13 Road Drainage and the Water Environment

13.1 Introduction

This section details the road drainage and water environment assessment undertaken in relation to the proposed scheme following the guidelines set out in Part 10, Volume 11 of the DMRB (Ha 216/06, May 2006).

An assessment of impacts on water quality and drainage during the construction period is undertaken in Section 15 – Disruption Due to Construction.

13.2 Methods

13.2.1 Baseline Methods

Areas of water quality and/or drainage importance have been identified from the results of a desk study and from consultations with the Scottish Environmental Protection Agency (SEPA), Scottish Natural Heritage (SNH), the Tweed Foundation and SBC.

A plan of the study area showing the locations of watercourses is provided in Figure 13.1.

13.2.2 Impact Assessment Methods

This assessment has been carried out using the guidelines set out in HA216/06, Part 10, Volume 11 of the DMRB and the procedures set out in CIRIA. Report 142.

As outlined in Chapter 4 (Approach and Methods) of this report, impacts upon road drainage and the water environment were considered in terms of both the site value/sensitivity (i.e. importance) and the magnitude of impact. The significance of predicted impacts was then determined through a combination of site value (Table 13.1) and impact magnitude (Table 13.2) as detailed in Table 13.3 below.

Importance of Water Environment Attribute

The importance of each water environment attribute was determined following the criteria detailed in Table 13.1 below.

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Table 13.1. Criteria for Estimating the Importance of Water Environment Attributes.

Importance	Criteria	Typical Examples	
Very High	Attribute has a high quality and rarity on regional or national scale.	Surface Water:	EC Designated Salmonid/Cyprinid fishery. RQO River Ecosystem Class RE1. SEPA River Classification Scheme Class A1. Site protected under EU or UK wildlife legislation (Special Areas of Conservation (SAC including candidate sites), Special Protection Areas (SPA), Sites of Special Scientific Interest (SSSI), Ramsar site).
		Groundwater:	Major aquifer providing a regionally important resource or supporting site protected under wildlife legislation.Source Protection Zone (SPZ) I
		Flood Risk:	Flood plain or defence protecting more than 100 residential properties from flooding
High	Attribute has a high quality and rarity on local scale.	Surface Water:	RQO River Ecosystem Class RE2. SEPA River Classification Scheme Class A2. Major Cyprinid Fishery. Species protected under EU or UK wildlife legislation.
		Groundwater:	Major aquifer providing locally important resource or supporting river ecosystem. SPZ II.
		Flood Risk:	Flood plain or defence protecting between 1 and 100 residential properties or industrial properties from flooding.
Medium	Attribute has a medium quality and rarity on local scale.	Surface Water:	RQO River Ecosystem Class RE3 or RE4. SEPA River Classification Scheme Class B.
		Groundwater:	Aquifer providing water for agricultural or industrial use with limited connection to surface water. SPZ III
		Flood Risk:	Flood plain or defence protecting 10 or fewer industrial properties from flooding.
Low	Attribute has a low quality and rarity on local scale.	Surface Water:	RQO River Ecosystem Class RE5. SEPA River Classification Scheme Class C or D.
		Groundwater:	Non-aquifer.
		Flood Risk:	Flood plain with limited constraints and a low probability of flooding of residential and industrial properties.

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Magnitude of an Impact on an Attribute

The magnitude of impact on each attribute was determined following the criteria detailed in Table 13.2 below.

Table 13.2. Criteria for Estimating the Magnitude of an Impact on an Attribute.

Magnitude	Criteria	Typical Example
Major Adverse	Results in loss of attribute and/or quality and integrity of the attribute.	Surface Water: Potential high risk in Method A (HA216/06 Annex I) and potential failure of Total Zinc and Dissolved Copper in Method B. Calculated risk of pollution from an accidental spillage > 2% annually (Method D HA216/06 Annex I). Loss or extensive change to a fishery. Loss or extensive change to a Nature Conservation Site. Groundwater: Loss of an aquifer. Potential high risk in Method C (HA216/06 Annex I) of pollution to groundwater from routine runoff - risk score > 250. Calculated risk of pollution from accidental spillages > 2% annually (Method D HA216/06 Annex I). Flood Risk: Increase in peak flood level (1% annual probability) > 100mm (Methods E & F HA216/06 Annex I).
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute.	Surface Water: Potential high risk in Method A (HA216/06 Annex I) and either potential failure of Total Zinc or Dissolved Copper in Method B. Calculated risk of pollution from an accidental spillage > 1% annually and < 2% annually (Method D HA216/06 Annex I). Partial loss in productivity of a fishery. Groundwater: Partial loss or change to an aquifer. Potential medium risk, in Method C (HA216/06 Annex I), of pollution to groundwater from routine runoff – risk score 150-250. Calculated risk of pollution from accidental spillages > 1% annually and < 2% annually (Method D HA216/06 Annex I). Flood Risk: Increase in peak flood level (1% annual probability) > 50mm (Methods E & F HA216/06 Annex I).
Minor Adverse	Results in some measurable change in attribute quality or vulnerability.	Surface Water: Potential high risk in Method A (HA216/06 Annex I) and no change in Total Zinc and Dissolved Copper in Method B (Annex I). Calculated risk of pollution from accidental spillages > 0.5% annually and < 1% annually (Method D HA216/06 Annex I). Groundwater: Potential low risk, in Method C (HA216/06 Annex I), of pollution to groundwater from routine runoff - risk score <150. Calculated risk of pollution from accidental spillages > 0.5% annually and < 1% annually (Method D HA216/06 Annex I). Flood Risk: Increase in peak flood level (1% annual probability) > 10mm (Methods E & F HA216/06 Annex I).

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Magnitude	Criteria	Typical Example
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity.	The proposed scheme is unlikely to affect the integrity of the water environment. Surface Water: Low risk in Method A (HA216/06 Annex I) and risk of pollution from accidental spillages < 0.5%. Groundwater: No measurable impact upon an aquifer and risk of pollution from accidental spillages < 0.5%. Flood Risk: Negligible change in peak flood level (1% annual probability) < +/- 10mm.
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring.	Surface Water: Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually) (Method D HA216/06 Annex I). Groundwater: Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk <1% annually) (Method D HA216/06 Annex I). Flood Risk: Reduction in peak flood level (1% annual probability) > 10mm (Methods E & F HA216/06 Annex I).
Moderate Beneficial	Results in moderate improvement of attribute quality.	Surface Water: Calculated reduction in existing spillage by 50% or more (when existing spillage risk > 1% annually) (Method D HA216/06 Annex I). Groundwater: Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually) (Method D HA216/06 Annex I). Flood Risk: Reduction in peak flood level (1% annual probability) > 50mm (Methods E & F HA216/06 Annex I).
Major Beneficial	Results in major improvement of attribute quality.	Surface Water: Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse. Groundwater: Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring. Recharge of an aquifer. Flood Risk: Reduction in peak flood level (1% annual probability) > 100mm (Methods E & F HA216/06 Annex I).

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Impact Significance

The significance of impact (beneficial and adverse) was determined as a combination of the value of the site and the magnitude of impact as shown in Table 13.3 below.

Table 13.3. Estimating the Significance of Potential Effects.

		SIGNIFICANCE OF POTENTIAL EFFECTS			
		MAGNITUDE OF IMPACT			
		Major	Moderate	Minor	Negligible
IMPORTANCE OF ATTRIBUTE	Very High	Very Large	Large/Very Large	Moderate/Large	Neutral
	High	Large/Very Large	Moderate/Large	Slight/Moderate	Neutral
	Medium	Large	Moderate	Slight	Neutral
	Low	Slight/Moderate	Slight	Neutral	Neutral

13.3 Baseline Conditions

13.3.1 Road Drainage

The Soutra South climbing lane is kerbed with gullies on both sides of the road. On the east side the gullies connect into a sealed drain and associated manholes which outfall into the Headshaw Burn at the bottom of the hill. On the west side of the climbing lane the gullies connect into a stone filter drain and associated catch pits. The drain crosses the A68 onto the east side at the bottom of the hill. This drain also outfalls into the Headshaw Burn.

The section of road between the bottom of the climbing lane and the Carfraemill DAL is the oldest section of road. The road is kerbed with gullies. On areas of embankment the gullies discharge direct onto adjacent fields and in areas of cut, it is likely that they connect into a collector drain, which eventually discharges onto the fields. Surface water runs off the high ground on the east side of the trunk road. This run off is interrupted by the trunk road. Therefore it is likely that there are stone conduits, which take this run off under the road. It is possible that these conduits form part of an old field drainage system and they may extend through to the Leader Water.

The Carfraemill Roundabout and DAL were constructed in 1993. The DAL has 1m hard strips and drainage is over the edge into stone filter drains and associated catch pits. The roundabout is kerbed with gullies, which connect into a sealed drain and associated manholes. The roundabout also has fin drains to drain the unbound materials of the road construction which connect into the manholes. All of the road drainage connects into an outfall, which discharges direct into the Leader Water opposite Carfraemill Roundabout.

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Although categorised as being of excellent / good water quality, the existing drainage systems are potentially affecting the baseline water quality of the Headshaw Burn and Leader Water. The current arrangement:-

- provides minimal treatment of pollutants normally found in carriageway run-off;
- provides minimal control of surface water run off rates; and
- does not allow for emergency spillage containment.

13.3.2 Surface Water

The main watercourse within the vicinity of the proposed scheme is the Headshaw Burn. Flowing generally in a southeasterly direction, it is located on the east side of the A68 at the northern end of the road improvement scheme in close proximity to the road, crossing to the west side just south of the C83 Kirktonhill junction. Approximately 50 metres downstream of the crossing point, it diverges away from the road to converge with Mountmill Burn where it then becomes the Leader Water. The Leader Water flows, in a general southeasterly direction, roughly parallel with the A68, at an offset of between 250m and 100m. There is a small un-named burn which joins the Leader Water from the northern side of the road, 50 metres west of Carfraemill Roundabout. The Leader Water is then joined on the east side by the Kelphope Burn, south of Carfraemill Roundabout.

SEPA has advised that the Water Quality Classification of Mountmill Burn is A1 (excellent) and that of the Leader Water below the confluence of the Mountmill Burn is Class A2 (very good). The Headshaw Burn is not classified but SEPA suggest it may be assumed that the water quality will be A1/A2. SEPA suggest that, in terms of the Water Framework Directive criteria, given the high water quality and the remoteness of the watercourses from population centres they are assumed to be of high/pristine status.

SEPA also provided details of the concentrations of dissolved copper and total zinc as set out in their Environmental Quality Standard (EQS). These levels are 3µg/l for dissolved copper and 15µg/l for total zinc. The 95th %ile flows (Q_{95}) for the Leader Water and the Headshaw Burn were also provided by SEPA and are 0.087 m^3/s and 0.043 m^3/s respectively. This information is used in the Water Quality Prediction calculations, discussed in Section 13.4.1 below (and presented in Appendix 13).

The Leader Water, Headshaw Burn and Mountmill Burn are included in the River Tweed SAC, designated under the EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna. The River Tweed is also a SSSI. The Tweed Foundation has confirmed that the Leader Water in the Oxton area contains salmon, brown trout and is likely to contain lamprey, and this is reflected by the A1/A2 water classification. Fish and associated ecological interests, including the fluvial geomorphology of the Headshaw Burn, are discussed in more detail in Chapter 8 (Ecology and Nature Conservation) and Appendices 9 and 10.

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Therefore, in accordance with Table 13.1, the Headshaw Burn and the Leader Water are assessed as **very high** value.

13.3.3 Groundwater

SEPA has indicated that in terms of ground water protection, the area in the vicinity of the proposed scheme is of medium vulnerability. This corresponds to Chapter 14 (Geology and Soils) which describes the drift strata as alluvial and boulder clay deposits overlying mainly sedimentary rocks. The lower Devonian conglomerate strata are locally important aquifers where the flow of groundwater is primarily in fissures and other discontinuities.

A borehole is known to be located at NGR 351100 653500 (Carfraemill Borehole), approximately 450m east north east of the Oxton Junction. The borehole is believed to be in use for water extraction, installed in the Lower Devonian strata and to have a rest water level of 1.25m above ground level (agl) due to artesian conditions. SEPA are not aware of any other boreholes within 2km radius of the site. It should be noted that although an abstraction-licensing regime is now in place in Scotland (The Water Environment (Controlled Activities) (Scotland) Regulations 2005), SEPA may not yet be aware of all abstractions in the vicinity of the site (operators of abstractions of <10m^3/day are not required to contact SEPA if they comply with the General Binding Rules (GBR).

There are no other reported private water supplies, sensitive to water pollution, in the area.

Chapter 14 (Geology and Soils) reports that from the Geotechnical Investigations undertaken in September / October 2005 and October 2007, the mean water levels are around 3m below ground level (bgl).

In accordance with Table 13.1, the groundwater is assessed as being of **medium importance.**

13.3.3 Flooding

Figure 13.2 shows SEPA's indicative river flooding map for the area. It shows the flood outline for an event with a 0.5% annual probability of occurrence. Although this mapping is only indicative, it is used as the basis for further investigation.

SEPA's mapping shows that there are flood plains associated with the Headshaw Burn, Mountmill Burn and the Leader Water. The flood plain associated with the Headshaw Burn currently affects the agricultural field adjacent to the southbound lane of the A68. The landowner for this area has indicated that approximately every 5 years the Headshaw Burn bursts its banks immediately north of Annfield bridge, which results in the field adjacent to the southbound lane of the A68 becoming flooded. The floodwater then follows the A68 southeast until the level of the road falls below the level of the flooded field. At this point the water has been known to cross the A68, approximately

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250 metres south of Annfield Bridge, into the farmland adjacent to the northbound lane of the A68.

The other potential flood risk areas do not affect the immediate A68 corridor within the scheme limits as there is a two to four metre level difference between the risk area and the carriageway. The remaining land within the indicative flood plain is agricultural land (see Chapter 7 – Land Use) and as there is a low probability of residential and industrial properties flooding, the Importance of Flood Risk is assessed, in accordance with Table 13.1, as being **low.**

13.3.4 Accidental Spillage

On any traffic carrying road there is the potential for the pollution of watercourses and groundwater supplies from accidental spillages of harmful chemicals and materials caused by road traffic accidents.

Calculations for the probability of a serious accidental spillage on any length of road are based on traffic flows, percentage of Heavy Goods Vehicles (HGV) and the layout of the carriageway and its junctions. The probability of a serious accidental spillage occurring in the design year (2025) with the existing road configuration in place has been calculated using the equation given in Annex I, HA216/06 Method D. The calculation sheet is provided in Appendix 14 and the results are summarised in Table 13.4 below.

Table 13.4. Assessment of Pollution Impacts from Accidental Spillages.

Option	Risk	Return Period
Existing Road Configuration	1.79×10^{-4}/year	5586

The DMRB indicates that the acceptable risk of a pollution incident should normally be 1 in 100 years for discharges to aquifers and to reaches of sensitive watercourses.

The return period of 1 in 5586 years therefore indicates that the risk of pollution as a result of the existing road configuration is below any level that would be significant.

As an accidental spillage incident would impact on the surface water and groundwater attributes of this site, the importance of each will be used when assessing the predicted impact significance.

13.4 Assessment of Impacts

This section provides a discussion of potential effects occurring during the operation of the proposed new road alignment in accordance with the requirement of the DMRB. Impacts associated with the construction phase are outlined in Chapter 15 (Disruption due to Construction). In addition, potential impacts relating to fish and other species that utilise the aquatic environment are discussed in Chapter 8 (Ecology and Nature

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13.4.1 Road Drainage

The scheme would result in an increase in road surface area through the widening of the existing mainline and the introduction of the proposed new side road.

In addition to widening the existing A68, the C83 and D47/5 junctions will be stopped up and the D47/5 will be realigned with a new junction provided approximately 100m south of the existing junction. This will maintain access onto the A68 for vehicles on the east side of the road. On the west side of the A68, a new side road will be provided between the existing C84 and C83 side roads. This will avoid traffic on the west of the A68 having to access the A68 via Oxton.

Potential impacts on the water resources of the study area may result through increases in road run-off volumes due to the increase in surface area. The Headshaw Burn and the Leader Water (part of the River Tweed SAC/SSSI) were identified as the most vulnerable hydrological features within the study area as they are in close proximity to the proposed scheme and will form part of the drainage network. However, increases in run-off volumes are not anticipated to be large enough (negligible impact) to affect the water courses, field drainage or to instigate localised flooding.

Following the methodology of Method A in HA216/06, a Simple Assessment of Pollution Impacts from Routine Runoff was carried out for the existing and proposed road configurations in the design year (2025). Copies of the calculation sheets are given in Appendix 13 and the results are summarised in Table 13.5 below.

Table 13.5. Simple Assessment of Pollution Impacts from Routine Runoff.

	Watercourse	Watercourse 95th%tile Flow (V_R)	Road Runoff Flow (V_H)	Dilution (V_R / V_H)
Existing Conditions	Leader Water	7516	68.9	109
	Headshaw Burn	3749	35.1	107
Proposed Scheme	Leader Water	7516	135.2	55.6
	Headshaw Burn	3749	59.2	63.4

In accordance with Figure A.2 in HA216/06, a watercourse of Class A1, with a design year (2025) AADT flow of 11,748 vehicles and a dilution of more than 5.6 times, does not require any further assessment to be undertaken.

Therefore with the results for the proposed scheme showing a minimum dilution of 55.6, it is evident that no further assessment of the Pollution Impacts from Routine Runoff is required.

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However for completeness, although not strictly required, the calculation sheets contained in Appendix 13 also include the Water Quality Prediction Calculations for both the existing and proposed road configurations. The results of the calculations are given in Table 13.6 below.

Table 13.6. Water Quality Prediction.

	Watercourse	Pollutant	
		Dissolved Copper	Total Zinc
Existing Conditions	Leader Water	2.1 µg/l	9.3 µg/l
	Headshaw Burn	2.1 µg/l	9.4 µg/l
Proposed Scheme	Leader Water	2.6 µg/l	11.1 µg/l
	Headshaw Burn	2.5 µg/l	10.7 µg/l
	Environmental Quality Standard (EQS)	**3.0 µg/l**	**15.0 µg/l**

It can be seen from these results that the calculated levels of dissolved copper and total zinc for the proposed scheme in the design year (2025) are not significantly greater than that of the existing configuration and are less than the EQS. These results tie in well with the statement in the DMRB that a route with less than 15,000 AADT is unlikely to have any noticeable effects on receiving water quality.

Although the Headshaw Burn and the Leader Water are of excellent to good quality (A1/A2 classification) and are consequently assessed as being of very high sensitivity, the potential magnitude of impact on water quality as a result of pollutant run-off is concluded to be **negligible adverse**. These factors combine together to give a **neutral** impact significance.

Local fish populations within the watercourses are not anticipated to be impacted due to the potential for dilution and dispersion of any small amounts of polluted run-off prior to reaching the water, although this is addressed in detail within Chapter 8 (Ecology and Nature Conservation).

Potential effects on water quality due to physical disruption to watercourses are discussed below in Section 13.4.3.

In terms of groundwater, the risk of groundwater impacts have been assessed in accordance with Method C of HA216/06, Annex 1. The results of this assessment are provided in Appendix 15 and discussed below.

The score of 190 shows that the risk of impact of pollution on groundwater is **medium**, which in accordance with Table 13.2 equates to a **moderate adverse** magnitude of impact. Therefore when combined with medium importance value gives an overall **moderate adverse** impact significance.

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This however does not take into account the impact that the existing road drainage has on groundwater. With the absence of SUDS, the existing road drainage already has a **moderate adverse** impact significance on the groundwater. The proposed installation of stone filter drainage, a swale and a pond will improve the existing drainage regime and provide the opportunity to prevent pollutants from entering the groundwater table.

The impact of the scheme on existing groundwater resources is therefore considered to be of **negligible beneficial** magnitude with an overall **neutral** impact significance.

13.4.2 Accidental Spillage

As detailed in Section 13.3.5, the probability of an accidental spillage on any length of road is dependant on traffic flow, HGV percentages and the layout of the carriageway and junctions.

Similar to that carried out for the existing situation in Section 13.3.5, the probability of a serious accidental spillage occurring with the proposed scheme in place has been calculated using the equation given in Annex 1,HA216/06 method D – "Assessment of Pollution Impacts from Accidental Spillages". The calculation is given in Appendix 14 and the results are shown in Table 13.7 below.

Table 13.7. Assessment of Pollution Impacts from Accidental Spillage.

Option	Risk	Return Period
Proposed Scheme	1.69×10^{-4}/year	5579 years

As mentioned in section 13.3.5, the DMRB indicates that a return period of 1 in 100 years indicates an acceptable risk for discharges to aquifers and to reaches of sensitive watercourses. The magnitude of impact compared to existing situation is considered to be **negligible adverse**, therefore the overall impacts on both the groundwater and surface water attributes of this site are **neutral**.

13.4.3 Physical Disturbance to Surface Waters

Bridge Extension

As the scheme involves widening the existing A68 carriageway, an extension of the existing Annfield Bridge over the Headshaw Burn will be required. Potential impacts on water quality, water flow dynamics and the passage of migratory fish generated by this widening work will occur only during the construction period. Mitigation measures will be in place to minimise these potential impacts, as discussed in paragraph 13.5. Once fully constructed, the bridge extension will have no significant impact on either the water quality of the burn or the drainage of the area. An assessment of potential impacts on water quality and drainage as a consequence of the construction period is undertaken in Chapter 15 (Disruption Due to Construction). Potential ecological implications of the bridge extension are discussed in Chapter 8 (Ecology and Nature

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The impact of the bridge extension on Headshaw Burn is considered to be of **negligible adverse** magnitude and combined with the very high site value the overall impact significance is **neutral**.

New Bridge

A second bridge spanning Headshaw Burn will be required as part of the new side road between the existing C84 and C83 side roads. The design of this bridge includes abutments which are set back a distance from the burn so that construction works will not interfere in any way. Once constructed, the new bridge will have no significant impact on either the water quality of the burn or the drainage of the area. Potential ecological implications of the bridge extension are discussed in Chapter 8 (Ecology and Nature Conservation).

13.4.4 Flooding

In addition to SEPA's indicative river flooding mapping, the Flood Estimation Handbook CD-ROM was used to obtain the catchment areas and characteristics (HD216/06, Annex 1 - Method E). This information along with information on watercourse channels was used to determine the extent of the functional flood plains (as defined SPP7: Planning and Flooding (Scottish Executive, 2004)).

The flood plain shown on Figure 13.2, associated with the Headshaw Burn, upstream of Annfield Bridge, which currently floods the adjacent field and part of the A68 is mainly due to the large catchment area, which includes Soutra and the Lammermuir Hills. This flood plain will be affected by the construction of the earthworks embankment for the re-aligned D47/5 side road. The D47/5 embankment will prevent the flood water from reaching the A68 and, with the mitigation measures described in 13.5 below, will still provide suitable flood water storage to prevent flooding of the D47/5 and keep downstream flood risk to a minimum. The impact magnitude of this new link is therefore considered to be negligible, therefore when combine with the **low** importance of the flood risk for the area, gives a **neutral** overall impact significance**.**

One element of the proposed scheme potentially at risk from flooding in this area is the proposed new pedestrian/equestrian/cyclist underpass. However the ground between the Headshaw Burn and the proposed underpass is high enough to prevent the underpass from being flooded.

The flood plains associated with Mountmill Burn and the Leader Water, which are also shown in Figure 13.2, are a result of the large catchment areas for the Leader Water and tributaries and the low lying farm land between Oxton and the A68. Therefore the additional 1.4 hectares of carriageway (widened A68 and new side road) proposed by the scheme is considered to be of **negligible adverse** magnitude, thus giving a **neutral** overall impact significance**.**

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Although the local farmer has suggested that the field adjacent to Mountmill Burn has never flooded during the 20 years that he has owned it, the flood outline for an event with a 0.5% annual probability of occurrence is shown to encroach slightly on the route of the proposed new side road.

However the new side road will be on embankment at the location where it encroaches on the flood plain and therefore should not be at risk of flooding. The road is also very lightly trafficked therefore if it is ever flooded during an extreme event, the impact of this would be minor. The associated reed bed is also shown to be within the flood plain but the impact of this being flooded is assessed as being minor, considering the low traffic flows involved and the small area of road draining to it.

The potential loss of flood water storage capacity as a result of the construction of the new side road is also very minor and this has been kept to a minimum by the alignment design adopted. This **minor** impact magnitude combined with the **low** importance of the flood risk in this area, results in a **neutral** impact significance.

13.5 Mitigation

Road Drainage

Potential water quality and drainage impacts, either generated or exacerbated by the proposed scheme can be mitigated and improved, from the existing direct drainage systems, through the development of Sustainable Drainage Systems (SUDS). The principle of SUDS is to maintain, as far as possible, the original drainage pattern of the site, catchment topography, ground conditions and the location of discharge points.

SUDS principles will be included in the form of over the edge filter drains, swales, soakaways, reed beds and detention pond. SEPA have approved preliminary drainage designs and consultations will continue throughout the detailed design and construction of the drainage regime. Details of the preliminary drainage designs are presented within Figures 13.3, 13.4 and 13.5.

Utilising a combination of techniques specified in CIRIA Report 609: Sustainable Drainage Systems – Hydraulic, Structural and Water Quality Advice, SUDS can reduce the concentrations of contaminants by up to 80%. Also, the use of these drainage systems will afford an additional level of containment should an accidental spillage occur. This will provide time for emergency procedures to be put into place and will further reduce the potential implications of pollution. With the use of a detention / retention pond within the drainage design, this will minimise the peak run-off flows from the A68 and surrounding area reaching the watercourses and reduce the potential of flooding downstream of the scheme.

The Water Environment (Controlled Activities) (Scotland) Regulations, 2005 (CAR) were brought in to force by SEPA in April 2006 and these regulations will be relevant to all possible alterations of watercourses and drainage within the scheme. Details of all requirements will be finalised through consultations with SEPA and following the CAR

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guidelines throughout the detailed design of the drainage.

SEPA along with the Environment Agency and the Environment and Heritage Service in Northern Ireland have produced of a range of Pollution Prevention Guidance Notes (PPGs). Each PPG is targeted at a particular industrial sector or activity and aims to provide advice on statutory responsibilities and good environmental practice. As well as being used by Agency staff, the PPGs also function as invaluable sources of advice for industry and members of the public. The following PGGs will be used for the development of the proposed scheme:

- PPG01 General guide to the prevention of water pollution;
- PPG05 Works and maintenance in or near water;
- PPG06 Working at construction and demolition sites;
- PPG21 Pollution Incident Response Planning; and
- PPG22 Dealing with spillages on highways.
- PPG01 and PPG22 will be referred to in terms of Water Quality and Drainage.

Therefore the implementation of SUDS will ensure that any adverse impacts on the groundwater and surface water attributes will remain as low as possible and on the whole the impacts will be slightly beneficial.

Following construction of the scheme, the SUDS will be maintained by Transport Scotland's maintaining authority.

Bridge Extension

The Tweed Foundation, SNH and SEPA consultation responses, included in Appendix 1, recommend that sufficient care should be taken when designing and constructing the proposed bridge extension to ensure that the appropriate engineering techniques and timings are adopted. This is to prevent changes in flow dynamics, adverse scouring, avoid the fish breeding / spawning seasons and to allow the safe passage of migratory fish within the watercourse. The bridge extension will be designed and constructed in accordance with the Water Framework Directive and SEPA's licensing requirements / conditions (river works application), for the protection, improvement and sustainable use of watercourses in the area. Following the guidance of SEPA and the continued consultation with the three bodies will ensure that any impacts on water quality will be minimised.

Given the **negligible adverse** magnitude of the anticipated impacts and the very high value of the site, mitigation measures will ensure the significance of the impacts remain as low as possible.

New Bridge

As the design of the new bridge will eliminate any work within the watercourse, no mitigation measures are required. However, best practice techniques (e.g. application

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of PPG and pollution prevention measures) will be applied, as appropriate.

Flooding

The flooding of the A68, caused by Headshaw Burn, will be controlled with the construction of the earthwork embankments for the D47/5 re-alignment. The junction for the re-alignment will be located 20 metres south of Annfield Bridge and will stop the flood water travelling further south to affect the A68. Soakaways will be constructed within the field to allow the trapped water to dissipate back into the ground water table and this will be further aided with the proposed tree planting scheduled for this area (see Chapter 9 – Landscape Effects). Also, the inclusion of SUDS to filtrate, dissipate and detain the scheme drainage, will remove risk of the peak flows from the existing road drainage being discharged to the watercourses and adding to the risk of flooding downstream.

As detailed in 13.4.4 of this chapter these mitigation measures will still provide suitable flood water storage to prevent flooding of the D47/5 and keep downstream flood risk to a minimum.

Given the low traffic flows on the proposed new side road and the fact that it will be raised above the flood level no further mitigation will be required to prevent the road from flooding.

Furthermore due to the minimal effect on the Mountmill Burn's flood plain, no mitigation measures are considered necessary.

The implementation of SUDS along with the other proposed mitigation measures will ensure that any increase in flood risk will be kept to a minimum and thus the impact significance of the scheme will remain **neutral**.

Accidental Spillage

The provision of SUDS will have a beneficial impact in terms of accidental spillage, as they will reduce further the risk of pollution from an accidental spillage reaching the groundwater and surface water attributes of the site.

13.6 Residual Impacts

Residual impacts are identified in Table 13.8 below.

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Table 13.8. Impacts Upon Water Resources With and Without Mitigation.

Predicted Impact	Without Mitigation	With Mitigation
Headshaw Burn - water quality impacts through increased run-off.	Neutral	Slight Beneficial
Headshaw Burn - water quality impacts through accidental spillage.	Neutral	Slight Beneficial
Leader Water - water quality impacts through increased run-off.	Neutral	Slight Beneficial
Leader Water - water quality impacts through accidental spillage	Neutral	Slight Beneficial
Groundwater impacts	Neutral	Neutral
Flooding	Neutral	Neutral
Bridge extension impacts	Neutral	Neutral
New Bridge	Neutral	Neutral

With the high sensitivity of the site and the neutral impact of the proposed scheme without mitigation, the incorporation of the SUDS, which can improve water quality by up to 80%, will result in a slight benefit to the water quality, drainage and flood risk of the area.

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