11. Road Drainage and the Water Environment

11.1 Introduction

11.1.1 This chapter presents the results of the DMRB Stage 3 Assessment of the potential impacts of the Proposed Scheme on the water environment. The assessments have focussed on surface waters and floodplains, and consider potential impacts upon:

- water quality
- hydromorphology
- hydrology and flood risk
- surface water dependent public and private water supplies

11.1.2 This chapter is supported by the following technical appendices:

- Appendix A11.1 Hydromorphology Assessment
- Appendix A11.2 Flood Risk Assessment
- Appendix A11.3 Drainage Network Water Quality Calculations
- Appendix A11.4 Baseline Conditions

11.1.3 It should be noted that this chapter deals with impacts on surface water only. Groundwater impacts, including those to groundwater fed private water supplies and ponds, and those from road drainage discharges to groundwater, are discussed in Chapter 10 (Geology, Soils and Groundwater).

11.1.4 Consequential impacts on locations with nature conservation value, aquatic and marginal habitats, and associated fauna are discussed in Chapter 12 (Ecology and Nature Conservation).

11.1.5 Planning policy documents are summarised in Chapter 19 (Policies and Plans). Furthermore, Chapter 19 includes a compliance assessment of the Proposed Scheme against National, Regional and Local Planning Policies.

Impacts Scoped Out

11.1.6 There are no Designated Sites within 5km of the Proposed Scheme classified for water environment related features. Nationally designated sites located downstream, with water environment citations, are outlined below for regional context.

11.1.7 The Findhorn Terraces Site of Special Scientific Interest (SSSI) is located on the bank of the River Findhorn[i], approximately 8km downstream of the Proposed Scheme. It has a total documented area of 56.8ha and is designated for fluvial geomorphology and quaternary geological features.

11.1.8 Allt a' Choire SSSI is approximately 12km downstream of the Proposed Scheme, designated for fluvial geomorphology features on two small tributaries of the River Findhorn which are not hydrologically connected to the Proposed Scheme.

11.1.9 Given the respective citations and distances from the Proposed Scheme, these Designated Sites are not considered to be subject to potential impact and are not considered any further in the assessment.

11.1.10 The Proposed Scheme does not cross any areas at potential risk from coastal flooding and the tidal boundary of the River Findhorn is some 36km downstream of where the Proposed Scheme comes closest to the Findhorn at Tomatin. Therefore, coastal flood risk has been scoped out.

11.1.11 The SEPA groundwater flood map shows that there is no expectation of flooding from groundwater and the review of the geology (solid, superficial and aquifer vulnerability) maps presented in the A9 Dualling Programme Strategic Flood Risk Assessment [iv] indicated low likelihood of groundwater flooding, and it was therefore not considered a strategic issue. This has been excluded from the assessment.

Study Area

11.1.12 The study area generally refers to a broad 5km buffer surrounding the extent of the Proposed Scheme. Watercourse reaches which extend downstream of this corridor are also considered part of the study area due to hydrological connectivity.

11.1.13 In relation to the Flood Risk Assessment (FRA) the study area is based on the entire River Findhorn catchment as the FRA is required to assess the impacts on downstream sensitive receptors as well as in the immediate vicinity of the Proposed Scheme.

11.1.14 Specific baseline datasets are more limited in extent, to focus attention closer to the Proposed Scheme, for example water supplies have been identified within 1km of the Proposed Scheme, extending to 5km downstream.

11.1.15 National Pond Surveys have been undertaken as part of the Ecological Impact Assessment as detailed in Chapter 12 (Ecology and Nature Conservation) which have focussed on standing water bodies located within 150m of the Proposed Scheme.

11.2 Approach and Methods

11.2.1 The assessment has been carried out in accordance with the guidance contained in the Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 10 Road Drainage and the Water Environment (HD 45/09)[ii]. An explanation of the methods used is provided below.

Guidance

11.2.2 The following guidance documents have been used to inform the assessment:

- A9 Dualling Programme Strategic Environmental Assessment (SEA)[iii]
- A9 Dualling Programme Strategic Flood Risk Assessment (SFRA)[iv]
- Scottish Planning Policy (SPP) (paragraphs 254 – 268)[v]
- Highways Agency et al., Design Manual for Roads and Bridges (DMRB):
  - Volume 11, Section 3, Part 10 HD 45/09 – Road Drainage and the Water Environment[ii]
  - Volume 11, Section 4, Part 1 HD 44/09 – Assessment of Implications (of Highways and/or Road Projects) on European Sites (Including Appropriate Assessment)[vi]
  - Volume 4, Section 2, Part 3 HD 33/16 Design of Highway Drainage Systems[vii]
  - DMRB Part 7 HA 107/04 Design of Outfall and Culvert Details[viii]
- Society of Chief Officers of Transportation for Scotland's (SCOTS) 2009 'SUDS for Roads' guidance document[ix]

- The Highland Council - Flood Risk and Drainage Impact Assessment Supplementary Guidance[x]
- Scottish Environment Protection Agency (SEPA) publications:
  - The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) - A Practical Guide (February 2018)[xi]
  - Good Practice - River Crossings (Nov 2010)[xii]
  - Good Practice – Inlets and Outfalls (Oct 2008)[xiii]
  - SEPA Position Statement – Culverts (Jun 2015)[xiv]
  - Technical Flood Risk Guidance for stakeholders V8 – Feb 2015)[xv]
  - Flood Modelling Guidance for Responsible Authorities version 1.1[xvi]
  - WAT-RM-02 Regulation of Licence-level Engineering Activities[xvii]
  - WAT-RM-08 Sustainable Urban Drainage systems[xviii]
- Construction Industry Research and Information Association (CIRIA) publications:
  - C532 – Control of water pollution from construction sites: Guidance for consultants and contractors[xix]
  - C648 – Control of water pollution from linear construction projects. Technical Guidance[xx]
  - C649 – Control of water pollution from linear construction sites. Site guide[xxi]
  - C689 - Culvert design and operation guide[xxii]
  - C720 - Culvert design and operation guide supplementary technical note on understanding blockage risks[xxiii]
  - C753 – The SuDS Manual[xxiv]
- SNIFFER - WFD45 A functional wetland typology for Scotland[xxv]
- Scottish Government - River Crossings and Migratory Fish: Design Guidance[xxvi]
- Environment Agency publications:
  - The Fluvial Design Guide[xxvii]
  - Department for Environment, Food and Rural Affairs (DEFRA) / Environment Agency R&D Report FD1914 Guide Book of Fluvial Geomorphology[xxviii]
  - Accounting for residual uncertainty: updating the freeboard guide (Report – SC120014)[xxix]
- Pollution Prevention Guidance (PPGs) and Guidance for Pollution Prevention (GPPs):
  - PPG 1: Understanding your environmental responsibilities - good environmental practices
  - GPP 2: Above ground oil storage tanks
  - PPG 3: Use and design of oil separators in surface water drainage systems
  - PPG 4: Treatment and disposal of sewage where no foul sewer is available
  - GPP 5: Works and maintenance in or near water
  - PPG 6: Working at construction and demolition sites
  - PPG 7: Safe storage - The safe operation of refuelling facilities

- PPG 8: Safe storage and disposal of used oils
- GPP 13: Vehicle washing and cleaning
- PPG 18: Managing fire water and major spillages
- PPG 20: Dewatering underground ducts and chambers
- PPG 21: Pollution incident response planning
- PPG 22: Incident response - dealing with spills
- PPG 26: Safe storage - drums and intermediate bulk containers

Baseline Data Collection

11.2.3 Baseline studies focussed on the following activities for the study area:

- identification of international / nationally designated conservation sites with citations related to the water environment
- identification of surface water bodies; rivers, lochs, streams, ditches, ponds, etc.
- identification of current and historic flood risk
- collation of surface water body characteristics and Water Framework Directive (WFD) classification
- identification of surface water abstractions for local public and private water supplies
- identification of existing A9 water-related infrastructure i.e. culverts, bridges, outfalls and watercourse diversions

11.2.4 Baseline conditions have been determined through desk studies and site survey. The desk studies included review of the following information:

- the Stage 3 Proposed Scheme alignment
- Ordnance Survey (OS) raster mapping on 1:10,000, 1:25,000 1:50,000, 1:250,000 scale[xxx]
- Topographical survey (including aerial imagery) for the A9 Dualling corridor (Blom)
- 1:2,500 aerial photography and grid Digital Terrain Model (DTM)
- High precision 1:500 survey of the carriageway envelopes
- NextMap DTM
- Existing road drainage record drawings from Transport Scotland
- 3D models, including elevations and information of spans, headroom and clearance for each watercourse crossing and road structure
- National Library of Scotland historical mapping[xxxi]
- Old Maps historical mapping[xxxii]
- SEPA WFD classification results webpage[xxxiii]
- Natural Environment Research Centre (NERC) Sub-set of UK digital 1:50,000 scale river centre-line network[xxxiv]
- Public water supply data (Scottish Water)
- Private water supply data (The Highland Council)
- SEPA Indicative Flood Maps[xxxv]

- The National Flood Risk Assessment[xxxvi]
- Flood Estimation Handbook (FEH) CD ROM (V3)[xxxvii]
- Macaulay Institute for Soil Research Soil maps of Scotland (partial coverage) at a scale of 1:250,000[xxxviii] and at a scale of 1:25,000[xxxix]

11.2.5 Initial hydrological walkover surveys were undertaken from the 21st to the 24th July 2015, focussed on existing A9 water-related infrastructure and local water features. Consideration was given to potential scheme interactions in order to establish the sensitivity of receptors.

11.2.6 In relation to flooding, walkover surveys were undertaken on the 27th and 28th July 2015 focussing on existing culverts and floodplains. A prior review of SEPA flood maps and OS mapping was conducted in order to establish areas indicative of potential flooding issues, and to identify floodplain areas requiring further detail to be obtained during the site visit. These locations included the River Findhorn at Tomatin, Dalmagarry Burn, Moy Burn, and the Allt Creag Bheithin.

11.2.7 A hydromorphological walkover was undertaken from the 28th September to the 1st October 2015, this supplemented existing data collected during the hydrological walkover surveys and provided further evidence to support the sensitivity and impact assessments. A private water supply survey was carried out from the 1st to the 4th February 2016, to establish the location and type of private water supplies within the scheme area, and the number of properties fed by each supply.

11.2.8 Further walkover surveys were undertaken on the 16th February 2017 focussing on additional watercourse interactions including proposed crossings and discharge locations.

11.2.9 Supplementary topographical survey was carried out in October 2017 on several watercourses. The channel, associated floodplain and existing structures were surveyed as required. This data was used in the flood risk assessment, hydromorphological assessment and road drainage water quality assessment.

Consultation

11.2.10 There has been ongoing A9 Dualling Project stakeholder consultation through the Environmental Steering Group (ESG) and feedback following public exhibitions.

11.2.11 A meeting was held with SEPA on 22nd August 2016 to present the overall approach to modelling the existing floodplain and watercourse crossings and to address SEPA queries on the Preliminary Flood Risk Assessment (PFRA).

11.2.12 A second meeting was held with SEPA and the Findhorn, Nairn and Lossie Fisheries Trust on 20th December 2016 to discuss the proposal to realign the Dalmagarry Burn and to identify any specific requirements with respect to flood risk, hydromorphology and ecology that should be taken into account in the proposed Stage 3 design.

11.2.13 A survey of properties that are fed by private water supplies was carried out in February 2016 and February 2017 to gather further information, such as supply type, location and number of properties served by each. This has resulted in a number of suspected supplies being confirmed as defunct and therefore excluded from this assessment, and one further supply being included in the assessment which was previously not known of.

Assessment Methods

11.2.14 The approach has focussed upon the characteristics, and subsequent Proposed Scheme impacts upon, surface water hydrological catchments with reference to water bodies characterised by SEPA under the WFD. This hydrological catchment-based approach enables due consideration to be given to both individual locations and the wider cumulative impacts within larger surface water body areas.

Construction Pollution

11.2.15 Evaluation of the potential for pollution of surface waters, as a result of spillage and of the release of sediments into watercourses or water bodies, has involved a review of areas where construction would be required within or in close proximity (i.e. within 50m) to watercourses and water bodies. The number of proposed permanent road drainage discharge structures, the number of watercourse crossings and the individual length of each watercourse realignment has been quantified for the Proposed Scheme alignment.

11.2.16 The sensitivity or importance of the surface waters has been evaluated qualitatively, as has the magnitude of impact of the Proposed Scheme on each waterbody (as set out further below).

Pollution of Surface Waters from Routine Runoff

11.2.17 DMRB HD 45/09 specifies procedures for the assessment of pollution impacts from routine runoff on surface waters, known as 'Method A'.

11.2.18 The Method A assessment comprises two separate elements:

- HAWRAT Assessment: the Highways Agency Water Risk Assessment Tool (HAWRAT) is a Microsoft Excel application designed to assess the short-term risks related to the intermittent nature of road runoff. It assesses the acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment bound pollutants, respectively.
- EQS Assessment: Environmental Quality Standards (EQS) are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the WFD. The long-term risks over the period of one year are assessed through comparison of the annual average concentration of pollutants discharged with the published EQS for those pollutants.

11.2.19 To carry out these assessments a variety of baseline and drainage design information is required including: traffic volumes, areas of impermeable and permeable road surfaces to be drained, proposed treatment train, receiving watercourse dimensions and flow data, water hardness, presence of sensitive sites (considered as international / national designated conservation sites) and in-stream structures or features which may slow the flow.

11.2.20 In relation to the treatment train, preliminary road drainage design proposals were assessed assuming the proposed sustainable drainage systems included in the Stage 3 design are embedded mitigation (refer to Figure 5.10a-k). Reference values for effectiveness of the various systems at removing various pollutants are based on treatment system reduction factors published in DMRB HD 33/16[vii], further details on the values used are provided in Appendix A11.3.

11.2.21 The HAWRAT and EQS assessments apply to trunk roads with annual average traffic volumes greater than 10,000 vehicles/day. With modelled traffic volumes for the Proposed Scheme mainline ranging between 16,000 and 18,000 vehicles/day,

HAWRAT and EQS assessments have therefore been carried out for each of the Proposed Scheme mainline and junction road drainage outfalls. Cumulative assessments have also been carried out where multiple outfalls discharge to a single reach of a watercourse.

11.2.22 For side roads and access tracks, with local traffic flow volumes predicted to be less than 600 vehicle movements per day (with many routes having considerably lower predicted levels), the DMRB HD 45/09 Method A assessment was not deemed appropriate. Therefore, assessment of side road routine runoff has been carried out qualitatively on a case-by-case basis, taking into consideration site specific conditions, and with reference to the guidance provided in the CIRIA SuDS Manual, SCOTS SuDS for Roads and SEPA WAT-RM-08.

Pollution from Accidental Spillage

11.2.23 The DMRB document HD 45/09 specifies procedures for the assessment of pollution impacts from accidental spillage, known as Method D[ii]. A summary of the methodology is provided below, with full details provided in DMRB HD 45/09.

11.2.24 The assessment takes the form of a risk assessment, where the risk is expressed as the annual probability of a serious pollution incident occurring. This risk is the product of two probabilities:

- the probability that an accident will occur, resulting in a serious spillage of a polluting substance on the carriageway
- the probability that, if such a spillage did occur, the polluting substance would reach the receiving water body and cause a serious pollution incident

11.2.25 The probability of a serious spillage occurring is dependent on a variety of factors; traffic volumes, percentage of heavy goods vehicles in the traffic volumes, whether the road is motorway, rural or urban trunk road, the road type categories within the road drainage catchment under assessment i.e. ‘no junction’, ‘slip road’, ‘cross road’ or ‘roundabout’ and the length of each road type within the catchment.

11.2.26 The probability of a serious spillage subsequently causing a serious pollution incident is dependent on the receiving surface water body and the response time of the emergency services, i.e. less than 20 minutes, less than one hour, or greater than one hour.

11.2.27 Typically an annual probability of 1% (i.e. a 1 in 100 chance of a serious pollution incident occurring in any one year) is considered by DMRB as an acceptable risk. However, where a road drainage outfall discharges within 1km of a sensitive receptor, (such as a nationally designated conservation site), a higher level of protection is required, such that the risk has no greater annual probability than 0.5% (i.e. a 1 in 200 chance of occurring in any one year).

11.2.28 Evaluation of the predicted effects has been undertaken for all proposed mainline drainage networks in accordance with the guidance provided in Annex IV of HD 45/09 and outlined in the Impact Assessment Criteria section below.

11.2.29 With regards to side road and access track drainage, risk of pollution as a result of accidental spillage is considered to be very low due to the low traffic volumes anticipated. There is not, therefore, considered to be a significant impact in relation to accidental spillage from the Proposed Scheme side roads and access tracks.

Pollution from Road Salt

11.2.30 The DMRB does not provide a method for assessing the potential impacts of salt on the surface water environment. In the absence of an existing method for assessing salt concentrations in runoff and at the point of dilution, a simple and conservative risk-based model has been developed for use on projects within the A9 Dualling Programme that generally follows the approach taken by the HAWRAT method.

11.2.31 Full details of the salt assessment methodology and results are provided in Appendix A11.3.

11.2.32 It should be noted that the results of the salt assessment have not been included within the overall impact assessment for the Proposed Scheme, due to there being no defined UK short-term EQS for Cl-, an absence of any methodology for assessing the impacts of salt within the DMRB guidance and lack of published data on SuDS treatment efficiency of Cl-.

Alterations to the Hydromorphological Regime

11.2.33 The hydromorphology assessment has involved a desk study and preliminary screening exercise to identify sensitive watercourses and locations where impacts from the Proposed Scheme were most likely.

11.2.34 The screening exercise was carried out for all watercourses identified as being crossed by the Proposed Scheme, in order to identify those which met the following broad set of criteria:

- the watercourse is a permanent flowing system with a channel width >1m
- the watercourse is to be lost/culverted/diverted or potentially experience a significant change in water quality or quantity
- is not obviously canalised or heavily managed
- is hydrologically linked to a designated water-dependent site

11.2.35 Subsequently, a hydromorphological walkover survey was carried out to determine the specific character of the geomorphological forms and processes in each of these watercourses. Further details on the desk study, screening process and walkover survey are provided in Appendix A11.1 Hydromorphology Assessment.

11.2.36 The above information, in conjunction with data on the WFD status of the relevant water bodies, has been used in the evaluation of the sensitivity of the watercourses.

11.2.37 Locations of proposed bridges, culverts, watercourse diversions and outfalls associated with the Proposed Scheme have been reviewed. The magnitude of potential impacts on channel form and gradient, flow volumes and rates, and erosion and sedimentation processes has been evaluated qualitatively. Sediment entrainment and stream power calculations were also undertaken based on the outputs from the flood risk assessment hydraulic models, providing additional context to the assessment.

11.2.38 As part of the Proposed Scheme, it has been anticipated that the design of structures and any diverted channels will incorporate standard good practice measures, considered as embedded design for this assessment.

11.2.39 It should be noted that the DMRB does not outline a specific methodology or guidance on the evaluation of hydromorphological impacts. Therefore, hydromorphological sensitivity and impact magnitude criteria have been developed based on guidance

provided in the DEFRA/EA R&D Report FD1914 Guide Book of Fluvial Geomorphology[xxviii].

Increased Flood Risk

11.2.40 The appraisal of flood risk impacts associated with the Proposed Scheme has considered:

- increases in upstream water level caused by any restriction in flow
- loss of floodplain storage due to road infrastructure occupying areas which were previously available for flood storage or flows
- loss of floodplain conveyance due to road infrastructure crossing existing floodplain and forming a barrier to flow or modifying existing hydraulic links between channel and floodplain
- impediment of water flow caused by road infrastructure crossing existing drainage channels, causing potential blockage and altering local catchment area boundaries
- the diversion of watercourses and drains causing changes in catchment boundaries, channel flow capacities and floodplain storage

11.2.41 The Proposed Scheme has been designed to ensure neutral impact on flood risk as set out in the Strategic Environmental Design Principles (Appendix A4.1) and Chapter 5 The Proposed Scheme.

11.2.42 Existing watercourse crossings were identified from OS Mastermap data, Transport Scotland's structures database and confirmed from site visit. Peak flows were derived for each watercourse crossing catchment using the methodologies outlined in the Flood Estimation Handbook[xl] and methods agreed with SEPA. The hydraulic capacities of each crossing have been calculated using unsteady state one dimensional (1D) hydraulic models.

11.2.43 A matrix has been developed using professional judgement to categorise the magnitude of the potential impact from increasing hydraulic capacity at existing water crossings (Table 11.1 below) based on the scale of the change in flow and the size of the watercourse.

Table 11.1: Impact Magnitude of Changes to Flow Regime - Future Impact Matrix

Existing Culvert Capacity	0.5% AEP Peak Flow (m3/s)			
	<1	**1-5**	**5-25**	**> 25**
>0.5% AEP (1:200yr). No attenuation potential, upsizing will not have an impact on DS hydrograph.	Negligible	Negligible	Negligible	Negligible
1%-0.5% AEP Small potential for increasing DS flows if culvert is upsized.	Negligible	Minor	Moderate	Major
10% – 1% AEP Some potential for increasing DS flows if culvert is upsized.	Minor	Moderate	Moderate	Major
<10% AEP Significant potential for increasing DS flows if culvert is upsized.	Minor	Moderate	Major	Major

11.2.44 For the DMRB Stage 2 assessment a linked one and two dimensional (1D/2D) hydraulic model was developed for the River Findhorn. The hydraulic modelling was constructed using ISIS TuFlow and was carried out in accordance with SEPA's Technical Guidance for Stakeholders[xli]. The model, which is described in the Preliminary Flood Risk Assessment (PFRA), extends from the Allt Creag Bheithin (NGR NH 747 346) to Shenachie on the River Findhorn (NGR NH 828 339) including Moy Burn, Loch Moy, Funtack Burn, Dalmagarry Burn and the River Findhorn. The model has been further developed at DMRB Stage 3 to represent the developments to the Proposed Scheme and mitigation measures at key flooding locations.

11.2.45 The hydraulic model was used to identify areas where the Proposed Scheme may cause full or partial disconnection of the floodplain and where there may be loss of floodplain through encroachment of the Proposed Scheme. Subsequent changes in flood level at sensitive receptors has been quantified and the magnitude of this impact assessed using criteria given in DMRB 45/09.

11.2.46 Further details of the technical approach, parameters, modelling and proposed modelling can be found in Appendix A11.2 Flood Risk Assessment.

Loss or Change to Standing Water

11.2.47 Direct loss of standing water under the footprint of the Proposed Scheme has been identified. Activities occurring close to standing water bodies can also cause indirect effects, interrupting flows feeding the local water body. Standing water bodies within 500m of the Proposed Scheme have been identified using OS 1:10,000 mapping and have been considered alongside local topography in order to identify potential impacts on a case by case basis. All standing water bodies located outwith 250m of the Proposed Scheme are not considered to be affected due to intervening topography. Therefore, only those located within a distance of 250m of the Proposed Scheme have been considered further as part of this assessment.

11.2.48 The sensitivity or importance of standing waters have been evaluated qualitatively, with reference to the evaluation of a number of ponds in Chapter 12 Ecology and Nature Conservation, as has the magnitude of impact of the Proposed Scheme on each.

Loss or Change to Water Supplies

11.2.49 Public and private water abstraction information was provided in October 2015 by Scottish Water and The Highland Council, with a small number of owner-occupier consultations undertaken during DMRB Stage 2 and further consultation undertaken at DMRB Stage 3. The quality of the private water supply data provided by The Highland Council was variable, with grid references and type of supply (i.e. surface water or groundwater source) missing for a small number of supplies. In such cases, consultation has led to confirmation of supply type and location, and has also resulted in the removal of some previously suspected supplies from the Stage 3 assessment following confirmation of such now being defunct. Furthermore, investigations carried out at Stage 3 have also led to the inclusion of an additional supply serving three properties in the Moy area which was previously unaccounted for, as detailed in Appendix A11.4.

11.2.50 Potential impacts on water supplies have been evaluated qualitatively based on the potential hydrological linkage and distance between the construction areas of the Proposed Scheme and the water supply sources.

Impact Assessment Criteria

11.2.51 The predicted significance of impacts on surface waters and floodplains have been based on an evaluation of the feature and the potential impact from the Proposed Scheme, as recommended in HD 45/09.

Sensitivity

11.2.52 The sensitivity of the water bodies have been evaluated taking into account their quality, rarity, scale and substitutability. The criteria used in determining the sensitivity of each water body are detailed in Table 11.2, these are in accordance with the guidance and examples provided in HD 45/09.

Table 11.2: Criteria Used to Estimate the Sensitivity of Receptors

Sensitivity	Typical Criteria / Indicator of Value
Very High	Surface Water Quality[1] · Water Quality: 'High' WFD overall status. None or a negligible number of anthropogenic pressures and/or pollutant sources affecting the water feature WFD status, and/or potable water supply serving >10 properties in remote areas where there is no access to alternative supplies. · Dilution/Removal of waste products: Very low pollutant dilution/dispersal capacity (Q95 < 0.010m³/s) and/or significant number of existing discharges. · Biodiversity: 'High' WFD ecology status. Presence of aquatic species and/or habitats identified as important at an 'International' scale. Protected/designated site under EC or UK habitat legislation (e.g. Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar site), and/or no existing pressures to biodiversity.
	Hydrology and Flood Risk · Hydrological importance to internationally designated sensitive ecosystems and/or critical social and economic uses (e.g. water supply, abstraction, recreation, amenity). · Water feature with direct flood risk to > 100 residential properties or critical infrastructure (e.g. trunk road or main line railway, hospitals, schools, safe shelters).
	Hydromorphology Sediment Regime · Water feature sediment regime provides a diverse mosaic of habitat types suitable for species sensitive to changes in sediment concentration and turbidity, such as migratory salmon, freshwater pearl mussels. Water feature appears in complete equilibrium with natural erosion and deposition occurring. The water feature has sediment processes reflecting the nature of the catchment and fluvial system. Channel Morphology · Water feature includes varied morphological features (e.g. pools, riffles, bars, natural bank profiles) with no sign of channel modification. Natural Fluvial Processes

[1] Surface water' means all standing or flowing water on the surface of the land (e.g. rivers, lochs, canals, reservoirs, ponds/wetlands). Wetland' means an area of ground the ecological, chemical and hydrological characteristics of which are attributable to frequent inundation or saturation by water and which is directly dependent, with regard to its water needs, on a body of groundwater or a body of surface water.

Sensitivity	Typical Criteria / Indicator of Value
	· Water feature displays natural fluvial processes and natural flow regime, which would be highly vulnerable to change as a result of modification.
High	Surface Water Quality · Water Quality: 'Good' WFD overall status. A small number of anthropogenic pressures and/or pollutant sources that do not significantly affect the water feature WFD status and/or potable water supplies serving < 10 properties in remote areas where there is no access to alternative supplies and/ or use of water for extensive agricultural purposes · Dilution/Removal of waste products: Moderate pollutant dilution/dispersal capacity (Q95 = 0.01m³/s – 0.1m³/s) and/or several existing discharges at the waterbody scale. · Biodiversity - 'Good' WFD ecology status. Presence of aquatic species and/or habitats identified as important at a 'National' scale. Protected/designated site under EC or UK legislation (SAC, SPA, Ramsar, SPA, SSSI) and few existing pressures to biodiversity.
	Hydrology and Flood Risk: · Hydrological importance to nationally designated ecosystems and/or locally important social and economic uses (e.g. water supply, abstraction recreations, and amenity). · Water feature with direct flood risk to 1 -100 residential properties, >10 industrial premises, and/or other land use of high value or indirect flood risk to critical infrastructure.
	Hydromorphology Sediment Regime: · Water feature sediment regime provides habitats suitable for species sensitive to changes in sediment concentration and turbidity, such as migratory salmon, freshwater pearl mussels. Water feature appears largely in natural equilibrium with some localised accelerated erosion and/or deposition caused by land use and/or modifications. Primarily the sediment regime reflects the nature of the natural catchment and fluvial system. Channel Morphology: · Water feature exhibiting a natural range of morphological features (e.g. pools, riffles, bars, varied natural river bank profiles), with limited signs of artificial modifications or morphological pressures Natural Fluvial Processes: · Predominantly natural water feature with a diverse range of fluvial processes that is highly vulnerable to change as a result of modification
Medium	Surface Water Quality · Water Quality: 'Moderate' WFD overall status or not classified by SEPA. Likely to have deteriorated in water quality as a result of anthropogenic pressures and/or pollutant sources and/or potable water supplies, located within the vicinity of a mains water supply and/ or supplies used only for local agricultural purposes. Dilution/Removal of waste products: · High pollutant dilution and dispersal capacity (Q95 =0.1m³/s – 1m³/s) and/or a small number of existing discharges at the waterbody scale. Biodiversity:

Sensitivity	Typical Criteria / Indicator of Value
	· 'Moderate' WFD ecology status. Presence of aquatic species and/or habitats identified as important at a 'Local', 'Authority Area', or 'Regional' scale. Likely to exhibit a limited number of regional designated ecosystems and/or existing pressures which are likely to be affecting biodiversity.
	Hydrology and Flood Risk · Some but limited hydrological importance to sensitive ecosystems and/or social and economic uses · Water feature with direct flood risk to recreational land or high value agriculture (e.g. arable land, pastures, complex cultivation patterns and agro-forestry) and/or affecting < 10 industrial premises.
	Hydromorphology Sediment Regime · Water feature sediment regime provides some habitat suitable for species sensitive to change in suspended sediment concentrations or turbidity. A water feature with natural processes occurring but modified, which causes notable alteration to the natural sediment transport pathways, sediment sources and areas of deposition. Channel Morphology · Water feature exhibiting some morphological features (e.g. pools, riffles and depositional bars). The channel cross-section is partially modified in places, with obvious signs of modification to the channel morphology. Natural recovery of channel form may be present (e.g. eroding cliffs, depositional bars). Natural Fluvial Processes · Water feature with some natural fluvial processes, including varied flow types. Modifications and anthropogenic influences having an obvious impact on natural flow regime, flow pathways and fluvial processes.
Low	Surface Water Quality · Water Quality: 'Poor/Bad' WFD overall status or not classified by SEPA. Highly likely to be affected by anthropogenic pressures and/or pollution sources and/or heavily engineered or artificially modified features (e.g. Road and field drains, and ephemeral features) and/or not used for water supplies. Dilution/Removal of waste products: · Very High pollutant dilution and dispersal capacity (>1m³/s) and/or none or negligible existing discharges at the waterbody scale. Biodiversity · 'Poor/ Bad' WFD ecology status. No habitats/species of conservation and/or any existing pressures which are considered to be adversely affecting biodiversity. Areas considered to be of 'Less than Local' importance.
	Hydrology and Flood Risk · Minimal hydrological importance to sensitive ecosystems and/or social and economic uses. · Water feature with little or no flood risk, affecting low value agricultural land (e.g. rough grazing land).
	Hydromorphology Sediment Regime

Sensitivity	Typical Criteria / Indicator of Value
	· Water feature sediment regime which provides very limited physical habitat for species sensitive to changes in suspended solids concentration or turbidity. Highly modified sediment regime with limited/no capacity for natural recovery. Channel Morphology · Water feature that has been extensively modified (e.g. by culverting, addition of bank protection or impoundments) and exhibits limited-to-no morphological diversity. The water feature is likely to have uniform flow, uniform banks and absence of bars. Insufficient energy for morphological change. Natural Fluvial Processes · Water feature which shows no or limited evidence of active fluvial processes with unnatural flow regime or/and uniform flow types and minimal secondary currents.

Magnitude of Impact

11.2.53 The magnitude of the various impacts is evaluated taking into account the extent of loss and effects on integrity of the relevant water body attributes. The criteria used in determining the magnitude of impact are detailed in Table 11.3 below, and are in keeping with the guidance and examples provided in HD 45/09.

Table 11.3: Criteria Used to Estimate the Magnitude of an Impact on Receptors

Magnitude	Typical Criteria
Major Adverse	Surface Water Quality · Major shift away from baseline conditions such that change is likely to result in a downgrade in overall WFD status and/or total removal of the water feature's capacity to dilute pollutants and waste products and/or loss or extensive change to a fishery, water supply or nature conservation site; and/or · Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A, Annex I) and compliance failure with EQS values (Method B). Calculated risk of pollution from a spillage >2% annually (Spillage Risk Assessment, Method D, Annex I). Hydrology and Flood Risk · Major changes to flow regime (low, mean and/or high flows – at the site, upstream and/or downstream). An alteration to a catchment area in excess of a 25% reduction or increase. · Major changes to the flood characteristics of the floodplain or water feature leading to an increase in the magnitude or frequency of flooding (or both). Loss of floodplain which results in an increase in 0.5% AEP peak levels >100mm. Hydromorphology Sediment Regime · Significant impacts on the water feature bed, banks and vegetated riparian corridor resulting in changes to sediment characteristics, transport processes, sediment load and turbidity. This includes extensive input of sediment from the wider catchment due to modifications. Impacts would be at the waterbody scale. Channel Morphology · Significant/extensive alteration to channel planform and/or cross section, including modification to bank profiles or the replacement of a natural bed. This could include: significant channel realignment (negative); extensive loss of lateral connectivity due to new/extended embankments; and/or, significant modifications to channel morphology due to installation of culverts or outfalls. Impacts would be at the waterbody scale. Natural Fluvial Processes · Significant shift away from baseline conditions with potential to alter processes at the catchment scale. Condition Status · Substantial adverse impacts at the water body scale, which causes loss or damage to habitats. Impacts have the potential to cause deterioration in hydromorphology quality elements*. Prevents the water body from achieving Good status.
Moderate Adverse	Surface Water Quality · A moderate shift away from baseline conditions, likely to result in a decline in water quality, but not a downgrade in WFD overall status. Partial loss in productivity of a fishery or water supply. Reduction in the water feature's capacity to dilute pollutants and waste products, and/or

Magnitude	Typical Criteria
	· 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. Hydrology and Flood Risk · Moderate shift away from baseline conditions and moderate changes to the flow regime. An alteration to a catchment area in excess of 10% but less than 25%. · Loss of floodplain which results in an increase in 0.5% AEP peak levels of between 50mm and 100mm. Hydromorphology Sediment Regime · Some changes and impacts on the water feature bed, banks and vegetated riparian corridor resulting in some changes to sediment characteristics, transport processes, sediment load and turbidity. Impacts would be at the multiple reach scale. Channel Morphology · Some alteration to channel planform and/or cross section, including modification to bank profiles or the replacement of a natural bed. Activities could include: channel realignment, new/extended embankments, modified bed and/bank profiles, replacement of bed and/or banks with artificial material and/or installation of culverts. Impacts would be at the multiple reach scale. Natural Fluvial Processes · A shift away from baseline conditions with potential to alter processes at the reach or multiple reach scale. Condition Status · Moderate adverse impacts at the reach or multiple reach scale, which causes some loss or damage to habitats. Impacts have the potential to cause failure or deterioration in one or more of the hydromorphological quality elements. May prevent the water body from achieving Good status.
Minor Adverse	Surface Water Quality · A minor shift away from baseline conditions. Slight reduction in the water feature's capacity to dilute pollutants and waste products. Likely to result in a slight decline in water quality, but with no associated impacts on designated species/habitats or water supply; and/or · Failure of either soluble or sediment-bound pollutants in HAWRAT. Calculated risk of pollution from spillages >0.5% annually and <1% annually Hydrology and Flood Risk · Slight changes to the flow regime. An alteration to a catchment area in excess of 1% but less than 10%. · Loss of floodplain which results in an increase in 0.5% AEP peak levels of between 10mm and 50mm. Hydromorphology

Magnitude	Typical Criteria
	Sediment Regime · Limited impacts on the water feature bed, banks and vegetated riparian corridor resulting in limited (but notable) changes to sediment characteristics, transport processes, sediment load and turbidity at the reach scale. Channel Morphology · A small change or modification in the channel planform and/or cross section. Includes upgrade to and/or extension of existing watercourse crossing and/or structure with associated minor channel realignment with localised impacts. Natural Fluvial Processes · Minimal shift away from baseline conditions with typically localised impacts up to the reach scale. Condition Status · Minor adverse impacts at the reach scale, which may cause partial loss or damage to habitats. Impacts have the potential to cause failure or deterioration in one of the hydromorphological quality elements.
Negligible	Surface Water Quality · No perceptible changes to baseline conditions. No measureable change in water quality. No change in the water feature's capacity to dilute pollutants and waste products; and/or · No risk identified by HAWRAT. Risk of pollution from spillages <0.5% Hydrology and Flood Risk · Negligible changes to the flow regime (i.e. changes that are within the monitoring errors). An alteration to a catchment area of less than 1% reduction in area. · Negligible increase in peak flood level (increase in 0.5% AEP peak levels <10mm). Hydromorphology · Minimal or no measurable change from baseline conditions in terms of sediment transport, channel morphology and natural fluvial processes. Any impacts are likely to be highly localised and not have an effect at the reach scale.
Minor Beneficial	Surface Water Quality · Minor improvement over baseline conditions, with the potential to facilitate: a slight increase in the water features capacity to dilute pollutants or waste products, a slight improvement in the productivity of a fishery or water supply. Hydrology and Flood Risk: · Moderate improvement over baseline conditions involving a reduction in 0.5% AEP peak flood level of between 10mm and 50mm. Hydromorphology

Magnitude	Typical Criteria
	Sediment Regime · Partial improvement to sediment processes at the reach scale, including reduction in siltation and localised recovery of sediment transport processes. Channel Morphology · Partial improvements include enhancements to in-channel habitat, riparian zone and morphological diversity of the bed and/or banks. Natural Fluvial Processes · Slight improvement on baseline conditions with potential to improve flow processes at the reach scale. Condition Status · Slight beneficial impacts at the reach scale, which may cause partial habitat enhancement. Impacts have the potential to improve one of the hydromorphological quality elements.
Moderate Beneficial	Surface Water Quality · A moderate improvement over baseline conditions with the potential to facilitate: an upgrade in individual WFD quality elements, moderate increase in the water features capacity to dilute pollutants or waste products, a moderate improvement in the productivity of a fishery or water supply and/or Hydrology and Flood Risk · Moderate improvement over baseline conditions involving a reduction in 0.5% AEP peak flood level of between 50mm and 100mm. Hydromorphology Sediment Regime · Reduction in siltation and recovery of sediment transport processes at the reach or multiple reach scale. Channel Morphology · Partial creation of both in-channel and vegetated riparian habitat. Improvement in morphological diversity of the bed and/or banks at the reach or multiple reach scale. Includes partial or complete removal of structures and/or artificial materials. Natural Fluvial Processes · Notable improvements on baseline conditions and recovery of fluvial processes at the reach or multiple reach scale. Condition Status · Notable beneficial impacts at the reach to multiple reach scale. Impacts have the potential to improve one or more of the hydromorphological quality elements and/or assist the water body in achieving Good status.

Magnitude	Typical Criteria
Major Beneficial	Surface Water Quality · Major improvement over baseline conditions with the potential to facilitate: an upgrade in WFD overall status, substantial increase in the water features capacity to dilute pollutants or waste products, a substantial improvement in the productivity of a fishery or water supply; and/or · Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse Hydrology and Flood Risk: · Moderate improvement over baseline conditions involving a reduction in 0.5% AEP peak flood level >100mm Hydromorphology Sediment Regime · Improvement to sediment processes at the catchment scale, including recovery of sediment supply and transport processes. Channel Morphology · Extensive creation of both in-channel habitat and riparian zone. Morphological diversity of the bed and/or banks is restored, such as natural planform, varied natural cross-sectional profiles, recovery of fluvial features (e.g. cascades, pools, riffles, bars) expected for river type. Removal of modifications, structures, and artificial materials. Natural Fluvial Processes · Substantial improvement on baseline conditions at catchment scale. Recovery of flow and sediment regime. Condition Status · Substantial beneficial impacts at the catchment scale, which result in recovery/restoration of natural habitats suitable for supporting sensitive species. Potential improvement of overall status condition, which could lead to achieving Good status.

* Hydromorphological quality elements are: quality and quantity of flow; river depth and width variation; structure and substrate of the bed dynamics; river continuity; structure of the riparian zone.

Impact Significance

11.2.54 The estimation of the impact significance has been arrived at by combining the estimated sensitivity of the affected water bodies and the magnitude of the impacts as indicated in Table 11.4, following the guidance provided in HD 45/09. Where the significance is shown as being one of two alternatives a single description is provided based upon reasoned judgement.

Table 11.4: Criteria Used to Estimate the Significance of Potential Effects

Sensitivity	Magnitude of Impact			
	Major	Moderate	Minor	Negligible
Very High	Very Large	Large / Very Large	Moderate / Large	Neutral
High	Large / Very Large	Moderate / Large	Slight/Moderate	Neutral
Medium	Large	Moderate	Slight	Neutral
Low	Slight / Moderate	Slight	Neutral	Neutral

Limitations of the Assessment

11.2.55 This assessment has relied upon the accuracy and level of detail of the documented data sources. For instance, the identification of water bodies and current characteristics has involved reference to Scotland's Environment and SEPA websites for River Basin Management Plans (RBMPs) and associated WFD water body information sheets. The datasets are updated annually and the latest available information (2016) has been included.

11.2.56 With regards to the routine runoff assessment, use of HAWRAT presents several limitations. Firstly, a rainfall site must be selected from an embedded list of 21 sites across the UK, with only three located in Scotland. The closest and most geographically similar rainfall site is Ardtalnaig (near Aberfeldy). The annual average rainfall at Ardtalnaig is reported as being 1402mm while the annual average rainfall within the study area is approximately 1053mm. There is therefore potential for overestimation of flows within the receiving watercourses and from the road drainage networks. Additionally, HAWRAT uses two-way Annual Average Daily Traffic (AADT) volumes in the estimation of pollutant build-up on the road, where AADT data is entered in broad bands of 10,000 to 50,000, 50,000 to 100,000, and >100,000. Given that the volumes of traffic estimated for the Proposed Scheme (16,000-18,000 AADT) are at the lower end of the lowest traffic band it is likely that there is overestimation of the pollutant concentrations in the road runoff. Finally, the required treatment percentages returned by HAWRAT are very precise, however the guidance on the treatment efficiency of SuDS provided in HD 33/16 can only be used as broad indicator of performance. With all of the above in mind, a degree of pragmatism is required when designing and assessing the road drainage system; the treatment train should be sufficient to reasonably treat runoff.

11.2.57 In addition to the limitations associated with HAWRAT as outlined above, it should be noted that there is no direct linkage between the results and current or targeted WFD objectives. In order to be certain of the direction of impact (adverse/beneficial) it would be necessary to carry out a baseline HAWRAT assessment of the existing drainage system and compare the existing and proposed scenarios. However as there is no formal collection system or outfalls from the existing drainage this is not possible. Notwithstanding this, the fact that the existing drainage system provides no treatment, while the Proposed Scheme has committed to two levels of treatment for each network

as a minimum provides an adequate level of certainty that there will be no adverse impacts associated with the proposed drainage discharges.

11.2.58 The results of the hydromorphology walkover are based on a fluvial geomorphological walkover rather than a full fluvial audit approach, supplemented by desk study information and aerial imagery. The findings of the walkover are focussed around the immediate vicinity of the Proposed Scheme crossings and are not broken into reaches, except for those sections immediately upstream and downstream of the existing A9 crossing locations. Where possible a minimum of 250m upstream and downstream was surveyed; however, where this was not possible due to access restrictions, spot checks were taken at accessible locations upstream and downstream in order to establish a sufficient understanding of the watercourse processes and sensitivity.

11.2.59 The watercourse features and processes observed may vary over time/seasons and high flow events. Site surveys were undertaken under relatively dry conditions, and the overall watercourse function and stability were inferred through professional judgement and the interpretation of features on site. The Proposed Scheme is at preliminary design stage with detailed design to undertaken by the appointed contractor, therefore the precise nature of the impacts on the watercourses are potentially subject to change. In all cases the worst-case scenario has been considered and assessed.

11.2.60 The balance of surface water and groundwater influence on standing water bodies is not certain. Therefore, indirect impacts as a result of changes to hydrological catchments, such as drainage of ponds is not fully known. In all cases the worst case scenario has been considered and assessed.

11.2.61 Information on public and private water supplies has been provided by Scottish Water and The Highland Council, respectively. It is recognised that private water supply data may not have been accurately registered for all local properties, with limited information provided relating to current use, source type and source locations. Detailed consultation with a number of owner-occupiers has been carried out as part of both DMRB Stage 2 and Stage 3 to confirm location and use of water supplies within the scheme area, including those potentially not registered with The Highland Council.

11.2.62 The accuracy of hydraulic modelling is primarily dependent on the quality of hydrological and topographical data. Key factors include the resolution of the topographic data, the accuracy of surveys of hydraulic structures, the availability of data on past flooding and the limitations of the modelling software. SEPA and EA guidance[xvi,xxvii,xxix] advises that model accuracy is site specific and recommends that modellers use sensitivity analysis to assess model accuracy. Model accuracy is considered as a part of the flood risk assessment.

11.3 Baseline Conditions

11.3.1 Due to the large number of water environment receptors associated with the Proposed Scheme much of the detailed baseline information has been collated in Appendix A11.4 Baseline Conditions. This appendix provides detailed information on the following aspects of the water environment of the study area:

- rainfall
- surface water catchment and channel descriptions
- surface water flows
- standing waters
- water quality

- water supplies, abstractions and discharges, including:
  - public water supplies
  - private water supplies
  - SEPA CAR registered abstractions and discharges
  - existing road drainage discharges

11.3.2 Detailed baseline information on the hydromorphology and flood risk of the watercourses within the study area is documented in Technical Appendices A11.1 and A11.2, respectively.

11.3.3 A brief overview of the baseline conditions is provided below, complete with a summary table of all potential receptors, their assessed sensitivity for a variety of attributes and brief details of the justification for those sensitivity ratings

Overview

11.3.4 There are no conservation sites designated for water related features within the study area, or up to 5km downstream.

11.3.5 The Proposed Scheme lies entirely within the catchment of the River Findhorn, and interacts directly or indirectly with several of its larger tributaries, namely the Allt na Frithe, Allt Dubhag, Funtack Burn (with Dalmagarry Burn tributary) and Moy Burn (with tributaries); Allt na Loinne Mor, Allt na Slanaich and Allt Creag Bheithin), as shown in Figure 11.1a-k. In addition to these larger watercourses, the Proposed Scheme also interacts with numerous small streams, drains and ditches. Many of the smaller streams and drains are unnamed, therefore for ease of assessment they have been given project specific reference names.

11.3.6 In total the Proposed Scheme interacts with 40 watercourses. Within the study area these watercourses are generally typical of rural upland watercourses, exhibiting fast, shallow flow, moderate to steep gradients and a flashy response to rainfall events.

11.3.7 The larger burns are generally unmodified, except in localised areas such as in the vicinity of the existing A9 and Highland Main Line railway, as summarised in Table 11.5.

Table 11.5: Watercourse Hydromorphology Summary

Watercourse Name	Hydromorphological Description
Allt na Frithe (Figure 11.1d)	Watercourse exhibiting a good range of morphological features and active fluvial processes, with a diverse and dynamic range of flows. The observed features suggest potential for large sediment movements through the system. However, it has been modified/constrained by the adjacent land use and existing road and rail crossings.
Allt Dubhag (Figure 11.1e)	Watercourse near the existing crossing is already extensively modified with bed and bank protection and long culvert. The flows were uniform, despite some discrete areas of step-pools.
Dalmagarry Burn (Figure 11.1f)	Watercourse has historically been realigned and the existing channel is in part constrained by embankments and crossed several times. There were, however, signs of renaturalisation and evidence of very active sediment transport processes occurring, with step-pool sequences and large gravel bars around the existing A9 crossing.
Caochan na h-Eaglais	Minor watercourse with some dynamic fluvial features (step-pools, gravel bars) encouraging diverse flows. However, it has been extensively

Watercourse Name	Hydromorphological Description
(Figure 11.1h)	modified upstream and downstream of the existing crossing, and the upstream catchment is significantly affected by forestry.
Allt na Loinne Mòire (Figure 11.1h)	Watercourse exhibiting highly dynamic gravel bed features in the upstream section, but has been significantly modified by a now derelict reservoir, road and rail crossings. There are some signs of recovery, but the channel is still constrained.
Allt na Slànaich (Figure 11.1i)	Watercourse displays a wide range of morphological features and dynamic fluvial processes. It has been historically modified albeit limited to existing and old crossings.
Allt Creag Bheithin (Figure 11.1i-k)	Upstream survey limited by access, however downstream displayed a range of flows and morphological features, with large gravel bars. There were some sections of uniform flows and straightened planform.

11.3.8 The smaller drains that cross the Proposed Scheme are generally heavily modified or entirely man made, with little hydromophological diversity and have therefore been assessed as being of Low sensitivity.

11.3.9 In relation to flood risk, of the 25 existing A9 watercourse crossings there are nine crossings where the current capacity restricts flow downstream of the crossing. These are located on the Allt Creag Bheithin, Allt na Slanaich and in the vicinity of Dalmagarry. All other existing crossings can convey the 0.5% AEP peak flow including a 20% allowance for climate change.

11.3.10 Based on the SEPA Medium flood risk scenario (the 0.5% AEP event) mapping the following areas in the vicinity of the Proposed Scheme were identified as having a 'Medium – High' flood risk. Hydraulic modelling has been carried out to confirm and refine the flood extent mapping, as shown in Figure 11.1a-k (more detailed mapping of each area is presented in Appendix A11.2 Flood Risk Assessment):

- Allt na Frithe (near Tomatin), River Findhorn catchment
- Dalmagarry Burn, Funtack Burn sub-catchment
- Allt Creag Bheithin, Moy Burn sub-catchment

11.3.11 SEPA have also published flood mapping showing the likelihood of flooding from surface water (overland flow). The surface water flood maps show that there are some relatively small localised pockets of flooding on and adjacent to the A9 between the former Moy School and Moy Village, with 'High' likelihood of flooding shown on the A9 at Lynebeg.

11.3.12 The SEPA groundwater flood map shows that there is no expectation of flooding from groundwater. However, groundwater often acts as a contributing factor to flooding rather than the primary source, for example, with groundwater flows contributing to river baseflow. Chapter 10 (Geology, Soils and Groundwater) details the geology and hydrogeology of the study area, with the Hydrogeological Map of Scotland indicating that the glaciofluvial sands and gravels found in the river valleys represent high productivity aquifers. Groundwater flows within these deposits are expected to generally follow the surface topography, draining to the local watercourses. The limited groundwater monitoring available indicates that levels are stable but found at shallow depths.

11.3.13 A review of the Scottish Flood Defence Asset Database (SFDAD) shows there are no formal flood defence assets in the study area. However, there are some longitudinal earthen embankments present along the Moy Burn and Funtack Burn which are likely a result of historical watercourse straightening works aimed at maintaining the channel flow capacity and reducing the risk of adjacent agricultural land from flooding.

11.3.14 For each of the watercourses/floodplains identified as having potential flood risk impacts, several receptors sensitive to changes in flood risk were identified, with each flood receptor having a different sensitivity to flooding (e.g. rough grazing has a low sensitivity while essential infrastructure such as roads has a high sensitivity). Details of the flood risk receptors associated with each watercourse/floodplain and their individual sensitivities are provided in Appendix A11.2, while the range of sensitivities associated with each watercourse/floodplain is summarised in Table 11.6 below.

11.3.15 In relation to water quality, the Findhorn, the Funtack Burn and the Moy Burn are designated under the WFD, as shown in Figure 11.2. Both the Funtack and Moy Burns, and the Findhorn upstream of Tomatin, are considered to have 'Good' status; while the Findhorn downstream of Tomatin has a 'Moderate' status, due to barriers to fish migration. For watercourses that have not been classified, desk study data and visual inspections would suggest that water quality is generally good, but may have been impacted to some degree by existing road and rail drainage discharges, septic tank discharges and diffuse pollution from agricultural and forestry practices. This is further supported by the baseline ecological surveys and subsequent valuation of the watercourses, as described in Chapter 12. These found the larger watercourses to be of 'Local' importance, equating to Medium sensitivity, and the smaller watercourses and drains to be of 'Less than Local' importance, equating to Low sensitivity, as outlined in Table 11.2.

11.3.16 No surface water fed public water supplies were identified within the study area. Four surface water fed private water abstractions were identified as having the potential to be impacted by the scheme:

- Altcosach Hydrostation – abstraction from the Allt Cosach for hydropower, located approximately 2.5km downstream of the nearest element of the Proposed Scheme
- Tomatin Distillery (Figure 11.1d) – abstraction on the River Findhorn for the purposes of non-evaporative cooling, located approximately 80m downstream of the Proposed Scheme
- PWS Lynebeg (Figure 11.1h) – abstraction from a small unnamed burn (Watercourse Ref: Moy Burn Trib 1), supplying five residential properties; the intake is located upstream of the Proposed Scheme and will be unaffected, however a supply line passes under the A9 and could be disrupted during construction
- PWS Lynebeg Pond (Figure 11.1h) – abstraction from the southernmost pond (Pond 5) located between Lynebeg and Moy; supply pipework leads to a small well located adjacent to the Lynebeg Rail Bridge, thereafter towards the three properties served; supply is used for non-potable purposes (garden supply), and all properties are connected to mains water, however, each property retains the right to use the supply within their title deeds

11.3.17 There are six licenced discharges in the vicinity of the Proposed Scheme. Three relate to Tomatin Wastewater Treatment Works, located on the River Findhorn, approximately 3.3km upstream; two relate to brewing effluent and cooling water discharges from Tomatin distillery, located on the Allt na Frithe, approximately 700m upstream; and one relates to a sewage discharge serving the distillery cottages, also located on the Allt na Frithe approximately 650m upstream of the Proposed Scheme. It is also anticipated that there are numerous other sewage discharges from individual properties within the study area, in addition to drainage discharges associated with the Highland Main Line railway, the existing A9, the B9154 and other unclassified or private roads.

11.3.18 The existing A9 is understood to discharge unattenuated and untreated runoff, generally via kerbs, gullies and carrier pipes. However, the WS 2+1 section of A9 near Moy is drained via over the edge drainage into filter drains and thereby to the nearest

watercourse. Locations of existing outfalls were identified as far as possible from the original as-built drawings and recorded as part of the walkover surveys.

11.3.19 Standing waters within the study area comprise Loch Moy (Figure 11.1g-h) and numerous small ponds, most notably a cluster of three ponds located at Tigh an Allt (Ponds 12-14 on Figure 11.1e), and two ponds located between Lynebeg and Moy (Ponds 4 and 5 on Figure 11.1h). Several of the ponds have been screened out of the assessment as they are unlikely to be impacted by the Proposed Scheme due to distance and intervening topography. Of the remaining water bodies, only Loch Moy has been classified under WFD, having a status of 'High', equating to Very High sensitivity. The remaining smaller ponds have been assessed using the National Pond Survey methodology, as detailed in Chapter 12. The findings of these surveys found that in general the water quality of the ponds was good and their conservation value was considered to be of 'Local' importance, equating to Medium sensitivity.

Receptor Sensitivity

11.3.20 Receptor sensitivity has been evaluated on the basis of the baseline data presented in Appendices A11.1, A11.2 and A11.4, and summarised above, and using the criteria as set out in Table 11.2. Table 11.6 presents a summary of the sensitivity of surface water receptors.

11.3.21 In relation to flood risk there may be several receptors sensitive to changes in flood risk within the watercourses/floodplains identified, with each flood receptor having a different sensitivity to flooding (e.g. rough grazing has a low sensitivity, while essential infrastructure such as roads has a high sensitivity). Full details of the flood risk receptors associated with each watercourse/floodplain are provided in Appendix A11.2, while Table 11.6 below summarises the range of sensitivities associated with each floodplain.

Table 11.6: Summary of Watercourse Receptor Sensitivity

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
River Findhorn (Garbole to Tomatin)	Allt Cosach Trib 1	Water Quality	Not classified by SEPA, likely to be affected by existing road and rail discharges. A small headwater/existing A9 PED drain crossed by the Highland Main Line railway.	Low
		Dilution Capacity	Q95 <0.001m3/s, assumed existing road and rail discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small, heavily modified drain. Assumed to be existing A9 PED.	Low
		Hydrology & Flood Risk	Receptors include the HML, minor road (C1121), agricultural land	Medium - Very High
	Allt Cosach	Water Quality	Small burn draining moorland and rough grazing, runs parallel to the A9, C1121 and HML. Not classified by SEPA, likely to be affected by existing road and rail discharges.	Medium
		Dilution Capacity	Q95 0.010m3/s, assumed existing road and rail discharges	High
		Biodiversity	Not classified by SEPA. Assessed to be of 'Local' importance for nature conservation	Medium
		Hydromorphology	Small steep stream with some step-pool features, also straightened where in close proximity to C1121 and modified by hydrostation intake	Low
		Hydrology & Flood Risk	Receptors include minor road (C1121) and agricultural land	Medium
	Altchosach Hydrostation Abstraction	Water Quality	Hydropower abstraction, high water quality not critical, but high sediment load could damage hydroplant	Medium
		Water Quantity		High
	River Findhorn (Garbole to Tomatin)	Water Quality	'Good' Overall WFD Status	High
		Dilution Capacity	Q95 1.705m3/s, 3 existing discharges from Tomatin WwTP. Likely to have road and rail discharges and small domestic sewage discharges	Low
		Biodiversity	'Good' WFD Ecology Status, no designated sites	High

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Hydromorphology	'Good' Hydromorphology WFD Status. Within the Study Area, the River Findhorn is geomorphologically diverse, characterised by a meandering, moderate gradient channel, wide floodplain, cobble, gravel and boulder bed, and pool and riffle sequences.	High
		Hydrology & Flood Risk	Water feature with direct flood risk to residential properties, the A9, forestry and agricultural land	Low – Very High
River Findhorn (Tomatin to Dorback Burn)	River Findhorn (Tomatin to Dorback Burn)	Water Quality	'Moderate' Overall WFD Status, pressures relate to barriers to fish migration	Medium
		Dilution Capacity	Q95 1.705m3/s. Three existing discharges (Tomatin WwTP) 3.3km upstream. Likely to have road and rail discharges and small domestic sewage discharges	Low
		Biodiversity	'Moderate' WFD Ecology Status, no designated sites	Medium
		Hydromorphology	'Good' Hydromorphology WFD Status. Within the Study Area, the River Findhorn is geomorphologically diverse, characterised by a meandering, moderate gradient channel, wide floodplain, cobble, gravel and boulder bed, and pool and riffle sequences.	High
		Hydrology & Flood Risk	Receptors include the A9 agricultural land, forestry and tracks. There are residential properties (e.g. Tomatin House) and various non-residential properties located outside the 0.5% AEP.	Low – Very High
	River Findhorn Trib 1	Water Quality	Not classified by SEPA. Small drain/headwater watercourse draining woodland and grassland, crossed by the A9, with little flow observed at the time of survey. Potentially impacted by existing road discharges	Medium
		Dilution Capacity	Q95 0.002m3/s. No discharges identified, potential existing road drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small overgrown drain, with little flow at time of survey	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to receptors - forestry land and A9.	Very High
		Water Quality		Medium

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
	Tomatin Distillery Abstraction	Water Quantity	Non-evaporative cooling, high water quality not critical, but high sediment load could damage plant.	High
	Allt na Frithe	Water Quality	Not classified by SEPA. Large burn draining moorland, forestry and agricultural land, passes through Tomatin village. 3 licenced discharges, including cooling water and sewage effluent from Tomatin distillery. Potential diffuse rural pollution, and road and rail discharges.	Medium
		Dilution Capacity	Q95 0.023m3/s. 3 existing discharges (cooling water and sewage effluent) <1km upstream	High
		Biodiversity	Not classified by SEPA. Assessed to be of 'Local' importance for nature conservation	Medium
		Hydromorphology	This watercourse exhibits a good range of morphological features and active fluvial processes, with a diverse and dynamic range of flows.	High
		Hydrology & Flood Risk	Receptors include low and high value agricultural land, non-residential properties in Tomatin, residential properties, a minor road (C1121) and the A9	Low – Very High
	River Findhorn Trib 1.1	Water Quality	Not classified by SEPA. Small drain draining woodland and grassland, channel likely to be associated with the existing A9 PED. Potentially impacted by existing road discharges.	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential existing road drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small overgrown drain, with little flow at time of survey	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry and high value agricultural land.	Medium
	River Findhorn Trib 2	Water Quality	Not classified by SEPA. A small watercourse draining forestry. Potentially impacted by existing road discharges.	Medium
		Dilution Capacity	Q95 0.001m3/s. No discharges identified, potential existing road drainage discharges and rural diffuse pollution.	Very High

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small watercourse, overgrown banks with silty bed, very little flow at time of survey	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to receptors - forestry land and A9.	Very High
	Allt Dubhag	Water Quality	Not classified by SEPA. Small modified burn draining moorland and forestry. Potentially impacted by existing road discharges and small domestic sewage discharges	Medium
		Dilution Capacity	Q95 0.01m3/s. 2 domestic sewage discharges 590m upstream of the Proposed Scheme.	High
		Biodiversity	Not classified by SEPA, no designated sites. Assessed to be of 'Local' importance for nature conservation	Medium
		Hydromorphology	Watercourse near the existing crossing is already extensively modified with bed and bank protection and long culvert. The flows were uniform, despite some discrete areas of step-pools.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry and agricultural land.	Medium
	River Findhorn Trib 3	Water Quality	Not classified by SEPA. A small ephemeral drain associated with the existing A9 pre-earthworks. Potentially impacted by existing road discharges.	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential existing road drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small drain, overgrown banks with silty bed, very little flow at time of survey	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to <10 residential properties	High
Funtack Burn	Funtack Burn Trib 1	Water Quality	Not classified by SEPA. Small drainage ditch emerging from existing small A9 culvert/drain. Possibly existing road drainage outfall.	Medium

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential existing road drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	A small drainage ditch emerging from a culvert outlet on the southbound A9 embankment, with concrete lined banks and a silty bed	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to <10 non-residential properties	Medium
	Pond 14 (Tigh an Allt, South)	Biodiversity	Medium sized permanent pond, no obvious inflow, 3 outflows, including 1 to Pond 12. Likely to have a mixed hydrological dependence. Ecology surveys indicate good water quality and results indicate the pond is of 'Local' conversation value	Medium
	Pond 13 (Tigh an Allt, East)	Biodiversity	Small pond, no obvious inflow or outflow. Was screened out of ecology surveys, assumed to have conservation value of 'Less than Local'.	Low
	Pond 12 (Tigh an Allt, North)	Biodiversity	Medium sized permanent pond, online with Funtack Trib 1, additional inflow from Pond 14. Likely to have a mixed hydrological dependence. Ecology surveys indicate moderately good water quality, possibly impacted by road drainage discharges into the Funtack Trib 1. Assessed as having a 'Local' conservation value.	Medium
	Dalmagarry Burn Trib 1	Water Quality	Not classified by SEPA. A small watercourse draining open moorland. Potentially impacted by existing road and rail discharges.	Medium
		Dilution Capacity	Q95 0.002m3/s. No discharges identified, potential existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Small heavily modified watercourse, with long culvert under and downstream of existing A9	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to <10 non-residential properties.	Medium
	Dalmagarry Burn Trib 2	Water Quality	Not classified by SEPA. A small watercourse draining open moorland, crossed by the existing A9 and HML. Potentially impacted by existing road and rail discharges.	Medium

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Dilution Capacity	Q95 0.001m3/s. No discharges identified, potential existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small stream, modified by HML and A9 culverts	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to an unclassified road and agricultural land.	Medium
	Dalmagarry Burn Trib 3	Water Quality	Not classified by SEPA. A dry drainage ditch, draining open moorland and crossed by the HML and existing A9.	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small, ephemeral drainage ditch culverted under HML	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to an unclassified road and agricultural land.	Medium
	Dalmagarry Burn	Water Quality	Not classified by SEPA. Small river draining open moorland, crossed by the HML and existing A9. Potentially impacted by existing road and rail discharges.	Medium
		Dilution Capacity	Q95 0.038m3/s. No discharges identified, potential existing road and rail drainage discharges	High
		Biodiversity	Not classified by SEPA. 'Local' importance for nature conservation	Medium
		Hydromorphology	This watercourse has historically been realigned and the existing channel is constrained by embankments and crossed several times. There were, however, some very active sediment transport processes occurring, with step-pool sequences and large gravel bars around the existing A9 crossing.	High
		Hydrology & Flood Risk	Receptors include residential and non-residential properties at Dalmagarry Farm and Milton of Moy, the Ruthven Road, the HML, the A9 and high value agricultural land.	Medium - Very High
		Water Quality	Not classified by SEPA. Small watercourse draining open moorland.	Medium

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
	Dalmagarry Burn Trib 4	Dilution Capacity	Q95 <0.01m3/s. No discharges identified	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	A small, steep stream with a narrow channel and cobble bed draining agricultural land	Low
		Hydrology & Flood Risk	Receptors include low value grass/moorland	Low
	Dalmagarry Burn Trib 5	Water Quality	Not classified by SEPA. Small watercourse draining open moorland.	Medium
		Dilution Capacity	Q95 <0.01m3/s. No discharges identified	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Ephemeral drainage ditch, little flow, well vegetated.	Low
		Hydrology & Flood Risk	Receptors include low value grass/moorland	Low
	Funtack Burn	Water Quality	'Good' Overall WFD Status. Small river flowing from Loch Moy draining open agricultural land. Potential diffuse rural pollution.	High
		Dilution Capacity	Q95 0.183m3/s. No discharges identified.	Medium
		Biodiversity	'Good' WFD Ecology Status. 'Authority Area' importance for nature conservation	High
		Hydromorphology	The majority of the channel length has been straightened and the channel is fairly deep with steep banks and a slow steady flow along the flat valley floor	Low
		Hydrology & Flood Risk	Unclassified road, scattered residential properties and agricultural land	High
	Funtack Burn Trib 2	Water Quality	Not classified by SEPA. A small field drainage ditch draining agricultural grassland. No flow observed at the time of survey. Potentially impacted by diffuse rural pollution and existing road and rail discharges.	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential existing road and rail drainage discharges	Very High

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Ephemeral drainage ditch, heavily vegetated.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to agricultural land and unclassified road providing access to Dalmagarry Farm	Medium - High
	Funtack Burn Trib 3	Water Quality	Not classified by SEPA. A small drain draining forestry and agricultural grassland. No flow observed at the time of survey. Potentially impacted by diffuse rural pollution and existing road and rail discharges.	Medium
		Dilution Capacity	Q95 0.001m3/s. No discharges identified, potential existing road and rail drainage discharges.	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Steep ephemeral drain with cobble and gravel bed, finer sediments present downstream of existing A9 culvert. Overgrown banks.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to agricultural land and unclassified road providing access to Dalmagarry Farm	Medium - High
	Funtack Burn Trib 4	Water Quality	Not classified by SEPA. A small watercourse draining woodland and open grassland. Potentially impacted by diffuse rural pollution and existing road and rail discharges.	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential existing road and rail drainage discharges.	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Small stream, heavily modified downstream of existing A9 culvert, with stone/concrete channel	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to the B9154 and agricultural land.	High
	Funtack Burn Trib 5	Water Quality	Not classified by SEPA. A small watercourse draining woodland and open grassland. Potentially impacted by diffuse rural pollution and existing road and rail discharges.	Medium

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Dilution Capacity	Q95 0.001m3/s. No discharges identified, potential existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Not visited due to access restrictions, but assumed to be heavily modified by existing road and rail crossings	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to the B9154 and forestry.	High
	Funtack Burn Trib 6	Water Quality	Not classified by SEPA. Very small, steep drain/stream draining forestry. Potentially impacted by diffuse rural pollution and existing road and rail discharges.	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small, steep stream with gravel bed.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry and the HML	High
	Funtack Burn Trib 7	Water Quality	Not classified by SEPA. Very small, steep drain/stream draining forestry. Potentially impacted by diffuse rural pollution, small domestic sewage discharges and road and rail discharges.	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential small domestic sewage discharges and existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small, steep stream with gravel bed.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry and the HML	High
Loch Moy	Loch Moy	Biodiversity	'High' Overall WFD status.	Very High

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
	Funtack Burn Trib 8	Water Quality	Not classified by SEPA. Very small, drain/stream draining forestry. Potentially impacted by diffuse rural pollution and existing road and rail discharges.	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small stream (0.3m wide) with gravel, cobbles and boulders in bed	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry and the HML	High
	Funtack Burn Trib 9	Water Quality	Not classified by SEPA. Very small, drain/stream draining forestry. Potentially impacted by diffuse rural pollution and existing road and rail discharges.	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small stream (0.3m wide) with bed material comprising gravels and cobbles, with grass and moss in channel and a sluggish flow noted during time of survey.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry and the HML	High
	Caochan na h-Eaglais	Water Quality	Not classified by SEPA. Small burn draining forestry. Potentially impacted by diffuse rural pollution and existing road and rail discharges.	Medium
		Dilution Capacity	Q95 0.002m3/s. No discharges identified, potential existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	This watercourse shows some dynamic fluvial features (step-pools, gravel bars) encouraging diverse flows. It has been extensively modified immediately upstream and downstream of the existing A9 crossing.	Low

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry and access track and the HML	High
	Funtack Burn Trib 10	Water Quality	Not classified by SEPA. A small drain originating between the two ponds at Lynebeg and the HML. Potentially impacted by small domestic sewage discharges and road and rail discharges.	Medium
		Dilution Capacity	Q95 <0.001m3/s*. No discharges identified, potential small domestic sewage discharges and existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small drain, possibly associated with HML and B9154 drainage discharges	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to agricultural land.	Medium
	Pond 5 (Lynebeg, South)	Biodiversity	Large permanent pond, no obvious inflow, 1 outflow via the PWS intake. Likely to have a mixed hydrological dependence. Ecology surveys indicate good water quality and results indicate the pond is of 'Local' conversation value	Medium
	PWS Lynebeg Pond (Pond 5)	Water Quality	Pond abstraction, used for non-potable purposes. Serves 3 properties, all of which are connected to mains water, but retain the right to use the pond supply.	Medium
		Water Quantity		Medium
	Pond 4 (Lynebeg, North)	Biodiversity	Large permanent pond, no obvious inflow or outflow. Likely to have a mixed hydrological dependence. Ecology surveys indicate good water quality and results indicate the pond is of 'Local' conversation value	Medium
	Moy Burn Trib 1	Water Quality	Not classified by SEPA. A small burn draining forestry and open moorland. Supports 2 separate water supplies: PWS Lynebeg (serves five properties) and PWS Lynemore (serves one property), both sources located upstream of the Proposed Scheme.	Medium
		Dilution Capacity	Q95 0.002m3/s. No discharges identified, potential small domestic sewage discharges and existing road and rail drainage discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Hydromorphology	Small burn with cobble, boulder and gravel bed, modified in the vicinity of the existing A9 culverts	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry and the HML	High
	PWS Lynebeg	Water Quality	Abstraction from Moy Burn Trib 1. Serves five properties	High
		Water Quantity		High
	PWS Lynemore	Water Quality	Abstraction from Moy Burn Trib 1. Serves one property	Medium
		Water Quantity		Medium
Moy Burn	Allt na Loinne Mor	Water Quality	Not classified by SEPA. A large burn open moorland. Potentially impacted by small domestic sewage discharge and existing road and rail discharges.	Medium
		Dilution Capacity	Q95 0.012m3/s. 1 small domestic sewage discharge located 150m downstream of the Proposed Scheme. Potential road and rail discharges.	High
		Biodiversity	Not classified by SEPA. Assessed to be of 'Local' importance for nature conservation	Medium
		Hydromorphology	This watercourse exhibits highly dynamic gravel bed features in the upstream section. It has been historically affected by a now derelict reservoir, however is showing signs of recovery.	Medium
		Hydrology & Flood Risk	Water feature with direct flood risk to low value agricultural land, forestry and the HML	High
	Moy Burn	Water Quality	'Good' Overall WFD Status. A small river draining open moorland and agricultural land. Potentially impacts by rural diffuse pollution.	High
		Dilution Capacity	Q95 0.140m3/s. No discharges identified	Medium
		Biodiversity	'Good' WFD Ecology Status, no designated sites	High
		Hydromorphology	'Good' Hydromorphology WFD Status	High
		Hydrology & Flood Risk	Water feature with direct flood risk to the HML, B9154, an access road and agricultural land	Medium–Very High

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
	Moy Burn Trib 2	Water Quality	Not classified by SEPA. A small drain draining open moorland and grassland. Potentially impacted by existing road discharges.	Medium
		Dilution Capacity	Q95 0.001m3/s. No discharges identified, potential road discharges.	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Small, overgrown drain, heavily modified in the vicinity of the A9	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to low value agricultural land.	Low
	Moy Burn Trib 3	Water Quality	Not classified by SEPA. A small grassland drain, overgrown with macrophytes and a stagnant flow noted at the time of survey. Potentially impacted by existing road discharges.	Medium
		Dilution Capacity	Q95 0.001m3/s. No discharges identified, potential road discharges.	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Small, overgrown drain, heavily modified in the vicinity of the A9	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to low value grasslands.	Low
	Allt Creag Bheithin Trib 1	Water Quality	Not classified by SEPA. A small watercourse draining forestry plantation and grassland, with sluggish flow noted during survey. Potentially impacted by existing road discharges.	Medium
		Dilution Capacity	Q95 0.004m3/s. No discharges identified, potential road discharges.	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Small overgrown channel, with silty bed. Modified in the vicinity of the A9	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to low value grasslands.	Low
	Allt Creag Bheithin Trib 2	Water Quality	Not classified by SEPA. A small watercourse draining forestry plantation and grassland, with sluggish flow noted during survey. Potentially impacted by existing road discharges.	Medium

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential road discharges.	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Small overgrown channel, with silty bed. Modified in the vicinity of the A9	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to low value grasslands.	Low
	Allt na Slanaich	Water Quality	Not classified by SEPA. A medium sized burn draining open moorland and dense plantation forestry. Potentially impacted by existing road discharges.	Medium
		Dilution Capacity	Q95 0.010m3/s. No discharges identified, potential road discharges.	High
		Biodiversity	Not classified by SEPA. Assessed to be of 'Local' importance for nature conservation	Medium
		Hydromorphology	This watercourse displays a wide range of morphological features and dynamic fluvial processes. It has been historically modified due to existing crossing structures.	Medium
		Hydrology & Flood Risk	Water feature with direct flood risk to low value grasslands and farm access tracks	Medium
	Allt Creag Bheithin	Water Quality	Not classified by SEPA. A medium sized burn draining open moorland and forestry plantation. Potentially impacted by existing road discharges and diffuse rural pollution	Medium
		Dilution Capacity	Q95 0.011m3/s. No discharges identified, potential road discharges.	High
		Biodiversity	Not classified by SEPA. Assessed to be of 'Local' importance for nature conservation	Medium
		Hydromorphology	Upstream was limited by access, downstream locations displayed a range of flows and morphological features, with large gravel bars, some sections of uniform flows and straightened planform	Medium
		Hydrology & Flood Risk	Water feature with direct flood risk to the A9, B9154, the HML, an access track, low value grasslands and forestry	Low - Very High

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
	Allt Creag Bheithin Trib 3	Water Quality	Not classified by SEPA. A small burn draining forestry plantation. Potentially impacted by existing road discharges	Medium
		Dilution Capacity	Q95 0.001m3/s. No discharges identified, potential road discharges.	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Small burn with step-pool sequences and cobble and gravel bed. Modified in the vicinity of the existing A9 culvert	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry.	Medium
	Allt Creag Bheithin Trib 4	Water Quality	Not classified by SEPA. A small forestry drain. Potentially impacted by existing road discharges	Medium
		Dilution Capacity	Q95 0.001m3/s. No discharges identified, potential road discharges.	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Very small, overgrown channel, sluggish flow.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry	Medium
	Allt Creag Bheithin Trib 5	Water Quality	Not classified by SEPA. A small burn draining forestry and moorland.	Medium
		Dilution Capacity	Q95 0.002m3/s. No discharges identified	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Small stream (<1m wide) with bed material comprising gravel, cobble and sand bed. Silt present downstream of existing forestry track culvert.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry	Medium
	Midlairgs Burn	Water Quality	Not classified by SEPA. A medium sized burn draining areas of forestry and open moorland, crossed by a forestry access track.	Medium
		Dilution Capacity	Q95 0.002m3/s. No discharges identified.	Very High

WFD Catchment	Receptor	Attribute	Comment	Sensitivity
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Medium sized burn with step-pool sequences and bed material comprising sand, gravel and cobbles.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry	Medium
	Midlairgs Burn Trib 1	Water Quality	Not classified by SEPA. A small watercourse draining forestry and moorland, crossed by the existing A9. Potentially impacted by existing road discharges	Medium
		Dilution Capacity	Q95 0.001m3/s. No discharges identified, potential road discharges.	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Small burn, bed material comprises cobble, gravel and fine sediment. Existing A9 culvert half filled with gravel and sediment.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry	Medium
	Midlairgs Burn Trib 2	Water Quality	Not classified by SEPA. An artificial drain which intercepts part of the flow from the Midlairgs Burn Trib 1. Potentially impacted by existing road discharges	Medium
		Dilution Capacity	Q95 <0.001m3/s. No discharges identified, potential road discharges	Very High
		Biodiversity	Not classified by SEPA. 'Less than Local' importance for nature conservation	Low
		Hydromorphology	Artificial drain.	Low
		Hydrology & Flood Risk	Water feature with direct flood risk to forestry	Medium

* Estimated mean and low flow values, catchment too small to derive flow data from LowFlows.

11.4 Potential Impacts

11.4.1 The potential impacts of the Proposed Scheme are discussed in this section, subdivided into construction and operational impacts. For the purposes of this assessment construction impacts are generally considered to be short-term impacts which occur during the construction phase only. Operational impacts are considered to be long-term or permanent impacts affecting receptors after the construction phase is complete. It is recognised that many operational impacts are initiated by construction activities; however, the full effect of the impact may only manifest itself in the long-term.

11.4.2 The potential significant impacts from the Proposed Scheme which are considered within this section are:

- Pollution during construction due to increased generation and release of sediments and suspended solids, and increased risk of accidental spillage of pollutants such as oil, fuel and concrete associated with construction activities and site storage requirements.
- Pollution during road operation due to contaminants within routine road runoff. A broad range of potential pollutants, such as hydrocarbons i.e. fuel and lubricants, fuel additives, metal from corrosion of vehicles, de-icer and gritting material, can accumulate on road surfaces. These can subsequently be washed off the road surface during rainfall events, polluting the receiving surface water bodies.
- Pollution during road operation due to accidental spillage. On all roads there is a risk that accidents or vehicle fires may lead to an acute pollution incident. Where commercial vehicles are involved, potential pollutants that may be spilled could range from hazardous chemicals to milk, alcoholic beverages, organic sludges and detergents. Spilled materials may drain from the road surface, polluting the receiving surface water bodies.
- Alterations to the hydromorphological (fluvial geomorphological) regime, such as increased erosion, deposition and channel migration processes. These changes can occur as a result of channel modification associated with increased road surface drainage, new crossing structures, culverting, watercourse diversions and outfalls. A reduction in hydromorphological diversity can subsequently impact on water quality and biodiversity.
- Increase in flood risk caused by the development, both within the vicinity of the Proposed Scheme and also elsewhere in the catchment.
- Loss of standing waters where the Proposed Scheme would be constructed through existing ponds or alter the contributing surface water catchment to ponds.
- Loss or change to surface water fed water supplies due to degradation of water quality, changes in drainage patterns or disruption to supply infrastructure due to the Proposed Scheme.

11.4.3 Each impact is assessed using the methods outlined in Section 11.2. The potential impacts are assessed with embedded design mitigation as listed below, but without additional standard or project specific environmental mitigation and therefore consider a worst-case scenario.

11.4.4 Embedded mitigation included in the design of the Proposed Scheme comprises:

- minimising encroachment into areas at risk of flooding
- watercourse crossings will comprise either clear span bridges or portal frame culverts on the following watercourses:

- Allt na Frithe
- Allt Dubhag
- Dalmagarry Burn
- Caochan na h-Eaglais
- Allt Loinne Moire
- Allt na Slanaich
- Allt Creag Bheithin

· provision of a two-stage profile in all culverts to provide a low flow channel

· management of surface water runoff arising from the proposed A9 dual carriageway and side roads through appropriately located and designed drainage features

· provision of two levels of treatment on mainline drainage networks, with the exception of Networks 1A, 5A and 6A, which have three levels of treatment each

· the proposed culverts on the Moy Burn Trib 1, Allt na Slanaich and Allt Creag Bheithin have been designed with hydraulic capacities less than that required to pass the 0.5% AEP plus climate change flows, to mitigate potential downstream flooding (further information is provided in the flood risk section below)

· two flood compensation storage areas at the Allt Creag Bheithin

· good practice principles applied to the preliminary design of the Dalmagarry Burn realignment

11.4.5 Further detail of these embedded mitigations are included in the discussion of hydromorpholoigcal impacts below.

11.4.6 Figure 11.1a-k shows the Proposed Scheme elements which interact with the water environment, including proposed bridges, culverts, watercourse realignments, cut-off ditches, SuDs ponds and road drainage outfall locations.

Construction Impacts

Construction Pollution

11.4.7 Silt and sediment laden site runoff generated during construction activities, such as soil stripping and earthworks can have a detrimental impact if allowed to enter watercourses untreated. Fine sediments can increase water turbidity and smother stream beds, affecting water quality and causing harm to fish, aquatic invertebrates and plants by interfering with feeding, respiration and spawning. The effects of sediment release can extend considerable distances downstream.

11.4.8 In addition, spillages of potential pollutants such as oils, fuels, concrete, cement and sewage from construction staff welfare facilities can potentially occur during construction. Oils form a film on the water surface and can coat organisms, blocking respiration, photosynthesis and feeding. Biodegradation of oils in aquatic systems can lead to oxygen depletion and many hydrocarbons are toxic, persistent and bio-accumulate in the environment i.e. they build-up in the body tissue both directly and from feeding on other contaminated organisms. Concrete and cement is highly alkaline and can harm aquatic organisms if the pH of the receiving waters is affected.

11.4.9 The risk of sedimentation or spillage affecting watercourses would be highest where direct interaction with the water environment occurs, such as during construction of bridges, culverts and road drainage outfalls, and where watercourse diversions are

required. Additionally locations where construction would be required alongside and within 50m of a watercourse are also at increased risk.

11.4.10 The effects on water quality are anticipated to be acute and short term, however the consequential impact on aquatic ecology could be chronic and long term.

11.4.11 Based on the road drainage design, it is anticipated that there would be 12 mainline and junction road drainage outfalls discharging to surface waters, in addition there would be numerous surface water outfalls associated with side roads and access tracks. These outfall locations would require construction activity on channel banks, including pipe-laying and installation of appropriate outfall structures.

11.4.12 There is a requirement for 42 watercourse crossing features, including bridge structures culverts and drains; and 26 watercourse realignments for the Proposed Scheme. In most cases this will necessitate excavation of the channel bed and banks during construction.

11.4.13 Details of the specific construction activities and the potential impact significance for each surface water body are provided in Table 11.7.

Table 11.7: Potential Construction Pollution Impacts from the Proposed Scheme

Catchment	Receptor	Summary of Construction Activities and Specific Impacts	Attribute	Sensitivity	Magnitude	Significance
River Findhorn	Allt Cosach Trib 1	Construction of 1 x mainline drainage outfall (EA) and additional construction activities within 5m.	Water quality	Low	Moderate	Slight
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Minor	Slight
	Allt Cosach	Construction of 1 x side road (bus turning circle) outfall.	Water quality	Medium	Moderate	Moderate
			Dilution capacity	High	Minor	Slight
			Biodiversity	Medium	Moderate	Moderate
	Altchosach Hydrostation Abstraction	Located over 500m downstream of the proposed bus turning circle	Water Quality	Medium	Minor	Slight
			Water Quantity	High	Negligible	Neutral
	River Findhorn (Tomatin to Dorback Burn)	Construction of 1 x mainline drainage outfall (1A) and 1 x side road drainage outfall on this watercourse. In addition construction activities are proposed on several tributaries within 1km of their confluence with the Findhorn	Water quality	Medium	Moderate	Moderate
			Dilution capacity	Low	Minor	Neutral
			Biodiversity	Medium	Moderate	Moderate
	River Findhorn Trib 1	Construction of 1 x small drainage culvert, a PED outfall and a 176m realignment on this small drain. Also additional construction activities within 50m.	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large

Catchment	Receptor	Summary of Construction Activities and Specific Impacts	Attribute	Sensitivity	Magnitude	Significance
	Tomatin Distillery Abstraction	Construction of 1 x mainline outfall (1A) 115m upstream of the abstraction intake	Water Quality	Medium	Moderate	Moderate
			Water Quantity	High	Negligible	Neutral
	Allt na Frithe	Construction of 1 x crossing structure, 1 x mainline drainage outfall (2A), 2 x side road drainage outfalls, 2x PED outfalls and 135m realignment	Water quality	Medium	Major	Large
			Dilution capacity	High	Minor	Slight
			Biodiversity	Medium	Major	Large
	River Findhorn Trib 1.1	Construction of 1 x small drainage culvert and 2 x PED outfalls	Water quality	Medium	Moderate	Moderate
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Moderate	Slight
	River Findhorn Trib 2	Construction of 1 x small drainage culvert, 1 x side road drainage outfall, 2 x PED outfalls and 98m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Allt Dubhag	Construction of 1 x culvert, 1 x mainline drainage outfall (3A), 2 x side road drainage outfalls, 1 x PED and 140m realignment	Water quality	Medium	Major	Large
			Dilution capacity	High	Minor	Slight
			Biodiversity	Medium	Major	Large
	River Findhorn Trib 3	Construction of 2 x small drainage culverts and 1 x side road drainage outfall	Water quality	Medium	Moderate	Moderate

Catchment	Receptor	Summary of Construction Activities and Specific Impacts	Attribute	Sensitivity	Magnitude	Significance
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Moderate	Moderate
Funtack Burn	Funtack Burn Trib 1	2 x side road drainage outfalls and 280m realignment of this small drain	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Larger
	Pond 14 (Tigh an Allt, South)	Construction of side road embankment and embankment toe drainage within 20m of this pond	Biodiversity	Medium	Moderate	Moderate
	Pond 13 (Tigh an Allt, East)	Construction activities within 80m of this pond. However Pond 14, which feeds this pond, is located within 20m of construction activities.	Biodiversity	Low	Minor	Neutral
	Pond 12 (Tigh an Allt, North)	Drains feeding this pond are proposed to be realigned along the toe of the side road embankment within 5m of the pond.	Biodiversity	Medium	Major	Large
	Dalmagarry Burn Trib 1	Construction of 1 x small drainage culvert, 1 x PED and 160m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Dalmagarry Burn Trib 2	Construction of 2 x culverts, 1 x side road drainage outfall and 107m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large

Catchment	Receptor	Summary of Construction Activities and Specific Impacts	Attribute	Sensitivity	Magnitude	Significance
	Dalmagarry Burn Trib 3	Construction of 1 x culvert, 1 x side road drainage outfall and 92m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Dalmagarry Burn	Construction of 2 x crossing structures, 2 x mainline drainage outfalls (4A, 4B), 6 x side road drainage outfalls and 675m realignment	Water quality	Medium	Major	Large
			Dilution capacity	High	Minor	Moderate
			Biodiversity	Medium	Major	Large
	Dalmagarry Burn Trib 4	Construction of 1 x small drainage culvert, 4 x PED outfalls	Water quality	Medium	Moderate	Moderate
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Moderate	Slight
	Dalmagarry Burn Trib 5	Construction of 1 x small drainage culvert, 4 x PED outfalls	Water quality	Medium	Moderate	Moderate
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Moderate	Slight
	Funtack Burn Trib 2	Construction of 2 x culverts, 3 x side road drainage outfalls, 2 x PED outfalls and 135m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large

Catchment	Receptor	Summary of Construction Activities and Specific Impacts	Attribute	Sensitivity	Magnitude	Significance
	Funtack Burn Trib 3	Construction of 2 x culverts, 1 x mainline drainage outfall (5A), 4 x PED outfalls and 164m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Funtack Burn Trib 4	Construction of 2 x culverts, 4 x PED outfalls and 158m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Funtack Burn Trib 5	Construction of 3 x culverts, 1 x PED outfall and 462m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Funtack Burn Trib 6	Construction of 2 x culverts, 1 x mainline drainage outfall (6A), 1 x side road drainage outfall and 234m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Funtack Burn Trib 7	Construction of 2 x culverts, 1 x side road drainage outfall and 235m realignment to combine with Funtack Burn Trib 8	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large

Catchment	Receptor	Summary of Construction Activities and Specific Impacts	Attribute	Sensitivity	Magnitude	Significance
	Loch Moy	Construction activities on several tributaries within 200-300m upstream	Biodiversity	Very High	Minor	Large
	Funtack Burn Trib 8	Construction of 2 x culverts, 1 x side road drainage outfall and 235m realignment to combine with Funtack Burn Trib 7	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Funtack Burn Trib 9	Construction of 2 x culverts, 1 x PED outfall and 204m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Caochan na h-Eaglais	Construction of 2 x culverts, 1 x mainline drainage outfall (7A), 3 x PED outfalls and 160m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Funtack Burn Trib 10	1 x side road drainage outfall	Water quality	Medium	Moderate	Moderate
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Moderate	Moderate
	Pond 4 (Lynebeg, North)	Construction activities within 50m of this pond	Biodiversity	Medium	Minor	Slight
Moy Burn	Moy Burn Trib 1	Construction of 1 x culvert, 2 x PED outfalls and 80m realignment	Water quality	Medium	Major	Large

Catchment	Receptor	Summary of Construction Activities and Specific Impacts	Attribute	Sensitivity	Magnitude	Significance
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	PWS Lynebeg	Source located upstream of Proposed Scheme, and will therefore be unaffected. However supply pipeline passes under the A9 and may be disrupted by construction activities	Water Quality	High	Moderate	Medium
			Water Quantity	High	Moderate	Medium
	PWS Lynemore	Source located upstream of Proposed Scheme, and will therefore be unaffected. However supply pipeline passes under the A9 and may be disrupted by construction activities	Water Quality	Medium	Moderate	Medium
			Water Quantity	Medium	Moderate	Medium
	Allt na Loinne Moire	Construction of 1 x culvert, 1 x mainline drainage outfall (8A), 1 x side road drainage outfall, 2 x PED outfalls and 110m realignment	Water quality	Medium	Major	Large
			Dilution capacity	High	Minor	Moderate
			Biodiversity	Medium	Major	Large
	Moy Burn Trib 2	Construction of 1 x culvert, 1 x PED outfall and 259m realignment combined with Moy Burn Trib 3	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Moy Burn Trib 3	Construction of 1 x culvert, 1 x PED outfall and 259m realignment combined with Moy Burn Trib 2	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large

Catchment	Receptor	Summary of Construction Activities and Specific Impacts	Attribute	Sensitivity	Magnitude	Significance
	Allt Creag Bheithin Trib 1	Construction of 1 x culvert, 1 x mainline drainage outfall (9A), 2 x PED outfalls and 85m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Allt Creag Bheithin Trib 2	Construction of 1 x culvert, 2 x PED outfalls and 125m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Allt na Slanaich	Construction of 1 x culvert, 1 x side road drainage outfall, 3 x PED outfalls and 125m realignment	Water quality	Medium	Major	Large
			Dilution capacity	High	Minor	Moderate
			Biodiversity	Medium	Major	Large
	Allt Creag Bheithin	Construction of 3 x culverts, 2 x mainline drainage outfalls (XA, YA), 3 x side road drainage outfalls, 4 x PED outfalls and 95m realignment	Water quality	Medium	Major	Large
			Dilution capacity	High	Minor	Moderate
			Biodiversity	Medium	Major	Large
	Allt Creag Bheithin Trib 3	Construction of 1 x culvert, 2 x PED outfalls and 155m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large

Catchment	Receptor	Summary of Construction Activities and Specific Impacts	Attribute	Sensitivity	Magnitude	Significance
	Allt Creag Bheithin Trib 4	Construction of 1 x culvert and 128m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Allt Creag Bheithin Trib 5	No construction activity in the vicinity of this watercourse, however is crossed by an forestry road which will be used for construction access	Water quality	Medium	Negligible	Neutral
			Dilution capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
	Midlairgs Burn	Construction of 1 x culvert, 2 x side road drainage outfalls, 47m realignment	Water quality	Medium	Major	Large
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Major	Large
	Midlairgs Burn Trib 1	Construction of 1 x culvert and 2 x side road drainage outfalls	Water quality	Medium	Moderate	Moderate
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Moderate	Moderate
	Midlairgs Burn Trib 2	Construction of 1 culvert and 1 x mainline drainage outfall (ZA)	Water quality	Medium	Moderate	Moderate
			Dilution capacity	Very High	Minor	Moderate
			Biodiversity	Low	Moderate	Moderate

Construction Flood Risk

11.4.14 The magnitude of impact and significance of flood risk associated with the construction of the Proposed Scheme has not been assessed due to insufficient information on construction sequences and methods, however it is likely that mitigation measures would be able to mitigate the potential impacts.

Watercourse Crossings

11.4.15 The Proposed Scheme will include the upgrade, replacement, extension or construction of new watercourse crossings. The majority of the culverts will be constructed offline from the existing culverts which will maintain flows of the watercourses during construction. Minor local watercourse diversions at the inlets and outlets will also be necessary to allow offline construction

11.4.16 Should it be required to construct crossings online then the watercourse will be temporarily diverted through a temporary channel and/or pumped, which could result in flows being:

- conveyed more effectively downstream increasing the flood risk to the site and third parties
- water backing up due to insufficient capacity resulting in washout to the construction area

11.4.17 Materials and plant equipment stored on site could result in the blockage to existing structure and localised flooding to the site and sensitive receptors.

11.4.18 Excavation and construction works on the site could lead to blockage and or severance of surface water that could lead to localised flooding to the site and sensitive receptors.

11.4.19 During construction, localised ground-raising could result in displacement of floodwater and changes to the surface water runoff pathways increasing the flood risk to the surrounding area.

11.4.20 During construction, movement of materials on site including the creation of stockpiles could alter flow pathways and displace flood water.

11.4.21 The operation of plant may result in compaction of soils, which may reduce the infiltration capacity. This could result in an increase in surface water runoff leading to localised flooding and runoff into the receiving watercourse.

Floodplain

11.4.22 During construction, localised ground-raising could result in displacement of floodwater and changes to the surface water runoff pathways increasing the flood risk to the surrounding area.

11.4.23 During construction, movement of materials on site including the creation of stockpiles could alter flow pathways and displace flood water.

11.4.24 The operation of plant may result in compaction of soils, which may reduce the infiltration capacity. This could result in an increase in surface water runoff leading to localised flooding and runoff into the receiving watercourse.

Operational Impacts

Pollution from Routine Runoff

11.4.25 During operation, a broad range of potential pollutants, such as hydrocarbons i.e. fuel and lubricants, fuel additives, metal from corrosion of vehicles, de-icer and gritting material, can accumulate on road surfaces. These can subsequently be washed off the road during rainfall events, polluting the receiving water bodies. Routine runoff from road drainage networks can result in both acute and chronic impacts on water quality and subsequently on the biodiversity of the receiving watercourses, due to both soluble (in particular, dissolved copper and dissolved zinc) and sediment bound pollutants.

11.4.26 A drainage design has been developed for the Proposed Scheme as detailed in Chapter 5 and shown in Figure 5.10a-k, Drainage Plan. The 14 networks draining the mainline will be subject to a minimum of two levels of treatment, typically comprising filter drains and retention ponds, prior to discharge to surface waters. Opportunities to incorporate set-back outfalls, in the form of a short ditch or swale, have been considered where appropriate in order to provide additional water quality and habitat benefits.

11.4.27 The filter drains will generally be unlined, but may need to be lined with impermeable membrane in some embankment areas to prevent seepage into the embankment fill. This will be fully established at the detailed design stage. Although discharge will be primarily to surface waters, an assessment of the potential impacts on groundwaters has been undertaken and is presented in Chapter 10: Geology, Soils and Groundwater.

11.4.28 The proposed mainline surface water outfalls (shown in Figure 11.1a-k) have been subject to the HAWRAT and EQS assessments described in Section 11.2. The results of the assessments are provided in full in Appendix A11.3 Drainage Network Water Quality Calculations, and summarised in Table 11.8 below.

Table 11.8: Summary of Mainline Routine Runoff Assessment Results

Receptor	Attribute	Sensitivity	Drainage Network ID	Proposed Treatment	HAWRAT Assessment			EQS Assessment		Magnitude	Significance
					Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc		
Allt Cosach	Water quality	Medium	E-A	Grassed Channel & *Geocellular Storage Tank	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	High								Negligible	Neutral
	Biodiversity	Medium								Negligible	Neutral
River Findhorn (Tomatin to Dorback Burn)	Water quality	Medium	1-A	Filter Drains, Ditches & Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	Low								Negligible	Neutral
	Biodiversity	Medium								Negligible	Neutral
Allt na Frithe	Water quality	Medium	2-A	Filter Drains & Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	High								Negligible	Neutral
	Biodiversity	Medium								Negligible	Neutral
Allt Dubhag	Water quality	Medium	3-A	Filter Drains & Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	High								Negligible	Neutral
	Biodiversity	Medium								Negligible	Neutral
Dalmagarry Burn	Water quality	Medium	4-A	Filter Drains & Wet/Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	High								Negligible	Neutral
	Biodiversity	Medium								Negligible	Neutral
	Water quality	Medium	4-B	Filter Drains & Wet/Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	High								Negligible	Neutral
	Biodiversity	Medium								Negligible	Neutral
	Water quality	Medium	4-A & 4-B Cumulative	Filter Drains & Wet/Retention Ponds	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	High								Negligible	Neutral

Receptor	Attribute	Sensitivity	Drainage Network ID	Proposed Treatment	HAWRAT Assessment			EQS Assessment		Magnitude	Significance
					Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc		
	Biodiversity	Medium								Negligible	Neutral
Funtack Burn Trib 3	Water quality	Medium	5-A	Filter Drains & 2 Wet/Retention Ponds	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	Very High								Negligible	Neutral
	Biodiversity	Low								Negligible	Neutral
Funtack Burn Trib 6	Water quality	Medium	6-A	Filter Drains, & 2 Wet/Retention Ponds	Pass	Fail	Pass	Fail	Pass	Moderate	Moderate
	Dilution	Very High								Moderate	Large
	Biodiversity	Low								Moderate	Slight
Caochan na h-Eaglais	Water quality	Medium	7-A	Filter Drains & Wet/Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	Very High								Negligible	Neutral
	Biodiversity	Low								Negligible	Neutral
Allt na Loinne Moire	Water quality	Medium	8-A	Filter Drains & Wet/Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	High								Negligible	Neutral
	Biodiversity	Medium								Negligible	Neutral
Allt Creag Bheithin Trib 2	Water quality	Medium	9-A	Filter Drains & Surface Flow Wetland	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	Very High								Negligible	Neutral
	Biodiversity	Low								Negligible	Neutral
Allt Creag Bheithin	Water quality	Medium	X-A	Filter Drains & Wet/Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	High								Negligible	Neutral
	Biodiversity	Medium								Negligible	Neutral
	Water quality	Medium	Y-A	Filter Drains & Wet/Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	High								Negligible	Neutral

Receptor	Attribute	Sensitivity	Drainage Network ID	Proposed Treatment	HAWRAT Assessment			EQS Assessment		Magnitude	Significance
					Soluble Copper	Soluble Zinc	Sediment	Soluble Copper	Soluble Zinc		
	Biodiversity	Medium								Negligible	Neutral
Midlairgs Burn Trib 2	Water quality	Medium	Z-A	Filter Drains & Wet/Retention Pond	Pass	Pass	Pass	Pass	Pass	Negligible	Neutral
	Dilution	Very High								Negligible	Neutral
	Biodiversity	Low								Negligible	Neutral

*Geocellular storage tank provides flow attenuation with potential for limited water quality treatment, assessment is based solely on grassed channel

11.4.29 As can be seen above all networks, with a single exception, pass all aspects of the routine runoff assessment, resulting in impacts of negligible magnitude, and therefore **Neutral** significance.

11.4.30 Network 1A (Figure 5.10c, Drainage Plan) discharges into the River Findhorn approximately 100m upstream of the Tomatin Distillery abstraction intake. Although the preliminary routine runoff assessment indicated no treatment is required, a three stage treatment train has been incorporated into the design to provide an extra degree of protection to the abstraction.

11.4.31 Network 6A discharges into Funtack Burn Tributary 6 (Figure 5.10f-g, Drainage Plan), a very small stream/drain with reasonably good water quality, low biodiversity value, low flows and therefore limited dilution capacity. Downstream of the proposed outfall this channel flows steeply downhill through conifer plantation, before being culverted under the HML and B9154. The culvert discharges on the opposite side of the B9154 into peatland, approximately 80m downstream of the outfall.

11.4.32 Network 6A fails discrete elements of the routine runoff assessment, namely the HAWRAT assessment for short-term acute impacts from soluble zinc and the EQS assessment for the long-term chronic impacts from soluble copper. This is considered to be a Moderate magnitude impact, resulting in an impact of **Large** significance for dilution capacity, **Moderate** significance for water quality, and **Sligh**t significance for biodiversity.

11.4.33 The preliminary results of the assessments indicate that to mitigate these impacts a 63% percent reduction of copper and a 62% reduction of zinc was required. However, it should be noted that the HAWRAT assesses impacts using one of three broad bands of traffic volumes, in this case the lowest band of 10,000-50,000 Annual Average Daily Traffic (AADT); and estimates pollutant concentrations based on the upper limit of this range. As the AADT on the Proposed Scheme is expected to be approximately 18,000 vehicles/day, i.e. at the lower end of the range, it is possible that the assessment may be overestimating the pollutant loading in the runoff and therefore the treatment requirements.

11.4.34 Three stages of treatment are proposed on Network 6A: filter drains, followed by two retention ponds in series, as shown in Figure 5.10f-g, Drainage Plan. In total this treatment train is expected to provide 52% and 60% reductions in copper and zinc, respectively. This is a shortfall of 11% for copper and just 2% for zinc. It is unlikely that adding any further treatment stages will improve the results significantly.

11.4.35 Interrogation of the detailed results for the HAWRAT assessment on soluble zinc shows that with the proposed treatment train there will be on average 2.1 exceedances per year of the zinc 24 hour threshold. To put this into context the HAWRAT assessment methodology deems an average of 2 exceedances per year as acceptable.

11.4.36 In relation to the EQS failure for copper, the annual average soluble copper concentration downstream of the outfall (with the proposed treatment train) has been predicted to be 1.27µg/l. This is the total concentration of copper, not the bioavailable portion. The assessment has compared this value with the published EQS of 1µg/l bioavailable copper. It is possible that the bioavailable portion of the estimated downstream concentration is less than the EQS bioavailable limit.

11.4.37 It is likely that the residual levels of soluble copper and zinc will have a small impact on the water quality of the Funtack Burn Tributary 6, however the proposed treatment train will minimise this impact. Furthermore, it is likely that the existing A9 is currently

discharging untreated runoff into the channel. In providing the proposed three levels of treatment it is possible that the water quality of the stream may actually improve.

11.4.38 In light of the factors discussed above it is considered appropriate to revise the potential impact magnitude to Minor, resulting in an impact of **Slight** significance for water quality, and **Neutral** significance for biodiversity. In relation to dilution capacity, the combination of a Very High sensitivity and Minor impact magnitude would lead to a significance of Moderate, based on the impact significance matrix provided in Table 11.4. However, given the overall environmental value of this small, common, artificial drain it is felt that the impact on dilution capacity is of **Slight** significance at most.

11.4.39 In relation to the side roads and access tracks the general guidance in SEPA Regulatory Method WAT-RM-08 and the SUDS Manual's Simple Index Approach (SIA) has been taken into consideration in determining the treatment levels required. A minimum of two levels of treatment are proposed for the Ruthven Tomatin Link Road, Ruthven Moy Link Road and Lynebeg Link Road (all lightly trafficked C class or unclassified roads) as follows:

- The Tomatin Link Road will form part of Mainline Network 1A and will have three levels of treatment in the form of filter drains, ditches and a retention pond before discharging to the River Findhorn (Figure 5.10c).
- The Ruthven Tomatin Link Road drainage will be via verge edge filter strips and ditches prior to discharging to several tributary drains of the Findhorn and the Dalmagarry Burn (Figure 5.10c-e).
- The Ruthven Moy Link Road drainage will be via verge edge filter strips and ditches prior to discharging to several tributary drains of the Dalmagarry and Funtack Burns (Figure 5.10e-f).
- The Lynebeg Link Road to the west of the A9 mainline will drain via filter drains to an infiltration basin (Figure 5.10g-h).
- The Lynebeg Link Road to the east of the A9 mainline will drain via filter drains and a vortex separator prior to discharging to a tributary drain of the Funtack Burn, (Figure 5.10g-h).

11.4.40 Given the low traffic volumes, and therefore low pollutant loads expected on these roads the proposed treatment trains are considered adequate. The magnitude of the impact is therefore considered to be Negligible, with a subsequent significance of **Neutral** for all affected watercourses.

11.4.41 In accordance with the Simple Index Approach the following methods of treatment are proposed for the scheme's access tracks:

- The Windfarm Access track will drain primarily via ditches and swales to the Allt Creag Bheithin and the Midlairgs Burn. The Windfarm Access Left-in/Left-out (LILO) will drain via filter drain and retention pond to the Midlairgs Burn.
- The SuDS pond access tracks will drain via ditches and/or swales/grassed channels to: the River Findhorn; the Allt na Frithe; the Allt Dubhag; the Dalmagarry Burn; various tributary drains of the Funtack Burn; the Caochan na h-Eaglais; and the Allt Creag Bheithin, Allt na Slanaich, and several of their tributaries. Where the access tracks are in close proximity to the mainline SuDs ponds they may drain into the ponds themselves.

11.4.42 Given the exceptionally low traffic volumes expected on these tracks the proposed treatment trains are considered adequate. The magnitude of the impact is therefore considered to be Negligible, with a subsequent significance of **Neutral** for all affected watercourses.

Road Salt

11.4.43 Using the method and generic parameters set out in Appendix A11.3, the concentration of Chloride ion in the theoretical raw road runoff has been estimated to be 3411mg/l. The in-river concentrations at each of the mainline road drainage outfalls is presented in Table 11.9 below.

Table 11.9: Road Salt Assessment Results

Mainline Drainage Network ID	Impermeable Area (Ha)	Greenfield Runoff Rate (l/s)	Receiving Watercourse	Mean Flow (l/s)	In-river Cl^- Conc. (mg/l)	Pass / Fail
E-A	0.574	1.1	Allt Cosach	22	169	Pass
1-A	2.934	5.9	River Findhorn	10,000	2	Pass
2-A	1.484	3.0	Allt na Frithe	137	72	Pass
3-A	2.342	4.7	Allt Dubhag	59	251	Pass
4A & 4B	2.709	5.4	Dalmagarry Burn	199	90	Pass
5-A	2.918	5.8	Funtack Burn Trib 3	8	1,439	Fail
6-A	1.823	3.6	Funtack Burn Trib 6	2	2,203	Fail
7-A	1.248	2.5	Caochan na h-Eaglais	18	415	Pass
8-A	1.697	3.4	Allt Loinne Moire	74	150	Pass
9-A	4.084	8.2	Allt Creag Bheithin Trib 1	22	924	Fail
X-A	1.895	3.8	Allt Creag Bheithin (lower reach)	61	200	Pass
Y-A	3.096	6.2	Allt Creag Bheithin (upper reach)	22	749	Fail
Z-A	0.514	1	Midlairgs Burn Trib 2	4	697	Fail

11.4.44 As can be seen above, several of the outfalls located on the smallest drains and watercourses fail the road salt assessment. This is unsurprising given that, for these watercourses, a large proportion of the watercourse flow is attributed to the road drainage discharge itself. In these instances it is likely that there will be a short term impact on the watercourse due to road salt. For the theoretical calculations reported above, the road salt will discharge over a period of 7 hours. However, it should be noted that this is assuming a single gritter run/application of road salt. Any additional gritter runs during the winter weather event would prolong the period of salt discharge.

11.4.45 With regard to the watercourses where failures are anticipated, these are generally very small heavily modified drains with little or no biodiversity interest. Furthermore, each discharges into a larger watercourse a short distance downstream of the outfalls, where the salt content is diluted to levels below the acute impact threshold used in this assessment. Therefore, it is unlikely there will be any significant impact on the aquatic ecology of the study area.

11.4.46 It should be noted that the results of the salt assessment have not been included within the overall impact assessment for the Proposed Scheme, due to there being no defined UK short-term EQS for Cl^-, an absence of any methodology for assessing the impacts of salt within the DMRB guidance and lack of published data on SuDS treatment efficiency of Cl^-.

Pollution from Accidental Spillage

11.4.47 During operation, there is a risk that road traffic accidents or vehicle fires may result in accidental spillage of potential pollutants on the road surface. These may then enter the road drainage network and subsequently be discharged to the water environment, causing an acute pollution event.

11.4.48 The proposed mainline surface water outfalls have been subject to the accidental spillage assessments described in Section 11.2. The results of the assessments are provided in full in Appendix A11.3 Drainage Network Water Quality Calculations, and summarised in Table 11.10 below.

Table 11.10: Summary of Accidental Spillage Assessment Results

Receptor	Attribute	Sensitivity	Drainage Network ID	Return Period Probability (1 in X years)	Pass / Fail	Magnitude	Significance
Allt Cosach	Water quality	Medium	E-A	4596	Pass	Negligible	Neutral
	Dilution	High				Negligible	Neutral
	Biodiversity	Medium				Negligible	Neutral
River Findhorn	Water quality	Medium	1-A	2685	Pass	Negligible	Neutral
	Dilution	Low				Negligible	Neutral
	Biodiversity	Medium				Negligible	Neutral
Allt na Frithe	Water quality	Medium	2-A	10750	Pass	Negligible	Neutral
	Dilution	High				Negligible	Neutral
	Biodiversity	Medium				Negligible	Neutral
Allt Dubhag	Water quality	Medium	3-A	6445	Pass	Negligible	Neutral
	Dilution	High				Negligible	Neutral
	Biodiversity	Medium				Negligible	Neutral
Dalmagarry Burn	Water quality	Medium	4-A	11636	Pass	Negligible	Neutral
	Dilution	High				Negligible	Neutral
	Biodiversity	Medium				Negligible	Neutral
	Water quality	Medium	4-B	9966	Pass	Negligible	Neutral
	Dilution	High				Negligible	Neutral

Receptor	Attribute	Sensitivity	Drainage Network ID	Return Period Probability (1 in X years)	Pass / Fail	Magnitude	Significance
	Biodiversity	Medium				Negligible	Neutral
	Water quality	Medium	4-A & 4-B Cum	5368	Pass	Negligible	Neutral
	Dilution	High				Negligible	Neutral
	Biodiversity	Medium				Negligible	Neutral
Funtack Burn Trib 3	Water quality	Medium	5-A	3123	Pass	Negligible	Neutral
	Dilution	Very High				Negligible	Neutral
	Biodiversity	Low				Negligible	Neutral
Funtack Burn Trib 6	Water quality	Medium	6-A	9597	Pass	Negligible	Neutral
	Dilution	Very High				Negligible	Neutral
	Biodiversity	Low				Negligible	Neutral
Caochan na h-Eaglais	Water quality	Medium	7-A	8876	Pass	Negligible	Neutral
	Dilution	Very High				Negligible	Neutral
	Biodiversity	Low				Negligible	Neutral
Allt na Loinne Moire	Water quality	Medium	8-A	5066	Pass	Negligible	Neutral
	Dilution	High				Negligible	Neutral
	Biodiversity	Medium				Negligible	Neutral
Allt Creag Bheithin Trib 2	Water quality	Medium	9-A	3744	Pass	Negligible	Neutral
	Dilution	Very High				Negligible	Neutral
	Biodiversity	Low				Negligible	Neutral
Allt Creag Bheithin	Water quality	Medium	X-A	7777	Pass	Negligible	Neutral
	Dilution	High				Negligible	Neutral
	Biodiversity	Medium				Negligible	Neutral
	Water quality	Medium	Y-A	16787	Pass	Negligible	Neutral
	Dilution	High				Negligible	Neutral
	Biodiversity	Medium				Negligible	Neutral
Midlairgs Burn Trib 2	Water quality	Medium	Z-A	8100	Pass	Negligible	Neutral

Receptor	Attribute	Sensitivity	Drainage Network ID	Return Period Probability (1 in X years)	Pass / Fail	Magnitude	Significance
	Dilution	Very High				Negligible	Neutral
	Biodiversity	Low				Negligible	Neutral

11.4.49 As can be seen above the calculations indicate there is a very low risk of accidental spillage impacts associated with the mainline networks with all networks assessed as having an impact magnitude of Negligible and an impact significance of **Neutral**. These calculations have been carried out assuming no mitigation is in place. If the SuDs proposed for the treatment of routine runoff are taken into account the accidental spillage risks will fall further. As the spillage risks are significantly less than 1% for all networks, no further spillage prevention measures (i.e. shutoff valves, penstocks, stop logs, etc.) would be required to reduce the risk of a serious pollution incident

11.4.50 As discussed previously in Section 1.2, the side roads and access tracks have not been assessed for accidental spillage impacts. The low traffic volumes anticipated on these roads would indicate that the risk of accidental spillage is exceptionally low and therefore no impact is anticipated.

Alterations to the Hydromorphological Regime

11.4.51 Typical hydromorphological impacts upon receptors may include channel realignments, loss of features and potential failure of hydromorphological elements (morphology, quantity and dynamics of flow) resulting from works, loss or damage to existing habitats, replacement of natural bed and/or banks with artificial materials, and changes to planform.

11.4.52 The hydromorphology screening exercise outlined in Section 1.2, identified a total of 12 watercourse locations which required further investigation, situated on seven watercourses in the River Findhorn, Funtack Burn and Moy Burn WFD catchment areas. Potential hydromorphological impacts associated with proposed watercourse crossings, realignments and other modifications are summarised in Table 11.11, with further detail, including effects on stream power and sediment entrainment, provided in Appendix A11.1. Overall, the channels assessed were all stable, with no existing issues of erosion and sediment transport reported.

11.4.53 The initial assessment of potential impacts has taken into account the embedded design measures of mammal ledges and a two-stage profile in all culverts to provide a low flow channel.

11.4.54 In relation to the Dalmagarry Burn embedded design measures have included:

- The length of the reach has been increased from 640m to 680m (an increase of 6%). This is dictated to a certain degree by the A9 crossing point and the road embankment pushing the river c.40m to the north east, but the realignment will also include a natural sinuosity to encourage natural processes (erosion and deposition) which more closely reflects the pre-straightened length.
- The realignment comprises a wide corridor (10-20m) within which a low flow channel (4m) will be cut and allowed to adjust naturally. This will reduce the risk of the river migrating laterally across the floodplain on either side.

- Some bank protection is necessary at the upstream end on the left bank where the channel turns sharply. It is currently proposed to construct a reinforced concrete retaining wall over approximately 60m (see Figure A11.1.3 in Annex A). The banks further downstream can be formed of rough or green bank protection, comprising woody material that can also benefit fish habitat.
- The bed levels are varied in the existing channel due to the gravel deposition in the upper section. The steepest gradient (2.7%) is currently between the railway bridge and the existing road bridge. The gradient is shallower over the lower section dropping to 0.4% at the downstream tie in. The long profile of the realignment will reflect the average gradient over the top, middle and lower sections, and this will become more varied over time as it adjusts to its average flow and sediment regime.
- The flood risk assessment hydraulic modelling has been used to inform the size of the diverted channel. The guiding principle is that the new channel should have the same hydraulic characteristics as the existing channel. The flow capacity of the channel, average velocity and flood characteristics will be replicated as far as is practicable. The existing cross sections were initially moved laterally onto the proposed alignment and then adjusted until the channel could convey the 2-year return period flow. This is the flow that is carried within the main channel without spilling onto the floodplain.

11.4.55 The impacts span the construction-operation phase of the Proposed Scheme. For all watercourses considered as part of this assessment the magnitude of the potential impacts range from minor to moderate adverse, with an associated significance ranging from **Neutral** to **Moderate**.

11.4.56 There are many minor watercourses previously screened out from detailed hydromorphological assessment, but which will still require culverts, realignments or modifications to enable the Proposed Scheme to be constructed. The risks from these modifications are considered much lower and environmentally less sensitive. The impact on these Low sensitivity watercourses is considered to be of Minor magnitude, with a subsequent significance of **Neutral**.

11.4.57 Whilst the majority of those watercourses assessed within this report individually result in a relatively small loss of open watercourse as a result of the widening of the A9 mainline carriageway and new side roads, cumulatively this is over 200m or roughly twice the existing culverted watercourse length. Dalmagarry Burn does provide some compensation with an additional 40m of channel. However, replacing the concrete box culverts (with artificial beds) with portal frames which allow for natural substrates through the structures is an important benefit. Overall this is considered to have a **Neutral** impact.

Table 11.11: Hydromorphological Impacts Summary

Watercourse Name	Sensitivity	Crossing Ref	Summary of Potential Impacts	Magnitude	Significance
Allt na Frithe	High	A9 1250	Realignment & extended/replacement crossing – would result in loss of approximately 44m of open watercourse. The impact on the functioning of the watercourse itself would likely be minimal with gradients decreasing from 5% to 3%. The proposed culvert would be an improvement on the existing structure which currently possesses an overwide, concrete bed.	Moderate	Moderate
	High	A9 1245 F	No loss of open watercourse.	Negligible	Neutral
Allt Dubhag	Low	A9 1250 C25	Realignment & extended/replacement crossing –would result in a significant loss of open watercourse, approx. 44m. The proposed gradients are moderately steep, approx. 4% upstream and 8% downstream, compared to an estimated 6% and 5% respectively.	Moderate	Slight
Dalmagarry Burn	High	A9 1260	Realignment & extended/replacement crossing – realignment required to minimise the skew and span of the proposed bridge structure, and due to the proposed embanked mainline impinging on the current channel downstream of the crossing. Significant realignment of 680m of a moderate river channel; however, consultation with SEPA and the design team has enabled many of the potential impacts to be addressed through embedded mitigation. The channel would encompass a wide (between 12-20m) two-stage profile and a narrower low flow channel (approx. 4m). Some bank protection will be required to tie in with the bridge structure and around the sharp bend to protect the adjacent properties.	Moderate	Moderate
	High	A9 1260 SRB1	Loss of open watercourse approx. 9m and requires realignment of the Dalmagarry Burn (as above).	Moderate	Moderate
	High	A9 1260 ARB1	New crossing –will be a clear span structure or a portal framed culvert structure and will not require any realignment or impact on the river bed. There will be a loss of open watercourse, approx. 7m.	Minor	Slight
Caochan na h-Eaglais	Low	A9 1270 C80	Realignment & extended/replacement crossing – would result in loss of approximately 7m of open watercourse. The proposed gradients are very steep (10% and 8%). The topographic survey and site observations suggest the existing upstream gradient is between 8% and 15%. Any increase in stream powers resulting from the potential steepening of the gradient could initiate potential channel instability. The confinement of the channel laterally may result in incision (rather than lateral adjustment) as the channel tries to recover a more naturalised gradient.	Moderate	Slight

Watercourse Name	Sensitivity	Crossing Ref	Summary of Potential Impacts	Magnitude	Significance
	Low	A9 1270 C80 S	New Crossing – assumed to be a clear span structure or a portal framed culvert structure requiring little or no realignment of the watercourse. There will be an approximate 8m loss of open watercourse. The proposed gradients are very steep (9% and 7%). Based on structural design this assessment assumes a portal framed culvert structure requiring minimal horizontal or vertical realignment of the watercourse.	Moderate	Slight
Allt na Loinne Mòire	Medium	A9 1273 C8	Realignment & extended/replacement crossing – would result in loss of approximately 8m of open watercourse. The proposed channel gradient upstream will be reduced from 4% to 2% and downstream it would be reduced from 6% to 4%.	Moderate	Slight
Allt na Slànaich	Medium	A9 1273 C28	Realignment & extended/replacement crossing – would result in loss of approximately 36m of open watercourse. Upstream gradients will increase from 5% to 6% whilst downstream the gradients will decrease from 3% to 1%.	Moderate	Slight
Allt Creag Bheithin	Medium	A9 1273 C31 S (MC90 C1)	Realignment & new crossing – would result in loss of approximately 8m of open watercourse. The existing and proposed gradients are very low, <2%.	Minor	Slight
	Medium	A9 1273 C31	Realignment & extended/replacement crossing – would result in loss of approximately 12m of open watercourse. Upstream gradients will decrease slightly from between 3 and 1% to a steady 1% and downstream gradients will remain similar to existing < 1%.	Moderate	Slight
	Medium	A9 1273 MCY0 C1	Realignment & new crossing – would result in a loss of open watercourse of 6m. The channel upstream will be similar to existing and shallowed downstream from 2% and 1%.	Minor	Slight

Increased Flood Risk

11.4.58 The Proposed Scheme could potentially increase flood risk as a result of capacity improvements in watercourse crossings, development within the floodplain, increased runoff rates and volumes from hardstanding areas and proposed channel modifications such as watercourse realignment. These impacts span the construction-operational phases of the Proposed Scheme.

11.4.59 The assessment, which is reported in detail in Appendix A11.2 Flood Risk Assessment, considers the impact of the proposed watercourse crossings on the flood risk to downstream receptors and the impact of the Proposed Scheme on floodplain storage. The cumulative impact of the watercourse crossings on the floodplain was also considered.

Watercourse Crossings

11.4.60 The design process for the watercourse crossings is complex, taking account of a range of design criteria and constraints to develop the most appropriate crossing for each watercourse. The primary technical standards driving the design of culverts are DMRB HA107/04 Design of Outfall and Culvert Details (2004) and the CIRIA Culvert design and operation guide (C689) (2010). However, in addition to these technical standards, across all project areas there are other drivers that influence the culvert design which include:

- **Flood risk** - In the event that a culvert is either extended (based on current geometry) or replaced, the impact on flood sensitive receptors may change by either retaining more water on the upstream side of the A9 or by passing more water through the culvert. Extending a culvert in the absence of any other change may increase flood levels upstream, while replacing an existing culvert with a larger one will increase the flow downstream, possibly reducing water level upstream and increasing water level downstream.
- **Maintenance requirements** - Maintenance of culverts to meet DMRB standards (as defined by HA107/04) requires consideration of a minimum culvert size. This culvert may be larger than the culvert size required from a hydraulic perspective, in which case increasing the culvert size may have an impact on flood sensitive receptors downstream.
- **Ecological considerations** - When designing new culverts, consideration is given to the provision of adequate integrated mammal passage, which if required will influence culvert size. In addition, consideration is given to maintaining a natural bed level within the culvert barrel by burying the culvert invert such that the culvert is sized to carry both flood flow and river bed sediment.
- **Geomorphological considerations** - When increasing the size of a culvert there is the potential for influencing sediment transport which occurs during a flood, thereby impacting on either erosion or sedimentation in the vicinity of the culvert, both upstream and downstream.
- **Highway drainage design** - The culvert design, in terms of both gradient and cross-section, needs to be considered so that it does not conflict with the proposed scheme i.e. the proposed road structure and drainage system.

11.4.61 For all areas, these influencing factors need to be considered together on a case-by-case basis to develop the most appropriate culvert design for each crossing. This design process is iterative, such that the final design meets the fundamental design standard, which is that the proposed scheme remains free from flooding in the 0.5% AEP (200-year) design flood event plus an allowance for climate change (increase in flow of 20%),

and freeboard (typically 600mm). In this context freeboard is defined as the difference between the proposed scheme road level and the peak water level during the 0.5% AEP (200-year) plus climate change event.

11.4.62 The design approach for the watercourse crossings, which takes account of the culvert design guidance, allows for a degree of flexibility and engineering judgement to be applied to the culvert design, to take into account the various influencing factors outlined above. Watercourse crossings included within the FRA (Appendix A11.2) are all compliant with this guidance, with a focus on design considerations set out in CIRIA C689 and DMRB HA107/04.

11.4.63 One dimensional (1D) hydraulic modelling was undertaken to assess the required hydraulic capacity of structures under the main A9 alignment to pass the 0.5% AEP flow with a 20% allowance for climate change and an appropriate freeboard (the minimum freeboard allowance is 600mm for structures larger than 1.2m high and 300mm for smaller openings).

11.4.64 The magnitude of the impact is based on the proposed change in capacity of the existing structure (given in Table 11.1) to reflect the potential change in downstream flow when the culvert is replaced. For watercourses where no structure currently exists the magnitude has been set as negligible on the basis that all new structures have the capacity to convey the 0.5% AEP plus climate change.

11.4.65 The location of all proposed culverts and bridges are displayed in Figure 11.1a-k. The assessed impacts for each watercourse are given in Table 11.12.

Table 11.12: Watercourse Crossings Preliminary Impact Summary

Watercourse	Existing Structure ID	New Structure ID	Catchment ID	Sensitivity	0.5% Peak Flow (m^3/s)	Existing Capacity (m^3/s / AEP)	Preliminary Potential Magnitude	Preliminary Potential Significance
River Findhorn Trib 1	A9 1240 C2	A9 1240 C2	TM28	Very High	2.46	0.2 / <50%	Negligible	Neutral
Allt na Frithe	A9 1250	A9 1250	TM27	Low	17.1	48.9 / >0.1%	Negligible	Neutral
River Findhorn Trib 2	A9 1250 C17	D5	TM26	Very High	0.95	0.17 / <50%	Minor	Large
Allt Dubhag	A9 1250 C25	A9 1250 C25	TM25	Medium	7.65	10.5 / 0.5%+CC	Negligible	Neutral
River Findhorn Trib 3	A9 1250 C30	D8	TM24	High	0.24	0.26 / 0.5%	Negligible	Neutral
Funtack Burn Trib 1	n/a	DB	TM23	Medium	0.53	n/a	Negligible	Neutral
Dalmagarry Burn Trib 1	n/a	DG	TM22	Medium	3.20	n/a	Negligible	Neutral
Dalmagarry Burn Trib 2	n/a	A9 1250 C85	TM21	Medium	1.85	n/a	Negligible	Neutral
		A9 1250 C85 S						
Dalmagarry Burn Trib 3	n/a	A9 1250 C93	TM20a	Medium	0.68	n/a	Negligible	Neutral
Dalmagarry Burn	A9 1260	A9 1260	TM20	Very High	24.15	16.3 / 10%	Major	Very Large
	n/a	A9 1260 SRB1				n/a	Negligible	Neutral
	n/a	A9 1260 ARB1				n/a	Negligible	Neutral
Funtack Burn Trib 2	A9 1260 C20	A9 1260 C25	TM19	Very High	0.71	0.29 / ~10%	Minor	Large
		A9 1260 C25 S					Minor	Moderate
Funtack Burn Trib 3	A9 1260 C35	A9 1260 C35	TM18	Very High	2.55	0.8 / ~20%	Minor	Large
		A9 1260 C35 S					Minor	Large

Watercourse	Existing Structure ID	New Structure ID	Catchment ID	Sensitivity	0.5% Peak Flow (m^3/s)	Existing Capacity (m^3/s / AEP)	Preliminary Potential Magnitude	Preliminary Potential Significance
Funtack Burn Trib 4	A9 1260 C65	A9 1260 C65	TM17	High	0.93	3.7 / >0.1%	Negligible	Neutral
		A9 1260 C65 S					Negligible	Neutral
Funtack Burn Trib 5	A9 1260 C94	A9 1260 C94	TM16	High	1.59	0.68 / >0.1%	Negligible	Neutral
	n/a	A9 1260 CNR1	TM16	High	1.05	n/a	Negligible	Neutral
	n/a	A9 1260 C94 S	n/a	High	0.194	n/a	Negligible	Neutral
	n/a	A9 1270 CNR2	n/a	High	0.064	n/a	Negligible	Neutral
	n/a	A9 1270 C10 S	n/a	High	0.127	n/a	Negligible	Neutral
Funtack Burn Trib 6 / 7	A9 1270 C7	A9 1270 C35	TM15	High	0.22	0.88 / >0.1%	Negligible	Neutral
		A9 1270 C35 S					Negligible	Neutral
Funtack Burn Trib 8	A9 1270 C9	A9 1270 C50	TM14	High	1.00	0.81 / >0.1%	Negligible	Neutral
		A9 1270 C50 S					Negligible	Neutral
Funtack Burn Trib 9	A9 1270 C10	A9 1270 C60	TM13	High	0.28	0.65 / >0.1%	Negligible	Neutral
		A9 1270 C60 S					Negligible	Neutral
Caochan na h-Eaglais	A9 1270 C14	A9 1270 C80	TM12	High	3.57	5.32 / >0.1%	Negligible	Neutral
		A9 1270 C80 S			3.19	n/a	Negligible	Neutral
Moy Burn Trib 1	A9 1270 C19	A9 1273 C5	TM11	High	3.23	1.98/ 4%	Moderate	Large
Allt na Loinne Moire	A9 1270 C22	A9 1273 C8	TM10	Medium	9.65	18.46 / >0.1%	Negligible	Neutral
Moy Burn Trib 2/3	A9 1270 C30	A9 1273 C18	TM8	Low	1.10	1.87 / >0.1%	Negligible	Neutral
Allt Creag Bheithin Trib 1	A9 1270 C33	A9 1273 C22	TM7	Low	4.20	4.12 /0.5%	Minor	Neutral

Watercourse	Existing Structure ID	New Structure ID	Catchment ID	Sensitivity	0.5% Peak Flow (m^3/s)	Existing Capacity (m^3/s / AEP)	Preliminary Potential Magnitude	Preliminary Potential Significance
Allt Creag Bheithin Trib 2	A9 1270 C35	A9 1273 C24	TM6	Low	0.35	14.49 / >0.1%	Negligible	Neutral
Allt na Slanaich	A9 1270 C39	A9 1273 C28	TM5	Medium	9.02	0.73 / >0.1%	Negligible	Neutral
Allt Creag Bheithin (Lower)	A9 1270 C41	MC90 C1	TM4	Medium	7.65	5.13 / 2%	Moderate	Moderate
		A9 1273 C31				2.65 / >0.1%	Moderate	Moderate
Allt Creag Bheithin Trib 3	A9 1270 C48	A9 1273 C40	TM3	Medium	1.73	1.22 / >0.1%	Negligible	Neutral
Allt Creag Bheithin Trib 4	A9 1270 C59	A9 1273 C43	TM2	Medium	0.82	2.89 / >0.1%	Negligible	Neutral
Allt Creag Bheithin (Upper)	A9 1270 C43	A9 1273 C54	TM1	Medium	1.20	5.13 / 2%	Negligible	Neutral
		A9 1273 MCY0 C1	TM30				Negligible	Neutral
Midlairgs Burn	n/a	A9 1273 MCR1 C1	TM31	Medium	2.77	n/a	Negligible	Neutral
Midlairgs Burn 1	n/a	A9 1273 MCR0 C2	TM32	Medium	1.11	n/a	Negligible	Neutral
Midlairgs Burn 2	n/a	A9 1273 MCR0 C1	TM33	Medium	1.01	n/a	Negligible	Neutral

11.4.66 The proposed drain D5 (which replaces A9 1250 C17) gives a **Large** impact on the River Findhorn Trib 2 due to the fact that the existing drain has a capacity of less than the 0.5% AEP flow and the A9 has been included as a receptor. The outlet to the drain is only 220m upstream of the River Findhorn, the land use downstream of the drain is forestry and there are no sensitive receptors apart from the A9. If the A9 was not included as a receptor the impact would be **Slight**. The 1D model indicates that the proposed drain will operate under inlet control during the 0.5% AEP flood indicating that upstream storage is utilised as far as possible. Therefore no mitigation is proposed.

11.4.67 The new watercourse crossings in the vicinity of Dalmagarry (A9 1260, A9 1260 ARB1, A9 1260 SRB1, A9 1260 C25, A9 1260 C25S, A9 1260 C35 and A9 1260 C35S) have an impact on downstream flows ranging from **Moderate** to **Very Large**. The impact of changes in flow on flood risk is complex due to the interactions between the different watercourses and floodplains and has been assessed using the 1D/2D hydraulic model. The impact on flood risk and the need for mitigation has been progressed as a part of the floodplain assessment.

11.4.68 The proposed crossing A9 1260 ARB1 is not within the 0.5% AMJV baseline floodplain and the minimum freeboard between the bridge soffit and 0.5% AEP maximum water level with a 20% allowance for climate change is 600 mm. The magnitude is therefore Negligible and significance of impact **Neutral**.

11.4.69 The new culvert at Moy Burn Trib 1 (A9 1273 C5) was assessed as having an impact of Large significance if the capacity of the structure was to be increased from the 4% AEP (for the existing culvert) to the 0.5% AEP plus climate change, due to an increase in flood levels at the downstream mainline railway culvert. Therefore, as embedded design mitigation, the proposed culvert has been sized to have the same capacity as the existing 1.2m diameter culvert. The proposed culvert will be a 1.2m x 1.2m box culvert with 0.25m of bed material. The modelling confirms that flood levels will not increase at the main line railway or B9154 and that the A9 remains free from floodwater for the 0.5% AEP with a 20% allowance for climate change. The magnitude of the impact can therefore be reduced to Negligible, giving a revised significance of **Neutral**. No additional mitigation is proposed.

11.4.70 The proposed culverts MC90 C1 and A9 1273 C31 have a **Moderate** impact on the Allt Creag Bheithin. The cumulative impacts of replacing the culverts in this location on flood risk are assessed as a part of the floodplain assessment at Allt Creag Bheithin.

11.4.71 All other proposed crossings have a **Neutral** impact on the water crossings and do not therefore require mitigation.

Floodplain

11.4.72 The development of the Stage 3 Proposed Scheme and the assessment of flood risk has been an iterative process. Early in Stage 3 preliminary flood risk modelling was carried out for the developing preferred scheme, without any allowance for potential embedded mitigation, such as compensation storage, and with culverts designed to satisfy the strategic environmental design principles. The results of this preliminary floodplain assessment are given in Table 11.13. This preliminary assessment identified a number of significant potential impacts, which are summarised below. The Proposed Scheme and the flood risk modelling were subsequently refined and flood mitigation options developed as embedded mitigation to the Proposed Scheme. A summary of this mitigation is given below, with further detail provided in Appendix A11.2 Flood Risk Assessment. The revised potential impact assessment results, with embedded mitigation, are summarised in Table 11.14.

Table 11.13: Floodplain Receptor Preliminary Potential Impact Summary

Floodplain	Description	Receptors	Sensitivity	Preliminary Potential Magnitude	Preliminary Potential Significance
Allt na Frithe	The existing watercourse crossing at the Allt na Frithe (A9 1250) is to be replaced with a portal frame structure. The opening of the new structure will be 4.5m wide by 2.5m deep and 78m long. It has sufficient capacity to pass the 0.5% AEP with a freeboard. The existing structure has a hydraulic capacity greater than the 0.5% AEP so there will be no increase in downstream flow. The proposed alignment crosses the 0.5% AEP of the Allt na Frithe but as the proposed structure does not constrain the main channel and the outlet is less than 100m upstream of the confluence with the Findhorn there is no significant impact on modelled water levels. The model results show that there is no increase in water level at nearby sensitive receptors and that the A9 would not be submerged. The A9 road level is above the 0.5% AEP flood level with climate change.	Agricultural Land (upstream face of the road embankment)	Medium	Negligible	Neutral
		Agricultural Land (downstream face of the road embankment)	Medium	Negligible	Neutral
		Non Residential properties in Tomatin (Warehouses)	Medium	Negligible	Neutral
		Residential properties (Moss Villa, Freeburn Cottage and Pinewood)	High	Negligible	Neutral
		Minor Road (C1121) and Watercourse crossing	Medium	Negligible	Neutral
		A9 Dualling	Very High	Negligible	Neutral
Dalmagarry Burn	The Proposed Scheme impacts on the hydraulics of the floodplain at Dalmagarry due to the following modifications: · The new enlarged embankment crosses the 0.5% AEP floodplain · A new bridge crossing at the Dalmagarry Burn (A9 1260) · Removal of the old A9 bridge · Removal of existing flood relief culverts · Realignment of the burn for 640m downstream of the new bridge crossing · New Millennium culvert crossings under the main alignment and side road north of the farm (A9 1260 C25 and A9 1260 C25s) at NGR 785 325 · A SUDS basin will be located between the realigned burn and the new A90	Residential and non-residential properties at Dalmagarry	Very High	Negligible	Neutral
		Agricultural land located south of Dalmagarry Farm and between the Funtack Burn and Dalmagarry Burn (floodplain A)	Medium	Moderate Adverse	Moderate
		Agricultural land located west of the Highland mainline railway and north of the Dalmagarry Burn (floodplain B)	Medium	Negligible	Neutral
		Agricultural land located north of Dalmagarry Farm between	Medium	Moderate Adverse	Moderate

Floodplain	Description	Receptors	Sensitivity	Preliminary Potential Magnitude	Preliminary Potential Significance
	· 3 existing culverts that allow runoff from land to the west of the railway join the Dalmagarry Burn are to be replaced with 1.2m x 1.2m box culverts · A new bridge structure will be located to the west of the railway and crosses the Dalmagarry Burn (A9 1260 ARB1). It will be a reinforced concrete bridge providing NMU access to the NCN7 and farm vehicle access to land west of the railway line. · A new bridge structure (A9 1260 SRB1) will be located 17m downstream of the new A9 crossing (A9 1260) to allow the Ruthven Moy Link Road to cross the Dalmagarry Burn. It will be a reinforced concrete bridge with a span of approximately 16m and a total deck width of 7.3m The new bridge crossing A9 1260 has a greater opening than the existing bridge and does not constrain the 0.5% AEP flow (or the 0.5% AEP with climate change flow). During the preliminary modelling the realigned section of the burn was sized to replicate the existing flow regime as far as was practicable. A two stage channel was proposed to achieve a more natural hydromorphology. Various iterations of the design were run, with early iterations resulting in moderate increases in flood depths on Floodplains A and C, and associated minor reductions in flood levels and at the HML, and in the Ruthven Road and Milton of Moy areas	bounded by the A9 in the west and Funtack Burn in the east (floodplain C)			
		Ruthven Road and Bridge crossing (Funtack Burn)	Medium	Minor Beneficial	Slight Beneficial
		Milton of Moy (Residential property)	Very High	Minor Beneficial	Moderate Beneficial
		Highland Main Line Railway	Very High	Minor Beneficial	Moderate Beneficial
		A9	Very High	Negligible	Neutral
Allt Creag Bheithin	The existing A9 is a barrier to floodplain conveyance, with the Allt Creag Bheithin overtopping the A9 between NGR NH 748 347 and NH 750 347. The preliminary flood models included new watercourse crossings on the Allt Creag Bheithin and Allt Slanaich which had sufficient capacity to pass the 0.5% AEP with climate change and a freeboard allowance. This modelling indicated that although the risk of flooding on the A9 was removed there would be moderate increases in water levels at the downstream HML railway and minor increases at the B9154.	Forestry north of A9 between Allt Creag Bheithin and Allt na Slanaich	Low	Major Beneficial	Slight Beneficial
		Forestry north of A9 between Allt na Slanaich and Tributary of Allt Creag Bheithin 002	Low	Major Beneficial	Slight Beneficial
		Forestry north of A9 between Tributary of Allt Creag Bheithin 002 and Tributary of Allt Creag Bheithin 001	Low	Major Beneficial	Slight Beneficial

Floodplain	Description	Receptors	Sensitivity	Preliminary Potential Magnitude	Preliminary Potential Significance
		B9154	High	Minor	Moderate
		Highland Main Line Railway	Very High	Moderate	Very Large
		A9	Very High	Negligible	Neutral

11.4.73 There is no floodplain loss at Allt na Frithe and no impact on flood risk to sensitive receptors. Therefore, the Proposed Scheme passes the Sequential Tests 1 and 2 and no further assessment is required.

11.4.74 Preliminary modelling results indicated that the floodplain at Dalmagarry would be impacted by the Proposed Scheme due to a combination of a loss of floodplain storage, modifications to the hydraulic links between floodplains and changes in the morphology of the Dalmagarry Burn. Under these circumstances replacing floodplain storage displaced by the scheme does not guarantee that flood risk will not be increased. Modelling was therefore used to understand the hydraulics and to assess the effectiveness of proposed mitigation.

11.4.75 The 1D/2D hydraulic model has been used through an iterative design process to determine the size of the diverted channel. The guiding principle being that the new channel should have the same hydraulic characteristics as the existing channel. The flow capacity of the channel, average velocity and flood characteristics should be replicated as far as is practicable.

11.4.76 The existing cross sections were initially moved laterally onto the proposed alignment and then adjusted until the channel could conveyed the 50% AEP flow. This is the flow that is currently carried within the main channel without spilling onto the floodplain.

11.4.77 The channel bed widths vary from 10m at the outlet to the railway bridge to 8m some 250m downstream of the railway bridge and 2m at the downstream end of the diversion just upstream of where it returns to its existing alignment.

11.4.78 The left bank of the burn has been raised around the first bend of the diverted burn downstream of the proposed crossing (between NGR NH 787 322 and NH 788 322) to keep the 0.5% AEP in channel at this point. Flood water first leaves the channel at a low point on the left bank at NH 790 321 close to where it does at present. Flood water leaving the main channel flows northwards towards the Funtack Burn as it does at present. Flow eventually overtops the left bank of the Dalmagarry Burn at a second location (NGR NH 789 321) some 180m downstream of the new A9 crossing.

11.4.79 The proposed watercourse crossings that connect the Dalmagarry and Funtack floodplains have been included in the model to ensure that the impact of increasing the hydraulic capacity of the structures is included in the assessment. This specifically relates to structures A9 1260, A9 1260 C25, A9 1260 C25S, A9 1260 C25, A9 1260 C25S, A9 1260 C35 and A9 1260 C35S which currently have capacities less than the 0.5% AEP.

11.4.80 The removal of the flood relief culverts under the existing farm access road removes the existing flood pathway to the south of Dalmagarry Farm and ensures that the new access road is out of the floodplain.

11.4.81 The modelling results for the final embedded mitigation design indicate that there will be negligible changes in floodplain extents and depths in the vicinity of all the receptors, with the exception of the agricultural land within floodplain C to the north of Dalmagarry Farm. Within floodplain C water levels are anticipated to increase by 1-2cm for the 1% AEP, 0.5% AEP and 0.5% AEP plus climate change events. This is considered to be an impact of Minor magnitude, with a significance of **Slight**.

11.4.82 The modelling results also confirm that there is no impact on the flood hydrograph downstream of the confluence of the Dalmagarry and Funtack burns, and that the impact of the Proposed Scheme is fully mitigated.

11.4.83 Preliminary modelling of the Allt Creag Bheithin floodplain indicated that upsizing culverts A9 1273 C31 and A9 1273 C28 would return the flood flow path to a more natural state (prior to the construction of the existing A9) and remove the risk of flooding from the A9 itself. However the peak flood level at the Highland Main Line railway and the B9154 would increase, as a result. The peak 0.5% AEP water level is predicted to increase by 60mm at the railway bridge.

11.4.84 Compensation storage areas have therefore been included in the Proposed Scheme together with reduced culvert opening sizes as embedded mitigation. Two storage areas are to be located upstream of culverts A9 1273 C31 and A9 1273 C28. The opening area of the proposed culvert A9 1273 C31 has been set to 2m x 2m to control flood flow through the structure and allow water to overtop upstream on Allt Creag Bheithin into the two storage areas. This does mean that there is no freeboard at the upstream extent of culvert A9 1273 C31 during the 0.5% AEP event, however this is necessary to prevent adverse impacts downstream during flood events. At the downstream end of this culvert, there is 534mm freeboard during the 0.5% AEP event.

11.4.85 The area of each bore of the 3 bore culvert at A9 1273 C28 on Allt na Slanaich is proposed to be 1.85m high x 1.80m wide. The freeboard through each barrel is 650mm during the 0.5% AEP event satisfying the SEDP.

1.1.1 Modelling results for the Proposed Scheme with this embedded mitigation indicate that the 0.5% maximum flood levels on the B9154 and at the railway are predicted to remain unchanged with the compensation storage in place as are levels in and around Loch Moy.

11.4.86 A summary of the revised floodplain potential impact assessment, with the discussed embedded mitigation, is provided in Table 11.14 below.

Table 11.14: Floodplain Receptor Revised Potential Impact Summary

Floodplain	Embedded Mitigation Description	Receptors	Sensitivity	Revised Potential Magnitude	Revised Potential Significance
Allt na Frithe	No mitigation required	Agricultural Land (upstream face of the road embankment)	Medium	Negligible	Neutral
		Agricultural Land (downstream face of the road embankment)	Medium	Negligible	Neutral
		Non Residential properties in Tomatin (Warehouses)	Medium	Negligible	Neutral
		Residential properties (Moss Villa, Freeburn Cottage and Pinewood)	High	Negligible	Neutral
		Minor Road (C1121) and Watercourse crossing	Medium	Negligible	Neutral
		A9 Dualling	Very High	Negligible	Neutral
Dalmagarry Burn	The realigned section of the burn has been sized to replicate the existing flow regime as far as is practicable. A two stage channel is proposed to achieve a more natural hydromorphology. Bank heights have been set to control the time and volume of spill from the main channel onto the floodplain to ensure that the loss of floodplain storage is mitigated for and the impact downstream of the confluence with the Funtack Burn is neutral.	Residential and non-residential properties at Dalmagarry	Very High	Negligible	Neutral
		Agricultural land located south of Dalmagarry Farm and between the Funtack Burn and Dalmagarry Burn (floodplain A)	Medium	Negligible	Neutral
		Agricultural land located west of the Highland mainline railway and north of the Dalmagarry Burn (floodplain B)	Medium	Negligible	Neutral
		Agricultural land located north of Dalmagarry Farm between bounded by the A9 in the west and Funtack Burn in the east (floodplain C)	Medium	Minor	Slight Adverse
		Ruthven Road and Bridge crossing (Funtack Burn)	Medium	Negligible	Neutral
		Milton of Moy (Residential property)	Very High	Negligible	Neutral
		Highland Main Line Railway	Very High	Negligible	Neutral
		A9	Very High	Negligible	Neutral
Allt Creag Bheithin	Two storage areas are to be located upstream of culverts A9	Forestry north of A9 between Allt Creag Bheithin and Allt na Slanaich	Low	Major Beneficial	Slight Beneficial

Floodplain	Embedded Mitigation Description	Receptors	Sensitivity	Revised Potential Magnitude	Revised Potential Significance
	1273 C31 and A9 1273 C28. The opening area of the proposed culvert A9 1273 C31 has been set to 2m x 2m to control flood flow through the structure and allow water to overtop upstream on Allt Creag Bheithin into the two storage areas. The area of each bore of the 3 bore culvert at A9 1273 C28 on Allt na Slanaich is proposed to be 1.85m height x 1.80m wide.	Forestry north of A9 between Allt na Slanaich and Tributary of Allt Creag Bheithin 002	Low	Major Beneficial	Slight Beneficial
		Forestry north of A9 between Tributary of Allt Creag Bheithin 002 and Tributary of Allt Creag Bheithin 001	Low	Major Beneficial	Slight Beneficial
		B9154	High	Negligible	Neutral
		Highland Main Line Railway	Very High	Negligible	Neutral
		A9	Very High	Negligible	Neutral

Loss of Standing Water

11.4.87 Construction of the Proposed Scheme would involve direct loss of one standing water body adjacent to the existing A9 carriageway. Lynebeg Pond (P5) located at NGR NH 770 340 is encroached upon by cuttings associated with the Lynebeg underpass, and it is therefore anticipated that the pond will be drained and the entirety of the pond lost permanently.

11.4.88 Other standing water bodies may be subject to impacts such as by indirect disruption to inflowing surface water where the Proposed Scheme drainage cuts off or diverts some of the pond natural catchment, leading to drying out or a reduction in pond surface area or depth and subsequently impacting the biodiversity of the affected waterbodies. Table 11.15 below, summarises such potential impacts.

Table 11.15: Losses to Standing Water

Water Body ID and NGR	Sensitivity	Relative Location	Comment	Magnitude	Significance
P14 Tigh an Allt, South NH 795 308	Medium	Located approximately 20m east of proposed embankment toe drainage.	The existing A9 forms a barrier to surface runoff from the west reaching the pond. Given the location and ground conditions (river terrace sands and gravels) it is anticipated that groundwater forms a substantial proportion of the inflows to the pond. The close proximity of the proposed toe drainage is likely to affect surface water flows to some degree, but the groundwater flows should be unaffected, therefore the overall effect on the pond is unlikely to be significant.	Minor	Slight
P13 Tigh an Allt, East NH 795 308	Low	Located approximately 80m east of Proposed Scheme, within the Tigh an Allt property.	As this pond is connected to Ponds 14 and 12 it is anticipated that there will be some indirect impact on surface water flows, however these are not anticipated to be significant given the distance from the Proposed Scheme and the likely mixed hydrological / hydrogeological dependence of the pond.	Minor	Neutral
P12 Tigh an Allt, North NH 795 309	Medium	Located approximately 5m east of proposed embankment toe drainage	The proposed toe drainage will form a realignment of the existing inflow and outflow drains to this pond. The current design shows the new drainage ditch will bypass the pond, which is likely to reduce surface inflow to a greater degree than at Pond 14. However, this pond is anticipated to have a mixed dependence on surface flows, groundwater and rainfall; with the latter two sources being unaffected by the Proposed Scheme. Therefore the overall effect on the pond is expected to be moderate.	Moderate	Moderate
Loch Moy NH 772 347	Very High	Located approximately 180m east and downstream of the Proposed Scheme	Given the size of the waterbody it is anticipated that the Proposed Scheme will have no measurable effect on Loch Moy with regards to inflowing surface water or groundwater.	Negligible	Neutral
P5 Lynebeg, South NH 770 340	Medium	Located partly under the footprint of the Lynebeg underpass cuttings	It is anticipated that this pond with be entirely lost as a result of the encroaching Lynebeg underpass cuttings.	Major	Large
P4 Lynebeg, North NH 768 341	Medium	Located approximately 25m northeast and downstream of the proposed mainline	As widening of the mainline is proposed on the far side of the existing A9 from Pond 4 no change to the existing surface catchment of the pond is anticipated. Potential impacts on groundwater flows in this area are discussed in detail in Chapter 10: Geology, Soils and Groundwater, however in summary these should be unaffected by the proposed works in this area.	Negligible	Neutral

Loss or Change to Water Supplies

11.4.89 Given the intervening distance (over 500m) between the Allt Cosach Hydrostation intake and the drainage discharge from the bus turning circle (which will be drained via a grassed ditch) it is considered unlikely that there will be any impact on this water supply during the operational phase of the Proposed Scheme. Therefore, the impact is assessed as having a magnitude of Negligible and subsequent **Neutral** significance.

11.4.90 The Tomatin Distillery abstraction on the River Findhorn is located approximately 115m downstream of mainline drainage outfall 1A. This drainage network has been designed with three stages of SuDs treatment, namely filter drains, swales and a retention pond; and has been assessed as passing all aspects of the routine runoff and accidental spillage assessments as reported earlier. It is therefore considered unlikely that the Proposed Scheme will impact upon the water quality or quantity of the abstraction during the operational phase. Accordingly, the impact has been assessed as having a magnitude of Negligible and a significance of **Neutral**.

11.4.91 The Lynebeg Pond PWS, supplying a total of three properties for non-potable purposes, abstracts from Pond 5 (Lynebeg Pond, South). This private water supply will be lost when the pond is drained as a result of the Lynebeg underpass cutting impinging on the pond. The magnitude of impact on this receptor is therefore considered to be Major Adverse with a resulting significance of **Large**.

11.4.92 The Lynebeg and Lynemore private water supplies have been confirmed as having surface water sources uphill of the scheme, which would be unaffected by the Proposed Scheme. The magnitude of impact is therefore considered to be Negligible, and the significance **Neutral**.

11.5 Potential Mitigation

11.5.1 Embedded mitigation has been included within the Proposed Scheme design as detailed in Section 11.4. In addition to this there is a need for further environmental mitigation, both standard and project specific.

11.5.2 A list of standard mitigation measures has been developed for all projects within the A9 Dualling Programme; those related to road drainage and the water environment are detailed below in Table 11.16. In addition to these, scheme specific mitigation measures have also been developed as detailed in Table 11.17. The location and timing of measures is included in Chapter 21 (Schedule of Environmental Commitments) along with other general A9 standard mitigation and project specific mitigation relating to other topics.

Table 11.16: A9 Standard Mitigation Commitments

Mitigation Item	Description
SMC-W1	The Contractor will comply with the requirements of the Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended) (also known as the CAR Regulations) in relation to water features which require engineering work and construction activities. Works within or adjacent to water features may require a CAR licence, registration or compliance with the General Binding Rules (GBRs). Where required, a CAR application would be made to SEPA and this would include detailed information on the proposed activity, the potential impacts to the water environment, mitigation measures included in the design and a detailed construction methodology for all engineering activities.
SMC-W2	In relation to flood risk, the Contractor will implement the following mitigation measures during construction: · The Flood Response Plan (as part of the CEMP, refer to **Mitigation Item SMC-S1** in Table 21.1 of Chapter 21 (Schedule of Environmental Commitments)) will set out the following mitigation measures to be implemented when working within the functional floodplain (defined here as the 0.5% AEP (200-year) flood extent): - Routinely check the MET office Weather Warnings and the SEPA Floodline alert service for potential storm events (or snow melt), flood alerts and warnings relevant to the area of the construction works. - During periods of heavy rainfall or extended periods of wet weather (in the immediate locality or wider river catchment) river levels will be monitored using for example SEPA Water Level Data when available/visual inspection of water features. The Contractor will assess any change from base flow condition and be familiar with the normal dry weather flow conditions for the water feature, and be familiar with the likely hydrological response of the water feature to heavy rainfall (in terms of time to peak, likely flood extents) and windows of opportunity to respond should river levels rise. - Should flooding be predicted, works close or within the water features should be immediately withdrawn (if practicable) from high risk areas (defined as: within the channel or within the bankfull channel zone - usually the 50% (2-year) AEP flood extent). Works should retreat to above the 10% AEP (10-year) flood extent) with monitoring and alerts for further mobilisation outside the functional floodplain should river levels continue to rise. · Plant and materials will be stored in areas outside the functional floodplain where practicable, with the aim for temporary construction works to be resistant or resilient to flooding impacts, to minimise/prevent movement or damage during potential flooding events. Where this is not possible, agreement will be required with the Environmental Clerk of Works (EnvCoW). · Stockpiling of material within the functional floodplain, if unavoidable, will be carefully controlled with limits to the extent of stockpiling within an area, to prevent compartmentalisation of the floodplain, and stockpiles will be located >10m from watercourse banks. · Temporary drainage systems will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways. Where practicable, temporary haul routes will be located outside of the functional floodplain.
SMC-W3	In relation to construction site runoff and sedimentation, the Contractor will adhere to GPPs/PGGs (SEPA, 2006-2017) and other good practice guidance (Table 11.1), and implement appropriate measures which will include, but may not be limited to: · avoiding unnecessary stockpiling of materials and exposure of bare surfaces, limiting topsoil stripping to areas where bulk earthworks are immediately programmed;

Mitigation Item	Description
	· installation of temporary drainage systems/SuDS systems (or equivalent) including pre-earthworks drainage; · pre-earthworks drainage/SuDS with appropriate outfalls to be in place prior to any earthworks activities; · treatment facilities to be scheduled for construction early in the programme, to allow settlement and treatment of any pollutants contained in site runoff and to control the rate of flow before water is discharged into a receiving watercourse; · the adoption of silt fences, check dams, settlement lagoons, soakaways and other sediment trap structures as appropriate; · the maintenance and regrading of haulage route surfaces where issues are encountered with the breakdown of the existing surface and generation of fine sediment; · provision of wheel washes at appropriate locations (in terms of proposed construction activities) and >10m from water features; · protecting soil stockpiles using bunds, silt fencing and peripheral cut-off ditches, and location of stockpiles at distances >10m from water features; and · restoration of bare surfaces (seeding and planting) throughout the construction period as soon as possible after the work has been completed, or protecting exposed ground with geotextiles if to be left exposed.
SMC-W4	In relation to in-channel working, the Contractor will adhere to GPPs/PPGS (SEPA, 2006-2017) and other good practice guidance (Table 11.1), and implement appropriate measures which will include, but may not be limited to: · undertaking in-channel works during low flow periods (i.e. when flows are at or below the mean average) as far as reasonably practicable to reduce the potential for sediment release and scour; · no in-channel working during the salmonid spawning seasons unless permitted within any CAR license; · minimise the length of channel disturbed and size of working corridor, with the use of silt fences or bunds where appropriate to prevent sediment being washed into the water feature; · limit the removal of vegetation from the riparian corridor, and retaining vegetated buffer zone wherever reasonably practicable; and · limit the amount of tracking adjacent to watercourses and avoid creation of new flow paths between exposed areas and new or existing channels.
SMC-W5	Where channel realignment is necessary, the Contractor will adhere to good practice guidance (Table 11.1) and implement appropriate measures which will include, but may not be limited to: · Once a new channel is constructed, the flow should, where practicable, be diverted from the existing channel to the new course under normal/low flow conditions; · diverting flow to a new channel should be timed to avoid forecast heavy rainfall events at the location and higher up in the catchment (the optimum time will be the spring and early summer months to allow vegetation establishment to help stabilise the new channel banks); · with offline realignments, the flow will be diverted with a steady release of water into the newly constructed realignment to avoid entrainment of fine sediment or erosion of the new channel; and · any proposed realignment works will be supervised by a suitably qualified fluvial geomorphologist.

Mitigation Item	Description
SMC-W6	In relation to refuelling and storage of fuels, the Contractor will adhere to GPPs/PPGs (SEPA, 2006-2017) and other good practice guidance (Table 11.1), and implement appropriate measures which will include, but may not be limited to: · only designated trained and competent operatives will be authorised to refuel plant; · refuelling will be undertaken at designated refuelling areas (e.g. on hardstanding, with spill kits available, and >10m from water features) where practicable; · appropriate measures will be adopted to avoid spillages (refer to **Mitigation Item SMC-W7**); and · compliance with the Pollution Incident Control Plan (refer to **Mitigation Item SMC-S1**).
SMC-W7	In relation to oil/fuel leaks and spillages, the Contractor will adhere to GPPs/PPGs (SEPA, 2006-2017) and other good practice guidance (Table 11.1), and implement appropriate measures which will include, but may not be limited to: · stationary plant will be fitted with drip trays and emptied regularly; · plant machinery will be regularly inspected for leaks with maintenance as required; · spillage kits will be stored at key locations on-site and detailed within the Construction Environmental Management Plan (CEMP) (refer to **Mitigation Item SMC-S1**); and · construction activities will comply with the Pollution Incident Control Plan (refer to **Mitigation Item SMC-S1**).
SMC-W8	In relation to chemical storage, handling and reuse, the Contractor will adhere to GPPs/PPGs (SEPA, 2006-2017) and other good practice guidance (Table 11.1), and implement appropriate measures which will include, but may not be limited to: · chemical, fuel and oil storage will be undertaken within a site compound, which will be located on stable ground at a low risk of flooding and >10m from any watercourse; · chemical, fuel and oil stores will be locked and sited on an impervious base within a secured bund with 110% of the storage capacity; and · pesticides, including herbicides, will only be used if there are no alternative practicable measures, and will be used in accordance with CAR requirements, the manufacturer's instructions and application rates.
SMC-W9	In relation to concrete, cement and grout, the Contractor will adhere to GPPs/PPGs (SEPA, 2006-2017) and other good practice guidance (Table 11.1), and implement appropriate measures which will include, but may not be limited to: · concrete mixing and washing areas will: - be located more than 10m from water bodies; - have settlement and re-circulation systems for water reuse; and - have a contained area for washing out and cleaning of concrete batching plant or ready-mix lorries. · wash-water will not be discharged to the water environment and will be disposed of appropriately either to the foul sewer (with permission from Scottish Water), or through containment and disposal to an authorised site;

Mitigation Item	Description
	· where concrete pouring is required within a channel, a dry working area will be created; · where concrete pouring is required within 10m of a water feature or over a water feature, appropriate protection will be put in place to prevent spills entering the channel (e.g. isolation of working area, protective sheeting); and · quick setting products (cement, concrete and grout) will be used for structures that are in or near to watercourses.
SMC-W10	Sewage from site facilities will be disposed of appropriately either to a foul sewer (with the permission of Scottish Water) or via appropriate treatment and discharge as agreed with SEPA in advance of construction and in accordance with 'PPG04 Treatment and Disposal of Sewage' (SEPA, 2003 – 2013).
SMC-W11	In relation to service diversions and to avoid damage to existing services from excavations and ground penetration, including temporary severance of public and private water supplies through damage to infrastructure, the Contractor will: · locate and map all private or public water supply assets and other service infrastructure prior to construction; · take measures to prevent damage to services and to avoid pollution during service diversions, excavations and ground works; and · provide a temporary alternative water supply (e.g. bottled or tankered) if services are to be disrupted or diverted by the works.
SMC-W12	For works within areas identified as potentially containing contaminated land and sediment the Contractor will reduce the risk of surface water pollution to an acceptably low level through: · further site investigation to determine the level of contamination prior to construction to beginning; · the installation of temporary treatment facilities to enable removal of pollutants from surface waters; and · adoption of mitigation measures relating to contaminated land as outlined in Table 21.4.
SMC-W13	In relation to bank reinforcement, design principles and mitigation measures will adhere to good practice (SEPA, 2008a), which will include, but may not be limited to: · non-engineering solutions and green engineering (e.g. vegetation, geotextile matting) to be the preference during options appraisal; · requirements for grey engineering to control/prevent scour (e.g. rock armour, rip-rap, gabion baskets) to be minimised; and · post project appraisal to identify if there are issues that can be investigated and addressed at an early stage.
SMC-W14	In relation to outfalls, specimen and detailed design will ensure compliance with good practice (e.g. CIRIA, 2015b; The Highways Agency et al., 2004; SEPA, 2008b), which will include, but may not be limited to: · directing each outfall downstream to minimise impacts to flow patterns; · avoiding projecting the outfall into the watercourse channel; · avoid installation of outfalls at locations of known historical channel migration; · avoid positioning in flow convergence zones or where there is evidence of active bank erosion/instability;

Mitigation Item	Description
	· directing an outfall away from the banks of a river to minimise any potential risk of erosion (particularly on the opposite bank); · minimising the size/extent of the outfall headwall where possible to reduce the potential impact on the banks; and - post project appraisal to identify if there are issues that can be investigated and addressed at an early stage**.**
SMC-W15	In relation to watercourse crossings, specimen and detailed design will ensure compliance with good practice (SEPA, 2010b), which will include, but may not be limited to: · Detailed design will mitigate flood risk impacts through appropriate hydraulic design of culvert structures. Flood risk will be assessed against the 0.5%AEP (200-year) plus an allowance for climate change design flood event. Detailed design will mitigate any loss of existing floodplain storage volume, where required, by appropriate provision of compensatory storage. Where culvert extension is not practicable or presents adverse impact on the water environment, appropriately designed replacement culverts may be installed. · Detailed design will mitigate impacts on the water environment through appropriate design of culvert structures and watercourse modifications (e.g. realignments) with respect to fluvial geomorphology, and both riparian and aquatic ecology. · Detailed design of culverts and associated watercourse modifications will incorporate wherever practical: - adherence to design standards and good practice guidance (Table 11.1); - allowance for the appropriate conveyance of water and sediment for a range of flows (including at low flow conditions); - maintenance of the existing channel gradient to avoid erosion at the head (upstream) or tail (downstream) end of a culvert; - avoidance of reduction of watercourse length through shortening of watercourse planform; - minimisation of culvert length; - close alignment of the culvert with the existing water feature; - depressing the invert of culverts to allow for formation of a more natural bed (embedment of the culvert invert to a depth of at least 0.15m to 0.3m); and - roughening of culvert inverts to help reduce water velocities. - Post project appraisal of watercourse crossings will be undertaken to identify if there are issues that can be investigated and addressed at an early stage.
SMC-W16	In relation to channel realignments, specimen and detailed design will ensure compliance with good practice (Table 11.1), which will include, but may not be limited to: · minimising the length of the realignment, with the existing gradient maintained where possible; · design of the realignment in accordance with channel type and gradient; · if required, low flow channels or other design features to reduce the potential for siltation and provide an opportunity to improve the geomorphology of the water feature; · realignment designs will be led by a suitably qualified fluvial geomorphologist;

Mitigation Item	Description
	· where realignments result in an increase or decrease of channel gradient, the following principles will be applied: - an increased gradient within the channel (resulting in higher stream energies) will require mitigation in the form of energy dissipation, which could include the creation of a step-pool sequence; boulder bed-checks; plunge pools at culvert outlets; and/or; increased sinuosity; and - a decrease in gradient within the channel will require mitigation in the form of the construction of a low flow channel to minimise the impacts on locally varying flow conditions and reduce the risk of siltation of the channel. · Post project appraisal to identify if there are issues that can be investigated and addressed at an early stage.
SMC-W17	In relation to SuDS, the following mitigation measures will be implemented: · detailed design to adhere to design standards and good practice guidance (Table 11.1 of Chapter 11 Road Drainage and the Water Environment), including The SuDS Manual (CIRIA, 2015) and SuDS for Roads (SCOTS, 2010); · for each drainage run, a minimum of two levels of SuDS treatment within a 'treatment train' (see Table 11.18 for further details) to limit the volume of discharge and risk to water quality; · management of vegetation within ponds and drains through grass cutting, pruning of any marginal or aquatic vegetation (as appropriate to the SuDS component) and removal of any nuisance plants, especially trees; · SuDS retention ponds will be designed with an impermeable liner to maintain a body of standing water and provide treatment volume; · inspect inlets, outlets, banksides, structures and pipework for any blockage and/or structural damage and remediate where appropriate; and · regular inspection and removal of accumulated sediment, litter and debris from inlets, outlets, drains and ponds to avoid sub-optimal operation of SuDS; and · adherence to the maintenance plans specific to each SuDS component type as detailed within The SuDS Manual (CIRIA, 2015b).

Table 11.17: Project Specific Mitigation Commitments

Mitigation Item	Description
P12-W18	Prior to construction the Contractor shall produce a Surface Water Management Plan (SWMP) (or similar such document) that will be submitted to SEPA for approval as part of the CAR authorisation process for site discharges. This document will include details of temporary construction drainage and sediment control measures and will take into consideration the phasing of works, topography, land available for treatment of surface water and the location of surface water features. A preliminary assessment of construction SuDs requirements has been carried out, as discussed in Chapter 5: The Proposed Scheme, involving calculation of indicative sizes of settlement basins and identification of land that may be of use to the Contractor for the purposes of surface water and sediment control. These land areas lie within the Proposed Scheme construction area boundary (Figure 5.12).
P12-W19	To measure the effectiveness of implemented mitigation measures in protecting downstream water quality and aquatic ecological interests monitoring protocols prior to and during the construction phase will be developed within a site specific Water Quality Monitoring Plan, which will be

Mitigation Item	Description
	submitted to SEPA for approval prior to construction as part of the CAR authorisation process for site discharges. This would include, but would not be limited to: · Appointment of a suitably qualified Environmental Clerk of Works (EnvCoW), who will review the scheduling of earthworks, storage of materials, implementation of drainage and surface water treatment measures, and undertake monitoring of water quality, as detailed in standard **Mitigation Items SMC-W1, SMC-W3, SMC-W4, SMC-W6, SMC-W7, SMC-W8, SMC-W9 and SMC-W10**; EnvCoW will be provided with the authority to stop works and implement remedial action with immediate effect. · The location of sampling points, frequency and duration of monitoring, sampling parameters, thresholds and protocols for the notification of Stakeholders in the event of failures will be agreed with SEPA. · The monitoring programme will include baseline monitoring prior to construction, and monitoring post construction where deemed necessary. · Upstream control locations will be included, in addition to the main downstream monitoring locations. · Water quality monitoring locations will be co-located with proposed aquatic ecology monitoring locations where practicable.
P12-W20	To ensure the protection of surface water fed PWS a site specific Private Water Supply Protection Plan will be developed and submitted to SEPA for approval prior to construction. This will include, but will not be limited to: · Identification and mapping of all PWS sources and infrastructure that could be impacted by the proposed scheme. · Development of a PWS water quality monitoring programme preconstruction, during construction and post construction. · Development of a PWS contingency plan including provision of an emergency hotline telephone and arrangements for an alternative temporary water supply (tankers or similar). · Providing affected properties with an alternative supply prior to construction. Consideration of options will be undertaken in consultation with the land owner and may include the use of a mains water supply, for example.
P12-W21	In relation to culverts, as identified on Figure 11.1a-k, the Contractor will implement the following measures: · Natural bed substrate: for box culverts (i.e. with an artificial bed) a depressed invert set slightly below the existing bed level is require. This will allow space for natural bed substrates to be imported to form the bed level. For culverts less than 1.2 m diameter or height (internal height) the invert should be buried at least 15 cm below the natural bed level. For culverts 1.2 - 1.8 m diameter or height (internal height) the invert should be buried at least 20 cm below the natural bed level. For culverts greater than 1.8 m diameter or height (internal height) the invert should be buried at least 30 cm below the natural bed level. Baffles (precast or otherwise) may be required if there is a risk of the natural sediment flushing through at high flows. The culvert design should reflect the natural bed profile including bank to bank channel width, channel gradients and substrates where possible. Portal frames which do not possess an artificial bed do not require specific bed mitigation, but do still need an appropriate bed substrate; · Low flow channel: a low flow channel (sized appropriate to each watercourse) should be constructed within the culvert to maintain sufficient water depths and sediment transport through the culvert during normal flow conditions; · Fish passage: a 'buffer' zone will be created up and downstream of culverts to allow for the creation of habitats which will both enhance the watercourse, and incorporate features such as pools which will allow fish to rest before entering the culvert. The overall culvert design should

Mitigation Item	Description
	not in any way impede fish passage up and downstream, and the gradient should reflect the surrounding landscape, overly steep or shallow gradient should be avoided where possible; · Bank protection: although each culvert should be considered separately, it is likely that some bed and bank protection will be required upstream at transition between the watercourse and culvert. Hard (grey) bank and bed protection should be avoided where possible. Rip-rap and boulders (or 'greener' solutions where possible) and planted stone and coir rolls are preferable to gabions; · Transition: appropriate inlet and outlet structures should be provided to ensure smooth hydraulic transition and avoid erosion. Headwall arrangements at the upstream and downstream ends of a culvert should be suitably keyed into the bed and banks of the watercourse, should be the shortest length possible, and should be appropriate to the local environment; · Scour pool: scour pools at the outlet of the culvert should be constructed to dissipate energy and provide resting areas for fish. This is especially important for steeper culverts (>3%) and/or where stream powers are high; and · Outfalls: it is also important that the alignment of outfalls are designed to reduce scour around the structure and erosion of the adjacent river bed and banks. Discharge from the outfalls should be similar to the adjoining watercourse (see SEPA guidelines for more information).
P12-W22	In relation to river realignments/diversions (shown in Figure 11.1a-k) the Contractor will implement the following measures: · Bed gradient: maintaining the existing bed gradient will ensure the continuity of the existing sediment regime. Too low and excessive substrate may begin to deposit, blocking culvert entrances and/or reducing flood flow capacity, this also reduces sediment supply downstream. Too steep and excessive bank erosion and/or bed incision may begin to occur increasing sediment supply downstream (potentially depositing within culverts). Where the design of the road dictates a change to the bed gradient, mitigation will be necessary, which may include features such as step-pools, bed-checks and sediment traps; · Cross-section: the design of an appropriate low flow channel will also ensure the continuity of the existing sediment transport regime. A two-stage or multiple-stage cross-section can provide a wide range of benefits and preserve the existing low flow processes, allowing for natural adjustment and improve system resilience to low flow events. The multiple stage cross-section also encourages a range of habitats to form and accommodates flood flow capacity whilst ensuring a low flow channel is maintained; · Planform: the planform should reflect the existing channel where possible or restore historical planforms where the existing channel has been artificially modified; and · Boundary conditions: existing substrates should be collected, stored (without contamination) and reinstated. Where re-use of is not possible, substrates should be matched to local material. The suitability of substrates should be considered using empirical observations made by a qualified geomorphologist, as well sediment transport calculations (where deemed appropriate) and local sources. Other mitigation features such as woody material, gravel features (bars), vegetation and riffle-pools should be considered to further enhance and restore habitats and natural processes to the watercourse in appropriate locations. The design of any realignments, especially including features such as steps or bed checks will need to ensure they are suitable (i.e. passable) for any potential migratory fish species present. Consultation with freshwater aquatic ecologists is essential at the outset. The need for a realignment in all cases should be avoided (or minimised) where possible. Unnecessary modification to a river channel may initiate instability as the channel attempts to recover to a natural course.

Mitigation Item	Description
P12-W23	In relation to watercourse bank and bed protection the Contractor will ensure: · where bank protection is required (e.g. culvert inlets and outlets, tight meander bends or vulnerable areas), this should be formed of naturally occurring materials, stone and/or locally sourced hardwood wherever possible (rip-rap may be used at the toe of the bank). If the channel requires more engineered solutions it should be sympathetic to the local landscape and habitats, and used in combination with a planting scheme to improve the aesthetics and long-term stability of the banks. The role of vegetation for channel stability should also not be underestimated and consultation with the landscape architect should be undertaken at the earliest opportunity; and · where it is necessary to protect the bed from bed scour (incision) natural materials (boulders, ideally buried) should be used as opposed to smooth concrete to increase roughness, maintain flow diversity and reduce the risk of transferring the erosion downstream.
P12-W24	Where culverts are to be built online, early consideration is required of the design and implementation of temporary bypass channels. Temporary bypass channels should be constructed to maintain flow continuity and allow unimpeded fish migration through the watercourse. The design of any bypass diversion should also consider all the items listed above in **Mitigation Item P12-W22**, especially if intended to be in-situ for a long period of time. Other temporary works such as pipes or over-pumping should be used where a temporary bypass channel cannot be constructed.
P12-W25	In relation to the proposed Dalmagarry Burn realignment: The Contractor shall ensure that the standard mitigation measures specified in **Mitigation Items SMC-W13 to SMC-W17 and P12-W21 to P12-W23** are applied. Given the significance of the realignment further mitigation is required to minimise any potential impacts. These include: · appropriate bankside planting; · bank protection upstream and downstream of the new A9 bridge structure, especially on the left-hand bank immediately downstream of the bridge where the channel turns sharply; · installation of instream channel features to support the fish populations (i.e. undercut banks, woody debris etc.) and a wetland backwater utilising the downstream tie-in with the existing channel; · maximising connectivity with the adjacent floodplain to improve the natural functioning of the river system; · channel to possess a two-stage channel profile, with an appropriate low flow channel intended to connect with the second stage every year or two; · bed checks will be needed at appropriate locations (e.g. changes in bed gradient) to reduce the likelihood of incision occurring; and · boulders 300-600mm to be used to form bed features. The above will be agreed with SEPA via the CAR licencing process.
P12-W26	In relation to the proposed Allt na Frithe culvert and associated realignment: · appropriate bed checks and step-pool features along the realignment and bank protection around the entrance and exit to the culvert are to be installed;

Mitigation Item	Description
	· DMRB Stage 3 hydraulic modelling specifies the need for a cascade or similar feature to manage the flows entering the culvert. If confirmed at detail design, the currently proposed realignment should be extended upstream to reduce the impact of the gradient and potential impact on fisheries. The Proposed Scheme boundary has been extended upstream to allow for this; and · boulders approx. 200-300mm in diameter to be used to form bed features.
P12-W27	In relation to the proposed Allt Dubhag culvert and associated realignment: · DMRB Stage 3 hydraulic modelling specifies the need for a cascade or similar feature to manage the flows entering the culvert. If confirmed at detailed design, the currently proposed realignment should be extended upstream to reduce the impact of the gradient and potential impact on fisheries. The Proposed Scheme boundary has been extended upstream to allow for this likely increase in gradients heightens the need for appropriate step-pool/bed check features along the realignment and bank protection around the entrance and exit to the culvert; · Boulders approx. 100-200mm in diameter to be used to form bed features.
P12-W28	In relation to the proposed Caochan na h-Eaglais culverts and associated realignments: · boulders approximately 300-400mm in diameter to be used to form bed features. The steep gradients heightens the need for appropriate step-pool/bed check features along the realignment and bank protection around the entrance and exit to the culverts.
P12-W29	In relation to the proposed Allt na Loinne Moire culverts and associated realignment: · ensure appropriate bed checks and bank protection are installed; and · boulders approximately 200-300mm in diameter to be used to form bed features.
P12-W30	In relation to the proposed Allt na Slanaich culvert and associated realignment: · appropriate bed checks and step-pool features along the realignment and bank protection around the entrance and exit to the culvert are to be installed; · the currently proposed realignment should be extended upstream to reduce the impact of the gradient and potential impact on fisheries. The Proposed Scheme boundary has been extended upstream to allow for this; and · boulders approx. 300-600mm in diameter to be used to form bed features.
P12-W31	In relation to the proposed Allt Creag Bheithin culverts and associated realignments: · appropriate bed checks along the realignment and bank protection around the entrance and exit to the culvert are to be installed; and · boulders approx. 200-300mm in diameter to be used to form bed features.
P12-W32	To compensate for the loss of Pond 5 a new pond will be established immediately downhill of the existing pond. As per **Mitigation Item P12-E16** the new pond will be of a similar surface area to the original pond, but with sloping marginal shelves of gradient no greater than 1:8, ensuring the establishment of an extensive marginal wetland plant assemblage.

Mitigation Item	Description
	The new pond may be lined to ensure water retention, subject to ground and soil conditions. In the event pond lining is required, a natural bentonite clay product will be used to ensure the sustained hydrological viability of the replacement pond. Where possible, the new pond will be 'seeded' with translocated material from the existing pond (seed bank, sediment, and/or vegetation where practical) to encourage rapid establishment of similar successional characteristics as the pond being lost. The pond will otherwise be designed following good practice principles as described by SEPA Guidance on good practice in the management and creation of small waterbodies in Scotland The operational SuDS ponds are not to be considered as compensation for the loss of natural ponds. However they will be designed and planted to maximise their biodiversity.
P12-W33	At detailed design the embankment toe drainage will be modified to ensure the existing inflows and outflows to Pond 12 are maintained.
P12-W34	In relation to the Allt Creag Bheithin flood compensation storage areas: The Contractor will construct the storage areas and associated culverts as per the Proposed Scheme. The Contractor shall ensure that the standard mitigation measures specified in **Mitigation Items SMC-W1 to SMC-W4, SMC-W13 to SMC-W17 and P12-W21 to P12-W23** are applied. In addition, the Contractor shall: · Restore the storage areas in accordance with the landscape and ecological mitigation plans (given in Figures 13.8a-t of Chapter 13) · Adhere to the principles set out in the peat and soil management plan (Appendix A10.2).

11.6 Residual Effects

11.6.1 A summary of the residual effects associated with the Proposed Scheme is provided in Table 11.18 below. It should be noted that the impact significance stated in the table represents the residual impact, taking into account the mitigation discussed above. As such, there may be differences in the significance ratings listed compared with those discussed in Section 11.4, Potential Impacts.

11.6.2 As can be seen the vast majority of impacts have been assessed as having a residual effect of Neutral significance. Exceptions to this are:

- Construction pollution residual effects of **Slight** significance are predicted on most watercourses and two ponds due to the scale of the proposed works occurring directly on these receptors.
- Potential disruption to the private water supplies PWS Lynebeg and PWS Lynemore during the construction phase are expected to have a residual impact of **Slight**.
- Routine runoff discharges from Network 6A have been assessed as having residual effects of **Slight** significance on the biodiversity, water quality and dilution capacity attributes of the small drain Funtack Burn Tributary 6. The SuDS proposals embedded within the design will minimise the residual impact, as discussed in Section 11.4, however no further mitigation is practicable.
- Hydromorphological residual effects of **Slight** significance are expected on the Allt na Frithe, Dalmagarry Burn, Allt Loinne Moire, Allt na Slanaich and Allt Creag Bheitihin, due to the scale of the proposed watercourse crossing and realignment works required on each of these watercourses.
- Residual effects of **Slight** significance are predicted on Pond 12 (Tigh an Allt, North) and Pond 5 (Lynebeg, East). In the case of Pond 12 this is due to the alterations to the embankment toe drain which feeds the pond. The complete loss of Pond 5 will be mitigated by the provision of a replacement pond of similar size and characteristics.
- Residual effects of **Slight** significance are anticipated with respect to flood risk on the River Findhorn Tributary 2 due to the new watercourse crossing having greater hydraulic capacity than the existing structures.

Table 11.18: Summary of Residual Effects

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
River Findhorn (Garbole to Tomatin)	Allt Cosach Trib 1	Construction pollution	Water Quality	Low	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium - Very High	Negligible	Neutral
	Allt Cosach	Construction pollution	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Altchosach Hydrostation Abstraction	Construction pollution / loss of supply	Water Quality	Medium	Negligible	Neutral
			Water Quantity	High	Negligible	Neutral
		Operational pollution / loss of supply	Water Quality	Medium	Negligible	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
			Water Quantity	High	Negligible	Neutral
River Findhorn (Tomatin to Dorback Burn)	River Findhorn (Tomatin to Dorback Burn)	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Low	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Low	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Low	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	High	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Low – Very High	Negligible	Neutral
	River Findhorn Trib 1	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Tomatin Distillery Abstraction	Construction pollution / loss of supply	Water Quality	Medium	Negligible	Neutral
			Water Quantity	High	Negligible	Neutral
		Operational pollution / loss of supply	Water Quality	Medium	Negligible	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
			Water Quantity	High	Negligible	Neutral
	Allt na Frithe	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	High	Minor	Slight
		Increased flood risk	Hydrology & Flood Risk	Low – Very High	Negligible	Neutral
	River Findhorn Trib 1.1	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	River Findhorn Trib 2	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Allt Dubhag	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Minor	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	River Findhorn Trib 3	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
Funtack Burn	Funtack Burn Trib 1	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Pond 14 (Tigh an Allt, South)	Construction pollution	Biodiversity	Medium	Negligible	Neutral
		Loss of standing waters			Negligible	Neutral
	Pond 13 (Tigh an Allt, East)	Construction pollution	Biodiversity	Low	Negligible	Neutral
		Loss of standing waters			Negligible	Neutral
	Pond 12 (Tigh an Allt, North)	Construction pollution	Biodiversity	Medium	Minor	Slight
		Loss of standing waters			Minor	Slight
	Dalmagarry Burn Trib 1	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Dalmagarry Burn Trib 2	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Dalmagarry Burn Trib 3	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Dalmagarry Burn	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	High	Minor	Slight
		Increased flood risk	Hydrology & Flood Risk	Medium - Very High	Negligible - Minor	Neutral - Slight
	Dalmagarry Burn Trib 4	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Low	Negligible	Neutral
	Dalmagarry Burn Trib 5	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Low	Negligible	Neutral
	Funtack Burn	Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
	Funtack Burn Trib 2	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium - High	Negligible	Neutral
	Funtack Burn Trib 3	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium - High	Negligible	Neutral
	Funtack Burn Trib 4	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
	Funtack Burn Trib 5	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
	Funtack Burn Trib 6	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Pollution from routine runoff	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Minor	Slight*
			Biodiversity	Low	Minor	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
	Funtack Burn Trib 7	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
Loch Moy	Loch Moy	Construction pollution	Biodiversity	Very High	Negligible	Neutral
		Loss of standing waters			Negligible	Neutral
	Funtack Burn Trib 8	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
	Funtack Burn Trib 9	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
	Caochan na h-Eaglais	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Minor	Neutral
		Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
	Funtack Burn Trib 10	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Pond 5	Construction pollution	Biodiversity	Medium	Minor	Slight
		Loss of standing waters			Minor	Slight

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
	(Lynebeg, South)					
	PWS Lynebeg Pond (Pond 5)	Construction pollution / loss of supply	Water Quality	Medium	Minor	Slight
			Water Quantity	Medium	Minor	Slight
		Operational pollution / loss of supply	Water Quality	Medium	Minor	Slight
			Water Quantity	Medium	Minor	Slight
	Pond 4 (Lynebeg, North)	Construction pollution	Biodiversity	Medium	Negligible	Neutral
		Loss of standing waters			Negligible	Neutral
	Moy Burn Trib 1	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	High	Minor	Slight
	PWS Lynebeg	Construction pollution / loss of supply	Water Quality	High	Minor	Slight
			Water Quantity	High	Minor	Slight
		Operational pollution / loss of supply	Water Quality	High	Negligible	Neutral
			Water Quantity	High	Negligible	Neutral
	PWS Lynemore	Construction pollution / loss of supply	Water Quality	Medium	Minor	Slight
			Water Quantity	Medium	Minor	Slight
		Operational pollution / loss of supply	Water Quality	Medium	Negligible	Neutral
			Water Quantity	Medium	Negligible	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
Moy Burn	Allt na Loinne Moire	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Medium	Minor	Slight
		Increased flood risk	Hydrology & Flood Risk	High	Negligible	Neutral
	Moy Burn	Construction pollution	Water Quality	High	Negligible	Neutral
			Dilution Capacity	Medium	Negligible	Neutral
			Biodiversity	High	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	High	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium – Very High	Negligible	Neutral
	Moy Burn Trib 2	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Low	Negligible	Neutral
	Moy Burn Trib 3	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Low	Negligible	Neutral
	Allt Creag Bheithin Trib 1	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Low	Negligible	Neutral
	Allt Creag Bheithin Trib 2	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
			Biodiversity	Low	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Low	Negligible	Neutral
	Allt na Slanaich	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
		Alterations to the hydromorphological regime	Hydromorphology	Medium	Minor	Slight
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Allt Creag Bheithin	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Minor	Slight
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	High	Negligible	Neutral
			Biodiversity	Medium	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Medium	Minor	Slight
		Increased flood risk	Hydrology & Flood Risk	Low – Very High	Negligible	Neutral
		Construction pollution	Water Quality	Medium	Minor	Slight

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
	Allt Creag Bheithin Trib 3		Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Allt Creag Bheithin Trib 4	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Allt Creag Bheithin Trib 5	Construction pollution	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Midlairgs Burn	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral

WFD Catchment	Receptor	Potential Impact	Attribute	Sensitivity	Residual Magnitude	Residual Significance
	Midlairgs Burn Trib 1	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral
	Midlairgs Burn Trib 2	Construction pollution	Water Quality	Medium	Minor	Slight
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Minor	Neutral
		Pollution from routine runoff	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Pollution from accidental spillage	Water Quality	Medium	Negligible	Neutral
			Dilution Capacity	Very High	Negligible	Neutral
			Biodiversity	Low	Negligible	Neutral
		Alterations to the hydromorphological regime	Hydromorphology	Low	Negligible	Neutral
		Increased flood risk	Hydrology & Flood Risk	Medium	Negligible	Neutral

* Please refer to para 11.4.37 for explanation of derivation of significance rating.

11.7 References

[i] Scottish Natural Heritage (2015); SNHi – Information Service, SiteLink. Available at: http://gateway.snh.gov.uk/sitelink/index.jsp. (Accessed 4 December 2015).
[ii] The Highways Agency, Scottish Executive, Welsh Assembly Government and The Department Regional Development Northern Ireland (2009); Design Manual for Roads and Bridges, Volume 11, Section 3, Part 10 Road Drainage and the Water Environment HD45/09.
[iii] Transport Scotland (2013); A9 Dualling Programme Strategic Environmental Assessment (SEA).
[iv] Transport Scotland (2014); A9 Dualling Programme Strategic Flood Risk Assessment (SFRA).
[v] The Scottish Government (2014); Scottish Planning Policy (paragraphs 254 – 268).
[vi] The Highways Agency, Scottish Executive, Welsh Assembly Government and The Department Regional Development Northern Ireland (2009); Design Manual for Roads and Bridges, Volume 11, Section 4, Part 1 Assessment of Implications (of Highways and/or Road Projects) on European Sites (Including Appropriate Assessment) HD 44/09.
[vii] The Highways Agency, Scottish Executive, Welsh Assembly Government and The Department Regional Development Northern Ireland (2009). Design Manual for Roads and Bridges, Volume 4, Section 2, Part 3, Geotechnics and drainage. Drainage. Design of highway drainage systems HD 33/16.
[viii] The Highways Agency, Scottish Executive, Welsh Assembly Government and The Department Regional Development Northern Ireland (2004); Design Manual for Roads and Bridges, Volume 4, Section 2, Part 7 Design of Outfall and Culvert Details HA107/04.
[ix] Society of Chief Officers of Transportation for Scotland (SCOTS) (2009); SUDS for Roads guidance.
[x] The Highland Council (2013); Flood Risk & Drainage Impact Assessment: Supplementary Guidance.
[xi] Scottish Environment Protection Agency (SEPA) (2018); The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended), A Practical Guide, Version 8.2. February 2018. Scottish Environment Protection Agency.
[xii] SEPA (2010); Good Practice – River Crossings.
[xiii] SEPA (2008); Good Practice – Inlets and Outfalls.
[xiv] SEPA (2015); Position Statement – Culverts.
[xv] SEPA (2015); Technical Flood Risk Guidance for stakeholders.
[xvi] Flood Modelling Guidance for Responsible Authorities version 1.1
[xvii] SEPA (2013); Regulatory Method (WAT-RM-02) Regulation of Licence-level Engineering Activities.
[xviii] SEPA (2014); Regulatory Method (WAT-RM-08) Sustainable Urban Drainage systems (SUDS or SUD Systems).
[xix] CIRIA (2001) C532 - Control of water pollution from construction sites. Guidance for consultants and contractors.
[xx] CIRIA (2006) C648 – Control of water pollution from linear construction projects. Technical guidance.
[xxi] CIRIA (2006) C649 – Control of water pollution from linear construction sites. Site guide.
[xxii] Construction Industry Research and Information Association (CIRIA) (2010); C689 - Culvert design and operation guide.
[xxiii] CIRIA (2013); C720 - Culvert design and operation guide supplementary technical note on understanding blockage risks.
[xxiv] CIRIA (2015); C753 – The SuDS Manual.
[xxv] Scotland & Northern Ireland Forum for Environmental Research (SNIFFER) (2009); A functional wetland typology for Scotland: Field Survey Manual.
[xxvi] Scottish Government (2012); River Crossings and Migratory Fish: Design Guidance.
[xxvii] Environment Agency: The Fluvial Design Guide (http://evidence.environment-agency.gov.uk/FCERM/en/FluvialDesignGuide/Fluvial_Design_Guide_Overview.aspx)
[xxviii] Sear, D., Newson, M. & Thorne, C., (2003); Guidebook to Applied Fluvial Geomorphology. Department of Environment, Food and Rural Affairs.
[xxix] Environment Agency: Accounting for residual uncertainty: updating the freeboard guide (Report – SC120014)
[xxx] Ordnance Survey (OS) (2015); Raster mapping on 1:10k, 1:50k, 1:250k scale & Mastermap digital vector mapping.
[xxxi] National Library of Scotland historical mapping (2015); Available at: http://www.nls.uk/ (Accessed 4 December 2015).
[xxxii] Old Maps historical mapping (2015); Available at: https://www.old maps.co.uk/#/ (Accessed 4 December 2015).
[xxxiii] SEPA (2015); WFD Classification Results Webpage Available at: http://www.sepa.org.uk/environment/water/classification/classification-results/ (Accessed 21 March 2017).

[xxxiv] Moore RV, Morris DG and Flavin RW, 1994. Sub-set of UK digital 1:50,000 scale river centre-line network. NERC, Institute of Hydrology, Wallingford.
[xxxv] SEPA (2015); Flood Risk Management Maps. Available at: http://map.sepa.org.uk/floodmap/map.htm. (Accessed 4 December 2015).
[xxxvi] SEPA (2015); The National Flood Risk Assessment. Available at: http://www.sepa.org.uk/environment/water/flooding/flood-risk-management/national-flood-risk-assessment/. (Accessed 4 December 2015).
[xxxvii] Centre for Ecology and Hydrology (CEH) (2009); Flood Estimation Handbook (FEH) CD ROM (V3).
[xxxviii] Macaulay Institute for Soil Research (1982); Soil maps of Scotland (partial coverage) at a scale of 1:250,000.
[xxxix] Soil Survey of Scotland Staff (1970-1987); Soil maps of Scotland (partial coverage) at a scale of 1:25 000. Macaulay Institute for Soil Research, Aberdeen. Available at: http://www.soils-scotland.gov.uk/data/soil-survey25k (Accessed 4 December 2015).
[xl] Centre for Ecology and Hydrology (CEH) (2009); Flood Estimation Handbook (FEH) CD ROM (V3).
[xli] SEPA (2015) Technical Flood Risk Guidance for Stakeholders. Scottish Environment Protection Agency