Almondbank Flood Protection Scheme

ENVIRONMENTAL STATEMENT

Volume One

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Glossary of Terms and Abbreviations

Glossary

"A"- Weighting	A reduction/weighting applied to the low and high frequency components of noise applied to obtain a single number representing the sound pressure level of a noise containing a wide range of frequencies in a manner approximating the response of the human ear.
Abstraction	Removal of water from surface water or groundwater, usually by pumping and typically used for industrial, agricultural or drinking water supply.
Accidental Spillage	An incident that results in the escape of potentially polluting substances.
Acoustic	Pertaining to sound or to the sense of hearing.
Agricultural land classification	Classifies agricultural land in five categories according to versatility and suitability for growing crops.
Air Quality Action Plan	A plan put together by a local authority to improve the air quality in the Air Quality Management Area.
Air Quality Management Area	An area declared by a local authority where the air quality objectives are not likely to be achieved.
Air Quality Objective	Policy target generally expressed as a maximum ambient concentration to be achieved, either without exception or with a permitted number of exceedances with a specific timescale.
Air Quality Standard	The concentrations of pollutants in the atmosphere which can broadly be taken to achieve a certain level of environmental quality. The standards are based on the assessment of the effects of each pollutant on human health including the effects on sensitive sub groups.
Air Quality Strategy (AQS)	The AQS sets a framework for reducing hazards to human health from air pollution and ensuring that international commitments are met in the UK. The AQS is designed to be an evolving process that is monitored and regularly reviewed.
Ambient Air Quality	The condition of the air in the outdoor environment.
Ambient Noise	The total of all noise in the environment, other than the noise from the source of interest.
Annual Mean	The average (mean) of the concentrations measured for each pollutant for one year. Usually this is for a calendar year, but some chemical species are reported for the period April to March, known as a pollution year. This period avoids splitting winter season between 2 years, which is useful for pollutants that have higher concentrations during the winter months.
Archaeology	The scientific study of past human life and change through analysis of material remains that humans have left behind.
Artefact	An object or part of an object which has been used or created by a human and provides physical clues to the activity carried out by humans in the area of discovery.

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Attenuation (Sound)	The reduction of sound intensity by various means (e.g. air, humidity, porous materials).
Background Noise	The noise in the environment, other than the noise from the source of interest.
Barrier (Sound)	A sound barrier is any solid obstacle, which is relatively opaque to sound that blocks the line of sight from the sound source to receiver. Barriers may be erected specifically to reduce noise, for example: solid fences, earth berms, or freestanding walls.
Base Flow	The flow in a watercourse made up of groundwater. Base flow sustains the watercourse during extended periods of dry weather.
Biodiversity Action Plan	A framework for achieving the conservation of biodiversity based on the targeting of resources towards priority habitats and species.
Bronze Age	4000 BC to 701 BC.
Burn	Watercourses from large streams to small rivers.
Cairn	Mound composed of stones, sometimes with internal structures; usually a burial monument, but they are sometimes used as a memorial.
Cist	Small box-shaped stone-lined grave, usually from the Bronze Age, containing the cremated remains in an urn or a crouched burial.
Cropmark	An archaeological site no longer visible on the ground due to the removal of upstanding remains (often by ploughing). The sites are recorded from aerial photographs by differential crop growth over buried features such as pits, ditches and walls.
Decibel (dB)	The decibel is a logarithmic unit of measure of sound pressure.
Designated Site	An area which has been granted special protection under European, UK and/or Northern Ireland legislation, e.g. Special Protection Areas, Special Areas of Conservation and Sites of Special Scientific Interest.
Dilapidated	In a state of disrepair or ruin as a result of age or neglect.
Discharge	Release of effluent to surface water or groundwater, this may include treated sewage from wastewater treatment works and septic tanks, industrial effluent and road runoff.
Earthwork (Archaeology)	Any monument made entirely or largely of earth.
Enclosure	Any monument consisting of an enclosing feature, such as a bank or a ditch, usually earthen, such as barrows or ringforts.
European Protected Species	Any species (plant or animal) listed on Annex 2 or 4 of Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora; or bird species listed on Annex 1 of Council Directive 2009/147/EC on the conservation of wild birds.
Excavation	Intrusive fieldwork with a clear purpose, which examines and records archaeological deposits, features and structures and recovers artefacts, ecofacts and other remains within a specified area or site. This would lead to both a further programme of post excavation and publication and perhaps further excavation.
Exceedance	A period of time where the concentrations of a pollutant is greater than, or equal to, the appropriate environmental standard.

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Frequency (Sound)	Number of complete oscillation cycles per unit of time. The unit of frequency is the hertz (hz).
Groundwater	All water which is below the surface of the ground in the saturation zone (below the water table) and in direct contact with the ground or subsoil.
In Situ	In its original place.
Invertebrates	Aquatic animals with no backbone such as crustaceans and larval insects which inhabit the bottom of a stream or lake.
Iron Age	800BC to 42AD
L_{wa}	Is an A-weighted, logarithmic measure of the sound power of a noise source as a relation to the threshold of hearing.
LCA	Landscape character area.
Level	The logarithm of the ratio of a quantity to a reference quantity of the same kind. The base of the logarithm, the reference quantity, and the kind of level must be specified.
Limit Value (Air Quality)	A legally enforceable limit on the chemical characteristics a source of emission to air normally expressed as a maximum permissible concentration of a specified substance.
Logarithm	The exponent that indicates the power to which a number must be raised to produce a given number. For example, for the base 10 logarithm, used in acoustics, 2 is the logarithm of 100.
Noise	Any disagreeable or undesired sound or other disturbance.
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 micrometres.
Propagation	The passage of a signal from its source to a receiver. Some of the processes involved in propagation are absorption, reflection, and transmission.
Severance	The state of being separated or cut off.
Sheet Pile	Several columns of wood or steel or concrete that is driven into the ground to provide support for a structure or to provide a form of barrier.
Site (Archaeology)	Specific description of the area for an archaeological investigation, this is usually defined as an area of excavation but could refer to a building, or survey area.
Source-Pathway-Receptor	A model that is used in risk assessment to identify the source of any contamination, what the source may affect (receptor) and how the source may reach the receptor (pathway).
Standing Stone	Upright stone, usually single but sometimes in pairs and groups. They can be shaped or natural and are usually dated to the bronze age.
Surface Water	Waters including rivers, streams, ditches, lochs, ponds, canals, reservoirs, coastal waters and estuaries
Till	Largely sandy clay or stony clay, deposited beneath, on the margins of or at the sides of glaciers. Can also be largely granular with little clay content in some locations.
Topography	The arrangement of the natural and artificial physical features of an area.

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Uncertainty	A measure, associated with the result of a measurement that characterises the range of values within which the true value is expected to lie. Uncertainty is usually expressed as the range within which the true value is expected to lie with a 95% probability, where standard statistical and other procedures have been used to evaluate this figure. Uncertainty is more clearly defined than the closely related parameter 'accuracy', and has replaced it in recent European legislation.
Vibration	The oscillating, reciprocating, or other periodic motion of a rigid or elastic body or medium forced from a position or state of equilibrium.

Abbreviations

CEMP	Construction Environmental Management Plan
CELLfN	Cost Effective Landscaping : Learning from Nature
CMS	Construction Method Statement
dB	Decibel
EC	European Commission
EIA	Environmental Impact Assessment
ES	Environmental Statement
FRMA	Flood Risk Management (Scotland) Act
HDV	Heavy Duty Vehicle
LCA	Landscape Character Area
LCA	Land Compensation Act
LDP	Local Development Plan
MLURI	Macaulay Land Use Research Institute
NCN	National Cycle Network
RCS	River Corridor Survey
RPZ	Root Protection Zone
SAC	Special Area of Conservation
SEPA	Scottish Environment Protection Agency
SEERAD	Scottish Executive Environment and Rural Affairs Department
SPP	Scottish Planning Policy
UK	United Kingdom
WFD	Water Framework Directive

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ZVI	Zone of Visual Influence

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1 Introduction

1.1 The Project

1.1.1 Perth and Kinross Council are promoting a flood defence scheme in the village of Almondbank, near Perth, under the Flood Risk Management (Scotland) Act 2009 (FRMA). The FRMA creates a more sustainable approach to assessing and managing flooding across Scotland, while also bringing into law the European Directive 2007/60/EC on the Assessment and Management of Flood Risk (Floods Directive).

1.1.2 The scheme comprises a combination of flood defence walls, generally reinforced concrete with stone masonry coping and facing, together with earth embankments in locations where space is available. Bank reinforcement using sheet piles and erosion protection (geotextile matting, willow spilling, block revetment and rip rap) is also proposed in some locations. The playing fields in the centre of the village would be utilised as a flood storage area. The River Almond footbridge and the road bridge at the confluence between the River Almond and East Pow Burn would be raised. Improvements to existing drainage infrastructure would also be made at Bridgeton, Main Street and the Vector Aerospace site.

1.2 Scheme Objectives

1.2.1 The objectives of this scheme are as follows:

- To reduce the risk of flooding from the River Almond to people, property and the natural environment within the village of Almondbank.
- To ensure any proposed flood protection works are both technically sound and economically viable.
- To ensure that any proposed flood protection works have minimum effect on the environment as a whole and where possible protect, conserve and enhance it.
- To ensure that the works have minimal impact on public open space and the use of this open space, specifically they should not:
  - be visually intrusive;
  - obstruct public access; or
  - adversely affect the general amenity of the river.
- To ensure the works do not provide a health and safety risk to the people of Almondbank.

1.3 Environmental Impact Assessment

1.3.1 In March 2005 an environmental assessment of the proposals for a flood relief scheme at Almondbank commenced. Various revisions have been made to the scheme design since then and a final scheme is now being progressed.

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1.3.2 The need to prepare an Environmental Statement (ES) is governed by the implementation into UK Law of European Union Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment. In Scotland, the Directive is implemented by the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2011 (Scottish Statutory Instrument 2011 No. 139), referred to as the EIA Regulations. The regulations apply to projects, which require planning permission in response to an application under Part III of The Town and Country Planning (Scotland) Act 1997 (Part 2 of the EIA Regulations).

1.3.3 The EIA Regulations require that an ES is prepared for specific types of development before they can be given development consent. The proposed scheme falls within a development type listed in Schedule 2 to the regulations and an ES must be prepared when there are likely to be significant effects on the environment. The proposed scheme is within/adjacent to an environmentally sensitive location and therefore requires an EIA.

1.3.4 This was confirmed by Perth and Kinross Council in their response to a request for a screening opinion under the EIA regulations.

1.4 Content of the Environmental Statement

1.4.1 Regulation 4(1) of the EIA Regulations stipulates requirements relating to the information to be included in an ES. Schedule 4 of the EIA Regulations details the requirements under Parts I and II.

1.4.2 Regulation 4(1) indicates that an ES must include information referred to in Part II and such information referred to in Part I of Schedule 4 as is reasonably required to assess the environmental effects of the development and which, having regard in particular to current knowledge and methods of assessment, the applicant can reasonably be required to compile, taking into account the terms of any scoping opinion given. The ES has been prepared in accordance with Parts I and II.

1.4.3 The information required along with an indication of the chapter in which the relevant information can be found in this ES, is provided below.

- a description of the development comprising information on the site, design and size of the development (Chapter 4).
- a description of the measures envisaged in order to avoid, reduce and, if possible, remedy any significant adverse effects (Chapters 7 - 15).
- the data required to identify and assess the main effects which the development is likely to have on the environment (Chapters 7 - 15).
- the main alternatives studied by the applicant and the main reasons for selection, taking into account the environmental effects (Chapter 3).
- a non-technical summary of the information provided under the four bullets above (provided in the front of the ES and as a stand alone document).

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1.5 Structure of the Environmental Statement

1.5.1 This ES is divided into two volumes as follows:

- Volume One - the main statement; and
- Volume Two - figures associated with the text provided in Volume One, together with the appendices (containing additional technical information to support the ES).

1.5.2 The ES text contained in Volume One is presented in 17 chapters as follows:

- Chapter 1 provides an introduction to the proposed scheme and to the ES.
- Chapter 2 summarises the need for the scheme.
- Chapter 3 provides a review of the scheme alternatives that were considered.
- Chapter 4 comprises a scheme description.
- Chapter 5 contains a summary of the general approach and methods used for the various detailed assessments reported in Chapters 7-15.
- Chapter 6 provides the results of the consultation exercise undertaken with key statutory and non-statutory consultees.
- Chapters 7 through to 15 report the findings of the studies and assessments which have been undertaken for the scheme. Where appropriate, mitigation measures are described. To aid the understanding and relationship between the various technical assessments, these chapters are presented in a standardised format which is described in Chapter 5.
- Chapter 16 presents a summary of environmental impacts discussed in Chapters 7 to 15 and summarises the environmental design and mitigation measures which the predicted impacts and their likely effects described in Chapters 7-15 have been based on. These would form part of the detailed design, construction and future operation of the scheme.
- References used during preparation of the ES are presented in Chapter 17.

1.5.3 The figures contained within Volume Two are generally numbered in accordance with the chapters within Volume One, whereas the Appendices are numbered sequentially and do not relate to the chapter headings.

1.5.4 A Non-Technical Summary is bound into the front of Volume One and is also available as a separate document.

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1.6 Environmental Statement Review and Comments

1.6.1 Any person wishing to comment on the Environmental Statement should write to:

Jim Valentine
Executive Director of the Environment Service
Perth and Kinross Council
The Atrium
137 Glover Street
Perth
PH2 0HY

1.6.2 Written responses are invited within 28 days of the advertised date of publication of the Environmental Statement.

1.6.3 Printed copies of the Environmental Statement may be obtained from the above address at a charge of £150. A CD is available for £10.

1.6.4 The Environmental Statement is also available for public viewing at the above address during normal office hours and also on the Perth and Kinross Council website (www.pkc.gov.uk).

1.6.5 Copies of the Non-Technical Summary of the Environmental Statement are available free of charge.

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2 The Need for the Scheme

2.1 Site Context

2.1.1 Almondbank is a small historic village located approximately 4km to the west of Perth, as shown in Figure 1.1 - Location Plan. The village was originally built up on either side of a stone arch bridge crossing the River Almond. More recent developments have taken place slightly further downstream of this crossing point where the land is flatter and extends to the river edge.

2.1.2 The village comprises several groups of houses, the Vector Aerospace site, a fish farm/trout fishery, a playing field and a bowling club (see Figures 4.1a and 4.1b). The River Almond and its tributary the East Pow Burn (confluence at Almondbank) are part of the River Tay Special Area of Conservation (SAC).

2.1.3 A number of locations in the Almondbank area are particularly susceptible to flooding, these include:

- College Mill Trout Farm;
- residential properties on the left bank of the River Almond;
- a bowling green;
- a playing field;
- Lochty Industrial Estate;
- Vector Aerospace site; and
- a group of residential properties on the right bank of the River Almond including Low's Work Cottages.

2.1.4 Table 2.1 below outlines the key flood events that have occurred in Almondbank together with a brief description of each event. The information was collected from Perth and Kinross Council, consultation with Almondbank residents and previous reports from various consultants.

Table 2.1: Summary of flood events in Almondbank

Event	Description
January 1909	Approximately one square mile of land flooded in Almondbank. Extensive and widespread flooding occurred and was exacerbated by thawing snow fall.
January 1993	This flood was extensive throughout Almondbank affecting in particular the Trout Farm, Vector Aerospace, Deer Park and Low's Work Cottages. The former Black Bridge was washed away during this event. It seems that fast thawing of heavy snow and heavy rainfall contributed to this flood event.
September 1999	This flood was on a similar scale to the January 1993 event and affected also in particular the Trout Farm, Vector Aerospace, Deer Park and Low's Work Cottages. The gauge data for this event shows that the peak flow was similar to the January 1993 event, but the event had a shorter duration.

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Event	Description
December 1999	Flooding from the East Pow Burn occurred at a similar magnitude to the September 1999 event. No gauge records were available on the East Pow Burn.
January 2011	High flows along the River Almond, as a result of snow thaw, caused localised erosion along both banks of the River Almond. Flooding occurred on the East Pow Burn and affected Lochty Park and Vector Aerospace.

2.1.5 In the ten years between 1993 and 2004, various studies were undertaken to assess the risk of flooding at Almondbank and to suggest appropriate flood defence measures. These studies culminated in the design of a 1 in 200 year flood protection scheme for the village (allowing for a 1 in 100 year standard together with a climate change allowance) in March 2004.

2.1.6 In 2005 Perth and Kinross Council commissioned Mouchel to undertake further up-to-date studies and to provide an outline design for a feasible flood protection scheme for Almondbank. The Almondbank Flood Management Options Report (Mouchel Parkman, March 2006) considered various options for managing flooding conditions through the village (see Chapter 3 – Alternatives for further information). Further flood modelling was then undertaken and flood management for Almondbank considered in more detail, as described in the Hydraulic Modelling and Options Assessment Report (Mouchel, 2011), and a final flood protection scheme designed.

2.2 Need for the Scheme

2.2.1 The River Almond at Almondbank is changing from a river flowing in a steep sided valley, to one flowing in a wider more open valley. The channel carries high flows from Glen Almond and is a wide, fast flowing channel. The most influential hydraulic feature on the river, in terms of local flooding, is Low's Work Weir situated at the downstream end of the village. The weir has recently been repaired and reinstated by Perth & Kinross Council.

2.2.2 At present there are no existing formal flood defences in the village, despite flooding in the last few years.

2.2.3 The worst flood in recent times occurred on 16th January 1993 with a peak flow of 233m^3/s. This event has been estimated as a 1 in 70 year return period event and caused widespread damage within the village. The flood event inundated both the residential sites along the left bank of the River Almond and also the industrial sites in the town including the Vector Aerospace site and College Mill Trout Farm. In addition, the footbridge in the centre of the village known as the Black Bridge was washed away.

2.2.4 In February 1994 Babtie Group delivered their first report investigating flooding from the River Almond and included elements of hydraulic modelling and a preliminary economic appraisal of flood damages. In March 1996 Ove Arup & Partners provided a more detailed analysis of the economic impact of both flooding and potential flood

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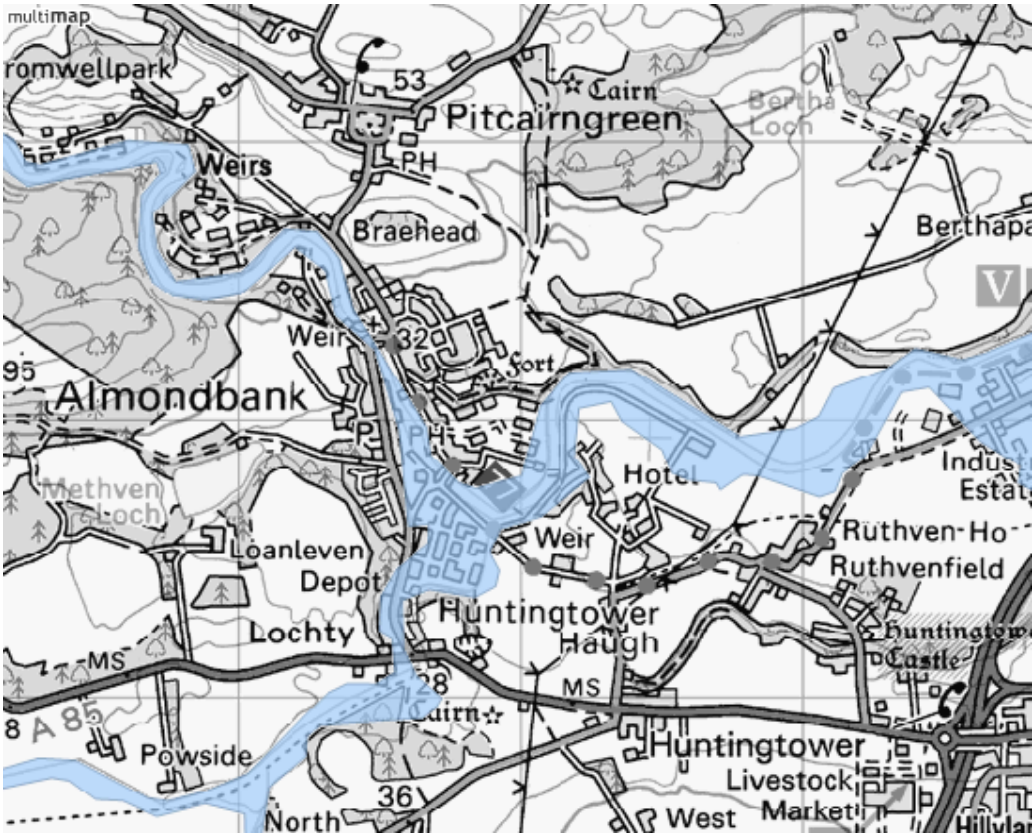
defence schemes. Further flood studies were then undertaken by Babtie into flooding in the East Pow Burn (1998), a Flood Risk Assessment for the new development at Almond Valley Village (1998) before they reappraised the Flood Defence scheme for the River Almond in March 2000. This report examined the same elements of flooding as the 1994 report, but applied more recent economic appraisal techniques building a much stronger case for flood defences.

2.2.5 In March 2004 Royal Haskoning produced a report on the development of a flood defence scheme. They provided an outline design of the flood defence scheme, a draft flood prevention order and an economic appraisal to justify the scheme.

2.2.6 More recent studies undertaken by Mouchel, have tested the previous investigation and modelling work undertaken and have confirmed the need for the flood protection scheme to provide vital protection to properties and residents within Almondbank.

2.2.7 The light blue area shown in Image 2.1 represents the area that could be affected by fluvial flooding in a 1 in 200 year return period event if there were no flood defences bridges or other structures (the only existing formal flood defences located in Almondbank is a flood wall approximately 100 metres in length close to Waterside Cottages). Image 2.2 illustrates the effect of the proposed flood protection scheme on reducing the extent of fluvial flooding.

Image 2.1: SEPA's indicative 1 in 200 year undefended flood outline



Source: http://www.sepa.org.uk/flooding/flood_risk_maps/view_the_map.aspx

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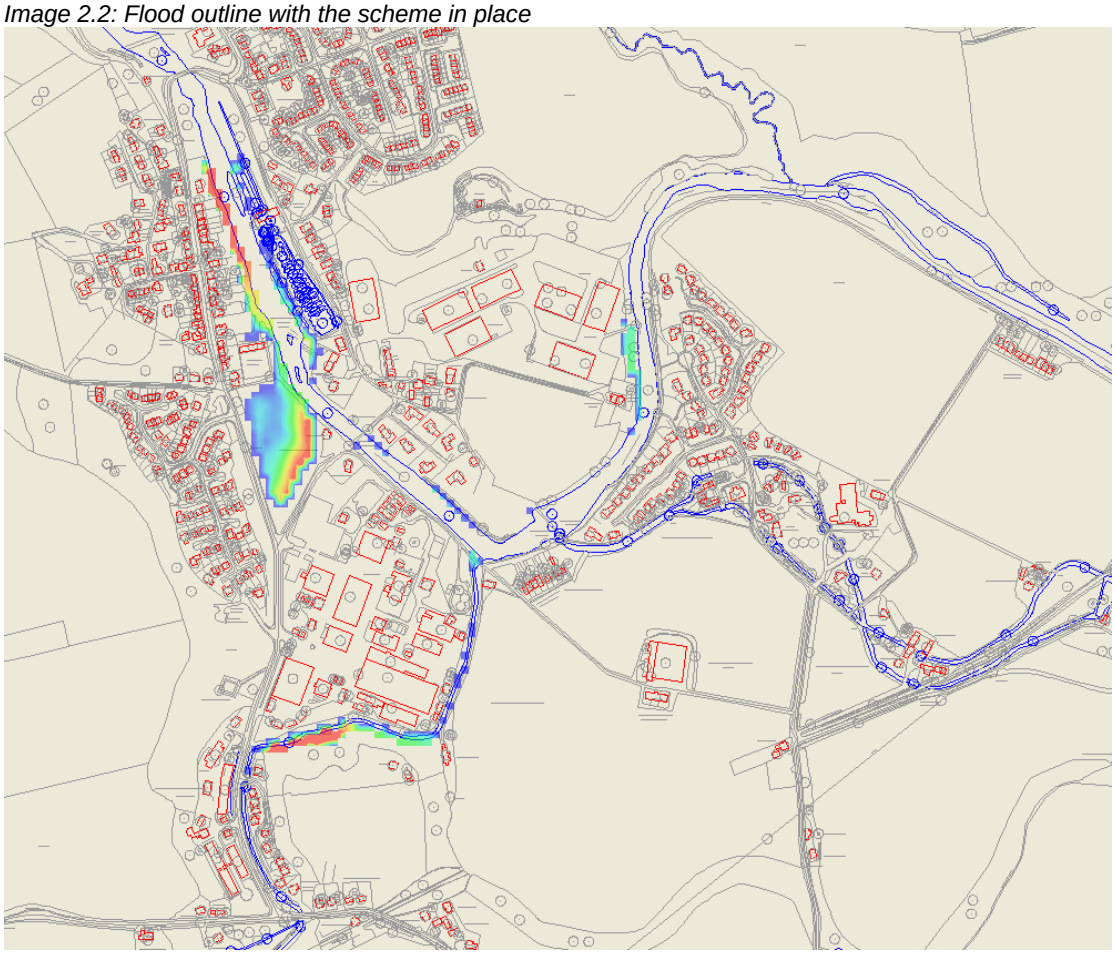
Image 2.2: Flood outline with the scheme in place



Source: Mouchel (2013), Almondbank Flood Mitigation Scheme Technical Report.

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3 Alternatives

3.1 Alternative Options Considered

3.1.1 The Almondbank Flood Management Options Report (Mouchel Parkman, March 2006), considered various options for managing flooding conditions through the village of Almondbank, based on the following factors: topography; flow regime; observed features; environmental impact; financial implications; and calculations/hydraulic modelling. Previous engineering reports had not explored alternative options, suggesting only one type of flood management scheme; hard defences using flood walls and embankments.

3.1.2 Options considered for the sustainable management of floods for both the River Almond and the East Pow Burn are described in Appendix 1 and summarised below. The information provided in sections 3.1.3 to 3.1.10 includes the flood management options explored in the 2006 Options Report. Sections 3.1.11 to 3.1.13 focus on the more recent consideration of flood management for Almondbank detailed in the Hydraulic Modelling and Options Assessment Report (Mouchel, 2011) and then section 3.2.1 summarises all the various options/alternatives considered.

The River Almond

3.1.3 Various flood defence options including diversion; channel online storage, offline storage and the use of flood embankments and flood walls were considered.

3.1.4 The diversion channel option was discounted due to issues associated with the topography of the local area, difficulties of transferring flow into the diversion channel and the limited capacity of the receiving watercourse to accommodate the flows.

3.1.5 The online storage option was discounted because of the need to construct a large retaining structure across the river with potentially significant environmental implications. Specific maintenance and safety precautions would also need to be implemented as the area of impounded water would be classed as a reservoir under the Reservoirs Act (1975). Offline storage was also considered unviable because of the lack of suitably located sites for temporary flood water storage that have not already been developed.

3.1.6 It was considered that the use of mainly direct defences (embankment and flood walls) would be the most viable in terms of buildabilty and cost and would also present the least potential for significant environmental impacts.

East Pow Burn

3.1.7 East Pow Burn is a tributary of the River Almond, joining the main channel slightly upstream of Low's Work Weir. The burn drains an area to the south of the main Almond catchment, and is a less steep catchment than the receiving watercourse. The channel at Almondbank is a narrow, steep channel with supercritical flow

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regimes dominating much of the reach. The flow conditions in the tributary are likely to be affected by the Low's Work Weir similarly to the upstream reaches of the River Almond. Investigations, using a development of Royal Haskoning's hydraulic model, indicate that high flows in the River Almond at Low's Work Weir would cause flooding along the last 200m of the channel before the confluence with the River Almond, even at nominal flows in the East Pow Burn itself.

3.1.8 Relative to the flows in the River Almond, the flows in East Pow Burn were recorded as very small. Accounting for approximately 10% of the flow in the River Almond, any flood management measures on East Pow Burn would have a negligible effect on flows in the River Almond. As such, the flood management options for the East Pow were considered in isolation from the River Almond catchment options.

3.1.9 Various flood defence options for the East Pow Burn were considered, including a diversion channel; online storage, offline storage and the use of flood embankments and flood walls.

3.1.10 No feasible route for a flood diversion channel could be identified. Online flood storage was discounted as, to be effective, it would need to be combined with other defences and it would be costly to construct and maintain as it would classify as a reservoir similar to such an option for the River Almond. Offline storage was considered unviable because of the lack of suitably located sites that would be effective in fully alleviating flooding from the East Pow. The use of flood embankment and flood walls was therefore considered to be the preferred option and the most economically viable.

Alternative Options Considered During 2010

3.1.11 The 2004 flood defence scheme proposed by Royal Haskoning was tested within the flood model developed by Mouchel in 2011 and the scheme was observed not to protect Almondbank for the 1 in 200 year flood return period event. It was noted that some of the flood embankments and walls proposed would need to be raised and lengthened to prevent flood water flowing around the defences.

3.1.12 Three solutions were therefore proposed by Mouchel, as follows:

- Solution 1 – flood defence walls and embankments along the River Almond and the East Pow Burn corridors with two storage areas;
- Solution 2 – flood defence walls and embankments along the River Almond and the East Pow Burn corridors with one storage area and a diversion channel; and
- Solution 3 – flood defence walls and embankments along the River Almond and the East Pow Burn corridors with one storage area.

3.1.13 Solution 3 has been selected as the 'preferred solution'. An embankment has been incorporated along the lower section of the East Pow Burn in preference to a flood storage area in Huntingtower field or a diversion channel. The preferred solution

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similarly to Solutions 1 and 2 incorporates a flood storage area in the playing field area and flood defences along the River Almond from the upstream end of the Trout Farm hatchery to downstream of Low's Work Cottages and the properties at Craigneuk. Flood defences have been also incorporated along the East Pow Burn from the A85 road bridge to the East Pow Burn/River Almond confluence.

3.2 Summary of Flood Management Options

3.2.1 Table 3.1 below provides a summary of the various flood management options

Table 3.1: Summary of flood management options

Flood Management Option	River Almond	East Pow Burn
Diversion channel alone	Topography and capacity make available routes uneconomic.	Limited route availability, possible route diverting water from the East Pow to the River Almond would be difficult and costly to implement.
On-line storage alone	Extremely high storage volume required renders scheme uneconomic.	Flooding due to inundation from the River Almond renders online scheme on the East Pow Burn uneconomic as downstream flood defences are still required. Storage area would remove a large area of land from the town, would require strict maintenance commitments under the Reservoir Act and presents a safety hazard to Almondbank residents.
Off-line storage alone	No available site.	A site within Almondbank would not alleviate flooding in the channel, upstream sites do not alleviate flooding around confluence with River Almond. Storage area would remove a large area of land from the town, would require strict maintenance commitments under the Reservoir Act and presents a safety hazard to Almondbank residents.
Flood walls and embankment **(2004 proposals)**	Economically viable scheme. Flood defences insufficient height and length, would be breached by flood water flowing around them.	Economically viable scheme. Flood defences insufficient height and length, would be breached by flood water flowing around them.

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Flood Management Option	River Almond	East Pow Burn
Flood walls and embankment, with local storage area **(Solution 3 proposals)**	Economically viable scheme. Almondbank would be fully protected. Incorporates a flood storage area at the playing field.	Economically viable scheme. Almondbank would be fully protected.

3.2.2 Given the constraints imposed by the urban development in and around Almondbank, coupled with the high peak flows, direct defences in the form of the 2011 embankment and flood wall scheme (Solution 3) provides appropriate protection within Almondbank and is economically viable.

3.2.3 Solution 3 has been selected as the 'preferred solution' as it would enable the town to be fully protected up to a 1 in 200 year return period flood event. This option is described in more detail in Chapter 4.

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4 Scheme Description

4.1 Background

4.1.1 The scheme comprises a combination of flood defence walls, generally reinforced concrete with stone masonry coping and facing, together with earth embankments in locations where space is available. Bank reinforcement using sheet piles and erosion protection (geotextile matting, willow spilling, block revetment and rip rap) is also proposed in some locations. The existing playing fields in the centre of the village would be utilised as a flood storage area. The River Almond footbridge and the road bridge at the confluence between the River Almond and East Pow Burn would be raised. Improvements to existing drainage infrastructure would also be made at Bridgeton, Main Street and the Vector Aerospace site.

4.1.2 To allow for the approximation and uncertainties inherent in mathematical modelling, a freeboard allowance[1] was added to design levels. The freeboard also allows for the effect of local water level variations and in addition, in the case of embankments, for settlement.

4.1.3 Following consultation with SEPA in relation to the current scheme proposals and flood protection design guidelines, it was determined that the proposed flood mitigation measures should be designed to accommodate a 1 in 200 year flood event, referred to as the 'design event'.

4.1.4 The outline design of the scheme is represented in Figures 4.1a and 4.1b, with detailed plans of all scheme components provided in drawings 716516/AFO/199 to 716516/AFO/216 (contained in Volume Two) illustrating the structures required to be erected as part of the scheme. Cross Sections are presented in drawings 716516/AFO/301 to 716516/AFO/312 (Volume Two).

4.1.5 A description of the components of the proposed flood protection measures is provided below, sub-divided into key locations along the scheme extent.

4.2 Bridgeton Road Bridge

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/200)

[1] The height added to the predicted level of a flood to take account of the height of any waves or turbulence and the uncertainty in estimating the probability of flooding.

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4.2.1 The outline design proposes to mitigate against the impact of overflow from the combined sewer west of Bridgeton Road Bridge through the use of approximately 115m length combined kerb and drainage system on Main Street.

4.2.2 A kerb drainage system is proposed to intercept surface water flows from a section of Main Street, extending from No.19, heading south eastwards towards College Mill Road, continuing westward towards the River Almond road bridge. Prior to reaching the road bridge the intercepted flow would discharge, via a buried outfall pipe, into the River Almond at a location upstream of the road bridge.

4.3 College Mill Trout Farm

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/201, 202, 203, 204, 301 & 302)

4.3.1 The outline design proposes to mitigate the risk of flooding to the trout farm with a combination of sheet piles, a demountable defence, pumping station, drainage infrastructure and reinforced concrete flood defences along with the upgrading and replacement of access routes and sluices. These aspects are described in more detail in the following paragraphs.

4.3.2 A side weir and associated sluice gate on the existing College Mill Lade intake would be constructed to prevent excess flows entering the trout farm. Any excess flows would spill via a discharge channel back into the River Almond. The lade channel would require reinforcement works to ensure its stability.

4.3.3 A demountable defence would be constructed adjacent to the proposed Mill Lade sluice and tied into the sheet pile wall. The proposed demountable defence and side weir arrangement is designed to allow vehicle access to the Mill Lade entrance approximately 50m further upstream. A 136m long sheet pile wall would tie into the existing College Mill Road embankment and continue along the perimeter of the trout farm following the line of the river bank to the proposed ramp access immediately upstream of the existing main trout farm outfall.

4.3.4 The most northerly wall incorporating the demountable defence would provide additional protection against tree debris which has been known to artificially raise local flood levels. The proposed sheet pile wall would be clad in a suitable material and be protected from erosion at the toe on the river side.

4.3.5 In order to maintain the safe operation of the trout farm it would be necessary to raise the existing access routes, using structural retaining walls where necessary, to tie in with flood defence levels, allowing the owner to maintain access and operation during a design flood event.

4.3.6 A 285m long reinforced concrete flood wall would protect the internal area of the trout farm from the ‘raceways’ to the most southerly pond, allowing flood water to occupy the area between this and the river. The existing sluice in this location would be replaced to tie in with the proposed flood defence wall height. The riverside of the

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wall would be protected from river erosion. From here the reinforced concrete flood wall would follow the existing access track southward to the west of the ponds, allowing the existing vehicle access to flood during the design flood event.

4.3.7 Access to the river bank would be maintained along this stretch with the construction of a set of permanent access steps over the reinforced concrete flood wall.

4.3.8 The existing trout farm drainage outfall would be modified to flow into the proposed flood defence pumping station and retention well, located at the current outfall. This would maintain a 24 hour operation of the ponds during design flood events.

4.3.9 All outfalls from the trout farm ponds and the hatchery would be fitted with flap valves to inhibit the backflow of water from the river during design flood events.

4.4 Bowling Green

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/ 204 & 308)

4.4.1 The bowling green is shown to be at risk of flooding for the 1:200 year design event. In order to mitigate this risk, it is proposed to remove the existing perimeter wall and replace this with an approximately 100m long reinforced concrete flood wall. The existing pedestrian access gate would be re-located from its current location in the northeast corner of the green to the southwest corner, where ground levels are outwith the flood risk area.

4.5 Playing Fields

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/204, 205, 206, 207, 308 & 309)

4.5.1 It is proposed that the area containing the playing fields on the right bank of the River Almond is designed to work as a storage area for excess flood waters during a flood event from the River Almond. It is proposed to construct a 246m long earth embankment (of varying height up to approximately 1.8m), with an impermeable core, to the southwest and southeast perimeters of the playing fields. This would allow for flood waters to be contained within this area during a flood event and allowed to discharge back, under control, into the River Almond as water levels begin to reside.

4.5.2 Swale drainage has been incorporated along the inside of the embankment to channel flows as the flood event recedes. This would discharge through a piped outfall beneath the earth embankment into the River Almond at its eastern extent.

4.5.3 Vehicle and pedestrian access to the playing field is to be maintained by constructing an access track over the embankment at the existing playing field pavilion location. The access track would tie into the existing track along the river bank and be accessed from the existing playing fields car park off Main Street.

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4.5.4 When the flood storage area is in use during a flood event several measures have been proposed to protect members of the public. A continuous fence would be constructed along the top of the embankment and vehicle access over the embankment would be physically restricted.

4.5.5 Extensive warning signage would be erected around the flood storage area, along with access steps and gates within the embankment construction. Life buoys would be placed at intervals around the flood storage area in case of an emergency.

4.5.6 The current pavilion is in a dilapidated condition and it is proposed that it is demolished and a new pavilion built in a similar position, protected from flooding. The river bank along the length of the playing fields would be stabilised and protected from erosion.

4.6 Main Street

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/ 205)

4.6.1 The outline design proposes to mitigate against overflow from the combined sewer along the lower section of Main Street, flowing southwards towards Vector Aerospace, through the use of 157m of combined kerb and drainage system on Main Street.

4.6.2 The combined kerb and drainage system is proposed to intercept surface water flows from a section of Main Street, from just north of East Drive to just south of Mackenzie Drive. Intercepted flows would discharge, via a buried outfall pipe beneath the playing fields, into the River Almond at a location upstream of the steel footbridge (former Black Bridge).

4.7 College Mill Road Properties

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/ 204 & 302)

4.7.1 The properties to the southeast of College Mill Trout Farm located on College Mill Road (Rhencullew, Rhourkton House and Druids House) would be protected from flood waters by the construction of a 165m long reinforced concrete flood wall with associated erosion protection. The wall, of varying height up to 0.7m high, would be in line with their property boundaries along the left river bank.

4.8 SEPA Gauge

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/ 204 & 303)

4.8.1 Access to the existing SEPA flow gauge and apparatus would be maintained with the provision of access steps over the reinforced concrete flood wall. The gauge and apparatus would be protected and maintained during construction works.

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4.9 Footbridge (Former Black Bridge)

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/ 206, 207 & 303)

4.9.1 In order to help mitigate the risk of flooding at this location it is proposed to increase the soffit height of the footbridge by 1m relative to the design event flood water levels plus an allowance for freeboard. In order to achieve this increase in height it is proposed that the existing footbridge is relocated approximately 12m upstream and placed on newly constructed bridge abutments.

4.9.2 Relocating the footbridge would ensure that the newly constructed abutments are designed to withstand the increase in height and would ensure the minimal of disruption to pedestrians during the construction period.

4.9.3 As a result of the increase in footbridge height it would also be necessary to build new access ramps to the footbridge, these would tie into the adjacent reinforced concrete flood wall structures running along the left and right banks of the River Almond. The footbridge would be designed to allow for disabled access.

4.9.4 The reinforced concrete flood wall on the right bank (southwest) in this location would tie into both the earth embankment at the perimeter of the playing fields and the footbridge access ramp and would continue for a short distance south eastwards along the un-named access road to Low's Work cottages. The river side of the reinforced concrete flood wall would be protected against erosion.

4.9.5 The reinforced concrete flood wall on the left (northeast) bank at this location is the continuation of the reinforced concrete flood wall protecting the properties on College Mill Road which would also tie into the footbridge ramp access, continuing south eastwards towards the properties at Deer Park. The river side of the reinforced concrete flood wall would be protected from erosion.

4.10 Vector Aerospace (formerly DARA) Site

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/206, 208, 212, 214, 215, 310 & 311)

4.10.1 The Vector Aerospace site would be protected from flooding from both the River Almond and the East Pow Burn with the proposed construction of 360m of reinforced concrete flood walls and 430m of sheet piled walls along with the maintenance of existing gabion structures, erosion protection and riverbank strengthening works.

4.10.2 Insufficient capacity of the combined sewer serving the lower section of Main Street and residential areas puts the Vector Aerospace site at risk from surface water flooding from excess runoff. Section 4.6.1 describes the proposed kerb drainage system to mitigate this risk.

4.10.3 Construction of the fluvial flood defences to protect the Vector Aerospace site would prevent the surface water drains from functioning and surface water would collect on

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the site. Therefore a pump station would be constructed to deal with surface water flooding behind the proposed flood defences.

4.11 Un-named access road along north east boundary of Vector Aerospace site to Water Treatment Works and Low's Work cottages

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/206, 207, 208, 212, 213, 303 & 304

4.11.1 It is proposed to contain flood waters from the River Almond along the un-named access road to Low's Work cottages. This would be achieved by slightly increasing the finished road level at the northwest end at a suitable gradient to tie in with the reinforced concrete flood wall. The increase in finished road level would be supported with a structural retaining wall along its short length.

4.11.2 At this point the 270m length of reinforced concrete flood wall (of varying height up to approximately 0.41m) would be constructed on the southwest side of the access road and follow the boundary of the land owned by Vector Aerospace, the finished road level would decrease to tie in with existing levels. This would allow flood water to flow onto the access road but would ensure that any flood water is contained and allowed to discharge back to the River Almond as flood levels recede.

4.11.3 The proposed length of the access road subject to the flow of flood water would be designed and constructed to withstand this. The elevation of the access road to the Wastewater Treatment Works would be raised in line with the adjacent flood defence heights to prevent any flood water from entering the works. It is proposed that an alternative access to the treatment works would be provided to the rear of the works through the Vector Aerospace site.

4.12 Deer Park

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/208, 303 & 304)

4.12.1 The properties adjacent to the left (northeast) bank of the River Almond, located on Deer Park (No's 1, 2 & 3), would be protected from flood waters by the continuation of the 128m length of reinforced concrete flood wall with associated erosion protection, to follow the line of their property boundaries. The wall would be of varying height up to approximately 1.1m.

4.12.2 At the boundary between No 3 & 4 Deer Park, the reinforced concrete flood wall would tie into an earth embankment (of varying height up to approximately 2.4m) that would follow the line of the top of the left river bank from this point. The 190m length of earth embankment would be constructed with an impermeable core to ensure that flood waters are contained within the River Almond. This embankment follows round just upstream of Low's Work weir, where it ties into high ground.

4.12.3 Any surface waters collecting on the 'dry' side of the embankment would drain to a surface water drainage channel and discharge to the River Almond via pipes through

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the embankment, a flap valve would be required on each pipe to prevent flood water from the River Almond from flowing back into the 'dry' area.

4.13 Craigneuk East and West

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/209 & 306)

4.13.1 The agricultural field to the south west of the Craigneuk properties would be protected with 339m of earth embankment (of varying height up to approximately 1m) that would follow the boundary of the field as it heads towards Criagneuk. The earth embankment would be constructed with an impermeable core to ensure that flood waters are contained within the River Almond. Maintenance access to the River Almond would be maintained in the southwest corner of the field, formed as part of the embankment.

4.13.2 This embankment would tie into a new flood wall erected around the properties at Craigneuk. The length of wall protecting the properties at Craigneuk would be protected from erosion on the river side of the embankment. This is recommended due to the nature of the river at this point and would be designed to minimise the loss of trees in this area.

4.13.3 The flood wall continues to follow the river bank past Craigneuk until it reaches a point where it ties into existing higher ground levels; this location ensures continuous protection against the design event flood water levels.

4.13.4 Any surface waters collecting on the 'dry' side of the embankment/flood wall would drain to a surface water drainage channel and discharge to the River Almond via pipes through the embankment/wall. A flap valve would be required on each pipe to prevent flood water from the River Almond from flowing back into the 'dry' area.

4.14 Low's Work Cottages

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/212 & 305)

4.14.1 It is proposed that Low's Work cottages would be protected from flood waters by 110m of reinforced concrete flood wall constructed along the top of the right river bank. The flood wall would be of varying height up to approximately 1.5m. An integral requirement of the proposals would be to increase the bridge height at the confluence of the River Almond, following the line of the river bank along the front of the properties and tying into the existing masonry wall outside the most easterly cottages.

4.14.2 The road access adjacent to the reinforced concrete flood wall would undergo works to increase the elevation in order to tie in with the proposals to raise the road level at the confluence. The property side of the proposed access track would be supported with a structural retaining wall where necessary, until the change in elevation required ties back into the existing road levels.

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4.15 East Pow Burn Flood Protection Proposals

4.15.1 The East Pow Burn flood protection proposals can be summarised by the property or land that they are designed to protect and are described and referenced to the relevant scheme drawings below.

Lochty Housing Estate (including bridge crossing)

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/215, 216, 311 & 312)

4.15.2 In order to mitigate the risk of flooding in this area and to contain the flood waters within the East Pow Burn it is proposed to remove the existing culverted road bridge structure at the entrance to Lochty Park Housing Estate. This structure would be replaced with a higher single span road bridge to allow more water to pass through during a flood event.

4.15.3 As a result of increasing the height of the bridge at the entrance to Lochty Park, the adjacent road(s) would also be subject to works to tie into the new elevations. Main Street to the north and south of the junction would be re-graded to tie in with the new bridge structure with structural retaining walls being constructed to support the elevated sections of road. Lochty Park Road would also be subject to some re-grading with the need to make some alignment and elevation changes to existing residential accesses.

4.15.4 In conjunction with the raised road bridge, the Lochty Park properties upstream and downstream of the bridge crossing would be protected on the right bank by 260m of reinforced concrete flood wall along their property boundaries, tying into the new bridge and parapet structure. The wall would be of varying height up to approximately 1.1m. Erosion protection would be introduced along the length of the toe of the flood wall. On the opposite bank of the watercourse it is proposed to construct 277m of sheet pile flood wall (of varying height up to 1.2m) to ensure that flood water is contained within the East Pow Burn.

4.15.5 The upstream extent of the reinforced concrete floodwall on the right bank (from the new bridge towards the A85) ties into the existing stone retaining wall at the junction of Main Street with the A85. The upstream extent of the sheet pile wall on the opposite bank ties into existing ground levels approximately 25m north of the junction.

4.15.6 The downstream extent of reinforced concrete flood wall on the right bank to the boundary of No1 Lochty Park would continue, turning eastwards to follow the bank of the East Pow Burn, tying in to higher ground levels. The downstream sheet pile wall on the left bank would continue to follow the bank of the East Pow Burn, heading eastwards following the security fence line to the south and south east boundary of Vector Aerospace and continuing north until it ties in with the new bridge structure at the confluence with the River Almond.

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Vector Aerospace

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/214, 215, 310 & 311)

4.15.7 The sheet pile flood wall running along the left bank of East Pow Burn at Lochty Park would continue to follow the river bank to the south and south east boundary of Vector Aerospace, to provide continued protection to the site from fluvial flooding.

4.15.8 Any existing access points to the river bank along this length would be maintained with the provision of access steps over the flood defence wall, including access to the pipe bridge, helipad access and also access for river maintenance. Where possible any existing gabion baskets that have been placed in the watercourse to provide erosion protection would remain unless they restrict the construction of the proposed defences or where they are thought to be unstable.

East Pow Burn Confluence with River Almond

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/212, 213, 214, 304, 310 & 311)

4.15.9 In order to mitigate the risk of flooding in this area and to contain the flood waters both within the East Pow Burn and the River Almond, it is proposed to remove the existing road bridge structure and replace it with a higher single span road bridge to allow more water to pass through during a flood event. The raised elevation of the road and associated parapet structure would tie into adjacent flood defences to contain water within the watercourses, in the event of a flood.

4.15.10 As a result of increasing the level of the road bridge crossing the confluence, the adjacent roads would also be subject to works to tie into the new elevations.

4.15.11 The road to the northwest of the confluence, past the water treatment works towards Main Street, would be re-graded to tie into existing road levels at a suitable gradient.

4.15.12 The existing vehicle access to Puddledub, to the south of the confluence, would be re-routed as a result of the proposed flood defences to the right (southeast) bank of the East Pow Burn.

4.15.13 The road to the northeast of the confluence, providing access to Low's Weir Cottages, would be re-graded to tie back into existing road levels. Any increase in road elevation would be supported with structural retaining walls and the re-graded roads would be protected against flooding from both the River Almond and East Pow Burn with the construction of an 80m long reinforced concrete flood wall, at an approximate height of 1.5m.

4.15.14 The road to the southeast of the confluence, providing access to Brockhill, the Huntingtowerfield Farm and a route through to Ruthvenfield, and the A85 at Huntingtower, would also be re-graded to tie back into existing road levels. Increases to road elevation would be supported by structural retaining walls.

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4.15.15 To the left (west) bank of the East Pow Burn, Vector Aerospace would be protected by a sheet pile flood wall that would tie into the proposed bridge structure, this sheet pile flood wall continues to follow the Vector Aerospace boundary to give continued protection against flood waters in the East Pow Burn.

4.15.16 On the opposite bank of the East Pow Burn, Brockhill would also be protected by a low embankment (up to 1m high) supporting a sheet pile flood wall. This wall would tie into the proposed bridge structure and continue south past the property where it would tie into a 130m length of earth embankment that would be constructed a small distance back from the existing riverbank in order to provide an additional area for the containment of any flood waters. The right (east) bank of the East Pow Burn would be widened at the south end of the earth embankment to increase the capacity of the river. Associated bank strengthening and erosion protection would be provided for this and the immediate upstream and downstream banks.

4.15.17 At the confluence of the watercourses, the southern bank of the River Almond, where it follows the bend, would be protected with a reinforced concrete flood wall (of varying height up to approximately 1.6m). This would tie into the replacement road bridge structure to ensure continued defences and the containment of flood waters within the watercourses. The north western extent of the reinforced concrete flood wall ties in with the re-graded road levels and the eastern extent of the reinforced concrete flood wall continue along the river bank in front of Low's Work Cottages until it ties into the existing masonry wall.

Puddledub

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/214, 310 & 311)

4.15.18 In order to mitigate the risk of flooding to the property at Puddledub, a 64m section of sheet pile flood wall would be constructed along the right bank of the East Pow Burn in order to contain any flood water within the watercourse. This sheet pile wall would tie in to high ground to the south west of the property and would tie into the proposed earth embankment to the north east. Erosion protection would be provided to the right bank of East Pow Burn in line with the proposed sheet pile wall and embankment.

4.15.19 As a result of the flood protection proposals at the confluence and proposed works immediately upstream of the confluence, the proposed previously referenced earth embankment would be constructed along the current access to the Puddledub property. It is therefore proposed to divert the access to the property away from the proposed earth embankment and associated structures. These proposals would provide Puddledub with protection against flooding and would maintain access in the event of a flood occurring.

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Brockhill

(Volume Two, Appendix 2, Drawing Ref: 716516/AFO/212, 213, 304, 310 & 311)

4.15.20 Brockhill would be provided with protection against flooding through the sheet pile wall with embankment along the right (east) bank of the East Pow Burn and the reinforced concrete flood wall along the south bank of the River Almond. The access road to Brockhill and the road to the east would be realigned to tie into the proposed bridge level. The new road levels would be supported by a structural retaining wall along the north east and northwest boundaries of Brockhill. An alternative car parking area would be provided to the south east of the house with access from the track to the east of the property.

4.16 Construction Programme

4.16.1 Construction of the scheme would commence following the flood order procedure and confirmation of funding, planning approval, detailed design and the construction contract procurement process. As such the start date cannot be confirmed at this stage however, it is unlikely that construction would commence before 2015. Construction would be phased and would be undertaken over a period of approximately 36 months.

4.16.2 Constraints to the construction programme relate to the timing of site clearance operations and the implementation of measures to reduce potential adverse effects on the existing environment.

4.17 Construction Methods

Introduction

4.17.1 Working methodologies, construction areas and access arrangements would be finalised during the detailed design phase of the works, anticipated to be during 2013/14. However, construction of the scheme is likely to comprise the following key activities:

- Site clearance and topsoil stripping;
- Establishment of site compounds and fencing;
- Environmental protection measures
- Accommodation works, possibly including any service diversion;
- Flood wall construction and gabion emplacement;
- Flood embankment construction;
- Sheet pile installation;
- Installation of bank erosion protection measures; and
- Roadworks, bridge construction and bridge relocation.

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4.17.2 An outline Construction Method Statement has been prepared for the scheme and is provided in Appendix 3. This document provides further information of anticipated construction methods required to build the proposed flood protection measures. A Construction Environmental Management Plan (CEMP) would be prepared by the contractor prior to construction of the scheme to further specify how site activities would be managed in order to ensure that risks to the environment are minimised.

Earthworks

4.17.3 The foundations for the flood walls would be excavated and the surplus material would either be appropriately stored for subsequent re-use on site or disposed of off site depending on the material suitability. Material would need to be imported to site to provide fill for the construction of the earth embankments.

Construction Plant

4.17.4 Typical types of construction plant likely to be used during the construction phase are listed below:

- Tracked 360° excavators;
- Lorries – delivery and removal of material;
- Dumper trucks;
- Vibratory roller;
- Sheet pile driver;
- Crane;
- Concrete wagon and pump;
- Small hand held plant; and
- Site personnel vehicles - relatively low numbers of cars.

4.17.5 Potentially noisy on-site activities are discussed in detail in Chapter 13 (Air Quality and Noise). The contractor would be required to adhere to maximum noise levels which would be specified within the contract document in accordance with Perth and Kinross Council requirements.

Construction Site Access Routes

4.17.6 The main access route to the site would be the A85 and Almondbank Main Street (see Figure 14.1). Access would also be required along the residential streets of Lochty Park, College Mill Road, Craigneuk Road and Deer Park. Tracks leading to Puddledub and Brockhill (adjacent to the East Pow Burn), the Bowling Green and Low's Work Cottages (along the perimeter of Vector Aerospace) and tracks leading to the properties and agricultural land at Craigneuk would also be used. Access to Vector Aerospace as well as a number of residential properties gardens would be necessary.

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Hours of Working

4.17.7 Typical standard working hours would be from 0700 to 1900 Monday to Friday. Weekend working would only be undertaken if requested in advance by the Contractor and approved by the Site Engineer and may consist of a reduced standard working day.

Lighting Requirements

4.17.8 Portable lighting may be required during the construction phase if natural light is inadequate during working hours.

Fencing

4.17.9 Working areas will be temporarily fenced off for public safety reasons. Fencing will also be erected where required to delineate any temporary closure or diversion of sections of footpaths/roads.

Establishment of Site Compound and Services

4.17.10 A site compound would be established in the vicinity of construction activities. The precise location of the compound has not yet been determined, and would be considered by the successful Contractor at a later stage. However, the compound would be sited appropriately in order to minimise environmental intrusion/impact and so that, after site restoration, there are no permanent adverse environmental effects.

4.17.11 Once the area for the compound is agreed, topsoil would be stripped and the area covered with sub-base material. The area may also be surfaced if necessary. Portable cabins may be erected on site to accommodate offices and welfare facilities. The compound area would be defined using security fencing. The reinstatement of the compound area would require the removal of temporary services, surfacing and sub-base and the area finished to the satisfaction of the landowner.

4.17.12 Along with the site compound, closer working areas at the exact location of the flood defences would be required. These would be appropriately fenced and may be used to temporarily store plant overnight.

Traffic Management

4.17.13 Traffic management would be required during the construction phase and this may comprise temporary road diversions, road restrictions and traffic signalling. A traffic management plan would be prepared by the contractor with the agreement of Perth and Kinross Council.

Waste Management

4.17.14 A Waste Management Plan would be prepared by the contractor. This would ensure that waste materials are appropriately managed and wherever possible that materials

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would be reused on-site rather than removed for disposal. With regard to reducing energy use associated with material importation, consideration would be given to locally manufactured or sourced material.

4.17.15 There would be the need to import fill materials to the site for the construction of the earth embankments. Where possible, suitable excavated material would be stored on site and reused. However, the ground investigation information available to date would indicate the excavated material is unlikely to be suitable for construction of an impermeable earth embankment, unless a central impervious core was included. Construction of the walls and embankments would require concrete to be imported to the site as required.

4.17.16 Methods to reduce the amount of waste generated would be put in place during the construction period and would include limiting the amount of excess material brought onto the site, for example the acceptance of unpackaged material where appropriate. The re-use and recycling of wastes would also be considered and methods to achieve this set out in the CEMP. This may also have positive economic benefits as the costs of raw materials and waste disposal continue to rise.

4.17.17 Special care would be taken during deliveries, particularly when any hazardous materials are involved. Deliveries would be supervised at all times and any containers clearly labelled with the nature and volume of their contents. Loading and unloading areas would be clearly marked and isolated from the surface water run-off to watercourses.

Pollution Prevention Measures

4.17.18 The contractor would be required to comply at all times with the requirements of the final scheme specification with regard to prevention of pollution. Consultation would be held with SEPA to agree measures required to prevent pollution to watercourses, measures to deal with accidental spillages and discharge points to watercourses. Material storage areas and site compounds would be appropriately bunded to prevent leakage of potential contaminants into the surrounding water environment. Generators would be housed within containment areas to prevent possible spread of any accidental spillages. Wheel washing facilities would be available, if necessary, for all haulage plant so as to avoid deposition of dirt onto public roads and to reduce the possibility of contamination of watercourses.

Landscaping Proposals

4.17.19 The outline scheme design has been developed taking into account the following key landscape principles:

- Consideration of how to achieve best fit with the existing landform.
- Retention and best use of existing vegetation.
- Protection of nearby properties.

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- Minimising damage to other landscape elements.
- Minimising damage to sites of ecological or archaeological interest.

4.17.20 These principles and the following techniques would be considered and developed during the detailed design, in consultation with interested parties, to reduce negative impact and to enhance amenity and landscape character.

- Landscape planting design to be in keeping with existing natural vegetation patterns and types and where possible native species would be used.
- Earthworks contouring to blend into the surrounding landscape as much as possible.
- Reinstatement and enhancement of habitat connectivity.
- Conservation of wildlife and biodiversity enhancement.

4.17.21 The procedure set out in the Scottish Executive's 'Cost Effective Landscaping : Learning from Nature'(CEL:LfN) would be applied to ensure that all mitigation measures are effective, represent best value for money and make a positive and sustainable contribution to the character and biodiversity of the site.

4.17.22 The principal landscape issue on this scheme is to prevent adverse effects at source. Disturbance to the existing woodland would be reduced to the minimum required to incorporate the scheme elements and achieve effective flood protection.

4.17.23 Semi-natural riparian woodlands hold a key position in Scotland's natural environment, protecting the riverbanks, controlling erosion, and promoting conditions suitable for aquatic flora and fauna by providing shade, cover, and screening. The particular woodlands at Almondbank are also of importance to local amenity and landscape character.

Construction Method Statement

4.17.24 As indicated above, an outline Construction Method Statement (CMS) has been prepared as a separate document to the ES (also provided in Volume Two, Appendix 3). The objective of the CMS is to provide a general framework for how those construction works within proximity of the River Almond and East Pow Burn would be implemented and controlled in order to avoid any deterioration in the River Tay SAC features of interest. The CMS would be further developed during the detailed design of the scheme. The contractor awarded the construction of the scheme would develop more detailed construction methods and specify management for different parts/aspects of the scheme though preparation of the CEMP, although they would be required to work within the framework set out in the CMS.

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5 Approach and Methods

5.1 Approach

5.1.1 This ES has been prepared in accordance with the requirements of the Directive on the effects of certain public and private projects on the environment which is implemented in Scotland through the Environmental Impact Assessment (Scotland) Regulations 2011.

5.1.2 This ES includes consideration of the following environmental parameters:

- Land use and recreation
- Landscape and visual
- Water quality and hydrology
- Ecology
- Cultural heritage
- Geology, soils and contamination
- Air and noise
- Traffic and access
- Cumulative impacts

5.2 Format of the Assessment Chapters

5.2.1 The assessment of impacts has generally been undertaken in accordance with the following process for all environmental parameters:

- Scope of the assessment which introduces the surveys and assessment that have been undertaken specific to the environmental parameter reported in the chapter.
- Legislative context which describes regulations and guidance that are relevant to the environmental parameter reported in the chapter and that have been taken into account during the assessments.
- Methods of assessment which details the methodologies adopted for the various assessments of the baseline environment and predicted impacts.
- A description of the baseline conditions of the site and its environs.
- A description of the predicted beneficial and adverse impacts and an assessment of their significance.
- Identification of mitigation measures in light the evaluation of predicted impacts.
- A description of residual effects, inclusive of any mitigation measures.

5.2.2 Deviations from this general approach are explained in relevant chapters.

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Baseline Conditions

5.2.3 The impact assessment for each environmental parameter has been undertaken in comparison with the 'baseline' situation. The 'baseline' refers to the existing site conditions and how these are predicted to change if the scheme did not proceed. Baseline information has been gathered through site visits, the review of maps, data collection, consultation with statutory and non-statutory organisations and field surveys.

Predicted Impacts

5.2.4 Predicted impacts arising from the scheme have been identified and described and an assessment of the level of significance for each effect determined as far as practical.

5.2.5 Significance varies according to the environmental aspect and the context in which the assessment is made and depends to a large degree on the availability of data relating to existing environmental conditions and the value applied to these conditions. However, in general, the level of significance of impacts has been defined using a combination of the sensitivity of the environmental feature and the magnitude of impact. The significance of impacts has been defined for each environmental parameter in the appropriate sections.

5.2.6 Sensitivity has generally been defined according to the relative value or importance of the feature, i.e. whether it is of national, regional or local importance or by the sensitivity of the receptor.

5.2.7 Magnitude of impact has been determined by reference to any legislative or policy standards or guidelines, and the following factors:

- The degree to which the environment is affected, e.g. whether the quality is enhanced or impaired.
- The scale of the change, e.g. the size of land area or number of people affected and degree of change from the existing situation.
- The scale of change resulting from impacts.
- Whether the effect is temporary or permanent.

5.2.8 The nature of impacts may vary and may be direct or indirect, secondary, cumulative, short, medium or long-term, permanent or temporary and positive or adverse. These types of impacts have all been considered.

5.2.9 Consideration has also been given to the potential for cumulative/interactive impacts associated with the proposed scheme. In a broad sense, cumulative impacts refer to the accumulation of effects on the environment relative to other past, present or foreseeable actions that occur in an additive or interactive manner.

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5.2.10 A separate chapter (Chapter 15) has been included to consider cumulative effects for all topics.

Mitigation Measures

5.2.11 Mitigation measures have been developed based on guidance provided in Planning Advice Note 58 on EIA as illustrated in Table 5.1. This considers mitigation as a hierarchy of measures ranging from prevention of environmental effects by avoidance, through to compensatory measures for effects that cannot be remedied.

Table 5.1: Hierarchy of mitigation measures

Level of Mitigation	Definition
Prevent	To prevent adverse environmental effects at source for example through choice of site or specification of construction equipment.
Reduce	If adverse effects cannot be prevented, steps taken to reduce them through such methods as minimisation of cause of impact at source, abatement on site and abatement at receptor.
Remedy/offset	When effects remain that cannot be prevented or reduced, they are offset by such remedial or compensatory action as provision of environmental improvements, opportunities for access and informal recreation, creation of alternative habitats and prior excavation of archaeological features.

5.2.12 The approach to the mitigation of adverse environmental impacts has been to avoid them wherever possible. This can be achieved by consideration of ways in which to prevent adverse effects during the scheme design stage, rather than relying on measures to mitigate the effects. Where avoidance of impacts is not feasible (due to engineering or economic requirements), measures are proposed to minimise or reduce potential adverse impacts through abatement measures either at source, at the site (for example, by the use of noise attenuation measures or screen planting and landscaping), or at the receptor (for example, translocation of plant species). Where adverse effects cannot be prevented or reduced, consideration has been given to the specification of measures that offset or, in certain circumstances, compensate for any damage. These would require further specifications and incorporation into the detailed scheme design and/or Contract Documents.

Residual Effects

5.2.13 The assessment of residual effects takes into account mitigation measures to be adopted. Where there is any uncertainty as to whether a specific measure can be successfully implemented, or the precise details of mitigation cannot be defined at present (for example, if the results of further investigations are required), this is clearly stated, and the range of potential impacts with and without mitigation are defined.

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5.3 Scheme Design Modifications

5.3.1 The assessment of impacts and the proposed mitigation measures are based on an outline scheme design. This design and the environmental mitigation measures defined in the ES to address predicted environmental effects would be further developed together during the detailed design stage and prior to construction. This may result in some changes to the design information provided in Chapter 4, however, it is anticipated that the outline design would be developed in a manner such that it has no material change to the effects of the scheme on the environment. In addition, there may be opportunities to reduce predicted impacts.

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6 Scoping and Consultation

6.1 Introduction

6.1.1 This chapter describes the consultation process that was undertaken during preparation of the ES. Consultation is a key element of environmental 'scoping' which is the initial stage of an environmental impact assessment where decisions are made on the relevant information and topics to be assessed. Scoping is an iterative process that may continue throughout the detailed planning and design stages of the project.

6.2 Consultation Process

Purpose of the Consultations

6.2.1 The purpose of the consultation exercise was to:

- Ensure that statutory consultees (i.e. those with responsibilities for protecting the environment and regulating any activities which may adversely effect existing environmental conditions) and other non-statutory bodies with a particular interest in the environment are informed of the proposed scheme and are provided with an opportunity to comment.
- Obtain baseline information regarding existing environmental site conditions.
- Establish key environmental issues and identify potential impacts to be considered during the environmental assessment.
- Identify those issues which are likely to require more detailed study and those which can be justifiably excluded from further assessment.
- Provide a means of identifying the most appropriate methods of impact assessment.

6.2.2 All consultees were initially contacted in June 2005 by letter, informing them of the details of the proposed scheme and requesting that they provide any specific baseline information that they may hold or any comments that they may have concerning the proposals. The information requested was tailored specifically for each consultee and scheme layout drawings were provided.

6.2.3 Additional consultations were also carried out during 2007, following the project hold period, in order to update the information previously provided in 2005. Consultation with Scottish Natural Heritage and the Scottish Environment Protection Agency has been ongoing since then.

6.2.4 Public meetings, exhibitions, press releases, newsletters and consultations with planning and statutory and non-statutory consultees have all contributed to the development and assessment of the proposed scheme. Public exhibitions/meetings

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were undertaken on 23 Jan 2008 (meeting), 30 Jan 2008 (exhibition) and 22-23 June 2011 (exhibition).

Consultees

The statutory and non-statutory organisations consulted with are listed below:

Statutory consultees

- The Health and Safety Executive
- Historic Scotland
- Perth and Kinross Council (Environmental Services; Planning and Transportation)
- Scottish Environment Protection Agency (SEPA)
- Scottish Natural Heritage
- Scottish Executive Air, Climate & Engineering Unit
- Scottish Executive Development Department Planning Division
- Scottish Executive Environment and Rural Affairs Department (SEERAD)
- Scottish Executive Wildlife and Habitats Division
- Scottish Water

Non-statutory consultees

- Architectural Heritage Society of Scotland
- Architecture and Design Scotland
- Biological Records Centre
- Byways and Bridleways Trust
- College Mill Trout Farm
- Council for Scottish Archaeology
- Cyclists' Touring Club Scotland (Tayside)
- Garden History Society
- Methven Community Council
- National Trust for Scotland
- Perth Bat Group
- Perth and Kinross Heritage Trust
- Perth and Kinross Squirrel Group
- Royal Commission of Ancient and Historical Monuments of Scotland
- Royal Society for the Protection of Birds Scotland
- Scottish Badger Group

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- Scottish Biodiversity Forum
- Scottish Civic Trust
- Scottish Cyclists Union
- Scottish Wildlife Trust
- Scotways
- Sustrans Scotland
- Tay Salmon Fisheries Board
- Tayside Ornithologists Club

Key Issues Raised

6.2.5 The key issues raised by the individual consultees are summarised in Table 6.1, below. It should be noted that not all consultees provided a response.

Table 6.1: Key consultee issues

Consultee	Key Issues
Architectural Heritage Society of Scotland	• Concern over direct or indirect impacts upon Low's Work Weir.
Perth Bat Group	• Full bat survey during summer recommended.
Perth and Kinross Council (Environmental Services)	• Various sites within the Almondbank area have been earmarked for contaminated land surveys.
Perth and Kinross Council (Planning and Transportation)	• Suggestion to re-use existing footbridge
Perth and Kinross Squirrel Group	• Appropriate species surveys recommended.
Royal Society for the Protection of Birds	• Two SSSIs identified – Almond Bank and Methven Woods. • Scheme should promote sustainable flood management.
Scottish Badger Group	• Badger survey recommended.
Scottish Environment Protection Agency	• Discussions ongoing with regard to the requirements of the Water Framework Directive, Water Environment and Water Services (Scotland) Act and the Water Environment (Controlled Activities) Regulations.
Scottish Natural Heritage	• Identified River Tay SAC designated for atlantic salmon, river lamprey, sea lamprey, brook lamprey, otter and oligomesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or *Isoete-Nanojuncetea*, known as clearwater lochs. • Potential presence of Freshwater Pearl Mussel – survey recommended. • Key issues expected to be addressed in detail include ecological impacts (especially in relation to the River Tay SAC) and landscape and visual impacts.

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Consultee	Key Issues
Scottish Water	• Would welcome the opportunity to discuss the implications of water level rises on water treatment infrastructure.
Sustrans Scotland	• Enquired as to whether the proposed scheme could facilitate the upgrading/extension of the NCN77 along the River Almond towards Perth. • Indicated the need to keep the route open at all times during construction.
Tayside Ornithologists Club	• Highlighted potential for impacts upon voles and bats and identified the potential for the presence of New Zealand Flatworm.
General public	• Loss of trees. • Erosion of riverbanks.

6.2.6 All the issues raised during the consultation process have informed the conduct or findings of the various assessments reported in the ES.

6.3 Scope of the Assessments

6.3.1 Taking into account information received from the consultation process and through initial site visits, the assessment has been scoped to include the following aspects:

6.3.2 Land use and recreation – the assessment considers the likely effects of the proposed scheme on existing and future land use. The main effects considered are land-take and effects on agricultural land, community land, private property, development land and recreational facilities.

6.3.3 Landscape and visual – the assessment focuses on the predicted impacts associated with the proposed development in relation to the existing landscape and visual context surrounding the flood protection proposals. The assessment considers the existing landscape character conditions and visual amenity of the surrounding landscape; summarises the methodology used for the assessment; reports on the likely landscape and visual impacts resulting from the scheme; and outlines appropriate mitigation to address adverse effects.

6.3.4 Water Quality and hydrology - the assessment focuses on the predicted impacts that the proposed scheme could have on surface waters and groundwater. It reports on the desk-based assessment and site walkover undertaken to determine baseline conditions in terms of surface waters and groundwater in the vicinity of the proposed scheme. Consideration is given to the potential impacts relating to water quality and hydrological aspects arising both during the construction phase and impacts relating to the operational and maintenance phases.

6.3.5 Potential impacts of the scheme in relation to water resources and waste management issues were scoped as key issues during the consultation process. Specific aspects are listed below:

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- Design flood return periods and downstream flood risk issues.
- Consideration of Water Framework Directive objectives – sufficient information is required regarding affected watercourses such that the planning authority can determine the risk to the status of these water bodies.
- Pollution avoidance and control – all pollution risks and measures to minimise them should be identified (particular issues are likely to be associated with sediment and mineral oils).
- Habitat enhancement - opportunities for habitat creation and enhancement should be identified where possible.
- Recycling of materials and use of secondary aggregates.
- Waste minimisation and waste management.
- Erosion – increased flows and associated velocities and affect on sediment loads and transport, with consideration to fish species in the River Almond and East Pow Burn.

6.3.6 Ecology – the assessment focuses on ecological receptors considered ecologically valuable, receiving protection through legislation, or that are subject to provisions in planning policy. Likely impacts and effects of the scheme on these receptors have been assessed, and where necessary mitigation and compensation measures to offset an overall negative impact have been proposed.

6.3.7 The ecological assessment therefore focuses on the receptors listed below:

- River Tay Special Area of Conservation.
- Running water.
- Riparian woodland.
- Otter.
- Fish (salmonids and lamprey).
- Freshwater Pearl Mussel.
- Bats.

6.3.8 Cultural heritage – the assessment considers the potential for effects associated with the proposed scheme with respect to cultural heritage and is mainly focused on disturbance aspects.

6.3.9 Air quality and noise – the assessment includes:

- an evaluation of impacts associated with construction-related dust on sensitive receptors located in the vicinity of the works during the anticipated construction period for the proposed scheme;

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- an evaluation of construction-related emissions associated with the use of parts of the local road network by heavy duty vehicles (HDVs) delivering materials and components and disposing of excess soils and waste during construction; and
- potential noise and vibration impacts at sensitive receptors during the construction of the proposed scheme.

6.3.10 The discussion of potential impacts concentrates on effects during the construction period, as operation of the scheme would not result in any noise or air quality issues.

6.3.11 Traffic and access - the assessment includes:

- desk-based study to determine current road usage, including vehicle movements and access arrangements in the vicinity of the proposed flood protection scheme; and
- assessment of how the activities associated with the construction phase are likely to impact on existing road users.

6.3.12 The discussion of potential impacts concentrates on effects during the construction period, as traffic generated post construction and during scheme operation would be limited to intermittent and infrequent use of local roads by generally light vehicles, requiring access to the locality for maintenance purposes or in the event of an emergency.

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7 Land Use and Recreation

7.1 Scope of the Assessment

7.1.1 This chapter provides an assessment of likely effects of the proposed scheme on existing and future land use. The main effects considered are land-take and effects on agricultural land, community land, recreational facilities, private property and development land.

7.1.2 The study area was taken as the footprint of the scheme and an approximate 500m area around it. Baseline information was collated through desk-based assessment and site walkovers.

7.2 Legislative and Planning Context

7.2.1 Reference has been made to the following policy and planning documents:

Scottish Planning Policy (2010)

7.2.2 The Scottish Planning Policy provides a statement on the land use planning system in Scotland. It sets out the key principles and the Government's priorities for the system to guide policy formation and decision making towards the goal of sustainable development and economic growth. Sustainable development has been a key consideration in the development of the proposed flood protection scheme with a thorough assessment of alternative flood management options having been undertaken.

7.2.3 The proposed scheme meets the flood protection needs of local residents and commercial operations whilst minimising adverse effects on the environment and recreational qualities of the area. Temporary flood storage is included in the proposed scheme through use of the playing field area.

Perth Area Local Plan (1996, Amended 2000) and Perth Area/Central Area Draft Local Plan (2004)

7.2.4 The Perth Area Local Plan covers Perth City and the surrounding countryside and villages. In November 2000 Alteration No.1 (housing land) was adopted updating housing land allocations to 2006. The Plan sets out specific local development policies and proposals.

7.2.5 Under the Town and Country Planning (Development Planning) (Scotland) Regulations 2008 a new system of Development Planning is being developed. This will replace the current Development Plan system of Structure Plans and Local Plans, although these will remain in use until new Plans are adopted under the new system. The new Development Plan system for Perth and Kinross will consist of the Strategic Development Plan (TAYplan) prepared jointly by Perth & Kinross, Dundee, Angus and Fife Councils (adopted in 2012 and replaced the previous Structure Plan) and a Local Development Plan (LDP) to cover all of Perth and Kinross. The LDP will

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replace the existing six Adopted Local Plans. Until the LDP is in place the existing Local Plans remain in force.

7.2.6 The Perth Area/Central Area Draft Local Plan (December 2004) was prepared and intended to replace the Perth Area Local Plan (1996). However, following advice from the Scottish Government, Perth and Kinross Council decided not to progress with this plan and instead to replace it with the new LDP which would cover the entire Council area.

Perth and Kinross Core Paths Plan (January 2012)

7.2.7 A Core Paths Plan has been produced by Perth and Kinross Council, as required by the Land Reform (Scotland) Act 2003, and was adopted in January 2012. The plan identifies a system of paths (Core Paths) to provide reasonable non-motorised public access throughout the entire Perth and Kinross area. There is no specification for Core Paths, some may be just desire lines across rough ground and some may be built paths suitable for all users. Most Core Paths make use of existing paths and tracks, but new links may also be created.

7.3 Methods of Assessment

Baseline methods

7.3.1 The identification of existing land use and the location of community-focused and recreational facilities, private property and land indicated for future development was made by reference to OS mapping and Perth and Kinross Council development plan documentation (as outlined above).

7.3.2 In addition, a number of field surveys were conducted during 2005, 2006, 2009 and 2011.

7.3.3 Agricultural land classification information from the Macaulay Land Use Research Institute (MLURI) – Sheet 53 Blairgowrie (1:50,000 scale) - was also consulted although it is noted that not all agricultural land within the area has been classified.

Impact assessment

7.3.4 As outlined in Section 5, impacts were considered in terms of both site value and magnitude of impact. The significance of predicted impacts was then determined through a combination of value and magnitude.

Land use value

7.3.5 The value, or sensitivity, of land use was determined as detailed in Table 7.1 below. It should be noted that not all agricultural land within the area has been classified and where this is the case, the value is assumed to be high. With respect to agricultural land, the value of the land can be qualified by reference to the land capability grading system (see section 7.4).

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Table 7.1: Definition of land use value

Value	Definition
High	Private residential buildings, forestry of national commercial or recreational importance, community, recreational and development land of high national value. Agricultural land of Prime Quality, including Grade 1 to Grade 3.1.
Medium	Land associated with private property. Forestry, community, recreational and development land of value regionally/locally. Agricultural land assessed to be of Grades 3.2 to 5.3.
Low	Forestry, community, recreational and other land of no specific importance. Agricultural land assessed to be of Grades 6.1 to 7.

Impact magnitude

7.3.6 The severity, or magnitude, of impact was assessed independently of the site value and assigned to one of the categories presented in Table 7.2 based on professional judgement:

Table 7.2: Impact magnitude ratings for land use

Rating	Definition
Major	A major loss or alteration of land or where there would be complete severance of important parts of a site such as to significantly affect the post-development value of the site. Major beneficial change such that post-development value of the site is significantly improved.
Moderate	A loss, alteration of severance of land such that the post-development value of a site would be diminished but to a minor degree. Beneficial change such that post-development value of the site is improved.
Slight	Minimal loss, alteration or severance of land such that there would be a measurable change but this would not significantly affect the use of land from pre-construction conditions. Beneficial change such that post-development value of the site is slightly improved.
Negligible	Very little appreciable effect on existing land use or where there are impacts which are not considered relevant to the existing use of the land and would not affect value.

Impact significance

7.3.7 The significance of impact (beneficial and adverse) was determined as a combination of the value of the site and the magnitude of impact as shown in Table 7.3 below.

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Table 7.3: Significance ratings for land use

Site Value	Magnitude of Impact			
	Major	**Moderate**	**Slight**	**Negligible**
High	Major	Major	Moderate	Slight
Medium	Major	Moderate	Slight	Negligible
Low	Moderate	Slight	Negligible	Negligible

7.3.8 The impacts upon features of landscape, ecological and archaeological importance are assessed in Chapters 8, 10 and 11 respectively.

7.4 Baseline Conditions

Agricultural Land

7.4.1 The accepted classification system for agricultural land use capability identification in Scotland, devised by the Macaulay Land Use Research Institute, comprises a seven class system. The methodology considers climate, gradient, soil, wetness, erosion and pattern. Classes 1 to 4 are suited to arable use while land in Classes 5 and 6 is more suited to improved grassland and rough grazing. Land in Class 7 is considered to be of very limited agricultural value and usually incorporates fully developed land found in urban areas.

7.4.2 As shown on Figure 7.1, an arable field of Class 2 agricultural land (Huntingtower Haugh area) is located immediately to the south of the residential property named Brockhill (adjacent to the confluence of the River Almond and East Pow Burn). Land within Class 2 is capable of producing a wide range of crops, with the level of yield high but less consistency obtained than on Class 1 land due to the effects of minor limitations affecting cultivation, crop growth or harvesting. Huntingtower Haugh is separated from the adjacent (to the northeast) Huntingtower Field by the access track/Core Path to Huntingtower Field Farm Cottages. This land is susceptible to flooding from the East Pow Burn. It was noted during site visit in 2011 that fields associated with Huntingtower Haugh adjacent to the East Pow Burn had been turned to grassland use. Although in Spring 2012, the land had been ploughed once again and become arable.

7.4.3 An area of improved grassland/arable land (not classified under the MLURI Land Use Capability for Agriculture Classification System) is located to the east of the residential properties at Deer Park. This field of approximately 2.7ha extends eastwards to the boundaries of the properties at Craigneuk and is bounded to the north by industrial storage units and to the south by the River Almond. Based on the results of the flood modelling work undertaken, this field is susceptible to flooding from the River Almond.

7.4.4 Overall the agricultural land in the study area is considered to be of medium to high value.

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Woodland

7.4.5 As indicated on Figure 7.1, the banks of both the River Almond and the East Pow Burn are tree lined for the majority of the scheme area. As described in Chapter 10, this narrow strip of vegetation is composed of semi-natural broad leaved woodland. The largest area of woodland, with regard to its extent from the riverbank, is found immediately to the north of College Mill Trout Farm up to Almondbank Bridge.

7.4.6 Scattered trees and scrub are also present within the study area and the playing field adjacent to Main Street is bounded by several trees. There are no areas of commercial woodland within the scheme area.

7.4.7 Overall woodland in the area can be considered to be of medium value, particularly with regard to its recreational amenity value.

Private Property

7.4.8 A number of private residential properties are located adjacent to both the River Almond and East Pow Burn. The closest properties to the River Almond, with gardens backing onto the river, are those in the Deer Park area (property numbers 1, 2, 3 and 4 Deer Park as well as Rhencullen, Rhourkton, Druid's House and a property at College Mill Trout Farm); all on the eastern bank. In addition the majority of properties along Almondbank Main Street also have back gardens within 10m of the western edge of the River Almond. Other residential properties sited within close proximity to the River Almond include: The Courts (immediately to the north of the Vector Aerospace site); Low's Work Cottages and Brockhill (by the confluence of the East Pow Burn and the River Almond), properties on the northern side of Almond Grove (to the east of Low's Work Weir); and Craigneuk East and Craigneuk West on the opposite side of the river from Almond Grove, adjacent to the industrial storage area.

7.4.9 Being situated at the confluence, Brockhill is also adjacent to the East Pow Burn. Further upstream on the East Pow Burn and within 20m to the south is Puddledub. Property numbers 1, 2, 3, 4, 5 and 10 Lochty Park have gardens bound by the East Pow Burn and the other properties within the Lochty Park area, including View Mount, are within 20m of this watercourse.

7.4.10 There is considerable variety of land use for business and industrial purposes within the study area. The largest local employer is Vector Aerospace which lies adjacent to both the River Almond and the East Pow Burn at the southern end of the village. This site has incurred substantial damage as a result of previous flood events and extensive flood protection measures (gabion baskets) are already in place on the East Pow Burn in response. Immediately to the east of Vector Aerospace, at the Almond/ East Pow confluence is the Scottish Water Wastewater Treatment Works which has an outfall into the River Almond protected by 2 gabion baskets. To the north of Vector Aerospace on the opposite side of the playing field is Almond Valley Bowling Club, a walled outdoor bowling green within 20m of the River Almond.

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South of Vector Aerospace and on the opposite side of the East Pow Burn the land is also under the ownership of the Vector Aerospace.

7.4.11 Immediately to the west of Main Street at Lochty Park, is Lochty Industrial Estate which is divided into approximately 40 units for use by small businesses including garage premises and storage. Further north along Main Street in the centre of the village is a shop (No.6), Post Office (No.17) and Almondbank Inn (No. 29-31).

7.4.12 To the north of the study area on the eastern bank of the River Almond is College Mill Trout Farm which has occupied the location since the late 1960s. Further to the south on College Mill Road, some 60m to the east of Black Bridge is a small workshop/garage premises and to the east of this a complex of industrial units (storage sheds).

7.4.13 Adjacent to the north of Black Bridge, on the eastern bank is a SEPA gauging station. Narrow tracts of undeveloped land on the banks of the River Almond (and up to the centre line of the river), including the access road along the south bank to Low's Work cottages are understood to be under private ownership.

7.4.14 Private property is considered to be of medium value.

Recreational and Community Facilities

7.4.15 Public access routes (see Figure 7.1) in the vicinity of the River Almond are heavily used for recreational purposes, particularly dog walking by local residents. The route along the unnamed access road from the playing field car park at Black Bridge, bounded by the right bank of the Almond and the northern perimeter fence of Vector Aerospace, to Low's Work Cottages and beyond is particularly popular. This route is identified as a core path. In addition to its scenic quality this route's popularity is expected to be due to the link it provides between the newer properties in the Almond Grove area and the heart of the village centred on Main Street. Also on this route is the playing field just off Main Street. As shown on Figure 7.1 the core path route continues past the bowling green and crosses Main Street.

7.4.16 Part of the core path route along the river bank coincides with the National Cycle Network (NCN) Route 77, with the two routes diverging at Black Bridge – the NCN route crossing the footbridge and proceeding up College Mill Road to Main Street.

7.4.17 The aforementioned playing field includes one full size football pitch with a pavilion and adjacent car park. This is the largest singe open recreational space within the village and can be accessed from Main Street by a footpath at the northern end and a tarmac road at the southern end running parallel with the northern perimeter fence of Vector Aerospace.

7.4.18 Almond Valley Bowling Club green and pavilion are located adjacent to the playing field area.

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7.4.19 It is understood that the original course of the River Almond in the centre of the village was modified in the 1980s. Anecdotal evidence suggests that the river was previously some 20m closer to the bowling club before the realignment works and that this area was historically the main point of flooding. The bank in this area has been protected from erosion by the installation of rock armour. The river bank adjacent to the playing field pavilion has been significantly eroded in recent years, to such an extent that a section of footpath between the playing field and the river is now closed.

7.4.20 Community facilities in the village include a post office on Main Street and a nursery and burial ground just to the north of Locty Park industrial estate, off Main Street.

7.4.21 Fishing is also a popular pastime on the River Almond and anglers are known to frequent the promontory adjacent to the confluence of the Almond and the East Pow Burn. The Tay District Salmon Fisheries Board is the statutory authority with responsibility for protecting and improving salmon fisheries in the River Tay and its tributaries. Impacts upon fisheries are discussed in Chapter 10 – Ecology.

Development Land

7.4.22 The Perth Area Local Plan (adopted 1996 and amended 2000) identifies areas allocated for housing development within the vicinity of Almondbank village (see Figure 7.1). The potential for the construction of 150 houses on the site currently occupied by the industrial storage complex and the agricultural land to the south is identified (Ref. ALT H26 on Figure 7.1). This latter site was carried forward into the Perth Area/Central Area Draft Local Plan (December 2004). In the draft plan the site is named Pitcairnfield Works and the 12ha site is earmarked for a total of 250 houses. Developer requirements are identified as follows:

- New access into the site (new bridge crossing of the Almond).
- Flood risk assessment.
- Drainage improvements.
- Retention of mature trees around the river edge except where removal is required for river crossing.
- Pedestrian links to village.

7.4.23 It is noted that the Perth Area/Central Area Draft Local Plan is not being progressed further as Perth and Kinross Council are preparing a new Development Plan which covers the whole of the Council area.

7.4.24 The Local Plan also identified an area of land known as Almondbank Valley Village (as shown Figure 7.1) which would provide 1,800 new homes, a new primary school, sports/play areas, local shopping and employment facilities, new water and sewage infrastructure, and associated landscape works and vehicular and pedestrian access. This proposal are not currently being progressed

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7.4.25 Given the regional and local importance of community and development land the overall value is considered to be medium in accordance with the criteria in Table 7.1 above.

7.5 Predicted Impacts

7.5.1 Predicted impacts resulting from the direct or indirect effects on existing land use both during the construction and operational phases of the scheme include the following:

- Beneficial impact in relation to the protection of private property, including both commercial and residential property, from a 1 in 200 year level flood event.
- Loss, damage or disturbance of agricultural land, woodland, recreational land and land used by the community or land identified for future development.
- Damage and disturbance to land within the boundaries of private property.
- Disruption to existing land access arrangements.

7.5.2 Predicted disruption to existing access arrangements to private property is discussed in Chapter 14 – Traffic and access, whilst potential air quality and noise impacts are assessed in Chapter 13. Potential impacts on woodland in terms of landscape and ecological value are discussed in Chapters 8 and 10, respectively.

7.5.3 Permanent land take for the scheme as a whole is estimated at 0.44ha. There would be additional temporary land take during the construction period, however, on completion of the works this would be re-instated to its original condition prior to construction in consultation with appropriate landowners and occupiers.

Agricultural Land

7.5.4 The construction of the flood embankment and new access road south of Brockhill along the East Pow Burn, would result in the permanent loss of a small marginal area of Class 2 arable land/grassland on the margins of fields at Huntingtower Haugh. Total agricultural land take is approximately 0.8ha with approximately 0.13ha permanent and 0.67ha temporary. Temporary land take during the construction period would be returned to agricultural use on completion of the works. Given that the proposed flood embankments are to be constructed at the margins of the fields there are not anticipated to be any severance or viability issues and access to the fields would not be affected. There may be minor disruption during the construction period. Field drainage is expected to be largely unaffected with the obvious exception that during flood events the embankments would prevent floodwaters reaching nearby residential properties. Any flood water collecting on the ‘dry’ side of the embankment would drain to a surface water drainage channel and discharge to the River Almond via pipes through the embankment.

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7.5.5 The magnitude of impact upon agricultural land (high value) at Huntingtower Haugh/Brockhill is assessed as negligible adverse and as such the significance of the impact is slight adverse and localised.

Woodland

7.5.6 The siting of the flood protection proposals has been chosen to reduce tree loss as much as possible. Some tree removal and thinning along the river banks would be necessary to accommodate the linear flood defences, for example, in the vicinity of Deer Park where the flood wall and embankment are required. Trees would also require removal along the banks of the River Almond adjacent to the fish farm where sheet piling and erosion protection is required. In addition it is anticipated that a small number of the trees lining Main Street at the playing field may require felling to accommodate the flood embankment proposed in this location. Mature trees at the confluence of the River Almond with the East Pow Burn would be removed to accommodate construction of the replacement road bridge. Along the East Pow Burn some trees would also be lost where the watercourse is to be widened along an approximate 50m stretch. A section of the Lochty Industrial Estate hedge along Main Street would also require removal to construct the retaining wall here.

7.5.7 As the woodland in the above locations is not commercially owned and operated, it is considered to be of low value in land use terms, and classed as amenity woodland. Therefore, in a purely land use context, and based on the ratings in Table 7.2 the impact magnitude is assessed as slight adverse at a local level. As such the impact significance is considered to be negligible.

Private Property

7.5.8 A number of private residential properties adjacent to the River Almond and East Pow Burn would be directly affected by the proposals primarily through the construction of flood protection components within private gardens. Other properties may be affected through temporary land take within gardens, required during the construction period, however, this land would be returned to pre-construction condition on completion of the works. No residential properties would be demolished. In common with residential properties a number of commercial properties including College Mill Trout Farm, Vector Aerospace and Lochty Industrial Estate would be directly affected by the proposed scheme through on-site construction works. Table 7.4 below provides an assessment of the magnitude and significance of the impact of the scheme on private property.

7.5.9 Although the assessment relates to land take impacts, it should be noted that there are obvious benefits on private property associated with flood protection which the proposed measures would provide. This beneficial impact is considered to be of major magnitude and significance.

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Table 7.4: Impacts on private property (without mitigation)

Property (all high value)	Impact	Magnitude of Impact	Significance of Impact
Residential			
Rhencullew, Rhourkton and Druid's House	Permanent land take for construction of flood wall and erosion protection in garden. Where there is existing access to the river this would be restored over the wall. Temporary land take within garden during construction period.	Negligible adverse Slight adverse	Negligible Slight
Deer Park No's 1-3	Permanent land take for construction of flood wall in garden. Existing access to river to be maintained and timber decking for No.1 Deer Park reinstated. Temporary land take within garden during construction period.	Negligible adverse Slight adverse	Negligible Slight
Deer Park No. 4	Permanent land take for construction of earth flood embankment and surface water drainage channel. Temporary land take within garden during construction phase.	Slight adverse Slight adverse	Slight Slight
Properties on Main Street Almondbank	No Impact	None	None
The Courts	No Impact	None	None
Low's Work Cottages	Potential for temporary land take, within gardens, during construction of flood wall and new road bridge/altered road levels.	Negligible adverse	Negligible
Brockhill	Permanent and temporary land take, within garden, during construction of flood embankment, sheet pile wall and new road bridge and altered road levels/retaining wall. Alternative car parking area to be provided.	Slight adverse	Slight
Properties on the northern side of Almond Grove	No Impact	None	None
Craigneuk East and Craigneuk West	Permanent land take for construction of the flood wall and erosion protection in garden of Craigneuk East (temporary land take for construction possible within gardens of both Craigneuk East and Craigneuk West).	Negligible adverse	Negligible

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Property (all high value)	Impact	Magnitude of Impact	Significance of Impact
	Temporary land take within garden during construction period.	Slight adverse	Slight
Puddledub	Potential for temporary land take, on northern edge of property, during construction of sheet pile wall and erosion protection.	Negligible adverse	Negligible
Lochty Park No's 1- and 10 Heron Lodge	Permanent land take on periphery of gardens to facilitate construction of new road bridge, flood wall and erosion protection. Ramp access to No.s 1 and 2 to be provided. Temporary land take within gardens during construction phase.	Negligible adverse Slight adverse	Negligible Slight
Heron Lodge	Temporary land take within garden during construction phase.	Negligible adverse	Negligible
Commercial			
Vector Aerospace	Permanent and temporary land take on periphery of site to facilitate construction of flood walls, sheet piles and erosion protection and for gabion basket removal.	Negligible adverse	Negligible
Scottish Water WWTW	Permanent and temporary land take on periphery of site to facilitate construction of flood wall and sheet piling.	Negligible adverse	Negligible
Almond Valley Bowling Club	Temporary land take at perimeter of site to facilitate construction of flood wall.	Negligible adverse	Negligible
Lochty Industrial Estate	Permanent (including hedge removal) and temporary land take on eastern edge of site to enable construction of retaining wall bordering Main Street.	Slight adverse	Slight
Commercial premises on Main Street	No Impact	None	None
College Mill Trout Farm	Permanent and temporary land take primarily on eastern margins of hatchery and ponds to construct flood wall, sheet pile wall, sluice gate, site drainage, pumping station and new access provision.	Slight to moderate adverse	Slight to moderate
Workshop on College Mill Road	No Impact	None	None
Industrial Units	No Impact	None	None
Undeveloped	Permanent and temporary land	Negligible	Negligible

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Property (all high value)	Impact	Magnitude of Impact	Significance of Impact
private land on the banks of the River Almond	take to enable construction of flood protection scheme. Land would generally be protected to 1 in 200 year flood event level thereby enhancing value of undeveloped land or in the case of temporary land take, returned to its original state on completion of construction having facilitated the construction of the scheme for the benefit of the village as a whole.	adverse	

7.5.10 As shown in Table 7.4 above, the adverse impact upon land associated with private and commercial property (medium value), directly affected by the proposals and susceptible to flooding, is assessed as generally negligible to slight, with possible moderate impact on the trout farm. It is envisaged that implementation of the flood protection scheme would have economic and social benefits (as a result of reduced flood risk) which would greatly outweigh adverse impacts resulting from permanent and temporary land take.

7.5.11 For a more detailed insight to the dimensions of flood scheme elements, reference should be made to typical cross section drawings in Volume Two.

Recreation and Community Facilities

7.5.12 Public access routes in the locality of the flood protection scheme (NCN Route 77 / Core Paths) would be temporarily affected, however, a staged approach to construction would ensure that such routes are passable for the majority of the construction period. Temporary closure of the Black Bridge would be required in order to move it to a new upstream position. Likewise the construction of the new road bridge at the confluence of the River Almond and East Pow Burn would temporarily disrupt movement along the existing access road. Considering the expected short timescale of closure of some routes and minor disturbance of others, i.e. narrowing of walkways, during construction the impact magnitude is assessed as slight adverse giving an impact significance of slight adverse (based on medium value of routes).

7.5.13 Construction of the earth flood embankment to the south of Almondbank playing fields would involve both permanent and temporary land take. A new section of access road would also be constructed across the existing playing field car park and the pavilion rebuilt in a similar position to its current location. This would also involve both permanent and temporary land take. The works would include earthworks to the existing car park to provide the required ground levels as well as maintaining access to the bowling club to the north. Whilst a section of the playing fields is expected to be closed during construction works, a good proportion of open space would still be available to the public. Permanent land take to facilitate construction of

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the embankment may require the existing football pitch markings to be moved marginally northwards, however, there is adequate space to allow this.

7.5.14 As part of the scheme, it is intended that the playing field area would be used as temporary storage for flood water in a flood event, and therefore would be out of use during these periods. The magnitude of impact upon the playing field (medium value) is assessed as slight adverse giving an impact significance of slight adverse.

7.5.15 Construction of the flood wall around the bowling club is not expected to require closure of the club, especially if works are undertaken outwith the summer season.

7.5.16 Although there are few suitable locations for angling within the study area due to the location of private property and woodland, the promontory adjacent to the confluence of the River Almond and East Pow Burn is observed to be a favoured location. It is expected that angling activity may be temporarily disrupted during the construction period, in particular by construction of flood walls and the new road bridge. Given the temporary nature of the disruption and scope for alternative positions a short distance downstream, the impact magnitude is assessed as negligible and as such the impact significance is determined as negligible.

7.5.17 There would be no direct, permanent impact on any community facilities. There is potential for temporary, intermittent disruption to access to the nursery and burial ground during construction works in the vicinity of Lochty Park. Access would, however, be maintained during the construction phase and traffic management implemented where necessary.

Development Land

7.5.18 Land identified in the Perth Area Local Plan for housing at the site currently occupied by the industrial units to the north of the Almond (Ref. ALT H26 on Figure 7.1) would be marginally affected. Although flood protection works are proposed within the boundary of site, the footprint of the works is unlikely to significantly diminish the value or suitability of the land for housing development from existing conditions. The area would receive protection from 1 in 200 year flooding and therefore would benefit in this respect. It should, however, be noted that any proposed development would need to take account of Scottish Planning Policy relating to flooding and development planning. The impact magnitude and significance in relation to this potential development site (medium value) is therefore assessed as negligible.

7.6 Mitigation

The following mitigation measures would be adopted during construction and post construction to reduce or offset the loss of land and disruption to existing land uses:

- Minimisation of land-take (permanent and temporary) where possible, especially within private residential and commercial property boundaries, areas of agricultural land and public recreational areas.

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- Minimisation of woodland land-take, in particular the woodland corridor adjacent to the Almond and East Pow and mature native species.
- Maintain existing access arrangements to property, fields as well as movement along public access routes. If this is not possible provide alternative access arrangements during the construction period (see also Chapter 14 – Traffic and Access) and limit closures to off-peak periods. Consider access arrangements prior to works on site and construct necessary facilities before undertaking any works that may cause disruption.
- Provide designated temporary access points where accessibility and severance may pose a temporary problem.
- Demarcation of the working corridor to prevent disturbance to adjacent areas.
- Careful consideration to tree removal during the detailed design to reduce tree loss. Where practicable/feasible consider lopping of branches rather than complete removal.
- Adoption of good practice procedures in relation to careful soil stripping, handling and storage during site clearance, construction and restoration periods.
- Good construction site practices to be implemented to control noise, dust and the risk of pollution.
- Re-use of excavated agricultural soils in earth mounding and landscape mitigation.
- Reinstatement of field drains where applicable.
- Restoration of all disturbed areas, including private gardens, agricultural land, commercial property, recreational/community land and implement landscaping where appropriate (see Chapter 8 Landscape and Visual).
- Tree planting to partially compensate for loss of existing trees.
- Where appropriate, provision of compensation to landowners/occupiers for loss of land.

7.7 Residual Effects

7.7.1 Whilst the design of the proposed scheme would minimise agricultural land-take the loss of a small area of Class 2 agricultural land remains unavoidable, however, through effective minimisation of temporary land take surrounding the flood walls and embankments and reduced flood risk the residual effect is slight adverse and not significant. The scheme has also been designed to minimise woodland land take and, although the removal and maintenance of trees would be considered in more detail as part of the detailed design, significant further reduction in the area affected is not expected to be possible. As the woodland is not commercially owned and operated, in a purely land use context this loss is negligible and not significant.

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7.7.2 Private property including both residential and commercial are the main beneficiaries of the flood protection scheme and would be protected to 1 in 200 year flood event level. The residual impact significance is assessed as major beneficial, particularly as mitigation such as landscaping would be undertaken to minimise adverse construction related aspects.

7.7.3 Despite mitigation to put in place diversions where possible and limit closures of footpaths it is evident that some temporary closures would be unavoidable, i.e. during construction of the new bridge at the confluence of the River Almond and East Pow Burn and relocation of Black Bridge. In these cases there are limited options for diversions and as such the residual effect remains slight adverse and not significant.

7.7.4 The small reduction in the proportion of public open space in the locality due to the footprint of flood protection and the temporary intermittent disruption of the playing field during operation of the scheme means the residual effect remains as slight adverse and not significant.

7.7.5 The nature of the flood protection measures within the proposed housing site (ALT H26) and surrounding area (flood embankments) do not appear to be conducive to development of this land for housing (this is discussed further in Chapter 15 on Cumulative Effects). No mitigation is proposed to remedy this as significant design changes to the entire scheme would be expected to be necessary, therefore, the residual effect is slight adverse and not significant.

7.7.6 In summary, no significant residual land use effects are predicted.

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8 Landscape Character and Visual Effects

8.1 Scope of the Assessment

8.1.1 The assessment reported in this chapter focuses on the predicted impacts associated with the proposed scheme in relation to the existing landscape and visual context surrounding the flood protection proposals.

8.1.2 The assessment considers the existing landscape character conditions and visual amenity of the surrounding landscape; summarises the methodology used for the assessment; reports on the likely landscape and visual impacts resulting from the scheme; and outlines appropriate mitigation to address adverse effects.

8.1.3 The study area for the assessment was selected as 1 km each side of the centreline of the River Almond and East Pow Burn. Although the river and burn may be visible to a degree beyond this distance, it is considered that any potential landscape or visual effect outside this corridor would not be considered significant.

8.2 Legislative and Planning Context

8.2.1 A summary of planning policy documents and guidance relevant to the landscape and to the proposed scheme, and which were referred to during the assessment is provided in Appendix 5.

8.3 Methods of Assessment

General approach

8.3.1 The assessment identifies the predicted changes in the form, quality and value of the landscape (landscape character) within proximity of the proposals and in views of the area as experienced by residents and visitors to Almondbank.

8.3.2 Character is defined as a composite of physical and cultural elements. Landform, hydrology, vegetation and land-cover, land use pattern and cultural features and associations combine to create a common ‘sense of place’ and identity which can be used to categorise the landscape into definable units (commonly called character zones). Quality relates to the intrinsic aesthetic appeal demonstrated by a character zone.

8.3.3 The value of a landscape reflects communal perception on a local, regional, national and international scale. It is frequently addressed by reference to international, national, regional and local policy designations determined by statutory and planning agencies. Absence of such a designation does not, however, infer a lack of value. Factors such as accessibility and scarcity can render areas of otherwise unremarkable quality highly valuable as a resource at the local level.

8.3.4 There are a number of ways in which development of the type proposed can influence landscape character. Development can directly change people’s perception

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and experience of landscape depending on existing context, the scale, form, colour and texture of the proposals, the nature of activity associated with the type of development and the distance and angle of view. Impacts associated with landscape character include:

- The scale and form of development can prove inappropriate and intrusive in the context of existing landform, settlement and overall character.
- Development proposals can affect important landscape elements, possibly involving the loss or fragmentation of important and distinctive landscape features such as hedgerows, woodland, trees, field pattern and built form.
- The proposals can introduce activity, features and forms that are out of keeping with established cultural or historic landscapes.
- The proposals can contribute to the regeneration of despoiled landscapes and the establishment of areas of new landscape if mitigation measures can be implemented.

8.3.5 The assessment focuses on the current development proposals and measures the nature and magnitude of change in comparison to the existing baseline context of the area. The prime concerns are the extent to which the proposals would intrude into the existing receiving environment.

8.3.6 Where appropriate, reference is made to other environmental parameters to the extent that they influence the analysis of landscape context and evaluation of the implications of the scheme proposals.

Assessment methodology

8.3.7 A summary of the methodology adopted for the landscape and visual assessments is provided below, with a more comprehensive description of guidance documents and impact assessment criteria given in Appendix 5.

8.3.8 The assessment relies on thorough understanding and observation of the baseline receiving landscape and visual context to assess their character and quality, as well as a thorough understanding of the scheme proposals. These enable the sensitivity to change and magnitude of change to be identified. The significance of the impact of the proposals on both the landscape itself and their effect on receptors can then be assessed. Potential mitigation measures can subsequently be identified and residual effects assessed.

8.3.9 The assessment has been carried out in accordance with standard guidelines, references and guidance documents. The guidelines enable levels of quality, sensitivity, magnitude of change and impact to be defined by means of tables and matrices (see Appendix 5).

8.3.10 To summarise, the key stages in the landscape and visual impact assessment process are:

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- Site survey and analysis.
- Desk-based review of relevant information including planning policy guidance.
- Appraisal of landscape value and identification/valuation of visual receptors.
- Identification of predicted impacts on landscape character and views experienced by sensitive receptors and evaluation of the significance of change.
- Identification of appropriate landscape design and mitigation measures in respect of any significant adverse impacts.
- A description of the anticipated residual significant effects taking into account any mitigation strategies.

Desk study

8.3.11 The Perth Area Local Plan and the Perth Area/Central Area Draft Local Plan were consulted to establish the presence of any areas of statutory landscape designation and protection. Current 1:25,000 and 1:10,000 scale and historical Ordnance Survey maps were also examined.

8.3.12 The Local Plan, as well as national planning policy, were reviewed to gather existing and proposed land use data and planning related policies.

8.3.13 Data relating to archaeology, ecology, buildings and settlements were reviewed to provide a thorough appreciation of conservation interest. Other human interests were established by analysing data relating to recreation and public rights of way.

8.3.14 The landscape was then classified into distinct character areas and types, which share common features and characteristics based on:

- The pattern and scale of landform, land cover and built development.
- Special values including national and local landscape designations, Conservation Areas and historical and cultural associations.
- Specific potential receptors of landscape and visual impact, including important parts of the landscape, residents, visitors, travellers and other groups of viewers.

Field survey

8.3.15 The study area for field survey was selected as 1 km each side of the centreline of the River Almond and East Pow Burn. Although the river and burn may be visible to a degree beyond this distance, it is considered that any potential landscape effect outside this corridor would not be considered significant. The term significant in the context of landscape or visual impact in this assessment refers to the level at which

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the changes to the landscape would be clearly perceived and mitigation measures considered essential.

8.3.16 The study area was originally visited during March 2005, in order to: confirm the information obtained during the desk study; to become familiar with site conditions; and to assess views to and from the River Almond and the East Pow Burn. The Zone of Visual Influence (ZVI) is the area from which the rivers may be visible.

8.3.17 A review of tree cover and species likely to be affected by the proposals was undertaken.

8.3.18 Public use of open spaces, roads and footpaths was also observed. Further information relating to public use of the environment is provided in Chapter 7 (Land Use and Recreation) and Chapter 14 (Traffic and Access).

8.3.19 The study area was revisited in September 2009 and June 2011 to assess any changes to landscape character and the ZVI, as a result of the revised proposals. This visit concentrated on the areas of change, rather than reviewing the whole.

8.4 Baseline Conditions

Regional and historical context

8.4.1 The study area is approximately 4km to the west of the City of Perth and for the purpose of this assessment extends approximately 1km each side of the River Almond from north of College Mill Trout Farm downstream past Craigneuk to the northern limit of the industrial unit complex and the East Pow Burn from Lochty Bridge to the River Almond. It also includes Huntingtower Haugh, an agricultural holding south of the River Almond.

8.4.2 The lower river corridor has provided suitable sites for industrial development. In the last century mills were established to harness the water power where the river crosses igneous dykes resulting in the construction of the Town Lade and associated houses to support the industry. Today the mills have gone but some of the houses remain, notably Low's Work cottages. The river continues to provide the essential flow of water for a more modern industry namely the College Mill Trout Farm. The immediate river valley, amenity and mixtures of landscape character, both built and natural, has attracted new housing development to the area.

Designated sites

8.4.3 The following designated features are present within the study area:

- Low's Work Cottages – Listed Building (Category B)
- Low's Work Weir – Listed Building (Category B)
- Huntingtower Cairn – Scheduled Ancient Monument
- Huntingtowerfield Bleach works – Listed Building (Category B)

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- Bridge House – Listed Building (Category B)
- Waterside Cottages - Listed Building (Category B)
- Methven Castle - Garden and Designed Landscape
- The Fort near Bridgeton is a Scheduled Monument

8.4.4 These sites are further considered in Chapter 11 and shown on Figure 11.1.

Landscape Character Areas

8.4.5 Within the wider context of the Lowland River Corridor landscape character (as defined in the Tayside Landscape Character Area (LCA) study 1999), the study area has been subdivided into five distinct local character zones. Each of these is visually and/or physically distinct from its surroundings. These zones generally relate to physical attributes such as existing water features, built form, land cover, trees and woodland cover, land use, settlement pattern and accessibility. The main characteristics of each local character zone are outlined below, incorporating an assessment of quality, sensitivity and significance.

8.4.6 The landscape character areas are shown in Figure 8.1.

Character Zone 1 - Flood Plain

Topography

8.4.7 This character zone comprises open and generally flat and agricultural pasture with areas of sports pitches and built development. The developed land contains a mixture of housing, recreational land, industry and agriculture.

8.4.8 These areas are surrounded to a greater or lesser extent by bands of woodland or sparser trees or hedgerows, some of which form part of the river character area. Occasional open views are afforded from the agricultural areas although these views are generally limited and contained by the surrounding trees and hills.

Vegetation

8.4.9 The most significant landscape features in this character zone are the woodland fringes along the banks of the River Almond. These are mixed age and native species woodlands, with occasional ornamental and non-native coniferous trees associated with the gardens of individual dwellings. Species include Ash, Elm, Willow, Hawthorn, Horse Chestnut and Sycamore. There are individual large mature specimens of Horse Chestnut in a triangle of woodland between No.4 Deer Park and Craigneuk fields, as well as occasional mature trees (Ash and Elm mainly) on and near the top of the river banks.

8.4.10 There is a gap in the woodland belt close to Low's Work Weir, allowing longer views across the fields.

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8.4.11 The wooded left river bank from this point up to Craigneuk consists of generally younger trees and large shrubs, with a higher proportion of willow. At the top of the bank is a distinct path which is separated from the Craigneuk fields by another narrow tree belt. This path becomes a mown grass path towards Craigneuk East & West, with mixed planted trees associated with the gardens of these two houses. In particular, two young oaks near the garden entrance and two young spruce trees on the river side of the path.

8.4.12 The right bank of the River Almond, north of the playing field, is also well supplied with trees, mainly Ash, Sycamore and Rowan, but they are less dense and the banks are more open and accessible, with a wide swathe of mown grass between the shallower banks and the garden fences. This section is less natural in character than the Deer Park to Craigneuk section.

8.4.13 The west side of the playing field, adjacent to the Main Street, has a tree belt to the north comprising oak and ash, with an understorey of hawthorn, snowberry and elder fading to intermittent hedgerow plants with one very large mature Ash tree further south. A dense mixed native hedgerow of hawthorn, ash, sallow, sycamore, bramble, dog-rose, hazel and blackthorn characterises the playing field's south-east boundary with the Vector Aerospace site.

View 1: Hedge between playing field and Vector Aerospace.

8.4.14 Huntingtower Haugh is less vegetated, except along the right bank of the East Pow Burn, then extending south to form a strongly wooded rising slope.

8.4.15 To the north and east, the fields are again generally open, edged on one side by a wooded strip following the river bank. See View 2 below.

Character Zone 1 - Flood Plain - Housing

8.4.16 The housing within this character area is of mixed age and character.

- Low's Work Cottages – a row of Listed Buildings (Category B).
- Waterside Cottages - an isolated row of 19th & 20th century houses (Category B Listed Buildings) on the right bank of the River Almond.

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- Deer Park – individual late 20th century riverside houses surrounded by large gardens. These are very tidy, suburban style homes. The curtilage of numbers 1 to 4 includes the bank of the River Almond, with associated dense woodland, including some large, mature specimens, mainly Ash, Elm and Sycamore.
- Almond Grove – detached bungalows between the River Almond and Towns Lade. Almond Place is a later development of larger houses off Almond Grove. Timber fencing, mainly close-board, screens these housing developments from the riverside footpath except at a mown grass 'village green' directly opposite Craigneuk, which has post-and-wire fencing.

View 2: The rear of Low's Work cottages viewed from the track to Huntingtowerfield Farm showing remnants of estate landscape planting.

View 3: Almond Place residential housing viewed from the Bleachers Way showing the flood plain in the foreground, the backdrop of trees and the River Almond screened by trees on the right

Character Zone 1 - Flood Plain - Industry

8.4.17 A high proportion of the land in the immediate vicinity of the River Almond and East Pow burn is in industrial use. In contrast, and in immediate proximity to the high amenity of the area along the river banks sits the Vector Aerospace (View 4 below)

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and a waste water treatment works. The site and a floodlit car park is surrounded by a chain link fence allowing open views to and from the industrial area , although the wooded river banks screen the site from the east (Huntingtower Field), at least in summer.

View 4: The Vector Aerospace site is surrounded by a chain link fence allowing open views into the site.

View 5: View of industrial storage units site from the footpath by Low's Work weir showing the tree horizon that surrounds the study area and the gap in tree cover at this location.

8.4.18 The wastewater treatment works is noisy and occasionally discharges strong smelling effluent into the watercourse.

8.4.19 The industrial units north of Craigneuk and east of College Mill Road (View 5) comprise a complex of large storage sheds that are relatively unobtrusive and situated against a woodland backdrop. There is regular movement of heavy goods vehicles to and from this site.

Recreation

8.4.20 The village playing field, used for both formal team sports and informal use, and a bowling green (see View 6 below) are located on the left riverbank with the Vector Aerospace site to the south.

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View 6: Playing fields and Bowling Green with rear view of properties along Almondbank Main Street.

8.4.21 The undeveloped land comprises four remaining areas of flood plain on which there is no development. They are:

- The playing fields.
- Huntingtower Haugh.
- Craigneuk.
- The land to the east of the River Almond downstream from Low's Work weir beyond Almond Grove.

8.4.22 In summary and using the criteria given in Appendix 5, Character Zone 1 has a low sensitivity. It is an ordinary quality landscape with some features of value.

Character Zone 2 – Remnants of Estate Landscape

Topography

8.4.23 The topography of this character zone is similar to zone 1.

Vegetation and Settlement

8.4.24 Huntingtower estate landscape is characterised by remnants of early architecture and specimen tree planting dating from the eighteenth and early nineteenth century.

8.4.25 This character area includes College Mill Trout Farm (View 8 below), which is mainly sited on a secluded lower bank of the River Almond. It contains a number of mature specimen conifers, remnant of the original Estate planting and some original architecture at the mill associated with the works.

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View 7: The Clock Tower.

View 8: College Mill Trout Farm – with remnant Estate Conifers.

8.4.26 The listed Clock Tower (View 7) can be seen from Huntingtowerfield, which is bordered by a smaller number of large coniferous trees.

8.4.27 In summary the landscape quality of this character zone is good, with low to medium sensitivity.

Character Zone 3 – The River Almond

Topography and Vegetation

8.4.28 The River Almond, which flows roughly from west to east through Almondbank, has formed incised channels through the soft soils of the broad valley floor to form steep sided river banks. The banks are, for the most part, clothed in mixed species semi-natural deciduous woodlands enclosing the river and screening it from the wider landscape. Occasional longer views down or up stream are available as the river bends and where gaps appear in the trees.

8.4.29 Species present include ash, oak, sycamore, willow, cherry, horse chestnut, elm, hawthorn and beech. Some of these trees are very large mature specimens.

8.4.30 Recent temporary erosion protection has been installed (in 2011) along the right and left banks of the river downstream of the weir and this has led to the removal of some trees (View 9 and 10 below). The erosion bund shown in View 10 is currently being removed as part of the works to reinstate the dilapidated Low's Work weir.

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View 9: River Almond erosion protection, right bank adjacent to Almond Grove.

View 10: River Almond erosion protection, left bank at Low Works Weir.

Settlement

8.4.31 Housing on the east side of Main Street and newer housing estates east of Low's Work Weir line the river bank and, with their highly maintained and manicured gardens sometimes with neat fences and street furniture, contrast with the well wooded and natural character of the river elsewhere.

View 11: View towards the River Almond from immediately downstream (south) of Deer Park.

View 12: Occasional mature trees grow alongside the path on the right bank.

View 13: Right bank of River Almond – mature trees growing low down on river bank.

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8.4.32 Where the river crosses more resistant igneous rock, short lengths of rapids occur and Low's Work Weir (Category B Listed) is one such example.

8.4.33 A foot-bridge links the footpath on the right side of the river at the playing field to College Mill Road (see View 14 below).

8.4.34 As noted above, Low's Work Weir has recently being restored.

View 14: Existing Footbridge.

Recreation

8.4.35 There is a footpath (identified in Perth & Kinross Council's Core Paths Plan 2012) and cycle route (National Cycle Network (NCN) Route No 77), shown on Figure 7.1, which links Perth to Glenalmond and beyond on the right bank of the River Almond. This footpath, and cycle way, is a popular facility and a car park by the playing fields provides access.

8.4.36 The river itself is used for fishing and is the key feature for those using the riverside footpath and cycle route.

8.4.37 In summary the quality of this landscape character zone is assessed as very attractive with a medium to high sensitivity to change.

Character Zone 4 – Upper Valley

Topography

8.4.38 This zone is characterised by sloping land which rises from the river valley. The centre of Almondbank village, incorporating mixed age and size housing developments, is located on the slopes adjoining Main Street to the west of the River Almond and College Mill Road to the east of the river.

8.4.39 The village is physically separate from the river and the flood plain.

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Settlement – Residential

8.4.40 The predominant residential developments within this character zone are:

- Almondbank Village (Main Street) – traditional village with a mixture of, shops, work places, inn and residential houses each side of Main Street.
- Mackenzie Drive and Admiralty Wood development – detached and semi-detached family houses with gardens to the front and back.
- College Mill Road – mainly detached housing of established properties, some of which date back to the eighteenth century, with mixed-period infill, mainly 20th century, between the older properties.

8.4.41 Main Street receives a constant stream of traffic from the industrial areas as well as local and through traffic.

8.4.42 In summary the quality of this character zone is good, with medium sensitivity to change.

Character area 5 – The East Pow Burn

Topography and vegetation

8.4.43 The East Pow Burn follows a natural course around the southern and eastern boundary of the Vector Aerospace site. Its relative inaccessibility, overgrown banks and dilapidated structure, especially near its confluence with the River Almond, have enriched its value as a wildlife habitat.

8.4.44 Near its confluence with the River Almond, the East Pow Burn is heavily shaded by dense vegetation and inaccessible in places, with steep slopes, but opens out to the south, where it runs parallel and close to the east side of Main Street linking Lochty Bridge with Almondbank village.

View 15: East Pow Burn near confluence with River Almond.

View 16: East Pow Burn erosion protection at Lochty Park.

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8.4.45 Bank erosion protection has been installed along sections of the East Pow Burn upstream of the entrance to Lochty Park (see View 16 above).

Character Zone 5 – Pow Burn Housing

8.4.46 Some housing is associated with this character area:

- Lochty Park – a small group of bungalows close to the Lochty Industrial Estate and Main Street leading into Almondbank.
- Heron Lodge – immediately south of Lochty Park and adjacent to the East Pow Burn.

Character Zone 5 – Pow Burn Industry

8.4.47 Lochty Industrial Estate is screened from the road by leylandii hedging and is set against a wooded backcloth. In September 2009 the slope behind this estate was undergoing highly visible construction works. This work is still progressing for housing and industrial units.

View 17: Lochty Industrial estate showing leylandii screen planting and tree horizon.

View 18: Lochty Industrial Estate September 2009 - major works to sloping bank.

8.4.48 In summary the quality of this landscape is good to ordinary and the zone has a medium sensitivity to change.

Summary of Landscape Character

8.4.49 The study area comprises a variety of landscape character zones, all contained within a broad river valley surrounded by an imposing visual ridgeline of mature deciduous woodland. The River Almond, together with its steep banks, footpath and mature woodland fringe, forms a well defined and strong landscape element threading through these landscape types. The unattractive character of the Vector Aerospace site directly adjacent to the river has a negative impact and detracts from the attractive character of the overall area.

8.4.50 The proposed flood protection scheme is therefore set within a varied rural landscape, ranging from wooded river valleys to agricultural flood plains, within which the settlement of Almondbank is situated. The village and river are very attractive, despite the nearby areas of industrial infrastructure.

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Visual Context

8.4.51 The extent of the area from which the proposed study area is currently visible (the visual envelope) is shown in Figure 8.2 and the key visual receptors within this zone that may potentially be affected by the proposed scheme are indicated in Figure 8.3. These receptors are summarised into categories in Table 8.1.

8.4.52 Views of the proposed flood protection measures are constrained to a relatively narrow area around the study area due to a combination of existing belts of woodland, steep banks and twisting roads and tracks. It is difficult to gain longer distance views across the whole surrounding countryside.

Table 8.1: Summary of visual receptors

Type of Receptor	Figure 8.3 Reference	Receptor Name
Residential	26 to 37; 40 to 42	Deer Park and individual houses on left bank of River Almond
	11 and 12	Almond Grove & Almond Place
	1; 2; 2a	Lochty Park
	22 and 23	Craigneuk
	9	Low's Work Cottages
	44 to 51; 53	College Mill Road
	54 and 55	Main Street
	58	The Courts
	66 to 69; 21	Housing around Huntingtower
Recreational	55	Bowling Green
	56	Playing Field
	59	NCN Route 77 (Visitors and Commuters)
	60	Riverside Footpath (Leisure walkers)
Industrial & Commercial	6	Vector Aerospace
	3	Lochty Industrial Estate
	24	Industrial units
	43	College Mill Trout Farm
	38 and 39	Garage and adjoining store
	4	Lochty nursery school
Agricultural	21	Huntingtowerfield Farm
	7	Puddledub
	n/a	Craigneuk (fields)
Roads	63	A85
	64	Main Street

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8.4.53 The potential visual impact of the proposals is limited by the following factors:

- The river is cut off visually from the wider landscape by its wooded banks.
- The woodland that surrounds the river valley has a dominant influence on the visual characteristics of the landscape.
- The proposed new structures in the landscape would be relatively inert in that they would be motionless, emit no light or noise (except for the occasional use of the pumping station) and quickly be embraced into the landscape by mitigation works and rapid vegetation growth.
- The linear alignment of the flood protection measures would not be entirely continuous.
- The different appearance of each individual flood defence element would reduce its overall visual impact.

8.5 Predicted Impacts

Landscape Character

8.5.1 This section considers the changes in the fabric, character and quality of the landscape that are likely to occur as a result of the implementation of the proposals.

8.5.2 The principle aspects of the proposals with potential for impact on landscape character are:

- The extent of the flood walls and sheet piling.
- The height, materials and location of the walls.
- The location and extent of the embankments.
- Loss of trees.

8.5.3 The text below provides a summary of the anticipated impacts on the five identified local character zones.

Character Zone 1 – Flood Plain

Construction Phase Impacts

8.5.4 The character of this landscape is good in the undeveloped and agricultural areas, and poorer around the industrial estates. The main landscape impact during the initial stages of the construction phase would be the removal of trees and other vegetation from various points along the left bank of the River Almond to enable the installation of the sheet piling, flood walls and erosion protection.

8.5.5 Vegetation and trees would also require to be cleared to allow for removal of the existing bridge at the Almond/East Pow Burn confluence and construction of the structure and also for installation of sheet piling and for widening of the East Pow Burn.

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8.5.6 This would be followed by the installation of the raised embankments along the left bank of the River Almond between No 4 Deer Park & Craigneuk. Much of the embankment is behind and within existing woodland, although the embankment crosses the woodland to continue along the river at Craigneuk, before changing to a flood wall angling westward to meet higher levels near the boundary with the industrial unit complex. There would be some loss of trees, but no large mature trees.

View 19: Craigneuk West viewed from the rear of Heatherdale, Deer Park.

View 20: River footpath access to Craigneuk would be crossed by an embankment, steps would provide access over the embankment.

8.5.7 The embankment around the playing field would accrue beneficial impacts as it would provide enclosure and assist in screening views.

8.5.8 A low flood embankment with sheet pile core, flood walls and retaining walls associated with the raised levels of the adjacent new bridge and road levels, would protect the property of Brockhill, close to the confluence of the River Almond and East Pow Burn. These would be carefully integrated into the existing earthworks, but there would be loss of mature trees.

8.5.9 The sensitivity of this zone is low overall, the magnitude of change medium, and the significance of the impact is slight to moderate adverse.

Operational Phase Impacts

8.5.10 The development would create a discernable change to the wooded boundaries of the open flat landscape until the proposed mitigation planting has had time to grow to a sufficient height to merge with existing vegetation and screen the scheme components, a period of approximately 15 -20 years.

8.5.11 The proposed embankment enclosing the playing field would introduce a feature of a comparable scale to the existing industrial units within the Vector Aerospace site. In the wider context, it would be viewed as a coherent landscape component. As the existing views towards the industrial units are currently poor, the embankment in this area would improve the views, especially once the embankment is planted and trees have time to grow.

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8.5.12 The residual overall impact for Character Zone 1 would reduce from slight adverse impact in the opening year to neutral as mitigation planting matures.

Character Zone 2 – Estate Remains

Construction Phase Impacts

8.5.13 Individual specimen conifers at College Mill Trout Farm may need to be removed or lopped to allow construction of the flood wall. There would also be loss of trees along the banks of College Mill Trout Farm due to the installation of erosion protection, sheet pile wall and reinforced concrete flood wall.

8.5.14 On the right bank of the river north of Low's Work Weir the reinforced concrete flood wall would extend along the riverbank to tie into an existing wall.

8.5.15 The sensitivity of this zone is low to medium, the magnitude of change medium, and the significance of the impact would be slight to moderate adverse impact.

Operational Phase Impacts

8.5.16 The flood protection measures would cause only a minor alteration within this zone, and the residual overall impact for Character Zone 2 would be slight adverse impact to neutral.

Character Zone 3 – The River Almond

Construction Phase Impacts

8.5.17 The main impact during the construction phase would be the removal of trees and riverside vegetation to allow the construction of the flood walls and relocated bridge abutments and where embankments cut through tree belts from behind the trees to the bank sides and back again. The installation of erosion protection along the banks in several location would also result in the loss of riparian vegetation.

8.5.18 The sensitivity to change is medium to high and the magnitude of change is in the order of low, with medium in a few locations where mature trees need to be removed. The significance of impact in the short term would be moderate adverse impact.

Operational Phase Impacts

8.5.19 It is proposed that replacement trees are planted as mitigation for those removed (key areas for tree planting are indicated on Figure 8.4). These trees would take time to mature (around 20 – 75 years, depending on species). Flood embankments would be seeded, and appropriately planted where feasible (i.e. where the integrity of the flood structure can be safely maintained)

8.5.20 The residual overall impact for Character Zone 3 is moderate adverse impact in the opening year, reducing to neutral over time as mitigation planting matures.

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Character Zone 4 – The Upper Valley

Construction Phase Impacts

8.5.21 Although the kerb drainage to the north east of Almondbank Bridge (the road bridge on Main Street) would require the removal of some trees to gain access and to excavate a trench for the new outfall to the river this would not change the quality of the landscape.

8.5.22 A reinforced concrete wall would be built around the bowling green and provide enclosure.

8.5.23 The sensitivity to change is medium and magnitude of change during the construction phase is negligible, as the upper valley landscape character would not be altered by the proposals; the significance of impact would be slight adverse impact.

Operational Phase Impacts

8.5.24 The loss of trees resulting from installation of the new outfall to the river impact would be mitigated over time as the area naturally regenerates. As during construction, the overall quality of the landscape would not be altered.

8.5.25 The overall residual impact for Character Zone 4 would be slight adverse impact reducing to neutral over time.

Character Zone 5 – The East Pow Burn

Construction Phase Impacts

8.5.26 The proposed replacement road bridge, sheet piling, flood walls, burn widening and bank erosion protection would result in the loss of riparian vegetation, including trees and shrubs. The naturally occurring vegetation that has established on the existing slopes would be replaced by engineered structures and would alter the existing character of the river corridor. This would lessen the landscape and wildlife value of the river although it is noted that the recent erosion protection measures along the East Pow at Lochty Park have already somewhat adversely affected the landscape quality of the riparian corridor.

8.5.27 The works proposed are likely to impact upon the private gardens of No. 1-5 Lochty Park and the evergreen hedge planted to screen Lochty Industrial Estate would require to be replanted.

8.5.28 The sensitivity to change is medium and the overall adverse magnitude of change to Lochty Park during the construction phase is assessed as medium and the significance of impact would be moderate adverse impact.

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Operational Phase Impacts

8.5.29 The landscape should be able to recover where sloping banks remain, by natural regeneration, assisted by mitigation planting.

8.5.30 The overall residual impact for Character Zone 5 during the operational phase is moderate adverse impact reducing to slight over time as mitigation planting matures.

8.5.31 A summary of landscape impacts relating to each of the activities associated with the flood protection scheme, based on the findings of the assessment of the landscape character areas above, is provided in Appendix 6.

Visual Impact

8.5.32 During the construction phase, the visual impacts would include:

- Removal of vegetation, particularly trees and bank-side vegetation, mainly along river banks.
- Construction traffic – large vehicles moving along roads and throughout the site.
- Earth-moving – stripping of topsoil, installation of temporary topsoil stores and permanent embankments – mainly in floodplain and on river banks.
- Installation of sheet-piling and associated cladding along steep sections of river bank.
- Installation of flood walls and associated stone facing and fencing works at upper levels of river bank.
- Removal and replacement of the bridge at confluence of River Almond and East Pow Burn, and associated raising of road levels.
- Removal and replacement of the bridge at Lochty Park and associated road level changes.
- Removal and replacement of the foot-bridge across the River Almond.
- Installation of new planting – on river banks and new embankments.

8.5.33 Dense woodland vegetation along river banks and the steep nature of the valley would restrict views of the proposed flood protection works from many of the visual receptors identified on Figure 8.3. Many of the properties around the proposed site are residential, and a few would be directly affected by the proposals, mainly during the construction phase, when they would be affected by operational impact of large vehicles working within the site, the removal of trees and vegetation along the river banks, and the installation of fairly substantial walls and embankments, all of which would adversely affect the appearance of the river valley.

8.5.34 However the degree of change to existing views during the operational phase would generally be low, reducing over time as vegetation is re-established. The overall

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significance during the construction period is considered to be moderately adverse in the short term with the exception of the playing field where the embankments would screen the Vector Aerospace site and are therefore slightly beneficial.

Visual Impact Summary

Table 8.3 below provides a summary of visual impact on each of the receptors identified on Figure 8.3 and in the Visual Impact Tables in Appendix 7.

Table 8.3: Summary of visual receptor impacts

Visual Receptor Reference	Visual Receptor Name	Sensitivity	Magnitude of Change	Significance of Impact (on day of opening)	Significance of Impact (15 years after opening)
Residential					
1-2	Lochty Park	Medium	Low to Medium	Slight to Moderate Adverse	Negligible
2a	Heron Lodge	Medium	Low	Slight Adverse	Negligible
7	Puddledub	High	Medium	Major/Moderate Adverse	Slight Adverse
8	Brockhill	Medium	High	Major/Moderate Adverse	Moderate/Slight Adverse
9	Low's Work Cottages	High	Medium	Major/Moderate Adverse	Slight Adverse
11	Almond Grove	Medium	Low	Slight Adverse	Negligible
12	Almond Place	Medium	Negligible	Negligible	Negligible
13-15, 17-20, 69	Housing around Huntingtower & Clocktower Dyers Close & Clocktower Mews Lade Cottage	Medium to High	Negligible (not visible)	N/A	N/A
21	Huntingtowerfield Farm Cottage	Medium	Low	Slight Adverse	Slight/Negligible Adverse
22	Craigneuk East	High	High	Major Adverse	Moderate Adverse
23	Craigneuk West	High	High	Major Adverse	Moderate/Slight Adverse
26	4 Deer Park	High	High	Major Adverse	Moderate/Slight Adverse
27, 29	2&3 Deer Park	High	Medium	Major/Moderate Adverse	Moderate/Slight Adverse
32	1 Deer Park	High	Medium	Major/Moderate Adverse	Slight Adverse
28, 30, 31	5 - 7 Deer Park	High	Low	Moderate/Slight Adverse	Negligible

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Visual Receptor Reference	Visual Receptor Name	Sensitivity	Magnitude of Change	Significance of Impact (on day of opening)	Significance of Impact (15 years after opening)
33 - 37	Heatherdale Woodlea The Beeches Myrtle Cottage Bridge House	High	Low	Moderate Adverse	Slight/Negligible Adverse
40	Druid's House	High	Medium	Major/Moderate Adverse	Slight Adverse
41	Rhencullen	High	Low	Moderate Adverse	Slight Adverse
42	Rhourkton	High	Low	Moderate Adverse	Slight Adverse
44-50	College Mill Road	Medium	Negligible (not visible)	N/A	N/A
51	College Mill	High	Medium	Major/Moderate Adverse	Slight/Negligible Adverse
53	Pitcairnfield Cottages	Medium	Negligible (not visible)	N/A	N/A
54	3 - 5 Main Street	Medium	Low	Slight Adverse	Negligible
55	Almondbank Village (Main Street)	Medium	Negligible (not visible)	N/A	N/A
58	The Courts	Medium	Medium	Moderate Adverse	Slight Adverse
66	Braeriach	High	Low	Moderate Adverse	Slight/Negligible Adverse
65, 67, 68	Admiralty Wood & Mackenzie Drive Jeanniebank Sit-ma-lain	Medium	Negligible (not visible)	N/A	N/A
Leisure					
25	The Fort	Low	Negligible (not visible)	N/A	N/A
56	Bowling Green	Medium	Low	Moderate/Slight Beneficial	Moderate Beneficial
57	Playing Field	Medium	Medium	Moderate/Slight Beneficial	Moderate Beneficial
59	National Cycle Network (NCN) Route 77	High	Low	Moderate Adverse	Negligible
60	Riverside Footpath/NCN Route 77	High	Low	Moderate Adverse	Slight/Negligible Adverse

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Visual Receptor Reference	Visual Receptor Name	Sensitivity	Magnitude of Change	Significance of Impact (on day of opening)	Significance of Impact (15 years after opening)
61	Huntingtower Footpath	High	Negligible (not visible)	N/A	N/A
62	Footpath to Fort	High	Negligible (not visible)	N/A	N/A
Commercial					
3	Lochty Industrial Estate	Low	Negligible (not visible)	N/A	N/A
6	Vector Aerospace	Low	Low	Slight/Negligible Adverse	Negligible
16	Huntingtower Hotel	High	Negligible (not visible)	N/A	N/A
24	Industrial units	Low	Low	Slight/Negligible Adverse	Negligible
38	Garage	Low	Low	Slight/Negligible Adverse	Slight/Negligible Adverse
39	Store	Low	Low	Slight/Negligible Adverse	Slight/Negligible Adverse
43	College Mill Trout Farm	Low	Medium	Moderate/Slight Adverse	Slight/Negligible Adverse
Other					
4	Lochty Nursery School	Low	Low	Slight/Negligible Adverse	Negligible
5	Burial Ground	Negligible	Negligible (not visible)	N/A	N/A
10	Low's Work Weir	Medium	Medium	Moderate Adverse	Slight/Negligible Adverse
52	Graveyard	Low	Negligible (not visible)	N/A	N/A
63	A85	Low	Negligible (not visible)	N/A	N/A
64	Main Street	Low	Low	Slight/Negligible Adverse	Negligible

8.5.35 Table 8.4 below identifies the range of visual impacts accrued by receptors within the study area. The location of receptors is shown on Figure 8.3 and detailed in Appendix 7.

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Table 8.4: Overall summary of visual impact

Impact Significance	Total number of receptors effected	
	Winters day (worst case scenario) on Day of Opening	Winters day (worst case scenario) fifteen years after Opening
Major adverse	3	none
Major/moderate adverse	8	none
Moderate adverse	12	1
Moderate/slight adverse	6	5
Slight adverse	6	7
Slight/negligible adverse	6	13
Negligible	1	16
Not visible	29	29
Moderate beneficial	none	2
Moderate/slight beneficial	2	none

8.5.36 There would be moderate beneficial impacts for two outdoor space receptors; receptor 56 – bowling green and receptor 57 – playing fields.

8.5.37 For a number of receptors there would be significant adverse impacts as described in the paragraphs below.

8.5.38 For three properties (receptors 22 and 23 – Craigneuk east and west and receptor 26 – no 4 Deer Park) the impact on the day of opening would be major adverse. This impact would reduce through time to a moderate/slight adverse impact however for property 22 the moderate adverse impact would remain after fifteen years.

8.5.39 For seventeen properties (receptor 7- Puddledub, receptor 8 - Brockhill, receptor 9 – 1 to 10 Low Works Cottages, receptor 27 – no 3 Deer Park, receptor 29 – no 2 Deer Park, receptor 32 - no 1 Deer Park, receptor 40 - Druids House, receptor 51 – College Mill) the impact on the day of opening would be major/moderate adverse. This impact would reduce through time to slight adverse or negligible for fourteen properties however for receptors 8 – Brockhill, receptor 27 – no 3 Deer Park and receptor 29 - no 2 Deer Park the impact would remain moderate to slight adverse after fifteen years.

8.5.40 For the twelve properties experiencing moderate adverse impacts in the winter year of opening this would reduce to slight or negligible after fifteen years.

8.5.41 For receptors 60 (Riverside Footpath) and receptor 59 (National Cycle Route 77) the moderate adverse impact on the year of opening would reduce significantly to a slight to negligible adverse impact for receptor 60 and a negligible adverse impact for receptor 59 impact in the winter after fifteen years.

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8.6 Mitigation

8.6.1 Mitigation of adverse impacts associated with construction and operation of the proposed flood protection measures would be an iterative process involving a combination of three approaches:

- Prevention: Prevention of adverse effects at source – e.g. environmentally aware engineering design of the individual activities and their setting in the landscape.
- Reduction: Reduction of adverse impacts that cannot be eliminated successfully by prevention – e.g. replacing lost vegetation and landscape planting and seeding design to improve landscape and visual integration.
- Offsetting: The provision of alternative or compensatory measures where appropriate and feasible - e.g. the creation of new habitats, contributions to local biodiversity and the wellbeing of local wildlife.

8.6.2 At this outline design stage, the overall aspirations of an appropriate landscape mitigation strategy and have been set out (see Chapter 4) and this would be developed in more detail in tandem with the detailed design.

8.6.3 As landscape and visual factors are closely related the mitigation measures described in this section consequently relate to both aspects.

8.6.4 The following key mitigation principles are proposed and these are illustrated in Figure 8.4.

Design of flood defence structures

8.6.5 The package of flood protection measures offer an opportunity to:

- contain the playing field space;
- screen the undesirable views into the Vector Aerospace works;
- enhance amenity; and
- integrate the area more coherently into the landscape.

8.6.6 The existing hedge on the approach to the playing field car park would be supplemented by landscape planting in proximity of the earthworks which would tie in visually with Admiralty Wood. In addition an area at entrance to the playing field car park off Main Street would be landscaped to provide a more attractive element.

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View 20: Large tree on Main Street by playing field which would be protected

8.6.7 Particular attention would be given to the impact on residential property. Potential impacts on the gardens of Nos. 1-6 Lochty Park may require reinstatement and consultation with owners or occupiers.

8.6.8 Properties along the Almond riverbank (Rhencullew, Rhourkton, Druid's House, and nos. 1-4 Deer Park) would require reinstatement or screen planting put in place.

Bridges

8.6.9 The proposed location of the new footbridge would require screening in the form of mixed native hedgerow planting to match the existing roadside planting, so as to limit any additional visual intrusion to No. 1 Deer Park.

8.6.10 The replacement road bridge at the River Almond/ East Pow Burn confluence would be carefully considered during the detailed design phase, specifically in relation to its design form and minimising the loss of mature trees as a result of its footprint. Particular attention would be given to the use of materials that would blend the structure more easily into the surrounding landscape and also reduce its visual intrusion in respect of users of the road/path and the property at Brockhill. Compensation planting would be provided to mitigate for loss of trees lost in this area.

8.6.11 Following the construction of the new road bridge between Lochty Industrial Estate and Lochty Park, the hedge at the industrial estate would be replanted.

Tree Protection

8.6.12 Where possible, the precise location and route of the erosion protection on the embankments and the flood walls would be adjusted to reduce the need for removal of high-quality mature trees. This is particularly relevant at:

- The left bank of the River Almond between Deer Park and Craigneuk, especially around the Deer Park houses, Low's Work Weir and Craigneuk gardens to avoid trees near the river bank and on the existing embankment.

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- The footpath along the right bank of the River Almond, where there are some mature trees, mostly in the bank and some close to both sides of the footpath.
- The playing field embankment would be curved around a mature ash tree whilst blending into the landform. The hedge on the southern boundary with the Vector Aerospace site would be preserved and integrated with adjacent planting.

8.6.13 Whilst it is desirable to retain as many trees as possible, especially large mature trees, this would not always be possible where significant excavations are required and/or where changes of finished surface level are necessary, especially where these impact significantly on the Root Protection Zone (RPZ) of such trees. Tree roots contribute to the stability of banks, so the removal of mature trees would be undertaken only as a last resort. Adjustments to the proposals would be made to enable valuable trees to be kept, where these do not reduce required flood protection standards.

8.6.14 Compensatory and enhancement planting would be undertaken in key locations where space allows.

Bankside Vegetation and Embankments

8.6.15 The use of biodegradable geosynthetic materials facilitates the regeneration of bank-side vegetation and can be used to protect tree roots. The use of coir rolls and/or willow spiling would be considered in combination with these, depending on the bank profile and detailed requirements.

8.6.16 It would not be possible to maintain the bankside vegetation at College Mill Trout Farm, due to the extent of the flood protection requirements in this location, including sheet piling, new access arrangements within the site, flood walls and erosion protection. Some compensatory planting on the opposite bank would help to mitigate the losses.

8.6.17 The embankment/flood wall to protect Craigneuk readily lends itself to being integrated into the existing vegetation, by ensuring that new planting on the embankment matches the existing tree and shrub mix, allowing it to visually blend into the background.

8.6.18 The embankment along the left bank of the River Almond upstream and downstream from Low's weir can be integrated visually with physical elements of the weir by designing it as a natural extension of the landform. This would help to reduce the disturbance to the existing woodland between No 4 Deer Park and the river.

8.6.19 Careful environmental consideration would be given to the source of the material for construction of the embankments. Local sources are the most desirable, both in terms of suitable material content and reduced transportation, and would be used where possible and practicable. Any alternative sources would be selected so as to

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provide similar material which would not change the content of regenerating vegetation.

8.6.20 The embankment to protect Brockhill and Puddledub would require careful design to minimise its impact. This would aim to prevent Brockhill from seeming to be excessively surrounded by sheet-piling and retaining walls and steep banking. The eastern profile would integrate with the existing field contours relatively gently without too much land take, whilst allowing for the new access to Puddledub, and would incorporate some landscape planting.

8.6.21 Where the design objectives require tree and shrub planting, native species of local provenance to match existing trees, such as oak, ash, beech, alder and maple, occasional willows, with smaller trees and shrubs including hawthorn, rowan, hazel and elder, would be used to strengthen biodiversity and visual character of the area.

8.6.22 Existing topsoil would be stripped and stored on site for re-instatement on site, and would act as a natural seed bank for indigenous plants. All areas of bare earth would be grass seeded or suitable ground conditions created within the woodlands to encourage natural regeneration. Wildflower species would be included in grass mixtures. They would be carefully selected to be appropriate for the locality and be of Scottish/regional provenance.

8.7 Residual Effects

8.7.1 The landscape and visual effects of the proposed operations on a winter's day 15 years after construction have been assessed taking into account the mitigation measures proposed above.

Landscape

8.7.2 It is anticipated that with the mitigation approach described above the proposed operations would be well integrated into the existing landscape. The amenity of the area in the vicinity of the playing field would be greatly enhanced over a period of fifteen years.

8.7.3 The overall residual effect on the receiving landscape character areas can be summarised as:

- Character zone 1 – Flood Plain – Slight adverse to neutral.
- Character zone 2 – Estate Remnants – Slight adverse to neutral.
- Character zone 3 – River Almond – Moderate adverse reducing to neutral.
- Character zone 4 – Upper Valley – Slight adverse to neutral.
- Character zone 4 – East Pow Burn – Moderate adverse to slight adverse.

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Visual

8.7.4 For many receptors which would have views of the flood protection scheme, the potentially significant effect on the year of opening would reduce to a slight adverse to negligible effect in the winter after fifteen years.

8.7.5 There would be a range of visual benefits to users of the bowling green and the playing fields. Although for a number of properties there would be significant adverse impacts, this would reduce over time as mitigation develops and matures. For receptor 22, Craigneuk East, the moderate adverse impact is predicted to remain after fifteen years.

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9 Water Quality and Hydrology

9.1 Scope of the Assessment

9.1.1 The assessment reported in this chapter focuses on the predicted impacts of the proposed scheme on surface waters and groundwater. It reports on the desk-based assessment and site walkover undertaken to determine baseline conditions in terms of surface waters and groundwater in the vicinity of the proposed scheme. Consideration is given to the potential impacts relating to water quality and hydrological aspects arising both during the construction phase and impacts relating to the operational and maintenance phases. The assessment also includes specific mitigation measures to prevent, reduce or offset predicted impacts.

9.1.2 The study area was taken as the footprint of the scheme and an approximate 500m area around it.

9.2 Legislative and Planning Context

9.2.1 The following legislation, policies, plans and guidelines have been taken into account in the assessment.

Water Framework Directive 2000/60/EC and the Water Environment and Water Services (Scotland) Act 2003

9.2.2 The protection of water quality and quantity has increasing importance in terms of the Water Framework Directive, especially relevant due to the water dependant ecosystems that may be potentially directly/indirectly affected by proposed development. The Water Framework Directive 2000/60/EC (WFD) came into force in December 2003 and establishes a framework for the protection of inland surface waters, transitional waters, coastal waters and groundwater. The framework aims to:

- Prevent further deterioration and protect and enhance the status of aquatic ecosystems and, with regard to their water needs, terrestrial ecosystems and wetlands directly depending on the aquatic ecosystems;
- Enhance protection and improvement of the aquatic environment, inter alia, through specific measures for the progressive reduction of discharges, emissions and losses of priority substances, and the cessation of phasing-out discharges, emissions and losses of the priority hazardous substances; and
- Ensure the progressive reduction of pollution of groundwater and prevents its further pollution.

9.2.3 The WFD, transposed into Scottish Law through the Water Environment and Water Services (Scotland) Act 2003 (WEWS), requires “good ecological status” in inland surface waters, transitional waters and coastal waters by 2015. Ground waters must also be protected and restored to ensure the quality of dependent surface water and terrestrial ecosystems.

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9.2.4 The Scottish Environment Protection Agency (SEPA) is responsible for both the protection of "controlled waters" from pollution and for the prevention of pollution of the environment, harm to human health and detriment to local amenity by waste management activities. "Controlled waters" include watercourses and water contained in underground strata (or "groundwater") and it is an offence to pollute such waters, either deliberately or accidentally.

9.2.5 The Water Environment (Controlled Activities) (Scotland) Regulations 2011, more commonly known as the Controlled Activities Regulations or CAR, bring into effect the requirements of section 20 of the WEWS Act. The Regulations require that authorisation from SEPA be obtained for the following activities:

- discharges to all wetlands, surface waters and groundwaters (replacing the Control of Pollution Act 1974 (CoPA));
- disposal to land (replacing the Groundwater Regulations 1998);
- abstractions from all wetlands, surface waters and groundwaters;
- impoundments (dams and weirs) of rivers, lochs, wetlands and transitional waters; and
- engineering works in inland waters and wetlands.

9.2.6 Further consultation would therefore be required with SEPA on the specific authorisation required under CAR for the proposed flood protection scheme.

The Flood Risk Management (Scotland) Act 2009

9.2.7 The Flood Risk Management (Scotland) Act introduces a more sustainable and modern approach to flood risk management, suited to the needs of the 21st century and to the impact of climate change. It creates a more joined up and coordinated process to manage flood risk at a national and local level. Specific measures within the Flood Risk Management (Scotland) Act 2009 include:

- A framework for coordination and cooperation between all organisations involved in flood risk management.
- Assessment of flood risk and preparation of flood risk management plans.
- New responsibilities for SEPA, Scottish Water and local authorities in relation to flood risk management.
- A revised, streamlined process for flood protection schemes.
- New methods to enable stakeholders and the public to contribute to managing flood risk.
- A single enforcement authority for the safe operation of Scotland's reservoirs.

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The Freshwater Fish Directive (FFD), Directive 2006/44/EC and relevant UK transposition

9.2.8 The FFD makes provision for the protection and improvement of the quality of fresh waters capable of supporting or potentially capable of supporting certain fish species, should pollution be reduced or eliminated. It is a requirement of the Directive that relevant water bodies are classified as either salmonid or cyprinid waters. It also sets down minimum water quality criteria that must be met by such waters.

9.2.9 The FFD is transposed into Scottish legislation through: the Salmon and Freshwater Fisheries (Consolidation) (Scotland) Act 2003; the Surface Waters (Fishlife) (Classification) (Scotland) Amendment Regulations 1997 and the Surface Waters (Fishlife) (Scotland) Direction 1999.

The Groundwater Directive (80/68/EEC as amended by 91/692/EEC) and the Groundwater Daughter Directive (2006/118/EC)

9.2.10 The Directive addresses the protection of groundwater against pollution caused by certain dangerous substances. It places an obligation on member states to prevent pollution of groundwater by substances including hydrocarbons and to control the introduction of named metals, including copper.

9.2.11 The 'Daughter Directive' to the WFD establishes specific measures as provided for in the WFD to prevent and control groundwater pollution. It defines criteria for the assessment of good groundwater chemical status.

9.3 Methods of Assessment

Baseline methods

9.3.1 The baseline conditions are described and assessed for the following aspects:

- existing hydrology;
- existing surface water features and water quality; and
- existing groundwater.

9.3.2 The assessment was undertaken by means of consultations with SEPA (for information and advice with regard to water quality), Scottish Water and desk-based review of the following relevant documents:

- Almondbank Flood Mitigation Scheme Technical Report (Mouchel (2013).
- Almondbank Flood Mitigation Scheme – Hydraulic Modelling and Options Assessment Report (Mouchel, 2012).
- Almondbank Flood Mitigation Scheme – River Almond East Pow Burn Fluvial Geomorphological Assessment (Mouchel, 2012).

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- Almondbank Flood Management Options Report (Mouchel Parkman, 2006).
- Almondbank Flood Prevention Scheme, Engineer's Report (Royal Haskoning, 2004).
- Preliminary Geotechnical Site Investigation (April 2003), undertaken as part of the above Engineer's report.
- Rural Communities Flood Studies, Benefits and Costs of Flood Defences, Almondbank (Ove Arup, 1996).
- Report on Investigation of Flooding from River Almond (Ove Arup, 1994).

Impact assessment methods

9.3.3 As outlined in Chapter 5 (Approach and Methods), impacts were considered in terms of the attribute value / sensitivity and the magnitude of the impact. The significance of predicted impacts were then determined through a consideration of value and magnitude.

Site value

9.3.4 The site value, or sensitivity, of surface waters and groundwater was determined as detailed in Table 9.1 below.

Table 9.1: Definition of the value of surface waters and groundwater features

Value or sensitivity	Definition
Very High	Attribute has a high quality and rarity on a regional or national scale. Surface waters are EC designated Salmonid / Cyprinid fisheries, have a Water Framework Directive classification of High, are protected under European or UK wildlife legislation (SAC, SPA, SSSI, Ramsar site). Groundwaters are characterised by a major aquifer providing a regionally important resource or supporting site protected under wildlife legislation. Presence of a flood plain or defence protecting more than 100 residential properties from flooding.
High	Attribute has a high quality and rarity on local scale. Surface waters have a Water Framework Directive classification of High or Good, are major cyprinid fisheries, support species protected under EU or UK wildlife legislation. Groundwater aquifers provide locally important resource or support river ecosystem. Presence of a flood plain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
Medium	Attribute has a medium quality and rarity on local scale. Surface waters have a Water Framework Directive classification of Moderate. Groundwater aquifers provide water for agricultural or industrial use with limited connection to surface water. Presence of a flood plain or defence protecting 10 or fewer industrial properties from flooding.
Low	Attribute has a low quality and rarity on local scale. Surface waters have a Water Framework Directive classification of Poor or Bad. There are no aquifers and there is a floodplain with limited constraints and a low probability of flooding of residential and industrial properties.

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Impact magnitude

The severity, or magnitude, of each impact on surface waters and groundwater was assessed independently of value and, based on professional judgement, assigned to one of categories described in
Table 9.2 below.

Table 9.2: Impact magnitude ratings for water resources

Rating	Definition
Major	Loss of substantial part of feature; loss of integrity of feature; and/or serious pollution resulting in substantial/irreversible deterioration of the quality of existing water, such that ecology is greatly changed from the baseline situation and viable populations may be lost. Equivalent to downgrading two classes, e.g. from High to Moderate, or from Good to Poor. Major permanent or long term change to groundwater quality or available yield, which may impact upon local ecology. Existing resource use is irreparably impacted upon.
Moderate	Loss of noticeable proportion of feature; contribution of a significant proportion of effluent to a receiving waterbody; and/or partial deterioration in the quality of existing water such that species are adversely affected but populations are maintained. Change in the ecological status of the watercourse. Equivalent to downgrading one class, for example from Good to Moderate. Changes to the local groundwater regime are predicted to impact slightly on resource use but not rule out any existing supplies. Minor impacts on local ecology may result.
Minor	Measurable deterioration in the quality of the water but of limited proportion, degree or extent; and/or no change in water quality classification; ecology is slightly affected but populations are maintained. Equivalent to minor but measurable change within a classification. Changes to groundwater quality, levels or yields do not represent a risk to existing resource use or ecology.
Negligible	Discharges to surface water but effects are unlikely to be measurable. Change barely distinguishable from baseline surface water or groundwater conditions, approximating to a 'no change' situation. No discernible effect upon the waterbody's ecology. No change in classification.

Impact significance

9.3.5 The significance of impact (beneficial and adverse) was determined as a combination of value and the magnitude of impact as shown in Table 9.3 below.

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Table 9.3: Significance rating for water resources

Site Value	Magnitude of Impact			
	Major	**Moderate**	**Minor**	**Negligible**
Very High	Very Large	Large / Very Large	Moderate / Large	Neutral
High	Large / Very Large	Moderate / Large	Slight / Moderate	Neutral
Medium	Large	Moderate	Slight	Neutral
Low	Slight / Moderate	Slight	Neutral	Neutral

9.3.6 Mitigation measures have been identified based on SEPA guidance and on current good practice.

9.4 Baseline Conditions

General site context

9.4.1 The village of Almondbank is situated on the River Almond at its confluence with the smaller East Pow Burn. The confluence is located at the downstream of the Almond catchment, approximately 3.8km from the confluence of the River Almond with the River Tay. The site has historically suffered from flooding in the centre of town, adjacent to the watercourses. A particularly significant flood was experienced in January 1993 causing extensive damage to properties and structures in the centre of town.

9.4.2 Some work has already been undertaken on the channel in order to limit the effects of the rivers on the community of Almondbank through re-aligning the channel. This was undertaken in order to minimise erosion along the right river bank, adjacent to the bowling green. Further erosion protection has been put in place by DARA (now Vector Aerospace) along the banks of East Pow Burn in the form of gabion baskets. It is not known what consideration was made to maintaining the flow capacity in the East Pow when these gabions were placed.

9.4.3 Erosion protection (rock armour) has been installed along the River Almond (at the playing fields (right bank) and, more recently, downstream of Low Works Weir (left and right banks) in response to recent flood events in 2011.

Surface water features

9.4.4 The key surface water features within Almondbank are clearly the River Almond and East Pow Burn and these features are discussed in more detail in the sections on Water Quality and Hydrology below. The River Almond both influences and is influenced by several manmade features within Almondbank. A brief summary of each of these features is included below, ordered from the most upstream and passing downstream.

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9.4.5 The key features relating to surface water flow in the vicinity of Almondbank are shown on Figure 9.1.

College Mill Trout Farm

9.4.6 The College Mill Trout Farm is a hatchery and fish farm located on the left hand bank of the River Almond in Almondbank. The farm is operated by means of a small diversion from the Almond into the farm which in turn flows through the fish ponds before discharging back into the Almond. A flow of around 0.3m^3/s is maintained during normal flows to maintain the dissolved oxygen levels in the farm ponds. This is vital to support the fish stocks and any interruption to the flow in the summer greater than half an hour could result in stock dying.

9.4.7 Due to the location of the fish farm, it is not possible to discharge water whilst the River Almond is in flood. Consequently, provision needs to be made to discharge and circulate water during flood conditions. This is in addition to any defences constructed at the site to protect it from inundation.

Wastewater Treatment Works

9.4.8 The proposed defences through Almondbank are in close proximity to a wastewater treatment works which has emergency/storm outfalls to the River Almond. The flood protection works will have no impact on the operation of the treatment works.

Low's Work Weir and Town's Lade intake

9.4.9 Town's Lade is a man made channel running from Almondbank to Perth, discharging into the River Tay. The date of its construction is not known, however, it was in place by the 12th century at which point it is recorded as being used to drive mills. The opening to the channel is adjacent to Low's Work Weir, a Grade B listed boulder rubble weir, used to impound water and allowing a sluice gate to control inflow to the channel. This is the predominant flow in the channel as there is insufficient runoff generated along its length to form a significant flow. Recently, the downstream end of Town's Lade has been employed to carry storm flow from Perth to the River Tay. This activity has no impact on the channel at its upstream end where it is fed from the River Almond.

Surface Water Outfalls

9.4.10 Due to the nearby proximity of residential and commercial development it would be expected that there would be a number of surface water outfalls discharging to the Almond and the East Pow within the boundaries of the proposed scheme. Drainage investigations have identified the location of existing outfalls, and as part of the scheme they would all have a non-return valve fitted to prevent flood water backing up into them. It is not anticipated that surface water drainage/run-off will be adversely affected and measures have been designed into the scheme to accommodate any surface water build up in the existing drainage network.

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River Tay

9.4.11 The River Tay is approximately 3.8km downstream of the confluence of the Almond and East Pow Burn. It carries significantly higher flows than the Almond, draining a 2400 square mile catchment, including much of the Grampian Mountains. The baseflow in the River Tay is around 200m^3/s, of which approximately 7.2m^3/s is an inflow from the River Almond. Whilst no detailed assessment of the impact of the proposed flood protection scheme on the River Tay flows has been undertaken, it seems unlikely that the proposed works would have any significant effect, given the high flows being conveyed in the River Tay.

Water Quality

9.4.12 Under the terms of the Water Framework Directive, all river basin districts require to be characterised. The characterisation process requires SEPA to produce an initial assessment of the impact of all significant pressures acting on the water environment.

9.4.13 Surface water bodies are defined as being whole or parts of rivers, canals, lochs, estuaries or coastal waters. The main purpose of identifying water bodies is so that their status can be described accurately and compared with environmental objectives.

9.4.14 The WFD applies to all surface waters, but for practical purposes SEPA has defined a size threshold above which a river or loch qualifies automatically for characterisation. For lochs, the threshold is a surface area of 0.5 km^2; rivers must have a catchment area of 10 km^2 or more. In addition to these larger water bodies, smaller waters have been characterised where there is justification by environmental concerns and to meet the requirements of regulatory legislation such as for drinking water supplies.

9.4.15 Classification of status by SEPA considers water quality, hydromorphology, biological elements including fish, plant life and invertebrates, and specific pollutants known to be problematic. This provides a holistic assessment of ecological health. Heavily modified waterbodies, which can no longer be considered to be natural, are classified on the basis of 'ecological potential'. A key objective of this Directive is the achievement of 'good ecological status' (as a minimum) of all natural water bodies by 2015.

9.4.16 In terms of the study area, both the River Almond and the East Pow Burn are classified under the WFD system. The River Almond within the study area is classified by SEPA as overall 'Bad' status, based on 2008 data, and the East Pow Burn as overall 'Moderate' status. The classification grades through High, Good, Moderate, Poor and Bad status. Environmental objectives have been set to improve water quality with the River Almond expecting to achieve Good status by 2027 and the East Pow Burn by 2021.

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9.4.17 The River Almond and the East Pow Burn are part of the designated River Tay SAC and are also protected by the Fresh Water Fish Directive.

Groundwater vulnerability

9.4.18 A soil investigation, comprising of six boreholes along with associated sampling and testing, was undertaken in April 2003 as part of the study carried out by Royal Haskoning (reported in 2004). However the extent of the boreholes taken was limited. Only six boreholes were drilled; the deepest of which extended 4m below ground level (bgl). Since they were not very deep, only one borehole struck the water table. However, due to the rivers running through Almondbank, it is assumed that the water table lies at a similar level to the surface of the rivers during normal flow conditions.

9.4.19 Further ground investigation was undertaken between 22 September and 1 October 2010 and this comprised sinking of 15 boreholes with laboratory testing of samples taken. Long term monitoring of gas and groundwater levels at 7 of the borehole locations was also undertaken during October and November 2010.

9.4.20 The ground investigation revealed the highest groundwater level in the Vector Aerospace site at a level of 1.01m bgl. The nature of the ground (predominately sands and gravels) would indicate a relatively high permeability whilst the presence of the rivers would suggest a high water table and this is confirmed by the groundwater levels recorded which indicate the potential for shallow groundwater to be present in places.

Hydrology

9.4.21 The hydrology of the River Almond is dominated by the location of its headwaters in the Grampian Mountains. This means that the rainfall response leads to a high peak flow in the river channel a short time after rain has fallen on the hills which drops off quickly when the rainfall stops. Almondbank is situated at the edge of the upland catchment, just as the channel gradients are beginning to slow down. The combination of this change in gradient and the short rainfall response time in the upland catchment leads to flooding issues.

9.4.22 In its natural flow regime, the river carries all of the run-off from the upland area within the confines of the steep sided valley. Where the gradients begin to lessen, the valley begins to open out, forming a natural flood plain adjacent to the river channel. Here the water comes out of bank, reducing the volume of flow passed forward as it is detained in the floodplain. It is on this floodplain that the new developments in Almondbank have been constructed. Consequently, during periods of high flow within the Almond, flooding is experienced along the banks.

9.4.23 East Pow Burn is a much smaller catchment, carrying flow from the lower grounds to the west of Perth. It is a rural catchment, only entering Almondbank shortly before it discharges into the River Almond. The rainfall response is fast, although not as fast

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as the River Almond's response. Despite being smaller and having a slightly slower rainfall response, East Pow Burn is still responsible for flooding issues within Almondbank. Proportionally high flows in the river channel still come out of bank, entering the floodplain adjacent to the channel. This is exacerbated by flows in the Almond causing water to back up in East Pow Burn, artificially raising flows above those normally expected from the catchment runoff alone.

9.4.24 Flows in both East Pow Burn and the River Almond are very different for normal base flow conditions, as compared to the flood expected with a return period of two hundred years. Table 9.4 shows the flows expected using calculations based on the hydrological characteristics of the catchments concerned.

Table 9.4: Anticipated base and flood flows at Almondbank

	Approx. base flow (m^3/s)	Approx. flood flow* (m^3/s)
River Almond	7.2	311
East Pow Burn	1.2	42
River Tay	200	>2,500
* For 200 year return period event		

Sensitivity of surface water and groundwater resources

9.4.25 In accordance with Table 9.1 and considering the linkage to the River Tay, the sensitivity of the East Pow Burn and the River Almond is assessed as high. Using the criteria in Table 9.1, groundwater sensitivity is assessed as medium.

9.5 Predicted Impacts and Mitigation

Construction stage impacts

9.5.1 Potential effects on surface water and groundwater features during construction comprise:

- indirect contamination due to the release of site surface water run-off;
- indirect contamination due to accidental spillage of chemicals, fuels, oils, concrete and other building materials;
- physical damage or disturbance of existing riverbanks and riverbed;
- direct changes in surface flow due to interception or diversion of existing groundwater and other drainage pathways; and
- direct effects due to the placement of structures adjacent to/in the watercourse, with potential effects on existing flow regimes.

9.5.2 General details of likely construction techniques are provided in Chapter 4. On the whole, the scale of the construction works proposed is relatively minor, with the main influence on construction techniques and associated plant being the relatively tight

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access and working areas available along the majority of the scheme length. Consequently, it is expected that size of items of plant would typically be relatively small. The number of site compound areas required to facilitate access to the various components of the works would be dictated by the constraints imposed by the existing river channels. Detailed methods and conditions of work would be addressed in the Construction Environmental Management Plan (CEMP).

Surface waters

Release of surface water run-off/accidental spillage

9.5.3 The key factors determining the impact of any pollutant are the source of the pollutant, its pathway receptor and dilution and dispersion principles. Where the available dilution is high and the pollutant disperses rapidly, the resulting pollutant concentration would be low, although its toxicity could be potentially high. In the case of the Almond and East Pow, water is moderately fast flowing but shallow in places during normal flow conditions and therefore can have low dilution capabilities. However, it is a flashy and responsive catchment and quickly reacts to rainfall events becoming fast flowing and turbulent, with a higher dispersion capacity.

9.5.4 Site surface water run-off during the construction phase would require management including appropriate containment and drainage mechanisms to be agreed with the Contractor and SEPA. Natural surface water run-off would be diverted away from the site of construction activities.

9.5.5 During construction, many activities have the potential to pollute both surface water and groundwater features (i.e. the source of the pollutant). These include:

- works within the river channel;
- the movement of traffic and plant;
- earthworks (soil stripping and excavations);
- stockpiling of material along the working corridor and in the temporary storage compounds;
- the creation of concrete structures adjacent to the watercourse;
- storage of plant and materials; and
- accidental spillage of polluting materials.

9.5.6 These activities may result in the release of contaminated sediments, which if not adequately contained may become mobilised, draining into the water flow downstream of the works. Run-off may be high in suspended solids, fuel oils, lubricants and other chemicals used or stored on site. Sediment plumes, comprising suspended solid particles, may be formed. High concentrations of suspended solids adversely affect water quality and may disrupt or damage the aquatic ecosystem. The presence of organic or toxic materials in water speeds up the growth of algae and other plant life, which are then decomposed by microbial action and in turn reduce oxygen concentrations with potential adverse effects on aquatic life. Sediment

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input to watercourses may also lead to the denudation of plants by smothering the riverbed.

9.5.7 Due to the fact that construction work would be required in the river channel or near the river banks, there is a relatively high risk of polluting materials entering existing watercourses. This risk is particularly relevant for the construction of works within the river channel – such works would generally be undertaken during periods of low flow, to assist with any overpumping / cofferdam requirements, and therefore, due to the low flow, there is potential for higher concentrations of pollution arising from spillage or discharge of sediment into the natural channel.

9.5.8 Generally it is not envisaged that the construction of the works would require deep excavations, although this requirement would be confirmed during the ongoing detailed design to ensure stability of the proposed defences and adequate protection from seepage beneath the defence line.

9.5.9 The stockpiling of soft materials excavated during construction can also be a key issue as, once wet, it may form into slurry, which may enter watercourses and increase sediment loads. However, it is not envisaged that large quantities of soil would be excavated during the construction of the proposed defences. Where possible such material would be removed directly from site to an appropriate receptor point, although where suitable, excavated material would be reused on site for construction of earth embankments. A proportion of topsoil would also be stored on site for reinstatement purposes. This is discussed in more detail in Chapter 12.

9.5.10 During periods of low rainfall, the watercourses would experience low flows and exposed bankside areas. During these periods, any site surface water run-off passing to the burn may result in the deposition of sediments on parts of the riverbank/riverbed which may result in sudden re-suspension of sediments and flushing downstream or along the river channel as water levels rise. However, run-off from the working areas is likely to coincide with rainfall on the catchment thereby creating a diluting effect within the burns. Appropriate containment and drainage mechanisms would be incorporated and run-off dispersed during periods of higher flow.

9.5.11 It is important that the operational requirements of College Mill Trout Farm are taken into account during the development of the scheme through continuing close consultation with the farm owner. The proposed works (upstream sluice, low flood walls, sheet pile walls, and pumping stations) adjacent to the farm create a risk to the water quality within the ponds and may also interrupt operation of the farm.

9.5.12 There is also the potential for run-off from haul routes utilised during the construction period to enter nearby watercourses if not collected by existing surface water drainage systems and treated. Pollutants contained in run-off may include the following:

- suspended solids;

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- hydrocarbons from diesel, petroleum and lubricating oil leakages;
- hydrocarbons from exhaust emissions; and
- tyre wear deposits.

9.5.13 Such pollutants have the potential to adversely affect water quality with consequent effects on fauna and flora. This would be most applicable to the minor roads, and/or temporary haul roads that would be used, which currently do not encompass road drainage and water treatment mechanisms.

9.5.14 It is recognised that the risk of pollution of watercourses and groundwater during the construction period cannot be totally prevented, although it can be reduced through the incorporation of suitable protective measures as discussed below.

9.5.15 Measures aimed at eliminating or reducing the risk of any contaminated run-off or contaminated groundwater produced by the works, including sediment, entering the River Almond or East Pow Burn and potentially impacting groundwater resources would be designed in detail following the outline specification. This would be provided to the Contractor in accordance with the requirements of relevant SEPA Pollution Prevention Guidelines (including PPG1, PPG3, PPG5, PPG6, PPG7, PPG8, PPG13, PPG21 and PPG23). Key measures from these guidance documents are outlined below, however, the Contractor would be responsible for preparing Method Statements detailing the precise methods of working to be employed to address and manage the potential for pollution and these would be contained within the CEMP.

9.5.16 Adequate temporary pollution prevention measures would be required, agreed in advance of construction with SEPA, to ensure that pollution and watercourse disturbance associated with the construction works is minimised as far as possible and these would follow best practice guidelines including SEPA's Good Practice Guides, SEPA's Pollution Prevention Guidance (PPG) documents 1, 5, 6 and 21, SEPA's Special Requirements and SEPA's guidelines for water pollution prevention from civil engineering contracts (SEPA, 2006).

9.5.17 The most effective approach to mitigating potential adverse effects associated with pollution is to prevent the creation of adverse effects at the source. It would not be possible to avoid the production of site surface water run-off during construction, however, this would be minimised at source through the following measures:

- scheduling construction activities so that the area and duration of soil exposure are minimised;
- where possible, undertaking construction in phases, so that sections are restored before progressing to the next section/phase;
- reducing the movement of construction plant and equipment on site;
- locating stockpiled material away from existing watercourses; and
- the containment of run-off prior to treatment and discharge/disposal.

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9.5.18 Steps would also be taken to reduce potential adverse impacts of run-off, by on-site abatement measures comprising the following:

- stabilising disturbed areas as construction is completed, for example by seeding and vegetation establishment;
- provision of wheel washes where appropriate to reduce transfer of soil onto public roads;
- dewatering of construction site working areas;
- temporary diversion of existing flows in the affected watercourses; and
- incorporation of cut-off drains during construction.

9.5.19 Measures would be put in place and methods of working would be employed to reduce any adverse effects of potentially polluting materials such as oils, fuels or construction materials and agreed with SEPA, according to their regulations, prior to construction.

9.5.20 Measures to be taken by the Contractor are likely to include appropriate storage of all oils, fuels and chemicals in bunded areas. If necessary, spillage trays would be fitted to any stationary construction plant. Any water resulting from washing out/cleaning plant and equipment would be contained and sediments allowed to settle prior to discharge to watercourses. Any waste materials would be appropriately handled and stored in designated areas and removed from the site in accordance with the Duty of Care.

9.5.21 Soil would be stockpiled in a location away from watercourses. Bunding of the stockpile area would be provided, acting as an impermeable barrier. Should it prove necessary, the stockpile area could be covered with an appropriate geotextile material for containment purposes, which would reduce the risk of wind blown particles during dry weather conditions. If required, clay material could be imported for this purpose. Soils would be reinstated in dry conditions on appropriately contoured and prepared ground as specified in the method statement for the works to reduce the risk of sediments becoming mobilised and entering surface waters.

9.5.22 There would be no storage of potentially contaminating materials near to the watercourses. Fresh concrete and cement are very alkaline and corrosive and can cause serious pollution in watercourses. It is envisaged that concrete would be brought to the site by lorry as required, thereby negating the need for an on-site concrete batching plant.

9.5.23 Specific measures would be adopted, in agreement with SEPA, during concreting works to control quantities used at each location thereby minimising the risk of release to watercourses and local groundwater. This would consist of a barrier at each location, to contain the concrete and ensure it flows into the required position and does not spread unnecessarily across the surface.

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9.5.24 Natural surface water run-off would be diverted away from the construction activities by the incorporation, where practicable, of a cut off drain at the edge of the working corridor. This would catch existing surface water flow before it enters the working area and discharge it to the existing burn at the downstream side of the working corridor.

9.5.25 The prior approval of SEPA would be obtained in respect of the discharge to a watercourse of any pumped clean water from dewatering operations. If dewatering is undertaken using a powerful pump and/or at a high rate, then the river bed and bank could be disturbed and eroded, producing silty water. Particular care would be taken to ensure that a pump of a suitable size for the situation is used and at a rate which would not cause river bed disturbance. The discharge must be free from solids in suspension, oil or other polluting materials. Silt is classified as a non-toxic pollutant and, in the absence of other contaminants, silty water may be disposed of by pumping to a suitable settlement tank or over a grassed area. However, if any other contaminants are present SEPA would be consulted with regard to appropriate disposal.

9.5.26 Where deep excavations are required, such as for the construction of the bridge abutments, SEPA advice suggests that the corner of each excavation area could be used as a pump sump. Site workers or plant would be excluded from this area to avoid disturbing the water prior to dewatering.

9.5.27 At this stage it has not been possible to determine the volumes of water involved in any de-watering and/or cut-off processes and disposal methods/locations for proposed discharges. Dilution data is also unavailable at this time, however such calculations would be undertaken during development of the detailed scheme design.

9.5.28 In addition straw bales/sediment boom may be placed in the channel of the burn downstream of construction activity to act as an additional silt trap for the duration of in-channel works and removed thereafter.

9.5.29 During operation, measures to mitigate potential impacts associated with accidental spillage of potentially polluting materials to surface waters and groundwater would include adherence to SEPA requirements, as included in the CEMP and undertaking operational and maintenance work in accordance with SEPA Pollution Prevention Guidelines.

9.5.30 SEPA provide guidance and advice on pollution incident response planning (PPG21). This guidance would be taken into account by the Contractor to reduce the risk of an incident occurring and would be used in the preparation of a Method Statement detailing the emergency procedures that would be undertaken should a pollution event occur. In the event of a pollution incident, it is essential that site workers are aware of the procedures in place to deal with the situation. Potential hazards would be identified and contingency plans drawn up, giving advice on what action to take and who to inform. These plans would be clearly displayed and site workers made aware of their contents during site toolbox talks.

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9.5.31 With the implementation of the measures described above and those included as part of the scheme design (Chapter 4), the magnitude of adverse effects due to the release of suspended solids and other construction stage pollutants is predicted to be minor for both watercourses and of slight/moderate impact significance, based on the rating defined in Table 9.3 (high sensitivity watercourse and minor magnitude impact). Adverse effects would be of short-term duration.

Physical disturbance to existing riverbanks and riverbed

9.5.32 The works would result in considerable lengths of riverbank being disturbed during the construction of the flood embankments/walls, the bridge abutments and erosion protection. Although much of this would be temporary during construction and the landscaping establishment and maintenance period, the installation of erosion protection along sections of the River Almond would require considerable bankside vegetation/tree removal with potential localised alteration to bank morphology. The morphology of the riverbank along sections of the East Pow Burn would potentially also be lost due to the placing of sheet pile walls, removal of gabions and a 50m long stretch of channel widening adjacent to the Vector Aerospace site. However, any impact should be assessed in context of the existing situation, i.e. the lack of bank diversity where lengths of gabion baskets already exist.

9.5.33 A consideration during the ongoing design and construction is the stability of new embankments and reinstated river banks whilst grass and vegetation are establishing. Appropriate techniques would be included in the design, to minimise the risk of erosion should a significant flood event occur during the establishment of the new embankments and reinstated river banks or soon after their construction. These techniques would be discussed and developed in conjunction with SEPA.

9.5.34 Careful reinstatement, replacement and, where possible, enhancement would be required to ensure that the banks are recreated so as to allow vegetation to re-establish and species to re-colonise. In addition, similar riverbed characteristics would be restored where appropriate to enable colonisation by aquatic vegetation.

9.5.35 With mitigation in place, the magnitude of temporary impact during the construction phase is assessed as moderate and therefore of moderate to large significance.

Interception / diversion of existing water flows

9.5.36 The proposed scheme does not look to permanently intercept or divert water flows. However, during the construction it would be necessary to temporarily control/divert river flows for certain elements of the works. It is envisaged that this would predominately be along the East Pow Burn where, due to the size of the channel, proximity of the flood protection elements to the watercourse and limited working area it would be necessary to work within the channel, thus requiring river flows to be temporarily diverted. The method for this would be determined by the Contractor. Such works would need to be carried out whilst river levels are low (comparable with base flows reported earlier in this section).

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9.5.37 In addition it may be necessary to temporarily intercept and divert storm / overflows from the wastewater treatment works plus any surface water outfalls within the extents of the scheme. The requirements of such diversions would be agreed with the relevant statutory authority.

9.5.38 Adverse effects on the flow regimes in existing watercourses are envisaged to be temporary in nature, and the overall magnitude of impact is assessed as minor in terms of localised disturbance, and the significance to be slight for the River Almond and slight to moderate for the East Pow Burn.

Groundwater

9.5.39 Development can impact on groundwater both during construction and operation. For example, construction works that involve excavation can lead to dewatering of shallow aquifers. There is also a risk of spillage or leakage of fuel or oil from storage tanks or construction plant. Without suitable mitigation measures, these pollutants can enter ground water.

9.5.40 Excavations have the potential to impact on water bearing strata with consequential implications for local groundwater. The works would generally not require deep excavations. Although shallow areas of ground water would be encountered during construction of the works, deep ground water within underlying bedrock would not be affected. Potential adverse impacts on shallow groundwater during the construction period may result from direct effects associated with interception or indirect effects of contamination of groundwater due to the release of run-off during construction. The information obtained from ground investigations undertaken for the proposals would be provided to the designer and appointed Contractor so that the detailed scheme design and construction methods can be developed to appropriately deal with any potential groundwater issues.

9.5.41 Contaminants from construction site run-off or accidental spillage have the potential to percolate to groundwater with adverse effects on local groundwater quality. Such contaminants may include fuels, oils and lubricants from vehicles and plant, concrete from the construction of control structures and sediments from earth excavations. The disturbance of agricultural soils also has the potential for the release of nutrients and chemical compounds from pesticides and fertilisers. Without mitigation, the impact of contaminants on local groundwater quality and habitats and vegetation that depend on groundwater resources could be substantial.

9.5.42 However, the significance of the impact is reduced by the fact that the groundwater in the area is not currently used for abstractions, thereby minimising the risks to human health. Specific measures would be agreed between SEPA and the Contractor to maintain groundwater flows during construction and to address the potential release of any contaminants into groundwater. The risk of potential contamination is therefore assessed to be of negligible magnitude and of neutral significance.

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Post construction impacts

9.5.43 Potential effects on surface water and groundwater features during scheme operation comprise:

- surface water run-off from permanent access roads;
- potential effects on existing flow regimes (both surface and groundwater) due to placement of structures in the watercourse or floodplain;
- potential effects on existing groundwater pathways due to the placement of deep foundations adjacent to the watercourses; and
- potential effects on the operation of existing wastewater and surface water outfalls to the watercourses.

Surface water run-off from permanent access roads

9.5.44 The ongoing maintenance requirements for the proposed works would be relatively low. Flood walls/ sheet pile walls would require routine inspections only, and flood embankments would require periodic inspections and grass cutting. The proposed works to protect the College Mill Trout Farm would require the greatest maintenance activity.

9.5.45 Together with the close proximity of the flood defences to existing access roads, the requirement for additional permanent access roads would be minimal. The risk of adverse effects from road surface water run-off is assessed to be of negligible magnitude and of slight significance.

Changes in existing flow regimes

9.5.46 The flood works proposed are predominantly the construction of embankments and flood walls/sheet pile walls, generally located at the top of the natural river bank, or some distance inland. As such they would have no impact on the normal flow regime in the river for both, and would only affect the flow when the river is in flood. Since the defences would mainly hold the flow in bank up to the design event (1 in 200 year; 0.5% chance of exceedance in any one year), it would potentially increase the river level and flow velocity, as a result of the removal of the natural attenuation that is offered by the natural floodplain.

9.5.47 Whilst the topography around Almondbank is significantly flatter than the Almond catchment is in its upper reaches, the ground is still relatively steep. This results in a fairly small available floodplain adjacent to the River. The proposed flood protection scheme would prevent water from flowing onto the floodplain resulting in a loss of flood plain storage. However, when compared to the overall flows within the Almond, the volume of storage is insignificant. The majority of the flow conveyance, even with the natural flood plain in operation, is within the main channel. The additional conveyance afforded by the floodplain areas is minimal, as a large proportion of the floodplain area is developed and consequently provides barriers to the flow of water.

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9.5.48 In a large storm event, the limited floodplain storage would be filled at the peak flow in the channel. This means that the reduction in available flood plain storage after the construction of the flood protection scheme would have no impact on peak storm flows. The scheme does provide some offline storage in that it allows for the playing field area to flood and then drain when flood waters recede.

9.5.49 The increase in flow velocities as a result of the proposed works would be negligible (less than 5%) in the main. Some discrete areas, i.e. downstream of Low's Work weir and upstream of Lochty Park road bridge, would experience slightly greater increases and appropriate measures would be put in place to dissipate flow. In some areas, i.e. in proximity of College Mill trout farm, velocities would be reduced.

9.5.50 It is therefore considered that the effect of the proposed works, during operation, on peak river flows, levels and velocities is negligible.

9.5.51 Both the River Almond and East Pow Burn have been subject to bank erosion. As described above, this has led to work being undertaken to prevent further erosion, realigning the River Almond channel as it passes the bowling club, and by placing gabion baskets in East Pow Burn adjacent to the Vector Aerospace site. More recent temporary erosion protection has been installed along the River Almond (at the playing fields (right bank) and downstream of Low Works Weir (left and right banks). The proposed protection works would not create additional erosion once the scheme is fully operational, and the works include the provision of further erosion protection along the riverbanks where required. However, consideration needs to be given to additional erosion risks immediately following construction of new embankments and reinstatement of existing river banks.

9.5.52 It is not anticipated that the proposed flood protection scheme would have a significant impact on the flow regime in the River Tay. The proposed works would serve to protect the centre of Almondbank from flood damage, but would not result in a significant loss of flood storage. This is demonstrated by flow rates recorded during the large flood event in 1993. The event has been estimated as around a 1 in 70 year return period event and the flow in the River Almond was recorded at around 233m^3/s. By comparison, the flow in the Tay at Perth was recorded as 2270 m^3/s, meaning the Almond accounts for only 10% of the flow in the River Tay.

9.5.53 Clearly, the flood protection scheme would be designed to reduce the risk of flooding to developments within the natural floodplain, resulting in some loss of floodplain storage. Where practicable the defence line has been set back from the channel to minimise the loss of available floodplain (e.g. flood embankments within the playing field downstream of the bowling green and just upstream of Craigneuk East and West). The placing of such embankments across the natural floodplains requires consideration to the following:

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- Likely flood flow paths and velocities, to ensure defences are designed to withstand erosion forces and risk of seepage through / beneath embankments if flood water is stored in the floodplain for a significant period of time.
- Adequate means of draining floodplain areas when the flood subsides, e.g. installation of a swale at the base of the embankment around the playing field.

9.5.54 Under normal flow conditions, the College Bank Trout Farm would continue to operate in the same way that it does at the moment. It is during periods of high flow in the River Almond that the farm would require a different mode of operation. Flow into the farm would be controlled by a sluice gate whilst the discharge from the farm would need to be pumped over the top of the flood defences in order to maintain flow through the farm. This is essential to firstly protect the fish stock, but secondly to prevent unwanted species of fish entering the natural ecosystem from the fish farm.

9.5.55 Overall, changing flow regimes post-construction, both within the channel and floodplain, is assessed to be negligible magnitude and of neutral significance.

Physical damage to existing riverbank

9.5.56 There would be few long term effects on the riverbanks. The works along the River Almond are generally at top bank level, or at a distance back from the bank. This means that once construction is complete, the river banks would return to the same condition before the works were undertaken. It is along East Pow Burn that there is greater potential for the works to have a longer term impact.

9.5.57 The flood protection proposals outlined for East Pow Burn include sheet piling, removal of gabion baskets and a short stretch of river widening. However, as discussed in the section outlining construction impacts, this should be considered in context of the existing situation along the East Pow Burn, i.e. the lack of bank diversity where lengths of gabion baskets already exist.

9.5.58 Consultations made with SEPA and appropriate restoration of riverbanks to include softer engineering would ensure that the works undertaken would not degrade the river water quality.

9.5.59 Careful reinstatement, replacement and, where possible, enhancement would be required to ensure that the banks are recreated so as to allow vegetation to re-establish and species to re-colonise. In addition, similar riverbed characteristics would be restored where appropriate to enable colonisation by aquatic vegetation. A detailed site restoration strategy would be developed in discussion with relevant statutory organisations, such as SNH, and in conjunction with the adjacent landowners. Mitigation would be detailed in the CEMP to be prepared by the Contractor, prior to construction on site.

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9.5.60 Therefore, the magnitude of impact of the works once restoration has been implemented and planting matured would be minor and the significance of the impact would be slight.

Changes in groundwater pathways

9.5.61 The installation of linear structures with deep foundations can give rise to changes in groundwater levels, in this case on the landward side of the defence line, as a result of natural groundwater not being able to flow naturally to the receiving watercourse. The results of this are generally seen over a reasonably long time frame through an increase in groundwater levels giving rise to poor drainage of permeable areas and potential flood risk to cellars and basements.

9.5.62 Generally the proposed works do not involve deep foundations and, even in the absence of detailed groundwater information, it is expected that the impact on groundwater flow would be minimal.

9.5.63 One possible exception is the installation of sheet piling along the left bank of East Pow Burn, adjacent to the Vector Aerospace site. The toe level of these sheet piles is not known, but the risk of perched groundwater levels behind this section of defence would be assessed as part of the ongoing design. Where necessary, drainage to the landward side of the defences can be installed to help maintain existing flow regimes. The relatively high permeability of the soil helps to reduce the risk and as such it is assessed to be of negligible magnitude and of neutral significance.

Operation of existing wastewater and surface water outfalls

9.5.64 In a similar manner to groundwater flow, the installation of flood walls and embankments can interfere with the operation of existing wastewater and surface water outfalls.

9.5.65 Drainage investigations have identified the location of existing outfalls, and as part of the scheme they would all have a non-return valve fitted to prevent flood water backing up into them. It is not anticipated that surface water drainage/run-off will be adversely affected and measures have been designed into the scheme to accommodate any surface water build up in the existing drainage network.

9.5.66 The proposed defences are in close proximity to a wastewater treatment works which has emergency/storm outfalls to the River Almond. The flood protection works will have no impact on the operation of the treatment works

9.5.67 Overall the risk is assessed to be of a minor magnitude and of slight significance, with measures adopted to protect outfalls.

Summary of impacts

9.5.68 A summary of the impacts discussed above and their significance is provided in Table 9.5 below.

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Table 9.5: Summary of impacts and significance

Impact	During construction		Residual Impact Post construction	
	Magnitude	Significance	Magnitude	Significance
Surface water run-off	Minor	Slight/ moderate	Negligible	Neutral
Physical disturbance of existing riverbank/riverbed	Moderate	Moderate to large	Minor	Slight
Interception/diversion of existing flows	Minor	Minor to moderate	Negligible	Neutral
Groundwater impact	Negligible	Neutral	Negligible	Neutral
Operation of existing wastewater and surface water outfalls	-	-	Minor	Slight

9.6 Mitigation Summary

9.6.1 Appropriate mitigation measures have been discussed in the previous sections above in respect of preventing, reducing or offsetting the potential impacts on surface waters and groundwater. A summary of these measures is provided in Table 9.6.

Table 9.6: Summary of measures to address water quality and hydrology impacts

Description
Detailed Design and Construction Stage
Existing wastewater and surface water outfalls to the watercourses to have non-return valves fitted to prevent back flow, surcharge and contamination.
The adoption of appropriate pollution control procedures, in accordance with SEPA guidance, to reduce the risk of sediment laden surface water run-off entering watercourses and groundwater.
Specific control measures during concreting works to reduce the risk of concrete being released to local watercourses and groundwater.
Removal and disposal off-site or on-site treatment of any silty waters created in the construction site working areas and pumped out via any dewatering process undertaken.
Consent to discharge treated surface water run-off obtained from SEPA, if required.
Adequate measures to deal with fuel and oil transport and storage, such as the inclusion of appropriately bunded areas and spillage trays.
Adherence to the sustainable re-use of materials and best practice with regard to waste management.
Emergency/contingency procedures to deal with accidental spillages – SEPA pollution incident response planning.
Specific measures to be agreed between SEPA and the Contractor to maintain groundwater flows during construction.

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Description
A detailed site restoration strategy would be developed in discussion with relevant statutory organisations, such as SNH, and in conjunction with the adjacent landowners.
Post Construction Stage
Appropriate drainage to the landward side of flood walls to ensure groundwater levels and flow regime are unaffected by the permanent works. Appropriate drainage to areas retained as floodplain. Appropriate interface between the flood defence structures and existing combined / surface water outfalls. Careful bank/watercourse restoration to include: - soft engineering techniques - landscaping (seeding and planting); - facing of structures with local stonework; - appropriately designed bank re-profiling incorporating wet ledges where feasible; and - localised bed protection where appropriate.

9.7 Residual Effects

Surface waters

9.7.1 With the implementation of the proposed mitigation measures described above and those included as part of the scheme design (Chapter 4), there would be no significant residual effects on surface waters during construction or post-construction during scheme operation.

Groundwater

9.7.2 With the implementation of the proposed mitigation measures described above and those included as part of the scheme design (Chapter 4), there would be no significant residual effects on groundwater during construction or post-construction during scheme operation.

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10 Ecology

10.1 Scope of the Assessment

10.1.1 This chapter reports the impacts of the Almondbank flood protection scheme on wildlife including sites, habitats and species of nature conservation importance.

10.1.2 The chapter considers the baseline ecological conditions (habitats and floral / faunal species present) within a study area encompassing the scheme and its surroundings up to 500m either side of the stretches of the River Almond and the East Pow Burn where flood protection is proposed, as shown in Figures 10.1a and 10.1b.

10.1.3 Receptors considered ecologically valuable, receiving protection through legislation, or that are subject to provisions in planning policy have been assessed to determine the likely impacts and effects of the scheme on them, and where necessary mitigation and compensation measures to offset an overall negative impact have been proposed.

10.1.4 The assessment is focused on sites designated for their ecological/nature conservation value, terrestrial and aquatic habitats and fauna associated with the proposed scheme corridor identified during initial consideration of the site context and consultations with a range of nature conservation organisations. The ecological assessment therefore focuses on the receptors listed below:

- River Tay Special Area of Conservation.
- Running water.
- Riparian woodland.
- Otter.
- Fish (salmonids and lamprey).
- Freshwater Pearl Mussel.
- Bats.

10.1.5 The ecological survey area was defined during the ecological scoping exercise as the sections of the River Almond and the East Pow Burn and adjacent habitats that would be directly affected by the proposed flood protection scheme. In general the margin of the ecological survey area is formed where the built environment of Almondbank (and to a lesser extent farmland) borders the wildlife habitats of the River Almond and East Pow Burn.

10.2 Legislative and Planning Context

The following legislation, policies and guidance have been taken into consideration during the assessments:

- Conservation (Natural Habitats, &c.) Regulations 1994.
- Conservation of Habitats and Species Regulations 2010.

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- Wildlife and Countryside Act 1981 (as amended).
- Nature Conservation (Scotland) Act 2004.
- The Wildlife and Natural Environment (Scotland) Act 2011.
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011.
- Salmon and Freshwater Fisheries Act 1975.
- Scottish Planning Policy.
- Perth Area Local Plan (1996 and 2000 amendment).

10.2.1 Legislation and policy relating to specific species is summarised in the relevant technical appendices (Appendices 12 to 15) contained in Volume 2 of the ES.

10.2.2 Sites (within the "Natura 2000" network) and species ("European Protected Species" or EPS) highlighted as requiring conservation by all EU member states are protected in the UK by the Conservation (Natural Habitats etc) Regulations 1994. EPS are protected from deliberate capture, injury or death, disturbance, and destruction of their places of rest or shelter. These species are also protected in a similar way by the Wildlife and Countryside Act 1981, which further protects all wild birds and their nests and all UK reptile species, as well as areas designated as Sites of Special Scientific Interest (SSSIs).

10.2.3 In addition to the species and habitats protected under wildlife legislation, many more are included on lists of UK Biodiversity Action Plan (BAP) priority species and habitats (established as a material consideration in the planning process by the Nature Conservation (Scotland) Act 2004) as well as being classified as features of principal conservation importance. Local versions of these national action plans exist in the form of Local BAPs (LBAPs); the Almondbank area is covered by the Tayside LBAP, which contains action plans of relevance to the study area for water and wetlands, woodland, otter, salmon and bat species. Inclusion in the BAP places a responsibility on the planning system and the UK government to work to achieve conservation goals through the decision making process. These designations are therefore material considerations in the planning process.

10.2.4 Freshwater fish (including brown trout *Salmo trutta* and Atlantic salmon *Salmo salar*) receive protection through the Salmon and Freshwater Fisheries Act 1975. The Act makes certain polluting acts which affect fish an offence. Brown trout and Atlantic salmon also receive protection under legislation implementing EU directives.

10.2.5 Potential negative impacts on water resources, such as pollution, are controlled by The Water Environment (Controlled Activities) (Scotland) Regulations 2011. The legislation makes it an offence to undertake certain activities that may negatively affect the water environment. Such actions are controlled and licensed by the Scottish Environmental Protection Agency (SEPA), which may impose conditions it considers necessary or expedient for the protection of the water environment.

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10.2.6 Local and national Scottish planning policy also contains provisions for nature conservation. The Scottish Biodiversity Strategy, published in 2004, places responsibilities on planning authorities regarding the protection of habitats and species.

10.2.7 The Scottish Planning Policy (SPP) sets out the key principles and the Government's priority goal of sustainable development and economic growth. SPP states that "Flood risk management measures should avoid or minimise detrimental effects on the ecological status of the water environment. In all cases opportunities for habitat restoration or enhancement should be sought."

10.2.8 Protective policy for ecology and nature conservation is also set out in local authority Development Plans. The Perth Area Local Plan (1996, amended 2000) also contains policies aimed at protecting designated sites and protected species.

10.3 Methods of Assessment

10.3.1 The studies and assessments have been undertaken in accordance with the Institute of Ecology and Environmental Management (IEEM) Guidelines for Ecological Impact Assessment in the United Kingdom (IEEM, 2006). They have involved the following tasks:

- identification and description of the baseline environment including identification of resources to be assessed and establishment of their value;
- evaluation of potential impacts of the scheme on the baseline conditions;
- identification of mitigation measures to avoid, reduce or compensate likely significant adverse impacts; and
- description of the predicted residual effects taking into account proposed mitigation.

10.3.2 The identification, description and evaluation of the baseline environment have involved a combination of desk-based review of existing data sources, consultation with statutory and non-statutory agencies and organisations and site surveys.

Desk study and consultations

10.3.3 A consultation and data collation exercise was carried out to obtain baseline information prior to carrying out ecological surveys.

10.3.4 Sources of data referred to include:

- Online databases (magic.gov.uk, nbn.org.uk, sepa.org.uk.
- Perth Area Local Plan.
- Tayside Local Biodiversity Action Plan.
- UK Biodiversity Action Plan.

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10.3.5 The following statutory and non-statutory bodies were contacted for information. The organisations and individuals were consulted through a combination of letters, emails and telephone conversations:

- Fife and Kinross Badger Network;
- Perth Bat Group;
- Perth and Kinross Council;
- Perth and Kinross Squirrel Group;
- Royal Society for the Protection of Birds Scotland (RSPB);
- Scottish Badgers;
- Scottish Biodiversity Forum;
- Scottish Environment Protection Agency (SEPA);
- Scottish Executive Wildlife and Habitats Division;
- Scottish Natural Heritage (SNH);
- Scottish Wildlife Trust (SWT);
- Tay Salmon Fisheries Board;
- Tayside Ornithologists Club; and
- The National Trust for Scotland.

Field survey methodologies

10.3.6 Site surveys for particular habitats and species have been undertaken as indicated in Table 10.1 below. Relevant protective legislation and adopted survey methods are detailed in Appendices 8 to 15.

Table 10.1: Site ecology surveys

Species	Type of Survey	Timing
Habitats		
Phase 1 habitat survey	Standard Phase 1 habitat survey (JNCC, 2007	July 2005
	Updated Phase 1 habitat survey	September 2009 February 2010 May 2011 April 2012 May 2013
River Corridor Survey	Standard River Corridor Survey methods (NRA, 1992)	July 2005
Protected species		
Otter	Survey as part of extended Phase 1 Habitat Survey	July 2005

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Species	Type of Survey	Timing
	Specific update survey	October 2007
	Specific update survey of otter holt on East Pow Burn only	July 2010
	Specific update survey	April 2012
Water vole	Survey as part of extended Phase 1 Habitat Survey	July 2005
Bat	Habitat based appraisal	October 2007 September 2009 April 2012 (validation of previous surveys)
Red squirrel	Habitat based appraisal	September 2009
Badger	Survey as part of extended Phase 1 Habitat Survey	July 2005
Lamprey	Specific survey	September 2008
Fresh Water Pearl Mussel	Specific survey	October 2007

10.3.7 Scottish Badgers noted, during consultation, that there are no records of badger *Meles meles* activity in the Almondbank area. Detailed surveys were not carried out although searches were made for signs of badger throughout the study area during the other field surveys.

10.3.8 During consultation in 2007, the Tay Salmon District Fisheries Board advised that formal fish surveys were not required in respect of the proposed scheme at the time. Later consultation with SNH in 2009 confirmed that a formal fish survey was not necessary.

10.3.9 Consultation with SNH in March 2010 determined that there would be no need to repeat the Phase 1 Habitat Survey, the River Corridor Survey (RCS); or any of the protected species surveys for submission of the Environmental Statement.

10.3.10 Phase 1 Habitat update surveys were, however, conducted and the findings used to update the Phase 1 dataset where required.

Data limitations

10.3.11 As the original Extended Phase I habitat survey was conducted in July some early-flowering plant species may no longer have been in evidence by the time of the survey. However, it is considered that the survey results, supported by the findings of more recent update surveys, are representative of the habitats and flora of the site, and include the dominant and characteristic species.

10.3.12 No active and/or disused setts or other signs of any badger activity were recorded during the RCS and Phase 1 survey after thorough search. As far as possible all

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areas of dense vegetation were investigated for signs of badger activity, however the time of year was not ideal for such a survey as territorial badger behaviour (e.g. territory marking using dung pits) is not commonplace in mid-summer. A specific detailed badger survey was not considered necessary.

10.3.13 A large area of woodland that lies to the south and east of the East Pow Burn is part of the Vector Aerospace site, with the main site to the north of the East Pow Burn. Access to this land was not possible for reasons of security when the survey was carried out. Nevertheless, this limitation did not prevent the detailed survey of the riparian habitats of the burn and its adjacent habitats and therefore it is not considered to be a significant constraint.

Evaluation of biodiversity value

10.3.14 IEEM (2006) "Guidelines for Ecological Impact Assessment in the United Kingdom" form the basis for the system used to evaluate the importance of ecological receptors. Specific criteria against which the value of ecological receptors has been evaluated include:

- Habitat size, shape, diversity (e.g. mosaics, mono-cultures) and connectivity;
- Physical conditions (e.g. natural, semi-natural, buildings/hard standing);
- Biodiversity, including species richness, range and populations of plant and animals communities;
- Rarity and typicalness of plant and animal communities;
- Stage/stability of ecological succession and habitat development trajectory;
- Typicalness of the physical environment;
- Position in an ecological or geographical unit; and
- Potential and intrinsic value, ease of re-creation.

10.3.15 Each of the identified sites, habitat types, mosaics/communities and associated species/populations have been attributed a biodiversity value based on the IEEM guidelines as indicated below

- International - warranting designation as a Special Protection Area (SPA), Special Area of Conservation (SAC) or Ramsar site or of conservation value in a European context;
- National - warranting designation as a Site of Special Scientific Interest (SSSI) or of nature conservation value to Scotland;
- Regional - of nature conservation value to the central belt of Scotland;
- County - warranting designation as a site or of nature conservation value to Tayside area;
- District - of nature conservation value to the Perth & Kinross area;

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- Local - of nature conservation value within approximately 5km of the scheme; and
- Within zone of influence only - of nature conservation value solely in the context of the Site and its immediate surroundings.

10.3.16 In the evaluation of biodiversity value, reference is also made to UK and LBAPs, inclusion on national or county Red Data Books, and to conservation status (such as nationally notable/scarce species, etc). However, the inclusion within a BAP reflects the fact that the population of the habitat concerned is in a sub-optimal state (and hence that conservation action is required) and does not necessarily imply any specific level of value. Despite this, priority BAP species/habitats may represent a material planning consideration.

Evaluation of potential and predicted impacts

10.3.17 Impacts related to loss, fragmentation or degradation of habitats, death or disturbance of animals and potential changes in species range or populations have been defined and described taking into account:

- Magnitude - the size of an impact in quantitative terms where possible.
- Extent - the area over which an impact may occur.
- Duration - the time for which an impact is expected to last.
- Reversibility - a permanent impact is one that is irreversible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it; a temporary impact is one from which short-term recovery is possible.
- Timing and frequency - whether impacts are constantly ongoing, separated but recurrent or single events and whether they occur during critical seasons or life stages of habitats and fauna.

Significance of impacts

10.3.18 The IEEM guidance defines an ecologically significant impact, whether negative or positive, as one that affects the integrity of a defined site or ecosystem and / or the conservation status of habitats or species.

10.3.19 It also advocates an approach whereby the impact is described in terms of the geographic context within which it would be significant. For example, ‘a significant impact at a local scale’.

10.3.20 The geographic context of the impact does not inevitably correlate with the value assigned to a site, habitat or species in the baseline description. It can be the case that an impact on a habitat of national importance would be significant at a local level depending on the implications relative to the parameters considered during the evaluation of the impact.

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10.3.21 Any legal implications have also been described along with policy implications.

Probability

10.3.22 In addition to significance, the probability that the impact would occur has been defined in accordance with IEEM guidelines and as indicated below:

- certain / near certain - probability estimated at 95% chance or higher;
- probable - probability estimated above 50% but below 95%;
- unlikely - probability estimated above 5% but below 50%; and
- extremely unlikely - probability estimated at less than 5%.

Mitigation

10.3.23 Where likely significant impacts have been identified, mitigation measures have been included as part of the proposed scheme to ensure legal compliance relative to designated sites and protected species and to reduce or compensate the potential significance of impacts and their effects upon relevant receptors.

Habitats Regulations Appraisal

10.3.24 As an SAC the River Tay is classed as a Natura 2000 site. The EC 'Habitats Directive' (Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora) establishes the requirement for an assessment of potential impacts (e.g. from a scheme or development) upon Natura 2000 sites. This is referred to as the Habitats Regulations Appraisal (HRA) processes. Stage 1 of the HRA is intended to identify whether the project is 'likely to have a significant effect' on a European site, referred to as 'screening'. If the screening process identifies the potential for significant adverse impacts on a Natura 2000 site, Stage 2 of the HRA needs to be completed.

10.3.25 A Stage 1 HRA has been completed for the Almondbank flood protection scheme and is available as a separate report.

10.4 Baseline Conditions

Designated sites

10.4.1 The River Almond and East Pow Burn are part of the River Tay Special Area of Conservation (SAC), designated for Atlantic salmon *Salmo salar*, river lamprey *Lampetra fluviatilis*, brook lamprey *Lampetra planeri*, otter *Lutra lutra* and oligomesotrophic standing water.

10.4.2 Information obtained through consultation indicates that the River Almond itself supports a high quality salmon population and the Tay is consistently one of the top three Scottish salmon rivers. It is also likely, although population data is less abundant, that the Almond supports lamprey species. In addition, the SAC also

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supports the European protected species, otter. The SAC is also important as it contains oligotrophic and mesotrophic standing-waters that support rare aquatic macrophytes, however the Almondbank area is unconnected with this aspect of the Tay's ecology.

10.4.3 Salmon, lamprey and otter are all listed on the UK Biodiversity Action Plan (UKBAP) and are noted in the Tayside Local LBAP as priority species.

10.4.4 The SAC is of international biodiversity value.

10.4.5 Approximately 1.5 km east of the study area there is a geological SSSI (Almondbank SSSI, NO084262, 1.1 Ha in size). The SSSI is of national biodiversity value. The proposed construction or operation of the proposed scheme would not have any material direct or indirect impact on this site due to its geological nature and its distance away from the scheme. The site is therefore not considered further.

10.4.6 SNH is responsible for the recording of 'inventory woodlands' and they are included within the Local Plan. Consultations with SNH and Perth and Kinross Council did not identify any 'inventory woodland' within the ecological survey area.

Habitats

10.4.7 Habitat types identified during the Phase 1 Habitat survey are shown on Figures 10.1a and 10.1b. The following habitats are present within the 500m of the proposals. Areas of particular note were target noted during the survey and a description of these areas is provided in Appendix 9.

Woodland and scrub

10.4.8 Woodland habitats in the study area include semi-natural broad-leaved woodland, mixed plantation and scrub. The majority of the woodland in the study area is riparian in nature and is described in the RCS (Appendix 10). However, an extensive area of mixed plantation woodland (mainly mature conifers with subordinate broad-leaved tree cover) borders the western edge of Almondbank village, which in general provides potentially suitable red squirrel habitat. However, as the plantation is effectively separated from the main part of the survey area by the Almondbank built environment it is deemed to be ecologically distinct from the wildlife habitats of the River Almond and East Pow Burn.

10.4.9 Particular woodlands of note recorded during the survey comprise:

- Target Note (TN) 1: High forest semi-natural broad-leaved woodland fringes either side of the steep river valley at the northern extent of the River Almond that was surveyed.
- TN 7: A reasonably large area of semi-natural broad-leaved woodland to the south of the East Pow Burn on steeply sloping ground down to the burn.

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- TN 2: A moderately large river island located close to the eastern bank of the River Almond. The island has become well colonised by young scrub-sized woodland habitat. In 2005 the island was vegetated with rank neutral grassland.

10.4.10 Between the original 2005 survey and recent 2012 survey, the main change to riparian woodland is the installation of erosion protection along two stretches of the River Almond downstream of Low's Work Weir and a length of gabion baskets along the East Pow Burn at Lochty Park. This necessitated the removal of riparian vegetation, including some trees.

10.4.11 Areas of semi-natural broadleaved woodland are of county biodiversity value, whilst areas of plantation woodland are of local biodiversity value. Scrub is of biodiversity value within the zone of influence only.

Running water

10.4.12 The watercourses within the survey area comprise the River Almond and East Pow Burn, described in detail in the RCS (Appendix 10). Under the WFD, the River Almond within the study area is classified as overall 'Bad' status, based on 2008 data, and the East Pow Burn as overall 'Moderate' status. Environmental objectives have been set to improve water quality with the River Almond expecting to achieve Good status by 2027 and the East Pow Burn by 2021. Observations made during ecological fieldwork tend to suggest that the water quality of the East Pow Burn may be affected by discharges from diffuse pollution sources (e.g. agriculture and road run-off) and possibly to some extent from point-source pollution sources (e.g. industry).

10.4.13 River channel vegetation is not a significant aspect of the ecology of the study area due to the typically fast flowing nature of its watercourses. Bank vegetation is essentially that of the adjacent habitat with flora characteristic of wet woodland. Watercourses are listed on the UKBAP and Tayside BAP.

10.4.14 Between the original 2005 survey and recent 2012 survey, there have been no significant changes evident to the essential character of the River Almond and East Pow Burn, e.g. flow regimes, river substrates, etc. Changes, albeit localised, have occurred to riparian habitats of the River Almond since 2005 and they are described in the sections on woodland, grassland, and tall ruderal habitats.

10.4.15 As they are included within the River Tay SAC designation, the River Almond and East Pow Burn are of international biodiversity value.

Wetland

10.4.16 Wetlands habitats, such as marsh and swamp, are rarely present within the ecological survey area due to the prevalence of intensive agriculture and human settlement.

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10.4.17 Wetland habitat is only present at one locality on the East Pow Burn (Target Note 3). This comprises an area of marshy grassland (dominated by reed sweet-grass Glyceria maxima) with some scattered willow scrub Salix sp. on approximately 50m of the north bank of the East Pow Burn.

10.4.18 Wetland habitat is of local biodiversity value.

Agricultural land

10.4.19 Land utilised for intensive agriculture forms approximately one quarter of the ecological survey area itself, although the majority of the survey area is bordered by farmland. Agricultural land dominates the flat lying land (floodplain) that lies on either side of the River Almond, and to the east of the East Pow Burn. All the farmland within the survey area comprises arable land and improved grassland and the margins of the fields are fenced.

10.4.20 Arable land is of biodiversity value within the zone of influence only.

Grassland

10.4.21 Grassland (predominantly amenity grassland) occurs sporadically and is not a major feature of the survey area. The main area of amenity grassland is located on flat lying land adjacent to the right bank of the River Almond (west of the (Black Bridge) footbridge over the Almond) and forms a public playing field and adjoining bowling green. The western and southern margins of this amenity grassland are bordered by species-rich hedges. There is also a large private garden present on the right bank of the bend in the River Almond opposite the confluence with the East Pow Burn and also at Criagneuk where a flood embankment and wall are proposed.

10.4.22 A narrow strip of rank semi-improved neutral grassland (Target Note 11) is evident on the remnants of a former railway embankment that divides an area of arable land from an area of improved grassland to the north of the River Almond between Deer Park and Craigneuk. The semi-improved grassland strip forms a potential wildlife corridor for mammals and invertebrates. Scattered scrub is starting to develop within parts of the grassland. The improved grassland is typified by a lack of floristic diversity and dominated by perennial ryegrass *Lolium perenne*.

10.4.23 During the earlier field surveys, an approximately 30m length of the north bank of the River Almond was dominated by rank semi-improved neutral grassland (Target Note 10). About 50% of the stretch of grassland which forms the bank of the river was heavily eroded by the river, and recent erosion protection (rock revetment) has been installed (in 2011) to alleviate this. A kingfisher *Alcedo atthis* was recorded flying along the riverbank in this area during the 2009 fieldwork.

10.4.24 Semi-improved neutral grassland and improved grassland habitat is of local biodiversity value and amenity grassland of value within zone of influence only.

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Tall ruderal vegetation

10.4.25 Tall ruderal vegetation represents a minor component of the survey area. This type of vegetation characteristically develops on soft and fertile soils and is present on the western bank of the River Almond, upstream of the bowling club and at the edge of woodland on the north side of Low's Work (weir).

10.4.26 Tall ruderal vegetation is of biodiversity value within the zone of influence only.

Habitats associated built-up areas

10.4.27 Being centred on the village of Almondbank the survey area comprises a considerable proportion of built-up habitats mainly formed by detached houses (modern and old) with large secluded gardens. In their own right these features do have wildlife potential. The older buildings have potential to contain bat roosts and also potentially form nesting sites for swallow *Hirundo rustica*, house martin *Delichon urbica* and swift *Apus apus*.

10.4.28 To the west of the East Pow Burn a large industrial area (Vector Aerospace), a wastewater treatment works and an industrial estate form a significant proportion of the Almondbank area. They have no ecological value. The only building directly affected by the construction of the flood protection scheme would be the existing playing field pavilion which would be demolished and rebuilt. This building has some bat roost potential.

10.4.29 Almondbank fish farm and hatchery (Target Note 4) is situated on a narrow, mostly flat lying land on the east bank of the River Almond. The site contains a mill lade and several feeder channels and ponds. In-between these water features are landscaped areas with amenity grassland and scattered mature exotic conifers and broad-leaved trees. There is a large, old mill building within the site. In general the site has very good bat habitat potential including the old mill buildings, the mill lade and the scattered mature trees. A grey squirrel *Sciurus carolinensis* population was recorded within the local area in 2005.

10.4.30 In terms of potential to support protected species, the fish farm buildings/mill lade and older housing are of local biodiversity value.

Flora

10.4.31 No individual plant species or plant communities of botanical significance were recorded during the extended Phase 1 habitat survey. During 2005, invasive non-native species were recorded, including giant hogweed *Heracleum mantegazzianum* within the riparian woodland on the left bank of the River Almond, south of the fish farm close to the site of a dismantled weir (Target Note 5). In 2012, the plant had spread considerably and was evident along both banks of the River Almond. This species is listed in Wildlife and Natural Environment (Scotland) Act 2011 and it is an offence to cause the plant to spread or grow.

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10.4.32 Himalayan balsam *Impatiens glandulifera* was identified along the north bank of the River Almond (Grid Ref NO 070 260). This species is listed in Wildlife and Natural Environment (Scotland) Act 2011 and it is an offence to cause the plant to spread or grow.

10.4.33 Variegated yellow archangel *Lamiastrum galeobdolon subsp. Argentatum* was identified along the north bank of the River Almond (Grid Ref NO 067 259) and the south bank of the River Almond (Grid Ref NO 065 261). This species is listed in Wildlife and Natural Environment (Scotland) Act 2011 and it is an offence to cause the plant to spread or grow.

10.4.34 A single stand of rhododendron *Rhododendron ponticum* was identified on the bank of the River Almond (Grid Ref NO 070 257). This species is listed in the Wildlife and Natural Environment (Scotland) Act 2011 and it is an offence to cause the plant to spread or grow.

10.4.35 Small, dispersed stands of the introduced flowering herb species monkeyflower *Mimulus guttatus* and pink purslane *Clatonia sibirica* were found by the riverbank of the River Almond. These species are not considered to be aggressively invasive (compared to alien species such as Japanese knotweed).

Protected Species

Badger

10.4.36 No signs of badger activity, past or present, were recorded during the surveys.

10.4.37 Potential badger habitat within the survey area is restricted by the presence of the adjacent built environment and lack of suitable burrowing conditions (i.e. little soft soil, banks mainly comprising boulders). Potentially suitable badger habitat, in the form of well established, relatively secluded broadleaved woodland and possibly good foraging habitat (amenity grassland), is located within the land to the east of Lochty Park, close to the East Pow Burn. This area would be unaffected by the proposed works.

10.4.38 Badger has therefore not considered further in this assessment.

Otter

10.4.39 The presence / absence of otters was surveyed for along the River Almond and the East Pow Burn. Presence was identified from field signs of otter activity such as otter spraints, footprints, slides, tracks, potential holt sites and couches. Evidence was recorded of the presence of other species important to otter ecology such as American mink, which are believed to directly compete with otter for food sources such as fish, birds and small mammals.

10.4.40 During the River Corridor Survey in 2005 four otter spraints were observed on boulders on the east bank of the River Almond, (RCS sections 1 and 2) (see Appendix 10: Figures 2 and 3, Tables 3 and 4). An otter holt and several spraints

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were found near the East Pow Burn confluence. This holt, together with a second on the River Almond, were recorded during the 2007 survey and again in the 2012 survey.

10.4.41 The evidence of otter recoded during the 2007 and 2012 surveys is detailed in Appendix 11 and shown on Figure 10.2. Due to the status of the otter as a European Protected Species and the potential for persecution, precise grid references for the location of holts/resting sites is not provided. Details are given in a Confidential Annex to the ES (Figure 10.3), available upon request from the authors.

10.4.42 The otter holt on the East Pow Burn, with the potential to be affected by the works, was surveyed again in July 2010. No evidence of otter, such as spraints, prints or runs/pathways, was found within the holt or within its immediate vicinity. The interior of the cavity was dry and approximately 30cm deep. There were some cobwebs present, indicating a lack of recent mammal activity. The holt was still evident during April 2012, but with no signs of recent use.

10.4.43 The 2012 field survey identified that the otter holts previously found are still present. Numerous otter spraints were found during the field survey, as well as a single otter footprint. In addition, an additional otter holt/resting site was identified along the north bank of the River Almond (see Confidential Annex for location). This potential holt appeared to be in use with paths radiating from the area. There were fresh otter spraints surrounding the potential holt and a single otter footprint was found close by.

10.4.44 Otters associated with the proposed scheme have a regional biodiversity.

Water Vole

10.4.45 The RCS suggested that a short section of the East Pow Burn, at the area of marshy grassland on left bank of the bend in the East Pow Burn, contained potential water vole habitat with soft banks and marginal vegetation comprising stands of tall grasses on either bank. However, no evidence of water vole was discovered anywhere in the survey area. Moreover, desk study and consultations did not reveal any present or past records of the species on the River Almond (and tributaries) in the Almondbank area. Anecdotal information from the manager of the fish farm indicated that there is a high level of mink activity in the area, and high levels of mink do tend to preclude the presence of water vole (as mink predate heavily on the latter).

10.4.46 Water vole has therefore not considered further in this assessment.

Bats

10.4.47 During consultation, the Perth Bat Group noted that some ad hoc bat surveys in the Almondbank area were carried out in the mid to late 1990s. Common pipistrelles *Pipistrellus pipistrellus* have been recorded around the College Mill trout farm and on the adjacent stretch of the River Almond but there are no recorded roosts in the area. However, on-site discussions (July 2005 and May 2011) with the fish farm manager revealed that there is a possible roost and/or hibernaculum within the long stretch of

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tunnel that carries the mill lade to the farm. Further downstream the area of the River Almond by the footbridge is noted by the Perth Bat Group for records of foraging Daubenton's bats *Myotis daubentonii*.

10.4.48 Initial survey work in relation to the flood protection scheme was undertaken as part of the extended Phase 1 habitat survey to look for the presence of, or the potential for, bat roosts within the survey area. Observations of mature trees and other structures, such as bridges, with bat potential were made where present. Trees with bat potential have cracks, crevices, loose bark flakes or dead limbs, while structures with bat potential have cracks and crevices, particularly in the mortar between bricks. Signs of bats include scratch marks, urine stains and droppings and chattering noises can also be heard if bats are in a roost. No detailed bat surveys (i.e. dawn/dusk surveys or individual tree examination) were undertaken at this stage, and this approach was agreed with SNH.

10.4.49 Bat habitat surveys were conducted during 2007 and 2009 and the results provided in Appendix 12 and Appendix 13, respectively. As agreed with SNH, an update of the 2009 survey was undertaken in April 2012 to confirm the previous findings.

10.4.50 A number of large mature trees are present within the survey area, many of these exhibiting dead/dying limbs, rotting, scarring and varying levels of ivy coverage. Such features require consideration for their potential to support roosting bats. In addition, the wide open river, open fields and hedge lines which are present to varying extents throughout the site, provide good foraging habitat for bats in the area.

10.4.51 The bat potential of the riparian corridor of the River Almond is generally high as the adjacent buildings contain potential roost sites and the riparian woodland provides very suitable bat foraging habitat (open sided, linear in nature and with dense ivy in the canopy layer providing good shelter for bats). The riparian woodland of the East Pow Burn also has high bat potential with several large crevices noted in the woodland's mature trees, with dense ivy in the canopy (which helps to shelter bat roosts).

10.4.52 Key features of specific note with respect to bats, that have the potential to be affected by the works can be summarised as follows (refer to Appendix 13 for Target Note locations and the full survey report):

- TN 4: A small stand of very large, mature ash, beech, sycamore and oak, at the end of the mixed-species hedge that flanks a small playing field. The beech tree is of interest due to the presence of scarring and localised rotting which offers some bat roost potential. The oak exhibits localised rotting along with some peeling bark which also offers some bat potential.
- TN 7: A small stand of deciduous trees along the right bank of the river in the north east corner of the playing field. A larger mature ash, and ivy-covered sycamore are of interest with regards potential to support roosting bats.

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- TN 8: A small sports pavilion in the south east corner of the playing field. It was noted in 2012 that this structure had become more dilapidated, which has increased its potential for bat roosting.
- TN 8: The River Almond passes beneath a footbridge (Black Bridge) near the centre of the scheme, adjacent to the playing fields. Several mature ash and sycamore covered with dense ivy that border the river have moderate potential to support roosting bats. An ash by the footbridge on the left bank has high bat potential.
- TN 10: Several large oak trees are present on the left bank of the East Pow Burn adjacent to the A85 bridge over the burn provide some potential interest to roosting bats.
- TN 12: Semi-natural broad-leaved woodland dominated by birch and sycamore with a few mature willows is present along the banks of the East Pow Burn, to the south of the Vector Aerospace site. One mature willow close to where the burn passes under the access road to Lochty Park has low to moderate bat potential.
- TN 14: Mature trees of varying species including willow Salix sp. between the East Pow Burn and an access track. Dense ivy covers a number of the trees along with scarred and cracked trunks (especially on a number of the willow trees) represents an area of potential interest for roosting bats.
- TN 15: A large mature oak set back from the river in the front garden of the residential property (Brockhill) at the East Pow Burn/River Almond confluence. The upper reaches of the tree may have features with potential to support roosting bats. A small number of mature ivy covered ash and sycamore on the banks of the East Pow Burn near the bridge may also support potential roosts.
- TN 16: Five large mature ash and one alder, all covered with dense ivy and with dead limbs visible, on the left bank of the River Almond near the Low's Work weir. These trees have moderate to high potential to support roosting bats.
- TN 17: Large mature trees flank both banks of the river here, with dense ivy coverage a feature throughout. Trees of particular interest include a very large sycamore adjacent to the footpath on the right bank, together with an oak on the right of the footpath. Ivy coverage is very dense in places and, together with localised rotting, scarring and dead limbs, represents an area of moderate potential with regards bat roost suitability.

10.4.53 The footbridge (Black Bridge) that is to be relocated as part of the works has no bat roosting potential, being comprised of a metal frame with no suitable crevices, etc. The A85 road bridge at the northern end of the survey area has some potential due to some areas of loose mortar, although this bridge would not be affected by the proposed scheme.

10.4.54 The survey area has a county biodiversity value relative to bats.

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Red Squirrel

10.4.55 During consultation, the Perth and Kinross Red Squirrel Group stated that there are recent records of both red squirrel *Sciurus vulgaris* and grey *squirrel Sciurus carolinensis* in the area that surrounds Almondbank. They advise that Perth is a 'bridgehead' zone for red squirrel and grey squirrel interaction and is therefore a particularly sensitive area in terms of red squirrel activity. Three recent red squirrel records were provided by the group, two lie outside the geographical scope of this study but one record (Almondbank/Moulinalmond, NO063265, December 2002) is located in mixed woodland about 300m northwest of the ecological survey area.

10.4.56 Observations for any potential red squirrel habitat were carried out during the extended Phase 1 habitat survey and also during further habitat based assessment in 2009 (see Appendix 13). This included recording sightings (where and when) and behaviour, counting of any nest sites (dreys) or individuals observed, along with noting any evidence of feeding, droppings, scratched trees and hairs. The presence of grey squirrels was also recorded, as a species whose presence directly impacts on the ecology of red squirrel, through direct competition for food resources. A detailed survey was not undertaken.

10.4.57 No evidence of red squirrel was observed during the extended Phase 1 habitat survey, although suitable habitat is present in the form of the riparian woodland and most importantly due to the presence of the large area of mixed plantation woodland at the western edge of Almondbank. Consultation revealed that this plantation is likely to support an active population of red squirrel. There are records of the species (from 2007) in the form of sightings in and around the Methven Wood and Cromwellpark woodlands to the north-west of the scheme. The closest such record is less than 500m from the northern extent of the survey area. Further records (from 2007) indicate the presence of red squirrel in the woods to the east of Pitcairngreen, to the north east of the survey area (approximately 1km from the eastern edge).

10.4.58 On the eastern side of the River Almond grey squirrels *Sciurus carolinensis* were present within the vicinity of trout farm in the northeast part of the survey area which illustrates the much more adaptable nature of greys (that can thrive in built up areas) compared with red squirrels that generally require large blocks of woodland to maintain a stable population. During 2009 survey, grey squirrels were also observed at a number of locations within the survey area, especially along the footpath adjacent to the right bank of the river, downstream of the footbridge.

10.4.59 The results of the 2009 red squirrel evaluation indicated that due to the lack of suitable red squirrel habitat within the areas affected by the works, and the presence of grey squirrel, further survey work would not be necessary.

Birds

10.4.60 The study area contains habitats suitable for breeding birds, including deciduous woodland, riparian corridor, scrub, arable farmland, parkland and gardens. Although these habitats are not uncommon in any way, it is probable that the study area acts

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as a corridor linking local habitats with the wider area. Woodland copses for example are valuable in linking woodlands separated by open fields, particularly for small songbirds that would otherwise be under increased threat of predation from birds of prey as they cross open fields.

10.4.61 No bird nests were observed during the extended Phase 1 habitat survey, although it is highly likely that a range of common woodland birds use the trees within the riparian areas for breeding. Common bird species, listed as RSPB amber (medium conservation concern) or green (no specific conservation concern), recorded during surveys include blackbird, wren, wood pigeon *Columba palumbus*, grey wagtail *Motacilla cinerea* and swallow *Hirundo rustica*. The RSPB red listed (high conservation concern) house sparrow *Passer domesticus* was also recorded in several of the private gardens that lie adjacent to the River Almond and East Pow Burn.

10.4.62 Dipper *Cinclus cinclus* was recorded flying up and down the River Almond, although there were no definite indications that they nest here, and dipper (listed as a key species in the Tayside BAP) was recorded flying up and down the East Pow Burn. It is possible that this species nests crevices within the stone-built gabion river bank. Heron were also regularly observed on the Almond. Kingfisher *Alcedo atthis* were recorded along the River Almond resting on boulders and flying up and down the river but no indications of nesting. The Almond represents reasonably suitable kingfisher feeding habitat with riparian woodland with fishing perches above pools with abundant small fish.

10.4.63 Overall, the survey area has a local biodiversity value relative to breeding birds.

Fish

10.4.64 The River Almond is noted as a salmonid river and contains very suitable salmonid habitat with good water quality and a good diversity of hydrological features, channel substrate and variability of bank shading (from overhanging branches and trees). More specially, habitat evaluation tends to suggest that the river is particularly suited to supporting a healthy population of salmon parr. In the case of the East Pow Burn water quality is significantly lower compared with the River Almond and it is consequently envisaged that the burn is not particularly suitable for salmonids.

10.4.65 A fish farm (principally producing rainbow trout) on the left bank (Target Note 4 on Figure 10.1a) is a major feature of the surveyed section of the River Almond. It is well screened from the river, but discharges into the river from two points. This site is operated as a commercial enterprise only. Further upstream of the proposed scheme (approx. 1.5km to the north at Cromwellpark), a fish hatchery is present which concentrates more on breeding native fish populations for potential release to the River Tay catchment.

10.4.66 During consultation, the Tay Salmon District Fisheries Board acknowledged that the site was highly suitable to support salmonids, and particularly suitable to support salmon at all life stages: ova, juvenile, parr and adults. Suitable spawning and

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juvenile habitat exists within the footprint of the scheme along both the River Almond and East Pow Burn.

10.4.67 A salmonid habitat assessment was carried out on the River Almond in November 2010 in relation to proposed repair to Low Works Weir (Bull, C, 2010). Habitat for juvenile and adult salmonid fish was found to be present throughout the entire length of the surveyed reach between College Mill fish farm and just upstream of Waterside Cottages. Mixed and deep juvenile habitat was the most abundant category found. Suitable shallow gravel and marginal areas for fry were present throughout the surveyed reach with abundant nursery habitat for fry and parr available. Suitable gravels and flow conditions to allow adult spawning activity were present at every glide where the channel gradient increased from a pool to a riffle. Deep adult pool habitat was the most limiting habitat in the surveyed reach, although the regular distribution of these features was considered to be adequate for adult refuge during migration. Low's weir was assessed as being easily passable for adult salmonids and partially passable for adult lampreys and eels. A fish pass has been recently constructed as part or repairs to the weir.

10.4.68 The survey area has a county biodiversity value relative to salmonid species.

Lamprey

10.4.69 Previous surveys have reported lampreys to be present in the River Tay and River Almond catchment (APEM 2004). All three of the lamprey species are listed in Annex II of the River Tay SAC description as a qualifying feature for the site selection.

10.4.70 A survey for lamprey was carried out in September 2008 at five locations along the River Almond and East Pow Burn. The full survey report is included as Appendix 14. River/brook lamprey larvae were recorded on both watercourses. Although the River Almond has relatively few suitable fine sediment habitats within the surveyed river section, ammocoetes were present at two out of the three sampling sites. Two sample sites were surveyed on the East Pow Burn with one of these sites returning results of river/brook lamprey larvae. The highest river/brook lamprey densities were found in the East Pow Burn with 10 larvae per m^2, representing a favourable conservation status ($10m^{-2}$ threshold value for favourable condition set out by the JNCC).

10.4.71 A lamprey survey (habitat evaluation and sampling) was also conducted on the River Almond in November 2010 in relation to proposed repair to Low Works Weir (Bull, C, 2010). The habitat evaluation revealed limited suitable lamprey habitat along the River Almond. Six patches between College Mill fish farm and Waterside Cottages were considered to have the potential to provide suitable, but sub-optimal conditions, for lamprey ammocoetes. Abundant spawning habitat for lampreys was found to be present across the entire surveyed reaches both upstream and downstream from Low's weir. All of the four sites sampled returned results of river and brook lamprey ammocoetes, with a total of 58 lampreys sampled from $5m^2$ of habitat. The density at

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three of the habitat patches sampled falls below the favourable conservation status threshold, but the mean value of 11.68m^{-2} for all 4 sites compares favourably.

10.4.72 The survey area has a county biodiversity value relative to lamprey species.

Freshwater Pearl Mussel

10.4.73 During the consultation exercise, SNH indicated that freshwater pearl mussel *Margaritifera margaritifera* (FWPM) has been recorded upstream and downstream of Almondbank and therefore SNH consider that the species may be present within the proposed area of work. FWPM is not currently a River Tay SAC qualifier species; but a protected species under the Wildlife and Countryside Act 1981 (as amended).

10.4.74 A transect survey for freshwater pearl mussels and a record of substrate types within the main stem of the River Almond and East Pow Burn was therefore undertaken in October 2007. The aim of the survey was to identify specific areas that are most likely to support freshwater pearl mussels using information on their habitat preferences from previous studies and experience. The full survey report is included as Appendix 15.

10.4.75 A total of thirty seven (50m) transects were undertaken. Substrate characteristics differed between the main stem of the River Almond and East Pow Burn, with the substrate within the main river generally more suitable to support freshwater pearl mussels i.e. it is dominated by cobble and boulder substrate with a sub-dominant layer of finer pebble, gravels and sands. In contrast, the East Pow Burn, was considered to have less substrate suitable to support freshwater pearl mussels, given that the substrate was dominated by smaller sized substrate i.e. gravels and pebbles, with cobbles generally sub-dominant. The overall amount of suitable habitat within the survey area was fairly minimal.

10.4.76 No freshwater pearl mussels were found during the surveys within both the River Almond and East Pow Burn. This species is considered absent and not considered further.

Summary of biodiversity value

10.4.77 The site of the proposed flood protection scheme includes the River Almond SAC. There are no other areas with a statutory nature conservation designation within or adjacent to the study area.

10.4.78 The watercourses of the River Almond and East Pow Burn provide a valuable wildlife corridor, in particular as they pass through built-up areas and intensively managed arable land which otherwise generally has more limited value for wildlife.

10.4.79 The study area habitats are important for the protected species that they support, including the European protected species otter, evidence of which was found along the River Almond (spraints) and East Pow Burn (holt and spaints); bats (European protected species) likely to forage along the watercourse corridor and also possibly

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roost in trees and buildings adjacent to the river. Kingfisher and dipper also utilise the river corridor, with dipper possibly nesting within the engineered stone structures along the bank of the East Pow Burn.

10.4.80 Tables 10.2 and 10.3 below provide a summary of the biodiversity value of habitats and species within the survey area.

Table 10.2: Summary of habitat biodiversity value

Habitat Type	Habitats Present	Biodiversity value
Woodland	Semi-natural broadleaved woodland	County
	Plantation woodland	Local
	Scrub	within the zone of influence only
Running water	River Almond and East Pow Burn	International (due to inclusion in SAC designation)
Wetland	N/A	Local
Grassland	Semi-improved neutral grassland	Local
Farmland	Arable	within the zone of influence only
Recreational Space	Amenity grassland	within the zone of influence only
Other	Tall ruderal	within the zone of influence only
Built-up areas	Fish farm buildings/mill lade and older housing	Local

Table 10.3: Summary of species biodiversity value

Species	Biodiversity value
Otter	Regional
Bats	County
Breeding birds	Local
Salmonids	County
Lamprey	County

10.5 Predicted Impacts and Mitigation

River Tay SAC

10.5.1 The Stage 1 HRA determined that the flood protection scheme would be unlikely to have a significant effect, alone or cumulatively with other projects and plans, upon the conservation objectives of qualifying features of the River Tay SAC.

10.5.2 Ensuring that any in-river works are undertaken outwith the sensitive periods for fish and lamprey (as set out in the section on salmonids and lamprey below), combined with strict adherence to the water quality and otter protection measures also set out below, it is considered highly unlikely that significant effects upon Atlantic salmon, the three lamprey species and otter in the River Tay SAC would occur. The integrity of the SAC site would not be affected.

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Habitat disturbance, damage and loss

Semi-natural broadleaved woodland

10.5.3 Although the location and design of the flood protection works has been developed to minimise tree removal, there would be disturbance to and loss of habitat as a result of the creation of flood walls and embankments and the need to access the river bank for these works. This would mainly involve direct removal of areas of bankside woodland, including some mature native trees, (bird breeding habitat and potential bat roosts). This would occur at:

- the Almondbank road bridge where a road drainage outfall is required;
- in the vicinity of the fish farm;
- on the left bank of the Almond downstream of the footbridge; and
- on the left bank downstream of Low Works Weir.

10.5.4 There would also be alterations to existing engineered banks (e.g. where gabion baskets are present along the East Pow Burn) which may provide foraging areas, shelter or nesting sites for bird species such as kingfisher and dipper. Access to the site of the flood protection works would also be required and this is likely to involve the removal of some areas of additional habitat.

10.5.5 The proposed flood protection works have the potential to effect wider habitat patterns through fragmentation of the linear riparian woodland corridor, which currently forms an excellent facility for the movement of wildlife to other areas in the wider vicinity. Owing to the frequently limited bank width throughout the survey area, i.e. where the existing built up environment comes in close proximity to the watercourse, the removal of vegetation and placement of walls and other structures would be necessary and may further fragment existing linear habitats.

10.5.6 Tree removal and fragmentation issues would be considered further as part of the detailed design and measures put in place to ensure that loss, fragmentation/severance is minimised as far as practicable.

10.5.7 This would include temporarily fencing off of working areas and access points during the construction period so that vehicles do not unnecessarily enter areas outwith the defined working areas. All site clearance works would be undertaken in accordance with appropriate and detailed method statements. Method Statements would also be produced for construction activities such as working in or near to watercourses and would meet the requirements of any statutory, legal or contractual requirements.

10.5.8 Where possible mature trees within the site would be retained, particularly trees within the riparian woodland zone. Appropriate landscaping including the planting of additional native broad-leaved trees would be carried out as part of site restoration in order to reduce the impact of flood works and provide a buffer zone to the built up areas.

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10.5.9 As part of the detailed design, once the precise number and location of trees that would be affected is confirmed, a tree condition survey would be carried out to determine the value of trees, root protection zones and the potential for mitigation to retain as may trees as possible, for example through micrositing of walls and erosion protection.

10.5.10 Where new planting is to take place, for example on embankment slopes, a native species mix appropriate to the locality would be used. Provision would be made for aftercare to ensure that vegetation establishes and, in the case of trees and scrub, plants which fail within the first three years would be replaced. This provides an opportunity to enhance, to a degree, the biodiversity and habitat value of the scheme area.

10.5.11 The loss/fragmentation/severance of riparian planting as an ecological resource would be of moderate magnitude in the context of the existing planting as a whole. It would be temporary as new planting matures and adds to the diversity of species composition and stages in succession. The short-term impact (< 5 years) would be adverse and significant within the zone of influence of the proposed scheme. With management focused on the retention of diversity and composition as the proposed planting establishes and matures in the medium term (5 - 10 years), it would become beneficial and certain within the zone of influence of the proposed scheme. The existing value of the established riparian corridor would, therefore, be reinstated and enhanced.

10.5.12 Taking into account the nature conservation value of woodland habitat, extent of permanent and temporary loss in the context of the survey area and wider area and commitment to replacement/additional planting, it has been concluded riparian woodland loss/fragmentation/severance would be adverse and certain but that it would not result in a significant effect relative to biodiversity and nature conservation in the longer term.

Running water

10.5.13 The proposed works that have the capacity to cause disturbance to river habitats (riverbanks and river channels) of the River Almond and East Pow Burn are:

- Placement of erosion protection at locations along the River Almond and East Pow Burn.
- Erection of a sluice gate within the lade of the trout farm upstream of College Mill Trout Farm Hatchery and associated flood walls, sheet piling and pumping station.
- The construction of a new footbridge (the site of the ‘Black Bridge’) and abutments on the River Almond. Note, the current footbridge about 15m downstream of this locality is a temporary structure whose removal would have no ecological impact.

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- The demolition and replacement of the minor road bridge over the East Pow Burn at its confluence with the River Almond and the construction of a new road bridge and abutments at the same location.
- Widening a short stretch (approx. 50m) of the East Pow Burn on the right bank to the north of the Green Arces property.
- The augmentation of steel sheet piles adjacent to the Vector Aerospace/Wastewater Treatment Works site and by Lochty Park residential area on the East Pow Burn.
- Installation of flood defence walls and erosion protection on the right bank of the East Pow Burn that borders Lochty Park residential area/Almondbank Main Street.
- The demolition and replacement of the road bridge over the East Pow Burn to Lochty Park residential area.

10.5.14 The above proposed works are likely to impact upon the river bank and channel habitats of the River Almond and the East Pow Burn at the immediate localities of construction work or 'footprint' and immediately downstream. In general, works adjacent to the River Almond would not directly affect the main river channel. This is based on the assumption that all construction activity would be undertaken from land adjacent to riverbank or within a dry working area established close to the riverbank. Impacts to river habitat would occur during the construction phase to stretches of riverbank where gabion baskets would be removed along the East Pow Burn and where this watercourse would be widened (through removal of riverbank) along an approximate 50m section. The placement of erosion protection is also likely to affect areas of bankside.

10.5.15 Demolition of the existing road bridge structures is likely to have a direct impact upon the watercourses themselves from debris falling into the watercourses and from working activities to remove any material from the watercourses. All works however, would take place from the banks, with appropriate protective sheeting used where necessary, and this would minimise the risk of disturbance.

10.5.16 Assuming that the new footbridge abutments and bridge decking would be constructed from the river bank and not within the watercourses, any impact to the banks of the River Almond would be restricted to the immediate footprint of the river bank for the new abutments and would not impinge upon the actual watercourse or river flow.

10.5.17 Taking into account the nature conservation value of running water habitat, extent of permanent and temporary disturbance in the context of the survey area and wider area, it has been concluded that the impact would be adverse and certain but that it would not result in a significant effect relative to biodiversity and nature conservation.

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Pollution of watercourses

10.5.18 Potentially polluting activities include soil stripping, construction of concrete walls and excavations, which may release contaminants, e.g. cement, concrete or silt-laden surface runoff, to watercourses with consequential adverse effects on water quality and on aquatic species (including invertebrate and fish) and terrestrial species feeding in these areas (such as otter).

10.5.19 As discussed in Chapter 9, there is a high risk of sediments released from construction activities entering either the East Pow Burn or the River Almond. Without appropriate mitigation, this could have implications for important migratory fish populations and spawning gravels in the River Almond, and further downstream in the River Tay, and also on freshwater invertebrates present in the watercourses. Accumulation of solids on the riverbed can adversely affect fish spawning and nursery areas. Run-off high in suspended solids can clog the gills of fish and fill the inter-gravel spaces of spawning beds and cause suffocation of eggs. Particularly sensitive time periods would be when fish eggs and fry are present, between October and May, as they are extremely vulnerable to pollutants in watercourses. In addition the input of sediments to the River Almond may adversely affect lamprey spawning and development.

10.5.20 There is also the potential for vehicle pollutants entering the watercourse from equipment present on site adversely affecting water quality with consequent effects on fauna and flora.

10.5.21 The pollution control measures described in sections 9.5 and 9.6 would be adopted to protect water quality and aquatic ecology.

10.5.22 As discussed in Chapter 9, dry working areas would be created to minimise direct disturbance to the river. If works are subsequently identified as being required from within the watercourses, the impact would potentially be detrimental to salmonid, lamprey and riverine habitats. Detailed Construction Method Statements and appropriate licensing under the Controlled Activities (Scotland) Regulations 2005 would be required. Such unavoidable works would be discussed in advance with SEPA and the fishery interests in order to establish an appropriate methodology for reducing the risk of impact.

10.5.23 Taking into account the proximity and extent of the working areas to watercourses and the proposed mitigation, it has been concluded that the potential impacts on aquatic habitats associated with the release of sediments and or pollutants into watercourses would not have a significant effect on the quality or nature conservation value of watercourses within the survey area or downstream.

Changes in river hydrology

10.5.24 It is assumed at this stage that there would be no changes in the existing flow characteristics/regimes as a result of the operation of the completed scheme, and no

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recordable or significant increase in erosion. Such effects, if they occur, may have implications for fish passage and spawning and effect riparian vegetation and would require assessment/agreement with SEPA and the local fisheries interests. The scheme is designed to only affect high flood water flow conditions, with normal flows being unaffected as the majority of defences are set back from the river bank thus allowing the river to continue unrestricted.

10.5.25 During the construction it would be necessary to temporarily divert or overpump river flows for certain elements of the works. It is envisaged that this would predominately be along the East Pow Burn where, due to the size of the channel, proximity of the defence line to the watercourse and limited working area it would be necessary to work within the channel, thus requiring river flows to be diverted, probably via over pumping. Such works would need to be carried out whilst river levels are low (comparable with base flows reported earlier in this section).

10.5.26 In addition it may be necessary to temporarily intercept and divert storm / overflows from the wastewater treatment works plus any surface water outfalls within the extents of the scheme. The requirements of such diversions would be agreed with the relevant statutory authority.

10.5.27 Adverse effects on the flow regimes in existing watercourses are envisaged to be temporary in nature, although uncertain, and further consideration would be required once details of the nature, duration and timing of activities are known.

Invasive species

10.5.28 Stands of Japanese knotweed and giant hogweed were recorded during the survey. These plants are extremely invasive and their disturbance should be avoided. It is illegal to cause the spread of Japanese knotweed and giant hogweed. Relevant areas would be fenced off, clearly marked and all contractors made aware of its presence on site and where it is located. No tracked vehicles would be allowed to enter areas where invasive species are present, and there would be no movement of soils contaminated by invasive species fragments around or from the site. Should stands of Japanese knotweed/giant hogweed require disturbance during the construction works, the plant(s) material must either be removed and disposed of safely at a licensed landfill, to be buried to at least 5m in depth, and the removal area treated, or alternatively the plant treated in situ (can take up to three years to completely eradicate).

Fauna

Otter

10.5.29 Construction activity along the River Almond and East Pow Burn at the River Almond/East Pow Burn confluence, in particularly the removal and replacement of the existing road bridge and installation of sheet piling, and installation of the flood wall/erosion protection at the fish farm, may adversely affect the otter holts recorded within 30m of the proposed works. A survey of the holts shall be completed prior to

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the start of construction works to determine if they are being actively used by otter or are breeding holts. If this is the case and the loss of holts cannot be avoided, then a protected species licence would be required to remove the holt. The requirement for a replacement holt(s) would also be discussed and agreed with SNH. Works within 30m of the otter holt(s) with the potential to disturb otter would require a protected species licence from SNH.

10.5.30 The field surveys also identified other signs of otter activity along the River Almond and East Pow Burn. Care would be taken to reduce significant alteration of the banks along the River Almond so that adverse disturbance effects on movements of the local otter population are avoided. The pre-construction survey of otter would determine current activity levels and whether any further otter resting sites might be affected by the works. If a holt or resting site lies within 30m of the works then a protected species licence is likely to be required from SNH. SNH would be consulted prior to any on-site activities to determine whether or not a licence for potential disturbance to otter is required, particularly given the proximity of the otter holts to operations on the River Almond and East Pow Burn.

10.5.31 Increased noise emissions created by construction has the potential to impact on otter. The level of disruption experienced would depend on the working practices that would be used. Assuming construction activities would be carried out during daylight hours, and that standard good working practices are set in place, including adherence to appropriate thresholds and conditions, the temporary effects of elevated noise is not likely to have any long term significant impacts on otter.

10.5.32 Taking into account the commitment to replace any active otter holts if necessary, provide for passage for otter through the proposed structures, restrictions on working during the parts of the day when the species is most active and the use of lighting to facilitate works in the vicinity of watercourses and control measures relative to sedimentation and pollution, it has been concluded the scheme would not have a significant effect on the status or conservation value of otter within the study area.

Bats

10.5.33 Although the location and design of the flood protection works has been developed to minimise tree removal, there would be disturbance to and loss of riparian habitat as a result of the creation of flood walls and embankments and the need to access the river bank for these works. This may result in temporary disturbance to bat foraging activity along the river corridor. Although, it is anticipated that this would be minimised by the phased and intermittent nature of works at specific locations along the river and by proposed mitigation planting.

10.5.34 There is the potential for disturbance of the possible bat roost/hibernaculum within the trout farm mill lade tunnel while the sluice and sheet pile walls are being installed (although not directly affected). The magnitude and significance of any impact cannot be predicted until the presence/absence of bat use at the site is determined. In addition, prior to the demolition of any existing bridges (the footbridge across the

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Almond and the road bridge at the Almond/East Pow confluence) and the playing filed pavilion, there is a risk that bats might be present. Although no suitable bat roost opportunities were confirmed during field survey, a pre-construction bat survey would be undertaken as a precautionary measure.

10.5.35 Several mature trees close to the watercourses have the potential to support a bat roost, although none were confirmed during the field surveys.

10.5.36 As part of the detailed design, once the precise number and location of trees/groups of trees that would be affected is confirmed, further survey and inspection for signs of bats by a suitably experienced ecologist would be required and an assessment of bat roost potential made. Any licensing requirements would be determined at this stage. In addition, a further check would be made of trees with high bat roost potential immediately prior to the commencement of tree felling operations. If a bat roost were found, work on the tree in question would cease, SNH would be informed and a Scottish Government licence would be sought to permit the lawful completion of works to that tree.

10.5.37 To offset the impact of woodland losses, bat boxes would be erected within remaining areas of riparian woodland. This would be carried out in consultation with the local bat group.

10.5.38 Initial loss of foraging habitat and fragmentation of commuting routes associated with loss of riparian woodland would be certain, adverse and negative at a local level. The impact would, however, be substantially reduced as a result of the proposed planting such that the impact on the species would not be significant.

10.5.39 The potential use of lighting on site during the construction phase is not considered to be a significant issue since there is existing light spillage from the industrial and urban area around the scheme. It is anticipated that all works would be undertaken during daylight hours due to the work being in close proximity of watercourses and residential properties. No night-time working requirements have been identified, and if this is required, extended working hours would have to be agreed with the Council and other relevant statutory authorities.

10.5.40 Taking into account the mitigation measures described above, it has been concluded the scheme would not have a significant effect on the nature conservation value of bats associated with the study area.

Breeding birds

10.5.41 Construction work may have a range of impacts on breeding birds. The two key potential impacts are (a) direct disturbance to nesting birds, (b) indirect impact by inadvertently encouraging opportunist predators such as raptors, gulls and crows due to reduction in tree and shrub cover.

10.5.42 Vegetation/tree removal would be undertaken outwith the bird breeding season (i.e. carried out between late August and March) where possible to ensure no bird nests

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with young or eggs are destroyed. Alternatively, if vegetation removal is required during the bird breeding season, trees and scrub would be checked for the presence of breeding birds/active nests by a qualified and experienced ecologist, immediately prior to clearance. Should active nests be identified all clearance works would cease until SNH have been contacted and appropriate action has been agreed. This may include defining an appropriate buffer zone around the nest site that shall not be disturbed until the end of the bird breeding season or until any young have fledged.

10.5.43 New/replacement planting would help to reinstate ground cover and close woodland 'gaps' as far as is practicable. To offset the impact of woodland losses on nesting birds, bird boxes would be erected within remaining areas of riparian woodland.

10.5.44 Noise from machinery and equipment may cause temporary local disturbance effects to birds but would be short term during construction and, phased across the different locations. Potentially more disruptive operations include any particularly noisy activities, such as piling. This would be a short term impact limited to two key areas (at the fish farm on the Almond and adjacent to Vector Aerospace on the East Pow) and, with the implementation of appropriate piling techniques to reduce noise and vibration, no significant impact is anticipated.

10.5.45 Taking into account the mitigation measures described above, it has been concluded the scheme would not have a significant effect on the nature conservation value of birds associated with the study area.

Salmonids and lamprey

10.5.46 The River Almond is an important salmon river, with lamprey also recorded as being present. These important species would be susceptible to construction related impacts. Potential sources of impact include noise vibration from piling/flood wall construction/bridge demolition, sediment pollution from run-off or work activities, disturbance to the river bed itself and hydrological flow changes/fish passage.

10.5.47 It is assumed at this stage that no changes would occur to the existing flow regime and that the hydraulic dynamics of the watercourses would be unaltered and no specific construction activities would be taking place within the river itself. Impacts upon in-stream ecology and fish spawning gravels are not likely to be significant. Passage of fish would be maintained at all times and would not be detrimentally affected by the proposals.

10.5.48 In-river works would be restricted to areas close to river banks and around new bridge structures. Appropriate licences would be required under the Controlled Activities (Scotland) Regulations 2011 and Method Statements / programmes of timing would need to be produced. No in-river works would be completed during fish spawning or fry emergence periods of salmonids (between January and June). In addition, no barriers shall be placed within the watercourses which may affect fish passage. Wherever possible in-river works would also be restricted during fish migration upstream to spawning gravels (November to January). Therefore, it is recommended that any in-river works are completed between June and September

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only. As the works would be undertaken in phases, the precise nature and timing of works would need to be determined and agreed with the Tay Salmon Fisheries Board.

10.5.49 Piling works, particular on the East Pow Burn where the watercourse is narrow and noise/vibration has the potential to cause a barrier affect, or physical harm to fish, would be restricted to least sensitive periods as described above. A 'soft start to piling will also be implemented and consideration given to intermittent piling to minimise the risk of disturbance/harm.

10.5.50 Any material removed from the river channel that is suitable to be returned would be carefully stored and reinstated in an appropriate manner/location as advised by the Ecological Clerk of Works. Suitable fish salmonid/lamprey spawning areas are to be created where practicable.

10.5.51 Taking into account the mitigation measures described above, it has been concluded the scheme would not have a significant effect on the nature conservation value of fish associated with the study area.

Summary of ecological impacts and mitigation

10.5.52 Table 10.4 below provides a summary of impacts on ecology and nature conservation associated with each flood protection activity and outlines proposed mitigation measures as discussed in the preceding sections.

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Table 10.4: Summary of potential ecological impacts and mitigation

Flood Protection Activity	Potential Impacts	Mitigation
Road drainage at A85 bridge	Loss of trees to lay drainage pipe in wooded area.	Minimise footprint of works and disturbance due to access. Confirm presence/absence of bat roost/squirrel dreys within any trees to be removed/affected. Timing of works to avoid disturbance to nesting birds.
College Mill Trout Farm *Sluice Gate* *Sheet Pile Wall* *Reinforced Concrete Flood Wall* *Erosion Protection* *Pumping Station*	Negligible loss of low value amenity grassland habitat at trout farm. Loss of/disturbance to riparian habitat and some mature trees with possible bat roost potential. If a bat roost exists within the tunnel of the Mill lade (as yet unconfirmed) there is potential for construction of the sluice gate/sheet piling to disturb bats. Otter holt may be directly affected by the proposed works. Disturbance and disruption to otter activity and movement is likely during construction due to bankside activity. Adverse impacts are unlikely where construction takes place away from the bankside and where riparian woodland cover is left undisturbed. No loss of kingfisher or dipper nesting habitat, but temporary disruption to feeding routes likely during construction. Potential pollution risk during construction.	Minimise footprint of works and disturbance due to access. Confirm presence/absence of bat roost within mill lade tunnel. Tree condition survey to evaluate which and how trees would be affected by the works. Further survey/inspection of trees to be removed for presence/absence of bats. Timing of works to avoid disturbance to nesting birds. Replant using native tree/shrub species planting appropriate to the area. Construction work would be preceded by checks for and removal of any invasive species such as Japanese knotweed and giant hogweed. Pollution control measures during construction.
Flood wall and erosion protection at Druids House/Rhoukton	Loss of/disturbance to riparian habitat and some mature trees with possible bat roost potential. Negligible loss of low value habitat (urban/bare ground and amenity gardens. No otter holts directly affected but disturbance and disruption to otter activity and movement is likely during	Minimise footprint of works and disturbance due to access. Tree condition survey to evaluate which and how trees would be affected by the works. Further survey/inspection of trees to be removed for presence/absence of bats.

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Flood Protection Activity	Potential Impacts	Mitigation
	construction due to bankside activity. Adverse impacts are less likely where construction takes place away from bankside.	Timing of works to avoid disturbance to nesting birds. Replant using native tree/shrub species planting appropriate to the area.
Abutments and footbridge across River Almond	Negligible loss of low value habitat (urban/bare ground and small area of amenity grassland). Disturbance to banks and watercourse channel. Temporary disruption to otter movement route.	Avoid work from within river channel. Care to avoid pollution of watercourse, particularly by concreting works in close proximity.
Flood wall and erosion protection at Deer Park	Loss of/disturbance to riparian habitat and some mature trees with possible bat roost potential. Negligible loss of low value habitat (urban/bare ground and small area of semi-improved neutral grassland. No otter holts directly affected but disturbance and disruption to otter activity and movement is likely during construction due to bankside activity. Adverse impacts are less likely where construction takes place away from bankside.	Replant using native tree/shrub species planting appropriate to the area. Construction work would be preceded by checks for and removal of giant hogweed plant recorded in vicinity just downstream of footbridge. Timing of works to avoid disturbance to nesting birds. Further survey/inspection of trees to be removed for presence/absence of bats.
Flood embankment at 4 Deer Park/Craigneuk East and West (some erosion protection)	Marginal loss of improved grassland habitat. Loss of some mature trees with possible bat roost potential.	Minimise footprint of works and disturbance due to access. Tree condition survey to evaluate which and how trees would be affected by the works. Further survey/inspection of trees to be removed for presence/absence of bats. Timing of works to avoid disturbance to nesting birds. Replant using native tree/shrub species planting appropriate to the area. Use native grass and flower seed mix to vegetate the sides of the new embankment to encourage development of species-rich grassland of value to invertebrates and small mammals.

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Flood Protection Activity	Potential Impacts	Mitigation
		Construction work would be preceded by checks for and removal of invasive species such as Japanese knotweed and giant hogweed. Checks for and removal of giant hogweed plant recorded in vicinity.
Flood embankment at Playing Fields	Negligible habitat loss around playing fields. Removal of some trees (number still to be determined) adjacent to Main Street.	Minimise footprint of works and disturbance due to access. Avoid tree loss where possible. Use native grass and flower seed mix to vegetate the sides of the new embankment to encourage development of species-rich grassland of value to invertebrates and small mammals Replant with native species appropriate to the area. Replace trees that are lost.
Erosion protection up and downstream of footbridge over River Almond.	Loss of/disturbance to riparian scrub/woodland habitat.	Minimise footprint of works and disturbance due to access. Utilise erosion protection techniques and materials that offer wildlife value to maintain riparian corridor. Plant with native species appropriate to the area.
Remove existing road bridge at Almond/East Pow confluence and replace with new bridge and retaining walls.	Disturbance to banks and watercourse channel. Temporary disruption to otter movement route.	Avoid work from within river channel. Care to avoid pollution of watercourse, particularly by concreting works in close proximity.

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Flood Protection Activity	Potential Impacts	Mitigation
Sheet pile wall (some erosion protection) on left bank of East Pow Burn between River Almond confluence and Lochty Park.	Sheet pile to mainly follow Vector Aerospace security fence line with minimal impact on riparian zone. Some loss of/disturbance to riparian scrub habitat and to watercourse channel where gabion baskets are to be removed. Otter holt may be directly affected by the proposed works. Disturbance and disruption to otter activity and movement is likely during construction due to bankside activity. Potential pollution risk during construction.	Minimise footprint of works and disturbance due to access. Avoid tree loss where possible. Otter licence likely to be required. Detailed method statement and reasonable avoidance measures to be drawn up and agreed with SNH. Creation of an artificial replacement holt if the loss of the existing holt cannot be avoided. Pollution control measures during construction.
Embankment adjacent to right bank of East Pow Burn.	Marginal loss of arable field.	Minimise footprint of works and disturbance due to access. Use native grass and flower seed mix to vegetate the sides of the new embankment to encourage development of species-rich grassland of value to invertebrates and small mammals.
Sheet pile wall, river widening and erosion protection on right bank of East Pow Burn between River Almond confluence and Lochty Park.	Some loss of/disturbance to riparian woodland habitat and to watercourse channel. Temporary disruption to otter movement route. Potential pollution risk during construction.	Minimise footprint of works and disturbance due to access. Avoid tree loss where possible. Construction work would be preceded by checks for and removal of invasive species such as Japanese knotweed and giant hogweed. Pollution control measures during construction.
Flood wall and erosion protection on right bank of East Pow Burn adjacent to Lochty Park residential area.	The banks of the Burn adjacent to the industrial works have already been extensively engineered and a not natural in character. There has been recent erosion protection installed along sections of the bank with riparian habitat removed. Habitat affected comprises scattered scrub, stands of tall ruderal vegetation with some 'gardened' riverbank (with some mown grass and planted exotic shrubs) that form extensions to residents' main gardens. Although there would be loss of riparian	Construction work would be preceded by checks for and removal of invasive species such as Japanese knotweed and giant hogweed. Avoid bird nesting season to protect dippers. Potential for enhancement planting where space allows. Seek opportunities to provide suitable dipper nesting crevices within erosion protection.

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Flood Protection Activity	Potential Impacts	Mitigation
	habitat, re-vegetation is likely to occur over time. Construction activity may impact upon dippers who may nest in crevices in the existing stone work. Temporary disruption to otter movement route. during construction, and less attractive habitat to otter in the future without mitigation.	Replant with native species appropriate to the area. Replace trees that are lost.
Removal of existing twin box culvert at entrance to Lochty Park residential area and construction of new clear span road bridge.	Potential disruption to otter movements up and downstream temporarily during construction.	New structure abutments to be set back from banks of burn to allow free passage for wildlife, in particular otter.
Sheet pile wall and erosion protection on left bank of East Pow Burn adjacent to Lochty Park residential area.	The banks of the Burn adjacent to the industrial works have already been extensively engineered and a not natural in character. There has been recent erosion protection installed along sections of the bank with riparian habitat removed. Although there would be loss of riparian habitat, re-vegetation is likely to occur over time. Piles would lessen opportunities for bankside vegetation to establish in the future. Construction activity may impact upon dippers nesting in crevices in the existing stone work. Temporary disruption to otter movement route. during construction, and less attractive habitat to otter in the future without mitigation.	Construction work would be preceded by checks for and removal of invasive species such as Japanese knotweed and giant hogweed. Avoid bird nesting season to protect dippers. Potential for enhancement planting where space allows. Seek opportunities to provide suitable dipper nesting crevices within erosion protection. Replant with native species appropriate to the area. Replace trees that are lost.
Raised ground levels and retaining wall at entrance to Lochty park to allow for new road bridge.	Negligible habitat loss and no material impacts on species likely. Work may affect species-rich hedge running alongside Main Street with consequent loss of habitat.	Replant native-species hedgerow if possible.

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10.6 Residual Effects

10.6.1 With the implementation of the above mitigation measures, no significant ecological impacts resulting from this scheme are predicted. A summary of residual effects is provided in Table 10.5.

Table 10.5: Residual effects

Impact	Summary of Mitigation Measures	Residual Effect	Significance
Direct loss of riparian woodland habitat.	Definition and control of working areas. Protection of vegetation outwith clearance areas. Replanting and seeding with native species appropriate to locality where practicable.	Short to medium term loss of small areas of riparian woodland, reinstated though replacement planting.	Not significant
Disturbance to river banks and river channel	Works generally undertaken form the river banks. Protective sheeting to be used where appropriate to prevent debris entering the river. Banks to be reinstated.	Short to medium term disturbance.	Not significant
Pollution of watercourses	Pollution control measures during construction.	Low risk of pollution.	Not significant
Changes in river hydrology	No significant impact anticipated. Scheme detailed designed to ensure no alteration to existing normal flow regime.		
Direct impact on otter foraging habitat and likely disturbance/loss of otter holt(s)	Agree reasonable avoidance measures, working method statement and mitigation measures with SNH and apply for otter disturbances licence as applicable. Construction of an artificial holt in advance of works may be required. Maintain free passage along watercourses during construction period. Ensure new crossing structures do not deter otter from moving up and downstream	Otter activity maintained.	Not significant
Disturbance to bat foraging. Potential for disturbance to bat roosts in trees.	Further survey and inspection for signs of bats to determine licence requirements. Replanting where practicable. Erection of bat boxes.	Bat activity maintained.	Not significant
Disturbance to protected and breeding birds. Loss of possible dipper nesting site.	Vegetation clearance outside nesting season Pre-clearance checks if summer clearance cannot be avoided. Create crevices in gabion walls suitable for dippers to nest in and work	Breeding bird potential maintained.	Not significant

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Impact	Summary of Mitigation Measures	Residual Effect	Significance
	on existing stonework areas on East Pow Burn outside nesting season if practicable. Minimise disruption to bird feeding activity along watercourse corridor e.g. by minimising in-stream works and timing of works.		
Disturbance to salmonids and lamprey.	Timing of in-river works to avoid sensitive period for salmonids and lamprey. Soft start and intermittent in-river piling works. Control of runoff from working areas. Minimise in-river works. Scheme detailed designed to ensure no alteration to existing normal flow regime. Reinstate any material temporarily removed from river bed. Suitable fish salmonid/lamprey spawning areas created where practicable.	Temporary disturbance during construction.	Not significant

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11 Cultural Heritage

11.1 Scope of the Assessment

11.1.1 This chapter provides an assessment of the potential effects associated with the proposed scheme with respect to cultural heritage.

Cultural heritage is concerned with archaeological remains, Listed Buildings, Conservation Areas, Historic Gardens, Designed Landscapes and other heritage designations. Generally four categories of archaeological remains are encountered comprising:

- Upstanding remains: built structures such as buildings, field boundaries, and features such as standing stones and stone circles.
- Earthworks: soil-covered remains that can be seen as surface undulations at ground level. These can include ruined buildings or their foundations, banks, mounds, ramparts, ditches, gullies and hollows.
- Buried features: soil-covered remains which have no visible trace at ground level (possibly revealed by aerial photography).

11.1.2 Artefact scatters: scatters of potsherds, flint, tools, metal objects, animal bones, worked stone, mortar or human remains.

11.1.3 Palaeoenvironmental evidence may also be found in association with archaeological remains and this can be used for dating purposes and to provide evidence of past land use or landform change.

11.1.4 The assessment of cultural heritage has been based on information obtained form desk study investigations. The study area that was considered comprises the footprint of the scheme components and an approximate 500m buffer around them.

11.2 Legislative and Planning Context

National planning framework

11.2.1 Previous planning guidance on archaeology and the historic environment was provided within Scottish Planning Policy SPP 23 - Planning and the Historic Environment (Scottish Government, October 2008). This was superseded by the Scottish Planning Policy (SPP) (Scottish Government, February 2010). The SPP sets out the national planning policy for the historic environment with a view to its protection, conservation and enhancement. It indicates how the planning system would contribute towards the delivery of Scottish Ministers' policies as set out in the current Scottish Historic Environment Policy (SHEP) (Historic Scotland, July 2009) and also outlines the role of Historic Scotland and Local Authorities and others in the planning process.

11.2.2 The SHEP provides the Scottish Ministers' vision and strategic policies for the wider historic environment. It covers: the designation of sites and structures of sites which

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are important features of the historic environment (statutory designations (Scheduled Monuments, Listed Buildings and Conservation Areas) and non-statutory designations (Historic Battlefields and Gardens and Designed Landscapes)); consents procedures; and the conservation of and access to properties that are looked after by Historic Scotland on behalf of the Scottish Ministers'.

Local planning

Perth Area Local Plan (Adopted March 1996, Amended Nov 2000)

11.2.3 The Perth Area Local Plan covers Perth City and the surrounding countryside and villages. The Plan sets out specific local development policies and proposals, including the following with respect to cultural heritage:

Policy 17 – Historic Gardens and Designed Landscapes

11.2.4 The Council will protect and seek to enhance Historic Gardens and Designed Landscapes.

Policy 21 – Archaeology

11.2.5 The Council will safeguard the settings and archaeological landscapes associated with Scheduled Ancient Monuments.

Policy 22 – Archaeology

11.2.6 The Council will seek to protect unscheduled sites of archaeological significance.

Policy 23 – Archaeology

11.2.7 Where it is likely that archaeological remains may exist, developers will be required to undertake archaeological investigation by a professional qualified archaeological organisation or archaeologist.

Policy 25 – Listed Buildings

There will be a presumption against the demolition of Listed Buildings.

Perth Area/Central Area Draft Local Plan, (December 2004)

11.2.8 The Perth Area/Central Area Draft Local Plan (December 2004) was prepared and intended to replace the Perth Area Local Plan (1996). However, following advice from the Scottish Government, Perth and Kinross Council decided not to progress with this plan and instead to replace it with the new Development Plan which will cover the entire Council area. Key policies of the Draft Local Plan 2004 of relevance to the proposals and protection of cultural heritage are comparable to those outlined above in the currently adopted Local Plan.

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Designated sites

Scheduled Ancient Monuments (SAMs)

11.2.9 Scheduled Ancient Monuments (SAMs) are nationally important sites and monuments that are legally protected under the Ancient Monuments and Archaeological Areas Act 1979.

Historic Designed Landscapes

11.2.10 Often, though not exclusively, large designed gardens and landscapes were formed as a setting for important buildings, or for recreation. Many of the buildings for which these landscapes were formed are afforded statutory protection, and the landscapes themselves are safeguarded through development plan policies.

Listed Buildings

11.2.11 Listed buildings are those buildings of special architectural or historic interest that help enrich cultural history. The lists of buildings in Scotland is aimed at safeguarding the built heritage and promoting its understanding and is compiled and maintained by Historic Scotland on behalf of the Scottish Ministers, in accordance with the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997.

11.2.12 The listings are divided into three categories based on different levels of interest or importance. Around 8% of the total are Category A, 60% Category B and 32% Category C(S).

11.2.13 Category A listed buildings are those of national or international importance, either architectural of historic, or particularly good (minimally altered) examples of a specific period, style or building type. Category B refers to buildings of regional or more local importance, or major examples of a particular period, style or building type which may have been altered. Category C(S) relates to buildings of local importance, lesser examples of any period, style or building type, as originally constructed or altered, and simple, traditional buildings or part of planned group, such as an estate or industrial complex.

11.3 Methods of Assessment

Baseline methods

11.3.1 Information regarding existing and potential cultural heritage features within the vicinity of the proposed scheme has been collated through a desk-based review of existing archaeological data and consultation with Historic Scotland and Perth and Kinross Heritage Trust. The objective of the desk study was to identify any of the following cultural heritage features:

- Scheduled Ancient Monuments (SAMs).
- Listed Buildings.
- Designed Landscapes.

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- Conservation Areas.
- Unscheduled sites recorded on the National Monuments Record of Scotland (NMRS) and/or the Sites and Monuments Record (SMR).

11.3.2 Archaeological Sites of Regional Importance.

Impact assessment methods

11.3.3 Impacts are considered in terms of both the site value (refer to Table 11.1 below) and the magnitude of impact (refer to Table 11.2 below). The significance of predicted impacts is then determined through a combination of value and magnitude as set out in Table 11.3. It should be noted that this is not a rigid procedure and that professional judgement also plays an important part in this analysis process.

Site value

11.3.4 The site value, or status, of each site was determined by reference to any designations and by consultation with Historic Scotland and Perth and Kinross Heritage Trust as detailed in Table 11.1 below. Adjustments to the above classification were occasionally made where appropriate, based on professional judgement.

Table 11.1: Definition of site value for cultural heritage

Status	Designation
Very High	**International importance** World Heritage Sites. Assets of acknowledged international importance. Assets that can contribute significantly to acknowledged international research objectives.
High	**National importance** Scheduled Ancient Monuments (SAMs). Undesignated sites of schedulable quality and importance. Assets that can contribute significantly to acknowledged national research objectives. Listed buildings, Category A.
Medium	**Regional importance** Designated or undesignated sites that contribute to regional research objectives. Listed Building, Category B.
Low	**Local importance** Designated and undesignated assets of local importance. Assets compromised by poor preservation and/or poor survival of contextual associations. Assets of limited value, but with potential to contribute to local research objectives. Listed Building, Category C.

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Status	Designation
Negligible	Assets with very little or no surviving interest and/or of no architectural or historical note.

11.3.5 Additionally, Conservation Areas and Designed Landscapes apply to areas of varying status, from local to national. Levels of importance, based on professional judgement, have been individually assigned where Conservation Areas and historic Designed Landscapes are affected by the proposed scheme.

Impact magnitude

11.3.6 The severity, or magnitude, of impact is assessed independently of the site value. Impacts were assessed both for individual sites and, where groups of buildings or features were affected, as a combined impact. Impacts on sites may be direct (such as damage or severance), or indirect impacts on setting. The magnitude of impact is assigned to one of the following categories listed within Table 11.2 below, based on professional judgement.

Table 11.2: Impact magnitude ratings for cultural heritage

Rating	Definition
Major, adverse	Change to key elements of an asset, such that the resource is totally altered. Comprehensive changes to setting.
Moderate, adverse	Changes to many key elements of an asset, such that the resource is significantly modified. Considerable changes to setting that affect the character of the asset.
Slight, adverse	Change to key elements of an asset, such that the asset is slightly different. Change to the setting of an asset, such that it is noticeably changed.
Negligible, adverse	Very minor changes to elements of an asset or its setting that hardly affect it.
No change	No change to fabric or setting.
Slight, beneficial	Minor enhancement of an asses and/or a minor beneficial effect on setting.
Moderate, beneficial	Moderate enhancement of an asset and/or a moderate beneficial effect on setting.
Major, beneficial	Major enhancement of a site and/or its setting.

Impact significance

11.3.7 The significance of impact (beneficial and adverse) is determined as a combination of the value of the site and the magnitude of impact as shown in Table 11.3 below.

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Table 11.3: Significance rating for cultural heritage

Site Value	Magnitude of Impact				
	Major	**Moderate**	**Slight**	**Negligible**	**No Change**
Very High	Very Large	Large/Very Large	Moderate/ Large	Slight	Neutral
High	Large/Very Large	Moderate/ Large	Slight/ Moderate	Slight	Neutral
Medium	Moderate/ Large	Moderate	Slight	Neutral/Slight	Neutral
Low	Slight/ Moderate	Slight	Neutral/Slight	Neutral/Slight	Neutral
Negligible	Slight	Neutral/Slight	Neutral/Slight	Neutral	Neutral

11.4 Baseline Conditions

11.4.1 Historic Scotland and Perth and Kinross Heritage Trust were contacted in respect of the provision of the following baseline information:

- Details of sites of archaeological or built heritage value (national, regional or local).
- Details of any Historic Gardens, Designed Landscapes, Listed Buildings or Conservation Areas.
- The potential for unidentified or unrecorded archaeological features or remains.
- Any comments on the proposed scheme.

11.4.2 The following recorded features have been identified within the vicinity of the scheme, the location of which is shown on Figure 11.1.

Scheduled Ancient Monuments (SAMs)

11.4.3 Two SAMs have been identified within the study area. Scheduled Monument No. 2641, Pitcairngreen/Pitcairnfield Fort (Ref. 31 on Figure 11.1), is located some 250m to the northeast of College Mill Trout Farm. The remains of this Iron Age (800BC to 42AD) fort are described in Perth and Kinross Historic Environment Record as follows:

'This fort is situated at a height of 130ft OD on the crest of a descent of some 40ft which forms the N border of a promontory surrounded on the other sides by the River Almond. It stands at the edge of a cultivated field at a distance of 230 yards E of Pitcairnfield House. Much of the fort has been destroyed by ploughing and it has been further disfigured by the planting of trees within it and by the construction of two large water tanks in the SW sector. A pathway running along the brink of the descent has caused further mutilation, while what appears to be the termination of a substantial field boundary runs into the SE part'.

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'The fort probably consisted of a D-shaped enclosure measuring about 190ft from E to W by about 120ft transversely. This is now surrounded by a ditch with no rampart on the inner lip, and it is possible that such a rampart did once exist but has been removed. The ditch measures up to 5ft in depth and 20ft in width. The whole of the NE section now stands alone, but the W part has a substantial stony bank along its outer lip. It is probable that this originally continued round to the NE, but that it has been obliterated in this sector. A second rampart lies outside the arc of the first, but after a stretch of only 40ft it too has been destroyed. The N arc of the ditch is breached by a stone built causeway which appears to be of comparatively recent construction. The entrance was probably in the E, between the present termination of the ditch and the brink of the descent to the S. In addition to the tanks and the trees, the interior contains a sub-rectangular enclosure formed by a ruinous dyke, but is otherwise featureless'.

11.4.4 Scheduled Monument No. 2267, Huntingtower Cairn (Ref. 32 on Figure 11.1), is located approximately 300m to the southeast of Lochty Bridge.

11.4.5 This Neolithic to Bronze Age (4000BC to 701BC) cairn is described in Perth and Kinross Historic Environment Record as follows:

'A large, oval, cairn of earth and stones measuring 32m N-S by 28m E-W and about 5m in height. There is a suggestion of a ditch but this is caused probably by an old plantation bank around the base of the cairn. Surmounted by trees, otherwise good condition.'

Historic Designed Landscapes

11.4.6 Methven Castle Historic Garden and Designed Landscape is located immediately to the west of Lochty and Almondbank Village. The Castle itself is understood to have been built to the designs of John Mylne in 1664 with additions in 1800-1825 by James Gillespie Graham. The landscape designers, if any, are unknown, but it is known that the grounds were laid out in their present structure from c1796.

11.4.7 At its closest to the proposed scheme, the eastern boundary of the historic garden and designed landscape follows the western edge of the Almondbank road, opposite the Pow Burn at Lochty. At this location Lochty Industrial Estate occupies the outer edge of the designation.

Listed Buildings

11.4.8 Historic Scotland records indicate that there are thirteen listed structures within the study area, as indicated in Table 11.4 below and shown on Figure 11.1.

Table 11.4: Listed Buildings

Fig 11.1 Ref	Site Name	NGR	Category and Number	P&K HT Ref.
1	Almondbank, St Serf's Church/Almondbank, Former United Free Church;	NO06512635	B – 17916	MPK8647

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Fig 11.1 Ref	Site Name	NGR	Category and Number	P&K HT Ref.
	Pitcairngreen Free Church; Old Church			
2	Almondbank, 2-8 (even no.s) Bridgeton	NO06532633	C(S) – 17910	MPK12110
4	Bridgeton, 11 Bridgeton Brae	NO06572632	C(S) – 17915	MPK13590
5	Bridgeton, 9 Bridgeton Brae	NO06582632	C(S) – 17914	MPK13582
6	Almondbank, 5,7 Bridgeton	NO06572631	B - 17913	PK13691
7	Almondbank, 1,3 Bridgeton	NO06582630	C(S) – 17912	PK13689
8	Almondbank, 4 Kirkhall Road, Old Manse/Pitcairngreen, Old Manse	NO06622629	B - 17911	PK11766
15	*Pitcairnfield, Craigneuk Road, Bridge House	NO06792586	B – 17918	MPK13672
18	*Low's Work/Lowswark; River Almond; Perth Town Lade; Low's Work Weir	NO06982568	B – 18304	MPK2063
19	*Low's Work Cottages (Huntingtower Haugh, Huntingtower Bleachfield, 1-8 Lows Work Cottages)	NO06972560	B – 18305	MPK10492
23	Huntingtowerfield, Bleach and Dye Works/ Huntingtower Bleachworks; Huntingtowerfield Bleachwork	NO07212577	B – 18306	MPK5326
24	Huntingtowerfield, 1-3 The Stables	NO07292569	B – 19871	MPK13576
29	Tofthouses (cottages, horse engine house)	NO06852510	B – 18301	MPK13730

Unscheduled sites

11.4.9 A number of unscheduled and unlisted heritage sites are recorded within the study area, as indicated in Table 11.5 below.

Table 11.5: Unscheduled Sites

Fig 11.1 Ref	Site Name	Monument Type	NGR	P&K HT Ref.
3	Almondbank, Old Bridge of Almond/River Almond; Almondbank Bridge	Road Bridge	NO06472629	PK2044
9	Almondbank	Urn, Cist	NO06202600	MPK2094
10 & 11	Almondbank 'Scroggiehill'	House, Horse Engine House	NO06412007 / NO06433610	MPK2067 / MPK10734

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Fig 11.1 Ref	Site Name	Monument Type	NGR	P&K HT Ref.
12	*Almondbank, College Mill/College Mill Trout Farm; River Almond	Linen Mill	NO06592611	PK8648
13	*Almondbank, Old Parish Church/ Pitcairn; St Serf's Church; Redgorton Church; Almondbank Graveyard	Church, Cemetery	NO06632612	MPK5547
14	*Almondbank, Pitcairnfield House	House	NO06662608	MPK11764
16	*Pitcairnfield Bleachworks	Bleach Works, Chapel, Railway	NO06832581	MPK8023
17	Almondbank, Craigneuk	House, Building	NO07082585	MPK11053
20	Almondbank, Huntingtower, Dog Graves	Inscribed Stone	NO07052561	MPK2107
21	*Perth, Town's Wark/Boot of Balhousie; Lowswark; Town's Lade	Ditch, Watercourse, Mill Lade, Ditch	NO09522452	MPK3508
22	Huntingtowerfield, Bleach and Dye Works, Egg-End Boiler	Boiler House	NO07202570	MPK2109
25	Huntingtowerfield Farm	Farmhouse, Farmstead	NO07172546	MPK8008
26	Royal Naval Stores Depot, Almondbank/RNSD Almondbank; Pitcairnfield Works; Royal Naval Aircraft Workshops	Storehouse	NO06902590	MPK6932
27	*Puddledub	Cropmark(s), Pit(s)	NO06702520	MPK2070
28	Almondbank Station/Almond Bank Station; Lochty Bridge	Railway Station	NO06712513	MPK5651
30	Perth – Crieff Railway	Railway	NN98142285	MPK6724

* Sites marked with an asterisk within the above tables have been identified by Perth and Kinross Heritage Trust as sites that may be affected by the proposed works given their proximity.

11.4.10 Perth and Kinross Heritage Trust and The Architectural Heritage Society of Scotland have both identified Low's Work Weir (see Ref. 18 in Table 11.4 above) as of interest The weir is Category B listed and was constructed to provide water for the Town Lade (Ref. 21 in Table 11.5 above) which runs through Perth to this day and originally flowed outside the old city wall. The weir has recently been repaired to its original condition.

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Previously unrecorded sites/features

11.4.11 Although no other archaeological sites are known to exist at this time, there is the potential for unrecorded archaeological features within the study area that may have survived undetected.

11.5 Predicted Impacts

11.5.1 The flood protection scheme has sought to reduce the risk of adverse impacts on known features of cultural heritage through careful design which avoids any direct impact on the location of such sites.

11.5.2 Developments of the nature proposed have the potential to result in both positive and negative effects on cultural heritage assets. Potential beneficial impacts may occur as a result of enhanced protection from flooding. Potential direct/indirect adverse impacts that may result from the flood protection scheme relate to disturbance or damage through noise, vibration and disturbance during construction and possible effects on setting.

11.5.3 There would be no impacts of severance of loss of amenity on cultural heritage resources. This is based on the relatively small scale linear nature of the works proposed for the flood protection scheme, their containment in close proximity to the river and the fact that access would be maintained.

11.5.4 Ground disturbance would result from construction activity including: construction of embankments and walls; installation of erosion protection, installation of new bridges; use of temporary site accesses by construction vehicles; use of material storage areas and landscaping operations.

11.5.5 Neither of the two identified SAMs within the study area, Pitcairngreen/Pitcairnfield Fort and Huntingtower Cairn (Ref. 31 and 32 on Figure 11.1), which are of national importance and high value in accordance with the criteria in Table 11.1, are expected to be directly or indirectly affected by the scheme (no impact). This is primarily due to their distance from the proposed areas of work i.e. over 250m in both cases.

11.5.6 Three listed buildings, all Category B, are located within close proximity to the proposed area of works:

- Low's Work Cottages (Ref. 19) at the eastern end of the scheme;
- Bridge House (Ref. 15) on Craigneuk Road; and
- Low's Work Weir (Ref. 18).

11.5.7 All these structures are identified as of regional importance and medium value in accordance with the criteria in Table 11.1. The anticipated impact magnitude in relation to Bridge House is assessed as negligible adverse and as such the impact significance is neutral/slight and not significant. Bridge House is set back from the River Almond, and therefore also from the proposed works, and may be subject to

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minimal disturbance during the construction period due to the expected use of Craigneuk Road for site access.

11.5.8 Both Low's Work Cottages and Low's Work Weir are not expected to be directly impacted by the proposed scheme but given their proximity there is potential for medium effects on setting, particularly temporary impacts during the construction phase (slight adverse impact magnitude). However, it should be noted that Low's Works Weir has been refurbished by the Local Authority in advance of the implementation of the flood protection scheme.

11.5.9 Potential impacts upon Low's Weir, as a result of hydrological changes in the Almond and East Pow, are considered to be negligible (see also Chapter 9 – Water Quality and Hydrology). Overall the impact significance in relation the setting of both Low's Work Cottages and Low's Work Weir is assessed as slight adverse.

11.5.10 There are five unscheduled sites in close proximity to the proposed area of works which may potentially be affected:

- Pitcairnfield House (Ref. 14) to the north of Deer Park;
- Town's Lade (Ref. 21) running east from Low's Work Weir;
- St Serf's Church (Ref. 13) to the north of College Mill Trout Farm;
- Pitcairnfield Bleachworks (Ref. 16); and
- College Mill Trout Farm (former linen mill, Ref. 12).

11.5.11 None of these sites, all considered of local importance and low value in accordance with the criteria in Table 11.1, would be directly affected by the flood protection proposals. Minor effects, or less, on setting (negligible adverse impact magnitude) are anticipated during the construction period. As with Low's Weir, hydrological changes are not expected to affect the Town's Lade. College Mill Trout Farm and Pitcairnfield Bleachworks can be identified as in closest proximity to the scheme, however, the Trout Farm is an active business and the residential properties have been built on much of the Bleachworks site limiting the sensitivity of the sites. Overall for unscheduled sites the impact significance is assessed as negligible.

11.5.12 There is potential for unknown cultural heritage assets to be encountered during construction and therefore appropriate contingency planning would be adopted to deal with any finds.

11.5.13 The location of any site compounds has not been assessed since their location, size and construction details have yet to be determined. However, they would be located to avoid known features of heritage interest as identified above. Site compounds would be temporary facilities, with areas fully reinstated following completion of the works. Once these areas have been confirmed, the potential for impact upon unknown cultural heritage assets would be evaluated and appropriate contingency planning adopted where necessary.

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11.6 Mitigation

11.6.1 Potential adverse impacts on known features of cultural heritage interest have primarily been avoided by careful scheme design so as not to directly impact on the location of known sites.

11.6.2 No significant impacts have been identified with regard to the development of the proposed scheme at this stage and therefore specific mitigation measures are not considered necessary. However, Construction Contract Documents would include general measures to be employed by the Contractor to protect known and unknown features/areas of interest.

11.6.3 Should significant unknown cultural heritage assets be encountered during construction, there would be a requirement for the contractor to notify the Environmental Clerk of Works and agree appropriate mitigation.

11.7 Residual Effects

11.7.1 No significant impacts to cultural heritage in relation to the development of the proposed scheme have been identified.

11.7.2 Potential implications relating to the disturbance of unrecorded sites may occur, however, due to the value of sites identified in the area to date, significant impacts are thought unlikely.

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12 Geology, Soils and Contaminated Land

12.1 Scope of the Assessment

12.1.1 This chapter comprises the desk-based assessment undertaken to determine the potential impacts of the scheme on geology, soils and contaminated land in the study area.

12.1.2 Preliminary studies into environmental constraints and resources established that there are no sites of geological importance associated with the proposed scheme corridor and surrounding area. The studies and assessments have focused on establishing the form and status of the geology and soils associated with the proposed scheme corridor. The presence of potentially contaminated land and likely impacts relative to sensitive receptors which could arise during construction has also been considered.

12.1.3 The study area relative to geology and soils has included the scheme footprint and an approximate 1km area around it. The study area for the identification of potentially contaminated land has focused on areas within the scheme corridor or immediately adjacent to the corridor.

12.1.4 Sensitive receptors considered include construction staff, residents living in the vicinity of the proposed working areas and users of publicly available areas close to the proposed working areas. Users of the proposed scheme following completion of construction have not been included in the assessment, there being no likelihood of significant impact relative to contamination following completion of construction.

12.1.5 There is also the risk that existing soils and surface and groundwater could be affected by the disturbance and release of contaminants during construction. The risk relative to soils is addressed in this chapter. The risks relative to the water environment are addressed in Chapter 9.

12.2 Legislative and Planning Context

Part IIA of the Environmental Protection Act 1990

12.2.1 Part IIA of the Environmental Protection Act sets out a regulatory framework for the identification and remediation of contaminated land and includes a statutory definition for contaminated land.

12.2.2 Contaminated land is defined as ‘land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that:

- significant harm is being caused or there is a significant possibility of such harm being caused; or
- pollution of controlled waters is being, or is likely to be, caused.

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Contaminated Land (Scotland) Regulations 2005

12.2.3 The regulations update the Contaminated Land (Scotland) Regulations 2000 and set out provisions relating to the identification and remediation of contaminated land under Part IIA of the Environmental Protection Act 1990.

12.3 Methods of Assessment

Baseline methods

12.3.1 The assessment was undertaken by means of consultations with Scottish Natural Heritage (for information relating to statutory designated SSSI's of geological or geomorphological importance) and Perth and Kinross Council Environmental and Regulatory Services (for information on areas of known or potential for contamination) and desk based review of relevant information including the following:

- Geotechnics, Almondbank Flood Mitigation Scheme Factual Report (November 2010).
- Royal Haskoning, Almondbank Flood Prevention Scheme Engineer's Report (March 2004);
- British Geological Survey (BGS) 1:50,000 scale geological Sheet 48W Perth – Drift Edition (1985) and Sheet 48 Perth – Solid Edition (1983).

12.3.2 The baseline conditions are described and the assessment undertaken for the following aspects of ground conditions:

- solid geology;
- drift geology;
- contaminated land; and
- agricultural soils.

Impact assessment methods

12.3.3 As outlined in Chapter 4 – Approach and Methods, impacts were considered in terms of both the site value and the magnitude of the impact. The significance of predicted impacts was then determined through a combination of value and magnitude.

Site value

12.3.4 The site value, or status, of each site was determined as detailed in Table 12.1 below.

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Table 12.1: Definition of value for geology and soil resources

Value or Sensitivity	Definition
High	Nationally or internationally designated geological sites, e.g. Sites of Special Scientific Interest and/or the presence of rare or sensitive geological features and soils.
Medium	Regionally or locally designated geological sites, e.g. Regionally Important Geological Sites (RIGS) and/or the presence of geological features and soils with limited distribution and/or moderate sensitivity.
Low	Unprotected geological features and soils of limited value.

Impact magnitude

12.3.5 The severity, or magnitude, of impact was assessed independently of the site value and, based on professional judgement, assigned to one of categories described in Table 12.2 below.

Table 12.2: Impact magnitude ratings for geology, soil and contaminated land

Rating	Definition
Major	Complete or partial (> 50%) loss of a geological asset and/or major effects upon use of soil resources such as to significantly affect the post-development value. Potential for disturbance to significant contamination with risk to human health and the environment.
Moderate	Loss of between 20% to 50% of a geological asset and/or moderate effects upon use of soil resources. Potential for disturbance to contamination with possible risk to human health or the environment.
Slight	Loss of <20% of a geological asset and/or limited effect upon soil resources. Potential for disturbance to low level contamination with no risk to human health or limited environment impact.
Negligible	Negligible change from pre-construction conditions.

Impact significance

12.3.6 The significance of impact (beneficial and adverse) was determined as a combination of the value of the site and the magnitude of impact as shown in Table 12.3 below.

Table 12.3: Significance rating for geology, soil and contaminated land

Site Value	Magnitude of Impact			
	Major	**Moderate**	**Slight**	**Negligible**
High	Major	Major	Moderate	Slight
Medium	Major	Moderate	Slight	Negligible
Low	Moderate	Slight	Negligible	Negligible

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12.3.7 Potentially contaminated sites have been assessed based on the type and extent of contaminants which might typically be associated with the historical use of the site.

12.3.8 Consideration has then been given to the relationship of the site to the areas that would be disturbed during construction of the scheme. Where potentially contaminated sites are located within areas that would be disturbed by construction, these have been assessed. For each site where potential contaminants could be mobilised a risk assessment has been undertaken using a source-pathway-receptor model.

12.4 Baseline Conditions

Geological conditions

12.4.1 Geology and soils play an important part in determining the environmental characteristics of a region. The underlying geology has a major influence on landform and rocks provide the parent material from which soils are created. The nature of the rock helps to determine not just the nature and chemistry of the soil formed, but also the rate at which it forms. This in turn strongly affects the vegetation that would grow naturally and the type of agriculture or horticulture that can be sustained.

Superficial deposits

12.4.2 Superficial deposits in the scheme area comprise Alluvium which overlies glacial material. Four River Terraces are located within the study area. One such terrace runs north/south from Almondbank Bridge to Lochty essentially following the line of Main Street. Another runs northwards, adjacent to the east of East Pow Burn, from the south eastern corner of the Vector Aerospace site before curving round the northern edge of Low's Work Cottages and traversing Huntingtower Field south-eastwards. It then continues southwards along the main access road to the Huntingtower area. The two other terraces are considerably smaller in extent. These are the terrace in the Scraggier Hill area (west of the centre of the village) which forms an arc between East Drive and Scroggiehill access road and another such feature immediately to the east of the northern end of College Mill Road.

12.4.3 Drift deposits in the wider area, beyond the River Almond and East Pow Burn corridors, comprise Glacial Melt water Deposits and Glacial Till.

Bedrock

12.4.4 The bedrock beneath the site comprises the undivided, mainly cross bedded sandstone, of Devonian (Lower) age. In this area the Scone Formation (Oarlock Group) sandstones are purplish-grey and contain intraformational limestone debris.

12.4.5 To the north the bedrock comprises mudstone which is described by BGS as sandy and poorly sorted. This is Devonian in age and part of the Cromlix Formation (Strathmore Group). On the boundary between the sandstone and mudstone is a Quartz-dolerite dyke (Permo-Carboniferous). Also at this boundary are two local

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faults – one running east/west with a downthrow to the north whilst the other runs northwest/southeast with a downthrow to the northeast. The more extensive Kinnoull Fault is located over 1km to the south and runs northwest/southeast with a downthrow to the northeast.

Sensitivity

12.4.6 There are no sites or features designated or identified as being of geological interest that would be affected by the scheme, the geological/soil attributes are easily substitutable. Therefore, using the criteria in Table 12.1, the geology in the locality is assessed as being of low sensitivity.

Strata/Soils

12.4.7 A preliminary site investigation was undertaken by Royal Haskoning between the 1st and 3rd April 2003 to provide initial geotechnical information with regard to the proposed flood protection scheme. As part of this exercise soil samples were taken. Borehole records for six locations in the vicinity of the proposed scheme are available and have been reviewed to provide the following baseline information:

12.4.8 Borehole No.1 (Craigneuk Road to the north of properties at Deer Park)

- Surface to 0.6 m – stone chippings and dark grey/black compact fine to coarse mixed gravely sand with occasional cobbles and brick fragments
- 0.6 m to 1.0 m – dark brown firm to stiff fine sandy clayey silt with occasional fine subrounded to rounded gravels
- 1.0 m to 2.5 m – orangey brown medium to coarse angular to subangular sandstone fragments with sand and gravel matrix

12.4.9 Borehole No.2 (Northern bank of the River Almond opposite the Almond/East Pow confluence)

- Surface to 0.15 m – topsoil with brick fragments
- 0.15 m to 2.0 m – dark brown medium compact slightly fine sandy clayey silt
- 2.0 m to 4.0 m – brown compact small to large rounded to subrounded gravel in fine to coarse sand

12.4.10 Borehole No.3 (Western Edge of the Playing Field at Almondbank)

- Surface to 0.1 m – topsoil
- 0.1 m to 0.8 m – dark brown medium compact very silty very fine sand with occasional small to large rounded to subrounded gravels
- 0.8 m to 4.0 m – light brown medium compact small to medium rounded to subrounded gravely medium to coarse sand with occasional cobbles (from 2.0 m damp with occasional pockets of silt

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12.4.11 Borehole No.4 (Southern end of College Mill Trout Farm)

- Surface to 0.1 m – topsoil
- 0.1 m to 4.0 m – light brown medium compact small to medium rounded to subrounded gravely medium to coarse sand with occasional cobbles (occasional small to large rounded to subrounded gravels)

12.4.12 Borehole No.5 (Eastern bank of the River Almond at Black Bridge)

- Surface to 0.1 m - topsoil with brick fragments
- 0.1 m to 0.9 m – dark brown fine to coarse sand with frequent pockets of ash and brick fragments with small to medium rounded to subrounded gravels with occasional slate fragments
- 0.9 m to 1.1 m – light grey sandstone cobble with medium to coarse grey sand and small to large rounded gravels
- 1.1 m to 1.5 m – dark brown medium compact very silty, very fine sand with occasional small to large rounded to subrounded gravels
- 1.5 m to 3.0 m – light brown medium compact small to medium rounded to subrounded gravely medium to coarse sand with occasional cobbles

12.4.13 Borehole No.7 (Western bank of the East Pow Burn to the north of Lochty Park)

- Surface to 0.1 m – topsoil
- 0.1 m to 0.6 m – brown very silty very fine sand
- 0.6 m to 1.5 m – light brown medium compact small to medium rounded to subrounded gravely medium to coarse sand with occasional cobbles

12.4.14 Further ground investigation was undertaken between 22 September and 1 October 2010 and this comprised sinking of 15 boreholes with laboratory testing of samples taken. Long term monitoring of gas and groundwater levels at 7 of the borehole locations was also undertaken during October and November 2010.

12.4.15 The results broadly concurred with the early findings.

12.4.16 Made Ground was encountered in 7 of the 15 locations although in the majority of places the thickness was not substantial (less than 0.50m). Exceptions to this were localised in the northwest of the scheme (north of the fish farm), adjacent to the footbridge and at the bowling green. In particular at the borehole at the bowling green encountered Made Ground containing man made detritus such as concrete, metal and brick down to a depth of 3.40m and anecdotal evidence would suggest that a significant area west of the river is reclaimed land. No visible signs of contamination were noted.

Sensitivity

12.4.17 The sensitivity or value of soil resources has been determined using the criteria described in Chapter 7 – Land Use. This categorises land in terms of its capability

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for crop production. In accordance with Table 7.1, soil sensitivity is assessed as low for the majority of the site with small areas of high value soil associated with the areas of Class 2 land at Huntingtower Haugh, shown on Figure 7.1.

Contamination

12.4.18 Consultation with Perth and Kinross Council Environmental and Regulatory Services provided an indication of potential areas of contamination in the vicinity of the scheme, the locations of which are shown in Figure 7.1. These comprise:

- Vector Aerospace.
- Residential properties at Deer Park, the site of the former Pitcairnfield Bleach Works.

12.4.19 Soil samples collected by Royal Haskoning during the preliminary site investigation in April 2003 were sent for chemical analysis. Samples from BH2 (0.5m), BH2 (1.6m), BH5 (0.8m), BH5 (1.2m) and BH7 (1.5m) were analysed for a range of potential contaminants including metals, chloride, sodium and extractable petroleum hydrocarbons.

12.4.20 The chemical testing results identified one (BH5, 0.8m) sample with elevated concentrations of lead (1,075mg/kg) and zinc (1,522mg/kg). This concentration of lead exceeds the Contaminated Land Exposure Assessment (CLEA) Soil Guideline Value of 450mg/kg for residential and 750mg/kg for industrial end use.

12.4.21 Further investigation carried out by Perth and Kinross Council in 2007 (intrusive site investigation and quantitive risk assessment) in relation to former bleach works at Deer Park indicated that the site is not considered to be classed as 'contaminated land' and does not present any risk to human health and controlled waters. A former gas chamber known to exist was not found during the investigations. The study indicated that there appeared to be no linkage between any contamination and groundwater. However, it was noted that appropriate measures should be adopted to dispose of topsoil excavated from this area for scheme construction.

12.4.22 As indicated above, the more recent 2010 ground investigation did not reveal any specific contamination issues.

12.5 Predicted Impacts

Introduction

12.5.1 There are a variety of ways in which development can impact on geological resources, for example through physical degradation (sterilising, contaminating or compacting) or removing soils, particularly those associated with prime agricultural land, or sterilising underlying mineral resources. Excavating exposures of rocks or superficial geological deposits of specific scientific interest can represent a serious impact if the features of interest are not reproduced elsewhere in the area. Similarly,

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removal or modification of geomorphological features can affect their scientific value or the local landscape resource.

12.5.2 Disturbance of ground may accelerate erosion and result in surcharging with consequential impacts such as subsidence. In addition surcharging and erosion of contaminated land may result in the release of potentially polluting materials.

12.5.3 Potential impacts in relation to the scheme are discussed in more detail below.

Soils

Physical degradation

12.5.4 It has been assumed that construction of the proposed scheme would affect no more than the top 2m of existing ground.

12.5.5 The soils at the site generally comprise a relatively thin layer of topsoil underlain by alluvial deposits. Potential physical impacts during construction include compaction of topsoil and subsoil, which may result in poor plant growth, due to the restriction of plant roots, reduced infiltration of water into the soil and reduced aeration. Soil compaction may also result in increased erosion and increased run-off with the risk of pollution (including nutrients and pesticides) to surface waters. Inappropriate soil stripping, storage, handling and reinstatement of topsoil and subsoil can also result in degraded soil condition.

12.5.6 Compaction may occur through the use of heavy plant and equipment in the working areas and storage compounds. In the context of the wider area, similar soils are plentiful and therefore the magnitude of impacts of soil compaction is anticipated to be negligible and of slight adverse significance. Impacts would be reduced through the provision of defined working areas, which would be fenced off to prevent vehicles entering land outwith this area. Tracked vehicles would be used wherever possible.

12.5.7 All material to be used or reused during construction would be stockpiled in designated areas within the site boundary. Any topsoil requiring stockpiling would be handled in a manner so as to retain its potential to support plant growth. No discernible impact on soil capability is envisaged, but the scheme would result in a loss of a small amount of agricultural land and this is discussed further in Chapter 7 – Land Use and Recreation.

12.5.8 The Contractor would be responsible for the disposal of surplus material and this must be undertaken in accordance with Duty of Care requirements. The Contractor would determine the receiving point of material to be exported. Preliminary consideration of potential traffic impacts associated with haulage has been undertaken in Chapter 14 – Traffic and Access, although this would require further assessment during the detailed design stage.

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Soil contamination

12.5.9 Direct soil contamination may occur through accidental spillage of fuel, oils and lubricants from construction vehicles and plant. This may result in detrimental effects on plant-life and this would be of particular concern in respect of soils within residential property gardens, and agricultural soils. Soil contamination may also present a hazard to the public if present in recreational areas. Through leaching, soil contaminants may enter the River Almond or East Pow Burn as well as local groundwater resources. The potential effects of water pollution upon the aquatic environment are discussed in Chapters 9 and 10.

12.5.10 Using the source-pathway-receptor model the potential risk of soil contamination is as follows:

- Source: undetermined though may be hazardous to human health or the environment.
- Pathway: absorption, ingestion, inhalation or touch of potentially contaminated material which would most likely occur during ground clearance, earthworks and excavations.
- Receptors: soil and vegetation, construction workers, residents and the general public.

12.5.11 Although there is a risk of soil contamination, best practice methods would be used to prevent spillage from construction vehicles and plant and these will be included in the CEMP.

Ground stability

12.5.12 Construction of flood walls and embankments within close proximity to the banks of the River Almond and East Pow Burn may have implications with regard to bank stability. Detailed ground investigations would be necessary to fully explore this issue amongst other geotechnical aspects. Engineering solutions may be necessary to ensure long-term stability. This would be undertaken at the detailed design stage.

Contaminated land

12.5.13 As discussed above, Perth and Kinross Council Environmental and Regulatory Services has indicated that there is a possibility that areas of land contamination exist within the footprint of the proposed scheme. Of particular concern was the potential for historical contamination associated with the former Pitcairnfield Bleach Works site. Anecdotal evidence suggests that the Deer Park residential area may have formerly been a dumping ground for waste materials from the former bleach works.

12.5.14 However, further investigation by the Council indicated that there appeared to be no linkage between any contamination and groundwater. The more recent 2010 ground investigation did not reveal any specific contamination issues.

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12.5.15 Deer Park is likely to be disturbed during the construction works. The source-pathway-receptor model for this potential risk is outlined below:

- Source: undetermined though unlikely to be hazardous to human health or the environment.
- Pathway: ingestion, inhalation or touch of potentially contaminated material which would most likely occur during ground clearance, earthworks and excavations.
- Receptors: construction workers, residents of nearby houses.

12.5.16 Excavated material from the Deer Park area would be appropriately removed and dealt with as a precautionary measure and this may entail in-situ treatment of soils or removal off-site to an appropriately licensed facility in accordance with the Environmental Protection (Duty of Care) (Scotland) Regulations 2011.

12.6 Mitigation Measures

12.6.1 Mitigation measures would be formalised as part of the construction contract by way of the Construction Environmental Management Plan (CEMP). The CEMP would include a specific soils and contaminants management plan. The plan would require method statements for work being undertaken where the risk of contamination has been established to identify a process of investigation focused on establishing specific contaminants, appropriate working methods and protective measures to be adopted.

12.6.2 Potentially adverse impacts on soil quality would be minimised by:

- Limiting the extent and location of the working areas and storage areas.
- Implementation of erosion and sediment controls.
- Appropriate handling and storage of spoil.
- Re-use of excavated materials, where possible, in earth embankments and landscaping.
- Restoration of disturbed areas.

12.6.3 Clearly defined working areas would be fenced off and construction vehicles access would be strictly regulated to limit wider impacts on soils.

12.6.4 Soil handling procedures would be adopted by the Contractor relating to handling in wet conditions, stockpiling and import of soils for earthworks. These methods are aimed at retaining soils in a condition suitable for plant growth and for agricultural production in line with pre-existing land quality. Individual soil types, including topsoil and subsoil, required for restoration purposes and landscaping would be identified prior to excavation, stored separately and restored back to their parent area. Where it is necessary to remove superficial soil deposits during the excavation of earthworks, these would be utilised, where possible, during construction elsewhere on the scheme.

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12.6.5 Soils would be reinstated in dry conditions on appropriately contoured and prepared ground as specified in the method statement for the works. They would be replaced in the correct sequence and care taken to avoid contamination with other materials and to avoid any compaction.

12.7 Residual Effects

12.7.1 It has been concluded that with the appropriate investigations and identified mitigation measures in place it is unlikely the proposed scheme would have any significant effect on the geology and soils associated with the proposed scheme corridor or on at-risk receptors and construction workers in particular.

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13 Air Quality and Noise

13.1 Scope of the Assessment

13.1.1 The assessment relative to air quality and noise has involved:

- an evaluation of impacts associated with construction-related dust on sensitive receptors located in the vicinity of the works during the anticipated construction period for the proposed scheme;
- an evaluation of construction-related emissions associated with the use of parts of the local road network by heavy duty vehicles (HDVs) delivering materials and components and disposing of excess soils and waste during construction; and
- potential noise and vibration impacts at sensitive receptors during the construction of the proposed scheme.

13.1.2 Potential effects have been discussed for the construction period only, as no discernable effects on existing air quality or ambient noise levels are anticipated during scheme operation.

Construction-related dust

13.1.3 The assessment of construction-related dust has been focused on receptors located within 200m of the working areas and compounds required for construction of the proposed scheme. The 200m distance has been selected on the basis that the substantial proportion of dust particles associated with construction of the type proposed are relatively large and would normally be deposited within 100m of the source site. The 200m buffer allows for the likelihood that smaller volumes of finer dust particles would be likely to be deposited beyond the 100m buffer.

Construction traffic emissions

13.1.4 The assessment of the impacts of construction related traffic emissions on local air quality has considered the additional movements of HDVs on the local network. Sensitive receptors are generally assumed to be properties within 200m of the affected routes. Beyond this distance emission concentrations are generally considered to be close to local background levels.

Construction-related noise

13.1.5 The study area for construction-related noise has been set at 300m from the construction corridor for the proposed scheme. This reflects the distance, within which, impacts could potentially have a significant effect. Guidance provided in BS5228 - Part 1: Noise Control on Construction and Open Sites, (2009) indicates that prediction of levels beyond this distance is unreliable.

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13.1.6 Receptors considered have been selected to be representative of the closest sensitive uses to the proposed scheme. They include residential properties, schools, churches; hospitals and care homes.

13.2 Legislative and Planning Context

Reference has been made to the following legislation, strategies and regulations.

Council Directive 2008/50/EC on ambient air quality and cleaner air for Europe (CAFE) and the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007)

13.2.1 Directive 2008/50/EC or the Ambient Air Quality Objective stresses the importance of combating emissions of pollutants at source and identifying and implementing emission reduction measures at local, national and EU level. The Directive pays special attention to particulate matter and ground-level ozone pollution because of their potential for human health impacts (but also seeks to control other emissions and protect the wider environment).

13.2.2 The Directive revised and combined five separate existing pieces of legislation: The Air Quality Framework Directive, the Council Decision on Reciprocal Exchange of Information and the First, Second and Third Air Quality Daughter Directives (the Fourth Daughter Directive would be consolidated at a later date.

13.2.3 The Directive details air quality limit values and exposure-related objectives for a number of air pollutants established by the European Parliament and Council for the protection of human health, vegetation and ecosystems. These have been transposed into UK legislation by the 2007 Air Quality Strategy for England, Scotland, Wales and Northern Ireland. Nitrogen dioxide (NO_2) and particulate matter in the form of PM_{10} are two of the pollutants addressed by the Directive and Regulations.

13.2.4 The limit values for NO_2 and PM_{10} are detailed in Table 13.1 below.

Table 13.1: Limit values for NO_2 and PM_{10}

Pollutant	Limit value	Averaging period
NO_2	200 µg/m^3 Not to be exceeded more than 18 times per year	1 Hour Mean
	40 µg/m^3	Annual Mean
PM_{10}	50 µg/m^3 Not to be exceeded more than 35 times per year	24 Hour Mean
	40 µg/m^3	Annual Mean

Environment Protection Act 1990

13.2.5 The Environmental Protection Act (EPA) (Section 79, Chapter 43, Part III - Statutory Nuisances and Inspections) contains a definition of what constitutes a 'statutory nuisance' with regard to dust and places a duty on Local Authorities to detect any

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such nuisances within their area. Dust arising from construction works could lead to statutory nuisance if it 'interferes materially with the well being of the residents, i.e. affects their well being, even though it may not be prejudicial to health'.

The Control of Pollution Act 1974 (CoPA)

13.2.6 The Control of Pollution Act 1974 (CoPA) relates to the control of noise and vibration from construction sites by the means of the imposition of appropriate conditions and by the development of agreed working procedures.

13.2.7 Sections (S) 60 and 61 of CoPA gives local authorities in Scotland, England and Wales special powers for controlling noise arising from construction and demolition works on any building or civil engineering site. S60 refers to the control of noise on construction sites and provides legislation by which local authorities can control noise from construction sites to prevent noise disturbance occurring. In addition, it recommends that guidance provided by BS5228 be implemented to ensure compliance with S60. S61 refers to prior consent for work on construction sites and provides a method by which a contractor can apply for consent to undertake construction works in advance.

13.3 Methods of Assessment

Baseline methods

13.3.1 Baseline information was collated through desk study and site visit to establish the location of sensitive receptors which may be affected during the construction phase. Information was also gathered with regard to the proposed site access requirements during construction. The desk study reviewed relevant literature as follows:

- Ordnance Survey Explorer 369, Perth and Kinross, 1:25 000 scale.
- Preliminary scheme design drawings and information regarding construction vehicle movements and typical noise levels for construction plant.
- UK National Air Quality Information Archive – http://www.airquality.co.uk
- Scottish Air Quality database - http://www.scottishairquality.co.uk

13.3.2 With regard to existing noise emissions, potential effects were not raised by consultees as a key issue due to the temporary nature of any anticipated increases in noise levels. Baseline monitoring was therefore not carried out, however the noise levels associated with equipment to be used during construction has been estimated and the location or sensitive receptors in the vicinity of the scheme considered in relation to these predicted noise levels.

Impact assessment methods

13.3.3 The assessment of impacts was carried out with reference to the scheme preliminary design drawings and information on construction methods (Chapter 4) together with

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estimates of noise levels associated with the construction equipment to be used on site (Table 13.6).

13.3.4 As outlined in Chapter 5 – Approach and Methods, impacts were considered in terms of both the sensitivity of receptors affected and the magnitude of the impact on these receptors. The significance of predicted impacts was then determined through a combination of sensitivity and magnitude.

Sensitivity of receptors

13.3.5 The sensitivity of receptors susceptible to changes in air quality and noise nuisance was determined as detailed in Table 13.2 below.

Table 13.2: Sensitivity of receptors

Sensitivity	Definition
High	Highly sensitive human receptors at the following locations: • Hospitals and schools (air quality and noise); • Residential properties during the night-time (noise); • Outdoor recreational areas (air quality and noise); and • Receptors located within 200m (air quality) and 300m (noise) of proposed scheme.
Medium	Moderately sensitive human receptors at the following locations: • Residential properties and commercial premises during the daytime (air quality and noise); • Site workers (temporary exposure – air quality and noise); and • Receptors located 200m (air quality) / 300m (noise) to 500m from proposed scheme.
Low	Low sensitivity receptors at the following locations: • Residential and other properties unoccupied during site working hours (air quality and noise); • Commercial sites with significant baseline noise levels (noise); • Farmholdings and industrial sites (air quality and noise); • Pedestrians/walkers (transient exposure – air quality and noise); and • Receptors located further than 500m from proposed site (air quality and noise).

Impact magnitude

13.3.6 The severity, or magnitude, of impact was assessed independently of the sensitivity of receptors and, based on professional judgement, assigned to one of the categories described in Table 13.3 below.

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Table 13.3: Impact magnitude ratings for air quality and noise

Rating	Definition
Major	Substantial increase in PM_{10} above the UK threshold level. Dust generation sufficient to give rise to dust deposition and nuisance complaints. Noise increase affecting sensitive receptors for prolonged periods and with potential health implications
Moderate	Increase in PM_{10} but generally below the UK threshold level. Dust deposition rates potentially giving rise to dust layer. Moderate level of disturbance to sensitive receptors due to noise level increases but with no adverse health effects.
Slight	Small increase in PM_{10} but below the UK threshold level. No observable dust deposition. Detectible noise increases but short term and sporadic.
Negligible	Largely undetectable changes in relation to the baseline conditions.

Impact significance

The significance of impact (beneficial and adverse) was determined as a combination of the sensitivity and magnitude as shown in Table 13.4.

Table 13.4: Significance rating for air quality and noise

Site Value	Magnitude of Impact			
	Major	**Moderate**	**Slight**	**Negligible**
High	Major	Major	Moderate	Slight
Medium	Major	Moderate	Slight	Negligible
Low	Moderate	Slight	Negligible	Negligible

13.4 Baseline Conditions

Sensitive receptors

13.4.1 In terms of changes in air quality and increased noise emissions, sensitive receptors are defined as those locations where members of the public may be regularly exposed to airborne pollutants or noise disturbance. This includes dwellings (long-term impact), amenity facilities (medium term) and site workers (short-term impact). The sensitivity of these receptor points can vary depending on their individual characteristics and distance from the scheme.

13.4.2 Potential air quality and noise receptors in the vicinity of the proposed scheme generally comprise residential properties and recreational facilities including the Bowling Club and adjacent playing fields on the western bank of the River Almond. These receptors are identified in Table 13.5 below along with their approximate distance from the proposed scheme location. It should be noted that

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properties/features may be located close to more than one element of the scheme and therefore the approximate distance shown in the table only indicates the closest element. Furthermore, it is recognised that there may be a number of additional receptors in the vicinity of the flood scheme should the land identified for development of housing be built upon. However, these developments would be phased over a number of years and therefore as this assessment considers current conditions these receptors have been excluded at present.

Table 13.5: Potential air quality and noise receptors

Receptor	Approximate Distance From Scheme (m)
Pitcairn Cottages and other residential properties lining the western edge of College Mill Road (numbers 3-23)	10-20m to the east
Residential properties within Bridgeton	30m to the north-east
Pitcairn School	280m to the north
College Mill Trout Farm	Within area of works
Rhencullew, Rhourkton and Druid's House residential properties	Within area of works
Residential properties on Almondbank Main Street (Numbers 23 to 59)	50m to the west
Residential properties on Almondbank Main Street (Numbers 3-21)	Adjacent to scheme - within 40m
Almond Valley Bowling Club and Pavilion	Within area of works
Residential properties numbers 1, 2, 3 and 4 Deer Park	Within area of works
Residential properties at Deer Park, excluding numbers 1,2,3 and 4	Adjacent to scheme
Residential properties of Craigneuk East and Craigneuk West	Within area of works
Residential properties on Almond Grove, Almond Place, Almond Crescent and surrounds	30m to the east/south-east
Playing Field and Pavilion adjacent to Bowling Club	Within area of works
Residential Properties on Mackenzie Drive and Admiralty Wood	30m to the west
Vector Aerospace site	Within area of works
The Courts residential property	Adjacent to scheme
Scottish Wastewater Treatment Plant	Within area of works
Brockhill and Low's Work Cottages residential properties	Within area of works
Puddledub residential property	Adjacent to scheme
Burial Ground	30m to the north-west
Lochty Industrial Estate including Honeypot Nursery School	Within area of works
Lochty Park residential properties numbers 1-5 and 10	Within area of works
View Mount, Carngeal, Admiralty Cottages and Station House	10m to the east
Lochty Cottage and Wildwood residential properties	60m to the west

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Baseline air quality

National air quality standards

13.4.3 Under Part IV of the Environment Act 1995, the Government introduced the concept of local air quality management and placed duties on all local authorities to undertake periodic reviews of air quality in their areas to assess present and likely future air quality against prescribed objectives for a number of pollutants. These objectives incorporate standards derived from the Ambient Air Quality Directive which specifies limit values for each pollutant and compliance years when standards should be met. These limit values are aimed at the protection of human health and ecosystems. The objectives are contained in the Air Quality Strategy for England, Scotland, Wales and Northern Ireland (2007).

13.4.4 Where the objectives are not likely to be met, the local authority must designate an Air Quality Management Area (AQMA) and produce an Air Quality Action Plan for improvement in air quality.

13.4.5 In 2006 Perth and Kinross Council declared the whole of Perth an AQMA following detailed assessment in 2004, which found that there would be areas of exceedences for NO_2 and PM_{10}. An Air Quality Action Plan was prepared and approved and included an air quality monitoring strategy and preparation of progress reports. The Perth and Kinross Air Quality Progress Report 2011 records exceedences at 20 locations in Perth and indicates that the AQMA should remain in place for Perth City Centre, with NO_2 and PM_{10} monitoring continued. The village of Almondbank lies outwith the AQMA.

Background air quality

13.4.6 Ambient air quality in the vicinity of the scheme is anticipated to be relatively good considering the semi-rural nature of the surrounding landscape. The main source of emissions is anticipated to be the Vector Aerospace site and the wastewater treatment works adjacent to the River Almond. Traffic emissions are anticipated to be low and mainly associated with local use of the road network which comprises, with the exception of the A85 to the south, single carriageway minor roads. Other sources of air emissions may arise as a result of farming activities such as vehicle movements and the use of other farm machinery although these are not expected to contribute significantly to overall ambient air quality. In the absence of site-specific baseline monitoring data, and considering the location of the proposed flood protection scheme, it is anticipated that pollutant levels at the site would be significantly less than those levels recorded at the monitoring stations in Perth. No specific air quality issues are therefore envisaged with regard to the baseline situation.

Baseline noise levels

13.4.7 Noise can be defined as unwanted sound, the effects of which vary considerably among individuals. However, it is generally agreed that the degree of interference

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would be related to the level of noise, particular characteristics such as tone, intermittency, duration, and the time of day when it occurs. The acceptability of noise from a particular source would depend on the above factors but also on the existing noise environment in the locality. When compared with the 'background' noise, a specific source of noise may give rise to interference of the enjoyment of the use of premises which persons living in the locality might reasonably expect. Such situations would give rise to nuisance and may prevent the use of open areas for rest and relaxation and interfere with normal activities, inside a building.

13.4.8 The basic unit of noise measurement is the decibel (dB), (a logarithmic ratio of sound pressure relative to a standard pressure). In order to give a decibel value, which describes the 'loudness' of a sound, the sound pressure level is normally 'weighted' using a weighting scale (A-weighting) to take account of the frequency of the sound in question. Noise measurements are then quoted in A-weighted decibels (dB(A)or LA).

13.4.9 The location for the proposed scheme elements can be described as moderately quiet urban fringe and, therefore, it is important to ensure that ambient or background noise levels are adequately protected. Existing background noise sources are relatively low and, as for air quality, associated with operations at the Vector Aerospace site and vehicular use of the local road network. It is assumed that the peak times for vehicle movements along the road network would be during the morning (08:00 until 09:30 – AM peak) and the evening (17:00 until 18:30 – PM peak) Monday to Friday as people travel to and from work.

Construction phase

13.4.10 For the purposes of this assessment it has been assumed that the construction period would be undertaken in a number of phases. Construction work would not take place in each phase simultaneously but may occur during one or more phase at a time.

Predicted vehicle and plant movements during construction

13.4.11 As described in Chapter 4, typical vehicles expected to be used during the construction period would comprise the following:

- Tracked 360° excavators
- Crane
- Lorries
- Dumper truck
- Vibratory roller
- Sheet pile driver
- Concrete wagon and pump
- Small hand held plant

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- Site personnel vehicles - relatively low numbers of cars

13.4.12 The movement of vehicles would be restricted to one specific access point per operation/set of operations wherever possible. However, there would be a considerable number of vehicle trips on/off site in relation to soil removed from excavations, transport of materials and equipment required for the construction of flood walls, embankments and associated infrastructure. There would also be vehicle movements associated with site personnel, specifically at the start and end of each working day; however this is expected to entail relatively low numbers of cars. The majority of trips made would involve the removal of surplus soil material to a receptor site, the location of which is yet to be confirmed.

13.5 Predicted Impacts

Air quality

13.5.1 The impact assessment is intended primarily to determine the likelihood of pollution concentrations occurring that might be harmful to human health arising from the release of dust and particulate matter and emissions from construction vehicles and plant.

13.5.2 With regard to the operational phase of the scheme, no significant potential air quality impacts were identified due to the low number of operational vehicle movements on site during normal operations, i.e. periodic maintenance/service visits. This assessment therefore concentrates on potential construction impacts.

Dust emissions

13.5.3 Dust is generally described as particulate matter in the size range 1 - 75µm. The most significant health issues are related to fine particulates less than 10µm (PM_{10}) as they can be inhaled and may affect the respiratory system. Particles in this small size fraction would generally not make a significant contribution to any visible dusts.

13.5.4 Fugitive dust and particulate matter may be generated during excavations and backfilling operations. Construction equipment and off-site haul vehicles used for transportation of plant and materials may also produce emissions. The pollutants of primary concern include fugitive dust, PM_{10}, reactive organic gases, oxides of nitrogen, carbon monoxide and, to a lesser extent, sulphur dioxide. The compounds released into the air by road vehicles give rise to a variety of environmental effects over different geographical ranges and time periods.

13.5.5 Although it is difficult to quantify dust emissions resulting from construction activities, it is possible to carry out a qualitative estimate of potential dust impacts. This is done by considering the timescale of the construction works and local climatic conditions, the anticipated level of traffic generated, the surrounding environment of the development sites and the proximity of sensitive receptors.

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13.5.6 Potential air quality impacts may result during the construction period which includes site preparation, earthworks and reinforced concrete works. The key impacts on air quality relate to movements of construction materials, plant and vehicles and the release of dust. Such activities include:

- Excavation, removal and storage of soil.
- Dirt being deposited on public roads and site access routes.
- Construction of concrete structures.

13.5.7 The construction period would be phased and works would be split so as not to occur continuously in all areas, thereby controlling the potential level of airborne emissions.

13.5.8 Soils would be carefully stripped over a short period and any stockpiling would occur away from sensitive receptors. Stockpiles would be appropriately bunded and covered where necessary and the condition of the material in the stockpiles regularly monitored, particularly during prolonged dry periods, in order to ensure there is no excessive release of dust. Reuse of excavated material on site where possible would reduce the need for importing additional materials. Surplus material would be transferred by lorry from the site to an appropriate receptor point. Lorries containing fine material would be covered during transfer.

13.5.9 The dispersion of airborne pollutants can be influenced by a number of factors including particle size, wind speed, wind direction and rainfall. In general terms, the stronger the wind speed, the larger the particle size that it can carry, and the further a pollutant may be dispersed.

13.5.10 Although the wind direction is generally from the southwest, this can be variable. Residential properties located to the northeast of the locations where embankments are to be constructed, in particular, may potentially experience dust nuisance from construction activities during mean wind conditions. In relation to construction of the flood wall and erosion protection adjacent residential properties of Rhencullew, Rhourkton and Druid's House (all within the area of works) may be susceptible. However, given the scale of the proposed embankment and the shelter provided by trees lining the eastern bank of the River Almond, the impact magnitude is assessed as slight resulting in a potential impact of moderate adverse significance on the highly sensitive residential properties.

13.5.11 There may also be impact of a slight magnitude upon properties at Deer Park and especially No.4 (high sensitivity residential within the area of works) giving a potential impact of moderate adverse significance. Again at this location river bank vegetation and trees would provide some degree of shelter from the wind. Works associated with the road bridge at the confluence of the River Almond and the East Pow Burn immediately to the rear of Brockhill is anticipated to have an impact of slight magnitude on that property as well as Low's Work Cottages (all high sensitivity residential) resulting in a potential impact of moderate adverse significance. Given that the location for this element of the scheme is an arable field dust emissions are not expected to be any more significant than through seasonal agricultural activity.

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13.5.12 Construction of the flood wall at Craigneuk is anticipated to have an impact of slight magnitude on Craigneuk East and Craigneuk West (both within the works area and high sensitivity residential) giving a potential impact of moderate adverse significance. Likewise activities at the playing fields may cause a slight impact upon The Courts (high sensitivity residential property) resulting in a potential impact of moderate adverse significance. However, it is important to note that these impacts are likely to be for intermittent periods and it is therefore predicted that dust emissions during the construction works are unlikely to have any direct long term impact upon local residents.

13.5.13 Pedestrians and cyclists using the local road and path network and recreational facilities are classed as transient receptors in that the duration of their exposure to any works-generated dust and airborne emissions is relatively minimal and they are able to move away from any particularly dusty activities. However, they are still considered as sensitive receptors. Road users would be re-routed where necessary and pedestrians may be temporarily restricted from following pathways or using sections of recreational areas within the vicinity of operations, i.e. access routes along the banks of the River Almond and the playing field off Main Street. As such these receptors are unlikely to be significantly affected by air pollution during the construction period.

13.5.14 Potential effects are anticipated to be most applicable to construction site workers. Such effects, although temporary in nature, are identified as moderate adverse. Appropriate health and safety measure would be incorporated to ensure that no long-term adverse effects on site operatives occur.

Construction traffic emissions

13.5.15 Air pollutants emitted from construction vehicles give rise to a variety of environmental effects over different geographical ranges and time periods. Some compounds have immediate and very local effects with the potential to damage health and the environment. The incomplete combustion of a hydrocarbon fuel results in the formation of organic compounds, carbon monoxide (CO) and particulates.

13.5.16 There would be a number of road vehicle movements generated per day during construction of the scheme, peaking during specific activities. Those properties located in the vicinity of proposed haul routes comprise houses along Main Street, College Mill Road and Craigneuk Road as well as Lochty Park and Deer Park. Low's Work Cottages, Brockhill and The Courts would also be affected. The use of these haul routes would be intermittent over the construction phases and, with emission control measures in place (described in section 13.6 below). These properties are unlikely to be adversely affected by any vehicular emissions during the transport of materials to and from the site.

13.5.17 The use of on-site construction plant, such as excavators and trucks would also emit airborne pollutants, particularly nitrogen dioxide (NO_2) and carbon monoxide (CO), which may have an impact on the local environment, local receptors nearby the

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location of the construction works and site workers. However, by ensuring that all the plant complies with relevant emissions standards and is well maintained, any adverse impact would be minimised, and the magnitude of impact is assessed to be low.

13.5.18 The works are envisaged to have no long-term significance in terms of air pollution on the existing environs. Some degree of short-term dust generation is likely but is considered to be very localised in its effect and of temporary nuisance to only a few residential properties. Appropriate dust suppression techniques would be applied where necessary.

Noise and vibration

13.5.19 The construction of the scheme has the potential to generate noise and vibration effects which, if not properly controlled, may result in nuisance to sensitive receptors in the vicinity. Construction activities associated with the scheme which may create noise nuisance comprise earthworks, piling activities, use of peckers, compressors and generators and the movement of materials, vehicles and plant.

13.5.20 The level of noise experienced from a source would reduce with increasing distance from the source. The degree of attenuation would depend on the nature and size of the noise source, the type of ground over which it is propagated, weather conditions and the presence of physical structures, which may reflect and enhance propagation or act as acoustic barriers. Typically the level of sound from a 'point' source would reduce by 6 dB for every doubling of distance from the source, although the reduction would be enhanced by absorption when travelling over soft ground. An acoustic barrier would provide approximately 10 dB attenuation if a source is out of line of sight from the reception point. Above 10 dB attenuation may be achieved depending on the relative heights and distances of source and barrier.

13.5.21 Precise details regarding the type and size of plant and equipment to be used during construction have not been determined at this stage, nor the occasion of use confirmed. Neither is it possible to determine the exact site location of these components. Therefore assumptions have been made regarding the likely plant to be used and their estimated noise levels, as detailed in section 13.4.11 above and Table 13.6 below. These are typical noise levels based on examples of activities and plant provided in British Standard (BS) 5228 Part 1 and 4 1997. As the construction activities proceed there would be differences in the level and duration of noise impact. These differences would vary between the various phases of the construction programme and on a day to day basis.

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Table 13.6: Typical construction plant noise levels

Activity	Plant	Power rating kW	Sound Pressure Level dB L_{WA}	Sound Pressure Level dB L_{WA} @10m
Site preparation and excavation	Lorry	-	-	82
	Tracked Excavator	186	116	86
	Dumper	13	95	67
	Pneumatic Breaker	-	118	90
	Compressor	-	123	95
	7.5 kVa Generator	-	100	72
	Water Pump	7.5	106	78
Embankment construction and sheet piling	Silent Piler Rig	-	58	45
	Lorry	-	-	82
	Tracked Excavator	186	116	86
	Dumper	13	95	67
	Pneumatic breaker	-	118	90
	Compressor	-	123	95
	7.5 kVa Generator	-	100	72
	Water pump	7.5	106	78
	Tracked crane	42 - 22t	114	86
	Vibratory roller	-	102	74
Concrete structures	Lorry	-	-	82
	Mixer truck discharging	$6m^3$	112	84
	Concrete pump		106	78
	Vibrator poker		102	81
	Generator		122	94
	Power float		100	72
Road Surfaces	Tracked excavator	186	116	86
	Lorry	-	-	82
	Asphalt spreader	90	96	68
	Road roller	-	96	68
Ancillary operations	Pneumatic Hammer	41 kg	124	96
	Percussion drill	10 kg	104	98
	Scaffold	Installation	100	72
	Arc Welder and Generator	10 kVa	103	75

13.5.22 Perth and Kinross Council would specify noise level thresholds which the Contractor would be required to be adhere to during the construction period so that significant noise disturbance to the local community is avoided. Noise would be temporary and intermittent throughout the construction period and potential noise sources restricted to the defined working areas. Given the close proximity of numerous residential properties and indeed that works would be carried out within the bounds of a number of properties (see Table 13.4), predicted noise disturbance is therefore assessed to

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be of moderate magnitude at worst and of major adverse impact significance (based on a high sensitivity of receptor).

13.5.23 As for air quality, discussed above, properties located in the vicinity of proposed haul routes may potentially be affected by the movement of vehicles and plant along these routes. Although there would be substantial numbers of trips along the haul routes, vehicle movements would be intermittent over the construction phases and therefore the magnitude of any noise/vibration impact is predicted to be no more than slight and of moderate adverse significance to residential receptors.

13.5.24 Continuous noise is generally regarded as most significant in that it has the greatest potential for nuisance effects on sensitive receptors. Such noise is associated with generators which can remain operational throughout the working day. However, the use of generators would be restricted and they would be suitably located and fenced off if necessary to reduce noise levels so as not to cause disturbance to any residential properties in the vicinity.

13.5.25 During construction of the new road bridges at Lochty Park and at the confluence of the East Pow Burn and River Almond excavations and raising of road surface levels may present the potential for vibration effects on nearby properties. Continuous vibration from plant and equipment has the potential to create more substantial vibration impacts. However, the aforementioned operations would be expected to result in transient vibration levels with a moderate adverse impact significance at worst.

13.5.26 BS7385 (Vibration Effects on Buildings) indicates that at a distance of greater than 40m from a vibration source, any building is unlikely to be damaged. Wherever possible plant and methods of working would be adopted to ensure that significant nuisance to nearby residents is minimised. In addition, the Perth and Kinross Council Environmental Health Officer would set limits on working methods and activities to control noise and vibration. The Contractor would agree these in advance of any site clearance or construction works on site.

13.5.27 As piling works are required as part of the flood protection scheme, and in some locations in close proximity to residential property such as at Lochty Park, there is potential for building damage due to vibration. Mitigation would therefore be required in order to ensure no significant impact results.

13.6 Mitigation

General mitigation measures for dust and particulate emissions

13.6.1 The general mitigation measures to be employed during the construction phase to mitigate potential impacts resulting from dust and particulate emissions would include the following:

- imposition and enforcement of speed limits on site access roads and unpaved ground;

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- sheeting of lorries carrying dusty material on and off site;
- locating stockpiles of potentially dusty material away from sensitive locations;
- use of wheel washing facilities, where necessary to prevent dirt being tracked onto local roads;
- regular use of a water-assisted dust sweeper on local roads if necessary, to remove any material tracked out of the site;
- dust suppression during dry conditions;
- cessation of all clearing, grading, earth moving, or excavation activities in periods of high winds (i.e. greater than 25 miles per hour averaged over one hour) coincide with dry conditions.
- minimisation of the area disturbed by earthmoving or excavation operations so as to prevent the generation of excessive amounts of dust.

13.6.2 Traffic emissions during construction would be minimised by the implementation of a Traffic Management Plan (TMP). The TMP generally includes timing of construction activities, providing detours around construction areas, limiting movements on arterial roads to off-peak hours and providing a public relations contact to inform residents and motorists of the construction programme.

13.6.3 As part of site supervision, the Contractor would monitor dust emissions arising both from construction works and generated traffic and undertake inspections as necessary. Visual assessments of emissions would be made frequently and remedial actions taken immediately in the case of abnormal emissions. If there is repeated evidence of airborne dust being deposited off site, the Contractor would undertake monitoring to identify the source.

Noise and Vibration

13.6.4 All construction works would be carried out in accordance with BS5228, “Noise and Vibration Control on Construction and Open Sites”. BS5228 provides guidance on general mitigation measures. Such measures which would be incorporated into the construction contract include:

- use of good well maintained plant and where possible new plant manufactured under recent EC guidelines for manufacturers; and
- maintenance of silencers and moving components, where necessary.

13.6.5 Perth and Kinross Council guideline noise levels would not be exceeded during the construction period. During all excavations vibration would require to be restricted to a level of 10mm/s ppv at all potential receptors.

13.6.6 The Contractor would be required to take note of the control measures for relevant plant listed in BS5228 and apply the appropriate measures where practicable, including temporary screening or enclosure of noisy plant, control of “on times” for

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noisy plant, and positioning of plant as far as possible from noise sensitive locations and receptors.

13.6.7 In order to help to reduce any short-term noise disturbance, all construction activities would be undertaken in accordance with best practice. This would include maintenance of equipment in good condition, switching off machinery when not in use and working, wherever possible, only during normal daytime working hours.

13.6.8 Piling works would be undertaken intermittently and a soft start would be implemented.

13.6.9 The need for regular noise monitoring of the construction sites would be determined by Perth and Kinross Council Environmental Health Department. Although no specific monitoring is envisaged at this stage, occasional measurement of noise levels would be conducted to check that noise levels are meeting the appropriate BS standards and that no nuisance complaints occur. This requirement would be incorporated in the appropriate Method Statements and undertaken by the Contractor during the construction period.

13.6.10 Prior to any potentially noisy on site operations, including piling, the need for any noise screening would be identified and screening provided as appropriate.

13.6.11 In terms of vibration, structural building surveys would be carried out before, during and after construction for properties within 40m of piling works areas. Careful consideration would be given to the choice of piling rig, and piling activities would be restricted to specific working hours. During piling operations, vibration levels would be monitored.

13.6.12 The Contractor/Perth and Kinross Council shall delegate a point of contact who would be present on site to respond to queries or noise/vibration nuisance complaints from the local public.

13.7 Residual Effects

13.7.1 No significant residual impacts with regard to air and noise emissions are anticipated.

13.7.2 The impact on the local air quality would be mainly of short-term duration, concerning local residents at properties within the works areas and the site workers. However application of the mitigation measures detailed in Section 13.5 during the construction works would considerably reduce the risks associated with airborne and dust emissions.

13.7.3 With the implementation of appropriate mitigation during the use of any particularly noisy on-site activities, significant noise nuisance is unlikely, although further consideration would be required with regard to ensuring that those properties within the areas of works are not detrimentally affected.

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14 Traffic and Access

14.1 Scope of the Assessment

14.1.1 The following assessments have been undertaken:

- desk-based study to determine current road usage, including vehicle movements and access arrangements in the vicinity of the proposed flood protection scheme; and
- assessment of how the activities associated with the construction phase are likely to impact on existing road users.

14.1.2 Due to the fact the detailed design for the proposed scheme has not been determined at this stage, there is currently limited information available regarding: details of construction methods, activities and type/number of equipment/plant required; programming of works/activities; precise haul routes and times of use, etc. This assessment therefore constitutes a preliminary consideration of traffic and accessibility issues.

14.1.3 It should be noted that the discussion of potential impacts concentrates on effects during the construction period, as traffic generated post construction and during scheme operation would be limited to intermittent and infrequent use of local roads by generally light vehicles, requiring access to the locality for maintenance purposes or in the event of an emergency.

14.1.4 Although it is recognised that there would be impacts on the local road network during the construction period, it is assumed these would be temporary in nature with no long-term alterations in existing traffic patterns anticipated. It was therefore considered that detailed traffic counts would not be required for the baseline assessment and indeed that detailed computer modelling of junction capacity/predicted traffic movements during construction would be unnecessary.

14.1.5 The study area for the assessment encompasses affected routes within the immediate scheme area, generally up to 500m, including connection to the nearest 'A' road, the A85.

14.2 Methods of Assessment

Baseline methods

14.2.1 Baseline information was collated through desk-top study to establish the existing situation with regard to the location and use of roads in the vicinity of the scheme which may be affected during the construction phase. Information reviewed included the following:

- Ordnance Survey Explorer 369, Perth and Kinross, 1:25 000 scale, Edition A, 2001.
- Outline scheme design drawings.

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Impact assessment methods

14.2.2 The assessment of impacts was carried out with reference to preliminary design drawings and information on construction methods (Chapter 4).

14.2.3 As outlined in Chapter 5 – Approach and Methods, the significance of impacts was considered in terms of the sensitivity of receptors (i.e. the existing road network and its users and access arrangements) affected and the magnitude of the impact on these receptors.

Sensitivity of receptors

14.2.4 The sensitivity of roads and their users and access arrangements was determined as detailed in Table 14.1 below.

Table 14.1: Sensitivity of roads and access arrangements

Sensitivity	Definition
High	Rural minor roads and access tracks with low traffic flows but limited capacity to absorb any traffic increases. Accesses largely direct to private residences and farmholdings. No dedicated facilities for pedestrians and cyclists.
Medium	Suburban minor roads, forming part of commuter routes, and consequently with moderate traffic flows. Moderate capacity to absorb traffic increases. Accesses direct and indirect to private residences and commercial property. Limited facilities for pedestrians and cyclists – generally only pavements.
Low	Trunk roads or local roads within more urbanised areas, often key commuter routes with relatively high traffic flows. Greater capacity to absorb additional traffic. Greater proportion of indirect accesses (compared with direct accesses) to residential areas or commercial sites. Limited use of carriageway by pedestrians and cyclists. Pavement generally available and occasional cycle route.

Impact Magnitude

14.2.5 The severity, or magnitude, of impact was assessed independently of the site value and, based on professional judgement, assigned to one of the categories described in Table 14.2 below.

Table 14.2: Impact magnitude ratings for traffic and accessibility

Rating	Definition
Major	Increase in vehicle numbers of >25%. Significant delays experienced by existing traffic and journey times substantially lengthened Accesses closed or traffic diverted. Considerable disruption to pedestrians and cyclists and heightened risks in relation to road safety.
Moderate	Increase in vehicle numbers by 10 to 25%. Likelihood of intermittent delays for existing road traffic and marginal increase in journey times.

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Rating	Definition
	Intermittent disruption to accesses during key activities. Moderate disruption to pedestrians and cyclists and attendant road safety implications.
Slight	Minor increase in vehicle numbers (<10%). Minor delays to existing road traffic possible but little effect on journey times. Limited disruption to accesses, primarily during site set-up. Minor disruption to pedestrians and cyclists.
Negligible	Negligible change to baseline conditions.

Impact Significance

14.2.6 The significance of impact (beneficial and adverse) was determined as a combination of the value of the site and the magnitude of impact as shown in Table 14.3.

Table 14.3: Significance rating for traffic and accessibility

Site Value	Magnitude of Impact			
	Major	**Moderate**	**Slight**	**Negligible**
High	Major	Major	Moderate	Slight
Medium	Major	Moderate	Slight	Negligible
Low	Moderate	Slight	Negligible	Negligible

14.3 Baseline Conditions

Road network

14.3.1 The proposed site of the scheme is within the village of Almondbank and adjoining Lochty, some 4 km to the west of Perth city centre. The village is linked to Perth and the A9 (skirting the western edge of the city) to the east by the A85 trunk road. In the opposite direction, approximately 4 km to the west along the A85, is the village of Methven and a further 16 km west of Methven is the town of Crieff.

14.3.2 The A85 does not pass through Almondbank village itself, the village centre (approx. 1 km north of the A85) is reached via an unclassified road (Main Street) running north from the A85 at Lochty (where the A85 crosses over East Pow Burn). The unclassified road/Main Street crosses the River Almond a short distance to the north of the village centre and continues northwards to the village of Pitcairngreen. At Pitcairngreen the road splits with one branch leading north-eastwards to Luncarty whilst the other branch leads north-westwards, crossing the River Almond further upstream then veering to the south west towards Methven. Through the village, from the A85, Main Street includes provision for pedestrians in the form of a formal pavement along one (or both) sides of the road. Main Street is also used by cyclists, and presumably occasional equestrians.

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14.3.3 Despite the presence of relatively large employers such as Vector Aerospace and to a lesser extent Lochty Industrial Estate the villages of Almondbank and Pitcairngreen to the north are very much within the commuter belt of Perth. The most direct route to the city being via the unclassified road/Main Street leading through the centre of the village and connecting with the A85 at Lochty as described above. Whilst there are a number of minor roads branching off this route, these are accesses to residential areas and other private property. Indeed there is only one crossing point over the River Almond (to the north of the village centre) for vehicles and this is expected to have constrained the development of any further through routes.

14.3.4 The main vehicular access route to the western bank of the River Almond within the village (to access the Bowling Club and Playing Field) as well as the residential properties at Low's Work, Brockhill and Puddledub branches off Main Street north-eastwards between the southern edge of the playing fields and the perimeter fence of Vector Aerospace. From the car park adjacent to the river this tarmaced route runs south-eastwards parallel to the river and over a small bridge crossing of East Pow Burn to Low's Work Cottages. The road is also used to access the Scottish Water Wastewater Treatment Plant adjacent to the confluence of the Almond and East Pow Burn. The route is used by pedestrians and cyclists, and presumably occasional equestrians.

14.3.5 The properties at Low's Work and Brockhill can also be accessed from the east. Approximately 750m to the east of the Lochty/Almondbank turn off on the A85, and is an unclassified road leading northwards to the Huntingtower Haugh area comprising the Huntingtower Hotel and newer residential development on Almond Grove, Almond Place etc. Within 500m to the north of the A85 on this unclassified road is an unsurfaced track running west to Huntingtower Field Farm Cottages. This route which is in poor condition and heavily potholed continues in a north-westerly direction to Low's Work Cottages and connects with the main access to these properties (described above) on the southern side of the bridge over the East Pow Burn. Both the aforementioned routes form part of the National Cycle Network Route 77 (NCN77) and are used by pedestrians and cyclists. Also in the vicinity of the confluence is an un-surfaced access track leading south to Green Acre residential property. This route terminates at Green Acre.

14.3.6 Approximately 150m north of the Lochty/A85 junction and leaving Main Street in an easterly direction is the residential access road of Lochty Park. This route is a dead end but crosses the East Pow Burn which runs parallel with Main Street at this point. Beneath the bridging structure is a box culvert. It should be noted that both Lochty Industrial Estate and the Vector Aerospace site are accessed directly from Main Street.

14.3.7 College Mill Road, running parallel with the eastern bank of the River Almond, diverges southwards from Main Street after crossing Almondbank Bridge. This route provides access to commercial property including College Mill Trout Farm, the Ministry of Agriculture storage complex and a workshop/garage premises as well as a number of residential properties on College Mill Road itself, Deer Park and

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Craigneuk Road. All traffic entering College Mill Road must return via that route as this is a no through route.

14.3.8 Listed below is a summary of roads within the vicinity of the proposed scheme:

- The A85, running east (to Perth)/west (to Crieff) immediately to the south of Lochty.
- Main Street heading north from the A85 at Lochty through the centre of Almondbank Village and on to Pitcairngreen Village.
- Unclassified tarmac road, branching north-eastwards from Main Street, providing access to Almond Valley Bowling Club and Playing Field as well as to properties in the Low's Work area and the Scottish Water Wastewater Treatment Works. As well as connecting with the Huntingtower Field Farm Cottages track this route also meets the track south to Puddledub residential property at the same locality.
- Unclassified road leading to Huntingtower Haugh area with un-surfaced track branching westwards (after approx. 500m) to provide access to Huntingtower Field Farm Cottages and linking with the main access to properties at Low's Work (to the north-west) near the confluence of the Almond and East Pow.
- Lochty Park access road turning east off Main Street and crossing East Pow Burn.
- College Mill Road running south from Almondbank Bridge and parallel to the eastern bank of the river. Providing access to College Mill Trout Farm, the Ministry of Agriculture storage complex as would as linking with Deer Park and Craigneuk Road further to the south and the surrounding residential properties.

14.3.9 All routes are accessible to pedestrians and cyclists and are presumed to have occasional equestrian usage also.

Existing traffic

14.3.10 It is assumed that the peak times for vehicle movements along the road network would be during the morning (08:00 until 09:30 – AM peak) and the evening (17:00 until 18:30 – PM peak) Monday to Friday as people travel to and from work.

14.4 Predicted Impacts

Construction traffic access

14.4.1 Construction of the scheme would involve excavation (and removal) of soil to facilitate the construction of floodwall foundations, emplacement of gabions and sheet piling. Topsoil stripping would also take place within the footprint of the flood embankments. A proportion of the topsoil is expected to be stored on site for reuse, however, surplus material would be removed and transported off site to a suitable

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receptor point (yet to be determined). Quantities of imported earth would be required, to construct the flood embankments, along with other materials such as concrete, sheet piles, gabions and stone masonry products. It is anticipated that the largest proportion of vehicle trips per day would occur during the earth removal period and importation of materials phase. However, it is anticipated that soil transportation and importing of other materials using public roads would be spread over the working day but avoiding the AM peak and PM peak wherever possible. In addition the geographical coverage of the scheme and expected phased approach to construction would mean that vehicle movements would be staggered to an extent.

14.4.2 All construction traffic (for every component of the proposed scheme) is expected to travel along the A85 and enter Main Street leading to Almondbank Village at Lochty. Traffic flow along the A85 as well as traffic exiting and entering the Lochty junction may be affected during the construction period due to the presence of site vehicles. Given that the scheme components are dispersed over a considerable area it is anticipated that this single entry point to Almondbank may see the greatest potential for disruption.

14.4.3 Construction within the vicinity of Lochty would necessitate access to Lochty Park and Lochty Industrial Estate, just off Main Street. Further to the north the adjacent Vector Aerospace and Playing Fields/Low's Work access junctions would be used to provide access to enable construction adjacent to the East Pow Burn (largely via the Vector Aerospace site). Access to the right bank of the River Almond and the East Pow confluence would be via the main access to Low's Work running along the bank of the Almond. Additional access to this area is possible via the Huntingtower Haugh access road and the track via Huntingtower Field Farm Cottages although this has been poorly maintained and may not be suitable for large plant.

14.4.4 Construction traffic associated with works on the left bank of the River Almond would require to pass through the village centre and cross Almondbank Bridge which is limited to single directional flow of traffic at any one time due to a priority to oncoming traffic restriction. Construction plant would also require to use College Mill Road. College Mill Trout Farm would be accessed at the northern end of College Mill Road, whilst works close to other residential property would be accessed either directly from College Mill Road or from the adjoining Deer Park. With regard to works at Craigneuk traffic would follow College Mill Road and its continuation, Craigneuk Road, which becomes un-surfaced after a short distance and terminates at the residential properties of Craigneuk East and West.

14.4.5 Potential impacts associated with the construction period comprise:

- Increase in vehicle numbers on public roads causing disruption and an increase in travel times due to large slow moving vehicles.
- Traffic flow restrictions and temporary road closures during construction of flood protection infrastructure and associated improvements to road infrastructure.

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- Disruption to existing access arrangements through construction traffic movement and construction phase land take.
- Road safety implications for other sensitive users of the road network, such as pedestrians, cyclists and equestrians.
- Damage to the existing road surface and verge due to use by heavy construction vehicles.

14.4.6 These impacts are assessed below in terms of effects on local roads, including the A85.

A85

Increase in vehicle numbers

14.4.7 As detailed in Chapter 4, typical vehicles to be used during the construction period would comprise the following (some of which would not be allowed to move on the public road):

- Tracked 360° excavators
- Crane
- Lorries
- Dumper truck
- Vibratory roller
- Sheet pile driver
- Concrete wagon and pump
- Small hand held plant
- Site personnel vehicles - relatively low numbers of cars

14.4.8 There would also be vehicle movements associated with site personnel, specifically at the start and end of each working day, however this is expected to entail relatively low numbers of cars.

14.4.9 In accordance with the criteria described in Table 14.1, the A85 is assessed as medium sensitivity in terms of its capacity to accommodate increased road traffic during the construction period. It is likely that disruption could occur if the number of vehicles increased substantially, particularly during the AM peak and the PM peak. The main construction related movements on public roads would comprise the transport of earth on and off site and the delivery of other construction materials. These movements are expected to be spread throughout the day but there is always the potential for concentrated periods of vehicle movements at certain times during the day.

14.4.10 Using the ratings provided in Tables 14.2 and 14.3, the magnitude of the impact without any mitigation would be slight adverse (less than 10% increase in vehicle

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numbers) which combined with a medium sensitivity, gives an impact significance of slight adverse.

Traffic flow restrictions

14.4.11 Whilst there would be no requirement for traffic management on the A85 it is recognised that there is the potential, during busy periods, for congestion at the Lochty junction particularly as construction related vehicles attempt to enter and exit Main Street. For example, traffic heading west towards Crieff may be temporarily delayed behind construction vehicles looking to turn right, across the eastbound lane and into Main Street. Furthermore, any traffic management implemented during at Lochty which may restrict traffic to one lane controlled by traffic lights, could have the potential to result in traffic backing up Main Street to the junction with the A85.

14.4.12 Although there may be some delays with large construction vehicles turning into Main Street during peak AM and peak PM periods, it is anticipated that when averaged over the working day, the magnitude of disruption to other users of the A85 would be slight adverse and of slight significance overall based on the medium sensitivity of the A85.

Existing access arrangements and sensitive users

14.4.13 There are a number of direct accesses to private property on the A85 in the vicinity of the junction between Main Street and the A85 (Lochty junction). These include accesses to View Mount, Carngeal and Admiralty Cottages to the east of the junction, adjacent to the eastbound carriageway. Station House is also situated to the east of the Lochty junction but on the opposite site of the A85, adjacent to the westbound carriageway. The impact magnitude of vehicle queuing at the junction is assessed to be negligible, when averaged over the working day, and therefore of negligible significance overall.

14.4.14 The A85 at Lochty Junction includes sections of pavement for non-vehicular use and is therefore classed as medium sensitivity using the criteria in Table 14.1. The magnitude of impact on cyclists and pedestrians due to potential queuing of construction traffic is assessed as negligible. The significance of impact would therefore be negligible.

Damage to existing carriageways

14.4.15 It is assumed that the A85 has been constructed to appropriate trunk road standards with the ability to sustain use by heavy vehicles such as fully laden lorries. Damage to the road surface is therefore unlikely to be caused by site construction vehicles and assessed as of negligible significance.

Local Roads

Increase in vehicle numbers

14.4.16 Local roads in the vicinity of the scheme (comprising Main Street, Low's Work access road, Huntingtower Field Farm Cottages access track, College Mill Road, Craigneuk

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Road, Deer Park and Lochty Park) are assessed as high sensitivity in that they have a low capacity to cope with additional traffic that would be generated during the construction period.

14.4.17 Due to the lack of data regarding existing vehicle numbers using these roads, it is not possible to predict the percentage increase in traffic during the construction period. It is possible that the increase could exceed 20% on some routes such as College Mill Road but this is due to the relatively low usage of these roads which are not through routes. In contrast Main Street is unlikely to see vehicle number increases above 10%. Given these circumstances impact magnitude is assessed as moderate adverse and therefore of moderate adverse significance overall.

Traffic flow restrictions

14.4.18 The new road bridge and associated works at Lochty and the new road bridge at the confluence of the River Almond and East Pow Burn are identified as construction operations with the greatest potential effect on traffic flow and access. Construction of the new road bridge at Lochty is expected to result in a temporary access restriction to properties at Lochty Park for a short period whilst the existing bridge is removed and replaced. Lochty Park is not a through route and there are no alternative vehicular access routes. In addition traffic management would be required on Main Street during this operation and during other works in this locality including raising of the road levels to accommodate the bridge, construction of retaining walls at the edge of Lochty Industrial Estate and erection of sheet pile walls along East Pow Burn adjacent to Main Street. Despite disruption during construction development of the scheme components would provide flood protection for Main Street at this location, thereby greatly reducing the potential for enforced closure in the future due to flooding.

14.4.19 The new road bridge at the confluence of the Almond and East Pow Burn would entail closure of the existing bridge for a short period to remove and replace the structure. This would mean that access to properties to the east of the East Pow Burn, i.e. Brockhill, Green Acre and Low's Work Cottages, would be temporarily restricted via the main access road running from Main Street via the playing field car park and along the western bank of the River Almond. There is an alternative, namely the un-surfaced track from the south-east via Huntingtower Field Farm Cottages which could be used during the anticipated short closure period and would be able to absorb the low numbers of vehicles requiring access. During the construction of the flood wall along the right bank of the River Almond it is expected that the aforementioned main access to properties in the Low's Work area may be narrowed to allow a sufficient working area.

14.4.20 The sensitivity of local roads to traffic flow restrictions is assessed as medium primarily because of the relatively limited number of properties likely to be affected and that no main arteries i.e. Main Street are expected to require complete closure. Given a phased approach to construction and the expected short periods of closure required for specific operations the impact magnitude is assessed as moderate adverse at worst and therefore the overall impact significance is moderate adverse.

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Existing access arrangements and sensitive users

14.4.21 There are several private access points off the local road network, within close proximity to the scheme, these include commercial premises such as Lochty Industrial Estate, the Vector Aerospace site, the Scottish Water Wastewater Treatment Plant, College Mill Trout Farm and the workshop/garage on College Mill Road. Residential property includes: The Courts, Brockhill, Green Acre and Low's Work Cottages on the banks of the River Almond, properties on Lochty Park; properties to the south of the trout farm and at Deer Park on the left bank of the River Almond and properties at Craigneuk. With the exceptions of Vector Aerospace and Lochty Industrial Estate the properties identified are all accessed via minor roads and not directly from Main Street. Moreover, with the exception of The Courts and the workshop/garage on College Mill Road access to all the properties may be required by various construction plant to allow construction of the scheme. This is discussed further in Chapter 7 (Land Use).

14.4.22 The potential impacts upon traffic flow (and therefore accessibility) in relation to temporary closure of the bridges at Lochty Park and the confluence of the River Almond and East Pow Burn have been assessed above. Given the requirement for direct access to the majority of the aforementioned properties (access provisions of sensitivity high) by construction plant, the impact magnitude is assessed as slight to moderate. This is because disruption is expected to peak at site set up and from then on access would generally be maintained although exceptions may apply sporadically during certain activities. The impact significance is assessed as moderate to major adverse.

14.4.23 There are no specific facilities for pedestrians (with the exception of a pavement along Main Street) and cyclists, such as footpaths or cycleways adjacent to the local roads affected by construction site traffic and therefore sensitivity is classed of high using the criteria in Table 14.1. That said, it is important to note that much of the minor road network off Main Street e.g. the access road to Black Bridge and beyond to Low's Works, as well as College Mill Road is part of National Cycle Network Route 77. These routes, including a link north from Black Bridge to Main Street via the southern boundary of the bowling green, are also designated as Rights of Way. Potential disruption to sensitive users and road safety implications are assessed to be of moderate adverse magnitude primarily given the close proximity of the works to these routes. Overall the impact significance, without mitigation, is assessed as major adverse.

Damage to existing carriageway

14.4.24 The local roads surrounding the scheme comprise surfaced narrow single carriageway (Main Street) or single track routes (College Mill Road and other minor routes). These roads are susceptible to damage by heavy construction vehicles and without appropriate mitigation, collapse of the road surface and roadside verges may potentially result. This would be likely to cause subsequent impacts on road safety for other users and is assessed as of slight adverse magnitude and of moderate adverse significance overall.

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14.5 Mitigation

14.5.1 In order to address the predicted impacts on existing road users during the construction period a Traffic Management Plan (TMP) would be prepared by the Contractor and agreed with Perth and Kinross Council in advance of any works on site. The Contractor would require to present each property owner with a programme of works relating to the property and to agree specific access arrangements at each property. It is assumed that every effort would be made to ensure that main accesses to properties are useable throughout the construction period. As described above and particularly with regard to residential properties at Lochty Park the removal and replacement of the road bridge would necessitate a temporary closure and there is no alternative access available to these properties.

14.5.2 The TMP would identify key areas where there may be potential conflict between construction site vehicles and local traffic and provide measures to prevent any road safety issues and to reduce potential delays and resultant increase in vehicle travel times for those using the local road network and the A85. The TMP may require one-way systems to be implemented on narrow roads i.e. on the access road to Low's Work where there is the potential opportunity for construction traffic to exit or enter along the track to Huntingtower via Huntingtower Field Farm Cottages. Moreover, due to space restrictions on most routes, construction plant not in use would be returned to designated storage areas to minimise disruption to vehicles or other road users.

14.5.3 Particular consideration would be given to protecting the safety of sensitive users, such as pedestrians and cyclists using the local road network for recreational purposes. This may require temporary diversions at key locations to avoid conflict with construction site traffic. Typically, traffic signaling and warning signage would also be included within the TMP.

14.5.4 Mitigation measures to reduce nuisance to vehicle travellers relating to the deposition of dirt onto public roads would generally involve the use of wheel washing facilities and water bowsers on site.

14.5.5 Any roadside verges or existing road surfaces impacted by construction vehicles would be reinstated to existing conditions following the construction phase.

14.6 Residual Effects

14.6.1 A summary of predicted impacts with and without mitigation is provided in Table 14.7 below.

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Table 14.7: Summary of impacts

Road	Predicted Impact	Impact Significance with Mitigation	Residual Impact (long term)
A85	Increase in Vehicle Numbers	Slight adverse	Negligible
	Traffic Flow Restrictions	Slight adverse	Negligible
	Existing Access Arrangements and Sensitive Users	Negligible	Negligible
	Damage to Existing Carriageway	Negligible	Negligible
Local Road Network	Increase in Vehicle Numbers	Slight adverse	Negligible
	Traffic Flow Restrictions	Slight adverse	Negligible
	Existing Access Arrangements and Sensitive Users	Slight to Moderate adverse	Negligible
	Damage to Existing Carriageway	Slight adverse	Negligible

14.6.2 There would be short term impacts associated with the construction phase of the scheme. With the implementation of mitigation described in Section 14.5 above, all impacts are predicted to be slight adverse or less with the exception of impacts upon existing access arrangements and sensitive users in relation to the local road network which would be slight to moderate adverse in the short term given the proximity of the works which is largely unavoidable. Residual impacts would be negligible.

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15 Cumulative Impacts

15.1 Scope of Assessment

15.1.1 This chapter considers two forms of cumulative impact comprising either:

- combinations of impacts that have been identified during the studies and assessments reported in Chapters 7-15 which would be likely to affect a single receptor; or
- impacts which, in combination with impacts associated with other development which is yet to be implemented, would be likely to have an effect on the environment of greater significance than the proposed scheme in isolation.

15.1.2 In both instances the focus is on the main likely significant cumulative impacts rather than reporting all interactions or combinations.

15.2 Cumulative Impacts on Specific Receptors

River Almond and East Pow Burn

15.2.1 Construction of the flood protection scheme would impact on the River Almond and East Pow Burn. There is the potential for adverse effects on water quality and aquatic ecology resulting from disturbance to river banks and the river channel and from potential run-off of pollutants from construction activities. There would also be impacts on the character of the riverine corridor as a result of the removal of trees necessary for the works footprint and the presence of construction plant and equipment. There would be some disruption to riverside footpaths with potential access restrictions whilst construction works are proceeding. The majority of impacts would mostly occur during the construction phase and would be temporary, however some impacts, such as tree removal would impact on the river corridor for a longer period of time following scheme completion. Adverse effects on the landscape character, ecological value, water quality and amenity value of the watercourses would be mitigated (as described in Chapters 7 to 10), such that in the long term there are no significant in-combination impacts.

Residential properties and recreational/amenity users

15.2.2 Other receptors in proximity to the scheme that may be subject to cumulative impacts are residential properties and recreational/amenity users of footpaths, the playing field and the bowling green. Such impacts would mainly be associated with the construction phase and relate to potential in-combination effects of visual intrusion and noise/vibration disturbance. Visual intrusion would occur as a result of large vehicles working within the site, the removal of trees and vegetation along the river banks, and the installation of fairly substantial walls and embankments, all of which would adversely affect the appearance of and views to the river corridor. As discussed in Chapter 8, some properties in proximity of the scheme would be directly affected by the proposals and would experience a significant change in their existing

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view in the short to medium term. The degree of change to existing views during the operational phase would reduce over time as vegetation is re-established. With regard to noise/vibration nuisance, Perth and Kinross Council would specify noise and vibration level thresholds which the Contractor would adhere to during the construction period so that significant noise disturbance to the local community is avoided. Noise would be temporary and intermittent throughout the construction period and potential noise sources restricted to defined working areas. Adverse visual intrusion and noise/vibration disturbance effects on residential properties and recreational/amenity users would therefore be mitigated such that there are no significant in-combination impacts.

15.3 Cumulative Impacts with Other Development

Housing development

15.3.1 The Perth Area Local Plan (1996) and Perth Area/Central Area Draft Local Plan (2004) identify areas allocated for housing development within the vicinity of Almondbank village (see Figure 7.1). The potential for the construction of up to 250 houses on the site currently occupied by the industrial storage complex and the agricultural land to the south (Ref. ALT H26 on Figure 7.1) is identified. Although flood protection works are proposed within the boundary of this site, the footprint of the works is unlikely to significantly diminish the value or suitability of the land for housing development from existing conditions. The area would receive protection from 1 in 200 year flooding and therefore would benefit in this respect.

15.3.2 It is unlikely that the flood protection scheme construction period would coincide with any development of this housing site. If this situation was to change then there is expected to be considerable scope to phase both the construction of the flood protection scheme and any housing development construction activity so as to avert the potential for any significant cumulative effects with regard to noise/vibration, dust emissions, disruption to traffic movements and local access. No cumulative impacts are therefore predicted.

15.3.3 There is potential for cumulative effects resulting from changes to the landscape and visual amenity of the Almondbank area caused by the proposed flood protection scheme in conjunction with potential increased housing development in Almondbank. This may affect the way in which the landscape is experienced and alter the large open character of the flood plain through further loss of trees and increased urbanisation of the riverine environment. However, considering the limited tree cover within the area defined for housing and the potential for the site to be screened from riverside receptors, cumulative impacts are not anticipated to be significant in the long term. There would be a benefit to the area in that the existing industrial storage sheds would be removed, and further positive effects could occur if any new housing development were to include amenity tree planting that would enhance the site.

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Low Work's Weir

15.3.4 The listed Low Work's Weir is currently undergoing repair and restoration and therefore the structure has already been altered, with appropriate consent. The flood mitigation measures would not have any further effect on the weir and there would be only a slight effect on setting during the construction period. No significant cumulative effects are therefore predicted.

15.3.5 The repair works to Low Works Weir would be completed in advance of the flood scheme and therefore no cumulative construction air quality or noise/vibration impacts to nearby receptors are therefore predicted.

Farming activities

15.3.6 Minor adverse impacts may arise if the construction of the flood protection scheme, and particularly the works adjacent to arable farmland, coincided with the harvesting period. This could result in increased numbers of slow moving vehicles on public roads causing disruption as well as adding to the level of risk to sensitive users such as pedestrians and cyclists in regard to safety. Measures would be put in place to minimise disruption including timing of the works and traffic management where necessary.

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16 Schedule of Environmental Commitments

16.1 Introduction

16.1.1 The assessment of the proposed scheme has identified a number of potentially significant impacts that would arise as a result of the construction and future use of the scheme. Mitigation measures have been identified with a view to reducing these potentially significant impacts.

16.1.2 The key environmental design and mitigation measures identified and reported in this ES are scheduled below (Table 17.1).

16.1.3 The Schedule of Environmental Commitments would be incorporated into the flood protection works construction contract documents and the appointed Contractor would be required to adhere to these requirements throughout the contract period. The construction commitments would be addressed through the CEMP.

16.1.4 The Schedule of Environmental Commitments table includes the following information:

- Description of the mitigation measure;
- Mitigation objective;
- Location and timing of mitigation;
- Monitoring requirements (if required); and
- Any additional comments.

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Table 17.1: Schedule of Environmental Commitments

Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
Land Use				
Minimisation of land take.	To minimise loss of land and disturbance to land during construction.	Entire scheme during detailed design and construction.	Monitored during construction by Environmental Clerk of Works. Details to be included in Method Statements and Construction Environmental Management Plan (CEMP).	Liaison between Contractor and landowner if required.
Maintain existing access arrangements and provide alternatives where this is not possible.	To minimise disruption and maintain access to land, property and recreational areas/rights of way.	Entire site, wherever access routes would be affected.		Liaison between Contractor and landowner if required.
Site restoration including private gardens, recreational areas and commercial property. Maximise return of land to agricultural use. Tree planting to compensate for loss of trees. Reinstatement of any disturbed field drains.	To minimise permanent loss of land and to enable land disturbed during the construction phase to be returned to its original use as quickly as possible.	Entire site, during detailed design and construction.		Liaison between Contractor and landowner if required.
Careful soil removal and handling procedures during site clearance and restoration.	To reduce damage to soil structure and agricultural capability	Entire site, during construction and restoration.		N/A
Re-use of surplus soils during site restoration where possible.	To reinstate land using existing soils and reduce the need for importation of materials and waste disposal off-site.	Entire site, during construction and restoration.		N/A
Landscape and Visual				
Landscape design in accordance with Scottish Executive's landscape design and management policy: Cost Effective landscape: Learning from Nature.	To ensure that the flood prevention scheme is properly integrated into and related to its setting.	Throughout the scheme, its preparation, construction and maintenance period.	Throughout the detailed design and contract period to assess any further action required.	N/A

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Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
Particular care and attention has been given in the design to avoiding disturbance to trees and woodland. This care would continue during the construction of the scheme.	To minimise adverse impact on landscape character.	Throughout the scheme, its preparation, construction and maintenance period.	Throughout the detailed design and contract period to assess any further action required.	Some disturbance would be inevitable. Woodland would be reinstated where practicable and compensation planting undertaken.
The appearance of each individual engineering element (gabions, concrete walls, earth embankments, pumping station, bridge) to be carefully considering as to how they relate to each other and to their setting.	To achieve integrated engineering and landscape design.	Throughout the scheme, its preparation, construction and maintenance period.	Detailed design, throughout the contract period to assess any further action required.	N/A
Visually prominent concrete wall to be faced and coped with natural stone. Trees and shrubs to be planted where appropriate.	To reduce the adverse impact of concrete walls, especially when viewed from the public land south of the river.	Between the residential properties of Rhourkton and Druid's House and the river. Along the flood wall adjacent to the river footpath and Vector Aerospace where practicable.	Throughout the detailed design and contract period to assess any further action required.	Tree/shrub planting to comprise typical local riverside species. All other visually prominent walls to be treated likewise.
Provide screening in the form of mixed native hedgerow planting to match the existing roadside planting between the footbridge and No. 1 Deer Park.	To provide additional screening to and from the re-located foot-bridge. To limit any additional visual intrusion to No. 1 Deer Park.	Between the bridge and No. 1 Deer Park north of the river. Contract requirement.	Post-construction under landscape maintenance contract.	N/A
Replant the hedge at Lochty Industrial Estate.	To reinstate screening of the Industrial Estate from Lochty Park properties opposite.	Following the construction of the new road bridge between and Lochty Park.	Post-construction under landscape maintenance contract.	N/A

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Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
Design earth flood embankments so they do not appear unnecessarily artificial.	To properly integrate and relate the functional structures to their settings.	4 locations: 1. along the riverbank south of No. 4 Deer Park to Low's Work weir 2. South of Brockhill. 3. South of Craigneuk East and west. 4. Along the southern boundary of the playing field.	Throughout the detailed design and contract period to assess any further action required.	Trees and shrubs would be planted to complement the earth moulding in locations 1 and 4. The embankment and tree planting along the southern boundary of the playing field would partially screen the unattractive appearance of the Vector Aerospace when viewed from the playing field and beyond.
Construction of dwarf stone wall in the same materials and style as the riverside wall opposite Low's Weir Cottages.	To provide continuity of landscape character.	Along the riverside of the access road to Low's Weir Cottages.	Throughout the contract period to assess any further action required.	N/A
Reinstate burn-side habitat and private gardens impacted upon by the scheme. Use of biodegradable geosynthetic materials to aid regeneration of bank-side vegetation and protect tree roots. Use of coir rolls and/or wouldow spiling to be considered in combination with these.	To restore landscape character, local amenity and ecological value of the burn.	Each side of East Pow Burn in the vicinity of Lochty Park.	Throughout the detailed design and contract period to assess any further action required.	The ecological value of the burn-side habitat can not be replaced in the short term. It would develop progressively in time.
Existing topsoil stripped and stored on site for re-instatement on site. All areas of bare earth grass seeded or suitable ground conditions created within the woodlands.	To restore landscape character, local amenity and encourage natural regeneration.	Entire site, post-construction.	Throughout the contract period to assess any further action required.	N/A

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Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
Water Quality and Hydrology				
Existing wastewater and surface water outfalls to the watercourses to have non-return valves fitted.	To prevent back flow, surcharge and contamination	Along watercourses.	During the detailed design construction phases	N/A
Adoption of appropriate pollution control procedures, in accordance with SEPA guidance. Specific control measures during concreting works. Stockpile any construction materials away from watercourses.	To reduce the risk of sediment laden surface water / concrete being released to local watercourses and ground water.	In working areas and site compounds at all times during construction.	During construction.	Reference to SEPA Pollution Prevention Guidelines.
Adequate measures to deal with fuel and oil transport and storage, such as the inclusion of appropriately bunded areas and spillage trays.	To capture potentially polluted run-off before it enters local watercourses.	Installed on construction sites prior to the commencement of works until works are completed.	Ensure rainfall is collected in the drain by checking settling tanks after storm events.	N/A
Install cut-off drains	To capture potentially polluted run-off before it enters local watercourses.	Installed on construction sites prior to the commencement of works until works are completed.	Ensure rainfall is collected in the drain by checking settling tanks after storm events.	N/A
Dewatering of groundwater in excavations.	To protect groundwater from pollution from the construction site.	At working sites where excavation is required from start of excavation until completion of works.	Monitor groundwater levels using suitable monitoring wells.	N/A
Scheduling of earthworks to minimise soil exposure.	To prevent surface water run off washing sediment into watercourses and protect the river banks.	Across all working areas for the duration of construction.	During construction.	N/A
Sustainable re-use of materials and best practice with regard to waste management.	To fulfil material/waste management requirements.	Across all working areas during construction/post-construction.	During construction.	N/A

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Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
A detailed site bank /watercourse restoration strategy.	To reinstate riparian corridor.	Across all working areas during construction/post-construction.	Post-construction under landscape maintenance contract.	Developed in discussion with relevant statutory organisations, such as SNH, and in conjunction with the adjacent landowners.
Ecology and Nature Conservation				
Minimise footprint of flood prevention operations and disturbance due to access.	To reduce habitat loss.	Entire scheme, during detailed design and construction.	Monitored on site during site preparation and construction activities. Details to be included in Method Statements.	Reference to best practice guidelines.
Otter disturbance licence likely to be required from Scottish Natural Heritage. Detailed method statement and reasonable avoidance measures to be drawn up and agreed with SNH. Creation of an artificial replacement holt if the loss of the existing holt(s) cannot be avoided.	To mitigate for loss/disturbance to otter holt.	At specific locations, pre-construction and site restoration.	Monitored on site during site preparation and construction activities. Details to be included in Method Statements.	Discussion with ecological specialist/SNH required.
Checks for and removal of invasive plant species. Strategy for removing giant hogweed for welfare of construction workers.	To avoid the spread of invasive species and reduce risk of injury.	Entire scheme, pre-construction.	Monitored on site during site preparation and construction activities. Details to be included in Method Statements.	Reference to best practice guidelines.
Vegetation clearance to be undertaken between August and March (i.e. outwith the bird breeding season). All areas of vegetation to be checked for the presence of bird nests prior to removal.	To avoid disturbance to nesting birds.	Entire scheme, prior to site clearance.	Monitored on site during site clearance and construction activities. Details to be included in Method Statements.	Discussion with ecological specialist required.

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Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
Works within river channel to be completed between the months of June and October. If works are necessary in the river channel outwith this period, mitigation will be agreed with	To avoid salmonid spawning periods, thereby reducing damage/disturbance to fish eggs that may be present in the watercourses.	Works within river channel, during construction.	Monitored on site during site preparation and construction activities. Details to be included in Method Statements.	Consultation with Tay District Salmon Fisheries Board.
Further survey and inspection by a suitably experienced ecologist / licensed bat worker of trees with bat roost potential that are to be felled. Determine any licensing requirements.	To ensure no bat roosts are damaged/destroyed.	Entire scheme, prior to site clearance.	Monitored on site during site clearance and construction activities. Details to be included in Method Statements.	Discussion with ecological specialist required.
Containment and treatment of construction site surface water run-off prior to discharge to any watercourse.	To reduce risk of pollution and ensure water quality/habitats and species not detrimentally affected.	Entire scheme, during construction.	Regular monitoring of watercourses. Details to be included in Method Statements.	Consultation with SEPA.
Adequate pollution prevention measures would be required to be put in place in close consultation with SEPA. Locate material storage compounds away from watercourses. Containment and treatment of surface water run-off high in suspended solids prior to discharge to any watercourse.	To ensure water quality is maintained, reduce risk of pollution.	Along scheme length, at key locations, during construction.	Regular monitoring of watercourses during construction. Details to be included in Method Statements.	Reference to SEPA Pollution Prevention Guidelines and other best practice
Minimise noise and vibration emissions through use of sensitive construction techniques.	To reduce any impact on wildlife and habitats.	Entire scheme, during detailed design and construction.	Monitored on site during construction. Details to be included in Method Statements.	N/A
Seek opportunities to provide suitable dipper nesting crevices and water vole habitat within gabion structures.	To promote habitat enhancement and address loss of bankside.	Where gabions are proposed, during construction/restoration.	Monitored on site during construction. Details to be included in Method Statements.	Discussion with ecological specialist required.

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Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
Ensure that flood prevention operations allow free passage for wildlife, in particular otter.	To minimise disturbance to wildlife activity.	Along scheme length, during construction.	Details to be included in Method Statements.	N/A
Reinstate the beds and banks of watercourses to an agreed standard.	To minimise disturbance to the beds and banks of watercourses and sensitive species.	All watercourses affected, during/post-construction.	Monitored on site during construction activities and post-construction/restoration. Details to be included in Method Statements.	Discussion with ecological specialist and SEPA.
Replanting using native tree/shrub species planting.	To mitigate loss of habitat to footprint of flood prevention operations.	Along scheme length, at key locations, during site restoration.	Details to be included in Method Statements. Monitored as part of post construction maintenance period.	Discussion with ecological specialist/landscape architect required.
Use native grass and flower seed mix to re-vegetate the sides of the new embankment to encourage development of species-rich grassland of value to invertebrates and small mammals.	To mitigate loss of habitat to footprint of flood prevention operations.	Along scheme length, at key locations, during site restoration.	Details to be included in Method Statements. Monitored as part of post construction maintenance period.	Discussion with ecological specialist/landscape architect required.
Cultural Heritage				
Fencing-off of working areas and careful siting of storage compound.	To minimise the risk of disturbance or damage to listed buildings as well as visual impact on setting.	Entire scheme during construction but especially in the vicinity of the B-Listed Low's Work Cottages.	Monitored during construction by Environmental Clerk of Works. Details to be included in Method Statements and Construction Environmental Management Plan (CEMP).	Liaison with qualified archaeologist.
Contractor to be made aware of the potential for discovery of unrecorded sites and consequently the need to adopt careful construction techniques.	To minimise the risk of disturbing or damaging previously unrecorded archaeological sites.	Entire site during construction period.	Details to be included in Method Statements and CEMP.	Contractor to cease work immediately on making any archaeological discovery. Qualified archaeologist to be consulted.

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Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
Geology, Soils and Contamination				
Excavated material from the Deer Park area would be appropriately removed and dealt with.	To remove any potential source of contamination.	Deer Park during construction.	Monitor during construction.	Contractor to implement appropriate mitigation measures.
Limit extent of working and storage areas. Erosion and sediment controls. Correct handling and storage of spoil. Restoration of disturbed areas. Tracked vehicles to be used where possible. Pollution prevention measures to be put in place to prevent accidental spillage.	To minimise soil degradation and contamination and to return areas to existing use where possible.	Entire site during construction and restoration.	Monitored on site during construction period by the Environmental Clerk of Works. Details to be included in Method Statements and CEMP.	N/A
Appropriate disposal or re-use of surplus material. Recycling of soils on site for embankment construction and landscaping. Determination of receptor site for surplus material.	To maximise re-use of soil on site and where this is not possible an appropriate receptor site to be identified.	Entire site during construction and site restoration.	Monitored on site during construction period by the Environmental Clerk of Works. Details to be included in Method Statements and CEMP.	N/A
Air and Noise				
Phased approach to Construction. Cessation of earthworks during high winds. Minimise area of earthworks. Careful soil stripping and stockpiling away from sensitive receptors. Lorries containing fine materials to be covered. Dust suppression techniques to be used where necessary. Enforcement of speed limit for construction vehicles on site. Use of water assisted dust sweeper on local roads if required.	To minimise release of dust and particulates from construction activities and plant.	Entire working area during construction. Especially in areas where earth embankments are to be constructed.	Monitored on site during construction period by the Environmental Clerk of Works. Details to be included in Method Statements and CEMP.	N/A

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Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
Noise thresholds to be set by PKC. Use of well-maintained plant. Maintenance of silencers and moving parts where necessary. Noise screening if necessary. Switching off of equipment when not in use and noise generating activities to be conducted during normal working hours. Vibration levels to be restricted at all sensitive receptors. Soft start to piling and piling to be undertaken intermittently. Structural assessment/monitoring of buildings in close proximity to piling works.	To minimise generated noise/vibration levels that could result in nuisance to sensitive receptors or damage to buildings.	Entire site prior to and during construction period. Vibration assessment particularly at Lochty Park.	Monitored on site during construction period by the Environmental Clerk of Works. Details to be included in Method Statements and EMP.	Liaison with PKC Environmental Health.
Traffic and Access				
Traffic Management Plan (TMP) to be developed and implemented in conjunction with a phased approach to construction. Deliveries to site to be spread throughout the working day where possible.	To provide measures to enhance safety and prevent conflicts between road users and site traffic.	Public roads and site access points during construction period.	Monitored during construction by the Environmental Clerk of Works. Details to be included in TMP.	TMP to be agreed with PKC Roads Department. Consultation with local landowners and residents.
Temporary diversions for pedestrians, cyclists etc. where necessary to avoid conflict with construction traffic and bride/road works operations.	To minimise safety risks to pedestrians, cyclists and equestrians.	Public roads and site access points during construction period.	Monitored during construction by the Environmental Clerk of Works. Details to be included in TMP.	Details to be included in TMP.
Use of wheel washers and water bowsers.	To reduce potential public nuisance.	Public roads and site access points during construction period.	Monitored during construction by the Environmental Clerk of Works. Details to be included in Method Statements and EMP.	N/A

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Mitigation Measure Description	Mitigation Objective	Location and Timing of Mitigation	Monitoring Requirements	Additional Comments
Reinstatement of any damaged road surfaces and verges following construction	To restore road surfaces and verges to original condition prior to construction.	Public roads and site accesses post construction	Monitored during construction by the Environmental Clerk of Works. Details to be included in Method Statements and EMP.	To be agreed with PKC.
Socio-Economic				
Good site working practice to minimise land take and maintain access (fencing off of working areas). Phased construction. Traffic Management. Use of local labour where possible. Pollution prevention measures. Site restoration.	To minimise socio-economic and recreational issues.	Entire site during and following construction.	Monitored on site during construction period by the Environmental Clerk of Works. Details to be included in Method Statements and CEMP.	N/A

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