Note (TN)	Grid Reference	Description
S18 TN4	NT 13391 78236	Mixed Plantation. Closed 30m, even-aged canopy of abundant Sycamore <i>Acer pseudoplatanus</i> , Scots Pine <i>Pinus sylvestris</i> , frequent Ash <i>Fraxinus excelsior</i> , plus occasional Wych Elm <i>Ulmus glabra</i> , Beech <i>Fagus sylvatica</i> , Horse Chestnut <i>Aesculus hippocastanum</i> . The shrub layer is scattered with abundant Elder <i>Sambucus nigra</i> and frequent Sycamore saplings. The ground often bare, flora is dominated by Ivy <i>Hedera helix</i> with abundant Nettle <i>Urtica dioica</i> , frequent Gooseberry <i>Ribes uva-crispa</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> and Male Fern <i>Dryopteris filix-mas</i> .
S18 TN5	NT 13741 78273	Mixed Plantation. Closed 30m, even-aged canopy of Beech <i>Fagus sylvatica</i> with frequent Scots Pine <i>Pinus sylvestris</i> . Occasional Elder <i>Sambucus nigra</i> over bare ground in deep shade with frequent Ivy <i>Hedera helix</i> and occasional Broad Buckler Fern <i>Dryopteris dilatata</i> and Male Fern <i>Dryopteris filix-ma</i>
S18 TN6	NT 13919 78130	Broad-leaved Woodland. Immature secondary woodland on embankment slopes of disused railway line. Closed canopy to 20m of self sown poles with abundant Ash <i>Fraxinus excelsior</i> and Sycamore <i>Acer pseudoplatanus</i> , plus frequent Goat Willow <i>Salix caprea</i> , Hawthorn <i>Crataegus monogyna</i> , and Elder <i>Sambucus nigra</i> . The ground often bare, plus locally abundant Nettle <i>Urtica dioica</i> , and frequent Male Fern <i>Dryopteris filix-mas</i> .
S1 TN27	NT 12824 74059	Ruderal Vegetation. Abundant Japanese Knotweed <i>Fallopia japonica</i> , Butterbur <i>Petasites hybridus</i> , Indian Balsam <i>Impatiens glandulifera</i> , Nettle <i>Urtica dioica</i> , Ground Elder <i>Aegopodium podagraria</i> , frequent Creeping Thistle <i>Cirsium arvense</i> , Common Hogweed <i>Heracleum sphondylium</i> and Cleavers <i>Galium aparine</i> . Scattered Osier <i>Salix viminalis</i> , Elder <i>Sambucus nigra</i> , Sycamore <i>Acer pseudoplatanus</i> , Wych Elm <i>Ulmus glabra</i> . Continuous 1m wide marginal Reed Canary-grass <i>Phalaris arundinacea</i> stand.

Target Note (TN)	Grid Reference	Description
S1 TN28	NT 12743 74256	Ruderal Vegetation. Abundant Japanese Knotweed <i>Fallopia japonica</i> , Butterbur <i>Petasites hybridus</i> , Indian Balsam <i>Impatiens glandulifera</i> , Nettle <i>Urtica dioica</i> , Ground Elder <i>Aegopodium podagraria</i> , frequent Creeping Thistle <i>Cirsium arvense</i> , Common Hogweed <i>Heracleum sphondylium</i> and Cleavers <i>Galium aparine</i> . Scattered Osier <i>Salix viminalis</i> , Elder <i>Sambucus nigra</i> , Sycamore <i>Acer pseudoplatanus</i> , Wych Elm <i>Ulmus glabra</i> . Continuous 1m wide marginal Reed Canary-grass <i>Phalaris arundinacea</i> stand.
S1 TN29	NT 12587 74270	Ruderal Vegetation. Abundant Butterbur <i>Petasites hybridus</i> , Nettle <i>Urtica dioica</i> , frequent Indian Balsam <i>Impatiens glandulifera</i> , Common Hogweed <i>Heracleum sphondylium</i> , Russian Comfrey <i>Symphytum x uplandicum</i> , False Oat-grass <i>Arrhenatherum elatius</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> , Creeping Thistle <i>Cirsium arvense</i> , Bramble <i>Rubus fruticosus</i> agg., Hedge Bindweed <i>Calystegia sepium</i> , Raspberry <i>Rubus idaeus</i> , Broad-leaved Dock <i>Rumex obtusifolius</i> . Plus frequent Reed Canary-grass <i>Phalaris arundinacea</i> and Branched Bur-reed <i>Sparganium erectum</i> in river margins. Scattered Elder <i>Sambucus nigra</i> , Hawthorn <i>Crataegus monogyna</i> , Ash <i>Fraxinus excelsior</i> and Willows <i>Salix</i> spp.
S20 TN1	NT 12072 74343	Broad-leaved Woodland. Open 25m canopy dominated by Sycamore <i>Acer pseudoplatanus</i> with frequent Sessile Oak <i>Quercus petraea</i> , Silver Birch <i>Betula pendula</i> , Ash <i>Fraxinus excelsior</i> , Wych Elm <i>Ulmus glabra</i> and, rarely, Scots Pine <i>Pinus sylvestris</i> . Scrub layer has abundant Bramble <i>Rubus fruticosus</i> agg., frequent Elder <i>Sambucus nigra</i> , Sycamore <i>Acer pseudoplatanus</i> saplings plus occasional Ash <i>Fraxinus excelsior</i> saplings and Hawthorn <i>Crataegus monogyna</i> . The ground flora has abundant Wood Meadow-grass <i>Poa nemoralis</i> , Cleavers <i>Galium aparine</i> , frequent Common Hogweed <i>Heracleum sphondylium</i> , False Oat-grass <i>Arrhenatherum elatius</i> , Cock's-foot <i>Dactylis glomerata</i> , Foxglove <i>Digitalis purpurea</i> and Broad Buckler Fern <i>Dryopteris dilatata</i> .

Target Note (TN)	Grid Reference	Description
S20 TN2	NT 11965 74328	Amenity Grassland. Frequently mown grassland dominated by Yorkshire Fog <i>Holcus lanatus</i> with frequent Common Bent <i>Agrostis capillaris</i> , Creeping Buttercup <i>Ranunculus repens</i> and Rough Meadow-grass <i>Poa trivialis</i> . The un-mown edges are dominated by False Oat-grass <i>Arrhenatherum elatius</i> with frequent Common Hogweed <i>Heracleum sphondylium</i> , Bramble <i>Rubus fruticosus</i> agg. and Ash <i>Fraxinus excelsior</i> saplings.
S20 TN3	NT 12007 74313	Marginal Vegetation. Swine Burn. Un-mown edges to Burn dominated by Reed Canary-grass <i>Phalaris arundinacea</i> with locally abundant Great Willowherb <i>Epilobium hirsutum</i> , frequent Ground Elder <i>Aegopodium podagraria</i> , Common Hogweed <i>Heracleum sphondylium</i> , Meadowsweet <i>Filipendula ulmaria</i> , Nettle <i>Urtica dioica</i> , Bramble <i>Rubus fruticosus</i> agg., plus occasional Branched Bur-reed <i>Sparganium erectum</i> , Red Campion <i>Silene dioica</i> and Broad-leaved Dock <i>Rumex obtusifolius</i> .
S20 TN4	NT 11911 74349	Broad-leaved Woodland. Closed 30m canopy including some large trees. Abundant Sessile Oak <i>Quercus petraea</i> , Sycamore <i>Acer pseudoplatanus</i> , Ash <i>Fraxinus excelsior</i> , Wych Elm <i>Ulmus glabra</i> regeneration, and, rarely, Beech <i>Fagus sylvatica</i> . The shrub layer has frequent Hawthorn <i>Crataegus monogyna</i> , Bramble <i>Rubus fruticosus</i> agg., occasional Elder <i>Sambucus nigra</i> and Rowan <i>Sorbus aucuparia</i> . The ground flora is dominated by Ivy <i>Hedera helix</i> with abundant Gooseberry <i>Ribes uva-crispa</i> , frequent Honeysuckle <i>Lonicera periclymenum</i> , Male Fern <i>Dryopteris filix-mas</i> , Cleavers <i>Galium aparine</i> , Nettle <i>Urtica dioica</i> , Wood Avens <i>Geum urbanum</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> and occasional Herb Robert <i>Geranium robertianum</i> . This woodland contains a rock exposure and a waterfall.

Target Note (TN)	Grid Reference	Description
S20 TN5	NT 11808 74494	Broad-leaved Woodland. Closed 20m canopy with abundant mature trees of Sessile Oak <i>Quercus petraea</i> , Ash <i>Fraxinus excelsior</i> , Sycamore <i>Acer pseudoplatanus</i> , plus Wych Elm <i>Ulmus glabra</i> regeneration and occasional Wild Cherry <i>Prunus avium</i> . Common Alder <i>Alnus glutinosa</i> is locally abundant along the outflow channel of the pool. The shrub layer is of frequent Hawthorn <i>Crataegus monogyna</i> , Elder <i>Sambucus nigra</i> and Beech <i>Fagus sylvatica</i> saplings plus occasional Holly <i>Ilex aquifolium</i> . The ground flora has frequent Common Dog-violet <i>Viola riviniana</i> , Broad-leaved Willowherb <i>Epilobium montanum</i> , Wood Meadow-grass <i>Poa nemoralis</i> , Cleavers <i>Galium aparine</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> , Wood Avens <i>Geum urbanum</i> , Male Fern <i>Dryopteris filix-mas</i> , Common Hogweed <i>Heracleum sphondylium</i> and Gooseberry <i>Ribes uva-crispa</i> .
S20 TN6	NT 11814 74436	Standing Water. Pike's Pool. Much of edge is shaded but a few stands of Reed Canary-grass <i>Phalaris arundinacea</i> occur, particularly around the inflow. Also scattered Meadowsweet <i>Filipendula ulmaria</i> . No aquatic plants, bottom dominated by filamentous algae, eutrophied by wildfowl. Contains fish.
S20 TN7	NT 11733 74464	Broad-leaved Woodland. Open scrubby woods of Sycamore <i>Acer pseudoplatanus</i> and Wild Cherry <i>Prunus avium</i> with frequent standing dead Wych Elm <i>Ulmus glabra</i> . Shrub layer of abundant Hawthorn <i>Crataegus monogyna</i> , Elder <i>Sambucus nigra</i> , Bramble <i>Rubus fruticosus</i> agg. and Ash <i>Fraxinus excelsior</i> saplings. Ground flora has abundant Nettle <i>Urtica dioica</i> , Cleavers <i>Galium aparine</i> , Broad-leaved Dock <i>Rumex obtusifolius</i> , Wood Avens <i>Geum urbanum</i> , Common Hogweed <i>Heracleum sphondylium</i> , Creeping Buttercup <i>Ranunculus repens</i> , False Oat-grass <i>Arrhenatherum elatius</i> , Cock's-foot <i>Dactylis glomerata</i> , frequent Red Campion <i>Silene dioica</i> , Herb Robert <i>Geranium robertianum</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> and Common Dog-violet <i>Viola riviniana</i> .

Target Note (TN)	Grid Reference	Description
S20 TN8	NT 11675 74464	Mixed Plantation. Recent plantation to 10m with Silver Birch <i>Betula pendula</i> , Scots Pine <i>Pinus sylvestris</i> , Larch <i>Larix</i> sp., Rowan <i>Sorbus aucuparia</i> , Sycamore <i>Acer pseudoplatanus</i> , Sessile Oak <i>Quercus petraea</i> , Ash <i>Fraxinus excelsior</i> , Wild Cherry <i>Prunus avium</i> and Beech <i>Fagus sylvatica</i> over a sward of Yorkshire Fog <i>Holcus lanatus</i> .
S20 TN9	NT 11946 74253	Broad-leaved Woodland. Steep ground with a mature closed 30m canopy dominated by large Sycamore <i>Acer pseudoplatanus</i> with frequent Ash <i>Fraxinus excelsior</i> , Silver Birch <i>Betula pendula</i> , Sessile Oak <i>Quercus petraea</i> , Wych Elm <i>Ulmus glabra</i> regeneration, and occasional Beech <i>Fagus sylvatica</i> . Shrub layer has frequent Hawthorn <i>Crataegus monogyna</i> , Common Dog Rose <i>Rosa canina</i> , Rowan <i>Sorbus aucuparia</i> , Elder <i>Sambucus nigra</i> , Bramble <i>Rubus fruticosus</i> agg. and Ash <i>Fraxinus excelsior</i> saplings. The ground flora has abundant Wood Avens <i>Geum urbanum</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> , Raspberry <i>Rubus idaeus</i> , frequent Herb Robert <i>Geranium robertianum</i> , Common Dog-violet <i>Viola riviniana</i> , Enchanter's-nightshade <i>Circaea lutetiana</i> , Ground Ivy <i>Glechoma hederacea</i> , Male Fern <i>Dryopteris filix-mas</i> , Cleavers <i>Galium aparine</i> and Ground Elder <i>Aegopodium podagraria</i> .
S5TN1	NT 11236 78819	Intertidal Boulders/Rocks. Rocks with Bladder Wrack <i>Fucus vesiculosus</i> beds attached.
S5TN2	NT 11430 78744	Ruderal Vegetation. Stand of Giant Hogweed <i>Heracleum mantegazzianum</i> where Linn Mill Burn out across the beech.
S5TN3	NT 11433 78753	Strandline Vegetation. Very narrow line of Maple-leaved Goosefoot <i>Chenopodium album</i> and Curled Dock <i>Rumex crispus</i> .
S5TN4	NT 11734 78859	Intertidal Boulders/Rocks. Rocks of harbour wall with Bladder Wrack <i>Fucus vesiculosus</i> beds attached.

Target Note (TN)	Grid Reference	Description
S5TN5	NT 13729 78402	Open Dune. Very narrow fringe of vegetation on sand headed against the sea wall. Has abundant Red Fescue <i>Festuca rubra</i> , frequent Sand Couch <i>Elymus farctus</i> and Orache <i>Atriplex</i> sp. Slightly higher Sweet Cicely <i>Myrrhis odorata</i> and Nettle <i>Urtica dioica</i> become abundant. Rare Species Present: Rare in Vice County: Sand Couch <i>Elymus farctus</i>
S9TN1	NT 13919 78392	Coastal Grassland. Small patch of grassland over rock outcrop. Dominated by Red Fescue <i>Festuca rubra</i> with abundant Common Bent <i>Agrostis capillaris</i> , frequent Cock's-foot <i>Dactylis glomerata</i> , Ribwort Plantain <i>Plantago lanceolata</i> , White Clover <i>Trifolium repens</i> , Ground Elder <i>Aegopodium podagraria</i> , Dandelion <i>Taraxacum officinale</i> agg., Coltsfoot <i>Tussilago farfara</i> , Cow Parsley <i>Anthriscus sylvestris</i> , Creeping Buttercup <i>Ranunculus repens</i> and Daisy <i>Bellis perennis</i> . Scattered Sycamore <i>Acer pseudoplatanus</i> , Wych Elm <i>Ulmus glabra</i> , Ash <i>Fraxinus excelsior</i> and Hawthorn <i>Crataegus monogyna</i> .
TN1	NT 09560 74031	Union Canal. Open water with marginal and emergent vegetation – Reed Sweet-grass <i>Glyceria maxima</i> and Meadowsweet <i>Filipendula ulmaria</i> dominant with rank bankside vegetation composed of Nettle <i>Urtica dioica</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> , Ground-elder <i>Aegopodium podagraria</i> , Cock's-foot <i>Dactylis glomerata</i> and Common Bent <i>Agrostis capillaris</i> .
TN10	NT 12179 78313	Echline Community Woodland. Small area of planted native broadleaf trees, less than 5m height, and shrubs, with small raised beds of native wildflowers. Species include Downy Birch <i>Betula pubescens</i> , Gean <i>Prunus avium</i> , Blackthorn <i>Prunus spinosa</i> , Rowan <i>Sorbus aucuparia</i> and Scots Pine <i>Pinus sylvestris</i> . Natural ground flora is species poor with False Oat-grass <i>Arrhenatherum elatius</i> , Ground-elder <i>Aegopodium podagraria</i> and Bramble <i>Rubus fruticosus</i> agg..
TN11	NT 12173 78165	Area of scrub within housing estate and amenity grassland. Exotic shrubs, birch <i>Betula</i> spp and cherry <i>Prunus</i> spp, with a large mound of rough grassland left in the middle of the area

Target Note (TN)	Grid Reference	Description
TN12	NT 13001 78238	Amenity grassland with scattered Ash trees in middle of the town
TN13	NT 13215 78104	Small urban park with ornamental cherry trees and exotic shrubs. Little wildlife interest except for small tits and finches
TN14	NT 10824 77037	Small stand of Scots Pine <i>Pinus sylvestris</i> , dead Elm <i>Ulmus</i> sp and Hawthorn <i>Crataegus monogyna</i> . Abundant Nettle <i>Urtica dioica</i> in ground flora.
TN15	NT 12480 77239	Shelterbelt at Newbiggin Farm. Mature broadleaf plantation woodland with Sycamore <i>A. pseudoplatanus</i> dominant, Pedunculate Oak <i>Q. robur</i> occasional. Poor shrub layer with Elder <i>S. nigra</i> and Sycamore saplings. Very disturbed and enriched ground flora. Some dead wood.
TN16	NT 13051 77952	50m section of the Ferry Burn, culverted at either end with another small culvert in the middle section. Substrate consists of gravels and silt. Canopy consists of Sycamore <i>Acer pseudoplatanus</i> with Wych Elm <i>Ulmus glabra</i> with shrub layer of Hawthorn <i>C. monogyna</i> and Elder <i>Sambucus nigra</i> . Bluebells <i>Hyacinthoides non-scripta</i> in the ground layer. This margin is very narrow and is confined to the sloping bankside, with close-mown amenity grassland immediately adjacent.
TN17	NT 13764 77746	Area of scattered Hawthorn <i>Crataegus monogyna</i> scrub between community centre and new housing development. Includes a section of amenity grassland planted up with whips in Tuley tubes.

Target Note (TN)	Grid Reference	Description
TN18	NT 13049 77711	200m section of the Ferry Burn, hemmed in by housing and amenity grassland. Substrate is gravels and silt, with culverts and assorted rubbish. Mature Sycamore <i>A. pseudoplatanus</i> canopy along the burn edge with Wych Elm <i>Ulmus glabra</i> with Hawthorn <i>C. monogyna</i> and Elder <i>S. nigra</i> shrub layer. Disturbed ground layer with Ground-elder <i>Aegopodium podagraria</i> and Nettle <i>Urtica dioica</i> abundant. A triangular section of broadleaf woodland opens out upstream of a small path crossing the burn. Composed of Pedunculate Oak <i>Quercus robur</i> and Sycamore <i>A. pseudoplatanus</i> canopy, Hawthorn <i>C. monogyna</i> and Elder <i>S. nigra</i> shrub layer. The ground layer of this part consists of some wet hollows with Soft Rush <i>Juncus effusus</i> , Broad leaved Dock <i>Rumex obtusifolius</i> Creeping Buttercup <i>Ranunculus repens</i> and Meadowsweet <i>Filipendula ulmaria</i> . The drier ground layer is disturbed with ruderal vegetation
TN19	NT 13818 77166	Triangular section of broadleaf woodland adjacent to wooded lane. Canopy dominated by Sycamore <i>A. pseudoplatanus</i> with occasional Pedunculate Oak <i>Quercus robur</i> . Well developed shrub layer with abundant Hazel <i>Corylus avellana</i> , with Holly <i>Ilex aquifolium</i> and Elder <i>S. nigra</i> . Ground layer was very damp with a carpet of Lesser Celandine <i>Ranunculus ficaria</i> . Wood Dock <i>Rumex sanguineus</i> , Bluebell <i>H. non-scripta</i> and Common Dog-violet <i>Viola riviniana</i> also present. Dead wood frequent, both standing and fallen. A pair of Buzzards <i>Buteo buteo</i> were disturbed overhead, but no evidence of a nest in this stand of trees.
TN23	NT 10573 76845	Small area of broad-leaved woodland. Ash <i>Fraxinus excelsior</i> and Sycamore <i>Acer pseudoplatanus</i> dominant, underplanted with Rowan <i>Sorbus aucuparia</i> and Gean <i>Prunus avium</i> . Ground layer enriched with Nettle <i>Urtica dioica</i> abundant. Bluebell <i>Hyacinthoides non-scripta</i> present
TN24	NT 10007 76501	2 stands of Japanese Knotweed <i>Fallopia japonica</i> on roadside verge, opposite cottages.

Target Note (TN)	Grid Reference	Description
TN25	NT 13396 76702	Birchwood dominated by Downy Birch <i>Betula pubescens</i> with Common Lime <i>Tilia x vulgaris</i> along the boundary. Understorey with <i>Rhododendron ponticum</i> abundant. Enriched ground flora with Nettle <i>Urtica dioica</i> , Ground-elder <i>Aegopodium podagraria</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> and Bramble <i>Rubus fruticosus</i> agg. Good structural diversity in areas not dominated by <i>R. Ponticum</i> , with both fallen and standing dead wood and natural regeneration filling the gaps in the canopy.
TN26	NT 13793 76735	Wet grassland. Improved grassland which has been left to diversify naturally. Species poor with Soft Rush <i>Juncus effusus</i> , Common Bent <i>Agrostis capillaris</i> , Creeping Bent <i>Agrostis stolonifera</i> , and Creeping Buttercup <i>Ranunculus repens</i> abundant, with Cock's-foot <i>Dactylis glomerata</i> and Rough Meadow-grass <i>Poa trivialis</i> . Scattered Grey Willow scrub <i>Salix cinerea</i> agg. developing. Fairly rank and nutrient rich, it is surrounded by intensively managed farmland and is part of a network of less intensively managed areas connected by scrub woodland and rough grass corridors.

Target Note (TN)	Grid Reference	Description
TN27	NT 13404 76471	Woodland strip composed of Hybrid Larch <i>Larix x eurolepis</i> , Pinus sp and Sycamore <i>Acer pseudoplatanus</i> . Well structured understorey with Elder <i>Sambucus nigra</i> and Wych Elm <i>Ulmus glabra</i> frequent, and occasional Hazel <i>Corylus avellana</i> and apple <i>Malus</i> sp. Enriched ground flora of Nettle <i>Urtica dioica</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> , Ground-elder <i>Aegopodium podagraria</i> and Bramble <i>Rubus fruticosus</i> agg., with a remnant woodland flora in the deeper parts of the wood; Male Fern <i>Dryopteris Felix-mas</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> , Common Dog-violet <i>Viola riviniana</i> , Wood Avens <i>Geum urbanum</i> and Lesser Celandine <i>Ranunculus ficaria</i> . Abundant standing and fallen dead wood present. <i>Rhododendron ponticum</i> is frequent throughout. The strip expands to the west in the northern section of the wood and has open glades with wet hollows, with Sallow <i>Salix caprea</i> and Meadowsweet <i>Filipendula ulmaria</i> in patches, with Common Bent <i>Agrostis capillaris</i> , Creeping Bent <i>Agrostis stolonifera</i> and Rough Meadow-grass <i>Poa trivialis</i> .
TN28	NT 13508 76099	Broadleaf woodland. Sycamore <i>Acer pseudoplatanus</i> dominant with Pedunculate Oak <i>Quercus robur</i> frequent. Abundant <i>Rhododendron ponticum</i> in the shrub layer. Ground flora enriched, with Nettle <i>Urtica dioica</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> , Ground-elder <i>Aegopodium podagraria</i> and Cleavers <i>Gallium aparine</i> , with Common Bent <i>Agrostis capillaris</i> and Rough Meadow-grass <i>Poa trivialis</i> . Contains both standing and fallen dead wood.
TN29	NT 13996 76887	Strip of rough, semi-improved grassland with scattered Hawthorn <i>Crataegus monogyna</i> and occasional Wych Elm <i>Ulmus glabra</i> , with planted cherry <i>Prunus</i> sp present. Pedunculate Oak <i>Quercus robur</i> and Ash <i>Fraxinus excelsior</i> at northern end of the strip. Ground layer with Common Bent <i>Agrostis capillaris</i> , Red Fescue <i>Festuca rubra</i> , Smooth Meadow-grass <i>Poa pratensis</i> , Ribwort <i>Plantain</i> <i>Plantago lanceolata</i> , Germander <i>Speedwell</i> <i>Veronica chamaedrys</i> and Crosswort <i>Galium cruciata</i> .

Target Note (TN)	Grid Reference	Description
TN35	NT 10090 75960	Swine Burn - turbid, with steep banks. Appears canalised with ruderal bank vegetation composed of Nettle <i>Urtica dioica</i> , Ground-elder <i>Aegopodium podagraria</i> and Rosebay Willowherb <i>Chamerion angustifolium</i> . Surrounding woodland strip composed of Sycamore <i>Acer pseudoplatanus</i> , Elder <i>Sambucus nigra</i> and Hawthorn <i>Crataegus monogyna</i> . Ground layer of semi-improved grassland.
TN36	NT 10165 75845	Muriehall Wood. Conifer plantation composed of pines <i>Pinus</i> sp, half of which has been felled and replanted with native broad-leaved species. Section north of the track is broad-leaved woodland Downy Birch <i>Betula pubescens</i> and willow <i>Salix</i> sp suffering from windthrow due to removal of conifers. The southern, unfelled, section is mixed plantation with Scots Pine <i>Pinus sylvestris</i> and Sycamore <i>Acer pseudoplatanus</i> . Abundant <i>Rhododendron ponticum</i> in eastern side of the wood. The ground layer is composed of abundant Broad Buckler Fern <i>Dryopteris dilatata</i> , and Male Fern <i>Dryopteris filix-mas</i> , with Wood Sorrel <i>Oxalis acetosella</i> , Common Dog-violet <i>Viola riviniana</i> and Ramsons <i>Allium ursinum</i> . Fallen dead wood present but little standing dead wood.
TN37	NT 10403 75787	Embankment of semi-improved grassland with scattered Bracken <i>Pteridium aquilinum</i> and broadleaf trees; Sycamore <i>Acer pseudoplatanus</i> dominant with Hawthorn <i>Crataegus monogyna</i> and poplar <i>Populus</i> sp, and occasional Pedunculate Oak <i>Quercus robur</i> . Common Bent <i>Agrostis capillaris</i> , Red Fescue <i>Festuca rubra</i> , Tufted Hair-grass <i>Deschampsia cespitosa</i> and Cock's-foot <i>Dactylis glomerata</i> in the ground layer.
TN38	NT 10559 75788	Carmelhill Thicket. Former conifer plantation felled and replanted with native broadleaf species. <i>Rhododendron ponticum</i> frequent in the shrub layer. Ground layer is rank with Tufted Hair-grass <i>Deschampsia cespitosa</i> , Soft Rush <i>Juncus effusus</i> and Bramble <i>Rubus fruticosus</i> agg. A stand of Scots Pine <i>Pinus sylvestris</i> and Hybrid Larch <i>Larix x eurolepis</i> has been retained on the eastern edge.

Target Note (TN)	Grid Reference	Description
TN39	NT 10853 75801	Carmelhill Wood. A stand of broadleaf woodland which includes a disused reservoir. Canopy is composed of Sycamore <i>Acer pseudoplatanus</i> and Ash <i>Fraxinus excelsior</i> . Shrub layer consists of Hawthorn <i>Crataegus monogyna</i> and Elder <i>Sambucus nigra</i> with occasional Holly <i>Ilex aquifolium</i> . Sycamore <i>A. pseudoplatanus</i> and Ash <i>F. Excelsior</i> saplings coming through the shrub layer. There has been some underplanting with native broadleaf species. Ground layer has Tufted Hair-grass <i>Deschampsia cespitosa</i> , Common Bent <i>Agrostis capillaris</i> , Primrose <i>Primula vulgaris</i> , Bluebell <i>Hyacinthoides non-scripta</i> , Red Campion <i>Silene dioica</i> , Hedge Woundwort <i>Stachys sylvatica</i> and Foxglove <i>Digitalis purpurea</i> . There is a substantial amount of enriched or disturbed soil with Nettle <i>Urtica dioica</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> , White Dead-nettle <i>Lamium album</i> , Creeping Thistle <i>Cirsium arvense</i> and Bramble <i>Rubus fruticosus</i> agg. A section near the road has been used as a tip and is covered in ruderal vegetation, and some planting of ornamental varieties of bluebell, primrose and daffodil has taken place. The reservoir itself has improved grassland with Sycamore <i>A. pseudoplatanus</i> planted around the perimeter.
TN4	NT 11475 78721	Small patch of Japanese Knotweed <i>Fallopia japonica</i> next to the road.
TN40	NT 10940 75697	Humbie Quarry. Sheer rock faces arising straight out of what is apparently deep water. There is very little aquatic or marginal vegetation. A pair of Tufted Duck <i>Aythya fuligula</i> were noted. The woodland composition changes to mixed wood to the south of the quarry with mature coniferous species interspersed in the canopy.

Target Note (TN)	Grid Reference	Description
TN41	NT 10485 75452	Humbie Reservoir. Artificial loch stocked for a local fishing club. Marginal vegetation consists of Yellow Flag Iris <i>pseudacorus</i> , Meadowsweet <i>Filipendula ulmaria</i> , Watercress <i>Rorippa nasturtium-aquaticum</i> , Lesser Spearwort <i>Ranunculus flammula</i> , Soft Rush <i>Juncus effusus</i> , Hard Rush <i>Juncus inflexus</i> and Reed Sweet-grass <i>Glyceria maxima</i> , Creeping Bent <i>Agrostis stolonifera</i> , with occasional Marsh Marigold <i>Caltha palustris</i> and Cuckoo Flower <i>Cardamine pratensis</i> . In the upper reaches of the loch are extensive, dense stands of Mare's-tail <i>Hippuris vulgaris</i> almost completely covering the surface. An extensive algal bloom was present in the lower section of the loch. The loch supported a pair of Mute Swans with 7 cygnets, 3 pairs of Coots and 10+ Mallards. Bankside vegetation is rank, composed of Nettle <i>Urtica dioica</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> , Creeping Thistle <i>Cirsium arvense</i> , and Broad-leaved Dock <i>Rumex obtusifolius</i> .
TN42	NT 10809 75484	A former mining spoil heap with a thicket of mature scrub woodland, composed of Hawthorn <i>Crataegus monogyna</i> and Elder <i>Sambucus nigra</i> , with Whin <i>Ulex europaeus</i> and Bramble <i>Rubus fruticosus</i> agg. on the more open areas. Good structural diversity.
TN43	NT 13814 75830	Craig Brae. Exposed rock outcrop covered in dense scrub; Whin <i>Ulex europaeus</i> , Hawthorn <i>Crataegus monogyna</i> , Elder <i>Sambucus nigra</i> , with some Ash <i>Fraxinus excelsior</i> , Sycamore <i>Acer pseudoplatanus</i> and Gean <i>Prunus avium</i> woodland.
TN5	NT 11287 78751	Mixed plantation woodland, nearing maturity. Canopy layer with Sycamore <i>Acer pseudoplatanus</i> and Hybrid Larch <i>Larix x europaeus</i> dominant. Shrub layer with Elder <i>Sambucus nigra</i> dominant, Holly <i>Ilex aquifolium</i> and Wych Elm <i>Ulmus glabra</i> occasional. Ground layer enriched, with Nettle <i>Urtica dioica</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> and Bramble <i>Rubus fruticosus</i> . Remnant woodland flora along edges with Dogs Mercury <i>Mercurialis perennis</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> , Herb-Robert <i>Geranium robertianum</i> and Garlic Mustard <i>Alliaria petiolata</i> , with Common Bent <i>Agrostis capillaris</i> and Rough Meadow-grass <i>Poa trivialis</i> .

Target Note (TN)	Grid Reference	Description
TN6	NT 11069 78280	Neglected plantation woodland. Sycamore <i>Acer pseudoplatanus</i> dominant with Beech <i>Fagus sylvatica</i> abundant. Pedunculate Oak <i>Quercus robur</i> and Scots Pine <i>Pinus sylvestris</i> present. Poor understorey with Elder <i>Sambucus nigra</i> occasional and <i>Rhododendron ponticum</i> frequent. Ground layer enriched or bare under Beech shade, with Nettle <i>Urtica dioica</i> , Ground-elder <i>Aegopodium podagraria</i> and Raspberry <i>Rubus idaeus</i> .
TN64	NT 12309 74534	A large garden which has been neglected for a number of years. Sycamore <i>Acer pseudoplatanus</i> dominant in the canopy with Hawthorn <i>Crataegus monogyna</i> , Elder <i>Sambucus nigra</i> , Hazel <i>Corylus avellana</i> and ornamental cherries <i>Prunus</i> sp. There is a shaded burn running through this woodland, connecting it with a small area of broadleaf woodland and amenity grassland over the road. Woodland composed of Silver Birch <i>Betula pendula</i> , Hazel <i>Corylus avellana</i> and cherries <i>Prunus</i> sp
TN65	NT 12770 74371	Allotments. Hedges, long grasses, introduced shrubs providing a diversity of habitats between town and intensively managed countryside.
TN66	NT 12996 74219	Garden nursery with very diverse landscape of amenity grassland, hedges, shrubs and trees, many of which are non-native but all together provide a variety of ecological niches in an intensively agricultural landscape.
TN67	NT 12019 74021	Niddrie Burn. Good flow rate, gravel/stone substrate with riffles and pools. No emergent or marginal vegetation, with tall ruderal bankside vegetation: Nettle <i>Urtica dioica</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> , Creeping Thistle <i>Cirsium arvense</i> , Creeping Buttercup <i>Ranunculus repens</i> , Ground-elder <i>Aegopodium podagraria</i> . The burn has a well developed shrub and tree layer along the bank, with Hawthorn <i>Crataegus monogyna</i> , Bramble <i>Rubus fruticosus</i> agg. and Dog Rose <i>Rosa canina</i> agg. in the shrub layer, with Sycamore <i>Acer pseudoplatanus</i> , Alder <i>Alnus glutinosa</i> and willow <i>Salix</i> sp as mature canopy. There is a significant amount of litter deposited along the stream bed.

Target Note (TN)	Grid Reference	Description
TN68	NT 13222 74101	Broadleaf plantation woodland with some conifer species. Sycamore <i>Acer pseudoplatanus</i> dominant in the canopy but has been underplanted in the past with Silver Birch <i>Betula pendula</i> , Beech <i>Fagus sylvatica</i> , Copper Beech <i>Fagus sp</i> , Rowan <i>Sorbus aucuparia</i> and Whitebeam <i>Sorbus aria</i> agg. Understorey developing with Elder <i>Sambucus nigra</i> dominant, plus Hazel <i>Corylus avellana</i> and Hawthorn <i>Crataegus monogyna</i> frequent. Introduced shrubs are frequent in the understorey. The ground layer has Bluebell <i>Hyacinthoides non-scripta</i> plus other exotic bluebell species, daffodils <i>Narcissus spp</i> , Lesser Celandine <i>Ranunculus ficaria</i> , Broad Buckler Fern <i>Dryopteris dilatata</i> , Pink Purslane <i>Montia sibirica</i> , Foxglove <i>Digitalis purpurea</i> and Red Champion <i>Silene dioica</i> . There is little dead wood. A pair of Buzzards <i>Buteo buteo</i> were disturbed while surveying.
TN7	NT 12532 78635	Area of neutral grassland with dense scrub under the Forth Road Bridge. Red Fescue <i>Festuca rubra</i> (d) with Cock's-foot <i>Dactylis glomerata</i> (a) and Ribwort Plantain <i>Plantago lanceolata</i> (a). Other species included Creeping Thistle <i>Cirsium arvense</i> , Tufted Vetch <i>Vicia cracca</i> , Garlic Mustard, Red Clover <i>Trifolium repens</i> , Herb Robert <i>Geranium robertianum</i> , along with Nettle <i>Urtica dioica</i> , Rosebay Willowherb <i>Chamerion angustifolium</i> , Ground-elder <i>Aegopodium podagraria</i> . Scrub included Hawthorn <i>Crataegus monogyna</i> , Elder <i>Sambucus nigra</i> , Bramble <i>Rubus fruticosus</i> agg., Whin <i>Ulex europaeus</i> , Broom <i>Cytisus scoparius</i> .
TN8	NT 12868 78389	Small area of allotments within the heart of the town. Scrub, rough grass, small hedges providing structural diversity.
TN9	NT 12179 78313	Area of rough semi-improved neutral grassland with broadleaf woodland situated between main road and housing estate. Woodland composed of Ash <i>Fraxinus excelsior</i> with Wood Avens <i>Geum urbanum</i> and Cow Parsley <i>Anthriscus sylvestris</i> in the ground layer. Well used by small songbirds and small children.

Groundtruthing Phase 1 Target Notes

Target Note	Description
1	Construction activities for M9 Extension
2	Lost due to M9 construction works
3	Loss of Semi-improved grassland due to M9 extension works
4	Tall ruderal
5	Hedge
6	Watercourse
7	Tall Ruderal boundary
8	Variety of Birds singing; Blue Tit, Wren, Bullfinch
9	Bat potential
10	Area of Scattered Scrub
11	Japanese Knotweed recorded
12	Wall
13	Ephemeral/short perennial
14	Broad leaved Semi-natural woodland with hedge parallel to road A111
15	Mature trees with bat potential
15	Species poor, improved grassland
16	Scattered Scrub (A22)
17	Scattered Scrub (A22)- Continuous along the length of the road
18	Neutral Grassland
19	Dense/Continuous Scrub
20	Watercourse
21	Broad leaved woodland plantation
22	Broad leaved woodland plantation
23	Hedge & Wall
24	Hedge
25	Hedges line track

D6 LANDSCAPE

D6.1 INTRODUCTION

The following section considers the potential impacts of the four crossing options and their associated infrastructure on the landscape resource of the study area.

In accordance with good practice and the requirements of STAG Part 2 Appraisal the assessment of landscape effects has been undertaken following the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 5, taking into account the Supplementary Guidance for Landscape and Visual Assessment by the Scottish Executive (February 2002) and with reference to the Guidelines for Landscape and Visual Impact Assessment (GLVIA), published by the Landscape Institute and the Institute of Environmental Management and Assessment in 2002.

The landscape appraisal of the four options has involved a review of published documentation (including development plans, Ordnance Survey mapping, aerial photographs and data on conservation interests in the study area) combined with site surveys in order to describe and evaluate the existing components, character and quality of the landscape of the study area. A review of the Scottish Natural Heritage (SNH) Landscape Character Assessments for Fife and the Lothians has also been undertaken with particular consideration given to the landscape areas and types within 5km either side of each of the four alignment options. Site survey and the associated analysis of the landscape was restricted to an area extending up to 3km from each of the alignment options, as these are the areas within which all significant landscape impacts are likely to occur. This area is hereinafter referred to as the study area.

D6.2 IMPACT CRITERIA

The main criteria used to evaluate the potential impact on landscape character comprise the following:

- The extent to which existing landscape components and features would be lost or modified by the proposals (such as lost woodland or modified landform);
- The existence of the proposed form of development within the landscape and its current role as a determinant of existing character; and
- The extent to which new or additional development of the type proposed would alter the balance and hence perception of the landscape character of the area development.

Impact can be detrimental for example, where features or key characteristics such as established planting, old buildings or structures have to be removed.

Alternatively it can prove beneficial for example, where derelict buildings or poorly maintained landscape features are repaired, replaced and maintained or there is the introduction where appropriate, of new tree planting and a landscape structure where none currently exists.

Account has been taken of the effect that any mitigation measures, typically planting or landform are likely to have in minimising potentially detrimental impacts or improving the landscape composition of the area.

The appraisal findings are represented using a descriptive scale ranging from major - moderate - minor adverse through neutral to an ascending scale of minor - moderate – major beneficial.

Explanation of the impact ratings is provided in Table D6.1 below:

Table D6.1: Landscape Significance Criteria

Type of Impact	Rationale for Assessment of Significance
Major Adverse Impact	<ul style="list-style-type: none"> ▪ The proposals are at considerable variance with the landform, scale and pattern of the landscape; ▪ They are likely to degrade, diminish or even destroy the integrity of a range of characteristic features and elements or their setting; ▪ They would be substantially damaging to a high quality or highly vulnerable landscape; and ▪ They are in serious conflict with policy for the protection of nationally recognised countryside.
Moderate Adverse Impact	<ul style="list-style-type: none"> ▪ The proposals are out of scale with the landscape, or at odds with the local pattern and landform; ▪ Mitigation would not prevent the scheme from scarring the landscape in the longer term as some features of interest would be partly destroyed or their setting diminished; and ▪ They are in conflict with policy for the protection of nationally recognised countryside.
Minor Adverse Impact	<ul style="list-style-type: none"> ▪ The proposals do not quite fit the landform and scale of the landscape; and ▪ They cannot be substantially mitigated for because of the nature of the proposal itself or the character of the wider landscape.
Neutral Impact	<ul style="list-style-type: none"> ▪ The proposals are well designed to complement the scale, landform and pattern of the landscape; ▪ They incorporate measures for mitigation to ensure that the scheme would blend in well with surrounding landscape features and elements;

	<p>and</p> <ul style="list-style-type: none"> They avoid conflict with national policies towards protection of the countryside.
Minor Beneficial Impact	<ul style="list-style-type: none"> The proposals fit well with the scale, landform and pattern of the landscape; They incorporate measures for mitigation to ensure they would blend in well with the surrounding landscape.
Moderate Beneficial Impact	<ul style="list-style-type: none"> The proposals significantly enhance the form and pattern of the landscape; and They further national objectives to regenerate degraded countryside.
Major Beneficial Impact	<ul style="list-style-type: none"> The proposals constitute a major restructuring and enhancement of a degraded landscape.

Impacts of moderate and above have been considered significant, as this is the level at which the changes to the landscape would be clearly perceived. The assessment year has been taken as year fifteen after scheme completion.

Limitations of the Appraisal

The assessment of effects on the landscape has been undertaken by a combination of desk and field survey. The appraisal has been based on the outline engineering design presented in Volume 2 which for the purposes of this study, forms the basis upon which the appraisal and indicative landscape mitigation is founded.

Detail on the extent and scale of earthworks including the horizontal and vertical alignments of the road works is not currently known and has not therefore informed or been included in the appraisal.

For the purposes of this appraisal, it has been assumed that where a tunnel runs under a designated landscape feature such as a Garden and Designed Landscape, there would be no resulting impact on the integrity of the designation.

D6.3 KEY ISSUES

Overview

The study area comprises some very diverse landscape types largely resulting from the unique geological processes which underpin the landscape and the resulting agricultural and mineral wealth which first attracted settlement to the area. The current landscape of the area centred around the Firth of Forth reflects this combination of human and geological influences and forms a distinctive character marked by volcanic outcrops, intricate shorelines

and wide sweeping views across the Forth. Hills to the north and south of the firth form a backdrop for views within the area, as well as providing long distance elevated views across the firth. The rail and road bridges in particular are a strong focus for views within the study area and are an important, iconic landmark for Edinburgh, the Lothians and Fife as well as Scotland as a whole.

Landscape Designations

The landscape designations identified in the Dunfermline and West Fife, Rural West Edinburgh and Edinburgh City local plans are illustrated in the relevant drawings contained within Volume 2 and include:

- Gardens and Designed Landscapes (GDL);
- Area of Great Landscape Value (AGLV);
- Area of Outstanding Landscape Quality (AOLQ);
- Greenbelt; and
- Tree Preservation Orders (TPO).

Gardens and Designed Landscapes

The Lothians and to a slightly lesser extent Fife are richly endowed with designed landscapes and formal gardens, which collectively and individually, have a significant influence on the landscape character of the area. The Inventory of Gardens and Designed Landscapes held by SNH identifies the Lothians as having one of the highest concentrations of such features in Scotland. The list is not comprehensive and there are many sites which also make an important contribution to the landscape of the study area. The most important feature of these designed landscapes are the deciduous woodland belts, which form prominent features in the wider landscape, providing a strong spatial structure considerably influencing the character of the landscape. Also of significance are the parklands and mature parkland trees, boundary walls and architectural features including large estate houses, lodge houses, gates and bridges. Visual linkages between neighbouring policies are another important aspect where external 'borrowed' landscapes feature in the composition of views from within an estate.

There are ten nationally designated GDLs identified on the Inventory which fall within the study area and include the following:

- Donibristle Bay (Fife);
- Fordell Castle (Fife);
- Pittencrief Park (Fife);

- St Colme House (Fife);
- Dalmeny (West Edinburgh) – Tunnel Crossing E would tunnel below the GDL;
- Dundas Castle (West Edinburgh) – Tunnel crossing E would directly affect the GDL and Bridge crossing D and Tunnel crossing D would run less than 500m to the west of the GDL;
- Craigiehall (West Edinburgh);
- Hopetoun House (West Lothian and West Edinburgh) – Tunnel crossing C and D would tunnel underneath the GDL and Bridge crossing D would run within 500m to the east of the GDL;
- House of the Binns (West Lothian); and
- Newliston (West Edinburgh).

A summary description of the above ten GDLs and their key characteristics and importance is contained in Annex D6.1

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Areas of Great Landscape Value / Areas of Outstanding Landscape Quality

In the local plans covering the study area, areas designated for their exceptional landscape quality are generally referred to as Areas of Great Landscape Value (AGLVs). The Rural West Edinburgh Local Plan (2003) refers to Areas of Outstanding Landscape Quality (AOLQ). AGLVs and AOLQs are essentially the same; they are not a statutory designation but are intended to highlight areas of outstanding landscape quality (locally) which should be safeguarded locally from inappropriate development. Within the study area there are three AGLVs (on the north shore Cullaloe Hills/The Binn and Broomhall/Bellknowes west of Rosyth and on the south shore, Forth Shore) and five AOLQs (Dalmeny Estate, Dundas Estate, Newliston, Cammo and Humble/Carmelhill).

The only AGLV to be directly affected would be Broomhall/Bellknowes west of Rosyth where Tunnel Crossing C would encroach on the eastern periphery.

Greenbelt

Under local plan policy, the local landscape character of greenbelt designated land is to be protected, maintained and enhanced. Within the study area the greenbelt stretches from Dundas Castle to the south west of the existing road and rail bridges to Dalmeny and Craigiehall in the east. Bridge Crossing D and Tunnel Crossing E would run through greenbelt designated land.

Tree Preservation Orders

There are four Tree Preservation Orders (TPOs) within the study area, which lie out with the boundaries of protected areas and are as follows:

None of these TPOs would be affected by any of the four crossing options.

Landscape Character

Scottish Natural Heritage, in conjunction with partner Councils, has undertaken detailed review and classification of the various landscape areas and types of landscape in Scotland. The north section of the study area is covered by Fife Landscape Character Assessment, dated 1999 (Review Number 113) and the southern section by the Lothians Landscape Character Assessment, dated 1998 (Review Number 91).

North of the Forth

The Fife Landscape Character Assessment divides Fife into nineteen distinctive Landscape Character Types. The key features and characteristics which make each of the landscape types distinctive are identified and described. The study area of the four alignment options includes six different landscape character types and their key characteristics and features are identified below⁶.

Pronounced Volcanic Hills and Craigs

Key characteristics and features of the above landscape character type are as follows:

- Conspicuous, pronounced, often distinctive and recognisable hills or hill ranges sometime protruding high above the lowlands or extending the Uplands of Foothills so defining the edge of the other landscape types and the extent of views across the lowlands;
- Important as backdrops to other landscape types;
- Distinctive shapes, silhouettes and skylines, with recognisable shapes, peaks and slopes;
- The evidence of active natural systems and processes e.g. weathering and erosion.
- Burns, often in gullies or folds or narrow glens;
- Woodlands, steadings and other buildings well-related to landform;
- Farmsteadings and other individual buildings and structures and the lack of villages or larger settlements;

⁶ D.Tyldesley and Associates (1999). Fife landscape character assessment. Scottish Natural Heritage Review. No 113.

- Evidence of ancient human settlement with historical and archaeological features visible;
- The presence of occasional point features, contributing to the identity of some landscape units;
- The presence of numerous small quarries, most now discussed and well screened but some large, exposed quarries that detract from the landscape character;
- The combination of steep sided, rugged, open landform and land cover on the hills, and the shallower, smoother, more vegetated and more intensively used lower slopes;
- Medium to large-scale, open, simple, sloping, curved, quiet and balanced landscapes with smooth or varied textures and muted colours; and
- Some extensive views across other landscape types.

Lowland Hills and Valleys

Key characteristics and features of the Lowland Hills and Valleys landscape character type are as follows:

- The variety and subtlety of landform;
- The open, regular farmland patterns of medium-scale fields of arable and grasslands;
- The variable pattern of post and wire fences and mostly tall hedges with hedgerow trees;
- The extensive areas of plantations, shelter planting, roadside planting and policies linked to large estates;
- The regular often linear pattern of the distribution of steadings and larger settlements and towns all of which are generally well related to the landscape;
- The network of roads often well related to landform;
- Other dominant linear and point features of plantations and tree groups, individual trees or local buildings;
- A generally tended, safe, quiet, balanced and calm landscape, but also a busy, random, disturbed and noisy one in the more urban, industrialised areas;
- The variety of interrelated middle and long distance views of, from and across the low hills; and

- The variety, continuity maturity and subtlety of the landscape with its long history of settlement.

Tunnel Crossing E would fall within this landscape character type.

Coastal Hills

Key characteristics and features of the Coastal Hills landscape character type are as follows:

- Close association with the coast, either through views of the sea, the Firths or the estuaries or indirect coastal experiences of sounds, smell, etc.;
- Predominantly large, open, undulation arable fields, often with no field boundaries or with mainly wire fences, low hedges or some stone dykes and little other vegetation cover;
- Isolated farms and extended or converted farmsteads amongst open, exposed fields;
- Extensive seaward views across the North Sea or the Firths and land beyond, but generally views to landward are contained by hills in the near distance;
- Distinctive edges to the character type, created either by distinct breaks of slope or by rivers, roads, built development or the Coastal Cliffs or Braes;
- General lack of tree cover, with relatively few plantations and shelterbelts;
- Some pasture and rough hill grazing on the poorer hill soils;
- Infrequent, small, often exposed and conspicuous settlements of stone or white or pale colourwashed render and grey roofs and single story or two story houses with small windows to the sea; and
- Generally a simple, sloping, balanced, active, organised, tended, farming landscape with regular or geometric patterns.

All four options would directly affect this landscape character type.

Coastal Braes

Key characteristics and features of the Coastal Braes landscape character type are as follows:

- The high, steep, wooded, rounded braes;
- The narrow platforms of land at the foot of the braes;
- The small, linear, traditional, bright and colourful coastal settlements;

- The narrow, sinuous coastal roads and steep, narrow roads down folds in the braes from the Coastal Hills;
- The peninsulas and wider areas of the small raised beaches which remain open, undeveloped, recreational areas;
- The maritime, navigation, boating infrastructure and features typical of coastal villages;
- The lime kilns built into the braes and associated industrial archaeology;
- The Coastal Braes are a small-scale, diverse, colourful, balanced, usually active or busy landscape which is semi-natural in character on the wooded slopes but semi-urban and organised on the land at the foot of the braes; and
- Views are important, they are confined when looking landwards and so views tend to be seawards where they are of a vast scale, across the Firth of Forth.

Coastal Flats

Key characteristics and features of the Coastal Flats landscape character type are as follows:

- Flat low-lying, open, large-scale, exposed coastal landscapes at sea level;
- Intensively cultivated, geometrically laid out, large to medium-scale, predominantly arable fields or forestry plantations with rectilinear, fenced enclosures or without enclosure;
- A variety of other land uses, particularly industrial and other built developments, golf courses and other grasslands;
- The slight sinuous or angular roads raised above the fields with stone dykes or open sides;
- Isolated, scattered or regularly spaced farmsteads, conspicuous due to lack of screening, in contrast to the designated landscapes which are well screened by policy planting and shelterbelts;
- Straight ditches, sea walls and flood banks with small bridges;
- Several point features of interest that are conspicuous in the flat landscape;
- A coastal landscape where the character is always influenced by the sea and can be particularly affected by the weather conditions and views of the sky and the sea;

- The wide range of landscape experiences depending on the particular landscape unit and the weather condition; typically dominated either by the area of development or the coast;
- Away from the urban areas and forestry plantations it is a large-scale, open (and high winds very exposed), simple, flat, balanced landscape with varied textures and colours and slow movement; in the plantations it is a small-scale, confined, uniform, tended, very calm and sheltered landscape with straight lines, simple patterns and little variation in colours or textures;
- Seaward views are invariably extensive and may be extensive across the Flats themselves; and
- Landward, views are generally towards the Cliffs, Braes, Coastal Hills or Coastal Terraces.

The Firth of Forth

Key characteristics and features of the Firth of Forth are as follows:

- A very large-scale, flat, horizontal and natural landscape dominated by the weather conditions and the colour of the sea and the sky and the movement of waves;
- The many off-shore islands;
- The navigation and shipping artefacts on the water;
- The frequent but very slow movements of vessels of a variety of types;
- A maritime landscape where the character is always influenced by the sea and can be particularly affected by the weather conditions and views of the sky and the sea;
- The effects of lights reflecting on the Firth at night;
- The Forth Rail and Forth Road Bridges; and
- Often a calm, bright, colourful and smooth, exposed landscape with extensive views.

Other than Bridge Crossing D, none of the other options would directly affect this character type.

South of the Forth

The Lothians Landscape Character Assessment divides the Lothians into seven broad landscape character types within which a further twenty six detailed Landscape Character Areas are identified. The document provides a description of each of the Landscape Character Areas, their positive and

negative attributes and key strategic aims and guidelines for each. The four route options fall within two landscape character types – Coastal Margins and Lowland Plains. The Coastal Margins landscape type is characterised primarily by its close proximity to the Firth of Forth. The landscape is generally flat with slight undulations although raised beaches and dunes may feature. Arable farmland, including Class 1 Agricultural Land dominates the landcover however this is interrupted by an urban strip stretching from Silverknowes in North West Edinburgh to Prestonpans in the East. The Lowland Plains landscape type is characterised also by the predominance of arable farmland forming plains in the heart of the region which is divided into sections by the Pentland Hills and Edinburgh City. Within each of these landscape character types there are a further two landscape character areas. Character Area 26, “Linlithgow / Queensferry Farmlands” covers the majority of the route options, however, more peripheral sections of route infrastructure fall within Character Area 21, “Lower Almond Farmlands”.

Linlithgow / Queensferry Farmlands

This character area is classified by arable lowland terrain separated with clipped or overgrown hedgerows or lines of ash, oak and sycamore trees, interspersed with ridges and hills on the border of the Firth of Forth. The hills formed by igneous rocks merge to the south of Linlithgow to form the Bathgate Hills and to the east of Queensferry to form the Mons Hills.

The shoreline to the west of the Forth Bridges is characterised by a progression of mudflats, wooded slopes and areas of raised beach extending from the waters edge. East of the bridges the coastline consists of a series of small rocky headlands which accumulate to form Hound Point.

The Union Canal and Linlithgow loch are the two prominent inland water features within this character area although there are a number of smaller ponds associated with designed landscapes. Estate landscapes feature highly in this area as does the busy transport network.

The positive attributes relevant to the study area include:

- Rolling Terrain with some prominent igneous outcrops;
- Significant woodland cover, concentrated mainly within several major private estates;
- Well-maintained hedgerows and field boundaries;
- Predominant agricultural character;
- Diversity of coastal scenery and habitats; and
- Views of the Forth and its bridges.

The negative attributes relevant to the study area include:

- Dense transport route network, with further routes including possible second Forth Road bridge proposed;
- Threat from further residential/industrial expansion linked to possibility of second Forth Road bridge; and
- A few prominent remaining oil-shale bings.

It identifies the key strategic aim of this character area as conserving prevailing rural character.

Tunnel Crossing D would directly affect this character area.

Lower Almond Farmlands

Forming part of the Lothians lowland plain, this character area is a matrix of predominantly arable farmland which slopes to a height of 246m in the south providing expansive views of the surrounding landscape. The land is divided by clipped or overgrown hedgerows, fences or stone walls interspersed with areas of good quality pastureland and rural dwellings. The west of Edinburgh is largely developed and the extensive transport network, pylon lines, bings and quarries extends into this character area fragmenting integrity of the farmland.

The positive attributes relevant to the study area include:

- Rural matrix of predominantly arable farmland;
- Subtle topographic and woodland features; and
- Surviving strong field enclosure elements.

The negative attributes relevant to the study area include:

- Multiple urban expansion pressures, leading to significant cumulative impacts;
- Continuing road corridor extension pressures; and
- Prominent quarrying and landfill impacts.

It identifies the key strategic aim of this character area as to prevent further fragmentation of predominantly rural character.

All of the four options would affect this character area.

D6.4 APPRAISAL OUTCOME

The potential impact on landscape character has been considered for each crossing option. The extent to which the four different options would affect the existing landscape character varies substantially depending on the individual components of each scheme option and the capacity of the existing landscape to absorb these components. It should be noted that the character of the Firth of Forth and the coastal fringe landscapes is very dependant on atmospheric and weather conditions with relatively frequent haars and low cloud substantially changing the experience and character of the landscape.

The main sources of landscape impact associated with the crossing options would be as a result of the new road construction connecting the crossings with the existing road network, road upgrades including widening, re-profiling and junction alterations, tunnel and portals, the bridge structure and toll plazas (if required).

Mitigation measures associated with the reduction of potential adverse impacts on landscape character would involve detailed consideration of the vertical and horizontal alignment of the new roads, junction arrangements and tunnel portals during development of the scheme design and would include the following mitigation measures and objectives:

- Achievement of best fit with the contours;
- Retention and best use of existing vegetation;
- Protection for nearby properties through the use of existing features such as landform or existing planting;
- Avoidance where possible of the loss or damage to landscape features such as specimen trees, hedges, water features; and
- Avoidance where possible of the loss or damage to sites of ecological or archaeological interest.

The key principles of the landscape mitigation measures would include:

- Any new planting should be carefully considered to integrate with the local landscape character whilst meeting the design objectives of the scheme and making a positive contribution to the biodiversity and nature conservation value of the area. It is anticipated that this would primarily require the use of native species; and
- Landscape planting, earthworks (mounding and earth shaping) and other mitigation measures where appropriate to minimise the visual impact of the scheme and enhance the existing local landscape character and structure.

The above mitigation commitments have been considered during the assessment process and are reflected in the appraisal of overall permanent effects.

TUNNEL C

Tunnel Crossing C does not directly affect any designated landscapes although it runs beneath or adjacent to a number of designated features. The construction compound areas do, however, directly affect a number of designated areas including the AGLV to the west of Rosyth and Hopetoun House AGLV.

The northern tunnel portal and new section of road alignment would run immediately adjacent to the AGLV to the west of Rosyth and would potentially have minor impacts on the setting of the AGLV although its integrity is unlikely to be affected. On the south shore, the tunnel would run beneath Hopetoun House GDL, AGLV and Country Park with the southern portal and associated infrastructure within one kilometre to the south of the GDL/AGLV. Dundas Castle GDL, AOLQ and Country Park lies within two kilometres to the north east of the southern portal and new road and junction. Newliston GDL and Country Park lies approximately two kilometres to the south of the M9 tie in with Humber Reservoir AOLQ less than one kilometre east of the junction tie in with the M9. However, the setting of these designated landscapes on the south shore is unlikely to be affected by the proposed works.

The proposed junction alignment to the north of the Forth would sever the attractive matrix of rolling arable farmland with boundary hedgerow and tree planting features being lost. The alternative road alignment to the north east of Limekilns would result in the loss of a swathe of deciduous woodland planting which forms an attractive landscape feature. It would also result in the loss of some mature specimen oak trees which extend along the field boundary and access road to Blackhall Farm. The fairly extensive structure planting which currently exists around the grade separated junction and effectively reduces the mass of the junction in the townscape would also be lost.

The portal and newly connecting road infrastructure to the south of the Forth would lie in a relatively contained section of the landscape with the existing M9 motorway corridor to the immediate north and a band of woodland planting around the railway and the Union Canal to the south. The works would be seen in proximity to the existing infrastructure which combined with the fairly limited road works would further minimise impacts on the landscape.

The construction compounds for the tunnel shaft and portal to the north of the Forth would involve the temporary loss of gently undulating arable farmland and the permanent loss of sections of hedgerow, tree and woodland scrub planting. The shaft compound area falls within an AGLV. The construction compound area for the tunnel portal to the south of the Forth would occupy a large area of gently undulating arable land. The shaft compound area would avoid the woodland planting along the foreshore but would directly abut the north-west boundary of Hopetoun House GDL. Long term impacts on the setting of the GDL are unlikely.

Overall impacts on the landscape character of the area affected by Tunnel Crossing C are considered to be Moderate Adverse.

BRIDGE D

This option would involve the introduction of a third bridge crossing the Forth to the immediate west of the existing road bridge. Associated road improvements to the north of the Forth would mainly involve widening of the existing infrastructure combined with a number of junction improvements and a new junction interchange to the east of Rosyth and north of Inverkeithing. The infrastructure requirements to the south of the Forth would be more extensive with new junction arrangements, the toll plaza (if required) and an extensive section of new road to connect with the M9.

This option would not directly affect any designated landscapes although a short section of the new road alignment to the south of the toll plaza (if required) would fall within a peripheral section of greenbelt designated land. A number of AGLVs and GDLs lie within one to two kilometres of the road works to the north of the Forth, however, the setting of these designated areas is unlikely to be affected. To the south of the Forth the toll plaza (if required) and new road alignment would run in close proximity to both Hopetoun House and Dundas Castle GDLs as well as a further two AOLQs. Impacts on the setting of Dundas Castle GDL is unlikely, however, the historic setting of Hopetoun House GDL would be affected by this crossing option. The designed vista extending from the house and along the drive would be impacted with the introduction of a third bridge crossing with resultant Moderate Adverse impacts on the historic setting of the GDL. Potential Minor Adverse impacts on the setting of the AOLQs are possible as well as on views from Dalmeny and Dundas Castle GDLs.

The character of the Firth of Forth is strongly influenced by the existing bridges which form a prominent focus to views throughout the coastal fringe landscape. The introduction of a third bridge structure has the potential to affect this. The proposed bridge crossing option would be taller than both the existing bridges and has the potential to dominate the current visual relationship between the road and rail bridges. A further bridge structure could increase the influence of the bridges on the landscape and decrease the apparent scale of the Firth. When viewed from longer distances the scale of the Firth would probably not be compromised by a third structure, however, from closer viewpoints the apparent scale could appear reduced and dwarfed by the presence of a third bridge structure. Depending on the how the bridges are viewed within the landscape the visual relationship of the existing bridges can appear harmonious although in some more oblique views it can appear more discordant. The introduction of a third bridge is likely to exacerbate the potential for incompatible views and visual conflict between the structures.

The additional infrastructure works associated with the bridge to the north of the Forth would involve the introduction of a prominent new junction and

associated loss of a large section of attractive ancient woodland along the foreshore to the east of St Margaret's Hope. This is an important landscape feature which combined with the visually significant ridge line, creates a positive contribution to the landscape structure of the north shore and the setting of North Queensferry and the road bridge. The widening improvements to the existing sections of road to the north of the existing bridge would result in the loss of roadside planting although in the majority of locations this could be reinstated. The proposed new junctions and associated road alignments to the north of Inverkeithing whilst not as extensive as those proposed for Tunnel Crossings D and E would nonetheless create prominent structures within the landscape and further sever the open valley landscape.

To the south of the Forth the toll plaza (if required) and new road and junction layout would form a prominent structure within an open landscape with the additional loss of some of the boundary tree and hedgerow planting from the periphery of the site. The extensive band of woodland planting to the south of the marina, which currently contributes to the extensive wooded shoreline typical of the southern foreshore connecting the various designed landscapes, would also be lost. The introduction of approximately two and half kilometres of new road would further increase the prominence of transport corridors within this relatively open landscape further fragmenting the integrity of the rolling farmland typical of the area. A number of landscape features would be lost including roadside planting particularly around the planted embankments of the M9, as well as along some of the minor roads. Field boundaries would be severed with the loss of hedgerows, isolated trees and shelterbelt planting. The cluster of properties around Toley Wells would be severed by the road proposals with the demolition of at least one of the properties. A further property would become severed by one of the new junctions with the M9 with the new interchange to the north east of Winchburgh creating a major structure within the relatively open valley landscape. Mitigation planting would help to partially integrate the new road corridor into the landscape, however, it would still remain a prominent linear feature.

The construction compounds on the north shore around the existing dockyard area would generally be viewed in relation to the industrial character of Rosyth dockyard which forms a prominent feature along the north shore of the Firth. A further construction compound has been identified at Buckhaven which is a former oil rig construction yard. Temporary impacts on landscape character are therefore considered to be minimal at all of these locations.

Two construction compounds have been identified on the south shore, one of which would occupy the land at Port Edgar marina and the second on rising agricultural land on the western edge of South Queensferry. Both of these sites would result in significant temporary impacts on the local landscape character.

It is considered that a new bridge structure and extensive section of new roadway has the potential to substantially change the character of the Firth of

Forth and its hinterland with the potential for Major to Moderate adverse impacts.

TUNNEL D

Tunnel Crossing D would directly affect Humble Reservoir AOLQ as the toll plaza (if required) and new road tie in with the M9 would dissect it creating a significant impact on the integrity of this local landscape designation. Hopetoun House, Dundas Castle and Newliston GDLs all lie within one to two kilometres of the new infrastructure works to the south of the Forth. It is unlikely, however, that the setting of these GDLs would be affected by the works. The portal construction compound does lie within Hopetoun House AGLV and immediately abuts the boundary of the GDL. Direct temporary impacts on the AGLV and indirect impacts on the setting of the GDL are likely although long term impacts as a result of the tunnel shaft are unlikely to be significant.

Extensive new infrastructure is proposed as part of this option with resulting significant impacts on the character of the landscape both to the north and south of the Forth. The new roads and junction improvements to the north of the Forth would result in the introduction of prominent structures into the open valley landscape to the north of Inverkeithing and further severance of scrub woodland and grassland which currently separates the existing bridge road network from the western edge of Inverkeithing. Whilst the existing landscape comprises a number of infrastructure corridors and to a certain extent some of the junction improvements would relate to these, the introduction of further linear routes and prominent junction structures would further fragment the landscape particularly in the more open valley areas. Pockets of woodland planting would also be lost including scrub woodland around the site for the tunnel portal as well as roadside planting and more extensive hedgerow and boundary tree planting, all of which provide structure to the existing landscape framework. The new road network would also result in the demolition of two properties and a number of commercial premises.

The tunnel portal construction to the south of the Forth would result in significant earthworks which would appear relatively incongruous with the existing landscape structure. A swathe of woodland planting would be lost to the south of the toll plaza (if required) which forms part of the AOLQ along with boundary planting associated with various roads, water courses and fields. As with the infrastructure works to the north of the Firth the introduction of a grade separated junction and associated linear corridors would further fragment the integrity of the landscape.

The construction compound associated with the northern tunnel portal comprises arable land which rises steeply to the south. Significant levelling of the ground would be required which would have considerable impact on the local landscape character. The construction site for the shaft would occupy an area of made ground to the west of St Margaret's Hope which is largely open

with some colonising scrub planting and peripheral woodland scrub. This site would appear as a continuation of the industrial nature of this section of the north shore landscape associated with Rosyth dockyard to the west with resulting minimal temporary impacts.

Due to the substantial area of cut required to form the southern tunnel portal an extensive area of gently rolling agricultural land would be required during construction further extending the influence of the works on the landscape. The construction site for the shaft lies within Hopetoun House AGLV and abuts the GDL. It comprises arable land gradually rising to a high point in the site before falling to the European Technology Park to the north. Temporary indirect effects on the setting of Hopetoun House GDL would result although these would not be significant in the long term.

Overall impacts on the landscape character of the area affected by Tunnel Crossing D are considered to be Major to Moderate Adverse.

TUNNEL E

Tunnel Crossing E would directly affect Dundas Castle GDL (and AOLQ), a designation of national landscape importance and would pass through a section of greenbelt designated land. The construction compound for the southern shaft would also immediately abut Dalmeny GDL and AOLQ.

Infrastructure works associated with the tunnel to the north of the Forth would be extensive with various new junctions and roads proposed. Impacts on the landscape would be similar to Tunnel Crossing D above but would be more extensive with greater fragmentation of the landscape and the introduction of a number of prominent junction arrangements which would be out of keeping with the existing landscape structure of open arable fields interspersed with hedgerow planting. Whilst a number of linear features extend along the valley floor such as a road and railway corridor the new road alignment to connect the tunnel with the M90 would run against the linearity of the valley and would consequently appear to be more incongruous and obtrusive. The area around both of the northern tunnel portal options would be particularly prominent as they would appear either within the open valley landscape of agricultural fields and hedgerow planting or within the more steeply rising valley slopes to the north. Extensive bands of woodland planting generally associated with higher ground on the valley sides form important landscape features which would generally remain intact.

The infrastructure to the south would result in the loss of woodland planting both within the designed landscape of Dundas Castle as well as a band of woodland planting through which the tunnel portal and toll plaza (if required) would cut to the north east. The new road and junction arrangement would result in the loss of a section of the historic planting including a section of tree planting which probably formed part of the original approach to the house along the South Drive as well as an area of planting which would have once

formed part of the 'Great Park'. A section of the stone boundary wall would also be lost and views would be opened up from the house with the new junction forming a prominent element and focus to the designed vistas from the house. The proposed infrastructure works associated with this crossing option would have a Major Adverse impact on the integrity of the designed landscape and on its wider landscape setting.

The construction compound for the northern tunnel shaft would occupy sections of the northern shore with the portal construction sites covering an extensive area of open arable land within the valley which would result in significant temporary impacts. The construction compound for the southern shaft would occupy an area of arable land with pockets of mature tree planting and intermittent hedgerow boundary planting. The areas of mature tree planting should be protected during construction along with the more integral sections of hedgerow planting along some of the field boundaries. The setting of Dalmeny GDL is unlikely to be affected by the proximity of the compound area although there could result temporary minor indirect impacts.

Overall impacts on the landscape character affected by Tunnel Option C are considered to be Major Adverse as a result of the direct impacts on the nationally important designated landscape of Dundas Castle.

D6.5 SUMMARY

Table D6.2 below summarises the potential temporary and permanent impacts that each of the four options are considered to have on the landscape character.

Table D6.2 - Summary of Assessment

Proposal	Overall Effects	Temporary	Overall Effects	Permanent
Corridor C - Tunnel	Moderate Adverse	to Major	Moderate Adverse	
Corridor D - Bridge	Major Adverse		Moderate Adverse	Major to Moderate Adverse
Corridor D - Tunnel	Major Adverse		Moderate Adverse	Major to Moderate Adverse
Corridor E - Tunnel	Major Adverse		Moderate Adverse	Major Adverse

Overall, all of the four options are considered to have significant permanent impacts on the landscape resource of the study area with Tunnel Crossing E and Tunnel and Bridge Crossing D the most significant. Bridge Crossing D has the potential to result in Major to Moderate Adverse impacts due to the introduction of a third bridge crossing and the fragmentation of the landscape

as a result of the introduction of the extensive section of new road and the associated demolition of residential properties. Similarly Tunnel Crossing D would result in fragmentation of the landscape and the loss of residential and commercial premises. Impacts associated with Tunnel Crossing E have the potential to be Major Adverse as a result of the direct impacts on Dundas Castle GDL, a landscape resource of national importance.

ANNEX D6.1 – GARDENS AND DESIGNED LANDSCAPES

The following section provides a summary of the ten Inventory designated Gardens and Designed Landscapes (GDL) which fall within the study area. The summaries below are presented geographically in relation to their location, north or south of the Firth.

FORDELL CASTLE

Fordell Castle (Date of Inclusion: 2005)

National Grid: NT 147 855

Council Area: Fife

Access: There are no formal access arrangements

Importance of Site (Values)

Work of Art: High

The parkland landscape with contrived 'natural' planting and the walled Castle gardens, remodelled in the late 19th/early 20 centuries and noted as exemplars of their time, give this site high value as a Work of Art.

Historical: Outstanding

The recorded, complex, multi-period landscape history of Fordell gives it outstanding Historical value. It is a prominent example of one of the ornamental designed landscapes in Fife, associated with a coastal estate, where wealth was derived from coal mining.

Horticultural: Some

The parkland trees and woodland provide some Horticultural Value

Architectural: Outstanding

The site has outstanding Architectural value due to the presence of Fordell Castle and Fordell Chapel, Category A listed buildings.

Scenic: Outstanding

The prominent perimeter woodlands and topography ensure that the policies are highly visible and contribute strongly to the landscape character of the area. Thus the site is of outstanding Scenic value.

Nature Conservation: Outstanding

Fordell has outstanding Nature Conservation interest due to its valuable habitats supporting diverse flora and fauna. The woodlands are Ancient Woodland of plantation origin, where red squirrels have been recorded. Brown long-eared and pipistrelle bats have also been found.

Archaeological: High

The Fordell waggonway earthworks, surviving from the exploitation of the Cuttlehill coalpits and leading from them to St David's Coal Harbour, give this site high Archaeological value.

Description:

“An early 19th century landscape design by Thomas White, Jnr. (1764-1836) incorporating a 16th century castle, gardens, early 18th century designed landscape and industrial complex. It is a multi-period landscape of some complexity and includes the archaeological remains of the Fordell waggonway, first established in 1756.”

Fordell Castle is situated 4.8km (3miles) east of Dunfermline and has a highly distinctive landscape stretching between the M90 and the sandstone Cullaloe Hills to the east. The castle looks northwards from a raised garden terrace over the Fordell Burn and along a lime avenue east, other views are enclosed and restricted by gardens.

The surrounding parkland including the site of the old Fordell House boasts extensive views, aided by ha-ha's, towards Dalgety Bay and the Firth of Forth and can be viewed from the A921.

The Fordell estate consists of numerous listed buildings including the Castle itself, Chapel, Vantage Farm, Coach House and Ravenscraig Castle amongst others. The walled garden to the west of the Castle is surrounded in part, on the eastern side by a stone and brick lined wall, the other walls are now incomplete. The garden is now used for a commercial nursery and caravan park. Plantation woodland is present on the site of the old Fordell House and there are extensive policy woodlands, mixed woodlands and commercial plantations. The surrounding castle grounds are split from north to south by a large yew hedge 25ft high and 11ft thick. The gardens to the north of the castle are very elaborate and to the east are a bowling lawn, raised garden terraces and shaped beds. To the west of the hedge consists of circular flower beds and a rose garden.

DONIBRISTLE

Donibristle (Date of Inclusion: 1987)

National Grid: 65 NT 165 888

Region: Kingdom of Fife

Council Area: Fife

Parish: Dalgety

Access: There are no formal access arrangements

Importance of Site (Values)

Work of Art: None

The designed landscape has mostly vanished; it has no value as a Work of Art today.

Historical: High

The recorded history of the site dates back to the Abbots of St. Colme and it is most interesting for its connections with the Earls of Moray.

Horticultural: None

There is nothing of any Horticultural value left.

Architectural: Outstanding

The grounds provide the setting for a Category A building.

Scenic: Little

As most of the estate has been obliterated by modern housing development, this obscures any views of the house. It does provide a little interest from its immediate surroundings on the foreshore.

Nature Conservation: None

Areas of Nature Conservation interest are confined to the Firth rather than the site itself

Description:

“Formerly an impressive late 18th century Thomas White landscape, the designed landscape is all but lost to housing development.”

Donibristle House is situated on the north shore of the Firth of Forth, 5km (3 miles) to the west of Aberdour. The 18th century house was set in a valley at the north end of Donibristle Bay and faced south-east with fine views across the Firth.

So little remains of the original design and so much of the former tree cover has been lost due to a fire in 1592, that it is important to keep the remaining trees which are presently unmanaged. There are plans to rebuild the main house and to restore the service wings and this would provide an opportunity to restore the shrubbery in the immediate environs of the house. The remaining mixed deciduous woodland gardens vary in age between 20 - 100 years old and some over 170 years of age.

Little remains of any original garden. Remaining walls of the walled garden lie to the north-west of the house, which now enclose a shops, car park and pub. The north-west section of the wall however still houses a stable.

Rose beds enclosed by box hedges and a few shrubbery plants are all that remain of the terraced garden in the front terrace court yard. However, a yew and sweet chestnut are still both standing and aged about 200 years old.

PITTENCRIEF PARK

Pittencrieff Park: (Date of Inclusion: 1987)

National Grid: 65 NT 085 870

Region: Kingdom of Fife

Council Area: Fife

Parish: Dunfermline

Access: A public park, open daily

Importance of Site (Values)

Work of Art: High

The designs commissioned for Pittencrieff Park in the 1900s by Mawson and Geddes and presented in book form to the Carnegie Dunfermline Trust were implemented in part and give this site high value as a Work of Art.

Historical: Outstanding

The associations with Andrew Carnegie give this site outstanding historical value.

Horticultural: Some

The Rock Garden contains some interesting plants and good accession records are now kept up.

Architectural: Outstanding

The designed landscape provides the setting for an A listed house and there are many other interesting Architectural Features in the Park.

Scenic: Some

Views of the Park from the surroundings are limited by the Park walls but the Glen is an attractive feature so near to the town centre.

Nature Conservation: Little

The park has a little Nature Conservation value, mainly due to its nature trail educational value.

Description:

“Gifted to the people of Dunfermline by Andrew Carnegie in 1903, the layout and features of Pittencrieff Park have included design work by Patrick Geddes, Thomas Mawson and Robert Lorimer”

The 31ha (76 acres) of Pittencrieff Park is situated on the west side of the town of Dunfermline. Pittencrieff House is set in the centre of the Park just south of the Tower Hill with extensive views to the south. The layout of the Park has remained basically the same since it became a public park in 1903 with the addition of the park buildings, ornamentation and pathways.

The former parks are now regularly mown grass complete with a network of paths connecting the entrances to the aviary, pavilion and children’s paddling pool and playground.

The stables have been demolished and replaced with Italian Gardens and a rock garden to the west of the house is under the care of a five year development plan to replace some of the plants and improve the paths and access to the garden. The focal point of the formal garden, west of the house, is the ‘Ambition’ statue laid out with lawn, island beds and stone flags.

In 1973 the tropical houses, which originally replace the glasshouse (1913), were themselves replaced by the Floral House, a large range of hothouses.

The Laird’s Garden a former kitchen garden is today laid out as formal gardens with manicured lawns and bedding plants.

‘The Glen’, the local name for the Tower Burn glen has been landscaped with rockwork and steps as well as a Japanese garden and a small summerhouse. Although the design of the water cascades still remain, the water flow in the burn has reduced and the plants have become overgrown with weeds.

ST COLME

St Colme (Date of Inclusion: 2005)

National Grid: NT 183 844

Region: Kingdom of Fife

Council Area: Fife

Parish: Aberdour

Access: There are no formal access arrangements

Importance of Site (Values)

Work of Art: Outstanding

The planting combines with the natural landform and long-distance panoramic views to give this site outstanding value as a Work of Art.

Historical: High

The recorded history of the site gives it high Historical value.

Horticultural: Some

The mixed deciduous policy planting gives the site some horticultural value.

Scenic: High

St Bridget's Church in association with the Category B and Category C listed buildings gives this site outstanding architectural value. The assessment also takes account of the historical relationship of the grounds to Donibristle House.

Scenic: High

The site is significant in contributing to the landscape character on this section of the Forth shore and the coastal settlements of Dalgety Bay and Aberdour. Views of the estate from the Forth and its role as open green space in a densely built up and expanding urban area, give the site high scenic value.

Nature Conservation: Some

The site's coastal situation provides some Nature Conservation Interest.

Archaeological: High

The site has high archaeological potential and interest due to its proximity to Inchcolm Priory.

Description:

“The early 19th-century parkland landscape comprises a significant part of the former Donibristle estate and has long been associated with it. The St Colme landscape comprises the eastern approaches to Donibristle House, and is one of a number of important designed landscapes along the south Fife coast. The landscape design is of high quality.”

St Colme House is situated on the Donibristle estate, between Aberdour and Dalgety Bay on elevated ground overlooking Barnhill Bay, with extensive views over the Firth of Forth to Edinburgh and the Lothian coast. St Colme house and its grounds consist of a category A church, category B coachhouse, walled gardens and gate lodge. The north entrance gate and doocot are listed C. Scheduled Ancient Monuments are also present.

St Colme House itself is a category B listed building built in c.1845 from random rubble.

The surviving drives remain a strong, well-preserved feature of the St Colme House designed landscape. However, the east drive successfully exploits views over the Firth of Forth and along the Fife coast. The parkland planting has been cleverly executed to enhance the outline of ridges or hills viewed from this drive.

On the west of St Colme House are 18th century formal parks, once associated with Dalgety House and Gardens. Towards the end of the 18th century the layout of the parkland was formalised with the introduction of planting belts and clumps.

The woodland planting of mixed deciduous trees around St Colme in clumps and belts along ridges creates a striking impact. It also provides welcomed shelter from the wind it experiences due to its elevated position above the Firth of Forth.

St Colme House sits within an open lawn, part of a variety of gardens together with a modern rockery and walled garden dating back to 1836.

DALMENY

Dalmeny (Date of Inclusion: 1987)

National Grid: 65 NT 168 780

Region: Edinburgh and the Lothians

Council Area: City of Edinburgh

Access: Open seasonally

Importance of Site (Values)

Work of Art: Outstanding

The present designed landscape has outstanding value as a Work of Art both historically and in its present form.

Historical: Outstanding

Dalmeny has outstanding Historical value in view of its connections with the Primrose family since the 17th century and the good historical records of the development of the landscape since that time.

Horticultural: Some

The woodland garden and arboretum have some Horticultural value in their present form.

Architectural: Outstanding

The designed landscape provides the setting for category A listed buildings and thus has outstanding Architectural value.

Scenic: Outstanding

The designed landscape has outstanding Scenic value due to its scale and situation on the shores of the Firth of Forth.

Nature Conservation: Outstanding

The Forth Bridge/Crammond Coast SSSI is important for its intertidal mudflats for overwintering wildfowl, and for the geological exposures of the Carboniferous oil shales group and the basaltic sills. The site has outstanding value for Nature Conservation

Description:

“A beautiful design composition dating from the 17th century which makes a major contribution to the surrounding scenery and in views from the other side of the Firth of Forth. Dalmeny is also outstanding in its architectural and nature conservation values.”

Dalmeny is situated in the Edinburgh Green Belt on the shore of the Firth of Forth some 11.5 km (7 miles) to the west of Edinburgh. The former A90 from Cramond Bridge which is now the B924, and the A90 dual carriageway linking the city with the Forth Road Bridge, form the south-western boundary of the policies. The River Almond forms the south-eastern boundary, flowing into the Firth of Forth at Cramond. It covers nationally designated land including Greenbelt, SPA and SSSI.

The 740ha (1,829 acres) of designed landscape around the Dalmeny estate dates back to c.1770 century and consists of the main Dalmeny house and several out buildings including gate lodges, chapel and a walled garden, all of which are listed. The extensive parkland within the estate was set out in the early 19th Century however the total area is broken up by the presence of Long Established Plantation Woodland and shelter strips. Tree clumps are also present throughout and along the main driveway of the house to Dalmeny Village.

Throughout the estate there are extensive ha-ha wall systems and a 9-hole golf course that extends to the shore of the Firth of Forth. To the west of the arboretum, established by the 5th Earl of Rosebery, lies the four acre south-facing walled garden surrounded by four walls 20 feet high.

DUNDAS CASTLE

Dundas Castle (Date of Inclusion: 2001)

National Grid: NT 115 775

Region: Edinburgh and the Lothians

Council Area: City of Edinburgh

Access: There are no formal access arrangements.

Importance of Site (Values)

Work of Art: High

The picturesque layout of the policies and gardens at Dundas give this site high value as a Work of Art.

Historical: Outstanding

The known development of the landscape, together with the ground evidence supported by documentary detail, give this site outstanding Historical value.

Horticultural: Little

The planting at Dundas which includes trees from the 18 century, and 19 century conifers, provides some Arboricultural value.

Architectural: Outstanding

As the setting for a Category A listed building and other architectural features, including the remarkable 17 century fountain sundial, Dundas has outstanding Architectural value.

Scenic: High

The views into the woodland and park of Dundas give this estate high Scenic value.

Nature Conservation: High

The variety of habitat types within this landscape ' woodland, parkland, cultivated ground and water ' give Dundas high Nature Conservation.

Archaeological: Outstanding

The wealth of early recorded features, including the 17 century walled gardens, give Dundas outstanding Archaeological value.

Description:

“A significant, well-documented 18th century landscape remodelled in the 19th century. The 19th century picturesque landscape, incorporating 18th century features, is still largely intact with notable picturesque walks and views around the loch”.

Situated to the west of the A8000, 1km south of South Queensferry, Dundas Castle sits on 110m north-east facing slopes with extensive views over the Firth of Forth and towards the Forth Bridges. The views extend along the ridge of Dundas Hill over to the Pentland Hills, south of Edinburgh and Lily Loch.

The Dundas estate dates back to c.1120 with a 1424 castle tower house and 1818 Gothic Mansion. The castle itself is a Category A listed building with many of the out-buildings also of listed status including the Stable Court, Renaissance Fountain Sundial, Ice house and Walled Garden The Old Dundas Castle and Sundial are listed as Scheduled Ancient Monuments.

Features such as a renaissance fountain with sundial dating back to early 17th Century suggests the presence of elaborate gardens, however there is little information remaining regarding the Renaissance garden. Additional garden features such as the 18th Century pleasure garden and bowling green and early 19th Century Walled Garden have been neglected over the years and are now overgrown. Extensions of the boundaries imposed during the 19th Century are still present today in the form of Long Established Plantation Woodland.

Dundas Castle is partially screened from the public road to the east by two lines of deciduous trees planted across the parkland in the late 19th Century. The gardens of the castle consist of mown lawns, planted borders and mixed trees. Belts of woodland to the north and south lead along the drives and were originally thicker to provide game cover. Walks along the lower slopes of Dundas Hill are completely overgrown; however those on the upper sections are maintained and clear.

CRAIGIEHALL

Craigiehall (date of inclusion 1987)

National Grid: 65 NT 165 751

Region: Edinburgh and the Lothians

Council Area: City of Edinburgh

Access: There are no formal access arrangements

Importance of Site (Values)

Work of Art: Little

Craigiehall has a little value as a Work of Art in its present form, the 18th century designed landscape structure having been largely lost.

Historical: High

Craigiehall has high Historical value in its connections with the Marquis of Annandale and subsequently the Hope family.

Horticultural: Little

The specimen conifers remaining on the east drive of Craigiehall have a little Horticultural value.

Architectural: Outstanding

Craigiehall has outstanding Architectural value as it provides the setting for several interesting architectural features.

Scenic: Some

The woodlands of Craigiehall have some value in the local scenery.

Nature Conservation: Little

The undisturbed woodlands and the pond provide a little Nature Conservation interest.

Description:

“A designed landscape of historical and architectural interest, the main 18th century structure being largely lost. The doocrot and grotto are notable features and Craigiehall itself is category A listed.”

Craigiehall is situated on the banks of the River Almond approximately 9 km (5.5 miles) to the west of the city of Edinburgh. The A90 dual carriageway linking Edinburgh with the Forth Road Bridge forms the eastern boundary of the site. The estate is situated on the urban fringes of Edinburgh. Edinburgh Airport lies to the south-west, and to the south-east lies the estate of Cammo House which has now been partly developed for private housing. To the north, beyond the A90, is the estate of Dalmeny. The designed landscape is situated in a relatively flat landscape which reaches a high point on Lenn Hill, to the south of the River Almond. This was used as the setting for the 18th century Temple from which views of the policies could be gained against the background of the Fife Hills to the north, and West Lothian to the west. The River Almond cuts through the south part of the policies in the form of a deep gorge. The relatively flat nature of the landscape renders few views into the estate, except from the north, from which point the woodlands are important scenically. There are extensive views to the south and west from within the policies.

Craigiehall House is situated on the north bank of the River Almond in some 26 ha (64 acres) of designed landscape which extends north to the present main entrance, south to a minor road beyond the Belvedere Wood, east down to the broad avenue to the A90, and west to a loop of the River Almond. Reference to General Roy's map of c.1750 indicates that the designed landscape of this period was largely confined to the northern bank of the River Almond. The policies were extended south of the River by the Hon Charles Hope Vere after 1755 to a form indicated on the 1st edition OS map of c.1860, which still can be discerned today, although changes in ownership and land use over the years have resulted in the loss of some features of the original design.

HOPETOUN HOUSE

Hopetoun House (Date of Inclusion: 1987)

National Grid: 65 NT 089 790

Region: Edinburgh and the Lothians

Council Area: West Lothian

Access: Open seasonally

Importance of Site (Values)

Work of Art: Outstanding

Hopetoun has outstanding value as a Work of Art in its present form.

Historical: Outstanding

Hopetoun has outstanding Historical value due to its associations with the Hope family since the 17th century.

Horticultural: High

The plant collection established in the woodland garden and pinetum is of high Horticultural value.

Architectural: Outstanding

The designed landscape provides the setting for category A listed buildings and has outstanding Architectural value.

Scenic: Outstanding

The house and associated designed landscape is of outstanding Scenic value.

Nature Conservation: High

The woodlands and shoreline at Hopetoun provide high Nature Conservation value.

Description:

“One of Scotland's finest designed landscapes, dating from the 18th century and comprising of category A listed buildings, an important plant collection, fine parkland and woodland, all of which make a major contribution to the surrounding landscape.”

Hopetoun House, built between 1699 -1704, is situated 16km (10 miles) west of Edinburgh on the banks of the Firth of Forth. The House is situated within 469ha (1,159acres) of designed landscape on a flat plain above the river and the land rises southwards towards the A904 and is surrounded by agricultural land. It has views over the Firth of Forth and beyond to the Ochil Hills in Fife originally intended to be uninterrupted. The naval base at Rosyth and Forth Road and Rail Bridges however are now prominent features from the house. From the south the house is surrounded by agriculturally improved land and woodlands. Other main areas of woodland at Hopetoun extends along the shore to the north of the house and along the Midhope Glen

The estate is surrounded by a high wall with additional park and woodland. There are several long drives throughout the estate however only the eastern driveway is in use today. The House and its Grounds are now managed by the house's Preservation Trust and surrounding parkland is grazed by cattle, sheep and deer. Parkland on the east of the house is enclosed by a ha-ha and grazed by sheep.

The parkland has a general mix of trees including beech, ash, lime, oak and sycamore, the majority of which are over 100 years old. Replanting has taken place where over-mature timber has been removed and walks and hedges are maintained to high standards. The House's formal gardens are now replaced by manicured lawns, all of which gives the estate high tourism interest.

Hopetoun House and the estate buildings which include a workshop, gate lodges, main gate of the main drive and summer houses amongst others are all listed buildings. The designed landscape of the estate was prepared by William Adam however not all of the planned features were set in place. Plans of the surroundings date back to c.1750.

The lawn east of the drive is separated by a ha-ha, and there are formal gardens to the west of the house. The walled garden was originally sectioned, now it mainly consists of a pick nick and grassy area, other parts are overgrown and unmanaged.

HOUSE OF BINNS

House of the Binns (Date of Inclusion: 1987)

National Grid: 65 NT 052 786

Region: Edinburgh and the Lothians

Council Area: West Lothian

Access: Managed by The National Trust for Scotland

Importance of Site (Values)

Work of Art: High

The parkland setting of the house has high value as a Work of Art in its present form.

Historical: Outstanding

The House of the Binns has outstanding Historical value on account of its associations with General Tam Dalyell and the Dalyell family since 1612.

Horticultural: Little

The designed landscape has a little Horticultural value provided by the fine trees within the policies.

Architectural: Outstanding

The designed landscape has outstanding Architectural value as it provides the setting for buildings of exceptional architectural interest.

Scenic: Outstanding

The designed landscape of The Binns makes an outstanding contribution to the surrounding scenery.

Nature Conservation: High

There are a great variety of habitats provided in the older woodlands and parkland trees and in coastal and burnside areas, which give the site high value for Nature Conservation.

Description:

“With a rich historical association with the Dalyell family, House of the Binns is an attractive designed landscape which makes an outstanding contribution to the surrounding scenery, contains architectural features of exceptional interest and provides high nature conservation value.”

The House of the Binns is located within 92ha (227 acres) of designed landscape, 25.5km (16miles) west of Edinburgh north of the A904. The house

offers panoramic views across the Firth of Forth to Fife and of the Forth Road and Rail Bridges. The designed landscape of the estate dates back to 1750-1850 is highly significant in the locality of which the views are part, and extends south to the A904, west to the B9109, north to Mannerston park and east to the edge of the woodland. The original structure of the landscape remains today.

The House is a category B listed building and dates back to the 17th Century as is the Binns Tower, built in 1862.

Parkland extends to all the boundaries of the estate providing a picturesque setting for the house and is separated from the formal lawn by a ha-ha. The Sergeant's pond is situated near the west driveway, the main access point today, and a caravan park is located in the south-east corner of the site. Additional trees are being planted today to extend the one-present orchard and a new orchard has recently been established to the west of the house. The walled garden is leased to a landscape contractor and is in use as a nursery and to grow cut flowers for the house. There is also an ornamental garden to the south of the house and a small private garden used for growing herbs.

NEWLISTON

Newliston (Date of Inclusion: 1987)

National Grid: 65 NT 110 735

Region: Edinburgh and the Lothians

Council Area: City of Edinburgh

Access: There are no formal access arrangements

Importance of Site (Values)

Work of Art: Outstanding

Newliston has outstanding value as a Work of Art both in its present form and for its recorded value as a Work of Art in the past.

Historical: Outstanding

It has outstanding Historical value with good documentary evidence and associations with the 2nd Lord Stair, and William and Robert Adam.

Horticultural: Some

It has some value for its shrub rose collection (in connection with the collection at Malleny, q.v.)

Architectural: Outstanding

It provides the setting for a grade A listed building, one of the last country houses designed by Robert Adam. It also contains several other features of historical and architectural interest, including the doocot and the statue of Hercules. It has outstanding Architectural value.

Scenic: Some

Although Newliston's shelterbelts screen the park from the outside, they also provide woodland contrast with the surroundings and thus make some contribution to the scenery.

Nature Conservation: Some

There is some value for Nature Conservation in the relatively undisturbed mixed deciduous woodland cover and the habitats provided by the ponds.

Description:

“Dating back to a plan by William Adam made in 1725, the structural layout of the house, gardens, parkland and woodland can still be seen today. The house was one of the last country houses designed by Robert Adam and is category A listed.”

Newliston is located 14.5km (9miles) west of Edinburgh, 4km (6.5miles) south of the Forth Road Bridge. Although it is secluded by parkland and woodlands it is surrounded by major trunk roads to Edinburgh City and Airport, and the Forth Road Bridge. Many of the intended views from the estate are now interrupted due to the development of Edinburgh’s urban fringe.

The 299ha (739 acres) of designed landscape dates back to 1720s and consists of a walled garden containing a B listed sundial and a tennis court which replaced the original bowling green. The design for the formal garden dates back to 1759 and is surrounded by a deep ha-ha. There are two remaining ponds along the north-west axis and two along the east-west axis with linking canals there is also a shrubbery which lies to the west of the house. At the entrance of the house there is a horseshoe-shaped enclosure surrounded by a ha-ha, originally used for schooling horses. The presence of Dutch Elm disease has resulted in the felling of old trees and planting of new mixed deciduous species.

Several out-buildings and structures within the Newliston estate are listed including Newliston House itself, the coach-house, East Lodge, Doocot and Walled Garden.

D7 VISUAL AMENITY

D7.1 INTRODUCTION

The following section considers the potential impacts of the four crossing options and their associated infrastructure on the visual amenity of the study area.

Landscape and visual impacts are closely related issues with considerable overlap between the two assessments. Visual amenity is defined as the pleasantness of the view or outlook of an identified receptor or group of receptors. The visual impact assessment determines the degree of anticipated change to visual amenity, considering buildings, areas of public open space, roads and footpaths that would occur as a result of the proposed scheme. The buildings, open spaces, roads and footpaths that would yield views of the crossing options are collectively referred to as 'receptors'.

In accordance with good practice and the requirements of STAG Part 2 Appraisal the assessment of visual effects has been undertaken following the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 5, taking into account the Supplementary Guidance for Landscape and Visual Assessment by the Scottish Executive (February 2002) and with reference to the Guidelines for Landscape and Visual Impact Assessment (GLVIA), published by the Landscape Institute and the Institute of Environmental Management and Assessment in 2002.

The visual appraisal of the four options has involved desk studies combined with site survey of potential receptors. Key components of the assessment of visual amenity included:

- Identification of the approximate zone of visual influence to establish the effective boundaries within which each of the four options could potentially affect people's views of the landscape within the wider area surrounding the crossing options;
- Field assessment of affected receptors to verify the elements of the four crossing options which would be visible from the various receptors; and
- Visual evaluation and impact assessment.

D7.2 IMPACT CRITERIA

The evaluation and impact appraisal has involved consideration of the extent to which the crossing options would change the composition of the existing view and the sensitivity to change based on the information gathered through site survey and analysis.

Account has been taken of the effect that any mitigation measures, typically planting or landform are likely to have in minimising potentially detrimental impacts on visual amenity.

The appraisal findings are represented using a descriptive scale ranging from major - moderate - minor adverse through neutral to an ascending scale of minor - moderate – major beneficial.

Explanation of the impact ratings is as follows:

- Major Adverse (or beneficial) Impact: where the proposal would cause a very noticeable deterioration (or improvement) in the existing view;
- Moderate Adverse (or beneficial) Impact: where the proposal would cause a noticeable deterioration (or improvement) in the existing view;
- Minor Adverse (or beneficial) Impact: where the proposal would cause a barely perceptible deterioration (or improvement) in the existing view' and
- Neutral: where there is no discernible deterioration (or improvement) in the existing view.

Impacts of moderate and above have been considered significant, as this is the level at which changes would be clearly perceived. The assessment year has been taken as year fifteen after scheme completion.

Limitations of Appraisal

Like the landscape assessment, the visual assessment has been undertaken by a combination of desk and field survey. The appraisal has been based on the outline engineering design presented in the drawings contained in Volume 2, which for the purposes of this study, forms the basis upon which the appraisal and indicative landscape mitigation is founded.

Detail on the extent and scale of earthworks including the horizontal and vertical alignments of the road works is not currently known and has not therefore informed or been included in the appraisal. Furthermore the level of detail available at the time of the appraisal has limited the extent of visual assessment detail which could be effectively undertaken in the field. As a result not all properties, buildings, footpaths or public open spaces have been visited and particularly in urban areas visual receptors have been grouped to reflect the level of assessment detail required to inform the STAG Part 2 appraisal.

D7.3 KEY ISSUES

The baseline landscape and its broad visual context are described earlier in Section D6 Landscape Character. To the north of the Forth the majority of receptors are located in the urban areas of Inverkeithing, Rosyth and south-

eastern parts of Dunfermline as well as a number of scattered receptors across the more open countryside. To the south of the Forth receptors are generally more dispersed with various scattered receptors across the rolling countryside with groups of receptors generally limited to the urban area of South Queensferry. Groups of key receptors identified during the field survey are identified below and are illustrated on the relevant drawings contained within Volume 2.

TUNNEL C

In general receptors fall into the following categories:

North of the Forth

- Residential properties on the southern periphery of Dunfermline;
- Residential properties to the north and north west of Rosyth;
- Scattered residential properties to the west of Rosyth including properties at Pattiesmuir and Blackhall Farm;
- Residential properties on the eastern periphery of Limekilns;
- Commercial buildings in Pitreavie business park and industrial estate;
- Commercial buildings in Dunfermline business park; and
- Various roads and rail corridors.

South of the Forth

- Residential properties on the northern fringe of Winchburgh;
- Scattered residential properties to the north of Winchburgh; and
- Various roads and rail corridors.

BRIDGE D

In general receptors fall into the following categories, however, it should be noted that the bridge would be visible from an extensive area and only receptors with immediate views of the proposed bridge have been identified.

North of the Forth

- Residential properties on the south western periphery of Dunfermline;
- Residential properties to the north and north east of Rosyth;

- Scattered residential properties around Middlebank;
- Residential properties on the northern periphery of Inverkeithing;
- Residential properties at Hillend;
- Scattered residential properties to the north west of Hillend;
- Residential properties in North Queensferry;
- Commercial buildings in the industrial estate to the east of Rosyth;
- Industrial buildings in Rosyth dockyard;
- Various viewpoints of the Forth bridges; and
- Various roads and rail corridors including the Forth Road and Rail bridges.

South of the Forth

- Residential properties in South Queensferry;
- Residential properties
- Scattered residential properties across the rolling countryside between Winchburgh and South Queensferry;
- Various viewpoints of the Forth bridges including Newton Lay-By;
- Commercial/business units at the European Technology Park; and
- Various roads and rail corridors.

TUNNEL D

In general receptors fall into the following categories:

North of the Forth

- Residential properties on the south western periphery of Dunfermline;
- Residential properties to the north and east of Rosyth;
- Scattered residential properties around Middlebank and the area of new residential development to the north of Middlebank;
- Residential properties on the north, east and western peripheries of Inverkeithing;
- Residential properties at Hillend;

- Scattered residential properties to the north west of Hillend;
- Commercial buildings in the industrial estate to the east of Rosyth; and
- Various roads and rail corridors.

South of the Forth

- Scattered residential properties across the rolling countryside between Winchburgh and Dundas Estate, including Westfield Farm, Westmuir House and farm, and Swineburn Cottage;
- Scattered residential properties to the east of Winchburgh;
- Properties to the south of the M9 on the northern periphery of Newliston GDL; and
- Various roads and rail corridors.

TUNNEL E

In general receptors fall into the following categories:

North of the Forth

- Residential properties on the south western periphery of Dunfermline;
- Residential properties to the north and east of Rosyth;
- Scattered residential properties around Middlebank and the area of new residential development to the north of Middlebank;
- Residential properties on the north, eastern peripheries of Inverkeithing;
- Residential properties at Hillend;
- Scattered residential properties to the north west of Hillend;
- Commercial buildings in the industrial estate to the east of Rosyth; and
- Various roads and rail corridors.

South of the Forth

- Residential properties on the southern edge of South Queensferry;
- Residential properties at Humber cottages and to the east of Dundas Castle GDL;

- Commercial buildings on the western edge of the Royal Elizabeth Yard; and
- Various roads and rail corridors.

D7.4 APPRAISAL OUTCOME

Visual impacts would result from various elements of the proposed crossing options but most notably from the new infrastructure, the bridge structure and the tunnel portals. The mitigation commitments outlined in the landscape character assessment have been considered during the visual assessment process and are reflected in the appraisal of overall permanent effects.

The relevant drawings contained within Volume 2 identify the key visual receptors associated with each of the four crossing options. Major Adverse impacts would be associated with residential properties which have immediate views of the development or where the focus to their view would substantially change. Visual impacts would be less where receptors are less sensitive to change such as commercial buildings or where the changed view is peripheral and more distant.

Bridge Crossing D would have the greatest visual impact due to the extensive visual influence it would exert. All of the tunnel crossing options to the north of the Forth would have a broadly similar extent of visual influence whilst to the south of the Forth, Tunnel Crossings C and E would have the least visual influence. Tunnel Crossing D would have less of a visual impact on receptors than Bridge Crossing D, although more than the other tunnel options.

D7.5 SUMMARY

Table D7.1 below summarises the potential temporary and permanent impacts that each of the four options are considered to have on visual amenity.

Table D7.1 - Summary of Assessment

Proposal	Overall Temporary Effects	Overall Permanent Effects
■ Corridor C - Tunnel	■ Minor Adverse – ■ Major Adverse	■ Minor Adverse – ■ Major Adverse
■ Corridor D - Bridge	■ Minor Adverse – ■ Major Adverse	■ Minor Adverse – ■ Major Adverse
■ Corridor D - Tunnel	■ Minor Adverse – ■ Major Adverse	■ Minor Adverse – ■ Major Adverse
■ Corridor E -	■ Minor Adverse –	■ Minor Adverse –

Tunnel	Major Adverse	Major Adverse
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During the construction period, the majority of receptor groups which directly overlook the development corridor, or with immediate views towards it would experience significant and adverse visual impacts as a result of the visually intrusive construction activity associated with the construction of the development. In the long term, significant and adverse visual impacts would be limited to more sensitive receptor groups (expectation and importance of the changed landscape to the receptor) and those with an immediate orientation towards the development.

The majority of visual impacts would result from the new infrastructure associated with all of the crossing options, to a lesser extent the tunnel portals and most extensively from the new bridge structure of Bridge Option D. Whilst all of the four crossing options would result in various receptors experiencing impacts ranging from Major Adverse through to Minor Adverse or Neutral depending on their proximity to the development and their angle of view it is considered that Bridge Option D would have the greatest visual impact due to the extensive visual influence that the bridge would exert.

D8 AGRICULTURE AND SOILS

D8.1 INTRODUCTION

This assessment considers the effect the proposals have on agricultural land, soil and contaminated land. Baseline information was obtained by means of a desk study review of designated areas, land classification maps and aerial photography. No fieldwork was carried out to confirm the findings of the desk study.

D2 KEY ISSUES

Agricultural Land Quality

Agricultural land is classified using the Land Capability Classification for Agriculture (LCA) produced by the Macaulay Land Use Research Institute (MLURI). This classification integrates soils data with both climate and topographical knowledge to assign land into classes for their suitability for various agricultural crops and management practices. There are seven classes some of which are subdivided, where classes 1, 2 and 31 are regarded as the best and most versatile and are collectively termed prime quality land.

Prime quality agricultural land constitutes less than six per cent in Scotland and it is therefore considered that, “the best and most versatile land should not be built on unless there is no other suitable site for the particular purpose.” (Circular No. 18/1987 Development Involving Agricultural Land) On the northern shore prime quality agricultural land is protected under Policy COU5 which states that, “Irreversible development of prime agricultural land will not be supported only if there are overriding national or local circumstances.” On the southern shore, under Policy E7 in the Rural West Edinburgh Local Plan 2003 (RWELP), “Permission will not be given for development which would result in irreversible damage to, or permanent loss of, prime quality land.”

In order to determine the class of agricultural land affected Land Capability for Agriculture Maps (1:50 000), produced by the Macaulay Institute for Soil Research, were reviewed.

Severance or Loss of Agricultural Land

Farms differ in size, layout and type of business, therefore the loss or severance of part of a farm by new transport infrastructure may affect their viability to varying degrees. To assess any severance and loss of agricultural land consultation with the Scottish Executive Environment and Rural Affairs Department (SEERAD) should be carried out to enable an assessment of the impact on the viability of the individual farms. Furthermore consultation with the affected land owners or farming tenants should be undertaken with the

intention of determining, from an individual farming perspective, the expected impacts. However due to time, budgetary and access constraints consultation with SEERAD and individual farmers was not possible and is therefore not included in this assessment. However a desk based approach using geo-referenced maps and aerial photography has been used to identify the affected fields.

All the proposals have a significant impact on the loss and severance of large areas of agricultural land. However in order to assess the impact individually for each corridor it is necessary to know how much of the land would be viable post construction due to severance. With the information available the impact for all the corridors is assessed as moderate to major negative due to the large area of land potentially affected.

Designated Agricultural Areas

Agricultural land generally isn't formally protected under a specific designation however it is included within other national or local designations. These include: Environmentally Sensitive Areas (ESAs), a national designation, which are areas of special landscape, wildlife or historic interest which can be protected or enhanced by supporting specific agricultural practices. These areas are not necessarily areas of particularly good quality agricultural land. Greenbelt and Countryside Areas are local policy areas that relate to open land in the rural areas which may be either cultivated or uncultivated.

Corridor D Tunnel and Corridor D Bridge do not affect any fields that are protected under a national or local designation. Corridor D Tunnel however affects agricultural land that is within the Countryside Policy Area (RWELP) and Corridor E Tunnel affects agricultural land that is within the Greenbelt (RWELP) therefore there is a moderate negative impact for these two proposals.

Soils

The loss of valuable agricultural soil during construction can occur even if it is kept stored and reinstated; as it is liable to degradation in quality. It is also typical for soils to take a number of years to restore their structure after being reinstated. However appropriate storage methods and the establishment of suitable crops and additional drainage once reinstated can help the process.

D8.3 MITIGATION

Mitigation for temporary impacts

For all the proposals, a negligible impact for the temporary construction activities has been assigned. This is based on the assumption that mitigation measures relating to care during construction, maintenance of access, repair and replacement of agricultural drains and reinstatement of agricultural fields

to enable continued farming practices would be carried out correctly and that construction works would be limited to the proposed corridors.

Mitigation for permanent impacts

For all the proposals the common permanent impact is the loss of agricultural land required for the operation of the bridge or tunnel proposal within their corridors. The proposals could also result in areas of land being unsuitable for further agricultural use because the remaining field area (between the field boundary and the proposed alignment) is considered too small for viable farming use.

Where a severed field is still large enough to be viable, bridges or underpasses would be built to maintain access roads to fields to enable safe crossing of agricultural machinery and enable continued agricultural use. Compensation has been assumed for areas of permanent loss as well as agricultural land which are no longer viable for farming use due to severance.

D8.4 APPRAISAL OUTCOMES

Do Minimum

The Do Minimum option would not cause a significant impact on agriculture or soils as there would be no significant additional land take or construction of other structures associated with this scenario, in the immediate study area.

Permanent Impact on Agricultural Land Quality (All Options)

All the options affect agricultural land which is mostly classified as prime quality agricultural land. Therefore, the permanent effect for all the options are assessed as moderate negative.

Permanent Impact on Severance or Loss of Agricultural Land (All Options)

All the options have a significant impact on the loss and severance of large areas of agricultural land. In order to assess the impact individually for each corridor it is necessary to know how much of the land would be viable post construction due to severance. However, due to time and access constraints consultation with Scottish Executive Environment and Rural Affairs Department (SEERAD) and individual farmers was not possible and is therefore, not included in this assessment. With the information available the impact for all the corridors is assessed as moderate to major negative due to the large area of land potentially affected which exceeds the threshold for significant impact as defined in.

Permanent Impact on Designated Areas (All Options)

Corridor D Tunnel and Corridor D Bridge do not affect any fields that are protected under a national or local designation. However, Corridor D Tunnel affects agricultural land that is within the Countryside Policy Area (Rural West Edinburgh Local Plan - RWELP) and Corridor E Tunnel affects agricultural land that is within the Greenbelt (RWELP) therefore there is a moderate negative impact for these two options.

Permanent Impact relating to Construction Sites (All Options)

For all the options the shaft construction sites would most likely result in the permanent loss of the entire field due to the size of the permanent structures together with their required access routes. This together with the loss of prime quality agricultural land means a moderate negative impact has been assigned except where the loss of land is within the Countryside Policy Area for Corridor D Tunnel, where a major negative impact has been assigned.

Permanent Impact on Soils (All Options)

Due to the degradation of soil quality during storing and the time it takes for soils to restore its structure after being reinstated, a minor negative impact on soils is considered for Corridor D Bridge.

A significant negative impact is considered for all the tunnel options as they would potentially disturb larger quantities of soil, particularly during cut and cover activities. In addition, there would be considerable quantities of spoil to be disposed of from the tunnel options. Some of this could be disposed of to landfill or disposed of to designated marine areas outwith the Firth. Alternatively, as most of this material would comprise marine sediments and boulder clay some of this material could be used for various other construction or restoration projects, such as land reclamation, within and outwith Scotland. Overall, for all tunnels the impact is assessed as being moderate negative.

Note that in this case the lengths of approach roads have been assumed to be similar for all options.

Permanent Impact relating to Contaminated Land (All Options)

The appraisal of contaminated land issues is solely based on evidence from current and historical Ordnance Survey maps at this stage. The actual presence of contaminated land would be investigated by preliminary ground investigations proposed for the crossing options and ultimately by a detailed investigation on the route of the selected option. The appraisal indicates that there is some potential for occurrence of contaminated land on all routes. However, Corridor D Tunnel and Corridor E Tunnel have the greatest potential for contamination being a significant issue, based on the number of potential occurrences noted and the range of industrial activities involved. Corridor C Tunnel is indicated to have the least potential.

D8.5 SUMMARY

The appraisal has shown that there are potentially significant negative impacts on agriculture and soils for all the proposals. However with the information available the bridge proposal appears to be very slightly advantageous as it appears to affect the least agricultural land area and the alignment doesn't pass through any policy areas. Furthermore it has a lower potential for locally altering the soil structure due to the nature of construction of a bridge over that of a tunnel.

D9 CULTURAL HERITAGE

D9.1 INTRODUCTION

This section discuss the archaeological and cultural heritage issues associated with the four crossing proposals of the Firth of Forth, followed by a discussion of potential impacts and broad mitigation measures. The assessment of the impacts of the proposed scheme on cultural heritage in and adjacent to the scheme has considered:

- Scheduled Ancient Monuments;
- Listed Buildings and other structures of architectural or historic interest;
- Conservation Areas;
- Gardens and Designed Landscapes; and
- Other archaeological sites and areas.

Baseline data was collected for an irregularly shaped study area, designed to cover the various options and the surrounding area, from the following sources:

- City of Edinburgh Sites and Monuments Records held on the Canmore⁷ database.
- Fife Sites and Monuments Records held on the Canmore database.
- West of Scotland Archaeology Service for West Lothian,
- The Statutory List of Buildings of Special Architectural or Historic Interest,
- The National Monuments Record of Scotland,
- The Inventory of Gardens and Designed Landscapes in Scotland, and
- Local Plans.

The data from these was plotted onto base mapping. Sites located within approximately 500m of each proposed route alignment are discussed and an initial assessment of archaeological potential has been made.

Further information regarding the Gardens and Designated Landscapes impacted by the options can be seen within the landscape assessment and Annex D6.1 of this report.

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⁷ Canmore – The Royal commission for the Ancient and Historic Monuments of Scotland (RCAHMS) database of archaeological sites, monuments, buildings and maritime sites in Scotland.

Background

The first human occupation of Scotland began around 10,000 years ago at the end of the last Ice Age. The area around the Firth of Forth has always been a focus of occupation. One of the first known settlements, a Mesolithic encampment, dates to approximately 8500BC and was discovered at Cramond near Edinburgh. Evidence of the later prehistoric periods can still be seen in this area in the form of funerary monuments and hill forts. The northern boundary of the Roman Empire is often perceived as lying at Hadrian's Wall in Northumberland. However, the Romans had a strong presence in Scotland. The Antonine Wall was built from earth and ran between Old Kilpatrick on the Clyde and Kinneil on the Forth and effectively created a militarised zone, including forts and regular Roman patrols, between the two walls.

The natural divide through Scotland caused by the Forth and Clyde Rivers, highlighted by the Antonine Wall, resulted in a concentration of settlement in the area. The settlement of Queensferry is so named as it had long been the location of a crossing point over the river. The Queen in question was Margaret, wife of Malcolm Canmore, who regularly used the ferry at this point to cross between Edinburgh and her palace at Dunfermline in the 10th century. These early settlements, along with the ease of travel provided by the river, meant the area around the Firth of Forth continued to prosper but also made it a target for attack. Many of the known cultural heritage sites lining the firth relate to centuries of defence of Scotland and range from Iron Age hill forts to World War II anti-aircraft batteries.

Many of the known archaeological and cultural heritage sites in the areas surround the crossing options are clustered around settlements such as North and South Queensferry, Inverkeithing, Rosyth and Limekilns. However, this is not an indication of an absence of features across the rest of the area. Many cultural heritage features are identified during the development process and therefore a false impression of the spread of these features is given in areas of previous development.

D9.2 KEY ISSUES

C TUNNEL

Within the Corridor C Tunnel option there are seven Scheduled Ancient Monuments (SAMs) and 28 listed buildings. There is also one entry on the Inventory of Gardens and Designed Landscapes. This is associated with Hopetoun House.

All of the SAMs are of national importance. Two of the SAMs are castles, Midhope Castle and Duntravie Castle, which are also designated as listed buildings. Two are the sites of churches, Auldathie Church and Rosyth Old Kirk (also a listed building). The remainder of the SAMs comprise Abercorn Fort, a section of the Union Canal and Pitreavie House dovecot (also listed).

Of the listed buildings within the Corridor C Tunnel option, three are Grade A and are of national importance, eight are Grade B and of regional importance and 17 are Grade C and of local importance. The Grade A listed buildings are all castles and the Grade B and C buildings are mainly residential houses, although some churches are also designated.

Hopetoun House and its designed gardens and landscape date to the 15th century and forms the ancestral home of the influential Hope family. As well as the house holding a Grade A listing the surrounding landscape is classed as at least high value in all the designed landscape assessment categories.

There are 52 undesignated archaeological sites that fall within the Corridor C Tunnel option. These sites date from all periods ranging from prehistoric burials to modern military sites. Of these, 26 are military sites and are mainly associated with Pitreavie Castle, was a defended house dating to the 17th century. It was acquired by the Air Ministry in 1938 and became an RAF base coordinating the operations of the Royal Navy and the Royal Air Force Coastal Command. During World War II it was the base for NATO operations in the North Atlantic area. The military sites recorded in the area include pillboxes, communication towers and anti-aircraft batteries. Military infrastructure is also recorded and includes sites such as...

There are also seven sites relating to burials within the corridor. There are four recorded cist burials which are box-like stone lined graves which are covered by large stone slabs or capstones. This form of burial dates to the Bronze Age and often includes grave artefacts such as jewellery and weapons. There is also evidence of more recent burial practices such as the graveyard associated with St Margret's Church.

The other sites in the area relate to industrial and military use of the area, as well as limited evidence of prehistoric settlement.

D BRIDGE

Within the Corridor D Bridge option there are four Scheduled Ancient Monuments (SAMs) and 116 listed buildings. There are also four designated gardens and landscapes and two Conservation Areas.

The SAMs consist of a souterrain⁸ in the northern section of the scheme and the Union Canal and Duntarvie Castle to the south of the Forth. All are of national importance.

There are 116 listed building within the Corridor D bridge option. The 41 Grade C buildings are of local importance and predominantly comprise residential buildings with some retail properties. Many of the Grade B buildings are slightly larger or of higher status such as schools, large houses and structures relating to the railway links in the area. These are of regional

⁸ Souterrain – an underground chamber or passage

importance. The nationally important Grade A buildings include the current Forth Road Bridge, Duntarvie Castle and Old Duloch House and its associated buildings.

There are four entries on the Inventory of Gardens and Designed Landscapes. These are Fordell Castle, Dundas Castle and Newliston and all are all protected because of their historical, architectural and natural status.

The corridor of the D Bridge option includes a section of the Kirkliston and Dalmeny Conservation Areas in the south east of the study area. The Kirkliston Conservation Area is based around the medieval church and includes the buildings making up the historic core of the village. The southern section of the Conservation Area, which includes the old mill, falls within the proposed option corridor. The Dalmeny Conservation Area includes the Kirk, manse and churchyard as well as several other residential buildings. The village was once part of the Dalmeny Estate which is now a registered garden.

The Corridor D Bridge option crosses through the South Queensferry Conservation Area. Known archaeological evidence suggests that there may have been settlements in this location since the early prehistoric period and there has been a crossing over the Forth from this location for at least 1000 years. The village developed in the 16th century when the villagers pledged their allegiance to Dunfermline Abbey allowing it extra privileges in trading and customs. This coupled with its good location as a seaport have resulted in its continual development through the centuries. The Conservation Area covers the area including the historic water front and village. The Fife Local Plan suggests that there is a Conservation Area in North Queensferry. However, it was not included in data provided by Fife Council and therefore a full assessment has not been undertaken of impacts upon this area.

There are 185 undesignated archaeological sites recorded in the route corridor. These date from all periods, ranging from prehistoric burial remains to modern military sites.

The known archaeological sites in this area are dominated by military and maritime sites from the modern period. The Firth of Forth is a major shipping way with a port, oil rig manufacturer and the Royal Navy docks at Rosyth. Forty-eight of the recorded sites are linked to the maritime history of the area. These records include ships that have been lost in the firth as well as yards, piers and harbours linked to this important industry. The Royal Naval Dockyards were opened in 1909 to strengthen the presence of the Royal Navy in the North Sea. The yard was sold to a private company in 1997.

The other known archaeology sites in this option corridor are largely linked to social activity. There are a number of locations connected to the change of burial rights ranging from burial mounds to graveyards. The archaeology of the wider region suggests that people have lived in this area for thousands of years. Stone axes from the prehistoric period, Roman coins and indication of

medieval and post-medieval farming practices all inform of this continuing occupation.

During initial consultation with the County Archaeologist for the City of Edinburgh and Historic Scotland, it was indicated that Port Edgar and the area surrounding it, particularly around Inchgarvie House (a Grade C Listed Building), has been identified as an area of very high archaeological and historic interest. Although little archaeological work has been carried out specifically in this area, research has suggested that it may include settlement dating from all periods from the Mesolithic onwards. Several of the buildings within Port Edgar are related to the military occupation of the area and are of particular historical interest. Following recent assessment by Historic Scotland they are likely to be added to the register of Listed Buildings at Grade C.

D TUNNEL

Within the Corridor D Tunnel option there are five Scheduled Ancient Monuments (SAMs) and 100 listed buildings. There are also five entries on the Inventory of Gardens and Designed Landscapes and two Conservation Areas.

The SAMs consist of a souterrain, an enclosed settlement and Pitreavie House dovecot in the northern section of the scheme, and the Union Canal and Duntarvie Castle to the south of the Forth. All are of national importance.

Of the listed buildings, eight are Grade A and are of national importance, 42 are Grade B and of regional importance and the remaining 50 are Grade C and of local importance. The Grade A listed buildings comprise Dalmeny Parish Church and churchyard, remains associated with Old Duloch House, Duntarvie Castle, Pitreavie Castle and the museum on Queen Street in Inverkeithing. The Grade B and C buildings are largely residential houses and cottages.

The designated landscapes which fall within the Corridor D Tunnel option are Fordell Castle to the north of the Forth and Dundas Castle, Hopetoun House and Newliston to the south of the Forth. While three of the designated landscapes are only touched by the edge of the corridor the gardens of Dundas Castle are significantly closer to the line of the proposed road network. The landscape at Dundas Castle is well documented and is recorded as having been re-landscaped in the 19th century. The estate has belonged to the Dundas family since c.1120.

The Corridor D Tunnel option includes the western section of the South Queensferry Conservation Area. Known archaeological evidence suggests that there may have been settlements in this location since the early prehistoric period and there has been a crossing over the Forth from this location for at least 1000 years. The village developed in the 16th century when the villagers pledged their allegiance to Dunfermline Abbey allowing it extra privileges in trading and customs. This coupled with its good location as

a seaport have resulted in its continual development through the centuries. The Conservation Area covers the area including the historic water front and village.

There are 119 undesignated archaeological sites recorded in the route corridor. These date from all periods, ranging from prehistoric burial remains to modern military sites.

The recorded archaeological sites relate to many aspects of social, industrial and military activity within the Corridor Tunnel D option. Several sites reflect the changes of social practices. Burial traditions through the periods have ranged from prehistoric barrows to post-medieval graveyards. A number of the sites relate to the industrial development in the area with the Union Canal and several railway lines were used to transport goods brought up the firth by ship.

There are a large number of sites dating to the modern period many of which are military in origin due to the Royal Navy Dockyard at Rosyth and Pitreavie Castle. Pitreavie Castle is a defended house dating to the 17th century. It was acquired by the Air Ministry in 1938 and became an RAF base coordinating the operations of the Royal Navy and the Royal Air Force Coastal Command. During World War II it was the base for NATO operations in the North Atlantic area. These military sites listed include pillboxes, communication towers and anti-aircraft batteries.

This corridor would also impact on the archaeologically important area around Inchgarvie House and Port Edgar as detail above.

E TUNNEL

Within the Corridor E Tunnel option there are two Scheduled Ancient Monuments (SAMs) and 74 listed buildings. There are three entries on the Inventory of Gardens and Designed Landscapes as well as three Conservation Areas.

The SAMs consist of a souterrain and an enclosed settlement. Both are located in the northern part of the scheme and are of national importance.

Of the listed buildings, six are Grade A and are of national importance, 34 are Grade B and of regional importance and the remainder are Grade C and of local importance. The Grade A listed buildings comprise Pitreavie Castle, remains associated with Old Duloch House and St Cuthberts Church and graveyard. The Grade B and C buildings are largely residential houses and cottages.

The designated gardens and landscapes include Dalmeny Garden which crosses the width of the corridor along the waterfront at the southern edge of the Forth. The castle itself was influenced by Barnbougle Castle and was built in the 13th century. The grounds date to the 17th century. The gardens associated with Dundas Castle and Newliston also fall within the corridor.

A small section of the Queensferry and Kirkliston Conservation Areas on the south side of the Forth lie within the Corridor E Tunnel option. These areas are not directly crossed by the proposed road alignments. The third Conservation Area is Dalmeny, which lies entirely within the corridor.

There are 97 undesignated archaeological sites recorded in the route corridor. These date from all periods, ranging from prehistoric stone axes to modern military sites

As with the other corridor options, military remains dominate the previously recorded archaeological sites. The study area encompasses both the sites of Pitreavie Castle and Dalmeny Park, which contains the sites of World War II defence mechanisms such as pillboxes, barrage balloon sites and anti-aircraft battery foundations.

This option has records of sites relating to the social and industrial activity in the area. Several burial sites from a number of periods are recorded alongside evidence of industrial activity. However, it is the river and other transportation methods that make up a large number of the previously recorded sites. The option study area includes several sites relating to the railway, including the Forth Bridge, as well as cranes, yards and stations. It is likely that the railway was used for the transportation of goods brought into and out of the firth by boat.

D9.3 APPRAISAL OUTCOMES

Assessment of impacts on Cultural Heritage receptors has been made based on the data available from Historic Scotland, the Historic Environment Records and the National Monument Record for Scotland. A walkover survey was not undertaken at this stage.

Impacts on the archaeological and heritage sites have been made based upon the information available to date. Once an option has been chosen and more detailed plans developed it is likely that the impact assessment will change. Full details regarding the impacts discussed, in brief, below can be found in the Cultural Heritage STAG tables submitted as part of this report.

All of the options would have a major impact on the historic landscape and seascape of the Firth of Forth and its environs. Further work, in conjunction with the landscape assessment, will be required to fully appraise these impacts.

The construction of any one of these options is likely to have a beneficial impact on the designated landscape associated with Dundas Castle. The A8000 which defines the eastern boundary of the designated landscape is currently a major arterial feeder route for the current Forth Road Bridge. The improvements to the road networks in the area and the construction of new approach routes would remove the congestion from this road and improve the setting of the landscape.

With all options there is the potential for the discovery of previously unrecorded archaeological sites, the impact on any such sites cannot be assessed at this stage. Once options have been taken forward to the next stage further research will be required to fully establish the likelihood of discovery of such sites.

All impacts are likely to be permanent.

C TUNNEL

The Corridor C Tunnel would create both direct physical impacts and indirect visual impacts upon archaeological sites, the built heritage and historic landscapes. Both direct and visual impacts would also be caused by the linkages to the current road network.

There are four sites of national importance that would be impacted by this option. The Scheduled Ancient Monuments of Duntarvie Castle and Aldcathie Church would suffer a minor and moderate adverse visual impact respectively. The site of the Battle of Pitreavie lies to the north of the current A823, which would be improved as part of the road network supporting the tunnel. The extent of the battle site is unknown, however both direct and visual impacts across this area are likely.

The registered gardens of Hopetoun House directly overlie this option. It is unknown at this stage how the construction of the tunnel may impact the gardens. Further analysis in consultation with the design engineers would be required to fully assess this impact.

Four sites of regional importance may be directly impacted by this option. Two military defence sites lie close to the alignment of the road system and are impacted by improvement work. Blackhall Farm to the north west of Rosyth would be directly impacted by the proposed junction. The tower house and formal gardens at Midhope Castle overlie the proposed alignment of the tunnel. However, it is unknown if, or how, they would be impacted by the development.

A further five recorded archaeological sites would be impacted by this option. These impacts are both direct and visual and are likely to be minor.

The magnitude of the impact from this option is considered to be Moderate Adverse.

D BRIDGE

The Corridor D Bridge option would create both direct physical impacts and indirect visual impacts upon archaeological sites, the built heritage and historic landscapes. Both direct and visual impacts would also be caused by the linkages to the current road network.

There are nine sites of national importance that would be impacted by this option. The Scheduled Ancient Monument of a souterrain at Middlebank House would likely be directly impacted by the proposals. This would lead to an impact of Major Adverse, unless the design of the road layout can be amended to avoid this site. Duntarvie Castle, also a Scheduled Ancient Monument, would suffer a minor adverse visual impact.

There would be visual impacts upon three Grade A Listed Buildings. The impacts on Old Duloch House and its associated Listed structures are considered to be Moderate Adverse. Of greater impact are the visual impacts upon the Grade A Listed Forth Road and Rail Bridges. The impacts upon these bridges are considered to be Major Adverse.

The proposed Corridor D Bridge option would visually impact upon three registered gardens/landscapes and directly impact a fourth. The directly impacted landscape is that associated with Hopetoun House. The proposed bridge would cross directly over this area and the impact is considered to be moderate adverse. This landscape would also be adversely visually affected by the proposals, as would the designated landscapes associated with Dundas Castle, Fordell Castle and Newliston. These impacts are all considered to be moderate adverse.

The option would have adverse impacts upon Queensferry Conservation Area, a regionally designated site. This impact is considered to be moderate adverse. Twelve further sites of regional importance would be impacted by the proposals. Of these, three would suffer direct impacts and the remainder would be visually affected.

The directly impacted sites are the sites of military remains and potential settlement at Inchgarvie House (see below for more information). These impacts vary between Major and Moderate Adverse. The visually impacted sites comprise eight Grade B Listed Buildings, which would suffer Minor Adverse impacts.

This option would result in a major impact on the area surrounding Port Edger and Inchgarvie House which were identified as area of high archaeological potential by the City Archaeologist for Edinburgh. The exact nature of these potential remain is unknown at this stage and therefore the significance of this impact is unknown. In addition, Historic Scotland have proposed that military buildings at Port Edgar are suitable for Listing at Grade C and therefore the Corridor D Bridge would impact upon this.

A further five recorded archaeological sites would be impacted by this option. These impacts are both direct and visual and are likely to be minor.

The magnitude of the impact from this option is considered to be Major Adverse

D TUNNEL

The Corridor D Tunnel option will create both direct physical impacts and indirect visual impacts upon archaeological sites, the built heritage and historic landscapes. Both direct and visual impacts will also be caused by the linkages to the current road network.

There are five sites of national importance that would be impacted by this option. The Scheduled Ancient Monuments of a souterrain at Middlebank House and Duntarvie Castle would suffer a moderate and minor adverse visual impacts respectively.

Duloch House, a Grade A Listed Building would suffer a Moderate Adverse visual impact, as would four designed landscapes/gardens. These comprise Hopetoun House, Dundas Castle, Fordell Castle and Newliston.

Eight sites of regional importance would be impacted by the proposed option. Direct impacts would be had upon the site of a barrage balloon and upon potential settlement at Inchgarvie House. Adverse visual impacts would be had upon the Conservation Area at Dalmeny and on five Grade B Listed Buildings. These impacts are likely to be minor.

A further five recorded archaeological sites would be impacted by this option. These impacts are both direct and visual and are likely to be minor.

There may also be a negative impact on the area surrounding Port Edgar and Inchgarvie House as the alignment of the proposed tunnel passes directly beneath it. Further work in conjunction with design engineers would be required to assess the nature of this impact.

The magnitude of the impact from this option is considered to be Moderate Adverse.

E TUNNEL

The Corridor E Tunnel option would create both direct physical impacts and indirect visual impacts upon archaeological sites, the built heritage and historic landscapes. Both direct and visual impacts would also be caused by the linkages to the current road network.

There are five sites of national importance that would be impacted by this option. A Scheduled Ancient Monuments of Balbougie Enclosed Settlement may suffer adverse visual impacts. However, the extent of this impact cannot be determined from mapping and a site visit is required to fully assess this. The impact is likely to be minor.

Duloch House, a Grade A Listed Building would suffer a Moderate Adverse visual impact. Three sites included in the Inventory of Gardens and Designed Landscapes would also be impacted. The landscape associated with Dalmeny may be directly affected. It is uncertain at this stage if the road would be underground here and further assessment is needed. If the road has emerged

from the tunnel by this time, the impact is considered to be Moderate Adverse. Visual impacts would also be had upon the landscapes associated with Dundas Castle and Newliston.

Nine sites of regional importance would be impacted by this option. Direct impacts would be had upon military defence sites. These impacts are considered to be Moderate Adverse. Dalmeny Conservation Area is crossed by the proposed alignment. If the road is above ground at this stage the impact would be Moderate Adverse. Similarly, the line of the road crosses Spencerfield House, a Grade B Listed Building, which would suffer a Moderate Adverse impact if the road is above ground at this point. The remaining five sites are Grade B Listed Buildings that would be visually affected. These impacts are considered to be Minor Adverse.

A further seven recorded archaeological sites would be impacted by this option. These impacts are both direct and visual and are likely to be moderate or minor adverse.

The magnitude of the impact from this option is considered to be Moderate Adverse.

D9.4 SUMMARY

Table D9.1 below summarises the likely permanent impacts upon the cultural heritage resource by the proposed crossing options. The preferred option in terms of archaeology and cultural heritage is the C Tunnel as this has the least impact upon archaeological and heritage sites. The least preferred option is the D Bridge option as it has the most adverse impact upon archaeology and cultural heritage.

Table D9.1 Summary of Impacts on Cultural Heritage

Proposal	Overall Permanent Effects	Sites of National Importance	Sites of Regional Importance	Sites of Local Importance
Corridor C - Tunnel	Moderate Adverse	4	4	5
Corridor D - Bridge	Major Adverse	9	13	5
Corridor D - Tunnel	Moderate Adverse	5	8	5
Corridor E - Tunnel	Moderate Adverse	5	9	7

ANNEX D9.1- WORKSHEET 5 – CULTURAL HERITAGE

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Proposal Name:		Proposed new crossing of the Firth of Forth. Option C Tunnel.						Worksheet CH5: Cultural Heritage – Project Level, Assessment Score	
Historic Features	Major Negative	Moderate Negative	Minor Negative	Neutral / Uncertain	Minor Positive	Moderate Positive	Major Positive		
International	▲								
National		2	1	1▲					
Regional	1	2	1	▲					
Local/Other			5	▲					
Key Data Sources	City of Edinburgh Sites and Monuments Records held on the Canmore database. Fife Sites and Monuments Records held on the Canmore database. West of Scotland Archaeology Service for West Lothian, The Statutory List of Buildings of Special Architectural or Historic Interest, The National Monuments Record of Scotland, The Inventory of Gardens and Designed Landscapes in Scotland.								
Key Assumptions	Sites directly impacted by the proposals will be destroyed. Assessment of impact is not based on detailed layouts. All remaining sites not listed here will maintain a neutral impact.								

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Proposal Name:	Proposed new crossing of the Firth of Forth. Option D Bridge.							Worksheet CH5: Cultural Heritage – Project Level, Assessment Score						
Historic Features	Major Negative	Moderate Negative	Minor Negative	Neutral / Uncertain	Minor Positive	Moderate Positive	Major Positive							
International	▲							Formatted: Not Highlight						
National	3	5	1	▲				Formatted: Not Highlight						
Regional	2	2	3	▲				Formatted: Not Highlight						
Local/Other			5	▲				Formatted: Not Highlight						
Key Data Sources	City of Edinburgh Sites and Monuments Records held on the Canmore database. Fife Sites and Monuments Records held on the Canmore database. West of Scotland Archaeology Service for West Lothian, The Statutory List of Buildings of Special Architectural or Historic Interest, The National Monuments Record of Scotland, The Inventory of Gardens and Designed Landscapes in Scotland.													
Key Assumptions	Sites directly impacted by the proposals will be destroyed. Assessment of impact is not based on detailed layouts. All remaining sites not listed here will maintain a neutral impact.													



Proposal Name:		Proposed new crossing of the Firth of Forth. Option D Tunnel.						Worksheet CH5: Cultural Heritage – Project Level, Assessment Score	
Historic Features	Major Negative	Moderate Negative	Minor Negative	Neutral / Uncertain	Minor Positive	Moderate Positive	Major Positive		
International	▲							Formatted: Not Highlight	
National	▲	6	1	▲				Formatted: Not Highlight	
Regional	▲	2	6	▲				Formatted: Not Highlight	
Local/Other			5	▲				Formatted: Not Highlight	
Key Data Sources	City of Edinburgh Sites and Monuments Records held on the Canmore database. Fife Sites and Monuments Records held on the Canmore database. West of Scotland Archaeology Service for West Lothian, The Statutory List of Buildings of Special Architectural or Historic Interest, The National Monuments Record of Scotland, The Inventory of Gardens and Designed Landscapes in Scotland.								
Key Assumptions	Sites directly impacted by the proposals will be destroyed. Assessment of impact is not based on detailed layouts. All remaining sites not listed here will maintain a neutral impact.								



Proposal Name:	Proposed new crossing of the Firth of Forth. Option E Tunnel.			Worksheet CH5: Cultural Heritage – Project Level, Assessment Score			
Historic Features	Major Negative	Moderate Negative	Minor Negative	Neutral / Uncertain	Minor Positive	Moderate Positive	Major Positive
International	▲						
National		4		1			
Regional		4	5				
Local/Other		2	4	1			
Key Data Sources	City of Edinburgh Sites and Monuments Records held on the Canmore database. Fife Sites and Monuments Records held on the Canmore database. West of Scotland Archaeology Service for West Lothian, The Statutory List of Buildings of Special Architectural or Historic Interest, The National Monuments Record of Scotland, The Inventory of Gardens and Designed Landscapes in Scotland.						
Key Assumptions	Sites directly impacted by the proposals will be destroyed. Assessment of impact is not based on detailed layouts. All remaining sites not listed here will maintain a neutral impact.						

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