

## **A13.1: Baseline Conditions (Road Drainage and the Water Environment)**

### **1 Introduction**

1.1 This appendix is set out as follows:

- Section 2: provides baseline information relating to those surface water features (SWFs) that are located within the study area and have remained scoped into the assessment. This information is grouped by SWF and includes: a brief description of the SWF; information relating to the hydrology and flood risk, fluvial geomorphology and water quality of the SWF; and a description of the proposed works within or near to the SWF.
- Section 3: sets out information relating to Nitrate Vulnerable Zones.
- Section 4: details the SEPA classifications for the Water Framework Directive (WFD) waterbodies that flow within the study area.
- Section 5: provides the annual 95 percentile river flow ( $Q_{95}$ ) for those SWFs that are proposed to receive a routine runoff discharge during operation, as used in the HAWRAT routine runoff assessment.
- Section 6: describes designated sites that can be found in the study area.
- Section 7: sets out the information on discharge consents provided by SEPA.
- Section 8: sets out the information on abstraction licences provided by SEPA.
- Section 9: summarises the importance of each attribute of a SWF and describes the indicators of quality that have been used to determine the importance.

### **2 Baseline Description and Evaluation – Surface Water Features**

#### **SWF 01: Inshes Burn**

##### *Brief Description of SWF*

2.1 The source of Inshes Burn appears to lie to the south of Balvonie Wood (outside of the study area, to the south). It enters the study area to the north of Raigmore Hospital and flows in a north-easterly direction through the study area before joining Scretan Burn (SWF 02) and flowing under the existing A96, across the railway and downstream into the Moray Firth (to the north-west of Inverness).

##### Hydrology and Flood Risk

2.2 Inshes Burn is identified by the medium Scottish Environment Protection Agency (SEPA) Flood Map to be at risk of river flooding during a 0.5% Annual Exceedance Probability (AEP) (200-year) event in its upper reaches in the Woodgrove Gardens and Dellness Park/Avenue/Road areas. This is, however, approximately 3km upstream of the existing A96 road crossing of the combined Inshes/Scretan Burn. In its lower reaches (in the immediate vicinity of the existing A96 road crossing) the Flood Map identifies only limited flood risk to surrounding properties / industry. There are no culverts in close proximity to the proposed Scheme which could pose a flood risk.

2.3 As the proposed Scheme is not anticipated to modify the hydraulics of this watercourse or its flood plain, no further quantification of the baseline flood risk has been undertaken.

##### Fluvial Geomorphology

2.4 From the source to Dell of Inshes, the watercourse flows along a natural, sinuous planform and is lined continuously with broadleaf trees. The channel is relatively small and has a coarse gravel bed with vegetated banks. Land use adjacent to this section is predominantly agricultural.

2.5 From Dell of Inshes to the sea, the watercourse flows along a relatively low gradient across

predominantly urban land use. The channel planform appears to have been realigned to run alongside roads in a number of places. In urban zones, the banks have been reprofiled creating a trapezoidal channel cross section and the channel appears to be disconnected from its flood plain. Banks are either vegetated or reinforced by stone or concrete walls and channel width is approximately 0.8 to 1m. Bed material is mainly gravel with some cobbles. The channel is choked with vegetation (Diagram 1).

#### Water Quality

- 2.6 SWF 01 receives flow from at least three direct tributaries. It has a relatively small catchment (in comparison to the River Nairn (SWF 23)) that comprises agricultural fields and part of Inverness (including residential, commercial and industrial areas). This SWF may also receive runoff from the major and minor road network and from the railway.
- 2.7 SWF 01 has a low dilution and dispersion capacity.

#### Description of Proposed Works

- 2.8 There are not expected to be any in-channel works associated with this SWF; such works are downstream of the confluence with SWF 02. In addition, this SWF would not receive any discharges of routine runoff from the proposed Scheme. However, this SWF would flow close to the most westerly extent of the proposed Scheme.



**Diagram 1: SWF 01 Choked with Vegetation at the Time of Survey (GR - NH 69186 45637 September 2013)**

#### **SWF 02: Scretan Burn**

##### Brief Description of SWF

- 2.9 The source of Scretan Burn appears to lie to the east of Milton of Leys (a suburb of Inverness) and the A9 (outside of the study area, to the south). This SWF enters the study area to the south of Inverness Retail and Business Park; it flows in a north-easterly direction through the study area, joining with SWF 01, before flowing under the existing A96, across the railway and into the Moray Firth (to the west of Smithton Junction).

##### Hydrology and Flood Risk

- 2.10 Scretan Burn does not feature on the SEPA Flood Map (medium risk) extent. This map identifies flood risk extents due to a 0.5% AEP (200 year) flood event. However the watercourse does flow in close proximity to numerous residential areas and the lower reaches of the watercourse may pose a flood risk to agricultural land, road and railways, and the retail park at Smithton.
- 2.11 Under baseline conditions, initial assessment by hand calculation of the culvert and channel

capacities of this water feature has indicated that under the design 0.5% AEP (200 year) plus climate change flood event:

- the Ashton Farm road culvert is free flowing at the design flow, with both headwater and tailwater levels contained within the watercourse banks;
- the existing channel in the vicinity of the proposed new alignment contains the design flow within the banks; and
- the existing A96 culvert is free flowing at the design flow, with both headwater and tailwater levels contained within the watercourse banks.

#### Fluvial Geomorphology

- 2.12 The majority of SWF 02 (Scretan Burn) within the study area flows through unmanaged rough grassland upstream of the existing A96 and deciduous woodland downstream of the existing A96. A complex vegetated riparian zone is present along the majority of both banks comprising grasses, shrubs and trees and measuring over 1.5m wide.
- 2.13 SWF 02 flows through a predominantly straight planform with a uniform cross-section upstream of the culvert to the east of Inverness Business and Retail Park. Downstream of this culvert the channel is relatively sinuous with a non-uniform cross-section. Large areas of erosion were present downstream of the existing A96 due to a natural increase in gradient. This could also be a result of reduced channel roughness caused by the significant reinforcement associated with the existing A96 culvert. Bank material within this section predominantly consisted of earth with steep, vertical or undercut bank profiles (Diagram 2).
- 2.14 Several sections of SWF 02 has artificial banks, mainly consisting of gabion baskets and concrete reinforcement (Diagram 3), some of which are being undermined, most noticeably downstream of the existing A96 culvert. The channel bed is predominantly armoured with cobbles and gravels in the upstream section while downstream sections (i.e. north of the existing A96) consists of varied substrate from boulders to silt. Several silty deposits are present downstream of the existing A96 culvert. The channel width ranges between 1 to 3m within the study area.
- 2.15 The dominant flow types are smooth and rippled flow throughout SWF 02, with some pools present in upstream sections. In sections where the channel is choked with vegetation, stagnant flow is also present.
- 2.16 Three culverts are present within the study area, including one under the existing A96 (Diagram 4) which includes a 4m high wing wall. Artificial concrete beds are present immediately downstream of the culvert under the existing A96 and a local access route (Diagram 5 and 6). Four weirs are also present within the study area (Diagram 7). These structures locally impact longitudinal and lateral connectivity within the channel.
- 2.17 Sections of SWF 02 upstream of the existing A96 crossing appear to be narrowing or laterally adjusting. Downstream of the existing A96 culvert, the watercourse appears to be incising and widening. SWF 02 appears to be a sink for sediment upstream of the existing A96 culvert; and an exchange of sediment downstream of the existing A96 culvert where several sections are locally eroding and depositing.

#### Water Quality

- 2.18 SWF 02 receives flow from at least five direct tributaries. It has a relatively small catchment (in comparison to the River Nairn) that comprises agricultural fields and part of Inverness (including residential and commercial areas). This SWF may also receive runoff from the major and minor road network and from the railway.
- 2.19 SWF 02 has a low dilution and dispersion capacity.

#### Description of Proposed Works

2.20 This SWF would need to be realigned to facilitate the proposed Scheme. In addition, three outfalls for discharging routine runoff from the proposed Scheme (Outfalls A, B and C) and one new culvert (C02) would be constructed within this SWF. The lengths of all proposed realignments and culvert extensions are provided in Chapter 13 (Road Drainage and the Water Environment), Section 13.5 (Impacts – Construction) Table 13.10 and Section 13.6 (Impacts – Operation) Table 13.13. In addition, the approximate impermeable road drainage area draining to each outfall is described in Chapter 13 (Road Drainage and the Water Environment), Section 13.6 (Impacts – Operation) Table 13.12.



**Diagram 2: Undercut Bank Downstream of the Existing A96 Culvert (GR - NH 69896 46056 October 2015)**



**Diagram 3: Gabion Basket Bank Reinforcement Upstream of the Existing A96 Culvert (GR - NH 69896 46056 October 2015)**



**Diagram 4: Looking Upstream at the Existing A96 Culvert and Wing Wall (GR - NH 69896 46056 October 2015)**



**Diagram 5: Reinforced Bed and Banks Downstream of the Culvert Under the Local Access Route to Ashton Farm (GR - NH 69889 46020 October 2015)**



**Diagram 6: Reinforced Bed and Banks Downstream of the Existing A96 Culvert (GR - NH 69896 46056 October 2015)**



**Diagram 7: Weir in Upstream Section of Study Area (GR - NH 69787 45851 October 2015)**

### **SWF 03: Cairnlaw Burn**

#### Brief Description of SWF

- 2.21 The source of Cairnlaw Burn appears to lie to the north-west of Muckovie Quarry (disused), south of Easter Muckovie (outside of the study area, to the south). This SWF enters the study area to the north of Ashton Farm; it flows in a north-easterly direction through the study area, under the existing A96, across the railway and into the Moray Firth, north of Cairnlaw.

#### Hydrology and Flood Risk

- 2.22 The SEPA Flood Maps identify numerous areas including properties, a minor road and the railway, which are at medium risk (0.5% AEP, 200 year) of flooding from the Cairnlaw Burn. A few properties have been identified as at risk in the Cradlehall area, a number of properties and the railway has been identified as at risk at Milton (downstream of the existing A96 crossing), and agricultural land along the burn and a minor road have been identified as at risk between these two areas. The proposed Scheme footprint of the A96 also enters the flood extent areas shown on the SEPA Flood Map. The watercourse (and associated tributaries) also flows in close proximity to numerous residential developments (including a school) in the upper reaches of the watercourse.
- 2.23 Baseline conditions for this water feature have been assessed using a numerical hydraulic model to ascertain the flow conditions and flood extents under the design 0.5% AEP (200-year) plus climate change flow. The model results indicate the existing A96 is at risk from the surcharging of the existing culverts and flood flows coming out of bank.

#### Fluvial Geomorphology

- 2.24 SWF 03 flows through a predominantly slightly sinuous planform within a straight riparian corridor with a uniform cross-section in the downstream section (Diagram 8) and a non-uniform cross-section in the upstream section. Banks mainly consist of earth material with a steep profile and the majority of substrate consists of gravels and silt (Diagram 9). Gravel bars are present throughout SWF 03, with several silt deposits also present within the downstream section. Eroding and undercutting banks are present throughout the course of the channel.
- 2.25 The surrounding land use mainly consists of arable farmland with some sections of broadleaf woodland and semi-improved grassland. A semi-continuous vegetated riparian zone is present on both banks in the downstream section (north of the existing A96) and a fragmented riparian buffer is present in the middle and upstream section. The majority of the SWF within the study area had a channel width of 0.5 to 0.8m.
- 2.26 The dominant flow type is pool-riffle, with some sections of rippled and smooth flow. Four culverts are present within the study area that passed under Barn Church Road, the existing A96 (Diagram 10), the railway and a small local road. SWF 03 appears to be predominantly overdeep with limited lateral connectivity.
- 2.27 Upstream of the existing A96 culvert, SWF 03 alternates between narrowing and laterally adjusting while downstream of the railway line culvert SWF 03 appears to be stable and is assessed to be a sink for sediment.

#### Water Quality

- 2.28 SWF 03 receives flow from at least eight direct tributaries. It has a medium sized catchment (in comparison to the River Nairn) that comprises agricultural fields and residential areas in the suburbs of Inverness. This SWF may also receive runoff from the major and minor road network, from the railway and from a small number of farmsteads.
- 2.29 SWF 03 has a low dilution and dispersion capacity.
- 2.30 Chapter 11 (Habitats and Biodiversity) identifies the presence of an internationally important fish species (European eel) within this SWF.

Description of Proposed Works

- 2.31 Two sections of this SWF would need to be realigned to facilitate the proposed Scheme. One of the realignments would join this SWF to its tributary (SWF 05), upstream of the point where the two watercourses currently meet. Two outfalls for discharging routine runoff from the proposed Scheme (Outfall D and E) and two culverts (C03 and C04) would be constructed within this SWF. Both outfalls and one of the culverts would be constructed downstream of the new confluence between SWF 03 and SWF 05. The other culvert would be constructed upstream of this confluence.



**Diagram 8: Straight Upstream Section (GR - NH 70613 46501 October 2015)**



**Diagram 9: Substrate Observed Upstream of the Existing A96 Culvert (GR - NH 70674 46641 October 2015)**



**Diagram 10: The Barn Church Road Culvert (GR - NH 70454 46155 October 2015)**

**SWF 04: Tributary of Cairnlaw Burn (1)**

Brief Description of SWF

- 2.32 The source of this SWF lies in the vicinity of Easter Bogbain, south-east of Upper Muckovie (outside of the study area). This SWF enters the study area to the west of Smithton. It flows in a northerly direction through the study area, before joining with SWF 03 (described previously) to the north-west of Stratton (also within the study area).

Hydrology and Flood Risk

- 2.33 SWF 04 does not appear on 0.5% AEP SEPA Flood Map (its catchment area is likely to be less than the 3km<sup>2</sup> threshold for the SEPA Flood extent maps). Within the study area, this water feature comes in close proximity to numerous properties including properties at Stratton, Smithton and Westhill as well as numerous individual dwellings. The watercourse also crosses the railway and a number of roads.
- 2.34 This watercourse has been incorporated in the hydraulic model representing SWF 03 to capture any effects of the Barn Church Road culvert extension (on SWF 03) propagating upstream along

SWF 04. The model indicates the design flow (0.5% AEP (200-year) plus climate change) remains within channel.

#### Fluvial Geomorphology

2.35 SWF 04 has undergone high impact realignment in the upper catchment upstream of Culloden Road where the planform is very straight, presumably to accommodate drainage for the agricultural and forestry land.

2.36 Downstream of Culloden Road, as the river flows through urban settlements of Westhill and Smithton, the planform of the channel is more natural and sinuous. There is also a substantial riparian zone throughout the urban settlements, consisting of a continuous broadleaf treeline. The river also flows through a number of culverts in the urban area. There are likely to be outfalls which contribute to sediment input. As the river leaves the urban land, channel planform becomes artificially straight as it flows over agricultural land once again into the Cairnlaw Burn (SWF 03) at Stratton. The downstream section of SWF 04 immediately upstream of its confluence with SWF 03 has a wide cross section (approximately 3m) and cobble and pebble substrate (Diagram 11).

#### Water Quality

2.37 SWF 04 receives flow from at least four direct tributaries. It has a relatively small catchment (in comparison to the River Nairn) that comprises agricultural fields and residential areas in the suburbs of Inverness. This SWF may also receive runoff from the minor road network and from the railway.

2.38 SWF 04 has a low dilution and dispersion capacity.

#### Description of Proposed Works

2.39 There are not expected to be any in-channel works associated with this SWF; such works are downstream of the confluence with SWF 03. In addition, this SWF would not receive any discharges of routine runoff from the proposed Scheme. However, this SWF would flow close to the most westerly extent of the proposed Scheme.



**Diagram 11: Cobbles and Pebbles Observed in Downstream Section (GR - NH 70448 46081 October 2015)**

### **SWF 05: Tributary of Cairnlaw Burn (2)**

#### Brief Description of SWF

2.40 This is a short SWF that flows in its entirety within the study area (in a north-westerly direction). The source of this tributary appears to lie to the north of Caulfield Road, Smithton, to the south of a former hotel. The tributary flows into Cairnlaw Burn to the south of Cairnlaw and the existing A96.

#### Hydrology and Flood Risk

- 2.41 SWF 05 does not feature on the SEPA Flood Map as its catchment area is less than 3km<sup>2</sup>.
- 2.42 As any flood risk impact on SWF 05 will be linked to the modifications carried out to SWF 03, this watercourse has been included in the hydraulic modelling of SWF 03. The model indicates the design flow (0.5% AEP (200-year) plus climate change) remains within channel.

#### Fluvial Geomorphology

- 2.43 SWF 05 (Tributary of Cairnlaw Burn (2)) is a small sinuous channel measuring approximately 0.8 to 1m wide and located within an area of woodland (Diagram 12). Flow type is predominantly smooth with some sections of rippled flow. Channel substrate consists of gravels however, at the time of survey leaf litter obscured sight of the channel bed in several locations. Water in the channel appears to sink before its confluence with SWF 03 and no distinct channel is visible within the downstream section (approximately 15m from SWF 03).

#### Water Quality

- 2.44 SWF 05 does not appear to receive flow from any tributaries. It has a very small sized catchment (in comparison to the River Nairn) comprising agricultural fields and the hotel.
- 2.45 SWF 05 has a low dilution and dispersion capacity.

#### Description of Proposed Works

- 2.46 This SWF would need to be realigned to facilitate the proposed Scheme. There would be some additional in-channel works downstream of the new confluence between SWF 03 and SWF 05 (refer to description for SWF 03).



**Diagram 12: SWF 05 Located Within Strip of  
Woodland (GR - NH 70831 46556 October 2015)**

### **SWF 06: Kenneth's Black Well**

#### Brief Description of SWF

- 2.47 Kenneth's Black Well appears to have its source to the south of Culloden Wood, north of the B9006 Millburn Roundabout – Culcabock – Castle Hill – Culloden Moor – Croy – Gollanfield – Fort George Road. Kenneth's Black Well flows in a north-westerly direction through the study area before forming a tributary of SWF 03 (described previously) close to its mouth, between the railway line (to the south) and Cairnlaw (to the north).

#### Hydrology and Flood Risk

- 2.48 The SEPA Flood Map medium flood extent (0.5% AEP, 200-year) outline shows there is a potential flood risk to properties within the Kenneth's Black Well catchment. A number of properties are located in the flood extent outline downstream of a school in Culloden as well as a number of

properties in Milton of Culloden Smallholdings and adjacent agricultural land. The railway line and the proposed Scheme are also located in areas identified at risk of flooding. The middle/upper reaches of the water feature and associated tributaries also flow in close proximity to residential areas, cross roads, the railway and flow at the edge of a school grounds in Culloden. The Flood Map indicates school grounds are at potential flood risk.

- 2.49 Due to the potential vulnerability of the residential properties, railway line and existing A96, this water feature is graded as very high sensitivity in terms of hydrology and flood risk (this grading will be reviewed as baseline assessment is refined).
- 2.50 As a consequence of the high sensitivity of the SWF 06 catchment to flood risk, this watercourse has been subject to numerical hydraulic modelling to examine its performance under baseline and post-development conditions. The results of the baseline modelling indicate the design 0.5% AEP (200-year) plus climate change flow comes out of bank upstream of the existing A96 at Burnside and flows across the existing A96 and the Aberdeen to Inverness railway line.

#### Fluvial Geomorphology

- 2.51 SWF 06 (Kenneth's Black Well) forms a road drain for the majority of its course within the study area. A semi-continuous vegetated riparian zone is present on both banks, approximately 1m wide.
- 2.52 The majority of the SWF has a straightened planform with a uniform cross-section measuring approximately 1m wide. Banks mainly consist of earth and have a resectioned profile. The dominant channel substrate is imbricated cobbles, gravel and silt (Diagram 13). Multiple depositional features are present including gravel side bars and riffles. Various flow types were observed on-site including a pool-riffle sequence, smooth flow and rippled flow.
- 2.53 Four culverts (Diagram 14 and 15) are present along the course of SWF 06 within the study area and reinforced concrete banks are present along the majority of the river along Caulfield Road and immediately upstream and downstream of the existing A96 culvert. A large concrete lined weir with a steep gradient (approximately 45°) is also present immediately upstream of the existing A96 culvert (Diagram 16). This impact reduced the lateral and longitudinal connectivity of the channel throughout the study area.

#### Water Quality

- 2.54 SWF 06 receives flow from at least three direct tributaries. It has a relatively small catchment (in comparison to the River Nairn) that comprises agricultural fields, an area of woodland (Culloden Wood) and residential areas in Culloden. This SWF may also receive runoff from the minor road network and the railway.
- 2.55 SWF 06 has a low dilution and dispersion capacity.

#### Description of Proposed Works

- 2.56 This SWF would need to be realigned to facilitate the proposed Scheme. In addition, one outfall for discharging routine runoff from the proposed Scheme (Outfall F) and five new culverts (C05, C26, C27, C29 and C30) would be constructed within this SWF.



**Diagram 13: Substrate Observed Upstream of the Existing A96 Culvert (GR - NH 70858 46828 October 2015)**



**Diagram 14: Twin Pipe Culvert Observed in Upstream Reach (GR - NH 71168 46865 October 2015)**



**Diagram 15: Twin Pipe Culvert and Bank Reinforcement in Upstream Reach (GR - NH 71168 46865 October 2015)**



**Diagram 16: Weir Upstream of the Existing A96 Culvert (GR - NH 70823 46835 October 2015)**

### **SWF 07: Drain at Allanfearn**

#### Description of SWF

- 2.57 This is a short drain that flows along one field boundary in a westerly direction from Allanfearn Farm (within the study area). The drain joins a second drain in the north-western corner of this field. At this point both drains sink underground. The second drain flows along the western boundary of the same field. The drain appears to resurface between the existing A96 and a sewage works, to the west of Allanfearn Farm. The drain is then culverted beneath the sewage works before entering the Moray Firth, immediately to the north.

#### Hydrology and Flood Risk

- 2.58 SWF 07 does not feature on the SEPA Flood Map extents as it has a catchment area less than the threshold of 3km<sup>2</sup>. The water feature may pose a flood risk to agricultural land, and a small number of dwellings (including Allanfearn Farm and Allanfearn Cottage) due to its close proximity to these properties/assets.
- 2.59 This watercourse has simple hydraulic characteristics and relatively localised catchment sensitivity to flood risk. Therefore, the baseline assessment has been undertaken using simple hand-calculations and a simple routing model to determine the flow conditions during the 0.5% AEP (200-year) plus climate change design event. The initial results for the design event, indicate that:
- the culvert (SWF07-B) on the eastern tributary, beneath the farmstead and minor road surcharges and flow goes out of bank; and
  - the culvert (SWF07-A) under the existing A96 surcharges and goes out of bank.

- 2.60 The existing culverts therefore potentially pose a flood risk to the existing A96 (SWF07-A) and a dwelling located in close proximity to the culvert (SWF07-B).

Fluvial Geomorphology

- 2.61 SWF 07 (Drain at Allanfearn) is a straight trapezoidal agricultural drainage ditch flowing through arable agricultural land (Diagram 17). The channel has partially vegetated, resectioned earth banks (Diagram 18) and a complex vegetated riparian zone is present on both banks. The southern channel was choked with terrestrial vegetation at the time of survey. Smooth and stagnant flow was observed with silty deposits present throughout its course.
- 2.62 At the downstream extent, a culvert with a 0.15m hydraulic jump is present impacting longitudinal connectivity. Lateral connectivity is impacted throughout by embankments and an overdeep channel.

Water Quality

- 2.63 There are no tributaries to either drain. The catchment of these drains is very small (in comparison to the River Nairn) comprising agricultural land and a farmstead.
- 2.64 SWF 07 has a low dilution and dispersion capacity.

Description of Proposed Works

- 2.65 Two sections of this SWF would need to be realigned to facilitate the proposed Scheme. In addition, a culvert (C06) would be constructed within this SWF.



**Diagram 17: Straight Uniform Planform  
Downstream of the Culvert (GR - NH 71660 47420  
October 2015)**



**Diagram 18: Vegetated Earth Banks Downstream of  
the Culvert (GR - NH 71587 47316 October 2015)**

**SWF 08: Fiddler's Burn**

Brief Description of SWF

- 2.66 Fiddler's Burn has its source from springs at Viewhill, near the School of Forestry, in Culloden Wood (outside of the study area, to the south). This SWF flows in a north-westerly direction through the study area before entering the Moray Firth to the north of Allanfearn.

Hydrology and Flood Risk

- 2.67 SWF 08 does not feature on the SEPA Flood Map extents as it has a catchment area less than the threshold 3km<sup>2</sup>. The burn passes through farmland in the vicinity and downstream of the proposed Scheme alignment. The watercourse may pose a flood risk to a number of residential properties in the upper/middle reaches of the catchment and to a school / school grounds in Balloch as the burn flows in close proximity to them. The burn also crosses over numerous roads and two railway lines

which may be at risk.

- 2.68 SWF 08 has relatively simple hydraulic characteristics and relatively localised catchment sensitivity to flood risk. Therefore, the baseline assessment has been undertaken using simple hand-calculations and a simple routing model to determine the flow conditions during the 0.5% AEP (200-year) plus climate change design event.
- 2.69 Initial results for the design event, indicate that:
- the existing farm access culvert is undersized to pass the design flow, resulting in headwater depths which overtop the channel banks; and
  - the existing culvert by which SWF 08 crosses the existing A96 surcharges leading to flow going out of bank and flooding of the roadside fields potentially posing a flood risk to the existing A96.

#### Fluvial Geomorphology

- 2.70 SWF 08 (Fiddlers Burn) has a straight planform through arable farmland and semi-improved grassland. A complex vegetated riparian zone is present in upstream areas, decreasing in width and complexity with increasing distance downstream. The channel has a uniform cross-section and resectioned earth banks throughout its course. Substrate mainly consisted of silt with some coarse gravels and pebbles. Rippled flow was the dominant flow type at the time of survey.
- 2.71 Lateral and longitudinal connectivity is impacted throughout the course of the SWF 08 due to embankments, an overdeep channel and a culvert under the existing A96. The channel is choked with vegetation throughout the study area (Diagram 19). SWF 08 is assessed to be a sink for sediment, narrowing in some areas and stable in others.

#### Water Quality

- 2.72 SWF 08 receives flow from at least three minor tributaries. It has a relatively small catchment (in comparison to the River Nairn) that comprises agricultural fields, areas of woodland (Culloden Wood) and residential areas in Balloch. SWF 08 may also receive runoff from the major and minor road network and from the railway.
- 2.73 SWF 08 has a low dilution and dispersion capacity.

#### Description of Proposed Works

- 2.74 This SWF would need to be realigned to facilitate the proposed Scheme. In addition, an outfall for discharging routine runoff from the proposed Scheme (Outfall G) and a culvert (C07) would be constructed within this SWF.



**Diagram 19: Choked Channel upstream of the Existing A96 Culvert (GR - NH 72891 47724 October 2015)**

## **SWF 09: Tributary of Rough Burn**

### Brief Description of SWF

- 2.75 The source of this tributary appears to be immediately to the north of the railway line, to the east of Balloch. This SWF flows in both a northerly and north-easterly direction through the study area before forming a tributary of Rough Burn (SWF 12, described later) close to the point where Rough Burn flows into the Moray Firth, west of Scottack Farmhouse.

### Hydrology and Flood Risk

- 2.76 The SEPA Flood Map medium (0.5% AEP event) flood extent outline shows a residential property, and grounds at Balmachree and Lonnie, plus agricultural lands around the SWF from south of High Wood to the Rough Burn confluence are within the flood extent outlines and therefore at potential flood risk. A number of roads, the railway line and the proposed Scheme are also in the flood extent outline for this SWF. A small number of properties are also in relatively close proximity to the SWF.
- 2.77 The hydraulic characteristics of this watercourse are relatively straightforward, and the flood risk sensitivity is relatively localised around the proposed Scheme, hence flood risk assessment has been carried out using hand calculations which consider the hydraulic performance of culverts and channel sections at key locations in the vicinity of the proposed Scheme.
- 2.78 For the baseline conditions and the 0.5% AEP (200-year) plus climate change design flow, initial results indicate that:
- the culvert (SWF09-A) carrying flow across the existing A96 is surcharged and flow has been assessed as going out of bank;
  - the culvert (SWF09-B) upstream of the proposed Scheme has also been assessed as surcharging and going out of bank; and
  - at the location of the proposed new alignment culvert, baseline conditions indicate the open channel is adequate.

### Fluvial Geomorphology

- 2.79 SWF 09 (Tributary of Rough Burn) flows through arable agricultural land, along a straight channel planform with a uniform cross-section (Diagram 20). The channel has a vegetated riparian zone on both banks throughout its course within the study area.
- 2.80 Earth banks are overgrown and the channel is choked with vegetation throughout. The channel substrate is varied and consists of silt, sand, gravels and cobbles. There is no evidence of erosion or depositional features within the study area.
- 2.81 Longitudinal connectivity is impacted by four culverts along the course of SWF 09 within the study area (Diagram 21). An outfall is present immediately downstream of the confluence with SWF 11, indicating a potential source of fine sediment. Lateral connectivity with the flood plain is limited due to an overdeep channel and an embankment on both banks throughout its course. SWF 09 is assessed as being a stable watercourse acting as a sink for sediment.

### Water Quality

- 2.82 SWF 09 receives flow from at least four direct tributaries. It has a relatively small catchment (in comparison to the River Nairn) that comprises agricultural fields and an area of woodland (High Wood). This SWF may also receive runoff from the major and minor road network and from the railway.
- 2.83 SWF 09 has a low dilution and dispersion capacity.

Description of Proposed Works

- 2.84 Two outfalls for discharging routine runoff from the proposed Scheme (Outfall H and I) and a culvert (C08) would need to be constructed within this SWF.



**Diagram 20: Straightened Uniform Upstream Reach (GR - NH 74103 48630 October 2015)**



**Diagram 21: Culvert Under the Existing A96 (NH 74066 48692 October 2015)**

**SWF 10: Indirect Tributary of Rough Burn (1)**

Brief Description of SWF

- 2.85 This SWF forms a tributary of SWF 09 within the study area, to the north-east of Balloch and to the south of the existing A96; therefore, it is also an indirect tributary of SWF 12 (described later). This is a short SWF that has its source in High Wood, to the east of Balloch (outside of the study area). It flows in a northerly direction through the study area and does not receive flow from any tributaries. It has a very small sized catchment (in comparison to the River Nairn) that comprises agricultural fields and an area of woodland (High Wood).

Hydrology and Flood Risk

- 2.86 SWF 10 does not feature in the flood extent of a 0.5% AEP event on the SEPA Flood Maps due to its small catchment size. The watercourse flows through agricultural land and woodland before its confluence with SWF 12, no properties/industry are located in the vicinity of the watercourse.
- 2.87 As there is no direct impact from the proposed Scheme on this watercourse, assessment is limited to consideration of upstream propagation of water levels due to modifications to SWF 09 downstream of the confluence.

Description of Proposed Works

- 2.88 There are not expected to be any in-channel works associated with this SWF. In addition, this SWF would not receive any discharges of routine runoff from the proposed Scheme.
- 2.89 This SWF has been scoped out of the water quality and geomorphology assessment for both construction and operational impacts because it flows approximately 120m to the south of the proposed Scheme (at its closest point) and the relief of the land rises between the proposed Scheme and this SWF.

**SWF 11: Indirect Tributary of Rough Burn (2)**

Brief Description of SWF

- 2.90 This SWF forms a tributary of SWF 09 within the study area, to the south of Newton of Petty and

the existing A96 and to the east of SWF 10. It is also an indirect tributary of SWF 12. This is a short SWF that has its source in an area of woodland to the east of Balloch, and to the north-east of SWF 09. It flows in a northerly direction through the study area.

#### Hydrology and Flood Risk

- 2.91 SWF11 does not feature in the flood extent of a 0.5% AEP event on the SEPA Flood Maps. The watercourse flows through agricultural land and woodland before its confluence with SWF12. No properties / industry are located in the vicinity of the watercourse.
- 2.92 SWF 11 has relatively simple hydraulic characteristics and relatively localised catchment sensitivity to flood risk. Therefore, the baseline assessment has been undertaken using simple hand-calculations and a simple routing model to determine the flow conditions during the 0.5% AEP (200-year) plus climate change design event.
- 2.93 The results indicate that the culvert (SWF11-A) carrying flow across a track upstream of the proposed Scheme is surcharged and has been assessed as going out of bank.

#### Fluvial Geomorphology

- 2.94 SWF 11 (Indirect Tributary of Rough Burn (2)) flows through arable agricultural land, along a straight channel planform with a uniform cross-section. The channel has a vegetated riparian zone on both banks throughout its course within the study area.
- 2.95 Earth banks are overgrown and the channel was choked with vegetation throughout. The channel substrate is varied and consisted of silt, sand, gravels and cobbles. There is no evidence of erosion or depositional features within the study area. Longitudinal connectivity is impacted by one culvert and lateral connectivity with the flood plain is limited due to an overdeep channel and embankments on both banks. SWF 11 is assessed as being stable and acting as a sediment sink.

#### Water Quality

- 2.96 SWF 11 does not receive flow from any tributaries. It has a very small sized catchment (in comparison to the River Nairn) that comprises agricultural fields and an area of woodland.
- 2.97 SWF 11 has a low dilution and dispersion capacity.

#### Brief Description of Proposed Works

- 2.98 There are not expected to be any in-channel works associated with this SWF. In addition, this SWF would not receive any discharges of routine runoff from the proposed Scheme. However, this SWF would flow close to the proposed Scheme.

### **SWF 12: Rough Burn**

#### Brief Description of SWF

- 2.99 Rough Burn appears to have its source near Feabuie Croft, between Feabuie (to the east) and Culloden Wood (outside of the study area, to the south). This SWF flows in a northerly direction through the study area. It receives flow from at least 12 direct tributaries before flowing into the Moray Firth, to the west of Castle Stuart (outside of the study area, to the north).

#### Hydrology and Flood Risk

- 2.100 Rough Burn is identified on SEPA Flood Maps (0.5% AEP flood extent outline) as posing potential flood risk between a point just north (downstream) of the existing A96 to the Moray Firth. The water feature poses potential flood risk to a property near Castle Stuart, the railway line, adjacent agricultural land and a number of minor roads. Anecdotal evidence from local stakeholders has suggested this water feature has damaged the railway line at times of high flows supporting the SEPA flood extent outline. Outside the SEPA flood extent mapping there is also potential flood risk

to a number of properties and a factory which are located in close proximity to the water feature (this includes properties in the upper catchment and properties and a factory downstream of the proposed Scheme).

- 2.101 Due to the potential vulnerability of the existing A96, this water feature is graded as very high sensitivity in terms of hydrology and flood risk. This grading will be reviewed as baseline assessment is refined.
- 2.102 This watercourse has been assessed using numerical modelling to represent the complex channel hydraulics. Baseline results indicate the design 0.5% AEP (200-year) plus climate change flow comes out bank upstream of the proposed Scheme and flow across agricultural land before flowing in the direction of SWF 11.

#### Fluvial Geomorphology

- 2.103 SWF 12 (Rough Burn) flows through arable agricultural land, broadleaf woodland and along the boundary of Morayston Farm (aggregate industry). A complex vegetated riparian zone is present on the majority of both banks; however, no riparian buffer is present in the section immediately upstream of the existing A96 culvert.
- 2.104 The SWF typically has a sinuous channel planform with a non-uniform cross-section. The majority of the burn within the study area has steep or vertical banks composed of earth or bedrock (Diagram 22, 23 and 24). Banks get gradually shallower with increasing distance upstream of Morayston Farm. Substrate varies throughout the course of the channel and comprised bedrock, boulders, silt, gravels and cobbles (Diagram 25). Various flow types are present, including step-pool sequences, pool-riffle sequences, rippled, smooth and natural free-fall flow. Free-fall flow is also present over a weir downstream of Morayston Farm (Diagram 26). Berms, riffles, side bars and mid-channel bars are present throughout this SWF. Some sections of scour and undercutting are present, particularly at locations where banks comprise of earth or cobble material.
- 2.105 Lateral connectivity is impacted by a gorge-like channel upstream of Morayston Farm and two bridges including one under the existing A96 which also has a reinforced artificial concrete bed (Diagram 27). Longitudinal connectivity is impacted within the study area by a culvert, two weirs and a debris dam.
- 2.106 SWF 12 is assessed as laterally adjusting with evidence of channel narrowing.

#### Water Quality

- 2.107 SWF 12 has a medium sized catchment (in comparison to the River Nairn) that comprises agricultural fields and an area of woodland. This SWF may also receive runoff from the major and minor road network, from the railway and from a farmstead.
- 2.108 SWF 12 has a low dilution and dispersion capacity.

#### Brief Description of Proposed Works

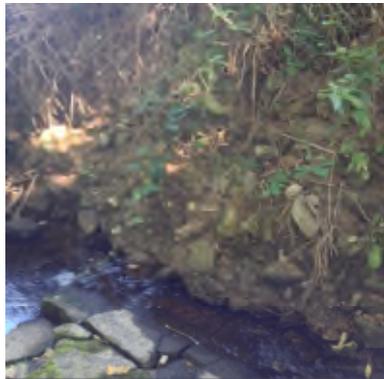
- 2.109 This SWF would need to be realigned to facilitate the proposed Scheme. In addition, a culvert (C09) would be constructed within this SWF. This SWF would not receive any discharges of routine runoff from the proposed Scheme.



**Diagram 22: Resistant Banks Immediately Upstream of Morayston Farm GR - NH 75192 48904 October 2015)**



**Diagram 23: Vegetated Banks in Upstream Section (GR - NH 75329 48504 October 2015)**



**Diagram 24: Resistant Banks in Close Proximity of Morayston Farm (GR - NH 75220 48988 October 2015)**



**Diagram 25: Cobbles Upstream of the Existing A96 Road Bridge (GR - NH 75186 49148 October 2015)**



**Diagram 26: 2m Weir Upstream of the Morayston Farm (GR - NH 75236 49100 October 2015)**



**Diagram 27: The Artificial Bed Under the Existing A96 Road Bridge (GR - NH 75134 49201 October 2015)**

### **SWF 13: Tributary of 'Unnamed Burn – Castle Stuart to Source (Tornagrain)' (1)**

#### Brief Description of SWF

2.110

This tributary appears to have its source to the north of High Wood and to the south-west of Kerrowaird (within the study area). This SWF flows in a northerly direction through the study area before flowing into SW14 (described later), to the north of the railway line and to the east of Tornagrain Wood (also within the study area).

Hydrology and Flood Risk

- 2.111 SWF 13 is shown in the SEPA Flood Map flood extent outline (0.5% AEP event) at its confluence with the Unnamed Burn (SWF 14). Given the flood risk is largely associated downstream of the confluence with SWF 14 flood risk, downstream of the confluence will be discussed separately (in SWF 14). There is also a property at Kerrowaird which is located within 40m of this tributary which could potentially be at risk of flooding. The tributary also passes under the existing A96 and runs in close proximity to the minor road to Kerrowaird.
- 2.112 The relatively localised flood risk and straightforward hydraulics of this watercourse have allowed it to be assessed by simple hand calculations which consider the hydraulic performance of culverts and channel sections at key locations in the vicinity of the proposed Scheme. Simple hydraulic routing has also been carried out for the culvert underneath the existing A96 (SWF13-2).
- 2.113 Assessment of the baseline conditions under the 0.5% AEP (200-year) plus climate change design flow indicates the following:
- the existing culvert beneath the existing A96 surcharges and results in a headwater level which is out of bank. This indicates the existing A96 may be at flood risk;
  - the existing railway culvert (SWF13-A) also surcharges under the design flow, but flow is predicted to remain within the bank height; and
  - the assessment of the existing open channel section at the location of the proposed new alignment crossing indicates that the channel is adequately sized to convey the design flow.

Fluvial Geomorphology

- 2.114 SWF 13 (Tributary of 'Unnamed Burn – Castle Stuart to source (Tornagrain)' (1)) mainly flows through broadleaf woodland and semi-improved grassland. A continuous vegetated riparian zone is present along both banks downstream of the existing A96 measuring approximately 2m wide.
- 2.115 SWF 13 has a straight channel planform with a uniform cross-section section and a channel width of approximately 0.7m. Banks are predominantly resectioned and are composed of earth. The majority of flow was not visible at the time of survey due to dense vegetation (Diagram 28), however some sections of rippled flow were observed. Lateral connectivity is impacted by embankments and an overdeep channel and longitudinal connectivity is impacted by a culvert under the existing A96. This SWF is assessed as being stable and a sink for sediment.

Water Quality

- 2.116 SWF 13 does not have any tributaries. It has a very small sized catchment (in comparison to the River Nairn) that comprises agricultural fields and an area of woodland. This SWF may also receive runoff from the existing A96 and the railway.
- 2.117 SWF 13 has a low dilution and dispersion capacity.

Brief Description of Proposed Works

- 2.118 Two outfalls for discharging routine runoff from the proposed Scheme (Outfall J and K) and a culvert (C10) would need to be constructed within this SWF.



**Diagram 28: Choked Channel Downstream of the Existing A96 Culvert (GR - NH 76044 49753 October 2015)**

#### **SWF 14: Unnamed Burn – Castle Stuart to Source (Tornagrain)**

##### Brief Description of SWF

- 2.119 This SWF is classed by SEPA as a small water body, referred to as 'Unnamed Burn – Castle Stuart to source (Tornagrain)'. It appears to have its source to the south of Easter Feabuie (outside of the study area, to the south), between High Wood (to the north) and Culloden Forest (to the south). This SWF flows in a north-westerly direction through the study area. The un-named burn forms a tributary of Rough Burn to the east of Scottack Farmhouse (outside of the study area, to the north).

##### Hydrology and Flood Risk

- 2.120 SWF 14 is identified in the SEPA Flood Map flood extent outline (for a 0.5% AEP, 200-year event) as posing a potential flood risk to land adjacent to the watercourse from just upstream of the railway to its confluence with Rough Burn (SWF 12). The area downstream of the railway comprises of predominantly flat farmland, with isolated properties identified within the flood risk zoning. Minor roads and the railway are also identified within the SEPA flood extent outline. There is anecdotal evidence from local stakeholders of flooding occurring around the SWF 14 - SWF 15 confluence and affecting the local farmland and woodland. This water feature also flows in close proximity to a property near Easter Feabuie (upper reaches of the catchment) and properties in the Tornagrain and Drumvoulin areas.
- 2.121 The hydraulic characteristics of this watercourse are relatively straightforward, and the flood risk sensitivity is relatively localised in the vicinity of the proposed Scheme, hence flood risk assessment has been carried out using hand calculations which consider the hydraulic performance of culverts and channel sections at key locations in the vicinity of the proposed Scheme.
- 2.122 For the baseline conditions and the 0.5% AEP (200-year) plus climate change design flow, initial results indicate that:
- the existing culvert crossing the existing A96 is simulated to be free flowing and remains in-bank during the design event simulation; and
  - water level in the existing open channel at the crossing point of the proposed new alignment breaches the banks and flood the local farmland when subject to the design flow.

##### Fluvial Geomorphology

- 2.123 SWF 14 (Unnamed Burn – Castle Stuart to source (Tornagrain) (2)) follows a straight platform through arable farmland and broadleaf woodland. A continuous vegetated riparian zone is present on both banks, measuring approximately 2m wide (Diagram 29). The SWF is overgrown and choked with terrestrial vegetation.
- 2.124 The channel cross-section is uniform and banks are earth and steep in profile. Silt is the dominant substrate; however, some gravel bars are also present. Rippled and stagnant flow types are dominant within the channel; however, during the time of survey, some sections had no flow present. Lateral connectivity is limited due to embankments and an overdeep channel. Longitudinal connectivity is also impacted by a culvert under the existing A96. SWF 14 is assessed as being stable and a sink for sediment.

#### Water Quality

- 2.125 SWF 14 receives flow from at least ten tributaries. It has a relatively small catchment (in comparison to the River Nairn) that comprises agricultural fields and an area of woodland. This SWF may also receive runoff from Tornagrain (a hamlet), the major and minor road network (including the existing A96) and the railway.
- 2.126 SWF 14 has a low dilution and dispersion capacity.

#### Brief Description of Proposed Works

- 2.127 A culvert (C11) would need to be constructed within this SWF. This SWF would not receive any discharges of routine runoff from the proposed Scheme.



**Diagram 29: Riparian Buffer Observed Upstream  
from the Confluence with SWF 15 (GR - NH 76289  
50208 October 2015)**

### **SWF 15: Tributary of 'Unnamed Burn – Castle Stuart to Source (Tornagrain)' (2)**

#### Brief Description of SWF

- 2.128 This is a very short SWF that has its source within the study area, to the north of Tornagrain, within Tornagrain Wood. It flows in a westerly direction along one field boundary before joining with SWF 14 (also within the study area).

#### Hydrology and Flood Risk

- 2.129 SWF 15 does not appear on the SEPA Flood Map in the flood extent outline for the 0.5% AEP (200-year) flood event. There is, however, anecdotal evidence from local stakeholders of flooding occurring around the SWF 14 - SWF 15 confluence and affecting local agricultural land and woodland. The watercourse crosses the existing A96 and a minor road.
- 2.130 The hydraulic characteristics of this watercourse are relatively straightforward and the flood risk sensitivity is relatively localised, hence flood risk assessment has been carried out using hand

calculations which consider the hydraulic performance of culverts and channel sections at key locations in the vicinity of the proposed Scheme.

2.131 For the baseline conditions and the 0.5% AEP (200-year) plus climate change design flow, initial results indicate that:

- the culvert crossing the existing A96 remains in bank during the design simulation;
- the existing culvert under the railway line does not surcharge and remains in-bank;
- a minor footpath culvert within the wood is simulated to be surcharged and flow has been simulated to go out of bank; and
- baseline assessment of the existing open channel capacity at the proposed Scheme crossing point indicates adequate capacity to pass the design flow without overtopping the banks.

#### Fluvial Geomorphology

2.132 SWF 15 (Tributary of 'Unnamed Burn – Castle Stuart to Source (Tornagrain)' (2)) flows through arable farmland and broadleaf woodland. A continuous vegetated riparian zone was recorded on both banks and measured approximately 2m in width. The channel is overgrown and choked with terrestrial vegetation.

2.133 SWF 15 follows a straight planform with a uniform cross-section and channel width measuring approximately 1m (Diagram 30). Banks are earth with resectioned profiles. Substrate mainly consists of silt, with some sections of gravel. Rippled flow is the dominant flow type throughout this SWF; however, several sections of stagnant flow are also present.

2.134 Longitudinal connectivity is impacted by a culvert under the existing A96 and lateral connectivity is limited due to embankments on both banks and an overdeep channel. SWF 15 is assessed as being stable and a sink for sediment.

#### Water Quality

2.135 SWF 15 has no tributaries. It has a very small sized catchment (in comparison to the River Nairn) comprising one agricultural field. It may also receive runoff from the existing A96.

2.136 SWF 15 has a low dilution and dispersion capacity.

#### Brief Description of Proposed Works

2.137 A culvert (C12) would need to be constructed within this SWF.



**Diagram 30: Straight Uniform Upstream Reach with Resectioned Banks and Overdeepened Channel (GR - NH 76421 50247 October 2015)**

## **SWF 16: Tributary of Ardersier Burn**

### Brief Description of SWF

- 2.138 This tributary appears to have its source to the west of Dalcross Castle, between High Wood and Culloden Forest (outside the study area, to the south). It flows first in a north-easterly direction and then in a north-westerly direction through the study area. It receives flow from approximately 15 SWFs, including SWF 18 and SWF 19 (described later). This SWF flows through Inverness Airport, to the north of the study area. It enters the Moray Firth to the south of Ardersier (a village), outside of the study area (to the north).

### Hydrology and Flood Risk

- 2.139 SWF 16 features on the SEPA Flood Map in the flood extent outline for the 0.5% AEP (200-year) flood event. The water feature is shown to be at risk of flooding from Mid Coul to its confluence with the Ardersier Burn. The flood map shows significant areas of flood risk to the south-west of Inverness Airport runway, within the airport grounds and between the north-east end of the airport runway and the confluence with the Ardersier Burn.
- 2.140 Due to complex hydraulics and the sensitivity of the watercourse to flood risk, this water feature has been numerically modelled to assess both baseline flood risk and any impact from the proposed Scheme. The baseline modelling indicates the 0.5% AEP (200-year) plus climate change flow would come out of bank upstream of the proposed Scheme and flood water would flow across agricultural land to the Aberdeen to Inverness railway and the airport.

### Fluvial Geomorphology

- 2.141 SWF 16 (Tributary of Ardersier Burn) flows through arable farmland, broadleaf woodland and semi-improved grassland. A continuous vegetated riparian zone is present in upstream sections. The SWF is overgrown with terrestrial vegetation.
- 2.142 SWF 16 has a straight channel planform with a uniform cross-section and resectioned earth banks (Diagram 31 and 32). Substrates include fine and coarse gravels, pebbles and cobbles (Diagram 33). Rippled flow is the dominant flow type throughout this SWF; however, several sections of stagnant water and dry channel are also present.
- 2.143 Lateral connectivity is impacted due to embankments and an overdeep channel and longitudinal connectivity is impacted by a single culvert under a single carriage access road to Inverness Airport.
- 2.144 Evidence of channel narrowing was recorded upstream of the culvert at the time of survey; in contrast the downstream channel which appeared to be stable and possibly aggrading. This SWF is assessed as acting as a sediment sink.

### Water Quality

- 2.145 SWF 16 has a medium sized catchment (in comparison to the River Nairn) that comprises agricultural fields, areas of woodland and part of Inverness Airport. It may also receive runoff from some very small settlements (including Mid Coul), the major and minor road network (including the existing A96) and the railway.
- 2.146 SWF 16 has a low dilution and dispersion capacity.

### Brief Description of Proposed Works

- 2.147 This SWF would need to be realigned to facilitate the proposed Scheme. Three outfalls for discharging routine runoff from the proposed Scheme (Outfall L, V and M) and two new culverts (C13 and C14) would need to be constructed within this SWF. In addition, one existing culvert

would need to be modified.



**Diagram 31: Straight Channel Downstream of the Culvert (GR - NH 76929 50781 October 2015)**



**Diagram 32: Straight Silty Channel in Downstream Section (GR - NH 76929 50781 October 2015)**



**Diagram 33: Substrate Observed Downstream of the Culvert (GR - NH 77234 50921 October 2015)**

### **SWF 17: Drains at Culblair**

#### Brief Description of SWF

- 2.148 This is a very short SWF that appears to have its source between the Mid Coul Cottages and Culblair, to the north of the existing A96, within the study area. This SWF flows into a second pond at Culblair Farm (also within the study area). The SWF then appears to be culverted before flowing between the railway line and Inverness Airport for approximately 580m.

#### Hydrology and Flood Risk

- 2.149 SWF 17 does not feature on the SEPA Flood Map data on account of its small catchment area. Anecdotal evidence suggests the land to the north of Culblair alongside the railway is prone to flooding, and this may be associated with SWF 17.
- 2.150 The hydraulic characteristics of this watercourse are relatively straightforward and the flood risk sensitivity is relatively localised, hence flood risk assessment has been carried out using hand calculations. A simple routing model has also been used to assess the existing culvert. For the baseline conditions and the 0.5% AEP (200-year) plus climate change design flow, results indicate that:
- the open channel at the location of the proposed new culvert crossing carries the design flow within the banks; and

- the culvert beneath the railway line surcharges and results in headwater depths greater than bank height, leading to flooding in the surrounding field.

Fluvial Geomorphology

- 2.151 SWF 17 is an artificial ditch with no riparian buffer zone. The surrounding land use is rough pasture used for grazing and marshland. A road also runs alongside the drain.

Water Quality

- 2.152 SWF 17 receives flow from a pond and another very short drain. It has a very small sized catchment (in comparison to the River Nairn) that comprises a small number of agricultural fields.
- 2.153 SWF 17 has a low dilution and dispersion capacity.

Brief Description of Proposed Works

- 2.154 Two culverts (C22 and C31) would need to be constructed within this SWF.

**SWF 18: Indirect Tributary Drains of Ardersier Burn**

Brief Description of SWF

- 2.155 The main drain flows through the study area in a north-westerly direction. It joins SWF 16 to the east of Inverness Airport (outside of the study area, to the north). The source of the main drain appears to be to the north of Balblair, within the study area.

Hydrology and Flood Risk

- 2.156 SWF 18 is identified by SEPA Flood Map as posing flood risk around the watercourse from the south of Milton of Gollanfield farm to the confluence with SWF 16, which is supported by local stakeholder evidence.
- 2.157 Flood risk assessment has been carried out for this watercourse using hand calculations appropriate for the straightforward hydraulics and relatively localised flood risk. A simple routing model has also been used for the Milton of Gollanfield culvert (SWF18-A). For the baseline conditions and the 0.5% AEP (200-year) plus climate change design flow, results indicate the following:
- The existing A96 culvert is free flowing, with water levels lower than bank height.
  - The existing culvert carrying a back road over a tributary drain is free flowing with water levels in-bank.
  - The existing culvert carrying a back road over the watercourse at Milton of Gollanfield is simulated to be surcharged and go out of bank during the design simulation. There are a few properties within close proximity to this culvert and therefore they are at potential flood risk.
  - The existing open channel at each location whereby the proposed new alignment crosses SWF 18 has sufficient capacity to pass the design flow with water levels remaining in bank.

Fluvial Geomorphology

- 2.158 SWF 18 (Drainage Ditch Network/ tributary of the tributary of Ardersier Burn) flows through arable farmland, broadleaf woodland, and semi-improved grassland. In downstream sections, a continuous vegetated riparian zone is present on both banks measuring approximately 3m wide.
- 2.159 The majority of the SWF has a straight planform, a uniform cross-section and resectioned earth banks; however, upstream areas are relatively sinuous with more variation in cross-sectional profiles. The channel measures approximately 1.2 to 1.5m wide. Substrate varied throughout the SWF and included silt, sand, gravel, pebbles and cobbles (Diagram 34). Several silt and gravel

deposits are present within this SWF. Flow types include a step-pool sequence (Diagram 35), a riffle-pool sequence, rippled and smooth flow.

- 2.160 Longitudinal connectivity is locally impacted by three culverts and three weirs (Diagram 36). Latitudinal connectivity of this SWF is constrained by an overdeep channel and extensive bank reinforcement (wood piling) on both banks from the existing A96 for approximately 250m downstream (Diagram 37). This SWF is predominantly stable; however, upstream of the existing A96 culvert, the SWF is laterally adjusting.

Water Quality

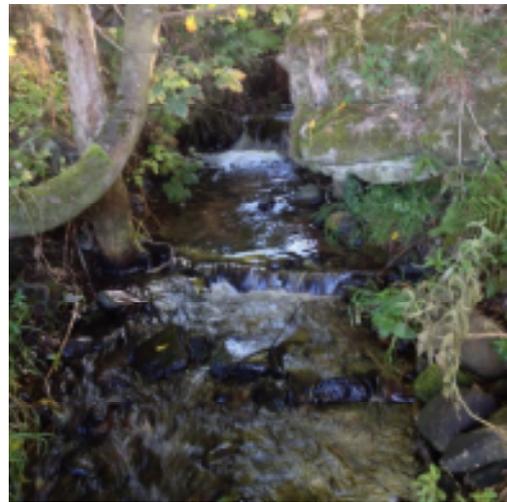
- 2.161 SWF 18 receives flow from approximately five drains/SWFs. It has a relatively small catchment (in comparison to the River Nairn) that comprises agricultural fields, areas of woodland and part of Inverness Airport. It may also receive runoff from two very small settlements (Drumine and Milton of Gollanfield), the major and minor road network (including the existing A96) and the railway.
- 2.162 SWF 18 has a low dilution and dispersion capacity.

Brief Description of Proposed Works

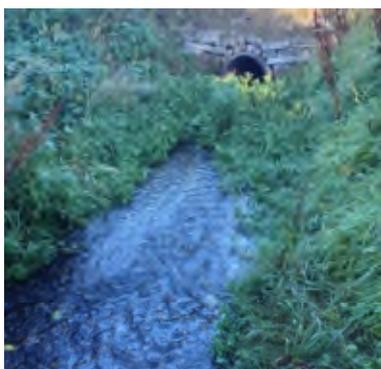
- 2.163 This SWF would need to be realigned to facilitate the proposed Scheme. In addition, one outfall for discharging routine runoff from the proposed Scheme (Outfall N) and two culverts (c15 and C16) would need to be constructed within this SWF.



**Diagram 34: Substrate Observed in Downstream Section (GR - NH 79074 51677 October 2015)**



**Diagram 35: Step-pool Sequence Observed in Downstream Reach (GR NH 79001 52159- October 2015)**



**Diagram 36: A96 Culvert (looking  
Upstream) (GR - NH 79074 51677 October  
2015)**

**Diagram 37: Outfall and Bank Reinforcement  
Downstream of the Existing A96 Culvert (GR - NH  
79074 51677 October 2015)**

## **SWF 19: Balnagowan Burn**

### Brief Description of SWF

- 2.164 Balnagowan Burn appears to have its source to the east of Bemuchlye, south-west of Blar nàm Fiadh Wood (outside of the study area, to the south). However, SEPA's RBMP Interactive Map shows that the Balnagowan Burn WFD waterbody extends further to the west of this point, to a minor road that runs between Lochside and Wester Lochend. This length of SWF 19 is not shown on OS mapping. SWF 19 flows in a north-westerly direction through the study area. This SWF forms a tributary of SWF 16, south of Ardersier, close to the point where SWF 16 flows into the Moray Firth.

### Hydrology and Flood Risk

- 2.165 SWF19 is identified on SEPA Flood Map data as posing flood risk downstream of the existing A96, from a point near Tomhommie through to Ardersier. Burnside cottage, north of Flemington, is the only residence in the zoned area of flood risk, the remainder is agricultural land.
- 2.166 The hydraulic characteristics of this watercourse are relatively straightforward, and the flood risk sensitivity is relatively localised around the proposed Scheme, hence flood risk assessment has been carried out using hand calculations. A simple routing model has also been used for the baseline conditions and the 0.5% AEP (200-year) plus climate change design flow, initial results indicate the following:
- the culvert crossing the existing A96 (SWF19-A) has been simulated to surcharge and go out of bank during the design simulation posing a potential flood risk to the existing A96;
  - the culvert crossing the railway line (SWF19-B) has also been simulated to surcharge and go out of bank posing a potential flood risk to the railway;
  - no results yet available for location of new minor road / farm access crossing; and
  - the open channel forming baseline conditions at the proposed Scheme crossing is predicted to have sufficient capacity to convey the design flow within the banks.

### Fluvial Geomorphology

- 2.167 SWF 19 (Balnagowan Burn) mainly flows through semi-improved grassland and broadleaf woodland. A fragmented vegetated riparian zone is present on both banks, consisting of reeds, grasses and brambles. In several sections, this SWF is choked by terrestrial vegetation (Diagram 38).
- 2.168 SWF 19 has a straight planform with a uniform cross-section and resectioned vegetated earth banks. Silt is the dominant substrate throughout this SWF. Areas of smooth, rippled and stagnant flow are present, with some areas of dry channel also present. Scour is present in several locations throughout this SWF (Diagram 39). Diffuse pollution from the surrounding arable land appears to have caused water in the channel to be orange in colour and dense areas of filamentous algae to form (Diagram 40).
- 2.169 Two culverts impact longitudinal connectivity along the SWF and the overdeep channel and embankments limit lateral connectivity with the flood plain and the potential for lateral adjustment.
- 2.170 This SWF is assessed to be narrowing and appears to be a sink for sediment.

### Water Quality

- 2.171 SWF 19 receives flow from at least 10 direct tributaries. It has a relatively small catchment (in

comparison to the River Nairn) that largely comprises agricultural fields. It may also receive runoff from the major and minor road network (including the existing A96) and the railway.

2.172 SWF 19 has a low dilution and dispersion capacity.

Brief Description of Proposed Works

2.173 Three outfalls for discharging routine runoff from the proposed Scheme (Outfall O, P and Q) and two culverts (C17 and C23) would need to be constructed within this SWF. In addition, this SWF would need to be extended along one field boundary to accommodate Outfall O.



**Diagram 38: Choked Upstream Section (GR - NH 82464 54037 October 2015)**



**Diagram 39: Scour Observed on the Left Bank in Upstream Reach (GR - NH 82977 53463 October 2015)**



**Diagram 40: Polluted Water with Orange Filamentous Algae Observed in Upstream Reach (GR - NH 82977 53463 October 2015)**

**SWF 21: Field Ditch Tributaries of Balnagowan Burn**

Brief Description of SWF

2.174 This SWF is formed from a series of agricultural and forestry drains that flow within Blar nàm Fiadh wood, within the study area. These drains meet on the western boundary of the wood to form one drain. This small section of drain flows in a westerly direction to join SWF 19 to the west of the wood, south of the railway line.

Hydrology and Flood Risk

2.175 SWF 21 does not feature on SEPA Flood Map. However, high groundwater and surface water ponding in the vicinity were recorded during consultation with local stakeholders.

2.176 No further quantification of flood risk on this water feature has been undertaken as the proposed

Scheme is not anticipated to affect the hydraulics of this water feature, nor is the proposed road anticipated to be at risk of flooding from this minor water feature.

Fluvial Geomorphology

- 2.177 SWF 21 is completely overgrown with terrestrial vegetation and no flow was visible at the time of survey.

Water Quality

- 2.178 These tributaries have a very small catchment (in comparison to the River Nairn) that comprises an area of woodland and a small number of agricultural fields. They may also receive runoff from the major and minor road network (including the existing A96) and the railway.
- 2.179 SWF 21 has a low dilution and dispersion capacity.

Brief Description of Proposed Works

- 2.180 There are not expected to be any in-channel works associated with these drains. In addition, this SWF would not receive any discharges of routine runoff from the proposed Scheme. However, the drains would flow close to the proposed Scheme.

**SWF 22: Alton Burn**

Brief Description of SWF

- 2.181 The source of Alton Burn appears to be an area of open water called the 'Loch of the Clans' located to the south of the Blar nàm Fiadh wood (outside of the study area, to the south). SWF 22 flows in both a northerly and north-westerly direction through the study area. It flows through Nairn Golf Course (outside of the study area, to the north) before entering the Moray Firth on the north-eastern edge of Nairn.

Hydrology and Flood Risk

- 2.182 SWF 22 is the cause of significant areas of flood risk shown on SEPA Flood Map data. Upstream of the proposed Scheme crossing, the flood risk zone is typically narrow, and follows the route of the watercourse. Downstream, the flood risk zone expands to skirt the properties of Moss Side and Lochdhu to the north, and Balnaspirach to the south. The downstream flood risk zone mirrors remarks made by local residents and stakeholders during consultation.
- 2.183 In the vicinity of the proposed Scheme, this water feature has relatively simple hydraulics and relatively localised sensitivity to flood risk. Therefore hand calculation techniques have been used to assess baseline flood risk at various key channel locations / existing culverts in the vicinity of the proposed Scheme. A simple routing model has also been used to assess the existing local road culvert.
- 2.184 Under baseline conditions the 0.5% AEP (200-year) plus climate change design flow, results indicate that:
- the existing local road culvert (SWF 22-A) surcharges with headwater level higher than bank height; and
  - the existing open channel at the proposed crossing point of the proposed Scheme has capacity to pass the design flow without overtopping.

Fluvial Geomorphology

- 2.185 SWF 22 (Alton Burn) flows through arable farmland, rough grassland and semi-improved grassland. A fragmented vegetated riparian zone is present on both banks measuring approximately 2m wide. The SWF is overgrown with terrestrial vegetation.

- 2.186 SWF 22 has a straightened planform with a uniform cross-section (Diagram 41). Earth banks are partly vegetated and predominantly resectioned in profile. A silt bed is present throughout the course of the SWF. Water is stagnant in upstream sections, with rippled flow present further downstream. Poaching and bank slumping is present on both banks; however, being more extensive on the unfenced left bank (Diagram 42). Areas of bank failure and exposed eroding banks were also noted throughout SWF 22.
- 2.187 Lateral adjustment and connectivity is impacted in this SWF by embankments, an overdeep channel and sections of bank reinforcement. Longitudinal connectivity is impacted by three culverts (Diagram 43) and a historic ford. A small footbridge was also observed immediately downstream of the historic ford.
- 2.188 SWF 22 is assessed as narrowing and is deemed to be a sediment sink.

Water Quality

- 2.189 SWF 22 appears to receive flow from only one direct tributary, a short drain. It has a relatively small catchment (in comparison to the River Nairn) that comprises agricultural fields and part of the town of Nairn (largely residential). It may also receive runoff from the major and minor road network (including the existing A96) and the railway.
- 2.190 SWF 22 has a low pollutant dilution and dispersion capacity.

Brief Description of Proposed Works

- 2.191 One outfall for discharging routine runoff from the proposed Scheme (Outfall R) and two culverts (C18 and C25) would need to be constructed within this SWF.



**Diagram 41: Straight Channel Downstream of the Culvert (GR - NH 85153 54275 October 2015)**



**Diagram 42: Poaching Observed Throughout the Study Reach (GR - NH 85414 54424 October 2015)**



**Diagram 43: Gabion and Culvert Under Local Access Route (GR - NH 85414 54424 October 2015)**

### **SWF 23: River Nairn**

#### Brief Description of SWF

- 2.192 The River Nairn rises in the Monadhliath Mountains, over 20km to the south-west of the study area. This SWF has a large catchment (in comparison to the other SWFs within the study area) that includes agricultural land, moorland and woodland. The River Nairn does not pass through any settlements until it reaches Nairn, close to its mouth.

#### Hydrology and Flood Risk

- 2.193 The River Nairn has a significant flood plain within the study area indicated on SEPA Flood Map data. The proposed Scheme crosses the River Nairn between the Howford Bridge and Broadley Farm, where the flood plain is narrowest. Upstream of Howford, the flood plain widens significantly and the identified area of flood risk includes much agricultural land and several farmhouses and cottages. Downstream of Broadley, the river enters the outskirts of Nairn, with a broad flood risk zone which includes parts of the Househill, Firhall, and Balmakeith residential areas. Further downstream, some properties in the town centre are within the identified flood risk zone.
- 2.194 Due to the potential vulnerability of properties in Nairn, and the river's ecological designation (Protected Area for Freshwater Fish under WFD), this water feature is graded as very high sensitivity in terms of hydrology and flood risk.
- 2.195 In order to assess the baseline flood risk from the River Nairn in the vicinity of the proposed Scheme, numerical hydraulic modelling has been undertaken. Initial baseline assessment results for the 0.5% AEP (200-year) plus climate change flow largely match the flood extents presented by the SEPA data described above.

#### Fluvial Geomorphology

- 2.196 SWF 23 (The River Nairn) is a relatively large watercourse which predominantly flows through broadleaf woodland surrounded by arable farmland and areas of development. A continuous tree lining is present on both banks throughout the study area.
- 2.197 The channel is approximately 11m wide and has a sinuous and meandering planform with non-uniform cross sectional profiles. Banks are earth and either steep, vertical or undercut in profile. Channel substrate ranges from boulders to silt; however, the majority of substrate consists of cobbles and pebbles. Various flow types are present including a pool-riffle sequence, rippled flow and smooth flow. Riffles (Diagram 44), side bars (Diagram 45) and mature islands are also present throughout the course of the SWF. A large side channel (mostly dry with some areas of pooled stagnant water at the time of survey) is located downstream of the B9090 Loch Flemington – Clephanton – Cawder – Nairn Road crossing, measuring approximately 8m wide and 100m in length (Diagram 46). A large debris dam is also present on the side channel (Diagram 47). Exposed tree roots, eroding banks and undercut banks indicate that the SWF is active.
- 2.198 As this SWF is naturally incised, there is limited lateral connectivity with the flood plain. No modifications are assessed to be impacting longitudinal connectivity within the study area. The B9090 Loch Flemington – Clephanton – Cawder – Nairn Road crosses this SWF by means of a clear-span bridge. The SWF is assessed as laterally adjusting and narrowing.

#### Water Quality

- 2.199 SWF 23 receives flow from numerous direct tributaries along its length before flowing through Nairn and entering the Moray Firth to the north (outside of the study area). It is also likely to receive runoff from a number of major and minor roads (including the existing A96) and the railway.
- 2.200 SWF 23 has a medium pollutant dilution and dispersion capacity.

Brief Description of Proposed Works

- 2.201 One outfall discharging routine runoff from the proposed Scheme would need to be constructed within this SWF (Outfall S). The proposed Scheme would require a clear span bridge crossing the SWF.



**Diagram 44: Riffle Observed Downstream of the Side Channel (GR - NH 87719 54170 October 2015)**



**Diagram 45: Wide Channel with Side Bars Downstream of B9090 Loch Flemington – Clephanton – Cawder – Nairn Road Bridge (GR - NH 87659 53862 October 2015)**



**Diagram 46: Side Channel Observed Downstream of the B9090 Loch Flemington – Clephanton – Cawder – Nairn Road Bridge (GR - NH 87722 54088 October 2015)**



**Diagram 47: Debris Dam Observed at Upstream Extent of the Side Channel (GR - NH 87714 54063 October 2015)**

**SWF 24: Tributary of the River Nairn**

Brief Description of SWF

- 2.202 This is a short SWF that has its source within an area of woodland approximately 1km to the south of Nairn (within the study area). This SWF flows in a northerly direction through the study area. It flows into the River Nairn, immediately to the south of Nairn (outside the study area, to the north).

Hydrology and Flood Risk

- 2.203 SWF 24 does not feature in SEPA Flood Map data due to the small catchment, and no stakeholder comments were received during consultation regarding flooding of this watercourse.
- 2.204 Due to the ecological designation of this watercourse, as a Protected Area for Freshwater Fish under WFD (associated water body of the River Nairn); this water feature is graded as very high sensitivity in terms of hydrology and flood risk.
- 2.205 This watercourse has relatively localised sensitivity to flood risk, and simple hydraulic

characteristics therefore hand calculations were employed to assess the flood risk under baseline conditions. The baseline assessment identified that under the 0.5% AEP (200-year) plus climate change design flow, for the existing open channel section at the proposed site of the new culvert carrying the proposed Scheme, water levels remain within bank height and no flooding occurs.

#### Fluvial Geomorphology

- 2.206 SWF 24 (Tributary of the River Nairn) forms a boundary between broadleaf woodland and arable agricultural land. No significant vegetated riparian zone is present on either bank.
- 2.207 This SWF had a predominantly straight planform with a uniform cross-section measuring approximately 0.8m wide (Diagram 48). Banks are resectioned, earth and partly vegetated. Various substrates are present along the course of the SWF, including silt, sand, gravel and pebbles (Diagram 49). Silt deposits, side bars and riffles are also present within the study area of SWF 24. Erosion is limited to being mainly around a small footbridge and associated bank protection. The dominant flow type is rippled flow, with some sections of stagnant flow through sections choked with vegetation.
- 2.208 Lateral connectivity is limited due to an overdeep channel, bank protection and a small footbridge (Diagram 50) and no structures are assumed to impact longitudinal connectivity within the study area. SWF 24 is assessed to be narrowing and acting as a sink for sediment.

#### Water Quality

- 2.209 This SWF receives flow from one short drain. It has a very small catchment (in comparison to the River Nairn) that comprises agricultural fields and part of the town of Nairn (largely residential). It may also receive runoff from a minor road and a small residential area to the south-east of Nairn.
- 2.210 SWF 24 has a low pollutant dilution and dispersion capacity.

#### Brief Description of Proposed Works

- 2.211 Two outfalls for discharging routine runoff from the proposed Scheme (Outfall T and U) and a culvert (C19) would need to be constructed within this SWF.



**Diagram 48: Straightened Upstream Reach (GR - NH 88930 54380 October 2015)**



**Diagram 49: Substrate Observed in Downstream Section (GR - NH 88949 54693 October 2015)**



**Diagram 50: Small Footbridge Constructed  
Over Downstream Reach (GR - NH 88973 54630  
October 2015)**

### **SWF 26: Auldearn Burn**

#### Brief Description of SWF

- 2.212 The source of Auldearn Burn is between Laiken Forest and Arr Wood (outside of the study area, to the south). Auldearn Burn flows first in a northerly direction, and then in a westerly direction, through the study area before forming a tributary of SWF 23 (described previously) within Nairn (outside of the study area, to the north). It feeds a number of small lochs and two reservoirs along its course towards SWF 23.

#### Hydrology and Flood Risk

- 2.213 SWF 26 is shown by SEPA Flood Map data to pose considerable flood risk to agricultural land in the vicinity of the proposed Scheme, but few properties are located within this zone. West of Auldearn, the flood extends through fields between the B9111 Auchnacloch – Auldearn Road and the existing A96, and also into the edge of fields south of the B9111 Auchnacloch – Auldearn Road. North of the existing A96, the grounds of Boath House around the confluence of SWF 31 and SWF 26 are shown at risk. The proposed Scheme passes to the north of Auldearn, where the flood extents are around 90-100m wide, from Boath Lodge (itself within the flood risk zone) downstream to the Balmakeith area where the Auldearn Burn enters the River Nairn flood plain. Local stakeholder remarks on flooding mirror the SEPA data.
- 2.214 Due to the potential impacts on properties around Auldearn and the ecological designation of this watercourse, (as a Protected Area for Freshwater Fish under WFD - associated water body of the River Nairn); this water feature is graded as very high sensitivity in terms of hydrology and flood risk..
- 2.215 Due to the complexity of the watercourse combined with high sensitivity to flood risk, SWF 26 has been assessed using numerical modelling. This indicates that the 0.5% AEP (200-year) plus climate change flow would come out of bank upstream of the proposed Scheme, flowing across agricultural land following the valley floor.

#### Fluvial Geomorphology

- 2.216 SWF 26 (Auldearn Burn) mainly flows through semi-improved grassland, residential areas and broadleaf woodland. A fragmented vegetated riparian zone is present on both banks.
- 2.217 This SWF has a predominantly straight planform with a uniform cross-section, with some sections laterally adjusting within its banks (Diagram 51). Vegetated, earth banks are resectioned in profile. Consolidated gravels, pebbles and sand are the dominant channel substrate throughout SWF 26 (Diagram 52). Depositional features include gravel bars. Rippled flow is the dominant flow type.

Exposed bank roots and undercut banks indicate that the SWF had the potential to erode.

- 2.218 Longitudinal connectivity is impacted by six water crossings (Diagram 53, 54 and 55) and lateral connectivity is impacted by an overdeep channel and areas of bank reinforcement. An outfall also discharges into the SWF immediately downstream of the existing A96 culvert (Diagram 56) potentially providing an input of fine sediment. SWF 26 is assessed to be narrowing and laterally adjusting in areas.

Water Quality

- 2.219 SWF 26 has at least 14 direct tributaries. It has a medium sized catchment (in comparison to the River Nairn) that comprises agricultural fields and an area of woodland. It may also receive runoff from the major and minor road network (including the existing A96) and from part of Auldearn (a village) and part of Nairn.
- 2.220 SWF 26 has a medium dilution and dispersion capacity.

Brief Description of Proposed Works

- 2.221 This SWF would need to be realigned to facilitate the proposed Scheme. In addition, three outfalls for discharging routine runoff from the proposed Scheme (Outfall W, X and Y) and one culvert (C20) would need to be constructed within this SWF.



**Diagram 51: Straightened Downstream Reach (GR - NH 90292 56199 October 2015)**



**Diagram 52: Substrate Observed Upstream of the Culvert at Auchnacloch (GR - NH 90292 56199 October 2015)**



**Diagram 53: The B9111 Auchnacloch – Auldearn Road Bridge (GR - NH 90292 56199 October 2015)**



**Diagram 54: Culvert Under the Existing A96 at Auchnacloch (GR - NH 90292 56199 October 2015)**



**Diagram 55: Culvert Under the Existing A96 at Auldearn (GR - NH 91710 55759 October 2015)**



**Diagram 56: Outfall Immediately Downstream of the Existing Auldearn A96 Culvert (Gr - NH 91710 55759 October 2015)**

### **SWF 29: Tributary of Auldearn Burn (2)**

#### Brief Description of SWF

- 2.222 This is a very short SWF that flows in an easterly direction along three field boundaries to the west of Auldearn (within the study area) before forming a tributary of SWF 26. The source of this SWF lies to the east of Russell's Wood.

#### Hydrology and Flood Risk

- 2.223 SWF 29 does not feature in SEPA Flood Map data, and no stakeholder comments have been received regarding flooding of this watercourse.
- 2.224 No further baseline flood risk assessment has been undertaken as the proposed Scheme is not anticipated to affect the hydraulics of this water feature, nor is the proposed road anticipated to be at risk of flooding from this minor water feature.

#### Brief Description of Proposed Works

- 2.225 There are not expected to be any in-channel works associated with this watercourse. In addition, this SWF would not receive any discharges of routine runoff from the proposed Scheme.
- 2.226 This SWF has been scoped out of the water quality and fluvial geomorphology assessments for both construction and operational impacts because it flows approximately 130m to the east of the proposed Scheme (at its closest point) and the relief of the land rises between the proposed Scheme and this SWF.

### **SWF 31: Auldearn Burn - Brightmony Tributary**

#### Brief Description of SWF

- 2.227 SWF 31 is formed from a series of streams and drains in Brightmony and Easter Brightmony Wood (outside of the study area, to the south). This watercourse flows in a north-westerly direction through the study area before joining SWF 26 to the north of Auldearn (within the study area).

#### Hydrology and Flood Risk

- 2.228 SEPA Flood map identifies a corridor of flood risk along the length of SWF 31, affecting principally

agricultural land but skirting properties at Meadowfield, Broombank and Boath House all on the outskirts of Auldearn. The proposed Scheme does not directly impact the flood risk of SWF 31 through flood plain encroachment or new/modified crossings; however, any impact on the Auldearn Burn (SWF 26) downstream of the confluence with SWF 31 may increase the flood risk on this tributary. Stakeholder remarks received during the consultation phase support the Flood Map data with evidence of flooding in the grounds of properties at Boath House.

- 2.229 SWF 31 has been included in the numerical model representing SWF 26, to capture effects of the proposed Scheme (which crosses SWF 26 downstream of the SWF 26/31 confluence) propagating upstream into the SWF 31 catchment; however baseline results are not yet available.

#### Fluvial Geomorphology

- 2.230 SWF 31 is a small watercourse forming the boundary between two arable agricultural fields. The SWF has a significant riparian buffer measuring approximately 2m wide and consisting of grasses, shrubs and a scattered tree lining (Diagram 57). Water has predominantly smooth flow and substrate is mainly silt with some fine gravels.



**Diagram 57: Substantial Riparian Buffer Zone on SWF 31 (GR - NH 91960 55890 October 2015)**

#### Water Quality

- 2.231 Outside of Brightmony and Easter Brightmony Wood this burn receives flow from at least five watercourses. It has a relatively small catchment (in comparison to the River Nairn) that comprises woodland and agricultural land. It may also receive runoff from the major and minor road network (including the existing A96).
- 2.232 SWF 31 has a low dilution and dispersion capacity.

#### Brief Description of Proposed Works

- 2.233 There are not expected to be any in-channel works associated with this SWF. In addition, this SWF would not receive any discharges of routine runoff from the proposed Scheme. However, the dual carriageway realignment would be constructed within 100m of this SWF.

#### **SWF 33: Drain at Penick Farm**

##### Brief Description of SWF

- 2.234 This is a very short SWF that flows in its entirety within the study area. It rises close to Penick Farm and flows alongside a small section of a minor road, although the direction of flow is not clear.

#### Hydrology and Flood Risk

- 2.235 SWF 33 is not featured in SEPA Flood Map data due to its very small catchment area.
- 2.236 No further quantification of baseline flood risk has been undertaken as the proposed Scheme is not anticipated to affect the hydraulics or catchment of this water feature, nor is the proposed road anticipated to be at risk of flooding from this minor water feature.

Fluvial Geomorphology

- 2.237 SWF 33 has a low gradient and flows through a predominantly arable land use. There is no riparian zone along most of this watercourse.
- 2.238 The channel is choked with vegetation in places and there are some sections that appear to have no flow in summer months. Where bed material was visible, silt and coarse gravel are predominant and it is likely that much of the sediment is sourced from the adjacent arable fields as there is no buffer zone to trap sediment from field runoff. Banks are generally gentle sloping, however can be quite steep in places. In some places the channel crossing section appeared to be trapezoidal, indicating reprofiled banks. Bank vegetation is generally a simple community consisting of grass and shrubs with occasional, scattered trees.

Water Quality

- 2.239 SWF 33 has no tributaries. It has a very small catchment (in comparison to the River Nairn) that comprises a small amount of agricultural land. It may also receive runoff from part of the minor road.
- 2.240 SWF 33 has a low dilution and dispersion capacity.

Brief Description of Proposed Works

- 2.241 There are not expected to be any in-channel works associated with this SWF. In addition, this SWF would not receive any discharges of routine runoff from the proposed Scheme. However, the SWF would flow close to the proposed Scheme.

**SWF 34: Tributary of Auldearn Burn (4)**

Brief Description of SWF

- 2.242 This SWF is formed from a series of drains within Inshoch Moss (within the study area). It flows in a predominantly westerly direction through the study area and forms a tributary of Auldearn Burn, to the north of Auldearn (within the study area).

Hydrology and Flood Risk

- 2.243 SWF 34 appears on SEPA Flood Map, indicating a narrow flood risk zone encompassing agricultural land and no properties. This watercourse contributes to flooding downstream of the confluence with the Auldearn Burn SWF 26.
- 2.244 SWF 34 has been included in the numerical model representing SWF 26, to capture effects of the proposed Scheme (which crosses SWF 26 downstream of the SWF 26/34 confluence) propagating upstream into the SWF 34 catchment; however baseline results are not yet available.
- 2.245 Flow estimates have been prepared for the baseline case, to inform road drainage and outfall design.

Fluvial Geomorphology

- 2.246 SWF 34 (Tributary 4 of Auldearn Burn) flows through mainly arable farmland and semi-improved grassland. The SWF has a continuous vegetated riparian zone on both banks, measuring approximately 3m wide.

- 2.247 SWF 34 has a straight planform with a trapezoidal uniform cross-section. Banks are fully vegetated with a resectioned profile. Channel substrate and bank material was not visible at the time of survey due to being obscured by overgrown vegetation (Diagram 58).
- 2.248 Longitudinal connectivity is impacted by one culvert and two minor weirs within the study area. Lateral connectivity with the flood plain is limited by an overdeep channel. SWF 34 is a sediment sink.

Water Quality

- 2.249 SWF 34 has a relatively small catchment (in comparison to the River Nairn) that comprises woodland and agricultural land. It may also receive runoff from the minor road network.
- 2.250 SWF 34 has a low dilution and dispersion capacity.

Brief Description of Proposed Works

- 2.251 There are not expected to be any in-channel works associated with this SWF. In addition, this SWF would not receive any discharges of routine runoff from the proposed Scheme.



**Diagram 58: Choked Channel Conditions Upstream  
of the Culvert (GR - NH 92279 56494 October 2015)**

**SWF 35: Tributary of the Auldearn Burn - Brightmony Tributary**

Brief Description of SWF

- 2.252 This is a very short watercourse that has its source to the east of Auldearn and to the south of the existing A96. This watercourse flows along one field boundary before joining with SWF 31. The entirety of this watercourse flows within the study area.

Hydrology and Flood Risk

- 2.253 SEPA Flood Maps show that for the 0.5% AEP (200-year) event, flood risk is posed to a narrow corridor following the watercourse from Garblies downstream to the existing A96 crossing at Broombank.
- 2.254 No further baseline flood risk assessment has been undertaken as the proposed Scheme is not anticipated to affect the hydraulics of this water feature, nor is the proposed road anticipated to be at risk of flooding from this minor water feature.
- 2.255 Flow estimates have been prepared for the baseline case, to inform road drainage and outfall design.

Fluvial Geomorphology

- 2.256 SWF 35 is a straightened field drain with a limited riparian buffer zone and a scattered tree lining.

Water Quality

- 2.257 SWF 35 has no tributaries. It has a very small sized catchment (in comparison to the River Nairn) that comprises agricultural land and a small area of woodland.
- 2.258 SWF 35 has a low dilution and dispersion capacity.

Brief Description of Proposed Works

- 2.259 One outfall for discharging routine runoff from the proposed Scheme (Outfall Z) would need to be constructed within this SWF.

**Loch Flemington**

- 2.260 Loch Flemington is a small (approximately 14ha), shallow, eutrophic loch formed in a kettlehole situated among various fluvioglacial landforms produced in the last glaciation. The loch has a limited exchange of water with no obvious outlet, and supports a largely undisturbed aquatic plant community associated with eutrophic conditions, including diverse submerged and emergent vegetation and sedge fen. The loch is located approximately 230m to the south-east of the proposed Scheme at its closest point, to the south of Lochside.
- 2.261 Loch Flemington is designated as a Special Protection Area (SPA) and located within the Kildrummie Kames Site of Special Scientific Interest (SSSI).

**Ponds**

- 2.261.1 Chapter 11 (Ecology and Nature Conservation) identifies 39 ponds within the study area (Figure 11.5: Protected Species). Two seasonal ponds would be lost under the footprint of the proposed Scheme (Pond 25.1 and Pond 25.1).
- 2.261.2 SWF 31 is artificially connected to Pond 36 in its lower reaches. SWF 31 would not require any in-channel works and would not receive any routine runoff during operation

### **3 Nitrate Vulnerable Zones**

- 3.1 Nitrate Vulnerable Zones (NVZs) are areas designated as being at risk from agricultural nitrate pollution. The proposed Scheme does not pass through a NVZ.

### **4 Water Framework Directive Classifications**

- 4.1 Under the Water Framework Directive (WFD), SEPA classifies water bodies according to their ecological and water quality status. These are useful indicators of biodiversity/water quality, respectively. They are classified on a five point scale (bad/poor/moderate/good/high). The objectives of the WFD are for all water bodies to achieve or maintain an overall status of 'good' by 2021 or over agreed timescales, up to or beyond 2027. Artificial or heavily modified water bodies (HMWB) have less stringent targets to meet, however, these water bodies need to achieve at least 'good ecological potential' over the same timescales.
- 4.2 Within the study area, SEPA has classified seven SWFs. The classifications, which are from 2014 and have been taken from Scotland's Environment Interactive Water Map (SEPA 2015c), are provided in Table 1, from west to east. In addition to the classifications, pressures and activities that are considered responsible for a SWFs water quality being less than good status are provided. These are also shown in Table 1, where available.

**Table 1: SEPA WFD Water Body Classifications**

Surface Water Feature (SWF)	Ecological Status/Potential	Water Quality Status	Responsible Pressures (water quality)	Responsible Activities (water quality)
SWF 03: Cairnlaw Burn	Moderate Status	Good	Not provided	Not provided
SWF 12: Rough Burn	Moderate Status	Moderate	Not provided	Not provided
SWF 16: Tributary of Ardersier Burn (Mid Coul to source)	Good Status	Good	N/A	N/A
SWF 16: Tributary of Ardersier Burn (sea to Mid Coul)	Bad Potential	Moderate	Diffuse source	Rural sources
SWF 19: Balnagowan Burn	Bad Potential	Moderate	Diffuse source	Rural sources
SWF 23: River Nairn - Moray Firth to River Farnack confluence	Moderate Status	High	N/A	N/A
SWF 26: Auldearn Burn	Moderate Status	Moderate	Diffuse source	Rural sources

4.3 The ecological and water quality statuses of the rest of the SWFs that flow within the study area have not been classified by SEPA. Therefore, an assumption about the ecological statuses of these SWFs has been made based on the following:

- moderate ecological status has been assumed for those SWFs that have artificial or realigned channels; little or no riparian zone and / or are choked with vegetation; and
- good ecological status has been assumed for those SWFs that have a natural planform and / or a good riparian zone.

4.4 The assumed statuses are provided in Table 2 (Importance of Each Attribute of a Water Feature).

## 5 River Flows

5.1 The annual 95 percentile river flow of a SWF ( $Q_{95}$ ) is the flow exceeded for 95% of the time (i.e. it is a measure of the flow of water in the river when it is very low). This is important because it is an indication of the capacity of the SWF to dilute and disperse any contaminants discharged into it without significant harm to water quality or ecosystems.

5.2 The National River Flow Archive holds records from a gauging station on the River Nairn, for the period between 1979 and 2014. This gauging station is located approximately 530m to the north of the point where the proposed Scheme would cross the River Nairn. The annual 95 percentile river flow (i.e. flow exceeded 95% of the time) recorded at this site is  $0.883\text{m}^3/\text{s}$ .

5.3 There is no record of a gauging station on any other SWFs that flow within the study area. Therefore, a  $Q_{95}$  value has been calculated for all SWFs that would receive runoff from the proposed Scheme using area scaled Low Flows Enterprise  $Q_{95}$  flow estimates from a selected representative catchment.

5.4 The calculated  $Q_{95}$  values are as follows:

- SWF 02 (for Outfall A, B and C):  $0.011\text{m}^3/\text{sec}$ ;
- SWF 03 (for Outfall D and E):  $0.011\text{m}^3/\text{sec}$ ;
- SWF 06 (for Outfall F):  $0.010\text{m}^3/\text{sec}$ ;
- SWF 08 (for Outfall G):  $0.003\text{m}^3/\text{sec}$ ;
- SWF 09 (for Outfall H and I):  $0.006\text{m}^3/\text{sec}$ ;

- SWF 13 (for Outfall J and K): 0.002m<sup>3</sup>/sec;
- SWF 16 (for Outfall L and V): 0.010m<sup>3</sup>/sec;
- SWF 16 (for Outfall M): 0.009m<sup>3</sup>/sec;
- SWF 18 (for Outfall N): 0.007m<sup>3</sup>/sec;
- SWF 19 (for Outfall O): 0.0001m<sup>3</sup>/sec;
- SWF 19 (for Outfall P and Q): 0.005m<sup>3</sup>/sec;
- SWF 22 (for Outfall R): 0.012m<sup>3</sup>/sec;
- SWF 23 (for Outfall S): 0.853m<sup>3</sup>/sec;
- SWF 24 (for Outfall T and U): 0.003m<sup>3</sup>/sec;
- SWF 26 (for Outfall W): 0.038m<sup>3</sup>/sec;
- SWF 26 (for Outfall X and Y): 0.031m<sup>3</sup>/sec; and
- SWF 35 (for Outfall Z): 0.003m<sup>3</sup>/sec.

5.5 The Q<sub>95</sub> calculated for Outfall O (into SWF 19) was a very low value of 0.0001m<sup>3</sup>/sec. This is below the threshold of values that can be input into the HAWRAT tool. Therefore, a value of 0.001m<sup>3</sup>/sec was used because this is the lowest value that can be input into HAWRAT. The use of such a value under these circumstances is endorsed by the DMRB method.

## **6 Designated Sites**

6.1 Within the study area, SWF 23 (River Nairn), SWF 24 (Tributary of the River Nairn) and SWF 26 (Auldearn Burn) were designated as salmonid fisheries under the recently repealed Freshwater Fish Directive (FFD). They are now protected areas under the WFD. It is possible that these designated sections of SWF receive existing discharges from the local road network.

6.1.1 A number of the watercourses that flow through the study area flow into the Moray Firth, which has the following ecological designations:

- Inner Moray Firth Wetland of International Importance (Ramsar);
- Inner Moray Firth SPA;
- Longman and Castle Stuart Bays SSSI; and
- Moray Firth SAC.

6.2 Chapter 11 (Ecology and Nature Conservation) contains further information about the ecological designations of the Moray Firth, including the impacts arising from the proposed Scheme.

6.3 Loch Flemington is designated as a SPA and located within the Kildrummie Kames SSSI. The loch is designated as a SPA for supporting a breeding population of Slavonian Grebe (*Podiceps auritus*). This is a species of European importance. Kildrummie Kames SSSI is designated for its special glacial landforms and its wetland habitats. The site is also important because it contains an impressive stand of juniper scrub.

## **7 Discharge Consents**

7.1 A number of discharges to surface water have been identified within the study area from information provided by SEPA on 15 January 2016. These are listed below, with their CAR licence numbers:

- CAR/R/1120495: Faylea, Milton of Culloden; sewage treatment works final effluent to SWF 06;
- CAR/L/1026128: Inverness/Culloden Sewerage Network, Thornhill Cottage; combined sewer overflow and emergency overflow to SWF 08;

- CAR/R/1076010: Skenepark Farm Cottage, Skenepark; septic tank effluent to SWF 24;
- CAR/R/1076012: Skenepark Farmhouse, Skenepark; septic tank effluent to SWF 24; and
- CAR/L/1026159: Nairn Sewerage Network, Mill of Boath; combined sewer overflow to SWF 31.

## 8 Water Abstractions

8.1 A small number of surface water abstractions have been identified within the study area. These are listed below, next to their respective CAR licence numbers:

- CAR/L/1004398: three surface water abstractions for Mid Coul Farms, Culblair Farm, from: Loch Flemington; an un-named man made reservoir; an un-named man made pond; SWF 12; SWF 16; and SWF 17 (one abstraction from each);
- CAR/L/1009797: two surface water abstractions for Kildrummie Farm, from: SWF 22; and SWF 23 (one abstraction from each);
- CAR/L/1011124: a single surface water abstraction for Househill Farm, from SWF 26; and
- CAR/S/1010484: a single surface water abstraction for Broombank Farm, from SWF 31.

## 9 Importance

**Table 2: Importance of each Attribute of a SWF**

Water Feature/SWF	Attribute	Indicator of Quality	Importance
SWF 01 Inshes Burn	Hydrology and Flood Risk	Drains a relatively small catchment. Receives water from at least three direct tributaries. Receptors: <ul style="list-style-type: none"> <li>• Retail Park;</li> <li>• existing A96<sup>†</sup>; and</li> <li>• local road network.</li> </ul> Identified by the SEPA flood map to pose a flood risk to residential areas in its upper reaches during a 0.5% AEP event. In its lower reaches (in the immediate vicinity of the existing A96 road crossing) there is limited flood risk to surrounding properties / industry. There are no culverts in close proximity to the proposed Scheme which could pose a flood risk.	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Channel choked with vegetation, extensively realigned with a trapezoidal cross section and reinforced banks. The channel was culverted under several roads.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: urban/residential; agriculture/forestry upstream. Potential additional pollutant sources: road and railway drainage/runoff and diffuse urban/ rural sources.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 02 Scretan Burn	Hydrology and Flood Risk	Drains a small sized catchment. Receives water from at least five direct tributaries. Receptors: <ul style="list-style-type: none"> <li>• Retail Park;</li> <li>• existing A96<sup>†</sup>;</li> <li>• proposed Scheme*<sup>†</sup>; and</li> <li>• farmland.</li> </ul> This SWF flows in close proximity to numerous residential areas and the lower reaches of the SWF may	Very high

Water Feature/SWF	Attribute	Indicator of Quality	Importance
		pose a flood risk to agricultural land, road and railways, and the retail park at Smithton. SWF02 has no associated flood risk in the vicinity of the proposed Scheme due to its existing (SWF02-2) or proposed culvert (SWF02-1).	
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Channel choked with vegetation and extensively realigned. Bed substrate consisting of fine/coarse gravels, some variability in flow types.	Medium
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture and urban/residential. Potential additional pollutant sources: road and railway drainage and diffuse rural/urban sources.	High
	Dilution and removal of waste products	Low/Medium pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 03 Cairnlaw Burn	Hydrology and Flood Risk	Drains a medium sized catchment. Receives water from at least eight direct tributaries. Receptors: <ul style="list-style-type: none"> <li>• &lt;10 residential properties;</li> <li>• existing A96<sup>†</sup>;</li> <li>• proposed Scheme*;</li> <li>• local road network;</li> <li>• Aberdeen to Inverness Railway Line;</li> <li>• farm land; and</li> <li>• potential upstream impacts in Culloden.</li> </ul> SEPA map indicates flood risk to agricultural land, properties, the railway and a road. The SWF and its tributaries also flow in close proximity to numerous residential areas (including a school) in the upper reaches of the catchment. SWF 03 has two existing culverts in the vicinity of the proposed Scheme. The model results indicate the existing A96 is at risk from the surcharging of the existing culverts and flood flows coming out of bank. .	Very high
	Fluvial geomorphology	WFD 'Physical Condition' parameter status: Moderate. Predominantly cobble bed with depositional features. Diversity of flow types. Morphological alterations for mixed farming.	Medium
	Water quality/supply	WFD water quality status: Good (2014). Surrounding land use: agriculture, some urban/residential. Potential additional pollutant sources: road and railway drainage and diffuse rural/urban sources.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: Moderate (2014). Fisheries status: not designated. Presence of fish species of International importance identified in Chapter 11 (Habitats and Biodiversity).	Very high
SWF 04 Tributary of Cairnlaw Burn (1)	Hydrology and Flood Risk	Drains a small sized catchment. Receives water from at least four direct tributaries. Receptors: <ul style="list-style-type: none"> <li>• &lt;10 residential properties;</li> <li>• existing A96<sup>†</sup>;</li> <li>• proposed Scheme*;</li> <li>• local road network;</li> <li>• Aberdeen to Inverness Railway Line;</li> <li>• farm land; and</li> </ul>	Very high

Water Feature/SWF	Attribute	Indicator of Quality	Importance
		<ul style="list-style-type: none"> <li>potential upstream impacts in Culloden.</li> </ul> <p>No SEPA flood map information (catchment less than 3km<sup>2</sup>). The SWF flows through residential areas, across the railway and crosses a number of roads therefore posing a potential flood risk. Baseline modelling results indicate flood flows would remain in bank.</p>	
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Cobble substrate and depositional features including side bars. Rippled flow and vegetated riparian buffer.	Medium
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture, some urban/residential. Potential additional pollutant sources: road and railway drainage and diffuse rural/urban sources.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 05 Tributary of Cairnlaw Burn (2)	Hydrology and Flood Risk	Drains a very small sized catchment. Does not receive flow from any tributaries. Receptors: <ul style="list-style-type: none"> <li>&lt;5 residential properties;</li> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*;</li> <li>Aberdeen to Inverness Railway Line;</li> <li>farm land; and</li> <li>grounds of former hotel.</li> </ul> <p>This SWF is not included in the SEPA Flood Map as its catchment is less than 3km<sup>2</sup>. Potential flood risk to surrounding land / grounds of the former hotel. This watercourse joins SWF03 before reaching the existing A96. Baseline condition flood risk (flow conditions and extents) will be linked to SWF03 and therefore this SWF has been included in the SWF03 hydraulic model. Baseline modelling results indicate flood flows would remain in bank.</p>	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. No distinct channel evident and no channel substrate (i.e. only detritus and earth as per surrounding forest floor) in the downstream section.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: woodland/forestry and agriculture. Potential additional pollutant sources: diffuse rural sources and former hotel.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Good' equivalent assumed. Fisheries status: not designated.	High
SWF 06 Kenneth's Black Well	Hydrology and Flood Risk	Drains a small sized catchment. Receives water from at least three direct tributaries. Receptors: <ul style="list-style-type: none"> <li>10-20 residential properties;</li> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*;</li> <li>local access road;</li> <li>Aberdeen to Inverness Railway Line; and</li> <li>farm land.</li> </ul>	Very high

Water Feature/SWF	Attribute	Indicator of Quality	Importance
		SEPA map indicates flood risk to agricultural land and a number of residential properties. The SWF also runs in close proximity to a school grounds, residential areas and crosses the railway and a number of roads potential resulting in flood risk. SWF 06 has three existing culverts in the vicinity of the proposed Scheme. Baseline modelling indicates flood flows would come out of bank and present risk to the existing A96 and properties nearby. .	
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Extensive channel realignment and culverted under several roads and access tracks. Fragmented riparian zone.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture; urban/residential and forestry upstream. Potential additional pollutant sources: diffuse rural/urban sources and road and railway drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR licence for sewage treatment works final effluent discharge.	Medium
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 07 Drain at Allanfearn	Hydrology and Flood Risk	Drains a very small sized catchment. Does not receive flow from any tributaries. Receptors: <ul style="list-style-type: none"> <li>• &lt;5 residential properties;</li> <li>• existing A96<sup>†</sup>;</li> <li>• proposed Scheme*;</li> <li>• minor access road;</li> <li>• Aberdeen to Inverness Railway Line;</li> <li>• major sewage treatment works; and</li> <li>• farm land.</li> </ul> This SWF is not identified on SEPA flood map as the drain has a catchment area of less than 3km <sup>2</sup> . There is a potential flood risk to a small number of dwellings as well as surround land due to its close proximity to them. SWF 07 has two existing culverts downstream of the proposed Scheme. The existing culverts pose a flood risk to the area of land surrounding the culverts as they have been assessed as going out of bank during the design event.	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Artificial watercourse with no natural channel or bank features (overdeep and trapezoidal cross section). Channel choked with vegetation.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture/urban/residential. Potential additional pollutant sources: diffuse rural sources, road and railway drainage and urban/residential.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 08 Fiddler's Burn	Hydrology and Flood Risk	Drains a small sized catchment. Receives flow from at least three direct tributaries. Receptors: <ul style="list-style-type: none"> <li>• &lt;5 residential properties;</li> <li>• existing A96<sup>†</sup>;</li> </ul>	Very high

Water Feature/SWF	Attribute	Indicator of Quality	Importance
		<ul style="list-style-type: none"> <li>proposed Scheme*; and</li> <li>farm land.</li> </ul> <p>Not identified on SEPA flood map as catchment less than 3km<sup>2</sup>. Potential flood risk to a number of properties as well as a school due to the SWFs close proximity. The burn also crosses a number of roads and two railway lines.</p> <p>SWF08 has one existing culvert downstream of the proposed Scheme. The existing culvert (SWF08-A) poses a flood risk as it has been assessed as going out of bank during the design event.</p>	
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Artificial watercourse with limited natural channel or bank features (overdeep and trapezoidal cross section). Channel choked with vegetation.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture; urban/residential and forestry upstream. Potential additional pollutant sources: diffuse rural sources, road and railway drainage; and urban/residential.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR licence for combined sewer overflow and emergency overflow discharge.	Medium
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 09 Tributary of Rough Burn	Hydrology and Flood Risk	Drains a small sized catchment. Receives flow from at least four direct tributaries. Receptors: <ul style="list-style-type: none"> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*; and</li> <li>farm land.</li> </ul> <p>The SEPA Flood Map (0.5% AEP event outline) indicates potential flood risk to agricultural land, a property as well as a number of roads and the railway. A small number of properties are also in relatively close proximity to the SWF.</p> <p>SWF09 has two existing culverts within the vicinity of the proposed Scheme and one new culvert is proposed to be built as part of the proposed Scheme. The existing culverts (SWF09-A and 09-B) pose a flood risk as both culverts have been assessed as going out of bank during the design event.</p>	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Embanked, straightened watercourse with limited natural channel or bank features (overdeep and trapezoidal cross section). Channel choked with vegetation.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture; forestry upstream. Potential additional pollutant sources: diffuse rural sources and road and railway drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 10 Indirect tributary of Rough Burn (1)	Hydrology and Flood Risk	Drains a very small sized catchment. Does not receive flow from any tributaries. Receptors: <ul style="list-style-type: none"> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*; and</li> </ul>	Very high

Water Feature/SWF	Attribute	Indicator of Quality	Importance
		<ul style="list-style-type: none"> <li>farm land.</li> </ul> <p>This SWF is not identified in the flood extent (0.5% AEP event) on SEPA flood map. This SWF feeds into SWF 12 which is at risk.</p>	
SWF 11 Indirect tributary of Rough Burn (2)	Hydrology and Flood Risk	<p>Drains a very small sized catchment. Does not receive flow from any tributaries.</p> <p>Receptors:</p> <ul style="list-style-type: none"> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*<sup>†</sup>; and</li> <li>farm land.</li> </ul> <p>This SWF is not identified in the flood extent (0.5% AEP event) on SEPA flood map.</p> <p>SWF11 has one existing culvert within the vicinity of the proposed Scheme. The existing culverts (SWF11-A) poses a flood risk to the area of land surrounding the culvert as the culvert has been assessed as going out of bank during the design event. .The watercourse joins SWF09 before reaching the proposed Scheme.</p>	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Embanked, straightened watercourse with limited natural channel or bank features (overdeep and trapezoidal cross section). Channel choked with vegetation.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture and woodland/forestry. Potential additional pollutant sources: diffuse rural sources.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 12 Rough Burn	Hydrology and Flood Risk	<p>Drains a medium sized catchment. Receives flow from at least 12 direct tributaries.</p> <p>Receptors:</p> <ul style="list-style-type: none"> <li>farm;</li> <li>&lt;5 residential properties;</li> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*<sup>†</sup>; and</li> <li>farm land.</li> </ul> <p>Properties and a factory identified at potential risk of flooding predominantly downstream of the proposed Scheme. Dam and sluice upstream of the proposed Scheme could be affected.</p> <p>SWF 12 has two existing culverts (SWF 12-A / 12-B) in the vicinity of the proposed Scheme. Out of bank flows from upstream of the proposed Scheme are modelled to flow across the route.</p>	Very high
	Fluvial geomorphology	WFD 'Physical Condition' parameter status: Good. Bedrock and cobble bed. Natural planform along most of channel, including waterfalls, however modifications present, particularly downstream of existing A96. Choked with vegetation in places.	High
	Water quality/supply	WFD water quality status: Moderate (2014). CAR licence for surface water abstraction for Culblair Farm. Surrounding land use: agriculture; forestry upstream. Potential additional pollutant sources: diffuse rural sources and road and railway drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: Moderate (2014).	Medium

Water Feature/SWF	Attribute	Indicator of Quality	Importance
		Fisheries status: not designated.	
SWF 13 Tributary of 'Unnamed Burn - Castle Stuart to source (Tornagrain)' (1)	Hydrology and Flood Risk	Drains a very small sized catchment. Does not receive flow from any tributaries. Receptors: <ul style="list-style-type: none"> <li>• &lt;5 residential properties;</li> <li>• existing A96<sup>†</sup>;</li> <li>• proposed Scheme*; and</li> <li>• farm land.</li> </ul> Tributary not shown on the SEPA Flood extent outline (0.5% AEP). A property at Kerrowaird is located within 40m of the watercourse and therefore at potential flood risk. SWF 13 has two existing culverts within the vicinity of the proposed Scheme. One of the existing culverts (SWF13-2) poses a flood risk as the watercourse has been assessed as going out of bank during the design event.	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Reprofiled banks. Choked with vegetation. Extensive channel realignment.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture; some woodland/forestry. Potential additional pollutant sources: diffuse rural sources and road and railway drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 14 Unnamed Burn - Castle Stuart to source (Tornagrain)	Hydrology and Flood Risk	Drains a small sized catchment. Receives flow from at least 10 direct tributaries. Receptors: <ul style="list-style-type: none"> <li>• existing A96<sup>†</sup>;</li> <li>• proposed Scheme*; and</li> <li>• farm land.</li> </ul> SEPA flood map (0.5% AEP flood extent outline) indicates flood risk to agricultural land, properties, roads and the railway. There are also a few properties in the middle/upper reaches of the catchment located in close proximity to the SWF and therefore at potential flood risk. SWF 14 has one existing culvert within the vicinity of the proposed Scheme. The existing culvert (SWF14-A) has not been assessed as posing a flood risk as the watercourse was simulated to stay in bank during the design event simulation.	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Intermittent riparian buffer zone. Extensive channel realignment. Reprofiled banks. Embanked channel choked with vegetation.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture; some woodland/forestry upstream. Potential additional pollutant sources: diffuse rural sources and road and railway drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 15	Hydrology and	Drains a very small sized catchment.	Very high

Water Feature/SWF	Attribute	Indicator of Quality	Importance
Tributary of 'Unnamed Burn - Castle Stuart to source (Tornagrain)' (2)	Flood Risk	Does not receive flow from any tributaries. Receptors: <ul style="list-style-type: none"> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*;</li> <li>farm land; and</li> <li>woodland.</li> </ul> <p>Not identified on SEPA flood map flood extent outline for the 0.5% AEP event. Anecdotal evidence indicating flooding at the confluence of SWF 14 and 15 resulting in flooding to woodland/agricultural land.</p> <p>SWF 15 has three existing culverts within the vicinity of the proposed Scheme. One of the existing culverts (SWF 15-A) has been assessed as posing a flood risk as the watercourse is simulated to go out of bank during the design event.</p>	
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Extensive channel realignment. Reprofiled banks. Overdeep channel choked with vegetation.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture; some woodland/forestry. Potential additional pollutant sources: diffuse rural sources and road drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 16 Tributary of Ardersier Burn	Hydrology and Flood Risk	Drains a medium sized catchment. Receives flow from at least 15 direct tributaries. Receptors: <ul style="list-style-type: none"> <li>&lt;5 residential properties;</li> <li>farm;</li> <li>Inverness Airport;</li> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*;</li> <li>local road network; and</li> <li>farm land.</li> </ul> <p>SEPA map indicates flood risk to agricultural land and Inverness Airport.</p> <p>SWF16 has two existing culverts (SWF16-A and SWF16-B) in the vicinity of the proposed Scheme. Baseline modelling confirms the SEPA flood map.</p>	Very high
	Fluvial geomorphology	WFD 'Physical Condition' parameter status upstream section 'Mid Coul to source': Good (2014). WFD 'Physical Condition' parameter status downstream section 'sea to Mid Coul' (HMWB): Bad (2014). Extensive channel realignment. Culverted in several locations, particularly due to runway and airport infrastructure.	Low
	Water quality/supply	WFD water quality status (Mid Coul to source): Good (2014). WFD water quality status (sea to Mid Coul): Moderate (2014). CAR licence identified in SEPA data for surface water abstraction for Culblair Farm. Surrounding land use: agriculture; some forestry towards the top of the catchment; Inverness Airport in the lower catchment. Potential additional pollutant sources: diffuse rural sources, aircraft fuel and associated pollutants, road and railway drainage and historic contaminants from disused railway.	High

Water Feature/SWF	Attribute	Indicator of Quality	Importance
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status (Mid Coul to source): Good (2014). WFD overall ecological potential (sea to Mid Coul): Bad (2014). Fisheries status: not designated.	High
SWF 17 Drains at Culblair	Hydrology and Flood Risk	Drains a very small sized catchment. Receives flow from at least two direct tributaries. Receptors: <ul style="list-style-type: none"> <li>&lt;10 residential properties;</li> <li>farm;</li> <li>proposed Scheme*;</li> <li>Aberdeen to Inverness Railway Line; and</li> <li>farm land.</li> </ul> SWF 17 is not identified on the SEPA flood map. SWF 17 feeds into SWF 16 which is identified as being at risk. SWF17 has one existing culvert (SWF17-A) within the vicinity of the proposed Scheme. The existing culvert has been assessed as posing a flood risk as the watercourse was simulated to go out of bank during the design event simulations. Culvert SWF17-A also goes underneath the railway line and therefore there is a potential flood risk to the railway line from this watercourse.	High
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Realigned channel with limited riparian buffer zone. Artificial drain – no natural channel or bank features.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. CAR licence identified in SEPA data for surface water abstraction for Culblair Farm. Surrounding land use: agriculture and Inverness Airport. Potential additional pollutant sources: diffuse rural sources, aircraft fuel and associated pollutants.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 18 Indirect tributary drains of Ardersier Burn	Hydrology and Flood Risk	Drains a small sized catchment. Receives flow from at least five direct tributaries. Receptors: <ul style="list-style-type: none"> <li>&lt;5 residential properties;</li> <li>two farms;</li> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*;</li> <li>farm land.</li> </ul> SEPA Flood map indicates flood risk to agricultural land from SWF18. Existing culvert SWF18-A has been assessed as posing a flood risk as the watercourse was simulated to go out of bank during the design event simulation. There are also houses located in close proximity to this culvert which are potentially at risk of flooding.	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Limited riparian buffer zone. Reprofiled banks, overdeep channel with hard bank reinforcement in places. Extensive channel realignment. Channel choked with vegetation.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed.	High

Water Feature/SWF	Attribute	Indicator of Quality	Importance
		Surrounding land use: agriculture/forestry and Inverness Airport. Potential additional pollutant sources: diffuse rural sources, aircraft fuel and associated pollutants, and road and railway drainage.	
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 19 Balnagowan Burn	Hydrology and Flood Risk	Drains a small sized catchment. Receives flow from at least 10 direct tributaries. Receptors: <ul style="list-style-type: none"> <li>existing A96<sup>†</sup>;</li> <li>proposed Scheme*<sup>†</sup>; and</li> <li>farm land.</li> </ul> SEPA Flood map indicates flood risk to agricultural land. SWF19 has two existing culverts within the vicinity of the proposed Scheme. Existing culverts SWF19-A and 19-B have been assessed as posing a flood risk as the watercourses were simulated to go out of bank during the design event simulation. The SWF 19-A culvert crosses underneath the existing A96. The other existing culvert SWF19-B crosses the railway line and is located upstream of the proposed Scheme. Given the culverts have been simulated to go out of bank they poses a direct flood risk to the existing A96 and to the railway line.	Very high
	Fluvial geomorphology	WFD 'Physical Condition' parameter status: Bad. Limited riparian buffer zone. Extensive channel realignment.	Low
	Water quality/supply	WFD water quality status: Moderate (2014). Surrounding land use: agriculture. Potential additional pollutant sources: diffuse rural sources and road and railway drainage.	Medium
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: Bad (2014). Fisheries status: not designated.	Low
SWF 21 Field ditch tributaries of Balnagowan Burn	Hydrology and Flood Risk	Drains a very small sized catchment. Does not receive flow from any tributaries. Receptors: <ul style="list-style-type: none"> <li>Aberdeen to Inverness Railway Line;</li> <li>proposed Scheme*<sup>†</sup>; and</li> <li>farm land.</li> </ul> SWF21 is not identified on the SEPA flood map. SWF21 is located upstream of the proposed Scheme and is not crossed by it.	High
	Fluvial geomorphology	WFD morphology parameter status: not classified. Artificial watercourse through forestry. Channel choked with vegetation.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: woodland/forestry and agriculture. Potential additional pollutant sources: diffuse rural sources and road and railway drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium

Water Feature/SWF	Attribute	Indicator of Quality	Importance
SWF 22 Alton Burn	Hydrology and Flood Risk	Drains a small sized catchment. Receives flow from at least one direct tributary. Receptors: <ul style="list-style-type: none"> <li>&lt;10 residential properties;</li> <li>Aberdeen to Inverness Railway Line;</li> <li>proposed Scheme*; and</li> <li>farm land.</li> </ul> Flood risk to numerous properties in Nairn and agricultural land. SEPA flood map indicates active flood plain with the potential to affect properties. SWF22 has one existing culvert within the vicinity of the proposed Scheme. The existing culvert (SWF22-A) has been assessed as posing a flood risk as the watercourse is simulated to go out of bank during the design event simulation. The culvert crosses a minor road and therefore may pose flood risk to the road.	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Limited riparian buffer zone. Extensive channel realignment. Overdeep and overwide channel which is choked with vegetation.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. CAR licence identified in SEPA data for surface water abstraction for Kildrummie Farm. Surrounding land use: agriculture, rural grassland; some urban/residential downstream. Potential additional pollutant sources: diffuse rural sources and road and railway drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 23 River Nairn	Hydrology and Flood Risk	Drains a large sized catchment. Receives flow from numerous direct tributaries. Receptors: <ul style="list-style-type: none"> <li>approximately 40 domestic properties within 2km of proposed bridge;</li> <li>farm buildings;</li> <li>proposed Scheme*;</li> <li>farm land; and</li> <li>ecologically designated watercourse.</li> </ul> The SEPA Flood Map indicates flood risk to agricultural land and properties from SWF 23. Baseline modelling confirms the SEPA flood map.	Very high
	Fluvial geomorphology	WFD 'Physical Condition' parameter status for River Nairn – Moray Firth to River Farnack confluence: Good. Natural planform with few modifications. Dynamic geomorphology, varied flow types and in-channel habitats. Continuous riparian buffer zone.	Very high
	Water quality/supply	WFD water quality status: High (2014). CAR licence identified in SEPA data for surface water abstraction for Kildrummie Farm. Surrounding land use: agriculture; some woodland/forestry; urban/residential downstream (Nairn). Potential additional pollutant sources: diffuse rural/urban sources and road and railway drainage.	Very high
	Dilution and removal of waste products	Medium pollutant dilution/dispersal capacity. CAR discharges: none.	Medium
	Biodiversity	WFD overall ecological status: Moderate (2014). Protected Area for Freshwater Fish under WFD.	Very high
SWF 24 Tributary of the	Hydrology and Flood Risk	Drains a very small sized catchment. Receives flow from at least one direct tributary.	Very high

Water Feature/SWF	Attribute	Indicator of Quality	Importance
River Nairn		<p>Receptors:</p> <ul style="list-style-type: none"> <li>• woodland;</li> <li>• farm land;</li> <li>• proposed Scheme*; and</li> <li>• ecologically designated watercourse.</li> </ul> <p>The SEPA Flood Map indicates flood risk to agricultural land from SWF24.</p>	
	Fluvial geomorphology	<p>WFD hydromorphology parameter status: not classified. Extensive channel realignment. Lack of riparian zone in places. Modifications such as embankment and culverts present. Channel choked with vegetation.</p>	Low
	Water quality/supply	<p>Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture; woodland/forestry upstream. Potential additional pollutant sources: diffuse rural/urban sources and road drainage.</p>	High
	Dilution and removal of waste products	<p>Low pollutant dilution/dispersal capacity. Two CAR licences for septic tank effluent discharge.</p>	Medium
	Biodiversity	<p>WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Protected Area for Freshwater Fish under WFD (associated water body of the River Nairn).</p>	Very high
SWF 26 Auldearn Burn	Hydrology and Flood Risk	<p>Drains a medium sized catchment. Receives flow from at least 14 direct tributaries. Receptors:</p> <ul style="list-style-type: none"> <li>• approximately 20 residential properties;</li> <li>• proposed Scheme*;</li> <li>• local road network;</li> <li>• Auldearn sewerage treatment works;</li> <li>• farm land; and</li> <li>• ecologically designated watercourse.</li> </ul> <p>The SEPA Flood Map indicates flood risk to agricultural land and residential properties from SWF 26. SWF 26 has five existing culverts (SWF26-A to D) within close proximity to the proposed Scheme. Baseline modelling shows more limited flood extents than the SEPA flood map but out of bank flows are present in the vicinity of the proposed Scheme.</p>	Very high
	Fluvial geomorphology	<p>WFD hydromorphology parameter status: Moderate. Some morphological diversity and varied flow typed. Gravel and cobble substrate. Limited riparian buffer zone. Channel choked with vegetation in places.</p>	Medium
	Water quality/supply	<p>WFD water quality status: Moderate (2014). CAR licence identified in SEPA data for surface water abstraction for Househill Farm. Surrounding land use: agriculture; some grassland/woodland. Potential additional pollutant sources: diffuse rural/urban sources and road drainage.</p>	High
	Dilution and removal of waste products	<p>Medium pollutant dilution/dispersal capacity. CAR discharges: none.</p>	Medium
	Biodiversity	<p>WFD overall ecological status: Moderate (2014). Protected Area for Freshwater Fish under WFD (associated water body of the River Nairn).</p>	Very high
SWF 31 Auldearn Burn - Brightmony Tributary	Hydrology and Flood Risk	<p>Drains a small sized catchment. Receives flow from at least five direct tributaries. Receptors:</p> <ul style="list-style-type: none"> <li>• &lt;5 residential properties;</li> <li>• existing A96<sup>†</sup>;</li> </ul>	Very high

Water Feature/SWF	Attribute	Indicator of Quality	Importance
		<ul style="list-style-type: none"> <li>proposed Scheme*; and</li> <li>farm land.</li> </ul> <p>The SEPA Flood map indicates flood risk to agricultural land and some downstream properties.  SWF31 is located to the South of the proposed Scheme.  SWF31 has been included in the SWF26 model as it is a tributary of SWF26.</p>	
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Embanked, realigned watercourse with straight planform and overdeep cross-section. Limited riparian buffer zone.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. CAR licence identified in SEPA data for surface water abstraction for Broombank Farm. Surrounding land use: agriculture and woodland/forestry. Potential additional pollutant sources: diffuse rural sources and road drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR licence identified in SEPA data for combined sewer overflow discharge.	Medium
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 33 Drain at Penick Farm	Hydrology and Flood Risk	Drains a very small sized catchment. Does not receives flow from any tributaries. Receptors: <ul style="list-style-type: none"> <li>&lt;5 residential properties;</li> <li>existing A96†;</li> <li>local road network; and</li> <li>farm land.</li> </ul> SWF 33 is not identified on the SEPA flood map. SWF 33 is a ditch located North of the proposed Scheme. Culvert flood risk assessment is not required for this watercourse.	Very high
	Fluvial geomorphology	WFD hydromorphology parameter status: not classified. Straightened watercourse with limited riparian buffer zone.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture. Potential additional pollutant sources: diffuse rural sources and road drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 34 Tributary of Auldearn Burn (4)	Hydrology and Flood Risk	Drains a small sized catchment. Receives flow from at least one direct tributary. Receptors: <ul style="list-style-type: none"> <li>&lt;5 residential properties</li> <li>existing A96†</li> <li>proposed Scheme*</li> <li>farm land</li> </ul> The SEPA Flood map indicates flood risk to agricultural land from this SWF. SWF34 has one existing culvert (SWF34-1) within close proximity to the proposed Scheme. .	Very high
	Fluvial geomorphology	WFD morphology parameter status: not classified. Extensive channel realignment. Channel choked with vegetation in places.	Low

Water Feature/SWF	Attribute	Indicator of Quality	Importance
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture; some grassland/woodland. Potential additional pollutant sources: diffuse rural sources and road drainage.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
SWF 35 Drain, tributary of Auldearn Burn - Brightmony Tributary	Hydrology and Flood Risk	Drains a very small catchment. Does not receive flow from any tributaries. Receptors: farm land. SWF 35 is located to the south of the proposed Scheme. Culvert flood risk assessment is not required for this watercourse.	Low
	Fluvial geomorphology	WFD morphology parameter status: not classified. Small, realigned channel with scattered tree lining.	Low
	Water quality/supply	Not classified under WFD. 'Good' water quality assumed. Surrounding land use: agriculture and woodland/forestry. Potential additional pollutant sources: diffuse rural sources.	High
	Dilution and removal of waste products	Low pollutant dilution/dispersal capacity. CAR discharges: none.	Low
	Biodiversity	WFD overall ecological status: not classified. 'Moderate' equivalent assumed. Fisheries status: not designated.	Medium
Loch Flemington	Hydrology and Flood Risk	Shallow loch. It is believed to be a naturally controlled loch with a complex outflow system with significant surface groundwater interactions. Receptors: <ul style="list-style-type: none"> <li>• approximately 20 residential properties;</li> <li>• local road network;</li> <li>• farm land; and</li> <li>• ecologically designated water body.</li> </ul>	Very high
Ponds	Biodiversity	Chapter 11 (Ecology and Nature Conservation) identifies the pond habitats as being of less than authority level importance.	Low
<p>† The existing A96 influences water feature flood risk sensitivity due to its current importance as part of the national trunk road network. Post-development, once replaced by the new alignment as a trunk road, the existing road will be reduced to local or regional importance.</p> <p>* It is acknowledged that the proposed Scheme will be designed such that dual carriageway alignment levels are higher and above the 0.5% AEP (200-year) flow water level. Therefore the presence of the proposed Scheme has not been counted in assigning a sensitivity rating for each watercourse to flood risk.</p>			