Kyleakin Fish Feed Factory

Marine Harvest

Environmental Impact Assessment - Volume 2 of 4: Main Report

Chapter 9: Hydrology and Flood Risk Assessment (FRA) Tables

Final

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Contents

9. Hydrology and Flood Risk Assessment Tables

The following tables present the results of an assessment of impacts to the water environment from the proposed Marine Harvest site at Kyleakin. The assessment has adopted the principles of the environmental assessment methods presented in the *Design Manual for Roads and Bridges Volume 11 Section 3, Part 10 Environmental Assessment* (HD45/09), which consider firstly the sensitivity of the different attributes of the water environment such as hydrology and flood risk, water quality, biodiversity etc. The second phase of the assessment considers the nature and magnitude of any potential impacts on each of these attributes and the final assessment brings these two together via an impact matrix, which identifies the significance of any impact. Where there is an impact of Moderate or Large Significance then additional mitigation measures are considered and identified. The assessment made is based on the current design of the Proposed Development, including embedded design features intended to avoid environmental impacts. These include the location and scale of the proposed buildings, changes to ground levels, provision of a surface water drainage system within the site and the diversion of the Allt Anavig to avoid and manage flood risk impacts. It also assumes application of best-practice construction methods, as described within *CIRIA C532 Control of Pollution from Construction Sites*, as well as SEPA's Pollution Prevention Guidance (PPG) documents. Additional mitigation measures identified are therefore in addition to these embedded design features.

Since submission of the original Environmental Statement Chapter 9 (under planning reference 16/03869/FUL) an updated Flood Risk Assessment (FRA) and a Hydrogeomorphological Assessment have been undertaken (see **Section 9.5**). The full details of the FRA and Hydrogeomorphological Assessment are included in **Appendix 9.1** and **9.2**.

9.1 Baseline Sensitivity

Water Feature	Attribute	Description	Sensitivity
Allt Anavig Catchment is approx. 5.5km^2 at the inlet to the culvert	Hydrology and Flood Risk	Allt Anavig crosses straight through the proposed site, via a 2m diameter culvert discharging directly to the coast. Fluvial risk is thought to be a problem due to the culvert. Culvert has a maximum capacity of 13.9m^3/s so would pass flows from approximately a 1 in 10 year event but not in more extreme events. Estimated 1 in 200 year flows are approximately 30.1m^3/s. Reservoir flooding is a low possibility due to the reservoir present, inundation is a small but potentially significant risk as the consequences could be severe. Surface water flood risk is limited, some minor pockets of flooding in some existing depressions within the site.	High
	Fluvial Geomorphology	Allt Anavig has been modified to include a culvert of approx. 185m in length within the site, with a projecting and raised outlet at the coast. Approximately 90m upstream is a man-made reservoir and a further 115m upstream is a 92m culvert beneath the A87. The channel is therefore heavily modified and impacted by culverts and features that will influence the natural geomorphological processes. The channel is steep and the predicted flows are high, therefore, despite the watercourse it is expected to be a relatively high power environment.	Medium
	Water quality / supply	SEPA water quality status: Not classified, though assumed to be Good, as per adjacent classified water bodies. Flow appears to be continuous, receives runoff from Beinne na Greine and Sgùrr na Coinnich via the Allt na Pairce-fraoich and Allt Lochain na Saile. Allt Anavig flows into the reservoir on the site and then into the culvert before discharging to the coast. Existing pressures: None identified. Potential pollutant sources: • Point source pollutants from road drainage (A87 within 100m of the site which cross the Allt Anavig). Contaminated land sites within close proximity: • A87 potential contaminants associated with road traffic, otherwise there is only extensive forestry upstream.	High
	Dilution and removal of waste products	Small watercourse so likely to have limited dilution capacity. A87 crosses the Allt Anavig so likely to be traffic discharge.	High

Water Feature	Attribute	Description	Sensitivity
	Biodiversity	SEPA ecological status: Not classified No designations.	Low
Groundwater	Water quality	SEPA water quality and water flows/levels status: Good (currently) and expected to remain so for the long term. • Groundwater across the entirety of the Isle of Skye is protected for drinking water abstraction.	High
	Flood Risk	Groundwater flooding is not expected to have significant impacts on the site. Groundwater emergence is not expected given elevation of site and proximity to coast, however, any emergence would result in similar extent / mechanisms as surface water.	Low

9.2 Impact Magnitude

Phase	Attribute	Description	Impact Magnitude
Construction	Hydrology and Flood Risk	Temporary disturbance and changes to channel dimensions during construction of channel diversion which may impact on the hydraulic flow characteristics of Allt Anavig	Minor adverse
	Fluvial Geomorphology	Alterations to channel morphology, flow patterns and sediment dynamics during the construction of the channel realignment. Sediment release during in-channel works, site clearance operations and earthworks in the vicinity of Allt Anavig and the reservoir. This could result in reduced morphological diversity due to smothering of the channel bed by sediment, an increase in turbidity and impact on active features such as gravel deposits. Reduced bank stability during the construction of the channel diversions / realignments or other works requiring vegetation clearance of the banks of the water features. This could result in increased bank erosion and associated sediment release. Disturbance of existing channel bed forms and morphological features.	Minor adverse
	Water Quality	An increase in suspended sediment from construction due to soil-stripping, compound preparation, soil storage and other earthworks due to loosening and erosion of sediment and creation of dust, debris and rubble which could form silt-laden runoff and migrate to down gradient water features. This could also result in smothering of substrates / habitats, remaining in situ for a long period before they are degraded, dispersed or disturbed. An increase in alkalinity or poor management from spillages of concrete or cement. A decline in water quality in the watercourse and downstream at the Inner Sound due to accidental release of oils, fuels and chemicals from mobile or stationary plant. Sewage inputs from accidental / uncontrolled release from sewers through or unsatisfactory disposal of sewage from site welfare facilities. Inputs of contaminants from disturbance of potentially contaminated land with potential drainage pathways to Allt Anavig.	Minor adverse
Operation	Hydrology and Flood Risk	Introduction of new impermeable areas within the surface water catchment could potentially increase the volume and peak flow of Allt Anavig and could therefore contribute to a minor increase in flow flood risk. Direct discharge to coast via Allt Anavig.	Negligible
		Channel diversion removes flood risk from Allt Anavig for events up to the 1 in 200 year (plus climate change) and significantly reduces residual risks from reservoir flooding within the site.	Moderate Beneficial

Phase	Attribute	Description	Impact Magnitude
	Fluvial Geomorphology	Alterations to channel morphology, flow and sediment dynamics upstream and downstream, including impacts to longitudinal and latitudinal connectivity, caused by diversion. Alteration to flow patterns could result in changes to erosional and depositional processes. This would occur locally around structures and with potential for additional impacts upstream and / or downstream.	Moderate adverse
	Water Quality	Site drainage system introduces a mechanism to capture pollutants that may reach surface water features and the Inner Sound through discharges of runoff from the proposed scheme or from accidental spillages via outfalls or other surface water pathways. Introduction of new roads and increased amount of traffic associated with the plants functioning may result in increased point and diffuse pollution.	Minor adverse

9.3 Summary of Water Environment Impacts

A summary of potential impacts during *construction* is presented in the table below.

Water Feature	Attribute	Sensitivity	Magnitude of Impact	Significance of Impact	Mitigation
Allt Anavig	Hydrology and Flood Risk	High	Minor adverse	Slight adverse	Management of flood risk during construction.
	Fluvial Geomorphology	Medium	Minor adverse	Slight adverse	Use of best-practice measures for working within a watercourse and managed through CAR licencing.
	Water quality / supply	High	Minor adverse	Slight adverse	Use of best-practice construction methods for working near water.
	Dilution and removal of waste products	High	Negligible	Neutral	None
	Biodiversity	Low	Minor adverse	Neutral	None
Groundwater	Water quality	High	Negligible	Neutral	None
	Flood Risk	Low	Negligible	Neutral	None

A summary of potential impacts during *operation* is presented in the table below.

Water Feature	Attribute	Sensitivity	Magnitude of Impact	Significance of Impact	Mitigation
Allt Anavig	Hydrology and Flood Risk	High	Moderate beneficial	Moderate beneficial	Measures to manage residual risks.
	Fluvial Geomorphology	Medium	Moderate adverse	Moderate adverse	Measures to reduce and manage risk of erosion and scour along realigned watercourse.
	Water quality/supply	High	Minor adverse	Slight adverse	Oil interceptors incorporated into drainage system and spillage control mechanism
	Dilution and removal of waste products	High	Negligible	Neutral	None
	Biodiversity	Low	Minor adverse	Neutral	None
Groundwater	Water quality	High	Negligible	Neutral	None
	Flood Risk	Low	Negligible	Neutral	None

9.4 Specific Impacts and Mitigation

During construction it is assessed that there are impacts of Slight significance to flood risk, fluvial geomorphology and water quality as a result of the need to construct a diversion to the Allt Anavig, which will require working near to and within the watercourse. The risk is related to the proximity of the works to the watercourse and the risk of pollution and impacts on conveyance and geomorphological processes. Best-practice construction methods will be adopted and the works will be undertaken under appropriate licencing and with appropriate flood warning systems in place to ensure no risk to contractors or visitors to the site.

During operation it is assessed that there are impacts of Moderate significance to flood risk and fluvial geomorphology. From a flood risk perspective the diversion of the watercourse provides an opportunity to manage out the existing flood risk from the Allt Anavig, and this is achieved by the appropriate sizing of the channel. This also has a significant effect on the residual risk of reservoir failure, resulting in an overall Moderate Beneficial impact on flood risk.

The increased capacity of the channel, its steepness and the creation of a significant bend in the channel introduces areas in which there may be a concentration of stream power and subsequently scour, which is the source of the Moderate Adverse magnitude impact and the Moderate Adverse impact significance. Additional measures are recommended to appropriately manage the risk of erosion in this location, and to manage the velocity of flow within the channel and around structures in general to ensure the sustainability of the diversion over the lifetime of the development.

9.5 Updated Flood Risk Assessment and Hydrogeomorphological Assessment

9.5.1 Flood Risk Assessment (FRA)

A flood risk assessment (see **Appendix 9.1**) was carried out in accordance with SEPA's Technical flood risk guidance for stakeholders (**Ref 9-1**) as required by SEPA. A range of sources was considered: coastal, fluvial, reservoirs, pluvial and groundwater. The work included hydraulic modelling of the Allt Anavig watercourse and a review of extreme sea levels, existing flood risk mapping and ground investigation data. The risk of fluvial flooding is high due to restricted flow capacity of the Allt Anavig culvert; the proposed reservoir overflow and diversion channel will provide additional capacity. There is a residual risk of culverts blockage, and hydraulic modelling has shown that 10% blockage could lead to external flooding whilst 50% blockage could lead to internal flooding, with impacts on access and egress from the site. The risk of blockage could be reduced either by installing coarse inlet screens to prevent large debris from entering the culvert or debris management within the reservoir and its catchment. Accesses should be raised slightly to provide safe access and egress in the event of blockage and flooding. There is a moderate risk of reservoir breach or overtopping. This could be reduced through routine inspection and maintenance to ensure that the reservoir remains sound. Due to the short response time for occupants downstream if the dam were to fail, emergency response procedures should be developed, supported by reservoir water level monitoring and alarms triggered by rapid or significant water level change.

Coastal flooding is low risk as the proposed floor and ground levels are above extreme sea level. There is a slight risk of flows backing up upstream of the Allt Anavig culvert if extreme sea levels are combined with high river flows.

Pluvial flooding is low risk, although surface water drainage should be installed to capture runoff and direct it to a watercourse or the lagoon. Groundwater flooding is also low risk; it has been assumed that any groundwater reaching the surface will follow pluvial flow paths. Canals and artificial drainage systems were not seen to pose a risk.

9.5.2 Hydrogeomorphological Assessment

A hydrogeomorphological assessment of Allt Anavig was also undertaken (see **Appendix 9.2**), in line with SEPA, 2012 Supporting Guidance (WAT-SG-21) Environmental Standards for River Morphology, to meet the requirements of planning conditions specified by SEPA.

The assessment included consideration of the potential impacts on the existing non-culverted reaches within the site, as well as the risks and opportunities associated with the proposed work with respect to sediment erosion, transportation and deposition.

A short section (approximately 90 m) of semi-natural channel would be depleted of flow under normal conditions, but utilised as an overspill channel for additional flow under flood conditions (for events with a return period between 1 in 50 years and 1 in 200 years). Under non-flood conditions, flow would be diverted through a new alignment, via a small lagoon to a new marine discharge location.

The new channel would consist of an initial length of enclosed/open culvert to the lagoon, with a naturalised channel downstream of the lagoon. The lower reach would pass through a short length of box culvert beneath an access road before extending to the marine environment. Each section would have a low risk of erosion, mitigated through engineered design features within the upstream section, with more naturalised solutions within the lower reach, including the use of coarse substrate, rock revetment, step pool cascade and boulder baffles. Sediment transport would be facilitated, especially within the naturalised lower section, by the addition of a V-cut low flow channel.

The lower, semi-naturalised reach would include connectivity with the marine environment, providing access to a new extent of inter-tidal habitat for marine species within the adjacent Marine Protected Area.

9.6 References

Ref. 9-1 Scottish Environmental Protection Agency, *Technical flood risk guidance for stakeholders* (Ref. SS-NFR-P-002, SEPA, 2015)