Technical Report – Surface Water

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Contents

1. Introduction – the transboundary submissions

1.1 On 23rd April 2025, Loughs Agency (LA) submitted a 'Transboundary Consultation TB25.01: Curraghinalt Project'. ("the LA Transboundary Submission")

1.2 This Transboundary Response provides geomorphological, hydrological and hydraulic information to address comments made in the LA Transboundary Submission, considering points specifically related to the small watercourses close to the Curraghinalt Project.

1.3 The LA Transboundary Submission raises a number of points related to the small watercourses and the asserted impact of the mine on stream flows, sediment movement and channel hydraulics, and how these processes impact fish habitat. The watercourses in question are: Pollanroe Burn, Unnamed Watercourse, Curraghinalt Burn, Attagh Burn and Glenealy Burn. The LA Transboundary Submission asserts that changes to these burns have the potential to have downstream impacts that will affect the Owenkillew SAC and rivers in the Republic of Ireland.

1.4 Whilst the impacts on these watercourses were discussed in detail in the project Surface Water Impact Assessment (Second Addendum to the ES, Appendix C4) but given the specific nature of the points raised by the LA Transboundary Submission, we have undertaken some additional analyses to address their concerns. For context to assist the reader, we summarise the conclusions of the SWIA in Section 2. The rest of this Transboundary Response outlines our recent analyses and provides direct responses to the points raised by LA. The aim is to show that any impacts of the mine on stream flows will have no significant effect on the burns and downstream rivers, consistent with the conclusions in the SWIA.

1.5 We would note that LA did not make specific points related to the changes in flows in the Owenreagh and Owenkillew Rivers (and downstream). LA suggest that changes in flow in the small burns will impact salmon in a manner that will impact salmon populations in the rivers, but do not highlight any impacts on flows in the rivers. As a result, these rivers are not considered further in this report. The impacts of the mine on flows in these rivers are negligible and our reading of the lack of reference to flow in these watercourses by the LA means that LA also have this opinion. We would note that further information on the impact of the mine on water quality and flows in the River Foyle is provided in the shadow Habitats Assessment (sHRA) and Annex 13 of sHRA submitted with Bennu Environmental's Transboundary Response ('SLR Report')

2. Data Sets and Analysis

Key Data Sets

2.1 The report is based on (i) information provided in the SWIA and recent survey data collected on site in summer 2025. In addition to this report there are further additional reports which provide more information on fish, fish habitat, Fresh Water Pearl Mussels and the morphology of the burns. These reports are;

2.1.1 Fish Survey Results – Annexes 2 and 3 of sHRA submitted with Bennu Environmental's Transboundary Response ('Fish Survey Report')

2.1.2 Burn Fish Habitat Report – Annex 5 of sHRA submitted with Bennu Environmental's Transboundary Response ('Fish Habitat Report')

2.1.3 Dr Peter Cosgrove report – Annex 16 of sHRA submitted with Bennu Environmental's Transboundary Response ('Cosgrove Report')

2.1.4 SLR Hydro-morphology report – Annex 4 of sHRA submitted with Bennu Environmental's Transboundary Response ('SLR Report')

2.2 The SWIA describes the impact of the project on flows in the watercourses adjacent to the Curraghinalt mine and these impacts are summarized below.

2.3 The recent survey data considered in this report includes;

2.3.1 LiDAR and aerial photographic data collected by Six West survey contractors (Six West - Home). Data is presented in relevant sections of this report.

2.3.2 Channel cross-sections measured by land survey by Six West for each watercourse taken at accessible locations on the burns. Data is presented in relevant sections of this report.

2.3.3 Photographs and observations undertaken by Dr [redacted] on 31st July 2025, under low flow conditions. Data is presented in relevant sections of this report.

Summary of Impacts of Mine on Stream flows from SWIA

2.4 The impacts of the mine on stream flows were discussed in detail in the SWIA and then outlined in our October 2024 Statement of Case. The key points are summarized again below in brief.

2.5 For the Pollanroe Burn average and low flows will be increased over baseline conditions due to the diversion of a small part of the Unnamed Watercourse (5%) to the Pollanroe Burn and due to pumping of groundwater from the underground mine. Average flow rates are predicted to be around 15L/s above baseline conditions. Flood flows will be reduced with runoff within the mine site retained within water management ponds.

2.6 For the Unnamed Watercourse flows will be slightly reduced with 5% of the catchment diverted to the Pollanroe Burn.

2.7 For the Curraghinalt Burn there will be a slight reduction in flows mainly due to cessation of flow from the old adit with mine water pumped to the Pollanroe catchment, with a slight reduction in flow due to the lowering of the local groundwater table.

2.8 For the Attagh and Glenealy Burns flows are also slightly reduced due to the lowering of the local groundwater table.

2.9 Table 2-1 summarises the key changes in flow for each watercourse.

Purpose of Additional Data

2.10 The SWIA provided a detailed assessment of the impact of the mine on stream flows. It also assessed the impact of changes of stream flows on water depths, stream velocities and wetted channel areas at flow monitoring locations where channel cross-sections were available. The impacts were not considered significant, so additional data was not considered required at that time. However, following consultation responses and specific questions on flows, depths and velocities in the small burns additional data has been obtained to allow further analyses to be undertaken at more locations in the burns. In addition, LA have questioned the sensitivity of the small burns and the quality of fish habitat in the burns. Therefore, additional information has been obtained that provides more insight into the nature of the burns which can be used in this report, used by fish specialists and correlated to hydro-morphological work undertaken in the SLR Report.

2.11 Additional channel cross-section data allows calculations of the effect of the mine on water depths, velocities and wetted areas at more and different locations than considered in the SWIA.

2.12 The drone survey data provides additional topographical and visual information on sections of the burns which were not accessible on foot. This information provides insights into the channel form, their geomorphology, nature of the channel habitats and any man-made impacts on the streams.

2.13 A walkover survey was undertaken during low flow conditions to provide photographic evidence of the channel under these conditions as these are key flow conditions for the consideration of fish habitat. The end of July 2025 followed a period with no rain and flows in the burns were considered as representative of Q_{85-90}, which is close to the Q_{95} condition assessed in the SWIA, see Figure 2-1. Due to the timing of previous visits, we had not been able to photograph the streams under such low flow conditions. This information shows the nature of the channel under low flow conditions and provides hydrologists, geomorphologist and fish specialists field data to illustrate these important flow conditions.

Details of Analyses Undertaken Using LiDAR and Land Survey

2.14 LiDAR is an airborne laser (Light Detection and Ranging) that 'scans' the ground producing a detailed topographical grid. LiDAR will pick up trees and other man-made objects but well-developed processing methods allows the removal of these points to leave behind ground level data. For this project the LiDAR data was collected using a drone by Six West. At the same time as LiDAR data was collected aerial photographs were taken over the same area, providing high resolution images which are particularly useful for sections of these watercourses where walking access was not available.

2.15 In locations where there was ground access channel cross-sections were taken (5 per watercourse) using standard land survey equipment. These sections were taken to (i) allow comparison and testing of LiDAR data and to provide more detail of the channel form (to avoid constraints due to LiDAR data).

2.16 The cross-sections were used to build HECRAS river models of reaches of each of the watercourses. HECRAS is widely used river modelling software package (HEC-RAS) that can use cross-section data to convert flows into predicted water levels, water depth and a range of other hydraulic parameters (e.g., velocity, flow area)

Photographs and Observations from 31st July 2025 site visit

2.17 [redacted] of Kaya Consulting Limited undertook a walkover site visit for selected small watercourses on 31st July 2025. The purpose of the site visit was to visit the small burns during a period of low flows. Summer 2025 was dry and the site visit was preceded by weeks of mainly dry weather. Figure 2-1 indicates that, based on public data from DfI Rivers, that the flows on 31st July were likely indicative of a 85-90%ile low flow, i.e., flows that would be expected to be exceeded for 85-90% of the year. Therefore, the conditions visible on the site were indicative of drier than average conditions, but they were not so dry to be representative of the 95%ile low flow, which is the low flow condition considered in the SWIA and typically used as a common flow statistic for very low flow conditions.

2.18 In summary, where the LA comments refer to 95%ile low flow conditions and fish habitat, the flows in the burns would be even less than were visible on the 31st July 2025 field trip and shown on those figures.

Table 2-1: Summary of Small Burns and Impact of Mine on Flows

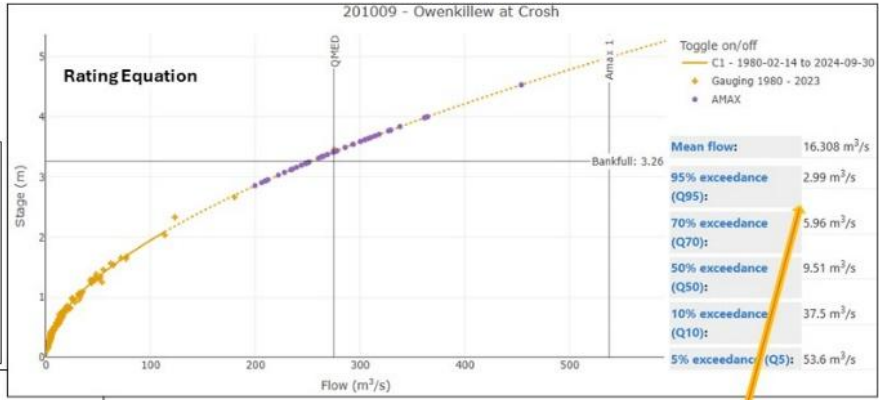
Watercourse	Catchment Area (km^2)	Baseline Annual Average Flow (L/s)	Impact of Mine under Average Flows (L/s)
Pollanroe Burn at its mouth	2	58	+15
Unnamed Watercourse at its mouth	1.4	40	-1.98
Curraghinalt Burn at its mouth	1	28	-1.85
Attagh Burn at its mouth	0.6	17	-0.94
Glenealy Burn at its mouth	1.1	31	-0.66

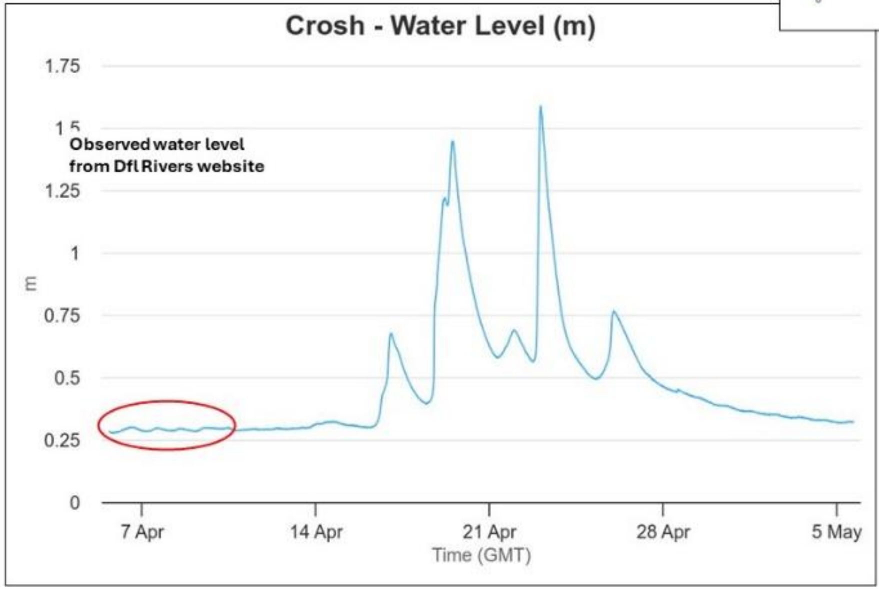
Figure 2-1: Details of stream flow conditions during 31st July 2025 site visit

Rating Equations

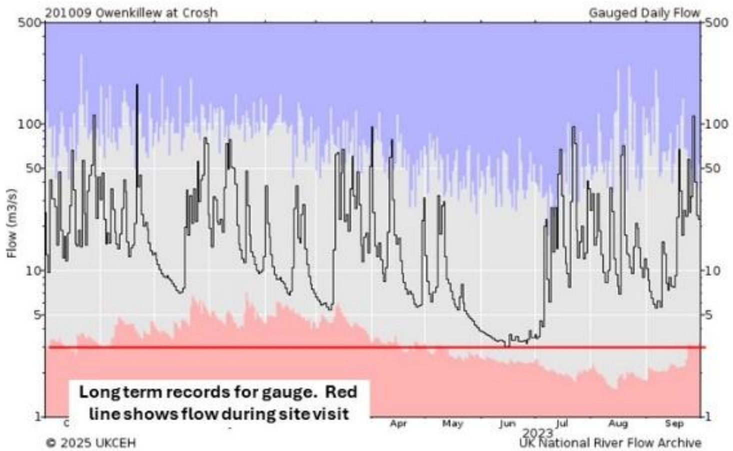
REF	LIMB	DETAILS	EQUATION	START DATE	MAX STAGE (M)	END DATE
C1	a	N/A	Q = 21.043 * (h + 0.1600) ^ 2.060	14/02/1980	0.963	01/01/2100
C1	b	N/A	Q = 34.610 * (h -0.1020) ^ 1.729	14/02/1980	2.087	01/01/2100

This slide has Dfl Rivers water level data from their flow gauge at Crosh, converted to flow using the station rating curve
Flow in Owenkillew was around 85-90%ile low flow. Flow in burns might be lower as there will be less baseflow supporting the burns, but this is reasonable estimate of flow conditions. Therefore, the field photos show low flow conditions, but not the lowest flows.





Based on rating curve and level of 0.289m, flow = 4.04m³/s



3. Pollanroe Burn

Site Data and Hydraulic Calculations

3.1 The reach of the Pollanroe Burn from Crockanboy Road to the Owenreagh River is shown in Figures 3-1 and 3-2 with further details in Figures 3-4 to 3-6.

3.2 The watercourse flows though agricultural land with good vegetation cover on stretches of the channel but with a number of exposed sections. The channel is impacted by man-made structures, notably a water gate (fence across channel), ford and the Crockaboy Road culvert, as highlighted in Figure 3-2.

3.3 The channel down valley gradient is shown in Figure 3-3, which indicates a lower gradient section for the first 500-600m of the channel upstream of Owenreagh River, then a channel with sections varying from 3.5% to 10.6%. Based on the table in Figure 3-3 the channel gradient would indicate a channel form between a Plane Riffle, Plane Bed or Step Pool form.

3.4 Figure 3-4 shows details of the channel at its downstream end. No access was possible to this reach so there are no close-up photographs, but the aerial image shows a broad, channel with coarse bed material (rocks are exposed in the channel bed). There is limited vegetation cover in this reach of the channel. Sediment is exposed on the banks of the channel and there is a bar in the Owenreagh close to the mouth of the burn.

3.5 Figure 3-5 shows the burn close to the middle reach of the surveyed area. The channel has more vegetation cover in this area and the image shows a step-pool form consistent with the higher gradient sections of the channel in this area (see photographs in later sections of this report which show photos of step-pools in other burns). There is a ford across the channel in this reach with damaged banks at the ford and some bank erosion elsewhere, noted in Figure 3-5. The channel would be expected to be shallower in the ford section.

3.6 Figure 3-6 shows the channel upstream of Crockanboy Road where there was access for cross-section survey and to view the channel. The reach has a gradient of 3%, based on the cross-section survey, which is consistent with the channel gradient throughout the whole reach of the Pollanroe Burn apart from steeper sections shown on the long profile (Figure 3-2). The photographs show a broad, shallow channel with coarse grain bed material. The channel shows widely spaced steps and pools which are consistent with a transition between a steeper step-pool channel and a plane bed channel. The Crockanboy Road crossing has an arch form its upstream end (arching over the channel), but in the middle of the culvert there is a smaller circular concrete culvert with no natural bed. The bottom right photo on Figure 3-6 shows the shallow depths within the culvert section, with the culvert forming a clear barrier to fish along the burn.

3.7 As outlined in Section 2 the mine will increase average and low flows in the Pollanroe Burn and reduce flood flows. Predictions of the impact of these changes in flows were made using the channel sections and a HECRAS model.

3.8 The impacts of the change in flow on average velocity, flow area and maximum water depth are provided in Figure 3-7 and 3-8 for a range of flow conditions. The results show very small impacts on any of these parameters, for example under average flow conditions the change in flow due to the mine is predicted to result in 1.3cm (0.013m) change in flow depth and a 0.022m^2 change in flow area and a 0.02m/s change in flow velocity. The changes under average flow conditions are all positive, meaning an increase in depth and flow area, which would be expected to increase available channel habitat under these lower flow conditions; this should be viewed as a positive in terms of habitat. At the same time the change in velocity is very small and would not cause any change in acceptable conditions for fish, if they were in the burn (i.e., under average conditions average velocity is predicted to change from 0.64m/s to 0.66m/s only).

3.9 As noted above, the surveyed reach has a similar gradient to other reaches of the burn downstream of Crockanboy Road (and not accessible for land survey) and the reach close to the Owenreagh River, so results presented for the surveyed reach would be expected to be applicable to these other sections of the burn.

3.10 The results presented in this section are consistent with those already presented in the SWIA (Table 9-9, 9-10 and 9-11) which showed negligible changes in hydraulic parameters during operations.

Specific Responses to Loughs Agency Consultation

3.11 In terms of the LA consultation response the LA make the following specific comments related to Pollanroe Burn and its hydrology, hydraulics and geomorphology. The text from the LA consultation response is provided in italics and grey text, with our responses provided below each point.

3.12 These responses focus on the comments related to downstream sections of the burn where fish have been observed (specifically paragraphs 10.5, 10.22, 10.23, 10.24, 10.25, 10.26, 10.29, 10.32, 10.34.

3.13 LA Paragraph 10.5. Loughs Agency surveys have shown that the habitat within the Pollanroe Burn contains spawning gravels and cobbles which become mobilised in higher flows. The applicant has not accurately assessed the habitats within the Pollanroe Burn. Any determinations made on the basis of the evidence provided by the applicant in relation to the habitat or ecological value are wrong. Increased flows within the Pollanroe Burn will mobilise gravels, cause scouring and reduce the availability of spawning habitat within the Pollanroe Burn. This will lead to a reduction in spawning habitat which will have an adverse impact on the population of Atlantic salmon in the Owenkillew River and tributaries SAC.

3.14 A discussion of the presence of fish and fish habitat is covered in reports prepared by project fisheries specialists. In terms of flow conditions, the mine will reduce flood flows in the Pollanroe Burn. This has been covered in detail in the SWIA and has been addressed numerous times in responses to LA and other agencies (e.g., SWIA Table 9-11 and 9-13, as well as DGL SoC TR, Chapter 2. Paragraph 10.5 above, suggests that erosion and scouring caused by increased flows will 'lead to a reduction in spawning habitat within the Pollanroe Burn'. LA provide no evidence, assessments or calculations that support this assertion.

3.15 The impact of the mine on flood flows, water depths and velocities is discussed above. Given the large sediment size in the channel it would only be moved at high flows and high velocities, with the standard Hjulstrom Curve (showing velocities needed to move sediment in rivers) reproduced in Figure 3-9 and showing that velocities over 1.1 to 1.2m/s are needed to move sediment above 10mm in size and 1.4-1.5m/s for sediment above 100mm in size. The results in Figure 3-7 show that during a 2-year flood the predicted average velocity at the peak flow is 1.7m/s and this is unchanged pre- and post-development, showing no change in how large sediment would be moved during high flow events.

3.16 LA Paragraph 10.22. The applicant argues (point 7 RR9 executive summary) that increases in low and average flows in the Pollanroe Burn are beneficial and pose no risk to fish or fish habitats. This is incorrect. First, the assumption that increased flow is universally beneficial oversimplifies the complexities of aquatic ecosystems. Although deeper water and increased wetted widths can enhance habitat availability, they would also alter the natural flow regime, disrupt sediment transport, and impact habitat stability, which is critical for Atlantic salmon. Atlantic salmon and other aquatic organisms, such as macroinvertebrates which are a vital food source for Atlantic salmon, rely on specific flow regimes at specific times of year, and even slight changes can disrupt spawning, feeding, and migration behaviours, particularly for sensitive species such as Atlantic salmon.

3.17 The impacts of the mine on flows in the Pollanroe are discussed in detail above and in the SWIA (Section 9.2.2). As noted above there is no evidence that the changes in flow could increase sediment movement or impact habitat stability. The change in flows is small and does not take conditions outside the range of normal flow conditions experienced in the burn. There is no evidence that such small changes would have impacts on Atlantic salmon within the burn or in the SAC. LA do acknowledge that 'deeper water and increased wetted widths can enhance habitat availability' which is the argument being made by us in this report and in the SWIA.

3.18 LA Paragraph 10.23. The reliance on standards such as SR351 and UKTAG guidance for the Water Framework Directive (WFD) also does not negate the need for site specific evaluations. These standards focus on preventing flow reductions, but they do not imply that increases in flow, even within regular ranges, are automatically beneficial. Each watercourse has unique ecological characteristics, and a one-size-fits-all approach necessarily will not adequately address localised impacts.

3.19 We undertook site specific assessments of the impact of the mine on flows in the SWIA. However, in response to this comment we have undertaken additional surveys reported in this document which further clarify how the mine would impact flows and other hydraulic parameters in the small streams close to the Project. This work has also provided more context on the nature of these small watercourses in terms of their geomorphology and the nature of the channels. The conclusions drawn in this report are consistent with those in the SWIA. We conclude that the changes in flow would be overall beneficial to the downstream reaches of Pollanroe Burn in terms of increased water depth and flow area under low and average flow conditions, but even if it were concluded that these were not significantly beneficial, there is no evidence that the changes would have significant negative impacts which would affect the conclusions made in the SWIA, i.e., the impacts would be no better or worse than neutral.

3.20 LA Paragraphs 10.24. The applicant states that the mine's water management will lower flood flows in the Pollanroe Burn (point 8 executive summary RR9) and that erosion concerns are overstated; The applicant is wrong. Firstly, the statement overlooks the cumulative impacts of increased low and average flows over time on channel geomorphology. While it is accurate to say that erosion typically occurs during high-flow events, even small but sustained increases in low and average flows will alter sediment transport dynamics and the stability of bed material. For example, subtle changes in flow velocity and wetted perimeter will incrementally shift fine sediments and affect the structure and composition of the channel bed and banks. Alteration of the channel bed and banks will impact Atlantic salmon habitat. Reducing the available salmon habitat will result in a failure to achieve the Conservation Objectives of the Owenkillew River and tributaries SAC.

3.21 LA provides no evidence that 'even small but sustained increases in low and average flows will alter sediment transport dynamics and the stability of bed material'. They provide no evidence that 'subtle changes in flow velocity and wetted perimeter will incrementally shift fine sediments and affect the structure and composition of the channel bed and banks'. They provide no calculations or site-specific observations to support any of these assertions or any minor changes, never mind changes that could affect the Conservation Objectives of the Owenkillew River SAC.

3.22 Photos of Pollanroe Burn showing the bed material in the channel and its banks are provided in this section. Additionally, hydraulic calculations are provided showing the impact of the mine on flows, water depths and velocities. It is clear that the channels of the burns have coarse grained bed material which would require substantial flow velocities to move, see Figure 3-9. Fine sediment does not play a significant role in the geomorphology of these channels. Fine sediment is also not beneficial to spawning areas, which are generally composed of gravels. It is clear from the velocity predictions for low and average flows in Figures 3-7 and 3-8 that the velocities are well below the rates required to move sediment in the Pollanroe Burn based on Figure 3-9. Therefore, the small increases in flow in the Pollanroe Burn during low and average flows would not be able to impact on sediment movement (erosion and deposition) or the geomorphology of the Pollanroe Burn channel.

3.23 It is noted that as part of the operational environmental monitoring programme (SGEMAP) there will be an annual geomorphological assessment of the Pollanroe Burn that will allow an assessment of any inter-annual changes in the channel and if they were to occur it would allow mitigation measures to be put into place (e.g., further monitoring, bank improvements, sediment addition).

3.24 *10.25. Additionally, the claim that bed material in the Pollanroe Burn is large and resistant to erosion under normal conditions does not reflect reality on the ground (Loughs Agency habitat survey data 2024 Appendix 3). In any event, variations in substrate composition, bank material, and channel morphology would create localised areas of vulnerability. In these areas, moderate increases in flow would accelerate erosion or sediment displacement, leading to downstream sedimentation or changes in habitat conditions. Furthermore, while an annual geomorphology survey is proposed as part of the SGEMAP. Geomorphological changes are often incremental and are unlikely to be immediately apparent in annual surveys, particularly if baseline conditions are not well understood or if monitoring does not capture subtle shifts in sediment transport or channel morphology. Given the factual inaccuracies present throughout the applicant's data to this point, Loughs Agency expect any monitoring carried out by the applicant to be of a standard high enough to effectively react to changes in the geomorphology to be protective of salmon habitat.*

3.25 We would note that '*Loughs Agency habitat survey data 2024 Appendix 3'* referenced by LA above provides no information on bed material, geomorphology or bed grain size. LA provide no evidence that bed material would be moved in low and average flow conditions in the burn. They provide no assessment of likely velocities in the burns under these conditions to be compared to the grain size of the bed material. They provide no evidence that increases to low and average flows in the Pollanroe Burn would '*accelerate erosion of sediment displacement*'.

3.26 A discussion on why the small changes in low and average flows in the Pollanroe Burn would not impact sediment erosion and deposition is provided under the response to Paragraph 10.24.

3.27 LA suggest that any changes to the channel would be incremental and not apparent in annual surveys, suggesting any changes would be very small from year to year allowing adaptation by fish. It also suggests that annual changes in bed form due to variation in flow are themselves minor and unlikely to be able to be monitored which is consistent with our assessment that changes in sedimentation patterns are driven by infrequent high flow events and not normal flow conditions. The LA appear to be suggesting that the mine would have a potential impact that is so small that it cannot be measured, but that it is sufficient to argue that the project cannot go ahead. This cannot be the standard to which a project is assessed.

3.28 As noted above, geomorphology surveys are part of the operational environmental monitoring programme (SGEMAP). If required, a Survey methodology could easily be devised to monitor the stream geomorphology in high detail including photographic surveys by land or by drone, with data provided in this report highlighting the information that can be collected by drone, to augment proposals in the SGEMAP, if required.

3.29 LA Paragraph 10.26. Lastly, the applicant fails to address the potential for indirect impacts on erosion processes. For instance, altered flow regimes impact riparian vegetation through erosion. Riparian vegetation is essential in stabilising banks and reducing erosion. Reduced vegetation coverage or changes in plant species composition due to altered hydrological conditions will exacerbate bank instability, even if bed *material itself is resistant to erosion. Increased bank erosion will smother spawning gravel. By compacting the gravel, salmon are unable to create redds and spawn. If Atlantic salmon are unable to spawn this will result in a failure to meet the conservation objectives of the SAC.*

3.30 LA provide no evidence that any changes to flows in Pollanroe Burn will cause any of the effects outlined above, including reduced vegetation cover or changes in plant species composition of exacerbate bank instability. They also provide no evidence of where/how bank erosion would smother spawning gravel in the Pollanroe Burn.

3.31 An assessment of the impact of the mine on water depths, velocities and flow areas in the Pollanroe Burn is provided in this Section, which is consistent with information provided in the SWIA.

3.32 Risks of bank erosion are much more likely due to livestock or farm crossing than any change in water levels due to the mine, with many examples of bank erosion due to these causes presented in this report.

3.33 LA extrapolate from generalisations about changes to stream banks to the potential failure to meet Conservation Objectives of the SAC, despite no evidence of the first step in the process, never mind the final step. This is all conjecture and does not engage with information provided by DGL in SWIA, SoC or Rebuttals where detailed information is provided on changes in flows and water levels, which should be clear would not produce the impacts outlined by LA.

3.34 LA Paragraph 10.29. The conclusions of the SWIA in relation to changes in flow conditions in the Pollanroe Burn cannot be independent of fish presence. Any assessment of impact from the changes in flow will have an impact on Atlantic salmon and their habitat within the Pollanroe Burn. The applicant has misrepresented and understated the distribution of Atlantic salmon and their habitats in the Pollanroe Burn throughout their ecology documents. Loughs Agency habitat survey carried out in November/December 2024 (appendix 3) highlighted the extent and quality of habitat within the Pollanroe Burn, Unnamed watercourse and Curraghainalt Burn. The habitat found within the Pollanroe Burn is a product of the natural flow rates found within the catchment of the Pollanroe Burn. Altering the flow within the burn, such as an increased flow will disrupt these habitats. The applicant has stated that the magnitude and significance of impacts on the instream habitat from the alteration of flows can be claimed to be positive and/or negligible in relation to salmon habitat within the Pollanroe Burn, however this is because the applicant has incorrectly assessed the habitat. The applicant cannot legitimately determine a negligible impact when ignoring the presence of a site selection feature of the SAC.

3.35 A discussion of the presence of fish and fish habitat is covered in reports prepared by project fisheries specialists. A discussion of the impact of the mine on sediment movement is provided above. In terms of a general comment on habitat we would note that having greater water depths and flow areas under average and low flows would generally be considered as beneficial.

3.36 *LA Paragraph 10.32. Section 1.4.3.2 states that 'NED are satisfied that the Pollanroe Burn does not meet the criteria of a headwater.' Loughs Agency refers to Department for Infrastructure's Gold mine rebuttal submission and in particular paragraphs 19 to 27 of NIEA's submission which refutes the applicant's claim. The Pollanroe Burn meets the criteria of being classified as a headwater due to: it being a low order stream, its location in the upper reaches of the Owenkillew catchment, which can be concidered close to or part of the source and its ecological importance (particularly in its support of Atlantic salmon, salmon habitat and low trophic level macroinvertebrates which are a vital food source for Atlantic salmon).*

3.37 Our comment refers to DAERA Consultation of 24th April 2020, Section on Natural Heritage by NED in their comments on Addendum to Environmental Statement (Section 6.6.2). NED were making a very specific point related to the use of the term 'headwater' within the Water Framework Directive, where a 'headwater' stream to a designated 'water body' can be considered in a similar way to that water body. An assessment of headwaters has been undertaken by EA in England (Priority River Habitat - Headwater Areas (England) | Natural England Open Data Geoportal). Such a nationwide assessment has not been undertaken in Northern Ireland and NED were confirming that the Pollanroe Burn was not considered as a 'headwater' in this context.

3.38 The terms 'headwater' also has a more general descriptive use meaning an upland catchment close to the source of a burn or river. Clearly, the Pollanroe Burn is a headwater in a descriptive sense, but that is not the relevance of the point made in our rebuttal or being made by NED.

3.39 *LA Paragraph 10.34. Loughs Agency agree with* [redacted] *in that the three watercourses are all high value and high sensitivity. It is plain from the supporting evidence provided by Loughs Agency (habitat survey, redd counting electrofishing surveys, eDNA results, appendices 1 to 5) that the presence of Atlantic salmon and their habitat means that these watercourses are of high ecological value and are therefore of high sensitivity in terms of man-made alterations. Impacts on upland sections of these watercourses will have a cascading effect of impacts on Atlantic salmon. The alteration of flows through creation of attenuation of ponds, rerouting of a percentage of the Unnamed watercourse catchment to the Pollanroe Burn and the discharge into the Curraghinalt Burn will all impact the individual ecosystems of each watercourse. These impacts will include reduction in available habitat, reduction in macroinvertebrate numbers and increased likelihood of erosion during flood conditions. These will have downstream impacts on Atlantic salmon resulting in a decrease in the population. This will result in a failure to maintain or enhance the population of Atlantic salmon as outlined in the Conservation Objectives. By reducing Atlantic salmon populations in these watercourses, the applicant will impact the Conservation Objectives of the River Finn and tributaries SAC by reducing the density of out migrating smolts.*

3.40 LA make reference to the Statement of Case provided by Dr [redacted] for FODC. In her Statement of Case Dr [redacted] makes a reference to the SWIA and suggests that the small burns (including Pollanroe Burn) should be considered as having a high Sensitivity within the context of the SWIA and not the low sensitivity they were assessed in the SWIA. Also Dr [redacted] makes similar points to those made by LA related to the increases in low and average flows in the Pollanroe Burn impacting on fluvial geomorphology, erosion and sedimentation patterns, and noting that increases in flow in the Pollanroe Burn should not be considered as beneficial. These points are addressed below, as well as 3 minor points related to the SWIA and flows in the Pollanroe Burn. Dr [redacted] also makes points related to the upland streams of the Pollanroe Burn (at mine site) which are covered in the SLR hydro-morphology report

3.41 Within the SWIA the Pollanroe Burn is assigned a Low Sensitivity in terms of Surface Water Hydrology including Flooding, based on criteria in Table 7-1 of the SWIA. Dr [redacted] her SoC suggests that all the small watercourses considered in the SWIA should be assigned High Sensitivity, given they are connected to watercourses (Owenkillew and Owenreagh Rivers) which are designated as having High Sensitivity.

3.42 The approach taken to define sensitivity in the 2020 ES (Table 7.1) is typical of approaches in other EIAs. It is noted that EIAs undertaken by Dr [redacted] / WRC use a similar approach and clearly differentiate between High Sensitivity streams of national significance and Low Sensitivity streams of local significance. Under WRC's own criteria it is clear that these small watercourses would not be considered as High Sensitivity. We are content that the burns meet the categorization of Low Sensitivity and following discussions with project ecologists and fish specialists they are content the burn is of low sensitivity in terms of ecological features. It is clear that the burns have been excluded by regulators from designated site boundaries and WFD classifications.

3.43 It also seems obvious that there is a difference in sensitivity between the Owenreagh and Owenkillew Rivers and the small burns and not all watercourses should be assigned High Sensitivity as proposed by Dr [redacted] Furthermore, even if FODC would argue that the lower reach of the Pollanroe Burn (below Crockanboy Road) was not a low sensitivity section of the burn, due to the presence of fish; there are no predicted negative effects in this reach with respect to surface water flows, i.e., the conclusions of the SIWA would remain as assessed with no significant effect of the mine on these reaches. The only reaches assessed with a negative impact in the SWIA are the upland sections of the burn. Following work in the SLR Report there should be no argument that these upland reaches would be assessed as low sensitivity streams, such that the assessment made in the SWIA remains.

3.44 In terms of the impact of the changes in flow in the Pollanroe Burn on geomorphology, erosion and sedimentation these points have been addressed under LA Paragraphs 10.5, 10.32 and 10.25 where similar points are made by LA.

3.45 In Section 6.5.8 of her SoC, Dr [redacted] states that no in-depth consideration is given to increasing frequency and higher intensity of storm rainfall and the effect on flood levels in the Pollanroe Burn. Dr [redacted] is incorrect, as the SWIA was undertaken consistent with DfI Rivers guidance in terms of climate uplifts for flood flows, as outlined in the project Flood Risk Assessment. DfI Rivers has no objection to the development in terms of flood risk. In addition, the impact of climate change on rainfall and flows is explicitly considered in the SWIA with climate change included in Water Balance modelling and groundwater models.

3.46 In Section 6.5.1 of her SoC, Dr [redacted] states there has been no apparent consideration of effects of high-intensity storms on flow rates, erosion and scour patterns within the burn channel. We would strongly refute this as the impact of the mine on flood flows in the Pollanroe Burn was considered in detail in the SWIA and project Flood Risk Assessment. It is clear the project will reduce peak flows in the Pollanroe Burn. DfI Rivers has been consulted with respect to flood risk and has No Objection to the project in terms of flood risk.

3.47 In Section 6.5.13 to 6.5.16 of her SoC, Dr [redacted] makes comments related to the Water Balance Report. Dr [redacted] comments relate to the lack of a rainfall year with >1 in 100-year return period within the UK Met Office Lough Fea rainfall dataset used as input to the Water Balance report. These comments confuse work undertaken to assess the overall water management at the mine (Water Balance) with flood flow considerations. Given the storage of runoff from the mine site in the large water management ponds (which acts as a buffer for short-term rainfall events) the Water Balance modelling and flood assessment work consider rainfall conditions on different timescales. The Water Balance work considers rainfall conditions on a monthly and annual basis, hence the description of annual rainfall totals provided in the Water Balance Report and referenced by Dr [redacted] in her response. In contrast flood events are generated by shorter duration rainfall events (hourly or daily), therefore, the reference to the return period of any individual annual rainfall total is not relevant to the discussion of flood conditions and Dr [redacted] is wrong to make this connection. More information on how these different rainfall conditions were considered in the Water Balance and SWIA is outlined below.

3.47.1 The Water Balance model considers flow rates on the daily, monthly and seasonal scale appropriate to assess storage and management of water within the Water Management Ponds on site, and to test how the RO WTP will manage these flows. This approach is a standard approach for any mining project, to test the water management at the site for a range of climatic conditions that could occur during the life of the project. This approach used available Lough Fea data (54-years) and given the duration of the project (20 years) there was a sufficiently long period of rainfall to allow testing of the Water Balance model to the satisfaction of DfI's reviewers (Golder Associates). The presence of four years with between 1 in 20 and 1 in 50 year wet year rainfall and one with around 1 in 80-year wet year rainfall was considered more than sufficient to test the water management at the mine. It should also be noted that the assessment considered the impact of climate change on seasonal rainfall patterns for the life of mine.

3.47.2 The impact of flood conditions was explicitly considered within the SWIA and Water Balance based on standard flood hydrology models (UK Flood Estimation Handbook methods and appropriate rainfall statistics for flood estimation) and these methods were used to help design water management infrastructure (such as ditches), as well as the required flood storage volume within the Water Management Ponds. A project Flood Risk Assessment report was prepared and was reviewed by DfI Rivers with No Objection. The flood risk component uses appropriate return period flows based on Northern Ireland legislation (1 in 100-year + climate change event considered in the flood risk assessment) and design conditions considered appropriate for the site (1 in 1,000-year event for design of water management infrastructure and additional flood storage in the Water Management Ponds). The Water Balance modelling included the flood storage requirements at the mine in its operation, assessing (and showing) that the appropriate flood storage volume (1 in 1,000-year 24-hour storm) was always available in the water management ponds on top of any water stored due to mining operations. This provided the connection between the flood calculations and the Water Balance modelling.

3.47.3 Therefore, we strongly refute any implication that appropriate methods have not been used in the Water Balance assessment or when considering flood flows at the site.

Summary and Conclusions – Pollanroe Burn

3.48 Pollanroe Burn is a small, upland watercourse with a coarse bed channel. It is characterised by low water depths under average and low flow conditions and high velocities under flood flows. The Curraghinalt mine will result in small increases in average and low flows during operations and a reduction in flood flows. Calculations presented in the SWIA and supplemented here show small changes in water depth, flow area and flow velocity during mine operations. The increase in depths and flow areas under low and average flow conditions would generally be considered as positive in terms of greater habitat under these flow conditions.

3.49 Calculations show that the changes in flow would not impact on erosion or deposition in the channel, given the coarse nature of the sediment in the channel and the fact that increases in flow due to the mine occur during low and average flows would not impact sediment movement.

3.50 The additional data and calculations do not change the conclusions of the SWIA in terms of impacts on flows, hydraulics and geomorphology of the Pollanroe Burn and they illustrate that the concerns raised by LA are not valid and that the changes to the burn would not have significant local, national or transboundary effects.

Figure 3-1: Coverage of LiDAR and aerial photo for Unnamed Watercourse and Pollanroe Burn

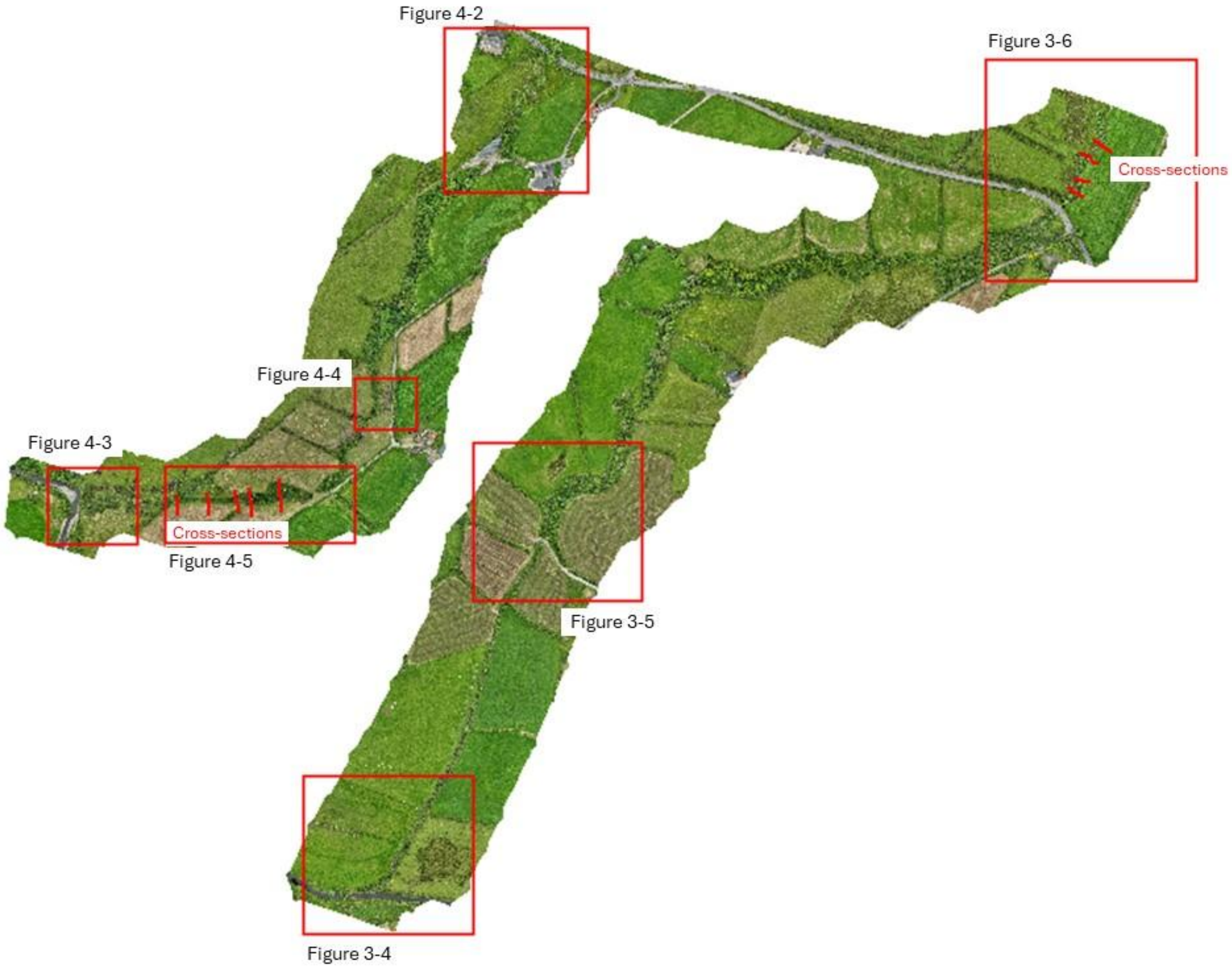


Figure 3-2: Overview of Unnamed Watercourse and Pollanroe Burn

Figure 3-3: Long profile of Pollanroe Burn from LiDAR data, with channel morphology type based on channel

Geology	Slope	Sinuosity	Type	Sub-type
Bedrock	Any	Any	A	Bedrock, Cascade
Not bedrock	>10%	Any	A	Cascade
	>3% - ≤10%	Any	B	Step Pool
	>0.5% - ≤3%	≤1.1	B	Step Pool, Plane Bed
		>1.1	C	Plane Riffle
	>0.1% - ≤0.5%	Any	C	Plane Riffle, Braided, Wandering
	>0.05% - ≤0.1%	≤1.4	C	Plane Riffle, Braided, Wandering
		>1.4	D	Actively Meandering
	>0.01% - ≤0.05%	Any	D	Actively Meandering
	≤0.01%	Any	F	Low Gradient Passive Meandering

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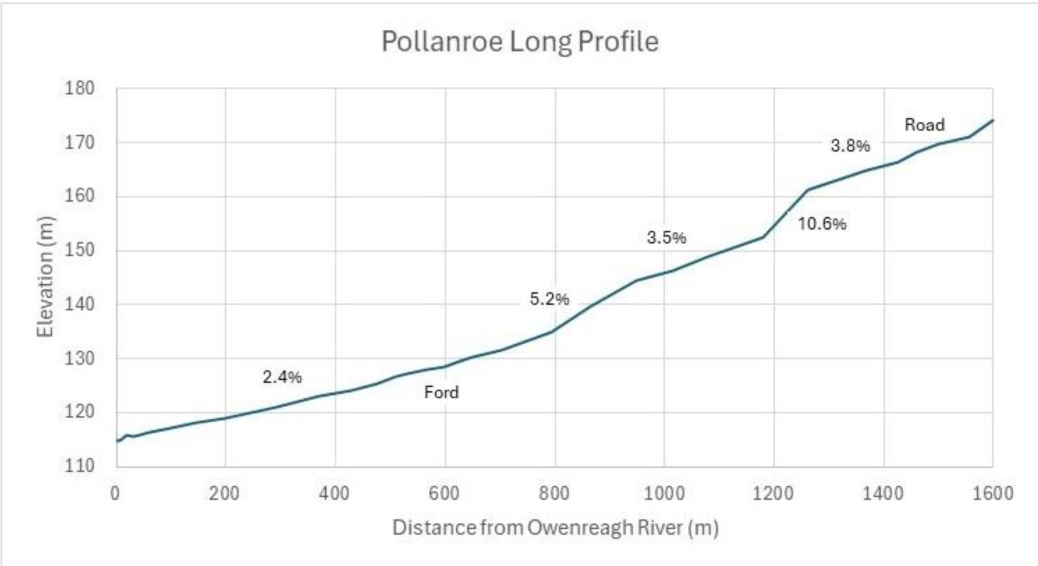


Figure 3-4: Detail of Pollanroe Burn near its mouth, with location in Figure 3-1

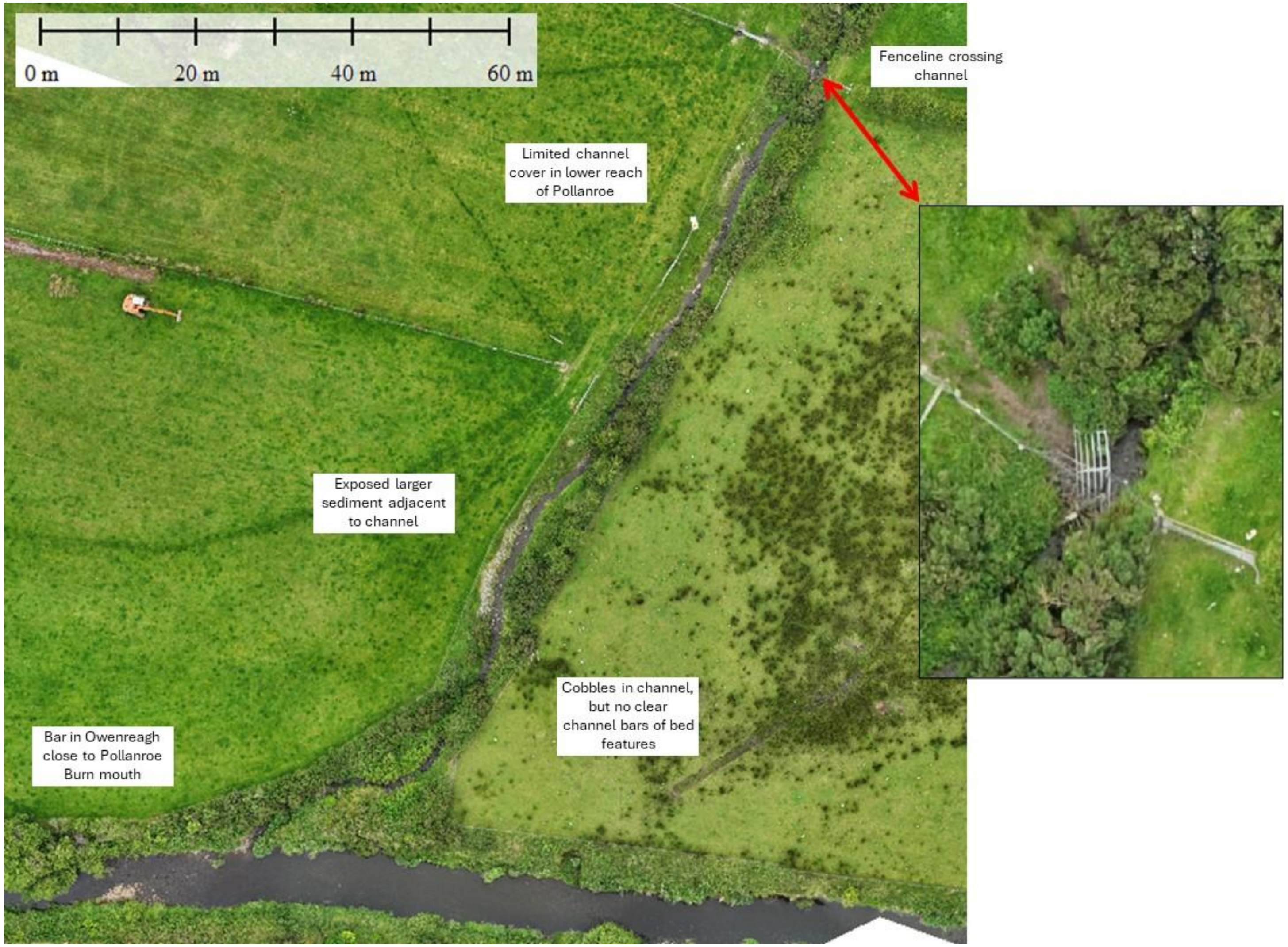


Figure 3-5: Detail of Pollanroe Burn near its central reach, with location in Figure 3-1

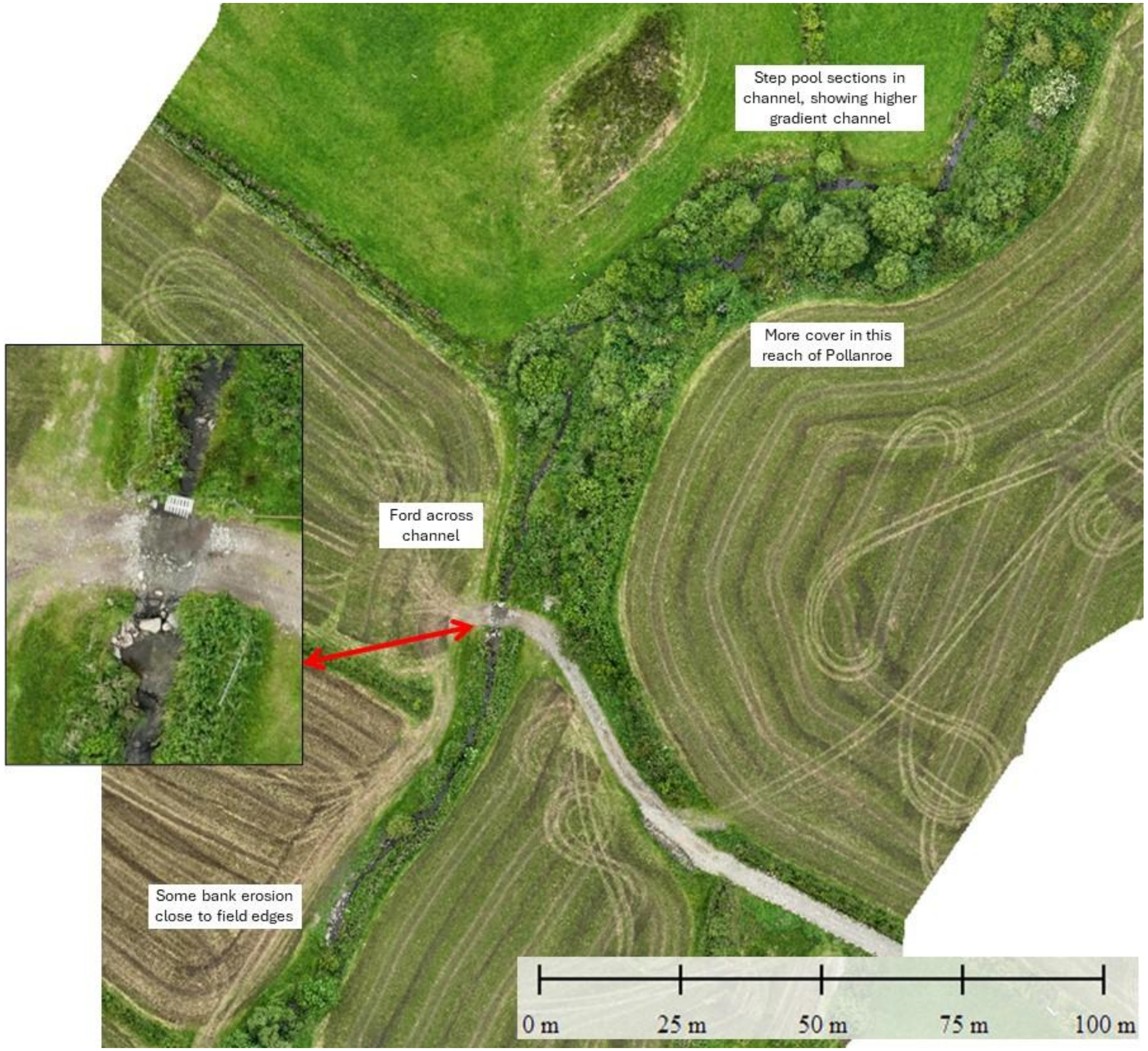


Figure 3-6: Detail of Pollanroe Burn upstream of Crockanboy Road, with cross-section locations

Figure 3-7: Predicted Impact of Changes in Flow in Pollanroe Burn with observed cross-sections with 2-year flood level

Pollanroe Burn

	2.04	Pollanroe at Mouth	
Catchment Area (km^2)	1.4	At cross-section locations	
Average Annual Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	39.9	54.9	
Average Velocity (m/s)	0.640	0.660	0.020
Flow Area (m^2)	0.062	0.084	0.022
Max Depth (m)	0.083	0.096	0.013
Annual 95%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	6.8	15.8	
Average Velocity (m/s)	0.450	0.520	0.070
Flow Area (m^2)	0.015	0.030	0.015
Max Depth (m)	0.047	0.059	0.012
Annual 5%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	140	155	
Average Velocity (m/s)	0.900	0.930	0.030
Flow Area (m^2)	0.158	0.169	0.011
Max Depth (m)	0.135	0.141	0.006
2-year Flood Flow	**Baseline**	**Post-Dev**	**Difference**
Fflow (L/s)	1537	1368	
Average Velocity (m/s)	1.700	1.700	0.000
Flow Area (m^2)	1.119	0.973	-0.146
Max Depth (m)	0.487	0.449	-0.038

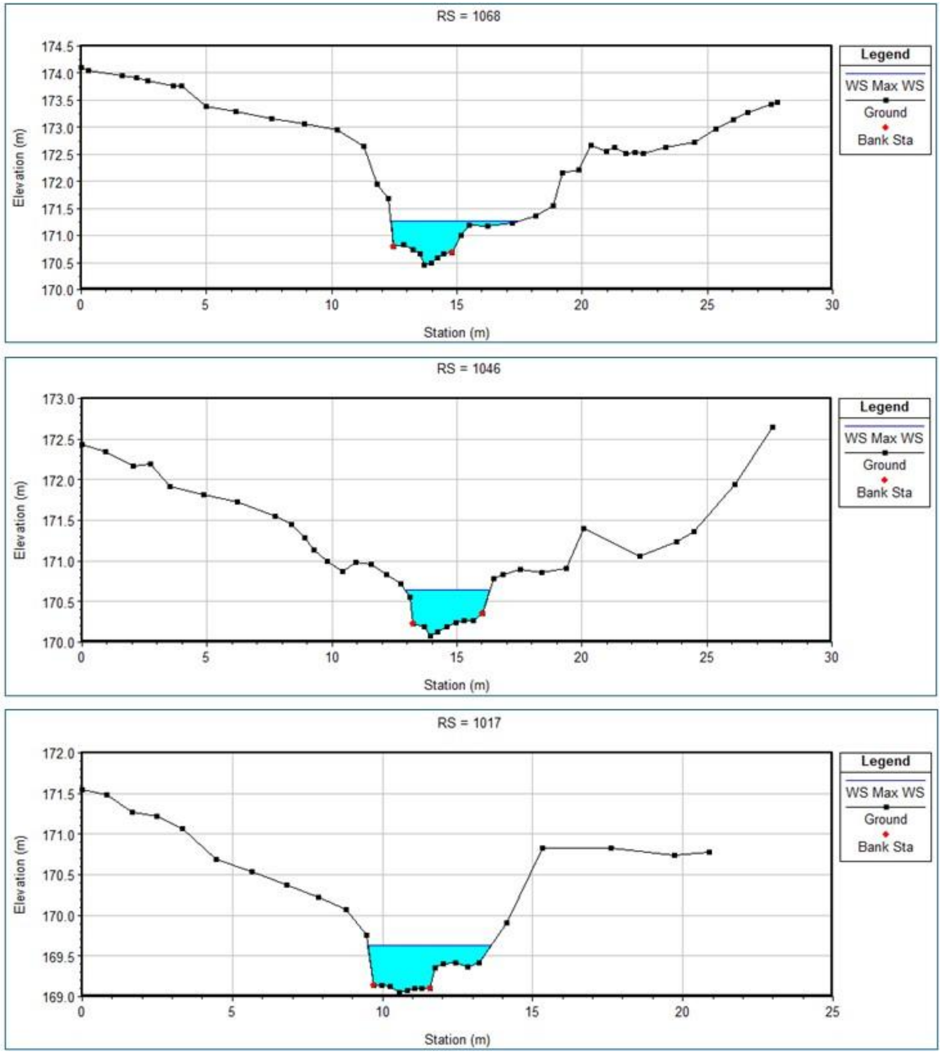


Figure 3-8: Predicted Impact of Changes in Flow in Pollanroe Burn (monthly flow) with observed long profile with 2-year flood level

Baseline	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	67.1	46.8	46.3	33.3	19.6	15.6	13.0	18.6	25.2	39.0	46.6	61.0
Average Velocity (m/s)	0.720	0.700	0.700	0.620	0.500	0.530	0.520	0.480	0.550	0.640	0.700	0.680
Flow Area (m^2)	0.094	0.068	0.067	0.054	0.040	0.030	0.025	0.039	0.046	0.061	0.067	0.090
Max Depth (m)	0.102	0.087	0.086	0.077	0.066	0.059	0.055	0.066	0.071	0.082	0.086	0.100

Post-Dev	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	82.6	58.5	57.7	44.7	28.8	25.7	24.2	31.9	39.8	49.4	61.6	76.5
Average Velocity (m/s)	0.750	0.670	0.670	0.660	0.550	0.560	0.620	0.610	0.650	0.670	0.680	0.740
Flow Area (m^2)	0.111	0.088	0.087	0.068	0.053	0.046	0.039	0.052	0.062	0.074	0.091	0.104
Max Depth (m)	0.110	0.098	0.098	0.087	0.076	0.072	0.066	0.076	0.083	0.091	0.100	0.107

Difference	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	15.5	11.7	11.4	11.4	9.2	10.1	11.2	13.3	14.6	10.4	15.0	15.5
Average Velocity (m/s)	0.030	-0.030	-0.030	0.040	0.050	0.030	0.100	0.130	0.100	0.030	-0.020	0.060
Flow Area (m^2)	0.017	0.020	0.020	0.014	0.013	0.016	0.014	0.013	0.016	0.013	0.024	0.014
Depth (m)	0.008	0.011	0.012	0.010	0.010	0.013	0.011	0.010	0.012	0.009	0.014	0.007

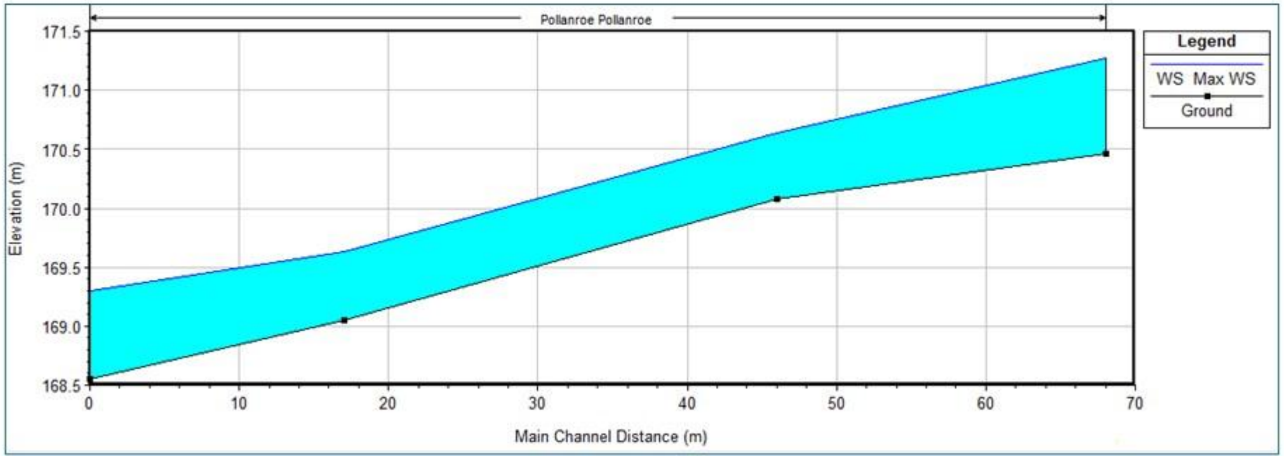
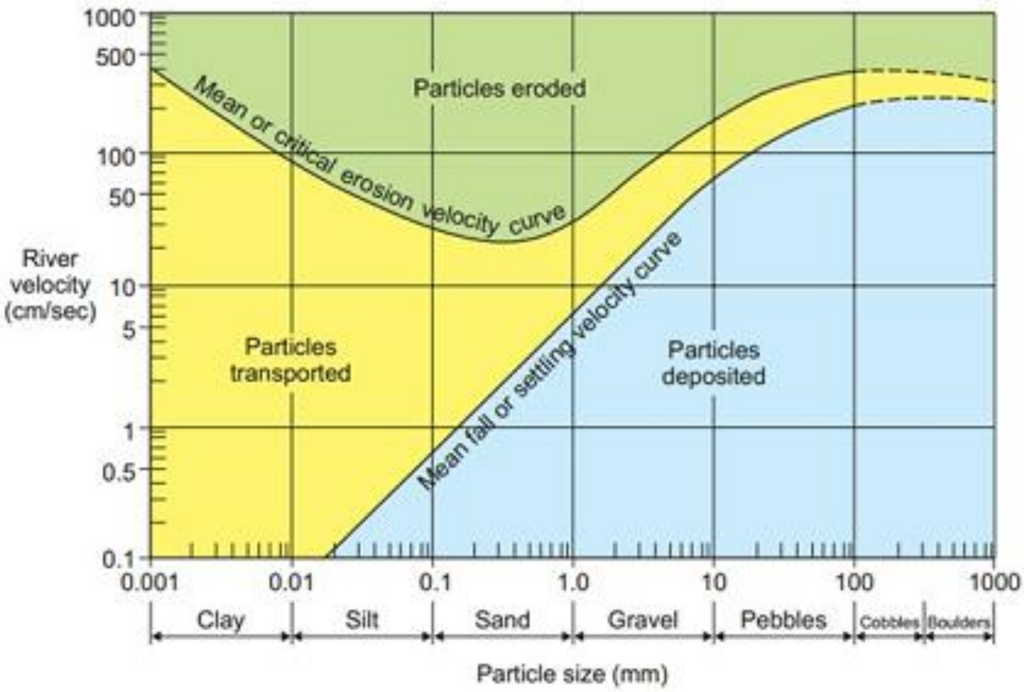


Figure 3-9: Hjulstrom Curve which relates stream flow velocity to erosion/deposition of sediment particles of different sizes



4. Unnamed Watercourse

Site Data and Hydraulic Calculations

4.1 The reach of the Unnamed Watercourse from Crockanboy Road to the Owenreagh River is shown in Figure 3-1 with further details in Figures 4-2 to 4-5.

4.2 The watercourse flows though agricultural land with good vegetation cover on stretches of the channel but with a number of exposed sections. The channel is impacted by man-made structures (notably a farm crossing culvert, long culvert under a farm building and the Crockaboy Road culvert, as highlighted in Figure 3-2) as well as areas of bank erosion caused by animals accessing the channel to cross or to drink water (as shown in Figure 3-2 and in detail in Figure 4-4)

4.3 The channel down valley gradient is shown in Figure 4-1, which indicates a lower gradient section for the first 250-300m of the channel upstream of Owenreagh River, then high gradient sections upstream of that consistent with a Step-Pool geomorphology, which are high velocity channels (steps can be seen in the aerial photo in Figure 4-2). The gradient of the lower reach is close to the theoretical boundary between a Step-Pool and Plane Bed channel form (see table in Figure 4-1), with photographs of the lower reach in Figure 4-5 which corresponds well with a channel that shows poorly formed steps and pools across a coarse grained channel consistent with the transition between a Step Pool and Plane Bed channel.

4.4 Aerial images show a gravel bar at the mouth of the watercourse, with the burn channel perched above the main river level, separating the two channels and spreading flow from the burn across the bar where it enters the river.

4.5 Figure 4-5 shows the reach of the channel where cross-sections were measured. This section is downstream of the farm crossing culvert where there is a pronounced step in the channel at the culvert outlet. The channel base is around 3-4m wide. At the time of the photos in Figure 4-5 the channel was experiencing low flow conditions and steps across the channel were shallow at only 1 – 7cm depth with no obvious deep pools and flow passing around boulders and cobbles in the channel bed providing no obvious central, deeper channel. It is notable that under these conditions there was obvious algae growing in the channel suggesting high nutrient loadings, likely from farmland.

4.6 As outlined in Section 2 the mine will reduce flows in the Unnamed Watercourse by 0-5%. Taking the highest of these values, predictions of the impact of a 5% decrease in flows were made using the channel sections and a HECRAS model.

4.7 The impacts of the change in flow on average velocity, flow area and maximum water depth are provided in Figure 4-6 and 4-7 for a range of flow conditions. The results show negligible impacts on any of these parameters, for examples under average flow conditions the change in flow due to the mine is predicted to result in 2mm (0.002m) change in flow depth and a $0.003m^2$ change in flow area and a 0.01m/s change in flow velocity – all unmeasurable changes.

4.8 It should also be noted that under average and low flows the water depths in the channel would be expected to be extremely low and would restrict the ability of the channel to support large fish, with or without the mine.

Specific Responses to Loughs Agency Consultation

4.9 In terms of the Loughs Agency consultation response the Loughs Agency make the following specific comments related to Unnamed Watercourse. The text from the LA consultation response is provided in italics and grey text, with our responses provided below each point.

4.10 LA Paragraph 10.9. The applicant has mischaracterised salmonid habitat surveys, wrongly claiming any habitat which is not optimal is 'failing' due to the grading of habitat falling below grade 1. Sections 8.5 to 8.9 of this submission outline the importance of salmon habitat and how this characterisation is wrong. The loss of 5% of the catchment flows of the Unnamed watercourse will impact the salmonid habitat, particularly during low water and drought conditions.

4.11 This report focusses on changes in flow conditions. The impact on Unnamed Watercourse has already been covered in our Rebuttal Statement related to Surface Water (Section 4.14 in response to the LA SoC for the mine). It was noted '*The SWIA ES took a conservative approach and considered this change could result in a 5% decrease in low and average flows which would be acceptable under UKTAG guidance for WFD. In reality, under low and average flow conditions, the section of the Unnamed Watercourse diverted to the mine is close to the topographical divide and distant from the channel. Under low and average flow conditions, flows in the channel will be supported by groundwater and rainfall (or shallow subsurface flows) on land close to the channel in the valley bottom, such that the actual reduction in flow in the unnamed watercourse will be <5%, further confirming the conclusions made in the SWIA'*

4.12 The NIEA hydrology team (NIEA Statement of Case in respect of Abstraction of surface water upstream of the Pollanroe Burn and storage in the Clean Water Pond (AIL/2024/0009) and Abstraction of Mine Water trough dewatering of the underground mine and storage within the West Pond (AIL/2024/0008), Annex AIL 18) has already confirmed that 5% change in Unnamed watercourse is not considered as significant in terms of flow.

4.13 LA provide no evidence, assessments of calculations to support their conclusions. They provide no quantitative or site-specific assessment of how a small reduction in flows in Unnamed Watercourse would impact salmonid habitat. In the absence of this information, we have provided a site-specific assessment of the impact of changes in flows in the Unnamed Watercourse on key hydrological parameters that influence fish habitat. The results are provided in Figures 4-6 and 4-7 with discussion provided above.

4.14 Even without the mine in operation the water depths in the channel under low flows will be very low resulting in a small wetted area in the channel and very limited fish habitat and depths of water that would only be able to support the smallest of fish – if they were able to enter Unnamed Watercourse, given that the watercourse channel is perched above the Owenreagh River with a channel bar at the mouth of the watercourse (Figure 4-3)

4.15 Calculations show that changes in flow would result in negligible change in key hydraulic parameters compared to the baseline that would have no measurable effect on water depth, velocity or flow area and no measurable effect on fish habitat

4.16 *LA Paragraph 10.16. Loughs Agency have explained that alterations to natural flows of headwaters will impact salmonid habitat downstream with lower flows in the Unnamed watercourse impacting on spawning habitat in particular. Spawned salmon ova require certain depth and flow to ensure survivability. Reducing flows in the Unnamed watercourse will result in spawning habitat left above the low water level within the burn. Reducing the available spawning habitat will result in a failure to meet the Conservation Objective of maintaining salmon habitat. This will have an adverse impact on the Unnamed Burn due to the abundant numbers of Atlantic salmon that have been recorded in it.*

4.17 The LA provide no evidence for these conclusions, no site-specific assessment or calculations. LA are making very specific conclusions (that spawning habitat in Unnamed Watercourse will be exposed above the water level due to the reduction the catchment area) without reference to any spawning habitat location, or any flow or water level calculations. They also take a logical leap that the change would reduce spawning habitat to the point that there is a failure of the Conservation Objective for the Owenkillew SAC, without any data or assessment.

4.18 As outlined above (Item 10.15) the impact on Unnamed Watercourse has been considered in the SWIA (Section 9.2.2) and Rebuttal statements, with the NIEA Hydrology Team also considering the loss of catchment area insignificant on flows (NIEA SoC, Annex C AE1/24/1667606). Additional calculations are provided in this report that show no measurable change under a range of flow conditions. Survey of Unnamed Watercourse was not obtained for the SWIA, given the small changes in flows, and no access was allowed at that time for flow monitoring.

4.19 *LA Paragraph 10.17. The reduction in groundwater baseflow by 3-5% will have a detrimental impact as baseflow constitutes a larger proportion of river flows during dry periods, which are becoming increasingly frequent due to climate change. This reduction will exacerbate low flow conditions, leading to the Unnamed watercourse having lower periods of low flow every year, with extended dry periods during summer months. Such outcomes will have disproportionately severe impacts on aquatic habitats in the Unnamed watercourse, such as spawning or nursery habitat becoming dry during periods of low flow. Reductions in flows on headwaters are therefore exacerbated given their smaller size and upland catchment characteristics.*

4.20 As outlined under Item 10.9 above, the impact on low flows in Unnamed Watercourse was discussed in the SWIA (Section 9.2.2) and Rebuttals (Surface Water Rebuttal (RR9) Sections 4.14 and 4.15). We would highlight that any reduction is not due to a ‘reduction in groundwater baseflow’, but it is due to the reduction in overall catchment area.

4.21 As above, the LA provide no evidence for their conclusions, no site-specific assessment or calculations. Particularly there are no calculations to back up the assertion that Unnamed Watercourse could have 'extended dry period during summer ponds' and that 'nursery habitat becoming dry during periods of low flow'.

4.22 *LA Paragraph 10.34. Loughs Agency agree with Dr. [redacted] in that the three watercourses are all high value and high sensitivity. It is plain from the supporting evidence provided by Loughs Agency (habitat survey, redd counting electrofishing surveys, eDNA results, appendices 1 to 5) that the presence of Atlantic salmon and their habitat means that these watercourses are of high ecological value and are therefore of high sensitivity in terms of man-made alterations. Impacts on upland sections of these watercourses will have a cascading effect of impacts on Atlantic salmon. The alteration of flows through creation of attenuation of ponds, rerouting of a percentage of the Unnamed watercourse catchment to the Pollanroe Burn and the discharge into the Curraghinalt Burn will all impact the individual ecosystems of each watercourse. These impacts will include reduction in available habitat, reduction in macroinvertebrate numbers and increased likelihood of erosion during flood conditions. These will have downstream impacts on Atlantic salmon resulting in a decrease in the population. This will result in a failure to maintain or enhance the population of Atlantic salmon as outlined in the Conservation Objectives. By reducing Atlantic salmon populations in these watercourses, the applicant will impact the Conservation Objectives of the River Finn and tributaries SAC by reducing the density of out migrating smolts*.

4.23 LA make reference to the Statement of Case provided by Dr [redacted] for FODC. In her Statement of Case Dr [redacted] makes a reference to the SWIA and suggests that the small burns (including Unnamed Watercourse) should be considered as having a high sensitivity within the context of the SWIA and not the low sensitivity they were assessed in the SWIA. Also, Dr [redacted] makes a specific point that the reduction in flow in the Unnamed Watercourse would have a significant impact on flows and habitat in that watercourse.

4.24 Within the SWIA the Unnamed Watercourse is assigned a Low Sensitivity in terms of Surface Water Hydrology including Flooding, based on criteria in Table 7-1 of the SWIA. Dr [redacted] in her SoC suggests that all the small watercourses considered in the SWIA should be assigned High Sensitivity, given they are connected to watercourses (Owenkillew and Owenreagh Rivers) which are designated as having High Sensitivity.

4.25 The approach taken to define sensitivity in the SWIA is discussed in Section 3.42 and given the assessment in the SWIA and analyses in this report we are content that the burns meet the categorization of Low Sensitivity and following discussions with project ecologists and fish specialists they are content the burn is of low sensitivity in terms of ecological features. We would note that even if the watercourse were considered to be of higher sensitivity the impact of the mine on flows is considered Minor so the overall assessment would point to an effect of Minor significance at worst.

4.26 The effects on the flow reduction on water depth, flow area and velocity have been considered in Figures 4-6 and 4-7 with the conclusion being that there are negligible changes in these key hydraulic parameters. Dr [redacted] does not provide any site specific assessment to support her assessment that the flow reduction would have a significant impact. As discussed above, the SWIA took a conservative approach and considered this change could result in a 5% decrease in low and average flows. In reality, under low and average flow conditions, the section of the Unnamed Watercourse diverted to the mine is close to the topographical divide and distant from the channel. Under low and average flow conditions, flows in the channel will be supported by groundwater and rainfall (or shallow subsurface flows) on land close to the channel in the valley bottom, such that the actual reduction in flow in the unnamed watercourse will be <5%. This was discussed in our October 2024 Statement of Case for surface water (Para 2.26) and Surface Water Rebuttal (RR9) Sections 4.14 and 4.15. Therefore, the calculations in this report consider an upper (conservative) assessment of the impact of the mine on flows in the Unnamed Watercourse.

4.27 Our assessment of negligible impact is also supported by NIEA hydrology in Annex DC16 of the NIEA SoC. They undertook an assessment of the impact of changes on flows in the Unnamed Watercourse and concluded the changes were insignificant in terms of flow.

4.28 Dr [redacted] implies that impacts of dewatering of the mine on groundwater flows to the Unnamed Watercourse have not been considered. We would refute this and note that the SWIA is supported by detailed groundwater modelling of the area, and this predicted no impact on groundwater flows in the Unnamed Watercourse. This was highlighted within the SWIA (Section 9.2.2).

Summary and Conclusions – Unnamed Watercourse

4.29 Unnamed Watercourse is a small, upland watercourse with a coarse bed channel. It is characterised by low water depths under average and low flow conditions and high velocities under flood flows. The Unnamed Watercourse is also impacted by a number of culverted sections and animal crossings that result in obstructions to flow and channel and channel bank damage. The Curraghinalt mine will result in small decreases in average and low flows during operations. Calculations presented in the SWIA and supplemented here show negligible changes in water depth, flow area and flow velocity during mine operations.

4.30 Calculations show that the changes in flow would not impact on erosion or deposition in the channel, given the coarse nature of the sediment in the channel.

4.31 The additional data and calculations do not change the conclusions of the SWIA in terms of impacts on flows, hydraulics and geomorphology of the Unnamed Watercourse and they illustrate that the concerns raised by LA are not valid and that the changes to the burn would not have significant local, national or transboundary effects.

Figure 4-1: Long profile of Unnamed Watercourse from LiDAR data, with channel morphology type based on channel slope

Geology	Slope	Sinuosity	Type	Sub-type
Bedrock	Any	Any	A	Bedrock, Cascade
Not bedrock	>10%	Any	A	Cascade
	>3% - ≤10%	Any	B	Step Pool
	>0.5% - ≤3%	≤1.1	B	Step Pool, Plane Bed
		>1.1	C	Plane Riffle
	>0.1% - ≤0.5%	Any	C	Plane Riffle, Braided, Wandering
	>0.05% - ≤0.1%	≤1.4	C	Plane Riffle, Braided, Wandering
		>1.4	D	Actively Meandering
	>0.01% - ≤0.05%	Any	D	Actively Meandering
	≤0.01%	Any	F	Low Gradient Passive Meandering

SEPA (2012) Supporting Guidance WAT-SG-21 Environmental Standards for River Morphology

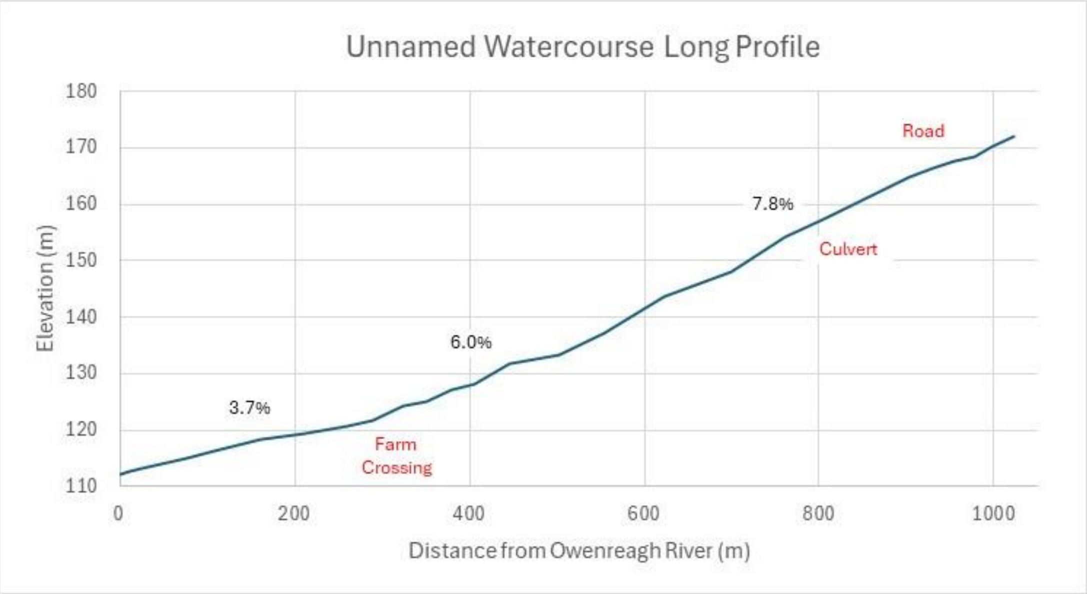


Figure 4-2: Upstream section of Unnamed Watercourse with location in Figure 3-1

Figure 4-3: Downstream section of Unnamed Watercourse with location in Figure 3-1

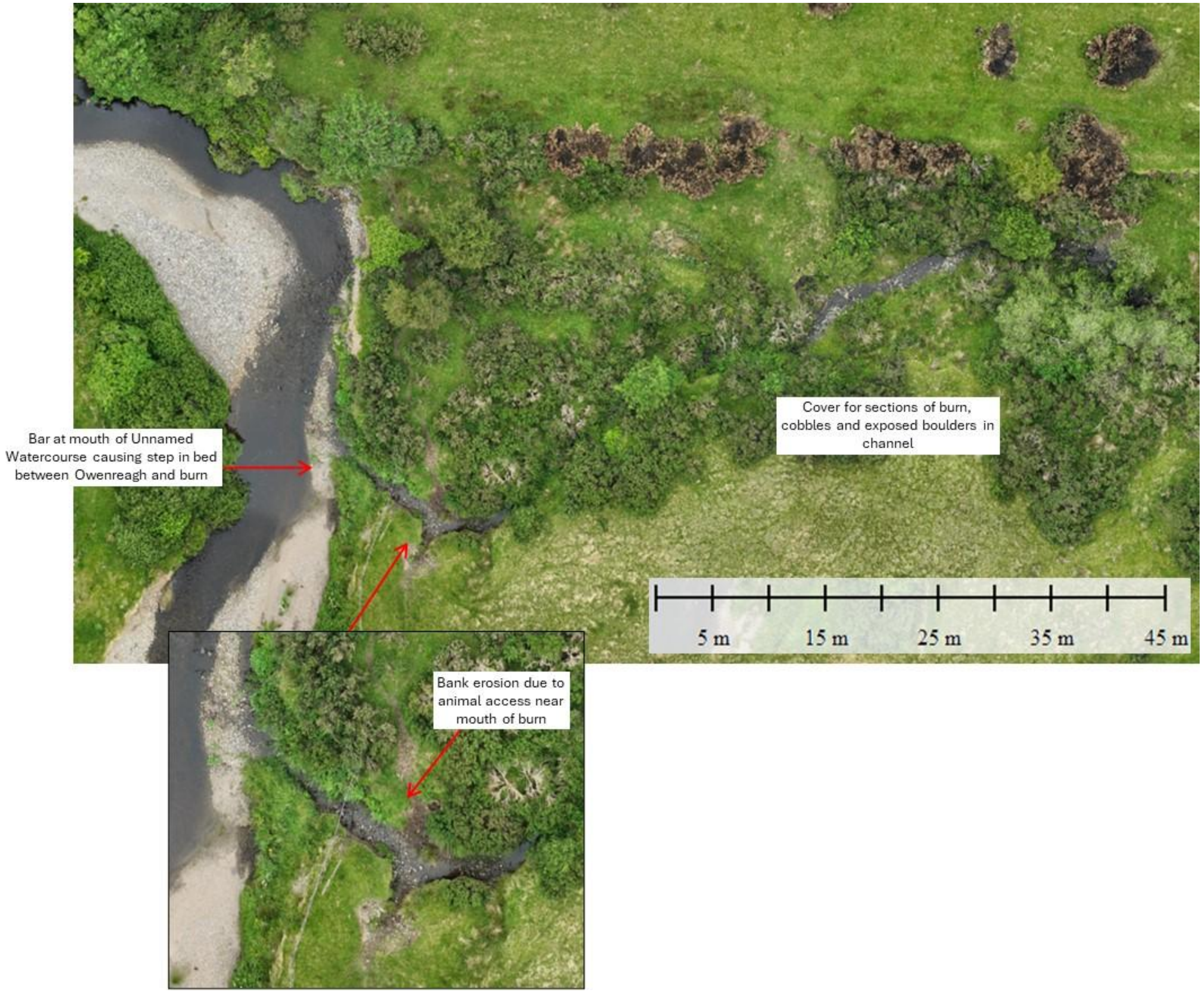


Figure 4-4: Close up of bank erosion on Unnamed Watercourse, with location in Figure 3-1

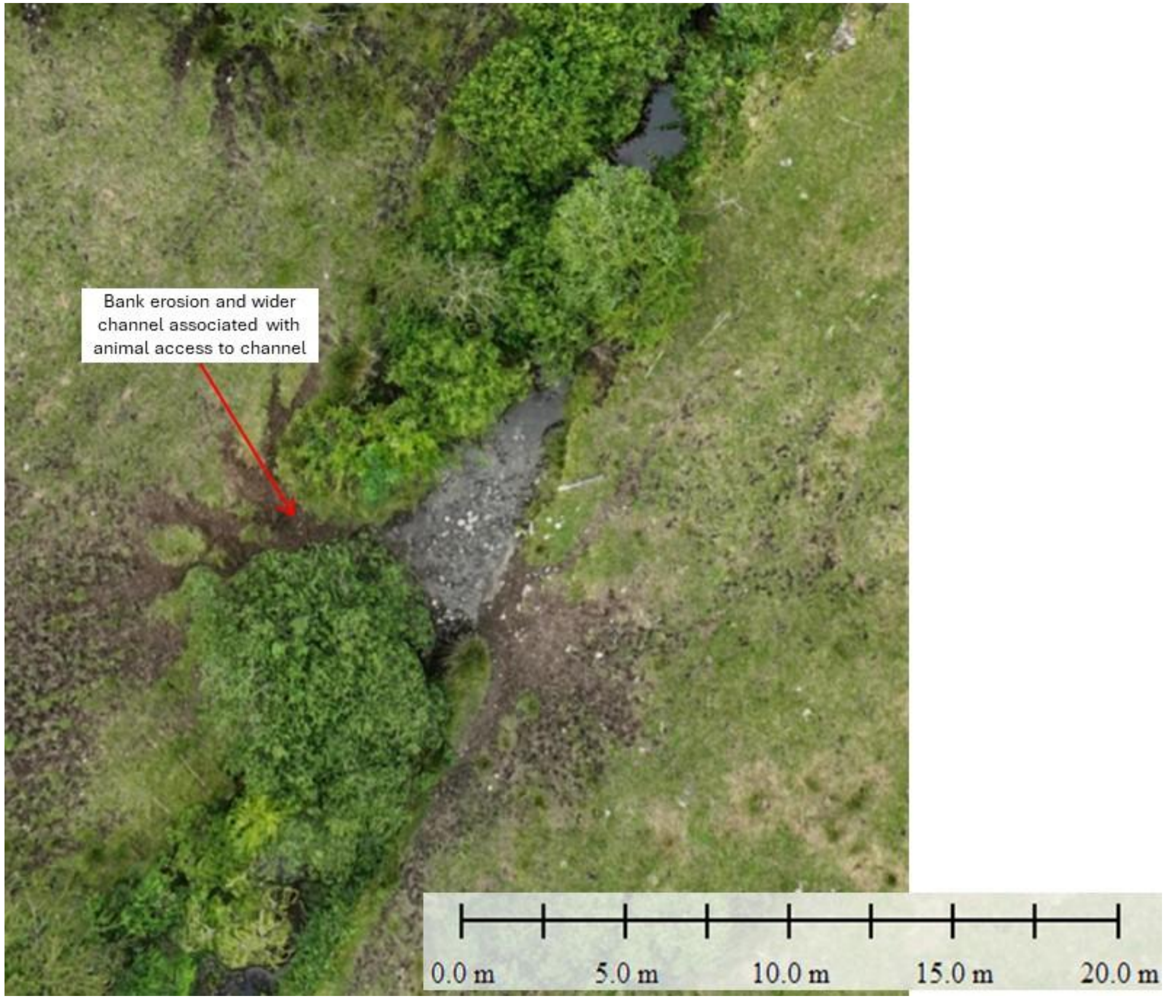


Figure 4-5: Close up of bank erosion on Unnamed Watercourse, with location in Figure 3-1

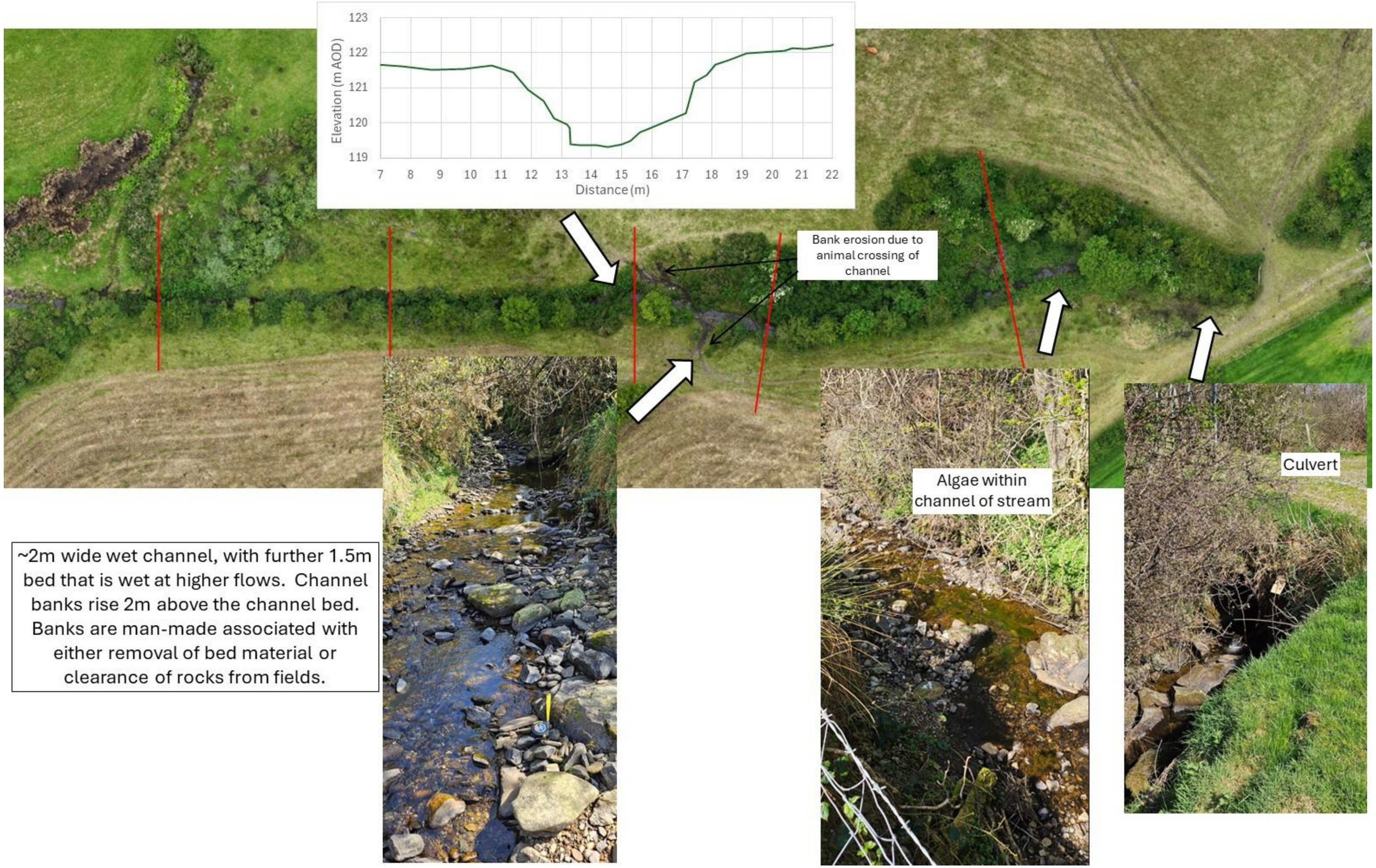


Figure 4-6: Predicted Impact of Changes in Flow in Unnamed Watercourse with observed cross-sections with 2-year flood level

Catchment Area (km^2)	1.39		
Average Annual Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	39.6	37.62	
Average Velocity (m/s)	0.390	0.380	-0.010
Flow Area (m^2)	0.103	0.100	-0.003
Max Depth (m)	0.109	0.107	-0.002
Annual 95%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	6.7	6.365	
Average Velocity (m/s)	0.220	0.220	0.000
Flow Area (m^2)	0.031	0.030	-0.001
Max Depth (m)	0.065	0.064	-0.001
Annual 5%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	139	132.05	
Average Velocity (m/s)	0.650	0.630	-0.020
Flow Area (m^2)	0.224	0.217	-0.007
Max Depth (m)	0.173	0.170	-0.003
2-year Flood Flow	**Baseline**	**Post-Dev**	**Difference**
Fflow (L/s)	1570	1491.5	
Average Velocity (m/s)	1.750	1.720	-0.030
Flow Area (m^2)	1.031	0.993	-0.038
Max Depth (m)	0.530	0.516	-0.014

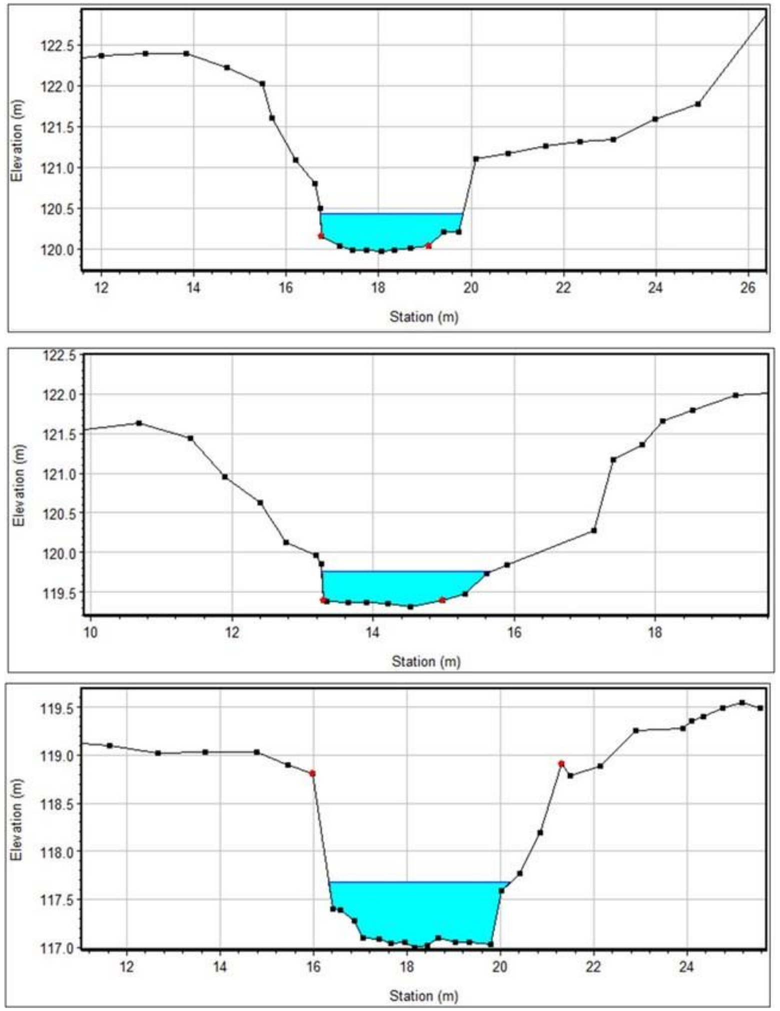
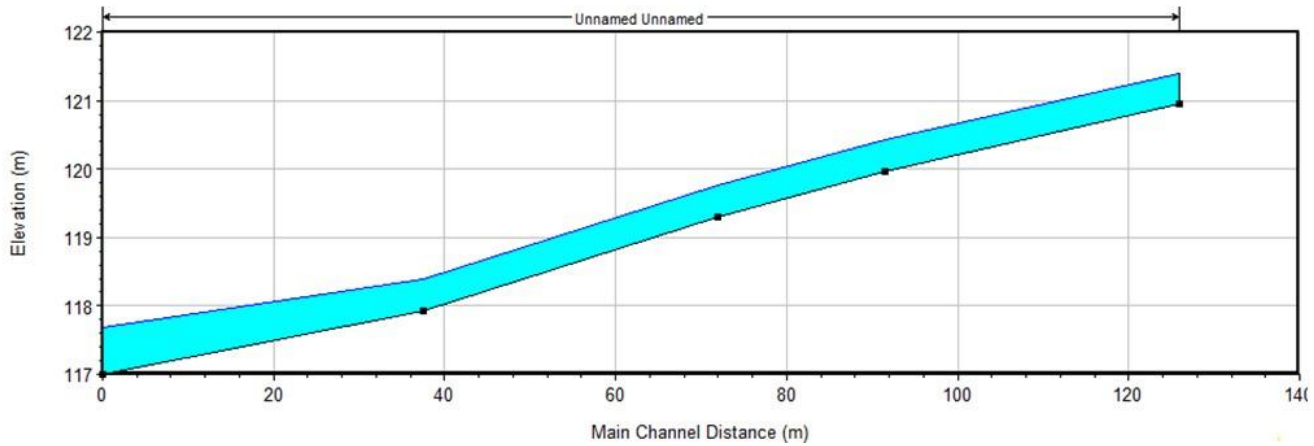


Figure 4-7: Predicted Impact of Changes in Flow in Unnamed Watercourse (monthly flow) with observed long profile with 2-year flood level

Baseline	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	62.5	52.8	46.9	35.8	28.5	21.5	16.5	23.0	29.2	44.1	54.8	59.8
Average Velocity (m/s)	0.460	0.430	0.410	0.380	0.350	0.310	0.280	0.320	0.350	0.400	0.440	0.450
Flow Area (m^2)	0.138	0.124	0.116	0.096	0.082	0.068	0.058	0.072	0.083	0.111	0.127	0.134
Max Depth (m)	0.129	0.121	0.116	0.105	0.097	0.089	0.083	0.091	0.098	0.114	0.123	0.127

Post-Dev	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	59.4	50.2	44.6	34.0	27.1	20.4	15.7	21.8	27.7	41.9	52.1	56.8
Average Velocity (m/s)	0.450	0.420	0.400	0.210	0.340	0.310	0.280	0.320	0.350	0.390	0.430	0.440
Flow Area (m^2)	0.134	0.121	0.112	0.165	0.079	0.066	0.057	0.069	0.080	0.108	0.123	0.130
Max Depth (m)	0.126	0.119	0.114	0.143	0.095	0.088	0.082	0.090	0.096	0.112	0.121	0.124

Difference	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	-3.1	-2.6	-2.3	-1.8	-1.4	-1.1	-0.8	-1.1	-1.5	-2.2	-2.7	-3.0
Average Velocity (m/s)	-0.010	-0.010	-0.010	-0.170	-0.010	0.000	0.000	0.000	0.000	-0.010	-0.010	-0.010
Flow Area (m^2)	-0.004	-0.003	-0.004	0.069	-0.003	-0.002	-0.001	-0.003	-0.003	-0.003	-0.004	-0.004
Depth (m)	-0.003	-0.002	-0.002	0.038	-0.002	-0.001	-0.001	-0.001	-0.002	-0.002	-0.002	-0.003



5. Curraghinalt Burn

Site Data and Hydraulic Calculations

5.1 The reach of the Curraghinalt Burn surveyed for this assessment is shown in Figure 5-1 with further details in Figures 5-2 and 5-3.

5.2 The watercourse flows though agricultural land with good vegetation cover on both banks of the channel. The channel is impacted by the road crossing close to the DGL offices with no other crossing points along the reach.

5.3 The channel down-valley gradient was calculated for the surveyed cross-sections, with the LiDAR unable to penetrate through the tree cover over much of the reach. The channel is around 15% in this area and from visual survey the gradient appears lower upstream of the surveyed reach, but is still steeper than 5-7% along its length. A channel with such a steep gradient would be comprised of very coarse-grained material with an overall Cascade or Step-Pool form. The channel bed is shown in detail in Figures 5-2 and 5-3. This is one of the steepest of all the channels considered in this report and the channel shows classic Cascade or Step-Pool forms with very large bed material and the channel profile broken into a series of rock step with small pools behind each step. During average or low flow and water would be in the gaps between large rocks in the step sections with no continuous (downstream) wetted channel. The photographs show some very steep, bedrock sections.

5.4 There is a very steep, rock section close to the mouth of the channel (bottom right photo in Figure 5-2, which would be expected to prevent fish access to upper reaches and providing a topographical divide between sections of the burn upstream and downstream of this steep reach.

5.5 As outlined in Section 2 the mine will slightly reduce flows in the Curraghinalt Burn during operations due to the end of flow from the existing adit (mine water is routed to Pollanroe Burn) and a lowering of the regional groundwater table. Based on these changes predictions of the impact of the decrease in flows were made using the channel sections and a HECRAS model.

5.6 The impacts of the change in flow on average velocity, flow area and maximum water depth are provided in Figure 5-4 and 5-5 for a range of flow conditions. The results show very small to negligible impacts on any of these parameters, for example under average flow conditions the change in flow due to the mine is predicted to result in 5mm (0.005m) change in flow depth and a 0.007m^2 change in flow area and a 0.02m/s change in flow velocity – all very small changes that would be unmeasurable in the field.

5.7 It should also be noted that under average and low flows the water depths in the channel would be expected to be extremely low and would restrict the ability of the channel to support fish, with or without the mine. The mine will have no impact on high flows. Given the sediment size in the channel, it would only be moved at high flow so there would be no impact of the mine on channel geomorphology, erosion or sedimentation.

Specific Responses to Loughs Agency Consultation

5.8 In terms of the LA consultation response the LA make reference to Curraghinalt Burn with respect to flows in their Paragraph 10.34, which also references the Statement of Case by Dr [redacted] for FODC. The text from the LA consultation response is provided in Section 3.39. Within the SWIA the Curraghinalt Burn is assigned a Low Sensitivity in terms of Surface Water Hydrology including Flooding, based on criteria in Table 7-1 of the SWIA. Dr [redacted] in her SoC suggests that all the small watercourses considered in the SWIA should be assigned High Sensitivity, given they are connected to watercourses (Owenkillew and Owenreagh Rivers) which are designated as having High Sensitivity.

5.9 Points related to the overall approach taken to define sensitivity of small watercourses have been discussed in Section 3.42 and 3.43 and are not repeated here.

5.10 With reference to the Curraghinalt Burn and additional information provided in this report it is clear the Curraghinalt Burn is a steep, rocky channel with shallow water depths over most flow conditions. Under high flow conditions there would be a risk of higher velocities locally in the channel. Changes in flow due to the mine are negligible, with almost no noticeable change in depths, flow area and velocity. We are content that it is a channel with low sensitivity in terms of hydrology. However, it is noted that even if the burn was considered to be of higher sensitivity, then the effects of mine are so low that with the SWIA the impacts would not have been considered significant.

Summary and Conclusions – Curraghinalt Burn

5.11 Curraghinalt Burn is a small, upland watercourse with a steep rocky channel. It is characterised by low water depths under average and low flow conditions and high velocities under flood flows. The Curraghinalt mine will result in small decreases in flows during operations, primarily due to the diversion of adit water to the Pollanroe catchment. Assessments presented in the SWIA and supplemented by calculations here show small changes in water depth, flow area and flow velocity during mine operations.

5.12 Calculations show that the changes in flow would not impact on erosion or deposition in the channel, given the coarse nature of the sediment in the channel.

5.13 The additional data and calculations do not change the conclusions of the SWIA in terms of impacts on flows, hydraulics and geomorphology of the Curraghinalt Burn and they illustrate that the concerns raised by LA are not valid and that the changes to the burn would not have significant local, national or transboundary effects.

Figure 5-1: Coverage of LiDAR and aerial photo for Curraghinalt Burn

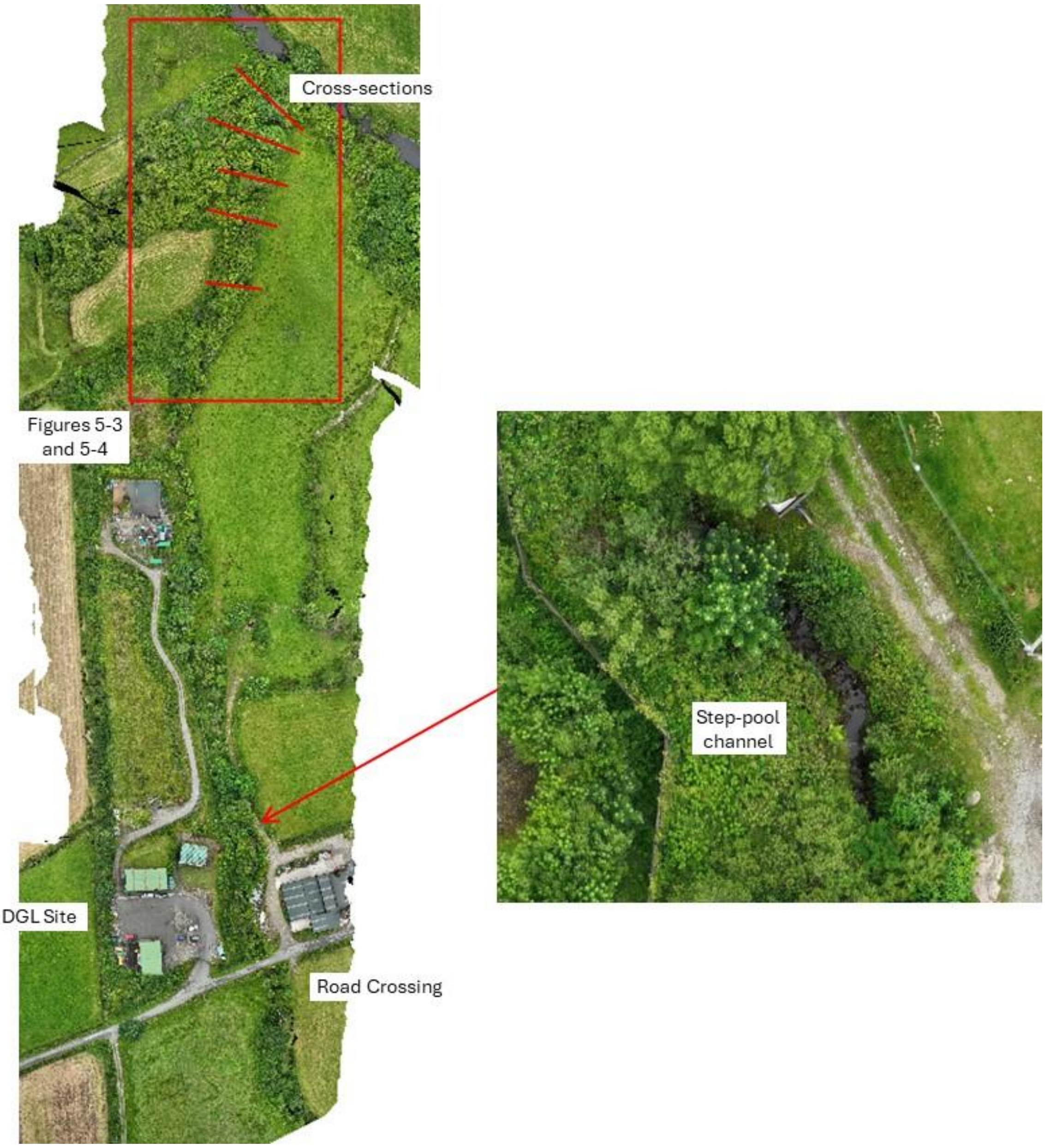


Figure 5-2: Lower reach of Curraghinalt Burn showing cross-section locations and key geomorphological features

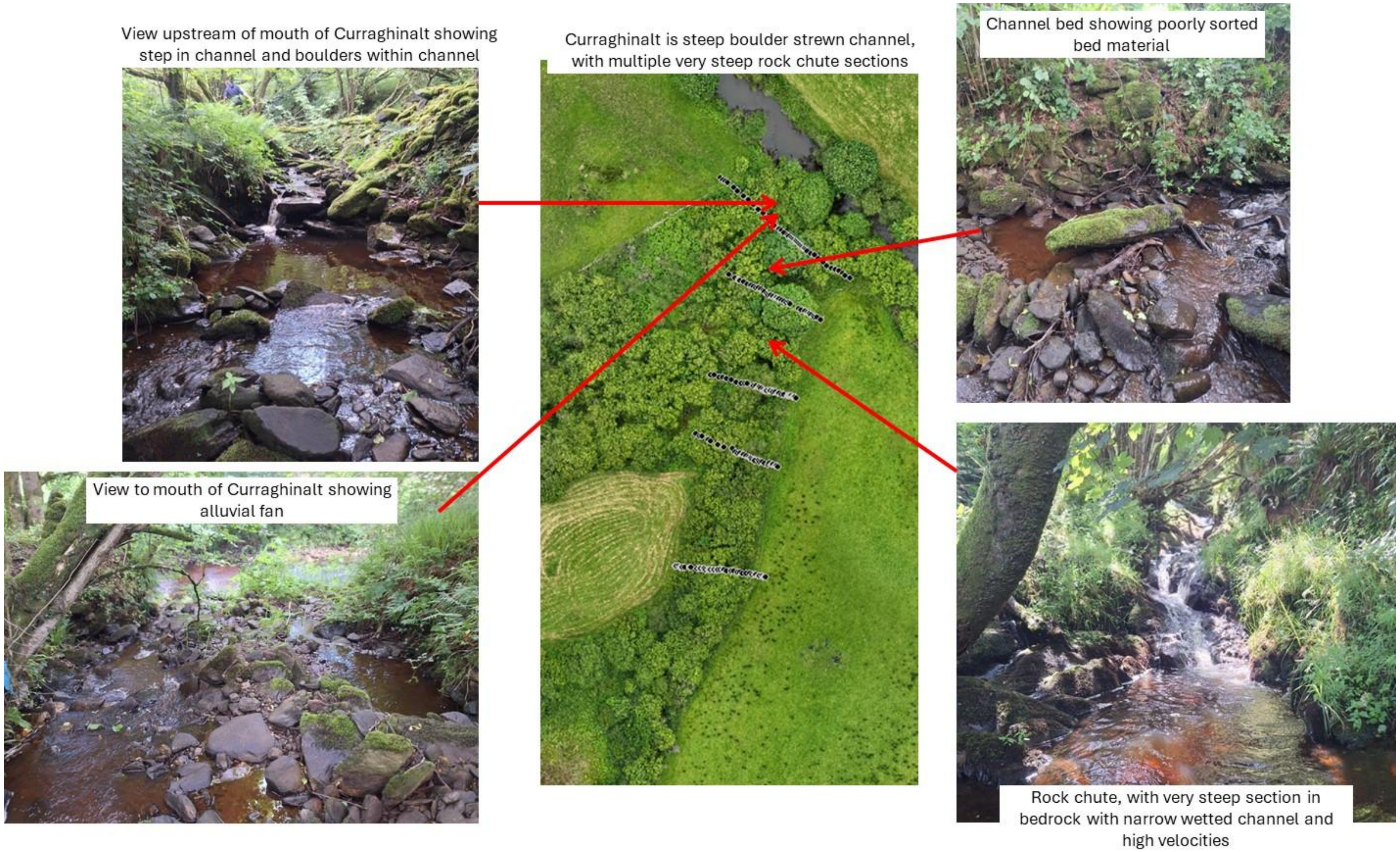


Figure 5-3: Lower reach of Curraghinalt Burn showing cross-section locations and key geomorphological features

Figure 5-4: Predicted Impact of Changes in Flow in Curraghinalt Burn with observed cross-sections with 2-year flood level

Curraghinalt Burn

Catchment Area (km^2)	1		
Average Annual Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	27.8	26.0	
Average Velocity (m/s)	0.360	0.380	0.020
Flow Area (m^2)	0.079	0.072	-0.007
Max Depth (m)	0.097	0.092	-0.005
Annual 95%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	4.7	2.9	
Average Velocity (m/s)	0.200	0.170	-0.030
Flow Area (m^2)	0.024	0.017	-0.007
Max Depth (m)	0.046	0.037	-0.009
Annual 5%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	100	98.2	
Average Velocity (m/s)	0.550	0.540	-0.010
Flow Area (m^2)	0.187	0.188	0.001
Max Depth (m)	0.148	0.148	0.000
2-year Flood Flow	**Baseline**	**Post-Dev**	**Difference**
Fflow (L/s)	1120	1120	
Average Velocity (m/s)	1.690	1.690	0.000
Flow Area (m^2)	0.713	0.713	0.000
Max Depth (m)	0.352	0.352	0.000

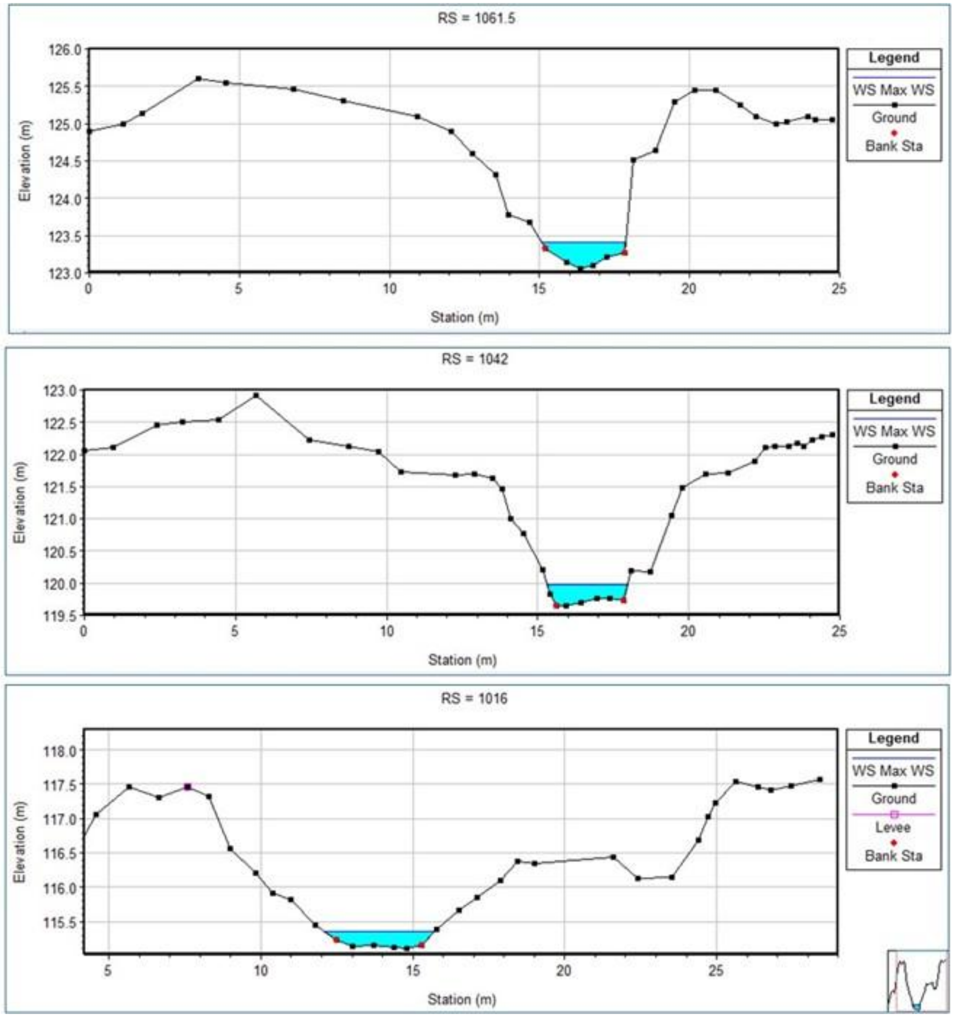
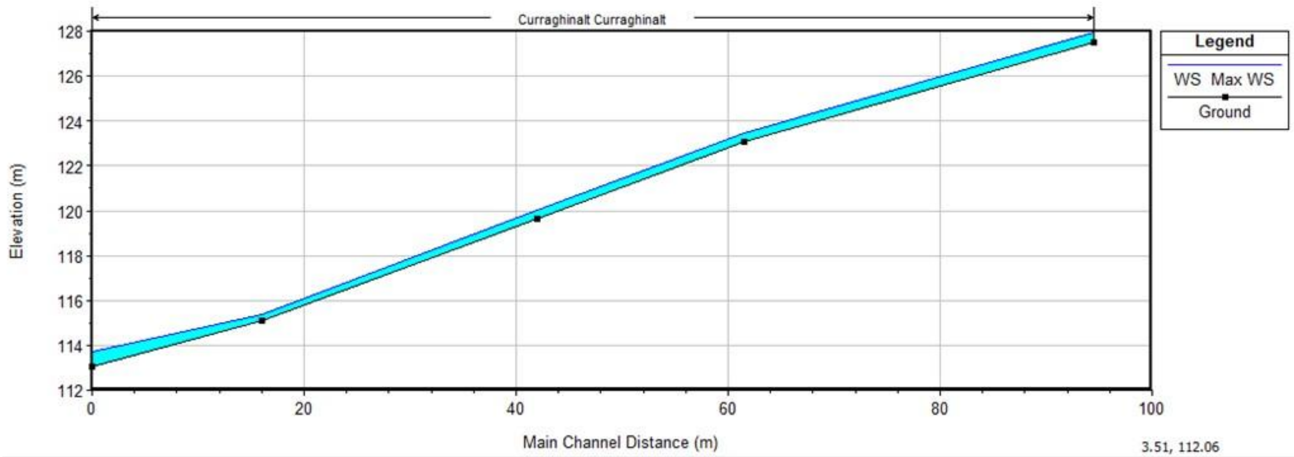


Figure 5-5: Predicted Impact of Changes in Flow in Curraghinalt Burn (monthly flow) with observed long profile with 2-year flood

Baseline	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	45.0	38.0	33.8	25.7	20.5	15.4	11.9	16.5	21.0	31.7	39.4	43.0
Average Velocity (m/s)	0.370	0.370	0.360	0.380	0.340	0.300	0.280	0.590	0.340	0.360	0.370	0.350
Flow Area (m^2)	0.125	0.105	0.097	0.070	0.062	0.053	0.045	0.029	0.063	0.091	0.110	0.125
Max Depth (m)	0.122	0.112	0.108	0.091	0.084	0.076	0.068	0.052	0.085	0.105	0.115	0.122

Post-Dev	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	43.1	36.1	31.9	23.9	18.6	13.6	10.0	14.7	19.1	29.9	37.6	41.2
Average Velocity (m/s)	0.350	0.380	0.360	0.350	0.340	0.290	0.520	0.300	0.340	0.350	0.370	0.350
Flow Area (m^2)	0.126	0.099	0.092	0.070	0.057	0.048	0.020	0.051	0.059	0.087	0.103	0.122
Max Depth (m)	0.122	0.109	0.105	0.090	0.079	0.071	0.041	0.074	0.081	0.102	0.112	0.121

Difference	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9	-1.9
Average Velocity (m/s)	-0.020	0.010	0.000	-0.030	0.000	-0.010	0.240	-0.290	0.000	-0.010	0.000	0.000
Flow Area (m^2)	0.001	-0.006	-0.005	0.000	-0.005	-0.005	-0.025	0.022	-0.004	-0.004	-0.007	-0.003
Depth (m)	0.000	-0.003	-0.003	-0.001	-0.005	-0.005	-0.027	0.022	-0.004	-0.003	-0.003	-0.001



6. Attagh Burn

Site Data and Hydraulic Calculations

6.1 The reach of the Attagh Burn surveyed for this assessment is shown in Figure 6-1 with further details in Figures 6-2 and 6-3.

6.2 The watercourse flows though agricultural land with good vegetation cover on both sides of the channel. The channel is impacted by man-made structures (notably a farm ford crossing, and two road crossings, as highlighted in Figure 6-1).

6.3 The channel down-valley gradient was calculated for the surveyed cross-sections, with the LiDAR unable to penetrate through the tree cover over much of the reach. The channel is 6.5% in this area and from visual survey the gradient was seen to increase upstream of the surveyed reach. As outlined for other burns a channel with such a steep gradient would be comprised of very coarse-grained material with an overall Step-Pool form. The channel bed is shown in detail in Figures 6-2 and 6-3 clearly showing a broad, shallow channel with large bed material and flow distributed across the channel at shallow depth between the large rocks. Step pool forms are clearly visible in the upstream reach (Figure 6-1).

6.4 A walkover survey of the mouth of the channel (Figure 6-2 and 6-3) showed a fan deposit (steep gravel/cobble feature) at the mouth of the burn where it joined the Owenkillew River. Upstream of the fan was a small pool sitting below a waterfall feature, with the pool clearly formed by water cascading over the waterfall. The overall effect of the fan and waterfall is to isolate the Attagh Burn channel from the Owenkillew River. The fan would be exposed above the water level for most flow conditions in the Owenkillew providing a barrier between the river and the pool. Then the waterfall was around a 1.5m vertical step in the burn profile again dividing the pool from the main burn channel.

6.5 As outlined in Section 2 the mine will reduce flows in the Attagh Burn by around 1 L/s. Predictions of the impact of a 1 L/s decrease in flows were made using the channel sections and a HECRAS model.

6.6 The impacts of the change in flow on average velocity, flow area and maximum water depth are provided in Figure 6-4 and 6-5 for a range of flow conditions. The results show negligible impacts on any of these parameters, for examples under average flow conditions the change in flow due to the mine is predicted to result in 2mm (0.002m) change in flow depth and a 0.003m^2 change in flow area and a 0.01m/s change in flow velocity – all unmeasurable changes.

6.7 It should also be noted that under average and low flows the water depths in the channel would be expected to be extremely low and would restrict the ability of the channel to support large fish, with or without the mine. This can be seen in the photographs associated with Figures 6-1 to 6-3 which are indicative of low flow conditions. This does not include the topographical restrictions at the mouth of the burn that would impact on fish to the channel in the first place.

6.8 The mine will have no impact on high flows. Given the sediment size in the channel, it would only be moved at high flow so there would be no impact of the mine on channel geomorphology, erosion or sedimentation.

Specific Responses to Loughs Agency Consultation

6.9 In terms of the LA consultation response the LA does not make direct reference to Attagh Burn. But the burn is indirectly referenced in their Paragraph 10.34, in that this paragraph references the Statement of Case by Dr [redacted] for FODC. The text from the LA consultation response is provided in Section 5. Within the SWIA the Attagh Burn is assigned a Low Sensitivity in terms of Surface Water Hydrology including Flooding, based on criteria in Table 7-1 of the SWIA. Dr [redacted] in her SoC suggests that all the small watercourses considered in the SWIA should be assigned High Sensitivity, given they are connected to watercourses (Owenkillew and Owenreagh Rivers) which are designated as having High Sensitivity.

6.10 Points related to the overall approach taken to define sensitivity of small watercourses have been discussed in Section 3.42 and 3.43 and are not repeated here.

6.11 With reference to the Attagh Burn and additional information provided in this report it is clear the Attagh Burn is a steep, rocky channel with shallow water depths over most flow conditions. Under high flow conditions there would be a risk of higher velocities locally in the channel. Changes in flow due to the mine are negligible, with almost no noticeable change in depths, flow area and velocity. We are content that it is a channel with low sensitivity in terms of hydrology. However, it is noted that even if the burn was considered to be of higher sensitivity, then the effects of the mine are so low that with the SWIA the impacts would not have been considered significant.

Summary and Conclusions – Attagh Burn

6.12 Attagh Burn is a small, upland watercourse with a steep rocky channel. It is characterised by low water depths under average and low flow conditions and high velocities under flood flows. The Curraghinalt mine will result in small decreases in flows during operations, due to the lowering of the local groundwater table. Assessments presented in the SWIA and supplemented by calculations here show small changes in water depth, flow area and flow velocity during mine operations.

6.13 Calculations show that the changes in flow would not impact on erosion or deposition in the channel, given the coarse nature of the sediment in the channel.

6.14 The additional data and calculations do not change the conclusions of the SWIA in terms of impacts on flows, hydraulics and geomorphology of the Attagh Burn and they illustrate that the concerns raised by LA are not valid and that the changes to the burn would not have significant local, national or transboundary effects.

Figure 6-1: Coverage of LiDAR and aerial photo for Attagh Burn

Figure 6-2: Lower reach of Attagh Burn showing cross-section locations and key geomorphological features

Figure 6-3: Mouth of Attagh Burn showing key geomorphological features

Figure 6-4: Predicted Impact of Changes in Flow in Attagh Burn with observed cross-sections with 2-year flood level

Attagh Burn

Catchment Area (km²)	0.6		
Average Annual Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	17.1	16.2	
Average Velocity (m/s)	0.230	0.220	-0.010
Flow Area (m²)	0.077	0.074	-0.003
Max Depth (m)	0.079	0.077	-0.002
Annual 95%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	2.9	2.0	
Average Velocity (m/s)	0.110	0.100	-0.010
Flow Area (m²)	0.025	0.021	-0.004
Max Depth (m)	0.035	0.030	-0.005
Annual 5%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	60	59.1	
Average Velocity (m/s)	0.370	0.370	0.000
Flow Area (m²)	0.165	0.163	-0.002
Max Depth (m)	0.144	0.143	-0.001
2-year Flood Flow	**Baseline**	**Post-Dev**	**Difference**
Fflow (L/s)	670	670	
Average Velocity (m/s)	1.110	1.110	0.000
Flow Area (m²)	0.647	0.647	0.000
Max Depth (m)	0.391	0.391	0.000

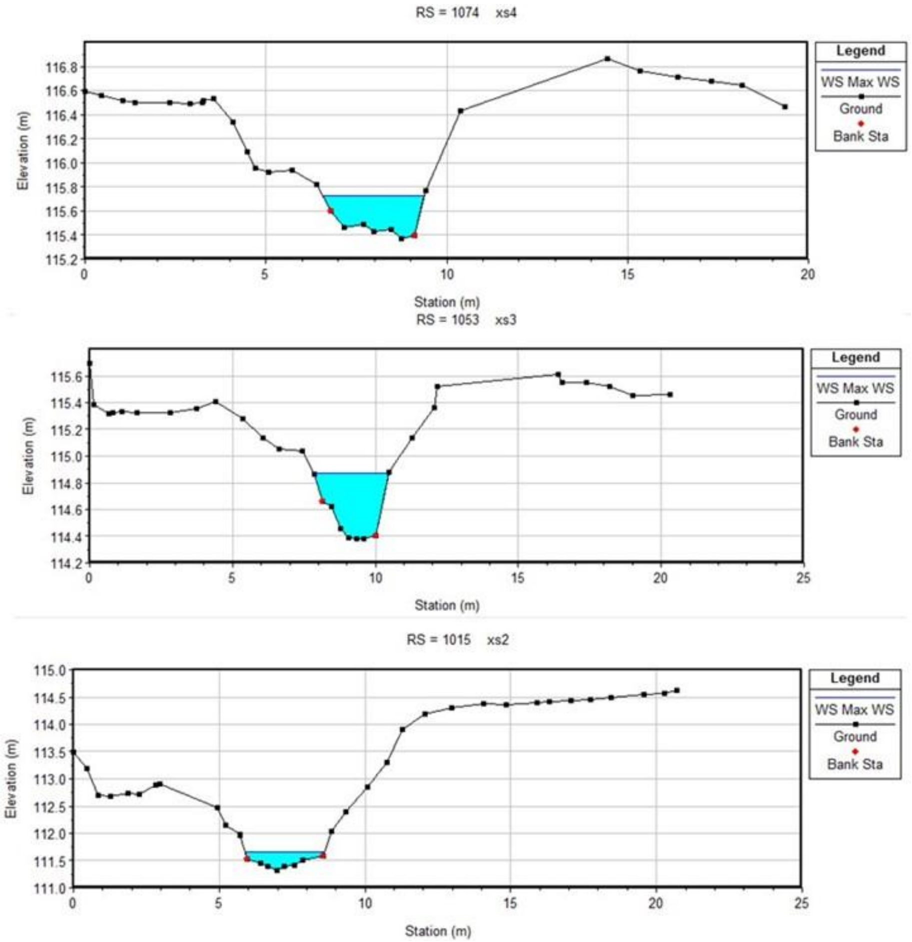
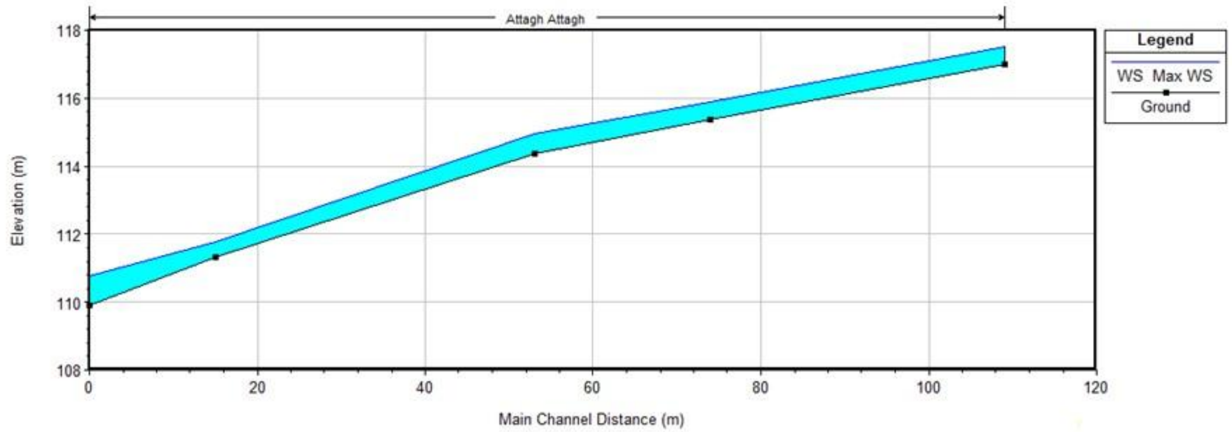


Figure 6-5: Predicted Impact of Changes in Flow in Attagh Burn (monthly flow) with observed long profile with 2-year flood level

Baseline	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	27.0	22.8	20.3	15.4	12.3	9.3	7.1	9.9	12.6	19.0	23.7	25.8
Average Velocity (m/s)	0.270	0.260	0.240	0.220	0.200	0.180	0.160	0.180	0.200	0.240	0.260	0.270
Flow Area (m^2)	0.100	0.091	0.085	0.072	0.064	0.053	0.045	0.055	0.064	0.082	0.093	0.097
Max Depth (m)	0.097	0.090	0.086	0.076	0.069	0.060	0.052	0.062	0.069	0.083	0.092	0.095

Post-Dev	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	26.0	21.9	19.3	14.5	11.4	8.3	6.2	9.0	11.7	18.1	22.7	24.9
Average Velocity (m/s)	0.270	0.250	0.240	0.220	0.190	0.170	0.160	0.180	0.190	0.230	0.250	0.260
Flow Area (m^2)	0.097	0.088	0.082	0.069	0.062	0.051	0.043	0.053	0.063	0.079	0.090	0.094
Max Depth (m)	0.095	0.088	0.083	0.073	0.067	0.058	0.051	0.060	0.068	0.081	0.089	0.093

Difference	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9	-0.9
Average Velocity (m/s)	0.000	-0.010	0.000	0.000	-0.010	-0.010	0.000	0.000	-0.010	-0.010	-0.010	-0.010
Flow Area (m^2)	-0.003	-0.003	-0.003	-0.003	-0.002	-0.002	-0.002	-0.002	-0.001	-0.003	-0.003	-0.003
Depth (m)	-0.002	-0.002	-0.003	-0.003	-0.002	-0.002	-0.001	-0.002	-0.001	-0.002	-0.003	-0.002



7. Glenealy Burn

Site Data and Hydraulic Calculations

7.1 The reach of the Glenealy Burn surveyed for this assessment is shown in Figure 7-1 with further details in Figures 7-3 to 7-6.

7.2 The watercourse flows though agricultural land with some vegetation cover for the channel, but with much of the channel exposed. The channel is impacted by man-made structures (notably a fence, animal crossing (gate) and one road crossing).

7.3 The channel down-valley gradient was calculated from the LiDAR and shown in Figure 7-2. The channel is very steep, being almost 14% at it's mouth and 7.5% over the rest of the measured reach. From field observations there is an even steeper, near vertical bedrock section, just downstream of the road bridge (see inset in Figure 7-1), which was not picked up by the LiDAR due to vegetation cover. This is one of the steepest of all the channels considered in this report and the channel shows classic cascade or Step-Pool forms with very large bed material and the channel profile broken into a series of rock step with small pools behind each step. During average or low flow and water would be in the gaps between large rocks in the step sections with no continuous (downstream) wetted channel. These bed forms are clearly shown and highlighted in Figures 7-3 to 7-6.

7.4 A visual survey (from opposite bank) of the mouth of the channel (Figure 7-5) showed a large fan/bar deposit (steep gravel/cobble feature) at the mouth of the burn where it joined the Owenkillew River. The Glenealy Burn channel is perched some 1.5m above the level of the river in the figure providing a topographical barrier for entry of fish to the burn.

7.5 As outlined in Section 2 the mine will reduce flows in the Glenealy Burn by around 0.7 L/s. Predictions of the impact of a 0.7 L/s decrease in flows were made using the channel sections and a HECRAS model.

7.6 The impacts of the change in flow on average velocity, flow area and maximum water depth are provided in Figure 7-7 and 7-8 for a range of flow conditions. The results show negligible impacts on any of these parameters, for examples under average flow conditions the change in flow due to the mine is predicted to result in 1mm (0.001m) change in flow depth and a 0.002m^2 change in flow area and no change in flow velocity – all unmeasurable changes.

7.7 It should also be noted that under average and low flows the water depths in the channel would be expected to be extremely low and would restrict the ability of the channel to support large fish, with or without the mine. This can be seen in the photographs associated with the figures below which are indicative of low flow conditions. This does not include the topographical restrictions at the mouth of the burn that would impact on fish to the channel in the first place.

7.8 The mine will have no impact on high flows. Given the sediment size in the channel, it would only be moved at high flow so there would be no impact of the mine on channel geomorphology, erosion or sedimentation.

Specific Responses to Loughs Agency Consultation

7.9 In terms of the LA consultation response the LA does not make direct reference to Glenealy Burn. But the burn is indirectly referenced in their Paragraph 10.34, in that this paragraph references the Statement of Case by Dr [redacted] for FODC. The text from the LA consultation response is provided in Section 5. Within the SWIA the Attagh Burn is assigned a Low Sensitivity in terms of Surface Water Hydrology including Flooding, based on criteria in Table 7-1 of the SWIA. Dr [redacted] her SoC suggests that all the small watercourses considered in the SWIA should be assigned High Sensitivity, given they are connected to watercourses (Owenkillew and Owenreagh Rivers) which are designated as having High Sensitivity.

7.10 Points related to the overall approach taken to define sensitivity of small watercourses have been discussed in Section 3.42 and 3.43 and are not repeated here.

7.11 With reference to the Glenealy Burn and additional information provided in this report it is clear the Glenealy Burn is a steep, rocky channel with shallow water depths over most flow conditions. Under high flow conditions there would be a risk of higher velocities locally in the channel. Changes in flow due to the mine are negligible, with almost no noticeable change in depths, flow area and velocity. We are content that it is a channel with low sensitivity in terms of hydrology. However, it is noted that even if the burn was considered to be of higher sensitivity, then the effects of the mine are so low that with the SWIA the impacts would not have been considered significant.

Summary and Conclusions – Glenealy Burn

7.12 Glenealy Burn is a small, upland watercourse with a steep rocky channel. It is characterised by low water depths under average and low flow conditions and high velocities under flood flows. The Curraghinalt mine will result in small decreases in flows during operations, due to the lowering of the local groundwater table. Assessments presented in the SWIA and supplemented by calculations here show small changes in water depth, flow area and flow velocity during mine operations.

7.13 Calculations show that the changes in flow would not impact on erosion or deposition in the channel, given the coarse nature of the sediment in the channel.

7.14 The additional data and calculations do not change the conclusions of the SWIA in terms of impacts on flows, hydraulics and geomorphology of the Glenealy Burn and they illustrate that the concerns raised by LA are not valid and that the changes to the burn would not have significant local, national or transboundary effects

Figure 7-1: Coverage of LiDAR and aerial photo for Glenealy Burn

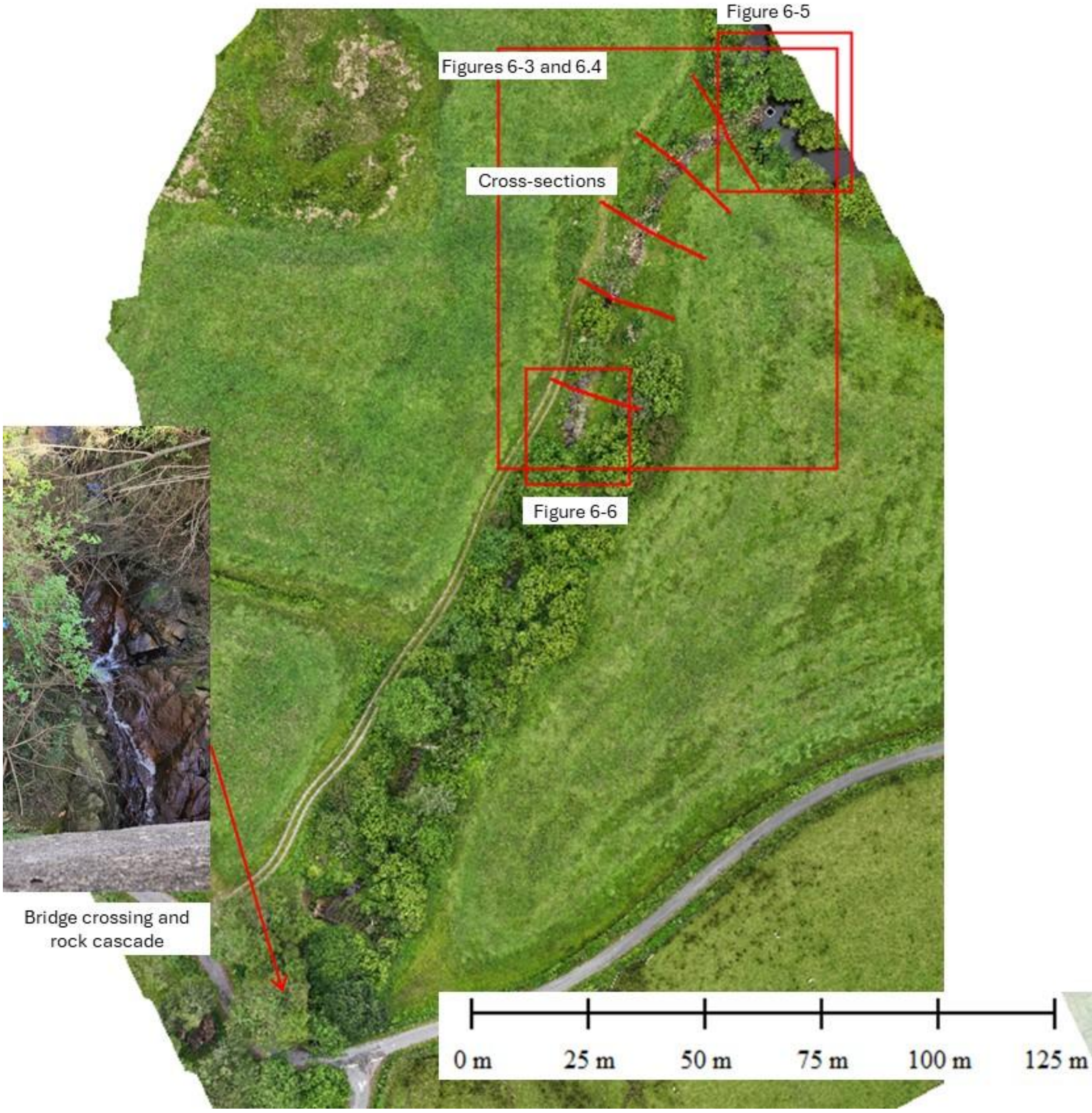


Figure 7-2: Long profile of Glenealy Burn from LiDAR data, with channel morphology type based on channel

Geology	Slope	Sinuosity	Type	Sub-type
Bedrock	Any	Any	A	Bedrock, Cascade
Not bedrock	>10%	Any	A	Cascade
	>3% - ≤10%	Any	B	Step Pool
	>0.5% - ≤3%	≤1.1	B	Step Pool, Plane Bed
		>1.1	C	Plane Riffle
	>0.1% - ≤0.5%	Any	C	Plane Riffle, Braided, Wandering
	>0.05% - ≤0.1%	≤1.4	C	Plane Riffle, Braided, Wandering
		>1.4	D	Actively Meandering
	>0.01% - ≤0.05%	Any	D	Actively Meandering
	≤0.01%	Any	F	Low Gradient Passive Meandering

SEPA (2012) Supporting Guidance WAT-SG-21 Environmental Standards for River Morphology

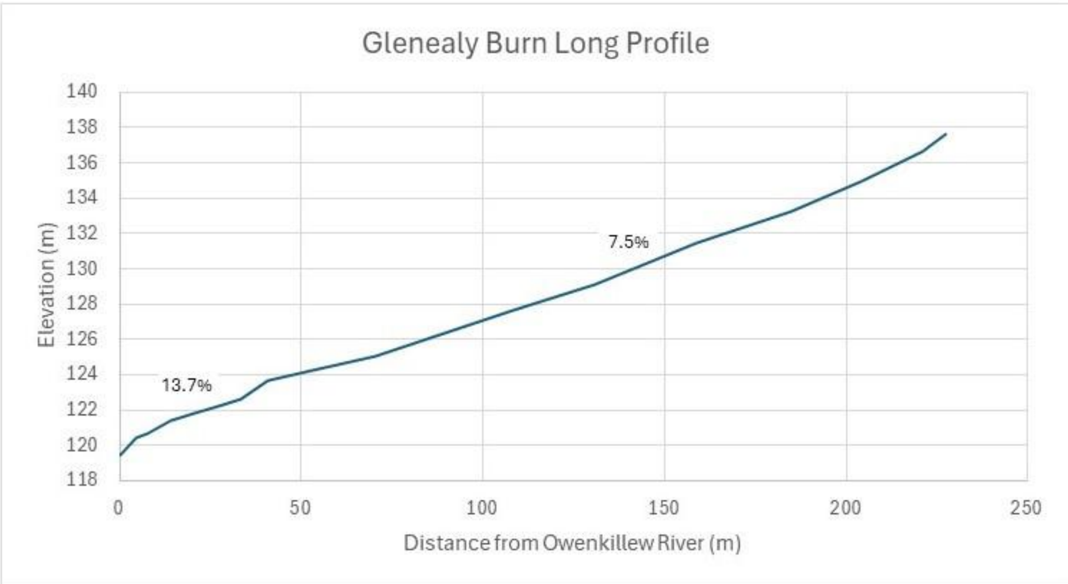


Figure 7-3: Downstream section of Glenealy Burn with location in Figure 7-1, showing key morphological features

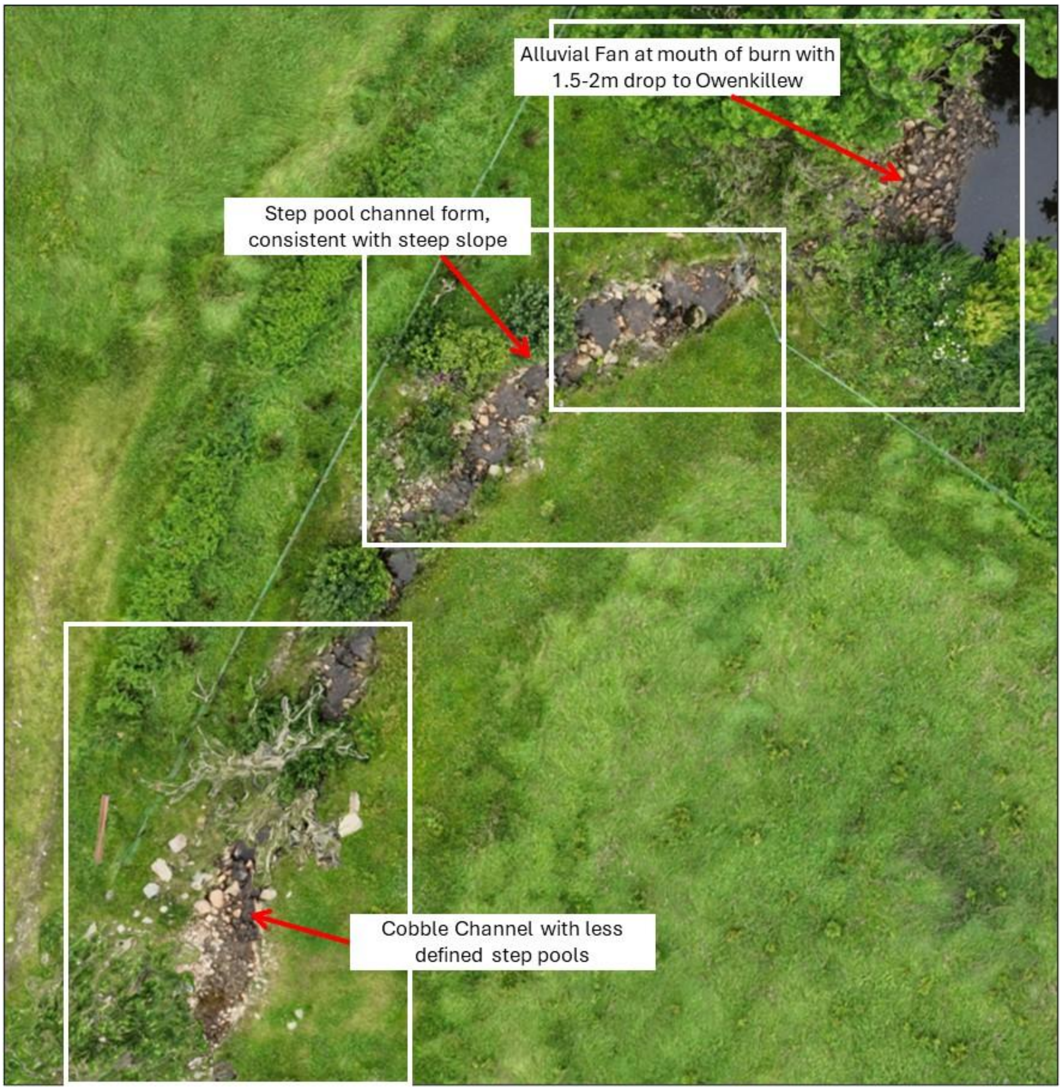


Figure 7-4: Reach of Glenealy Burn with surveyed section with location in Figure 7-1, showing key morphological features

Figure 7-5: Mouth of Glenealy Burn with location in Figure 7-1, showing key morphological features

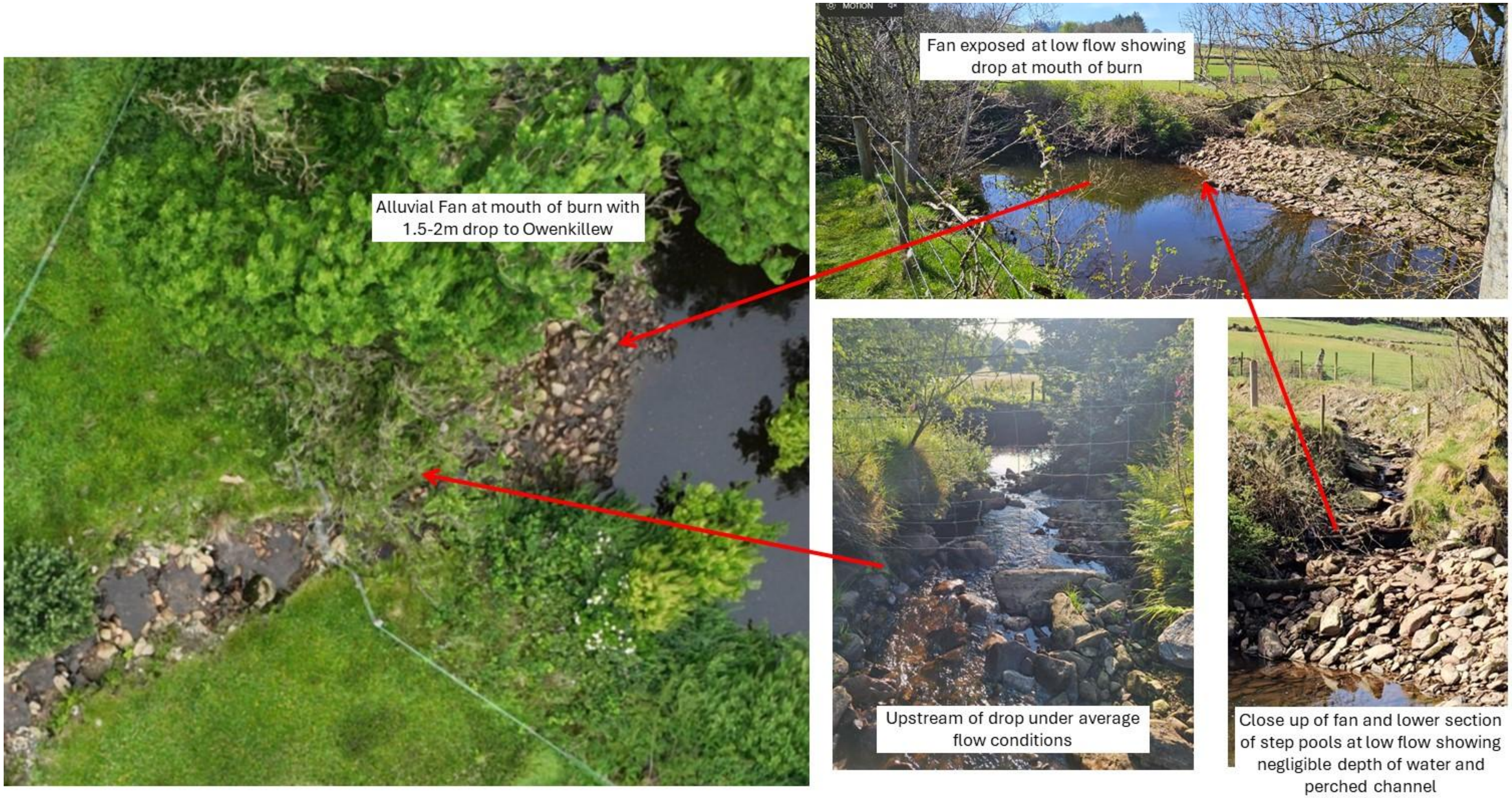


Figure 7-6: Detail of Glenealy Burn with location in Figure 7-1, showing key morphological features

Figure 7-7: Predicted Impact of Changes in Flow in Glenealy Burn with observed cross-sections with 2-year flood level

<u>Glenealy Burn</u>

Catchment Area (km^2)	1.1		
Average Annual Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	31.3	30.6	
Average Velocity (m/s)	0.250	0.250	0.000
Flow Area (m^2)	0.124	0.126	0.002
Max Depth (m)	0.122	0.123	0.001
Annual 95%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	5.3	4.6	
Average Velocity (m/s)	0.120	0.120	0.000
Flow Area (m^2)	0.038	0.042	0.004
Max Depth (m)	0.069	0.073	0.004
Annual 5%ile Low Flow	**Baseline**	**Post-Dev**	**Difference**
Flow (L/s)	110	110	
Average Velocity (m/s)	0.420	0.420	0.000
Flow Area (m^2)	0.262	0.262	0.000
Max Depth (m)	0.190	0.190	0.000
2-year Flood Flow	**Baseline**	**Post-Dev**	**Difference**
Fflow (L/s)	1230	1230	
Average Velocity (m/s)	1.420	1.420	0.000
Flow Area (m^2)	0.949	0.949	0.000
Max Depth (m)	0.458	0.458	0.000

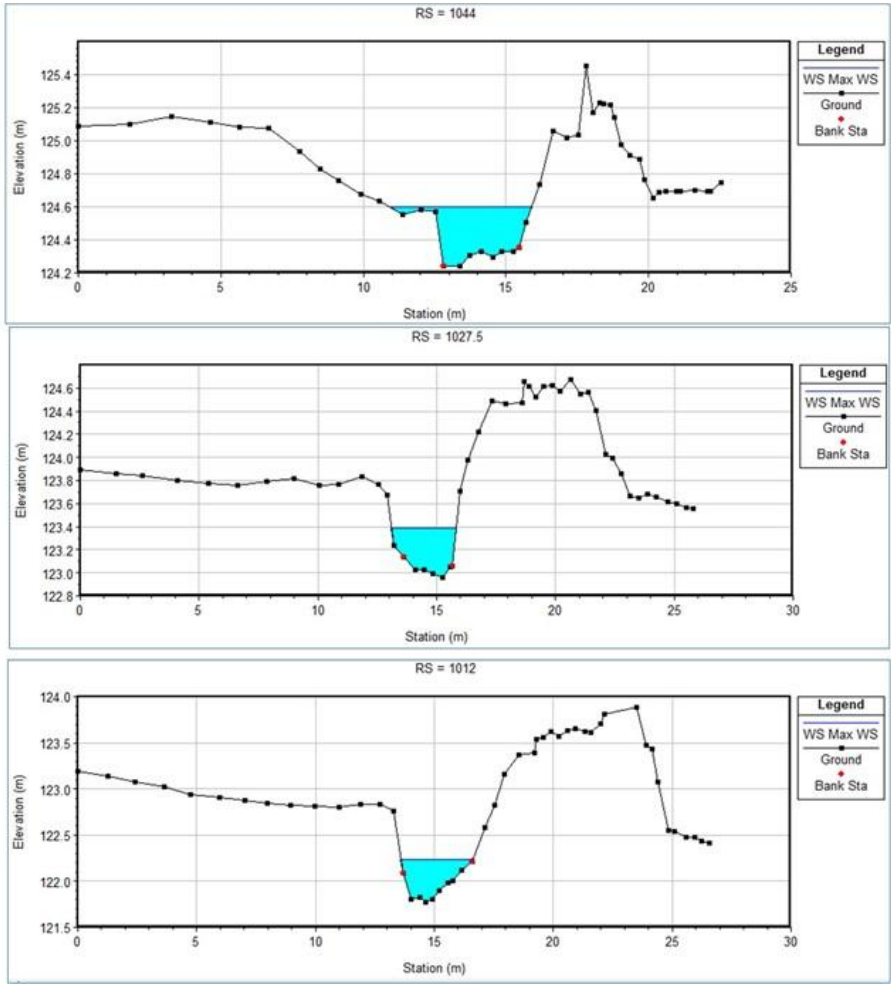
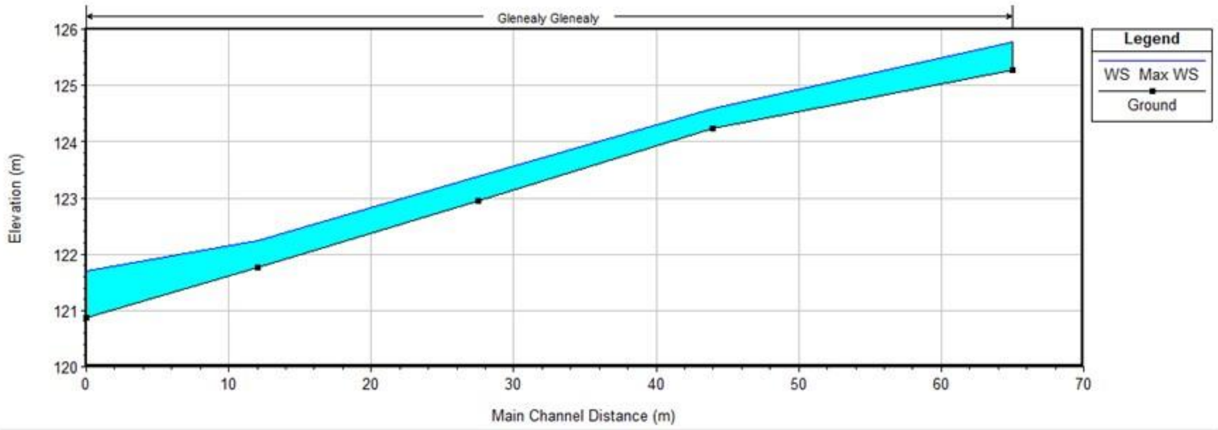


Figure 7-8: Predicted Impact of Changes in Flow in Glenealy Burn (monthly flow) with observed long profile with 2-year flood

Baseline	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	49.4	41.8	37.1	28.3	22.5	17.0	13.1	18.2	23.1	34.9	43.4	47.4
Average Velocity (m/s)	0.290	0.270	0.260	0.240	0.220	0.190	0.170	0.200	0.220	0.260	0.280	0.290
Flow Area (m^2)	0.167	0.150	0.138	0.116	0.102	0.084	0.073	0.088	0.103	0.133	0.154	0.162
Max Depth (m)	0.145	0.136	0.130	0.118	0.110	0.100	0.093	0.102	0.110	0.127	0.138	0.142

Post-Dev	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	48.8	41.1	36.5	27.6	21.9	16.3	12.4	17.5	22.4	34.2	42.7	46.7
Average Velocity (m/s)	0.290	0.280	0.270	0.240	0.220	0.200	0.170	0.200	0.220	0.260	0.280	0.870
Flow Area (m^2)	0.168	0.151	0.140	0.118	0.103	0.087	0.076	0.092	0.105	0.134	0.155	0.581
Max Depth (m)	0.145	0.137	0.130	0.119	0.110	0.101	0.095	0.104	0.111	0.128	0.139	0.321

Difference	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Monthly Flow (L/s)	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7	-0.7
Average Velocity (m/s)	0.000	0.010	0.010	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000	0.580
Flow Area (m^2)	0.001	0.001	0.002	0.002	0.001	0.003	0.003	0.004	0.002	0.001	0.001	0.419
Depth (m)	0.000	0.001	0.000	0.001	0.000	0.001	0.002	0.002	0.001	0.001	0.001	0.179



8. Coneyglen and Glenlark Burns

8.1 The Coneyglen and Glenlark Burns were surveyed at the same time as the other watercourses. These burns were surveyed to provide a comparison with the small watercourses next to the mine. Both these burns are significantly larger and lower gradient channels than the burns considered in the rest of this report, and they are considered examples of the sort of watercourses which could be considered highly sensitive watercourses in terms of hydrology and habitat, and which would be expected to have significant populations of fish.

8.2 The mine will have no impact on these watercourses.

8.3 The relative locations of Coneyglen and Glenlark Burns are shown in Figure 8-1. Both watercourses are tributaries of Owenkillew River, with Coneyglen 3km upstream of the Curraghinalt Burn and Glenlark Burn 250m upstream of the Curraghinalt. Their catchment areas and average flow rates, compared to Pollanroe and Curraghinalt Burns are provided in Table 8-1.

8.4 Figure 8-2 shows an aerial image of the Coneyglen Burn, with a detail of the reach of the burn close to the mouth in Figure 8-3. The long profile of the burn is shown in Figure 8-4. Illustrating it has a slope gradient of around 1%. Based on this gradient and the table in Figure 8-3, the channel should have a Plane Riffle form. Photos shown in Figure 8-3 highlights that the channel is broad with a good water covering. The bed material is coarse with examples of channel bars along its length forming a typical plane bed (straight coarse material) and with riffles (shallower areas caused by formation of gravel bars). The photographs can be compared to those for the smaller burns, with Coneyglen having a wider variety of channel habitats.

8.5 Cross-sections were measured close to the mouth of the Coneyglen Burn and a HEC-RAS model was constructed to show the water depth, flow area and flow velocity for a range of flow conditions and these are shown in Figure 8-5. The water depth under average flows is 0.335m with a flow area of 1.4m^2 and average velocity of 0.59m/s. Depths and flow areas are significantly larger than for the other small watercourses, providing much more habitat to fish along the reach. The depth will also vary along the reach with deeper flow in pool sections and shallower in riffles.

8.6 Figure 8-5 also shows the aerial photo of a section of Glenlark Burn. No cross-sections were collected for Glenlark, so it is provided as a visual comparison with the other watercourses. It shows similar geomorphology to the Coneyglen with a broad channel with channel bars at bends in the channel.

8.7 In summary, this information provides a counter-point to the data for the five smaller watercourses (Pollanroe, Unnamed, Curraghinalt, Attagh and Glenealy) showing the sort of larger watercourse which has significant fish habitat and which is an active, lower gradient river with gravel and cobble beds.

Table 8-1: Comparison of Coneyglen and Glenlark Burns to Pollanroe and Curraghinalt Burns

Watercourse	Catchment Area (km^2)	Average Flow (L/s)
Coneyglen Burn at its mouth	21.7	630
Glenlark Burn at its mouth	22.1	640
Pollanroe Burn at its mouth	2	58
Curraghinalt Burn at its mouth	1	28

Figure 8-1: Location of Coneyglen Burn and Glenlark Burn

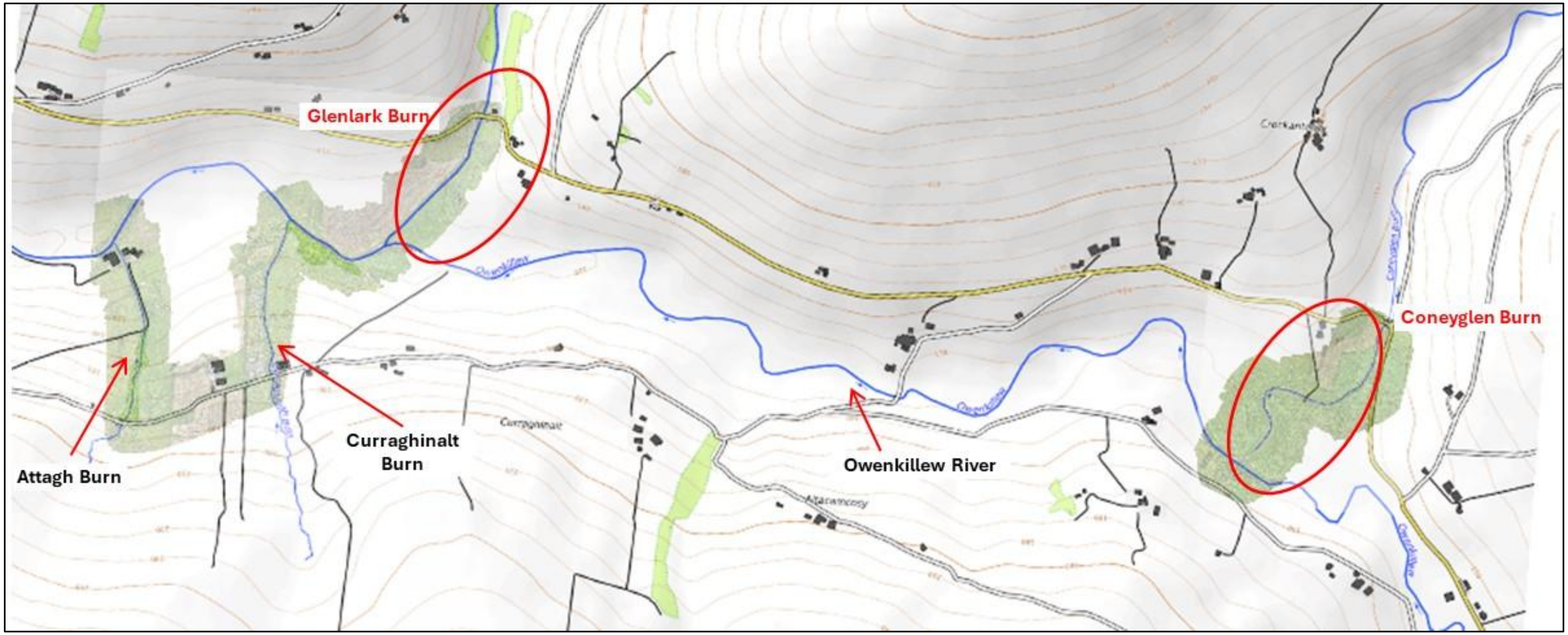


Figure 8-2: Coneyglen Burn reach that has been surveyed with LiDAR, showing channel cross-sections and key morphological features

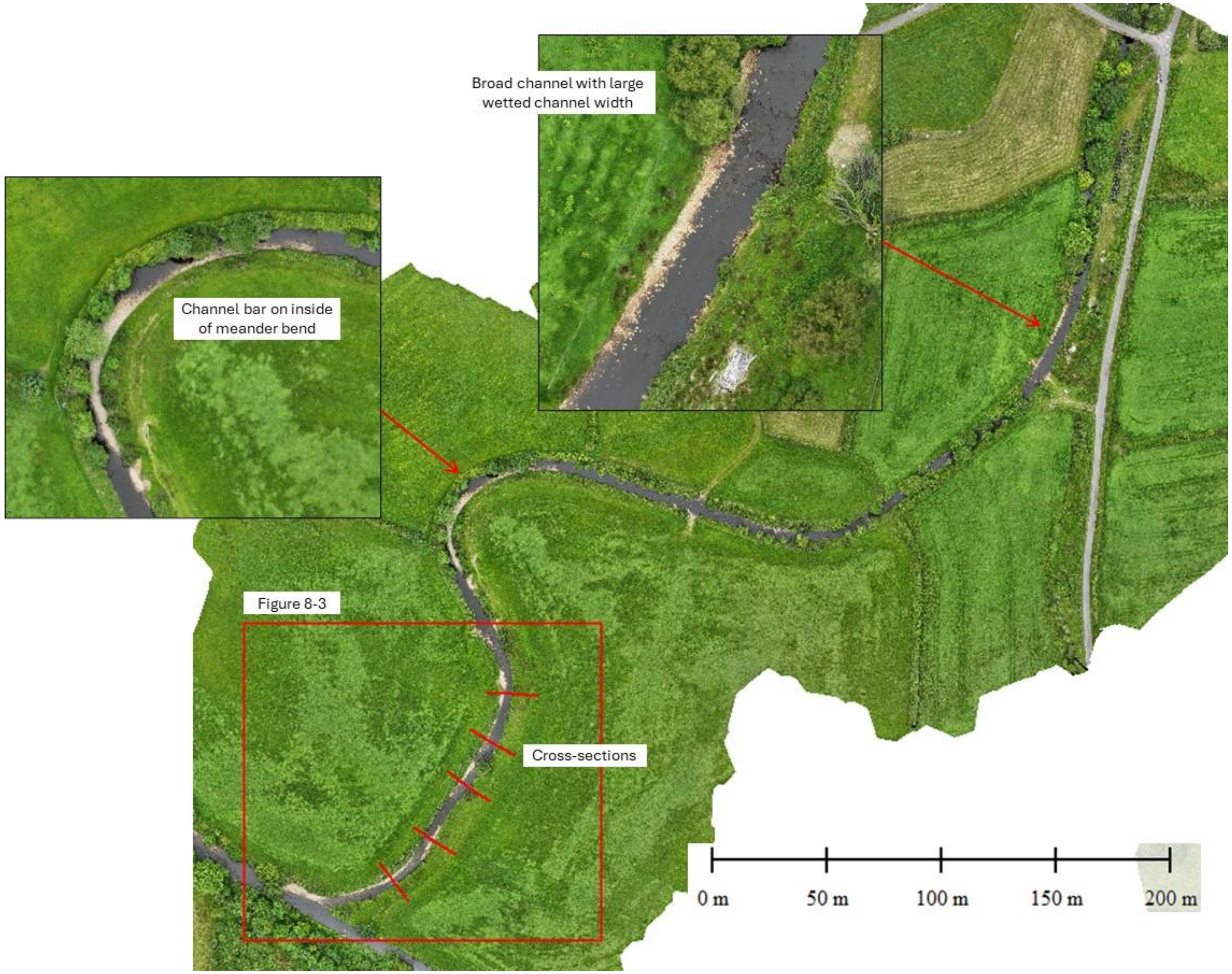


Figure 8-3: Detail of Coneyglen Burn with location in Figure 8-2, showing key morphological features

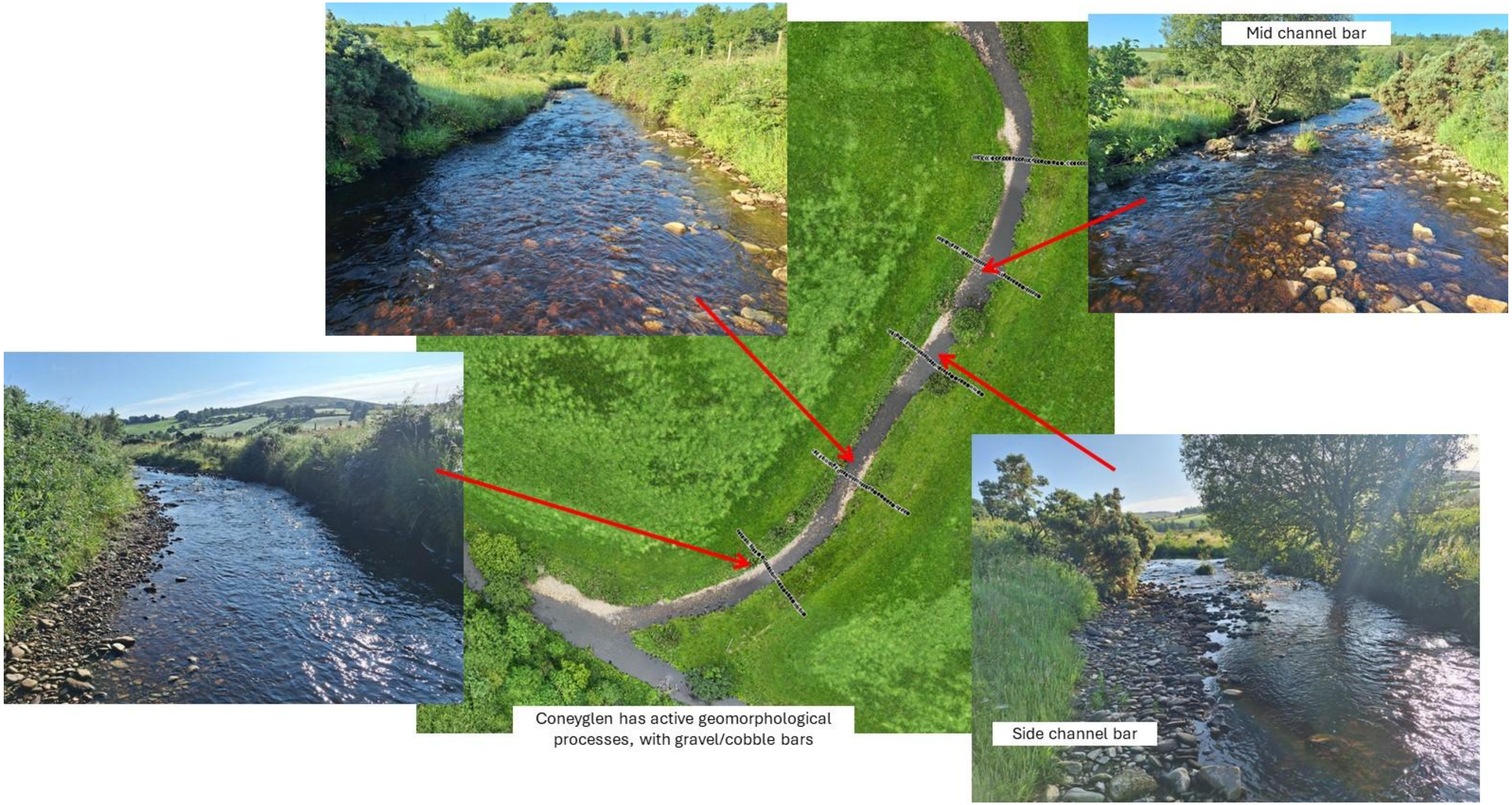


Figure 8-4: Long profile of Coneyglen Burn from LiDAR data, with channel morphology type based on channel slope

Geology	Slope	Sinuosity	Type	Sub-type
Bedrock	Any	Any	A	Bedrock, Cascade
Not bedrock	>10%	Any	A	Cascade
	>3% - ≤10%	Any	B	Step Pool
	>0.5% - ≤3%	≤1.1	B	Step Pool, Plane Bed
		>1.1	C	Plane Riffle
	>0.1% - ≤0.5%	Any	C	Plane Riffle, Braided, Wandering
	>0.05% - ≤0.1%	≤1.4	C	Plane Riffle, Braided, Wandering
		>1.4	D	Actively Meandering
	>0.01% - ≤0.05%	Any	D	Actively Meandering
	≤0.01%	Any	F	Low Gradient Passive Meandering

SEPA (2012) Supporting Guidance WAT-SG-21 Environmental Standards for River Morphology

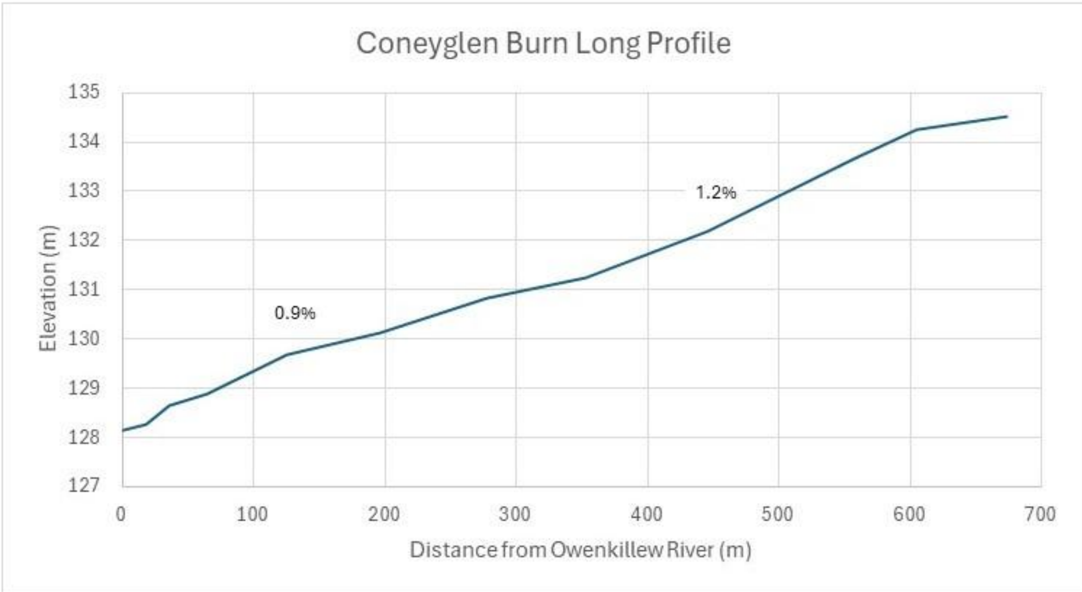


Figure 8-5: Cross-section and hydraulic details for Coneyglen Burn

Coneyglen Burn

Catchment Area (km^2)	21.7
Average Annual Flow	**Baseline**
Flow (L/s)	793.0
Average Velocity (m/s)	0.59
Flow Area (m^2)	1.386
Max Depth (m)	0.335
Annual 95%ile Low Flow	**Baseline**
Flow (L/s)	118.0
Average Velocity (m/s)	0.23
Flow Area (m^2)	0.516
Max Depth (m)	0.177
Annual 5%ile Low Flow	**Baseline**
Flow (L/s)	2170
Average Velocity (m/s)	0.95
Flow Area (m^2)	2.405
Max Depth (m)	0.508
2-year Flood Flow	**Baseline**
Flow (L/s)	16200
Average Velocity (m/s)	2.04
Flow Area (m^2)	9.853
Max Depth (m)	1.465

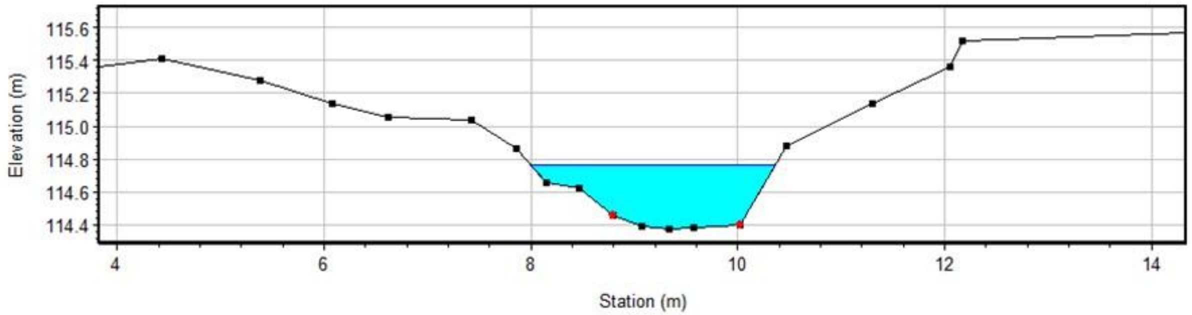
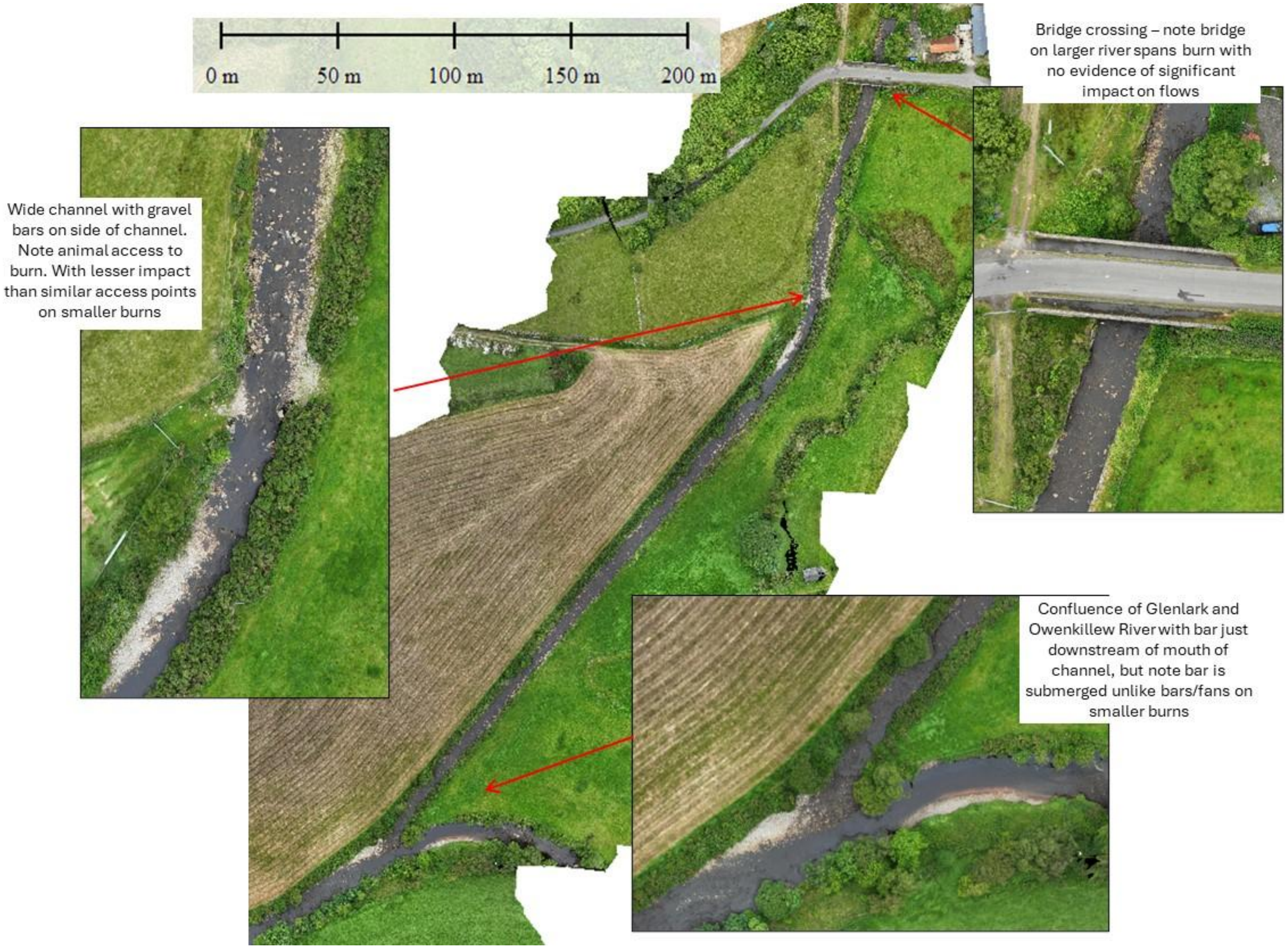


Figure 8-6: Glenlark Burn with key features highlighted



9. Summary and Discussion

9.1 This report addresses comments made by LA in their transboundary consultation response which focus on the impact of the mine on flows and hydraulics in the small burns close to the mine site, and the effect of any changes in flows and hydraulics on fish habitat.

9.2 The report provides more detailed calculations and visual evidence of the effect of changes in flow on water depth, velocity and flow area all parameters identified by LA as being important to fish and fish habitat. The assessment shows that any impacts of the mine on flows will result in negligible (unmeasurable in the field) changes in these parameters. The results presented here are consistent with the conclusions made in the SWIA and the new information would not change the conclusions of the SWIA.

9.3 It is our view that the impacts of the mine suggested by LA on fish and fish habitat are not borne out through analysis and that LA are setting the bar for a significant impact so low that their approach is not appropriate for the Environmental Impact Assessment process.

9.4 The comments made by LA follow from comments made by others (e.g., NIEA and objectors), which try to set flow and other standards (e.g., discharge consent values) which are unrealistically low and which are not based on impacts on target species. For example, NIEA propose discharge consent values of 0mg/L for many water quality parameters for the mine discharge and the unscientific (and un-manageable) nature of these proposals have been discussed in our rebuttal statement related to proposed Discharge Consent values (*). In terms of flow standards NIEA and LA make reference to JNCC (2016, 'Rivers') standards which are included in the Owenkillew SAC Conservation Objectives. The project SHRA provides arguments that these flow standards are not applicable to the small burns considered in this report; however, we understand that NIEA and LA wish to apply these standards to any salmon bearing stream that is upstream of an SAC where salmon is a target species. These flow standards suggest that an increase in flow rates (>10% of average flow and >5% at low flow) would not be acceptable, although it is widely appreciated that increases in low and average flows increases in channel habitat and would be beneficial to fish. This is reviewed in the light of the predictions made in this report in the supporting Fish Habitat and Fish Survey reports.

9.5 It is our case that even if these flow standards have any application to the burns they cannot be applied without consideration of the impact of changes in flow to fish or fish habitat.

9.6 It is assumed that if NIEA and LA apply these targets to the Pollanroe Burn, then they will need to apply them to all other developments impacting on streams that are potentially salmon bearing, and which lie upstream of an SAC where the JNCC flow targets are set (essentially everywhere in the Foyle catchment). We have undertaken a very brief review of the A5 Road (Western Transport Corridor) proposals and immediately identified an example (Appendix 1) where there are discharges into salmon bearing streams where the application of JNCC targets have not yet been considered and which would prevent discharge. Along the A5 route there are 62 discharge consent applications. Of these there appear to be 29 (based on our catchment assessment for listed discharge consent locations) which discharge into watercourses with areas smaller than the Pollanroe Burn (2.05km^2). If the JNCC targets are applied without consideration of impacts on fish and fish habitat then it can be assumed that any significant discharges would not comply, if the streams are considered salmon bearing. The conclusion is that the proposed application of JNCC standards by NIEA and LA for the Curraghinalt project is not consistent with the approach taken elsewhere and if applied elsewhere would create unnecessary constraints on almost any development that proposes discharges to watercourses.

10. References

EA (2013) Climate change approaches in water resources planning – overview of new methods. Report SC090017/R3

Carbon Brief, 2019. Explainer: The high-emissions 'RCP8.5' global warming scenario (carbonbrief.org)

Dfi Water and Drainage Policy Division, 2019. Technical Flood Risk Guidance in relation to Allowances for Climate Change in Northern Ireland, February 2019.

JNCC, 2016. Common Standards Monitoring Guidance for Rivers, Version September 2016. Common Standards Monitoring Guidance for Rivers

11. Appendix 1: Example of A5 Discharge

11.1 The example considers the discharge associated with the dewatering of Strahan's Quarry south of Strabane and discharges from a proposed road cutting near the quarry.

11.2 The cutting will involve pumping of Strahan's quarry (unknown discharge rate) and a permanent discharge from the proposed road cutting of 13L/s into the Flushtown Channel (WSP, 2022a) at a discharge point shown in Figure 11-1. The Flushtown Channel at the discharge point is around 1km^2, or around 50% of the catchment area of the Pollanroe Burn and the discharge rate is similar to the total increase in average flows to the Pollanroe.

11.3 The Flushtown Channel is identified as potentially salmon-bearing (WSP, 2022b) and is upstream of the River Finn SAC, so we would expect NIEA to apply the JNCC flow standards as the River Finn Conservation Objectives for flow are the same as for Owenkillew. Even considering if the salmon-bearing reach of the channel was further downstream at the 3km^2 catchment (location shown in Figure 1), then the CEH LowFLows2 software would indicate that Q95 in the stream is 6.6L/s, mean July flow of 24.5L/s and mean annual flow of 62.8L/s. Therefore, a discharge of 13L/s would be >5% change in the Q95 flow and >10% change in average flows, inconsistent with the Conservation Objectives.

11.4 Along the A5 route there are 62 discharge consent applications. Of these there appear to be 29 (based on our catchment assessment for listed discharge consent locations) which discharge into watercourses with areas smaller than the Pollanroe Burn (2.05km^2). Given the stringent nature of the Conservation Objectives, it can be assumed that any significant discharges would not comply with the objectives, if the streams are considered fish habitat. For a 2km^2 catchment the Q95 flow is likely to be around 4-5L/s, so 5% of this would be 0.2-0.25L/s only, providing almost no scope for any additional runoff. Even if there are no discharges during low flow conditions (i.e., not groundwater or dewatering related) the average annual flow would be around 40-50L/s resulting in an average discharge of no more than 4-5L/s. There are over 100 proposed road cuttings associated with development of the A5, and many will require permanent depression of the local groundwater table, passive collection of groundwater inflow, and diversion to surface water course (Mouchel, 2016).

11.5 These comments refer to flow rates only and do not consider the water quality aspects of the discharges. If NIEA and LA require the application of similar discharge consent values for the A5 discharges, which would be expected given the approach taken by NIEA and LA is not specific to the mine discharge, then this would also provide significant constraints on the any discharges associated with the road. As noted above there will be numerous discharges of groundwater from cuttings and the requirements outlined by NIEA and LA for the mine, including numerous 0mg/L discharge values would not be able to be achieved without high cost treatment (e.g., Reverse Osmosis).

11.6 Mouchel (2016). A5 WTC. Volume 3 Appendices. Table 16E.9. https://www.a5wtc.com/pages/environmental-statement

11.7 WSP (2022a). 16 Road Drainage and Water Environment. https://www.a5wtc.com/pages/environmental-statement

11.8 WSP (2022b). Habitats Regulations Assessment. Report of Information to Inform an Appropriate Assessment. 718736-3000-R-071 – River Foyle and Tributaries Special Area of Conservation. https://www.a5wtc.com/pages/environmental-statement

Figure 11-1: Strahan's Quarry Discharge Example for A5 Road