12.0 ROAD DRAINAGE AND THE WATER ENVIRONMENT

12.1 INTRODUCTION

12.1.1 The purpose of this chapter is to determine the potential impacts on the water environment that may result from the proposed improvement to the A737 at the Den. The UK Government and European Union put a high importance on maintaining and improving the quality of drinking water, watercourses, groundwater and coastal waters. Any run-off from a road which is not properly managed can result in significant damage to the existing hydrology and resident biodiversity.

12.1.2 Road authorities have attached greater importance to the issue of road run-off in recent years.

12.1.3 Pollution of the water environment through road drainage of surface water run-off can arise from a variety of sources including accidents, vehicle and road degradation, and oil leaks. Water pollution can be defined by four categories namely diffuse pollution, acute pollution, chronic pollution and routine run-off.

12.1.4 Diffuse Pollution arises from widespread activities such as agriculture or atmospheric deposition. Routine run-off is generally regarded as diffuse pollution, but in some instances can be categorised as point source pollution.

12.1.5 Acute Pollution occurs as a result of severe, but transient impacts, such as accidental spillage. Acute pollution could also result from a sudden discharge of silt laden water during road construction.

12.1.6 Chronic Pollution is the result of on-going low levels of pollution which may result in either lethal or non-lethal effects, the latter including reduced feeding / growth / breeding rates in certain organisms and hence impact on the ecosystem.

12.1.7 Routine run-off is the normal run-off from roads, which may contain contaminates and which could result in either acute or chronic impacts.

12.2 METHODOLOGY

12.2.1 The assessment has been undertaken in accordance with the DMRB Volume 11 Section 3 Part 10 Road Drainage and the Water Environment (HD 45/09). An assessment is required as the proposed design options will affect the existing watercourses along the length of the scheme.

12.2.2 The Simple Assessment undertaken within DMRB Volume 11 Section 3 Part 10, considers four principal areas which will be discussed and assessed within this chapter:

- Effects of Routine Runoff on Surface Waters;
- Effects of Routine Runoff on Groundwater;
- Pollution Impacts from Spillages; and
- Assessing Flood Impacts.

12.2.3 A site walkover was undertaken 7th October 2011 to record all watercourse within the vicinity of the scheme extents.

12.2.4 A desk top study to identify water resources was carried out using the following sources:

- Ordnance Survey Maps;
- Previous reports; and
- Data collated from a site visit.

12.2.5 This initial review was supplemented by consultations with statutory organisations, SEPA and Scottish Water and further consideration of available data. Details of the consultation undertaken are provided in paragraphs 12.2.14 – 12.2.17 and also with Chapter 3 Consultation.

12.2.6 The study area assessed extends 500m around the scheme for surface water and groundwater features.

Planning Policy, Legislative Context and Standards

Planning policy

12.2.7 Scottish Planning Policy (Flooding and Drainage) provides guidance on flooding issues and prevention of additional land and development being put at risk from flooding.

Legislative Context

12.2.8 The principal piece of legislation which relates to the issues of road drainage and the surrounding water environment is the Water Framework Directive, (WFD) (2000/60/EC)1. Within this legislation there are two principal objectives namely:

- Prevent the deterioration of the status of all surface and groundwater bodies; and
- Protect, enhance and restore all bodies of surface water and groundwater with the aim of achieving good surface water and groundwater status by 2015.

12.2.9 The WFD will ultimately repeal a number of other Directives by December 2013 namely:

- Freshwater Fish Directive, 78/659/EEC
- Shellfish Waters Directive, 79/923/EEC
- Groundwater Directive, 80/68/EEC and
- Dangerous Substances Directive, 76/464/EEC

12.2.10 Under the WFD, the Scottish Environmental Protection Agency (SEPA) is appointed as the Competent Authority with statutory powers and duties for protecting and monitoring the bodies of water as identified in river basin districts.

12.2.11 The flood defence role of SEPA is limited to flood risk assessment and provision of advice thereon, the provision of early warning of floods and river flow gauging. SEPA has general duties to conserve water resources and to promote conservation and enhancement of natural beauty. However it is not responsible for fisheries protection, which lies with the District Salmon Fisheries Boards.

[1] The Water Framework Directive (WFD) (2000/60/EC) Available from www.defra.gov.uk/environment/water/wfd

12.2.12 Consents are required from SEPA for engineering works which impact on the water environment under the Water Environment (Controlled Activities) (Scotland) Regulations (CAR) 2011. Road construction activities which require registration or licensing include culverts, watercourse diversions, Sustainable Urban Drainage Systems (SUDs) ponds, discharges and groundwater abstractions. The type of licence required will depend on the nature of the engineering work and the sensitivity of the surrounding water environment. Licences may be simple, complex or covered by general binding rules and require only registration.

Determination of Baseline Conditions

12.2.13 This chapter assesses the impacts on local water resources, water quality and drainage resulting from the proposed scheme. The information required for the assessment has been obtained from a desk top study, field investigations and consultations with SEPA regarding the proposed drainage.

Consultation

12.2.14 Consultations have been undertaken with Scottish Natural Heritage (SNH), Scottish Water, North Ayrshire Council Environmental Health and SEPA for advice on the water quality within the scheme extents.

12.2.15 SNH had no comments to make regarding the biodiversity of the water environment in the area.

12.2.16 SEPA commented that; "*Surface water run-off from this re-aligned road must be drained via a suitably designed SUD system. In this regard two levels of SUDS will be necessary". They also requested that surface water run-off from construction is also treated via a SUD system.*

12.2.17 Scottish Water attended a meeting 5th October 2011 to discuss the proposed scheme. Scottish Water had no concerns with the proposed works; however there are issues relating to the existing water supply mains.

12.2.18 Scottish Water confirmed the existing water supply at the west of the scheme (near Graze) is PVC mains and at the east (near Maulside Lodge) is steel mains.

12.2.19 North Ayrshire Council Environmental Health confirmed that no properties have private water supplies within The Den.

Determination of Impact Significance

12.2.20 The sensitivity of the water resources, in conjunction with the magnitude of the impact of the proposed scheme, are combined to determine impact significance. The criteria for assessing sensitivity are set out in Table 12.1. The criteria for assessing impact magnitude are set out in Tables 12.2 and 12.3. Once the sensitivity and impact magnitude have been determined, Table 12.4 is used to determine the overall significance of impact.

Table 12.1 Determination of Receptor Sensitivity

Sensitivity	Criteria	Typical Criteria Descriptors
Very High	Attribute has a high quality and rarity on regional or national scale	**Surface Water** EC Designated Salmonid/Cyprinid fishery WFD Class 'High' Site protected/designated under EC or UK habitat legislation (SAC, SPA, SSSI,WPZ, Ramsar site, salmonid water)/Species protected by EC legislation
		Groundwater Principal aquifer providing a regionally important resource or supporting site protected under EC and UK habitat legislation Drinking Water Protected Area.
		Flood Risk Floodplain or defence protecting more than 100 residential properties from flooding
High	Attribute has a high quality and rarity on local scale	**Surface Water** WFD Class 'Good' Major Cyprinid Fishery Species protected under EC or UK habitat legislation
		Groundwater Principal aquifer providing locally important resource or supporting river ecosystem
		Flood Risk Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding
Medium	Attribute has a medium quality and rarity on local scale	**Surface Water** WFD Class 'Moderate'
		Groundwater Aquifer providing water for agricultural or industrial use with limited connection to surface water
		Flood Risk Floodplain or defence protecting 10 or fewer industrial properties from flooding
Low	Attribute has a low quality and rarity on local scale	**Surface Water** WFD Class 'Poor'
		Groundwater Unproductive strata
		Flood Risk Floodplain with limited constraints and a low probability of flooding of residential and industrial properties

Table 12.2 Determination of Impact Magnitude on Surface Water

Impact Magnitude	Typical Criteria Descriptors
Major	Failure of both soluble and sediment-bound pollutants in Highways Agency Water Risk Assessment Tool (HAWRAT) (Method A, Annex I) and compliance failure with EQS values (Method B) Calculated risk of pollution from a spillage >2% annually Loss or extensive change to a fishery Loss or extensive change to a designated Nature Conservation Site
Major Beneficial	Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse
Moderate	Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) but compliance with EQS values (Method B) Calculated risk of pollution from spillages >1% annually and <2% annually Partial loss in productivity of a fishery.
Moderate Beneficial	HAWRAT assessment of both soluble and sediment-bound pollutants Becomes Pass from an existing site where the baseline was a Fail condition Calculated reduction in existing spillage by 50% or more (when existing spillage risk >1% annually)
Minor	Failure of either soluble or sediment-bound pollutants in HAWRAT Calculated risk of pollution from spillages >0.5% annually and <1% annually
Minor Beneficial	HAWRAT assessment of either soluble or sediment-bound pollutants becomes Pass from an existing site where the baseline was a Fail condition Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually)
Negligible	The proposed scheme is unlikely to affect the integrity of the water environment

Table 12.3 Determination of Impact Magnitude on Groundwater

Impact Magnitude	Typical Criteria Descriptors
Major	Loss of, or extensive change to, an aquifer Potential high risk of pollution to groundwater from routine runoff – risk score >250 (Groundwater Assessment, Method C, Annex I) Calculated risk of pollution from spillages >2% annually (Spillage Risk Assessment, Method D, Annex I) Loss of, or extensive change to, groundwater supported designated wetlands
Major Beneficial	Removal of existing polluting discharge to an aquifer or removing the likelihood of polluting discharges occurring Recharge of an aquifer
Moderate	Partial loss or change to an aquifer Potential medium risk of pollution to groundwater from routine runoff – risk score 150-250 Calculated risk of pollution from spillages >1% annually and <2% annually Partial loss of the integrity of groundwater supported designated wetlands
Moderate Beneficial	Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is >1% annually)
Minor	Potential low risk of pollution to groundwater from routine runoff – riskscore <150 Calculated risk of pollution from spillages >0.5% annually and <1% annually Minor effects on groundwater supported wetlands
Minor Beneficial	Calculated reduction in existing spillage risk by 50% or more to an aquifer (when existing spillage risk <1% annually)
Negligible	The proposed scheme is unlikely to affect the integrity of the water environment

Table 12.4 Determination of Impact Significance

		Impact Magnitude (Degree of Change)			
		Negligible	Minor	Moderate	Major
Receptor Sensitivity (Value)	Very High	Neutral	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Slight	Moderate	Moderate or Large
	Low	Neutral	Neutral or Slight	Slight	Slight or Moderate

12.3 BASELINE CONDITIONS

Study Area

12.3.1 The current road runs along the Garnock valley bottom and the existing rainfall catchment is delimited by the tops of the surrounding hills. The area of improvement lies within the River Garnock catchment area, which is designated as a protected area for freshwater fish. There are four watercourses in the vicinity of the site. Within the scheme extents an unnamed watercourse flows adjacent to the carriageway. This outfalls to the Powgree Burn which in turn outfalls to the River Garnock. The Bombo Burn lies to the south of the site. The surface watercourses are illustrated within Drawing No.10/SW/0901/037/215. Only the unnamed watercourse flows within the scheme extents.

Surface Water

12.3.2 There is an unnamed watercourse located adjacent to the existing A737 and along Auchengree Road, Photograph 12.1 below. Following inspection by a suitably qualified ecologist April 2005 and September 2008 this is not considered to offer suitable habitat for protected species such as water vole or otter. This burn is located approximately 2m from the carriageway and outfalls to the Powgree Burn 1.4km from the scheme.

Photograph 12.1: Surface Water drainage ditch adjacent to A737 and Auchengree Road

12.3.3 The sensitivity of the unnamed watercourse is assumed to be high, in accordance with Table 12.1. This is due to its importance at a local level and its designation as a minor watercourse by SEPA. The water quality of this watercourse has not been classified by SEPA and is thus assumed to be excellent. The burn is a tributary of the River Garnock which is designated for freshwater species. It is part of an overall catchment which is within a Drinking Water Protection Area. There are no fisheries or water supply abstractions along the River Garnock.

12.3.4 Domestic drainage systems outfall into this ditch where it runs through The Den as stated in the consultation with SEPA, Appendix B Consultation.

12.3.5 The River Garnock is out with the scheme extents (approximately 1.4km from the existing carriageway). It is classified by SEPA as having an overall status of 'Bad' with ecological status of 'Bad' and an overall chemical status of 'Fail'. The sensitivity of the River Garnock is classified as low in accordance with Table 12.1, due to its poor quality and medium importance at a local level.

Ground Water

12.3.6 The SEPA groundwater vulnerability map has been consulted and indicates that the site is underlain by a minor or moderately permeable aquifer which can be described as fractured or potentially fractured rocks which do not have a high primary permeability, or other formations of variable permeability. There is no indication that groundwater within the footprint of the site is abstracted for drinking water purposes; however the proposed

improvement is within an area classified as a 'drinking water protected area for groundwater[2].

12.3.7 The current groundwater status is classified as 'Poor' according to the SEPA interactive map. This is from a pressure source of diffuse source pollution from mining and quarrying of coal. SEPA has stated they have targets to bring the groundwater in this area to medium quality by 2017. It has been assigned a sensitivity of very high as the area is within a Drinking Water Protected Area.

Flooding

12.3.8 The proposed improvement is not within an area prone to flooding and is approximately 2km from the floodplain of the River Garnock[3]. The sensitivity of flooding is thus assessed as low in accordance with Table 12.1. There is evidence of localised flooding events to adjacent property due to poor surface water drainage of the surrounding land drainage regime.

Road Drainage

12.3.9 The existing road drainage consists of depressions adjacent to the existing carriageway, which hold water and allow it to drain away to neighbouring watercourses.

12.4 IMPACT ASSESSMENT

12.4.1 The assessment of potential impacts from road projects on the water environment should consider the following;

- Effects of routine run-off on coastal and inland surface waters,
- Effects of routine run-off on groundwater,
- Pollution impacts from accidental spillages, and
- An assessment of flood impact.

12.4.2 Taking account of the sensitivity of the watercourses in the area and the low traffic flows it is considered, following agreement with Transport Scotland that simple assessments are not required for routine run off to surface waters as the traffic flows are too low for use in the Highways Agency Water Assessment Risk Assessment Tool (HAWRAT).

12.4.3 Given the area is not prone to flooding (other than at localised areas where the road drainage is substandard), and is not within a floodplain, a simple assessment on flooding and flood risk assessment have not been undertaken. There will be additional SUDs ponds within the area, which will treat run-off, and attenuate the flow.

Proposed Drainage Design

12.4.4 The proposed road drainage design is presented on Drawings 10/SW/0901/037/217 and 10/SW/0901/037/218. It consists of a filter drain system with three treatment pond areas. One area is located to the western end of The Den, adjacent to the west bound carriageway. Treatment ponds will also be located adjacent to the east and west bound carriageways, at the junction with Auchengree Road.

[2] http://www.scotland.gov.uk/Topics/Environment/Water/17670/maps (accessed, 1/12/2011)
[3] SEPA Floodmap, http://go.mappoint.net/sepa/, (accessed 12/10/2011).

12.4.5 The proposed drainage design takes account of the septic tanks which are within the area, however the proposed drainage will not allow existing residential drainage to enter the treatment ponds, instead it will be kept separate and channelled directly into the existing ditch, adjacent to the old A737. This will prevent the formation of effluent within the treatment ponds.

12.4.6 All road drainage in the east bound verge and cut-off drains on the north side of the road and east of Brownhill Road are collected and diverted along the east verge to the basin lying to the north of the road at the east end of the scheme. From there the water outfalls into the unnamed watercourse in the Auchengree Road.

12.4.7 Field drainage west of Brownhill Road along with drainage from the access to Fernside is carried to the existing pipework through The Den.

12.4.8 Road drainage from the west is taken separately to a point west of No 1 The Den where some of it is released through the wet-land basins into the pipework through The Den. This was agreed with SEPA to provide a flushing system as this pipework takes the outfalls from the domestic septic tanks. The pipework through The Den is diverted at the junction of Auchengree Road with the A737 to a point along the line of the unnamed watercourse.

12.4.9 The remainder of the road drainage which is not passed through the wet-land is taken along with the road drainage east of this point into the basin lying on the south side of the A737 at the east end of the scheme. From there it is taken into the north basin.

12.4.10 The design is in accordance with DMRB Volume 4: Geotechnics and Drainage, Section 2 and the requirements of the local SEPA office, see Appendix B Consultation.

During Construction

Surface Water

12.4.11 There is potential for the unnamed watercourse within the scheme extents to become polluted during construction. This pollution can occur either through a point source pollution incident such as a fuel spillage, but also through more gradual pollution such as siltation, through excavation material entering the watercourse.

12.4.12 Licences under the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (CAR) will be required to culvert the ditch below the new road, and for re-alignment of the ditch at Auchengree Road. All details must be confirmed with the local SEPA office prior to works commencing. All method statements regarding de-watering of excavations must be approved by the local SEPA office prior to works commencing.

12.4.13 Conditions imposed on any CAR licences from SEPA must be adhered to by the contractor. If there any changes to the engineers design they must consult and submit an application for an altered/new CAR licence prior to commencement of works.

12.4.14 The magnitude of impact during construction is assessed as moderate in accordance with Table 2.2. In accordance with Table 12.4, the impact significance is assessed as moderate. This is due to the potential for a partial loss or /damage to key characteristics, features or elements. This will be as a result of spillages of fuels or oils from construction plant and/ or

sedimentation from excavation of soils on site. Impacts likely to occur to the water environment during construction are summarised in Table 12.5.

Groundwater

12.4.15 The proposed design does not result in direct discharges to ground water as the proposed drainage system comprises of filter drains which outfall to the unknown watercourse after passing through an attenuation basin. There will be no change to the current drainage in relation to groundwater from the proposed design.

12.4.16 Groundwater levels were noted as being 1m to 3m below the existing ground level.

12.4.17 There is a risk of spillages from fuels, oils, concrete, and other chemicals, seeping into the shallow groundwater. The project will also require at least one major construction compound, providing welfare facilities for the Contractor. The compound area will likely retain a store of fuels, oils, and other chemicals. Based on the potential for significant quantities of contaminants being released into the shallow groundwater through spillage, the magnitude of impact during construction is determined as minor. This results in an overall impact significance during construction of moderate.

Flooding

12.4.18 The area is not within a flood risk area. During construction the cutting of the embankment, which involves the removal of peat, and all excavations will be dewatered during construction. There will be small pools of water on site. In accordance with Table 2.2, Determination of Impact magnitude, this will result in an impact magnitude of minor, as there will be some measurable change in attributes, quality and vulnerability of the groundwater. As the sensitivity of flooding is low, in accordance with Table 2.4 the resulting impact significance will be slight.

12.4.19 Impacts of the construction phase are generally temporary, but their after-effects on water quality can be longer lasting. The nearby River Garnock is of ecological importance. Any potential impact to these must be taken into account. Refer to Table 12.5 for further details.

Table 12.5 Summary of Impacts during Construction without Mitigation

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude	Significance
Water Quality	Unknown Watercourse	Water Supply	Unclassified by SEPA	High	Moderate	Moderate
Dilution and Removal of Waste Products	River/Streams	Removal ofWaste products	Good	High	Minor	Moderate
Water Quality	Groundwater	Water supply/quality	Minor or Moderately permeable aquifer	Very High	Minor	Moderate
Water Quality	Groundwater	Vulnerability	Poor	Very High	Minor	Moderate
Flooding	Unknown Watercourse	Conveyance of flow	Good	Low	Minor	Slight

Post Construction

Surface Water

ACCIDENTAL SPILLAGE

12.4.20 This scheme is not expected to significantly increase traffic volumes or to alter vehicle type distribution, as no viable alternative routes exist, and hence no additional traffic is expected to be attracted to the improved section.

The base year used for this scheme is 2011

12.4.21 The probability of a serious accidental spillage was calculated using Method D, Annex I of DMRB, Volume 11, Section 3, Part 10, is as follows:

$Pacc = RL \times SS \times (AADT \times 365 \times 10^{-9}) \times (\% HGV \div 100)$

Where:

Pacc = probability of a serious accidental spillage in one year over a given road length;

RL = road length in km = 0.94km

SS = serious spillage rate (from Annex 1 Table D.1: Serious Accidental Spillages in Billion HGV km/year (DMRB, volume 11, Section 3, Part 10: Road Drainage and the Water Environment)) = 0.93 (A value of 0.93 represents the serious spillage rate of a rural trunk road with side road access).This is considered a worst-case scenario approach as three side roads are present within the scheme extents.

Therefore for the proposed scheme:

$Pacc = 0.94 \times 0.93 \times (9031 \times 365 \times 10^{-9}) \times 0.17$

$Pacc = 4.899 \times 10^{-4}$

The probability that a spillage will cause a pollution incident is calculated as follows:

$$Pinc = Pacc \times Ppol$$ Where:

Ppol = The risk reduction factor, dependent upon emergency services response times, which determines whether a serious spillage will cause a serious pollution incident. The value is selected from table D2: Probability of a Serious Pollution Incident Occurring as a Result of a Serious Accidental Spillage (DMRB, Volume 11, Section 3, Part 10.

Pinc = 1.853 x 10-4 x 0.6 (A value of 0.6 represents the probability of a serious pollution incident occurring as a result of a serious accidental spillage based to a surface water course in a rural location with a response time of less than 1 hour).

$Pinc = 4.899 \times 10^{-4} \times 0.6$

$= 0.00029$

12.4.22 The value of 0.00029 is significantly less than 1% annual probability of a serious accidental spillage causing a pollution incident. 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 magnitude of impact resulting from accidental spillages to surface waters is negligible in accordance with Table 12.2. This is due to the probability being below 0.5%.

12.4.23 In accordance with Table 12.4 the impact significance is assessed as neutral.

ROUTINE RUN-OFF

12.4.24 The current Annual Average Daily Traffic Flow (AADT) along this stretch of the A737 is 9031 (AADT). The existing base journey speed is 45mph (72kph). Transport Scotland were consulted and agreed that the routine run-off assessment for surface water for this scheme would not be required. From DMRB A1/5 Part 10 HD 45/09 step one requires AADT to be above 10,000.

Groundwater

12.4.25 The proposed design does not result in direct discharges to groundwater as the proposed drainage system comprises filter drains which tie into the existing piped drainage system. The proposed drainage design also includes treatment ponds; refer to Drawing No. 10/SW/0901/037/217 and 218. These ponds will not directly outfall to the groundwater.

12.4.26 Given there may be potential for indirect discharge to the groundwater an assessment in accordance with Method C of DMRB Volume 11, Section 3 Part 10 has been undertaken. Seven component properties are recognised which influence pollutant loading and the extent of passage through the soil. These components are traffic density, rainfall, soakaway geometry, unsaturated zone, flow type, effective grain size and lithology.

12.4.27 The current AADT is 9031, which is assigned a low risk in accordance with Table C1.2. According to the Met Office website[4] the average annual rainfall for the local area is between 1300 and 1700mm. Rainfall volume is therefore assigned a high risk to demonstrate a worst case scenario. From boreholes undertaken and trial pit logs, ground water was encountered at depths of 1.2m and has thus been assigned a high risk. The flow type contains consolidated deposits with mixed fracture and this has been assigned a medium risk factor. The grain size does contain coarse sand in parts, as a result and using a precautionary approach both the effective grain size and lithology have been assigned a medium risk.

12.4.28 Table 12.6 illustrates the results of the ground water assessment undertaken. Each component is weighted and the resultant overall risk score is calculated by adding each component score together.

[4] http://www.metoffice.gov.uk/climate/uk/averages/regmapavge.html#wscotland (accessed 15/11/2010)

Table 12.6 Groundwater Assessment

Component	Weighting Factor	Risk (score)	Risk Score
Traffic Density	15	1	15
Rainfall Volume (Annual Average)	15	3	45
Rainfall Intensity			
Soakaway Geometry	N/A		
Unsaturated Zone – Water table depth	20	3	60
Flow Type	20	2	40
Grain Size	7.5	2	15
Lithology	7.5	2	15
Overall Risk Score			**190**

12.4.29 The result of the groundwater assessment indicates there is a medium risk of impact, however the proposed improvement at The Den is not discharging directly to the groundwater and does not change any existing drainage to the groundwater. The new drainage design for The Den will be an improvement on the existing drainage network, and as such will facilitate two forms of treatment to road run-off. It is considered that there will be no change to the groundwater of the area on implementation of the new alignment. The magnitude of impact on groundwater is therefore assessed as negligible in accordance with Table 12.3 as the proposed scheme is unlikely to affect the integrity of the groundwater. In accordance with Table 12.4 the impact significance is determined to be neutral.

Flooding

12.4.30 The new road drainage design will alleviate localised flooding, which is currently evident on the carriageway at times of high rainfall. The introduction of the attenuation ponds contributes to the improvement on flooding and will ensure that there is no increased risk of flooding downstream. The magnitude of impact on flooding is assessed as minor beneficial in accordance with Table 2.2.

12.4.31 The impacts on the water environment during operation of the scheme are summarised in Table 12.7.

Table 12.7 Summary of Impacts Post Construction without Mitigation

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude	Significance
Water Quality	Unknown Watercourse	Water Supply	Unclassified by SEPA	High	Negligible	Neutral
Dilution and Removal of waste products (Septic Tank on site used by residential properties)	River/ Stream	Removal of Waste products	Good	High	Negligible	Neutral
Water Quality	Groundwater	Water supply/quality	Minor or moderately permeable aquifer	Very High	Negligible	Neutral
Water Quality	Groundwater	Vulnerability	Poor	Very High	Negligible	Neutral
Flooding	Unknown Watercourse	Conveyance of flow	Good	Low	Minor Beneficial	Slight beneficial

12.4.32 Paragraph 2.26 of Chapter Two, states that the impact significance categories are negative (adverse) impacts unless otherwise stated as positive (beneficial).

12.5 MITIGATION

During Construction

12.5.1 Refuelling of plant will take place within designated supervised areas; fuel tanks will be double-skinned and bunded around the base. Appropriate spill kits will be available on site should spillages occur. These kits will be of suitable size to deal with significant spillages of fuel, such as those experienced when HGVs leave the carriageway.

12.5.2 Sediment mitigation will be used on site to reduce potential pollution of watercourses. The Contractor shall produce a Site Management Plan (SMP), which will describe the specific procedures to be put in place to control sediment mobilisation, surface water discharges, and spillages.

12.5.3 Steps will be taken to ensure that the ponds are of appropriate size to accommodate periods of sudden heavy rain which can often reduce the effectiveness of such ponds.

12.5.4 The contractor's method statement for dealing with sediment mitigation would require to be accepted by SEPA.

Post Construction

12.5.5 There is not considered to be a requirement for any post construction mitigation, other than the proposed drainage design which will result in a beneficial impact.

12.6 RESIDUAL IMPACT

During Construction

12.6.1 Implementation of the mitigation measures detailed above will result in a negligible impact magnitude during construction as the integrity of the water environment is unlikely to be affected. This results in an impact significance of neutral as summarised in Table 12.8.

Post Construction

12.6.2 As there are no additional mitigation measures for post construction impacts, the significance of the residual impacts remain unchanged and are summarised in Table 12.9.

Table 12.8 Impacts during Construction with Mitigation

Potential Impact	Feature	Attribute	Quality	Importance	Mitigation	Magnitude	Significance
Water Quality	Unknown Watercourse	Water Supply	Unclassified by SEPA	High	The use of SUDs and sediment control	Negligible	Neutral
Dilution and Removal of Waste Products	River/Streams	Removal of Waste products	Good	High	The use of SUDs and Attenuation ponds	Negligible	Neutral
Water Quality	Groundwater	Water supply/quality	Minor or Moderately permeable aquifer	Very High	The use of SUDs and sediment control	Negligible	Neutral
Water Quality	Groundwater	Vulnerability	Poor	Very High		Negligible	Neutral
Flooding	Unknown watercourse	Conveyance of Flow	Good	Low	The use of SUDs and Attenuation ponds and filter drains	No change	Neutral

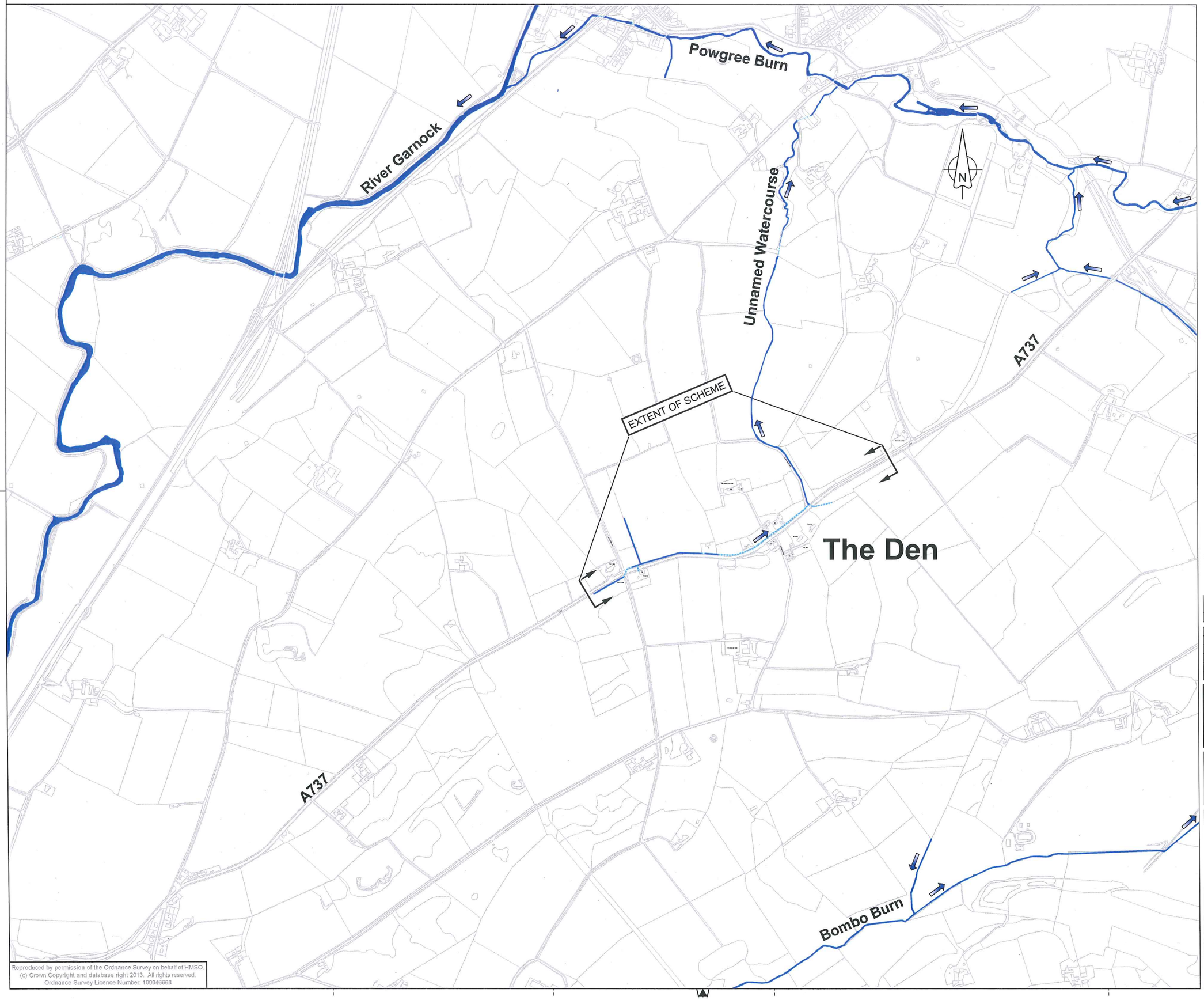
Table 12.9 Summary of Residual Impacts

Potential Impact	Feature	Attribute	Quality	Importance	Magnitude	Significance
Water Quality	Unknown Watercourse	Water Supply	Unclassified by SEPA	High	Negligible	Neutral
Dilution and Removal of waste products	River/ Stream	Removal of Waste products	Good	High	Negligible	Neutral
Water Quality	Groundwater	Water supply/quality	Minor or moderately permeable aquifer	Very High	Negligible	Neutral
Water Quality	Groundwater	Vulnerability	Poor	Very High	Negligible	Neutral
Flooding	Unknown Watercourse	Conveyance of flow	Good	Low	Minor Beneficial	Slight beneficial

12.7 CONCLUSION

12.7.1 The proposed improvement to the A737 at the Den is not predicted to present significant impacts on surface water bodies, groundwater or flooding.

12.7.2 It is predicted the proposed road drainage layout will improve the current situation on the A737 through preventing localised flooding on the carriageway. It is envisaged the installation of three treatment ponds will provide improved water quality within the surface water run off when compared to the existing run off from the A737.



LEGEND

- River, Burn, Watercourse
- Bridge or Culvert
- Flow Direction

EXTENT OF SCHEME

Rev	Revision details	Chkd	Appd	Date

Drawn: IWH		Preliminary	✓
Design: IWH		For comment	
Chkd: NS		For tender	
Appd: N.F.		For construction	
Date: 27/11/12		As constructed	

amey

Client

TRANSPORT SCOTLAND

Project Name

A737 TRUNK ROAD
THE DEN, DALRY

Drawing Title

ENVIRONMENTAL
WATER COURSES

Original Drawing Size : A1	Dimensions : -
Scale : 1 in 10000	Copyright © Amey

Drawing No: 10/SW/0901/037/215 | Rev:

S:\#SHARED\S001 - MTRIPS\09007 - The Den, Dalry\003 Design\002 Drawings\Work Area\1 Live Drawings\Environmental\Post Ext Audit\10_SW_0901_037_215 Watercourses.dwg, 29/01/2013 09:59:51, Iholland

S:\#SHAREDS\001 - MTRIPS\09007 - The Den, Dalry\003 Design\002 Drawings\Work Area\1 Live Drawings\Environmental\Post Ext Audit\10_SW_0901_037_217 to 218 Drainage Layout Rev A.dwg, 25/01/2013 13:11:58, lholland

0 100

The Graze

Track

Existing Ditch

Cut Line 1

Crossroads

12

Fernside

Cut Line 2

Drains

Treatment Basins/Wetland

Existing Ditch

Existing Drain

LEGEND

- Filter Drain
- Carrier Drain
- Detention Pipe
- Ditch
- Catch Pit
- Headwall

Rev	Revision details	Chkd	Appd	Date
A	Detail adjusted	JW	NS	24/1/13

Drawn:	Q.L.	Preliminary	✓
Design:	Q.L.	For comment	
Chkd:	I.H.	For tender	
Appd:	I.H.	For construction	
Date:	30/10/12	As constructed	
		Other	

amey

Client

TRANSPORT SCOTLAND

Project Name

A737 TRUNK ROAD
THE DEN, DALRY

Drawing Title

Environmental
Drainage Layout
Sheet 1 of 2

Original Drawing Size : A1	Dimensions : -
Scale : 1 in 500 @ A1	Copyright © Amey

Drawing No: 10/SW/0901/037/217

Rev: A

S:\#SHARED\S001 - MTRIPS\09007 - The Den, Dalry\003 Design\002 Drawings\Work Area\1 Live Drawings\Environmental\Post Ext Audit\10_SW_0901_037_217 to 218 Drainage Layout Rev A.dwg, 25/01/2013 13:09:37, Iholland

0 100

LEGEND

- Filter Drain
- Carrier Drain
- Detention Pipe
- Ditch
- Catch Pit
- Headwall

Cut Line 2

Treatment/Attenuation Basin

Existing Drain

Ditch

Maulside Lodge

A737

Track

27

29

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Rev	Revision details	Chkd	Appd	Date
A	Detail adjusted	IWH	NS	24/1/13

Drawn:	Q.L.	Preliminary	✓
Design:	Q.L.	For comment	
Chkd:	I.H.	For tender	
Appd:	I.H.	For construction	
Date:	30/10/12	As constructed	
		Other	

amey

Client: TRANSPORT SCOTLAND

Project Name
A737 TRUNK ROAD
THE DEN, DALRY

Drawing Title
Environmental
Drainage Layout
Sheet 2 of 2

Original Drawing Size : A1	Dimensions : -
Scale : 1 in 500	Copyright © Amey

Drawing No: 10/SW/0901/037/218

Rev: A