



# Stirling-Alloa-Kincardine Railway (Route Re-opening) and Linked Improvements (Scotland) Bill

## ENVIRONMENTAL STATEMENT

### VOLUME 2

### TOPIC SPECIFIC REPORTS

FEBRUARY 2003

**CLACKMANNANSHIRE COUNCIL**

**STIRLING - ALLOA - KINCARDINE RAILWAY (ROUTE RE-  
OPENING) AND LINKED IMPROVEMENTS (SCOTLAND) BILL**

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**VOLUME 2**

**TOPIC SPECIFIC REPORTS**

**FEBRUARY 2003**

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## **1. INTRODUCTION**

### **1.1 Background**

This document relates to the Stirling–Alloa–Kincardine Railway (Route Re-opening) and Linked Improvements (Scotland) Bill introduced in the Scottish Parliament on 27 March 2003 (to be confirmed). It has been prepared by Scott Wilson Scotland Limited on behalf of Clackmannanshire Council to satisfy Rule 9A.2.3(c)(iii) of the Parliament’s Standing Orders. The contents are entirely the responsibility of the promoter and have not been endorsed by the Parliament.

### **1.2 Purpose and Structure of Volume 2**

This document is Volume 2 (Topic Specific Reports) of the Environmental Statement, which presents the findings of the environmental studies undertaken for each topic. Volume 1 (Main Report) presents the Scheme proposals and provides a summary of the significant environmental effects. Volume 3 (Supporting Information) contains supporting information for a number of the specialist topics in Volume 2, references and a glossary of terms and abbreviations used. In addition, a separate Non-Technical Summary has also been prepared, which provides a brief summary of the Scheme and the principal findings of the environmental assessment in non-technical language.

This document describes the environmental studies for following specialist topics:

- § Policy Context
- § Land Use
- § Community Effects
- § Cultural Heritage
- § Agriculture
- § Air Quality
- § Landscape and Visual Effects
- § Ecology
- § Geology
- § Noise and Vibration
- § Water Resources
- § Traffic and Transport

## 2. POLICY CONTEXT

### 2.1 Introduction

The purpose of this chapter is to demonstrate how the Scheme shows consistency with current policy. Sources of information used include National, Regional and Local policy documents. The policy analysis will be directed specifically towards the three Scheme objectives of improving public transport accessibility links to Alloa, relieving pressure on the Forth Bridge, and improving freight transportation to Longannet Power Station. Therefore, certain policy areas linked with these objectives will be covered in more detail than less pertinent policies. No technical difficulties were experienced during the policy context assessment. Statutory consultations with Local Authorities were undertaken, and responses were received from Stirling, Clackmannanshire and Fife Councils.

### 2.2 Methodology

A desk top study has been undertaken to identify and review existing and emerging land use policy issues at a national (NPPG's/PAN's), regional (structure plans) and local level policy to identify existing and emerging issues, policy initiatives and Local Plan proposals relevant to the consideration of the Scheme, and its development implications for inclusion in the Environmental Impact Assessment. The scoping stage included consultation with the Local Authority planning departments, to consider the effect of the Scheme upon land use and transport policy (which is included in Volume 2 Chapter 13) and development patterns along the route and determine the major policy and land use concerns.

In assessing the effects of the Scheme in relation to policy objectives, it is important to set criteria, which allows the significance of the effect to be determined. DMRB (Vol. 11) provides guidance on the assessment of a (road) scheme in relation to National, Regional and Local policies, yet does not describe the criteria for assessment or the weighting that should be placed on particular policy objectives

Whilst noting the guidance contained within DMRB (Vol. 11), for the purposes of this environmental statement the assessment of the Scheme against policy objectives will identify the level of policy affected, the magnitude of any impact, and the effects that the Scheme has on promoting or inhibiting policy and proposal implementation. Table 2.1 indicates the levels of policy identified and assessed in relation to the Scheme, with Table 2.2 outlining the criteria to which the magnitude of effects on policy was assessed.

**Table 2.1: Level of Policy**

Levels of Identified Policies
National
Regional
Local

**Table 2.2: Magnitude of Impact Criteria**

<b>Magnitude of Impact</b>	<b>Level Conformity</b>
Significant	Directly implements/contravenes policy objective
Moderate	Promotes/inhibits policy implementation
Slight	Is a component of promoting/inhibiting policy implementation
Negligible	Has no beneficial/adverse role in promoting policy objectives

## **2.3 Consultation**

As part of the statutory consultation exercise the four local authorities of Stirling, Clackmannan, Fife and Falkirk were approached for their views of the Scheme. No significant issues were raised with regard to each authorities policy objectives, with Clackmannanshire Council highlighting its overriding support for the Scheme. Both Fife and Stirling Councils provided existing land-use data and further contact information as their response. There was no response from Falkirk Council with regard to consultation.

The Scottish Executive Development Department was also approached as a consultation body, with the only issues raised being the proposed Upper Forth Crossing and Link Road in Kincardine (see Volume 1, Figure 1.2).

The responses received from consultation bodies can be seen in Volume 3, Ch 1, Appendix 1B.

## **2.4 Baseline**

The baseline describes those National, Regional and Local policies and proposals that directly support the principle of the Scheme or present potential issues through future proposals or objectives that might be jeopardised by the reopening. Baseline investigations have been made relating to land use and national transport policy issues, with local transport policy being covered in Volume 2, Chapter 13. Land ownership is reported separately to the ES.

### **2.4.1 National Transport Policy**

In July 2000, the Government launched its ten-year transport plan 'Transport 2010'. This document explained the objectives for the future of transport and provided details on how this would be implemented. Key objectives of this document related to the promotion of sustainable and integrated forms of transport, linking people to the places they wanted to go through effective land-use planning, and creating an efficient, cost-effective yet safe transport network for all to benefit from.

This document outlined the ways and approaches that could be taken to achieve these objectives. The overriding factor in achieving full implementation of transport policy objectives, is the way that local and regional government co-ordinate with each other on transport issues, as well as how they integrate the transport agenda within their own policy framework. With this in mind it is prudent to take account of the policy framework, both Local and Regional, in relation to the location context of the Scheme.

With particular reference to Scotland, the 1998 White Paper ‘Travel Choices for Scotland,’ outlined the integrated approach that Government would adopt in an attempt to promote strategic transport initiatives in Scotland once Devolution occurred. Freight transportation is promoted in section 4.16 of the White Paper.

#### 2.4.2 National Social Policy

The promotion and implementation of policies that support social inclusion are paramount to the current political climate. In Scotland, ‘social justice’ has been promoted with the publication of ‘Social Justice: A Scotland where everyone matters.’ (1999). This outlines the Scottish Executives objectives in relation to promoting social inclusion, which are:

- § The elimination of child poverty
- § Full employment by providing opportunities for all those who can work
- § Securing dignity in old age
- § Building strong, inclusive communities

The promotion of these objectives requires policy tools equipped to tackle the overarching problems associated with social deprivation.

#### 2.4.3 National Economic Policy

The proposed Scheme could support national policies relating to economic development, for example, by way of improving access to employment and attracting local investment. Economic development will be covered in more detail within the Local Policy section.

#### 2.4.4 National Environmental Policy

The proposed Scheme could affect environmental policies at all levels with respect to improving air quality, providing alternatives to private car usage, promoting integrated transport systems, and improving access to public transport. However National Planning Policy Guidance 17: Transport and Planning (see Table 2.5) is considered to cover the environmental effects of a proposal such as the Scheme.

#### 2.4.5 National Planning Policy Guidance

National Planning Policy Guidance (NPPG) publications form part of the ‘Planning Series’, which also includes Circulars and Planning Advice Notes (PANs). The Scottish Executive describes NPPGs as:

‘...statements of Scottish Executive policy on Nationally important land use and other planning matters, supported where appropriate by a locational framework.’ (Scottish Executive website)

The following NPPGs are considered relevant to the proposed Scheme, as they provide guidance on development that would directly affect Central Government policy.

**Table 2.3: NPPG Description.**

<b>Planning Policy Document</b>	<b>Status of NPPG</b>
NPPG 5: Archaeology and Planning	This NPPG sets out the Government's planning policy on how archaeological remains and discoveries should be handled under the development plan and development control systems, including the weight to be given to them in planning decisions and the use of planning conditions. (NPPG 5, Para. 1)
NPPG 14: Natural Heritage	This NPPG gives guidance on how the Government's policies for the conservation and enhancement of Scotland's natural heritage should be reflected in land use planning. (PPG 14, Para. 1)
NPPG 17: Transport and Planning	This NPPG...is intended to develop the integrated land use and transport planning elements of the UK White Paper 'A New Deal for Transport: Better for Everyone' (NPPG 17, Para. 1)

#### 2.4.6 Regional Policy

Structure plans outline the main regional policy. The Scheme is directed by two such documents, The Clackmannanshire and Stirling, and Fife Structure Plans.

##### *Clackmannanshire and Stirling Structure Plan (Finalised August 2000)*

The Clackmannanshire and Stirling Structure Plan sets out the joint intentions of the two councils to meet their economic, social, and environmental demands whilst ensuring that the principles of sustainable development, in accordance with Local Agenda 21, are taken into account. The Clackmannanshire and Stirling Structure Plan supports the principle of sustainable development through its 'key principles,' outlined in Policy SD1. The principles that relate to the reopening of the Stirling-Alloa-Kincardine route are:

- § That full account has been taken of the impact on the environment. New development will only be permitted where it can be accommodated in an environmentally acceptable manner.
- § That the re-use of suitable Brownfield sites, including derelict, disused or contaminated sites and buildings within settlements, has been sought in preference to Greenfield sites.
- § The potential of the development to contribute towards the enhancement of employment opportunities, social inclusion, community safety and, where relevant, urban and rural regeneration.
- § That the potential of the development to promote efficient re-use of resources including energy, materials, land, buildings and infrastructure has been addressed.
- § Appropriate mitigation and compensatory measures will be required from developers if a potential adverse impact on the community or the environment has been identified.

The Structure Plan also supports the Scheme when it states that development will be promoted and encouraged within the 'Core Area' of the region, which encompasses the two major settlements of Stirling and Alloa, as it is considered by both authorities as a 'sustainable location.'



Furthermore, the greatest support for the Scheme is demonstrated by the Structure Plan's intentions of creating a sustainable and integrated transport network for the region. Policy TR1 promotes the concept of 'Integrated Transport' as sustainable practice, offering choice and efficiency to the public. There is also support for the Scheme in Policy TR2 (objective 3), where there is an encouragement in the shift of freight movement from road to rail routes. Policy TRP1 (objective 2) directly relates to the reopening of the Scheme as part of the Stirling-Alloa-Dunfermline rail route, and generally safeguards rail freight routes that can contribute towards regional development strategies.

#### *Finalised Fife Structure Plan (2001)*

Becoming operative, subject to modifications, on the 8<sup>th</sup> July 2002, the document outlines Fife Council's strategic intention for the Kingdom, with specific reference to sustainable development.

The Scheme proposal occupies part of West Fife, a mix of former fishing villages and extensive employment/industrial designations. The reopening of the line is proposed by the Fife Council as point 11 of PROPOSAL PT2, whereby the Council seeks to improve freight rail capacity within the region.

PROPOSAL PT2 also outlines the Councils support for the 'Kincardine Eastern Bypass', yet there is no policy support within this proposal for the Upper Forth Crossing, only the safeguarding of the existing Kincardine Bridge.

Policy E8 supports ScottishPower's intention of redeveloping the redundant site at Kincardine Power Station for clean coal technology generation.

#### *Falkirk Council Structure Plan: Report of Survey (2001)*

Although not directly affected by the proposed Scheme, it is important to respect the objectives of Falkirk Council, particularly on sustainable development, as the north-east coast of Falkirk looks over the Firth of Forth towards Fife. This factor has potential implications for impacts on the visual landscape, as it is within Fife that the Scheme forms a coastal railway between Kincardine and Longannet.

### 2.4.7 Local Policy

The Local Plans for Stirling, Clackmannanshire and Fife have been reviewed for policy relevance to the Scheme. There is also justification for examining Falkirk Council's adopted Local Plan as the coastal nature of sections of the Scheme may have an impact on the visual amenity south of the Firth of Forth.

#### *Stirling Local Plan (1999)*

The adopted plan does not have any specific policies that safeguard the reopening of the Scheme, but there are references to the benefit that the proposal would have on development opportunities in and around Stirling.

Policy STIR.T, whilst not safeguarding the Scheme, promotes the reopening of the Stirling to Alloa line for passenger use.

Policy STIR E1 safeguards the allotments at the Forth Viaduct and Stirling RFC's ground at Bridgehaugh, with the Council supporting proposals that enhance the open space areas and

contribute to the establishment of a “Green Corridor” network in the interests of amenity, outdoor recreation etc.

The Manor Powis level crossing provides access across the solum to the redundant Manor Powis Quarry site, which both the Stirling Council Adopted Local Plan (1999) Proposal Blar.1 and the current Clackmannanshire Adopted Local Plan (1994) Proposal T65 identify as an economic development site. Stirling Council has indicated that the site is currently being considered as a possible location for a waste transfer, recycling and composting facility through the Waste Management Planning process.

POL.E43 to POL.E45 aim to preserve the character of listed buildings by ensuring sympathetic development around them, the retention of original fittings and features, and a presumption against development that would adversely affect them unless strongly justified.

#### *Clackmannanshire Local Plan (1994)*

The adopted Local Plan for Clackmannanshire supports the concept of the reopening of the Stirling-Alloa-Kincardine route in broad terms. Policy INF 1, a presumption against development that will jeopardise the reopening of the Scheme, is the only safeguard of the proposal, and it is clear that details of the Scheme were not fully known at the time the plan was prepared. However, with the formulation and deposit of the Finalised Local Plan (2002) the Scheme is given greater policy support.

#### *Clackmannanshire Local Plan Draft Deposit: Finalised Local Plan (July 2002)*

This document, subject to the public consultation period, will supersede the existing adopted plan. The Plan supports the reopening of the Stirling-Alloa-Kincardine railway through its infrastructure schedule of sites, Plan Reference Numbers 7, 15, 21 and 34, with the provision of passenger services to Alloa and freight services to Longannet. Plan Reference Number 8 also supports the Scheme in principle by supporting the development of a new railway station at the Whins Road West site (former brewery site).

The Local Plan aims to ensure the viability of the Scheme by protecting the existing rail corridor. Policy INF 1 states that ‘there will be a presumption against development which would prejudice the reopening of the Alloa-Stirling-Kincardine rail line and stations at Cambus, Alloa and Clackmannan.’

The Local Plan does not give policy support to any development that would result in the loss of an asserted Right of Way or other paths forming part of the Clackmannanshire Country Path Network (Policy INF 3). Proposal T17 proposes a cycle route extension from the A907 to Cambus Main Street – crossing the railway west of the New Mills level crossing.

Proposal T6 proposes the closure of the Grange Road/Stirling Road junction, Alloa, at the level crossing whilst the 1994 Plan (Business Proposal 20) and Proposal 4 of the Local Plan First Alteration document 1997 propose an office development opportunity (between Stirling Road and the solum) – subject to the closure of Grange Road.

Proposal J16 identifies the ongoing development of the fledgling New Alloa Business Park for Class 4 use and possibly Class 5 and 6 use, whilst Proposal J10 includes Alloa Park on the eastern boundary of Alloa south of the solum, and the A907 as a Class 4 business development site.

Proposals T8 and J2 zone the brewery site for development of a new rail station with associated car park and integrated with development use options including non-food retail, business, leisure and hotel development.

The Local Plan also supports the proposal of the 'Eastern Relief Road' (now the Alloa Eastern Link Road), with Proposal T4 detailing the extent of works to be undertaken, and relating the road proposal to the Stirling – Alloa – Kincardine Route Re-opening.

Proposals H1(1) and H1(2) zone two sites for housing located directly adjacent to the west of the proposed Alloa Eastern Link Road alignment on the Diageo owned Carsebridge Bond land (which will have the capacity to accommodate approximately 200 housing units at a density of 30 units per hectare). The housing would be subject to the preparation of a masterplan for the entire expansion area with the proposed access for site H1(1) via Hilton Road and site H1(2) via the Alloa Eastern Link Road.

Proposals H12 to H16 zone five sites for housing (which will have the capacity to accommodate approximately 300 units) at Alloa Park south of the proposed new Clackmannan Road roundabout. The policies are subject to the preparation of a masterplan with a proposed phasing of housing construction. Access would be from the existing distributor road off the current roundabout entry from Clackmannan Road into the Alloa Park retail park.

Proposal J11 zones a 10 hectare area at the north of the Diageo Carsebridge Bond site (northeast of the proposed road alignment) for Class 4, 5 or 6 development use with the bonded warehouses in this location being cleared to permit business/industrial redevelopment use – subject to the preparation of a development brief. Access to the redeveloped site would be from the Whins Road roundabout via Carsebridge Road and/or the new Alloa Eastern Link Road.

The Local Plan lists the proposed development of an Autistic Centre directly adjacent to the south of the solum and east of the New Alloa Pavilions Business Park (Proposal CR9) - and for which planning consent has recently been given - whilst the current Alloa Health Centre site is zoned for future re-use/demolition with quality refurbishment/new build on site providing potential NHS Trust/Primary Care/Business/Housing use options (Proposal J8 & H5). In addition, Proposal CR10 proposes the provision of a new community centre to serve the Hawkhill area of Alloa south of the Clackmannan Road/Hilton Road junction.

Policy EN1 protects sites of Local Ecological Importance, by ensuring that development is not permitted where there will be a risk of being unable to achieve the guidelines and actions of the Local Biodiversity Action Plan (see chapter 9, Volume 2). Both the Manor Powis and New Alloa Marshalling Yards are designated wildlife sites by the Scottish Wildlife Trust, and are included within the Local Biodiversity Action Plan.

Policy EN7 states that development will not be permitted where it could destroy or adversely affect a Scheduled Ancient Monument. However, development may be permitted where the public interest in the Scheme outweighs the archaeological importance of the site, or where there is no appropriate alternative location for the proposal, or the proposal is designed to minimise any adverse impact on the site.

### *Fife West Villages Local Plan (2000)*

The Local Plan covers the section of the Scheme from Broomknowe, to the north of Kincardine and Longannet Power Station where the proposal ends. Within the West of Fife, the proposed railway would travel through an extensive area of industrial land-use and would also run adjacent to the estuarine coastline for approximately 2.2km between Kincardine and Longannet.

Fife Council support the reopening of the proposed Scheme, as Policy T3 states that ‘Fife Council will safeguard the Dunfermline to Kincardine coastal rail link.’ However, the release of land at Kincardine Power Station for employment development is an objective that the Council will actively seek. This would require that any reopening of the line would have to pay regard to the employment opportunities present, and the Council’s priorities.

Proposal PR19 encourages ScottishPower to produce a development plan for the site. However, in the absence of any progress in this, Fife Council in the same policy statement indicate that it will “pursue the release of the site for economic development purposes”.

Proposal PR29 supports the proposed extension of the Fife Coastal Path westwards from the Forth Bridge to the Kincardine Bridge along existing paths and negotiated access and new paths – with an indicative route provided in the Local Plan using the existing pathway adjacent to the north side of the embanked railway solum (east of Kincardine Bridge to Longannet) and along the existing Kincardine foreshore path (west from the Kincardine Bridge).

### *Falkirk Rural Local Plan (1994)*

There is no reference to the Scheme in the Local Plan, either in a supportive manner or by way of an objection.

## **2.5 Environmental Effects**

Generally, the Scheme accords with policy objectives as described below.

### **2.5.1 National**

In principle the Scheme supports Government policy agendas for providing integrated transport systems, reducing private car usage, promoting sustainable development and reducing levels of social exclusion.

### **2.5.2 Regional**

The Scheme supports regional transport, community and economic policies, as outlined in the relevant Structure Plans.

### **2.5.3 Local**

Policies outlined in the adopted local plans and any relevant amendments, support the re-opening of the Stirling-Alloa-Kincardine line for both freight and passenger services.

### **2.5.4 Summary of Environmental Effects**

The environmental effects of the Scheme on policy objectives are summarised in Table 2.4.

**Table 2.4: Summary of the Schemes Environmental Impacts on Policy Objectives**

Policy	Level of Policy/ Proposal Objective			Magnitude Of Impact				Comments
	N	R	L	Sig	Mod	Sli	Neg	
<b>Transport</b> Potential impacts on National transport agenda	D				+			The Scheme supports National Policy in terms of promoting sustainable transport
<b>NPPG 5: Archaeology and Planning</b> Potential effects of the Scheme on Cultural Heritage issues					-			The Scheme has negative effects on a nationally protected Scheduled Ancient Monument, and local listed buildings
<b>NPPG 17: Transport and Planning</b> Potential effects of the Scheme on Transport Planning Policy	D						-	The Scheme has negligible negative effects on the environment with regard to Natural Heritage issues
<b>NPPG 17: Transport and Planning</b> Potential effects of the Scheme on Transport Planning Policy	D			+				The Scheme supports National Planning Policy in terms of promoting sustainable transport
<b>Social</b> Potential effects of the Scheme on achieving Social Justice	D				+			The Scheme promotes social inclusion and eliminates inequalities in access to public transport
<b>Clackmannanshire and Stirling Structure Plan</b>								
<b>Policy SD1</b> Potential influence of the Scheme on the Region's Sustainable Development principles		D				+		The Scheme helps to promote regional sustainable development principles
<b>Policy TR1</b> Effects of the Scheme on the concept of Integrated Transport		D			+			The Scheme supports the promotion of integrated transport systems
<b>Policy TR2</b> Effects of the Scheme on moving freight transportation from road to rail		D		+				The Scheme actively promotes the modal shift of freight transport from road to rail
<b>Finalised Fife Structure Plan</b>								
<b>PROPOSAL PT2</b> (Kincardine Bridge and Eastern Bypass) The effect of the Scheme on the proposal to safeguard Kincardine Bridge and the route of the Kincardine Eastern Bypass		D					-	The Scheme would create additional considerations for the Upper Forth Crossing and Relief Road proposals in Kincardine

**Table 2.4: Continued**

Policy	Level of Policy / Proposal Objective			Magnitude Of Impact				Comments
	N	R	L	Sig	Mod	Sli	Neg	
<b>PROPOSAL PT2</b> (Freight Capacity) Promotion of policy seeking to improve freight capacity in the region		D		+				The Scheme supports the promotion of policies that seek to improve freight capacity in the region
<b>Policy E8</b> Effects of the Scheme on the redevelopment of Kincardine Power Station		D				+		The Scheme could help support the redevelopment of Kincardine Power Station by providing future rail links to the site.
<b>Stirling Local Plan</b>								
<b>Policy STIR.T</b> Effects of the Scheme on the proposed re-opening of the Stirling to Alloa line for passenger use			D	+				The Scheme would fully support the re-opening of a passenger service between Stirling and Alloa
<b>Policy STIR.E1</b> Effects of the Scheme on the safeguarding of the Forth Viaduct allotments and Bridgehaugh			D			-		The Scheme would not affect the site of the allotments and Bridgehaugh, but would have a small negative effect on the amenity of the recreational facilities
<b>Proposal Blar.1</b> Effect of the Scheme on restricting access to the Manor Powis Quarry Site			D			-		The Scheme would restrict access to an existing recreational use. Any future use may require provision of an access bridge.
<b>POL.E43 – POL.E45</b> The potential effects of the Scheme on Category A listed buildings.			D	-				The Scheme would permanently affect a small number of listed buildings.
<b>Clackmannanshire Local Plan</b>								
<b>Policy INF 1</b> Effects of the Scheme in supporting the re-opening of the Stirling – Alloa – Kincardine railway			D	+				The Scheme directly supports policies that promote the re-opening of the Stirling – Alloa – Kincardine railway.
<b>Policy INF 3</b> The potential effects of the Scheme on the Council's Right of Ways			D				-	The Scheme will have negligible negative effects on the Clackmannanshire Right of Ways

**Table 2.4: Continued**

Policy	Level of Policy/ Proposal Objective			Magnitude Of Impact				Comments
	N	R	L	Sig	Mod	Sli	Neg	
<b>Proposal T4</b> The effects of the Scheme on the proposed AELR			D	+				The Scheme directly supports the implementation of the AELR
<b>Proposal T8</b> The effects of the Scheme on the proposed Alloa Station			D	+				The Scheme directly supports the implementation of the new Alloa Station
<b>Proposal J2</b> Effects of the Scheme on the development of the former brewery site in Alloa			D		+			The Scheme actively seeks to develop the former brewery site in Alloa
<b>Proposal H1 (1 &amp; 2)</b> The effects of the Scheme on the development of Housing sites identified within the Local Plan			D		+			The Scheme would provide increased levels of access to identified housing sites
<b>Proposal H12 to H16</b> The effects of the Scheme with regard to the development viability of identified housing sites			D			+		The Scheme would provide increased levels of access to identified housing sites
<b>Proposal J11</b> The potential effect of the Scheme with regard to the redevelopment of industrial sites			D		+			The Scheme would provide increased levels of access to identified industrial sites
<b>Proposal CR9</b> The effects of the Scheme on proposed community development			D				-	The Scheme would have negligible negative effects on the amenity of proposed community facilities.
<b>Proposal J8 and H5</b> Effects of the Scheme on a proposed mixed use development on the Alloa Health Centre site			D			+		The scheme would have slight positive effects on improving access to the mixed-use development.
<b>Proposal T6</b> Effects of the Scheme on the closure of Grange Road level crossing			D		+			The Scheme would support implementation of any policy seeking to close Grange Road level crossing
<b>Proposal T17</b> The potential effects of the Scheme on the Council's Right of Ways			D				-	The Scheme will have negligible negative effects on the Clackmannanshire Right of Ways

**Table 2.4: Continued**

Policy	Level of Policy/ Proposal Objective			Magnitude Of Impact				Comments
	N	R	L	Sig	Mod	Sli	Neg	
<b>Proposal T65</b> Effect of the Scheme on restricting access to the Manor Powis Quarry Site			D		-			The Scheme would restrict access to an existing recreational use. Any future use may require provision of an access bridge.
<b>Business Proposal 20 and Proposal 4 (Local Plan First Amendment)</b> Potential effect of the Scheme on a proposed office development			D				-	The Scheme would slightly affect the setting of the proposed office development.
<b>Proposal J10</b> The effects of the Scheme on Alloa Park in terms of future business development			D			+		The Scheme would improve accessibility to future business development at Alloa Park
<b>Proposal J16</b> The effects of the Scheme on the ongoing development of the New Alloa Business Park			D			+		The Scheme would complement the continued development of the New Alloa Business Park
<b>Proposal CR10</b> The potential effects of the Scheme on the proposal to build community amenities			D				--	The proposal would have negligible effects on policies that propose community amenities
<b>Policy EN1</b> The effect of the Scheme on the Local Biodiversity Action Plan's designated wildlife sites.			D				-	There would only be negligible detrimental effects on the sites from the operational railway aspect of the Scheme
<b>Policy EN7</b> The effects of the Scheme on a Scheduled Ancient Monument			D		-			The Scheme would have direct negative impacts on the setting of a SAM



**Table 2.4: Continued**

Policy	Level of Policy/ Proposal Objective			Magnitude Of Impact				Comments
	N	R	L	Sig	Mod	Sli	Neg	
<b>Fife West Village Local Plan</b>								
<b>Policy T3</b> The effects of the Scheme on the safeguarding of the Dunfermline to Kincardine rail line			D		+			Implementation of the Scheme would increase the likelihood of safeguarding the Dunfermline to Kincardine rail line
<b>Proposal PR19</b> The effect of the Scheme in relation to the redevelopment of the former Kincardine Power Station site			D		+			The Scheme would increase the likelihood of redevelopment occurring at the former Kincardine Power Station
<b>Proposal PR29</b> The potential effects of the Scheme on the route of the Fife Coastal Footpath			D				-	The proposed Scheme would require the re-routing of the proposed Fife Coastal footpath.

D – Level of Policy

N – National

R – Regional

L - Local

+ Positive Effects  
- Negative Effects

Sig – Significant

Mod – Moderate

Sli – Slight

Neg – Negligible

## 2.6 Mitigation Measures

Mitigation measures are detailed under the specific topic chapters in Volume 2.

## 2.7 Summary

Various policy documents and legislative frameworks were consulted to assess the suitability of the scheme in relation to the UK's policy agenda. The Scheme is predominantly supported by National, Regional and Local policy, as principles of sustainable development, social inclusion and economic development are all promoted by the implementation of the Scheme.

However, certain policies and proposals are contravened by the Scheme. Primarily this refers to cultural heritage issues at Stirling (Listed Buildings) and Alloa (Scheduled Ancient Monument). Policies are also contravened due to the loss, albeit minor, of potential beneficial land-use throughout the Scheme.

The AELR supports the re-opening of the railway, by providing alternative access to East Alloa, allowing for the closure of Hilton Road level crossing. It is supported in principle by Clackmannanshire Finalised Local Plan policy.

### 3. LAND USE

#### 3.1 Introduction

The purpose of this chapter is to identify potential impacts arising from the Scheme on dominant land use, and to assess the significance of these impacts. The scheme may give rise to impacts through the loss of land for a particular use, known as land take. This can be of a temporary or permanent nature.

Agriculture is the primary land use along the route of the proposed Scheme, but there are also urban areas, namely Stirling, Cambus, Alloa, Clackmannan and Kincardine. Within these built up areas the Scheme will be passing in close proximity to a number of more specific uses, such as residential, industrial, commercial and recreational locations as well as sites of vacant/development land. There are also sites of archaeological and cultural importance within close proximity to the Scheme.

In assessing quantities of land-take, temporary and permanent acquisitions are based on the information provided within the Bill, Schedules 7 and 8, and the Plans and Sections.

#### 3.2 Methodology

The methodology was undertaken with reference to the DMRB (Vol. 11) Part 6 (Land-Use). Despite the Scheme being of a slightly different nature to those usually assessed using the DMRB principles, this methodology would offer the most competent analysis of land-use effects. A Stage 3 level of assessment is required for inclusion within an Environmental Statement. The methodology used to assess the effects of the Scheme on land-use is described in Table 3.1.

**Table 3.1: Methodology of Land-use Assessment**

<b>Methodology Stage</b>	<b>Process</b>
Collection of baseline data	A desktop study was the initial method of data collection. Documents referred to include the applicable Development Plans for assessing current and future land-use designations, with site visits undertaken in August and September 2002 to evaluate the present land-use throughout the Scheme.
Identification of potential land-take	Comparison of the Scheme design with land-use maps outlined the extent of potential land-take.
Consultation	Consultation was required to assess the planning authorities view on any potential effects of the Scheme on current and future land-use designations.

It must be noted that due to external factors such as location of land-use, land-use density, proximity to the solum and road, and the topographical nature of the land-use, there is an element of subjectivity within the assessment of the effect of the Scheme on land-uses, as each individual area of land-use is utilised in a different manner. This is an important consideration to recognise when assessing the significance of effects on Land-Use. These factors are explained below using residential land-use as an example.

### 3.2.1 Location of Land-Use

The geographical location of land uses can alter the significance of effects caused by a proposal. For instance, the effects on designated housing sites could be weighted according to the level of housing demand between each of the four main urban areas affected by the Scheme. It would be reasonable to assume that housing demand is highest in Stirling, followed by Alloa, then Clackmannan and finally Kincardine. This would mean that a designated housing site in Stirling of 5ha would experience a greater level of impact (adverse or beneficial) due to the implementation of 'the Scheme,' than a 5ha designated housing site in Kincardine, assuming all other variables are constant.

### 3.2.2 Density of Land-Use

The proposed density of an identified housing site would also determine the significance of effects placed upon the site by the proposed Scheme. By comparing two proposed housing sites, Site A and Site B, of 5ha located on a conceptual isotropic plain (an area having the same physical properties in all directions), the effects of land take on varying density levels can be assessed. If 1ha of land were required for 'the Scheme,' the result would be a 20% loss in development land for each site. If Site A proposed 100 new dwellings and Site B 50, Site A would lose 20 dwellings from its proposal, with Site B losing 10. This would mean that the same level of impact, i.e. 1ha of land take, would have a greater level of significance on Site A than Site B.

**Table 3.2: Magnitude of impact**

Magnitude	Criteria
Severe	The Scheme would result in the permanent land-take of existing beneficial land-uses, the severance of beneficial uses or prevent the development of designated Local Plan sites/proposals.
Moderate	The Scheme would result in the permanent land-take of existing land-uses of a less beneficial nature and would impact upon future development of designated Local Plan sites/proposals.
Slight	The Scheme would require temporary land-take
Negligible	Barely perceptible changes.

**Table 3.3: Importance of impact**

Importance	Criteria
High	Existing beneficial land-uses.
Medium	Designated Local Plan sites/proposals with developer interest.
Low	Existing land-uses of a less beneficial nature.
Negligible	Designated Local Plan sites/proposals with no developer interest.

The DMRB (Vol. 11) does not describe how the significance of impact should be scaled with regard to land-use. Therefore, Table 3.4 outlines the significance of impact for land-use by combining the scales of magnitude and importance.

**Table 3.4: Significance of Impact**

Importance of Receptor	Magnitude of Impact Upon Receptor			
	Severe	Moderate	Slight	Negligible
High	Substantial	Moderate	Minor	Negligible
Medium	Moderate	Moderate	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible
Negligible	Minor	Negligible	Negligible	Negligible

### 3.3 Consultations

Consultations were undertaken with the three Local Authorities of Stirling, Clackmannanshire and Fife as part of the statutory consultation process, and in keeping with guidance contained within DMRB Vol. 11. Initial consultations resulted in little indication of any potential adverse land use issues. Subsequent contact was also made throughout the assessment with each of the three Local Authorities to obtain information concerning development sites/proposals that are identified within the authorities Local Plan. The response to this request is shown in Table 3.5. Falkirk Council was also consulted as they are an adjoining council, but did not provide a response.

### 3.4 Baseline

Throughout the approximate 21km of railway line and 1km of link road, the Scheme passes through multiple land-uses. The following baseline study indicates the type and location of these land-uses, and the extent to which they exist. Through consultation and scoping, it was established that the prominent land uses in the study were residential, industrial, agricultural, commercial, recreational and vacant/development land. A land-use map is provided in Figure 3.1, outlining the main areas of land-use present in the study area.

#### 3.4.1 Agricultural Land Use

Agricultural land use within the Scheme is discussed in chapter 6, Vol. 2

#### 3.4.2 Residential Land Use

The relationship between residential areas of land use and the railway corridor vary between the urban and rural environments, with properties in open/agricultural land being more sporadic than planned.

In Stirling, there are groups of residential dwellings that are in proximity to the line at Causewayhead Road, Wallace Gardens Alloa Road and Ladysneuk Road. There are also new housing developments at various stages of implementation at the former Sunlight Factory and Kerrs Scrapyard sites, including Riverbank Stables. Progressing east there are a cluster of small cottages at Manor Powis located within 200m of the line, although it is not until the line reaches the western fringe of Alloa, where there is housing, both north and south within 50-100m of the line.

Residential areas are situated beside the railway as it passes Clackmannan where there is a mix of type and tenure, both north and south of the track, within 50m of the line. In addition, there are locations in west Kincardine where the track is only 100-150m away from residential areas. Within the centre of the former fishing village of Kincardine, just south of Kincardine power station, the track is within close proximity of the residential area which includes former fishing cottages, a church, and local amenities.

There are a number of residential dwellings close to the proposed route of the AELR, predominantly on Hilton Road. There are two housing sites to the south of the AELR route, which are designated by Policies H1 (1 and 2) in the Clackmannanshire Finalised Local Plan.

### 3.4.3 Industrial Land Use

Along the route there are eight key areas of industrial land use (Forth Street, Ladysneuk Road, bonded warehouses at Blackgrange, Cambus, Carsebridge Road, Kilbagie Mill, Kincardine Sewage Works and Longannet Power Station) three of which are of regional importance. There are approximately 50 bonded warehouses at Cambus, as well as the Longannet power station, and the former power station at Kincardine, currently vacant.

There is also provision of smaller-scale industrial sites at Stirling, just south of the Causewayhead Bridge as well as to the eastern fringe of the town, south of the line. There are again pockets of small-scale industrial land to the north of the track at Cambus and to the east of Alloa.

### 3.4.4 Commercial Land Use

There is a limited amount of commercial activity in close proximity to the railway, with the majority found in Alloa Town Centre, to the south-east/east of the former brewery site at Whins Road West. Construction has already started on the Pavilions Business Park to the west of Alloa.

### 3.4.5 Recreation Related Land Use

There is limited provision of recreation/leisure land uses along the route of the railway, however there are distinct areas in proximity to the scheme.

On the north bank of the River Forth at Stirling, to the east of the railway, there are allotments and Stirling RFC's home ground of Bridgehaugh. These facilities are used regularly, with Bridgehaugh often being used by a great number of people at one time.

Further along the route at Cambus Level Crossing, Cambus and District Bowling Club is located adjacent to the level crossing to the south. There is a small line of trees between the solum and the Bowling Green.

The Clackmannan County Cricket Club ground is situated by the site of the former Alloa New Marshalling Yards between Cambus and Alloa. The cricket ground is situated to the north of the solum, with the New Pavilions Business Park development to the south.

Within Alloa town centre there are various informal areas of recreation and purpose built leisure facilities adjacent to the railway such as green spaces, local parks and community facilities including a leisure centre. Moving eastwards, Alloa Football Club's home ground of Recreation Park is situated by the Scheme at Hilton Road.

There is a recreation ground, including a football pitch to the west of the AELR at Hilton Road. This is currently owned by Diageo Scotland Ltd and is used by Alloa Athletic Football Club as a training facility.

There is a large, open recreation ground at Devonway, Clackmannan that consists of open fields, a football pitch and a playground. The area serves a local housing estate and is bordered by the railway on its northern/eastern fringe.

Alexander Park is a community recreation area within the centre of Clackmannan, adjacent to the railway. It consists of open space, a playground and hard and soft landscaping. It is bordered to the south-east by residential dwellings.

There is a recreation ground within the former Kincardine Power station site, which predominantly comprises of a football pitch and associated open space. A more detailed and wider description of recreational facilities is provided in chapter 4, Vol. 2.

#### 3.4.6 Vacant/Development Land

There are a number of sites located along the route of the Scheme that have been designated for future development and some sites are currently vacant. These are detailed in the three authority Local Plans previously described. Table 3.5 provides an outline of these sites and the planning status for each individual area.

**Table 3.5: Schedule of Local Plan Identified Development Sites**

Local Plan Site Ref. No	Name	Designation	Size (ha)	Development Interest	Planning Status
<b>Stirling</b>					
BLAR. B1	Manor Powis Bing	Employment Opportunity	c. 10.7	Being considered as an option for location of Waste Transfer, Recycling & Composting facilities through the Waste Management Planning process.	No planning applications or consents. The Local Plan requires an environmental assessment of the site before consideration of any development proposal.
STIR.B1-B3	Forthside	Employment Opportunity	c. 13.9	Development being progressed by Stirling Joint Ventures.	N/A
STIR.H13	Alloa Road (2)	Housing	0.19	N/A	14 flats in two 2-storey blocks. Already built and occupied.
<b>Clackmannanshire</b>					
CR9	Autistic Centre	Community/Recreational	N/A	Autistic Centre committed.	Planning consent.
H1	Hilton Road (sites 1 and 2)	Housing	5.75	Subject to a Masterplan for entire expansion area. Subject to developer contribution to Alloa Eastern Link Road. Ground conditions will require investigation	N/A
H2	Whins Road	Housing	1.46	Development interest for housing.	Included in adopted and finalised Local Plan for either housing or business development.
H21	Cowden	Housing	0.53	Development almost complete.	N/A
H67	Station Road North, Cambus	Housing	1.50	Specific developer interest.	Planning consent issued subject to legal agreement.
H68	Station Road East	Housing	2.09	As H67	As H67

**Table 3.5: Continued**

Local Plan Site Ref. No	Name	Designation	Size (ha)	Development Interest	Planning Status
H73	Burnside (Phases 1&2)	Housing	3.96	No known developer interest at present.	Outstanding issue with SEPA to be concluded.
H74	Alloa Road East	Housing	0.76	Site under construction	Included in adopted Local Plan and Finalised Local Plan. Plotted development, part remaining.
H75	Cherryton Drive 2	Housing	1.04	Development complete.	N/A
H76	Alloa Road	Housing	0.30	Specific developer interest	Planning consent, revised plans have been submitted.
H78	Kennet Village	Housing	0.68	Development complete	N/A
J2	Whins Road West	Business	1.98	Developer interest from various parties. Site still under offer, therefore proposed uses not defined.	Included in Finalised Local Plan for mixed-use development.
J6	Whins Road East	Business	1.25	see H2	N/A
J10	Alloa Park	Business	1.96	Designated for business use. No specific proposals at present	Included in Finalised Local Plan
J11	Carsebridge Road (South)	Business	9.60	Redevelopment subject to development brief	N/A
J16	New Alloa Business Park	Business	20.12	Ongoing development	Included in adopted and finalised local plan
J38	Kilbagie	Business	12.65	No main developer interest.	Included in finalised local plan
J39	Manor Powis	Business	3.81	Potential for waste management site still under investigation.	Included in finalised local plan.
T14	Station Road (East & West)	Transport	N/A	Response from Railtrack advising against being part of other proposals.	Local plan safeguards for any future proposal.
T2	Clackmannan Road Car Park	Transport	N/A	Has been developer interest for retail/hot food take-away, but they are not supported.	Finalised local plan retains for car parking
T8	New Railway Station	Transport	N/A	Discussions with potential developer for J2	Included in finalised local plan
T4	Eastern Relief	Transport	N/A	General support of principle. Developer	Included in finalised local plan



**Table 3.5: Continued**

<b>Local Plan Site Ref. No</b>	<b>Name</b>	<b>Designation</b>	<b>Size (ha)</b>	<b>Development Interest</b>	<b>Planning Status</b>
	Road (Alloa Eastern Link Road)			interest for associated housing site.	
<b>Fife</b>					
PR18	Longannet Power Station	Business Opportunity	4.45ha (W) 3.9ha (E)	None	None
PR19	Kincardine Power Station	Employment Opportunity	49h	No developer history. May be required to use some of the site for the Upper Forth Crossing.	No planning history.

### **3.5 Environmental Effects**

The major land use issue is permanent land-take for signalling work, level crossing works, REB siting and the AELR.

Whilst there is a greater proportion of temporary rather than permanent land-take associated with the Scheme, this will be largely associated with the construction phase. After construction is complete, there is provision for all areas of temporary land take to be restored to the reasonable satisfaction of the owner. A schedule of temporary land-take associated with the Scheme is outlined below in Table 3.6. Information provided in the table is from west to east through the Scheme corridor.

There will also be permanent land-take for the scheme with the principal areas being required for the provision of the new Alloa station and ancillary features including car parking and the AELR. The locations of permanent land take and the affected land-use can be found below in Table 3.7.

From these tables the significant environmental impacts on dominant land use were identified and assessed in Tables 3.8 and 3.9.

**Table 3.6: Temporary Land Take**

<b>Location</b>	<b>Purpose</b>	<b>Existing Land Use</b>	<b>Land-Take (m<sup>2</sup>)</b>
Stirling Station	Access for construction	Public road and footway	460
Forth Street (adjacent to Forth Viaduct)	Construction compound and access	Embankments, public road and footways, electricity substation, verges paths and steps.	2,380
Lover's Walk, Stirling	Access for construction	Public road	650
River Forth and banks	Working space	River, banks, bridge, land	8,670
Bridgehaugh, Stirling Rugby Football Club	Construction compounds and access	Car Park, hard-standing and playing fields	10,100
Causewayhead Road, Stirling	Working space and access	Public road, footway, layby and verge	840
Abbeycraig Level Crossing	Construction compound and working space	Field and land/agricultural	11,940
Logie Burn, Stirling	Work space and access	Agricultural/Farm track	2,980
Grangehall, Stirling	Work space and access	Agricultural	1,650
Manor Neuk Level Crossing	Working space	Agricultural	80
Manor Powis Level Crossing	Construction compound	Field and Land	2,160
Blackgrange Level Crossing	Construction compound	Field, land and electricity pylons	11,080
New Mills Level Crossing	Construction compound and working space	Agricultural/open land	7,390
Cambus Level Crossing	Construction compound	Diageo storage area	5,390
Alloa New Marshalling Yard	Construction compound and working space	Disused Railway Marshalling Yard	44,880
Grange Road and Dirleton Gardens	Working space	Public road and footway	660
Alloa Sports Centre	Construction compound, working space and access	Recreational	1,380
Erskine Street, Alloa	Construction compound working space and access	Road, footways, cycle routes and general land	7,100
Former Brewery site, Alloa	Construction compound working space and access	Embankment, land, footways, public road and verge	1,850
Recreation Park, Alloa	Construction compound, working space and access	Recreation associated use	14,050
Bonded warehouses, Hilton Road, Alloa	Construction compound and working space	Industrial	19,670
Hilton Farm, Alloa	Construction compound working space and access	Agricultural	20,670
Helensfields, Clackmannanshire	Construction compound and working space	Public road, verges, footway and land	8,410
Black Devon river crossing	Construction compound working space and access	River, access, land and residential	8,600

**Table 3.6: Continued**

<b>Location</b>	<b>Purpose</b>	<b>Existing Land Use</b>	<b>Land-Take (approx. m<sup>2</sup>)</b>
Cattle Market off Alloa Road, Clackmannan	Construction compound working space and access	Access, land and verge	5,340
Kennet, Clackmannanshire	Access for construction	Access and verges	1,150
Kennet, Clackmannanshire	Construction compound and access	Verge and layby	2,870
Meadow End, Clackmannanshire	Construction compound working space and access	Agricultural road, verges and land	18,000
Kilbagie, Clackmannan/Fife	Work space and access for construction	Watercourse and drainage	1,710
Kilbagie, Clackmannan/Fife	Construction compounds	Fields and land	6,560
Broomknowe, Fife	Construction compound and working space	Fields and land	9,900
Tulliallan Bridge	Construction compound	Field and Land	270
Kincardine Power Station Fife	Access for construction and maintenance	Access and verges	2,400
Kincardine Power Station Fife	Construction compound	Land and scrub	7,530
		<b>TOTAL</b>	<b>248,770</b>

**Table 3.7: Permanent Land Take**

<b>Location</b>	<b>Purpose</b>	<b>Existing Land Use</b>	<b>Land Take (approx. m<sup>2</sup>)</b>
Ladysneuk Road	Signalling equipment and access (REB)	Waste ground	420
Waterside Level Crossing	Level crossing equipment	Road and pavement	300
Ladysneuk Road, Stirling	Provision of new vehicular access to premises (Riverside development and Waterside Cottage)	Hard-standing and access	2,450
Abbeycraig Level Crossing	Provision of new access road to premises and stopping up of existing level crossing junction	Existing road access	4,160
Logie Burn Culvert	Culvert headwalls	Culvert inlet and outfall	70
Grangehall Culvert	Culvert Headwalls and maintenance	Culvert inlet and outfall, access track	520
Manor Powis/ Powis Burn	Level crossing equipment, structure maintenance	Level crossing, watercourse	110
Blackgrange Level Crossing	Signalling equipment and access (REB), and relocation of utility apparatus	Agricultural	1,290
Cambus Viaduct	Scour protection to bridge pier	Watercourse	90
Cambus Level Crossing, Cambus	Signalling equipment and access (REB)	Former pumping station – potential development land	190
Gables Culvert	Culvert Headwall and maintenance	Culvert outfall	60
UB/117/41C-Culvert	Culvert Headwalls and maintenance	Culvert outfall	150
Alloa West, former Marshalling Yard	Signalling equipment and access (REB)	Development Land	350
Grange Road, Alloa	Footbridge	Council green-space	5,240
Mar Place, Alloa	Signalling equipment and access (REB)	Recreational	220
Erskine Street and Former brewery site, Alloa	Alloa Station, car park and station access	Development Land	7,030
Petrol Station, Ring Road, Alloa	New roundabout and station access	Commercial	9,720
Junction with Carsebridge Road, Hilton Road & Whins Road, Alloa	Upgraded roundabout at north end of Alloa Eastern Link Road	General infrastructure	4,360
Hilton Road, Alloa	Realignment of road to provide junction with new Alloa Eastern Link Road	General Land	570

**Table 3.7: Continued**

<b>Location</b>	<b>Purpose</b>	<b>Existing Land Use</b>	<b>Land Take (approx. m<sup>2</sup>)</b>
Diageo Bonded Warehouses and Hilton Farm	Alloa Eastern Link Road	Industrial and agricultural	65,600
21 Hilton Road, Alloa	Hammerhead	Residential	310
Recreation Park, Hilton Road, Alloa	Hammerhead and footbridge	Footpath, stadium access	1,010
Playground off Gaberston Avenue	Footbridge	Recreational	400
Playing field off Hilton Road,, Alloa Football Club Car park	Signalling equipment (REB) and track access	Recreational / car park	2,850
Hiltonhawk Way, Alloa	New vehicular access to premises (garage)	Public road and hard-standing	450
Farmland south of A907/ existing A907	Realignment of A907	Agricultural, infrastructure,	32,740
Hilton Farm Level Crossing	Stopping up existing junction	Infrastructure	40
Off A907 Helensfield	Access to Signalling equipment	Highway verge	350
A907 underbridge, Helensfield	Safeguarding limits	Highway verge	60
Northfield, Clackmannan	Culvert headwall and maintenance	Residential, watercourse	100
Station Road, Kincardine	Signalling equipment and access (REB)	ScottishPower – Development Land	210
		<b>TOTAL</b>	<b>141,420</b>

### 3.5.1 Effects of Construction

The construction of the Scheme will have a direct effect on land-use as it will temporarily remove/reduce land uses within the area, as shown in the table above. Exact details of the extent of construction compounds/operations, will be finalised by the Contractor.

**Table 3.8 Construction Effects on Land Use**

Land Use	Effects
Agricultural	See Chapter 6, Vol. 2
Residential	N/A
Industrial	Temporary land-take of industrial storage area (<19,670m <sup>2</sup> )
Commercial	N/A
Cultural/ Archaeological	See Chapter 5, Volume 2
Recreation	Temporary land-take of recreational facility car park (<1,380m <sup>2</sup> )  Temporary land-take of recreational associated area (<14,040m <sup>2</sup> )
Development/vacant land	Temporary land-take of vacant land at former brewery site (1,850m <sup>2</sup> )

### 3.5.2 Effects of Operation

The operation of the Scheme, with respect to both the road and rail components, will play an active role in the development process within the Stirling/Clackmannanshire/Fife region. The Scheme would either act as a catalyst for development at particular locations, or its operational nature would deter development, especially where land-use is of a non-conformist nature to the characteristics of the Scheme. The significance of the environmental effects of the Scheme on land-use is summarised in Table 3.10.

**Table 3.9: Operational Effects on Existing Land Use**

Land Use	Impacts
Agricultural	See Chapter 6, Vol. 2
Residential	Permanent land take at 21 Hilton Road (220m <sup>2</sup> )
Industrial	Demolition of three bonded warehouses and loss of industrial development land (65,600m <sup>2</sup> )  Permanent land-take at former pumping station, Station Road level crossing (210m <sup>2</sup> )
Commercial	Loss of petrol station at former brewery site (9,720m <sup>2</sup> )  Loss of commercial activity for AELR realignment (2,100m <sup>2</sup> )
Cultural/ Archaeological	See Chapter 5, Volume 2
Recreation	Permanent loss of open space at Grange Road (5,240m <sup>2</sup> )  Permanent land take at Alloa Leisure Bowl/Mar Place for REB location (220m <sup>2</sup> )  Permanent land take at Recreation Park and Gaberston Avenue, Alloa for footbridge construction (400m <sup>2</sup> )  Permanent land take Recreation Park, Hilton Road (1,010m <sup>2</sup> )
Development/ vacant land	Permanent land take at Alloa West, former Marshalling Yard required for signalling equipment and REB access (350m <sup>2</sup> )  Permanent land take for part development of former brewery site, Alloa for station and car park (~7,000m <sup>2</sup> )

**Table 3.10: Summary of the Significance of Environmental Impacts on Land-Use**

Feature	Potential Impact	Magnitude of Impact	Importance of Impact	Significance of Impact	Mitigation Measure
Agricultural	See Chapter 6, Volume 2				
Residential	Land Take at 21 Hilton Road	Severe	High	Substantial Adverse	Compensation
Industrial	Temporary land-take of industrial storage area	Slight	Low	Negligible Adverse	Compensation
	Demolition of industrial buildings and loss of industrial development land	Moderate	Low	Minor Adverse	Compensation
	Permanent land-take at former pumping station	Slight	Low	Minor Adverse	Compensation
Commercial	Loss of petrol station at former brewery site	Moderate	High	Moderate Adverse	Inclusion of petrol station in site master plan and potential compensation
	Loss of commercial activity for AELR realignment	Slight	High	Minor Adverse	Compensation
Cultural/ Archaeological	See Chapter 5, Volume 2				
Recreation	Land Take at Alloa Leisure Bowl for REB location	Moderate	Low	Minor Adverse	Compensation
	Land Take at Recreation Park and Gaberston Avenue for footbridge construction	Moderate	Low	Minor Adverse	Compensation
	Permanent land-take at Hilton Road for hammerhead construction	Slight	Low	Negligible Adverse	Compensation
	Land take at Grange Road for footbridge construction	Moderate	Low	Minor Adverse	Compensation
	Temporary land-take of recreational facility car park	Slight	Low	Negligible Adverse	Compensation
	Temporary land-take of recreational area	Slight	Low	Negligible Adverse	Compensation
Development land	Alloa West, former Marshalling Yard required for signalling equipment and REB access.	Slight	Negligible	Negligible Adverse	Compensation
	Part development of former brewery site for station and car park	Severe	Medium	Moderate Beneficial	Compensation



### **3.6 Mitigation Measures**

Table 3.10 highlights land use mitigation measures. Land taken temporarily for the construction phase should be returned to its former state on completion of works.

### **3.7 Summary**

The effects of the Scheme on land uses are predominantly relating to land take issues, both of a temporary and permanent nature. Where adverse effects are highlighted, suitable mitigation measures are prescribed, which are likely to include the provision of compensation measures. Whilst temporary land take occurs in a more significant quantity (24.8ha), it is important to remember that it will occur for a limited time (expected to be 18 months), and will therefore not present significant land take impacts, as land should be returned to its former state after the construction phase of the Scheme.

Permanent land-take is about 14.1ha. Compensation measures will be required for permanent land loss.

## **4. COMMUNITY EFFECTS**

### **4.1 Introduction**

An assessment of the community effects directly associated with the Scheme has been carried out and considers the effects of the proposals under the following headings:

- § Community Access Assessment – the potential temporary and permanent access effects on community facilities, amenities, public services, local businesses and associated economic development activity created by the Scheme construction and operational phases – see chapter sections 4.4 to 4.7 inclusive;
- § Cumulative Community Effects Assessment – based upon the findings of the other environmental disciplines contributing to the Environmental Statement where temporary and permanent factors have been identified which have potential community impact relevance – see chapter sections 4.8 to 4.9 inclusive.

### **4.2 Methodology**

The approach to the baseline and effects assessment was based upon a combination of a desk-top review of available documentation; three site visits along the length of the proposed line (August and November 2002) and consultations with relevant consultation bodies and other consultees. The consultation process and outcomes are summarised in section 4.3 of this chapter. Key documents reviewed in the community study include:

- § Clackmannanshire & Stirling Councils Structure Plan (Finalised Plan: August 2000) and the Clackmannanshire & Stirling Councils Structure Plan (Scottish Ministers Final Decision in response: March 2002);
- § Stirling Council Adopted Local Plan: 1999;
- § Stirling Council Local Plan Alteration No 1A – Stirling & the Rural Villages;
- § Clackmannanshire Council Adopted Local Plan (1994); Clackmannanshire Council Local Plan First Alteration document (1997); Clackmannanshire Council Local Plan Second Alteration Housing Land Supply document and the Clackmannanshire Council Finalised Local Plan (July 2002) - which is currently on deposit for public consultation;
- § Fife Council Fife Structure Plan Written Statement (finalised January 2001) – and operative from July 2002;
- § Fife Council West Villages Local Plan Finalised Version (February 2000);
- § OS Landranger Maps (1:50000) Nos 57/58/65 and OS Explorer Maps (1:25000) Nos 348/349/366/36;
- § Railtrack Stirling-Alloa Boundary Plan No.28701 (1:2500).

The community assessment methodology embraces a number of key considerations for existing receptors adjacent to, and in proximity, of the proposed 21.1km long Scheme between Stirling and Kincardine/Longannet (contained within an approximate 500 metre catchment corridor either side of the Scheme) and these are highlighted below. The study research has also identified a number of future development policies or proposals that could have community effect relevance and these are presented separately within the Policy Context chapter of this Volume 2 report. The scope of the community considerations in this chapter include:

- § Permanent or temporary displacement of residents from their home or land take from residential properties;
- § Permanent or temporary displacement of commercial properties or land take from commercial properties;

- § Permanent or temporary restriction of access or severance of access to community facilities;
- § Permanent or temporary closure of a community facility or service;
- § Permanent or temporary restriction of access or severance of access to commercial properties;
- § Permanent or temporary closure of commercial properties;
- § Permanent or temporary severance of public paths/cycleways/bridleways etc and public Rights of Way (RoW);
- § Scheme impacts on existing journey routes.

The key criteria, which have been applied to the baseline information in order to assess and predict the potential community effects, include the location of potential receptors (individual or cumulative sources); the scope (i.e. direct, indirect, cumulative etc); the magnitude of the predicted impact - the actual change taking place to the environment that has a direct community relevance - using the definitions provided in section 4.2 (Generic Methodology) of the Environmental Statement Volume 1 report (i.e. negligible/slight/moderate/severe) and the significance of the predicted impact – the product of an impact’s magnitude and the importance, sensitivity etc of the relevant community receptor(s) - again using the definitions provided in section 4.2 (Generic Methodology) of the Environmental Statement Volume 1 report (i.e. negligible/minor/moderate/substantial); the potential duration of the impact (e.g. temporary or permanent) and the scope to mitigate (minimise, avoid, compensate etc) the effects.

### **4.3 Consultations**

A number of consultations were held and the respective outcomes are summarised in Table 4.1 and Table 4.2 below. Table 4.2 includes relevant information (specifically related to the level crossings along the length of the Scheme) which was received in consultation responses to letters issued by Scott Wilson and also responses made by visitors to the series of public exhibitions which were held in Stirling, Alloa, Clackmannan and Kincardine as an integral part of the overall Scheme consultation and communication process.

**Table 4.1: Pedestrian/Cyclist/Bridleway Access Consultees**

Consultee	Consultee Information Request	Consultee Response Summary
Stirling Council (Access Officer & Assistant Access Officer)	Identification of public paths and Rights of Way	Identification of 3 public paths within the Scheme area (Abbeycraig, Ladysneuk Road to Abbeycraig level crossing, and the Cambuskenneth to Manor Powis claimed RoW – although this claimed RoW has not been substantiated by Stirling Council documentary evidence and is listed as a “possible RoW” in the “Book of Reference” prepared by Land Aspects consultants, which accompanies the Scottish Private Bill and listed as such in Schedule 6 of the Bill document).
Clackmannanshire Council (Team Leader Countryside Development Services)	Identification of public paths and Rights of Way	No asserted RoWs following/crossing the Scheme corridor but a claimed RoW has been highlighted over New Mills level crossing ( <i>which the Council states is referred to in the Scottish Rights of Way Society’s Catalogue of RoW’s</i> ) and which is listed as a “possible RoW” in the “Book of Reference” prepared by Land Aspects consultants, which accompanies the Scottish Private Bill and listed as such in Schedule 6 of the Bill document. This is acknowledged in the ES where relevant.
Fife Council (Planning & Building Control)	Identification of public paths and Rights of Way	Identification of public pathway (usable by pedestrians/cyclists/horseriders), parallel to the north side of the solum between Longannet and Kincardine. Acknowledged in ES where relevant.
The British Horse Society Scotland (Chair: BHS Scottish Access Committee)	Identification of Bridleway routes	Identification of only one permissive bridleway - along the unclassified, and locally known “Old Kennet Road” – from Kennet to the A977 via an overbridge (Old Farm Road - OB 119/27). Acknowledged in ES where relevant.
Sustrans Scotland (Manager)	Identification of cycle routes	Identification of 3 interfaces between the proposed National Cycle Route (No.76) network and the Scheme (at overbridge OB 117/43A at the A91; at Blackgrange level crossing; and at underbridge UB 119/36 at the A907 at Helensfield. Acknowledged in ES where relevant.
Diageo Carsebridge Bond (Business Manager - organised site visit)	Site visit in the context of the proposed alignment of the Alloa Eastern Link Road	Site visit granted and undertaken in conjunction with the Bond Business Manager on 22 October 2002.

**Table 4.2: Level Crossing Site Consultees**

<b>Level Crossing</b>	<b>Contacted Consultees</b>	<b>Consultee Response Summary (*Note: Response content acknowledged in ES where relevant.)</b>
Causewayhead	Wm.Kerr's Metal Merchant/Bryant Homes	Mr. Kerr confirmed Metal Merchant site and Riverside Stables had been sold to Bryant Homes. Stirling Council advised that no planning application had been received for this area. Planning brief advises that the developer should provide footbridge access over the railway to development and that vehicular access from the site should be via a junction off Ladysneuk Road. Bryant Homes advised they were aware of railway opening but claimed not to be aware of contents of development brief at that stage.
Waterside	Cambuskenneth, RSPCA, RICOH factory, Riverside Stables,	Mr Kerr (owner of Riverside Stables) response as above. The residents of No.138 Ladysneuk Road indicated concern about the noise levels associated with the level crossing. No further responses received from other contacted consultees.
Abbeycraig	Abbeycraig Level Crossing House, Broom Farm, and the 4 Broom Farm Cottages	Occupier of Abbeycraig Level Crossing House advised of no problem with the proposed crossing closure but requested that the road be blocked off properly in order not to leave a "dead-end" next to the house which could attract anti-social behaviour. The occupier also expressed concern about privacy and the retention of landscaping both bordering the railway and the track, which will be upgraded to provide an alternative route onto Ladysneuk Road. No further responses received from other contacted consultees.
Manor Neuk	Manorneuk Farm	The farm is used for cattle farming and is likely to change tenancy in early 2003. The current level crossing accommodation provides the only access to fields south of the solum. The crossing is required to fertilise fields, move and tend cattle. The respondent expressed the hope that there would be a reduced service frequency on a Sunday so that most crossing of the line in relation to the farm operation could be carried out on this day whilst the issue of potential visual intrusion was also raised.
Manor Powis	Stirling Council/Ecosse Rally Experience	Stirling Council currently let the land to the southwest of the Level Crossing to a weekend motor sport operator (Ecosse Rally Experience) on a monthly basis. This site is also being considered as a Waste Management and recycling site. If this proposal goes ahead, Stirling Council recognise that the volume of traffic associated with this use would necessitate an over-bridge which would be provided as part of the site redevelopment.
Blackgrange	Diageo, Grampian Foods, Snowie Group, Garvel Farm, Midtown Farm	Consultation responses still awaited from Grampian Foods, Midtown Farm or Garvel Farm. Diageo would support the upgrade of the crossing to an automatic half barrier with the provision of adequate lighting to ensure it is visible to their drivers at night. The Snowie Group wish to develop their land south of the line and their only concern was if they were asked to pay for an upgrade to the level crossing.

**Table 4.2: Continued**

Level Crossing	Contacted Consultees	Consultee Response Summary (*Note: Response content acknowledged in ES where relevant.)
New Mills	Diageo, recreational use	Diageo confirmed that the New Mills level crossing is no longer used as an emergency access route and stated support for the closure of the crossing and the path leading to the crossing from the A907 (a claimed RoW) although the company also advised that it would not be in support of a footbridge at that location. Any comments received from the general public regarding closure of this level crossing or the claimed RoW are still awaited.
Cambus	Diageo, Cambus	Diageo expressed no objection to the level crossing being brought back into use. Any comments received from the general public regarding the crossing being returned to operational use are still awaited.
Grange Road	Grange Road, St John's Primary School, Alloa Academy,	It is proposed to provide a footbridge over the operational line at the existing level crossing location following its closure ( <i>Proposal T6 in Clackmannanshire Finalised Local Plan 2002</i> ), in recognition of the pedestrian need particularly for school children as St John's Primary School (south of the solum) and Alloa Academy (north of the solum). The local Community Police Constable confirmed support of the road closure on safety grounds due to car speeds in proximity to St. John's Primary School. The residents of No.75 Grange Road expressed concern about noise and vibration and effect on property value from the line operation. No further responses received from other contacted consultees.
Hilton Road	Hilton Road, Alloa Athletic F.C., Central Scotland Fire Brigade	The occupier of No.21 Hilton Road expressed support for the closure of the level crossing and the occupier of No. 23 Hilton Road requested provision of a footbridge access over Hilton Road. The Gaberston Residents Committee advised that provided a DDA compliant footbridge was provided over the railway at Hilton Road, they had no objection to the level crossing closure. Alloa Athletic F.C. requested a CAD layout of the footbridge proposals and are currently considering the implications on their land ownership Central Scotland Fire Brigade were, at first, concerned by response times to Hilton Road (particularly those nearest the railway on the north side of the line). However, the Brigade have advised that at present they had a difficulty turning west from the fire station and then north onto Hilton Road due to the amount of traffic on the A907 and reported that the new Alloa Eastern Link Road overall should not affect response time to the north of Alloa. Consultation responses from the residents of No. 21 Hilton Road or "Comcille", Hilton Road with regard to the footbridge proposals are still awaited.

**Table 4.2: Continued**

Level Crossing	Contacted Consultees	Consultee Response Summary (*Note: Response content acknowledged in ES where relevant.)
Hilton Farm	Hilton Farm, Jellyholm Farm, Diageo	The landowner (the Earl of Mar) would support the closure of the level crossing. John Hendry and Sons, who farm the land, confirmed that would not object to closure of the level crossing and also hope that the Alloa Eastern Link Road scheme would improve drainage in their field. Diageo advised that this farming area is zoned for housing development (Policy H1(2) of the Clackmannanshire Finalised Local Plan 2002).
Kincardine Station Road	Scottish Power, Recreational space, Scottish Water, Fife Council	The occupier of Station House expressed concern with the condition of the road and illegal use of the existing accommodation crossing. The local community wish to have the Kincardine High Pier Crossing re-opened (closed in 1963). At the public exhibition, many Kincardine residents confirmed the need to have a safe crossing point to gain vehicular and pedestrian access to the pier area.
Longannet West Arrival	Scottish Power	Scottish Power confirmed that the road is used on a daily basis for maintenance of drains and recognised the need to upgrade the crossing for future traffic.
Longannet West Departure	Scottish Power	Scottish Power confirmed that the road is used on a daily basis for maintenance of drains and recognised the need to upgrade the crossing for future traffic.

#### 4.4 Baseline

The following sections provide a comprehensive baseline description of a range of community facilities including schools; indoor and outdoor sports, leisure and recreational amenities; hospitals, health centres, clinics, aged persons homes; post offices, churches; shops, business premises etc. For ease of reference these have been assessed at specific locations within a series of route sections between Stirling and Kincardine/Longannet and provide the framework for the later Environmental Effects, Mitigation and Summary assessments.

##### 4.4.1 Stirling Station to the A91/A907 Roundabout

*Forth Viaduct/Allotments directly adjacent to solum below embankment level/Stirling County RFC Bridgehaugh ground.*

An ambulance station (Lovers Walk/Customs roundabout) and Orchard House Hospital (Union St) are both located west of the Forth Viaduct. Both the Stirling Council owned garden allotments and the Stirling County Rugby Football Club (SCRFC) amenities are accessed via the railway underbridge with the solum at embankment level directly adjacent to the allotments and the rugby club. The SCRFC clubhouse is located within 100 metres of the solum.

### *Causewayhead Level Crossing*

Cleuch Road and the private level crossing currently provide the only access to a commercial business site (Wm. Kerr Metal Merchants) that is located within 50 metres - southeast of the solum level crossing. The Metal Merchants business is in the process of closing with the site (and the adjacent Riverside Stables site) having been sold to a developer (Bryant Homes) – although no planning application for new housing has yet been lodged with Stirling Council. A new Bett Homes housing development (“Craiglea”) is under construction on the site directly north-east of the Causewayhead level crossing and directly adjacent to the solum and to the west of the current Sunlight Laundry/Grampian Engineering business sites.

### *Waterside Level Crossing (Ladysneuk Road)*

Ladysneuk Road provides the only vehicular access to the south of the solum to the settlement of Cambuskenneth (less than 1 mile) and public service/business operations e.g. the RSPCA Stirling Animal Welfare Centre (within approx 500 metres of the solum), as well as the RICOH factory and the redundant Riverbank Stables site (see housing development proposal previously outlined) – with the last two receptors being directly adjacent to the solum at grade. Stirling Council has also indicated that the land area directly east of the RICOH plant is available for industrial expansion but there are no current known proposals.

### *Abbeycraig Level Crossing*

The level crossing provides access to Broom Farm and five other residential properties south of the solum (four Broom cottages and a property – Abbeycraig Level Crossing House - which is directly adjacent to the level crossing on the south side) with an existing public path link from south of the level crossing via a track to Ladysneuk Road (south of the RICOH factory and east of the available industrial expansion site).

### *A907/A91 New Stirling Eastern Ring Road Roundabout*

A section of the Cambuskenneth to Manor Powis claimed pedestrian RoW crosses the solum (west of the A91) and links to the A907 Alloa Road approximately 100 metres west of the A91/A907 roundabout.

#### 4.4.2 A907/A91 Roundabout to Alloa west (Grange Road Level Crossing)

### *Manorneuk Farm*

Manor Neuk level crossing provides the only farm access across the solum on a track to grazing land with farm house/buildings/grazing land also located within 100 metres to the north of the solum.



### *Manor Powis*

A row of cottages and a designated small open space play area are located at Manor Powis within 200 metres of the north of solum. The Manor Powis level crossing provides the only access across the solum to the redundant Manor Powis Quarry site, which is proposed as an economic development site. The site is currently leased on a monthly renewable basis to an operator of motor sports activities (Ecosse Rally Experience) and Stirling Council has indicated that the site is currently being considered as a possible location for a waste transfer, recycling and composting facility through the Waste Management Planning process.

### *Blackgrange Level Crossing*

The level crossing provides the only vehicular access to the Diageo Blackgrange Bond (directly adjacent to the solum at level on south side) and onwards to other locations including a poultry farm, farm, cottages and the Scottish Wildlife Trust (SWT) Cambus Pools Wildlife Reserve.

### *New Mills Level Crossing*

The Diageo Cambus Bond is located directly adjacent to the railway (north and south side) at grade. A claimed pedestrian RoW (referred to in the Scottish Rights of Way Society's Catalogue of RoWs) and emergency vehicular access route for the Cambus Bond bisects the Bond site. The claimed RoW crosses the railway at the New Mills pedestrian only level crossing providing a pedestrian access route to the River Devon e.g. for fishing (with onwards access via the Cambus Iron Bridge to the signposted SWT Cambus Pools Wildlife Reserve) *or* to Cambus village via Devon Place.

### *Cambus Level Crossing*

The only vehicular access to Cambus Village, the Cambus Bond and Cambus Farm is from the A907 via the Cambus level crossing on Station Road, Cambus. A new Carronvale Homes housing development ("Silver Meadows") is under construction directly northeast of the level crossing with Cambus & District Bowling Club and a playing field located directly adjacent to the solum at grade (southeast of the level crossing). Additional housing, a village shop (including a sub Post Office) and The Inn public house, are all located within 500 metres of the south of the solum.

### *Grange Road Level Crossing*

The level crossing would be closed severing vehicular and pedestrian access to/from Stirling Road at Grange Road. Housing, St. John's Primary School, the Church of Jesus Christ of Latter Day Saints and the ABC Nursery & Kids Zone are all located within 500 metres of the south of the solum. The Alloa Kingdom Hall (Jehovah's Witnesses) is located within 200 metres directly northwest of the solum, north of Stirling Road

4.4.3 Alloa west (Grange Road Level Crossing) to Clackmannan west (Helensfield Rail Bridge over A907)

*West of Former Alloa Brewery Site*

Two pedestrian access ways (on existing rail overbridges at Erskine Street and the Old Rail Bridge respectively) provide links from north Alloa to the Ring Road and on to the Town Centre e.g. shops, library, public houses and restaurants etc. The pedestrian access over the Old Rail Bridge – OB 117/37 (directly west of the former Brewery site) links into the Devon Way long distance footpath from Alloa to the south of Dollar. The Devon Way is listed as a “possible RoW” in the “Book of Reference” prepared by Land Aspects consultants, which accompanies the Scottish Private Bill (and is listed in Schedule 6 of the Bill). It is also identified by the British Horse Society Scotland as a route used by horse riders. It is proposed to remove pedestrian access over OB 117/37 as part of the Scheme works and upgrade the Erskine Street Bridge to provide full disabled access.

*Former Brewery Site (Alloa Station)*

The brewery site is currently a cleared development site which is zoned in the Clackmannanshire Council Finalised Local Plan (July 2002) for development of a new Alloa rail station with associated car park and integrated with development use options including non-food retail, business, leisure and hotel development.

*Whins Road*

Whins Road is a key road link from northeast Alloa to the Ring Road roundabout and the town centre. The road has an underbridge, which will require repair works as part of the Scheme programme.

*Former Balfour Road Level Crossing and Bruce Street*

The indicated former Balfour Road level crossing over the solum is currently blocked-up and access is severed by a fence line on the north side of the solum built on the adjacent private property (Gaberston Farm). There is an existing footbridge over the solum at the north end of Bruce Street providing established community pedestrian access over the solum.

*Hilton Road Level Crossing*

Hilton Road provides direct key pedestrian and vehicular access to the east Alloa suburbs from Clackmannan Road e.g. residences and businesses in Hallpark, Fairfield and New Sauchie etc.

*Alloa Eastern Link Road*

The alignment of the proposed AELR involves a new roundabout located to the south of the A907 Clackmannan Road with a new single-carriage road (max speed 30 mph) and pavement provision running north over the solum and heading north-west to link with the existing Whins Road/Hilton Road/Carsebridge Road roundabout. In between, spur access connections will be provided at the northern end of the AELR onto Hilton Road and to Hilton Farm and Jellyholme Farm at the southern end of the new link.

There are a number of key receptors, which will be directly affected by the AELR scheme. These are identified below.

- § Retail – The Alloa Park retail park on Clackmannan Road (containing a Safeway supermarket and a Focus DIY store, McDonald’s restaurant and a Safeway petrol station) is located directly east, and within 500 metres, of the proposed new link road roundabout south of the A907;
- § Business Enterprises -
- § The Alloa Auto-Breakers and Central Auto Services businesses are located within 100 metres to the west of the proposed new Clackmannan Road re-alignment
- § The Diageo Carsebridge Bond through which the proposed link road alignment bisects 3 of the existing bond warehouses to the south of the Bond site

Hilton Farm grazing land (owned by Diageo) and farmland to the south of the A907 Clackmannan Road, which will also be bisected by the proposed link road alignment; The new Cooperage Way Business Village (on Carsebridge Road) and the Alloa Clackmannan Enterprise Alloa Business Centre (on Whins Road) are located within 100 metres of the Whins Road/Hilton Road/Carsebridge Road roundabout;

- § Community Health: The Church of Scotland Gaberston House & Supported Houses long stay residential care home and the Scottish Society for Autistic Children Balmyre Centre - are both located on Whins Road within 50 metres of the Whins Road/Hilton Road/Carsebridge Road roundabout;
- § Recreation & Amenity: Diageo owned playing field (football pitch which is only used by Diageo employees and as a training ground by Alloa Athletic FC - with no general public amenity access) has a dedicated site access from Hilton Road and is located directly to the west of the proposed link road route alignment. In addition, a small public open space amenity including a children’s play park is located directly west of Hilton Road within c200 metres of the proposed AELR route alignment;
- § Housing: Hilton Crescent housing, and single properties (“Mayburn” on Hilton Road and the Woodend House bungalow on the corner of Carsebridge Road/Hilton Road) are all located within 50 metres of the proposed Scheme.

#### *Hilton Farm Level Crossing*

The level crossing provides a vehicular access road link from the A907 across the solum to Hilton Farm.

#### *Helensfield*

The A907 road links Alloa with Clackmannan The road has an under-bridge, which will require repair works as part of the Scheme programme. The western end of an open section of the National Cycle Network (Route No.76) terminates northeast of the Helensfield underbridge (UB 119/36) and the A907.

#### 4.4.4 Clackmannan (west) to Kincardine (central)

##### *Clackmannan: Mill Road*

The existing rail over-bridge at Mill Road (OB 119/32) provides vehicular access to the Mill Road/Alexander Court and Cherryton Drive housing locations from Alloa Road.

*Clackmannan: Alloa Road (East)*

New housing plots (c10 units) on land west of Hetherington Drive and north of Alloa Road (east) are located within 50 metres of the south of the solum at cutting and are currently advertised for sale. The development site would be an extension of recent housing construction at Hetherington Drive adjacent to the solum.

*Clackmannan: Brucefield Crescent/Northfield Gardens*

The existing rail overbridge at the north end of the access road to Brucefield Crescent/Northfield Gardens from the Alloa Road (OB 119/30) provides the only vehicular access to a single house and arable agricultural land located between the north of the solum and the A907.

*Kennet*

The existing rail bridge (OB 119/28) on the Alloa Road at Kennet is traversed by traffic to/from the A907/A977 roundabout east of Kennet whilst overbridge OB 119/27 carries a permissive bridleway along the “old Kennet Road” linking Kennet to the A977.

*Kilbagie Paper Mill*

The only vehicular access to the Paper Mill site is from the A977 via a private road bridge (OB 119/25) over the solum.

*Kilbagie Paper Mill to Kincardine*

Two existing farm access tracks (Inveresk and Broomknowe respectively) extend from the A977 to arable fields east and west of the solum with track access via rail under-bridges (UB 119/24 and UB 119/23 respectively). The Broomknowe track has a house/B&B and a Garage repair business located within approximately 200 metres of the east of the solum.

*Kincardine: Redundant Power Station site*

The sole access road to the redundant Scottish Power Kincardine Power Station site from the A977 is carried on a rail bridge over the solum (OB 119/21A).

*Kincardine: Station Road Level Crossing*

The Kincardine Station Road level crossing provides a formal pedestrian access across the solum to the foreshore area (which encompasses the defined Kincardine Conservation Area) for recreational purposes e.g. walking, dog exercising, shore fishing etc. The level crossing also provides vehicular access (along a partially un-adopted road which is privately owned) to a Scottish Water pumping station; the Scottish Executive owned pier (immediately west of the Kincardine Bridge); access to farm land and the Kincardine Colts football club changing accommodation/pitch to the west of the solum and a sluice for the River Forth flood plain. In addition, the level crossing also provided an emergency access route to the former Kincardine Power Station and future access may still be required for the proposed economic development use of the redundant site. The foreshore walk extends to the west around the boundary of the Scottish Power Kincardine Power Station site but the foreshore walk to the east stops at the pier to the east of Kincardine Bridge - although illegal access over the operational line is possible (west of Kincardine Bridge) and at the former Kincardine pier level crossing location (which was closed in 1963) to the east of the Bridge.

With the proposed closure of both the illegal pedestrian access points highlighted in the preceding paragraph this will sever the existing unofficial access across the solum at the Kincardine road bridge location although diversionary options for future consideration exist – subject to the formal finalisation of the detailed land take and route alignment requirements of the proposed Kincardine Eastern Link Road scheme e.g.:

- š From the Longannet to Kincardine public path via the road underneath the Kincardine Bridge (to the north of the solum) connecting to Forth Street and onwards to the Station Road level crossing;
- š From the Longannet to Kincardine public path across the A876 North Approach Road and via the pedestrian steps down onto Forth Street and onwards to the Station Road level crossing

#### 4.4.5 Kincardine (east) to Longannet Power Station

There are several existing community receptors along, or adjacent to, this route section. These include:

- š Housing - Inch House and Inch Farm are located approximately 500 metres north of the solum with vehicular access available from either the A985 or the B937 (the signposted Fife Coastal Tourist Route);
- š Community Health – the Kincardine Bridge Nursing Home (North Approach Road) and the Forth Bay Nursing Home (Walker Street) are located within approximately 500 metres north of the solum at around grade level;
- š Business Enterprises – Inch Farm (includes stables) and agricultural land is directly adjacent to the north side of the solum but with no farm activity access over the solum required;
- š Community Recreation – Fife Council Planning & Building Control section has indicated a public path adjacent to the north side of the solum below grade between Longannet Power Station and Kincardine Bridge. This route forms a section of the proposed Fife Coastal Path long distance route. In addition there is a playing field and bowling green located within approximately 500 metres north of the solum;
- š Tourism - The B937 signposted Fife Coastal Tourist Route is located within approximately 500 metres of the solum along this route section – at level.

## 4.5 Environmental Effects

### 4.5.1 Environmental Effects on the Baseline

The identification of the possible range, and of potential access based community effects, created by the Scheme Construction and Operation on the existing baseline receptors prior to mitigation are summarised in Table 4.3 below along with an indication of the magnitude and significance of the impact.

## 4.6 Mitigation

### 4.6.1 Mitigation Measure Opportunities

The identification of mitigation measures to avoid adverse community impacts; minimise the scale, significance or degree of impact; offset or compensate for predicted impacts is also included in Table 4.3 together with an indication of possible residual impacts.

**Table 4.3: Environmental Effects, Impacts and Mitigation Measures Assessment Summary (Continued over)**

<b>Location</b>	<b>Construction &amp; Operation Effects</b>	<b>Potential Impact</b>	<b>Magnitude of Impact</b>	<b>Significance of Impact</b>	<b>Mitigation</b>	<b>Predicted Residual Impacts</b>
Lovers Walk/Forth Viaduct/Bridgehaugh/ Allotments/Stirling County FC	Potential temporary disruption of hospital and ambulance station access along Lovers Walk to/from Riverside area of Stirling and <u>sole</u> site access at Bridgehaugh (vehicular – including emergency services – cyclists and pedestrians) during construction	Short Term Direct (Construction)	Moderate	Minor Adverse	Initiate early liaison with hospital, ambulance station, site owners/tenants and implement appropriate temporary works traffic management measures to ensure full emergency service and participant/spectator/supplier access is maintained during construction.	None predicted
Causewayhead Level Crossing	Permanent closure of level crossing to vehicular traffic, cyclists and pedestrians directly related to the Scheme works severs existing <u>sole</u> access to/from Causewayhead Road via Cleuch Road for business premises only - Wm. Kerr Metal Merchants site	Long Term Direct (Operations)	Severe	Substantial Adverse	Provide alternative vehicular and pedestrian access to Wm. Kerr owned site south of solum via Waterside level crossing and proposed new access road connection from site to Ladysneuk Road. However provision of a footbridge as Stirling Council developer brief condition requirement for the Wm. Kerr site would avoid need for diversionary pedestrian route.	An illustration of the predicted impact on pedestrian journey lengths and journey times is shown in Table 4.4 with the alternative pedestrian route following the level crossing closure shown in Figure 4.1 (unless provision of a footbridge is provided by future developer as a development brief condition when no alternative pedestrian route would be required)
Waterside Level Crossing	Scope includes potential temporary and permanent disruption effects on sole	Short Term Direct	Slight (Construction)	Minor Adverse (Construction)	Implement appropriate temporary works traffic	Potential extended local journey time

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
(Ladysneuk Road)	vehicular, cyclist and pedestrian access over the level crossing during the level crossing upgrade and construction works and line operation.	(Construction) and Long Term Direct (Operations)	and Severe (Operational)	and Substantial Adverse (Operational)	management measures to ensure access maintained during the automatic half barrier upgrade. Provision of barrier will maintain business/resident access over the solum and avoids permanent severance impact. Implement appropriate barrier programming to minimise “down time” and extensions to existing journey times over the crossing.	implications for vehicular traffic, cyclists and pedestrians with installation of barrier controls when barriers are down. Average barrier “down time” estimated to be approximately 3 minutes in every hour.
Abbeycraig Level Crossing	Closure of level crossing permanently severs existing vehicular, cyclist and pedestrian access to/from the A907 over the level crossing e.g. for residents of the four Broom Cottages and Abbeycraig Level Crossing House (a total estimated 10 - 15 residents based upon an assumed average of between 2 and 3 persons per household). <i>(The construction effects, impacts and mitigation on the Broom Farm operation are covered in Chapter 3 and the line operation effects, impacts and mitigation in Chapter 6)</i>	Long Term Direct (Operations)	Severe	Substantial Adverse	Initiate early community consultation and provision of alternative vehicular/pedestrian access via new vehicular/pedestrian route link provision from south of the level crossing to Ladysneuk Road with onward access to the Waterside level crossing and onto the A907 road.	An illustration of the predicted impact on pedestrian journey lengths and journey times is shown in Table 4.4 with the alternative pedestrian route following the level crossing closure shown in Figure 4.1
A907/A91 Roundabout	Permanent severance of Cambuskenneth to Manor Powis claimed RoW access over solum west of the A91 bridge (OB 117/43A)	Long Term Direct (Operations)	Moderate	Moderate Adverse	Provision of a pedestrian/cyclist footbridge over the operational line to maintain access – including provision for the proposed National	None predicted

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
					Cycle Network (No. 76) route section between Stirling and Alloa - requires technical feasibility assessment (which is currently being progressed by Stirling Council)	
Manor Neuk Level Crossing	Potential temporary and permanent restriction of <u>only</u> farm operation access over solum during the level crossing upgrade and construction phases and the line operation.	Short Term Direct (Construction) and Long Term Direct (Operations)	Slight (Construction)  Severe (Operational)	Minor Adverse (Construction)  Substantial Adverse (Operational)	Impose Contractor condition to “build-in” continued farm access over the solum during construction. Provision of User Worked Level crossing will maintain farm access over the line with no permanent severance impact – although restrictions on crossing the line due to the number of trains may possibly need to be implemented.	Minor restriction on farm operation crossing frequency over operational line
Manor Powis Level Crossing	Scope includes temporary and permanent disruption effects on <u>sole</u> vehicular, cyclist and pedestrian access over the level crossing during the level crossing upgrade and construction works and line operation.	Short Term Direct (Construction) and Long Term Direct (Operations)	Slight (Construction)  Severe (Operational)	Minor Adverse (Construction)  Minor Adverse (Operational)	Impose Contractor condition to “build-in” continued existing access over the solum during construction. Provision of User Worked level crossing will maintain access over the operational line with no severance impact.	None predicted
Blackgrange Level Crossing	Scope includes temporary and permanent disruption effects on sole vehicular, cyclist and pedestrian access over the level crossing during the level crossing upgrade and construction	Short Term Direct (Construction) a  Long Term Direct	Slight (Construction)	Moderate Adverse (Construction)	owners/residents and implement appropriate temporary works traffic management measures to ensure access maintained	Potential extended local journey time implications for vehicular traffic, cyclists and



Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
	works and line operation for major commercial properties and residences	Direct (Operations)	Severe (Operational)	Substantial Adverse (Operational)	during the automatic half barrier upgrade and construction works. Provision of barrier will maintain business/resident access over the solum and avoids permanent severance impact. Implement appropriate barrier programming to minimise “down time” and extensions to existing journey times over the crossing.	pedestrians with installation of barrier controls - when barriers are down. Average barrier “down-time” estimated to be approximately 3 minutes in every hour.
New Mills Level Crossing	Permanent severance of an established claimed ROW once level crossing closure is implemented (although it is understood that Clackmannanshire Council are supportive of removing pedestrian access rights and Diageo have confirmed the removal of their emergency access rights)	Long Term Direct (Operations)	Moderate	Moderate Adverse	Following closure of the New Mills level crossing a diversionary alternative over the Cambus Station Road level crossing on Station Road (c500 metres walking distance to the east of the New Mills level crossing) and westwards via Devon Place and a path to the Cambus Iron Bridge over the River Devon is available and would maintain pedestrian/cyclist etc access over the operational line in the vicinity of the New Mills location.	An illustration of the predicted impact on pedestrian journey lengths and journey times is shown in Table 4.4 with the alternative pedestrian route following the level crossing closure shown in Figure 4.1
Cambus Level Crossing	Scope includes the temporary and permanent effects on vehicular, pedestrian, cyclist access over the level crossing to/from Cambus village during the level crossing upgrade and	Short Term Direct (Construction) and Long Term Direct	Slight (Construction) Severe (Operational)	Minor Adverse (Construction) Substantial Adverse	Initiate early community liaison and implement appropriate temporary works traffic management measures to ensure access	Potential extended local journey time implications for vehicular traffic, cyclists and

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
	the level crossing upgrade and construction works and the line operation.	Direct (Operations)		(Operational)	measures to ensure access maintained during the construction and automatic half-barrier upgrade work. Provision of barrier will maintain business/resident access over the solum and avoids permanent severance impact from operation. Implement appropriate barrier programming to minimise “down time” and extensions to existing journey times over the crossing.	cyclists and pedestrians with installation of barrier controls – when barriers are down. Average barrier “down-time” estimated to be approximately 3 minutes in every hour
Grange Road Level Crossing	Permanent severance of existing vehicular, cyclist and pedestrian access over the solum at Grange Road with c70 houses contained within only an immediate c200 metres radius south of the solum, (a total estimated 140 -210 residents based upon an average of between 2 and 3 persons per household)	Long Term Direct (Operations)	Slight (Vehicles)  Severe (Pedestrians/ Disabled/ Cyclists)	Minor Adverse (Vehicles)  Substantial Adverse (Pedestrians/ Disabled/ Cyclists)	Existing alternative vehicular access is already available via the new Alloa West road overbridge/Smithfield Loan for current Grange Road vehicular users and access to the property at No. 25 Stirling Road following the road closure would be maintained. The proposed provision of a pedestrian/disabled user/cyclist overbridge would maintain respective access (including safe crossing) over the solum to residences and key community facilities e.g. St.	An illustration of the predicted impact on pedestrian journey lengths and journey times is shown in Table 4.4 with the alternative pedestrian route following the level crossing closure shown in Figure 4.1  Potential extended local journey time implications for vehicular traffic diverted via new Alloa West Road/Smithfield Loan.

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
					John's Primary School, and the Church of Jesus Christ of Latter Day Saints, the ABC Nursery & Kids Zone, Alloa Academy, the Alloa Kingdom Hall etc.	
West of former Alloa Brewery site	Permanent severance of pedestrian/cycle access (including Devon Way users) to/from Alloa town centre over existing Old Rail Bridge overbridge (OB 117/37) with retention of pedestrian access (including improved disabled access) on neighbouring Erskine St bridge (OB 117/38)	Long Term Direct (Operations)	Slight	Minor Adverse	Diversion of footpath from Old Rail Bridge to connect with Erskine Street pedestrian overbridge (c50 metres to the west) would retain existing pedestrian access and improve disabled access provision. Implement phased works to both bridges to prevent temporary route severance during construction – with negligible community/visitor inconvenience.	None predicted
Former Brewery Site (Alloa Station)	Potential temporary disruption to existing Ring Road traffic users during the station roundabout construction period including temporary severance of the existing vehicular access from the Ring Road to the shopping centre car park south of the Ring Road.  Pedestrian, disabled etc access could be maintained over the Ring Road during construction via the existing pedestrian controlled crossing south of Erskine Street.	Short Term Direct	Moderate	Moderate Adverse	Implement appropriate temporary traffic management measures e.g. temporary traffic light controls, contra flow during construction period to minimise disruption to Ring Road traffic and maintain vehicle access to the shopping centre car park.	Potential extended local journey time implications for vehicular traffic on the Ring Road held at temporary traffic lights, contra flows etc during the construction period.
Whins Road	Potential temporary disruption to	Short Term	Slight	Minor Adverse	Implement appropriate	Potential extended

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
	Whins Road vehicular traffic during bridge repairs (UB 117/35)	Direct (Construction)			temporary works traffic management measures e.g. lane closures and traffic light controls	local journey time implications for vehicular traffic on Whins Road held at temporary traffic lights during the construction period. Alternative route options e.g. via Hilton Road and Clackmannan Road west to Ring Road roundabout east) also have extended local vehicular journey time implications. No residual impact predicted for pedestrians, cyclists, disabled as it is assumed that such access under the Bridges would be maintained during the works period.
Former Balfour Road Level Crossing & Bruce Street	The former Balfour Road level crossing is currently permanently “blocked-off” with no community through access available.  Permanent access will be retained over existing Bruce Street pedestrian overbridge (OB 117/34B) but temporary severance during bridge repair works period.	<u>Balfour St</u>  Long Term Direct (Operations).  community through access available.  Permanent access will be	n/a	n/a	Initiate early community consultation with residents of Balfour Street, and those in the vicinity e.g. Park Place and Bruce Street to confirm the retention of the refurbished Bruce Street footbridge (c30 metres to the east) as a directly accessible pedestrian access route over the operational	No residual impact predicted as this maintains current baseline pedestrian access position at this location.

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
		access will be retained over existing Bruce Street pedestrian overbridge (OB 117/34B) but temporary severance during bridge repair works period.	Slight(Construction) Negligible (Operations)	Minor Adverse (Construction) Minor Beneficial (Operations)	route over the operational line. Alternative temporary pedestrian access option over the solum would be available via Hilton Road during Bruce St. footbridge works.	
Hilton Road Level Crossing	<p><i>(a) Closure of Level Crossing</i></p> <p>Permanent severance of existing vehicular and pedestrian access over the solum. It has potential implications for emergency services access e.g. the Clackmannan Road Fire Station response time to properties on Hilton Road located north of the closed level crossing on Hilton Road, northwest of Hilton Road and Hilton Crescent. – c90 houses. (a total estimated 180 - 270 residents based upon an average of between 2 and 3 persons per household)</p> <p><i>(b) Rail Operation</i></p> <p>Spectator management control and safety issues for Alloa Athletic FC matches.</p>	<p>Long Term Direct (Operations)</p>           <p>Long Term Secondary (Operations)</p>	<p>Severe (Vehicles/Cyclists/Disabled Users/Pedestrians)</p>           <p>Moderate</p>	<p>Substantial Adverse</p>           <p>Moderate</p>	<p>Initiate early community consultation to promote the Alloa Eastern Link Road as the replacement vehicular access option over the operational line in proximity to Hilton Road – with provision of guarantee that the level crossing will not be closed until the AELR is complete to maintain existing full access links over the solum. Provision of a new pedestrian overbridge on Hilton Road will prevent permanent pedestrian, cyclist and disabled access severance over the solum.</p> <p>Implement appropriate safety measures at Alloa</p>	<p>Potential for minor extended emergency vehicle response times from Clackmannan Road fire station to properties on Hilton Road immediately north of the closed level crossing and Hilton Crescent An illustration of the predicted impact on pedestrian journey lengths and journey times is shown in Table 4.4 with the alternative pedestrian route following the level crossing closure shown in Figure 4.1</p>

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
				Adverse	Athletic FC e.g. relocation of Hilton Road spectator gates; installation of appropriate fencing etc to completely segregate spectators from the directly adjacent operational line and provide safe passage to, and over, the pedestrian overbridge.	None predicted
Alloa Eastern Link Road	<p>Provision of alternative local, visitor, business and emergency service vehicular access over the solum with the closure of Hilton Road to through vehicular traffic</p> <p>Potential temporary severance/diversion of existing Clackmannan Road and Whins Road/Carsebridge Road vehicular, cyclist and pedestrian traffic during the</p>	<p>Long Term Direct (Operations)</p> <p>Short Term Direct (Construction)</p>	<p>Severe</p> <p>Moderate</p>	<p>Moderate Beneficial</p> <p>Moderate Adverse</p>	<p>Initiate early community consultation to promote the Alloa Eastern Link Road as the replacement access option over the operational line with the proposed permanent closure of Hilton Road to vehicular through traffic. Provision of new road spur connections will maintain access to/from the AELR for existing housing and business receptors e.g. Hilton Road/Hilton Crescent/Gaberston Avenue residents and Hilton Farm as well as essential services e.g. Clackmannan Road fire station.</p> <p>Implement appropriate temporary traffic and pedestrian management measures e.g. temporary traffic light controls, contra</p>	<p>Potential for extended response time implications for emergency service vehicle traffic from Clackmannan Road Fire Station attending properties on e.g. Hilton Road – immediately north of the solum/Gaberston Avenue/ Hilton Crescent.</p>

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
	roundabouts construction period				flow during construction period to minimise disruption and avoid temporary severance of existing community access.	
Hilton Farm Level Crossing	Permanent closure of level crossing severs existing vehicular/pedestrian access over solum to farm and farm house residence from the A907 (a total estimated 2 to 3 residents based upon an average of between 2 and 3 persons per household)	Long Term Direct (Operations)	Severe	Moderate Adverse	Alternative access to be provided via a spur connection from the proposed Alloa Eastern Link Road. Alternative farm access option already available prior to opening of the AELR - via Carsebridge Road/Jellyholm Farm road entrance	An illustration of the predicted impact on pedestrian journey lengths and journey times is shown in Table 4.4 with the alternative pedestrian route following the level crossing closure shown in Figure 4.1
Helensfield	Potential temporary disruption to A907 Alloa Road traffic during bridge repairs (UB 119/36)	Short Term Direct (Construction)	Slight	Moderate Adverse	Implement appropriate temporary works traffic management measures e.g. contra flows and lane closures with traffic light controls.	Potential extended local journey time implications for vehicular traffic on the A907 at Helensfield held at temporary traffic lights during the construction period No alternative vehicular route options at this location. No residual impact predicted for pedestrians/cyclists/disabled as it is assumed that such access under the Bridge would be maintained during the works period.

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
Clackmannan – Mill Road	Potential temporary disruption of vehicular and pedestrian access over overbridge (OB119/32) to housing estate from Alloa Road during construction and avoidance of temporary community access severance.	Short Term Direct (Construction)	Slight	Minor Adverse	Initiate early liaison with residents and implement appropriate temporary works traffic management/works programme measures to ensure the existing access from the Alloa Road is maintained.	Potential extended local journey time implications for vehicular traffic on Mill Road at the junction with Alloa Road (at the temporary traffic lights) during the construction period. No residual impact predicted for pedestrians/cyclists/disabled as it is assumed that such access on Mill Road over the bridge would be maintained during the works period.
Clackmannan – Alloa Road East (zoned as housing Policy H74 in Clackmannanshire Finalised Local Plan 2002)	Potential temporary disruption of site access for housing construction – if this overlaps with Scheme construction timetable.	Short Term Direct (Construction)	Slight	Minor Adverse	Initiate early liaison with land owner/ housing developer re the respective Scheme and housing development proposals (once known) to identify/resolve any potential issues.	None predicted
Kennet	Potential temporary disruption to vehicular/cyclist/pedestrian traffic flows on the Alloa Road at Kennet (OB119/28) during construction and avoidance of temporary local traffic severance Potential temporary disruption to permissive bridleway access on the old	Short Term Direct (Construction)	Slight	Moderate Adverse	Implement appropriate temporary works traffic management measures e.g. temporary contra flows, traffic light controls etc to ensure vehicular, cyclist and pedestrian access is maintained.	Potential extended local journey time implications for vehicular traffic with installation of temporary works traffic controls. No residual impact



Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
	permissive bridleway access on the old Kennet Road (OB 119/27) during the over-bridge repair works.	Short Term Direct (Construction)	Negligible	Minor Adverse	maintained. Implementation of bridge repairs programme that ensures bridleway access over the bridge is maintained throughout the temporary construction period.	No residual impact predicted for pedestrians/cyclists/disabled as it is assumed that such access on the Alloa Road would be maintained during the works period. No residual impact predicted for equestrian users.
Kilbagie Paper Mill	Potential disruption of <u>only</u> vehicular, cyclist and pedestrian access to commercial business enterprise site during construction and avoidance of temporary access severance.	Short Term Direct (Construction)	Slight	Minor Adverse	Initiate early liaison with site owners and implement appropriate temporary works traffic management measures to ensure temporary access maintained.	Potential extended local journey time implications for vehicular traffic during construction period. No residual impact predicted for pedestrians/cyclists/disabled as it is assumed that such access would be maintained during the works period
Kilbagie Paper Mill to Kincardine	Potential temporary severance of farm vehicle accesses below the solum during bridge decks replacement (UB 119/24 and UB 119/23).	Short Term Direct (Construction)	Moderate	Moderate Adverse	Initiate early liaison with Inveresk and Broomknowe farm owners and implement appropriate management/works programme measures to ensure temporary/permanent farm operational access is maintained.	None predicted
Kincardine Power Station	Potential temporary disruption of access over the solum (OB119/21A) to	Short Term Direct	Slight	Minor Adverse	Initiate ongoing liaison with Scottish Power and	None predicted

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
	site during construction.	(Construction)			implement appropriate temporary works traffic management measures to ensure vehicular, cyclist and pedestrian access is maintained – although alternative vehicular/pedestrian access feasible via the village and Hawkhill Road.	
Kincardine - Station Road Level Crossing	Potential temporary community vehicular, cyclist/disabled/pedestrian access severance over the solum to the foreshore area for recreational and business purposes during the level crossing upgrade and construction period	Short Term Direct (Construction)	Slight	Moderate Adverse	Initiate early liaison with the owner of Station House as well as wider village community consultation promoting the implementation of appropriate temporary works management measures to ensure public access (vehicular, cyclists, disabled, pedestrians) over the level crossing is maintained during the crossing upgrade (automatic half-barrier). Minor delay impacts on site user journey times provided by the temporary works traffic control measures	Potential extended local journey time implications for vehicular traffic, cyclists and pedestrians with installation of barrier controls - when barriers are down. Average barrier “down-time” estimated to be approximately 3 minutes in every hour
Kincardine (east) to Longannet Power Station	Acquisition of access rights along existing recreational path (usable by pedestrians, cyclists and horse riders) east of the solum between the North Approach Road, Sewage Works and Longannet Power Station to	Long Term Direct (Operation)	Long Term Direct (Operation)	Negligible Adverse	Implement appropriate temporary works access management measures as required to maintain pedestrian, cyclist, disabled user and horse rider access	None predicted

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
	Longannet Power Station to accommodate Scheme works. Potential permanent severance of established community recreation routes between the west of Longannet Power Station and the Kincardine foreshore north-west of the Kincardine Bridge	Long Term Indirect (Operations)	Moderate	Moderate Adverse	user and horse rider access along pathway during works period.  Undertake a feasibility assessment to identify a suitable alternative link to the Station Road level crossing – following the proposed closure of the illegal access points across the solum (below the Kincardine road bridge) and also taking into account finalisation of the Kincardine Eastern Relief Road scheme – to prevent permanent severance of access connections to the existing pathway between Longannet and the north side of the Kincardine Bridge at the foreshore, and for the proposed Fife Coastal Path route	Dependent upon outcome of feasibility assessment to define the most appropriate link route between the Kincardine foreshore (adjacent to the Station Road level crossing) and west of Longannet Power Station
	Level crossing upgrade works on private Longannet Power Station site (Western Arrival and Western Departure crossings)	Short Term Direct (Construction)	Negligible	Negligible Adverse	Implementation of proposal to provide public pedestrian access around the Longannet Power Station site (as an integral	None predicted

Location	Construction & Operation Effects	Potential Impact	Magnitude of Impact	Significance of Impact	Mitigation	Predicted Residual Impacts
					<p>component of the suggested route alignment of the proposed Fife Coastal Path connection from North Queensferry to Kincardine – which is contained in the Fife Council West Villages Local Plan Finalised Version - Feb 2000) provides a permanent and safer community recreational route – away from an operational line section on the Longannet Power Station land.</p>	

**Table 4.4: Predicted Pedestrian Journey Length & Time Impacts (Continued over)**

<b>Level Crossing Closure</b>	<b>Route Illustration (See Note 1)</b>	<b>Current Distance (metres) rounded</b>	<b>Alternative Route Distance (metres) rounded</b>	<b>Net Change in Journey Length (metres) rounded</b>	<b>Estimated Net Change in Time for Pedestrians (minutes) rounded (See Note 2)</b>	<b>Level of Impact (See Note 3)</b>	<b>Comments</b>
Causewayhead	Wm. Kerr Metal Merchants site ( <i>proposed housing development site</i> ) to sub Post Office northeast of the Causewayhead Road/A907 roundabout.	470m	780m	+310m	+4 mins (excluding possible barrier “down-time” at Waterside level crossing)	Moderate	Diversionary pedestrian route option only applicable if current housing development proposal proceeds to planning and only if no footbridge provision over the solum is made – see Note 1. below.
	Wm. Kerr Metal Merchant site ( <i>proposed housing development site</i> ) to Wallace High School	600m	1,570m	+970m	+12mins (excluding possible barrier “down time” at Waterside level crossing)	Severe	Diversionary pedestrian route option only applicable if current housing development proposal proceeds to planning and only if no footbridge provision over the solum is made – see Note 1. below.
Abbeycraig	Abbeycraig Level Crossing House to sub	750m	970m	+220m	+3mins (excluding possible barrier	Slight	Longer pedestrian route option over

Level Crossing Closure	Route Illustration (See Note 1)	Current Distance (metres) rounded	Alternative Route Distance (metres) rounded	Net Change in Journey Length (metres) rounded	Estimated Net Change in Time for Pedestrians (minutes) rounded (See Note 2)	Level of Impact (See Note 3)	Comments
	Post Office north-east of the Causewayhead Road/A907 roundabout				“down time” at Waterside level crossing)		Waterside Level Crossing and “Slight” in impact in terms of the estimated number of residents (10-15) whose journey would be affected (see <i>Abbeycraig</i> section in Table 4.3).
	Abbeycraig Level Crossing House to Alloa Road bus routes (bus stop location not available but taken in vicinity of Ladysneuk Road/Alloa Road junction)	460m	690m	+230m	+3mins	Slight	Longer pedestrian route option and slight in impact in terms of the estimated number of residents (10-15) whose journey would be affected (see <i>Abbeycraig</i> section in Table 4.3).
	Abbeycraig Level Crossing House to Abbeycraig public path at connection to A907 east of the level crossing	380m	1,420m	+1,040m	+12mins (excluding possible barrier “down time” at Waterside level crossing)	Severe	Longer pedestrian route option over Waterside Level Crossing but “Slight” impact in terms of the estimated number of residents (10-

Level Crossing Closure	Route Illustration (See Note 1)	Current Distance (metres) rounded	Alternative Route Distance (metres) rounded	Net Change in Journey Length (metres) rounded	Estimated Net Change in Time for Pedestrians (minutes) rounded (See Note 2)	Level of Impact (See Note 3)	Comments
							15) whose journey would be affected (see Abbeycraig section in Table 4.3).
New Mills	Junction of claimed RoW at the A907 to River Devon (eg for fishing)	520m	960m	+440m	+5mins (excluding possible barrier "down time" at Cambus Station Road level crossing)	Moderate	Longer route option over Cambus Level Crossing (which Clackmannanshire Council has indicated is "well used by a variety of local users")
	No.1 Main Street, Cambus to A907 via the claimed RoW	830m	660m	-170m	-2mins (excluding possible barrier "down time" at Cambus Station Road level crossing)	Slight	Shorter route option but route parallels traffic activity with increased traffic noise disturbance for pedestrians
Grange Road	Alexandra Drive residents (south end) via A907 Stirling Road and Grange Road level crossing to St. John's Primary School on Grange Road	270m	250m (excluding ascending/descending footbridge steps/ramps)	-20m	+1 min (allowance for ascending/descending footbridge steps/ramps)	Slight	Change in pedestrian journey distance negligible but involves an over (as opposed to) an at grade, solum crossing
Hilton Road	Level crossing to point where the footpath	95m	170m	+75m	+2mins (includes +1minute allowance for	Slight	Small change in pedestrian journey

Level Crossing Closure	Route Illustration (See Note 1)	Current Distance (metres) rounded	Alternative Route Distance (metres) rounded	Net Change in Journey Length (metres) rounded	Estimated Net Change in Time for Pedestrians (minutes) rounded (See Note 2)	Level of Impact (See Note 3)	Comments
	northwest of the level crossing links to Hilton Road (between No.31 & No.33 Hilton Road)				ascending/descending footbridge steps/ramps)		distance but involves an over (as opposed to) an at grade, solum crossing
Hilton Farm	Hilton Farm farmhouse to Alloa Park Retail Park	990m	1,390m	+400m	+5mins	Moderate	Longer option involving pedestrian crossing of new AELR as well as the existing A907 road

**Notes:**

**1. Causewayhead Level Crossing** – The only current receptor which would be affected by the closure of the Causewayhead level crossing is the Wm Kerr Metal Merchants business site, which at the time of drafting the ES had been sold (along with the adjacent Riverside Stables site) to Bryant Homes. It should be noted that the route illustration scenarios for the Causewayhead level crossing site therefore relate to these proposed housing development sites but for which no planning application has yet been lodged with Stirling Council. A consultation response from Stirling Council indicates that the Planning Brief for this site advises that the developer should provide footbridge access over the railway. A diversionary pedestrian route would therefore only be applicable if provision of a footbridge was in fact to be excluded as a finalised formal site development condition requirement for the Wm. Kerr Metal Merchant/Riverside Stables sites.

2. Assumes an average walking speed of 5 km/ph (Source: DMRB Vol 11)

3. Predicted levels of impacts based upon DMRB Vol 11 “New Severance” changes to current journey distance guideline classifications.



## 4.7 Community Access Effects

The Scheme entails the closure of a total of six level crossings. The closure of Grange Road and Hilton Road level crossings in Alloa - but with the provision of alternative pedestrian footbridges (including disabled and cyclist provision) and vehicular access routes (including for the latter, the Alloa Eastern Link Road scheme) - will prevent permanent severance of community access over the rail corridor at these two locations as well as improving pedestrian safety.

The closure of the Causewayhead level crossing in Stirling will permanently sever an existing vehicular/pedestrian access point to business premises (the Wm. Kerr Metal Merchants site which has recently been sold to Bryant Homes). Stirling Council has indicated that the planning brief for the development of the site should include the provision of a pedestrian footbridge over the railway as a developer condition requirement, which, if formally implemented, would maintain pedestrian access without the need for a diversionary route. An alternative vehicular access route from the proposed development site would be via a new road link connection from the site onto Ladysneuk Road. The provision of alternative access routes has also addressed permanent severance issues for both pedestrian and vehicular traffic at the Abbeycraig (Stirling) and Hilton Farm (Alloa) level crossings and for pedestrians at the New Mills level crossing.

Based upon the illustrative scenarios provided in Table 4.4 the level crossing closures will have a range of potential impacts. Whilst "Severe" and "Moderate" pedestrian journey time impacts have been identified for the two Causewayhead pedestrian route scenarios, the final overall assessment of impact is assessed as "Slight" at Causewayhead – based upon the explanatory Note 1 content provided at the foot of Table 4.4. One of the route scenarios given for Abbeycraig results in a "Severe" net additional journey distance ranking (based upon the DMRB Vol. 11 new severance guidelines) but DMRB Vol. 11 also recommends that the number of people whose journey will be affected should be considered when making the overall new severance assessment. Given the limited number of residential properties (5 houses and estimated 10-15 residents) affected by the proposed Abbeycraig level crossing closure, the overall assessment of impact at Abbeycraig is also assessed as "Slight" with the proposed mitigation providing an acceptable alternative diversionary route.

A brief summary of the key pedestrian effects are detailed in Table 4.5 below.

**Table 4.5: Changes in Journey Times for Pedestrians (Continued over)**

Route	Change in Journey Distance (m)	Change in Journey Time (mins)	Level of Impact
1. Causewayhead level crossing to sub Post Office at Causewayhead Road/A907 roundabout	+310m	+4 mins	Moderate (but see text in "Comments" column and in Note 1. of Table 4.4)
2. Causewayhead level crossing to Wallace High School	+970m	+12 mins	Severe (but see text in "Comments" column and in Note 1. of

Route	Change in Journey Distance (m)	Change in Journey Time (mins)	Level of Impact
			Table 4.4)
3. Abbeycraig level crossing to sub Post Office at Causewayhead Road/A907 roundabout	+220m	+3 mins	Slight
4. Abbeycraig level crossing to Abbeycraig public footpath at junction of A907	+1,040m	+12 mins	Severe (but see text in "Comments" column of Table 4.4)
5. Abbeycraig Level Crossing House to Alloa Road bus routes (bus stop location not available but taken in vicinity of Ladysneuk Road/Alloa Road junction)	+230m	+3 mins	Slight
6. Cambus Junction (New Mills) - Junction of claimed RoW at the A907 to River Devon	+440m	+5 mins	Moderate
7. Cambus Junction (New Mills) - No. 1 Main Street, Cambus to junction of A907 and claimed RoW	-170m	-2 mins	Slight
8. Alexandra Drive to St. John's Primary School, Grange Road.	-20m	+1 min (allowance for ascending /descending footbridge)	Slight
9. Hilton Road level crossing to public path between No.31 & No.33 Hilton Road	+75m	+2 mins (includes allowance for ascending /descending footbridge)	Slight
10. Hilton Farm farmhouse to Alloa Retail Park	+400m	+5 mins	Moderate

The implementation of possible temporary traffic controls on roads during the Scheme bridge repairs programme would result in the potential for some extended local journey times eg at Whins Road, Helensfield, Mill Road, Clackmannan, Kennet, Kilbagie and Kincardine Station Road level crossing. In addition, there will be temporary extended local journey time implications for vehicular traffic at the A907 Clackmannan Road and the Whins Road/Carsebridge Road areas during the construction of the new roundabouts and road alignments directly associated with the Alloa Eastern Link Road scheme as well as temporary extended local journey time implications during the construction of the Alloa Station entrance roundabout on the Ring Road.

## 4.8 Cumulative Community Effects Assessment

This chapter section identifies the potential cumulative community effects associated with the other relevant environmental assessment topics e.g. construction disruption, air quality, noise and vibration, landscape and visual effects. For ease of reference and continuity with the previous Community Access Assessment chapter section, these cumulative effects have also been assessed at specific locations within a series of route sections between Stirling and Longannet and are detailed below. It should be noted that where the community baseline information for the specific location has already been provided in the Community Access Assessment section, this has not been repeated. However, for those locations where no community baseline information has previously been provided, this information is presented. For each of the locations, an appraisal of the cumulative environmental discipline effects is given.

### 4.8.1 Stirling Station to the A91/A907 Roundabout

*Stirling Station/Forth Viaduct/Allotments directly adjacent to solum below embankment level/Stirling County RFC Bridgehaugh ground.*

Temporary construction noise and vibration (Forth Street) and landscape and visual effects and permanent operational noise, vibration and landscape and visual effects. There would also be temporary air quality effects (bridge works and Forth Viaduct works compound). Temporary works compound locations and construction access are proposed at Stirling station south of south car park, and at Forth Street/Lovers Walk on the southern side of the Forth Viaducts - as well as at the Bridgehaugh allotments and the Stirling County RFC ground and adjacent to the railway embankment on Causewayhead Road during the construction works period with increased temporary vehicle movement - particularly for the residents on, and within, the vicinity of Forth Street and Causewayhead Road.

#### *Causewayhead Level Crossing*

Combined community impact considerations include temporary construction noise and permanent operational noise effects for the site northeast of the solum (including the new Bett Homes "Craiglea" housing development). The key issues for the developed Wm Kerr/Riverbank Stables sites include increased vehicular movement/access to and from the sites - from the proposed new access road link to Ladysneuk Road south of the solum which will require permanent land take - as well as the aforementioned temporary construction and permanent operational noise effects on receptors in proximity to the solum. In addition, there will be a requirement for temporary works access to the railway line along Cleuch Road during the construction phase with associated works vehicle traffic movement.

### *Waterside Level Crossing (Ladysneuk Road)*

Temporary construction noise and visual amenity effects and permanent operational noise, vibration effects and visual effects are anticipated. There is also the potential for limited increased road vehicle movement at/over the level crossing (generated by the new access road from Ladysneuk westwards into the development sites south of the solum – see previous section) and the interface between the A907/Ladysneuk Road junction – although Stirling Council do not envisage a problem with traffic “backing-up” on to the A907 at the junction. Permanent landtake will be required to create the access road link to the Wm. Kerr Riverbank Stables development site (as indicated in the preceding section). In addition, it is proposed to place a permanent Relocatable Equipment Building (REB) site on land directly south-west of the level crossing with some permanent land take required and scope for associated increased vehicle movements/parking in the vicinity during the works period.

### *Logieburn Culvert*

Temporary vehicular access to Logieburn Culvert is required from the A907 Alloa Road directly across from residences with limited temporary increased vehicle movement and temporary land take required north and south of the solum (works space). There would also be temporary landscape and visual effects during the construction phase.

### *Grangehall Culvert*

Temporary vehicular access to Grangehall Culvert required from the A907 Alloa Road via an existing ROW track with limited increased temporary vehicle movement and temporary land take required north and south of the solum for working space. There would also be temporary landscape and visual effects during the construction phase.

### *Forth Viaduct to Abbeycraig Level Crossing*

In addition to the specific locations identified above, the following represent general receptors between the Forth Viaduct and the Abbeycraig level crossing, which would potentially be affected by the proposed line re-opening:

- š Housing - Extensive housing exists adjacent to the solum along virtually all of the length of this section between Forth Viaduct and Ladysneuk Road (most within 50 metres and at grade). This includes Council owned residential accommodation at Wallace Gardens which is located northwest of the Waterside level crossing;
- š Community Leisure – The Silver Tassie public house (which is currently on the market) is located directly adjacent to the solum north-west of the Causewayhead level crossing and another public house is located directly north of the Causewayhead Road/A907 roundabout;
- š Business Enterprise – The Remploy skills training centre is located directly adjacent to the north of the solum between Ladysneuk Road and Abbeycraig level crossing;
- š Shops – At junction of Causewayhead Road and the A907 Alloa Road north of the solum – including a sub Post Office located within an Alldays supermarket;
- š School – Wallace High School which is located to the west of Causewayhead Road at Dumyat Road;
- š Outdoor Recreation – Public park including play equipment located north of the A907 between Causewayhead Road and Ladysneuk Road;
- š Public Hall – Logie Kirk Hall located north of the A907 between Causewayhead Road and Ladysneuk Road.

Key community considerations include temporary construction and permanent operational noise (especially No. 60 Alloa Road) and vibration (locations between Waterside and Abbeycraig level crossings) and temporary construction and permanent operation landscape and visual effects. Temporary construction dust effects on properties within around 50 metres of the working area (e.g. Forth View) are predicted. In addition, a temporary works compound land take is required at Abbeycraig south-west of the level crossing with permanent land take also required for the stopping up of the existing level crossing junction and the creation of the new vehicular/cyclist/pedestrian link road connection south of the Abbeycraig level crossing to Ladysneuk Road.

#### 4.8.2 A907/A91 Roundabout to Alloa west (Grange Road Level Crossing)

##### *Manorneuk Farm*

The reinstatement of an operational line at Manorneuk Farm would generate temporary construction working space and permanent operation noise and vibration for the farmhouse residents. Access lands take required for level crossing works via Manor Powis level crossing.

##### *Manor Powis*

These include temporary construction and visual effects and permanent operation noise and vibration on the Manor Powis residents whilst there would be potential for temporary additional vehicle movement along the works traffic access road on the existing track linking the A907 to the level crossing site. Temporary land take would be required north and south of the solum including a works compound north east of the level crossing and access for construction between Manor Powis and Manorneuk Farm.

### *Blackgrange Level Crossing*

These include temporary construction and landscape effects and permanent operation noise, vibration and landscape effects. In addition, permanent REB and temporary works compound access and land-take (northeast and northwest of the level crossing) is proposed via the private road access to the Bond from the A907 with increased vehicle movements/parking etc during the upgrade works period. Temporary landtake would be required between Manor Powis and Blackgrange for relocation of utility apparatus with permanent rights of future access. The temporary landtake access would be from either the Manor Powis or Blackgrange level crossings.

### *New Mills Level Crossing*

Temporary works vehicular access will be required from the A907 Alloa Road with increased vehicle movement. There is a requirement for temporary works access along a track northwest of the level crossing to a temporary works compound proposed at a location adjacent to the Cambus Viaduct with the potential for increased vehicle movements in the vicinity during the works period. In addition, there will be temporary construction dust air quality effects created by the Cambus Viaduct bridge works and a temporary landscape effect with the installation of the construction works compound and work area.

### *Cambus Level Crossing*

Temporary construction noise and landscape effects and permanent operational noise, vibration and landscape effects. A permanent REB footprint with vehicle/pedestrian access is proposed for a location within the Scheme boundary directly northwest of the railway with a temporary works compound on the electricity sub station site also northwest of the solum. The works area will generate increased temporary vehicle movements in the vicinity during the works period.

### *Grange Road Level Crossing*

Temporary construction noise and landscape effects and permanent operational noise, vibration and landscape and visual effects for properties in proximity to the solum (but a reduction in road traffic noise and emissions with the cessation of through vehicular traffic over the level crossing). Temporary land take required for works area at Dirleton Gardens and on Grange Road directly south of the level crossing – with possible restricted access to No. 80 Grange Road - and the installation of the pedestrian footbridge will also result in permanent land-take and possible visual intrusion of adjacent housing at high level but will provide a safer public crossing of the solum.

### *A91/A907 Roundabout to Alloa west (Grange Road Level Crossing)*

In addition to the specific community effects outlined above, there are a number of general issues for existing key receptors along the route section including:

- š Housing – e.g. the new Carronvale Homes housing units at Cambus east of the level crossing and at west Alloa which are located within approximately 50 metres of the solum corridor;

- § Community Recreation – e.g. Cambus & District Bowling Club, Cambus playing field, Clackmannan County Cricket Club, and a public park are all located within approximately 50 metres of the solum corridor. Between Cambus and Alloa west, the Braehead Golf Club, the Arns Brae Pleasure Grounds (both north of the solum) and the Cambus to Smithfield Loan signposted public footpath which is also identified by the BHS Scotland as a route used by horse riders (south of, and parallel to, the solum) - are all contained within an approximate 500 metres catchment area;
- § Business Enterprises – e.g. New Alloa Business Park and agricultural grazing and arable land located within around 50 metres of the solum corridor and the Diageo Abercrombie Bond located within approximately 500 metres south of the solum. A temporary works compound to the north-west of the Pavilions Business Park road is proposed for the required track works between the east of Cambus and the Pavilions Business Park (which entails sizeable linear landtake south of the solum) with access to be taken from the new overbridge road link to the Pavilions Business Park creating additional vehicle movement and noise impacts during the works period for receptors within the vicinity. A permanent REB site is also proposed west of the Business Park requiring permanent land take

Key community impact considerations include safeguarding existing recreational open space – including public access to these sites and both temporary and permanent noise, vibration and landscape and visual effects on adjacent residents and business operations.

#### 4.8.3 Alloa west (Grange Road Level Crossing) to Clackmannan west (Helensfield rail bridge over A907)

##### *Former Brewery Site (Alloa Station)*

- § The brewery site is currently a cleared development site which is zoned in the Clackmannanshire Council Finalised Local Plan (July 2002) for development of a new Alloa rail station with associated car park and integrated with development use options including non-food retail, business, leisure and hotel development. There are a number of “in proximity” receptors to the cleared development site including:
  - § Business Enterprise - The Shell Garage directly adjacent to the south of the solum and north of the Ring Road – at level with vehicular and pedestrian access currently from the Ring Road. The Clackmannanshire Finalised Local Plan (July 2002) Policy T8 states that the petrol station may possibly be incorporated within the site development although the Scheme lay-out proposals allow for retention of the petrol station operation;
  - § Retail: - Retail Park (Co-op; Iceland etc; large car park) south of the Ring Road and another Shell Garage also south of the Ring Road within approximately 200 metres of the south of the solum - which will be a business operation lost to accommodate the new roundabout access to the Station from the Ring Road proposed within the Scheme works;
  - § Community Venue – the Spiers Centre (including a museum, and the Play Alloa and the Eagle Project community resource projects which is located south of the Ring Road within approximately 200 metres of the solum;
- § Housing - Existing Housing is located to north of existing embanked solum within an approximate 500 metres radius e.g. Sunnyside Court/Kingswell Park,/Hutton Park/Argyll Place/Argyll Street/Parkway etc.

Finalisation of the scope of combined community impacts will be dependent upon more detailed confirmation of the total development mix on the Brewery site – in addition to the identified proposals for the new Alloa rail station contained within the Scheme. The scope of the combined community effects of the new Alloa station provision will include temporary construction noise and landscape and visual effects as well as permanent noise, vibration and landscape and visual effects.

Temporary construction air quality effects created by the former Brewery underpass bridge repairs and the station temporary works compound are predicted. The extra vehicular activity from the existing busy Alloa Ring Road into the station car park is deemed unlikely to increase traffic levels to such an extent that traffic noise changes are noticeable.

Traffic management measures will be required during the construction of the roundabout for the new station access with temporary extended vehicular journey time implications. Provision of access to temporary works compound sites will be required (e.g. construction access via the Alloa Leisure Bowl car park to a construction compound south of the Centre for fabrication of the new track/turnout – which will temporarily interface with the Bowl patrons using the car park - and north of the Brewery site at Erskine Street and east at Whins Road) with associated vehicle movement and works access impacts on the residents in the vicinity including Parkway/ Erskine Street/Sunnyside Court/Whins Road.

Permanent landtake will be required for the station, car park development and the station access road. The proposed upgrading of the footpath/cyclepath from Argyll Street to the station site via the existing Brewery underpass (which is currently “blocked-up” with no public access) will provide a new community access facility to the station building and platform and to Alloa town centre for residents north of the operational line. Works on the Whins Road underbridge will require works access and may entail half road closures and temporary traffic light controls with extended travel time implications for traffic using Whins Road.

#### *Hilton Road Level Crossing*

Temporary construction noise and landscape and visual effects and permanent operational noise, vibration and landscape and visual effects on the adjacent receptors e.g. residents and Gaberston Avenue play park users located directly north and northwest of the crossing and Alloa Athletic F.C. located directly to the south-west of the crossing. Closure of the level crossing provides scope for vehicular access to the permanent REB location proposed to the southeast of the level crossing and the provision of a permanent turning area for Hilton Road users directly north of the closed level crossing.

The proposal to locate a temporary works compound in part of the dedicated spectators car park area used by Alloa Athletic FC with access from Hilton Road would have a consequential reduction in car parking capacity on match days and creates the potential for temporary construction dust effects. The realignment of Hilton Road to provide a junction with the New Alloa Eastern Link Road, the proposed footbridge alignment and vehicle turning area would all entail permanent land take.

The new footbridge would also result in limited loss of amenity open space at the play park north of the solum off Gaberston Avenue with possible high level footbridge user visual intrusion for Hilton Road residents (Nos. 21 to 31 Hilton Road) immediately north-west of the solum – but will provide a safer community crossing over the solum. The provision of a vehicle turning area immediately to the north of the closed level crossing will entail partial permanent garden land loss for the property at No.21 Hilton Road.



### *Alloa Eastern Link Road*

The construction and opening of the new AELR creates a number of combined community impact considerations for both the existing and identifiable potential future receptors. Temporary effects include construction noise on local residential properties e.g. for the residents on the east side of Hilton Road along its length (including Hilton Crescent) and the Gaberston House care home residents at the north-west end of Hilton Road as well as the Diageo Carsebridge Bond operation and residents located to the south-west of Carsebridge Road – particularly Woodend House.

The removal of topsoil and the embankment construction will create a temporary construction dust effect – particularly for the existing properties located at the top northwest section of the road alignment. Temporary works compounds associated with the road construction works will require some landtake – adjacent to the A907 at Hilton Farm level crossing. In addition there will be temporary landscape effects during the construction period and the potential for temporary additional construction vehicle movement on Clackmannan Road, Hilton Road and Whins Road during the roundabouts construction/amendment work. This will also require traffic management measures during construction with temporary extended travel time implications for the A907 Clackmannan Road and the Whins Road/Carsebridge road users.

Permanent combined effects include a long-term overall decrease in the number of people bothered by traffic operational noise from the link road operation. There will also be permanent road operational air quality changes for the existing properties on Hilton Road and Clackmannan Road east (reduction in air pollution concentrations) and Hilton Crescent (increase in air pollution concentrations) as well as permanent landscape and visual effects after the construction period.

Additional impacts on the existing receptors include permanent land loss e.g.

- š Loss of three existing bonded warehouses (also required for construction compounds/working space) creating site ownership severance at the Diageo Carsebridge Bond;
- š Partial loss of land at the Alloa Business Centre to the west of the Whins Road roundabout;
- š Loss of agricultural land and farm land severance (Hilton Farm) to accommodate the proposed road alignment between the two roundabouts and loss of agricultural land (south of Clackmannan Road) to accommodate the eastern leg of the proposed route alignment and the new A907 roundabout;
- š Partial loss of business site on Clackmannan Road (Alloa Auto-Breakers and Central Auto Services) at Hiltonhawk Road to accommodate the new southern roundabout and the western leg of the new A907 alignment as well as new vehicular access to the garage premises.

### *Hilton Farm Level Crossing*

The removal of farm access over the level crossing (with the provision of replacement permanent access via a spur connection from the AELR) will permit temporary scheme access to the temporary works compound from the A907 (north-east of the crossing on existing farm land). Access to the temporary compound will create additional limited vehicle movement to/from the A907 and there will be temporary landscape and visual amenity effects during construction.

*Alloa west (Grange Road Level Crossing) to Clackmannan west (Helensfield Rail Bridge over A907)*

In addition to the specific community effects outlined above there are a number of general issues for existing key receptors along this route section where the existing solum is at a combination of deep cutting/embankment and at grade (west to east) along the above line section.

Existing Key Receptors include:

- § Housing – particularly north and east of the Alloa Ring Road/Clackmannan Road/Whins Road roundabout;
- § Visitor Accommodation and Public House – Claremont Lodge Hotel and Peppe's bar (Kellie Place and Mar Place respectively);
- § Sports Venues and Community Recreation amenities – Alloa Athletic FC's Recreation Park and associated match day spectator car park, West End Park, Greenfield Park, Alloa Leisure Bowl, Clackmannan Road Sports Centre, the Bowling Club adjacent to Gaberston Farm and the Gaberston Avenue playground. A new Community Centre (Hawkhill Community Association) located directly south of the Clackmannan Road at the Hilton Road junction is currently under construction and will open by the spring of 2003;
- § Public Service venues – Alloa Health Centre, Alloa Town Hall, Alloa Police Station H.Q., Clackmannan Road Fire Station;
- § Business Enterprises – Cab hire company, Alloa Trading Centre small business unit complex, garage repair centre;
- § Church – Moncrieff United Free Church, on Drysdale Street, south of the solum and North Church on Mar Place, north of the solum;
- § Community Care – Ludgate House Resource Centre (elderly respite and day care) on Mar Place, and the A.L.L.O.A. Centre (Child/Adult care centre) on Hillcrest Drive south-east of the Alloa Ring Road/Whins Road roundabout and within approximately 500 metres south of the solum.

Key community impact considerations include temporary construction noise and landscape and visual effects. Permanent effects include operational noise (especially properties on Park Place, Alloa); operational vibration effects (Alloa Station, Park Place, Balfour Street and Bruce Street) and landscape and visual amenity effects. Temporary construction dust effects will be created by the bridge repairs (at Whins Road) and the temporary works compound (at the Ludgate/Marshall roundabout). Temporary land take for the trackworks is required with access from the Ludgate/Marshall roundabout with permanent landtake required at Mar Place for an REB and access. Permanent limited land take will also be required between the Hilton Farm level crossing and the Helensfield underbridge to give access from the A907 to signalling equipment. Additional temporary works compound provision for the Helensfield bridge works will also be required with access from the A907.

#### 4.8.4 Clackmannan (west) to Clackmannan (central)

*Clackmannan – Kennet*

Along this route section there are a number of general community issues for the existing receptors. These include:

- § Housing – combination of private and council housing through length of Clackmannan (from Devonway/Helensfield to Ladywood) for c1.5km located either adjacent to, or within 50 metres of the solum (north/south) – at a combination of embankment and deep cutting levels. The solum also passes within approximately 150 metres to the north of Kennet village housing at deep cutting level;
- § Community Recreation – open space (football pitch and play park) located directly east of Clackmannan cemetery at Devonway and south of the solum within 100 metres and below embankment level and Alexander Park (open space and play park) located to north of the solum (within 100 metres) above deep cutting level;
- § Public Amenity – the Clackmannan cemetery is located within c150 metres to the south-west of the solum below embankment level;
- § Business Enterprises – a Petrol Station located south of the solum at the Alloa Road/Kirk Wynd junction; a Works site and Yard located at the east end of Park Place and to the north of the solum (within 50 metres) at deep cutting level with access from Park Place existing rail over-bridge on the B910 Cattle Market road; Hillend Farm (pedigree Holsten Freisan cattle farm) – grazing field directly adjacent to north-east of solum and rail bridge over the A907; a combination of residential and farm properties/arable land at Helensfield located to the north of the solum (within c200 metres) of line; and at Kennet a combination of agricultural land/buildings located north and south of the solum and a Garage business (A.Manson & Sons) is located south of the solum (all within 50-100 metres) – and all at cutting level.

Key community effects include temporary construction noise and landscape and visual effects and permanent operational noise effects (especially Devonway and Northfield Gardens in Clackmannan); operational vibration effects (Devonway, Mill Bank Crescent, Mill Road, Hetherington Drive, Northfield and at Kennet) as well as operational landscape and visual amenity effects. Temporary air quality effects from the construction dust are predicted at several receptor locations (eg Devon Way, Mill Bank Crescent, Mill Road, Park Place, Northfield and at Kennet) and the maintenance of vehicular and pedestrian access during the construction works.

In addition, temporary works compounds and access from Helensfield Farm off the A907; via Mill Road, from Mill Villa and at the former Cattle Market site off Alloa Road in Clackmannan will be required with increased vehicle movements whilst the proposal to locate a temporary works compound on railway land between Clackmannan and Kennet, but accessed via a private farm track from the Alloa Road, raises the prospect of increased associated limited vehicle movement to/from the junction of the track with the Alloa Road during the works period. Temporary landtake will be required for construction access and compound at Kennet (Meadow End) with access from Old Farm Road for bridge and track works.

#### *Kilbagie Paper Mill*

These include temporary construction noise and landscape and visual effects. There would also be permanent operational noise and vibration effects. In addition, access to work areas for bridge repairs/traffic control works east and west of the solum with temporary land take implications is required.

#### *Kilbagie Paper Mill to Kincardine*

Combined effects include temporary construction noise and landscape and visual effects. There are also permanent operational noise, vibration effects and landscape and visual effects for the properties in proximity to the solum. A temporary works compound and work area is proposed on Inveresk farm land requiring land take to the west and east of the solum respectively but accessed from the A977 via the current track raising the prospect of increased associated temporary vehicle movement to/from the junction of the track with the A977 during the works period. In addition, temporary works access via Broomknowe Farm track to a work area for bridge repairs north of the underbridge and to Tulliallan culvert and overbridge (including a construction compound) southeast of the underbridge will be required.

*Kincardine: Redundant Power Station site*

These include temporary construction noise and permanent operational noise and vibration – but only once the currently cleared site is developed. In addition, there is a requirement for a permanent REB site located within the Scheme boundary south of the Hawkhill Road overbridge with a temporary works compound area on the Power Station site – at a precise location still to be determined. Both of these create the potential for increased vehicle movement and noise implications during the works period.

*Kincardine: Station Road Level Crossing*

Temporary construction noise and landscape and visual effects would accrue. There would also be permanent noise, vibration and landscape and visual effects on property (Station House) located directly adjacent to the east of the level crossing with the increased frequency of freight traffic. Temporary construction works access is required for installation of traffic light controls with permanent land take for an REB site proposed for the southwest of the level crossing

*Kincardine: west and central village areas*

In addition to the specific community effects outlined above there are a number of general issues for existing key receptors along this route section. These include:

- § Housing – much of the Kincardine village housing between the west of the village and the Kincardine Bridge (e.g. Broomknowe Drive/Hawkhill Rd/Kilbagie Street/Ochil View/Station Road/Ash Braes/Forth Street) is located either directly adjacent to, or within 100 metres of the solum – with many houses located at, or about grade);
- § Community Recreation – Tulliallan Golf Club is located within approximately 400 metres of the east of the solum; the Kincardine Colts FC ground/changing accommodation is located within approximately 150 metres of the solum below a slight embankment level (although it is understood that there is currently a proposal for the Club to relocate to another area in the village away from the railway);
- § and the Forth Street open space and play park areas are located within 100 metres of solum at grade;
- § Community Venues and Health Care – the Kincardine OAP Centre, and the Auld Hoose public house (both Forth Street); the Kilbagie Street Masonic Hall, Kincardine Health Centre and shops/public houses/restaurants; the Kincardine Library, Kincardine Post Office and a public house (all Keith Street); the Unicorn Restaurant & Bar (Excise Street) a nursery and the High Street shops are all located within approximately 500 metres of the solum at, or about grade;
- § Attractions – Old Tulliallan Castle which can be accessed via an unmetalled road from the A977 and the Tulliallan Castle overbridge (OB 119/22)

- § Business Enterprise – Hawkhill Farm has an access road (same as for Tulliallan Castle) and grazing land directly adjacent to the west of the solum – at deep cutting level. The farmhouse/buildings are located within approximately 200 metres of the west of the solum.

These include temporary construction noise and permanent noise and vibration effects (Broomknowe Drive and Ochil View). Additional effects include maintaining vehicle and pedestrian access on overbridges during the construction works and increased temporary construction vehicle movement to/from the A997, In addition, the provision of a permanent REB site with access from Hawkhill Road potentially creates enhanced vehicle/pedestrian movement and diesel generator noise impacts;

#### *Kincardine (east) to Longannet Power Station*

Potential community effects are likely to include possible increased noise and vibration effects from enhanced frequency of freight train activity. Temporary landscape and visual effects would occur during construction and acquisition of access and drainage rights may be required east of the solum between the North Approach Road and Longannet Power Station.

## **4.9 Cumulative Community Effects Summary**

A summary of the cumulative community effects is presented in a tabular format in the Environmental Statement Volume 1 report (Chapter 6) as an integral part of the overall summary of the key environmental impacts of the Scheme.

## **5. CULTURAL HERITAGE**

### **5.1 Introduction**

This chapter describes the archaeology and cultural heritage issues of the Scheme and was prepared by AOC Archaeology Group as sub-consultant to Scott Wilson.

The Scheme passes through the local authorities of Stirling, Clackmannanshire and Fife. Stirling and Clackmannanshire Councils are advised on archaeological issues by Stirling Council Environmental Services. Fife Council are advised on archaeological matters by Fife Archaeological Unit. Historic Scotland provides advice on any works affecting scheduled ancient monuments and Category A or B Listed Buildings.

This assessment is designed to meet the heritage requirements of current planning regulations set out in National Planning Policy Guidelines NPPG 5 and NPPG 18, and Planning Advice Notes PAN 42, which seek primarily to preserve heritage in-situ or, as a less favoured alternative, by record. In addition, no specific technical difficulties were encountered in this assessment.

#### **5.1.1 Objectives**

The objectives of this assessment are as follows:

- § To create a database of known archaeological sites within or in close proximity to the development area;
- § To assess the potential for unknown archaeological sites to exist within the development area;
- § To assess the sensitivity of the known archaeology, and the likely impact of the proposed development upon these remains;
- § To present a mitigation strategy for the developer that could allow the development works on the railway to proceed given the requirements of NPPG 5 (SOEnd 1994), NPPG 18 (SOEnd 1999), PAN 42 (SOEnd 1994a) and AM & AAA (1979).

### **5.2 Methodology**

A description of the methodology used in this assessment is presented in Appendix 2A, Volume 3. In essence, the archaeological or cultural heritage sensitivity of sites, buildings and monuments along the railway route has been evaluated and then cross-tabulated with the estimated magnitude of impact by the proposed development. Together these pairs of values have allowed a rating of the significance of impact by the development upon each site or monument. A listing of bibliographic, cartographic and photographic archaeological references is contained in Appendix 2B of Volume 3.

### **5.3 Consultations**

#### **5.3.1 Historic Scotland**

Historic Scotland was first consulted in August 2002 during the preparation of this assessment to obtain information about Scheduled Ancient Monuments (SAMs) in the vicinity of the Scheme. Mrs J D Edmond offered comments with regard to the development proposal on behalf of Historic Scotland (by letter, dated 14/08/02). This letter confirms that there are no SAMs along the railway line, but draws attention to SAMs in the vicinity. Based upon consultation of the 'Benefits Study Final Report' and the 'Appraisal of Options',

Historic Scotland state they have *'no reason to believe there will be significant extra negative effects on the settings of these scheduled sites'*, and *'no concerns about the re-opening'* at this stage. Furthermore, they state they have no comments to offer with regard to listed buildings and designed landscapes. However, they have recommended that detailed information be sought on conservation areas from the local planning authorities. Historic Scotland was approached once again in November 2002, regarding the effects of the proposed Alloa Eastern Link Road on scheduled ancient monuments. Mrs J D Edmond responded once again, stating that *'there is a scheduled ancient monument in close proximity to the southernmost roundabout called AMH/30176, Parkmill, cross slab ..... Your assessment should therefore look at the effects the development will have on the setting of this monument in accordance with government guidance, and the relevant policies in the Council's development plans'* (by letter, 15/11/02). An additional response was received from Historic Scotland regarding the AELR from Ms Sabrina Strachan (by letter, 27/11/02). This stated:

*'It would seem that, allowing for changes in the surroundings of the SAM since its scheduling, the proposed roundabout would impinge upon the north edge of the scheduled area. Works necessary to create the banking indicated upon your layout would inevitably fall within the scheduled area. I would therefore advise that the location of the proposed roundabout be revised to take this into account and provide a reasonable buffer around the SAM and consider ways in which the effect upon the setting of the SAM can be minimised'*.

### 5.3.2 Fife Council Archaeology Unit

Fife Council Archaeology Unit was approached for Sites and Monuments Records (SMR) data during preparation of the assessment. The Archaeology Unit sent back numerous records from the SMR, mostly relating to standing buildings, and a variety of associated data such as SMR mappings and extracts from publications relevant to the assessment area. They also considered the archaeological implications of the proposed redevelopment (letter from Mr Thomas Rees to AOC Archaeology Group, 19/09/02). Mr Rees stated he had considered *'all statutory and non-statutory archaeological constraint data sets'* in relation to the proposed development area in Fife. Mr Rees pointed out the possibility of unknown remains underlying the proposed development area, and also the invalidity of the supposed Roman Fort site on the reclaimed land southeast Kincardine (Site No.167).

### 5.3.3 Stirling & Clackmannanshire Councils

The archaeological advisor to Stirling and Clackmannanshire Council (Ms Lorna Main) was also approached for SMR data during preparation of the assessment. A response was received from Ms. Main by telephone, which confirmed that there were no further SMR sites to add to the assessment that were not already represented in the NMRS data (September 2002). Ms Main had no other comments to offer about the archaeological and cultural heritage sites in the assessment area other than comments regarding the up-to-date condition and status of some NMRS sites.

## 5.4 Baseline

### 5.4.1 Sites of archaeological or cultural heritage sensitivity

The archaeological and cultural heritage remains identified in the assessment area have each been assigned a Site No. They are listed in order of Site No. in the Site Gazetteer in Appendix 2C in Volume 3, and are generally ordered from west to east along the railway line. Descriptive details of each site are also shown in the Gazetteer. A concise look-up

table of all sensitive sites identified during the assessment is also shown in Appendix 2E in Volume 3. The estimated sensitivity of these sites has been classified and is shown in both of these Appendices. In addition, the location of all listed buildings within the Scheme and Scheduled Ancient Monuments and Conservation Areas immediately adjacent to the Scheme are shown on the Environmental Features and Designations map in Vol.1 Figure 1.2. Furthermore, Figure 5.1 in this volume also shows in more detail the Listed Building locations within the Scheme.

#### 5.4.2 Overview of sensitive remains

The railway line has an inherent cultural heritage value. There are a number of railway structures and other features registered as items of historic or cultural heritage interest in the National Monuments Record of Scotland (NMRS) and the Local Council Sites and Monuments Records. Furthermore, at Stirling the station building, two signal boxes and the associated 11 semaphore signals are all listed buildings. The type of signal boxes listed at Stirling Station are becoming more rare in Scotland, although about seventy traditional mechanical signal boxes still remain. There are several other disused or demolished railway structures along the line (eg bridges and former stations) that are recorded as monuments but are not protected by any designation. The remains of many other former railway structures survive along the line that have not been registered as monuments. There is also a slight geographical bias to the record because Fife Council have been especially active in adding sites to the Sites and Monuments Record.

In addition to the railway itself, there are a variety of other types of remains on the land bordering the railway, dating from a variety of periods ranging from the prehistoric to the modern era. Stirling, Alloa, Clackmannan and Kincardine are burghs of Late Medieval origin. Each of these towns contains a concentration of Late medieval remains recorded at their core, and the railway tends to pass close to these in each case. The Late Medieval remains include structures such as market crosses, tollbooths, bridges, tower houses, castles and churches.

There are relatively few sites of prehistoric date in the main assessment area (i.e. within 200m of the railway). They include a shell midden, cist burials, and a burial cairn. The findspot of a Roman coin is also known in Alloa. Generally it can be said that prehistoric sites are of moderate or high sensitivity due to their antiquity and relative rarity. There is an Early Medieval cross with the site of a cist and human burials east of Alloa at the AELR (Site No.102), which together make up a Scheduled Ancient Monument (SAM) of very high sensitivity. It is likely that other burials survive around this monument that are not included in the scheduled area, and these type of remains suggest the possibility that there was once an Early Medieval chapel at this site. Another Early Medieval chapel site is suspected at the north edge of Kincardine.

There are many industrial remains in the main assessment area dating from the 1800s or in some cases the later 1700s, including collieries, mills, breweries, distilleries and works, and their remains vary in sensitivity. Even some monuments with industrial and transport functions dating from the 1900s are registered, such as power stations and the Kincardine Bridge.

The most numerous types of item in the assessment area are residential standing buildings of historical interest, in most cases dating from the 1800s. Many of these are listed buildings, but there are also many that are not which are nonetheless included in the NMRS or SMR due to their date or historical character.



### 5.4.3 Implications of protective designations

#### *Scheduled Ancient Monuments*

There are no scheduled ancient monuments within the fenced strip that encloses the railway line and defines the main proposed development area. All SAMs within a 1 km distance of the railway are shown in Appendix 2F, Volume 3. A SAM at Site No.102, incorporating an Early Medieval cross and the site of a cist and human burials, is located at the edge of the proposed new roundabout at the south of the proposed Alloa Eastern Link Road (see Figure 5.2). Historic Scotland has indicated an apparent overlap of the proposed roundabout onto the edge of the scheduled area, and requires the layout of the roundabout to be revised to avoid the scheduled area. They have also requested that a buffer zone is left undisturbed around its edges it as an extra safeguard. There are 23 other SAMs located within 1 km of the railway. As the development will not directly impact upon any of these, no scheduled monument consent is required for this development. However, Historic Scotland has indicated that there could be a visual impact on the setting of the SAM at Site No.102. Note that several of the SAMs identified in this study are also designated as listed buildings. In such cases, the SAM legislation takes precedence over that of listed buildings.

#### *Listed Buildings*

There are 149 listed buildings within 200 m of the railway. However, the Scheme will only have a direct impact upon those at Stirling Station, comprising Stirling Middle and Stirling North signal boxes, and four of the sixteen associated semaphore signals (see Figure 5.1). These are category A Listed Buildings, and in the absence of the special provision in section 33 of and schedule 10 to the Bill listed building consent would be required for development works that will impact upon these structures. Like SAMs, the setting of Listed Buildings also has statutory protection. There is therefore potential for the proposed railway, its traffic, and the REBs, to exert a visual impact upon the setting of some of the listed buildings along the railway route. However, it should also be borne in mind that some of the listed buildings were built after the railway, in which case the railway and its engines may have formed part of the original setting of these buildings and need not be viewed as an feature incongruous with their setting today.

#### *Historic designed landscapes and gardens*

Two designated Historic Designed Landscapes extend to within the assessment area at Airthrey Castle and Tulliallan Estate. These designed landscapes, including various built, planted and landscaped features, are regarded as being of High cultural heritage sensitivity. The designation of these landscapes is not statutory, but aims to preserve the historical built and planted features on an estate as part of a coherent landscape. Although designed landscapes are not a material consideration in the planning process, their existence will be taken into account when development proposals are considered by Council planning departments.

#### *Conservation Areas*

Five towns and villages that the Scheme passes through contain designated Conservation Areas (CAs):

- § Stirling (the CA is situated close to the railway, and includes the station building area)
- § Alloa (the CA is located close to south side of the railway)
- § Clackmannan (The CA lies to the west of the railway)

- § Kennet (the CA includes all of the miners' row and gardens, bordering on the west of the railway)
- § Kincardine (the CA lies east of the railway)
- § Developments proposed within these designated areas are generally expected to be of a high quality, designed to blend in with or complement the traditional appearance of the historical built context. However, the Scheme is not actually included in any of the conservation areas, except for the small portion that runs through Stirling Station building. It is worth pointing out that another nearby conservation village at Culross will see some benefits due to reduced traffic on the section of line adjacent to the village, as traffic is diverted via the proposed new railway.

## 5.5 Environmental Effects

The results of the assessment of predicted impact are laid out in Volume 3 in Appendix 2D. This shows each feature of archaeological interest in the study area rated in terms of its archaeological sensitivity, along with the magnitude of impact predicted upon it from the proposed development. For each site, the rating of both of these factors was considered in combination in order to arrive at an assessment of the net predicted significance of impact on each archaeological site by the development.

### 5.5.1 Effects of construction

Unlike some other types of receptors, archaeology is a finite resource, and the groundbreaking and building works of the construction phase will result in permanent or residual impacts. The development works will permanently affect some listed buildings at Stirling Station, some unprotected bridges, and suspected remains in east and central Alloa.

The significance of impact upon Site No.'s 1 and 25 (Stirling Middle and North Signal Boxes) and Site No.6 (the associated semaphore signals) is calculated as Moderate-to-Major. Although these structures are of Very High cultural heritage sensitivity and classified as Category A listed buildings, their alteration will involve only a Slight magnitude of impact. The development of these structures aims to preserve as many original features as possible, and will not result in any changes to the structure or external appearance of the signal boxes. At Stirling North Signal Box (Site No.25) it is proposed to use an existing space at one end of the structure to house new electronic equipment that will function alongside the existing controls, separated from them by an existing internal partition. Two of the sixteen semaphore signals (SN 26 and SN27 et al) at Stirling Station will be replaced. Detailed design assessment may conclude that semaphore signals SN11 and SN 8 will also be replaced with minor repositioning a short distance south in each case. The signals will still be operated mechanically from the signal boxes. Stirling Railway Station is also a Category A listed building but the effects of the Scheme on the station building can be classified as negligible. There are two under track cable route crossings to be constructed in the vicinity of Stirling Station, however, this is not predicted to affect the fabric of the Listed station building.

Alloa Brewery site (Site No.95) is of Low archaeological and cultural heritage sensitivity. The brewery was recently demolished and much of the building complex comprised large, modern buildings. The site also appears to be situated just outside the area of the medieval burgh of Alloa. However, on the other hand the brewery developed on this site from 1810, and it is possible that foundations of some of the brewery buildings from the early 1800s at the core of this site or even remains from previous land-uses on the site might be preserved. The construction of the new Alloa Station may affect traces of buried remains at this site, thus it is estimated that overall there will be a Moderate significance of impact.

There will be a Low-Moderate significance of impact by the proposed Alloa Eastern Link Road upon Hallpark Distillery (Site No.99), and upon an area of pits identified from aerial photographs taken in 1946 (Site No.101 - Site of pits, east of Alloa). Three bonded warehouses at Site No.99, through which the proposed new road passes, will be demolished to make way for the road. They were built in recent decades during a phase in which the complex expanded southwards. They are not considered to be of cultural heritage value, being repetitive brick structures with corrugated tin roofs and minimal internal features. The former area of pits at Site No.101 has been wholly or partially infilled, and is also of low archaeological sensitivity.

Major works are proposed on the North British Railway Bridge over the Forth (Site No.32). These will comprise the strengthening of the south-west abutment, selective steelwork repairs to the superstructure, and complete blast-cleaning and painting. Overhanging scaffolding will be erected to enable this and to prevent debris falling into the Forth. The bridge is not a listed building and no consent will be required for its repair. The significance of impact on this structure is judged to be Low. The impact upon the original bridge fabric is deemed acceptable from a cultural heritage preservation point of view, since the works will help to conserve the bridge by improving its durability and sustaining its original intended use. Similarly, repairs will be made to a bridge at Kilbagie (Site No.123) and Erskine Street in Alloa (Site No.174). These bridges are of low cultural heritage sensitivity and their repair and re-use will ensure their long-term preservation. The impact of this work on the bridge at Kilbagie is judged to be negligible, while that on the Erskine Street Bridge, Alloa, will be Low. An arched, masonry, skew bridge in central Alloa (Site No.175 – Old Railway Bridge) will be demolished during the development, and the significance of impact on it will be Moderate. None of the bridges along the railway line are listed buildings, and most of them are not registered as monuments and are not considered to be of archaeological or cultural heritage sensitivity.

The site of Alloa Harbour Railway Branch (Site No.85) will be used as a works compound and access area, and will then be landscaped as part of the development. The site of the railway branch is of Low archaeological and cultural heritage sensitivity, and the development will have a Low impact on these remains because it will only affect a short stretch of this former railway line. This site lies close to the centre of the medieval burgh of Alloa, however, it seems likely that any medieval remains have been removed from this location by the cutting of the railway. The significance of the impact here is Low.

Kincardine Branch Railway (Site No.116) has been included in this assessment because the entire line is registered as a monument in Fife SMR. Since the line is being re-opened and upgraded, with other associated works, there will be an impact upon this monument. However, since the works will re-open the route they will ultimately allow its sustainable preservation and the impact is therefore judged to be beneficial.

The impact upon all other sites identified in this assessment is classified as either Marginal or None. In cases where other remains of former railway buildings or railway features are indeterminate or fragmentary, and they are located to the side of the line, impacts upon their sites is judged to be Marginal and the significance of impact Negligible. For example, several signal boxes are known from map evidence to have formerly stood along the route of the railway. Where these have been demolished it is unlikely that significant archaeological data could be derived from the excavation of their sites.

The proposed Alloa Eastern Link Road and roundabout will have no direct impact upon the SAM, although they will be constructed in close proximity to it. However, the new land-take for the road in the vicinity of this SAM is likely to be of high archaeological

sensitivity, as there is a high probability that further Early Medieval human burial remains could be recovered here that are associated with the stone cross and other burials previously found. The impact on these suspected remains by the road construction would be permanently destructive.

At most sites proposed for redevelopment, there is generally a small probability that unknown archaeological remains could survive beneath undisturbed patches of ground. The risk of encountering these along the railway line is likely to be low, since the work involved in the original construction of the railway may already have disturbed much of the ground within the fenced area.

Temporary impacts are those that could potentially prevail in the short-term during construction, e.g. due to arrangements for facilities such as work compounds and plant access. In this case the positions of the proposed construction sites, temporary storage areas and temporary roads do not coincide with any known sites of archaeological or cultural heritage sensitivity, with two exceptions in the centre of Alloa (former Railway Station and the former Brewery). The significance of impact by the temporary works, assuming they will not involve groundbreaking works, is Negligible.

#### 5.5.2 Effects of operation

Although situated outside of the Scheme area, there will be a slight operational impact with regard to public access arrangements to the memorial on the East Pier, Kincardine (Site No.163) once the railway is re-developed. Currently the public gain access by walking illegally across the operational railway between Kincardine and Longannet. However, in future, with increased train usage, access will be by another route, via the level crossing at Station Road, Kincardine.

Other operational impacts will be restricted to minor visual effects upon the archaeology and cultural heritage.

Two historical designed landscapes extend to within the assessment area at Airthrey Castle and Tulliallan. It is predicted that there will be little or no lines of sight between the railway and the designed landscape of Airthrey Castle (Site No.45). Historic Scotland describes the estate as being invisible from the roads around its perimeter and, furthermore, the topography of Abbeycraig and Spittal Hill (at the south of the estate) obscure almost all of the designed landscape from view from the railway. Furthermore, a built-up area of housing in the north of Stirling also separates the railway from the designed landscape. Airthrey Castle Estate lies 440 m north of the railway at its nearest point. As a result, no visual impact upon the setting of Airthrey designed landscape is anticipated.

Historic Scotland (1997) has classified Tulliallan Estate (Site No.131) as having 'some' scenic value, but also note that the designed landscape is the setting for several category A listed buildings on the estate. The lodge, offices and the estate are effectively screened from the railway by intervening buildings and trees. At its nearest point the estate is 200m from the railway. It is predicted that the visual impact by the railway on Tulliallan designed landscape will be negligible.

As described above, there are 24 SAMs located within 1km of the railway. In the vast majority of cases, there will be little or no effect upon the setting of these SAMs, due to their distance from the railway and due to the intervening topography, built features and trees. One SAM that will have its setting affected by the proposed new Alloa Eastern Link Road is the Early Medieval stone cross at Site No.102, situated on a small knoll at the south

edge of the proposed new roundabout at the south end of the Link Road. Due to the proximity and elevation of the proposed roundabout in relation to the scheduled cross-slab, a potentially significant visual impact upon its setting is predicted. The cross-slab site is located at a high point in the centre of a field, visible on the horizon from the present road and from the site of the proposed roundabout. The value of the setting is also enhanced by Clackmannan Tower, which forms the backdrop for the stone when viewed from the northwest. However, the value of its setting has otherwise been compromised. The NMRS entry records that *'long before 1829 the cross stood on the inside of a hedge-row and was situated about 160 paces from the old road between Alloa and Clackmannan, and a few paces W of it was an old parish road'* (1791). The setting of the monument has therefore been altered from its original appearance, since it used to stand against a hedgerow. It now stands on a small 'island' in the middle of a ploughed field. Indeed, from the existing road the cross might not even be recognised as a monument as it could be mistaken for a fence post from some angles. The setting of one other scheduled monument, Abbeycraig, will be slightly affected, since extensive views can be appreciated from the Wallace Monument on the summit, including some of the railway proposed for reopening.

The proposed new railway and the trains that it would carry could have an effect upon the protected curtilage and amenity of listed buildings in their vicinity. The REBs at Stirling Station, to be positioned next to the listed signal boxes, could potentially have a moderate visual impact upon their setting from some angles of view. Additionally, the design of the new station built at Alloa could impact upon the setting of the townscape and Conservation Area. There could also be minor visual effects upon the conservation areas through which the railway passes at Alloa, Stirling, Clackmannan, Kincardine and Kennet. However, a few factors that reduce this effect by the railway can be cited:

- § The railway is already an established feature in the landscape
- § The railway is lined for some of its length with mature trees and bushes
- § In many cases there is no inter-visibility between the railway and listed buildings, due to other intervening buildings
- § The railway runs through cuttings in some sections
- § Some parts of the landscape already has an industrial character

Trains, which are the source of most of the visual impact, are a mobile feature, which will appear on occasion, passing through the area. Therefore, the visual impact will be largely ephemeral.

### 5.5.3 Summary of significant effects

The signal boxes and semaphore signals by Stirling Station, which are Category A Listed Buildings, will be directly impacted upon by the proposals, representing impacts of Moderate-to-Major significance. Note, however, that the alternative option - to house all of the new controls in Stirling Middle Signal Box - would be more damaging. Construction of a new station on the site of the Alloa Brewery entails a Moderate significance of impact, since it will probably prove destructive to any buried remains that might underlie the site. Repairs to the North British Railway Bridge across the Forth to strengthen the bridge will represent an impact of Slight magnitude, although some beneficial impacts will result due to it being preserved and restored to its original function. The development works will also have a low and moderate significance of adverse impact on two arched, masonry over-bridges in the centre of Alloa, although they are not registered as monuments in any of the archives. The other adverse impacts are generally of Low significance, including works at the sites of former railway buildings and structures at the Alloa Harbour Railway Branch. The impacts by the proposed development on other known sites identified during the

assessment are otherwise of Negligible or No significance. Historic Scotland have pointed out a slight overlap of the south roundabout of the AELR with the edge of the scheduled area of Site No.102, however, this effect will be avoided by a revision of the roundabout layout.

In addition to the known features identified during this assessment, there is a small possibility that *unknown* and currently invisible remains could survive beneath the ground in the proposed development area. However, given that a variety of sources of evidence have been consulted during this desk-based assessment, the risk of such remains surviving beneath the site, and therefore the potential impact upon unknown, sensitive archaeology on the site, seems low. Nonetheless, it cannot ultimately be confirmed whether unknown archaeological remains survive buried in the land until groundbreaking excavation takes place. New land-take in the vicinity of the SAM at Site No.102 for the proposed new link road could contain unknown remains that would be destroyed in the course of the development.

Operational impacts include visual impact on the setting of nearby protected monuments, which are mostly negligible, with the exception of the Early Medieval cross at Site No.102, a scheduled ancient monument. There is also a slight operational impact created in relation to the public access afforded to a historic memorial on the eastern pier at Kincardine once the railway is operational, although an alternative method of access will be allowed.

## 5.6 Mitigation

The recommended programme of mitigation works to address direct, adverse impacts by the proposed development is outlined below.

Prior to any development works at the Stirling signal boxes (Site No.'s 1 & 25) it is recommended that a full photographic survey of the interior of both buildings is undertaken, to record all of the original features in-situ prior to their removal or replacement, and prior to the insertion of new equipment. It is understood that here will be no structural modifications to the signal boxes, therefore there is no need for any other historic building recording with regard to the proposed development. Any equipment that is to be removed from the block bench or wall cabinets in either signal box as part of the development should be salvaged and passed to a local or national museum. New block bench equipment should be of a design that blends in visually with the historical equipment. Consultation should be undertaken with the supplier of the REBs to develop a design for them that will be sympathetic towards the external appearance of the listed signal boxes at Stirling Station next to which they will be juxtaposed. In the absence of the special provision in the Bill listed building consent would be required for the work to the Stirling signal boxes.

In advance of any modifications made to the listed semaphore signals north and south of the station (Site No.6), it is recommended that the position of all current signal posts around the station is marked accurately on a scaled plan, with annotation or a diagram to show the route of the cables that link them to the signal boxes. They should also be photographed in their current positions. As the signals posts are to function mechanically as before (with some repositioned, and the re-routing of some cables), no further mitigation work is recommended. In the absence of the special provision in the Bill listed building consent would also be required for the work to the listed semaphore signals.

No historic building recording is recommended prior to the demolition of the four bonded warehouses in the south of Hallpark Distillery (Site No.99). However, it is recommended that an evaluation be undertaken on all new land-take in the path of the proposed road here.

This should comprise trial trenches totalling somewhere between 5% to 10% of the proposed new road area. At the southern extent of the road and at the proposed roundabout site the density of evaluation trenches should be increased in the anticipation of finding archaeological remains of high sensitivity in the vicinity of the SAM. Such remains are likely to comprise human burials associated with the SAM, or possibly even evidence of an associated Early Medieval chapel. During construction works it is recommended that all other topsoil stripping in the vicinity of the SAM on any ground that has not been archaeologically excavated is subject to archaeological monitoring. During construction of the road it is also recommended that the perimeter of the SAM is clearly delineated on the ground and fenced-off by archaeologists to help protect it from any impingement by the construction works and associated storage and soil dumping. Currently the layout of the south roundabout of the AELR overlaps slightly onto the area of a scheduled ancient monument, however the layout of the roundabout will be revised such that there is no overlap, and the revised plan will be re-submitted to Historic Scotland for approval. The area fenced-off during the works will also include a buffer zone around the edges of the monument as an extra safeguard against its disturbance. To reduce the visual impact on the setting of this cross-slab, it is recommended that the margin around the new roundabout is planted and should be slow growing, non-deciduous and native species of local provenance to blend in with surrounding wooded patches in the landscape that exist to the north and south of the SAM. The new planting must not extend into the scheduled area, since scheduled monument consent would be required for this.

To deal with the possible existence of sensitive buried archaeological remains on the Alloa Brewery site (Site No.95), archaeological monitoring during the ground-breaking works is recommended. Ground-breaking works at the site of Alloa Harbour Railway Branch (Site No.85) for the proposed landscaping should also be subject to archaeological monitoring. Due to the location of this site at the core of the Medieval burgh, there is a probability of encountering Medieval remains, although some of these have probably already been removed by the railway cutting.

Prior to undertaking repairs on the North British Railway Bridge over the Forth (Site No.32) the bridge should be photographed by appropriately qualified archaeological personnel as a contribution to the historical archives.

As at other proposed development sites, there is a small probability of encountering unknown archaeological remains during ground-breaking works. There are numerous temporary works compounds proposed along the railway. It is presumed that no ground-breaking works will be required in these areas. However, should ground-breaking works be necessary then archaeological investigation should be undertaken - this is particularly important in the areas of the Medieval burghs, eg in the centre of Alloa, and at other key locations such as the banks of the Forth in Stirling and at Hilton Farm close to the Early Medieval SAM.

Two arched masonry bridges (Site No.'s 174 & 175) in Alloa centre should be recorded by photography in advance of any development works on them.

Appropriately qualified archaeologists must undertake all of the above-recommended mitigation.

## **5.7 Summary**

This section assessed the impact of the Scheme on archaeology and cultural heritage. Ten sites of sensitivity are directly and adversely affected by the proposed development. The

significance of some impacts will be Low. The most significant impacts (Moderate-to-Major) will be to the signal boxes and signal posts at Stirling Station, since necessary modifications are required to the signalling network. However, these impacts could be mitigated by a programme of historic building recording by photographic survey prior to development. In addition, listed building consent will be required for the works to the listed buildings.

An archaeological evaluation by trial trenching is recommended in advance of construction of the Alloa Eastern Link Road, since there is a probability that human burials or other remains could be found here, associated with the nearby scheduled ancient monument.

Archaeological monitoring is recommended during groundbreaking works at the proposed site of Alloa Station, at the former site of Alloa Brewery. Archaeological monitoring is also recommended at another site that will be landscaped as part of the development in the centre of Alloa. It is recommended that repairs to the North British Railway Bridge at Stirling are preceded by a photographic survey, and that the two bridges west of the proposed new Alloa Station are also photographed by archaeological personnel prior to works on them.

Possible visual impacts by the proposed Alloa Eastern Link Road upon the setting of a scheduled Early Medieval stone cross, and by the REBs upon the setting of the listed signal boxes at Stirling Station were predicted. Otherwise, beyond the proposed development area the visual effects upon the setting of historic buildings, monuments and designed landscapes are predicted to be minor.



## 6. AGRICULTURE

### 6.1 Introduction

The purpose of this chapter is to assess the impact of the Scheme on agricultural land-use within Stirling, Clackmannanshire and Fife, over the length of the proposed route. The agricultural issues have been assessed separately from the land-use issues, as there were extensive areas of agricultural land within the route of the Scheme, and the proposed route of the AELR. During the identification of potential agricultural issues, the significant issues highlighted were those of land-take (both temporary and permanent) and the effects of severance associated with level crossing closures. There were no technical difficulties experienced during the agricultural assessment.

### 6.2 Methodology

The assessment of the Scheme impacts on agricultural land use has been undertaken in accordance with guidelines and procedures contained within DMRB, Vol. 11, Part 6, and included site visits to gather primary data. The assessment of the Scheme's impact on agriculture can be separated into two distinct aspects. There is the physical loss of agricultural land through permanent and temporary land take, and the effect that the Scheme has on individual farm units as operational businesses including the effect on livestock/crops and the potential impacts of severance.

The Macaulay Land Use Research Institute (MLURI) has developed a classification in Scotland to describe the quality of agricultural land (see Table 6.1) with Classes 1, 2 and 3.1 comprising the best and most versatile quality (prime agricultural land), and Classes 3.2 – 7 being able to produce a moderate to limited range of crops or having little agricultural value (non-prime agricultural land). This classification was used for this assessment.

**Table 6.1: Agricultural Classification in Scotland (MLURI, 1986)**

Class Descriptions	Class	Division Descriptions
<b>Land Suitable To Arable Cropping</b>		
Land capable of producing a very wide range of crops	1	Not Divided
Land capable of producing a wide range of crops	2	Not Divided
Land capable of producing a moderate range of crops	3 1	Consistently high yields of narrow range of crops, or moderate yields from a wider range
	3 2	Average production, but high yields of barely, oats and grass are possible. Other crops are limited to potatoes and forage crops.
Land capable of producing a narrow range of crops	4 1	Land suited for crop rotation, based on lay grassland, forage crops and cereals for stock feed.
	4 2	The land is primarily grassland with some limited potential for other crops.

**Table 6.1: continued**

Class Descriptions	Class	Division Descriptions
<b>Land Suited Only To Improved Grassland and Rough Grazing</b>		
Land capable of use as improved grassland	5 1	Establishment of grass and its sward presents no problem, and potential yields are high with ample growth throughout the season
	5 2	Sward establishment presents no difficulties but moderate or low access which may cause maintenance problems
	5 3	Land has properties which lead to trafficability and poaching problems, with a rapid deterioration in quality
Land capable of use only as rough grazing	6 1	Land has high proportions of palatable herbage in the sward
	6 2	Moderate quality herbage such as white and flying bent grasslands, rush pastures and herb-rich moorland
	6 3	The vegetation is dominated by plant communities with low grazing values
Land of a very limited agricultural value	7	Not Divided
Unclassified land (built up areas, quarries, collieries, bings, etc)	N/A	Not Divided

The importance of agricultural land, as shown in Table 6.2, is scaled in accordance with the MLURI's classification of agricultural land, based on guidance provided in the DMRB (Vol. 11). The magnitude of impact, as shown in Table 6.3, is defined by the amount of land-take required within each agricultural class,. The effects on livestock and severance issues are based on consultations with tenants and owners of agricultural land.

**Table 6.2: Importance of Agricultural Land (Based on MLURI Classification)**

Importance	MLURI Class
High	Class 1
Medium	Class 2 and 3a
Low	Class 3b
Negligible	Class 4 - 7

**Table 6.3 Magnitude of Agricultural Land-Take**

Magnitude of Impact	Agricultural Land-Take (ha)
Severe	>20ha
Moderate	5-20ha
Slight	<5ha
Negligible	Temporary land-take

As with more generalised categories of land-use, the DMRB (Vol. 11) does not specify how the significance of effects should be scaled with regard to effects on agriculture. Therefore, significance has been categorised by comparing the importance and magnitude of effects. Table 6.4 outlines the significance of impacts. These may be perceived as either adverse or beneficial.

**Table 6.4: Significance of Effects**

Importance of Receptor	Magnitude of Impact Upon Receptor			
	Severe	Moderate	Slight	Negligible
High	Substantial	Substantial/ Moderate	Minor	Negligible
Medium	Moderate	Minor	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

### 6.3 Consultations

As part of the statutory consultation process, the Scottish Executive were asked to highlight any issues concerning the Scheme that would fall within their remit. The Scottish Executive raised no issues with regard to agricultural concerns. Additional consultations regarding the AELR were undertaken in September 2002. No concerns were highlighted with regard to the extent of prime agricultural land take due to the AELR alignment.

Landowners in proximity to the proposed Scheme have been contacted as part of the public consultation process, and opportunities were provided at the public presentations and meetings for specific views to be expressed.

Further consultations have been undertaken with the owners/tenants of farms directly affected by level crossing closures at Abbeycraig (Broom Farm), Manor Neuk (Manorneuk Farm) and Hilton Farm (Hilton Farm) to address the issue relating to farm severance with particular reference to the increase in journey distance between areas within the individual farm holdings.

The outcome of these consultations are reported below in Table 6.5. Consultations were undertaken by telephone and on-site meetings. Further information of consultation responses on community severance can also be found in Chapter 4, Vol. 2.

**Table 6.5: Agricultural Consultations with Respect to Level Crossing Closures and Significant Permanent Agricultural Land-Take**

Name and Farm	Total Area of Farm Holding	Affect of Scheme	Farm Activity	Comments
Mr Brewster (owner) at Broom Farm	Approx. 48ha	Access to two fields, approx.9.3 hectares in size, north of the railway, from Broom Farm south of the railway	Mixed farming. Fields affected by Scheme used for silage, hay and grazing	Scheme implementation would restrict direct access to fields north of the line, and increase distance travelled via alternative route
Mrs Logan (owner) at Manorneuk Farm	Approx. 28ha	Access to two fields, approx. 7.7 hectares in size, south of the railway from Manorneuk Farm to the north of the railway	New tenant will farm beef livestock	Owner concerned with the number and proximity of train movements. New tenant not yet in occupancy.

**Table 6.5: Continued**

<b>Name and Farm</b>	<b>Total Area of Farm Holding</b>	<b>Affect of Scheme</b>	<b>Farm Activity</b>	<b>Comments</b>
Mr James Hendry (tenant) at Hilton Farm	Area of holding not provided. Involved in several farms, but only two affected by the scheme.	Two fields (approx. 14ha) severed by the AELR, with access issues south of the alignment	Mixed arable and beef livestock farming.  Affected fields west of AELR are for grazing; east of AELR for arable	Scheme would increase intra-farm journey distances. Potential concerns regarding the provision of access to grazing land at AELR.
Mr James Cuthbertson	Area of holding not provided	One field (approx. 10.3ha) severed by the AELR	North Parklands field is 50% arable and 50% beef livestock	Scheme would take prime agricultural land out of permanent use. There would be a loss of revenue and an increased level of fly tipping from the road.

## 6.4 Baseline

A combination of arable and livestock farming exists throughout the rail corridor . Fields tend to be of a large scale with a lack of hedgerow boundaries. Livestock farming is predominantly beef cattle. Farms along the route, which are in close proximity to the Scheme, are Broom Farm, Manorneuk Farm, Manor Farm, Garvel Farm, Midtown Farm, Orchard Farm, Hilton Farm, Jellyholme Farm, Hillend Farm West Lodge Farm, Meadowend Farm, Inveresk Farm, Hawkhill Farm, Broomknowe Farm and Inch of Ferryton Farm. GR Advanced Materials and Northern Hydro Seedings Ltd, have agricultural holdings that do not operate as a farm unit. The activity of the farms directly affected by the railway is given in Table 6.5

The quality of the agricultural land adjacent to the Scheme is evenly distributed, with the majority being Class 3.2 (land that can produce a limited range and yield of crops). However, there is an area of prime agricultural land surrounding Clackmannan that is Class 3.1, (land that can produce a high yield of a moderate range of crops, or a moderate yield of a high range of crops). This designation stretches to the eastern limits of Alloa.

The Macaulay Land Use Research Institute classify the soil crossed by the route as generally estuarine and lacustrine raised beach silts and clays”; the component soils are shown to be “ Non-calcareous gleys; some peaty gleys and peat”; Further information regarding soils is given in chapter 10, Vol. 2.

## 6.5 Environmental Effects

The reopening of the Stirling-Alloa-Kinross line will have limited impacts on the agricultural economy of the region, both in terms of the potential reduction in quality of the land, and the way in which the farms are run as businesses. Severance of fields may create difficulties in accessing certain areas of agricultural land.

The likely impact on soils from construction work, would be the contamination of soils through poor management of works compounds. Additionally, the removal of soils will occur where permanent land-take is required, which is particularly relevant to the construction of the AELR.

The significant issues are permanent land take of prime agricultural land for the AELR and the permanent access constraint to fields adjacent to level crossings. Temporary land take is of less significance, as land taken can be restored to agricultural use after construction. The focus of the assessment is therefore placed on fields that are affected by land take and access constraint. Table 6.6 summarises the impacts on agricultural land.

Garvel Farm, Orchard Farm and Jellyholme Farm are not affected by the Scheme.

#### 6.5.1 Construction Effects

Agricultural land will be required temporarily for construction access, compounds and the storage of plant machinery and equipment. This will occur at GR Advanced Materials, Broom Farm, Manorneuk Farm, Manor Farm, Hilton Farm, Hillend Farm, Meadowend Farm, Broomknowe Farm and Hawkhill Farm.

Farm access tracks will also be required for works access in relation to the repair of culverts (see Volume 1, Figure 2.1 Scheme Design). Severance impacts in relation to this will be minimised as farm access is maintained during construction periods.

Construction noise will have limited affects on agricultural land, where there is livestock grazing. Arable farming is unlikely to suffer from any temporary construction noise effects, and there is unlikely to be any significant reduction in crop yields.

There will not be any significant impacts from the construction of temporary haul roads, as the majority of works access will be accommodated by the existing level crossings, with the rail corridor acting as the principal works access route. Haul roads will only be necessary at temporary works sites, where they will utilise existing access routes where possible. This occurs between Alloa and Kincardine, particularly at Hillend Farm, where there are no level crossings, which could be used for access.

The significance of the environmental effects from construction of the Scheme on agricultural land are summarised in Table 6.6.

**Table 6.6: Summary of the Significance of Environmental Impacts on Agricultural Land Use (Construction)**

Feature	Potential Impact	Magnitude of Impact	Importance of Impact	Significance of Impact
Temporary Land-take (Haul Roads)	Temporary loss of <0.2ha of agricultural land at Broom Farm and Hillend Farm	Slight	Medium	Minor Adverse
Temporary Land-take (Works/Construction Compounds)	Temporary combined loss of approx. 4.4ha of agricultural land GR Advanced Materials, Broom Farm, Manorneuk Farm, Hilton Farm, Hillend Farm, Meadowend Farm, Inveresk Farm, Broomknowe Farm and Hawkhill Farm.	Slight	Low	Negligible Adverse
Construction Disruption	Noise disturbance to Livestock (general)	Negligible	Low	Negligible Adverse

### 6.5.2 Operation Effects

Permanent land take of agricultural land, of 0.02ha at both Broom Farm and Hawkhill Farm, will be lost for associated track works. Additionally, permanent land-take of 0.13ha of agricultural land will be required at Blackgrange, where provision is required for a permanent REB with associated access provision. The effects of this are minimised, as the land required is not classed as prime agricultural land. Permanent land-take of approximately 3.75ha will also be required for the construction of the AELR, which will comprise three fields of Class 3.1 prime agricultural land at Hilton Farm and Inch of Ferryton Farm.

The severance of farm units can be potentially another detrimental impact particularly where there are constraints placed on access, such as level crossings and road closures. The only severance occurs at the field to the southwest of the AELR. However, this field is designated for housing, but the development timescale is not known (see Table 3.5, Chapter 3, Volume 2. However, temporary access will be provided to the field, which will mitigate against severance. The location of this access point will be determined during the final design stage.

Partial severance will occur where the primary access between fields will be changed. This occurs at Manorneuk Farm, Broom Farm and Hilton Farm. At these locations, alternative routes are available, which will generate a marginal increase in farm costs in terms of time, fuel, and machinery fatigue.

The Scheme will impact on the field access at Broom Farm, with the closure of the track, which is a claimed Right of Way directly west of OB 117/43A (A91 – Stirling eastern ring road) and the closure of Abbeycraig level crossing. Prior to the closure of the line, the farmer crossed the railway via the same crossing, which was user-worked. This impact will increase journey distance between fields on opposite sides of the Scheme corridor by approximately 2.25km in each direction (see Figure 6.1).

In addition, there is also access between fields north and south of the Scheme via the A91 Stirling eastern ring road. However, discussions with the owner farmer confirmed that the access provided directly on to the A91 is only available to the fields south of the Scheme and to the east of the A91. The junction is unsuitable for making left or right turns onto the A91.

Drainage of agricultural land to the south-east of the bonded warehouses at Carsebridge, could be improved by the construction of the AELR. The AELR would act as a barrier to surface run-off and soil through-flow, preventing ponding within the southern limits of the field. The AELR can also increase slope stability by reducing soil creep to the north of the alignment. Although the AELR could improve drainage, this is unlikely to be an important issue as the land is designated for housing provision in the Clackmannanshire Local Plan, 2002. With regard to the railway, operational pollution from train engines will have a negligible impact on crop production and noise and vibration impact on livestock will be minimal, as disturbance will be sporadic and for a limited period at each instance. Emissions from vehicles using the AELR will not increase pollution on crops and livestock. There will be a transfer of traffic from Hilton Road to the AELR and this will simply move the focus of pollution slightly towards the agricultural areas in the east. Impacts are likely to be slight at the most due to the type of agriculture and quality of land that currently exists.

The significance of the environmental effects from the operation of the Scheme on agricultural land are summarised in Table 6.7.

**Table 6.7: Summary of the Significance of Environmental Impacts on Agricultural Land Use (Operation)**

Feature	Potential Impact	Magnitude of Impact	Importance of Impact	Significance of Impact
Permanent Land Take	Loss of 3.75ha of prime agricultural land at Hilton Farm and Inch of Ferryton Farm, as a result of the construction of the AELR	Slight	Medium	Minor Adverse
Permanent Land Take	Loss of 0.13ha of non-prime agricultural land at Blackgrange (Northern Hydro Seedings Ltd) for REB.	Slight	Low	Negligible Adverse
Permanent Land Take	Loss of 0.02ha of non-prime agricultural land both at Broom Farm and Hawkhill Farm for associated track works.	Slight	Low	Negligible Adverse

**Table 6.7: Continued**

<b>Feature</b>	<b>Potential Impact</b>	<b>Magnitude of Impact</b>	<b>Importance of Impact</b>	<b>Significance of Impact</b>
Permanent severance and access related issues	Permanent severance on farm access at Hilton Farm level crossing, and Broom Farm west of the A91, resulting in increased journey distances. Permanent access constraint at Manorneuk Farm, resulting from the installation of a user-worked crossing. Permanent severance at the field to the south-west of the AELR	Low - Moderate	Severe	Minor - Medium Adverse
Permanent rights to relocate and maintain utility apparatus	Approx. 1ha of agricultural land affected for the Rights to relocate utility infrastructure at Manorneuk Farm, Manor Powis Farm and Northern Hydro Seedings Ltd	Slight	Low	Negligible Adverse
Operational Disruption	Noise disturbance to livestock (general)	Negligible	Negligible	Negligible Adverse
Land Quality	Construction of AELR will improve drainage for prime agricultural land (Class 3.1) along the road alignment	Slight	Medium	Minor Beneficial

## 6.6 Mitigation

By utilising the existing railway corridor, the Scheme requires a reduced level of permanent land take than for a new railway.

To reduce the effects of construction disruption, best construction practice methods should be implemented which will prevent indirect effects to agricultural land and disturbance to livestock adjacent to the Scheme. Operational mitigation measures for livestock will not be required as disturbance from passing trains will be infrequent and for a limited period.

Compensation will need to be provided as a result of temporary land take for the works at GR Advanced Materials, Broom Farm, Manorneuk Farm, Hilton Farm, Hillend Farm, Meadowend Farm, Inveresk Farm, Broomknowe Farm and Hawkhill Farm, and for the haul roads at Broom Farm and Hillend Farm. Compensation will also need to be provided for the permanent loss of agricultural land at Broom Farm, Northern Hydro Seedings Ltd, Hilton Farm, Inch of Ferryton Farm and Hawkhill Farm.

Temporary severance resulting from the culvert repairs works will be mitigated against by ensuring that works access required does not unnecessarily impede on farm access by continuing to allow farm movement whenever possible.



At Broom Farm, the closure of Abbeycraig level crossing, and the crossing over the railway to the west of the A91 Stirling eastern ring road will result in increased journey distances, and will need to be addressed by compensation. Compensation will also need to be provided as a result of permanent severance at Hilton Farm, and may be required for the permanent minor inconvenience at Manor Neuk resulting from the introduction of a user worked level crossing.

Fencing is to be replaced along extensive lengths of the track, which will upgrade the boundary treatment of fields adjoining the railway. An access will require to be provided to the field to the southwest of the AELR if the housing development does not take place before the opening of the Scheme.

## **6.7 Summary**

Although the railway corridor is 21km long, the Scheme will result in the permanent loss of only 3.75ha of prime agricultural land from Hilton Farm, and 0.17ha of non-prime agricultural land from Northern Hydro Seeding Ltd, Broom Farm and Hawkhill Farm. The agricultural land required for the Scheme will be acquired from the farm owners.

Permanent land take will reduce the amount of prime agricultural land along the Scheme corridor, but the amount lost is not significant. Temporary land take will affect agricultural land along the Scheme corridor, but the effects will be negligible as land will be returned to its former state after the construction phase of the Scheme. Level crossing closures will impact upon farm units that contain fields both north and south of the railway line, however the retention and upgrading of the retained level crossings will mitigate against total severance. Affected farms will require compensation for direct impacts on their holdings.

There are also benefits of the Scheme, as a result of the upgrade of the boundary fences along the railway corridor.

## **7. AIR QUALITY**

### **7.1 Introduction**

The air quality chapter discusses air quality legislation and relevant pollutants. An assessment of the existing ambient air quality along the proposed railway and the Alloa Eastern Link Road is carried out. The potential air quality impacts of the Scheme in terms of construction dust, emissions from the operation of the railway, the transfer of the transport of coal from road to rail, and road traffic emissions from the AELR, are identified, and assessed in terms of the magnitude and significance of the impact.

No detailed data on the likely changes in traffic flows on local roads, due to construction traffic or the operation of the railway, has been provided. Therefore, it has not been possible to assess the secondary impact of such traffic flow changes, on air quality at receptors close to affected roads. However, local traffic flow data has been provided for the AELR.

### **7.2 Methodology**

#### **7.2.1 Construction Emissions**

Site preparation and construction works can generate dust emissions. Dust is defined in BS 6069 (1994) as particulate matter in the size range 1-75  $\mu\text{m}$  in diameter, and is produced through the action of abrasive forces on materials. Fine dust particles ( $\text{PM}_{10}$ ) are defined as particles less than 10  $\mu\text{m}$  in diameter, and are of the most concern regarding health effects, construction dust is generally larger in diameter than 10  $\mu\text{m}$  and, therefore, it does not necessarily increase existing levels of  $\text{PM}_{10}$  considerably.

It is very difficult to quantify emissions of construction dust; therefore, it is not possible to accurately predict likely rates of nuisance dust deposition or any changes in  $\text{PM}_{10}$  levels at nearby receptors. In addition, there are no statutory UK or EC standards relating to nuisance dust, though various guideline nuisance dust deposition rates of between 200 – 300  $\text{mg}/\text{m}^2/\text{day}$  have been used for mineral sites. To apply such guidelines, baseline and operational dust monitoring would be required, for the scale of construction works required for the Scheme dust monitoring is not considered appropriate. Therefore, a qualitative assessment of the likely magnitude of construction dust emissions is carried out, based on currently available information on construction activities and phasing. The significance of the impact of construction dust is assessed based on the proximity of the works to potentially sensitive receptors, and the likely duration of the works.

The identification of sensitive receptors considers residential properties, schools, hospitals and ecological receptors. It is considered reasonable to assume that the new housing to be built to the west of the AELR will not be occupied during the road construction.

Construction road traffic will generate the main pollutants associated with road traffic, nitrogen dioxide ( $\text{NO}_2$ ),  $\text{PM}_{10}$ , carbon monoxide (CO), and hydrocarbons including benzene and 1,3 butadiene. At this stage, before a contractor has been appointed, no information is available on likely volumes or routing of construction traffic, therefore, an assessment of the secondary impact on air quality of construction traffic, associated with both the railway and the AELR, has not been possible.

### *Construction Dust Legislation*

Dust and emissions from any construction site can amount to a statutory nuisance under Part III of the Environmental Protection Act 1990. If a Local Authority investigation determines that a statutory nuisance exists they must serve an Abatement Notice, requiring measures to abate the nuisance to be carried out, or restricting or prohibiting the activity. A more detailed discussion of statutory nuisance legislation is provided in Volume 3, Appendix 3A.

#### 7.2.2 Operational Emissions

##### *Train Emissions*

Diesel train engines are a source of the pollutants NO<sub>2</sub>, PM<sub>10</sub> and sulphur dioxide (SO<sub>2</sub>) during their operation. As in any combustion process, diesel train engines generate oxides of nitrogen (NO<sub>x</sub>), mainly in the form of nitric oxide (NO), which is then converted to NO<sub>2</sub> in the atmosphere, mainly due to a reaction with ozone. Only NO<sub>2</sub> is associated with adverse effects on human health. Diesel trains are also a source of carbon dioxide (CO<sub>2</sub>), which, while not a pollutant at the local scale, is a greenhouse gas that contributes to global warming. Further details of the sources and impacts of the pollutants and greenhouse gases generated by diesel trains is provided in Volume 3, Appendix 3B.

The permanent impact of the re-introduction of the railway is assessed by calculating the total quantity of the pollutants NO<sub>x</sub>, PM<sub>10</sub>, SO<sub>2</sub>, and CO<sub>2</sub> produced by the trains. The calculation is based on emission factors for each train type and pollutant in terms of g/km, provided by the National Atmospheric Emissions Database. The quantity of pollutants emitted is determined for a whole year. Baseline calculations are based on freight train movements between the stockyard in Kincardine and Longannet Power Station and the current freight routes from Fife, and Ayrshire via the Forth Bridge. Operational calculations are based on the proposed passenger service between Stirling and Alloa, the proposed transfer of the freight route from Ayrshire via Stirling to Longannet, and the continued use of the freight route from Fife and between Kincardine and Longannet power stations.

The significance of the impact of the Scheme is assessed in terms of the magnitude of the change in total pollution emissions between the baseline and operational scenarios, and comparison with annual emissions of the relevant pollutants from Longannet Power Station.

The coal wagons to be used on the railway are a potential source of wind blown coal dust, generated by the movement of the wagons along the track. It is not possible to predict and quantify any such emissions. Therefore, a qualitative assessment of the potential for significant impacts is carried out based on the type of wagons to be used.

##### *Road Traffic Emissions*

Changes in traffic flow due to the operation of the Scheme will result in changes in emissions of the five main pollutants associated with road traffic, NO<sub>2</sub>, PM<sub>10</sub>, CO, benzene and 1,3 butadiene. Further details of the sources and impacts of these pollutants are provided in Volume 3, Appendix 3B. Permanent changes in traffic flows are likely to occur due to the re-opening and closure of level crossings, the transfer of road traffic to rail, the operation of the new Alloa Station, and the operation of the new AELR.

A relatively large change in traffic flow, 10% or more, is often considered necessary to have a significant impact on pollutant concentrations (GoMMMS, 2000). No operational road traffic data has been provided, therefore, it is not known if any changes in traffic flow of 10% or more are likely to occur due to the railway, and an assessment of the secondary impact on pollution concentrations at receptors close to affected roads has not been possible.

However, an estimate of the reduction in the number of heavy-duty vehicles (HDV's) transporting coal from Ayrshire to Longannet Power Station, due to the transfer to rail, has been made. Therefore, the reduction in the annual emission of NO<sub>x</sub>, PM<sub>10</sub>, CO, non-methane hydrocarbons (NMHC) and CO<sub>2</sub>, generated by HDV's is calculated. The standard Design Manual for Roads and Bridges, Vol 11, Section 3, 2000 (DMRB) methodology based on the number of vehicles, distance travelled and average speed, is followed. The significance of the reduction in emissions from HDV's is assessed by comparison with the predicted quantity of emissions generated by the operation of the railway and Longannet Power Station.

A qualitative assessment of the likely impact of the re-opening and closure of a number of level crossings on road traffic emissions is carried out.

The detailed assessment of the air quality impacts of highway schemes, such as the AELR, is currently carried out following the approach set out in the DMRB. For such a small scheme as the AELR only the local air quality impacts are assessed, the impact on regional air quality and climate change is considered to be negligible. A detailed description of the DMRB methodology is provided in Volume 3, Appendix 3C.

The magnitude of the impact of the AELR is assessed by predicting the change in concentrations of the pollutants NO<sub>2</sub>, PM<sub>10</sub>, CO, benzene and 1,3 butadiene between the baseline and operational scenarios, at a selection of the closest sensitive receptors to the new road and surrounding affected roads. The identification of sensitive receptors considers locations where members of the public might reasonably be expected to be exposed over the averaging time of the relevant air quality objectives, see Table 7.1 and 7.2 below. This includes residential properties, schools and hospitals, as identified in Technical Guidance Note 4 (2000).

Pollution concentrations are predicted using the methodology outlined in the DMRB. The DMRB methodology takes account of the annual average 1-hour traffic flow, average speed, the proportion of HDV's and the distance from the centre of the road. The contribution of background pollution concentrations to the total predicted pollution concentrations has been determined based on the assessment of ambient air quality, see below.

DMRB is a screening level model which is widely accepted as overestimating pollution concentrations, particularly in open locations (DETR, 2001), however, the results will give a good indication of the magnitude of the change in pollution levels between the baseline and operational scenarios for affected road links and receptors.

The significance of the impact is assessed by comparing the predicted changes in pollution concentrations with guidelines of significance specified in the DMRB, (see Volume 3, Appendix 3C) and a comparison of the predicted concentrations with the latest air quality objectives, as detailed in Table 7.1 and 7.2 below.

In addition, the significance of the impact of the AELR on the local area is assessed by predicting the total number of houses within 200m of the new Link Road and the surrounded affected roads, which experience an improvement and a worsening of air quality, due to the AELR. Also, an overall 'assessment value' of the Scheme is calculated, as defined in the DMRB generalised local impact assessment, see Volume 3, Appendix 3C. The assessment value is based on the change in roadside NO<sub>2</sub> and PM<sub>10</sub> levels between the baseline and operational scenarios and the number of residential properties within 200m of each affected road link. A negative value indicates the Scheme has an overall beneficial impact, a positive assessment value indicates an overall adverse impact on air quality.

A total of 210 houses are designated in the Local Plan to be built between the proposed AELR and Hilton Road/Clackmannan Road. Therefore, the impact assessment is carried out both with and without these new houses in place.

#### *Train and Road Traffic Emissions Legislation*

The latest air quality objectives for the six local scale pollutants associated with emissions from trains and road traffic are set out in the Air Quality (Scotland) (Amendment) Regulations 2002 and the Air Quality (Scotland) Regulations 2000. The Air Quality Regulations have been formulated in response to a range of EC Directives (96/62/EC, 1999/30/EC, 2000/69/EC and 2002/3/EC). The latest regulations came into force in Scotland in June 2002 and tighten the previous objective for CO and supplement the existing objectives for benzene and PM<sub>10</sub>. Table 7.1 outlines the objectives in the 2000 regulations, and Table 7.2 the latest objectives in the 2002 amendment regulations. The objectives are based on the medical evidence of the effects of each pollutant on human health, taking account of the costs, benefits and technical feasibility of achieving the objectives.

Enforcement of the Air Quality Objectives is the responsibility of Local Authorities. Each Local Authority has been required under Part IV of the Environment Act 1995 to complete a 'Review and Assessment' of air quality within their area, to determine if there is any risk of exceeding the objectives by the relevant compliance dates. If any exceedances are predicted, the Local Authority must declare the affected area an Air Quality Management Area (AQMA). An Action Plan must be developed and implemented to reduce pollution concentrations below the objectives. All the Local Authority Review and Assessments carried out to date were completed with regard to the Air Quality (Scotland) Regulations 2000, or the previous 1997 regulations. The Review and Assessment process is ongoing therefore the next round of assessment in 2003/2004 must have regard to the additional requirements of the 2002 amendment regulations.

National air quality objectives have also been developed for the protection of vegetation and ecosystems, see Table 7.3. The objectives only apply in those areas of the UK, which are:

More than 20km from an agglomeration (population greater than 250,000); and more than 5km from industrial sources regulated under Part A of the 1990 Environment Act (replaced by the Pollution Prevention and Control (Scotland) Regulations 2000), motorways and built up areas of more than 5000 people.

Enforcement of these objectives is the responsibility of the government and devolved administrations, not local authorities.

**Table 7.1: Local Air Quality Objectives - Air Quality (Scotland) Regulations 2000**

Pollutant	Objective	Measured as	To be achieved by
Nitrogen Dioxide (NO <sub>2</sub> )	200 $\sigma\text{g}/\text{m}^3$ not to be exceeded more than 18 times/year (equivalent to the 99.8 <sup>th</sup> percentile)	1 hr mean	31/12/05
	40 $\sigma\text{g}/\text{m}^3$	Annual mean	31/12/05
Fine Particles* (PM <sub>10</sub> )	50 $\sigma\text{g}/\text{m}^3$ not to be exceeded more than 35 times/year (equivalent to the 90 <sup>th</sup> percentile)	24 hr mean	31/12/04
	40 $\sigma\text{g}/\text{m}^3$	Annual mean	31/12/04
Sulphur Dioxide (SO <sub>2</sub> )	266 $\sigma\text{g}/\text{m}^3$ not to be exceeded more than 35 times/year (equivalent to the 99.9 <sup>th</sup> percentile)	15 min mean	31/12/05
	350 $\sigma\text{g}/\text{m}^3$ not to be exceeded more than 24 times/year (equivalent to the 99.7 <sup>th</sup> percentile)	1 hr mean	31/12/04
	125 $\sigma\text{g}/\text{m}^3$ not to be exceeded more than 3 times/year (equivalent to the 99 <sup>th</sup> percentile)	24 hr mean	31/12/04
Carbon Monoxide <sup>#</sup> (CO)	11.6 mg/m <sup>3</sup>	Running 8hr mean	31/12/03
Benzene*	16.25 $\sigma\text{g}/\text{m}^3$	Running annual mean	31/12/03
1,3-Butadiene	2.25 $\sigma\text{g}/\text{m}^3$	Running annual mean	31/12/03

\*Supplementary objectives are in the 2002 Regulations, see Table 7.2

<sup>#</sup> Replacement objective is in the 2002 Regulations, see Table 7.2

**Table 7.2: Replacement and Supplementary Local Air Quality Objectives - Air Quality (Scotland) (Amendment) Regulations 2002**

Pollutant	Objective	Measured as	To be achieved by
Benzene	3.25 $\sigma\text{g}/\text{m}^3$ (supplements existing objective)	Running annual mean	31/12/10
Carbon Monoxide (CO)	10 mg/m <sup>3</sup> (replaces existing objective)	Running 8 hr mean	31/12/03
Fine Particles (PM <sub>10</sub> )	50 $\sigma\text{g}/\text{m}^3$ not to be exceeded more than 7 times/year (supplements existing objective)	24 hr mean	31/12/10
	18 $\sigma\text{g}/\text{m}^3$ (supplements existing objective)	Annual mean	31/12/10

**Table 7.3: Objectives for the Protection of Vegetation and Ecosystems**

Pollutant	Objective	Measured as	To be achieved by
Nitrogen oxides (NO <sub>x</sub> )*	30 $\sigma\text{g}/\text{m}^3$	Annual mean	31/12/00
Sulphur Dioxide (SO <sub>2</sub> )	20 $\sigma\text{g}/\text{m}^3$	Annual mean	31/12/00
	20 $\sigma\text{g}/\text{m}^3$	Winter average	31/12/00

\*Assuming NO<sub>x</sub> is taken as NO<sub>2</sub>

### 7.2.3 Existing Ambient Air Quality

A desk study of the following existing sources of information and monitoring data, relating to the pollutants NO<sub>2</sub>, PM<sub>10</sub>, SO<sub>2</sub>, CO, benzene and 1, 3 butadiene, has been carried out: -

- § Stirling, Clackmannanshire Fife & Falkirk Councils latest Review and Assessment of Air Quality;
- § Pollution monitoring results from relevant monitoring sites; and
- § Estimated UK background pollution levels.

Background pollution concentrations are provided in the National Air Quality Archive for a number of different years, the concentrations are converted to the current baseline year 2002 and the year of opening 2005 where possible, using the methods provided in either Technical Guidance Note 4: Review & Assessment Pollutant Specific Guidance, 2000, or the DMRB.

Ambient concentrations of NO<sub>2</sub>, PM<sub>10</sub>, CO, SO<sub>2</sub>, benzene and 1,3 butadiene along the Scheme are discussed with reference to the relevant air quality objectives as specified in the Air Quality Regulations, see Table 7.1, 7.2 and 7.3.

## 7.3 Consultations

Table 7.4 provides a brief summary of the consultations carried out with regard to the air quality assessment.

**Table 7.4: Consultations**

Consultee	Consultee Comment	Response
Stirling Council Environmental Health Dept.	Provided copy of Review & Assessment of Air Quality Report and latest monitoring results.	Data incorporated in ambient air quality assessment.
Clackmannanshire Council Environmental Health Dept.	Provided copy of Review & Assessment of Air Quality Report and latest monitoring results. Stated that impact of the railway on road traffic likely to be only potentially significant impact.	Data incorporated in ambient air quality assessment.
Fife Council Environmental Health Dept.	Provided copy of Review & Assessment of Air Quality Report and latest monitoring results.	Data incorporated in ambient air quality assessment.
Scottish Environmental Protection Agency (SEPA)	Provided ambient SO <sub>2</sub> monitoring data and emission data for Longannet Power Station	Data incorporated in ambient air quality, and train emissions assessment.

## 7.4 Baseline

### 7.4.1 Ambient Air Quality

A brief summary of the ambient air quality in the vicinity of the proposed railway and the AELR is provided below, full details, including the monitoring results from all the relevant monitoring sites are provided in Volume 3, Appendix 3D.

All three Local Authorities have concluded that the air quality objectives for NO<sub>2</sub>, PM<sub>10</sub>, CO, benzene, 1,3 butadiene and SO<sub>2</sub>, specified in the 2000 regulations, will be met within their areas by the required compliance dates, no AQMAs have been declared. The recently issued supplementary objectives for PM<sub>10</sub> and benzene, to be achieved by 2010, and the revised CO objective, must be considered by each Local Authority in the next round of Review and Assessment starting in 2003.

A summary of the average estimated background pollution concentrations in the vicinity of the proposed route, from the UK National Air Quality Information Archive is provided in Table 7.5. The specific estimated background pollution concentrations for the location of the proposed AELR are provided in Volume 3, Appendix 3E.

**Table 7.5: Average Background Pollution Concentrations**

Pollutant	Measured as	Stirling		Clackmannanshire		Fife	
		2002	2005	2002	2005	2002	2005
NO <sub>2</sub> σg/m <sup>3</sup>	Annual mean	7.4	6.8	5.0	4.6	6.9	6.3
PM <sub>10</sub> σg/m <sup>3</sup>	Annual mean	18.5	17.4	18.4	17.3	18.7	17.6
SO <sub>2</sub> σg/m <sup>3</sup>	Annual mean	-	2.5	-	3.5	-	5.4
	99.9 <sup>th</sup> percentile of 15 min means	-	94.5	-	124.2	-	184.4
CO mg/m <sup>3</sup>	Annual mean	0.16	0.15	0.16	0.15	0.16	0.15
Benzene σg/m <sup>3</sup>	Annual mean	0.24	-	0.24	-	0.14	-
1,3 Butadiene σg/m <sup>3</sup>	Annual mean	0.03	-	0.05	-	0.02	-

The predicted pollution concentrations are slightly higher in 2002 compared to 2005 as national measures are expected to gradually reduce background concentrations over time.

#### *Pollution Monitoring and Modelling*

NO<sub>2</sub> diffusion tube monitoring is carried out at various locations in all three local authorities, the results from Stirling and Alloa indicate the annual mean objective of 40 σg/m<sup>3</sup> is not exceeded even on the kerbside of major roads such as the A9 and A907.

In Fife, diffusion tube and continuous NO<sub>2</sub> monitoring in the centre of Kincardine has recorded annual mean NO<sub>2</sub> concentrations around the air quality objective of 40 σg/m<sup>3</sup>. However, it is unlikely that an AQMA will be declared due to the construction of the Eastern Link Road, which is expected to begin in 2003, it is anticipated that the Eastern Link Road will greatly reduce traffic through the centre of Kincardine.

Stirling Council has recently set up an SO<sub>2</sub> monitoring network based on diffusion tubes, two of which are in Stirling in the vicinity of the proposed route. The concentrations in 2001 are similar to the background levels obtained from the UK National Air Quality Information Archive.

SO<sub>2</sub> monitoring using bubbler samplers is no longer carried out in Stirling. In Fife three sites are operational, however, they are a considerable distance from the proposed route terminating in Kincardine. In Clackmannanshire one site is currently operational in the centre of Alloa. Between 1998 and 2001 the annual mean SO<sub>2</sub> concentration has been a



maximum of  $4 \sigma\text{g}/\text{m}^3$ , the daily maximum  $\text{SO}_2$  level is  $31 \sigma\text{g}/\text{m}^3$ , well below the objective of  $125 \sigma\text{g}/\text{m}^3$ .

Modelling of  $\text{SO}_2$  emissions from Longannet Power Station has been carried out both by the Scottish Environmental Protection Agency (SEPA) and Falkirk Council.  $\text{SO}_2$  levels close to but not exceeding the 15-minute objective were predicted for an area to the north east of Longannet Power Station. Following these results continuous  $\text{SO}_2$  monitors were installed in February 2001 by SEPA at Blair Hall to the north-west and Tulliallan to the north east of the power station. SEPA has advised that the initial results indicate the objectives are being met.

$\text{PM}_{10}$  monitoring is carried out at only 1 location within the three local authorities, at the kerbside of the Ring Road (A907) in the centre of Alloa, Clackmannanshire. However to date, only very limited data.

No monitoring of ambient CO, benzene, or 1,3 butadiene concentrations is currently carried out within Stirling, Clackmannanshire or Fife.

#### *Compliance with the Air Quality Objectives*

Background  $\text{NO}_2$  concentrations are very low through all three local authorities, well below the annual mean objective of  $40 \sigma\text{g}/\text{m}^3$ .

Background  $\text{PM}_{10}$  concentrations are well below the annual mean objective of  $40 \sigma\text{g}/\text{m}^3$  to be achieved by 2004. The predicted background concentrations in 2005 are just below the latest objective of  $18 \sigma\text{g}/\text{m}^3$ , to be achieved by 2010.

The predicted background 99.9<sup>th</sup> percentile of 15 min mean  $\text{SO}_2$  concentrations in 2005 are well below the objective in Stirling and Clackmannanshire, however in Fife a small area around the Longannet Power Station is predicted to exceed the objective of  $266 \sigma\text{g}/\text{m}^3$ .

The 8 hour running mean is approximately equivalent to the annual mean multiplied by 10, therefore, the average predicted background 8hr running mean CO concentration along the route is  $1.7 \text{mg}/\text{m}^3$  in 2002 and  $1.5 \text{mg}/\text{m}^3$  in 2005, well below the revised objective of  $10 \text{mg}/\text{m}^3$ .

Background annual mean benzene and 1,3 butadiene concentrations in 2002 are very low, well below the respective objectives of  $3.25 \sigma\text{g}/\text{m}^3$  and  $2.25 \sigma\text{g}/\text{m}^3$ . Concentrations are expected to decline over time therefore levels in 2005 are likely to be even lower.

The background  $\text{NO}_2$  and  $\text{SO}_2$  concentrations in Stirling suggest that the annual mean objectives to protect vegetation and ecosystems are easily met in 2002 and 2005, at all the designated sites in the vicinity of the proposed route, the Sites of Special Scientific Interest (SSSI) at Abbeycraig and Firth of Forth, and the Firth of Forth Special Protection Area (SPA).

#### *Conclusion*

Ambient pollution concentrations in close proximity to the majority of the route of the proposed railway are likely to be similar to the background levels provided in Table 7-5.  $\text{NO}_2$ ,  $\text{PM}_{10}$ , CO, benzene and 1,3 butadiene levels are likely to be elevated above background levels, but below the air quality objectives, where the route passes close to major roads such as the A907. In addition, ambient  $\text{NO}_2$ ,  $\text{PM}_{10}$  and  $\text{SO}_2$  concentrations are

likely to be elevated above background levels at the eastern end of the route around Longannet Power Station.

#### 7.4.2 Baseline Train Emissions

The total annual quantity of the pollutants NO<sub>x</sub>, PM<sub>10</sub>, and SO<sub>2</sub> and the greenhouse gas CO<sub>2</sub>, emitted by the diesel freight trains currently supplying Longannet Power Station are provided in Table 7.6. The predicted emissions do not change between 2002 and 2005. Details of the emission factors used in the calculations are provided in Volume 3, Appendix 3F.

**Table 7.6: Baseline Total Annual Rail Emissions**

Route	Route length (km)	No. trains/day	Total Emissions (tonnes/yr)			
			NO <sub>x</sub>	PM <sub>10</sub>	SO <sub>2</sub>	CO <sub>2</sub>
Kincardine - Longannet	2.0	1	0.2	0.0	0.0	6.9
Fife – Longannet	50.7	3	12.3	0.4	2.6	521.7
Ayrshire – Longannet	210.8	12	204.6	7.4	42.5	8676.2
<b>TOTAL</b>			<b>217.0</b>	<b>7.8</b>	<b>45.1</b>	<b>9204.8</b>

#### 7.4.3 Baseline Road Traffic Emissions – Alloa Eastern Link Road

Baseline NO<sub>2</sub>, PM<sub>10</sub>, CO, benzene and 1,3 butadiene concentrations have been predicted at six residential receptors, 47 Hilton Road, 7 Hilton Crescent, The Bungalow, Clackmannan Road, 66 Hawkhill Road, and two proposed new properties 20m from the centre of the Link Road, see Figure 7.1. The results are provided in Table 7.7 for the baseline scenarios, with (H) and without the proposed new houses. The predicted baseline pollution concentrations at the roadside (10m from the centre) of Hilton Road, Clackmannan Road and the Link Road are provided in Volume 3, Appendix 3G.

Baseline pollution concentrations decline at all receptors from 2002 to 2005 and 2020, despite an increase in traffic flows, due to the expected reduction in background concentrations and emissions per vehicle. The addition of the proposed 210 houses results in a slight increase in predicted pollution concentrations at all receptors.

The lowest baseline pollution concentrations are predicted at the two new houses and 7 Hilton Crescent, as these properties are a considerable distance from the existing roads. The highest concentrations are at receptors 2 and 4, which face onto Clackmannan Road, which has the highest baseline traffic flows.

The predicted baseline pollution concentrations at all receptors are well below the air quality objectives for NO<sub>2</sub>, CO, benzene and 1,3 butadiene, including the recent replacement and supplementary objectives for CO and benzene. Baseline annual mean PM<sub>10</sub> concentrations are well below the objective of 40 µg/m<sup>3</sup>, to be achieved by 2004, at all receptors. The recent supplementary objective of 18 µg/m<sup>3</sup> is exceeded in 2000 at five of the six receptors, and in 2005 at receptors 3 and 4, however, the background concentration in 2005 is 17.4 µg/m<sup>3</sup> without any contribution from road traffic, also the target for achieving the supplementary objective is not until 2010.

**Table 7.7: Baseline Pollution concentrations at the residential receptors**

Receptor	Year	NO <sub>2</sub> (µg/m <sup>3</sup> )			PM <sub>10</sub> (µg/m <sup>3</sup> )			CO (mg/m <sup>3</sup> )	Benzene (µg/m <sup>3</sup> )	1,3 butadiene (µg/m <sup>3</sup> )
		Annual Mean	99.8 <sup>th</sup> percentile of hourly means	No. hours / yr >200	Annual Mean	90 <sup>th</sup> percentile of 24 hr means	No. days/ yr >50	8 hr mean	Annual Mean	Annual Mean
1 – 46 Hilton Road	2002	16.9	76.3	0	19.3	34.6	0	1.97	1.04	0.14
	2005	14.2	65.8	0	18.0	32.3	0	1.76	0.91	0.13
	2005 (H)	14.7	67.9	0	18.0	32.3	0	1.78	0.92	0.13
	2020	11.6	55.0	0	16.4	29.4	0	1.48	0.79	0.11
	2020 (H)	12.0	56.6	0	16.5	29.5	0	1.49	0.79	0.11
2 – 7 Hilton Crescent	2002	9.7	45.7	0	18.7	33.4	0	1.70	0.85	0.12
	2005	8.7	40.9	0	17.5	31.4	0	1.55	0.79	0.11
	2005 (H)	8.8	41.4	0	17.5	31.4	0	1.56	0.79	0.11
	2020	8.2	38.2	0	16.2	29.0	0	1.38	0.73	0.10
	2020 (H)	8.3	38.8	0	16.2	29.0	0	1.38	0.73	0.10
3 – The Bungalow, Clackmannan Road	2002	31.3	124.2	0	20.8	37.2	5	2.45	1.38	0.19
	2005	26.0	107.5	0	19.0	34.1	0	2.11	1.11	0.15
	2005 (H)	26.2	108.3	0	19.0	34.1	0	2.12	1.12	0.16
	2020	19.4	85.6	0	17.0	30.4	0	1.66	0.90	0.12
	2020 (H)	19.6	86.2	0	17.0	30.4	0	1.66	0.90	0.12
4 – 66 Hawkhill Road	2002	24.4	102.4	0	20.0	35.9	2	2.21	1.21	0.17
	2005	20.3	88.7	0	18.5	33.2	0	1.93	1.01	0.14
	2005 (H)	20.7	90.1	0	18.5	33.2	0	1.95	1.02	0.14
	2020	20.6	89.8	0	17.1	30.6	0	1.71	0.93	0.13
	2020 (H)	20.8	90.4	0	17.1	30.6	0	1.71	0.93	0.13
5 – New House (North)	2002	9.9	46.6	0	18.7	33.5	0	1.70	0.86	0.12
	2005	8.9	41.6	0	17.5	31.4	0	1.56	0.79	0.11
	2005 (H)	9.0	42.1	0	17.5	31.4	0	1.56	0.80	0.11
	2020	8.3	38.9	0	16.2	29.0	0	1.38	0.73	0.10
	2020 (H)	8.4	39.3	0	16.2	29.0	0	1.38	0.73	0.10
6 – New House (South)	2002	8.8	41.4	0	18.6	33.3	0	1.66	0.83	0.11
	2005	7.8	36.6	0	17.5	31.3	0	1.53	0.78	0.11
	2005 (H)	7.9	36.8	0	17.5	31.3	0	1.53	0.78	0.11
	2020	7.4	34.4	0	16.1	28.9	0	1.36	0.72	0.10
	2020 (H)	7.4	34.5	0	16.1	28.9	0	1.36	0.72	0.10

## 7.5 Environmental Effects

### 7.5.1 Effects of Construction

In general 70-80% of construction dust is larger in diameter than 10 µm and therefore it does not necessarily increase existing levels of PM<sub>10</sub> considerably. Particles between 10 and 75 µm in diameter are not associated with adverse effects on human health, their main potential effects are:

- § Visual, the soiling of surfaces such as window ledges and cars causing a nuisance;
- § Physical and/or chemical contamination affecting e.g. laboratory and medical facilities;
- § Coating of vegetation and soil affecting the growth of vegetation; and
- § Contamination of water sources.

#### *Construction Dust Emissions - Railway*

For the purposes of the assessment of the temporary direct construction dust impacts of the construction of the railway, the construction works have been divided into a range of activities, see Table 7.8. The potential of each activity to generate dust has been ranked from negligible to severe, based on experience of previous projects.

**Table 7.8: Construction Activities**

<b>Construction Activity</b>	<b>Potential to generate dust</b>
Bridge structure blast cleaning	Severe
Infilling of bridges	Severe
Levelling of the surface at Alloa Station and car park	Severe
Ballast placing and tamping	Severe
On-site screening of spent ballast (if required)	Severe
Construction of new Alloa Station	Moderate
Clearance and shredding of vegetation	Moderate
Operation of the maximum 26 possible construction compounds, delivery, storage and removal of materials	Moderate
Movement of vehicles and equipment on unsurfaced areas	Moderate
Installation of new fences	Minor
Installation of drainage	Minor
Cable troughing and cable laying	Minor
Construction of two new footbridges	Minor
Removal of bridges	Minor
Road realignments	Minor
Removal of existing track	Negligible
General bridge structure repairs	Negligible
Surfacing of level crossings	Negligible

During construction works the most significant potential source of fugitive dust emissions are activities involving the excavation, movement and processing of potentially dusty materials such as soil and ballast.

No major earthworks, such as embankment and cutting construction, are required as part of the project. The most significant earthworks required are the infilling of two bridges, Line 199 UB33, Millbank Crescent and Line 119 UB35, Devonway, both in Clackmannan. Material will also be required to raise and level the existing ground surface at the site of the new Alloa Station and car park. Only very minor excavations are required for the activities

installation of fences, installation of drainage, cable troughing and laying, and the construction of Alloa Station.

The potential for stockpiles of materials to generate dust largely depends on the nature of the material. Earth is soft and friable compared to ballast. However, soil generally has a higher moisture content than ballast, therefore, they can both be a potentially significant source of dust.

Due to the very limited earthworks involved in the construction of the railway there will be no large long-term stockpiles of earth. At the two bridges to be infilled and the Alloa Station site, it is likely earth will be delivered directly to the site, therefore, a stockpile would not be required.

Stockpiles of ballast may be required at some construction compounds along the route, though it is likely that ballast will be brought in by either road or rail directly to the track.

The unloading and processing of ballast is a potentially significant source of dust, which is largely dependent on the moisture content of the material and the drop height to the stockpile.

The blast cleaning of 13 bridge structures has been ranked as an activity with a severe potential to generate dust due to the use of abrasive materials at high pressure.

The removal of vegetation from the track route will not generate dust, however, the vegetation may be shredded on site producing a fine sawdust type material, which could potentially be transferred off site.

The regular movement of vehicles and equipment on unsurfaced areas can generate dust both from the surface and from debris picked up by the vehicles on the wheels and underside of the vehicle while on site, in wet weather this can be transferred off site as mud.

To cause a nuisance outside the construction site dust must become airborne and reach a potentially sensitive receptor. The potential for dust to be lifted from the surface depends on the wind speed and the size of the dust particles. This potential is considerably reduced when the surface is wet, either from artificial dust suppression or from rainfall. Once airborne the location of the impact of the dust depends on the direction of the wind, the prevailing wind recorded at Grangemouth is from the west and south-west.

#### *Construction Dust Emissions – Alloa Eastern Link Road*

For the purposes of the assessment of the temporary direct impacts of construction dust due to the construction of the AELR, the construction works have been divided into a number of activities; see Table 7.9. The potential of each activity to generate dust has been ranked from negligible to severe, based on experience of previous projects.

The two activities involving the excavation of soil are ranked as the highest potential to generate dust, the removal of topsoil and the construction of the required embankments are both significant activities. The storage and movement of soil and the movement of vehicles on unsurfaced areas are also potentially significant sources of dust, as discussed above.

**Table 7.9: Construction Activities**

Construction Activity	Potential to generate dust
Removal of Topsoil	Severe
Embankment construction	Severe
Laying the sub-base	Moderate
Operation of the construction compound, delivery, storage and removal of materials	Moderate
Movement of vehicles and equipment on unsurfaced areas	Moderate
Bridge Construction	Minor
Road surfacing	Negligible

*Construction Road Traffic Emissions*

The construction of both the railway and the AELR will require some construction road traffic to access the various construction sites. The volume and routing of construction traffic has not yet been determined, as a contractor has not been appointed. Where possible, materials and equipment required for the construction of the railway will be track-based, minimising the use of road transport. Any construction traffic will result in an increase in traffic flow on affected roads, resulting in a corresponding increase in pollution concentrations at nearby receptors. In the absence of traffic data, it is not possible to predict the magnitude and significance of the secondary impact of construction traffic on air quality.

## 7.5.2 Effects of Operation

*Operational Train Emissions*

Technical Guidance Note 4 advises that emissions of NO<sub>x</sub>, PM<sub>10</sub> and SO<sub>2</sub> from diesel trains are too low to have any impact alongside railway tracks, except where there are large numbers of stationary idling engines, e.g. a major depot or terminus, with sensitive properties within around 50m. The proposed route between Stirling and Kincardine does not include any major depots or stations, therefore, the impact of emissions from diesel trains on the ambient air quality levels discussed in section 7.4.1, at the closest receptors to the tracks is considered to be negligible.

To illustrate the quantities of pollutants emitted by trains operating on the proposed route, the total annual emissions of the pollutants NO<sub>x</sub>, PM<sub>10</sub>, and SO<sub>2</sub> and the greenhouse gas CO<sub>2</sub>, emitted by the diesel freight trains supplying Longannet Power Station and the proposed new passenger service is calculated, see Table 7.10. Details of the emission factors used in the calculations are provided in Volume 3, Appendix 3F.

**Table 7.10: Operational Total Annual Rail Emissions**

Route	Route length (km)	No. trains/day	Total Emissions (tonnes/yr)			
			NO <sub>x</sub>	PM <sub>10</sub>	SO <sub>2</sub>	CO <sub>2</sub>
Kincardine - Longannet	2.0	1	0.2	0.0	0.0	6.9
Fife – Longannet	50.7	2	8.2	0.3	1.7	347.8
Ayrshire - Stirling	114.1	15	138.4	5.0	28.8	5870.2
Stirling – Longannet	21.1	15	25.6	0.9	5.3	1085.6
Passenger Stirling - Alloa	10.8	17	4.4	0.0	0.5	105.6
<b>TOTAL</b>			<b>176.8</b>	<b>6.3</b>	<b>36.4</b>	<b>7416.1</b>
<b>Change from Baseline</b>			<b>-40.3</b>	<b>-1.6</b>	<b>-8.8</b>	<b>-1788.7</b>

The operation of the new railway results in a direct minor reduction in the total quantity of pollution produced by the rail transport of coal to Longannet Power Station, due to the significant reduction in the distance travelled by freight trains from Ayrshire. The operation of the passenger service contributes a very small quantity of pollution.

The movement of coal wagons along the proposed railway is a potential source of coal dust. The wagons proposed to be used on the route are HTA-type wagons; they are the most modern available. Approximately 50% of the top of the wagon is enclosed by a 'crown sheet', which forms an integral part of the wagon. During loading a small quantity of coal can be deposited on top of the crown sheet and therefore, falls off as the wagon moves off, obviously this is only an issue close to the loading point. The crown sheet also minimises the potential for coal dust to be blown off the coal wagon, therefore, the magnitude of the impact of wind blown coal dust at sensitive receptors along the track, is likely to be minor at most.

#### *Operational Road Traffic Emissions*

The operation of the railway is likely to result in the transfer of some journeys from road to rail, resulting in a reduction in traffic flows along affected roads. The new Alloa Station may result in an increase in traffic flows on local roads leading to the station, as people travel to the station. An increase or decrease in traffic flow is likely to result in a corresponding increase or decrease in pollution concentrations at nearby receptors.

Following the opening of the railway, the aim is to transfer the majority of road based coal deliveries to rail. It is estimated that this will reduce the number of HDV's delivering coal to Longannet Power Station by 416 per day. The estimated quantity of NO<sub>x</sub>, PM<sub>10</sub>, CO, NMHC and CO<sub>2</sub> produced in 2005 by about 416 HDV's per day, travelling to and from the power station, 6 days a week, is provided in Table 7.11. It is assumed that about 296 of the 416 HDVs per day originate from Ayrshire and about 120 per day from Rosyth Port, and that the average speed is 40 mph.

**Table 7.11 Estimated annual pollution emissions from 400 HDV's per day travelling to Longannet Power Station in 2005.**

Route	No. HDVs (two way flow)	Route Length (km)	Total Emissions (tonnes/yr)				
			NO <sub>x</sub>	PM <sub>10</sub>	CO	NMHC	CO <sub>2</sub>
Ayrshire - Longannet	184704	105	161.2	3.6	23.7	9.9	10720.3
Rosyth - Longannet	74880	22	13.7	0.3	2.0	0.8	910.6
<b>TOTAL</b>			<b>174.9</b>	<b>3.9</b>	<b>25.7</b>	<b>10.8</b>	<b>11630.9</b>

The reduction in the number of coal lorries delivering to the power station will result in a slight reduction in road traffic emissions. Without road traffic data it is not possible to predict the magnitude of the impact on pollution concentrations at individual receptors along affected roads.

Current traffic flows across the majority of the 11 level crossings (excluding Station Road Kincardine and the Longannet level crossings which are currently in use) between Stirling and Kincardine are very minor, providing access to individual farms or premises. Therefore, the re-routing of traffic following the required level crossing closures would not have a significant impact on traffic flows on surrounding roads. The exception is the proposed closure of the level crossings at Hilton Road and Grange Road, both in Alloa.

The AELR is required to provide an alternative route around the closed Hilton Road level crossing, the impact of the Link Road is assessed below.

An alternative to the Grange Road level crossing is already available via Alloa Western Link Road. The Grange Road level crossing currently has a daily traffic flow of approximately 4400 vehicles, in the absence of detailed traffic data for the affected roads, it is not possible to quantify the impact of the transfer of this traffic from Grange Road to the Alloa Western Link Road. Though it is likely to result in a minor beneficial impact at residential properties in the vicinity of Grange Road, and a minor adverse impact on residential properties at the southern end of the Alloa Western Link Road.

The operation of the 5 level crossings to remain open described below has the potential to result in a worsening of air quality at nearby residential properties due to queuing traffic. 3 of the level crossings currently have very low traffic flows, which are not expected to increase following the re-opening of the railway, Manor Neuk (less than 50 vehicles/day), Manor Powis (less than 100 vehicles per day) and Cambus (less than 250 vehicles per day). Therefore, it is not considered that there is a potential for queues to develop at these crossings during the very short time the level crossings are closed. Blackgrange level crossing currently has a daily traffic flow of 1400, which is not expected to increase following the opening of the railway. No potentially sensitive receptors are located in the vicinity of Blackgrange level crossing, therefore, it is not considered further. Waterside level crossing currently has a daily traffic flow of 1100 vehicles, which is expected to rise to 1350 vehicles following the re-opening of the railway. A small number of residential properties are located on Ladysneuk Road adjacent to the northern approach to the level crossing. Due to the low traffic flow, and short time the crossing would be closed, it is not considered that a substantial queue of vehicles will develop even during peak hours. Therefore, the magnitude of the impact on air quality at the closest residential properties is considered to be negligible.

#### *Operational Road Traffic Emissions – Alloa Eastern Link Road*

The operation of the AELR has a significant effect on traffic flows on Hilton Road and Clackmannan Road, east and west of the junction with Hilton Road. Whins Road and Carsebridge Road to the north are unaffected.

Predicted operational NO<sub>2</sub>, PM<sub>10</sub>, CO, benzene and 1,3 butadiene concentrations at the six residential receptors, see Figure 7.1, are provided in Table 7.12, with (H) and without the proposed new houses.

The predicted operational pollution concentrations at the roadside (10m from the centre) of Hilton Road, Clackmannan Road the Link Road are provided in Volume 3, Appendix 3G.

The lowest operational pollution concentrations are at receptor 1 on Hilton Road, as would be expected as the majority of traffic on Hilton Road transfers to the Link Road. Operational pollution concentrations at properties facing onto Hilton Road are only slightly above background concentrations.

As for the baseline, the highest operational pollution concentrations are at receptors 3 and 4, which face onto Clackmannan Road.

The difference between the baseline and operational pollution concentrations at the six receptors are provided in Volume 3, Appendix 3G.



The operation of the AELR has a secondary beneficial impact on air quality at receptors 1, 3 and 4, which benefit from the reduction in traffic on surrounding existing roads, and a direct adverse impact at receptors 2, 5 and 6, which are closer to the AELR than existing roads.

The inclusion of the proposed 210 new houses reduces the magnitude of the reduction in pollution concentrations due to the Link Road at receptors 3 and 4 and increases the magnitude of the increase at receptors 2, 5 and 6.

**Table 7.12: Operational Pollution concentrations at the residential receptors**

Receptor	Year	NO <sub>2</sub> (µg/m <sup>3</sup> )			PM <sub>10</sub> (µg/m <sup>3</sup> )			CO (mg/m <sup>3</sup> )	Benzene (µg/m <sup>3</sup> )	1,3 butadiene (µg/m <sup>3</sup> )
		Annual Mean	99.8 <sup>th</sup> percentile of hourly means	No. hours / yr >200	Annual Mean	90 <sup>th</sup> percentile of 24 hr means	No.days/ yr >50	8 hr mean	Annual Mean	Annual Mean
1 – 46 Hilton Road	2005	9.3	43.7	0	17.6	31.5	0	1.56	0.80	0.11
	2005 (H)	9.8	45.8	0	17.6	31.5	0	1.58	0.81	0.11
	2020	8.6	40.3	0	16.2	29.0	0	1.38	0.73	0.10
	2020 (H)	8.9	41.6	0	16.2	29.1	0	1.39	0.74	0.10
2 – 7 Hilton Crescent	2005	12.1	57.3	0	17.8	31.9	0	1.64	0.84	0.12
	2005 (H)	13.8	64.0	0	17.9	32.1	0	1.69	0.87	0.12
	2020	10.4	48.8	0	16.3	29.2	0	1.42	0.76	0.10
	2020 (H)	11.4	53.9	0	16.4	29.4	0	1.45	0.77	0.11
3 – The Bungalow, Clackmannan Road	2005	20.5	89.4	0	18.5	33.2	0	1.92	1.00	0.14
	2005 (H)	22.9	97.6	0	18.7	33.6	0	2.00	1.05	0.15
	2020	15.9	72.3	0	16.7	29.9	0	1.56	0.84	0.12
	2020 (H)	17.5	78.4	0	16.8	30.2	0	1.60	0.87	0.12
4 – 66 Hawkhill Road	2005	17.8	79.5	0	18.3	32.7	0	1.83	0.95	0.13
	2005 (H)	19.8	86.8	0	18.4	33.1	0	1.90	0.99	0.14
	2020	14.0	65.1	0	16.6	29.7	0	1.52	0.81	0.11
	2020 (H)	15.4	70.4	0	16.7	29.9	0	1.55	0.83	0.12
5 – New House (North)	2005	14.5	66.8	0	18.0	32.2	0	1.71	0.88	0.12
	2005 (H)	16.9	76.4	0	18.2	32.6	0	1.79	0.93	0.13
	2020	11.9	56.1	0	16.4	29.4	0	1.46	0.78	0.11
	2020 (H)	13.5	62.8	0	16.5	29.6	0	1.50	0.80	0.11
6 – New House (South)	2005	14.7	67.6	0	18.0	32.3	0	1.72	0.89	0.12
	2005 (H)	17.2	77.4	0	18.2	32.6	0	1.80	0.93	0.13
	2020	12.0	56.7	0	16.4	29.4	0	1.46	0.78	0.11
	2020 (H)	13.6	63.5	0	16.5	29.6	0	1.50	0.80	0.11

## 7.6 Significance of Environment Effect

### 7.6.1 Construction Dust Emissions – Railway

Construction dust can only have a significant temporary impact on sensitive receptors if a receptor is located in fairly close proximity to the activity. Based on the scale and type of construction activities, the potential for dust to be transferred off site to affect PM<sub>10</sub> levels and cause a nuisance, is likely to be limited to receptors within around 50m of the working area. The minimum possible distance to the nearest sensitive receptor from the activities identified as having a severe or moderate potential to generate dust, are provided in Table 7.13. The construction process is estimated to be completed over an 18-month period.

**Table 7.13: Distance between construction activities and sensitive receptors**

Construction Activity	Location	Nearest sensitive receptor	Minimum Distance (m)
Bridge blast cleaning	Line 117 UB45	1-8 Forth View	55
		River Forth	-
	Line 117 UB42	-	>150
		River Devon	-
	Line 117 UB36	20 Kingswell Park	35
	Line 117 UB35A	29 Kingswell Park	20
	Line 119 UB34	30 Millbank Crescent	38
	Line 119 OB32	47 Alloa Road	15
	Line 119 OB31	62 Alloa Road	25
	Line 119 OB30	27 Brucefield Cres.	27
	Line 119 OB28	Bracken Brae	45
	Line 119 OB27	Bracken Brae	50
	Line 119 OB25	-	>150
	Line 119 UB23	-	>150
Line 119 OB21	34 Hawkhill Road	130	
Bridge Infilling	Line 119 UB35	135 Devonway	30
	Line 119 UB33	31 Millbank Crescent	20
Levelling ground surface at new Station	Alloa	20 Kingswell Park	85
Screening of ballast	Cambus	Cambus Cottage	85
Construction Compound	Stirling Station	1 Forth Place	40
	Forth Viaduct	1-8 Forth View	9
	Abbeycraig	Residential property, Alloa Road	20
	Logie Burn	Sidas Craigmill House	50
	Grangehall	-	>150
	Manorneuk	Residential property, Manorneuk	75
	Manor Powis	Residential property, Manorneuk	135
	Blackgrange	-	>150
	Cambus Junction	-	>150
	Cambus	Cambus Cottage	85
	Alloa West	-	>150
	Alloa Ludgate	1-17 Kellie Place	30
	Alloa new station	11 Sunnyside Court	2

**Table 7.13: Continued**

Construction Activity	Location	Nearest sensitive receptor	Minimum Distance (m)
	Hilton Road	Residential property	30
	Hilton Farm	-	>150
	Helensfield	Dalairn	60
	Black Devon Burn	135 Devonway	15
	Cattle Market	76 Alloa Road	10
	Kennet (north)	20 Ladywood	60
	Kennet (West Lodge Farm)	Bracken Brae	6
	Kilbagie Mill	Ambleside	118
	Kilbagie (south)	Ambleside Haven	65
	Broomknowe	Residential property, A977	140
	Tulliallan	-	>150
	Kincardine Power Station	-	>150
	Longannet Power Station	-	>150

Only 10 of the maximum 26 possible compounds are within 50m of a residential property and therefore, have the potential to result in moderate temporary dust impacts. The distances in Table 7.13 are the absolute minimum distance to the boundary of the land to be acquired or utilized, the distance to the boundary of the construction compound itself is likely to be greater, reducing the magnitude of the impact.

If required, the screen to process spent ballast would be likely to be located within the construction compound at Cambus. This compound is a minimum of 85m from Cambus Cottage and residential properties on Station Road, though within the compound the screen could be located a maximum of 140m from the houses. Therefore, the potential significance of the temporary dust impact is likely to be moderate.

8 of the 13 bridges which require cleaning are within 50m of the nearest residential property. Of these 8 bridges the Whins Road Bridge (Line 117 UB35A) is the largest and will take around 2 months to be repaired and cleaned. The remainder of the 8 bridges are smaller in scale, therefore works will last up to 1 month. The Forth Viaduct (Line 117 UB45) and the Cambus Bridge (Line 117 UB42) are over watercourses that are considered to be sensitive receptors; namely the River Forth and the River Devon respectively. Works are expected to last 6 months on the Forth Viaduct and 2 months on the Cambus Bridge. Both bridges to be infilled are within 50m of the nearest residential property. Therefore blast cleaning at a total of 10 bridges and infilling of 2 bridges has the potential to result in severe temporary dust impacts.

The minor earthworks required to level the ground surface at the new Alloa Station and car park are unlikely to have an impact, as the closest residential properties are 85m to the north.

The distance to residential properties from activities along the route of the railway, such as vegetation removal and ballast placing obviously varies considerably along the route. The majority of properties within 50m of the track are within the towns of Stirling, Alloa, Clackmannan and Kincardine, a small number of properties are within 10m of the track. Such works will progress along the track, therefore, the duration of the impact at individual receptors will be short.

The incorporation of effective site management procedures and the mitigation measures outlined in section 7.7 will ensure the impact of the construction works at nearby sensitive receptors is minimised.

### 7.6.2 Construction Dust Emissions – Alloa Eastern Link Road

Construction dust can only have a significant temporary impact on sensitive receptors if a receptor is located in fairly close proximity to the activity. The potential for dust to be transferred off site, to affect PM<sub>10</sub> levels and cause a nuisance, is likely to be limited to around 100m, from a construction process such as this, which involves considerable earthworks. The distance to the nearest receptor from the construction activities ranked as a severe or moderate potential to generate dust, is illustrated in Table 7.14.

The majority of the closest existing housing to the proposed new road is located off Hilton Road to the southwest, upwind of the site under the prevailing wind direction. Only a small number of properties on Carsebridge Road are located downwind of the northern end of the site. The northwest end of the AELR, where it ties into the existing A906 Whins Road and Carsebridge Road, is very close to existing residential properties. The southeast half of the AELR is more than 100m from any existing residential properties. Therefore, the significance of the temporary direct impact of construction dust is potentially severe at a limited number of properties during the construction of the northwest end of the AELR.

**Table 7.14: Distance between construction activities and sensitive receptors**

Construction Activity	Nearest sensitive receptor	Minimum Distance (m)
Removal of Topsoil	Woodend House, Carsebridge Rd.	15
Embankment construction	Mayburn, Hilton Rd.	25
Laying the sub-base	Woodend House, Carsebridge Rd.	15
Construction compound (Hilton Farm crossing)	-	>150m

The incorporation of effective site management procedures and the mitigation measures outlined in section 7.7 will ensure the impact of the construction works at nearby sensitive receptors is minimised.

### 7.6.3 Construction Traffic

Construction traffic associated with both the railway and AELR will have a secondary adverse impact on air quality at receptors close to affected roads. In the absence of construction and road traffic data it is not possible to quantify the magnitude or significance of this secondary impact. More detailed information regarding the volume of construction traffic will be available once a contractor is appointed.

### 7.6.4 Operational Train Emissions

The operation of the diesel trains will have a negligible direct adverse impact on ambient air quality adjacent to the new route from Ayrshire to Longannet via Stirling, and a negligible direct beneficial impact adjacent to the previous route from Ayrshire via the Forth Bridge.

To put the overall quantities of the pollutants emitted by the operational railway into context, Table 7.15 illustrates the total quantity of NO<sub>x</sub>, PM<sub>10</sub>, SO<sub>x</sub> and CO<sub>2</sub> emitted by Longannet Power Station in 2001.

**Table 7.15: Longannet Power Station Emissions 2001**

Total Emissions (tonnes/year)			
NO <sub>x</sub>	PM <sub>10</sub>	SO <sub>x</sub>	CO <sub>2</sub>
30,009	1570	82,412	13,547,241

Total annual emissions from the new passenger service and the rail transport of coal to Longannet Power Station via Stirling, are less than 1% of the total emissions from Longannet Power Station in 2001. The minor reduction in overall emissions generated by the rail transport of coal to the power station results in a direct minor beneficial impact.

The significance of the impact of coal dust blown off coal wagons is considered to be minor, due to the likely minor magnitude of the impact based on the design of the HTA coal wagons to be used.

#### 7.6.5 Operational Road Traffic Emissions

The transfer of journeys from road to rail will result in a beneficial secondary impact, any increase in traffic travelling to the new Alloa Station will result in an adverse secondary impact. In the absence of road traffic data it is not possible to quantify the magnitude or significance of these secondary impacts of the operation of the railway, on air quality at receptors close to affected roads.

The overall significance of the reduction in the number of HDV's transporting coal to Longannet power station is minor beneficial, the reduction in emissions is similar in magnitude to the total emissions from the transport of coal to the power station, and less than 1% of the corresponding annual emissions from Longannet Power Station. In the absence of road traffic data it is not possible to quantify the magnitude or significance of the beneficial impact at individual receptors close to affected roads.

The significance of the secondary effect of the closure of 4 of the 6 level crossings on air quality at nearby receptors is considered to be negligible. The impact of the closure of the Hilton Road level crossing and the required AELR is discussed below. Based on the magnitude of the likely impact, the significance of the likely secondary impact of the closure of the Grange Road level on air quality at affected residential receptors is considered to be minor.

Based on the magnitude of the likely impact, the significance of the secondary impact of the re-opening of 5 level crossings due to emissions from queuing traffic is considered to be negligible.

#### 7.6.6 Operational Road Traffic Emissions – Alloa Eastern Link Road

At all receptors the significance of the change in concentrations of CO, benzene and 1,3 butadiene is negligible. The magnitude of the change between the baseline and operational scenarios is very small and the operational concentrations are well below the relevant air quality objectives, see Table 7.1 and 7.2.

The change in PM<sub>10</sub> concentrations is below the criteria of significance specified in the DMRB at all receptors (see Volume 3, Appendix 3C). Operational annual mean PM<sub>10</sub> concentrations are well below the objective of 40 µg/m<sup>3</sup>, to be achieved by 2004 (see Table 7.1), at all receptors. The recent supplementary objective of 18 µg/m<sup>3</sup>, to be achieved by 2010 (see Table 7.2) is slightly exceeded in 2005 at receptors 3 and 4 (with and without the new houses) and receptors 5 and 6 (with the new houses), by 2020 it is achieved at all the

receptors. However, receptor 3 does experience a moderate reduction in PM<sub>10</sub> concentrations due to the AELR in 2005, compared to the baseline. See Figure 7.1 for air quality receptor locations at the AELR.

The change in annual mean NO<sub>2</sub> concentrations is above the DMRB criteria of significance of 4 µg/m<sup>3</sup>, though the air quality objective is not exceeded (see Volume 3, Appendix 3C), at receptor 1, 2 and 3 in 2005, receptor 4 in 2020 and receptor 5 and 6 in 2005 and 2020. The AELR has a direct substantial adverse impact on NO<sub>2</sub> concentrations at receptors 5 and 6, as would be expected as these receptors are only 20m from the centre of the new Link Road. The AELR has a direct moderate adverse impact at receptor 2, which is a greater distance from the Link Road, and a secondary substantial beneficial impact at receptors 1, 3 and 4, which benefit from the reduction in traffic flows on Hilton Road and Clackmannan Road.

The overall 'assessment value' of the AELR scheme for NO<sub>2</sub> and PM<sub>10</sub>, with and without the new houses, calculated according to the DMRB methodology, see Volume 3, Appendix 3C, is provided in Table 7.16. The calculations are provided in Volume 3, Appendix 3H. The areas within 200m of the Link Road, Hilton Road and Clackmannan Road included in the calculation of the assessment value, are illustrated in Figure 7.1.

**Table 7.16: AELR Scheme Assessment Value**

Pollutant	Without proposed new houses	With proposed new houses
NO <sub>2</sub>	-165	+1903
PM <sub>10</sub>	-39	+222

Without the proposed new houses the AELR Scheme has an overall minor beneficial impact, with the proposed new houses the Scheme has a moderate adverse impact.

The total number of houses within 200m of the Link Road, Hilton Road and Clackmannan Road, which experience an improvement and a worsening of air quality due to the AELR, with and without the proposed new houses, is provided in Table 7.17. The predictions with the new houses are only approximate as the layout of the individual houses within the designated areas is not yet known and has therefore been estimated.

**Table 7.17: Total number of residential properties experiencing an improvement and worsening of air quality due to the AELR**

Without proposed new houses		With proposed new houses	
Improvement	Worsening	Improvement	Worsening
394	60	143	521

Without the new houses over 85% of existing residential properties experience an improvement in air quality, with the new houses only 22% of properties experience an improvement. The properties that experience a worsening of air quality, with the new houses, are located within the following areas:-

- Properties on Carsebridge Road and Whins Road at the north west end of the AELR, which are a similar distance from Hilton Road and the Link Road (minor adverse impact);
- Properties in Hilton Crescent which back onto the Link Road (moderate adverse impact);

- § Proposed new houses (minor adverse impact increasing to a substantial adverse impact as the distance to the Link Road reduces); and
- § Properties within 200m of Clackmannan Road, west of the junction with Hilton Road (minor adverse impact, only with the new houses in place).

With the proposed new houses, operational traffic flows on Clackmannan Road west are predicted to increase by 15%, instead of a predicted small reduction in traffic flows without the new houses. This results in a minor increase in pollution at the majority of properties within 200m of Clackmannan Road, west of Hilton Road.

### 7.6.7 Summary

Table 7.18 summarises the magnitude and significance of the impacts of the Scheme on air quality, without mitigation.

**Table 7.18: Summary of the Significance of effects (without mitigation)**

Receptor	Potential Impact	Magnitude of Impact	Significance of Impact
Residential properties and rivers within 50m of railway works	Direct - Construction Dust	Severe	Substantial adverse
Residential properties within 100m of AELR works	Direct - Construction Dust	Severe	Substantial adverse
Potentially sensitive receptors within 200m of affected roads (residential properties, schools etc.)	Secondary - Construction Traffic	Not Known	Not known, adverse
Residential properties and designated ecological sites along the route	Direct - Operational Train Emissions	Negligible	Negligible adverse
Regional air quality	Direct – Operational Train Emissions	Minor	Minor beneficial
Residential properties and designated ecological sites along the route	Direct – Operational coal dust	Minor	Minor adverse
Potentially sensitive receptors within 200m of roads affected by the railway (residential properties, schools etc.)	Secondary - Operational Traffic Emissions	Not known, likely to be minor	Not known, likely to be minor beneficial
Residential properties within 200m of the AELR and surrounding affected local roads	Direct and secondary - Operational Traffic Emissions	Slight (without new houses) Moderate (with new houses)	Minor beneficial (without new houses) Moderate adverse (with new houses)

## 7.7 Mitigation

### 7.7.1 Construction Dust Emissions

Mitigation has been incorporated into the design of the railway proposals and the Alloa Eastern Link Road through the choice of construction compound locations. Within the compounds, the layout will be optimised to ensure any material stockpiles are located to



maximise the distance to residential properties and to take advantage of screening provided by the huts required on the compound site.

Standard best practice mitigation measures, as recommended in the CIRIA Environmental Good Practice Guide (1999), will be employed during both construction projects, including:-

- § Minimising the handling of materials such as soil and ballast;
- § Minimising drop heights;
- § Use of water bowsers during dry and/or windy conditions to damp down material stockpiles, unsurfaced areas and activities such as placing and tamping of ballast.
- § Sheeting of stockpiles if required;
- § Sheeting of lorries;
- § Restricting vehicle speeds on unsurfaced access routes and all unsurfaced areas to 10mph ; and
- § Regular use of road sweepers around the access point to compounds and working areas.

The use of such best practice measures should minimise the potential for dust to be generated by the majority of construction activities.

With regard to the shredding of vegetation removed from the track, if this is carried out on site, the location of the equipment in relation to sensitive receptors must be considered and any sawdust produced contained and enclosed for offsite disposal.

The blast cleaning of the bridges will be carried out by a specialist contractor, the bridge structure will be completely sheeted and enclosed by tarpaulins, residues made up of spent shot and removed paint will be collected and bagged within the sheeted area for offsite disposal. Vacuum methods may be used to maximise the collection of dust. The enclosure of the bridges over watercourses will extend beneath the bridge to minimise the potential for residues to enter the water and affect the Firth of Forth SPA, SSSI and Ramsar site.

The use of screening equipment is an authorised process under the Pollution Prevention & Control (Scotland) Regulations 2000. Therefore, if such equipment is required on site the operator must hold the required authorisation, issued and enforced by SEPA. It will contain a range of conditions covering the operation of the equipment, which are designed to prevent the emission of dust from the equipment.

The respective site managers will have responsibility on a day to day basis for determining if either the nature of the activities on site or the weather conditions is likely to result in the transfer of dust off site. If so remedial action shall be taken to minimise emissions, including the temporary suspension of works.

Good site management measures including keeping local residents informed and providing a point of contact for any concerns will encourage a positive relationship with the local community and minimise the likelihood of complaints.

#### 7.7.2 Operational Train Emissions

The re-routing of freight trains from Ayrshire via Stirling will result in a minor reduction in the total emissions produced by the transport of coal to Longannet Power Station by rail. The operation of the new section of railway between Stirling and Longannet will have a negligible impact on ambient air quality at the closest receptors along the proposed route. Therefore, no mitigation of train emissions is required or recommended.

The proposed type of coal wagons are the most modern available, measures to minimise the emission of coal dust are incorporated into the design of the wagons. Therefore, no additional mitigation is feasible or required.

### 7.7.3 Operational and Construction Road Traffic Emissions

The temporary secondary impact of emissions from construction traffic on local air quality will be minimised through the use of rail to transport materials on site and the use of track based equipment wherever possible.

No mitigation of road traffic emissions due to the AELR is required. The magnitude and significance of the permanent secondary impact on road traffic emissions due to the transfer of journeys from road to rail could not be assessed. However, it is likely to have a minor beneficial impact along the majority of the route, and potentially a minor adverse impact in the vicinity of the new Alloa Station, therefore, it is unlikely mitigation will be required.

In addition, due to the airborne nature of traffic emissions, once released into the atmosphere possible mitigation measures are very limited. Substantial mitigation can only be incorporated at the design stage, in the form of minimising any increase in traffic flows on local roads. This can be achieved through measures such as additional improvements to public transport, green travel plan initiatives etc.

## 7.7 Summary

Ambient air quality in the vicinity of the proposed railway and the AELR is generally very good, concentrations of NO<sub>2</sub>, CO, benzene and 1,3 butadiene in 2002 and 2005 (year of opening) are well below the latest air quality objectives for Scotland. Background PM<sub>10</sub> concentrations in 2005 are close to the latest supplementary air quality objective, to be achieved by 2010. Emissions from Longannet Power Station result in high SO<sub>2</sub> concentrations downwind, modelling and monitoring of SO<sub>2</sub> concentrations indicates that the objectives are unlikely to be breached. Ambient NO<sub>x</sub> and SO<sub>2</sub> pollution concentrations are also below the objectives for the protection of vegetation and ecosystems.

A qualitative assessment of the likely construction dust impacts of both the railway and the AELR has been carried out. No major earthworks are required for the construction of the railway, the major potential sources of dust have been identified as blast cleaning of 13 bridge structures, ballast placing and processing, the infilling of 2 bridges and the levelling of the Alloa Station site. Operations at the possible 26 construction compounds and the possible shredding of cleared vegetation are ranked as a moderate potential to generate dust. 10 of the construction compounds and 10 of the 15 bridges are within 50m of residential properties. A range of mitigation measures have been recommended, including the complete enclosure of bridges undergoing blast cleaning to ensure removed paint is collected and bagged.

The construction activities associated with the new AELR with the greatest potential to generate dust are the removal of topsoil and embankment construction. The northwest half of the AELR is located within 25m of a number of existing residential properties. A range of standard mitigation measures have been recommended including the use of water bowsers and sprays if required.

The air quality impacts of any combined changes in road traffic flows due to the construction of the railway and the AELR, and the operation of the railway and the new Alloa Station, have not been assessed, as traffic data was not available. However, the

magnitude of any resulting changes in pollution concentrations is likely to be small, no breaches of the air quality objectives at sensitive receptors is likely.

The total quantity of the pollutants NO<sub>x</sub>, PM<sub>10</sub>, SO<sub>2</sub> and the greenhouse gas CO<sub>2</sub>, produced by freight trains supplying Longannet Power Station has been predicted for the baseline and operational scenarios, in addition, the contribution from the proposed new passenger service between Stirling and Alloa has been calculated. The re-routing of freight trains via the proposed new line results in a minor overall reduction in pollution emissions, the new passenger service contributes a very small quantity of pollution. Total operational emissions are very low, less than 1% of the total emissions from Longannet Power Station in 2001. The operation of the railway has a minor beneficial impact on regional air quality.

The magnitude and significance of the potential impact of coal dust escaping from the coal wagons is considered to be minor, due to the type of wagons proposed to be used.

An estimate of the reduction in annual emissions of NO<sub>x</sub>, PM<sub>10</sub>, CO, NMHC and CO<sub>2</sub> due to the reduction in HDV's supplying coal to Longannet Power Station has been made. The reduction in the number of HDV's results in a minor reduction in annual pollution emissions and therefore has a minor beneficial impact on regional air quality.

Concentrations of the pollutants NO<sub>2</sub>, PM<sub>10</sub>, CO, benzene and 1,3 butadiene have been predicted at the nearest residential receptors to the AELR and the surrounding affected roads. Predictions have been carried out for the baseline and operational scenarios, with and without the proposed new housing developments designated in the Local Plan.

Due to the AELR, residential properties along Hilton Road and Clackmannan Road east will experience a significant reduction in pollution concentrations. Properties in Hilton Crescent and the majority of the proposed new houses will experience a significant increase. The majority of properties on Clackmannan Road west experience a minor reduction in pollution levels, without the new houses, and a minor increase with the new houses.

The predicted operational pollution concentrations at the selected residential properties are well below the air quality objectives for NO<sub>2</sub>, CO, benzene and 1,3 butadiene. Operational annual mean PM<sub>10</sub> concentrations are well below the objective of 40 µg/m<sup>3</sup>, to be achieved by 2004, at all receptors. The recent supplementary objective of 18 µg/m<sup>3</sup>, to be achieved by 2010, is exceeded in 2005 at the receptors on Clackmannan Road and the closest proposed new houses to the AELR, by 2020 it is achieved at all the receptors.

A total of 454 residential properties are located within 200m of the AELR, Hilton Road and Clackmannan Road, rising to 664 with the proposed new houses. Without the new houses 394 properties experience an improvement in air quality due to the AELR and 60 a worsening. With the new houses, 143 experience an improvement and 521 a worsening.

## **8. LANDSCAPE AND VISUAL EFFECTS**

### **8.1 Introduction**

This chapter summarises the landscape, visual and townscape impacts that are likely to occur as a result of the Scheme. The chapter also includes a consideration of opportunities to improve the Scheme's appearance and mitigate potential adverse landscape and visual impact. Residual landscape and visual effects (those which remain after mitigation) are included.

### **8.2 Methodology**

The methodology for this assessment is based on the Environmental Impact Assessment (Scotland) Regulations 1999 as amended by the Environmental Impact Assessment (Scotland) Regulations 2002 and best practice guidance from the following sources:

- § 'Guidelines for Landscape and Visual Impact Assessment' Second Edition, The Landscape Institute/Institute of Environmental Management and Assessment (Spon Press 2002) – (GLVIA);
- § 'Landscape Character Assessment' Guidance for England and Scotland, Carys Swanwick and Land Use Consultants (SNH and the Countryside Agency, 2002);
- § PAN 58 Environmental Impact Assessment.

In accordance with the GLVIA, landscape and visual impacts are assessed separately. A detailed explanation of landscape and visual assessment process, the difference between landscape and visual effects and definitions of the terms used in the assessment is given in Volume 3, Chapter 4. The process adopted for this assessment is in accordance with the GLVIA as outlined below:

- § Scoping – defines the study area and the level of detail of the study;
- § Baseline studies – relevant information about the site in the year of project commencement and about foreseeable future conditions (i.e. planned and committed developments). The baseline study is used to determine how the project will affect the existing situation. Both the landscape and visual baseline is examined;
- § Assessment – identifies the key potential landscape and visual impact, prediction of their magnitude and assessment of their significance;
- § Mitigation - suggested measures to reduce or remove significant adverse impacts.

The stages used for the recording of baseline conditions and the assessment of the impacts of the Scheme are:

The year of project commencement – to show the present baseline (year 2002, before the route re-opening).

Construction phase – to show the temporary impacts including the removal of vegetation specifically for construction and installation of temporary works compounds.

Year 1- to show the scheme as implemented including mitigation measures (after the completion of the project).

Year 15 (the established project in year 2017) – to show the established scheme when vegetation has reached some level of maturity and therefore mitigation measures will have become effective).

### *The Study Area*

The landscape context of the Scheme is shown in Figure 8.1. The study area for the visual analysis is principally determined by the zone of visual influence (ZVI) of the Scheme. An explanation of how the ZVI was generated is given in Volume 3, Chapter 4. The landscape analysis looks at a wider area to show how the route interacts with the wider landscape context and geographical features.

The Scheme will have effects throughout owing to the clearance of vegetation from the solum and slopes, permanent way laying, installation of signalling equipment/ cabling, erection of security fencing, drainage and its operational use and also in the locations where specific alterations are taking place, namely:

- § Passing loops at Forth Viaduct, Cambus to Alloa and Hilton Farm;
- § Alloa Station located at the former brewery site including car parking and landscaping;
- § Construction of an eastern link road adjacent to Hilton Road, Alloa;
- § Alterations to level crossings - either closure or upgrade, at a number of locations;
- § Footbridges at Grange Road and Hilton Road, Alloa;
- § Alterations and repairs to bridges/structures at a number of locations (including temporary scaffolding, blast cleaning/painting and bridge closures/infilling and removing);
- § Siting of permanent Relocatable Equipment Buildings (REB's) at a number of locations;
- § Siting of temporary works compounds at a number of locations;
- § Roadworks at a number of locations (including temporary road accesses/traffic control, level crossing roadworks, turning areas at crossings to be closed, signing and lighting);
- § Re-alignment of the track at Kincardine;
- § Installation of mitigation measures such as barriers to attenuate noise and vibration.

### **8.3 Consultations**

The following organisations have been consulted. Copies of consultation letters and responses are given in Volume 3:

- § SNH – No comments on landscape and visual issues;
- § Stirling Council – Commented that although the railway is an established landscape feature its visual impact could be significantly changed by the clearance of vegetation, erection of fencing etc;
- § Clackmannanshire Council – No comments on landscape and visual issues;
- § Fife Council – No comments on landscape and visual issues;
- § Falkirk Council – No response.

### **8.4 Baseline**

Landscape and visual amenity was included in the environmental appraisal section of the 'Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study' Feb 2002 (MVA, David Simmonds Consultancy and ERM). The findings from this study have been used as background information.

### *Planning Context, Landscape and Visual Designations*

Information was obtained from the following local plans:

- š Stirling Council Local Plan (adopted Dec 2000);
- š Clackmannanshire Development Plan (Clackmannanshire and Stirling Structure Plan, Finalised March, 2002, Clackmannanshire Finalised Local Plan, July 2002);
- š Falkirk District Rural Local Plan (adopted 1994);
- š Fife West Village Local Plan (adopted Feb 2000).

The local plan designations relating to landscape and visual amenity are shown in Figure 1.2, Volume 1. There are no areas designated for their landscape value on the route corridor. The following designations are adjacent or near to the Scheme:

- š Abbeycraig Area of Great Landscape Value (AGLV)- approximately 20m north of the route;
- š Ochil Hills Area of Great Landscape Value (AGLV) –approximately 20m north of the route at its closest point;
- š Forest Area of Great Landscape Value (AGLV) -approximately 200m north-east of the route at Clackmannan;
- š Tulliallan Castle Designed Landscape.

Townscape:

- š Stirling Conservation Area
- š Stirling Castle Amenity Area
- š Alloa Glebe Conservation Area
- š Kennet Village Conservation Area
- š Kincardine Conservation Area

Other designations, which influence visual amenity:

- š Forth Foreshore Footpath
- š Fife Coastal Path (West)

Trees:

- š Former Causewayhead Railway Station Tree Preservation Order -adjacent to the line;
- š Clackmannan Road/ Hilton Road, Alloa TPO – Two TPO's, one adjacent to the line and one affected by the Alloa Eastern Link Road proposal.

### *Landscape Character*

The landscape character context for the route is shown in Figure 8.2. The landscape character assessment for this study uses the national landscape character assessment prepared by Scottish Natural Heritage. The classifications used in this study are identified by:

- š No 124. Stirling to Grangemouth landscape character assessment, David Tyldesley and Associates, 1999 (SNH);
- š No. 96. Clackmannanshire landscape character assessment, ASH Consulting Group, 1998 (SNH);

§ No. 19. Dunfermline District landscape character assessment, David Tyldesley and Associates, 1995.

Figure 8.2 shows the 'landscape character types' and 'landscape units' identified by the assessments. There is some overlap between the study areas of the above documents and essentially the same landscape character types have been given different names. For simplicity the name used in the appropriate study, which covers the largest area of each character type, is used. The route is classified as follows and the key characteristics of each character type are described in Volume 3, Chapter 4:

- § The majority of the route lies within the '*Lowland River Valley*' landscape character type ('*Carse of Forth, East Stirling*' and '*Lower Devon Carselands*' landscape units);
- § The south-east section around Kincardine lies within the '*Coastal Flats*' landscape character type ('*Longannet*' and '*Kincardine*' landscape units);
- § Part of the south-east section is near to a '*Designed Landscape*' ('*Tulliallan*' landscape unit);
- § To the north-east of Clackmannan the route borders an area which lies within the '*Valley Fringes*' landscape character type ('*Devon Forth*' landscape unit);
- § Part of the south-east section borders the '*Lowland hills and Valleys*' landscape character type (Central Area, west of Dunfermline landscape unit).

For the purposes of this assessment the study area is further sub-divided into local landscape character areas as shown in Figure 8.1. These are areas of consistent and recognisable character delineated by physical, biological and man-made components of the landscape. The landscape baseline for each of the local character areas is described in Table 8.1 below and typical views for each local landscape character area are shown in Figure 8.3. Table 8.1 includes judgements about the value and sensitivity of the landscape in order to give an indication of the capacity of the landscape to absorb development. For simplicity an average rating for each of the local landscape character areas has been given but variations in value and sensitivity occur throughout the route.

**Table 8.1: Landscape Baseline**

Landscape Character	Local Landscape Character Area 1 Stirling	Local Landscape Character Area 2 Stirling to Alloa	Local Landscape Character Area 3 Alloa	Local Landscape Character Area 4 Alloa to Kilbagie	Local Landscape Character Area 5 Kilbagie to Longannet
<b>Geology</b>	Carboniferous millstone grit with extensive glacial and alluvial deposits	Carboniferous millstone grit with extensive glacial and alluvial deposits	Carboniferous West Phalian coal measures with glacial till	Carboniferous West Phalian coal measures with glacial till. Raised beach deposits.	Carboniferous millstone grit. Raised beach deposits.
<b>Landform</b>	Flat and low lying broad floodplain of the River Forth with pronounced river meanders. Steep volcanic crag and tail features	Broad plain of the River Forth with prominent ridge of hills to the north	Junction between undulating topography and flat flood plain of the River Forth. Prominent ridge of hills to the north	Undulating topography with rounded local hills	Flat and low lying broad flood plain of the River Forth. Land rises to the north-east.
<b>Land Use /Landscape Pattern</b>	Town centre/suburban/urban fringe, residential, infrastructure and mixed uses with abrupt edge to open flood plain. Flood plain- open space, sports facilities and pasture.	Predominantly agricultural (pasture) with scattered farms and settlements to the foot of the Ochils ridge. Isolated industry/mixed uses. Open landscape with prominent infrastructure corridor	Town centre/ mixed uses/ residential. Spaces defined by buildings	Open pasture with blocks of woodland. Isolated farms and settlements and small town of Clackmannan. Features on local hills eg Clackmannan Tower, Kennet radio mast.	Arable land/pasture on open floodplain. Prominent power lines and infrastructure. Settlement of Kincardine at the Forth crossing. Isolated farms and disused power station (Kincardine) and mine (Longannet). Castle (college) and estate policies.
<b>Vegetation</b>	Built up area with fragmented mature vegetation and planted screening. The trees/scrub within the solum of the railway line forms a green corridor.	Hedgerows, hedgerow trees and pockets of woodland. Intermittent line of mature self-sown trees/scrub and planted trees along the railway. Screen planting around industrial/warehouse developments.	Built up area with ornamental planting within private gardens and open spaces. The railway line forms a green corridor through the town and is in a deep wooded cutting at the western side.	Hedgerows and pockets of woodland along valleys and field corners. Blocks of plantation woodland to the north and west. The railway line forms a green corridor with mature trees and scrub.	Large areas of policy plantation woodland to the north-east. Coniferous forest on high ground to the north of Longannet. Scattered trees and hedgerows but largely open landscape. Railway forms a green corridor to Kincardine. Open along coastal section.



**Table 8.1: Continued**

<b>Landscape Character</b>	<b>Local Landscape Character Area 1 Stirling</b>	<b>Local Landscape Character Area 2 Stirling to Alloa</b>	<b>Local Landscape Character Area 3 Alloa</b>	<b>Local Landscape Character Area 4 Alloa to Kilbagie</b>	<b>Local Landscape Character Area 5 Kilbagie to Longannet</b>
<b>Planned and committed developments which will affect landscape character</b>	Business development adjacent to the line within the town centre. Open space protected.	Waste recycling plant adjacent to line. Business park being developed.	Eastern relief road (Hilton Road to A907) which is included in the scheme. Business and housing development adjacent to the line. Redevelopment of the former Brewery site including a new station, which is part of the scheme.	Housing development adjacent to the line.	Forth crossing and link roads/roundabouts to east and west.
<b>Value</b>	Within/ on the edge of the built up area within a well-defined transport corridor. Outside, but on the edge of the Conservation area. Within Stirling Castle amenity area. The route can be seen from the designated areas. Part of line in use <i>Medium/High</i>	Elevated feature within the landscape setting of Stirling and historic features and the Forth and its riparian features. Adjacent to Abbeycraig AGLV and near to the juxtaposition of the carselands with the Ochil hills (AGLV). <i>High</i>	Within the built up area. Townscape already fragmented by redevelopment/ road improvements etc. Adjacent to Alloa Conservation Area. A Tree Preservation Order is located in the area affected by the Alloa Eastern Link Road. The Park Mill Stone Cross Ancient Monument is adjacent to the site of the Alloa Eastern Link Road. <i>Medium</i>	Close to 'Forest' AGLV, Kennet Conservation Area. <i>High</i>	Northern section near to Tullallan Castle Designed Landscape. Adjacent to Kincardine Conservation Area. Coastal flats viewed from a wide area <i>High/Medium</i>
<b>Sensitivity</b>	The proximity of the designations gives the landscape a high sensitivity but the presence of the existing transport corridor reduces this. <i>Medium/High</i>	The flat landscape of the flood plain has a high sensitivity which is reduced by the presence of the existing transport corridor. Linear belts of mature vegetation increase the capacity of the landscape to absorb development. <i>Medium/High</i>	Although the route is in close proximity to the Conservation Area, a new landscape pattern has been established through redevelopment. The Tree Preservation Order was designated before the redevelopment of this part of Alloa and has already been eroded. <i>Medium/Low</i>	Undulating topography and woodlands increase capacity of landscape to absorb development <i>Medium/High</i>	The flat landscape, which can be viewed from a wide area, gives it a high sensitivity which is reduced by the presence of the existing transport corridor. The southern section, especially, is a well-defined transport link between power stations and former mine workings. <i>Medium</i>

NB See Figure 8.1, Volume 2 for locations of Local Landscape Character Areas

### *Visual Baseline*

The zone of visual influence (ZVI) is shown on Figure 8.1. The extent of visibility is determined by landform, trees and woodland plantations and, within the built up areas, by buildings and structures. Within the ZVI, visibility of the route is locally limited by trees and buildings. An overview of the route is afforded from a number of vantage points outside the ZVI including:

- š Stirling Castle
- š The Wallace Monument
- š The Ochil Hills
- š The high ground between the Devon and Forth valleys

Figure 8.1 shows representative viewpoints from which ‘before’ photographs have been taken for photomontages in Figure 8.4 showing typical views of the scheme. The visual receptors identified by the MVA feasibility study are listed in Appendix 4B, Volume 3 together with additional receptors identified at this stage in the study. Their sensitivity to visual change rating is determined by their proximity to the route and the extent to which they are screened by vegetation and barriers, cuttings etc. and whether the property is residential or business use. The importance of the view is taken into account and relates particularly to those receptors at important viewpoints and tourist destinations such as the Wallace Monument. Those which are close to the route (say within 50m) and which have direct views of it from the windows of houses are considered to have moderate to high sensitivity. During winter, die back of vegetation will open up screened views of the route from nearby properties.

The visual baseline can be summarised as follows:

- š The railway is well screened by mature trees and other vegetation along the majority of its route between Stirling and Kincardine;
- š Within Stirling the view of the route is fragmented. It appears as a green corridor on the edge of the town. The route is carried on bridges and embankments over the Forth;
- š Between Stirling and Alloa the land is flat with open views across the Carse of Forth. The railway is visible from a considerable distance from the A907 and the Ochil hills as an established, well-vegetated feature in the landscape although there are a number of sections where the route is open or only screened on the south side;
- š In the built up areas of Alloa and Clackmannan sections of the route is located in deep wooded cuttings that provide screening;
- š At the eastern edge of Alloa the area of the Alloa Eastern Link Road is a landscape already fragmented by new development;
- š Between Alloa and Kilbagie the route, which is largely screened by mature vegetation, passes through undulating landscape that provides natural screening;
- š From Kilbagie to Kincardine a section of the route is on embankment and forms a prominent high-level feature;
- š From Kincardine to Longannet the route goes along the coast with no screening. It is viewed from the A985 (T) at high level;
- š A significant number of houses along the route are very close to the line with direct views over the track bed and therefore have high sensitivity to changes in views.

## 8.5 Environmental Effects

### 8.5.1 Effects of construction

The construction process is temporary and therefore the effects are expected to be temporary also. Detailed information about the effects on the landscape resource and individual receptor groups is given in Volume 3, Appendix 4B. The following activities will cause landscape and visual effects:

- § The provision and use of haul routes and the movement of construction vehicles;
- § General site clearance of the solum and slopes and topsoil strip of the site particularly between Clackmannan and Kincardine where vegetation is dense;
- § Site clearance for the Alloa Eastern Link Road;
- § Siting of the contractor's main offices and a large number of works compound areas;
- § Scaffolding, fencing, roadworks, signing etc;
- § Work on the line including construction wagons, machinery etc.

### 8.5.2 Landscape Effects

The landscape effects of the construction works are included in Volume 3, Chapter 4, Appendix 4A.

### 8.5.3 Visual Effects

The visual effects of the construction works are included in Volume 3, Chapter 4, Appendix 4B. There are a significant number of receptors, in the region of 300 properties, living close to the scheme who will experience high visual effects as a result of vegetation clearance, erection of fencing, introduction of site compounds etc.

### 8.5.4 Effects of Operation

#### *Landscape Effects*

The sensitivity of the landscape resource, magnitude of landscape effects and significance of landscape effects including townscape effects (i.e. the potential effects on the features, spatial structure, character and appearance of built up areas) are assessed for each local character area. This information is presented in Volume 3, Chapter 4, Appendix 4A. The most significant landscape change would be the loss of the 'green corridor' as a result of the initial cutback of vegetation. Although the magnitude of effect would be initially high the significance to the landscape character would be less because the route is already well defined in the landscape by embankments, some of which are not vegetated, and cuttings. At year 15, re-vegetation will be well established. The management of vegetation for safety reasons will allow for re-growth to some extent. Volume 3, Chapter 4 gives a more detailed explanation of vegetation management. The proposals for specific locations (level crossings etc.) will have a negligible effect on landscape character apart from the Alloa Eastern Link Road that will have a moderate effect. However the road will be introduced into a landscape already recently changed and fragmented by new development and therefore could be absorbed with careful detailing and planting.

#### *Visual Effects*

The visual effects, the magnitude of effects and the significance of effects for the visual receptors in each landscape character area are listed in Volume 3, Chapter 4, Appendix 4B.

There are a number of development sites adjacent to the route and policies and proposals within the respective local plans that apply to sites adjacent to the route. For the purposes of this assessment it is assumed that mitigation will be provided within the site boundary, should the sites be developed in the future. The visual effects can be summarised as follows:

- š There are a significant number of receptors living close to and overlooking the line who will experience initial high visual effects as a result of vegetation clearance, erection of security fencing, traffic on the line and provision of noise barriers;
- š There are a small number of residents (in the region of 30-50) living close to locations where specific alterations are taking place whom will experience high initial visual effects reducing to medium visual effects at year 15.

#### *Townscape Effects*

Although the scheme borders several Conservation Areas, it is an existing defined route within an established transport corridor and therefore has minimal direct impact on the fabric of the townscape of any of the settlements it passes through. The only buildings that require any demolition are bonded warehouses at Hilton Road and a petrol filling station at Izatt Street, Alloa. In Alloa the site of the proposed station is already cleared. Here the Scheme is likely to have a beneficial effect on the townscape. The visibility of the Scheme from important spaces within each of the towns is negligible but there will be a loss of vegetation that will have an initial adverse visual effect. The eastern edge of Alloa is largely redeveloped and therefore the townscape will not be significantly disrupted. There will be a beneficial visual effect from the removal of traffic from the roads especially from Kincardine.

#### *Significance of Environmental Effects*

The significance of the landscape and visual effects are given in Volume 3, Chapter 4, Appendices 4A and 4B.

The overall significance of the environmental effects are as follows:

- š *Effects of construction;* The landscape effect would be *Moderate Adverse*. The visual effects would be *Substantial/Moderate Adverse*;
- š *Effects of Operation;* The overall significance of landscape effects for the whole route would be *Moderate Adverse* at year 1 and *Minor Adverse* at year 15. The overall significance of the visual effects would be *Substantial Adverse* at year 1 and *Moderate Adverse* at year 15. The overall significance of the townscape effects would be *Minor Adverse*.

## **8.6 Mitigation**

Noise barriers are proposed largely in the same locations where the visual amenity of receptors would be most affected. The noise barriers, which will be located on the scheme boundary, would also provide mitigation for loss of visual amenity. Where there is a loss of boundary planting, it is proposed to provide replacement planting. There are some locations where noise barriers are not proposed and where visual amenity will be adversely affected. In these locations screen planting on the boundary is recommended. The location of this landscape treatment is shown in Figure 2.1, Volume 1: Scheme Design. Cross-sections of landscape treatment in specific locations are shown in Figure 8.5.

Some of the REB's are in locations that require mitigation. It is recommended to provide hedges to screen the REB's at the following locations: Waterside level crossing and Cambus Level Crossing.

Replacement tree planting is recommended for embankments in prominent locations and where initial vegetation removal would adversely affect visual amenity as follows. Any tree planting in the vicinity of the track should be slow growing, non-deciduous and native species of local provenance:

- § To the north of the Forth Viaduct on both sides (Causewayhead Road and Sports Grounds);
- § Adjacent to Devonway/Helensfield on both sides;
- § Kilbagie embankment on the east side facing the A907.

Landscape treatment is also proposed at Alloa Station to the new car parking area. This will comprise tree and shrub planting to help soften the effect of the car park and the hard surface treatment. The location of this landscape treatment is shown in Figure 2.1, Volume 1: Scheme Design.

It will be necessary to re-instate the temporary works areas required to construct the Scheme. It is proposed that this will principally involve the re-seeding of areas that do not require a hard surface.

The Alloa Eastern Link Road is a major new feature in the landscape and it is proposed that there should be extensive tree and shrub planting at the two roundabouts, around the railway over-bridge and on the embankments of the road. In particular, tree and shrub planting will be included in the area adjacent to the existing houses in Hilton Road that face the AELR. Planting at the southern roundabout will include planting adjacent to the track and near to the Scheduled Ancient Monument no.102 (Park Mill Stone Cross). Any planting in the vicinity of the track and the SAM should be slow growing, non-deciduous and native species of local provenance. The planting proposals will be designed to respect the setting of the Park Mill Stone Cross Ancient monument. The landscape proposals are designed to provide a visual screen to soften the effect of the proposals. It is proposed to mitigate the Tree Preservation Order at the junction with the A907, which would be further eroded by the construction works, with replacement tree planting. The location of the landscape treatment of the AELR is shown in Figure 2.1, Volume 1: Scheme Design. Cross sections of the AELR landscape treatment are shown in Figure 8.5.

## **8.7 Summary**

The majority of the Scheme is on the flat, low lying broad floodplain of the River Forth with the prominent ridge of the Ochil hills to the north and forms a prominent green corridor in the landscape with some of the route carried on high embankment. Part of the Scheme, particularly in Alloa and parts of Clackmannan, passes through undulating terrain and is in deep wooded cuttings. The south east-section runs along the coastal flats. There are no areas designated for their landscape value on the route corridor but there are some AGLV designations and the Tullallan Castle Designed Landscape near to the route. There are several Conservation Areas adjacent to the route.

The Scheme will have landscape and visual effects throughout owing to the clearance of vegetation from the line, erection of security fencing and its operational use and also in the locations where specific alterations are taking place, particularly the Alloa Eastern Link Road. A significant number of houses along the route are very close to the route and have

high sensitivity to changes in views. The landscape effects of construction will be *Moderate Adverse*, and the visual effects will be *Substantial/Moderate Adverse*. The landscape effects of operation will be *Moderate Adverse* at year 1 and *Minor Adverse* at year 15. The visual effects of operation will be *Substantial Adverse* at year 1 and *Moderate Adverse* at year 15.

## **9. ECOLOGY**

### **9.1 Introduction**

This Chapter describes and evaluates the ecological impacts of the scheme as described in Volume 1, Chapter 2. Direct effects on resources resulting from activities that are an integral part of the project will be considered in this ecological assessment. In addition, the indirect, secondary and cumulative effects will also be examined. The duration of the effect (e.g. permanent or temporary and short, medium or long-term) will also be taken into account.

### **9.2 Methodology**

The overall approach to the assessment of the scheme was described in Volume 1, Chapter 4. The following description of methodology highlights particular features of the assessment of ecological impacts.

There is no single agreed method for ecological impact assessment, although certain general principles and approaches appear to be widely accepted. The method used for this study provides a systematic and transparent assessment of the significance of impacts upon ecological features. It is based upon current best practice outlined in legislation and planning policy (e.g. NPPG 14 Natural Heritage) and incorporates many of the principles set out in the draft guidance for ecological impact assessment being developed by a working group of the Institute of Ecology and Environmental Management (IEEM) (IEEM, November 2001, November 2002). It should be noted that the IEEM guidance is still under development; nevertheless the general principles that it encapsulates have been extracted from a variety of commonly accepted current guidance for ecological appraisals. The general guidance has been modified to meet the needs of this particular project; to ensure that a consistent approach has been applied across the disciplines; and that the timescale for the production of the ES could be met.

The assessment process requires the identification of key ecological features (resources) in an area and determination of their value, identification of the sources of impact and the sensitivity of receptors to these, determination of the nature, scale and duration of any effects (both direct and indirect) of the proposal upon sensitive receptors, identification of potential mitigation measures to reduce any adverse effects; and finally an assessment of the significance of any residual effects.

An ES is only required to report significant effects. A significant effect may be broadly defined as one that should be brought to the attention of those involved in the decision-making process. Guidance on how to determine the significance of an effect has been mainly of a generic nature (e.g. DoE Circular 2/99) and practitioners have been obliged to develop definitions for specific topics and projects. It is broadly accepted, however, that significance is defined in terms of the magnitude (scale) of the effect, and the value (importance) of the ecological feature experiencing that effect.

The fieldwork and assessment methods are described below. The approach taken to consultations is described in section 9.3.

### 9.2.1 Scoping

The scoping process should help to develop an understanding of the ecological context of the scheme and identify those factors to be assessed in more detail (IEEM, 2002). The overall approach to scoping for this study was described in Volume 1 Chapter 4 of this ES. The scope of the ecological assessment was informed by a review of the “Stirling-Alloa-Kincardine Rail Line Reopening Benefit Study” undertaken by MVA (2002), written consultation with consultation bodies (see section 9.3), the public consultation exercise described in Volume 1 Chapter 4 of the ES, and a review of existing published information (e.g. Local Development Plans). Further scoping took the form of an extended Phase 1 survey of the route (see section 9.2.3).

### 9.2.2 Geographical scope of assessment

The extent or area to be covered by ecological assessment varies depending upon the ecological context and the type of development being considered. There is no standard “buffer” area for a scheme, within which impacts should be assessed. For linear projects such as railways, a corridor c. 1km centred on the proposed route may be appropriate (Morris & Therivel, 2001). As the railway route already exists, and most of the proposed works will occur within the rail corridor, a decision was taken to confine the Phase 1 survey to the railway corridor and areas of permanent and temporary land take, although the desk study and consultations considered the presence of ecological receptors within a wider area (a minimum of 1 km wide corridor centred on the existing line). Deviations from this narrow survey corridor were made to assess potential use of the area by badger, otter and water vole (see Figure. 9.2). As the AELR represents a new development, the Phase 1 survey assessed an area of approximately 1 km width centred on the centre line of the proposed new road. Figure. 9.2 shows the geographical extent of the different forms of survey.

### 9.2.3 Fieldwork

The scope of the fieldwork was informed by research, consultations with consultation bodies (see section 9.3) the findings of an extended Phase 1 survey undertaken for this study (see section 9.4.3), and the timing and timescale of the study. Recommendations for further survey work are contained in section 9.6.1.

#### *Extended Phase 1 survey*

Phase 1 survey provides a rapid assessment of habitat presence and quality. Whilst it is focussed upon categorisation of parcels of land based on their vegetation, the potential value of areas to fauna is also considered. Blocks of land are assigned to recognised broad-habitat categories (e.g. semi-improved grassland, running water). Target notes are used to provide additional descriptions of features of particular note (e.g. key and characteristic species, presence of notable species, signs of faunal activity etc.). Species lists (after Stace, 1997) may also be produced. The purposes of the Phase 1 surveys undertaken for this study were to identify the type, quality and extent of habitats present within an area, and to identify any habitats or features that might require more detailed field investigations. Phase 1 survey is not to be regarded as a definitive representation of the conservation value or interest of any area of land. In addition, it must be noted that plant lists produced from one field survey do not record all species that may occur on a site in the course of a year, or over time.



Two “extended” Phase 1 habitat surveys were undertaken. The first was undertaken in August 2002, and covered the full width of the existing solum between Longannet power station and Stirling railway station (Figure 2.1, Volume 1). Following the addition of the AELR proposal, a further survey was undertaken in October 2002. This covered a corridor c. 1 km wide centred on the proposed route of the AELR.

The standard NCC Phase 1 survey method (JNCC, 1993) was used. A trained ecological surveyor walked the routes. The main habitats present were defined using the agreed criteria, and the extents of these were marked on a plan using standard alphanumeric codes. Target notes were used to provide additional details of habitat structures or points of interest.

### *Faunal Surveys*

The need for, and scope of, faunal surveys was assessed from the Phase 1 survey, review of existing information, the recommendations of the consultation bodies, and the constraints of the survey timetable.

**Invertebrates.** Scoping and consultation did not suggest any significant species or populations of invertebrates in the proposed development area, and the Phase 1 survey did not contain habitats of accepted importance to invertebrates such as dying timber and ancient woodland. Aquatic invertebrate data for the three major rivers was available from SEPA, which indicated that the communities were not particularly species rich. Consequently, no further survey work was undertaken.

**Amphibians.** The presence of amphibian populations, including protected species such as great crested newt (*Triturus cristatus*) was not identified as an issue for investigation during the consultation exercise (see section 9.3). The Phase 1 survey of the proposed AELR identified an area of habitat that may be of value to amphibian populations; a small area of marshy grassland with seasonal standing water located in an improved grassland field between the railway and the bonded warehouses in Alloa (grid reference NS 8985 9205). Although great crested newt has not been recorded from Clackmannanshire, as a precautionary measure this area requires further investigation for its amphibian populations. This could not be accommodated within the timescale for this study (survey work should be conducted between March – July) (see section 9.6.1).

**Reptiles.** Surveys for reptiles are often inconclusive. They may be recommended when the area is known to contain protected species or species at the edge of their geographical range. No reptile records were identified during this study, and reptile species (other than common lizard *Lacerta vivipara*), do not appear in local Biodiversity Action Plans for the areas concerned, suggesting that these are not species of local concern. The need for additional reptile investigations was not identified during scoping or consultation.

**Birds.** Bird surveys are usually required when a development may affect a breeding pair or population of a protected species, or a habitat supporting at least 1% of the UK population of that species. Surveys may also be required if there are species or populations of importance at a regional level. The need for additional bird survey work (either wintering or breeding birds) was not identified during the consultation or scoping exercise. The scheme is adjacent to the Forth Estuary, parts of which have been designated as a Special Protection Area (SPA) for their wintering bird populations. However, the boundary of the SPA is at least 1 km away from the route (see Figure. 9.1), and SNH did not identify the need to conduct additional investigations of the bird populations of the SPA or the Forth, or

the railway (see section 9.3 and Table 9.1). The timing of the study also precluded assessments of wintering birds.

Areas of scrub and trees were recorded from along the length of the railway line. These can have potential value for breeding birds, although no species of importance were identified during consultation. The scrub and woodland habitat have developed in c. the last 20 years, and these habitats are common and widespread throughout the area. Habitats attractive to birds were limited in extent along the line of the AELR. The timing of the study precluded the ability to assess breeding bird populations.

Mammals. The consultation exercise, and review of habitats present indicated that certain protected mammal species might be present along the route. The scope of the additional survey work undertaken for these species is described below.

Badger – Following discussions with the local badger group (see section 9.3 & Table 9.1), survey work for badger was conducted on two occasions. In August 2002 the existing rail route was surveyed; with a further survey in the agricultural fields either side of the road between the Gartarry roundabout and Kincardine undertaken in October. The areas surveyed for badger are shown on Figure. 9.2. The method followed the accepted standard approach of looking for signs of badger. This entails walking across the area concerned looking for signs. These are characteristic and sometimes quite obvious and include tufts of hair caught on barbed wire fences, conspicuous badger paths, footprints, small excavated pits or latrines in which droppings are deposited, scratch marks on trees, and snuffle holes, which are small scrapes where badgers have searched for insects and plant tubers, and setts (SNH, 2001).

Bats - The areas covered by the Phase 1 survey were also assessed for their bat potential. The routes of the railway and AELR were walked (in August and October respectively). The emphasis was upon identifying suitable roosting habitat. This includes mature trees with fissures and holes in the bark, and open brick work in bridges.

Otter – The local mammal recorder does not have records for otter on the watercourses crossed by the railway or proposed AELR (see section 9.3), and otter were not identified as an issue requiring further investigation during the statutory consultation (see Section 9.3 & Table 9.1). However, assessments of otter potential were made during survey work for this study. Signs of otter were sought adjacent to the numerous small burns currently culverted under the railway line. Signs such as paw prints, feeding areas, spraints and likely resting places were looked for within a short distance of each crossing. Separate assessments of otter populations along the three more major watercourses: the Forth, the Devon and the Black Devon were also made. At each of these three locations the riverbanks were surveyed for signs of otter to a distance of at 100 m upstream and downstream of the crossing point.

Water vole – As for otter, the local mammal recorder does not have records for this species on watercourses. Signs of water vole activity were checked for in conjunction with the otter searches.

#### *Other surveys*

Additional vegetation surveys may be required when a development is likely to affect a species that is protected or is nationally scarce. Surveys may also be warranted if there are vegetation types likely to be of regional value. Some habitat types that are listed in the relevant LBAPs as locally important were identified. The area and quality of these

(species-richness) habitats along the railway line was assessed as low during the Phase 1 survey, and the presence of these habitats was not identified as an issue of concern by consultees. The areas are also subject to ongoing maintenance and clearance. Consequently it was not deemed necessary to conduct additional species assessments.

The scoping exercise identified the presence of a number of statutory and non-statutory sites of nature conservation importance in the vicinity of the scheme (Figure 1.2, Volume 1). Site descriptions for these sites were reviewed, and based upon responses of consultees, and details of the scheme proposals, it was decided that they were unlikely to be affected by the scheme and so further survey work was not required.

#### 9.2.4 Assessment

The assessment methodology is based upon the framework being developed by IEEM (IEEM 2001, IEEM 2002).

##### *Value or importance of ecological resources*

Ecological features may be valued using generally accepted criteria, including rarity, designation and degree of protection. The IEEM draft guidance (IEEM 2002) assesses value in terms of the benefits that these features provide to people or society in general, and includes elements such as their contribution to biodiversity. The value of features may be described either in a geographical context (e.g. the feature is of importance at a European level), or at a more subjective level (e.g. of high importance). The criteria used to describe the value of ecological features for this study are set out in Table 9.1 and are based upon criteria identified in the IEEM draft guidance, and previous Environmental Statements produced by Scott Wilson.

To attain each level of value/importance, an ecological feature must meet the criteria in at least one of the areas set out in Table 9.2, although in some cases, professional judgement may be required to increase or decrease the allocation of specific value as outlined in the table. For example, the protection of a particular receptor through national or international legislation does not necessarily relate to the assessment of importance of that receptor to nature conservation. Thus, badgers are protected by national legislation, but if they are widespread and common in an area they may be of only local or regional importance. Likewise, certain habitats may be important within a regional context, and have been identified for priority action within the local biodiversity action plan (LBAP). However, the evaluation should be based upon the amount and quality of that habitat type present on the site itself, rather than its presence *per se*. This ensures that small areas of poor-quality habitat are not over-valued.

Three local Biodiversity Action Plans (LBAPs) cover the area crossed by the railway line; Clackmannanshire, Fife, and Stirling. All three have been referred to in determining the regional value of resources.

**Table 9.1: Value of Resources**

<b>Value of Resource</b>	<b>Scale of importance</b>	<b>Criteria</b>
Very High	International	<ul style="list-style-type: none"> <li>š A site designated, or identified for designation at the international level e.g. SPA, pSPA, SAC, cSAC and or Ramsar site</li> <li>š A sustainable area of habitat listed in Annex I of the Habitats Directive</li> <li>š Any regularly occurring population of an internationally important species e.g. UK Red Data Book species, which is listed as occurring in 15 or fewer 10 km squares in the UK, and that is identified as of unfavourable conservation status in Europe or global conservation concern in the UK BAP</li> </ul>
High	National	<ul style="list-style-type: none"> <li>š A site protected by national designations e.g. SSSI, NNR, Marine Nature Reserve.</li> <li>š A viable area of a priority habitat identified in the UK BAP, or of smaller areas of such habitat that are essential to maintain the viability of a larger whole.</li> <li>š A feature identified as of critical importance in the UK BAP.</li> <li>š Any regularly occurring population of a nationally important species that is threatened or rare in the region of the Country, and for which the LBAP identifies the need to protect all remaining sites.</li> </ul>
Medium	Regional	<ul style="list-style-type: none"> <li>š Viable areas of key habitat identified in the Regional BAP or smaller areas of such habitat that are essential to maintain the viability of a larger area.</li> <li>š Non-statutory sites that the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves.</li> <li>š Any regularly occurring, locally important population of a species listed in a Regional Red Data Book or LBAP on account of its regional rarity or localisation.</li> </ul>
Low	Local	Sites or populations that appreciably enrich the district habitat resource
	Negligible	No significant ecological value

*Scale of effects*

A number of factors may influence the scale or magnitude of an effect or impact including the area of site affected, the numbers of a species that are influenced, the duration of the effect, and whether or not the effect is reversible. Impacts in combination may have a cumulative effect that is greater than when the same impacts act in isolation. Cumulative impacts may entail the assessment of all the effects of the scheme upon a feature (e.g.

impacts at the construction and operation stage), or the combined impacts of a number of schemes that will affect the same area.

Poor knowledge about the response of different features to particular pressures means that the prediction of the scale of impacts can be difficult. Where possible effects have been quantified, and then assigned to a magnitude category based on the criteria set out in Table 9.2. Impacts may be positive or negative in nature and are described as ‘Negligible’, ‘Slight’, ‘Moderate’ or ‘Severe’.

**Table 9.2: Magnitude of Impact**

<b>Magnitude of Impact</b>	<b>Description</b>
Severe	The change is likely to cause a permanent wholesale change in the feature at the site (i.e. will affect the integrity of the receptor). Recovery (if it occurs) may only happen in the long-term (> 5 years) Examples include: <ul style="list-style-type: none"> <li>š loss of a particular habitat;</li> <li>š reduction of a habitat type to a size where it no longer remains viable;</li> <li>š loss of species that are characteristic of the site.</li> </ul>
Moderate	Substantial, but partial or temporary change to a habitat or species population (i.e. unlikely to have a permanent affect upon integrity of the feature at that site). Changes may be recoverable. Examples include: <ul style="list-style-type: none"> <li>š changes to the abundance or distribution of species at a site;</li> <li>š a decline in the area of a particular habitat at the site (but not to such an extent that the continued viability of that habitat at the site is in question);</li> <li>š a temporary loss of species that are characteristic of the site.</li> </ul>
Slight	Small changes to part of a site or species population.
Negligible	As it is rarely possible to state categorically that no changes will occur, this category covers those items for which very little change from baseline conditions is anticipated.
Positive	The change is likely to benefit the receptor in terms of its conservation status or integrity.

*Significance of impacts*

The above criteria for magnitude of impact and value of resource were combined to produce an overall evaluation of whether or not an effect is significant. Effects are described as ‘Substantial’ (S), ‘Moderate’ (Mo), ‘Minor’ (Mi), or ‘Negligible’ (N) according to Table 9.3.

**Table 9.3 Determination of significance**

<b>Magnitude of Impact</b>	<b>International (Very High)</b>	<b>National (High)</b>	<b>Regional (Medium)</b>	<b>Local (Low)</b>	<b>Negligible</b>
Severe	S	S	Mo	Mi	N
Moderate	Mo	Mo	Mi	Mi	N
Slight	Mo	Mi	Mi	N	N
Negligible	N	N	N	N	N

### *Confidence level*

It is sometimes of value to attribute a level of confidence to the accuracy of a prediction. Two levels have been identified for the purposes of this study. High confidence is assigned where the anticipated impact is either certain, or believed to be very likely to occur, based on reliable information or previous experience. Low confidence is assigned where the predicted impact and its level are best estimates, generally derived from first principles of ecological theory and the experience of the assessor. This category has also been used where there is limited information about species occurrence, although based on existing information important species are considered unlikely to be present. More information may be needed to improve the level of confidence. Unless otherwise stated, all the impacts are given at a high confidence level. Technical limitations that have affected the confidence of the accuracy of some of the predictions are identified in Section 9.2.5

#### 9.2.5 Constraints on the assessment process

The assessment process has been subject to a number of constraints and technical limitations that will limit the confidence of the accuracy of the prediction process. These constraints are highlighted below.

The assessment was commissioned in July 2002, with a final completion date of December 2002. Field survey work was undertaken in August onwards. The timing of ecological survey work is important in obtaining reliable information, as seasonal fluctuations occur, both temporally and spatially, for many species of plants and animals. The habitat survey of the railway line was undertaken in August. This is an acceptable time for such work, but there are a variety of spring and summer flowering species that may be less conspicuous at this time. This could influence the interpretation of the species-richness of areas of grassland, and the ground flora of woodland areas. The habitat survey of the AELR was undertaken in October. Whilst late for a survey of this type, it is an acceptable time of year. Again, certain flowering species may be overlooked, and grass and sedge species may have ceased to flower. This could have influenced the assessment of species-richness of wetland areas.

The badger surveys were undertaken in August and October. These are acceptable times for such surveys, but dense vegetation growth can obscure some signs of use (e.g. setts).

Some forms of survey were not possible during the timescale of the study. These included assessments of amphibian populations (usually conducted March – June), breeding bird surveys (usually conducted April – July), and wintering bird surveys (usually conducted December - February).

It is common (but not obligatory) to complete a scoping study before work on the full assessment is undertaken. The timescale for this study precluded such an approach, and assessment commenced prior to the completion of the scoping. Consultees identified few issues of concern for the either of the proposals, and hence the extent of fieldwork was kept to a minimum to be consistent with seasonal constraints on ecological surveys, and to allow works to be completed within the project timetable.

The need for some forms of additional survey work has been identified. This includes survey that could not be completed because of seasonal constraints, or that would be required to ensure that conditions have not changed prior to scheme commencement. These are discussed in section 9.6.1.

### 9.3 Consultations

The approach to consultation that was undertaken for this study is described in sections 4.4 and 4.5 of Volume 1 of the ES. Initially letters were issued to consultation bodies. Letters were also issued to organisations that cascade information to non-statutory organisations as part of the consultation exercise. Telephone contact was also made with certain organisations known to hold ecological data (e.g. local mammal recorder). Separate letters were sent to extend the scope of the inquiries to include the AELR. In response to comments on the substantially complete draft ES (Scott Wilson, December 2002), further approaches were made to a number of non-statutory consultees who have an interest in ecological issues (e.g. RSPB).

Consultees were asked to:

- š Identify any information that they held that would be relevant (including the presence of protected species or sites);
- š Identify any concerns that they may have about the reopening of the railway;
- š Identify issues that they would like to see included in the Environmental Statement;
- š Determine the existence of any protected sites or features of high conservation importance e.g. Sites of Special Scientific Interest (SSSI), Local Nature Reserves (LNR) etc.

A summary of the consultation responses is provided in Table 4-2 of Volume 1. Responses relating to ecological issues are provided in Table 9.4.

**Table 9.4: Consultees contacted with regard to nature conservation interests relating to the proposed project, and their responses<sup>1</sup>**

<b>Statutory consultees</b>	<b>Summary of Response</b>
Scottish Natural Heritage (SNH) Argyll & Stirling Office	Joint response. <b>Railway route:</b> - The route does not form part of any statutory sites for nature conservation. Although Abbeycraig SSSI (as described in section 9.4.1) is very close to the proposed route it does not appear that the proposal will have any adverse impact. The presence of the River Teith candidate SAC, which may be affected by work to the rail bridge crossing the River Forth at Stirling was highlighted. It was noted that Phase 1 data for Clackmannanshire may exist. <b>AELR:</b> – no concerns
SNH Forth and Borders Office	
SNH Tayside and Clackmannanshire Office	
Scottish Environment Protection Agency (SEPA)	Bridge works should be considered sensitive and measures taken to protect the water quality of rivers, using PPG 5.
Stirling Council Environmental Services Dept.	Highlighted designations for nearby area of Alloa Inches SSSI, which is part of the Firth of Forth, proposed SPA, and proposed Firth of Forth Ramsar site.
Stirling LBAP officer	No species records for the area. Provision of contextual habitat audit data for Stirling. Recommended speaking to CARSE (see below).
Clackmannanshire Council Local Planning Authority	No ecological concerns
Clackmannanshire LBAP officer	There are no records for protected species (including bats) for the vicinity of the scheme. Great crested newt has not been recorded from Clackmannanshire.
Fife Council Local Planning Authority	The Benefit Study Report (MVA, 2002) is considered to have identified relevant biodiversity information satisfactorily whilst the need for a Habitat Survey has been identified.
Fife LBAP officer	No species records for the area
Fife Nature	Contextual habitat data available.
Falkirk Council	Response awaited
Forth District Salmon Fisheries Board	Wish to be advised if any work is to be carried out to the Devon and Black Devon crossings.
<b>Non-statutory consultees</b>	
Central Scotland Bat Group	No data available for the area. Bats may use linear corridors for feeding, and gaps in stone bridges and trees as temporary roost sites. Bridges over water are most likely to be used as roost sites. A survey of possible sites should be conducted.
Mammal Society Local Recorder	Very few badger records. Noted single road kill in 2001.
Fife Badger Group	Very few records of badgers in the vicinity of the railway route, but expected to be present in small numbers. Badger survey recommended.

<sup>1</sup> This list comprises only those consultees with an interest in the nature conservation aspects of the project.  
Stirling - Alloa - Kincardine Railway (Route Re-opening) and Linked Improvements (Scotland) Bill  
Environmental Statement Volume 2 – Topic Specific Reports  
February 2003



**Table 9.4: Continued**

<b>Statutory consultees</b>	<b>Summary of Response</b>
Central Scotland Badger Group	No response
Royal Society for the Protection of Birds (RSPB)	No response
Scottish Wildlife Trust SWT	Welcomes rail re-opening in principle Highlighted the presence of Wildlife Sites in the locality Highlighted the need to take account of LBAP policies
Central Scotland Biological Records Centre (CARSE)	No significant species records for area. No amphibian records Further checks will be made
Vice County Plant recorders (Fife & Clackmannanshire and Stirling)	No significant species records
Scottish Environment Link	This is an umbrella organisation for environment groups working in Scotland. The letter was distributed to members, including RSPB and SWT and a single response was received from the National Trust for Scotland
Forth Estuary Forum	No responses were received directly through the Forum

In conclusion, few consultees have identified particular ecological issues that they feel should be addressed by the ecological assessment. The presence of a number of statutory and non-statutory sites was identified. Survey recommendations encompass Phase 1 survey, badger survey, and checks for bat roost potential – all of which were accommodated within the fieldwork programme for the study.

## **9.4 Baseline**

Areas designated of importance for nature conservation can be divided into statutory and non-statutory sites.

### **9.4.1 Statutory designated sites**

Neither the route of the railway or AELR pass through any statutory sites of nature conservation value, but there are sites of international and national importance in close proximity to the scheme. These are shown on Figure. 9.1 and are summarised below.

- § Abbeycraig Site of Special Scientific Interest (SSSI) (OS grid ref. NS 810 995) is located approximately 25m north of the railway line, at the western end of the route, northeast of Stirling. Approximately 8.82 hectares (21.8 acres) in size, it is designated due to its relatively undisturbed ancient woodland and a number of beetle species living at the northern limit for their British range. SNH does not expect this SSSI to be affected by the development;
- § Alloa Inches SSSI lies approximately 75 metres south of the railway line along the River Forth, south east of Alloa. SNH does not expect this SSSI to be affected by the development;
- § The Firth of Forth Special Protection Area (SPA) consists of a complex of estuarine environments and coastal habitats. It stretches east of Alloa to the coastal regions of Fife and East Lothian. The site is underpinned by the designation of the Firth of Forth SSSI, a 7510.1 hectare site, consisting of coastland and grassland habitats with a

diverse range of species, both flora and fauna. It is over 500m between the railway and the SPA at the nearest point, and is not expected to be directly affected by the development;

- § The Firth of Forth Ramsar site, consists of over 6313 hectares of inter-tidal flats, salt marshes, lagoons and sand dunes. This site it is not expected to be directly affected by the development;
- § The River Teith Special Area of Conservation (SAC). The site is focussed on the River Teith, but extends into the Forth. The eastern boundary of the site is immediately west of the operational railway bridge over the river, and is hence approx. 50 m upstream of the Forth Viaduct. The site has been selected for the presence of lamprey species (sea lamprey, *Petromyzon marinus*, brook lamprey *Lampetra planeri*, and river lamprey *L. fluviatilis*).

#### 9.4.2 Non-statutory designated sites

The route of neither the railway nor AELR pass through any sites designated for their local conservation value such as Local Nature Reserves or Sites of Nature Conservation Interest (SNCIs). However, there are a number of Wildlife Sites identified by the Scottish Wildlife Trust (SWT) as of local importance for nature conservation in close proximity to the route. These are shown on Figure 9.1 and include:

- § Blackgrange Tip/Manor Powis Bing (NS832945) Wildlife Site in Stirlingshire (W). This site was once an operational quarry and contains a variety of pioneer habitats including scrub, neutral grassland, tall ruderal habitats, with some areas of standing water;
- § Braehead Woodlands (NS862940) Wildlife site in Clackmannanshire. This is mainly an area of mature semi-natural woodland with some scrub and grassland areas; and
- § Alloa New Marshalling Yards (NS870932), which was a Proposed Wildlife Site, but is in the process of being developed.

#### 9.4.3 Habitats

The detailed target notes from the extended Phase 1 habitat survey are presented in Chapter 5, Volume 3, and the location of these is shown in Figure 9.2. A detailed Phase 1 habitat map has not been produced; such maps are usually produced at a scale of 1:10,000. At this scale the railway line (which is in the order of 10 m wide) would be represented by a strip of c. 1 mm width. Mapping different vegetation communities within such a width is not possible. Even if the scale of the map were changed to 1:5,000, the railway line would be in the order of 2 mm wide. The scale would need to be amended to something in the order of 1:100 if meaningful maps were to be produced. Such a scale of mapping is not considered to be appropriate given the ecological habitats that were present. A Phase 1 map of the proposed route of the AELR has been produced and is provided as Figure 9.3.

The value of these habitats has been assessed using the criteria outlined in section 9.2.4. Three LBAPs cover the extent of the route. As the value of particular habitats may vary within each county's LBAP, the value of the habitat, summarised in Table 9.4, is identified for each county.

#### *Rail Line*

The scheme is located within the existing railway corridor, and the habitats present are relatively new, having developed since the line ceased to be operational. As the line was closed between 1983 and 1993, the habitats have been established for no more than 20

years. Nevertheless, new habitats can quickly gain value for wildlife. A range of habitats, many of which are characteristic of disturbed ground, or abandoned developments were identified along the route of the railway. These are listed in Table 9.5, together with an estimate of the extent of each type within the survey boundary.

The most widespread habitat throughout the length of the railway is scrub, both scattered and continuous, dominated by hawthorn (*Crataegus monogyna*) and bramble (*Rubus fruticosus*). In some places this has spread in from the railway embankments and has colonised the track. A number of areas had recently had undergone scrub clearance at the time of the survey. The areas of developing scrub will have some value, particularly for birds. Scrub and woodland are widespread habitats in Clackmannanshire, Fife and Stirling, and hence this habitat has been assessed as of local value. It is not classed as a priority or broad habitat within any of the three Local Biodiversity Action Plans (LBAPs).

Also common throughout the length of the railway is tall ruderal vegetation, generally dominated by large stands of rosebay willowherb (*Chamaenerion angustifolium*) or common nettle (*Urtica dioica*). This is found throughout the length of the line. Such habitats are widespread, but do provide a food source e.g. for birds and invertebrates, and hence have been assessed as of local value. It is not classed as a priority or broad habitat within any of the three LBAPs .

Common tree species along the railway include willow (*Salix* sp.), ash (*Fraxinus excelsior*), sycamore (*Acer pseudoplatanus*), and birch (*Betula* sp.). These trees are mostly semi-mature, with a few mature specimens. They are often scattered along the railway embankment or in occasional wooded areas to the side of the railway line. Scattered broadleaved trees are present for much of the length of the line occurring in Fife and eastern Clackmannanshire. Dominant species are birch, ash, sycamore (*Acer pseudoplatanus*), willow and oak (*Quercus* sp.). These trees are immature, some of them having colonised the line since it was last an active railway, and therefore do not have the gaps or cracks that would allow bats to roost within them. They have been assessed as of local importance.

Areas of broadleaved woodland (both semi-natural and of plantation origin) are confined to the Clackmannanshire portion of the line, and two limited areas within Stirling. Small linear strips (approximately 5 m wide) are present along the boundary of the railway. These are dominated by ash, birch and willow. Broadleaved woodland is listed in the Clackmannanshire LBAP as a 'broad habitat' for which an action plan has been prepared. Woodland and scrub habitats account for 41% and 32% of all sites surveyed with Clackmannanshire and Stirling respectively, as part of the Scottish Wildlife Action Programme, Wildlife Site State and Status report (date 2002). Because of the low species diversity, and small scale of broadleaved woodland present along the line, this habitat has been assessed as of local-regional value.

Neutral grassland is found in several locations along lengths of the line within Clackmannanshire and Fife. Each area is small in size (approximately 200 m<sup>2</sup>), and occurs as linear strips immediately adjacent to the solum, or on the solum itself. The grassland is species-poor dominated by tufted hair-grass (*Deschampsia cespitosa*) and Yorkshire fog (*Holcus lanatus*), and considered to be of low quality. An action plan for neutral grassland has been included within the Fife LBAP. The areas of neutral grassland in Clackmannanshire have been assessed as of local value, whilst that present in Fife has been assessed to be of local/regional value. No further surveys of this grassland were recommended because of its small size and apparent species paucity.

Areas of bare ground become increasingly common near Stirling, and from Cambus westwards the solum is clear of any vegetation. These habitats are assessed as of negligible nature conservation value.

The route passes over a number of minor watercourses. These are listed in Chapter 12, Volume 2. These streams are currently culverted under the railway line, and are considered to have local nature conservation value. The route also crosses three, more major watercourses: the Black Devon, the Devon and the Forth. Viaducts/bridges currently support the railway across these rivers. All three rivers are of good water quality (see Chapter 12, Volume 2), and support migratory fish species. They have been assessed as of regional value.

### *AELR*

The area around the AELR is characterised by improved grassland or arable fields, small areas of scattered, planted broadleaved trees or mixed plantation woodland. Built land (the distillery buildings) is also present. The improved grassland and mixed plantation woodland are assessed as being of local nature conservation value.

Marshy grassland is only found in one area on the AELR section, which lies within Clackmannanshire. Grassland and marsh habitats account for only 23% of all sites surveyed with Clackmannanshire as part of the Scottish Wildlife Action Programme, Wildlife Site State and Status. This is a lower area percentage than that for grassland and marsh within Clackmannanshire and Fife. The marshy grassland supports a seasonal waterbody. Such waterbodies may be valuable to amphibian populations. This needs to be explored further. The area has been valued as being of local/regional importance (if it contains amphibian populations).

The proposed route also crosses the Brothie Burn. This is a relatively small watercourse, that is extensively culverted upstream and downstream of the proposed crossing rate. It has been assessed as of Fair water quality (see Chapter 12, Volume 2), and has been assessed as being of local value.

Other small areas of habitat affected in this location include a species-poor defunct hedge, and a small area of amenity grassland adjacent to the bonded warehouses. These are of negligible nature conservation value.

**Table 9.5 Summary Table of Phase 1 Survey for SAK Railway and AELR**

Habitat	Total Habitat (% cover)	Nature Conservation Value of Habitat (Scale of Value of Resource)		
		Stirling	Clack' shire	Fife
Broadleaved semi-natural woodland	2	Local/Regional	Local/Regional	Local/Regional
Broadleaved woodland of plantation origin	15	Local/Regional	Local/Regional	Local/Regional
Mixed plantation woodland	2	Local	Local	Local
Scattered broadleaved trees	15	Local	Local	Local
Scrub	28	Local	Local	Local
Tall ruderal	19	Local	Local	Local
Neutral grassland	7	Local/Regional	Local	Local/Regional
Marshy grassland	<1	Local	Local	Local
Improved grassland	2	Local	Local	Local
Amenity grassland	2	Negligible	Negligible	Negligible
Bare ground	8	Negligible	Negligible	Negligible
Small watercourses	Present	Local	Local	Local
Brothie Burn	Present	Local	Local	Local
Rivers Forth, Devon & Black Devon	Present	Regional	Regional	Regional

#### 9.4.4 Fauna

Invertebrates. No lists of terrestrial invertebrates were identified during research for this study. Invertebrates were not identified as an issue of concern, or a feature requiring further assessment by the consultation bodies, and there are no records for protected species. The Phase 1 survey did not identify habitats known to be of particular value to invertebrates such as dead timber or ancient woodland. It is likely that terrestrial invertebrate populations may be of no more than local importance, but this assessment is based on limited data, and hence has been awarded a low confidence rating.

SEPA conduct biological monitoring of invertebrate populations on the Rivers Devon and Black Devon. The invertebrate groups present are used to categorise water quality using the biological monitoring working party (BMWP) scores. An Average Score per Taxon (ASPT) can also be calculated. The River Devon is monitored at Tullibody Road Bridge. The BMWP score has ranged from 93 to 140 between October 1999 and July 2002, with an ASPT ranging from 4.62 to 5.9. These scores are indicative of rivers of "Fair" to "Good" quality.<sup>2</sup>

SEPA monitor the Black Devon at Mary Bridge. Invertebrate samples collected between November 1997 and November 2001 produced a BMWP score ranging between 24 and 112, with all but one record being a score of less than 100. The ASPT recorded over the same period ranged from 4 to 6.22, with most ASPT values lying between 5 and 6. Consequently the river would be assessed as of "Good" quality.

<sup>2</sup> Sites with an ASPT in excess of 4.2 are considered to be "Fair" quality; whilst those with an ASPT in excess of 5.0 are considered to be "Good" quality

SEPA do not have invertebrate data for the other minor streams crossed by the route. At the point where the Forth is crossed by the railway, the river is tidal, and its invertebrate fauna is likely to include some brackish-indicator species. Water quality results for some of the watercourses are available and these are presented in Chapter 12, Volume 2.

The aquatic invertebrate populations have been assessed as being of local importance, again with a low confidence rating.

**Fish:** The Forth, the Devon, and the Black Devon support fisheries for Atlantic Salmon (*Salmo salar*), sea trout and brown trout (*Salmo trutta*). Salmon are listed on Annex II of the Habitats Directive, 1994, and have been identified for priority action in Europe. They are also included in the local biodiversity action plans for Stirling and Clackmannanshire. Salmon are widespread in Scotland, but are undergoing population declines and for this reason have been identified as being of regional/national importance for the purposes of this study. Brown trout are included within the Clackmannanshire LBAP and have been assessed as having regional value, as have sea trout.

**Amphibians.** No existing records for the rail line or AELR were identified during research for this study. Amphibians were not identified as an issue of concern during consultations. However, potentially suitable habitat has been identified on the route of the AELR. The Phase 1 survey identified a small area of marshy grassland that supports a seasonal waterbody. Seasonal ponds can be particularly attractive to amphibian populations, as they do not support fish, which predate on young amphibians. Great crested newt is a protected species that has a widespread but local distribution in Scotland (UK BAP website). There are no records for the occurrence of great crested newt in Clackmannanshire, but as a precautionary measure the use of the seasonal wetland by amphibian populations requires further survey. This could not be accommodated within the timescale of this study. However, the likely impacts upon amphibian populations have been assessed within this ES. If Amphibian populations were present in the area of the marshy grassland they would be of regional importance (low confidence).

**Reptiles.** No existing records for the rail line or AELR were identified during research for this study. Reptiles were not identified as an issue for concern during consultations for this study, and the consultation bodies made no requests for further survey work. If present, reptile populations are likely to be of regional importance (low confidence).

**Birds.** No existing records for the rail line or AELR were identified during research for this study. Birds were not identified as an issue for concern during consultations for this study. The timing of the study precluded breeding bird surveys from being completed and the consultation bodies made no requests for further survey work.

The areas of scrub and woodland habitat that have developed along the route of the rail line may be of potential value to a variety of bird species, including several listed in LBAPs, and which are known to be declining nationally e.g. linnet *Carduelis cannabina*. Bird populations are potentially of regional importance (low confidence).

**Badger** – Consultation with three local badger groups had identified the presence of badger in the wider area. Surveys undertaken for this study failed to identify any signs of badger activity along the route of the rail line or proposed AELR, although suitable foraging habitat is present in the form of agricultural fields to the north of the railway line. If present, they would be of regional importance.

Bats – The local bat recorder noted an absence of information for the railway line, but did highlight the potential for masonry structures and old trees to be used as roost sites. Local BAP officers did not identify the presence of any bat species in the vicinity of the rail line or the AELR.

The potential presence of bat roost sites was assessed as part of this study. No obvious holes, cracks or cavities were found on old trees or bridges that would be suitable as summer roost or hibernacula for bats, and hence the bat roost potential of the proposed rail route is considered to be low. However, bats are protected species in Britain, and for this reason should be considered during the scheme design and implementation. Any bat roosts that are present are likely to be of local-regional importance.

Otter – The local mammal recorder did not have records for otter on the watercourses crossed by the rail line, and otter were not identified as a potential issue during the consultation exercise. The consultees did not request otter survey data to be collected. Nevertheless, a search was carried out for signs of otter during the study, with more comprehensive surveys conducted on the Forth, Devon and Black Devon. A summary of the findings of the surveys on the major rivers is provided in Chapter 5, Volume 3 of this ES. Evidence of otter activity was identified on the River Forth in the vicinity of the railway bridge. Spraints, estimated to be in the region of two months old, were found south of the railway bridge. The otter is a protected species, but is widespread in Scotland. For this reason it has been assessed as of regional importance.

Water vole – No records for water vole are currently lodged with the local mammal recorder. Water vole was not identified as an issue of concern during the consultation exercise, and the consultees made no requests for further survey work. Nevertheless, evidence of water vole activity was looked for at watercourse crossings, with more comprehensive surveys on the Forth, Devon and Black Devon. A summary of the findings of the surveys of the major rivers is provided in Chapter 5, Volume 3 of this ES. No signs were identified by the current study.

## 9.5 Environmental Effects

This section describes and identifies the effects of the scheme on the ecological receptors, and sub-divides them into construction and operation stages. The significance of these effects is discussed at the end of this section and are summarised in Table 9.6.

### 9.5.1 Sources of impacts

The scheme proposals were outlined in Chapter 2, Volume 1. These activities might have a range of effects or impacts upon ecological features at either the construction or operation phases. A distinction is often made between direct and indirect impacts. Direct impacts occur where the changes are directly attributable to an action associated with the scheme, such as the loss of habitat to the AELR. Indirect impacts usually arise as a ‘knock-on’ effect of the development and might include a decline in breeding success of a particular bird species due to a reduction in food on the railway line. Indirect effects are often more difficult to predict and quantify.

The key sources of impact on the ecological resources of the area resulting from the scheme have been identified as:

- § Habitat loss, a direct effect: The severity of this effect is directly related to the amount of habitat lost, the conservation value of that habitat, whether it is a temporary or

permanent loss, and whether it is recreatable. The scheme has been designed to keep the rail track within the existing railway corridor. This will limit the amount of new land required, and the habitats affected will be mainly those that have developed since the rail line ceased to be operational. Some areas of new land will be required beyond the existing railway, on either a temporary or permanent basis. The route of the AELR will require new landtake;

- § Habitat fragmentation, a direct effect: Severance of habitats and/or the wildlife corridors linking them is also considered to be a direct impact. The railway line is already established, and habitats will already have been fragmented. The impacts are most likely to be upon fauna that may be using the route. The AELR will represent a new linear route. Fragmentation can lead to reduced genetic diversity and an increase in the likelihood of species being lost if populations become isolated from each other;
- § Pollution of watercourses, an indirect effect: materials or chemicals/fuels may be released to watercourses either during the construction of the railway line (e.g. maintenance of bridges), or as a result of accidents during operation. The existing railway line includes numerous culverts that will require replacement, and there are also three main river crossings: the Forth viaduct, River Devon at Cambus and Black Devon Burn. Some scour protection works will be required for the major river crossings;
- § Disturbance, an indirect effect: Disturbance of wildlife in the form of noise, vibration or visual intrusion may arise from the operation of the rail line or AELR. These impacts may affect habitats outside the boundary of the construction site;
- § Management of rail corridor, an indirect effect: The subsequent management of the rail corridor will affect its potential wildlife value. The land lying adjacent to the track is likely to become colonised with a variety of pioneer species, and habitats currently present could re-establish if sympathetic management techniques are used;
- § Other indirect effects: Other potential indirect effects include localised changes in air quality, dust deposition, and changes in the pattern of drainage.

These potential sources of impact can be further sub-divided into temporary or permanent impacts. Permanent impacts include loss of land to the scheme. Temporary impacts arise during the construction phase (e.g. temporary use of land for storage of materials), and whilst short in duration, may have longer-lasting effects. For example, temporary loss of habitats of high nature conservation value can be as of great a magnitude as the permanent land take of lower value habitats due to the timescales over which recovery occurs (e.g. the time to re-establish woodland). Effects may be cumulative, if, for example, the land take affects the majority of an area used by a particular population of a species.

The route of the railway has been developed to keep new infrastructure within the existing railway corridor in order to minimise new land take. Some areas of permanent land take are required for the scheme, and these are listed in Table 2.2 of Volume 1 of this ES. Land take associated with the footprint of the AELR scheme is considered to be permanent in duration. Other areas of temporary land take are also required, and these are listed in Table 2.3 of Volume 1 of this ES.

Habitat fragmentation can reduce movement of species within the habitat area – this will already have occurred along the route of the railway line. The magnitude of impacts arising from habitat fragmentation will be related to the size and nature of the relative areas remaining and the degree of isolation incurred.

#### 9.5.2 Impacts due to construction

The railway line is already in place, although in some areas additional track will be re-laid and new level crossings are required. A new station in Alloa is also proposed, but does not



form part of this ES. The construction phase will focus upon refurbishment of the new line. Watercourse culverts require replacement, and some works are required to bridges. Full details of the works required are listed in Volume 1, Chapter 2 .

### *Rail line*

Scrub and other vegetation along the bed of the rail line, and adjacent to the track will need to be cleared. Some areas had already been cleared at the time that the Phase 1 survey was undertaken, and it is understood that further clearance may be ongoing.

Statutory designated sites: The route does not pass through any designated statutory sites. It passes close to Abbeycraig SSSI, designated for its ancient woodland and beetle populations, but is separated from it by the A907, and no impacts arising from this scheme are anticipated. The route does run along the foreshore of the Forth Estuary for a distance of approx. 2 km, and some restoration works to the seawall are anticipated near Longannet. But this section of the coastline is outwith the Forth SPA and Ramsar site, and no impacts upon the SPA are anticipated. Impacts upon Abbeycraig SSSI, Alloa Inches SSSI, and the Forth SPA/Ramsar site have been assessed as negligible.

The boundary of the River Teith cSAC is upstream of the Forth Viaduct. As the river is tidal at this point it is potentially vulnerable to changes in water quality resulting from construction activities. The cSAC is designated for lamprey species, and silt levels and chemical quality are important features of the site. The effect of discharges during operation will be dependent on whether the spill occurs on a flood (rising) or an ebb (receding) tide, and the nature and quantity of materials discharged. As only a small portion of the SSSI lies within the tidal section of the Forth (and hence only a small portion is vulnerable to effects), the potential magnitude of effect has been assessed to be moderate. Good site practice, and adherence to the requirements of PPG5 (SEPA, undated) will reduce the risk of spillage, and the magnitude of impact could be reduced to slight – moderate. Details of mitigation measures are contained in section 9.6. The construction methods for strengthening the Forth Viaduct will require further consideration during the detailed design stage. One option could involve the construction of small coffer dams around the bridge supports, which could lead to localised sedimentation. The impact of this upon the cSAC will depend on whether works are conducted during flood or ebb tides, and if present, are likely to be localised in extent, and so have been assessed as slight – moderate.

Non-statutory designated sites: The route does not pass through any non-statutory nature conservation sites, but it does run adjacent to one existing, and one proposed local wildlife site. Blackgrange Tip/Manor Powis Bing is an existing site identified for a range of habitats, and it is not anticipated that the works will affect the site. Alloa New Marshalling Yards was identified as a provisional site, but at the time of survey, the area had been cleared for development. No impacts upon non-statutory designated sites are anticipated.

Habitats: Most of the works will be confined to the existing rail corridor. The habitats present are relatively recent in origin, and are assessed to be of local or local/regional importance. It is not clear at this stage what proportion of the existing vegetation will have to be cleared to allow the works to proceed. For the purposes of this assessment it has been assumed that all the vegetation may need to be cleared during the construction phase, and this has been estimated as 8.1 ha of site clearance in Volume 1, Chapter 2. In practice, it may be possible to reduce the amount of vegetation cleared, and to retain areas of scrub etc. at the boundaries of the site. For example, only around 10% of the scrub vegetation present along the line occurs directly on the track. Some of this habitat loss will be temporary, as new areas of scrub and ruderal vegetation may be anticipated to develop over time. As it

has been assumed that all habitat will be removed in the short-term, but that the effect will be temporary and reversible, the magnitude of the impact upon habitats present within the railway corridor has been assessed as moderate using the categories defined in Table 9.2.

There will be some areas of permanent and temporary habitat loss outwith the rail corridor. The total area of each different type of habitat affected is provided in Table 9.6. A breakdown of the location of each area of habitat is provided in Chapter 5, Volume 3.

**Table 9.6 Habitats lost to both Permanent and Temporary Land take**

Habitats lost to Land take	Permanent Land Take (approx. m <sup>2</sup> )	Temporary Land Take (approx. m <sup>2</sup> )
Improved Grassland	8900	0
Scattered Trees	3850	6600
Tall Ruderal	2266	3750
Broadleaved Woodland	2066	3100
Scrub	1268	13850
Neutral Grassland	1000	700
Amenity Grassland	200	1000
<b>TOTAL</b>	<b>19,550</b>	<b>29,000</b>

The habitats to be lost to permanent land take are similar to those found along the railway corridor, and the AELR. Most of the land is improved grassland, but areas of scattered trees, broadleaved woodland, scrub, and neutral grassland are also affected. Similar habitats will also be subject to temporary land take. Impacts are assessed to be slight-moderate in scale.

The route crosses a number of minor watercourses that are currently culverted under the railway. No new culverts are proposed, but works are required to replace many of these; piped culverts will be replaced with pre-cast concrete box culvert units. Impacts will arise from the temporary diversion of water, and alterations to the streambeds in the vicinity of the culverts. As these are replacement culverts the impacts are considered to be moderate.

Three major watercourses; the Forth, the Devon and the Black Devon are crossed by the railway. The existing bridges and viaducts will need refurbishment works including some scour protection works. Impacts will include discharge of paint and rust flakes, oils, fuels etc., and some physical disturbance to the habitat. Impacts are considered to be temporary and, based on existing information about the works required, to be of a moderate scale.

Impacts to other habitats adjacent to the rail corridor are likely to be limited to the potential risk of deposition of dust during construction. This will be restricted to areas adjacent to the scheme and be of temporary duration, so is likely to result in a negligible impact. This impact will be largely mitigated by good site practice, especially during dust-generating activities (e.g. soil stripping). Appropriate mitigation is listed in section 9.6.

**Invertebrates:** Within the railway corridor (and in areas of land take), the temporary loss in habitat will have a knock-on (indirect) effect upon invertebrate populations. As areas of land re-establish semi-natural vegetation, new habitats for invertebrates will be formed. Thus, there may be a short-term decline in species abundance. The magnitude of effects has been assessed as moderate within the route of the railway and areas of permanent and temporary land take.

Aquatic invertebrate communities associated with the minor watercourses crossed by the route may be affected as a result of works to culverts. Culverts provide poor habitat for invertebrate communities. Any impacts will be temporary in nature, and arise from the need to divert flow during the period of the works. Adherence to good working practices can reduce the scale of any impacts. This is considered further in the mitigation section of this chapter (section 9.6). The impacts have been assessed as of moderate in scale.

Works are also required to bridges that span more major watercourses, namely the River Forth, the Devon and the Black Devon. Impacts could potentially arise as a result of accidental discharges of washing water, paint flakes, dust, chemicals etc. during the bridge refurbishment works. The scale of impacts is assessed to be moderate, although the scale and risk of harm can be reduced with careful working practices to slight. Some scour protection works may also be required for the Forth Viaduct and Cambus Viaduct, which could reduce the availability of habitat for particular species. The scale of impacts is likely to be moderate-severe in scale.

Fish: Fish will be vulnerable to similar impacts to those identified for aquatic invertebrates, but are more mobile and able to avoid areas of disturbance. Works to culverts could act to temporarily affect free movement of fish along watercourses, and measures to enable safe passage through culvert locations during restoration works will be required. These are considered further in section 9.6. The impacts upon fish populations in minor watercourses have been assessed as slight in scale (low confidence). The release of sediments, fuels, oils etc. could also have an adverse effect upon water quality and habitat suitability for fish. The magnitude of effects has been assessed as moderate. Risk and scale of harm could be reduced to slight with the use of appropriate construction techniques.

Repairs to bridges and viaducts over the Forth, Devon and Black Devon are required. It is not anticipated that passage of fish will be impeded during these works. The greatest risk of impact arises from the discharge of materials including silt, paint flakes, chemicals etc into the watercourse, which could increase sediment levels or affect water quality. The magnitude of impacts is estimated as moderate. Risks can be reduced by the use of appropriate working practices.

Amphibians: Based on existing information, amphibians do not appear to be present along the line, and hence no impacts are anticipated.

Reptiles: Opening up of the canopy will provide additional basking areas for any reptiles that are present, but there will be some loss of habitat cover. Indirect impacts arising from habitat clearance are likely to be short-term and temporary. Impacts have been assessed as slight (low confidence).

Birds: There will be a decline in potential nesting and feeding habitat for terrestrial bird species. The scale of the effect will depend upon the amount of scrub habitat that is cleared. Whilst it should be possible to retain some areas within the scheme, it has been assumed that it may all be cleared in the short-term. New scrub may develop during the operation of the scheme. Impacts upon nesting bird species can be reduced by careful timing of operations (see Section 9.6). The magnitude of impacts has been assessed as of moderate in scale.

Badger: No evidence of badger activity on or around the line was identified during survey work for this study. As they have been recorded from the wider area there is always a possibility that they may extend onto the line prior to works beginning. The badger is protected (see section 9.6), and so mitigation and precautionary measures linked to badger

have been assessed in this report. Current impacts upon badgers are assessed to be negligible.

**Bats.** Bat roost potential along the route was assessed to be minimal during the survey work for this study, and there are no records of bat use of the railway line. Nevertheless the presence or absence of roosts in individual trees, or crevices of bridges has not been confirmed, and further checks would be required prior to works commencing. Most bat roosts in trees, and masonry gaps in bridges are of a transitory status, a large number being used occasionally by an individual bat. Although protected, such roosts are considered to be only of local value for nature conservation; and impacts are assessed to be slight (low confidence).

The area includes habitats that are suitable for bat foraging, particularly the main rivers. Bats may use linear features as a focus for feeding activity, but as the bridges are already in place on the watercourses, the refurbishment works are not anticipated to affect feeding activity.

**Otter:** Signs of otter were only found along the banks of the River Forth. These were limited to old spraints; no resting places (including holts and couches) were found, although the woodland cover adjacent to the Forth Viaduct may provide suitable habitat. Further checks would be required prior to works commencing (see section 9.6). Construction impacts upon otter may result from localised habitat clearance around the base of the viaduct, and disturbance. Any habitat loss is likely to be small scale and temporary in nature. Otter appear to be able to become habituated to disturbance, and are often found in areas with a high degree of human activity. There are legal restrictions upon disturbance of otter, and these are considered further in section 9.6. Assuming that appropriate mitigation measures are in place, and that no resting places of otter are present within the vicinity of the Forth viaduct, the impacts have been assessed as moderate.

**Water vole.** No signs of water vole were recorded from any of the watercourses affected by the scheme, and therefore no impact is predicted.

#### *AELR*

The AELR represents a new linear feature in the landscape, which will lead to habitat loss, and fragmentation. During construction there is the potential for deposition of dust, which may impact on the growth of vegetation in surrounding habitats. This will be restricted to areas adjacent to the scheme and be of temporary duration, so is likely to result in a negligible impact. This impact will be largely mitigated by good site practice, especially during dust generating activities (e.g. soil stripping). Appropriate mitigation measures for this are listed in section 9.6. Noise and vibration disturbance to birds and other fauna during construction is expected to constitute a negligible impact to ecology and nature conservation in areas away from the road.

**Statutory designated sites:** The new road is at least 1 km away from the closest statutory designated site. No impacts upon such sites are anticipated.

**Non-statutory designated sites:** The proposed route lies more than 1 km away from the closest Local Wildlife Site. No impacts upon such sites are anticipated.

**Habitats:** Land is required for the scheme; most of this is either arable land, or existing built land. The road avoids the area of marshy grassland that has been assessed as of local value, but it could be vulnerable to deposition of dust etc. during construction, or run-off of

sediment-laden water. The road will separate this area from a narrow block of broadleaved woodland. Amphibian populations (if present) may use the grassland together with the woodland. Impacts upon the marshy grassland are considered to be negligible.

The Brothie Burn will be crossed by the new AELR, and it is understood that a culvert may be installed. Culverts detract from the natural character of watercourses, reduce the availability of light for aquatic species and change the character of the streambed. The Burn is already culverted elsewhere throughout its length. Impacts have assessed to be moderate-severe.

**Invertebrates:** Invertebrate populations associated with agricultural land are generally of low conservation value. Impacts are considered to be slight.

No data for invertebrate populations in the Brothie Burn were available. However, the burn is known to be culverted upstream and downstream of the proposed crossing point, and of only Fair water quality (see Chapter 12, Volume 2). It is understood that the burn may be culverted under the new road, and receive drainage from it. Culverting of watercourses reduces available habitat for invertebrate communities, and would be anticipated to have a severe effect. There is a risk of discharge of sediment and chemicals/fuels etc. into the Brook during construction. These could have a slight-moderate impact, and the risk of their occurrence can be reduced by applying good construction practice and following SEPA guidance.

**Fish:** Passage of fish along the Brothie Burn may be affected during the construction of the road and installation of the culvert. Impacts on water quality may also arise from discharges of silt, chemicals, fuels etc. The scale of effects is assessed to be moderate, but the risk of impact can be reduced with the application of good construction practice.

**Amphibians:** It has not been possible to assess the presence of amphibian populations in the marshy grassland area within the timescale for this study. The marshy grassland area supports standing water during the winter months, and such areas can be important for amphibians. This aspect requires further assessment, and recommendations for this are contained in section 9.6. The proposed route for the new road does not impinge upon this area of grassland and standing water, and there are no proposals for temporary storage areas in the vicinity. But, the road would separate the wetland area from areas of scrub and woodland within a 500 m radius that may be used by amphibians if present i.e. it could result in habitat fragmentation. Under such a scenario, mitigation measures would be required (see section 9.6). The magnitude of impact is likely to be slight –moderate (low confidence).

**Reptiles:** The existing habitats in the area are of poor quality for reptiles. Impacts are considered to be negligible.

**Birds:** The habitat available for birds is limited; there are some small areas or poor scrub. Impacts upon bird populations are assessed to be slight.

**Badger:** No signs of badger were identified along the route of the road, but as they are present in the wider area there is always a possibility that they may extend into the area prior to works beginning. The badger is protected (see section 9.6), and so mitigation and precautionary measures linked to badger have been assessed in this report. Current impacts upon badgers are assessed to be negligible.

Bats: Bat roost potential, and bat foraging habitat along the proposed route of the road was assessed to be low. Nevertheless the presence or absence of roosts in individual trees, or buildings has not been confirmed, and further checks would be required prior to works commencing (see section 9.6). No impacts are currently anticipated.

Otter & Water vole: Neither species was confirmed as being present on the Brothie Burn, in the vicinity of the new road crossing. However, given the protected nature of these species, further checks are advised (see Section 9.6). No impacts are currently anticipated.

### 9.5.3 Impacts during operation

#### *Rail line*

Statutory designated sites: No impacts upon the Abbeycraig SSSI, Alloa Inches SSSI or Firth of Forth SPA/Ramsar site are anticipated.

The Water Resource chapter (see Chapter 12, Volume 2) assesses the magnitude of impact of scheme operation upon water quality in the River Forth as minor (defined as slight in this chapter). The effects are likely to be localised and impacts upon the Teith cSAC and its notified interest features (i.e. lamprey species) are anticipated to be negligible. There will need to be routine maintenance of the viaduct, which may involve removal of rust, painting etc. There is a risk of these entering the Forth, and impacts upon the Teith cSAC are anticipated to be slight. There is a small potential risk to the water quality of the River Teith cSAC under accident conditions e.g. if there were a discharge of fuel or chemicals whilst a train was using the Forth Viaduct. The scale and effect of any accidental release would depend on the quantity and nature of material released, and the state of the tide (the river is tidal at this point, and as the cSAC is upstream of the viaduct a spill would need to occur on a flood tide to be affected). The scale of the risk can be further reduced by the introduction of mitigation measures (see section 9.6). The risk is not likely to be greater than the existing risk of a pollution incident resulting from the road bridges across the cSAC. Any impacts are likely to be localised (to within the tidal portion of the cSAC), and for this reason the magnitude of impact has been assessed as slight.

Non-statutory designated sites: No impacts are anticipated.

Habitats: Most of the effects during the operational stage constitute fragmentation of habitats that have been initiated in the construction phase, and many of the points relating to this issue have been discussed previously.

There is the potential for new habitats to develop along the operational railway line, subject to the management of the land adjacent to the line. With appropriate management (e.g. limited use of herbicides – see section 9.6.3), pioneer and ruderal species can develop, subject to meeting health and safety requirements for visibility etc. A positive impact is anticipated.

Impacts arising from deposition of oils, exhaust fumes etc. are likely to be restricted to within a few metres of the track, and are considered to be slight.

Impacts upon the water quality of minor watercourses has been assessed in the Water Resources chapter (Chapter 12, Volume 2). Slight (defined as minor in the Water Resources chapter) impacts upon quality are anticipated, with slight-moderate impacts upon physical features. Impacts upon the conservation interest of these watercourses has been assessed as slight –moderate.

Negligible – slight impacts upon the water quality and physical structure of the Forth, Devon and Black Devon are anticipated in the Water Resources Chapter (see Chapter 12, Volume 2). These would result from drainage from the railway line. Ongoing maintenance requirements e.g. painting may have slight-moderate impacts.

Invertebrates: Sympathetic management of the trackside vegetation could lead to the development of invertebrate habitat. Impacts are assessed to be positive.

Run-off from the railway is anticipated to have slight impacts on the minor watercourses that pass under the railway (see Chapter 12, Volume 2). Hence under normal operation the impacts upon aquatic invertebrates should be negligible - slight. Accidental spillages or releases to watercourses could potentially have greater impacts. With appropriate mitigation measures (see section 9.6), the scale and risk of such spillages can be reduced. The impact of accidental releases has been assessed as moderate – severe.

The quantity of run-off water compared to the volume of the rivers is likely to be low, resulting in a high dilution factor. Consequently, impacts upon aquatic invertebrate communities of the Forth, Devon and Black Devon are anticipated to be negligible – slight. Under accident conditions, releases of oils etc. might be anticipated to have moderate – severe effects.

Fish: Impacts upon fish populations of the minor watercourses are similar to those described for aquatic invertebrates, and are anticipated to be negligible – slight under normal operative conditions, but moderate if an accidental spillage occurred.

Negligible - slight impacts upon the fish populations of the Forth, Devon and Black Devon are anticipated under normal operational conditions. The impacts of an accidental spillage would depend upon the nature and quantity of the spill, but impacts could be moderate.

Amphibians: Based on existing information, amphibians do not appear to be present along the line, and hence no impacts are anticipated.

Reptiles: There is limited information about the effects of disturbance (mainly noise and vibration) upon reptile populations, although reptiles use vibration as an aid to detecting prey. This means that confidence in the assessment of impacts is low. Many animal species can become habituated to regular sources of noise or vibration. The tracks and ballast may provide good basking areas, and with careful management new areas of scrub may develop. It is anticipated that operational impacts upon reptile populations (if present) will be negligible – slight.

Birds: Bird usage of the operational line will be influenced by the amount of existing scrub and woodland vegetation that is retained, or allowed to develop. Assuming that habitat is retained, or allowed to develop, noise may affect the species present. Some species of bird are known to be sensitive to traffic noise (Reijnen *et al*, 1995). This sensitivity is thought to be due, in part, to the ability of the bird to project its song. Train noise will be more intermittent than road noise, allowing for periods of quiet between the passages of each train. Little information exists to quantify the impacts of train noise on bird species, so the confidence of the impact assessment is reduced. But it is anticipated that providing suitable habitat develops, the operational impacts on birds should be negligible – slight.

Badger: No signs of badger were recorded, and hence no operational impacts are anticipated.

Bats: No operational impacts are anticipated.

Otter: The main operational source of impact is likely to be noise and vibration during use of the line. Limited information exists for the effects of noise on otter (so confidence in the prediction is low). However, otter are found in a number of locations that experience human activity and noise and disturbance. The railway viaduct is some 15 – 20 m above the river and its banks, which will act to reduce the scale of impacts. The effect is assessed as negligible - slight.

Any accident resulting in the release of pollutants to the River Forth could have an indirect impact upon otters, if changes to water quality, or fish occurred. With the implementation of mitigation measures the risk of impacts is assessed to be low, although the impact could be moderate – severe.

Water vole. No signs of water vole were recorded from any of the watercourses affected by the scheme, and therefore no impact is predicted.

#### *AELR*

Most of the effects during the operational stage constitute fragmentation of habitats that have been initiated in the construction phase.

Statutory designated sites. The new road is at least 1 km away from the closest statutory designated site. No impacts upon such sites are anticipated.

Non-statutory designated sites: The proposed route lies more than 1 km away from the closest local Wildlife Site. No impacts upon such sites are anticipated.

Habitats: Air pollution caused by dust and particular deposition from exhaust fumes can have a localised impact on vegetation. The combination of this deposition and road salt does affect grass road verges. The effects are usually localised to within 1 – 2 m of the carriageway. Impacts are assessed to be slight.

There will be positive drainage measures to deal with run-off from the new road. This will include gullies and soakaways, and use of the existing drainage network for the A907. The northern portion of the new road will drain to the Brothie Burn via a settling pond (if required by SEPA). Further studies of the drainage network for the road are required as the Brothie Burn may not be able to accommodate additional flows (see Chapter 12, Volume 2). Run-off under normal operation conditions is anticipated to have a slight (minor) impact upon water quality of the Brothie Burn (see Chapter 12, Volume 2), and this in turn is estimated to have a slight impact upon its nature conservation value. Accidental spills could have a more severe impact upon the burn.

Invertebrates: No additional impacts to terrestrial invertebrates are anticipated during the operational phase. Impacts upon the water quality of the Brothie Burn are assessed as slight, and hence impacts upon aquatic invertebrate communities are likely to be slight also.

Fish: Impacts will be similar to those identified for aquatic invertebrates i.e. slight.

Amphibians: The presence of amphibians has not been confirmed, but if present, the main impacts would arise from habitat fragmentation already discussed.

Reptiles: There are no records for reptiles in the area, so no impacts are anticipated.



Birds: Road verges can develop value for bird life. If scrub and grassland areas are allowed to develop along the length of the road, new habitat for birds could be created. This would be a positive impact.

Badger: Badger has not been confirmed as present within the area, although a roadkill has been reported from the A907. No operational impacts are currently anticipated.

Bats: The bat foraging potential of the area appeared to be low, although no flight surveys were undertaken. The road does not appear to sever important linear features (such as hedges) that might be used by bats as feeding routes, although it does cross the Brothie Burn. The use of the area by bats should be further investigated (see Section 9.6)

Otter & Water vole: These species are not thought to be present on the Brothie Burn, and so no impacts are anticipated. Further checks for their presence are recommended (see Section 9.6).

#### 9.5.4 Significance of Impacts

The significance of the identified impacts is set out in Table 9.7. This is based on the criteria highlighted in section 9.2.4. The confidence of the impact assessment is also highlighted in the table. The stated effects assume that the mitigation measures identified in section 9.6 are applied to the design and operation of the scheme. Additional comments about the magnitude and significance of impacts if mitigation is not implemented are also included. The cumulative impacts arising from effects at the construction and operation phases are also identified in the Table.

**Table 9.7: Summary of Ecological Impacts (Continued over)**

Ecological feature	Nature Conservation value	Potential Impact/Effect	Magnitude of effect	Assessed Significance	Confidence of Impact assessment
River Teith including 3 species of cSAC of Lamprey	International	<p>Construction: Pollution from chemicals, construction materials, spillages or runoff (low risk with good site practice)</p> <p>Construction of coffer dams around bridge supports of viaduct, leading to localised sedimentation (may not be required)</p> <p>Operation: Run-off into the Forth during normal operations</p> <p>Release of materials during routine maintenance operations</p> <p>Accidental spillages during operation</p>	<p>Slight – moderate</p> <p>Slight-moderate</p> <p>Negligible-slight</p> <p>Slight</p> <p>Moderate</p>	<p>Moderate without mitigation – more likely to be minor with mitigation</p> <p>Minor - moderate</p> <p>Negligible-minor</p> <p>Minor</p> <p>Moderate</p>	<p>High</p> <p>High</p> <p>High</p> <p>High</p> <p>Low</p>
Habitats - General		<p>Operation: Development/planting of new areas of scrub habitat and woodland along route of AELR</p> <p>Deposition of oils, exhaust fumes etc. on developing habitats within a few metres of the track.</p> <p>Localised air pollution and deposition to within a few metres of the carriageway</p>	<p>Positive</p> <p>Slight</p> <p>Slight</p>	<p>Minor</p> <p>Negligible-minor</p>	<p>High</p>

Ecological feature	Nature Conservation value	Potential Impact/Effect	Magnitude of effect	Assessed Significance	Confidence of Impact assessment
Broadleaved semi-natural woodland	Local/Regional	Construction: Removal. It has been assumed that the entire habitat present within the rail corridor will be removed, although this may not be necessary. Some areas of habitat lost to permanent and temporary land take.	Moderate	Minor	High
Broadleaved woodland of plantation origin					
Mixed woodland	Local	Construction: Removal. It has been assumed that the entire habitat present within the rail corridor will be removed, although this may not be necessary.	Moderate	Minor	High
Scattered broadleaved trees	Local	Construction: Removal. It has been assumed that the entire habitat present within the rail corridor will be removed, although this may not be necessary. Some areas adjacent to the line lost to permanent and temporary land take.	Moderate	Minor	High
Scrub	Local	Construction: Removal. It has been assumed that the entire habitat present within the rail corridor will be removed, although this may not be necessary. Some areas adjacent to the line lost to permanent and temporary land take.	Moderate	Minor	High
Tall Ruderal	Local	Construction: Removal. It has been assumed that the entire habitat present within the rail corridor will be removed, although this may not be necessary. Small areas adjacent to the line lost to permanent and temporary land take.	Moderate	Minor	High

Ecological feature	Nature Conservation value	Potential Impact/Effect	Magnitude of effect	Assessed Significance	Confidence of Impact assessment
Neutral grassland	Local/Regional	Construction: Removal. It has been assumed that the entire habitat present within the rail corridor will be removed, although this may not be necessary. Small areas adjacent to the line lost to permanent and temporary land take.	Moderate	Minor	High
Marshy grassland	Local	Construction: Possible dust deposition or run-off Operation: Air pollution/ run-off from the road.	Negligible Slight	Negligible Negligible	High High
Minor watercourses	Local	Construction: Replacement of culverts affecting flow and physical features. Operation: Discharge of oils, fuels etc. in drainage from rail line.	Moderate Slight-moderate	Minor Minor	High High
Major watercourses: Forth, Black Devon	Regional	Construction: Refurbishment of bridges/viaducts, and scour protection works. Operation: Discharge of oils, fuels etc. in drainage	Moderate Negligible-slight	Minor Negligible – Minor	Low High
Brothie Brook	Local	Ongoing maintenance e.g. painting Construction: Installation of a culvert Operation: Drainage from road – normal Accidental spillages	Slight-moderate Moderate-severe Slight Severe	Minor Minor Minor Minor	Low High

Ecological feature	Nature value	Conservation	Potential Impact/Effect	Magnitude of effect	Assessed Significance	Confidence of Impact assessment
Terrestrial invertebrates	Local		<p>Construction: Clearance of habitat along rail line &amp; in areas of permanent and temporary land take.</p> <p>Clearance of habitats along AELR</p> <p>Operation: Development/planting of new habitats</p>	<p>Moderate</p> <p>Slight</p> <p>Positive</p>	<p>Minor</p> <p>Minor</p>	<p>Low</p>
Aquatic invertebrates of minor watercourses	Local		<p>Construction: Temporary loss of habitat (and species) during refurbishment of culverts.</p> <p>Release of pollutants, dust, materials, fuel etc. during construction works.</p> <p>Operation: Release of pollutants, oils etc. in drainage during routine operation</p> <p>Accidental spillages</p>	<p>Moderate</p> <p>Slight-Moderate</p> <p>Negligible-slight</p> <p>Moderate-severe</p>	<p>Minor</p> <p>Negligible</p> <p>Minor</p>	<p>High</p> <p>High</p>
Aquatic invertebrates of major watercourses	Local		<p>Construction: Temporary changes in water quality arising from release of oils, fuels, paint flakes etc.</p> <p>Habitat disturbance and changes in habitat in vicinity of scour protection works.</p> <p>Operation: Run-off of water containing oils, pollutants etc.</p> <p>Accidental releases of pollutants</p>	<p>Slight-moderate</p> <p>Moderate-severe</p> <p>Negligible – slight</p> <p>Moderate-severe</p>	<p>Minor</p> <p>Minor</p> <p>Negligible</p> <p>Minor</p>	<p>High</p> <p>High</p> <p>High</p>
Aquatic invertebrates of	Local		<p>Construction:</p>		<p>Minor</p>	

Ecological feature	Nature value	Conservation	Potential Impact/Effect	Magnitude of effect	Assessed Significance	Confidence of Impact assessment
Brothie Burn			Habitat disruption during construction of new culvert. Release of pollutants, dust, materials, fuel etc. during construction works. Operation: Changes to water quality resulting from run-off of road drainage	Severe  Slight-moderate  Slight	Minor  Negligible-Minor  Negligible	Low  Low  High
Fish of minor watercourses	Local		Construction: Interference with free passage along watercourses during culvert replacement works. Release of pollutants, dust, materials, fuel etc. during construction works. Operation: Run-off of water containing oils, pollutants etc. Accidental discharges	Slight  Moderate (slight if good construction practice used).  Negligible – slight  Moderate	Minor  Minor  Negligible  Minor	Low    High
Fish of major watercourses	Regional - National		Construction: Discharge of oils, sediments, fuels etc. affecting water quality. Operation: Run-off containing oil, pollutants etc. Accidental spillages	Moderate  Negligible – slight  Moderate	Minor-moderate  Minor  Moderate	High  High
Fish of the Brothie Burn	Local		Construction: Impedance of passage during construction of culvert.	Moderate	Minor	High

Ecological feature	Nature Conservation value	Potential Impact/Effect	Magnitude of effect	Assessed Significance	Confidence of Impact assessment
		Release of oils, fuels, sediment etc. into the watercourse during construction. Operation: Changes in water quality resulting from run-off of drainage water from the road	Moderate (slight if good construction practice used). Slight	Minor Negligible	High
Amphibians	Not confirmed as present	Construction: No impacts anticipated for rail line. Potential habitat fragmentation, if amphibians are present in area.	Slight-moderate	Minor	Low
		Operation: None identified			
Reptiles	Not confirmed as present	Construction: Habitat clearance of rail line Habitat clearance of AELR Operation: Disturbance along rail line and AELR	Slight Negligible Negligible-slight <i>if present</i>	Negligible Negligible Negligible - minor	Low Low
Birds	Local - Regional	Construction: Habitat clearance on railway line Habitat clearance along route of AELR Operation: Disturbance on rail line Development of new areas of habitat, principally scrub on rail line & grassland areas along AELR	Moderate Slight Negligible – slight Positive	Minor Negligible Negligible - minor	Low
Badger		No evidence of their presence			
Bats	Local	Construction:			

Ecological feature	Nature value	Conservation	Potential Impact/Effect	Magnitude of effect	Assessed Significance	Confidence of Impact assessment
			Removal of roost sites – <i>if present</i> Operational: None anticipated	None - Slight	None - Minor	Low
Otter	Regional		Construction: Clearance of cover around the Forth viaduct & disturbance during refurbishment Operation: Noise and disturbance Accidental releases of pollutants	Moderate  Negligible – slight Moderate - severe	Minor  Negligible Minor Minor moderate	High  High
Water Vole			No evidence of their presence			



## 9.6 Mitigation

Mitigation comprises two components: actions required to meet legal obligations with respect to protected species and actions required to minimise the identified adverse impacts upon ecological features.

### 9.6.1 Actions required to meet legal obligations

A number of protected species *may* be encountered during works for the scheme. The legal obligations relating to these species, and the actions required are set out below.

#### *Badger*

Badgers and their setts are fully protected under the Protection of Badgers Act 1992. The purpose of the legislation is to protect the animals from deliberate cruelty and the incidental effects of lawful activities. The legislation makes it an offence to:

- š wilfully kill, injure, take, possess or cruelly ill-treat a badger, or attempt to do so;
- š interfere with a sett by damaging or destroying it;
- š obstruct access to, or any entrance of, a badger sett;
- š disturb a badger when it is occupying a sett.

Badgers were not recorded during survey work for this study, but are known to be present in the wider area. To ensure compliance with the law the following actions are recommended:

- š a pre-construction badger survey of the railway route, adjacent fields, and the route of the AELR and vicinity should be undertaken. If badgers are thought to be present at that time further mitigation measures will need to be discussed and agreed with SNH;
- š construction staff should be briefed on how to recognise signs of badger in case they are encountered during the construction works.

If badgers do move into the areas affected by the scheme, appropriate mitigation will need to be discussed and agreed with SNH. This might entail badger fencing, badger crossing points (e.g. underpasses) etc.

#### *Bats*

All species of bat are protected by the Wildlife and Countryside Act 1981 and by the Conservation (Natural Habitats, &c.) Regulations 1994. The legislation makes it an offence to:

- š intentionally or deliberately kill, injure or capture a bat;
- š deliberately disturb a bat (whether in a roost or not);
- š damage, destroy or obstruct access to a bat roost;
- š possess or transport a bat or any part of a bat, unless acquired legally;
- š sell, barter or exchange a bat, or any part of a bat.

Bat roosts are protected whether or not the bats are present.

The survey work for this study suggests that there is a low potential of bat roost sites being present along the railway line, and the habitat along the AELR may also have low potential for bats. It is estimated that as many as twelve stone-built bridges between Claremont and

Hawkhill Road will need repairs to the masonry, and as bats can enter holes less than 3 cm across there is a small risk factor that they may be present. No flight surveys were undertaken. To ensure compliance with the law the following actions are recommended:

- a pre-construction flight survey of the rail route and proposed route for the AELR to determine bat usage of the area;
- pre-construction checks of all suitable roost sites using appropriate equipment (e.g. fibre-optic searches).

A suitably qualified and licensed individual should undertake all surveys. If bat roosts are found along the route discussions with SNH will be required. Licences are required to permit blocking or destruction of a roost. The Scottish Executive can issue licences following the application of strict criteria. These usually entail demonstration that the action is required for conservation purposes or for overriding reasons of public good. Recent cases in England suggest that licences may not be issued solely because a feature lies in the vicinity of a development.

#### *Otters*

Otter were recorded from the River Forth. They are protected by the Wildlife and Countryside Act (1981), and the Conservation (Natural Habitats &c.) Regulations 1994. The legislation makes it an offence to:

- intentionally kill, take or injure an otter;
- deliberately disturb an otter;
- damage or destroy an otter shelter, whether intentionally or not; and
- deliberately obstruct access to a place of shelter.

To ensure compliance with the legislation the following actions are recommended:

- a pre-construction check to ensure that no holts have been established in the area to be affected by the works (including the areas to be cleared to enable the bridge maintenance works). If holts or couches are encountered discussions with SNH will be required – exclusion areas of at least 20 m are usually required to reduce disturbance;
- briefing of site staff to make them aware of the signs of otter, their potential presence, and actions to be undertaken if otter are encountered.

If otter holts are found along the route discussions with SNH will be required. Licences are required to permit blocking access to or destruction of a resting place (includes couches and holts). The Scottish Executive following the application of strict criteria issues licences. These usually entail demonstration that the action is required for conservation purposes or for overriding reasons of public good. Recent cases in England suggest that licences may not be issued solely because a feature lies in the vicinity of a development.

If otters are found on the Brothie Burn, or other watercourses that are to be culverted, special mitigation measures may be required. These will be designed to ensure that safe passage of otter across the road (or railway) can be achieved. This may mean that otter ledges would need to be included into the culvert design.

#### *Great crested newt*

The presence of great crested newt has not been confirmed, and there are no previous records for Clackmannanshire. But as there is potentially suitable habitat adjacent to the

proposed route of the AELR. Great crested newt are protected by Schedule 5 of the Wildlife and Countryside Act (1981) as amended, and the Conservation (Natural Habitats & c.) Regulations 1994. The legislation makes it an offence to:

- § intentionally kill, injure, capture or disturb a great crested newt;
- § deliberately damage or destroy their breeding areas;
- § deliberately obstruct access to areas where they live and breed.

To ensure compliance with the legislation the following actions are recommended:

- § a pre-construction survey to check for the presence of great crested newts in the area of marshy grassland adjacent to the AELR. The survey should be conducted between April – June 2003 so that if newts are present appropriate mitigation can be incorporated into the scheme (e.g. newt fencing). The survey would need to be conducted by an appropriately trained and licensed surveyor;
- § briefing of site staff to make them aware of the signs of great crested newt.

If great crested newts are found to be present discussions concerning appropriate mitigation will be required with SNH. This might entail creation of new woodland habitats close to the wetland area, the erection of amphibian netting etc. Translocation is unlikely to be required, but the Scottish Executive is the authority that would issue licences for the removal or translocation of great crested newts. There are strict criteria for the circumstances under which licences will be issued; the test is usually to prove that the translocation is required for conservation purposes or for overriding public benefit. Recent examples from English cases suggest that the presence of protected species in an area where development is planned may not be sufficient reason for issue of a licence.

#### 9.6.2 Pre-construction phase

Discussions with SNH and the Forth Salmon Fisheries Trust are required at the detail design stage to ensure that culverts and bridge crossings are designed to allow fish passage.

SNH will also need to be consulted concerning proposals for strengthening the Forth Viaduct, to ensure that the approach will not impact upon the River Teith cSAC.

The design of drainage for the scheme should include provision for stopping the movement of pollutants into watercourses in the event of an accidental spill on the road or rail track.

An ecologist should be involved in the development of the soft landscaping plans for the scheme to ensure that opportunities for habitat recreation and enhancement are maximised. This should focus upon the creation of scrub and woodland habitats, re-establishment of areas of neutral grassland, and ensuring that cover adjacent to the Forth viaduct is re-established to favour otters.

The additional surveys identified in section 9.6.1 should be undertaken. There will be seasonal constraints on when this work can be completed.

#### 9.6.3 Construction phase

Best practice and good construction techniques will be applied to minimise the impacts of the scheme. The construction programme for the railway has been designed to limit vehicle movements as far as possible to within the existing railway line. It is also proposed to use

the rail track for transportation of materials. This will reduce the amount of disturbance to adjacent habitats and wildlife. The following additional measures are proposed:

#### *Ecological advice*

- § A scheme ecologist should be employed to provide advice during the construction works;
- § The scheme ecologist should walk the route of the railway and AELR prior to construction to highlight any areas of particular ecological sensitivity, or of changes to the status of protected species since the survey work was completed;
- § The scheme ecologist should advise and approve the proposed working methods for bridges over the major river crossings (Forth, Devon and Black Devon);
- § The scheme ecologist should advise on techniques to be used during culvert replacement operations to ensure that impacts to aquatic invertebrates are minimised, and that the safe passage of fish can be maintained. Advice on the re-establishment of the streambed should also be provided;
- § Sensitive areas should be clearly marked, and site staff briefed about these;
- § Site staff should be provided with an ecological briefing;
- § Procedures for dealing with unexpected encounters with protected species should be in place;
- § Disturbance associated with the AELR will be minimised by all site traffic following the haul route to and from the main works access points;
- § All works will be supervised where necessary by a suitably experienced ecologist.

#### *Minimisation of Disturbance to wildlife*

- § Materials entering and leaving work sites will be logged to ensure that no unnecessary on-site storage of construction products arises;
- § Water bowsers and smaller scale dust control shall be employed during periods of dry weather;
- § Site clearance activities should be undertaken outside the main bird breeding season (i.e. not between March – August);
- § The working area for the AELR should be clearly defined, and marked with temporary fencing. It should avoid incursion on the area of marshy grassland.

#### *Prevention of pollution and safeguarding of watercourses (also see measures included in Chapter 12, Volume 2)*

- § Works on the Forth viaduct should be timed to reduce the potential risks to the River Teith cSAC i.e. they should be timed to occur on ebb tides wherever possible;
- § The contractor shall manage and control construction works to ensure that good site practices in water management are followed and that water pollution is avoided. All pollution prevention measures shall be agreed with the Scottish Environment Protection Agency (SEPA);
- § For engineering works taking place on bridges over watercourses, SEPA has advised the use of the guidance document PPG5, “Works in, near or liable to affect watercourses.”;

- § Protective netting and sheeting should be used on all bridge works to prevent discharge of paint flakes etc. into watercourses. All netting etc. shall be securely fixed to avoid loss to the watercourse;
- § On site storage of chemical, fuel or construction materials shall be limited to those needed for immediate construction. All surplus materials are to be removed from the works site as soon as their immediate purpose has been concluded;
- § Any fuel or chemical stores should be secure from vandalism and appropriately banded to at least 110% capacity. These stores should be kept at a safe distance (specify distance & ref to SEPA guidance) away from watercourses and water bodies;
- § All potentially polluting liquids and solids associated with vehicles, equipment and machinery need to be identified to site staff so that spillages and washwaters can be prevented from entering watercourses;
- § Pollution contingency plans should be developed. These should include designated members of staff to deal with emergencies if they arise;
- § The contractor shall not wash tools and equipment in any watercourse. Washwater shall not be discharged into any watercourse or into road drains or disposed of in any way that could result in a discharge to controlled water;
- § Vehicles should be washed before leaving the AELR site; settlement ponds should be constructed to allow sedimentation and trap pollution;
- § Settlement ponds will be 110% minimum capacity, vandal-proof;
- § Mobile bunding or material for bund construction will be available should an emergency barrier need to be constructed to prevent material leakage from a works site into a watercourse;
- § Quantities of absorbent substrate shall be available to soak up spillages or leaks.

#### 9.6.4 Operational Phase

Surface run-off from roads contains a wide variety of pollutants. These include suspended solids (e.g. grit and de-icing salts), metals (lead, zinc, cadmium and iron, together with trace quantities of nickel, chromium and copper), and organic chemicals (e.g. oils), all of which would potentially have a detrimental effect upon watercourses. The drainage scheme for the AELR must be maintained to ensure that pollutants are removed. Further details are provided in Chapter 12, Volume 2.

Measures should be introduced to ensure that trains are not left standing on bridge crossings.

The maintenance activities along the operational rail line will influence its nature conservation potential. Cutting of vegetation should be kept to the minimum necessary for reasons of safety, and where possible scrub should be allowed to develop along the edges of the route. Herbicide use should also be avoided where possible.

Several invasive weed species such as Giant Hogweed (*Heracleum mantegazzianum*), and himalyan balsam (*Impatiens glandulifera*) often exploit linear corridors such as railway lines. Maintenance activities should check for the presence of these species. Eradication programmes should be introduced as and when necessary.

Any tree felling, pruning or disturbance to scrub should be undertaken outside the main bird breeding season (i.e. not between March – August).

Checks for the presence of bats should be undertaken prior to any re-pointing etc. works on masonry bridges.

### 9.6.5 Enhancement opportunities

The following measures should be incorporated into the detailed design of the scheme to enhance its potential value to wildlife:

Areas of scrub and broadleaved trees should be maintained along the route of the railway line, or incorporated into the landscaping plans.

Any areas of scrub and woodland adjacent to the Forth that are cleared for construction works should be reinstated. Areas of cover for otter should be incorporated into the landscape plans. Only native species should be used.

## 9.7 Summary

The ecological and nature conservation implications of the scheme have been assessed. This assessment has been based upon the responses of consultees, field survey, and experience. Some surveys could not be accommodated at the appropriate seasons within the timescale for this study, and recommendations for further work required prior to the construction of the scheme have been identified.

The impacts upon wildlife associated with the railway have been minimised by the use of the existing rail corridor. Ecological features along this line are fairly recent in development (maximum of 10 years), but even so some habitats of value in a local or local-regional context have developed. These include areas of scrub, broadleaved woodland and small, species-poor areas of neutral grassland. The rail line crosses numerous small watercourses, and, more notably, larger rivers including the Forth, Devon and Black Devon. The crossing of the Forth is located a short distance downstream of the River Teith cSAC, which has been selected, in part, for its lamprey populations. Other statutory and non-statutory sites occur in the vicinity of the route, but none are anticipated to be affected by the scheme.

The AELR represents a new linear feature in the landscape. Few habitats of value were noted along the route, other than an area of marshy grassland that is known to support a seasonal water body. The route also crosses the Brothie Burn.

Little data exists for the occurrence of some species groups, so the assessment of impacts upon these species is based on knowledge of their presence in the wider area (and hence the “risk” of them being present within the limits of the scheme), opinions of consultees and best judgement.

The only protected species confirmed as present is the otter. This occurs along the River Forth. Cumulative impacts upon this species during construction and normal operation of the scheme are considered to be minor. These can be minimised by the application of appropriate mitigation techniques. Impacts upon otter are predicted to be moderate only under an accident scenario that resulted in the discharge of pollutants into the Forth as the result of an accident. The risk and scale of impacts can be reduced by the application of appropriate safety measures. There are legal implications associated with the presence of this species, and further surveys will be required to ensure compliance with the law.

The potential presence of other protected species was identified, although no conclusive signs were obtained. Badger has been recorded from the wider area, but no signs of them were found during surveys conducted for this study. There are no records of bat species for the area, and checks for bat roost potential identified few possible locations. Signs of water

vole were sought, but their presence was not confirmed. An area of potential value to amphibians, including great crested newts was identified, but further survey work was not appropriate within the timeframe for this study. As there are legal obligations associated with the presence of these species, recommendations for further survey work have been included. Should any of these species be confirmed as present, discussions will be required with SNH, and additional mitigation measures will need to be agreed.

Important fish species are present in the Forth, Devon and Black Devon, and consultations will be required with the Forth District Salmon Fisheries Board about works in the river channel.

No severe impacts have been identified. Some moderate impacts have been identified; these include the potential effects of discharges of oils, fuels, paint flakes and other pollutants upon the River Teith cSAC. Although the site is located upstream of the scheme, the river is tidal at this point and so there is a small risk that materials could enter the edge of the site. The risks and scale of impacts can be used by the application of appropriate mitigation measures – including adherence to SEPA guidance. Possible moderate impacts could also be experienced by the Teith cSAC during the operation of the scheme as a result of routine maintenance operations, or of an accidental spill. Again the significance and risk of these impacts can be reduced by the application of good working practices and mitigation.

Fish species of a regional/national importance are present in the Forth, Devon and Black Devon and these may experience minor – moderate effects during construction as a result of discharge of sediments, oils etc. As for the Teith cSAC, the significance and risk of these impacts occurring can be reduced through careful construction practice. Ongoing maintenance and accidental discharges also have the potential to cause moderate effects upon these fish species.

Numerous impacts of a minor scale were identified. Several of these are linked to impacts on minor watercourses and the Brothie Burn that are anticipated to arise during the construction works. Minor impacts on watercourses include the direct risks of pollution, sediment discharge and run-off during construction and operation of the scheme, and the indirect impacts of resulting water quality changes on invertebrate and fish populations. Quantifying these impacts has been difficult in the absence of definitive information about the likely quality of the run-off water, but the scale of effects can be reduced by the use of mitigation measures.

Minor impacts are also anticipated individually to a range of habitat types as a result of either temporary or permanent land take. This also includes the impacts of clearing the vegetation that has colonised the line. A “worst case” scenario has been assumed; i.e. clearance of all vegetation, but this could be reduced. Some of these habitats are noted for action within the relevant local BAP, such as neutral grassland and broadleaved woodland. The examples present along the rail line were considered, in the main, to be small, species-poor examples. Cumulatively this loss of habitat is considered to be of minor – moderate significance, particularly in terms of the loss of suitable nesting habitat for bird species. The effects should be mitigated by minimising, where possible, the amount of scrub cleared along the railway line, inclusion of woodland and scrub in the landscape plans, and allowing scrub habitats to develop along the route of the operational railway (consistent with the requirements of safety).

In conclusion, the key elements to consider are:

- § the measures required to reduce the impacts of works upon the minor watercourses and major rivers crossed by the rail scheme;
- § the measures required to ensure that works do not affect important fish populations;
- § The requirements of species-protection legislation, and the additional survey work that will be required (during the appropriate seasons);
- § Ways of minimising the areas of habitat lost, particularly along the existing rail corridor, and the potential to include these features within landscaping plans.



## **10. GEOLOGY**

### **10.1 Introduction**

This chapter summarises the effects on the geology that are likely to occur as a result of the Scheme. The soils and underlying geology are important factors in determining many of the physical attributes of an area, such as the appearance of the environment, local flora, water quality and land use. Soils and the underlying bedrocks from which they derive can contain valuable resources, from fertile land for food production and agriculture to economically valuable mineral and water reserves.

The impact on both superficial geology and solid geology at depth is considered, as is the impact on mineral resources, such as coal seams. Proposals to ensure that the geological features along the route experience minimal impact from the Scheme are detailed and any effects on geology that remain after mitigation measures are included.

Consideration has been given to whether the planned route re-opening reduces or affects the resource base or inhibits future use of such resources. Further, proposed infrastructure works can impact on geological or geomorphological features, which are considered valuable in their own right (e.g. for academic or research purposes). Protected designated sites, such as Sites of Special Scientific Interest (SSSI) and Sites of Interest to Natural Science (SINS), would require measures to be taken to avoid or minimise adverse impacts from construction operations.

The site is described with reference to the Up and Down sides. The Up direction is from Kincardine to Stirling. Accordingly, the Up side is on the left hand side when facing Stirling. The Down side is on the opposite side of the railway.

### **10.2 Methodology**

Geology and soils along the route of the Scheme have been assessed from consultations with British Geological Survey (BGS) documentation, Babtie Feasibility Study 1999, earthworks inspection walkovers, Babtie Geotechnical Review 2002 and ground investigation reports by Foundation & Exploration Services 2002. Babtie carried out the initial earthworks inspection walkover in 1999, which formed part of the feasibility study issued in March 1999. Scott Wilson undertook a further walkover in July/August 2002. The ground investigation was undertaken by Foundation Exploration and Services between July and September 2002 on the instructions of and under the supervision of Babtie Group, acting on behalf of Clackmannanshire Council. The investigation comprised 25 No. light cable percussion holes to a maximum of 15m depth, 33 No. trial pits, 6 No. hand operated percussion holes to a maximum of 7m depth and 14 No. rotary open hole drillholes to a maximum of 70m depth. In-situ testing, sampling and laboratory testing were undertaken in accordance with schedules issued by Babtie. All exploratory holes were located on or near the existing railway route. The extent of the ground investigation was restricted. There were exploratory holes in the general vicinity of the sites of the proposed Alloa Station and Alloa Eastern Link Road (AELR). However, there were no exploratory holes at the locations of these proposed sites, or east of the former Kincardine Power Station, with particular reference to contaminated land testing.

The determination of the baseline conditions and the environmental assessment were undertaken in accordance with the generic methodology for the project. Modifications applicable to the elements dealing with contaminated land are described in the following section.

The receptors primarily considered are humans, terrestrial ecosystems and railway infrastructure, all of which could potentially be affected by land contamination. Demand for landfill capacity to accept contaminated spoil is also considered. Potential impacts on surface and groundwater resources that could arise as a result of land contamination are discussed in the chapter on Water Resources. The types of potential impacts arising from land contamination and the criteria used to determine significance are shown in Table 10.1 below for the railway.

**Table 10.1: Criteria for Significance of Effects**

Type of impact	Significant effect if:	Basis for assessment of potential risk
Impact on terrestrial flora and fauna on-site, due to excavation and temporary storage of contaminated material.	Potential risk to flora and fauna on construction sites.	Flora and fauna of ecological importance identified <sup>1</sup> and ICRL TTV <sup>2</sup> for phytotoxic elements exceeded or Dutch Intervention Values exceeded.
Impact on people or terrestrial flora and fauna off-site, due to excavation, transport and disposal of contaminated material, via windblown dust.	Potential risk to people.  Potential risk to flora and fauna off-site.	ICRL TTV <sup>2,4</sup> for parks, playing field and open spaces exceeded or Dutch Intervention Value exceeded.  Flora and fauna of ecological importance identified and ICRL TTV <sup>2,4</sup> for phytotoxic elements exceeded or ICRL TTV <sup>2,4</sup> for parks, playing fields and open spaces or Dutch Intervention Values exceeded. <sup>1,3</sup>
Impact on terrestrial flora and fauna, due to accidental spillages of fuel, oil, chemicals and other construction materials stored or used on construction sites.	Potential risk to flora and fauna.	Protected species or areas of ecological interest are located on-site or in the immediate vicinity of the construction site where chemicals, fuels and other construction materials may be stored. <sup>1</sup>
Impact on infrastructure or operation of the railway or proposed project, due to existing contamination or contamination which may arise from a third party source not associated with the railway.	Potential risk to infrastructure, implementation or operation of railway due to landfill gas migration.  Potential risk to infrastructure, implementation or operation of the railway due to any other contaminant.	Landfill within 250 m of railway/proposed works, which may or is known to produce landfill gas. Known source of contamination within 250 m of the railway/proposed works and contamination of a type which may affect infrastructure or construction works.
Impact on landfill capacity licensed for the disposal of contaminated material.	Requirement for disposal to landfill of contaminated spoil	Spoil contains contaminant concentrations exceeding Environment Agency (EA) Upper Threshold Values, or exceeding EA Leachate Quality Thresholds, or if no leachability tests undertaken, exceeding EA Lower Threshold Values.

Table Notes:

- i) Details on sites of ecological importance are presented in Chapter 9, Volume 2.
- ii) ICRL TTV = Interdepartmental Committee for the Remediation of Contaminated Land (ICRL) Trigger Threshold Value.
- iii) If the ICRL Trigger Threshold Value (ICRL TTV) for parks, playing fields and open spaces is exceeded, there may be a risk to people via airborne pollution (Environment Agency, 1997); in this case it is assumed that there will only be a significant effect if the Air Quality Chapter has also identified a significant effect due to dust and PM<sub>10</sub> impacts. This also applies to potential impacts on flora and fauna.
- iv) Soil Guideline Values for some of the "Group A Contaminants" were issued by The Environment Agency for use in England and Wales in 2002. At the time of writing, SGVs are available for Arsenic, Cadmium, Chromium, Inorganic Mercury, Nickel, Selenium and Lead. SEPA has indicated that these are also valid for use in Scotland.

The significance of an impact depends both upon the nature of the impact, its magnitude and duration and the sensitivity or importance of the receptors. The receptors may be directly or indirectly affected by particular types of impact. The assessment methodology is based on the Design Manual for Roads and Bridges (DMRB) modified as follows.

No statutory guidance exists ranking the importance/sensitivity of Geology and Soil receptors. The sensitivity of the receptor is scaled on the basis of the relative importance of the receptor as defined in Table 10.2.

**Table 10.2: Scale of the Importance of Geological Features**

<b>Importance</b>	<b>Criteria</b>	<b>Examples</b>
Very High	Attribute with a high quality and rarity, regional or national scale and limited potential for substitution.	Geological Site of Special Scientific Interest.  Regionally Important Geological Site (RIGS); or aquifer within the zone of influence of a public water supply borehole; or supplying wetland SSSI.
High	Attribute with a high quality and rarity, local scale and limited potential for substitution.  Attribute with a low quality and rarity, regional or national scale and limited potential for substitution.	Other exposed geological feature of major or educational value; or mineral reserve allocated on Local Minerals Plan.
Medium	Attribute with a medium quality and rarity, local scale and limited potential for substitution.	Other area of potential mineral resources.
Low	Attribute with a low quality and rarity, local scale and limited potential for substitution.	Other areas of superficial geology or geomorphological feature.

Magnitude of impact is defined wherever possible by the following terms: severe; moderate; slight, and negligible. Examples are given in Table 10.3.

**Table 10.3: Magnitude of Impact**

<b>Scale of Impact</b>	<b>Example</b>
<b>Severe</b>	Loss of exposed geological features
<b>Moderate</b>	Quarrying of rock for imported fill, or substantial changes due to cuttings
<b>Slight</b>	Superficial disturbance to geology; changes in geomorphology due to river diversion works.
<b>Negligible</b>	Changes to made ground deposits

The sensitivity of the receptor is scaled on the basis of the relative importance of the receptor, as defined in Table 10.2.

The significance of an effect is calculated by combining the scale of impact and sensitivity as shown in Table 10.4.

**Table 10.4: Significance Matrix**

Importance of Receptor	Scale of Impact Upon Receptor			
	Severe	Moderate	Slight	Negligible
Very High	Substantial	Substantial	Moderate	Minor
High	Substantial	Moderate	Minor	Negligible
Medium	Moderate	Minor	Negligible	Negligible
Low	Minor	Negligible	Negligible	Negligible

It is also of value to attribute a level of confidence by which the predicted impact has been assessed. The criteria for these definitions are set out in Table 10.5 below.

**Table 10.5: Confidence Levels**

Confidence Level	Description
<b>High</b>	The predicted impact is either certain, i.e., a direct impact, or believed to be very likely to occur, based on reliable information or previous experience.
<b>Low</b>	The predicted impact and its level are best estimate, generally derived from first principles of relevant theory and the experience of the assessor. More information may be required to improve the level of confidence.

Unless otherwise stated, confidence levels are high.

### 10.3 Consultations

Details of consultations undertaken in the preparation of the assessment of the Scheme on the geology of the area are detailed in Table 10.6 (these are consultation over and above those undertaken by Babbie whilst compiling the desk study and geotechnical review).

**Table 10.6: Consultations and responses**

<b>Consultee</b>	<b>Consultee Comment</b>	<b>Response</b>
Railtrack Mining Engineer	Mining reports – concern about integrity of worked seams under areas of major earthworks and re- construction.	Grouting of worked coal seams and capping of mine shafts within 30m of track in areas of twin tracking and new construction.
Clackmannanshire Council	Contaminated land and landfill site details along the route.	No data received at time of writing.
Scottish Environmental Protection Agency	Some restriction on works may arise with regard to the construction phase, river crossings, surface water drainage, flood defences and waste management issues.	Comments covered under water resources Volume 2, Chapter 12

## **10.4 Baseline**

### **10.4.1 Introduction**

A summary of the conditions pertaining to the Scheme follows. The area studied follows the proposed alignment from Stirling to Longannet Power station, south of Kincardine, and includes an area to the east of Alloa for the AELR.

### **10.4.2 Designated Geological Sites**

There are no specific geological features that are of statutory designated importance along the Scheme route. No features of high importance to geology have been identified along the route.

### **10.4.3 Underlying Geology and Superficial Deposits**

The following is based on geological mapping and memoirs published by British Geological Survey (BGS), historic mapping, Feasibility Study, results of the ground investigation and observations made during the recent earthworks inspection walkover. A summary is shown in Figure 10.1.

### **10.4.4 Solid Geology**

The solid geology along the Scheme route comprises Carboniferous Limestone series strata between Stirling and approximately the Blackgrange Crossing. Millstone Grit sub-crops beneath the site between Blackgrange and the western outskirts of Alloa, beyond which Productive Coal Measure strata are present beneath the remainder of the route to Kincardine.

### **10.4.5 Drift Geology**

British Geological Survey records indicate that the Scheme is underlain by raised beach deposits and associated marine and estuarine alluvium. Over the majority of the site, these consist of deposits of soft silts and clays, which are given the geologic term of ‘Carse Clay’. A historic borehole at the Forth Viaduct indicates that ‘mud and sand’ extend to 50m depth. However, the recent ground investigation (GI) did not confirm the full extent of

the soft clay. To the east of Mar Place Bridge (BH12) the boreholes did not prove the full depth of soft clay which extended below 5m depth.

Where the route crosses the River Devon and the Black Devon river, deposits of alluvium of flood plains and undifferentiated alluvium are noted.

The centre of Alloa, (including the proposed station site), and the areas between Clackmannan and Kincardine are underlain by fluvial deposits, mainly consisting of sands, gravels and sandy/gravelly clays. Although the ground investigation encountered various layers of sands and gravels, these are not considered to be a significant resource e.g. for future extraction.

Between Alloa and Clackmannan, the Scheme is directly underlain by marine deposits, again comprising mainly clays with some silt, sand and gravel bands. To the southeast of the Kincardine bridge, the site is reclaimed inter-tidal flats, composed of silt and clay. Organics and peat were found in the boreholes between Stirling and Manor Powis (BH02 to BH04).

From the River Devon Viaduct (BH05) to Kincardine (BH33) the upper deposits were found to be underlain by firm to stiff sandy/gravelly clays. However, between Stirling and Manor Powis Level Crossing, the boreholes did not penetrate the full depth of soft clay deposits.

Between Stirling and the western outskirts of Alloa, the raised beach deposits are noted to be post-glacial in age. Between Alloa and Kincardine, the raised beach deposits are late-glacial in age.

The route of the railway is generally located in close proximity to the River Forth, so fluvial and estuarine marine deposits comprising silts and soft clays are common. These deposits were encountered in the ground investigation.

Made Ground comprising reworked natural deposits (clay fill), processed rock (ballast) and waste or industrial by-products (ash, clinker and colliery shale), used as construction materials, is also present throughout the length of the railway to varying degrees.

#### 10.4.6 Soils

There are a variety of sub-soil types along the route of the proposed railway. The soil types and agricultural land capability are described in Chapter 6, Volume 2.

#### 10.4.7 Mineral Resources

The presence of Productive Coal Measures strata beneath the Scheme, in particular between Alloa and Kincardine, has led to mining activity in the past. Shallow mine workings are present along the route and records presented in the Geotechnical Review indicate that 18 shafts have also been identified within 50m of the line. During the ground investigation several boreholes (BH102, North of Stoney Cross and Comely Bank and BH107, northeast of St Serfs Grove to BH112, at the junction of A977 and road to Kilbagie House) detected open or partially collapsed mine workings. A further shaft was found, flooded and uncapped, in the vicinity of BH114, southeast of Kilbagie, at the foot of the northern edge of the embankment. Babbie reported that the Coal Authority has identified this to be a drainage shaft for the railway.

Reports received from the Railtrack Mining Engineer have identified mine shafts and areas of mine workings at depths of 50m or less along the route. Between the eastern outskirts of Alloa and Kennet shallow mineworkings are stated as being present beneath the majority of the line. Further south, between Kilbagie and Tulliallan long stretches of the route have also been identified by the mining engineer as overlying shallow mineworkings. At the time of writing, the Client has been unable to supply mining reports for sections of the route between Kincardine and Longannet power station and Stirling to Cambus.

Shallow mine workings and shafts are also present at the southern tie-in to the Eastern Link Road and the proposed railway overbridge.

Groundwater containing iron ochre was observed at several locations during the walkover e.g. west of Clackmannan and North of Kincardine. This is addressed in the Water Resources chapter.

#### 10.4.8 Landfill Sites and Contaminated Land

Clackmannanshire Council provided details of historical land use and areas of Unknown Filled Ground (UFG) along the route in December 2002. There are no licensed landfill sites on, or near to, the proposed route. Furthermore, no areas have been designated as Contaminated Land, as defined in accordance with the Contaminated Land Regulations.

The main features of historical land use adjacent to the railway are discussed below.

The area between the railway and river at Manor Powis is recorded as being mined for coal and lignite in 1958. There is a historic tip at Manor Powis with an area of 16.45 hectares, which has been labelled as UFG. No other information has been provided with respect to this tip, or other landfill sites along the route. It is possible that no records are available for sites completed prior to the introduction of licensing, or which were filled without the need for a licence, or which were operated with a registered exemption or landfilled illegally.

On the Up side between Cambus and the River Devon, there was a Factory, Brewery and Distillery. The brewery is recorded as extending to both sides of the railway.

At Alloa, the historical railway works and brewery and malting areas are recorded; the remains of the latter are visible on site. To the East of Whins Road, a Textile Factory (1896) is identified. On the Down side of the railway at the location of the proposed AELR crossing, mining and quarrying is recorded with a date of 1924, now identified as UFG. At Helensfield, north of Clackmannan, a metal foundry is recorded. On the Down side of the railway, near Riccarton in Clackmannan, mining of coal and lignite is recorded with a date of 1866, which is now identified as UFG. There is also a historical works area at this location of unknown type. On the Up side of the railway at Riccarton a historical railway works is recorded. At Kilbagie, a paper packaging dated 1952, a factory dated 1990 and a mining area is located offline on the Up side.

It is to be expected that contamination in the solum of the railway may have occurred and may occur in the future to varying degrees due to activities associated with operational railway activities. The Department of the Environment Industry Profiles provide information on the processes, materials and wastes associated with individual industries. The Industry Profile for Railway Land (DoE, 1995) lists some pollutants that could be present as a result of former railway operations. These include:

Wastes such as ash, clinker and domestic wastes (potentially containing metals, phenols, sulphates, and polycyclic aromatic hydrocarbons [PAH] ) used as fill materials to create embankments

- š Ash, coal and dust;
- š Crushed clinker used as ballast for track formation;
- š Wood preservatives such as creosote used on track sleepers;
- š Herbicide, historically including atrazine and simazine, but recent practice including diuron and glyphosphate used on running line and at depots;
- š Organic compounds including hydrocarbons, PAH, lubricating oils and greases, hydraulic brake fluids;
- š Inorganic compounds such as metal fines, asbestos fibres.

Some limited fly tipping within the railway boundary has occurred at bridges along the route and locally in other areas, in particular along the disused section between Cambus and Kincardine. Contamination normally associated with railway workings should also be considered. However, the walkover inspection showed no signs of any other contamination issues. The walk-over identified iron ochre stained water in several locations on and adjacent to the railway. These are likely to be associated with minewater risings or other groundwaters with high concentrations of soluble iron and are further addressed in the Water Resources Chapter.

#### 10.4.9 Contamination Identified During Ground Investigation

Further chemical testing carried out as part of the ground Investigation undertaken in July - September 2002 are presented in the Factual Report prepared by Foundation Exploration and Services dated 17 October 2002.

The soil samples recovered for analysis were taken from the surface or between depths of 0.1m to 1.3 m. 23 samples were analysed. Only two samples of near surface ash and clinker showed minor exceedances with respect to ICRCCL guideline values for phytotoxic metals (copper and nickel). Total petroleum hydrocarbons (TPH) were detected in two soil samples at low concentrations (29 to 62 mg/kg) below the Dutch Intervention Value. Two further soil samples were subjected to restricted suite of analyses for TPH, Polychlorinated Biphenyl (PCB), and pesticides. No values in excess of guideline values were recorded for TPH or PCB, and concentrations of pesticides did not exceed the limits of detection.

Leachate analyses to measure TPH, PCB and PAH were carried out on twenty five samples of soil recovered from the ground surface. TPH was detected in seven samples at concentrations (11 to 140  $\sigma$ g/l) below the Dutch Intervention Value. None of the samples analysed showed PCB concentrations above the limit of detection. The PAH levels were compared to the Environment Agency Leachate Quality Threshold values given in the EA Report on Guidance on the Disposal Of "Contaminated Soils". PAH slightly exceeded the Environment Agency Leachate Quality Threshold value in ten of the samples tested (0.21 to 0.46  $\sigma$ g/l). A value of 1.5 $\sigma$ g/l was recorded in a sample taken from the railway at the eastern end of the tip at Manor Powis (TP10/2). In addition, one sample recovered from the railway adjacent to the disused Alloa New Marshalling Yard (TP17), had a significantly higher leachable concentration of PAH (6.2  $\sigma$ g/l).

Five samples of groundwater from depths of 6m to 10.4m were subjected to chemical analyses. One sample, recovered at 10.4m below ground level from a borehole (BH9) located at the crest of the cutting located 100m Up from Claremont bridge in Alloa, was found to have leachable concentrations of cyanide (0.38mg/l) in excess of the UK and



European Union drinking water standards. Three samples of surface water (SW1, SW2, SW3) obtained on 13 August 2002 were analysed. TPH and PAH were detected in sample SW1, which was taken from under Mar Place bridge in Alloa. Sample SW2, from near the AELR railway crossing, was found to have concentrations of iron (540  $\sigma$ g/l) and PAH (2.8  $\sigma$ g/l) in excess of the Environment Quality Standard (EQS) for Drinking Water.

The new station at Alloa is to be built on the site of the former brewery. At the time of writing, there are no known contaminated land issues affecting the development of the site.

## **10.5 Environmental Effects**

### **10.5.1 Effects Of Construction**

#### *Effects on Underlying Geology*

The Scheme will have an overall negligible effect on the underlying geology of the area. This is because there will generally be a slight impact on a receptor of low importance. The Geotechnical Review and Feasibility Study do not provide information for designated geological sites. Apart from the AELR, the new railway track required will be placed along the line of the previous railway and the cuttings and embankments remaining along the disused route will form the earthworks structures for the new line. In some cases remedial works may be required to stabilise existing earthworks and retaining walls. The locations of proposed remedial works are based on the features visible during the walk over study in August 2002. Other features may be identified during detailed design stage following any devegetation of heavily overgrown side slopes and being granted permission to access areas of walls and slopes, which was withheld during the walk over in August 2002. The proposed sites and extents of remedial works to slopes are described in detail in Table 10.7 below.

**Table 10.7: Summary of Remedial Earthworks to Slopes**

Location	Downside/ Upside of track	Cutting/ Embankment	Description	Survey Notes	Proposed remedial works
Southeast side of River Devon crossing	US	E	6m high Slope 1:3	Pond close to cess at embankment toe	Trim back, backfill with granular fill. Retain slope profile of 1:3. Length 100m.
360-460m Up from Alloa cricket ground	DS	E	0.6m high Slope 1:2	Ballast settlement occurring	Trim back, backfill with granular fill. Retain slope profile of 1:2. Length 100m.
Between Mar Place and Ludgate bridges	US	C	9m high Slope 1:1.4	Refuse and spoil tip on slope	Remove spoil and trim to original slope profile. Length 100m.
Between Cattle Market and Mill Road bridges	US	C	6m high Slope 1:1.5	General slope failure (upper) due to excavation/over-tipping with spoil.	Remove spoil and trim to original slope profile. Length 80m.
130-220m Down from Cattle Market bridge	US	C	2.5m high Slope 1:2.05	Waste/spoil on slope. Scree bund above.	Remove spoil and trim to original slope profile. Length 80m.
400-500m Down from Northfield bridge	US	E	2.1m slope at 1:1.7	Slope instability due to rabbit burrows.	Trim back, backfill with granular fill. Retain slope profile of 1:1.7. Length 100m.
360-460m Down from Northfield bridge	DS	E	1.6m slope at 1:1.7	Ballast subsidence	Trim back, backfill with granular fill. Retain slope profile of 1:1.7. Length 100m.
10-90m Up from Kennet bridge	US	C	3m high Slope 1:2	Slope instability due to rabbit burrows.	Trim back, backfill with granular fill. Retain slope profile of 1:2. Length 80m.
20-60m Down from Old Farm Road bridge	US	C	5.8m high Slope 1:1.6	Ponding on track	Trim back, backfill with granular fill. Retain slope profile of 1:1.6. Length 40m.
120-160m Down from Old Farm Road bridge	DS	C	5.5m high 20∇slope	Slope instability due to rabbit burrows.	Trim back, backfill with granular fill. Retain slope angle at 20∇ Length 40m.
270-300m Down from Old Farm Road bridge	DS	C	8.5m high, slope at 1:1.7	As above	Trim back, backfill with granular fill. Retain slope profile of 1:1.7. Length 30m.
270-300m Down from Old Farm Road bridge	US	C	8.5m high slope at 1:1.6	As above	Trim back, backfill with granular fill. Retain slope profile of 1:1.6. Length 30m.
40-90m Down from Inveresk Farm bridge	US	E	6m high slope at 1:2	Ash, shale and colliery spoil on slope	Trim back, backfill with granular fill. Retain slope profile of 1:2. Length 50m

**Table 10.7: Continued**

Location	Downside/ Upside of track	Cutting/ Embankment	Description	Survey Notes	Proposed remedial works
210-240m Up from Tulliallan Castle bridge	US	C	2.7m high Slope 1:2	Friable shale outcrop on slope. Ponding on tracks	Trim back oversteep sections. Retain general slope profile of 1:2. Length 70m.
110-160m Up from Tulliallan Castle bridge	DS	C	4.7m high Rock cutting at 1:1.4	Unstable rock cutting	Trim back oversteep sections. Retain general slope profile of 1:1.4. Length 50m.
80-190m Up from Tulliallan Castle bridge	US	C	4m high rock cutting at 1:1.5	Unstable rock cutting	Trim back oversteep sections. Retain general slope profile of 1:1.5. Length 110m.
0-120m Down from Kincardin e Power Station Road	US	C	6m high Slope 1:1	Slump from rotation failure may be present, obscured by heavy vegetation	Regrade slope to 1:2 with concrete toe retaining wall. Possible temporary works required for excavation.
40-70m Down from Inveresk Farm bridge	DS	WALL	1m high	Track above. Sleeper pile and waling wall. Very bad condition. Retains ballast.	Replace wall with a graded 1:2 slope. Length 30m.

Table Notes:

§' Slope height and gradient taken from topographical survey information provided by the Client.

§' Length of remedial works is approximate. Actual length to be determined following detailed design.

Slope trimming, or scaling and controlled removal of unstable blocks may be required over a rock slope area in localised areas of North of Kincardine. The necessity of alternative remedial measures, such as rock netting, to ensure long term rock face stability will be considered in the detailed design stage.

Remedial works are also required to sections of retaining wall existing along the route. The general proposed approach, to minimise excavation and disturbance of the surrounding area, is to replace the unstable parapets with fencing, where necessary and re-point the underlying walls. Other works will involve dismantling a section of 1m high sleeper wall to the southeast of Kilbagie, presently in poor condition, and replacing it with a graded slope. Also an approximately 30m long section of wall, located 100m north of the level crossing at Kincardine, requires reconstruction. Two sections of the River Forth revetment are also in need of repair to ensure their long-term functionality. One section is located at Causewayhead Road, Stirling where rip-rap is proposed to be placed along a 200m length of wall. The other section is located 600m to the south of Kincardine sewage works, where reconstruction and replacement of stone setts is required around a culvert. In all cases, effects on both the underlying solid and superficial geology are expected to be negligible. This is because only a limited amount of excavation will be carried out and no work

extends to the bedrock. Minor reinstatement of stone setts is required in several discrete areas over an extensive length of the River Forth revetment south of Kincardine.

Construction of new structures, or the upgrade of old structures, along the route may involve foundations onto the underlying bedrock. New footbridges are required at Grange Road and Hilton Road. These will have a slight impact on the superficial deposits of the area.

During the construction stage a limited amount of geologically intrusive work will be required to ensure the stability of old mine workings and shafts. In areas where there are major bridge reconstructions, and at the passing loop to the East of Alloa, mine workings and voids at shallow depths will be grouted. Mineshafts will be backfilled and capped at ground level in these areas. The impact of grouting the workings and backfilling the shafts will be slight. It will have a negligible effect of a beneficial nature on the geology due to the long term stability of the workings and surrounding areas being ensured. The impact of the grouting and remedial works to shafts on the water resources is discussed in Chapter 12, Volume 2.

The Alloa Eastern Link Road will have a slight impact on the superficial deposits of the area resulting from the construction of new embankments with imported fill. The shallow mine workings below the earthworks and structure for the AELR will require consolidation grouting, which will have a slight impact on the underlying geology. The foundations required for the road bridge over the railway at the southern tie-in will also have a slight impact on the underlying geology.

#### *Effects on Soils*

The majority of the Scheme will have a negligible effect on soils in the area as limited new excavation or construction is required. Remedial works of the existing soil embankments and cuttings to ensure their long term stability are advised for several sections along the route. This would involve excavating slopes to a suitable profile and replacing excavated material with granular fill. It is proposed to utilise any the excavated material as landscape fill for the AELR, where possible, provided its level of contaminants are suitable for this use.

To the east of Alloa, the station and proposed link road will require new earthworks. The majority of the 1km stretch of road is to be on new embankment formed from imported material and may involve associated measures to reduce settlements such as band drains and basal reinforcement. With the exception of a short cut about 200m north of the railway crossing, a minimal amount of excavation is anticipated because the road is generally at grade or on embankment.

Noise barriers proposed for noise mitigation, as detailed in Chapter 11, Volume 2, can be constructed within the railway boundary with negligible effect on soils.

#### *Effects on Mineral Resources*

An attempt will be made to locate the 18 No. shafts identified in the Babbie Geotechnical Review. It is proposed to backfill and cap any shafts within 30m of the railway adjacent to bridge reconstructions and the passing loop east of Alloa. It is also proposed to locate, backfill and cap the shaft at Kilbagie, which is referred to in the Mining Engineers report as the ancient Kilbagie Engine Pit.

It is proposed that shallow workings are grouted in the areas beneath the passing loop to the east of Alloa where double tracks will be laid. Further shallow mine workings identified in the Mining Engineers report to the northeast of Kennet will similarly be grouted. Coal reserves at these locations are assumed to have been extracted and now unworked, so any treatment works will not be affecting a working mineral source.

Shallow mine workings identified in the area of the AELR southern tie-in are proposed to be treated over a 300m length to the north of the proposed railway overbridge. The zone of treatment varies from a width of 30m, under the majority of the route, to 90m, beneath the new embankment at the Hilton Farm junction. The proposed method of treatment is consolidation grouting.

Water with iron ochre staining was observed at several locations adjacent to the railway including the AELR. These were generally stagnant pools of surfacewater but some streams were also discoloured e.g. though the railway culvert located 350m Up from Tulliallan Castle bridge. The effect on the surfacewater and groundwater regime is discussed in the Water Resources Chapter.

No information has been provided with respect to consultations with the Mineral Valuer for the proposed AELR.

#### *Effects on Landfill Sites and Contaminated Land*

To date no information has been received for recorded landfill sites or areas of contaminated land that may be affected by the proposed reopening of railway. However, the walk over indicates that the railway is on low embankment adjacent to the tip at Manor Powis and is unlikely to be affected by any leachate present. In areas where fly tipping has occurred, the material will be removed and disposed of to an appropriate landfill facility licensed to receive the relevant classes of waste. This will possibly have a beneficial effect on the surrounding vegetation by reducing generation of leachate and pollution along the route.

No information has been received on landfill sites or contaminated land for the AELR. No such sites were visible during the walk over and it is anticipated that there would only be a slight impact on any contaminated land as it is constructed upon embankment, so minimal excavation and soil disturbance is required.

On the basis of the feasibility study, it was expected that there would be no contamination over and above that to be expected on stretches of running line. The chemical analyses appear to suggest that parts of the site investigated are potentially contaminated, but that the overall level of contamination is generally low in relation to the proposed end use of the site as an operational railway and that the contamination is generally likely to be associated with the ballast or ash and clinker fills.

### 10.5.2 Effects of Operation

When the Scheme is in operation, geologically intrusive work is not anticipated (other than grouting of mine workings to reopen the line). The effect of the new permanent way and the AELR on both the superficial and underlying geology is generally negligible. Significance of Environmental Effects

The significance of environmental effects to the geology of the area is detailed in Table 10.8 below

**Table 10.8: Significance of environmental effects**

Feature	Potential Impact/ Effect	Magnitude of Impact	Significance of Impact
Foundations to bedrock	Permanent impact of foundations to rock	Slight	Negligible Adverse
Rock trimming	Removal of unstable rocks	Slight	Negligible Beneficial
Excavation of failed slope material	Disturbance of flora/fauna	Slight	Negligible Adverse
Removal of tipped material on slopes	Disturbance of surrounding flora/fauna	Slight	Negligible Beneficial
Embankment construction for AELR	Permanent impact on soils due to new construction	Moderate	Minor Adverse
Grouting of worked coal seams	Long term stability of workings and surrounding area ensured	Slight	Negligible Beneficial
Filling and capping shafts	Long term stability of shafts and surrounding area ensured	Slight	Negligible Beneficial
Contaminated Land	Potential Effects on Flora and Fauna On-site due to excavation and storage of contaminated material	Slight	Negligible adverse subject to adoption of mitigation measures
Contaminated Land	Potential Effects on Humans, Flora and Fauna Off-site due to excavation, transport and disposal of contaminated material	Slight	Negligible adverse subject to adoption of mitigation measures
Contaminated Land	Impact on landfill capacity for disposal of fly-tipped or contaminated material	Slight	Negligible adverse subject to adoption of mitigation measures
Contaminated Land	Impact on railway infrastructure or operation of the project due to existing contamination	Slight	Negligible adverse subject to adoption of mitigation measures

## 10.6 Mitigation

The Scheme is considered to have a negligible effect on the soils and geology of the area. This is a consequence of the proposed rail line following the route of the existing disused railway thus using the existing solum and minimising the need for new structures and earthworks. Remedial works required to ensure the long term stability of some existing cutting and embankment slopes will be small scale and carried out to have minimal impact on underlying and superficial geology of the surrounding areas. Any new permanent works will not extend beyond the existing railway boundary. This will prevent the need for land acquisition and disturbance to the surrounding areas.

The AELR will have a slight impact on the superficial deposits and soils of the area resulting from the construction of new embankments with imported fill. However, where possible, excavated materials from slope remedial works for the railway will be utilised as landscape fill for the AELR.

Further investigation is required to determine the exact location of the shafts around the AELR and assess the condition and potential for instability in this area. The proposed treatment for these is consolidation grouting.

Although the results of the ground investigation indicate that significant amounts of hazardous material are not likely to be encountered during the construction works, procedures to be adopted in the event of potentially hazardous material being encountered will have to be included in the Promoter's tender contract documentation for the works. Method statements will be submitted to the appropriate Regulatory Authorities and compliance will have to be monitored by the Promoter's Representatives.

The Promoter's tender contract documentation for the works will make provision for the construction contractors to prepare a waste management plan identifying the following :-

- § Wastes that will be generated by the project and their classification;
- § Opportunities for re-use and recycling;
- § Proposed method of storage, handling and transportation of waste;
- § Means of disposal and the relevant consents and licensing requirements in compliance with statutory requirements;
- § Reporting and monitoring procedures.

The Waste Management Plan shall ensure that legislation and best practice are followed in order to reduce any adverse environmental impacts of managing waste.

The contractors shall carry out the works in such a way as to minimise the amount of spoil and waste to be disposed of, and to contain or limit, where reasonably practicable, adverse impacts arising from the presence of contaminated material encountered in the project.

Mitigation measures to prevent pollution of controlled waters from existing and future contamination during railway operation and de-commissioning are described in the chapter dealing with water quality.

Detailed investigations will be undertaken prior to detailed design of the scheme. This will include the former industrial land to be used for the proposed Alloa Station.

## **10.7 Summary**

Along the proposed route from Stirling to Longannet Power Station there will be a negligible effect on the soils and geology of the area. This is a consequence of the proposed rail line following the route of the existing disused railway thus using the existing solum and minimising the need for new structures and earthworks. Remedial works required to ensure the long-term stability of some existing cutting and embankment slopes and safety of abandoned mine workings and shafts will be small scale and carried out to have a negligible effect on underlying and superficial geology of the surrounding areas.

The AELR is also considered to have a negligible effect on the underlying geology of the area. Although a minor disturbance of superficial geology will occur there will be limited excavation and disposal of soils off site.

Most of the effects due to contaminated land or impacts on contaminated land will be avoided or controlled by the incorporation of best practice and the mitigation measures identified in the preceding section.

## 11. NOISE AND VIBRATION

### 11.1 Introduction

This chapter considers the noise and vibration impact on the adjacent areas of the railway and of the construction and operation of the Alloa Eastern Link Road.

The purpose of the assessment was to:

- š establish the existing background noise levels and identify noise and vibration sensitive locations;
- š assess the noise and vibration impacts of the construction work associated with the reopening of the line and the building of the link road;
- š assess the noise and vibration impacts of the operation of the line, including the identification of any buildings that may be eligible for noise insulation;
- š assess the noise and vibration impacts of the operation of the relief road, including the identification of any buildings that may be eligible for noise insulation;
- š provide recommendations on the mitigation of any construction and operational noise and vibration.

#### 11.1.1 Terminology, Guidance and Criteria

Noise and vibration terminology, guidance and criteria are discussed in greater detail in Volume 3, Chapter 6. The relevant standards and criteria applicable to the various phases of the railway and AELR are identified and detailed in full in Volume 3, Chapter 6, the consequences of which are outlined below.

##### *Noise*

From Volume 3, Chapter 6, for short-term daytime construction noise a limit of 70 dB  $L_{Aeq,1h}$  (free-field) is considered appropriate in the vicinity of the nearest noise-sensitive developments (i.e. local residential properties) – this should prove acceptable for up to 8 weeks per year at any single receptor throughout the course of the railway and road construction. For longer term demolition and construction activities a limit of 65 dB  $L_{Aeq,1h}$  (free-field) is appropriate.

For new fixed plant (at the new station at Alloa for example and other equipment to be sited along the railway) a limit of up to 5 dB(A) in excess of the existing ambient background noise level at nearest residential property is appropriate. On the basis that such plant could operate on a 24-hour basis, comparison of predicted levels with the existing minimum reasonable ambient background noise level throughout a 24-hour period measured at local residential property is considered appropriate.

For operational noise due to the passage of passenger and freight trains, the daytime, evening and night-time  $L_{Aeq}$  due to the operation of the line is appropriate for assessing the impact of the reopening by comparison with existing ambient noise levels for short-term impact, and with reference to social studies reporting public perception of railway noise for long-term impact. Additionally, the occurrence of  $L_{Amax,fast}$  values above 60 dB at the facades of residential properties during night-time (23:00-07:00) is appropriate for assessing the impact of the railway movements specific to sleep disturbance.

For any potential change in local road traffic as a consequence of the railway reopening the Design Manual for Road and Bridges provides a method of evaluating both the immediate



and long term impact of abrupt changes in the 18-hour traffic flow (06:00-24:00) in terms of the effects on occupiers of residential property. The inference from recognised literature is that a change of up to 1 dB(A), equivalent to road traffic flow changes of greater than – 20% or +25%, is not significant in terms of noise.

For new housing introduced to sites along the railway corridor, a noise assessment to the requirements of PAN56 would be required at those development sites to establish the necessity, if any, for noise mitigation measures to protect future residents from any existing high ambient noise levels. Consequently the impact of railway noise on potential residential development land adjacent the route is considered.

The Noise Insulation Regulations allow for provision of noise insulation (acoustic glazing and acoustic ventilation) to habitable rooms of properties that meet various requirements of the Regulations specific to new or increased noise from railways. These regulations are applicable in England and Wales but do not apply in Scotland. However, legal advice is that the criteria and standards of the regulations can be applied in cases such as this where no alternative legislation is applicable.

### *Vibration*

As discussed in detail in Volume 3, Chapter 6, data included in British Standard BS 6472: 1992 is used to assess the likelihood of adverse comment arising from local residents due to vibration associated with the construction and operation of the SAK railway using derived vibration dose values (VDVs).

Criteria in BS 5228: 1992 part 4 is used to assess the likelihood of structural damage arising from vibration associated with the construction and operation of the SAK railway from derived peak particle velocities (ppv's).

## **11.2 Methodology**

### 11.2.1 Noise – Demolition and Construction

The main prediction method used in this assessment for construction and fixed plant noise sources is based on those outlined in International Standard ISO 9613-2 and BS 5228: 1997, used to predict noise as a free-field equivalent continuous level averaged over a one-hour period ( $L_{Aeq,1h}$ ).

### 11.2.2 Noise - Operational

The prediction method for rail traffic has been undertaken to the requirements of the “Calculation of Railway Noise” (CRN) issued by the Department of Transport, 1995. This prediction method is used to predict the 18-hour  $L_{Aeq}$  level ( $L_{Aeq,18h}$ ) for daytime and a 6-hour  $L_{Aeq}$  level ( $L_{Aeq,6h}$ ) for night-time at 1 metre from the most exposed façade.

The prediction method for road traffic has been undertaken to the requirements of the “Calculation of Road Traffic Noise” (CRTN) issued by the Department of Environment and the Welsh Office, 1988. This is used to predict road traffic noise as an 18-hour  $L_{A10}$  level ( $L_{A10,18h}$ ) at 1m from the most exposed façade.

ISO 9613-2, CRN and CRTN are implemented in the SoundPLAN suite of computer programs, which is a sophisticated software noise prediction and assessment tool. SoundPLAN was employed for all construction, rail and road noise predictions, enabling

the calculation of free-field noise levels, façade noise levels and noise contours. A number of predictions were checked manually.

To assess the impact of the operation of the proposed railway, the advice given in GoMMMS (DETR, 2000) and Guidelines For Noise Impact Assessment (IOA/IEMA, draft, 2002) has been followed and the criteria in Table 11.1 have been employed, as discussed in Volume 3, Chapter 6.

**Table 11.1: Categorization of the Significance of Noise Impact**

Façade $L_{Aeq,18h}$ (from railway)	Increase in $L_{Aeq}$ (day, evening, night periods)			
	1 < 3	3 < 5	5 < 10	>10
< 55	negligible	negligible	Minor	minor
55 < 60	negligible	minor	Moderate	moderate
60 < 65	negligible	minor	Moderate	substantial
> 65	negligible	moderate	Substantial	substantial

### 11.2.3 Vibration - Construction and Operational

A full discussion of construction and operational vibration is included in Volume 3, Chapter 6.

Construction of the proposed development will potentially introduce vibration from construction plant to the area.

There are no nationally accepted formulae for prediction of passage of vibration through ground due to the non-uniform effects of different ground conditions, although some empirical formulae have been proposed for known ground conditions based on previously measured data.

In this instance, vibration due to construction has been calculated using measured source data and the propagation relationship taken from BS 5228: 1992: part 4. The Standard suggests that attenuation with distance should be calculated as the reciprocal of the source-receiver distance. Vibration predicted for construction routines (or from measurements taken at similar installations) can then be compared to both building damage criteria and human annoyance criteria described earlier and taken from BS 6472: 1992 and BS 5228: 1992 part 4.

Operational vibration has been calculated at a set of receptors using measured source data from another site and by making appropriate adjustments for distance and ground conditions.

## 11.3 Consultations

Telephone discussions and meetings were held with Environmental Health Officers from Stirling Council, Clackmannanshire Council and Fife Council, From these discussions, and with reference to site maps and their local knowledge, locations for baseline noise monitoring were discussed and a set of monitoring positions was agreed. Location monitoring positions were then finalised after local residents were approached by each Council.

## 11.4 Baseline

### 11.4.1 Noise

Ambient noise levels were monitored over extended periods of time at nine locations (for seven days at most of these), and over short-term periods (generally several hours) at four locations along the corridor of the proposed railway. The monitoring procedures adopted were in conformance with the requirements of BS 7445:1991 '*Description and measurement of environmental noise*' and all meters were checked for calibration before, during and after use. Measurements at all locations were made 'free field' (no vertical reflective surfaces within 3m of the microphone) at a height of 1.5m above ground level.

The sound level meters were programmed to measure a range of noise parameters including 15-minute  $L_{Aeq}$ ,  $L_{A90}$  and  $L_{Amax,fast}$  values.

The detailed ambient measurements are reported in Volume 3, Chapter 6. Average day (07:00-19:00), evening (19:00-23:00) and night (23:00-07:00)  $L_{Aeq}$  and  $L_{A90}$  values, for Monday through Saturday, were derived and are presented in Table 11.2.

**Table 11.2: Summary of Ambient Noise Measurements (Monday-Saturday)**

Ref	Location	07:00-19:00		19:00-23:00		23:00-07:00	
		Day		Evening		Night	
		$L_{Aeq}$	$L_{A90}$	$L_{Aeq}$	$L_{A90}$	$L_{Aeq}$	$L_{A90}$
	<b>Short-term monitoring</b>						
S1	Causewayhead Road, Stirling	65.6	55.9	61.9	49.7	-	-
C3	Kellie Place, Alloa	54.7	50.0	51.5	48.2	-	-
C4	2 Erskine Street, Alloa	56.1	52.0	-	-	-	-
C7	Mill Road, Clackmannan	48.2	40.9	45.2	37.0	-	-
	<b>Long-term monitoring</b>						
S2	40 Wallace Gardens, Stirling	51.2	43.9	44.4	40.5	38.6	32.4
C1	8 Station Road, Cambus	54.9	40.7	48.7	38.2	38.6	32.5
C2	Dirleton Gardens, Alloa	56.8	48.8	54.3	43.7	47.7	33.9
C5	21 Bruce Street, Alloa	48.5	39.4	45.1	37.1	37.0	29.5
C6	Helensfield, Clackmannan	54.5	49.3	51.4	47.3	49.8	44.9
C8	Northfield Gardens, Clackmannan	61.9	51.6	59.3	45.5	55.1	33.7
C9	Meadow Grove, Kennet, Clackmannan	56.1	52.4	54.7	51.1	53.9	47.9
F1	22 Broomknowe Drive, Kincardine	44.4	38.5	40.1	34.5	38.4	30.9
F2	17 Ochilview, Kincardine	47.5	42.7	43.8	38.3	40.8	33.6

The range of day, evening and night-time ambient noise levels monitored is not unusual for suburban and semi-suburban areas and generally lower than the nationwide average levels. The most recent National Noise Incidence survey found that 54% of the population of the UK live in dwellings exposed to daytime (07:00-23:00) noise levels above 55 dB  $L_{Aeq}$  and 67% to night-time noise levels above 45 dB  $L_{Aeq}$ .

### 11.4.2 Vibration

Given that there are no existing dominant sources of vibration local to the area (railway lines, heavy industry), no measurements of existing ambient vibration were undertaken.

## 11.5 Environmental Effects

### 11.5.1 Effects of Construction

#### *Railway Construction Noise*

The construction activities and associated equipment for the various phases of the work are shown in Volume 3, Chapter 6. Worst case free-field  $L_{Aeq,1h}$  levels were calculated at the nearest sensitive receptors for each phase of the work. The receptor locations are given in Table 11.3, chosen as representative of worst-case receptors (i.e. closest position to the line in a particular area or closest position to a construction compound). Construction compounds located near sensitive receptors were assumed to be enclosed by 2 metre high boarding. The substantial predicted free-field  $L_{Aeq,1h}$  levels are reported in Volume 3, Chapter 6.

**Table 11.3: Receptor Positions for Construction Noise and Vibration Assessment**

Ref.	Location	Ref.	Location
B-S2	100 Causewayhead Road, Stirling	B-C1	101 Devonway, Clackmannan
B-S6	36 Wallace Gardens, Stirling	B-C2	“Dalairn”, Helensfield, Clackmannan
B-S7	58 Wallace Gardens, Stirling	B-C3	1 Mill Road, Clackmannan
B-S10	58-60 Alloa Road, Stirling, Stirling	B-C9	Northfield, Clackmannan
B-S13	Manorneuk Farm, off A907	B-C11	20 Ladywood, Clackmannan
B-S14	3-4 Forth Street, Stirling	B-C13	20 Main Street, Kennet
		B-C15	“Bracken Brae”, Kennet
B-A2	12 Station Road, Cambus	B-C16	“Ambleside Haven”, Kilbagie
B-A6	75 Grange Road, West Alloa		
B-A9	9 Kellie Place, Alloa	B-K1	22 Broomknowe Drive, Tulliallan
B-A10	2 Erskine Street, Alloa	B-K2	49 Hawkhill Road, Kincardine
B-A11	39 Sunnyside Court, Alloa	B-K4	17 Ochilview, Kincardine
B-A12	26-28 Kingswell Park, Alloa	B-K5	16 Ochilview, Kincardine
B-A13	22 Park Place, Alloa	B-K7	13 Orchard Grove, Kincardine
B-A16	House, Hilton Road Crossing, Alloa	B-K8	Tulliallan Castle, Tulliallan

Free field  $L_{Aeq,1\text{ hour}}$  levels were calculated for all construction activities on the line without mitigation. Where calculated levels for any activity were above the short term criterion of 70 dB  $L_{Aeq,1\text{ hour}}$  at any receptor, noise levels were recalculated with mitigation in place (in the form of 2 metre high boarding adjacent to the working area).

Inspection of the substantial prediction Tables in Volume 3, Chapter 6 show that, except for one area in Clackmannan, predicted noise levels, with mitigation, are at or below the short term limit of 70 dB  $L_{Aeq,1h}$ . For many of the construction activities the predicted noise levels are below the longer term limit of 65 dB  $L_{Aeq,1h}$ .

At Devonway, Clackmannan (ref. B-C1 in Table 11-3) the short-term limit is exceeded for two of the operations associated with the installation of new track. The railway is on an embankment in this area and barrier positions were assumed to be at the railway property boundary in the calculations (i.e. at the foot of the embankment). The barrier attenuation will be small in this case. It is consequently recommended that temporary screens are

erected, close to the work, during welding and jointing and rail stressing, this reducing noise levels to below the short-term limit.

#### *Railway Construction Vibration*

With the exception of certain types of piling construction plant, the equipment listed in Volume 3, Chapter 6 is not recognised as sources of high levels of environmental vibration. Additionally, due to the nature of the work, construction activities will not be carried out for extended periods of time near sensitive receptors and vibration resulting from line work and operation of compounds is unlikely to be problematic.

Vibration from any necessary piling work on the Forth Viaduct would depend upon local ground conditions and the type of equipment used, but small diameter (150 – 200 mm) rotary bored piling equipment is expected to be used and would result in generally lower noise and vibration levels than other types of piling equipment.

Discussion in Volume 3, Chapter 6 indicates that rotary bored piling would result in vibration levels well below the limits of human annoyance and structural damage at the nearest properties to the viaduct and consequently complaints regarding vibration from piling work on the Forth viaduct are highly unlikely. There are various other low vibration (and low noise) piling options available.

#### *Alloa Eastern Link Road-Construction Noise and Vibration*

The details of all activities and associated equipment for the construction of the link road are given in Volume 3, Chapter 6. Construction noise was predicted to the following noise sensitive receptors, these potentially being the likely worst-case affected:

- § Property fronting roundabout, north end of Hilton Road;
- § Property backing on to proposed link road, Hilton Crescent;
- § Proposed new housing to south of Hilton Crescent, assumed to be 25 metres from proposed link road;
- § Property on Clackmannan Road, nearest to proposed new roundabout.

The substantial predicted construction noise levels are shown in Volume 3, Chapter 6.

With reference to Volume 3, Chapter 6 it can be seen that predicted noise levels are below the short-term daytime limit of 70 dB  $L_{Aeq,1h}$  at any given single receptor and that, for much of the work, the predicted noise levels are below the long term daytime limit of 65 dB  $L_{Aeq,1h}$ .

Consequently noise from construction of the Alloa Eastern Link road should prove acceptable at local residential properties.

Similarly, construction vibration is discussed in Volume 3, Chapter 6 and it is concluded most unlikely that vibration associated with the construction of the Alloa Eastern Link road would give rise to justifiable complaint or structural damage at local residential properties.

## 11.5.2 Effects of Operation

### *Railway Noise*

Noise impacts on the wider rail network are not considered because the number of trains affected by the scheme is generally small compared with overall train numbers (Stirling – Alloa – Kincardine Rail Line Reopening Benefit Study, MVA, February 2002).

For the supplied train schedule and speed profile, façade noise levels were calculated to both ground and first floor levels, using the recommended 'Calculation of Railway Noise' publication method, for selected properties fronting the railway corridor along the full length of the route. Selected properties were chosen to reflect the worst-case noise impact for single properties or groups of properties along the complete length of the line. Initially, no mitigation was assumed. The detailed results are tabulated in Volume 3, Chapter 6. For this assessment, it is understood that no trains would operate between 24:00 and 06:00 with the exception of maintenance work, and between each of the periods 23:00 – 24:00 and 06:00 – 07:00 there would be only one passenger train movement and no freight movements.

The façade noise levels were converted to daytime (07:00-19:00) and evening (19:00-23:00) free-field levels using recognized formulae (since a precise rail movement timetable is not currently available to allow actual time period calculation). For night-time (23:00-07:00) the indication is that there would only be two passenger train movements. These data were processed with the measured ambient noise levels to estimate the increases in daytime, evening and night-time free-field levels due to the operation of the line. The detailed results are tabulated in Volume 3, Chapter 6.

These results were used to assess the need for mitigation in the form of lineside barriers. Applying the methodology discussed previously, all properties subject to a façade noise level (due to railway noise) equal to or greater than 55 dB  $L_{Aeq,18h}$  (approximately 52 dB  $L_{Aeq,18h}$  free-field) and subject to an increase in free-field noise level equal to or greater than 5 dB(A) were considered in need of mitigation. Pan56 and the World Health Organisation suggest an onset of community annoyance at daytime 55 dB  $L_{Aeq,18h}$  and GoMMMs confirms that *'Therefore 55 dB  $L_{Aeq,18h}$  is the recommended cut-off level to use in estimating the total population annoyed'* (GoMMMs, Volume 2 paragraph 4.3.14). A 5 dB(A) or greater increase was chosen on the basis that increases of up to 3 dB(A) (in steady noise) generally goes unnoticed to the human ear.

A 2.0 m high barrier for line sections requiring mitigation was assumed and façade noise levels for the selected properties were recalculated. The detailed results are tabulated in Volume 3, Chapter 6.

As before, the façade noise levels were converted to daytime (07:00-19:00), evening (19:00-23:00) and night-time (23:00-07:00) free-field levels to allow comparison with the existing measured ambient free-field levels.

After noise barrier mitigation there are four properties where daytime railway noise levels approach the limit of 68 dB  $L_{Aeq,16h}$  and these properties (and possibly adjacent properties) may qualify for noise treatment to the provisions of the Noise Insulation Regulations (acoustic glazing, acoustic external doors and acoustic ventilation to habitable rooms). CRN requires that noise levels are measured where properties are within 10m of the railway to validate any tentative predictions at such close distance. Consequently it will be necessary to revisit these properties and take actual façade noise measurements once the

railway is operational to confirm the predicted noise levels and hence the qualification for noise insulation. These properties (or areas) are:

1. 60 Alloa Road, Stirling
2. Park Place, Alloa
3. Northfield Gardens, Clackmannan
4. Devonway, Clackmannan

By employing noise contour plots developed in the prediction work using the SoundPLAN software, a property count was carried out to assess the number of properties in each noise band (as given in Table 11.1) and the increases over the evening baseline noise levels (evening generally being the period of greatest impact, with most residents at home and potentially enjoying their gardens and with ambient noise levels reducing from daytime levels). The noise contour plots, with and without mitigation are given in Figures 11.1 through 11.24. Table 11.4 below summarises the number of residential properties and their daytime (06:00-24:00) exposure, at ground floor level, to railway noise.

**Table 11.4: Overall Summary of Noise Impact Due To Operation Of Railway (With Mitigation)**

Daytime ground floor façade noise level (due to railway) dB $L_{Aeq,18h}$	Total number of residential properties	Increase in Evening $L_{Aeq}$	Number of residents likely to be annoyed (from GoMMMS) (long term)	Actual number of residents likely to be annoyed (long term)
55 < 60	12	< 1	<16%	< 30
	2	1 < 3		
	31	3 < 5		
	33	5 < 10		
60 < 65	2	3 < 5	<22%	< 9
	15	5 < 10		
65 > 70	0	-	<30%	0

The residual impact, after mitigation in the form of lineside acoustic barriers, results in 48 properties along the route of the line exposed to a short-term moderate impact (an increase of 5-10 dB) and 33 properties exposed to a minor short-term impact (an increase of 3 to 5 dB(A)), as defined in Table 11-1, from a total of approximately 410 properties within 50m of the track along its proposed 21 km length.

This compares to 143 properties along the route of the line exposed to a short-term substantial impact (an increase > 10dB), 79 properties exposed to a short-term moderate impact (an increase of 5 – 10 dB) and 42 properties exposed to a short-term minor impact (an increase of 3 – 5 dB) for the case with no mitigation.

It can be seen that 95 properties would be exposed to a long-term daytime noise level in excess of 55 dB  $L_{Aeq,18h}$  (after mitigation). Specific to long term annoyance, using the average household occupancy of 2.4 residents per property, statistical information from Table 4.2 of GoMMMS indicates that less than 39 residents along the length of the 21 km railway would be 'annoyed' in the long term by rail traffic noise.

There is no recognised method for assessing the short-term impact of an increase in railway noise (although short-term impact assessment is reported in DMRB for increases in road traffic noise) due primarily to the lack of social studies along railways subject to abrupt increases (or reductions) in rail traffic. It is expected that in the short-term (from day of opening) there would be more residents annoyed by noise, this decreasing in the long term due to familiarisation. By considering a requirement for noise mitigation for areas subject to increases above 5 dB(A) (and above 55 dB(A)) it is considered that short-term annoyance has been reduced as far as reasonably practicable. Reference to the above table indicates that there would be only 48 properties subject to increases of 5-10 dB(A) (to above 55 dB  $L_{Aeq,18h}$ ) and if every resident at each of those properties were 'annoyed' in the short term then this is equivalent to approximately 115 residents, this reducing in the long term to the final figure (concluded above) of less than 39 residents 'annoyed'. (Other residents along the route may be annoyed in the short-term but since the final railway noise level at their properties would be below 55 dB  $L_{Aeq,18h}$  the implication is that in the long term those residents would not eventually be 'annoyed' by railway noise).

There are only two passenger train movements during night-time, one occurring in each period 23:00-24:00 and 06:00-07:00. Consequently, increases in night-time  $L_{Aeq}$  values at first floor level, due to the operation of the railway, are generally negligible, except for two properties on Alloa Road, Stirling, where the increases are approximately 6 dB. At these properties, however, the resultant free-field noise levels are still below 45 dB  $L_{Aeq,8h}$  and should prove acceptable.

Specific to night-time sleep disturbance, the  $L_{Amax,fast}$  level can be estimated from the train sound exposure level (SEL) using the equation;

$$L_{Amax,fast} = 0.973 SEL - 3.9 \log_{10}(t)$$

Where t is the time taken for the train to pass (in seconds)

For a Diesel Multiple Unit travelling at 70 mph estimated façade noise levels are:-

$$L_{Amax,fast} = 75 \text{ to } 81 \text{ at } 10 \text{ metres from the line, depending on the barrier attenuation}$$

$$L_{Amax,fast} = 70 \text{ to } 72 \text{ at } 20 \text{ metres from the line, depending on the barrier attenuation}$$

Inspection of the ambient baseline measurements shows a number of current exceedances of the 60 dB  $L_{Amax,fast}$  limit during the night-time period prior to railway development, at Wallace Gardens, Stirling, Dirleton Gardens, west Alloa and Bruce Street, Alloa. Consequently residents at these locations currently choosing to sleep with bedroom windows open might experience sleep disturbance from existing noise sources. Sleeping with bedroom windows closed would protect against likely sleep disturbance up to a façade level of 75 dB  $L_{Amax,fast}$ . Given that there would be only one passenger movement in each period 23:00-24:00 and 06:00-07:00 and that the maximum noise level may only exceed 75 dB  $L_{Amax,fast}$  at bedroom windows within approximately 15m of the track it is considered unlikely that  $L_{Amax,fast}$  levels due to these two train movements will contribute to sleep disturbance at properties in Stirling and Alloa. Indication is that there would be no timetabled railway movements at all in the period 24.00-06.00 and consequently no potential for sleep disturbance from rail movements for the majority of the night-time period.

At present there are 15 coal train deliveries per day via the Dunfermline to Longannet Power Station branch line, making a total of 30 train journeys per day on this line. With the



opening of the scheme, this will be reduced to four train journeys per day due to transfer of rail freight movements. A basic CRN calculation shows that the reduction in  $L_{Aeq,18h}$  façade noise levels from the rail line at properties within the rail corridor will be 9 dB. The Rail Line Reopening Benefit Study (MVA, February 2002) cites approximately 140 affected receptors on this branch line. The actual reduction in noise level at individual receptors will depend on the contribution of noise from other existing sources (e.g. road traffic) at these receptors. However, the indication is that there will be a 'moderate' noise reduction impact at 140 properties along the Dunfermline to Longannet branch line as a consequence of the proposed development.

#### *Fixed Plant Noise*

Ambient night-time noise levels indicate that the background noise falls to approximately 20 dB  $L_{A90}$  in the early hours of the morning at some residential properties along the proposed railway. This is a particularly low night-time noise level.

It is proposed that a limit of 25 dB  $L_{Aeq}$  at nearest residential property is set for noise from fixed plant that may operate on a 24-hour basis. For plant that operates on a daytime only basis a relaxed criterion of 40 dB  $L_{Aeq}$  is appropriate (from an evening minimum ambient background noise level of 34.5 dB  $L_{A90}$  measured at 22 Brooknowe Drive, Kincardine, Table 11.2).

Although proposed location of some plant is known, the actual fixed plant schedule is not finalised. Once this is finalised it is recommended that a specific fixed plant noise impact prediction is undertaken to enable identification of any necessary noise mitigation measures.

Fixed plant is relatively easy to attenuate (specification of noise-reduced plant, in-duct silencers, lined cowls, screening, purpose built enclosures etc.) and there is no reason why noise from fixed plant should prove problematical for the scheme.

#### *Alloa Station*

A new single platform station, and associated 56 space car park, is planned for Alloa. The operation of the station has the potential to cause noise nuisance due to station operations and car park activity.

The station will be accessed from the ring road in Alloa via a new roundabout. The ring road is a busy through route (>15000 vehicles per day) and the extra traffic due to the operation of the station car park is very unlikely to increase traffic levels to such an extent that traffic noise changes are noticeable.

Noise measurements at a similar sized station with associated car park (slightly larger at approximately 100 spaces) gave measured noise levels of 55-58 dB  $L_{Aeq,15min}$  at a location 25 metres from the station during the morning (07:00 to 09:00) and evening (17:00 to 19:00) "rush hour" periods. At Alloa, the nearest residential properties to the proposed station are in Sunnyside Court, 90 metres to the north. A level of 58 dB(A) at 25 metres is equivalent to 47 dB(A) at 90 metres. Also, properties in Sunnyside Court will be shielded from the station car park activity by the station buildings and fencing to the railway, resulting in an estimated "worst-case" noise level at Sunnyside Court of approximately 40 dB  $L_{Aeq}$ .

This level is only 4 dB(A) above the prevailing background noise level during the most sensitive periods (23:00-24:00 and 06:00-07:00); the station will not be operational during night-time and consequently it is concluded that noise from station activity will not be significant at Alloa.

#### *Level Crossings (Audible Warnings)*

Level crossings which are to be maintained and upgraded on the line will require audible warning signals. The Railtrack Group Standard, GK/RT0300 deals specifically with this issue and requires that the audible signal output be adjustable to suit local background noise conditions to ensure audibility in areas of high background noise level and to reduce potential for complaint in areas of low background noise level (an adjustment range of 60 to 80 dB(A) at 3 metres from the equipment is cited). There will be eight level crossings along the scheme, with residential property within 10m at Kincardine Station Road and 13m at Waterside. At all other crossings residential property is at significantly increased distance.

At minimum setting, an alarm noise level of 60 dB(A) at 3m becomes less than 50 dB(A) at 10m at property at Kincardine Station Road (for example). Ambient daytime noise levels to that area are reasonably low at typically 48 dB  $L_{Aeq}$  (location F2, 17 Ochilview, Kincardine). Consequently in proximity to the rail crossing the alarm would prove perfectly audible to pedestrians, exceeding the ambient noise by at least 10 dB(A), but at nearest residential property would not exceed ambient noise levels by more than 5 dB(A). This should prove perfectly acceptable. Warning horns are likely to prove highly directional and if directed to the footway and away from properties the noise level at the properties would be further reduced.

#### *Proposed Residential Developments in Stirling, Cambus, Alloa and Kennet*

There are currently four areas planned for residential development along the route of the railway. The potential impact of railway noise on those areas of land is considered here;

##### *Area between north end of Causewayhead Road and railway, Stirling*

Without mitigation the daytime 55 dB(A) contour, due to the operation of the railway, would be 50 metres from the rail head. Consequently, potential residential development within 50 metres from the rail head would require some form of mitigation to reduce daytime noise levels to below the upper limit of Noise Exposure Category A (NEC A) defined in PAN56 for noise not to be a concern. This would primarily involve a noise barrier to garden areas to protect garden areas and ground floor facades. Actual mitigation measures would depend on the layout of the proposed housing. Any such barrier is not included in the current specification for this railway.

With mitigation in the form of 2 metre high close-boarded wooden fencing (or similar) at the railway boundary, the daytime 55 dB(A) contour is reduced to 10 metres from the rail head, bringing a substantial part of the site into NEC A. For any areas of the site that remain in NEC B noise mitigation measures would be possible to reduce noise levels internal to habitable rooms (at NEC B this would primarily consist of acoustic ventilation).

With mitigation the night-time 45 dB(A) contour is within 10 metres from the railhead (only one passenger train in each of the hourly periods 23:00 – 24:00 and 06:00 – 07:00). Also, the estimated  $L_{Amax}$  levels at 10 metres from the railhead, during the period 23:00 to

07:00, are below the criterion level of 82 dB  $L_{Amax}$  given in PAN56 for classifying the site as NEC C. Additionally, there are only two events (one passenger train in each of the hourly periods 23:00 – 24:00 and 06:00 – 07:00) during the whole night-time period and PAN 56 requires that the  $L_{Amax}$  criterion is regularly exceeded more than twice in any hour to affect the classification of the site.

*Area to the rear of Station Road, Cambus, adjacent to the railway*

Similarly, without mitigation the daytime 55 dB(A) NEC contour, due to the operation of the railway, would be 60 metres from the rail head.

With mitigation, in the form of 2 metre high close-boarded wooden fencing (or similar) at the railway boundary, the 55 dB(A) contour is reduced to 16 metres from the rail head, bringing a substantial part of the site into NEC A. Any such barrier is not included in the current specification for this railway.

As for the previous site, with mitigation the night-time 45 dB(A) contour is within 10 metres from the railhead (only one passenger train in each of the hourly periods 23:00 – 24:00 and 06:00 – 07:00). Also, the estimated  $L_{Amax}$  levels at 10 metres from the railhead, during the period 23:00 to 07:00, are below the criterion level of 82 dB  $L_{Amax}$  given in PAN56 for classifying the site as NEC C. Additionally, there are only two events (one passenger train in each of the hourly periods 23:00 – 24:00 and 06:00 – 07:00) during the whole night-time period and PAN 56 requires that the  $L_{Amax}$  criterion is regularly exceeded more than twice in any hour to affect the classification of the site.

*Area to the rear of Hilton Road, Alloa between Hilton Road and the proposed Alloa Relief Road*

Without mitigation the 55 dB(A) contour, due to the operation of the railway, is at 50 metres from the rail head. With mitigation, in the form of 2 metre high close-boarded wooden fencing (or similar) at the railway boundary, the 55 dB(A) contour is reduced to 12 metres from the rail head, bringing a substantial part of the site into NEC A. Any such barrier is not included in the current specification for this railway.

There are no regular planned trains on this section of the track between 23:00 and 07:00.

*Area to the north of Kennet, Clackmannan, adjacent to the railway*

Without mitigation the 55 dB(A) contour, due to the operation of the railway, is at 55 metres from the rail head. With mitigation, in the form of 2 metre high close-boarded wooden fencing (or similar) at the railway boundary, the 55 dB(A) contour is at 10 metres from the rail head, bringing a substantial part of the site into NEC A. Any such barrier is not included in the current specification for this railway.

There are no regular planned trains on this section of the track between 23:00 and 07:00.

*Railway Vibration*

There is no standard prediction model for railway vibration. The transmission of vibration through ground is complex. Boundaries such as layers of soil, rock or building foundations can attenuate or enhance the transmission of vibration by refraction or interference. Furthermore, transmission into individual buildings will depend on the interface between the earth and foundations, and transmission through the building will depend on

construction. Such effects are virtually impossible to predict. Therefore, vibration is commonly assessed by site measurements of the similar vehicles travelling over similar track formations.

To enable accurate operational vibration predictions and a thorough assessment of operational vibration impact, extensive vibration measurements were carried out at a site where freight trains, of an identical type to those proposed for this development, are in operation. The detailed results are reported in Volume 3, Chapter 6.

The railway line will carry both passenger and freight. However, the greatest vibration impact would arise from coal freight trains serving the Longannet Power Station, comprising Class 66 diesel locomotives hauling nineteen HTA type coal wagons, these when loaded weighing of the order of nearly 2000 tons. There will be a total of 30 railway freight movements (loaded and unloaded) per day travelling at speeds of up to 60 mph, with no regular planned services during the night-time period.

The highest density of this type of railway traffic currently in operation is found on the line between Gascoigne Wood Colliery and Drax power station, Yorkshire. To provide an assessment of the likely vibration impact from trains travelling along the SAK line vibration measurements were made adjacent this line in October 2002 at a site to the West of Whitley Bridge Station near Eggborough.

The data from the vibration measurements was assessed for perceptible vibration using British Standard BS 6472 to calculate the standard Vibration Dose Value (VDV) for the 16-hour daytime period.

Potential for damage to property was assessed using the methodology described in British Standard BS 7385: Part 2 using measured peak particle velocity (ppv) values.

Table 11.5 below summarizes the conclusions of the vibration impact assessment specific to human annoyance.

It is concluded, from the table, that a reduction of only 20% in vibration level (a reduction of approximately 2 dB) is required to reduce daytime ground floor residential VDV's to below  $0.4 \text{ ms}^{-1.75}$ , for which there would be a 'low probability of adverse comment' (a 'minor' impact). Proprietary anti-vibration measures that could be included in the design of the railway could reduce transmitted vibration by up to 20 dB (to 10% of the original vibration level), a substantial reduction.

The indication is that vibration reduces significantly with distance and that, unmitigated, vibration from the railway is unlikely to prove problematic beyond approximately 20m from the nearest running rail.

Consequently, it is recommended that anti-vibration measures are incorporated into the track design where the track passes within 20m of residential property. The indication from the plan drawings is that approximately 1406 metres of track would require this mitigation. Actual mitigation at each necessary location would depend on local conditions, and further site specific investigations beyond the scope of this reporting would be required to specify the most appropriate mitigation for each section of track.

**Table 11.5: Predicted daytime VDV levels for various conditions (without vibration mitigation)**

Location	VDV ( $\text{ms}^{-1.75}$ ) per number of train pass-bys in the 16 hr daytime period					
	10 pass-bys	Impact	20 pass-bys	Impact	30 pass-bys	Impact
<i>20 mph, 11m from nearest running rail</i>						
<i>Open ground</i>	0.11	--	0.12	--	0.14	--
<b>Ground floor</b>	0.21	2	0.25	2	<b>0.28</b>	<b>2</b>
<b>First Floor</b>	0.42	3	0.50	3	<b>0.55</b>	<b>3</b>
<i>60 mph, 11m from nearest running rail</i>						
<i>Open ground</i>	0.18	--	0.22	--	0.24	--
<b>Ground floor</b>	0.36	2	0.43	3	<b>0.48</b>	<b>3</b>
<b>First Floor</b>	0.72	3	0.86	4	<b>0.95</b>	<b>4</b>
<i>60 mph, 20m from nearest running rail</i>						
<i>Open ground</i>	0.1	--	0.12	--	0.13	--
<b>Ground floor</b>	0.20	1/2	0.24	2	<b>0.26</b>	<b>2</b>
<b>First Floor</b>	0.40	2/3	0.48	3	<b>0.52</b>	<b>3</b>

Impact - 1 - Less than low probability of adverse comment  
 2 - low probability of adverse comment  
 3 - adverse comment possible  
 4 - adverse comment probable

The measurements show that there is no likelihood of building damage from railway vibration, even when using pessimistic prediction routines and formulae, since peak particle velocities (ppvs) would be significantly below the limits specified and discussed in Volume 3, Chapter 6, even without vibration mitigation measures.

#### *Alloa Eastern Link Road-Operational Noise*

An assessment, according to the procedures given in DMRB, was carried out for all sensitive properties within 300 metres of Hilton Road, Clackmannan Road and the proposed link road, reported in Volume 3, Chapter 6. A summary of the results is given in Table 11.6, below, which shows the percentage of people within the study area bothered by traffic noise.

It can be seen that the opening of the AELR in 2005, without the new housing development, will result in a slight decrease in the overall number of people bothered by traffic noise compared to the 2005 baseline. This arises primarily due to the transfer of road traffic from populated roads to non-populated roads. With the new housing development, the opening of the AELR in 2005 will result in a slight increase in the number of people bothered by traffic noise compared to the 2005 baseline.

**Table 11.6: Summary of Traffic Noise Assessment For Alloa Eastern Link Road**

Scenario	Total Number of Properties Considered	Number of Properties Bothered 'Very Much' or 'Quite a Lot' by Traffic Noise	% Bothered 'Very Much' or 'Quite a Lot' by Traffic Noise
2002 baseline	482	45	9
2005 baseline without new housing to east of Hilton Road	482	45	9
2005 baseline with new housing to east of Hilton Road	692	56	8
2020 baseline without new housing to east of Hilton Road	482	45	9
2020 baseline with new housing to east of Hilton Road	692	88	13
2005 operation (AELR) without new housing to east of Hilton Road	482	34	7
2005 operation (AELR) with new housing to east of Hilton Road	692	70	10
2020 operation (AELR) without new housing to east of Hilton Road	482	37	8
2020 operation (AELR) with new housing to east of Hilton Road	692	67	10

Long term, the operation of the AELR will result in an overall decrease in the number of people bothered by traffic noise, with and without the new housing development, compared to the 2020 baselines. There would be a decrease from 45 to 37 houses annoyed by noise between 2005 and 2020 as a result of the AELR excluding the new housing proposed east of Hilton Road. However, if the new housing proposed east of Hilton Road is taken into account, there will be a decrease from 88 houses to 67 houses annoyed by noise between 2005 and 2020 as a result of the AELR.

### 11.5.3 Significance of Environmental Effects

The significance of the environmental effects, without mitigation, are summarised in Table 11.7, below. For railway operational noise, the short-term impact will decrease due to familiarisation.

**Table 11.7: Significance of Effects**

<b>Feature</b>	<b>Potential Impact</b>	<b>Magnitude of Impact</b>	<b>Significance of Impact</b>
Railway Construction Noise	Short-term direct impact	Moderate/Severe	Minor Adverse
Railway Construction Vibration	Short-term direct impact	Slight/Moderate	Minor Adverse
AELR Construction Noise	Short-term direct impact	Slight/Moderate	Minor Adverse
AELR Construction Vibration	Short-term direct impact	Negligible/Slight	Negligible/Minor Adverse
Railway Operational Noise	Long-term direct impact	Moderate/Severe	Moderate/Substantial
Railway Operational Vibration	Long-term direct impact	Moderate/Severe	Moderate/Substantial
AELR Operational Noise	Long-term direct impact	Negligible/Slight	Minor Beneficial
Reduction in Traffic on Dunfermline-Longannet Branch Line	Long-term secondary impact	Slight/Moderate	Minor/Moderate Beneficial
Reduction in Coal Lorry Traffic	Long-term secondary impact	Slight/Moderate	Minor/Moderate Beneficial

## 11.6 Mitigation

### 11.6.1 Railway and Relief Road - Construction Noise and Vibration Mitigation

It is necessary to erect 2.0 m high temporary solid boarding to the perimeter of all construction works (both rail and road) to protect local residents from potentially high levels of construction noise. This is common practice on construction sites, to restrict access, dust, line-of-sight, litter, vandalism, noise and for security.

It will be specifically necessary to introduce 2.0 m high temporary solid boarding at source during work in close proximity to Devonway, Clackmannan during welding and jointing, and rail stressing.

It is expected that the contractors will follow best practicable means to reduce the noise impact upon the local community during construction work, including the following:

- š Proper use of plant with respect to minimising noise emissions and regular maintenance. All vehicles and mechanical plant used for the purpose of the works should be fitted with effective exhaust silencers and should be maintained in good efficient working order;
- š Selection of inherently quiet plant where appropriate. All major compressors should be 'sound reduced' models fitted with properly lined and sealed acoustic covers which should be kept closed whenever the machines are in use and all ancillary pneumatic percussive tools should be fitted with mufflers or silencers of the type recommended by the manufacturers;
- š Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum;

- § All ancillary plant such as generators, compressors and pumps should be positioned so as to cause minimum noise disturbance. If necessary, acoustic enclosures should be provided; and
- § Adherence to the codes of practice for construction working and piling given in British Standard BS 5228 and the guidance given therein minimising noise emissions from the site.

#### 11.6.2 Railway Operational Noise Mitigation

It will be necessary to undertake post-development operational noise levels at the following four properties (and adjacent properties) to confirm initial predictions suggesting that these properties may qualify for noise insulation to the provision of the Noise Insulation Regulations (although the Regulations have not yet been formally adopted in Scotland). CRN requires that noise levels are measured where properties are within 10m of the railway to validate any tentative predictions at such close distance.

- § 60 Alloa Road, Stirling
- § Park Place, Alloa
- § Northfield Gardens, Clackmannan
- § Devonway, Clackmannan

Should properties to these areas qualify for noise insulation then it will be necessary to provide acoustic glazing and acoustic ventilation to affected habitable rooms.

Noise (and vibration) impact mitigation through the introduction of a new railway can be achieved through appropriate design features, including the use of continuously welded rail, to be used for this scheme. In order to further mitigate the noise effects of the railway, it is proposed that 2.0m high noise barriers be erected as described in Table 11.8. The location of the proposed noise barriers are shown in Volume 1 Figure 2.1. The noise barriers are assumed to be close-boarded wooden fencing running along the railway corridor boundary but in practice any solid, non pervious barrier would be acceptable (earth mound, brick or blockwork wall, metal skin etc.). Fencing should be close boarded timber (i.e. no gaps between boards), minimum thickness 25 mm.



**Table 11.8: Proposed Noise Barrier Locations adjacent to the Railway**

<b>Location</b>	<b>Chainage</b>
<b>STIRLING</b>	
Fencing to west/north of line	374 – 1535
Fencing to north of line	1550 – 2300
Fencing to south of line	1850 – 2050
Fencing to north of line	3350-3550
<b>CAMBUS</b>	
Fencing to south of line	6500 – 6623
Fencing to south of line	6631 – 6800
Fencing to north of line	6800 - 7100
Fencing to north of line	7450 - 7600
<b>ALLOA</b>	
Fencing to south of line	8800 – 9300
Fencing to north of line	9100 – 9250
Fencing to south of line	10430 – 10800
Fencing to north of line	10650 - 11000
Fencing to south of line	11000 - 11200
Fencing to north of line	10250 - 10500
<b>CLACKMANNAN</b>	
Fencing to south of line	12440 – 12700
Fencing to north of line	12823 – 13400
Fencing to south of line	12823 – 13150
Fencing to south of line	13350 - 14000
Fencing to south of line	15071 – 15175
Fencing to east of line	15900 – 16152
<b>KINCARDINE</b>	
Fencing to east of line	17200 – 17500
Fencing to east of line	Ochilview (approx. 200m)
<b>Total length of barrier</b>	<b>7543 m</b>
<b>Total length of track perimeter</b>	<b>~42000 m</b>

It can be seen from Table 11.8 that a total barrier length of 7543 metres is recommended, forming proportionally 18% of the total 42km perimeter of the railway.

### 11.6.3 Railway Operational Vibration Mitigation

Mitigation measures for railway vibration can be achieved through careful design, operation and maintenance of the railway, not dissimilar to the mitigation measures summarized above for reducing noise. The principal method is through the design of an appropriate track formation and its interaction with the type of rolling stock under consideration.

As the train runs along the track irregularities of the running surface of wheels and rails give rise to dynamic forces causing vibration of the surrounding structures. Roughness is the term used to describe any irregularities in the surfaces of wheels and rails that will give rise to vibration (and noise). Using current best practice to minimise roughness this means using corrugation free continuously welded rails and vehicles with disc-braked wheels. To maintain a smooth surface of the correct profile and remove any corrugations that develop rails should be regular ground using a rail grinding train.

Long wavelength effects (>1m) can be controlled using on-track/machines to minimise irregularities in the vertical alignment of the rail head

Mitigation methods specifically for ground borne vibration are expensive and must be designed to suit the specific set of circumstances that exist at a particular site.

It is recommended that anti-vibration measures are incorporated into the track design where it passes within 20m of residential property. It is most unlikely that increased ballast depth would provide sufficient additional vibration mitigation. Appropriate anti-vibration measures would include:

- š Resilient rail fasteners
- š Resilient sleepers
- š Ballast mats

With reference to design plans, it is considered appropriate to introduce anti-vibration measures at the locations given in Table 11.9. It can be seen from the table that a total length of 1406 m is recommended for vibration mitigation, forming proportionally 7% of the total 21 km of the railway. It should be noted that specific anti-vibration measures incorporated at any particular location will be location dependent and will require on-site investigation and consultation with manufacturer's to identify the most appropriate mitigation method for each location.

**Table 11.9: Proposed Anti Vibration Measures to the Railway, which may include one or more of: resilient rail fasteners, resilient sleepers, ballast mats.**

Location Chainage	Length	Line Speed (mph)
Forth Street, Stirling	22	25
1510 – 1580	70	60
1670 – 1815	145	60
1935 – 1980	45	60
7505 – 7545	40	60
9100 – 9200	100	60
10330 – 10350	20	60
10505 – 10610	105	60
10760 – 10805	45	60
12585 – 12625	40	60
12660 – 12700	40	60
12830 – 12960	130	40
13027 – 13072	45	40
13405 – 13650	245	40
15108 – 15132	24	60
17330 – 17390	60	60
Ochilview, Kincardine	230	20
<b>Total length of vibration mitigation</b>	<b>1406 m</b>	
<b>Total length of track</b>	<b>~21000 m</b>	

## 11.7 Summary

The construction of the railway and Alloa Eastern Link Road is unlikely to result in justifiable complaints from local residents providing working areas are shielded by 2.0m high solid perimeter boarding, which may be removed upon completion of the work. At

'Devonway', Clackmannan it is recommended that temporary screens are incorporated at source (rather than the perimeter of the work) during welding, jointing and rail stressing work.

Comparison between ambient noise levels and predicted noise levels and reference to a daytime limit of 55 dB LAeq,16h for railway noise has enabled identification of noise mitigation measures in the form of a 2.0 m high noise barrier to be erected at 21 locations to run a total distance of 7,543 m of the 42.2 km perimeter of the railway boundary. After mitigation the indication is that of the order of 115 residents may be 'annoyed' by railway noise upon opening of the scheme, reducing to 39 residents 'annoyed' in the long-term.

Four residential properties, and possibly another eight adjacent properties, have been identified as potentially qualifying for noise insulation to the provisions of the Noise Insulation Regulations and, in accordance with the requirements of the Calculation of Rail Noise, operational railway noise monitoring at those properties will be necessary to justify any such claim due to proximity, within 10m, of those properties from the railway.

Noise from audible warnings at level crossings is unlikely to prove problematical to local residents, providing horn levels are set in accordance with local ambient noise levels.

There is no reason why noise from fixed plant should prove problematical.

It has been demonstrated that noise from station activity at Alloa is unlikely to give rise to justifiable noise complaints from local residents.

The impact of railway noise on four areas proposed for potential residential development has been assessed and the effect of noise reduction by perimeter noise barriers identified.

Although two night-time rail movements are currently proposed, these would both occur in the period 23.00-24.00 and 06.00-0.700 and it is not considered that night-time noise from these movements would cause undue sleep disturbance.

The opening of the Alloa Eastern Link Road will ultimately result in a reduction in the number of local residents annoyed by road traffic noise.

Measurement of vibration of coal freight trains identical to those proposed for the Scheme and subsequent vibration impact prediction routines has identified the requirement for vibration mitigation measures proposed where the track passes within 20m of residential property. A total of 17 such locations have been identified, requiring a total vibration mitigation railway length of 1406 m. There are a number of vibration mitigation measures available and investigation at each recommended location would be necessary to identify optimum site-specific mitigation measures. After mitigation it is considered most unlikely that vibration from railway movements would give rise to justifiable complaints from local residents.

It is most unlikely that vibration from railway movements would give rise to structural damage, of even a cosmetic nature, at local residential property.

## **12. WATER RESOURCES**

### **12.1 Introduction**

This chapter addresses the potential effects on water resources as a result of the proposed scheme. Water resources are taken to include surface waters (e.g. rivers, burns, static water bodies, tidal waters, etc.) and groundwater (e.g. shallow and deep aquifers). The geographical extent of the water resources assessed was based on corridors of defined width along the railway and road alignments. The corridor widths are described in the following sections.

### **12.2 Methodology**

#### **12.2.1 Baseline Conditions**

The baseline water resources conditions were evaluated from the following source data that included the following. Further details are given in Volume 3 of this ES.

- § Desktop investigation using OS Maps, previous feasibility studies, and an aerial video of the route;
- § Consultations with relevant consultation bodies and other organisations (SEPA, Scottish Natural Heritage, Scottish Water, Forth District Salmon Fisheries Board, British Geological Survey, and the Forth Estuary Forum);
- § Site visits carried out in August and October 2002;
- § Flow and water quality data provided by SEPA for major streams;
- § Flow data for minor streams evaluated from catchment data;
- § Water quality conditions of minor streams based on a visual/qualitative assessment and classification;
- § Ground water data from extant reports and British Geological Survey maps.

For the purposes of description, the discussion of the water resources features proceeds from geomorphology (shape, formation) to the hydrology (flows) and then to the water quality of any given water body. This is similar to the approach adopted by the Water Framework Directive, which describes water bodies in terms of their hydro-morphology, physical – chemical conditions, and biological conditions.

#### **12.2.2 Impact Identification**

Identification of the range and location of potential impacts was based on a review of similar projects and the professional experience of the assessment team. Potential generic impacts, which may arise from the construction or operation of such a road or rail scheme are identified in Volume 3 of this ES. It is noted that changes or impacts to water resources features may lead to or be associated with impacts, which are addressed separately in this ES (such as changes to the ecology, soil contamination, etc.).

Impacts on surface water resources were considered over a range of some 250m either side of the scheme (and further downstream where required), whilst groundwater features and impacts were considered over a width of some 1000m either side of the scheme. These extents are in line with other major railway studies (such as the East Coast Main Line and West Coast Route Modernisation environmental studies).

### 12.2.3 Impact Assessment

Impact assessment was based on the assessment methodology presented in Volume 1, with the significance of an impact depending on both the *magnitude* of the impact, and the *sensitivity* of the receptor. The *magnitude* of each impact on water resources evaluated on the following basis;

- š Major – resulting in complete loss of an attribute e.g. degrading of water quality classification, increased flooding, loss of significant fishery, etc.;
- š Moderate – resulting in an impact on the integrity of an attribute or loss of part of an attribute e.g. changes to water quality (but no change in classification), loss in production of a fishery, long term measurable, but not gross, changes to hydraulic characteristics;
- š Minor – resulting in a slight impact on an attribute e.g. measurable changes in some hydraulic characteristics but no significant effect on overall flow conveyance, measurable changes in some water quality parameters but no effect on classification, reduction in a fishery over a short run of river, etc.;
- š Negligible – resulting in an impact on an attribute but of insufficient magnitude to affect the use or integrity thereof e.g. discharges to watercourse but no significant loss in quality, fishery productivity or biodiversity, no increased flood risk, etc.

The *importance* or *sensitivity* of a receptor can be described as the use and value which society has assigned to it and its resilience to cope with changes resulting from an impact. For example, the sensitivity of water quality at a stream crossing beneath the railway may depend on the flows, as well as on the water quality classification of that water body. If the flows were low, any polluting effects as a result of construction work would readily change the water quality of the stream. If, however, the flow rate was normally quite high, any pollutant ingress to the river would be diluted by the high flow, and the sensitivity could be considered to be lower. So as to provide a degree of objectivity to the process, the sensitivity of surface water bodies was derived from a consideration of three factors:

- š The present water quality classification;
- š The flow rate;
- š The amenity value of the water body.

This analysis is presented as Table 12.2 in Section 12.4.1. The following table brings together the *magnitude* of the impact and *sensitivity* of the receptor to determine an overall impact significance.

**Table 12.1: Significance Matrix**

Sensitivity of Receptor	Magnitude of Impact			
	Severe	Moderate	Minor	Negligible
<b>High</b>	Substantial	Substantial	Moderate	Minor
<b>Moderate / High</b>	Substantial	Moderate	Minor	Minor
<b>Moderate</b>	Moderate	Moderate	Minor	Negligible
<b>Low</b>	Moderate	Minor	Negligible	Negligible

The assessment of impact significance also takes into account whether the impacts are direct / indirect, temporary / permanent, long term / short term, beneficial / adverse, and

primary / secondary, and these factors are discussed in relation to each of the environmental effects where appropriate in Section 12.5.

Most water resources impacts may occur over a wide range from negligible occurrence to widespread and / or damaging occurrence. The probability of an impact occurring has been taken account of in the assessment of the magnitude of each impact. For example, scour may be extremely minor, or it may be major. In each case where scour is possible over the length of the scheme, the probability of significant scour occurring has been taken account of when assessing the degree of magnitude.

#### 12.2.4 Mitigation Measures

Mitigation measures considered appropriate for the reduction of impacts on water resources features are likely to consist of control of construction techniques, the adoption of river bank protection measures, and appropriate design of any surface water drainage systems, and bridges or culverts. These are discussed in more detail in the mitigation section of this chapter. It is noted that in line with the overall methodology of this ES, the significance of the impacts are assessed assuming that normal or standard environmental features are “built in”, but without the adoption of any necessary special mitigation features.

### 12.3 Consultations

Between July and October 2002 water resources information was gathered and consultations were undertaken with consultation bodies and other organisations, including; Clackmannanshire Council, Scottish Environmental Protection Agency, Scottish Natural Heritage, Scottish Water, Forth District Salmon Fisheries Board, British Geological Survey, and Forth Estuary Forum. Responses from these bodies are contained in Chapter1, Volume 3.

In addition, meetings were held with Scottish Water and SEPA to discuss the water resources impacts and identify any further background information. Scottish Water confirmed that they had no record of any surface water or groundwater abstractions in the vicinity of the scheme, nor did they have any storage reservoirs that would be affected by the proposed works. SEPA provided hydrological and water quality data for the Forth, Devon, and Black Devon Rivers, as well as information covering the objectives for these water bodies.

### 12.4 Baseline

#### 12.4.1 Overview

There are 25 surface water features that have been identified within the 250m boundary either side of the scheme. Nineteen of these features are rivers, burns or drainage ditches, which generally cross the scheme from the higher ground to the north and east and drain into the River Forth to the south. Of the remaining six features there is one mill lade (disused), two small ponds, a culverted sewer, and two sections of the River Forth / Forth Estuary where the railway embankment runs parallel and in close proximity. These features are identified on Figure 12.1.

The SEPA Water Quality Classification system, which applies to all significant water bodies in Scotland (ref. SEPA River Classification Scheme (January 2002)), is based on an assessment of physical, chemical, and biological indicators. The following classifications are assigned to a watercourse based on sampling of the above characteristics:

- š Class A1 – Excellent – Sustainable salmonid fish population. Natural Ecosystem;
- š Class A2 – Good – Sustainable salmonid fish population. Ecosystem may be modified by human activity;
- š Class B – Fair – Sustainable coarse fish population. Salmonids may be present. Impacted ecosystem;
- š Class C – Poor – Fish sporadically present. Impoverished ecosystem;
- š Class D – Seriously polluted – Cause of nuisance. Fauna absent or seriously restricted.

SEPA Water Quality Classifications for the significant rivers and streams within the corridor of the scheme are presented in Table 12.2 below.

For the purposes of later assessment of impacts, the assessed sensitivity of each of these water bodies is also shown in Table 12.2, using the methodology described in Section 12.2.3.

SEPA agreed that the evaluation of baseline conditions should be based on data received from SEPA, augmented for minor streams by a visual / qualitative assessment based on SEPA's River Classification Scheme. This type of assessment is based on the presence of List A Contaminants (faeces, toilet paper, oils, non natural foam, sewage or oily smells) and List B Contaminants (Builders waste, Gross litter (furniture, motor vehicles, road cones, etc.)). For further details refer to Table 1 in the River Classification Scheme document. The classification was made on the following basis:

- š Class A1 – No List A / possibly minor List B contaminants;
- š Class A2 – Traces of List A contaminants and / or occasional List B contaminants, especially at easy access points;
- š Class B – As above;
- š Class C – List A contamination widespread and / or occasional conspicuous quantities, and / or gross amounts of List B contamination;
- š Class D – As above.

It is noted that the programming of this study resulted in site observations of all streams taking place during relatively high flow conditions. Most of the streams therefore exhibited a high degree of turbidity. Furthermore, the Black Devon water was highly coloured, indicating the presence of dissolved iron, possibly originating from mine workings, which are significant in this catchment.

The average flow rate and Water Quality Classification of the most significant of the surface water features are shown in the table below. A summary of the hydrological, water quality, and groundwater data sources along with additional baseline information is presented in Volume 3.

**Table 12.2 Key Water Resource Features and Sensitivity**

Receptor	Water Quality Classification	Flow Rate (m <sup>3</sup> /s)	Amenity Use	Overall Sensitivity
River Forth	B – C - B	High (42.8)	High e.g. Fishing, boating, canoeing, national ecological designations, etc.	Moderate
Logie Burn	B <sup>b</sup>	Low (0.2 <sup>a</sup> )	Low e.g. no leisure use or ecological designations, etc.	Moderate
River Devon <sup>c</sup>	A2	Moderate (4.9)	High e.g. some leisure use, designated salmon river, etc.	High / Moderate
Powis Burn	B <sup>b</sup>	Low (0.3 <sup>a</sup> )	Low	Moderate
Fairy Burn	B <sup>b</sup>	Low (-)	Low	Moderate
Brothie Burn	B	Low (0.1 <sup>a</sup> )	Low	Moderate
River Black Devon <sup>d</sup>	B	Moderate (0.9)	High e.g. important coarse fishery, some leisure use, flows through area of locally important wetlands	High / Moderate
Goudnie Burn	B <sup>b</sup>	Low (0.04 <sup>a</sup> )	Low	Moderate
Peppermill Dam outflow	B <sup>b</sup>	Low (0.06 <sup>a</sup> )	Low	Moderate

a Average Flow figures derived from IOH Low Flow Studies Reports

b Water Quality Classifications derived from qualitative / visual inspections as agreed with SEPA

c Noted by the Forth DSFB as an important Salmon Fishery

d Noted by the Forth DSFB as containing a healthy population of Brown Trout and other Coarse fish species

The present Water Quality Objectives for all of the watercourses in this area were noted by SEPA as being the preservation of the current Water Quality Classifications. It is noted that the inception of the Water Framework Directive may cause these objectives to be reviewed, however the Water Quality Objectives for individual watercourses have not yet been developed.

#### 12.4.2 River Forth

There are two areas where the scheme comes in close proximity to the River Forth, and hence may influence its geomorphology. The first is 1km north of the Forth Viaduct. The potential for scour at the embankment toe during periods of high river flow in this location is noted, as the railway embankment is on the outside of a bend in the river.

The second area is between Kincardine Bridge and Longannet Power Station, where the railway embankment runs parallel and in close proximity to the Forth Estuary. The entire



shoreline in this area is protected by a sea wall / revetment topped by a small parapet wall. Survey data was not made available in this vicinity. However, from inspections, it would appear that the railway is separated from the wall by a grassed embankment approximately 4 – 5 metres in width, the top of which is at the same level as the foot of the parapet wall. The railway line is approximately 1.5 metres below the top of this embankment.

The “tide line” (sea weed line) along the sea wall is some 1.5 – 2.0 metres below the top of the parapet wall. During the site visit the presence of debris washed up by the tide was noted along the base of the parapet wall, but there was no sign of any rubbish on the grassed embankment. During research and consultations there has been no note of any significant coastal erosion along this shoreline. However, the importance of coastal protection works to ensure the integrity of the railway embankment is noted.

In terms of hydrological conditions, Stirling Council have stated that the area of undeveloped land near the Forth Viaduct and the land belonging to Stirling Rugby Club is prone to flooding. In addition, properties in Cambus regularly experience flooding of their gardens during high tides and low-pressure conditions in the North Sea, but the properties themselves have so far remained above the flood mark. SEPA provided flood maps for the River Forth; however these do not cover the estuarine reaches of concern to this ES.

The water quality of the River Forth in these area ranges from poor (class C) to good (class B).

#### 12.4.3 River Devon

In terms of geomorphology, the River Devon is a relatively high-energy system, and this is exhibited through bank erosion and regular flooding in various places. In particular, the bank erosion at the Devon Viaduct is noted, where in the past gabions have been placed on the east (upstream) side of the railway embankment to prevent erosion. A flood plain some 300m wide is associated with the river where the rail crosses. An existing embankment partially blocks this flood plain, with the waterway restricted to the confines of the channel. Below the crossing the river is confined by the adjacent whiskey bond stores. It is noted that the scheme will not vary this arrangement.

With regard to the hydrology of the River Devon, flooding has been reported on various upstream reaches of the River Devon, particularly at Tillicoultry and on the A91 between Tillicoultry and Dollar. Such flooding is predominantly confined to roads and fields, but does come close to properties in the Tillicoultry area. It is noted that these areas are some distance (more than 5 km) upstream of the proposed scheme, and are unlikely to be affected by the works. No flooding has been reported in the proximity of the railway, although there was some evidence during the site inspection that the river may break its banks in this location during high flows.

The River Devon is the only watercourse crossed by the works that has a high water quality classification (A2).

#### 12.4.4 River Black Devon

The River Black Devon is a relatively moderate energy system, and this is exhibited through slight bank erosion in various places.

There have been no significant flooding problems reported along the Black Devon. Considering the incised nature of the watercourse through Clackmannan and beneath the

railway alignment, and the elevated nature of the alignment at the crossing, there would be no risk of flooding impacts due to the proposed works.

The water quality classification is class B (Fair). There is a higher than normal turbidity in this watercourse, and evidence of iron oxides in the water.

#### 12.4.5 Brothie Burn

The Brothie Burn is a relatively low energy system, and is extensively culverted throughout Alloa both upstream and downstream of the proposed scheme. There was no evidence of any significant bank erosion on the surveyed burn sections.

Various sections of the Brothie Burn are noted on the Clackmannanshire Council Flood Inspection List. Although no flooding occurrences have been reported in the last year, the ongoing requirement to clear culverts and hakes is noted.

The burn is a class B (Fair) watercourse. Since it runs through the urban areas of Alloa, it has the potential for significant levels of gross pollution at times.

#### 12.4.6 Other Minor Watercourses

The other minor streams noted in the previous table drain small catchment areas (each less than 15 km<sup>2</sup>), and are likely to be permanently flowing streams.

In terms of hydrological conditions, various sections of the Fairy Burn in Alloa are noted on the Clackmannanshire Council Flood Inspection List. No flooding occurrences have been reported in the last year, although the ongoing requirement to clear culverts and hakes is noted.

The only other burn with reports of flooding occurrences is the Goudnie Burn where it passes through Clackmannan. In particular, there are a number of culverts passing under the railway line near to a relatively newly developed residential area, and there have been reports of minor flooding into gardens.

#### 12.4.7 Other Surface Water Features

There are a number of environmental designations that relate to water resources features; namely Alloa Inches SSSI, Forth Special Protection Area, and the Forth Ramsar site. These can be directly or indirectly influenced by the characteristics (flow, water quality, etc.) of the River Forth and therefore also by this scheme. The assessment of ecological impacts is dealt with in a separate chapter of this ES. The Ecological Assessment has determined there are no significant impacts on these areas from the scheme.

There is an area of agricultural land to the east of Alloa, which because of the local topography and possibly the earlier constraint of the railway can collect a quantity of water during wet periods. This area is actively grazed and supports grass growth over the entire area. The Ecology Chapter notes that this area supports seasonal wetland and has the potential to support amphibians, although no amphibian surveys were carried out during the production of this ES given the inappropriate time of year for this work. The Ecology chapter has recommended that an amphibian survey be carried out on this area during March / April.

There are two known surface water abstractions in this area; one for the QUEST malt factory at Menstrie, taken from a loch in the Ochil Hills, and the other for the LPC Paper

Mill, taken via canal from the Peppermill Dam. The railway works would not affect the abstraction for QUEST. However, care should be taken during construction that the supply pipe for the LPC Paper Mill (which crosses the railway) is not damaged.

#### 12.4.8 Track Drainage Discharge and Water Quality

Over the majority of its length, the railway is either at grade, or on a low embankment. Rainfall on the railway would infiltrate through the ballast and disperse laterally down slope out of the embankment and/or vertically into shallow groundwater.

Significant containment and concentration of stormwater flows would only occur in cuttings. The major cuttings on the route are located at Alloa Town Centre, Clackmannan, Kennet / Meadowhead Farms, and Kilbaggie. It is noted that the scheme design will provide positive drainage in these cuttings, with outfalls to watercourses.

Chapter 10, Volume 2 refers to a number of incidences of iron ochre staining of water in cuttings, and a few occurrences of leachable pollutant values in groundwater and surface water samples over threshold levels. These included Iron, polyaromatic hydrocarbons (PAH) and Cyanide. It is possible that the highly coloured water in cuttings arises from groundwater migration from old mine workings.

It is noted that Chapter 10 includes recommendations for a Waste Management Plan, which should allow for the safe handling and disposal of material from the existing track, which may contain high levels of metals or organic pollutants.

#### 12.4.9 Ground Water

From the Hydrogeological Map of Scotland (BGS 1988) and the Groundwater Vulnerability Map of Scotland (BGS 1995) there do not appear to be significant ground water resources within the corridor of the scheme. It is however noted that some of the deposits may contain “locally important aquifers”, which are typically important for supplying base flow to rivers. It is noted that there are no known ground water abstractions in this area.

SEPA have confirmed that there is no current licensing system in Scotland for groundwater discharges or abstractions. Investigations for this study have not revealed any significant discharges to or abstractions from groundwater in this area. In addition, it is noted that there are no Source Protection Zones for groundwater in this area.

SEPA have produced a framework document entitled “Groundwater Protection Strategy for Scotland (1997)”, which identifies particular policies in regard to groundwater protection. SEPA note that two elements combine to assess the groundwater pollution potential of a particular area, namely the risk of pollution and the vulnerability of groundwater in the area. In line with Section 5.8 of the “Groundwater Protection Strategy”, surface run off from infrastructure developments is considered to pose a significant risk to groundwater resources, and SEPA seek to ensure that such infrastructure developments avoid Zone 1 (Inner Source Protection) Areas. There are no source protection zones in this area, and given that the strata is only moderately permeable land and the natural groundwater quality is noted as “poor”, then the sensitivity of the groundwater is considered to be *Low / Moderate*.

No groundwater pollution incidents or areas of groundwater quality degradation have been noted by SEPA. However, it is noted that a disused waste tip is located at Manor Powis, although there are no known surface or ground water issues attendant with this landfill site.

The presence of extensive mine workings across the area covered by the scheme is noted, and although a detailed description of these is contained in the Geology Chapter any impacts directly relating to water resources will be discussed later within this chapter.

## 12.5 Environmental Effects

Using the same approach as above, the potential impacts are discussed under the three categories of *geomorphology*, *hydrology* and *water quality* for each watercourse. It is recognised however, that an impact described under one of these categories could also have associated impacts in the other categories. The impacts are also sub-divided into those arising during *construction* and those that may occur during *operation* of the scheme.

A discussion of the aspects of the works most likely to affect the water resources features is included in Volume 3.

It is noted that the assessment of the AELR is different to that of the railway works. For that reason, and since the potential impacts of the AELR are limited to the Brothie Burn, all AELR impacts are discussed in Section 12.5.4.

### 12.5.1 River Forth

#### *During Construction*

The bank protection works that may be required to the River Forth at Stirling would likely involve the placement of rip-rap or other units down the bank face, without recourse to any excavation. If so, the magnitude of any impact in regard to geomorphology should be *minor*. If excavation of the bank is required, the impact would be higher (*moderate*), and suitable mitigation measures such as a silt curtain may be needed.

These bank protection works to the River Forth crossing also have the potential for increased flood risk during construction, while the waterway capacity is decreased. Mitigation of this risk requires care in plant and temporary works selection, and a flood risk assessment should be carried out by the contractor as part of the works planning. In view of the built up nature of this area, and the potential for flood damage, this risk is considered to be *moderate*.

Coastal protection works required to ensure the integrity of the railway along the Kincardine to Longannet Power Station section would likely involve the maintenance of existing defences (stone/masonry and rock revetments and concrete and masonry sea walls), which protect the entire coast in this vicinity. The magnitude of any impacts from such works should be *negligible / minor*. If however extensive maintenance works are required in certain areas, particularly those involving work in the inter tidal zone, then the impacts may become *moderate*, requiring that suitable mitigation measures are put in place.

It is however noted that the Highest Astronomical Tide (HAT) for Kincardine is at +6.3m Chart Datum (equivalent to +3.35m Ordnance Datum), with a recurrence interval of 1 to 1.5 years. The railway is noted as being at +4.2m Ordnance Datum as it passes through Kincardine, but there is no level information for the railway between Kincardine and Longannet. The estuary is relatively sheltered at this point with no significant fetch length

over which waves can develop. It is recommended that the final scheme design should take into account tidal heights, tidal surge, and wave heights with respect to overtopping of the sea wall and parapet in this area.

During refurbishment works to the Forth Viaduct there is potential for rust and paint to be deposited into the watercourses, particularly from blast cleaning operations. The adoption of Best Practice and good site management procedures (e.g. temporary enclosure of work areas and the use of debris management procedures) should minimise the possibility of debris reaching the River Forth. With these measures in place, and considering the reasonable buffering volume of water passing under these structures, any debris reaching the watercourses will not alter the water quality classification nor will it have a significant impact on the water quality either locally or downstream. This impact is considered to be *minor* in magnitude.

During the construction (particularly from construction compounds and temporary access roads) there is potential for sediment or pollutant laden run off, liquid paint, cleaning agents, fuels and other chemicals to enter the watercourses via surface erosion and accidental spillage. Should any sediment-laden run off or spillages occur then the impacts would be greatest in the vicinity of the incident, with impacts reducing with dilution as the contaminants move downstream. The impacts would be short term in nature with minor changes to some water quality parameters over this period. It is anticipated that the watercourse would quickly return to its original state after this period. Overall the magnitude of such an incident is considered to be *minor*, assuming that best practise is adopted.

#### *In Operation*

The bank protection works at Stirling may result in a slight long-term alteration to watercourse profiles. Once the works are complete and the watercourse is returned to its original route, the long term impacts are considered to be *negligible*.

Over the life of the railway operation, some ongoing maintenance work may be required to protect riverbanks and bridge abutments from scour, and preserve the integrity of the rail infrastructure. Such work may involve reinforcement of riverbanks, by either “soft” or “hard” engineering measures. These works would be localised and cause short term minor to moderate disruption to riverbank and bed area. Long term changes to the form of the channel are likely to be extremely small, and will have little impact on flow conveyance of the watercourse. On that basis, the magnitude of this impact is also considered to be *negligible*.

Any minor maintenance works on the existing coastal defences between Kincardine and Longannet Power Station are unlikely to significantly alter the current coastal alignment, or significantly impact upon the inter tidal habitat in this area. Therefore the magnitude of any long term impacts is considered to be *negligible*.

The railway embankment itself is an existing feature on the Forth floodplain therefore there are not expected to be any impacts to water movement across the flood plain from the reinstatement of track on this embankment.

A potential pollution source is from the trains themselves, and would arise from deposition of fuels, oils, or sewage wastes onto the tracks. These have the potential to be washed into nearby watercourses, or to migrate to shallow groundwater. It is anticipated that out with station areas, the migration of fuels or oils onto the track will be fairly minimal and any

such discharges would be retained within the track ballast or percolate slowly into the ground causing no significant effects. In addition, the volume of sewage wastes is likely to be fairly small owing to the short journey time between the various stations, and the fact that there are only 17 passenger trains each way every day. Therefore it is unlikely there would be any detectable effects on water quality. In addition to this, there is unlikely to be any significant direct discharges to watercourses of this nature. This impact is considered to be of a *minor* magnitude.

Another potential source of pollution may arise from maintenance of the landscaped trackside or roadside areas. It is anticipated this would involve regular applications of herbicides in order to control weed growth. If appropriate non-residual herbicides are used at the correct application rate and frequency, there should be no ongoing impact to the environment from this source. This impact is therefore considered to be *negligible*.

## 12.5.2 River Devon

### *During Construction*

Scour protection works are proposed for the River Devon, and this may involve work in the watercourse. In the absence of detailed information it has been assumed such works would involve the placement of additional rock armour around the abutments and the mid-river pier, and refurbishment or replacement of existing gabions.

These scour protection works would require careful planning in order to avoid impacts to the river. The works would cause moderate localised disturbance of the riverbed and riverbank in the vicinity of the works and for access to the works. It is anticipated that both terrestrial and aquatic flora and fauna in these areas may be disturbed during construction. However, assuming that riverbank areas are restored after construction, both terrestrial and aquatic systems should return to their original state, and the *magnitude* of any impacts on geomorphology is considered to be short term and *minor*. In order to minimise the impact on the River Devon's Salmon Fishery, it is recommended that in river working should be avoided during the period November to February and that all relevant SEPA Guidance is followed.

The scour protection works to the River Devon crossing have the potential for increased flood risk during construction, while the waterway capacity is decreased. Mitigation of this risk requires care in plant and temporary works selection, and a flood risk assessment should be carried out by the Contractor as part of the works planning. In view of the respective adjacent whisky bond stores and housing, and the potential for flood damage to these facilities, magnitude of hydrological impacts is considered to be *moderate*.

In regard to water quality related impacts, specific comments have been made in the above section on the River Forth (i.e. rust and paint, and sediment laden run off entering the watercourse) and these potential impacts also apply to the River Devon.

### *In Operation*

The scour protection works at the River Devon crossing may result in slight long term alteration to the profile of the watercourse. Once the works are complete and the watercourse is returned to its original route, the long term impacts on geomorphology are considered to be *negligible*.

During the operation of the railway it is anticipated that the scour protection works at the River Devon are likely to have a potential impact on the hydrology of the watercourse. The magnitude of this impact will be *negligible* in regard to flow conveyance and alteration of natural processes on the flood plain, as discussed above.

In regard to water quality related impacts, specific comments have been made in the above section on the River Forth (i.e. fuels, oils, and sewage from trains, as well as herbicides from maintenance of the trackside vegetation) and these impacts also apply to the River Devon.

### 12.5.3 River Black Devon

#### *During Construction*

Given the physical nature of the Black Devon crossing, i.e. considerably above the level of the watercourse, there is unlikely to be any significant impacts on either the geomorphology or the hydrology of this watercourse from the proposed works.

In regard to water quality related impacts, specific comments have been made in the previous section on the River Forth (i.e. rust and paint, and sediment laden run off entering the watercourse) and these potential impacts also apply to the River Black Devon.

#### *During Operation*

Given the physical nature of the Black Devon crossing, i.e. considerably above the level of the watercourse, there is unlikely to be any significant impacts on either the geomorphology or the hydrology of this watercourse during the operation of the scheme.

In regard to water quality related impacts, specific comments have been made in the above section on the River Forth (i.e. fuels, oils, and sewage from trains, as well as herbicides from maintenance of the trackside vegetation) and these impacts also apply to the River Black Devon.

### 12.5.4 Brothie Burn

In regard to the discharge of surface water run off from the AELR, the relevant surface watercourses, their classifications and presence of designated fisheries, and a provisional estimate of the likely risk of accidental spillage have been identified. However, based on the following advice provided in DMRB Volume 11 Section 3 Part 10 and the predicted traffic flows on the AELR (i.e. <15,000 AADT), it has been considered inappropriate to undertake a more detailed assessment of the impacts of surface water from the AELR on the receiving watercourses.

The DMRB notes that “pollution impacts on receiving waters appear to be restricted primarily to roads carrying more than 30,000 vehicles per day (Ellis 1997 “Transport and the Environment: Effects of Organic Pollutants on Water Quality (CIWEM)”), although for roads carrying more than 15,000 vehicles per day the level of pollution associated with surface water run off could be of concern”. In addition, the DMRB goes on to note that several studies by a variety of authors, one of which is CIRIA Report 142, report that surface water run off from roads with “Average Annual Daily Traffic flows (AADT’s) of less than 15,000” produce “virtually no noticeable effects” on the water quality of receiving watercourses.

Furthermore it is also noted that the DMRB states that the “Precautionary approach and the need for best practice indicate the need for the assessment of the possible impact of discharges from proposed trunk roads and motorways”. Based on consultations with the relevant Roads Authority (RA), the AELR is not classified as either a motorway or a trunk road. Consultations in regard to the AELR with the RA and the Scottish Executive noted that the impacts on receiving waters should be considered, but did not specify that a particular level of assessment was required.

Against that background, it was considered that the appropriate level of investigation of water quality impacts of the AELR would be a Stage 1 assessment in accordance with the DMRB Volume 11 Section 3.

The assessment of impacts in regard to flooding of the AELR (geomorphology and hydrology) have been prepared in line with the guidance in DMRB HA 71/95 ‘The Effects on Flooding of Highway Construction on Flood Plains’.

The general lack of design information for the AELR drainage works, mean that the assessments in regard to this element of the scheme have all been assigned only moderate confidence values.

#### *During Construction*

During the construction of the culvert to carry the AELR across the Brothie Burn there is potential for disturbance of the physical features of the channel and bank. It would be expected that there would be *moderate / severe* localised disturbance of the riverbed and riverbank in the vicinity of the works and for access to the works. It is anticipated that both terrestrial and aquatic flora and fauna in these areas will be disturbed during construction. In the area of the new culvert, where the burn will be realigned and regarded, these impacts will be permanent and are considered to be *moderate to severe* in nature.

During the construction of the Brothie Burn culvert there will be some form of land take around this watercourse and possibly a reduction in waterway capacity during the works. Mitigation of this risk requires care in plant and temporary works selection, and a flood risk assessment should be carried out by the Contractor as part of the works planning. In view of the adjacent whisky bond stores, and the potential for flood damage to these facilities, the magnitude of hydrological impacts is considered to be *moderate*.

In regard to water quality related impacts of the railway, specific comments have been made in the previous section on the River Forth (i.e. rust and paint, and sediment laden run off entering the watercourse) and these potential impacts also apply to the Brothie Burn.

#### *During Operation*

The regrading and realignment of the Brothie Burn under the proposed AELR will cause some permanent impacts on the watercourse profile. The long-term impacts are considered to be *minor to moderate*, depending on the final design solution.

During the operation of the Brothie Burn culvert there will be some permanent land take from the local flood plain of the Brothie Burn, and some long term alterations to the physical features affecting flow transmittal of the Brothie burn at this locality. However, good design, taking into account all relevant technical guidance on construction over watercourses, should minimise the magnitude of these impacts. At this stage the magnitude



of impacts on the hydrological features in the long term is considered to be *minor to moderate*.

Design details available at this stage indicate that “for the most part” the proposed AELR will drain into the Brothie Burn. It is highlighted that during the site inspection the Brothie Burn was flowing outside its normal channel in a number of locations, culverts leading from the bonded warehouses were all surcharging, and there was local flooding in the woodland and park downstream of the bonded warehouses. It is further noted that there was evidence that Brothie Burn had flooded in the vicinity of the rail crossing further downstream (site inspection August 2002). This evidence suggests that during storm flows the Brothie Burn may not be able to accept significant additional flows from the proposed AELR surface water drainage system. It is recommended that a detailed flood investigation be carried out as part of the surface water drainage system design. If the incremental effects of the AELR cause flooding of undeveloped areas or the AELR, then the impact magnitude is considered to be *moderate*. If incremental flooding due to the AELR results in increases in flood levels in residential or light industrial areas then the impacts are considered to be *severe*.

During the initial period of operation of the road it is expected that some suspended solids (sediments) from landscape works will enter the drainage system during periods of rainfall. Such discharges are likely to diminish in quantity over time, as the landscape works become fully vegetated. Impacts will be experienced over a medium term (perhaps 1 year to allow a full growing season), but the magnitude of such impacts will diminish over this period. Given the increasingly limited nature of such discharges, this impact is considered to be *minor*.

During the operation of the AELR there will be a certain amount of solids arising from wear of the road surface (e.g. grit, chippings and the like). It is anticipated that the road design to DMRB would result in sufficient measures to restrict the entry of such materials into the drainage system. On this basis it is considered that the volume of material reaching the watercourse will be small, and the magnitude of impact should be minor. Of more concern is the contamination of such particles with oil and fuel from the vehicles using the AELR (e.g. hydrocarbons). Again it is anticipated that the final road design will include measures to prevent significant quantities of such materials reaching the watercourse. On this assumption this impact is considered to be *minor*.

De-icing salts will commonly be used on the AELR between the months of November and March. This will have the affect of temporarily increasing the salt content (particularly Sodium Chloride) of the run off from the AELR. The salt content will be highly variable in nature and depend on the weather experienced in any particular year. It is also noted that the flows in watercourses is relatively high during these months, and as such the salts would be subject to reasonable dilution and dispersion on entering the watercourse. From guidance in the DMRB, it is noted that such pollution would be temporary and highly localised (concentrated at the outfall) in nature. From PPG 10 (SEPA) it is noted that the “*use of salt on highways is unlikely to lead to levels in the water environment that could effect aquatic life or drinking water supplies*”. Therefore the magnitude of such an impact is considered to be *minor*, depending on the extent of the de icing during each run off event.

The following preliminary spillage risk assessment has been undertaken, based on the projected traffic flows noted below and the methodology presented in DMRB Annex 3 Volume 11.

- § AADT flows of 7552 (southbound) and 5304 (northbound);
- § 8% HGV percentage;
- § assumed emergency response time of less than 20 minutes;
- § assumed runoff coefficient of 0.5;
- § an assumption that the watercourse is equivalent to RE 3.

A preliminary assessment of the spillage risk gives a return period of 1 in 346 years at the opening of the AELR, which is a lower probability than the recommended minimum of 1 in 100 years. On that basis, the impact significance is determined to be *Insignificant*.

#### 12.5.5 Other Minor Watercourses

##### *During Construction*

During culvert replacement works it is likely that the watercourses will require to be diverted or over-pumped past the site, with attendant physical disruption to the upstream and downstream watercourses. Assuming the original stream alignment is restored, then the impacts are considered to be short term in nature (i.e. during construction and for a growing season afterwards) and *moderate* in magnitude.

For those culverts requiring refurbishment only, the works may require the watercourses to be temporarily diverted to allow access. Bank and bed disturbance is likely to be minor, localised, and shorter in duration than culvert replacement. The magnitude of such impacts during the works would be *moderate*.

At all construction sites in proximity to the watercourses, there is the potential for the disturbance and mobilisation of soils during rainfall events from exposed earthwork areas, leading to sediment deposition in the bed of streams or increases in water turbidity. With best practice construction techniques, these occurrences would be minimised. However, continual vigilance during construction, and the adoption of a specific Erosion and Sedimentation Plan, will be required in order to avoid such events. The impact of such disturbance would be short term and temporary, and is considered to be *minor to moderate* in magnitude.

Where culvert repair or replacement works are undertaken it is assumed that the bypass channel or the pumping facilities would be sized so as to maintain the required flow conveyance of the watercourse. Such works should be designed around a suitable flood event (e.g. 1 in 10 or 1 in 20 year event) and should take account of the consequences of failure of the bypass system. It is considered that these works will have *minor* short-term localised impacts (mainly during construction), with *negligible* impacts on the watercourse over the long term.

In regard to water quality related impacts, specific comments have been made in the previous section on the River Forth (i.e. rust and paint, and sediment laden run off entering the watercourse) and these potential impacts also apply to the other minor watercourses.

##### *In Operation*

Several new or re-instated outlets may be required for surface water drainage from railway cuttings. These have the potential to cause localised scour and bank collapse during storm events due to high velocity / high flow rate discharges. Careful design and detailing is required so as to obviate this effect. The magnitude of this impact is considered to be *minor*.

During the operation of these culverts there will be some permanent long term alterations to the physical features affecting flow transmittal of these watercourses. However, good design, taking into account all relevant technical guidance on construction over watercourses, should minimise the magnitude of these impacts. At this stage the magnitude of impacts on the hydrological features in the long term is considered to be *minor to moderate*.

The development of improved drainage in cuttings for the railway could result in a degree of increase in the amount of iron-stained water intercepted by the works (see above). However, the whole of this area contains a large number of old mine workings, as exhibited by the conditions of the Black Devon. The increase in the contribution of possible mine water to the watercourses is judged to be minor, and would be distributed along the route of the railway. On that basis, this impact is assessed as *negligible*.

In regard to water quality related impacts, specific comments have been made in the above section on the River Forth (i.e. fuels, oils, and sewage from trains, as well as herbicides from maintenance of the trackside vegetation) and these impacts also apply to the River Black Devon.

#### 12.5.6 Other Surface Water Features

Direct impacts on designated areas via adjacent surface water features from either the construction or operation of the scheme are generally considered to be negligible or minor, see assessment presented within the Ecology Chapter. However, there are considered to be minor to moderate impacts on the River Teith cSAC which are discussed fully in the Ecology Chapter.

The scheme is not anticipated to impact upon the water abstractions for either QUEST or the LPC Paper Mill. However, care should be taken during construction that the supply pipe for the LPC Paper Mill (which crosses the railway) is not damaged.

#### 12.5.7 Ground Water

Based on the information provided in the Baseline section, i.e. no source protection zones in the area (i.e. no groundwater abstractions), groundwater generally of a poor quality naturally, and the fact that the railway is an existing feature, there is unlikely to be any significant impacts on groundwater quality from the scheme. Based on these factors the general impact on groundwater from the scheme is considered to be negligible / *minor*.

There will however be some impacts due to the grouting required to stabilise the mine workings in this area. In regard to any potential future abstractions, the overall effect of grouting is considered to be beneficial since it would tend to reduce any mine water risings, which may also be contaminated with soluble iron.

##### *During Construction*

During the grouting of “stoop and room” workings pollution of the groundwater due to cement dispersal will be minimised by constructing a perimeter wall with pea gravel and grout in advance of the main grouting. A small section at the upper end of the wall will remain open to allow displaced water to move from the grouted area to surrounding ungrouted workings. In this way water rising to the surface during grouting would be minimised. The working would then be grouted from lowest point and the groundwater displaced as grouting progresses up the dip of the strata. The displaced water may have a

high iron content and be contaminated with cement from the grout. Accordingly, provisions should be made to collect and treat any possible risings. Given these mitigation measures the pollution of surface water and ground water from grouting operations will be minimised. Based on the above any impacts on water resources are considered to be of a *minor* magnitude.

Long wall workings are usually collapsed and it is not usually necessary to construct a perimeter wall prior to infill grouting. Any pollution of adjacent groundwater during grouting is likely to be minimal due to an anticipated lack of continuity of the working. Provisions should be made to collect and treat any displaced water rising to the surface. Based on the above any impacts on water resources are considered to be of a *minor* magnitude.

Shafts within 30m of the railway in the area of the passing loop East of Alloa are to be backfilled with pea gravel, changing to a grouted pea gravel at a depth from the surface equal to at least three times the shaft diameter. A concrete cap, at least 0.5m thick, will then be placed over the shaft. The cap diameter should be at least twice the diameter of the shaft. Water displaced during the backfilling of the shaft may be contaminated and provisions should be made to collect and treat this if it rises to the surface. Based on the above any impacts on water resources are considered to be of a *minor* magnitude.

#### *In Operation*

The workings to be grouted have primarily been worked using long wall techniques and have usually collapsed. Accordingly, significant groundwater movements (and hence pollution during construction) along workings are unlikely due to an anticipated lack of continuity. The stoop and room workings at shallow depth East of Alloa are shown to extend a short distance north of the railway. The interpreted length to be grouted is about 200m. Grouting this short length is unlikely to have a significant effect on regional groundwater movements. However, the effect is considered to be *minor* beneficial in limiting water movements from a working that may have high iron content and thereby reduce any long term contamination of nearby surface water by any mine water risings.

Similarly, grouting of the collapsed long wall workings will have a slightly beneficial effect in reducing ground water movements and any long term contamination of nearby surface water by any mine water risings.

**Table 12.3: Summary of Water Resources Impacts**

Impact	Magnitude	Importance or Sensitivity of Receptor	Assessed Significance
<b>Construction Stage Impacts</b>			
<b>River Forth</b>			
River Forth bank protection (Stirling) – physical and hydrologic impacts.	Minor to Moderate	Moderate	Minor to Moderate
Forth Estuary coastal protection between Kincardine and Longannet	Minor to Moderate	Moderate	Minor to Moderate
Bridge works - debris (rust/ paint), chemical or paint spills into watercourses	Minor	Moderate	Minor
General works and compounds - runoff or spillage of fuels or other chemicals	Minor	Moderate	Minor
Sediment pollution to watercourses during construction	Minor	Moderate	Minor
<b>River Devon</b>			
River Devon scour protection – physical and hydrologic impacts	Minor to Moderate	Moderate/ High	Moderate
Bridge works - debris (rust/ paint), chemical or paint spills into watercourses	Minor	Moderate/ High	Minor
General works and compounds - runoff or spillage of fuels or other chemicals	Minor	Moderate/ High	Minor
Sediment pollution to watercourses during construction	Minor	Moderate/ High	Minor
<b>River Black Devon</b>			
Bridge works - debris (rust/ paint), chemical or paint spills into watercourses	Minor	Moderate/ High	Minor
General works and compounds - runoff or spillage of fuels or other chemicals	Minor	Moderate/ High	Minor
Sediment pollution to watercourses during construction	Minor	Moderate/ High	Minor
<b>Brothie Burn</b>			
Culvert construction - physical and hydrologic impacts	Moderate to Severe	Moderate	Moderate
General works and compounds - runoff or spillage of fuels or other chemicals	Minor	Moderate	Minor
Sediment pollution to watercourses during construction	Minor	Moderate	Minor
<b>Other Minor Watercourses</b>			
Culvert repair / replacement – physical and hydrologic impacts	Minor to Moderate	Moderate	Minor to Moderate
General works and compounds - runoff or spillage of fuels or other chemicals	Minor	Moderate	Minor
Sediment pollution to watercourses during construction	Minor	Moderate	Minor
<b>Other Surface Water Features – No Impacts</b>			
<b>Groundwater</b>			
Grouting – Pollution of surface / ground water with risings	Minor	Low / Moderate	Minor
<b>Impacts During Operation</b>			
<b>River Forth</b>			
River Forth bank protection – permanent physical and hydrologic impacts	Negligible	Moderate	Negligible
Forth Estuary – coastal protection works between Kincardine – Longannet	Negligible	Moderate	Negligible
Ongoing maintenance to river banks and bridge scour protection	Negligible	Moderate	Negligible

**Table 12.3: Continued**

<b>Impact</b>	<b>Magnitude</b>	<b>Importance or Sensitivity of Receptor</b>	<b>Assessed Significance</b>
Rail operations – track pollution due to fuels, oils, sewage	Minor	Moderate	Minor
Railway and Highway maintenance – herbicides	Minor	Moderate	Minor
<b>River Devon</b>			
River Devon scour protection – permanent physical and hydrologic impacts	Negligible	Moderate/ High	Minor
Ongoing maintenance to river banks and bridge scour protection	Negligible	Moderate/ High	Minor
Rail operations – track pollution due to fuels, oils, sewage	Minor	Moderate/ High	Minor
Railway and Highway maintenance – herbicides	Minor	Moderate/ High	Minor
<b>River Black Devon</b>			
Rail operations – track pollution due to fuels, oils, sewage	Minor	Moderate/ High	Minor
Railway and Highway maintenance – herbicides	Minor	Moderate/ High	Minor
<b>Brothie Burn</b>			
Permanent alteration of channel shape from construction of ELR	Minor to Moderate	Moderate	Minor to Moderate
Permanent hydrological impacts due to the new Brothie Burn crossing	Minor to Moderate	Moderate	Minor to Moderate
Hydrological impacts due to AELR surface water drainage outfall	Moderate to Severe	Moderate	Moderate
Pollution from suspended solids and hydrocarbons reaching the watercourse	Minor	Moderate	Minor
Pollution from use of de icing salts	Minor	Moderate	Minor
Railway and Highway maintenance – herbicides	Minor	Moderate	Minor
Pollution from Accidental Spillages	Negligible	Moderate	Negligible
<b>Other Minor Watercourses</b>			
Drainage outlets – potential bank damage in high flows	Minor	Moderate	Minor
Permanent alteration of physical / hydrological characteristics	Minor to Moderate	Moderate	Minor to Moderate
Rail operations – track pollution due to fuels, oils, sewage	Minor	Moderate	Minor
Railway and Highway maintenance – herbicides	Minor	Moderate	Minor
<b>Other Surface Water Features – no impacts</b>			
<b>Groundwater</b>			
Movement of potentially contaminated material out with mine workings	Minor (Positive)	Low / Moderate	Minor (Positive)

*Note: Unless stated otherwise all impacts are negative.*

## 12.6 Mitigation

### 12.6.1 Design

Many of the potential impacts will be avoided by good design practices. Aspects that have been considered during the concept design, and that should receive continuing attention during detailed design stages include:-

- § Checking the sizing of all culverts (those to be repaired as well as those to be replaced) for adequate flow capacity during storm events. Analysis and design should take account of the likely tail water levels (especially during mainstream flooding), siltation conditions in/downstream of culvert, potential vegetation growth near outlet, and climate change scenarios relating to the above;
- § Good detailing of culvert entrances and exits to avoid scour;
- § Analysis of afflux at river crossings as a result of any bridge works, including the placement of scour protection. As for culverts, the analysis should take account of appropriate downstream water levels and climate change effects. The influence of releases from upstream storages should also be considered;
- § Effective analysis of the potential for scour at all bridge and culvert sites, and good design of scour protection works. CIRIA Report C551 Manual on Scour at Bridges and other Hydraulic Structures is relevant in this respect;
- § Good design of discharge points (headwalls, etc.) for railway and highway surface water drainage. The designs should be such as to avoid scour effects around the outlet during storm events;
- § The design of the Brothie Burn culvert should seek to minimise impacts on the existing hydrological characteristics, and take into account the requirements and advice contained within HA 71/95. Of particular importance is the maintenance of adequate flow capacity during storm events and consideration of tail water levels;
- § The design of the ELR surface water drainage system should seek to minimise the entrainment of suspended solids;
- § Where appropriate drainage design should be in accordance with the principles of Sustainable Urban Drainage Systems (SUDS). Appropriate design guidance is given in the “SUDS Design Manual for Scotland and Northern Ireland”, and further liaison with SEPA should be undertaken during the detailed design of the scheme;
- § Design of all new river crossings and any culvert works on the scheme should be reviewed against the Scottish Executive’s “River Crossings and Migratory Fish: Design Guidance (April 2002)”. Amendments should be made to new river crossings where necessary in accordance with this guidance.

### 12.6.2 Construction

Construction should be carried out with due regard to the potential impacts on the watercourses adjacent to, or crossed by, the works. It is assumed that the works will be planned and executed with attention to relevant Best Practice Guidelines, including:

- § PPG1 – General Guide to the Prevention of Pollution;
- § PPG5 – Works In, Near, or Liable to Affect Watercourses;
- § PPG6 – Working at Construction and Demolition Sites;
- § PPG23 – Maintenance of Structures over Water;
- § Other relevant PPG documents, depending on the method of working;
- § CIRIA Report SP156 – Control of Water Pollution from Construction Sites.

The Contractor should produce detailed Method Statements (including an Erosion and Sedimentation Control Plan) for key activities that have the potential to cause harm to the environment. The following issues should be considered:-

- § Protection of the River Forth during works (including bank protection works) on the adjacent railway;
- § Protection of the River Devon water quality during scour protection works;
- § Construction of the Brothie Burn culvert;
- § Avoid flood risk to adjacent properties during works to culverts and bridges;
- § Protection of watercourses against debris, chemical spills, and silt movement;
- § The mitigation measures to prevent pollution of surface water would include construction of earth bunds to collect any spillages of grout and displaced (potentially contaminated) water from the workings allows settlement, testing (if necessary) and either release or offsite disposal depending on the water quality.

The planning of the works should take account of the following:

- § All pollution prevention control measures shall be agreed with SEPA;
- § All site water used for washing, cleaning of plant and tools should be contained on site and either treated or directed to the public sewerage system (with approval of Scottish Water);
- § The site management should include provision of equipment and suitably trained personnel to take and analyse water quality samples during works adjacent to watercourses. The sampling should be upstream, adjacent to, and downstream of the site;
- § All fuel and chemical stores should be bunded and guarded from vandalism;
- § All earth and soil stockpiles should be sited remote from watercourses, with a positive drainage system to prevent runoff of silt-laden water to watercourses.

### 12.6.3 Operation

Most of the potential ongoing or permanent impacts noted earlier will be obviated or minimised through good design. However, there will be a need for ongoing management and maintenance of the scheme infrastructure so as to prevent impacts during the scheme's life. Aspects that have been assumed to be included for during the operation of scheme include:

- § Periodic maintenance of bridges and culverts (such as re-painting, cleaning, etc.) should employ similar precautions to those noted above under "Construction";
- § Rolling stock should be maintained in good condition (no oil / fuel leakages);
- § Where possible passenger cars should be selected from those, which use either, controlled emission or sealed system toilets;
- § Vegetation management should be undertaken with care using non-residual herbicides at minimum dosages and appropriate intervals (see "Guidelines for the use of herbicides on weeds in or near watercourses and lakes" MAFF). The type and method of use of herbicides should be agreed with SEPA.

It is also noted that provision should be made for monitoring the implementation and operation of the mitigation measures, as this forms an integral part of any mitigation undertakings.



## 12.7 Summary

The proposals for the re-opening of the Stirling-Alloa-Kincardine Railway and the AELR will result in works over, adjacent to, or potentially affecting, several significant hydrological features. The potential impacts of the proposals on water resources (surface water and groundwater) have been reviewed in this chapter.

Significant hydrological features include the main rivers that the railway crosses (the Rivers Forth, Devon and Black Devon), as well as a number of smaller burns and drains. The groundwater features of the area have been assessed to be of minor significance with respect to the proposed works.

Significant aspects of these features include their physical shape and form (geomorphology), the flow regime (hydrology), and their water quality characteristics.

Information on the baseline conditions of these aspects was gathered from SEPA flow and water quality records, site inspections, and liaison with several consultees (in particular SEPA, Clackmannanshire Council, Forth District Salmon Fisheries Board, and the Forth Estuary Forum).

The impact of the proposals on these aspects of the water resources was assessed. Both construction stage and operational impacts were considered. A number of impact categories were reviewed, and have been summarised in the table above.

The significance of the impacts was assessed over a range from 'Negligible' to 'Minor', 'Moderate', and then 'Substantial'. None of the potential impacts were assessed as being Substantial. Three impacts were assessed as Moderate, namely:

- § Potential construction stage impact of scour protection works to the River Devon crossing, mainly the potential for elevated flood risk to adjacent or upstream properties;
- § Potential alteration of geomorphological and hydrological features of the Brothie Burn due to construction of the Brothie Burn crossing (AELR), particularly noting the possible impedance of flow during construction works (AELR);
- § Potential for hydrological impacts to the Brothie Burn from the introduction of the surface water run off from the AELR.

All other potential impacts were assessed as ranging from Negligible to Minor / Moderate. This generally agrees with the assessment presented in the Ecology Chapter, which notes that impacts on watercourses and their resident aquatic species are generally minor. However, it is noted that there may be moderate impacts from the scheme on the fish of major watercourses, these impacts are fully discussed in the Ecology Chapter.

It is considered that all of the possible impacts may be either avoided completely, or their risk minimised, through good design and construction practices. The previous sections in regard to mitigation contain guidance on the aspects that should receive particular attention during design, construction, and operation of the proposals. All of the points noted are standard measures that would normally be considered during the development of a scheme of this nature, and therefore the assessment of the scheme's environmental effects has been made based on their incorporation.

## **13. TRAFFIC AND TRANSPORT**

### **13.1 Introduction**

Reopening of the Stirling – Alloa – Kincardine rail line would have a number of implications for traffic and transportation both regionally and locally. These would arise from the following:

- § Changes to passenger and freight train movements on the rail network;
- § Modal shift of passengers and freight from road to rail and thus a reduction in road vehicle movements;
- § Increased local traffic movements to the new Alloa Station;
- § Traffic routing changes caused by the level crossing closures and upgrades.

The existing arrangement for moving coal to Longannet Power Station, as described in Volume 1 Section 2, takes up train paths across the Forth Bridge and on rail lines between the Forth Bridge and Ayrshire, in the west of Scotland. Relief of these movements would allow an increased number of passenger train services or improved performance in terms of punctuality on both Fife and Edinburgh-Glasgow services both of which could result in the carriage of more passengers thereby reducing road movements. Whilst this is a benefit brought about by the Scheme it is not possible at present to calculate its magnitude.

The completion of the Stirling to Kincardine line would provide through paths to Dunfermline and beyond for other types of freight. This improves freight flexibility and thus assists in freight modal shift from road to rail. Again this has not been quantified in the ES.

The provision of a passenger service between Alloa and Stirling, and thus onward direct services to Glasgow, will inevitably cause some existing road journeys to be made by rail in future. However, the level of demand and service provision and the relatively limited number of parking spaces at Alloa Station suggests that this modal shift would be modest and it has not been quantified. On the same basis the increased road traffic to Alloa Station will be modest and is not expected to be significant.

The traffic route changes caused by the level crossing revisions is described in this chapter.

### **13.2 Methodology**

Information was collated during the EIA and was provided by the Scottish Executive and Clackmannanshire Council and was also based on the Scheme design for the level crossings and the AELR. The area of study was limited to the route of the Scheme and the surrounding local and trunk roads. The impact of the strategic road network was not quantified, as effects were not considered to be significant.

The assessment of the ‘magnitude of impact’ on traffic and transportation at the level crossings was based on a scale comprising:

- § ‘Negligible’ (the criteria being a gated level crossing for Longannet Power Station with very infrequent vehicular traffic movements);
- § ‘Slight’ (the criteria being a user worked level crossing with limited farm vehicular traffic movements);
- § ‘Moderate’ (the criteria being an automated barrier level crossing causing vehicular traffic to queue on a public road or a level crossing with suitable alternative routes);

š or ‘Severe’ (the criteria being a level crossing which is to be permanently closed to vehicular traffic without suitable alternative routes).

In addition, ‘Negligible’, ‘Minor’, ‘Moderate’ or ‘Substantial’ were used to describe the ‘significance of impact’ based on the scale given in Volume 1. If the impact on level crossings has a positive or negative effect, these are described as ‘adverse’ or ‘beneficial’.

### 13.3 Consultations

The organisations contacted with regard to traffic and transportation interests were:

- š Scottish Executive
- š Stirling, Clackmannanshire & Fife Local Planning Authorities

Other organisations and interested parties had the opportunities to make comments on the scope of the assessment, the existing environment, potential impacts and mitigation measures, at the series of public meetings and exhibitions held in September 2002.

A summary of the consultation responses is provided below:

- š Scottish Executive: On going consultations are required for the following trunk road issues: the crossing of the existing A876(T) in Kincardine to the east of Kincardine bridge, the potential conflict with the proposed Upper Forth Crossing at Kincardine and the potential traffic impact issues relating to the location and use of freight terminals in the first stage of the project. The subsequent creation of passenger terminals should have an overall beneficial impact on the trunk road traffic, but consultation on the proposed locations, and access to the trunk road network would be required;
- š Stirling Council: No specific comment on traffic and transportation issues;
- š Clackmannanshire Council: No specific comment on traffic and transportation issues. However, traffic flow forecasts were provided for the AELR;
- š Fife Council: The Local Plan as amended shows two alternative routes for the new Forth crossing at Kincardine but it is as yet not known which option the Scottish executive will select. The intention is for the Scottish Executive to construct a new road bridge across the Forth upstream of the existing Kincardine Bridge. In addition, traffic will be diverted onto a new bypass around the south-east perimeter of Kincardine, linking onto the existing Kincardine Bridge, and the bypass is expected to be open in 2004. Information was also provided on the Rosyth Port access strategy;
- š All transport organisations with an interest in the Scheme were consulted. Those who responded were Strathclyde Passenger Transport (SPT), the Institute of Transport and Logistics (ILT), Freightliner Group, English, Welsh and Scottish Railway Limited (EWS), First Bus Group, Virgin Trains, ScotRail, Rail Passenger Council, Stagecoach, TransForm Scotland and the Road Haulage Association. In general, most transport organisations were in favour of the route re-opening;
- š In terms of passenger services, some concern was expressed by SPT with regard to the possibility of overcrowding of trains by the time they called at SPT stations such as Croy, Bishopbriggs and Lenzie, further down the line. First Bus Group were concerned about possible abstraction from bus between Stirling and Alloa. Bus travel still has a major role to play in offering frequent, local and inexpensive transport within Clackmannanshire and Stirling and should integrate with rail travel. The ILT stressed the need for integration;
- š Re-opening of the route for freight traffic is welcomed by Freightliner, EWS, TransForm Scotland and ClydePort as it offers greater opportunities of inter-operability

- of rolling stock throughout the UK and presents opportunities for additional freight to be transported by rail;
- š ScottishPower provided information on the operation and frequency of coal haulage by road to Longannet Power Station.

## **13.4 Baseline**

### 13.4.1 Local Transport Policy

Local Transport Strategies, although not a statutory requirement for Local Authorities in Scotland, are used by the Scottish Executive to identify areas for transport improvement and would therefore expect authorities to produce and update them accordingly.

Guidance on the formulation and implementation of Local Transport Strategies has been produced in a number of documents including, ‘Local Transport Strategies – Preliminary Guidance’ (1998) and ‘Guidance on Local Transport Strategies and Road Traffic Reduction Reports’ (February 2000 – supersedes the 1991 document). The following documents have been prepared with respect to this guidance.

#### *Stirling Local Transport Strategy, 2000*

The aim of Stirling’s Local Transport Strategy is to support the integration of local democracy and participation; social inclusion; sustainability and the promotion of quality services, by co-ordinating the provision and designation of land-use and its relationship with transport infrastructure.

The Stirling-Alloa-Kincardine re-opening is supported within the strategy both with regard to freight and passenger movement. It is earmarked as an important requirement for the integration of public transport and as a tool for reducing the dependency on private car usage.

#### *Clackmannanshire Local Transport Strategy, 2000*

The Council’s draft Local Transport Strategy emphasises the point that at present, Clackmannanshire has no passenger or freight rail services. This is clearly an important factor in the negligible role that public methods of transport have in the strategic travel market.

The strategy therefore endorses the reopening of the Stirling-Alloa-Kincardine line for both freight and passenger services as a matter of regional and strategic importance. The Council’s key objectives for the future of rail transportation in the area are to see the implementation of the following services:

- š Stirling-Alloa-Kincardine-Dunfermline freight route;
- š Alloa to Glasgow passenger rail service (link from Alloa to existing service from Stirling to Glasgow);
- š Stirling-Alloa-Kincardine-Dunfermline passenger rail service.

The reopening of the Stirling-Alloa-Kincardine stretch of line is integral to support these proposals. Clackmannanshire Council believe that the reopening of the line would ease the pressure currently placed on the central Scotland rail network, especially the services that are dependent on the Forth Rail Bridge.

### *Fife Local Transport Strategy, 2000*

'A Way Ahead: essential choices for travelling in and around Fife,' is the Council's strategy towards providing an integrated transport system for the area. Developments that improve the provision of transport infrastructure are supported, due to the industrial nature of the south of Fife and the port at Rosyth handling large quantities of freight for transport.

Fife Council considers that the potential of freight activity in the south of Fife and at Rosyth is underused. Rosyth has the ability to grow as a freight hub for the Kingdom of Fife, region and country. This notion would be greatly supported by the Scheme's proposed additional movement of freight traffic. This is seen as a priority of the Council, which initially targeted 2003 for the reopening of the Dunfermline to Stirling line for freight traffic.

Fife Council also aims to promote greater use of medium and long distance journeys to and from Fife. As part of this aim, the Local Transport Strategy states that it is the Council's desire to see the Dunfermline-Alloa-Stirling line open for passenger traffic by 2020.

#### 13.4.2 Trunk and Surrounding Local Roads

The Scottish Executive recently published the Draft Road Orders for the Kincardine Eastern Link Road. The road is to act as a bypass to the east of Kincardine, redirecting traffic away from the Town Centre.

The Scottish Executive has recently announced the route of the proposed Upper Forth Crossing at Kincardine. The preferred route will start from the Bowtrees roundabout at the end of the M876, cross the River Forth as a single carriageway, passing through the disused coalyards of the former Kincardine Power Station, through the adjoining farmland and join the A977 in a double roundabout junction at Gartarry.

There is a network of regional and local roads, which serves the population and land uses adjacent to the Scheme as shown in Figure 13.1. The principal regional roads are the M9 (Edinburgh to Dunblane), M876 (linking M9 and M80) and M80 (Stirling to A80 at Longcroft), and the principal local roads are the A876 (Kincardine Bridge), A985 (Kincardine to Rosyth), A977 (Kincardine to Kinross), A907 (Stirling to Dunfermline), A908 (Alloa to Tillicoultry) and A91 (Stirling to Dollar and beyond).

#### 13.4.3 Freight Terminals

It is recognised that the re-opening of the Stirling-Alloa-Dunfermline railway line would enhance the potential for rail freight services at Rosyth Port. However, this is not considered further as there are no quantified proposals for these services.

#### 13.4.4 Alloa Eastern Link Road

This road is included in the Scheme proposals and is to be located to the east of Alloa.

#### 13.4.5 Alloa Station

Alloa Station is currently closed and the only vehicular access is from the A907 Ring Road to the boundary of the former Brewery site.

### 13.4.6 Level Crossings

The fourteen level crossings, including those at Longannet, over which there is vehicular access along the route of the Scheme are described in Table 13.1.

**Table 13.1: Existing Level Crossings**

<b>Location</b>	<b>Baseline</b>
Causewayhead Level Crossing	This is an existing level crossing, which is currently not used by railway traffic, with access to Causewayhead Road. It is estimated that as access is only required to serve the Kerr's scrap yard, there will be less than 100 vehicles movements per day.
Waterside Level Crossing	This is an existing level crossing at Ladysneuk Road, which allows access from the A907 to the residential settlement of Cambuskenneth and is currently not used by railway traffic. Traffic levels are in the region of 1100 vehicles per day (2002).
Abbeycraig Level Crossing	This is an existing level crossing, which allows access from the A907 to the Broom Farm properties and is currently not used by railway traffic. Traffic levels are in the region of 150 vehicle per day (2002).
Manor Neuk Level crossing	This is an existing user worked level crossing which allows access from the former A907 and the farm to the agricultural land on the south of the railway and is currently not used by railway traffic. Traffic levels are less 50 vehicle per day (2002).
Manor Powis Level Crossing	This is an existing open level crossing which allows access from the A907 to the land on the south of the railway which is currently used temporarily for motor sports, but may be used as Landfill site in the future. Traffic levels are less 100 vehicle per day (2002).
Blackgrange Level Crossing	This is an existing level crossing and is currently not used by railway traffic. It provides access to the existing Diageo bonded warehouse and the poultry and other farms with a flow of 1,400 vehicle movements per day (2002) The flow will have a high proportion of HGV linked to the nature of the land use.
New Mills Level Crossing	This is an existing open level crossing which provides pedestrian and emergency vehicular access for Diageo from the A907 to the river on the south of the railway and is currently not used by railway traffic.
Cambus Road Level Crossing	This is an existing level crossing and is currently not used by railway traffic. It provides access across Station Road. Traffic levels less 250 vehicle per day (2002).
Grange Road Level Crossing	This is an existing level crossing at Grange Road with access to the A907, has traffic levels in the region of 4,400 vehicles per day (2002) and is currently not used by railway traffic. There is high number of school children movements over the level crossing due to the close proximity to Primary school to the south of level crossing.
Hilton Road Level Crossing	This is an existing level crossing at Hilton Road with access from the A907 to the northern part of Alloa, and is currently not used by railway traffic. The crossing is busy with flow in order of 9,100 vehicle movements per day (2002) there is potential for periods of increased use due to the Alloa Athletic Football ground being located to the west of Hilton Road, with a capacity of 3100 supporters.
Hilton Farm Level Crossing	This is an existing level crossing with access from the A907 to Hilton Farm, and is currently not used by railway traffic. There is no traffic survey information at this location.
Station Road, Kincardine Level Crossing	This is an existing user worked level crossing on Station Road giving access to Kincardine in the north and to the pier and to the former power station in the south, and is currently used by railway freight traffic.

**Table 13.1: Continued**

<b>Location</b>	<b>Baseline</b>
Longannet Power Station West Arrival Level Crossing	This is an existing private vehicular level crossing managed by Scottish Power at Longannet giving access to the Power Station, and is currently used by railway freight traffic. There is currently low vehicular usage.
Longannet Power Station West Departure Level Crossing	This is an existing private vehicular level crossing managed by Scottish Power at Longannet giving egress to the Power Station, and is currently used by railway freight traffic. There is currently low vehicular usage.

## **13.5 Environmental Effects**

### 13.5.1 Effects of Construction

The effects of construction on the trunk and surrounding local road network, Alloa Station, Alloa East Link Road and level crossings are included, where applicable, in the other topic construction sections in ES Volume 2.

### 13.5.2 Effects of Operation

#### *Trunk and surrounding Local Roads*

The operation of the railway may reduce the number of lorries supplying coal to Longannet Power Station by up to approximately 416 per day if the coal will instead be transported by rail. This would result in a permanent beneficial impact from the reduction of this number of coal carrying vehicles on the trunk and surrounding road network. The majority of the coal for Longannet Power Station comes from Ayrshire in the west, the A80/M80/M876/A985 being the principal route on which the coal is currently hauled. This is the route, therefore, that would experience the greatest reduction in coal carrying road vehicles of approximately 184,704 HDV's (Heavy Duty Vehicles) per year two-way flow. However, coal also comes from Rosyth Port along the A985, which will also benefit and will experience a reduction in coal carrying road vehicles of approximately 74,880 HDV's per year two way flow.

#### *Alloa East Link Road*

The operational traffic effects resulting from the AELR can be seen below in Table 13.2. The operation of the AELR will have overall a significant permanent/positive effect on traffic flows on Hilton Road and on Clackmannan Road, east and west of the junction with Hilton Road. Whins Road and Carsebridge Road to the north are unaffected.

**Table 13.2: Alloa Eastern Link Road Operational Traffic Effects**

Scenario	Road	2 way (24 hr)	% HGV	Speed (km/hr)	% change
<b>2002 CURRENT BASELINE</b>	Hilton Rd	8424	6	55	
	Clackmannan East	24336	8	53	
	Clackmannan West	15317	8	53	
	AELR	0	8	60	
<i>2005 BASELINE</i>	Hilton Rd	8821	6	55	
<b>Year of opening</b>	Clackmannan East	25480	8	53	
<b>without houses</b>	Clackmannan West	16037	8	53	
	AELR	N/A	N/A	N/A	
<i>2005 BASELINE</i>	Hilton Rd	9521	6	55	
<b>Year of opening</b>	Clackmannan East	25830	8	53	
<b>With houses</b>	Clackmannan West	16387	8	53	
<i>2020 BASELINE</i>	Hilton Rd	10269	6	55	
<b>15 yrs after opening</b>	Clackmannan East	29659	8	53	
<b>without houses</b>	Clackmannan West	18668	8	53	
<i>2020 BASELINE</i>	Hilton Rd	11083	6	55	
<b>15 yrs after opening</b>	Clackmannan East	30067	8	53	
<b>With houses</b>	Clackmannan West	19076	8	53	
<i>2005 OPERATION</i>	Hilton Rd	862	6	55	-90.2
<b>Year of opening</b>	Clackmannan East	17606	8	53	-30.9
<b>without houses</b>	Clackmannan West	16650	8	53	+3.7
	AELR	9410	8	60	
<i>2005 OPERATION</i>	Hilton Rd	862	6	55	-90.9
<b>Year of opening</b>	Clackmannan East	21020	8	53	-18.6
<b>with houses</b>	Clackmannan West	20097	8	53	+22.6
	AELR	12856	8	60	
<b>2020 OPERATION</b>	Hilton Rd	1004	6	55	-90.2
<b>15 yrs after opening</b>	Clackmannan East	18436	8	53	-37.8
<b>without houses</b>	Clackmannan West	19381	8	53	+3.8
	AELR	10954	8	60	
<b>2020 OPERATION</b>	Hilton Rd	1004	6	55	-90.9



**Table 13.2: Continued**

Scenario	Road	2 way (24 hr)	% HGV	Speed (km/hr)	% change
<b>15 yrs after opening</b>	Clackmannan East	24506	8	53	-18.5
<b>With houses</b>	Clackmannan West	23594	8	53	+23.7
	AELR	14965	8	60	

NB. Hilton Road has a weight restriction of 7.5 tonnes.

Source: Clackmannanshire Council.

#### *Alloa Station*

Vehicular modal shift from road to rail information was not available. However, there are 56 car parking spaces to be provided at the station in the Scheme based on an estimate of the likely requirement for parking provision from the Stirling-Alloa Kincardine Rail Line re-opening Benefit Study, Final Report, MVA (February 2002), an appreciation of local conditions and the likelihood of various land use changes/alterations envisaged over the next few years, and it can therefore be assumed that at least this amount of traffic will be generated which will need to access the surrounding road network. This will result in some permanent impacts on the surrounding road network but as detailed figures are not available it is assumed, that in view of the small number of parking spaces to be provided at the station, the impacts will be minor adverse. More importantly, the Scheme will result in modal shift of passengers from car to train as a result of the introduction of the train service to Stirling (hourly service with 17 passenger trains in each direction per day, Mon-Sat) and the potential for onward travel.

#### *Level Crossings*

The significance of the effects of the Scheme on level crossings over which there is vehicular access along the route of the Scheme is described in Table 13.3.

**Table 13.3: Significance of Level Crossing Effects**

<b>Location and proposal</b>	<b>Effect of operation</b>	<b>Magnitude of impact</b>	<b>Significance of impact</b>	<b>Mitigation</b>
Causewayhead Level Crossing – to be permanently closed	The permanent level crossing closure would result in severance and a journey time penalty for the Kerr’s scrap yard requiring up to an additional approximate 1.1km vehicular journey length.	Moderate	Moderate adverse	A new junction is to be constructed off Ladysneuk Road providing access to the area to the south of the railway including the Kerr’s scrap yard.
Waterside Level Crossing – to be retained and upgraded	Traffic will queue at the crossing during barrier down times. This will be a permanent effect. In addition, the closure of the Causewayhead Level Crossing will cause the displacement of about 100 vehicles onto Ladysneuk Road per day. Furthermore, the closure of Abbeycraig Level crossing will increase the flow on Ladysneuk Road in the order 150 vehicles movements per day. The cumulative effect would be to increase the flow to 1350 vehicles per day on Ladysneuk Road.	Moderate	Slight adverse	An automatic half barrier is proposed which will regulate traffic movements to facilitate controlled vehicular crossing of the railway.
Abbeycraig Level Crossing – to be permanently closed	The permanent level crossing closure would result in severance and a journey time penalty to the Broom farm properties and the Abbeycraig level crossing house requiring up to an additional approximate 1.2km vehicular journey length.	Moderate	Moderate adverse	A new road is to be constructed off Ladysneuk Road providing access to the Broom Farm properties.
Manor Neuk Level crossing– to be retained and upgraded	Level crossing is to be user worked and with the operation of the railway, there will be limited farm traffic queuing whilst trains pass the crossing. This will be a permanent effect.	Slight	Negligible	An user worked barrier is proposed which will regulate farm traffic movements to facilitate controlled vehicular crossing of the railway.
Manor Powis Level Crossing– to be retained and upgraded	There will be limited traffic queuing at the crossing during barrier down times. This will be a permanent effect.	Slight	Negligible	An user worked barrier is proposed which will regulate traffic movements to facilitate controlled vehicular crossing of the railway.
Blackgrange Level Crossing– to be retained and upgraded	Traffic will queue at the crossing during barrier down times. This will be a permanent effect.	Slight	Minor adverse	An automatic half barrier is proposed which will regulate traffic movements to facilitate controlled vehicular crossing of the railway.
New Mills Level Crossing – to be permanently closed	The permanent level crossing closure would result in severance of access and a journey time penalty to the river requiring up to an additional approximate 1.0km vehicular journey length.	Moderate	Minor adverse	Closure would cause minimal severance issues as access can be gained to the river via the Cambus Station Road Level Crossing and Devon Place.

**Table 13.3: Continued**

<b>Location and proposal</b>	<b>Effect of operation</b>	<b>Magnitude of impact</b>	<b>Significance of impact</b>	<b>Mitigation</b>
Cambus Level Crossing – to be retained and upgraded	Traffic will queue at the crossing during barrier down times. This will be a permanent effect.	Moderate	Minor adverse	An automatic half barrier is proposed which will regulate traffic movements to facilitate controlled vehicular crossing of the railway.
Grange Road Level Crossing – to be permanently closed	The permanent level crossing closure would result in severance to Grange Road south of the railway requiring an additional vehicular journey length of up to 1.6km. Residents in Grange Road would benefit from the large reduction in through traffic.	Moderate	Moderate adverse	A new Alloa West Link Road has been constructed off the A907 providing vehicular access to the area to the south of the railway including to Grange Road via Riverbank Estate. In addition, a new pedestrian bridge is proposed to be provided to give access over the railway at Grange Road.
Hilton Road Level Crossing – to be permanently closed	The permanent level crossing closure would result in severance to the A907 and to the northern part of Alloa. A journey time penalty of up to 1.9km may occur for some current users of the level crossing, but mainly only those whose journeys start or finish in Hilton Road or Clackmannan Road close to the level crossing. The alternative roads, especially the AELR, generally provide equally convenient, or more convenient routes.  Hilton Road residents would benefit significantly from the large reduction in vehicle movements along the road.	Severe (for limited number of users)	Minor-Moderate adverse	A new Alloa East Link Road, which will remove the main through traffic on Hilton Road, is to be constructed between the A907 and Carsebridge Road providing access to the area to the north and south of the railway including to giving access to Hilton Road via Carsebridge Road. A new pedestrian bridge is to be provided across Hilton Road.
Hilton Farm Level Crossing – to be permanently closed	The permanent level crossing closure would result in severance but the existing track access from Carsebridge Road will still remain open which also gives access to Hilton Farm requiring up to an additional approximate 0.8km – 2.5km vehicular journey length depending on proposed AELR travel direction.	Moderate	Minor adverse	A new Alloa East Link Road is to be constructed between the A907 and Carsebridge Road, from which access to Hilton Farm will be provided. In addition, the existing track access from Carsebridge Road will still remain open but connected to the new access track from the AELR
Station Road, Kincardine Level Crossing – to be retained and upgraded	Traffic will continue to queue at the crossing during barrier down times, which will increase in frequency. This will be a permanent effect.	Moderate	Minor adverse	The level crossing is to be upgraded with an Automatic Half Barrier Crossing, Locally Monitored (ABCL) style of level crossing. This will regulate traffic movements to facilitate controlled vehicular crossing of the railway.

**Table 13.3: Continued**

<b>Location and proposal</b>	<b>Effect of operation</b>	<b>Magnitude of impact</b>	<b>Significance of impact</b>	<b>Mitigation</b>
Longannet Power Station West Arrival Level Crossing – to be retained and upgraded	With the continuing operation of the railway with increased freight frequency, traffic will queue at the crossing during gate closure times. This will be a permanent effect.	Negligible	Negligible	The level crossing is to be upgraded with the provision of a gate, telephone, some minor re-grading of the approach road and vegetation clearance. This will continue to regulate traffic movements to facilitate controlled vehicular crossing of the railway.
Longannet Power Station West Departure Level Crossing – to be retained and upgraded	With the continuing operation of the railway with increased freight frequency, traffic will queue at the crossing during gate closure times. This will be a permanent effect.	Negligible	Negligible	The level crossing is to be upgraded with the provision of a gate, telephone, some minor re-grading of the approach road and vegetation clearance. This will continue to regulate traffic movements to facilitate controlled vehicular crossing of the railway.

## 13.6 Mitigation

### *Interface with Kincardine Eastern Link Road*

Although the proposed Kincardine Eastern Link Road does not directly affect the railway, careful consideration needs to be given during construction at its junction with the A876 at Kincardine Bridge, which is in close proximity to the railway at this location. In addition, the design of the proposed Upper Forth Crossing at Kincardine will need to consider both construction and operational issues to ensure that there will be no adverse impacts on the Scheme. On the basis of the available information the Scheme has taken account of these two proposals.

### *Alloa East Link Road and Alloa Station*

The AELR and Alloa Station are part of the Scheme and have been designed to carry the predicted traffic flows to mitigate adverse traffic and transportation impacts.

### *Level Crossings*

Details of the mitigation measures proposed for the level crossings are described in Table 13.3.

## 13.7 Summary

The Scheme proposals are likely to have a beneficial effect on the trunk and surrounding road network especially on the A876 and A985 at Kincardine with a significant reduction in the number of lorries supplying coal to Longannet Power Station. The modal shift from car to train following the introduction of the new passenger service will also benefit the trunk and surrounding road network including the A907.

The proposed AELR will take traffic off Hilton Road and provide an alternative route from the A907 to the Carsebridge Road roundabout. In addition, six of the fourteen level crossings will be closed and alternative provision has been made to accommodate affected traffic movements.