

Ffos-y-Fran, Merthyr Tydfil

Flood Consequences Assessment & Drainage Strategy

January 2025

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This report will remain valid for a period of twelve months (from the date of last issue) after which the source data should be reviewed in order to reassess the findings and conclusions on the basis of latest available information.

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Introduction

Waterco has been instructed to prepare a Flood Consequences Assessment (FCA) and Drainage Strategy in respect of restoration proposals of the former opencast mine at Ffos-y-Fran, Merthyr Tydfil, CF48 4AH.

The purpose of this report is to outline the potential flood risk to the site, the impact of the proposed reclamation scheme on flood risk elsewhere, and the proposed measures which could be incorporated to mitigate the identified flood risk (if any). This report has been prepared in accordance with the guidance contained in Planning Policy Wales (PPW) and Technical Advice Note 15 (TAN15): Development and Flood Risk.

This Flood Consequences Assessment has been supported by and should be read in conjunction with the Waterco Hydraulic Modelling Technical Note (document reference 15840-Modelling Technical Note-01) and the Waterco Water Framework Directive Assessment (document reference 15840-WFD-02).

Studies relating to water quality and groundwater have been undertaken by others. Full details are available in the Environmental Statement which supports the planning application.

Existing Conditions

The site covers an area of approximately 400 hectares (ha) and is centred at National Grid Reference (NGR): 307512, 206905. A location plan and an aerial image are included in Appendix A.

Online mapping (including Google Maps / Google Streetview imagery, accessed December 2024) shows that the site currently comprises an opencast coal mine, with operations having ceased in November 2023. The southern extent of the site comprises a motocross course positioned on an overburden mound. The motocross course is excluded from this assessment and is considered within a separate application.

The site is bordered by the Trecatti Landfill site and the A4060 (road) to the north, undeveloped moorland/agricultural land to the east and south, and the A4060 together with undeveloped moorland/agricultural land to the west. Access to the site is provided from Bogey Road off the A4060. Bogey Road intersects the central section of the site. There are also several haul roads within the site which provide access.

Local Topography

A topographical survey has been provided by the Client in July 2023. The topographical survey shows that the site slopes from approximately 475metres Above Ordnance Datum (m AOD) in the eastern extent (an overburden mound) to approximately 243m AOD at the base of the quarry void.

Topographic levels to m AOD have also been derived from a 1m resolution NRW composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). The LiDAR data generally corroborates the topographical survey.

Topographical information is provided as Appendix B.

Ground Conditions

Published Geology

The British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the southern extent of the site is partially underlain by superficial deposits of Devensian Till, generally comprising Diamicton. The superficial deposits are identified as being underlain by South Wales Middle Coal Measures Formation consisting of mudstone, siltstone and sandstone.

The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific basis.

Ground Investigations

There are several historical BGS borehole records located on site. Historical BGS borehole record reference SO00NE51, located immediately south-west of the quarry void, identifies:

- Sand and fine gravel of mainly coal, shale and seatearth from ground level to 1.5 metres below ground level (m.bgl)
- Dark brown to black, soft becoming very soft, sandy clayey silt (lagoonal fines) from 1.5m.bgl to 10.40m.bgl
- Dark brown to grey, soft, silty clay with fine gravel from 10.40m.bgl to 11m.bgl
- Dark brown to black, very soft, sticky, sandy clayey silt (lagoonal fines) from 11m.bgl to 12m.bgl
- Dark brown, soft, damp, sandy, silt with angular sandstone cobbles and gravel from 12m.bgl to 12.50m.bgl.

The BGS borehole record is included as Appendix C.

Hydrogeology

According to NRW's Aquifer Designation data, obtained from the BGS GeoIndex online mapping [accessed December 2024], the superficial Devensian Till deposits are classified as a Secondary Undifferentiated Aquifer. Secondary Undifferentiated Aquifers are assigned in 'cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type'.

The underlying South Wales Middle Coal Measures Formation is classified as a Secondary A Aquifer. Secondary A Aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.

The NRW's 'Source Protection Zones' data, obtained from the Welsh Government 'Data Map Wales' website [accessed December 2024], indicates that the site is not located within a groundwater Source Protection

Zone.

Groundwater

The following information has been provided by Groundwater Science Ltd:

The hydrogeology of the site is complex and heavily influenced by the underlying geology including the Dowlais and Penydarren Faults, previous workings and mine drainage systems including the Merthyr Free Drainage System and the Dowlais Free Drainage System. Five underground drainage courses are known to exist in the vicinity of the site. The Black Ball Watercourse, Penyrheol watercourse and Penydarren Water Level, discharge to the west of the site which eventually drains to the Afon Taff. The free drainage Rhas Las Level and the Big Coal Free Drain discharge to the Bute and Nant Llesg watercourses which flow eastwards to the River Rhymney near Pontlloftyn.

Mining activity has resulted in the removal and replacement of the coal measures with backfill. This has generally not disturbed the existing underground drainage systems. The Dowlais fault has been excavated down to a minimum pavement level of 245 m AOD. Groundwater levels obtained prior to the commencement of mining demonstrated the presence of a head differential of approximately 20 to 40 m across the fault from east to west, from an average elevation of 277 m AOD in the present pit area to approximately 220-240 m AOD. The presence of higher groundwater heads on the upthrow side of the fault relative to the downthrow side suggests that it previously behaved as a partial, low permeability barrier to groundwater flow from east to west. Removal of the fault and replacement with backfill is likely to have affected the flow regime within the excavated volume given the prior influence of the structure on the local groundwater regime.

The eventual post-recovery rest level of the water table through the emplaced backfill will be a function of the transmissivity of the material and pavement level of the removed fault, which conceptually will act as a spill point for groundwater from east to west. The observation that the pit lake level (which drilling in the pit floor has confirmed is in continuity with groundwater), recovered to at least 264 m AOD in 2020 and the present-day level of circa 280 m AOD (May 2024) demonstrates that the groundwater level is above the elevation of the excavated Dowlais pavement at 245 m AOD. If the backfill material was highly permeable, the gradient of the water table would be relatively flat and therefore the pit water level would be close to the Dowlais pavement level elevation. Instead, since the lake water level has recovered steadily within the current pit void area, it appears that the bulk transmissivity of the emplaced backfill is sufficiently low to allow the development of hydraulic gradients that are not dissimilar to those that were present when the groundwater system was governed by the transmissivity of the heavily worked coal measures and Dowlais fault before they were mined out.

Details of the groundwater regime and groundwater levels are provided as Appendix D. The highest groundwater level recorded on site is approximately 310m AOD. Groundwater levels adjacent to the pit void are generally in the region of 284m AOD.

Water within the quarry void has been pumped during mining. Since mining operations ceased in November 2023, the water level within the quarry void has reached a maximum level of approximately 280m AOD – 281m AOD. Water levels peaked in April 2024 and were shown to be receding in summer 2024. Figure 1, provided by Groundwater Science Ltd, shows water levels and volumes within the quarry void from August

2023 to July 2024.

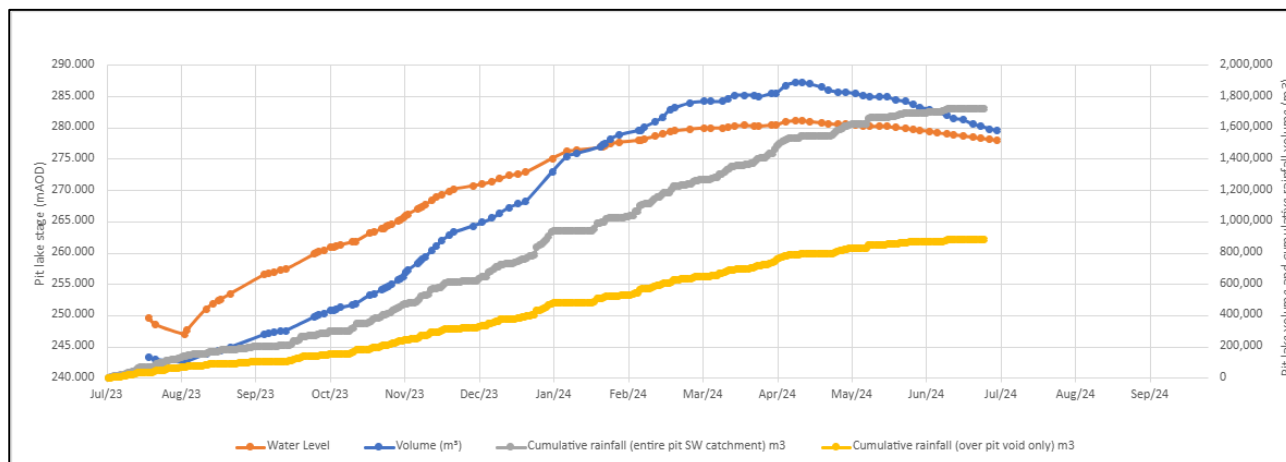


Figure 1 – Quarry Void Water Level and Volume

Local Drainage

Public sewer records have been obtained from Dwr Cymru Welsh Water (DCWW) in August 2024 and are included in Appendix E. The DCWW sewer records show that there are no public sewers within the site. There is a network of public surface water, combined and foul sewers serving the urban area of Merthyr Tydfil north-west of the A4060.

The site is intersected by a network of unnamed drainage ditches; some of which form part of historic workings on the site from previous mining activity. These carry rainfall runoff and discharge to watercourses local to the site. There are also a series of ponds and lagoons on site, several of which are designated as water treatment areas (sediment settlement lagoons).

Waterco Site Visit

A site visit was undertaken by Waterco on 11th September 2024. The purpose of the site visit was to inspect the waterbodies and watercourses on site, assessing their flow and hydrological connectivity to waterbodies downstream.

A plan showing the locations of hydrological features on site, together with a photographic record is included in Appendix F. A summary of the findings of the site visit is included below.

- At the easternmost extent of the site, immediately south-east of Overburden Mound 2 (OB2), an unnamed watercourse (ditch) becomes culverted under an internal access road and Bogey Road before continuing south to converge with Cwm Golau (watercourse). This ditch originates off site. The source was not identified during the visit.
- Immediately south of OB2 and west of the aforementioned ditch there is a wheel wash lagoon (NGR: 308769, 206295). This is a closed system and is not hydrologically linked to the watercourses on site.
- Further west within the site there is a water treatment area (designated as WC1). This comprises

2no. attenuation lagoons which discharge to 2no. settlement ponds via a penstock valve. Treated flows are then discharged to an unnamed ditch that drains to the Bargoed Taff. Inflows into these attenuation lagoons originate from ditches upstream (originating between OB1 & OB2). These ditches conveyed minimal flow during the time of the visit. Some iron staining was observed.

- Barrel wash lagoons are located at approximate NGR: 308106, 206498. Another washing area was located south-west at approximate NGR: 307920, 206489. Information from the Client reveals these are closed systems with no hydrological connectivity to the watercourses on site.
- 3no. culverts were identified on the north-western site boundary. Engineered ditches were observed along this site boundary; however, no flow was present at the time of visit. 2no. culverts are known to convey runoff under the A4060.
- A concrete channel was also observed in the northernmost extent of the site. This channel transitions into a culvert at approximate NGR: 307541, 207633 and is assumed to connect to the northernmost culvert along the north-western site boundary (known as Cae Harris culvert). No flow was observed during the site visit; it is assumed that the channel conveys surface water flows from OB1 during and following storm events.
- Water treatment area WB (see plan in Appendix F for reference) is located in the north-western extent of the site, comprising an attenuation lagoon which discharges to 2no. settlement ponds. Anecdotal information reveals that water is pumped into this lagoon from a sump at the base of the void. From the settlement ponds, water is then discharged via a consented outfall into the engineered ditch along the north-western site boundary.
- A lined lagoon was identified in the southern extent of the site, which discharges to Nant Cwm Blacs. The exact location of the outfall could not be determined at the time of the visit. A new man-made channel has also been construed in this area, however no flows were present at the site of visit.
- Sarn Howell Pond is located west of OB3 at approximate NGR: 307541, 205919. The outfall of this pond could not be identified at the time of the visit, however a ditch immediately south of this pond was visible. This ditch flows east and merges with another ditch which orientates south before flowing into the Bargoed Taff.
- Water treatment area WG is identified east of OB3 comprising of 1no. attenuation lagoon and 2no. settlement ponds. It is assumed that flows from this area discharge to Nant Gyrawd.
- The southernmost water treatment area WF is located south of OB3 and comprises 4no. settlement lagoons (all connected via a pipe). Inflows are controlled via a penstock valve. The outfall discharges to a large, shallow vegetated channel which eventually discharges to the Bargoed Taff downstream. Another outfall pipe was identified further north which conveys flows from OB3 into this channel.

Anecdotal information from the Client during the site visit revealed that Water treatment Areas WA and WJ, shown on the Conditions Plan (MA-CON-01) in Appendix G, have never been constructed.

Scheme Proposals

Scheme proposals are for the restoration of a former opencast coal mine. The key features of the final restoration strategy are to minimise bulk earthworks by retaining the existing groundwater lake that has formed naturally in the main quarry void following cessation of coal extraction and when the de-watering of the main void was no longer required. The sides of the main void will be re-profiled using existing spoil material and material from the overburden mound OB1. The height of OB1 would be reduced and re-profiled as a sinuous undulating ridge and areas of open rock face and scree retained for biodiversity and visual amenity. Existing ponds and water bodies, such important relics of the previous industrial extractive industries will be retained and enhanced for nature conservation and preserved as heritage assets. The overburden mounds of OB2 and OB3 will be retained and returned to areas of upland grassland with areas of woodland planting and heathland on the flanks and lower slopes.

Scheme proposals are included in Appendix H. The proposals also include 2no. drainage channels serving land west of the quarry void. The drainage channels will intercept runoff from the re-profiled quarry void sides and will drain water to the quarry void. This approach reduces potential erosion caused by uncontrolled surface water runoff down the side slope of the quarry void.

Flood Zone Category & Policy Context

Flood Zone Category

The Welsh Government Development Advice Map, included in Appendix I, shows that the site is located within Flood Zone A – an area considered to be at little or no risk of fluvial or tidal flooding, with a less than 0.1% (1 in 1000) annual probability of flooding.

The NRW 'Flood Map for Planning' (Appendix I) shows that the site is located within an area outside of the extreme flood extent (Flood Zone 1), meaning it has a less than 0.1% annual probability of flooding from rivers and the sea, including the effects of climate change.

Policy Context

The development is for restoration of the former open cast coal mine. In accordance with Section 9 of Technical Advice Note 15 (TAN15): Development and Flood Risk of Planning Policy Wales, development is considered appropriate in Flood Zone A provided that there is no increase in flooding elsewhere.

This report will assess the existing flood risk to the site and the impact that the proposed restoration scheme will have on flood risk elsewhere.

Sources of Flooding and Probability

Fluvial

The site is intersected by a network of surface water drainage ditches and leats, some of which form part of historic workings on the site from previous mining activity and known as the Dowlais Free Drainage System, that provided water to the Dowlais Ironworks. There are also a series of ponds and lagoons on site.

Nearby watercourses include the Bargod Taff and its tributary the Nant Gyrawd which flow southwards and are tributaries of the Afon Taff. The Afon Taff is located approximately 1.5km west of the site at its nearest point. The Nant Cwm Blacs, which flows westwards immediately south of the site, is also a tributary of the Afon Taff.

A plan showing the location of watercourses in the vicinity of the site is included as Appendix J. Goat Mill is located north-west of the site beyond the A4060 and receives flow from the watercourse on the north-western site boundary. Goat Mill flows south-west in this location and is a tributary of the Afon Taff. The Rhymni River is located approximately 2.5km east of the site and flows south in this location.

The NRW 'Flood Map for Planning (Rivers and Sea)' (Appendix I) shows that the site is located within an area outside of the extreme flood extent (Flood Zone 1), meaning it has a less than 0.1% annual probability of flooding from rivers, including the effects of climate change. As shown on the LiDAR plan (Appendix B), the site forms a high point within the surrounding topography and is elevated above all nearby watercourses.

The NRW 'Historic Flood Risk' map (Appendix F) indicates that the site is not located within a historical flood extent.

It can therefore be concluded that the risk of fluvial flooding is very low.

Tidal

The site is situated at a minimum of approximately 243m AOD (at the quarry void base) and is significantly above sea level. The site is therefore not at risk of tidal flooding.

Surface Water

Surface water flooding occurs when rainwater does not drain away through the normal drainage system or soak into the ground. It is usually associated with high intensity rainfall events but can also occur with lower intensity rainfall or melting snow where the ground is saturated, frozen or developed, resulting in overland flow and ponding in depressions in topography. Surface water flooding can occur anywhere without warning. However, flow paths can be determined by consideration of contours and relative levels.

The NRW 'Flood Risk from Surface Water & Small Watercourses' map (Appendix I) shows that there are areas across the site shown within surface water Flood Zones 2 and 3. Surface water Flood Zone 2 is defined as 'areas with 0.1% to 1% (1 in 1000 to 1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change'. Surface water Flood Zone 3 is defined as 'areas with more than 1% (1 in 100) chance of flooding from surface water and/or small watercourses in a given year, including the effects of climate change'.

The identified surface water flood risk on NRW mapping is generally constrained to existing ditches, lagoons / ponds and topographical low points. Any surface water flows leaving the site are directed off site within formal channels (ditches).

In order to fully quantify the surface water flood risk to the site, and the impact that the proposed restoration scheme has on surface water flood risk off-site, Waterco have undertaken a detailed surface water hydraulic modelling study. Full details of the hydraulic model build, and hydrology estimates are included in the Waterco Modelling Technical Note (document reference 15840-Modelling Technical Note-01).

The modelling study considers the following surface water (pluvial) events:

Table 1: Primary Simulations Under Normal Conditions (NC)

Pluvial Design Event (AEP)	Climate Change Allowance	Site Layout
3.33%	-	Existing (EXG) / Proposed Development (DEV)
1%	-	
1%	+40%	
0.1%	-	
0.1%	+40%	

*AEP = Annual Exceedance Probability.

During all the events detailed in Table 1, the water level in the quarry void (groundwater lake level) has been set at 284m AOD. This is the highest groundwater level recorded in piezometers directly adjacent to the quarry void. This level is also close to the highest recorded lake level (281m AOD) since quarrying operations ceased.

In addition to the events considered in Table 1, a high groundwater simulation has also been considered with respect to the 1% AEP plus 40% climate change (CC) event. A starting water level in the quarry void (groundwater lake) of 311m AOD has been utilised for the high groundwater scenario. This is a conservative water level based on the highest groundwater level recorded in piezometer standpipes within and directly adjacent to the site. The groundwater level of 311m AOD was recorded immediately east of the site. The purpose of this simulation is to determine the impact on water levels within the quarry void should a 1% AEP plus 40% CC rainfall event occur when water levels within the quarry void are high. Based on the proposed development plan (Appendix H), the lowest ground elevation on the perimeter of the void is approximately 340m AOD.

Maximum flood depth, velocity and hazard mapping has been provided for each simulation in Appendix K. Flood hazard ratings have been calculated in accordance with DEFRA document 'FD2320: Flood Risks to People' and EA guidance document 'Supplementary Note on Flood Hazard Ratings and Thresholds'.

Two model scenarios have been considered, namely the existing (EXG) and proposed (DEV) development scenarios. The existing scenario is based on the topographical survey and LiDAR data to represent the topography of the site in its existing form. The proposed scenario is based on proposed site levels provided

by RML (drawing 3274-RML-M3_FinalJul2024.dwg).

Existing Model Results

During the existing scenario, surface water flows are generally contained within existing drainage features such as ditches, ponds and lagoons. Water levels within the quarry void increase from 284m AOD (starting water level in the model) to 284.26m AOD during the 1% AEP plus 40% CC event. Figure 2 shows the surface water flood extent during the 1% AEP plus 40% CC event.

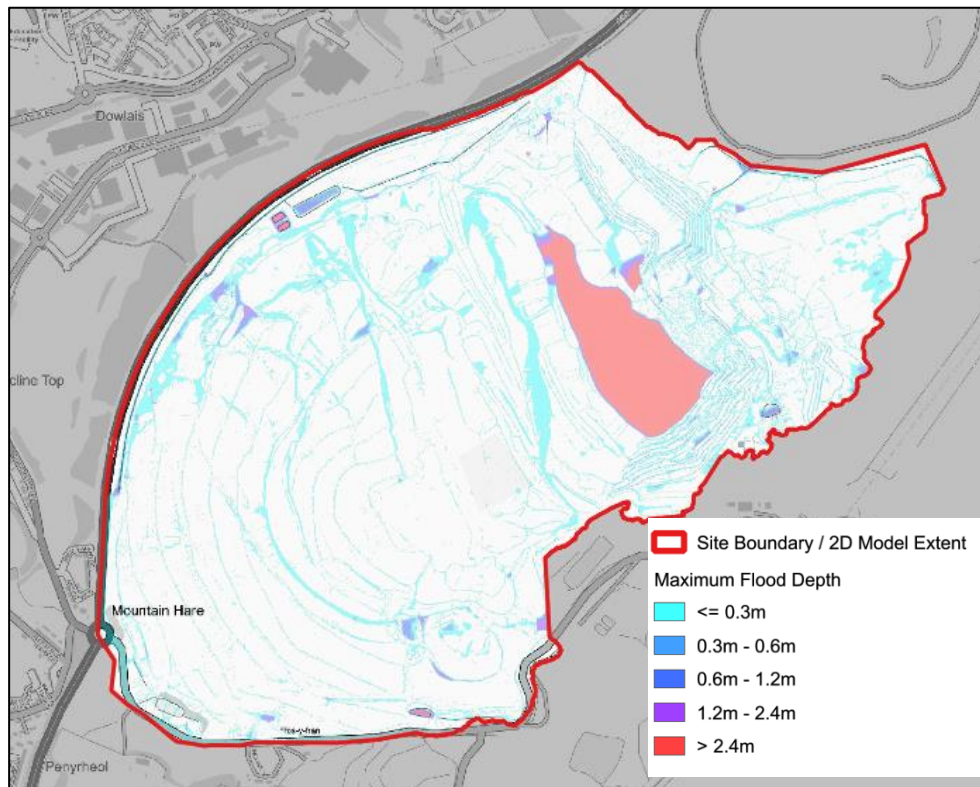


Figure 2 – 1% AEP plus 40% CC event – Flood Depths and Extent

During the 0.1% AEP plus 40% CC event, the lake water level increases from 284m AOD to 284.4m AOD.

During the high groundwater simulation where the water level in the quarry void has been set to 311m AOD, water levels in the quarry void increase by 0.2m (to 311.2m AOD) during the 1% AEP plus CC event. The lowest elevation along the perimeter of the quarry void is 340m AOD. As such, there is a freeboard of 28.8m between the quarry void lake level and surrounding topography during the 1% AEP plus 40% CC rainfall event coinciding with a conservative starting lake water level of 311m AOD.

Proposed Restoration Model

The potential impact of the proposed development on flood risk elsewhere has been quantified by comparing the existing and proposed development simulation results. To provide a detailed assessment of the relative changes in flood depths and extents throughout the site, a series of maximum flood depth difference maps have been created and are included in Appendix K.

The results of the proposed restoration model show that flow mechanisms are similar to that of the existing

scenario. The maximum depth difference maps show that the proposed development has negligible impact on off-site flood risk.

The model results show that where there are proposed cut and fill areas, there are minor changes to flood depths within the site. No new flood flow routes are created by the development and no additional flows are directed towards the site boundaries (and off-site). The changes in water levels on site as shown on the flood depth difference mapping is mainly attributed to differences in the triangulation of the existing and proposed Digital Terrain Models.

During the high groundwater simulation where the water level in the quarry void has been set to 311m AOD, water levels in the quarry void increase by 0.3m (to 311.3m AOD) during the 1% AEP plus 40% CC event. As such, there is a freeboard of 28.7m between the quarry void lake level and surrounding topography during the 1% AEP plus 40% CC rainfall event coinciding with a conservative starting lake water level of 311m AOD.

A 100mm increase in the quarry void lake water level is noted during the development scenario high groundwater scenario coinciding with a 1% AEP plus 40% CC event, when compared to the existing scenario. This is due to a slightly increased catchment area draining to the quarry lake, thereby reducing flows off-site. The increase is also due to rounding of the water levels to 1 decimal place.

It can be concluded that the risk of surface water flooding remains similar post-development with flows generally contained within drainage features and the quarry void. No additional flow is directed towards the site boundary and to third party land beyond. Minimum variation in the quarry void lake water level occurs as a result of the development and significant freeboard is available between the quarry void lake water level and the ground elevations at the perimeter of the quarry void. The quarry void water level is groundwater influenced with direct surface water flows (rainfall) having minimal impact.

Sewer

Flooding from sewers can occur when a sewer is overwhelmed by heavy rainfall, becomes blocked, is damaged, or is of inadequate capacity. Flooding is mostly applicable to combined and surface water sewers.

The DCWW sewer records (Appendix E) show that there are no public sewers within the site. There is a network of public surface water, combined and foul sewers serving the urban area of Merthyr Tydfil north-west of the A4060 road towards the site.

There are no records of sewer flooding affecting the site. The site forms a topographical high point and is elevated above all public sewers serving the urban area of Merthyr Tydfil. The risk of flooding from sewers is therefore considered to be very low.

Groundwater

Groundwater flooding occurs when water levels underneath the ground rise above normal levels. Prolonged heavy rainfall soaks into the ground and can cause the ground to become saturated. This results in rising groundwater levels which leads to flooding above ground.

The Dowlais and Penyarden Faults, previous workings and mine drainage systems including the 'Merthyr

Free Drainage System' and the 'Dowlais Free Drainage System' have significant influence on the sites underlying hydrogeology. Five underground drainage courses are known to exist in the vicinity of the site. The Black Ball Watercourse, Penyrheol watercourse and Penydarren Water Level, discharge to the west of the site which eventually drains to the River Taff. The free drainage Rhas Las Level and the Big Coal Free Drain discharge to the Bute and Nant Llesg watercourses which flow eastwards to the Rhymney River near Pontlloftyn.

Groundwater levels fluctuate seasonally. Groundwater levels for a range of piezometers on and adjacent to the site are shown in Appendix D. Whilst the risk of groundwater flooding to the surface across the majority of the site is low, groundwater will influence the water level within the quarry void. Water within the quarry void has been pumped during mining. Since mining operations ceased in November 2023, the water level within the quarry void has reached a maximum level of approximately 280m AOD – 281m AOD. Water levels peaked in winter months and were shown to be receding to a level of approximately 277m AOD in July 2024. The water levels recorded in the quarry void correlate to groundwater levels recorded on site.

Ground levels around the perimeter of the void are a minimum of 340m AOD and approximately 60m above the maximum water level recorded in the quarry void since mining operations ceased. The risk of the quarry void exceeding its capacity is therefore very low. Further details on groundwater, including a water balance study, are provided by Groundwater Science Ltd and are available within the Environmental Statement.

Artificial Sources

There are no canals in the immediate vicinity of the site. The NRW 'Flood Risk from Reservoirs' map (Appendix I) shows that the site is not at risk of flooding from reservoirs. It can therefore be concluded that the risk of flooding from artificial sources is very low.

The Reservoirs Act 1975 applies to large raised reservoirs, defined by the Reservoirs Act 1975 as:

- a) a large, raised structure designed or used for collecting and storing water, and
- b) a large, raised lake or other area capable of storing water which was created or enlarged by artificial means.

The quarry void lake comprises an excavation and is not raised or contained by a structure. As such, the quarry lake is not considered to be a reservoir.

Summary of Potential Flooding

Groundwater monitoring and hydraulic surface water modelling have shown that the restoration proposals do not increase flood risk off-site. Water levels within the quarry void do not come close to exceeding the capacity of the void even when considering an exceptionally high groundwater level (lake starting water level) coinciding with a 1 in 100 year plus 40% climate change rainfall event.

Surface Water Management

The site will be restored to permeable grassland, heathland and woodland planting with no impermeable areas proposed.

Drainage ditches are proposed on the re-graded slope on the western side of the quarry void. The drainage ditches will intercept runoff from the re-profiled quarry void sides and will drain water to the quarry void. The locations of the drainage ditches are shown in Figure 3.

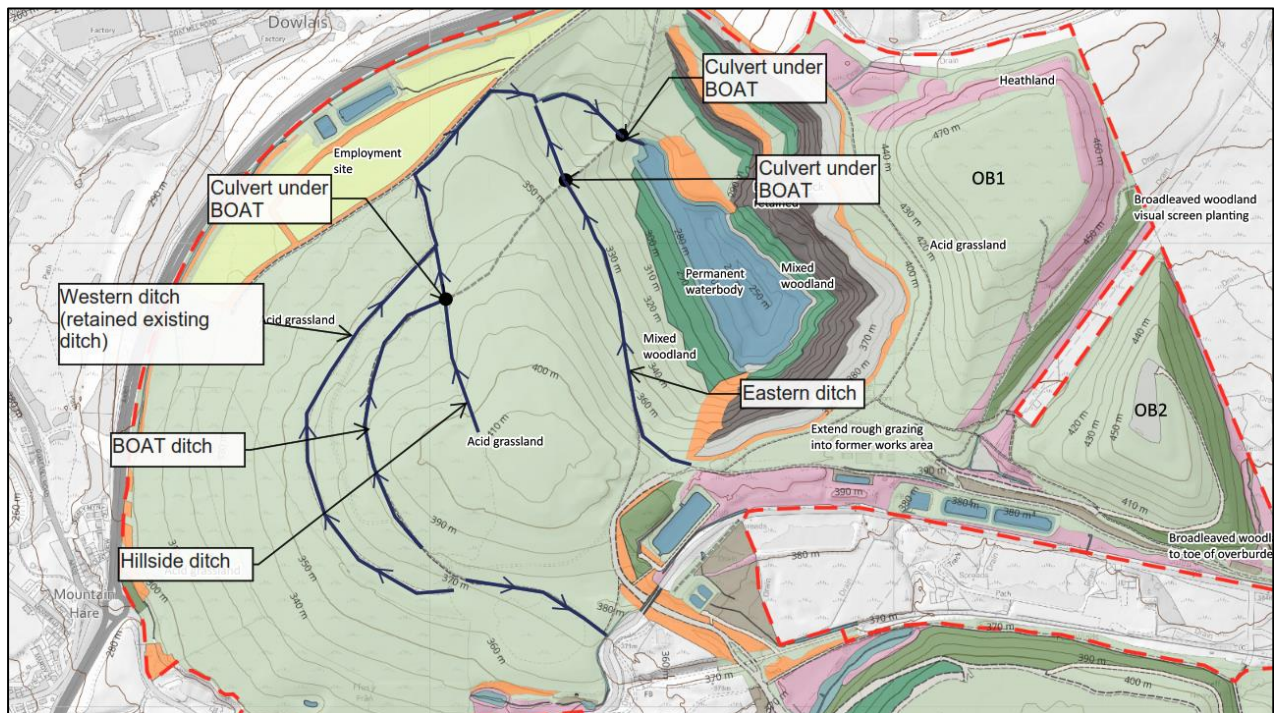


Figure 3 – Proposed Ditch Locations

The ditches are summarised as follows:

- **Eastern ditch** – a proposed ditch located west of the quarry void and drains flows from the hillside west of the void.
- **Western ditch** – comprises an existing ditch running along a railway corridor in the western extent of the site.
- **BOAT (Byway Open to All Traffic) ditch** – a proposed ditch along the alignment of the BOAT. A small section of this ditch will flow south-east to an existing ditch.
- **Hillside ditch** – a short run of proposed ditch draining a small valley where water is known to collect and flow during storm events
- **Combined ditch (excluding eastern ditch)** – Includes the channel which accommodates flow from the western ditch, BOAT ditch and Hillside ditch prior to merging with the eastern ditch.

- **Combined ditch (void inflow)** – includes flows from all ditches and the catchment area immediately north of the quarry void.

The focus of this Drainage Strategy is to estimate the runoff into the ditches and to estimate the ditch sizes required. No other changes to the site drainage are proposed.

The catchment area draining to each ditch has been estimated from the proposed development topography. The catchment area draining to each ditch is shown in Table 2:

Table 2: Ditch Catchment Areas

Ditch Reference	Catchment Area (ha)
Eastern Ditch	15.545ha
Western Ditch	8.53ha
BOAT Ditch	9.23ha
Hillside Ditch	2.51ha
Combined ditch (excluding eastern ditch)	28.22ha
Combined ditch (void inflow) – combined catchment area from all ditches	50.385ha

The catchment areas are shown in Figure 4.

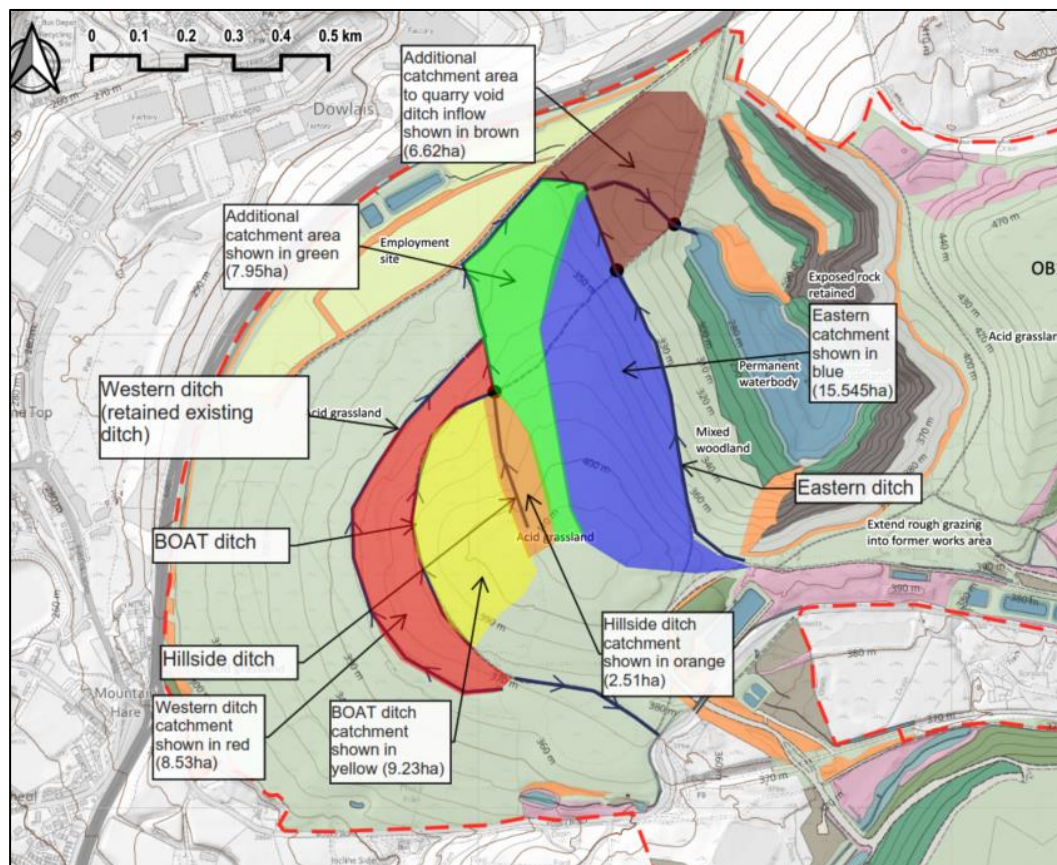


Figure 4 – Ditch Catchment Areas

Surface water flows in each ditch have been estimated using the ReFH2 method supplemented by Flood Estimation Handbook (FEH22) rainfall data. A summary of the flow rates for each catchment area for a range of storm events is provided as Appendix L and also in Table 3.

Table 3: ReFH2 Runoff Rates for Each Ditch Catchment

Storm Event	Eastern Ditch Catchment (15.545ha) m ³ /s	Western Ditch Catchment (8.53ha) m ³ /s	BOAT Ditch Catchment (9.23ha) m ³ /s	Hillside Ditch Catchment (2.51ha) m ³ /s	Combined Ditch Catchment (upstream of eastern ditch) (28.22ha) m ³ /s	Combined Ditch Catchments (50.385ha) m ³ /s
1 in 1 year	0.204	0.113	0.122	0.033	0.37	0.657
1 in 30 year	0.503	0.278	0.300	0.082	0.911	1.617
1 in 100 year	0.623	0.344	0.372	0.102	1.128	2.003
1 in 1000 year	0.902	0.498	0.538	0.147	1.632	2.899

A review of the FEH rainfall data shows that the 1 in 1000 year rainfall event is representative to, however slightly greater in rainfall intensity, to 1 in 100 year plus 40% climate change event. The sizing of the ditches will therefore be based in the 1 in 1000 year flow rates. This will ensure that the ditches can also accommodate the 1 in 100 year plus 40% climate change flows.

Ditch Sizing

The ditches have been sized using the Mannings Formula. Calculation outputs are provided as Appendix M. The ditch sizes are approximate only and will be verified at the detailed design stage.

Eastern Ditch

Based on a ditch bed slope of 1 in 30 (representing the shallowest fall along the ditch route), and a Mannings roughness coefficient of 0.029 (applicable to clean, straight natural channels), a 0.5m deep ditch with a bottom (bed) width of 0.3m, 1 in 2 side slopes and a top width of 2.3m would accommodate a flow of 1.651m³/s, sufficient to accommodate the 1 in 1000 year event.

Western Ditch

Based on a ditch bed slope of 1 in 103 (representing the shallowest fall along the ditch route), and a Mannings roughness coefficient of 0.029 (applicable to clean, straight natural channels), a 0.5m deep ditch with a bottom (bed) width of 0.3m, 1 in 2 side slopes and a top width of 2.3m would accommodate a flow of 0.904m³/s, sufficient to accommodate the 1 in 1000 year event.

BOAT Ditch

Based on a ditch bed slope of 1 in 100 (representing the shallowest fall along the ditch route), and a Mannings roughness coefficient of 0.029 (applicable to clean, straight natural channels), a 0.5m deep ditch with a

bottom (bed) width of 0.3m, 1 in 2 side slopes and a top width of 2.3m would accommodate a flow of $0.891\text{m}^3/\text{s}$, sufficient to accommodate the 1 in 1000 year event.

Hillside Ditch

Based on a ditch bed slope of 1 in 7 (representing the shallowest fall along the ditch route), and a Mannings roughness coefficient of 0.029 (applicable to clean, straight natural channels), a 0.5m deep ditch with a bottom (bed) width of 0.3m, 1 in 2 side slopes and a top width of 2.3m would accommodate a flow of $3.418\text{m}^3/\text{s}$, sufficient to accommodate the 1 in 1000 year event.

The Eastern, Western, BOAT and Hillside ditches are consistent in size; however, the flow capacity varies due to the bed slope associated with each ditch. The ditch sizes provided include a freeboard allowance. Larger ditches may be constructed, and further consideration will be given at the detailed design stage.

Combined Ditch (Excluding Eastern Ditch)

The western ditch, BOAT ditch and Hillside ditch merge and flow east across a gentle fall (approximately 1 in 100) prior to merging with the eastern ditch. This ditch will accommodate flows from the western ditch, BOAT ditch, Hillside ditch and flow from an additional 7.95ha area upstream of the ditch. The total contributing catchment area is 28.22ha.

Based on a ditch bed slope of 1 in 100 (representing the shallowest fall along the ditch route), and a Mannings roughness coefficient of 0.029 (applicable to clean, straight natural channels), a 0.7m deep ditch with a bottom (bed) width of 0.3m, 1 in 2 side slopes and a top width of 3.1m would accommodate a flow of $2.026\text{m}^3/\text{s}$, sufficient to accommodate the 1 in 1000 year event.

Combined Ditches (Void Inflow)

All ditches combine and flow south into the quarry void. The combined flow from the ditches (downstream of where the eastern ditch joins the merged channel of all other ditches) is $2.899\text{m}^3/\text{s}$ during the 1 in 1000 year rainfall event.

Based on a ditch bed slope of 1 in 18 (representing the shallowest fall along the ditch route north of the quarry void), and a Mannings roughness coefficient of 0.029 (applicable to clean, straight natural channels), a 0.6m deep ditch with a bottom (bed) width of 0.3m, 1 in 2 side slopes and a top width of 2.7m would accommodate a flow of $3.29\text{m}^3/\text{s}$, sufficient to accommodate the 1 in 1000 year event.

Ditch Design Considerations

Where ditches are laid at a shallow fall (a gradient shallower than 1 in 20), the ditches can be formed as grassed / vegetated channels. Where ditches are laid at a gradient in excess of 1 in 20, the ditches will be lined with concrete canvas (or similar alternative) as to minimise erosion. Flow rates on steeper gradients can also be controlled through consideration of plunge pools or ponds at frequent intervals. Such features would encourage biodiversity.

Culverts

An existing Byway Open to All Traffic (BOAT) intersects the site and will be retained. The BOAT crosses the proposed ditches in three separate locations with one crossing over the eastern ditch, one crossing over the

BOAT at the confluence of the BOAT ditch and Hillside Ditch, and one crossing where the ditches combine and flow south into the quarry void.

Based on the depth of the proposed ditches where culvert crossings will be made (0.5m – 0.6m) and ditch width (2.3m – 2.7m), box culverts would be the most practical option for the crossing points. As opposed to typical piped culverts, a box culvert would better retain the channel shape / capacity. Based on literature provided by FP McCann (manufacturer of box culverts), a 2.4m wide x 0.65m high box culvert would be suitable to accommodate a flow of up to 1.75m³/s. A 2.4m wide x 0.65m high box culvert would therefore be sufficient for the eastern ditch crossing and BOAT / hillside ditch crossing.

A 3m wide x 0.8m high box culvert would be suitable to accommodate a flow of up to 3.06m³/s. A 3m wide x 0.8m high box culvert would be sufficient for the crossing on the ditch which flows south into the quarry void.

Maintenance

Maintenance of the proposed ditches and culverts will be the responsibility of the site owner. A maintenance schedule is included in Appendix N.

Conclusions

Scheme proposals are for the restoration of a former opencast coal mine. The key features of the final restoration strategy are to minimise bulk earthworks by retaining the existing groundwater lake that has formed naturally in the main quarry void following cessation of coal extraction and when the de-watering of the main void was no longer required. The sides of the main void will be re-profiled using existing spoil material and material from the overburden mound OB1.

The NRW 'Flood Map for Planning (Rivers and Sea)' shows that the site is located within an area outside of the extreme flood extent (Flood Zone 1), meaning it has a less than 0.1% annual probability of flooding from rivers, including the effects of climate change. The site forms a high point within the surrounding topography and is elevated above all nearby watercourses. The risk of flooding from rivers is therefore very low and the site does not comprise functional floodplain.

In order to fully quantify the surface water flood risk to the site, and the impact that the proposed restoration scheme has on surface water flood risk off-site, Waterco have undertaken a detailed surface water hydraulic modelling study.

During the existing scenario, surface water flows are generally contained within existing drainage features such as ditches, ponds and lagoons. Water levels within the quarry void increase from 284m AOD (starting water level in the model) to 284.26m AOD during the 1% AEP plus 40% CC event.

During the high groundwater simulation where the water level in the quarry void has been set to 311m AOD, water levels in the quarry void increase by 0.2m (to 311.2m AOD) during the 1% AEP plus CC event. The lowest elevation along the perimeter of the quarry void is 340m AOD. As such, there is a freeboard of 28.8m between the quarry void lake level and surrounding topography during the 1% AEP plus 40% CC rainfall event coinciding with a conservative starting lake water level of 311m AOD.

The results of the proposed restoration model show that flow mechanisms are similar to that of the existing scenario. No new flood flow routes are created by the development and no additional flows are directed towards the site boundaries (and off-site).

During the proposed scenario high groundwater simulation where the water level in the quarry void has been set to 311m AOD, water levels in the quarry void increase by 0.3m (to 311.3m AOD) during the 1% AEP plus 40% CC event. As such, there is a freeboard of 28.7m between the quarry void lake level and surrounding topography during the 1% AEP plus 40% CC rainfall event coinciding with a conservative starting lake water level of 311m AOD.

New drainage ditches will be proposed on the re-graded western slope of the quarry void. The drainage ditches will be sized to accommodate flows during a 1 in 1000 year storm event.

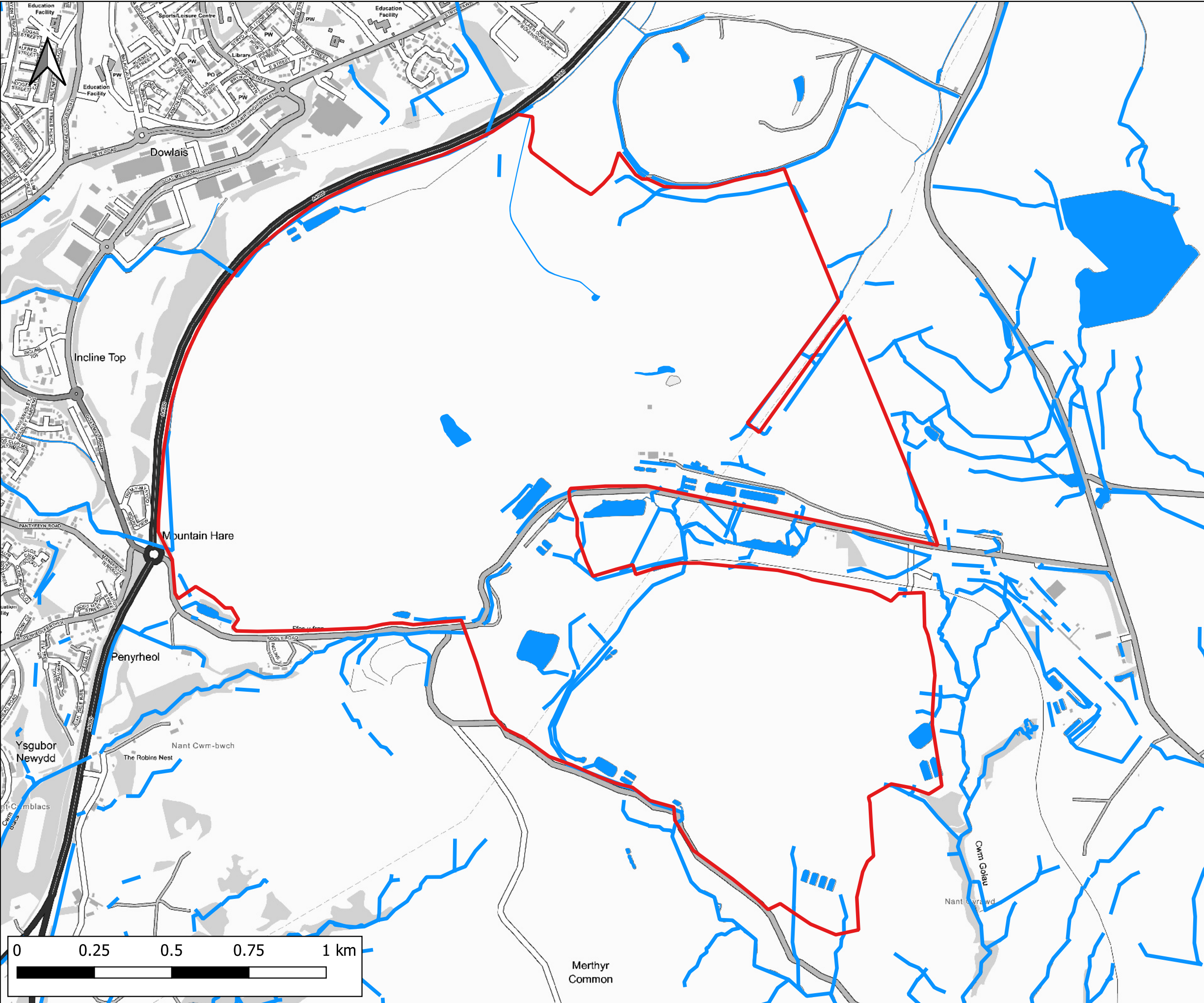
An existing Byway Open to All Traffic (BOAT) intersects the site and will be retained. The BOAT crosses the proposed ditches in three separate locations. Based on the depth of the proposed ditches (approximately 0.5m-0.6m) and width (2.3m – 2.7m), a box culvert would be the most practical option for the crossing points.

A Concept Designer's Risk Assessment (cDRA) has been prepared to inform future designers of any identified hazards associated with the scheme. The cDRA has been included in Appendix O.

Recommendations

1. Submit this Flood Consequences Assessment and Drainage Strategy to the Planning Authority in support of the Planning Application.
2. Undertake detailed design of the proposed ditches and culverts.
3. Install appropriate signage within the site alerting users of steep slopes and deep water within the quarry void.
4. Liaise with the Sustainable Drainage Approval Body (SAB) to determine whether a SAB application would be applicable for the proposals.

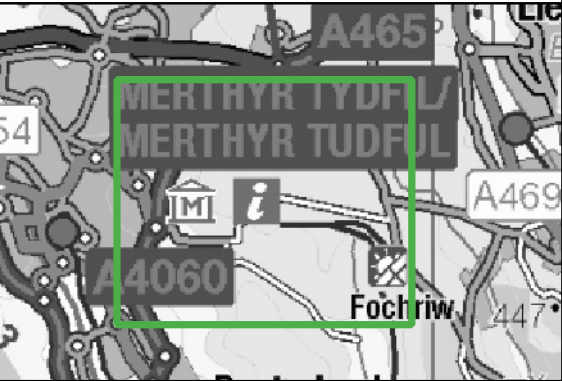
Appendix A Location and Aerial Plan



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Watercourses
- Waterbodies



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Location Plan			
PLOT STATUS:		DATE:	
FINAL		19-08-2024	
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MJW	AW	MW	1:12000
PLOT NAME:			REVISION:
15840_Location_Plan			-



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

Site Boundary

MERTHYR TYDFIL
MERTHYR TYDFIL
A4060
Fochriw

CLIENT:

Merthyr (South Wales) Ltd

www.waterco.co.uk

SCHEME:

Ffos-y-Fran, Merthyr Tydfil

PLOT TITLE:

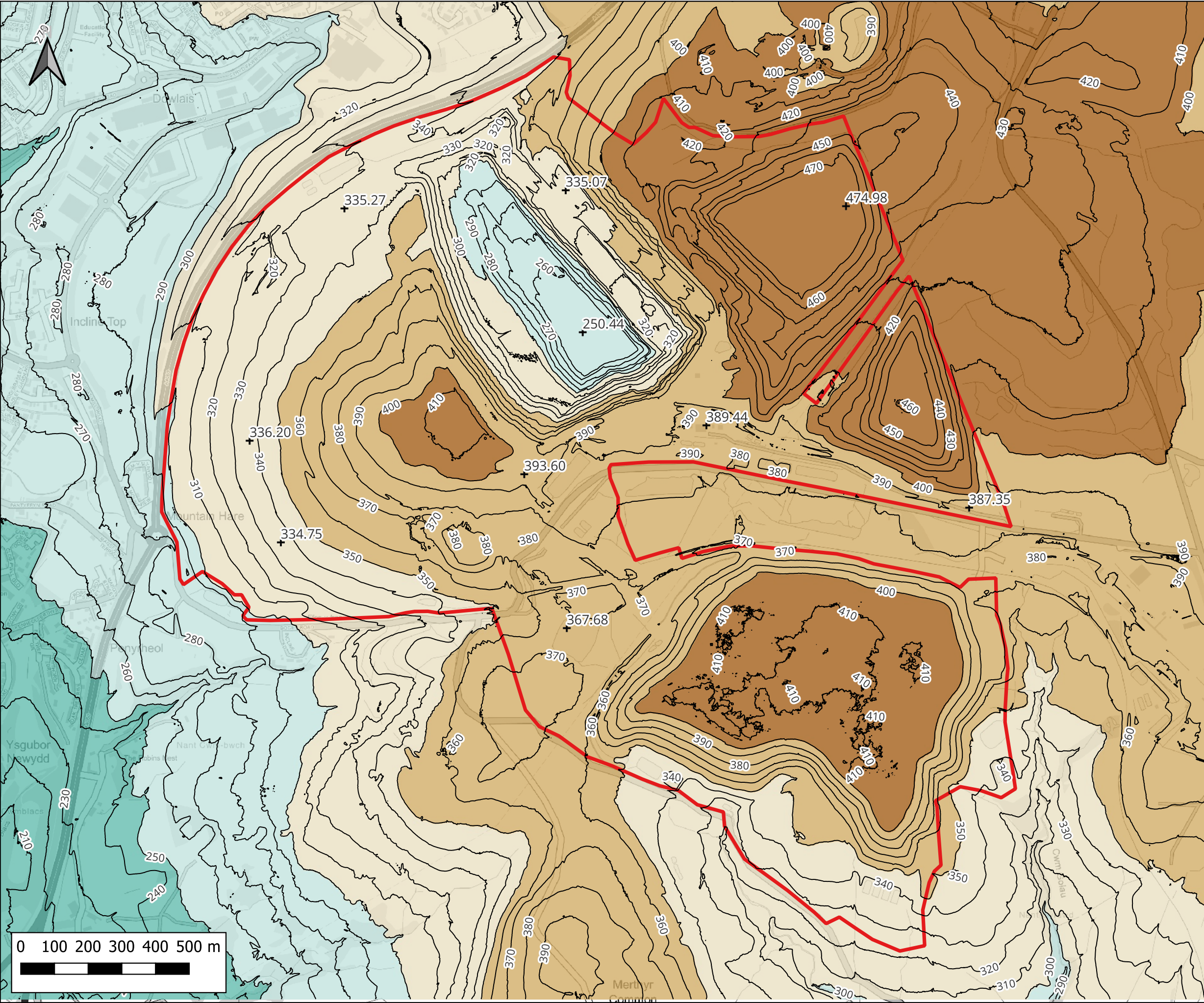
Aerial Plan

PLOT STATUS:		DATE:	
FINAL		19-08-2024	

DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MJW	AW	MW	1:12000

PLOT NAME:	REVISION:
15840_Aerial_Plan	-

Appendix B Topographical Data



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site boundary
- Site Levels (m AOD)
- 10m contour

Ground Elevations (m AOD)

- <= 250.0
- 250.0 - 300.0
- 300.0 - 350.0
- 350.0 - 400.0
- > 400.0

CLIENT:
Merthyr (South Wales) Ltd

SCHEME:
Ffos-y-Fran, Merthyr Tydfil

PLOT TITLE:
LiDAR Plan
1m Resolution
Data from Natural Resources Wales

PLOT STATUS: FINAL **DATE:** 19-08-2024

DRAWN: MJW **CHECKED:** AW **APPROVED:** MW **PLOT SCALE AT A3:** 1:11000

PLOT NAME: 15840_LiDAR_Plan **REVISION:** -

Appendix C BGS Borehole Record

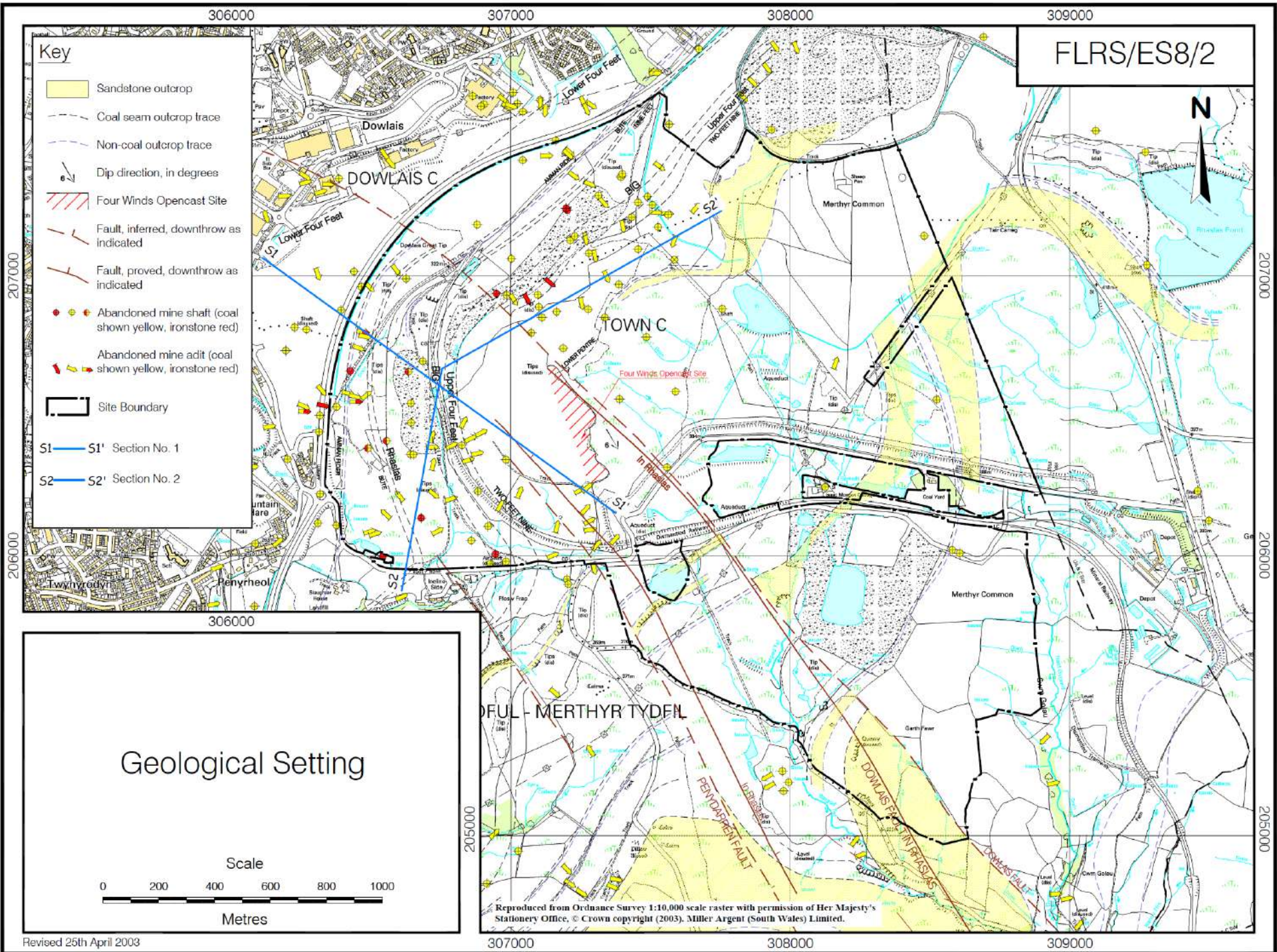
NATIONAL COAL BOARD - SOUTH WALES & SOMERSET										Appendix H	
Borehole Name & No Longtown 724										Record of Borehole LN1	
Contractor Drilling & Prospecting International Ltd.											
Drill type Gryphon 10											
Method of penetration Rotary Air Flush											
Elevation AOD 338.70 m Grid reference E 06677 N 06593											
Date started 25.10.75 Date completed 27.10.75											
Date		Depth m		Sample		Legend	Depth	Level m AOD	Piezo	Water	Description
From	To	R	RQD								
25/10	0.00	0.50	U100	5401							0.00 - 1.50m: SAND and fine GRAVEL of mainly coal, shale and seat earth (SPOIL: washery discard)*
	0.50	1.00	U100	5402							
	1.00	1.50	U100	5403							
	1.50	2.50	U100	5404							1.50 - 10.40m: (approx.) dark brown to black, soft becoming very soft, sandy clayey SILT, damp (SPOIL: lagoonal fines)*
	2.50	3.50	U100	5405							
	3.50	4.50	U100	5407							
	4.50	5.50	U100	5408							
	5.50	6.50	U100	5409							
	6.50	7.50	U100	5410							
	7.50	8.50	U100	5411							
	8.50	9.50	U100	5412							
	9.50	10.50	U100	5414							
Morning water levels											
Date	26/10										
BH Depth	2.50										
Casing	--										
Water	Dry										
⊗ Water encountered here ⊗ Water of ref x rose to here											
N.B. 1.50 - 12.50m: 1m penetrated to recover each U100 (soft ground) * Descriptions of spoil taken from jar samples.											
Logged by G.D. Date November 1975 Sir William Halcrow & Partners Sheet 1 of 2											



BGS ID: 259463 : BGS Reference: SO00NE51
British National Grid (27700) : 306680,206590

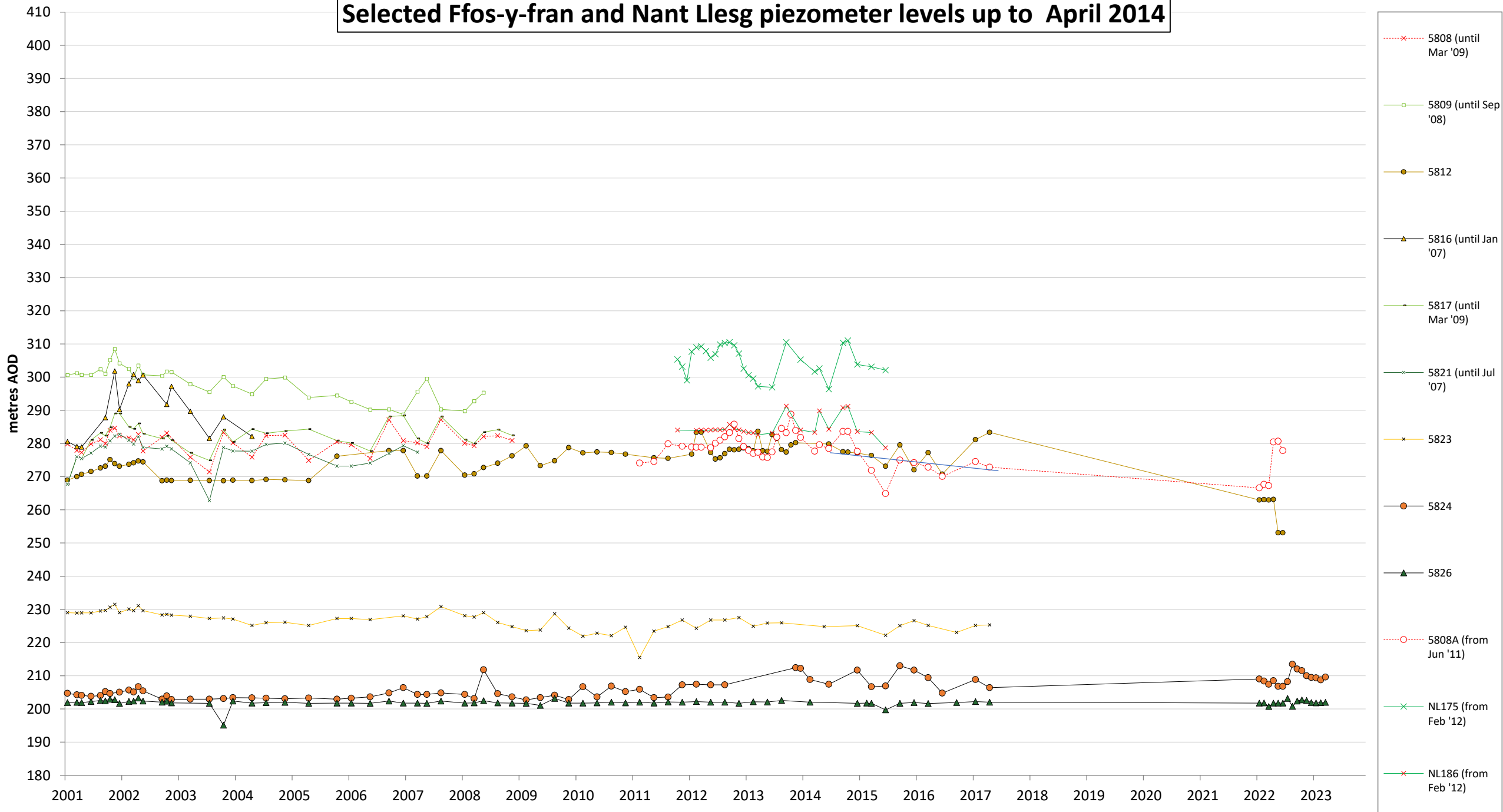
Contact BGS: ngdc@bgs.ac.uk

Appendix D Groundwater Data

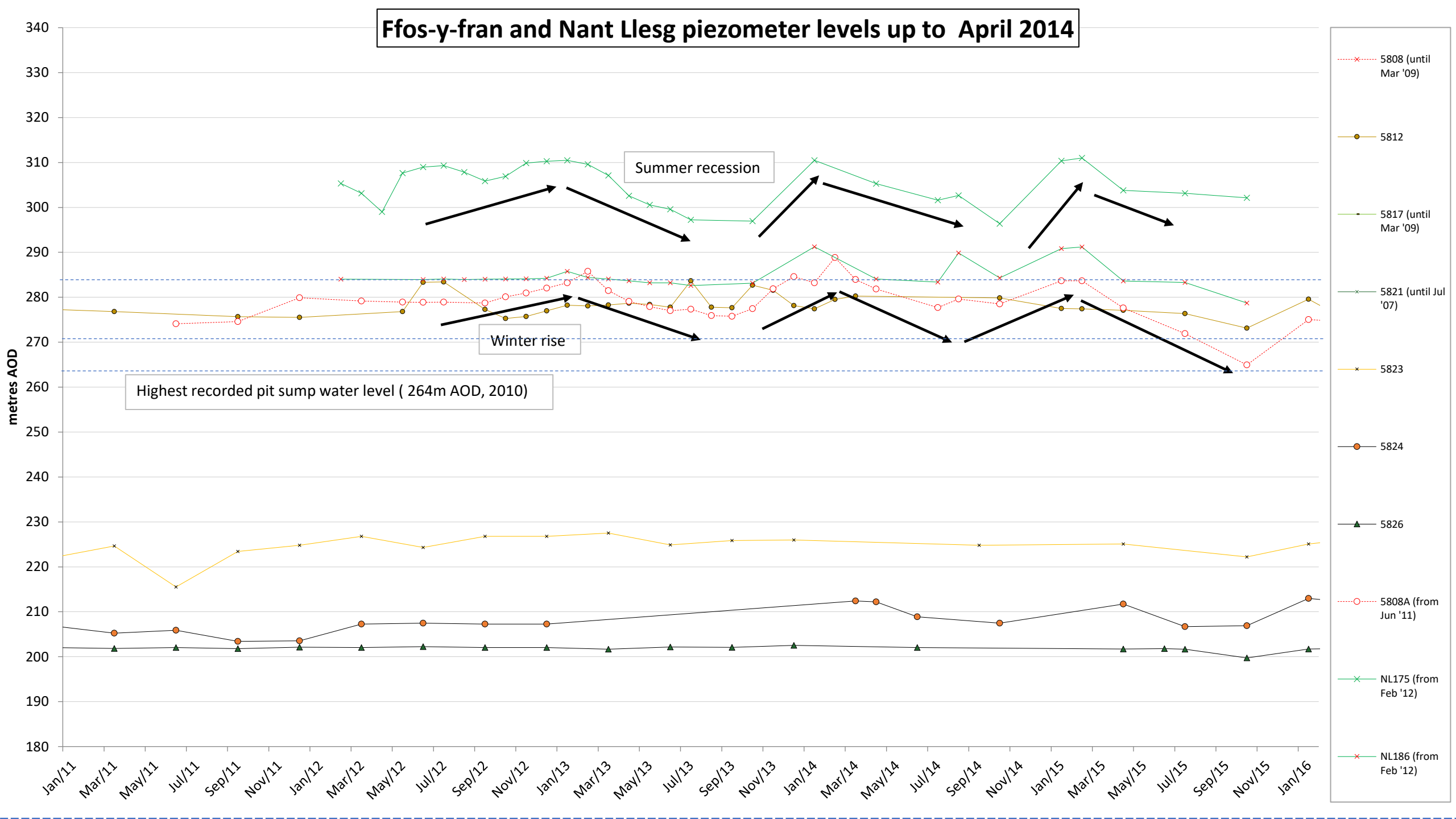




Selected Ffos-y-fran and Nant Llesg piezometer levels up to April 2014



Ffos-y-fran and Nant Llesg piezometer levels up to April 2014



Site groundwater heads, minimum levels

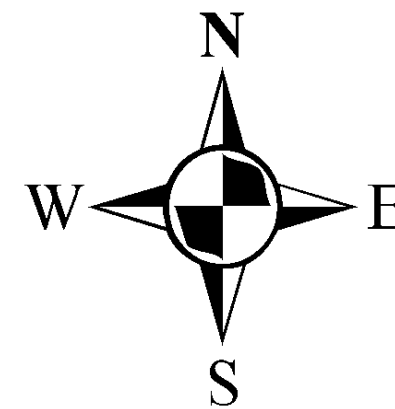


Appendix E DCWW Sewer Plan



Dŵr Cymru
Welsh Water

15840 - Ffos Y Fran Merthyr Tydfil CF48 4AH



LEGEND(Representative of most common features)

- Waste network:
- | | | | |
|--|--|--|---|
| | Foul chamber | | Outfall |
| | Surface water chamber | | LH |
| | Combined chamber | | Storm Overflow |
| | Combined sewer overflow | | Rising main |
| | Special purpose chamber | | Gravity sewer |
| | Treatment works | | Private sewer |
| | Pumping station | | Private sewer subject to Sect. 104 adaptation agreement |
| | Combined | | Private Sewer Transfer |
| | Surface Water | | Lateral Drain |
| | Foul | | Inspection Chamber |
| | Former S24 sewers (for indicative purposes only) | | |
- NB: Sewer symbol colour indicates the type.

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases, pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dŵr Cymru Cyllynedy (the Company) gives this information as to the position of its underground apparatus by way of general guidance only and on the basis of the best information available and to the best of its knowledge and belief. The accuracy of the information is not guaranteed. The Company is not responsible for any loss or damage caused by reliance on this information. The information is supplied for the purpose of providing a service to the public and is not intended to be used for any other purpose. The information is not to be used for any purpose other than the provision of a service to the public. The information is not to be used for any purpose other than the provision of a service to the public. The information is not to be used for any purpose other than the provision of a service to the public.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map Ref: 307367,206570
Map scale: 1:4000
Printed by: Warren Rees
Printed on: 22 Aug 2024

Appendix F Photographic Record and Site Visit Plan

Photo No.1	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Watercourse flowing south at approximate NGR: 308840, 206216	

Photo No. 2	15840 – Ffos Y Fran
Date: 11/09/2024 Description: The upstream are of the watercourse at approximate NGR: 308831, 206278. Some iron staining observed.	

Photo No.3	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Culvert at approximate NGR: 308833, 206276	

Photo No. 4	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Wheel wash lagoons. A closed system. Located at approximate NGR: 308791, 206290 (facing west)	

Photo No.5	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Water Treatment Area (WC1). Attenuation Lagoon Approximate NGR: 308372, 206416 (facing south-west)	

Photo No.6	15840 – Ffos Y Fran
Date: 11/09/2024 Description: WC1. Second attenuation lagoon. Approximate NGR: 308209, 206452 (facing south-west)	

Photo No.7	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Watercourse upstream. Water ponding before entering a culvert. Approximate NGR: 308142, 206510 (facing north-east)	

Photo No.8	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Culvert outlet. Open watercourse channel before being culverted beneath the road to WC1. Approximate NGR: 308132, 206490 (facing south-west)	

Photo No.9	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Settlement lagoons as part of WC1. Approximate NGR: 308097, 206481 (facing south-west)	

Photo No. 10	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Barrel Wash Treatment Ponds. A close system at approximate NGR: 307947, 206501	

Photo No.11	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Quarry void. Photo taken from viewing platform at approximate NGR: 307676, 206582	

Photo No. 12	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Watercourse on northern site boundary, flowing in an easterly direction. Concrete channel. Approximate NGR: 307559, 207676	

Photo No.13	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Culvert on northern site boundary at approximate NGR: 307549, 207667.	

Photo No. 14	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Concrete channel. Dry at time of visit. Photo taken at approximate NGR: 307543, 207631	

Photo No.15	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Culvert inlet at approximate NGR: 307542, 207626 (facing north-east)	

Photo No. 16	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Swale/ depression along northern boundary. Approximate NGR: 307365, 207550 (facing west)	

Photo No.17	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Attenuation lagoon as part of WB Approximate NGR: 306931, 207344 (facing west)	

Photo No. 18	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Overflow pipe from WB. Discharge to ditch along the northern boundary. Approximate NGR: 306778 , 207301	

Photo No.19	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Settlement ponds as part of Water Treatment Area (WB) Approximate NGR: 306758, 207240	

Photo No. 20	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Culvert conveying flows from the site under the A4060 Approximate NGR: 306366, 206572	

Photo No.21	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Open watercourse channel along the north-western site boundary conveying flows to the culvert Approximate NGR: 306369, 206575 (facing north-east)	

Photo No. 22	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Potential overflow culvert at approximate NGR: 306361, 206561	

Photo No.23	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Culvert conveying flows from the site under the A4060 Approximate NGR: 306591, 207113	

Photo No. 24	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Open watercourse channel along the north-western site boundary conveying flows to the culvert Approximate NGR: 306595, 207116 (facing north-east)	

Photo No.25	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Sump hole in the north-western extent of the site. Approximate NGR: 306463, 206797	

Photo No. 26	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Excavated channel (dry at time of visit) at approximate NGR: 307099, 206061	

Photo No.27	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Lined lagoon in the south-western extent of the site at approximate NGR: 307097, 206062	

Photo No. 28	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Culvert under road Approximate NGR: 307356, 206045	

Photo No.29	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Wetland at approximate NGR: 307350, 206040 Receives flows from the ditch which is culverted beneath Bogey Road	

Photo No. 30	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Watercourse originating within the central ecological area and flowing south Approximate NGR: 308044, 206178 (facing north)	

Photo No.31	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Pond located at approximate NGR: 308034, 206178	

Photo No. 32	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Water Treatment Area WG Attenuation Pond Located south-east of OB3 at approximate NGR: 308733, 205634 (facing east)	

Photo No.33	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Water Treatment Area WG Settlement ponds Photo taken at approximate NGR: 308781, 205553	

Photo No. 34	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Water Treatment Area WF. Comprises 4no. lagoons. Photo taken at approximate NGR: 308499, 205200 (facing south-west)	

Photo No.35	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Penstock regulating the water flow into the water treatment area. Approximate NGR: 308474, 205188	

Photo No. 36	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Wide vegetated channel conveying flow to the Bargoed Taff 308404, 205234. 2no. outlets discharge to this channel.	

Photo No.37	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Discharge point for the 4no. lagoons at Water treatment area WF Approximate NGR: 308403, 205165	

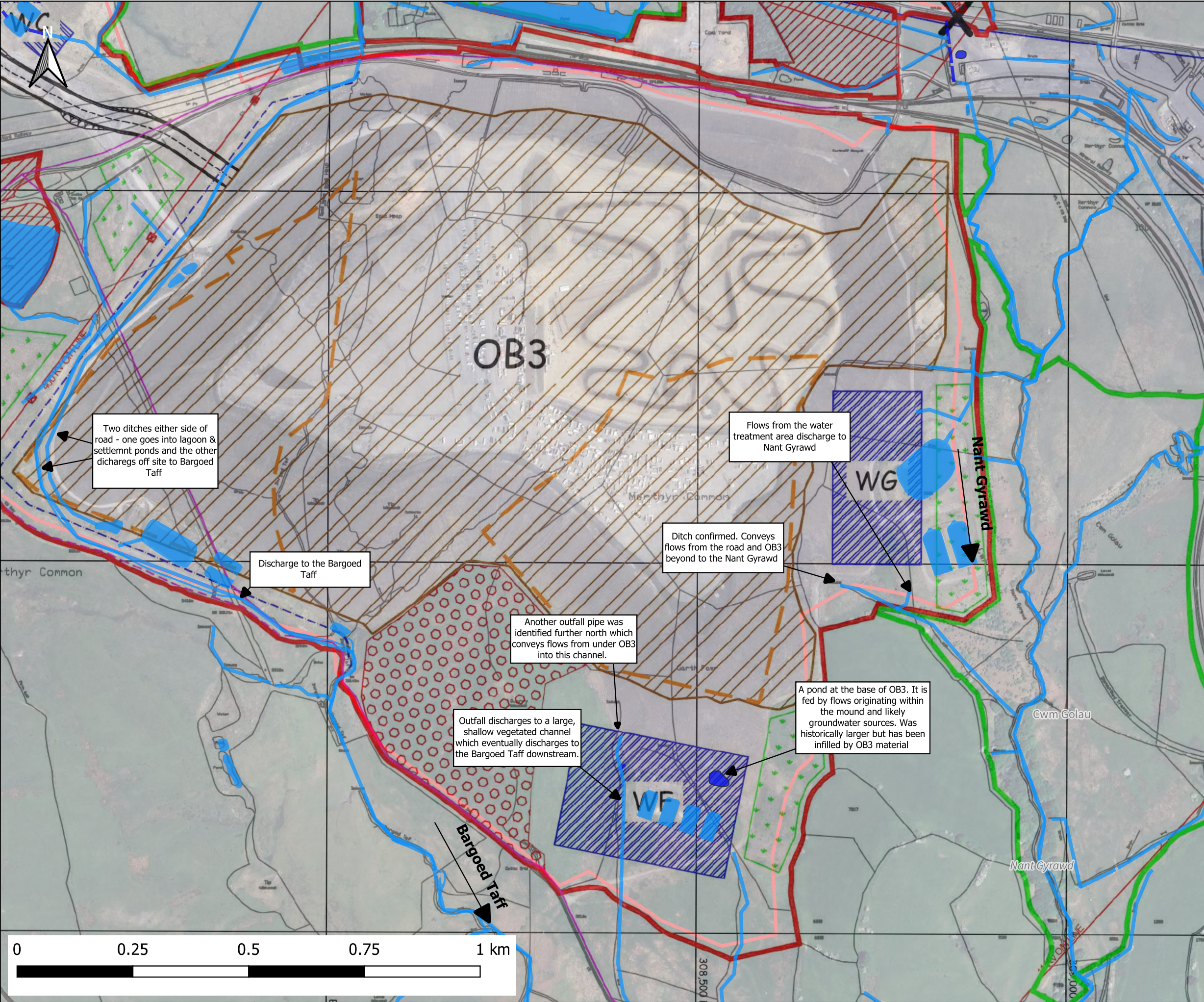
Photo No. 38	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Photograph showing settlement pond. Approximate NGR: 307731, 205565	

Photo No.39	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Photograph showing discharge to the Bargoed Taff. Approximate NGR: 307655, 205541	

Photo No.40	15840 – Ffos Y Fran
Date: 11/09/2024	
Description: Photograph showing Sarn Howell Pond from the south. Approximate NGR: 307566, 205848	

Photo No.41	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Photograph showing breach location to the west of Sarn Howell Pond. Approximate NGR: 307510, 205935	

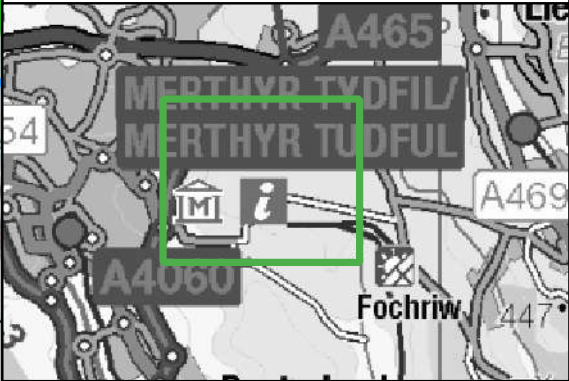
Photo No.42	15840 – Ffos Y Fran
Date: 11/09/2024 Description: Photograph showing assumed culvert which discharges towards the Bargoed Taff. Approximate NGR: 307675, 205810	



Notes:
The information provided within this drawing is based on anecdotal information from the Client

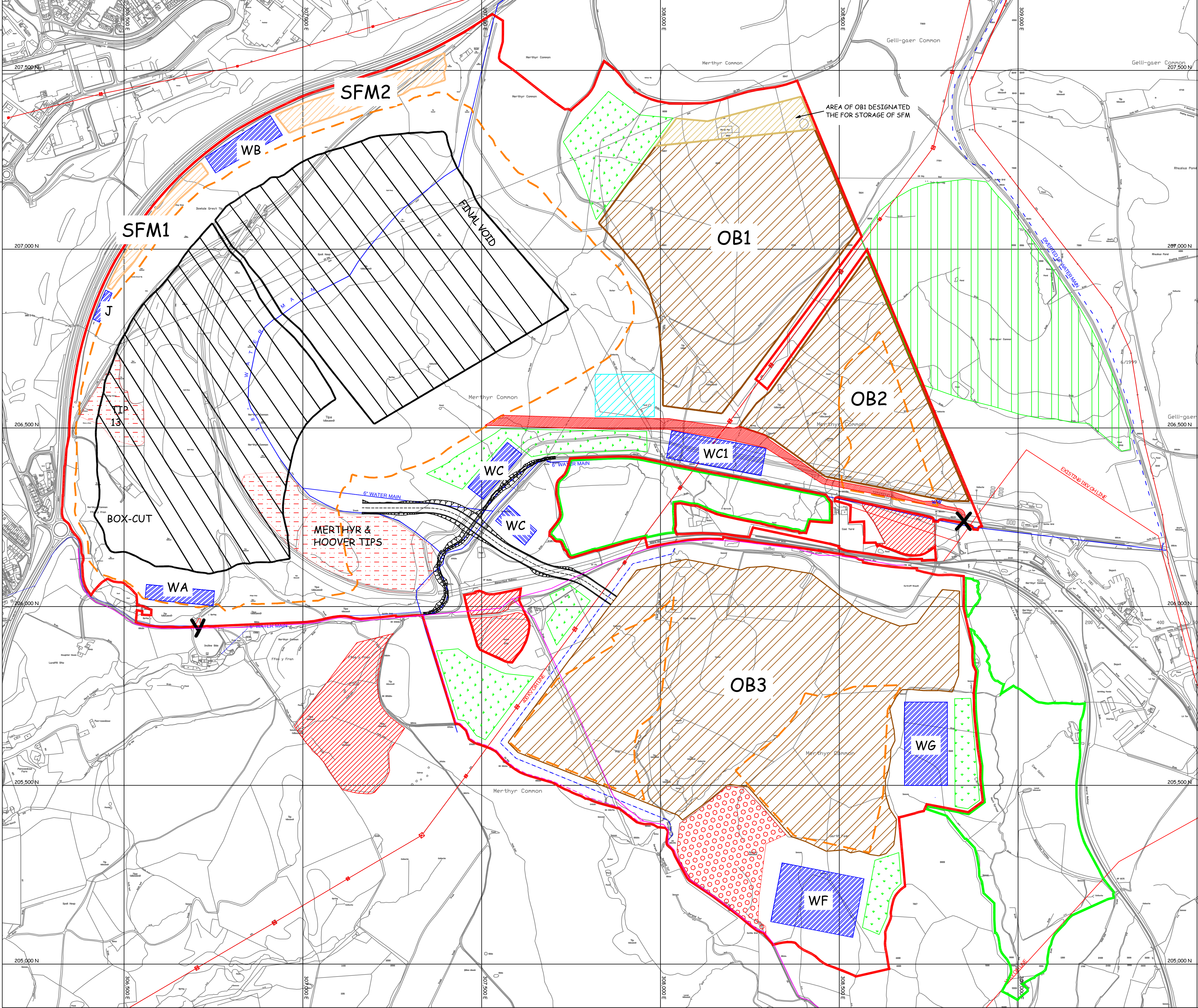
LEGEND

- Site Boundary
- Watercourses
- Waterbodies
- ASSUMED CULVERTS
- Identified waterbodies on site
- Identified watercourses on site



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Site Visit Record			
PLOT STATUS:			DATE:
FINAL			26-11-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MJW	AW	MW	1:5000
PLOT NAME:			REVISION:
15840_Site_Visit_Record			-

Appendix G Conditions Plan



LEGEND

Site Boundary (inside of symbol to be taken as boundary)

Excavation Area

Basal Seam Extraction Area

Existing Power Lines

Existing Water Mains

Diverted Water Main

Existing British Telecom lines

Diverted British Telecom Lines

XBogey Road Crossing Point

YSecondary Access Point for Abnormal Loads Only

WWWheelwash

Area of Waste Tips

Overburden Mounds

Baffle Embankment (Soil Forming Material)

Soil Mound (Soil Forming Material)

Soil Mound (Topsoil or Subsoil)

Water Treatment Areas

Plant Maintenance Area

Coerphilly cSINC

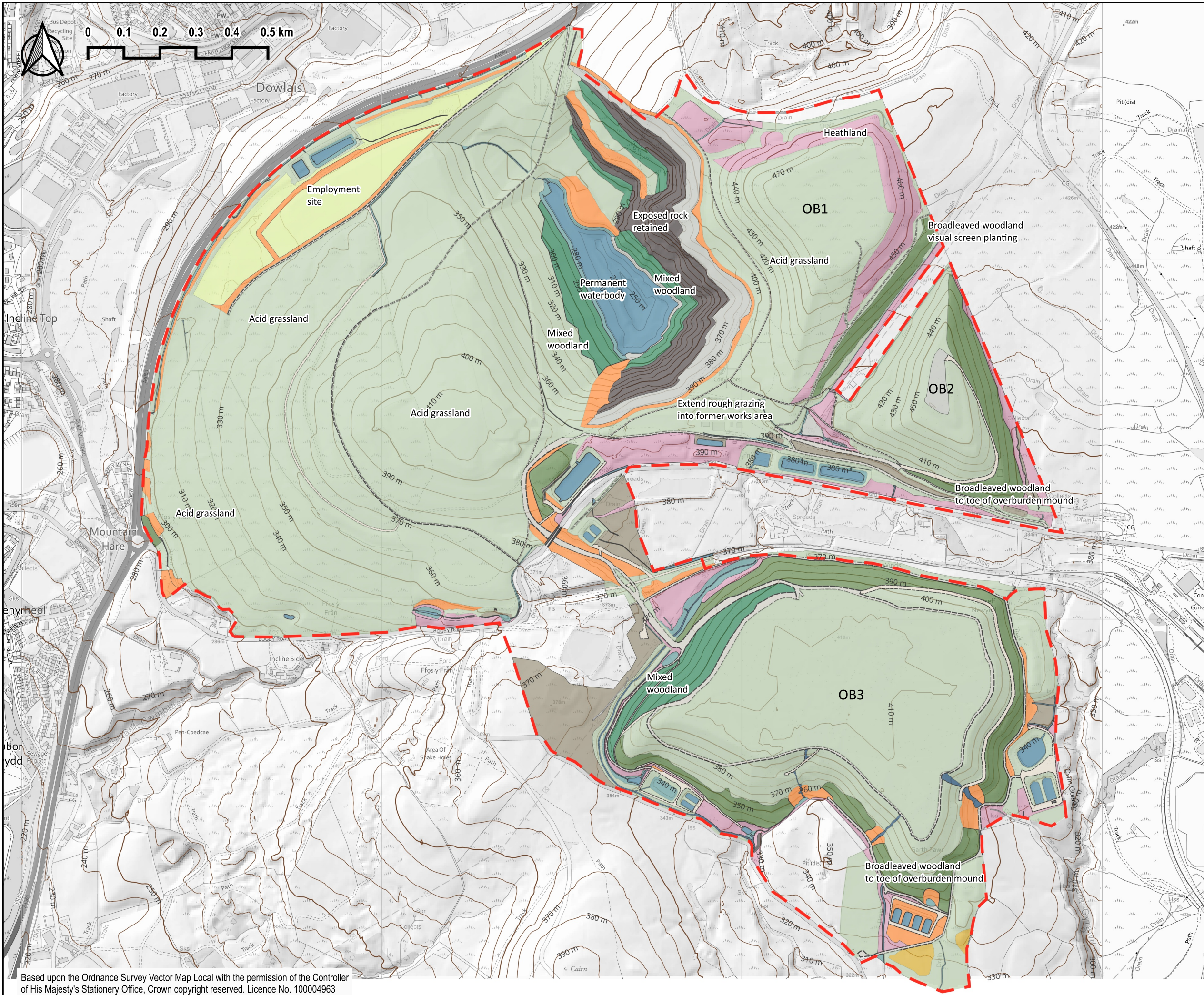
Ecological Areas Outside the Site Boundary

CADW Scheduled Ancient Monuments

GGAT Iron Age Settlement

Rev	Description of revision	Auth	Chkd	App	Date
	Miller Argent (South Wales) Limited Cwmbaroged Disposal Point Fochriw road Merthyr Tydfil CF48 4AE Tel: 01685 844381 Fax: 01685 845029				
FFOS Y FRAN LAND RECLAMATION SCHEME					
TITLE CONDITIONS PLAN					
CONSULTANT					
Designed DM		Drawn DM		Checked	
CAD/Dos filename:					
Scale 1:5,000		Size A1	Date 02/10/06		
Drawing No. MA/CON/01		Rev.	Contract Drawing No. N/A		
mill argent Reproduced from Land-Line © 1:1250/1:2500 scale data by permission of Ordnance Survey © on behalf of The Controller of Her Majesty's Stationery Office. © Crown copyright (2002). All rights reserved. Licence No. AL 100038467					

Appendix H Scheme Proposals



Cleient / Client:

MERTHYR
(SOUTH WALES)
LIMITED

Enw project / Project name:

FFOS-Y-FRAN FINAL RESTORATION

Teitl lluniad / Drawing title:

Proposed Development Plan
(indicative only)

Eglurhad / Key:

Site boundary

Restoration contour (10 m interval)

Land cover (indicative) [acres]

Improved grass [2.20]

Unimproved grass [600.34]

Mixed woodland [27.92]

Broad-leaved woodland [48.90]

Shrub [32.72]

Heathland [52.22]

Bog [24.12]

Inland rock [22.75]

Standing water [25.92]

Running water [2.66]

Freshwater marsh [11.72]

Other built structure [0.14]

Metalled roadway [23.61]

Pathway [13.11]

Multiple surface [27.36]

Bare surface [18.59]

WORK IN PROGRESS

Graddfa / Scale (A3):

1:10,000 @ A3

Dyddiad / Date:

Oct 2024

Darlunwyd gan:

RhE

Rhif lluniad / Drawing number:

3274-RML-DR-L-39

Gwilyddyl gan:

JS

Darparwyd gan / Prepared by:

RML

Based upon the Ordnance Survey Vector Map Local with the permission of the Controller of His Majesty's Stationary Office, Crown copyright reserved. Licence No. 100004963

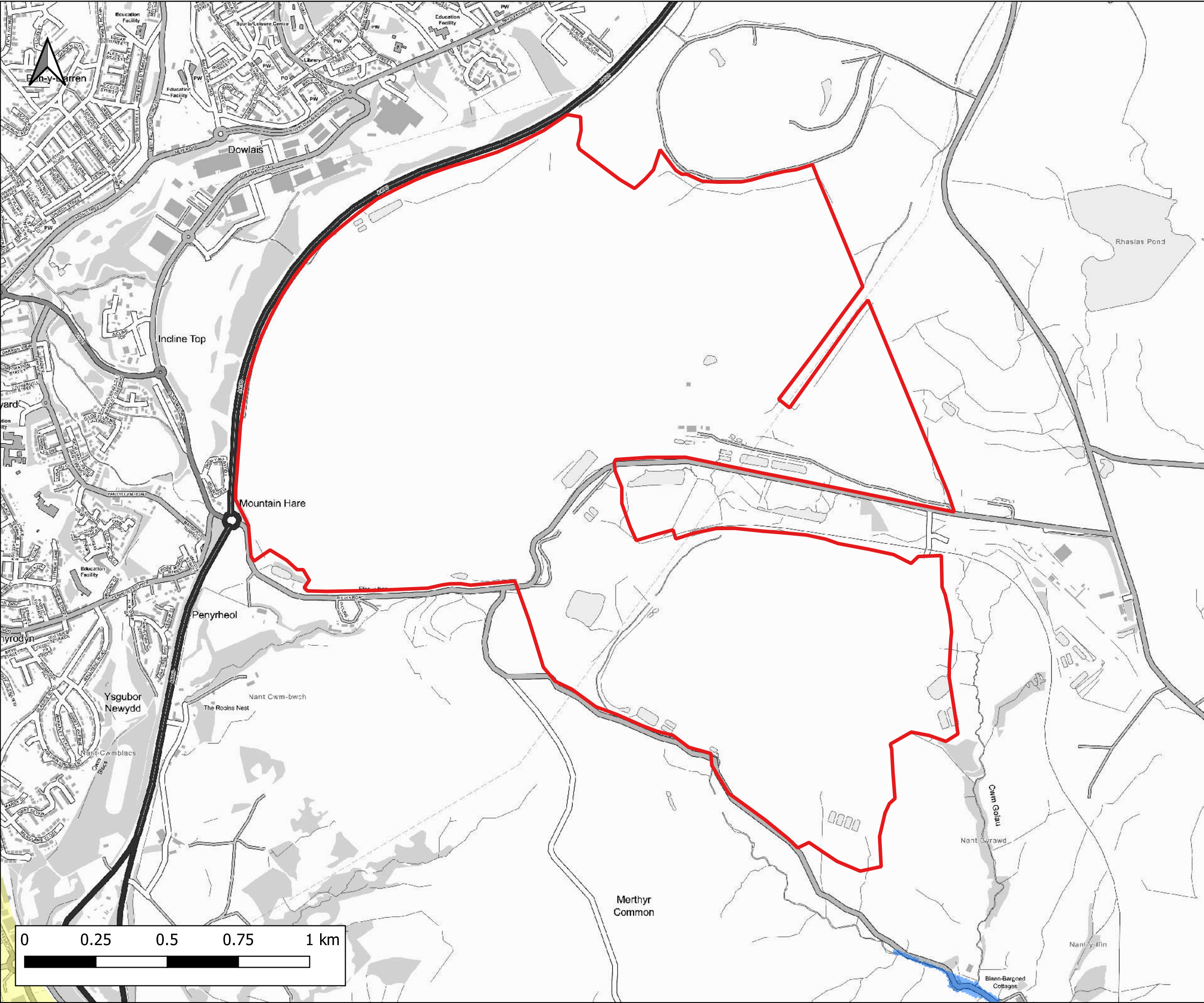
RML

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Rhif Ffôn/Tel: +44 (0)1824 704566, Ffôn/Fac: +44 (0)1824 705450

e-bost/e-mail: info@rml.co.uk, www.rml.co.uk

Appendix I NRW Flood Maps



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

Site Boundary

Development Advice Map (TAN15)

Zone A

Zone B

Zone C1

Zone C2

CLIENT:

Merthyr (South Wales) Ltd

www.waterco.co.uk

SCHEME:

Ffos-y-Fran, Merthyr Tydfil

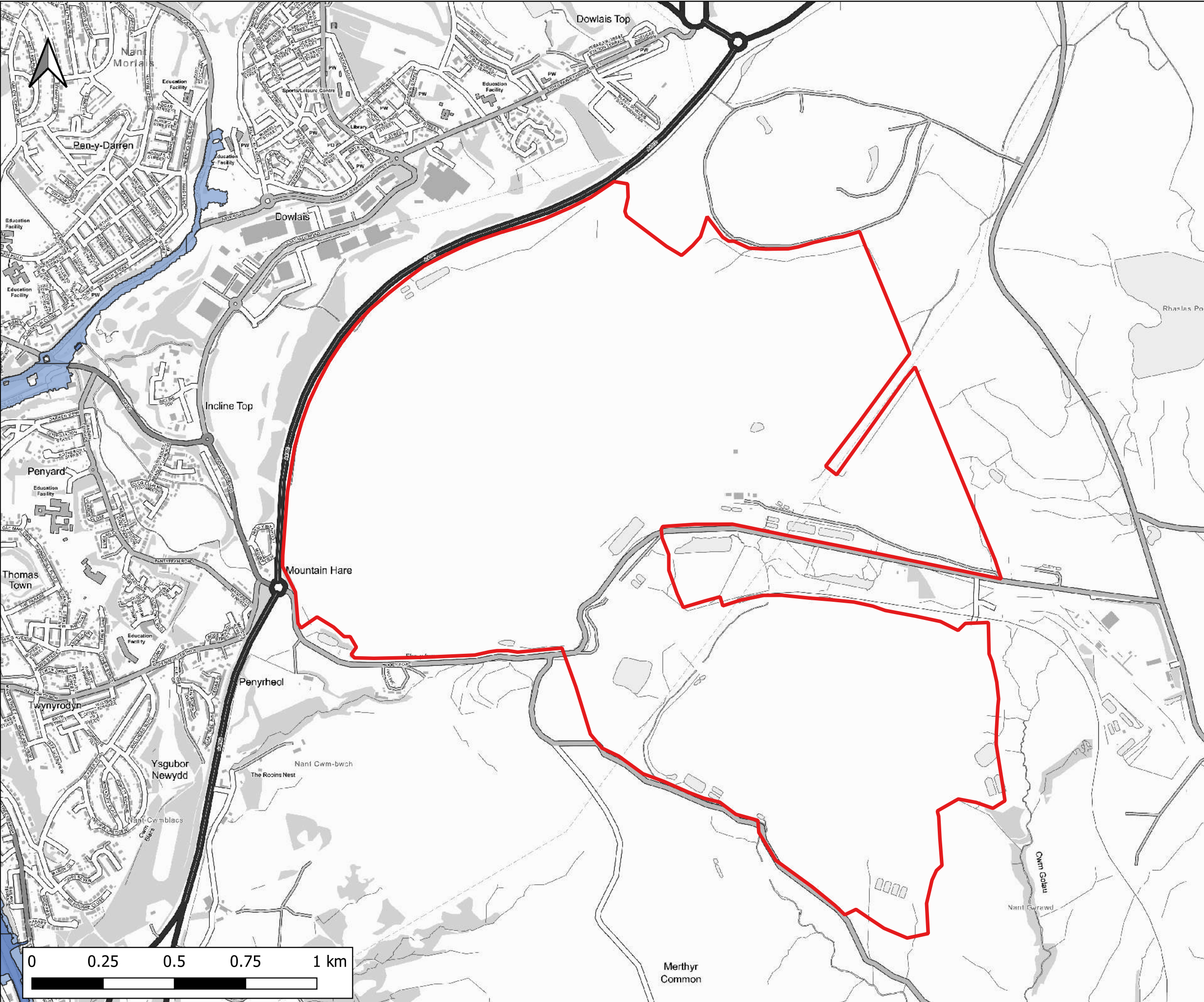
PLOT TITLE:

NRW Development Advice Map
Data accessed August 2024

PLOT STATUS:		FINAL		DATE:	19-08-2024
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MJW	AW	MW	1:13000

PLOT NAME:	REVISION:
15840_NRW_DAM_Map	-



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

Site Boundary

Flood Risk from Rivers

Flood Zone 1

Flood Zone 2

Flood Zone 3

CLIENT:

Merthyr (South Wales) Ltd

www.waterco.co.uk

SCHEME:

Ffos-y-Fran, Merthyr Tydfil

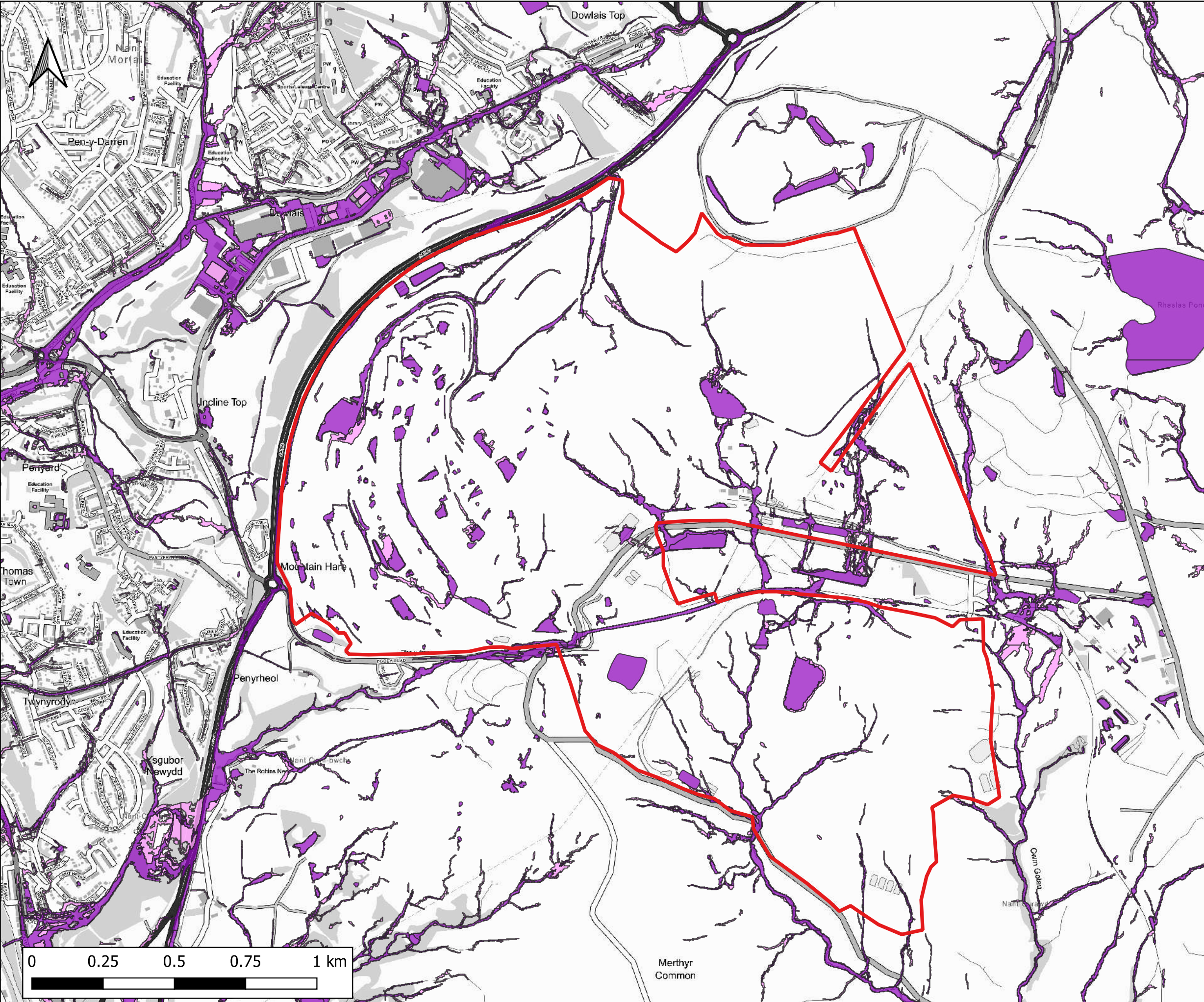
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NRW Flood Risk from Rivers
Data accessed August 2024

PLOT STATUS:		DATE:	
FINAL		19-08-2024	

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MJW	AW	MW	1:13000

PLOT NAME:	REVISION:
15840_NRW_Flood_Risk_from_Rivers	-



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

Site Boundary

Flood Risk from Surface Water & Small Watercourses

Flood Zone 2

Flood Zone 3

Flood Zone 1

CLIENT:

Merthyr (South Wales) Ltd

www.waterco.co.uk

SCHEME:

Ffos-y-Fran, Merthyr Tydfil

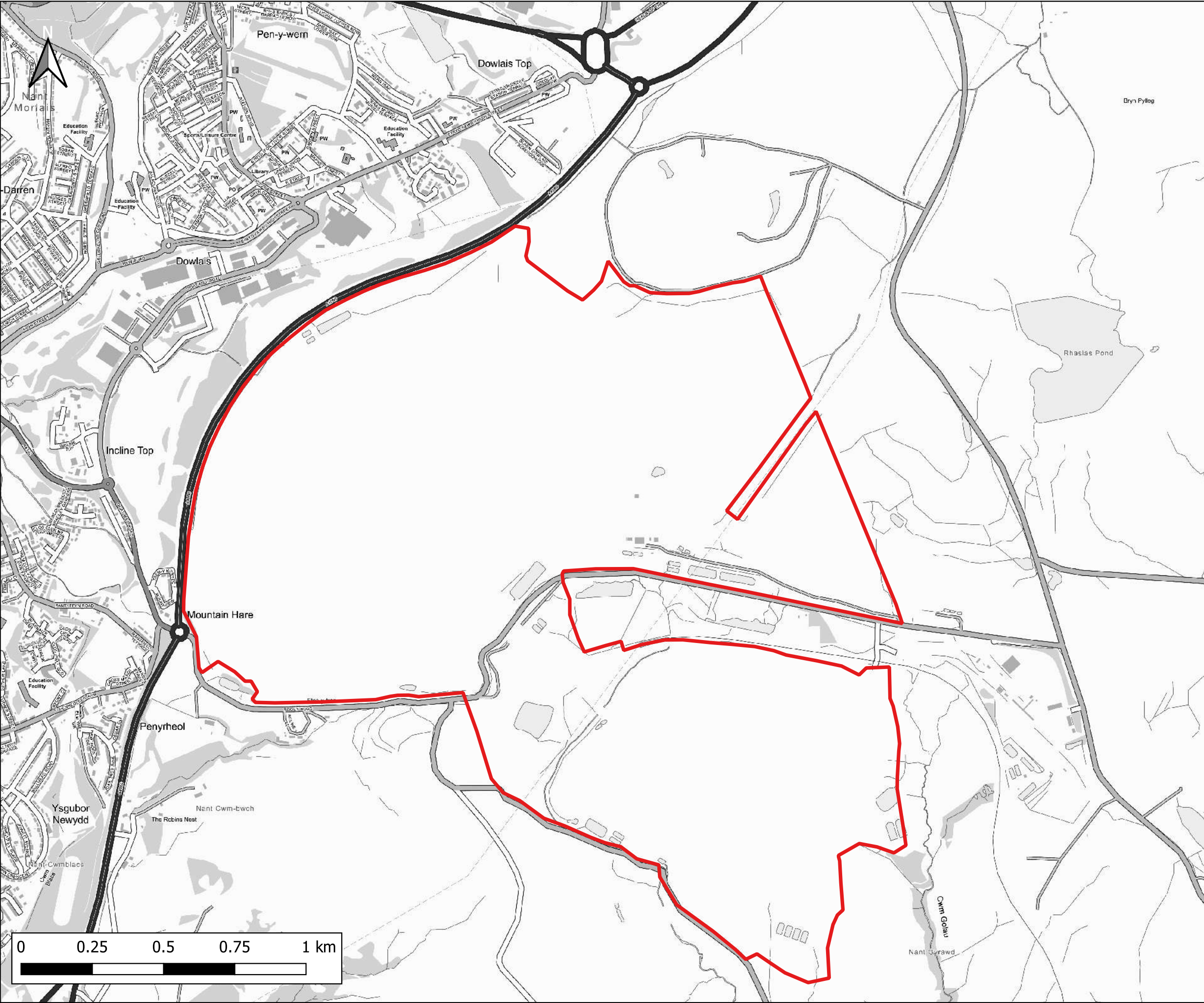
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NRW Flood Risk from Surface Water & Small Watercourses
Data accessed August 2024

PLOT STATUS:		DATE:	
FINAL		19-08-2024	

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MJW	AW	MW	1:13000

PLOT NAME:	REVISION:
15840_NRW_Flood_Risk_from_Surface_Water	-



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

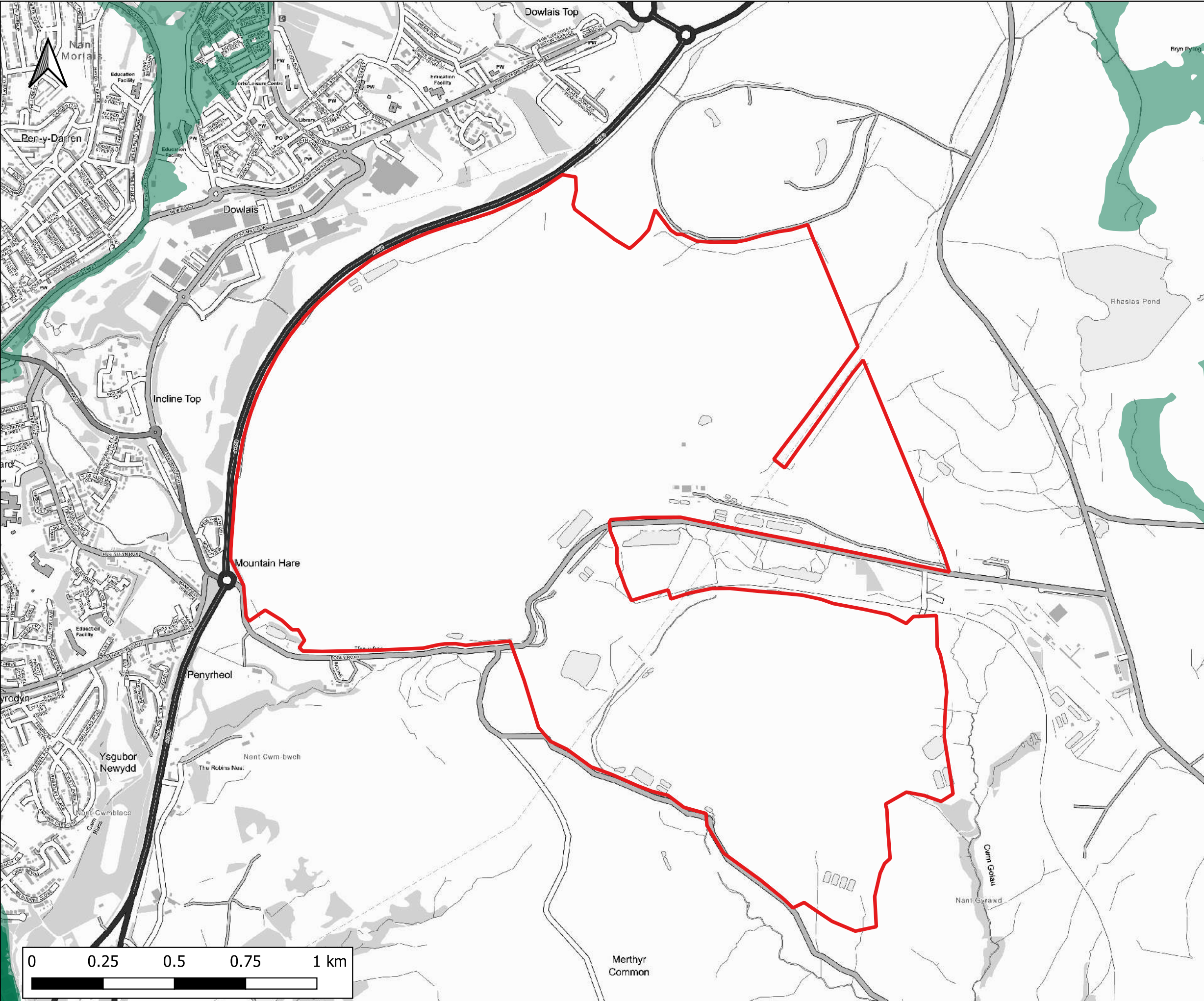
Site Boundary

Flood Risk from Sea

Flood Zone 2

Flood Zone 3

CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
NRW Flood Risk from the Sea Data accessed August 2024			
PLOT STATUS:			
FINAL			
DATE:			
19-08-2024			
DRAWN:			
MJW			
CHECKED:			
AW			
APPROVED:			
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REVISION:			
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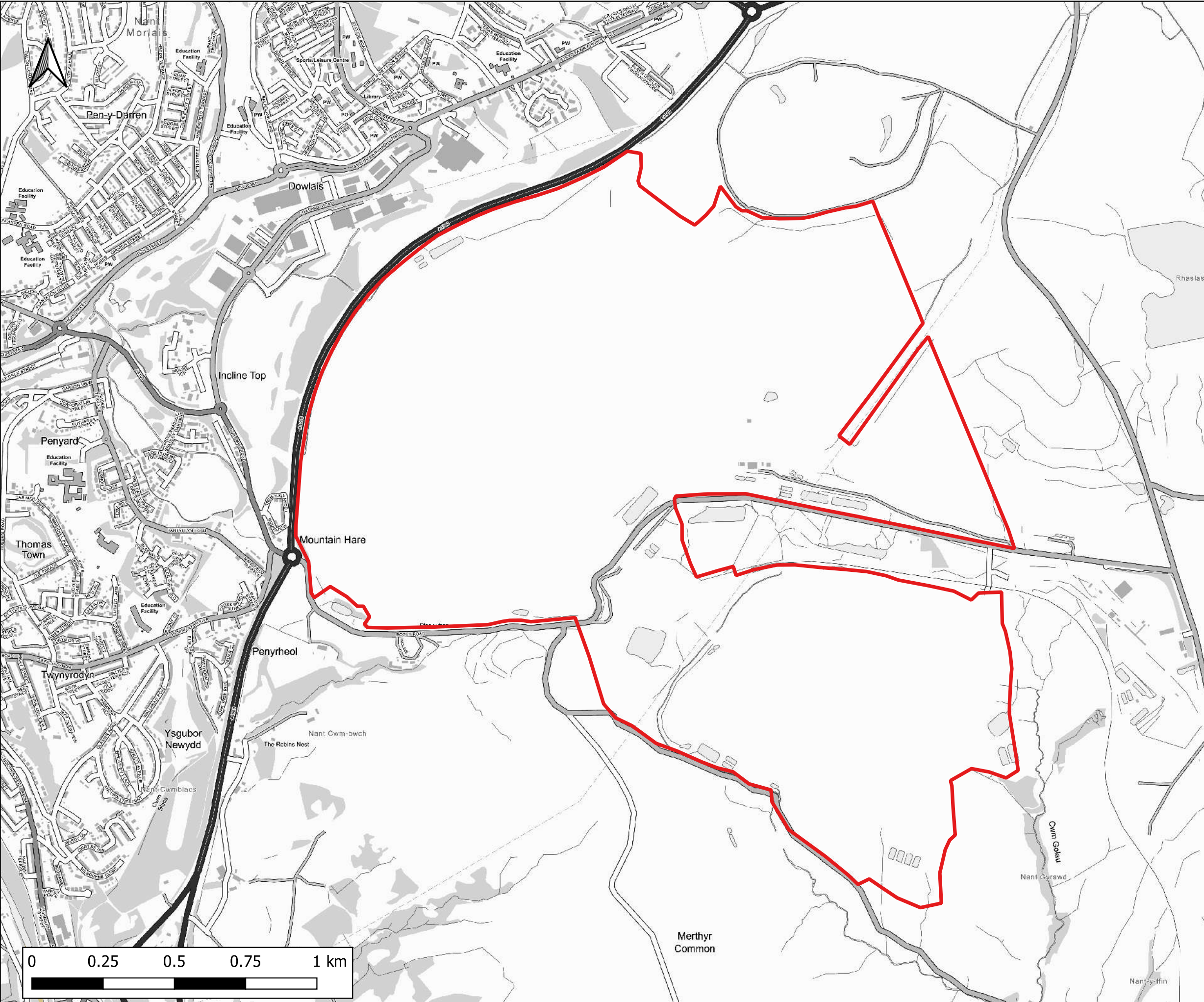


Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Flood Risk from Reservoirs Extent

CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
NRW Flood Risk from Reservoirs Data accessed August 2024			
PLOT STATUS:			DATE:
FINAL			19-08-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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PLOT NAME:			REVISION:
15840_NRW_Flood_Risk_from_Reservoirs			-



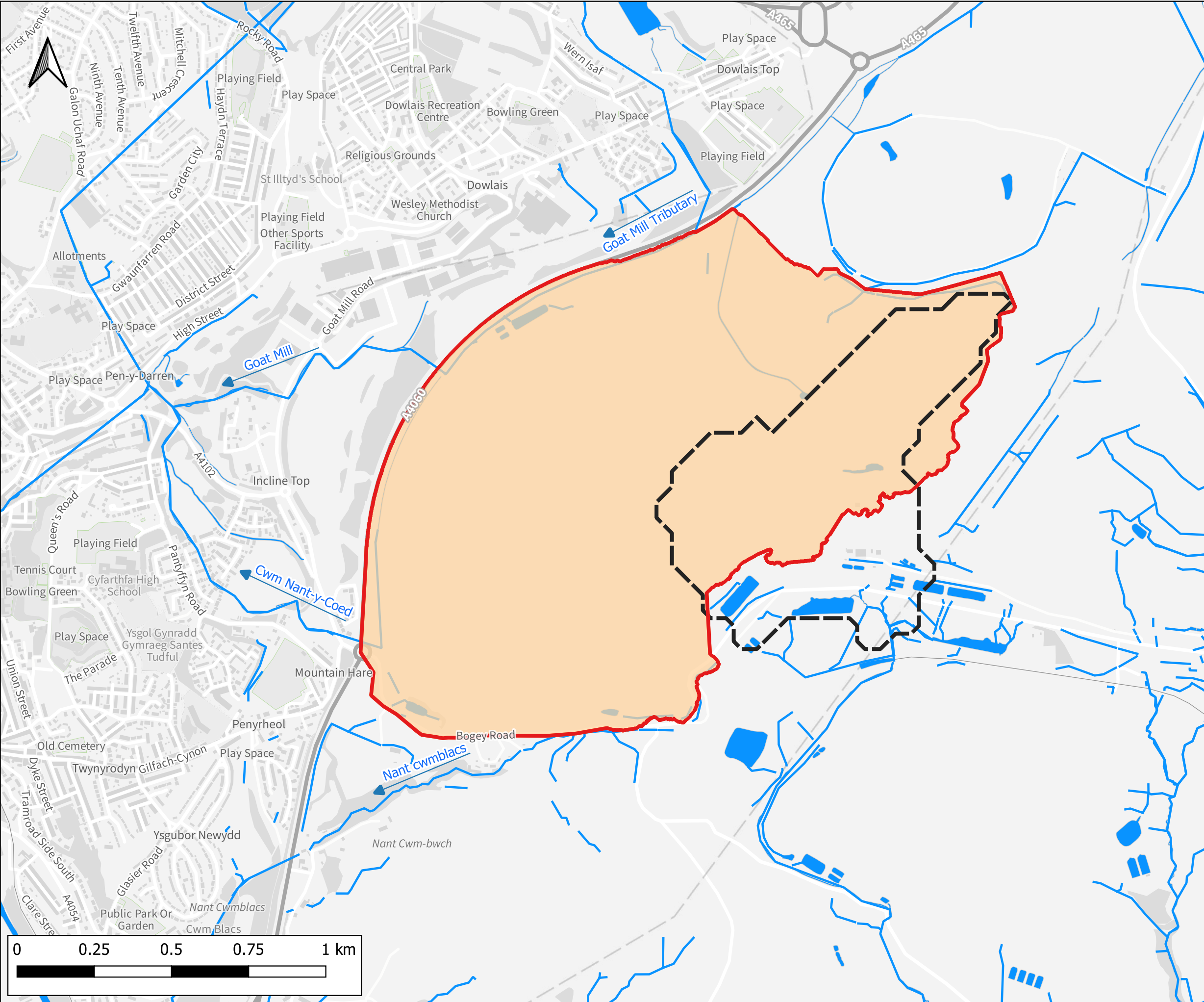
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Historic_Flood_Map

CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
NRW Historic Flood Risk Data accessed Augst 2024			
PLOT STATUS:			
FINAL			
DATE:			
19-08-2024			
DRAWN:			
MJW			
CHECKED:			
AW			
APPROVED:			
MW			
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15840_NRW_Historic_Flood_Risk			
REVISION:			
-			

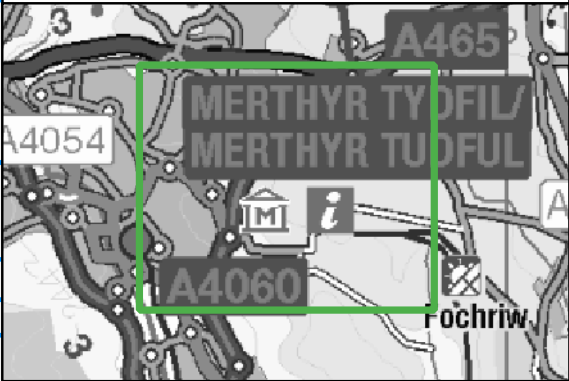
Appendix J Hydrological Features Plan



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

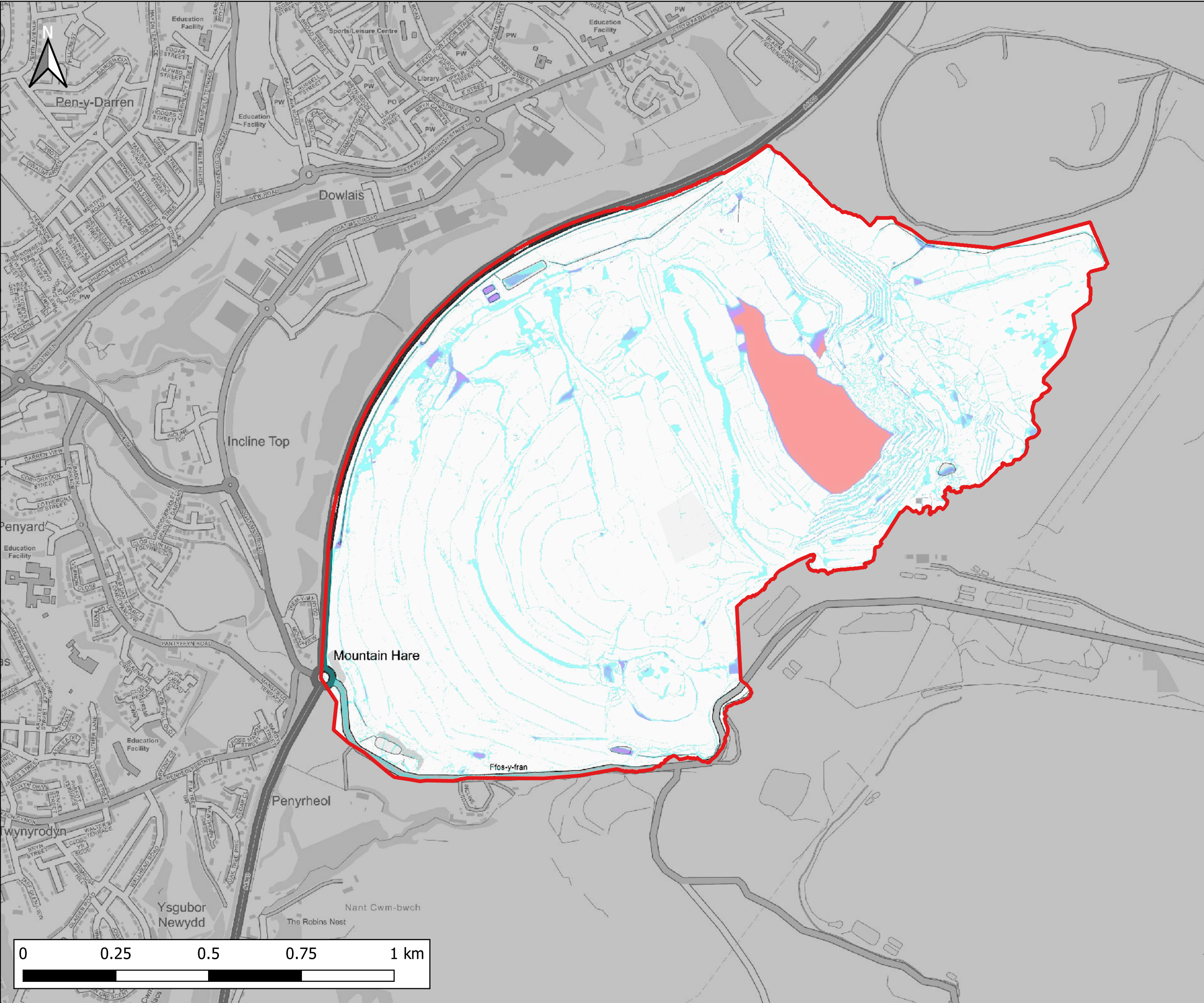
LEGEND

- Site Boundary
- FEH Catchment Boundary
- Updated Catchment Boundary
- Watercourses
- Waterbodies



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Hydrological Location Plan			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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15840_Hydrological_Location_Plan			-

Appendix K Pluvial Model Results



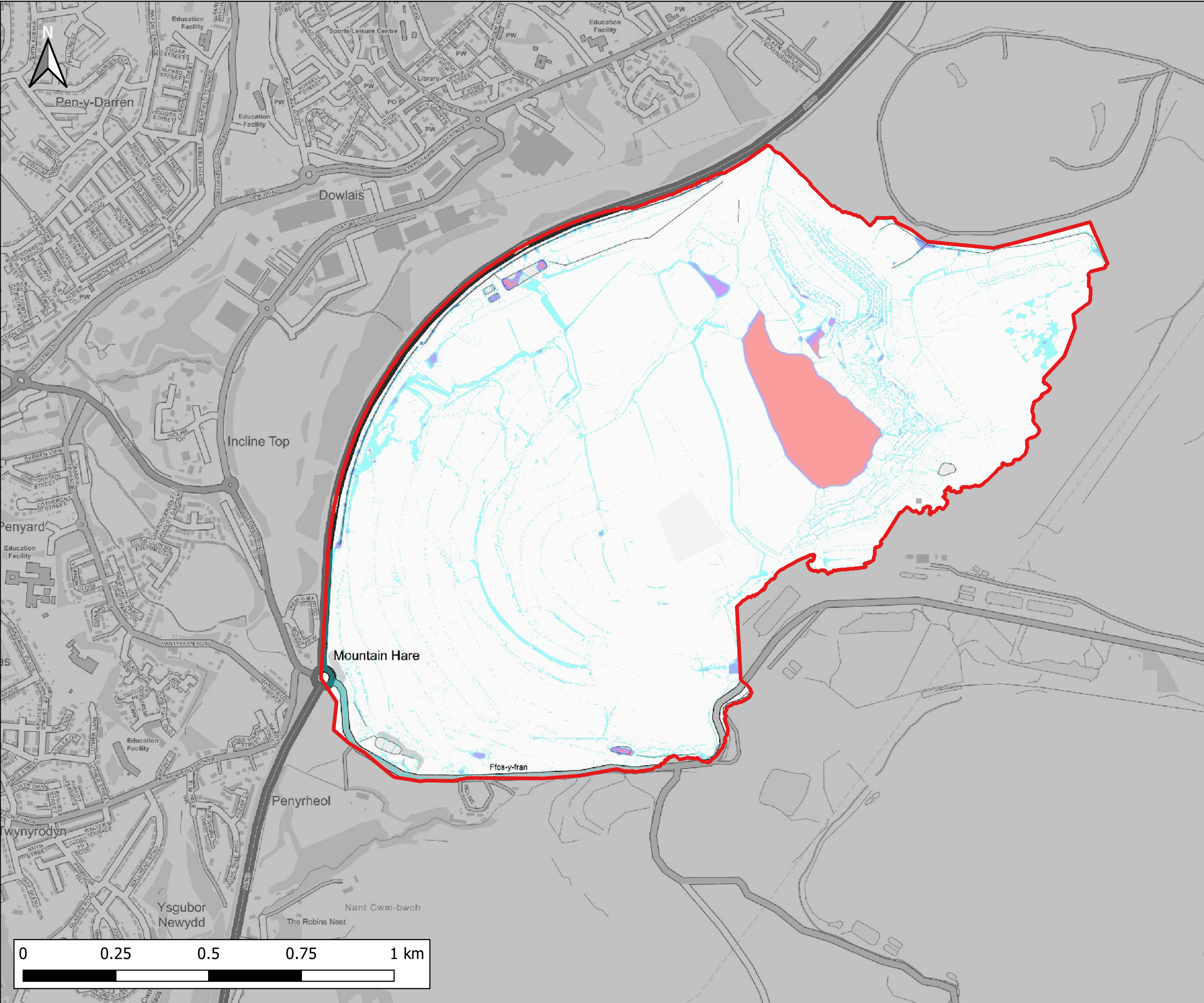
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth
- <= 0.3m
 - 0.3m - 0.6m
 - 0.6m - 1.2m
 - 1.2m - 2.4m
 - > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 3.33% AEP Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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PLOT NAME:			REVISION:
15840-FYF_R30_EXG_NC_005_d_Max_co			-



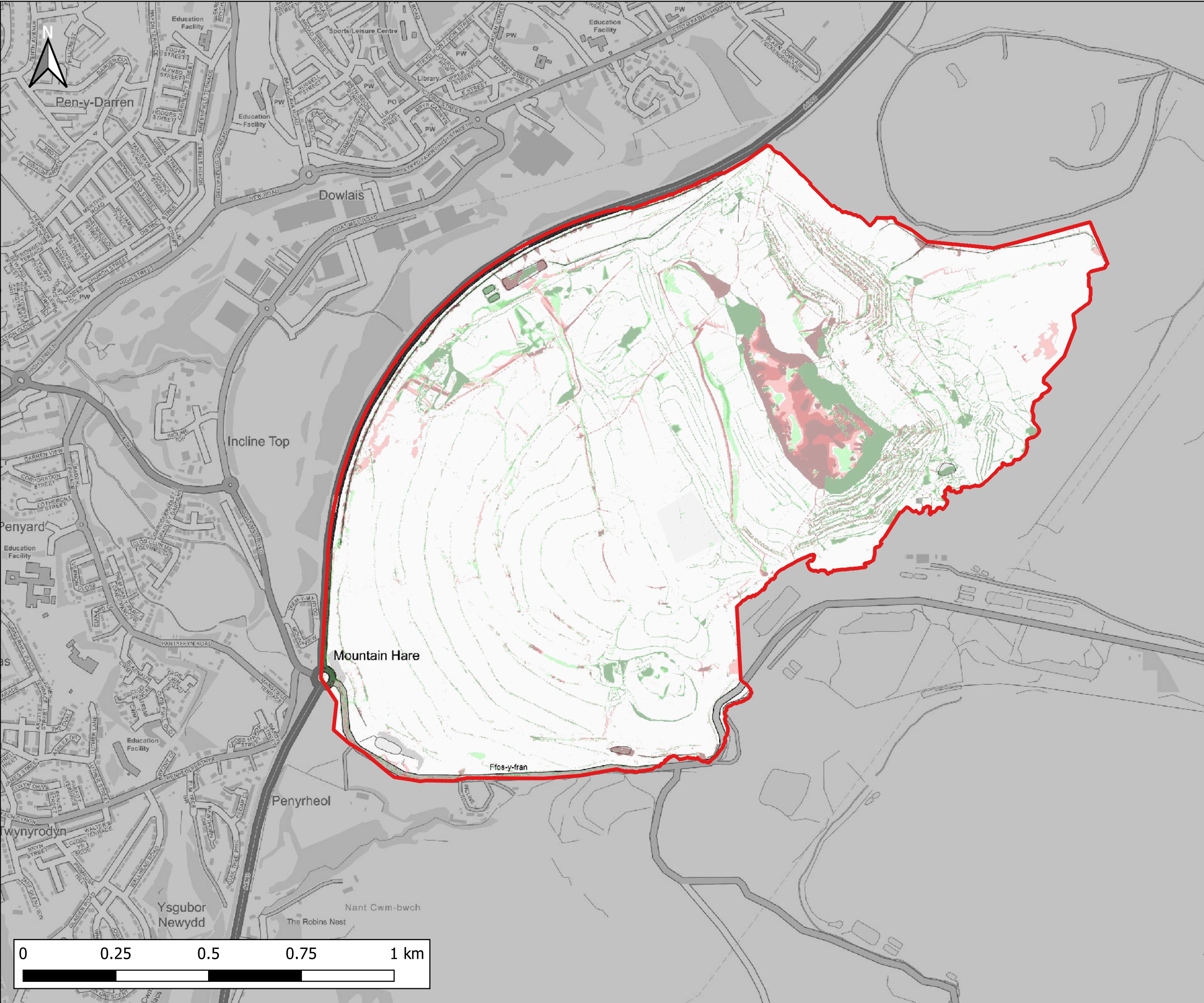
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth
- <= 0.3m
 - 0.3m - 0.6m
 - 0.6m - 1.2m
 - 1.2m - 2.4m
 - > 2.4m



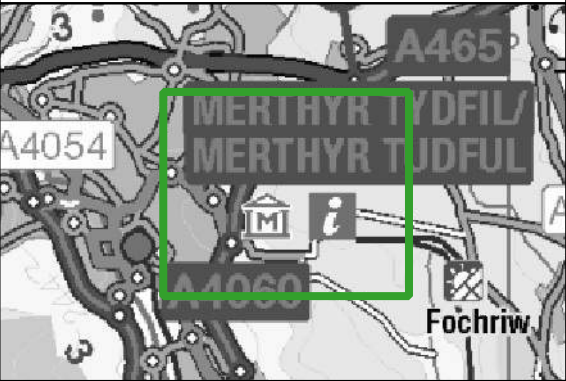
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Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
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PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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PLOT NAME:			REVISION:
15840-FYF_R30_DEV_NC_005_d_Max_co			-



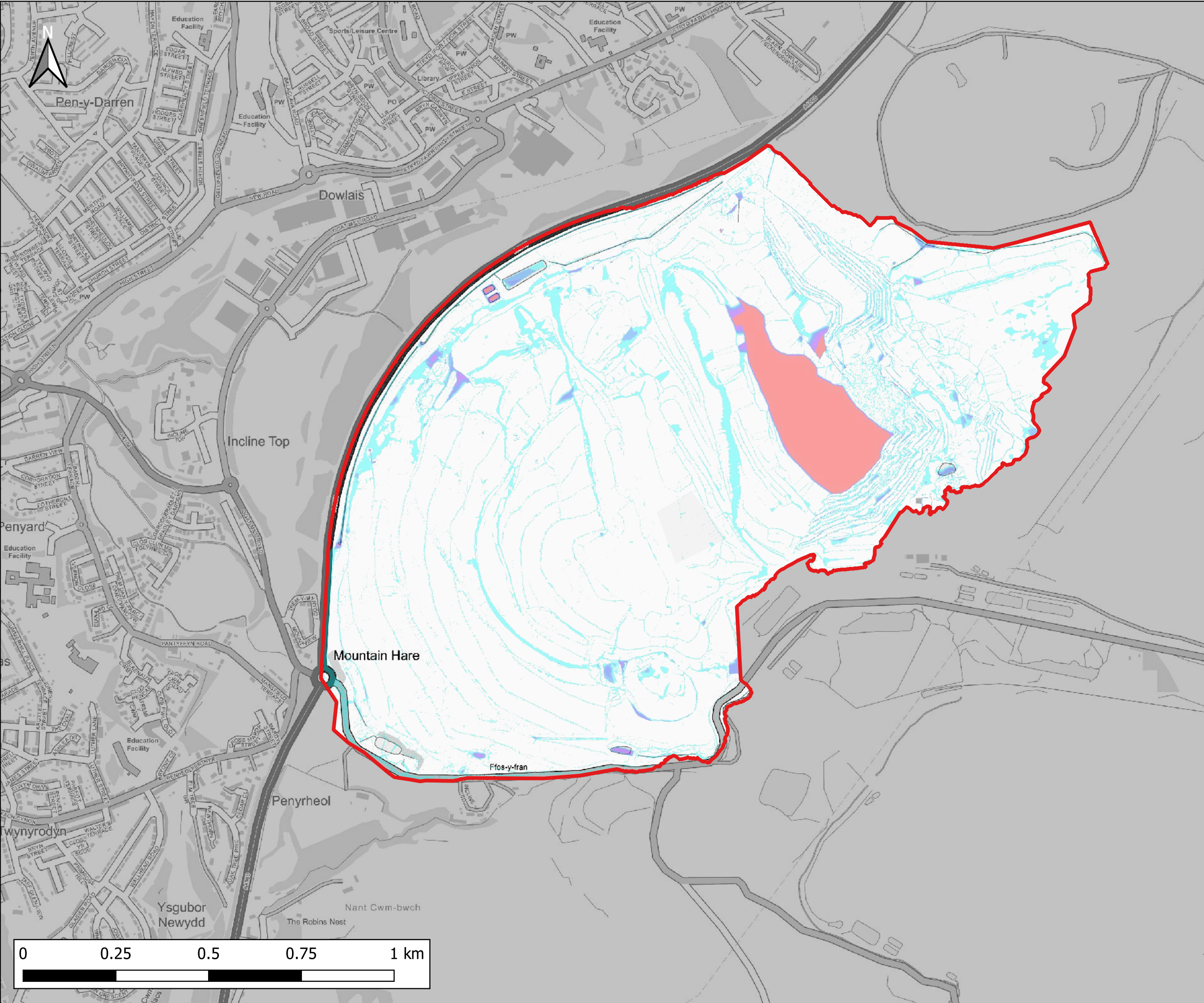
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth Difference
- > -100mm
 - 50mm to -100mm
 - 5mm to -50mm
 - No Change (+/- 5mm)
 - +5mm to +50mm
 - +50mm to +100mm
 - > +100mm



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth Difference 3.33% AEP Pluvial Event DEV-EXG Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
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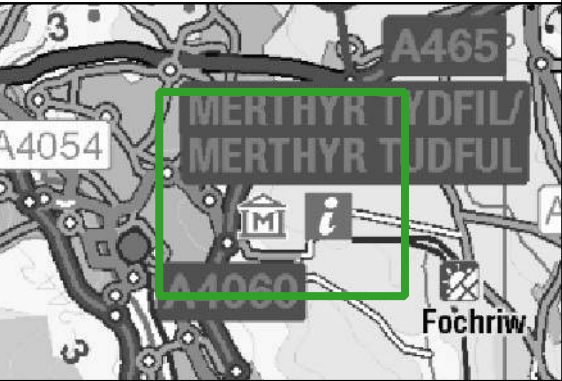
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1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

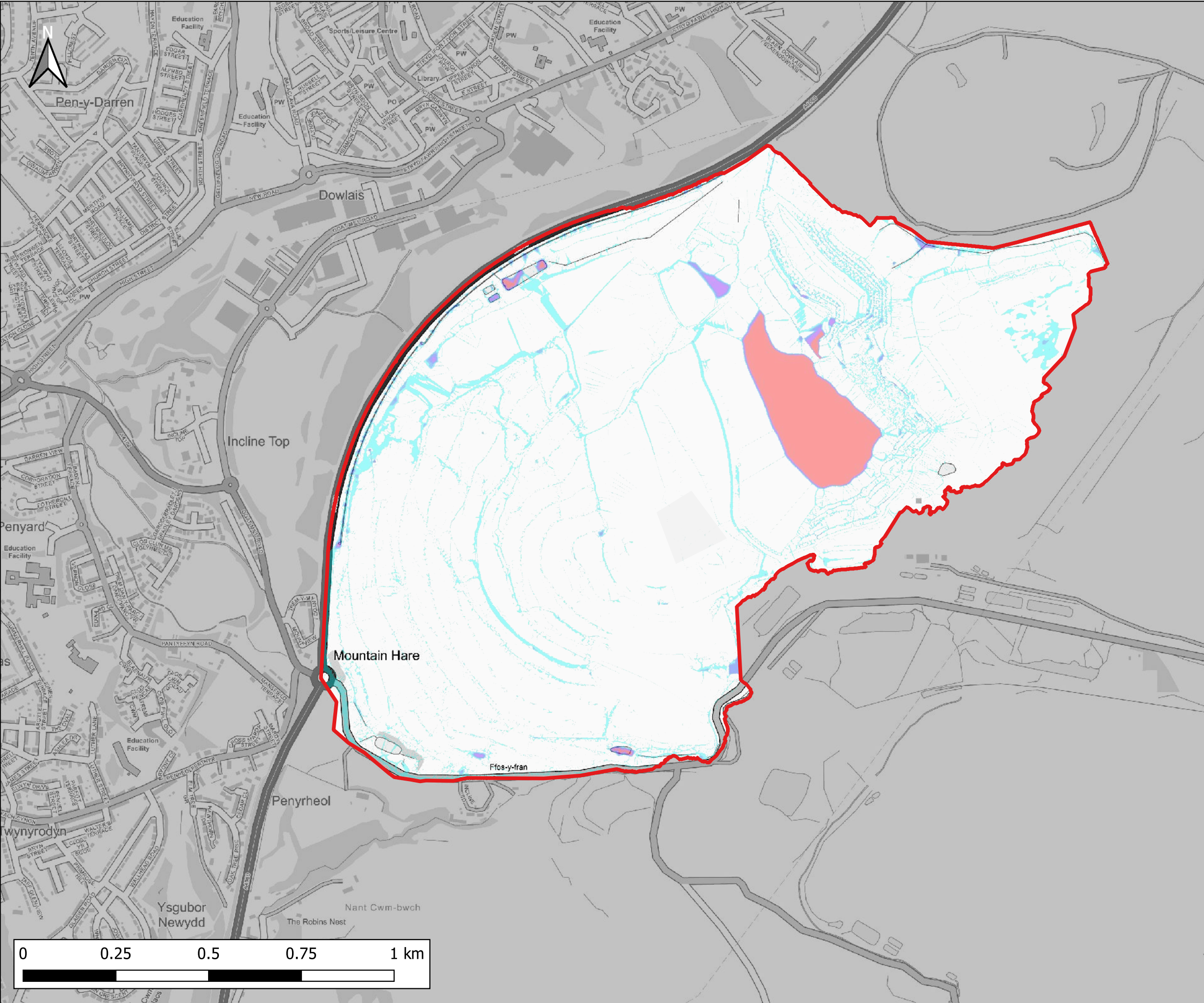
Site Boundary / 2D Model Extent

Maximum Flood Depth

- <= 0.3m
- 0.3m - 0.6m
- 0.6m - 1.2m
- 1.2m - 2.4m
- > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 1% AEP Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
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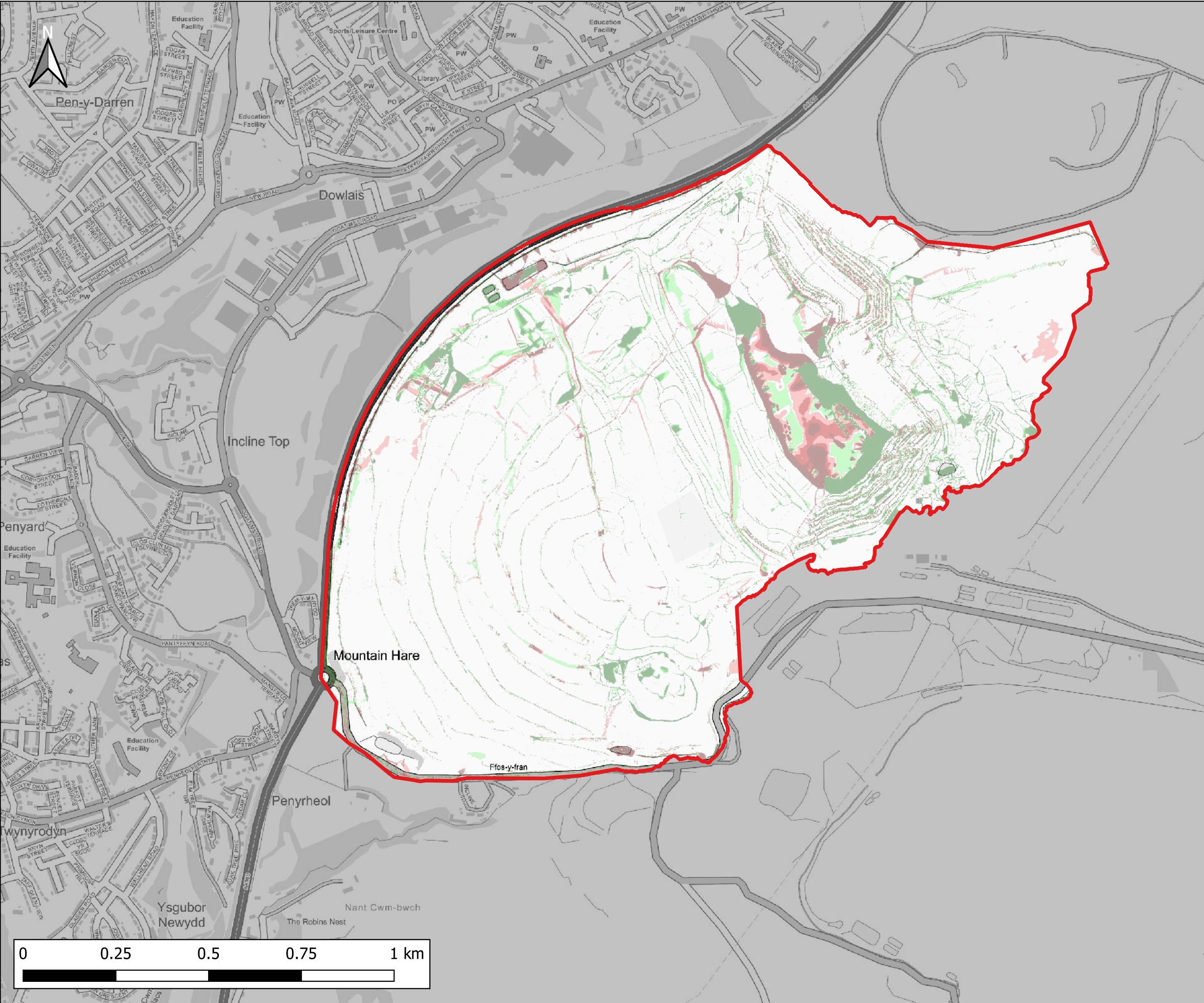
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth
- <= 0.3m
 - 0.3m - 0.6m
 - 0.6m - 1.2m
 - 1.2m - 2.4m
 - > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 1% AEP Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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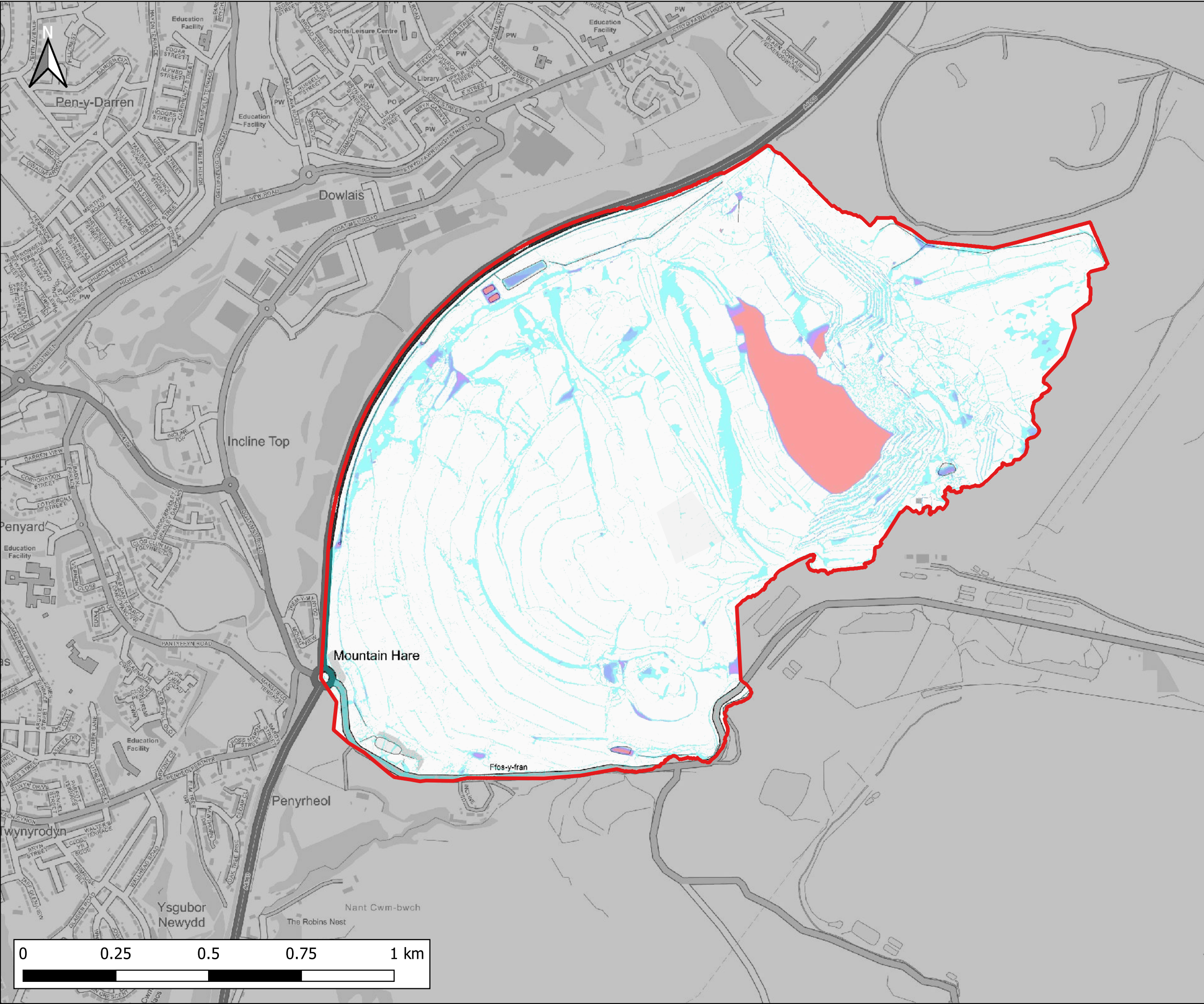
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2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth Difference
 - > -100mm
 - 50mm to -100mm
 - 5mm to -50mm
 - No Change (+/- 5mm)
 - +5mm to +50mm
 - +50mm to +100mm
 - > +100mm



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth Difference 1% AEP Pluvial Event DEV-EXG Normal Conditions			
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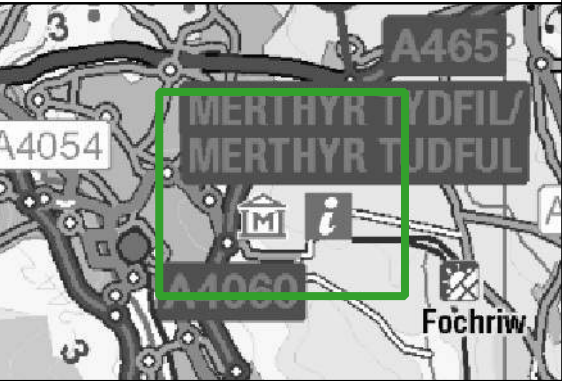
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

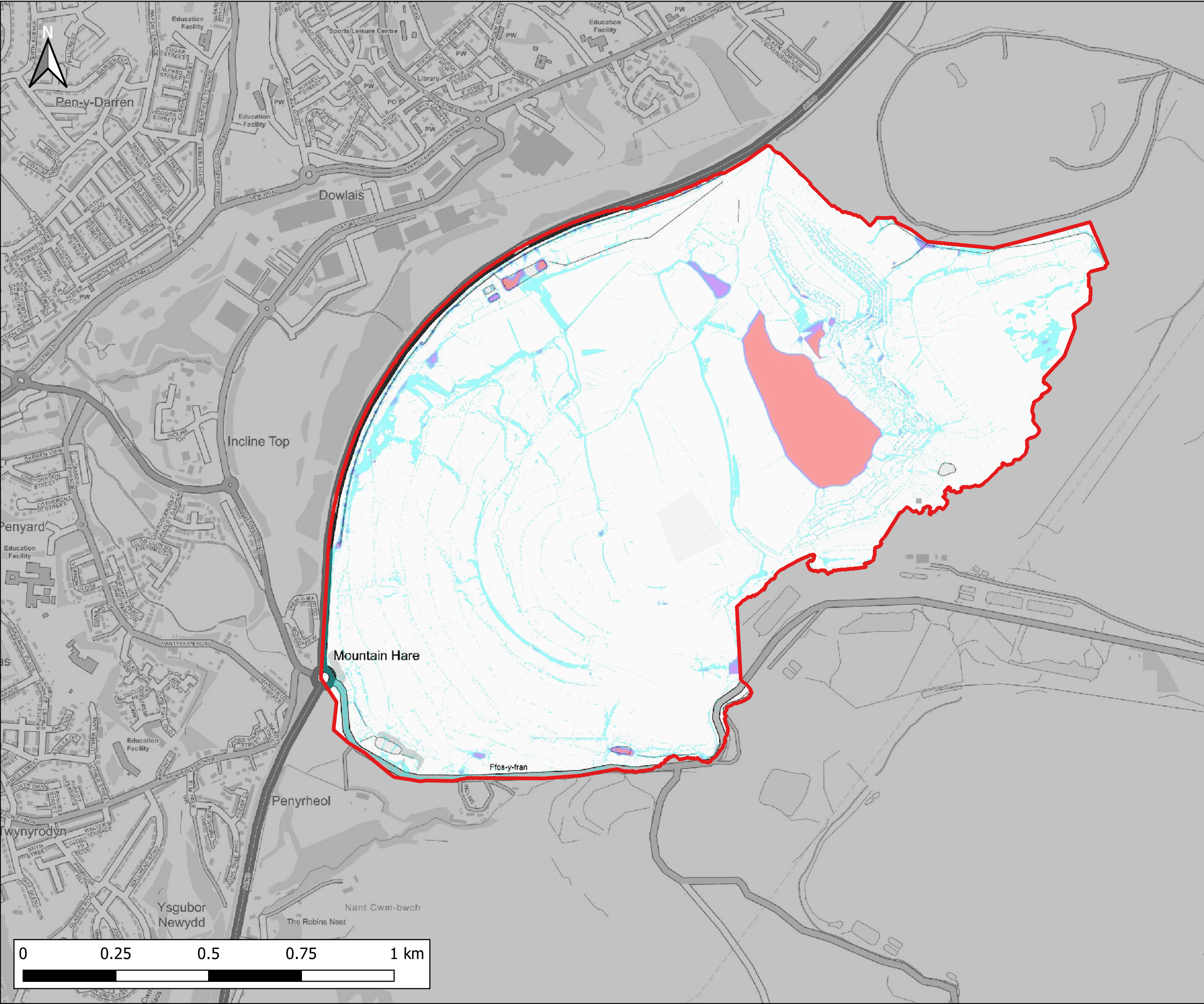
Site Boundary / 2D Model Extent

Maximum Flood Depth

- <= 0.3m
- 0.3m - 0.6m
- 0.6m - 1.2m
- 1.2m - 2.4m
- > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 1% AEP Plus 40% Climate Change Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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15840-FYF_R100CC40_EXG_NC_005_d_Max_co			-



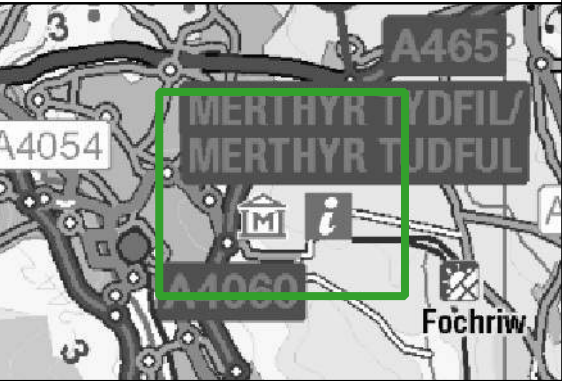
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1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
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LEGEND

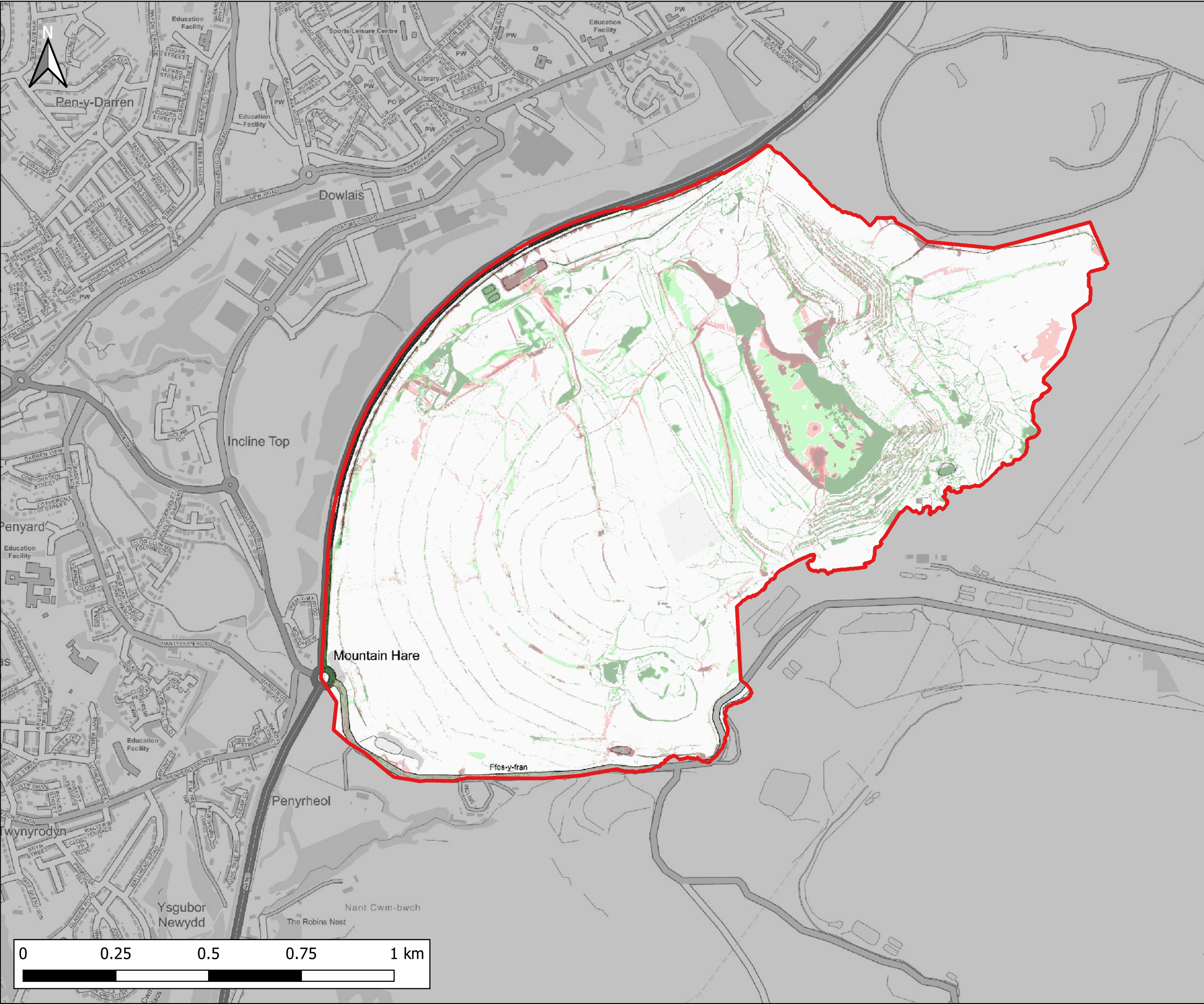
Site Boundary / 2D Model Extent

Maximum Flood Depth

- <= 0.3m
- 0.3m - 0.6m
- 0.6m - 1.2m
- 1.2m - 2.4m
- > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 1% AEP Plus 40% Climate Change Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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15840-FYF_R100CC40_DEV_NC_005_d_Max_co			-



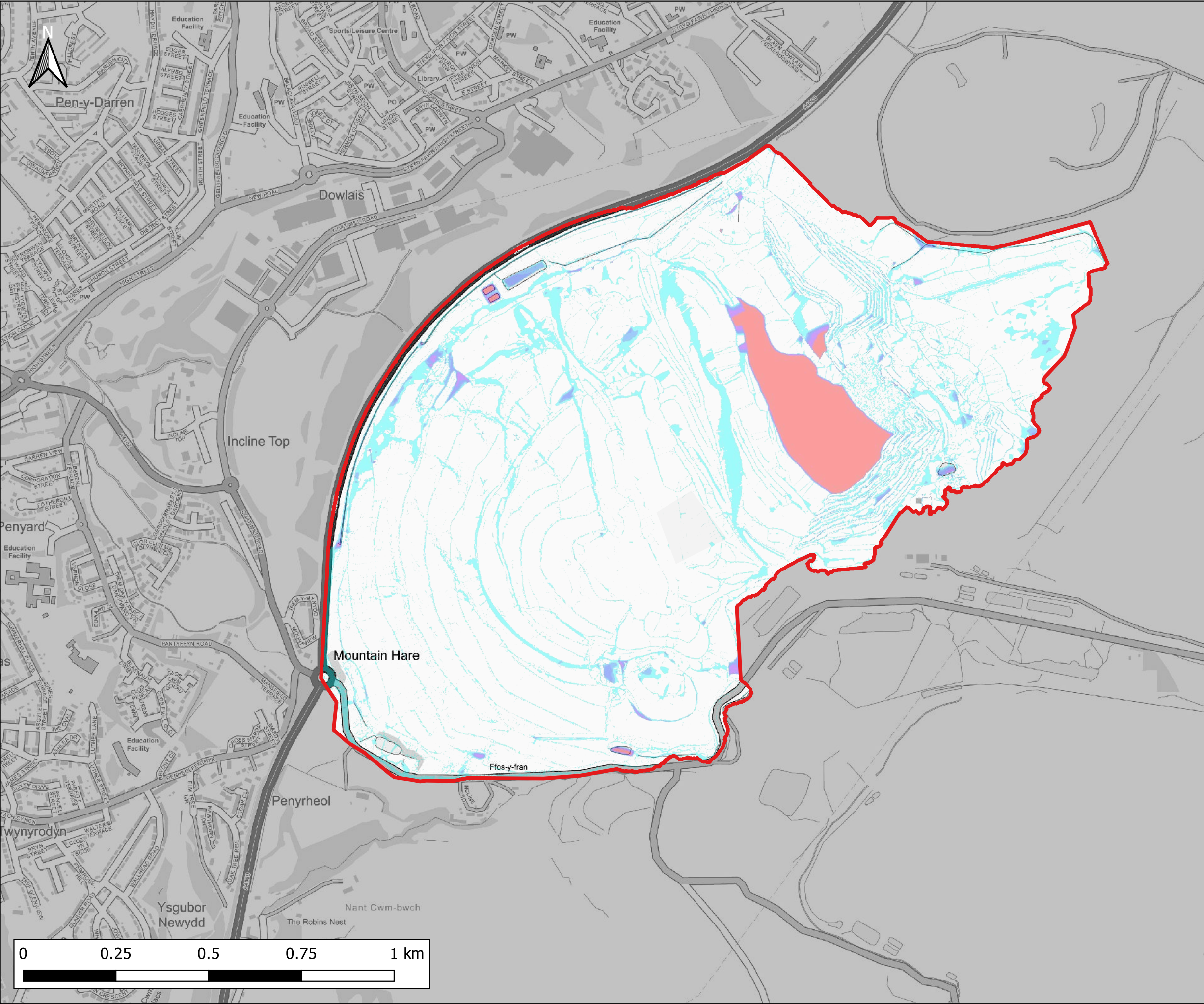
Notes:
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2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth Difference
- > -100mm
 - 50mm to -100mm
 - 5mm to -50mm
 - No Change (+/- 5mm)
 - +5mm to +50mm
 - +50mm to +100mm
 - > +100mm



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth Difference 1% AEP Plus 40% Climate Change Pluvial Event DEV-EXG Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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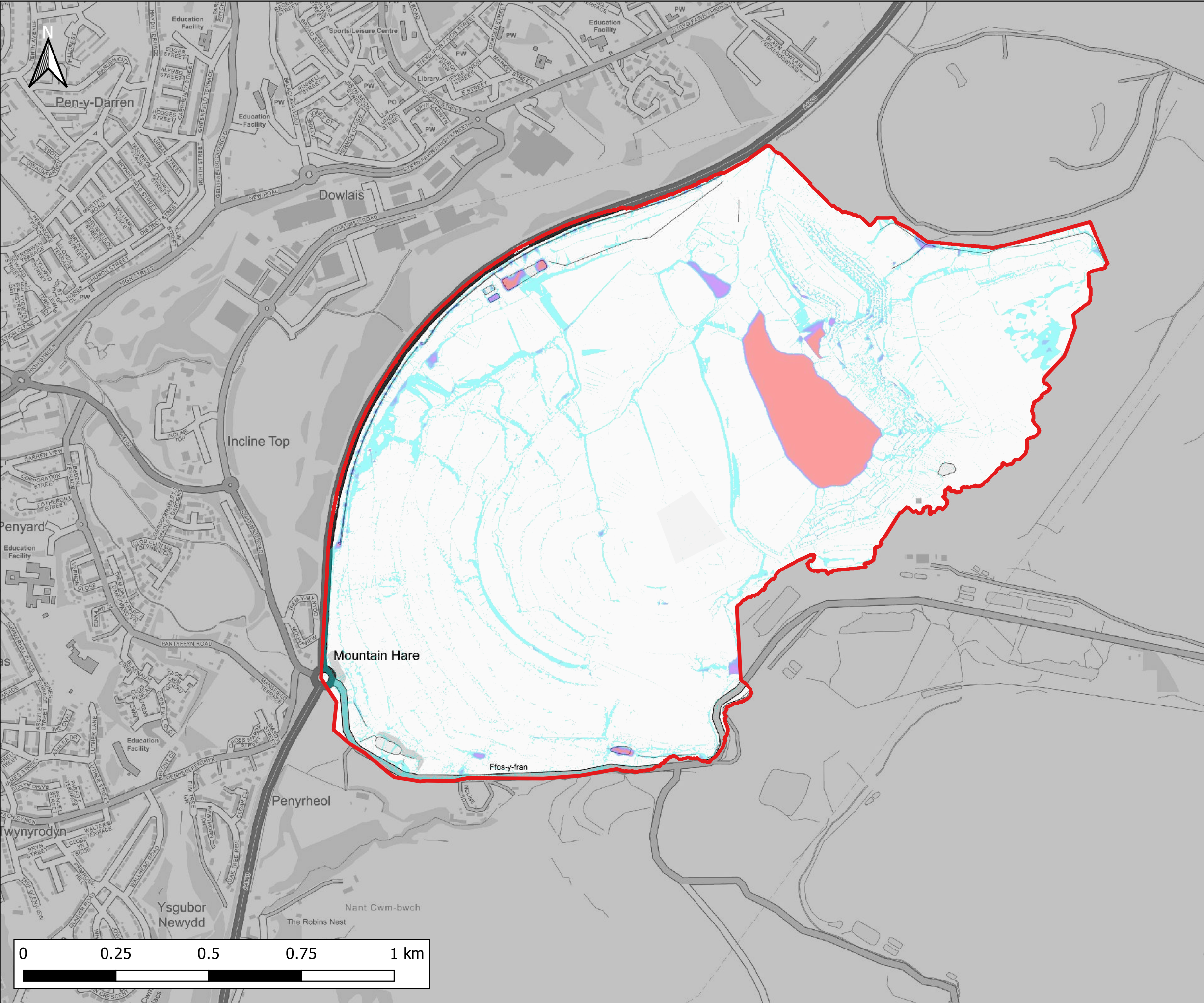
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth
- <= 0.3m
 - 0.3m - 0.6m
 - 0.6m - 1.2m
 - 1.2m - 2.4m
 - > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 0.1% AEP Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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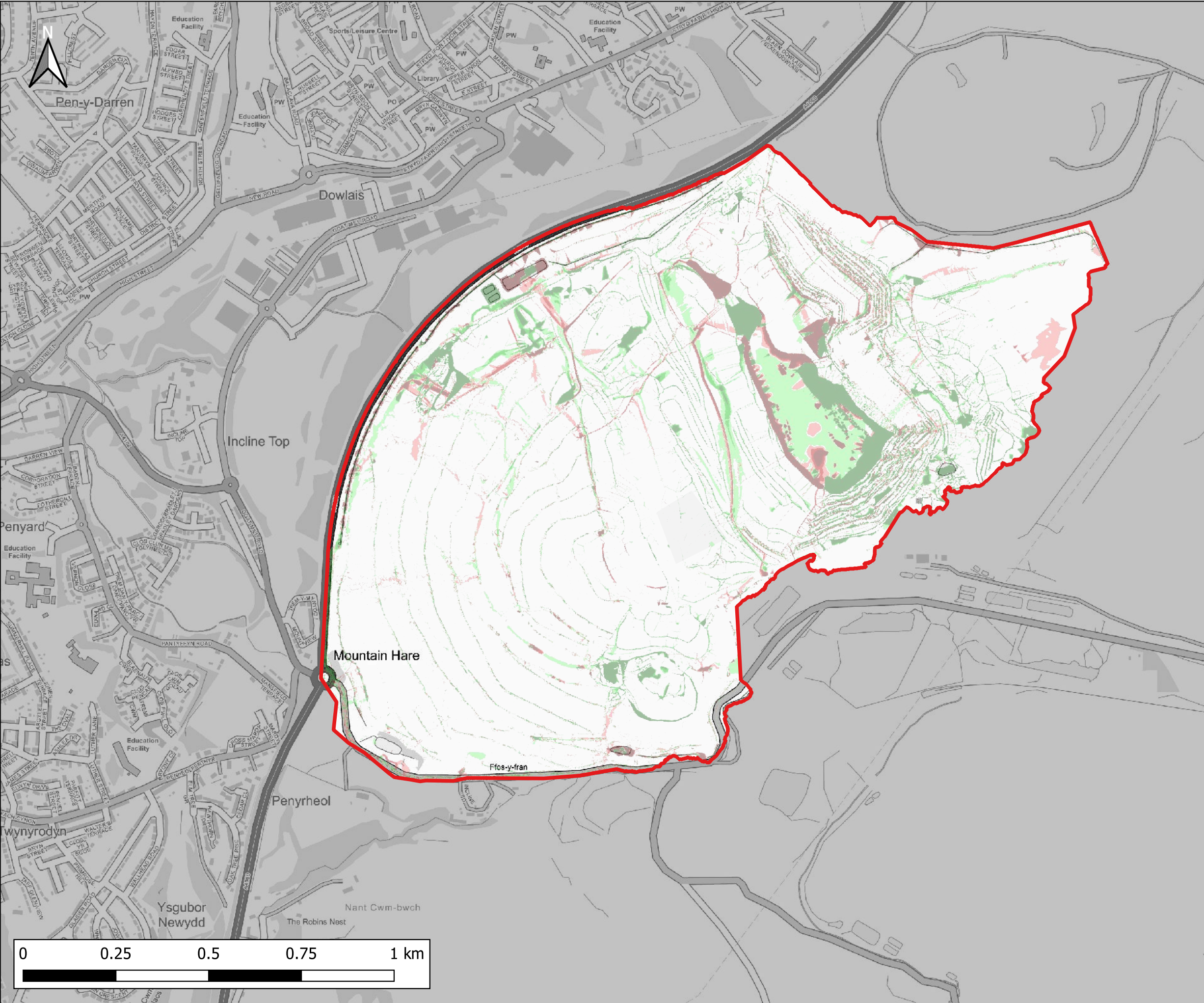
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2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth
- <= 0.3m
 - 0.3m - 0.6m
 - 0.6m - 1.2m
 - 1.2m - 2.4m
 - > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 0.1% AEP Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R1000_DEV_NC_005_d_Max_co			-



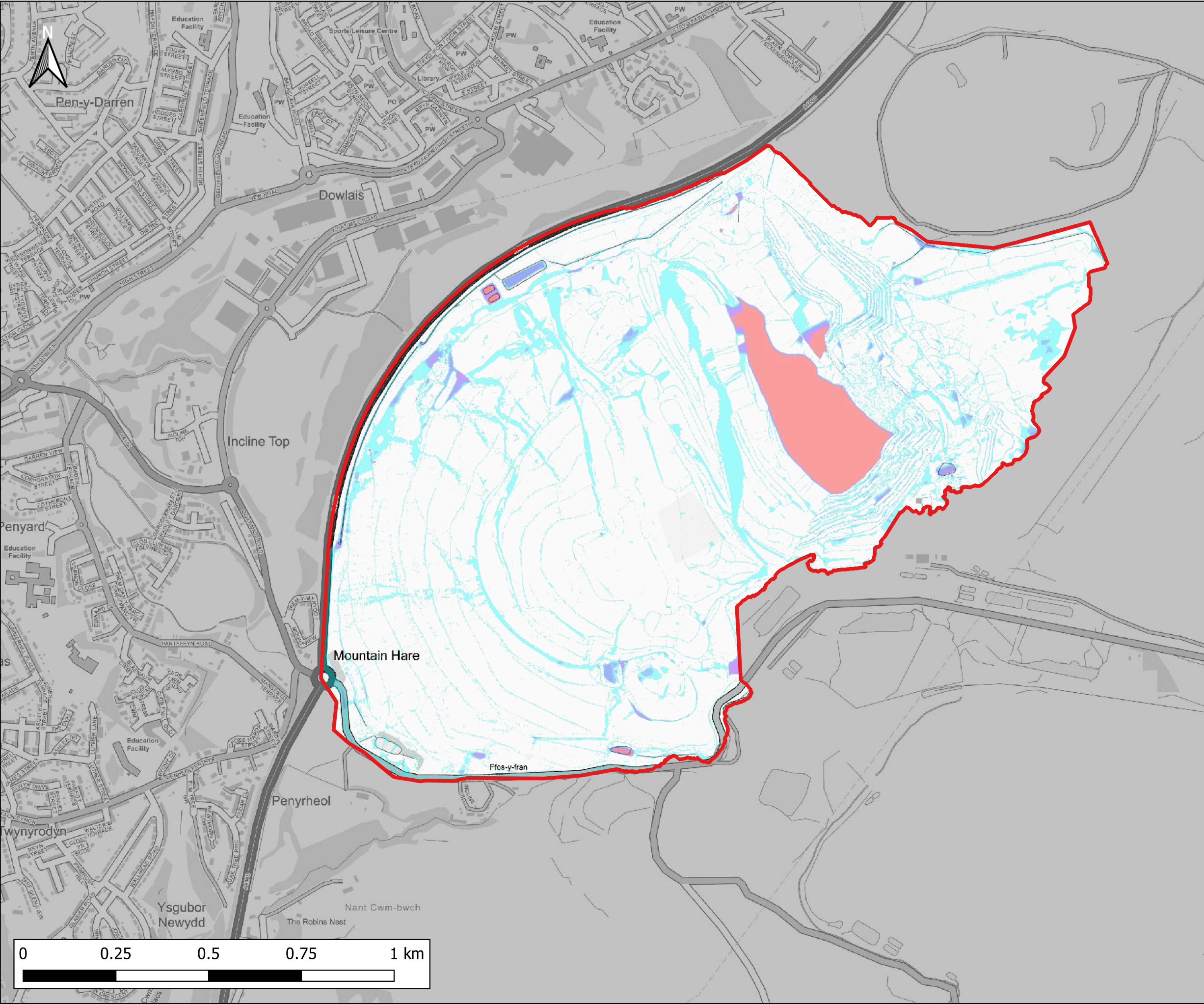
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth Difference
- > -100mm
 - 50mm to -100mm
 - 5mm to -50mm
 - No Change (+/- 5mm)
 - +5mm to +50mm
 - +50mm to +100mm
 - > +100mm



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth Difference 0.1% AEP Pluvial Event DEV-EXG Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R1000_DEV-EXG_NC_005_d-Diff_co			-



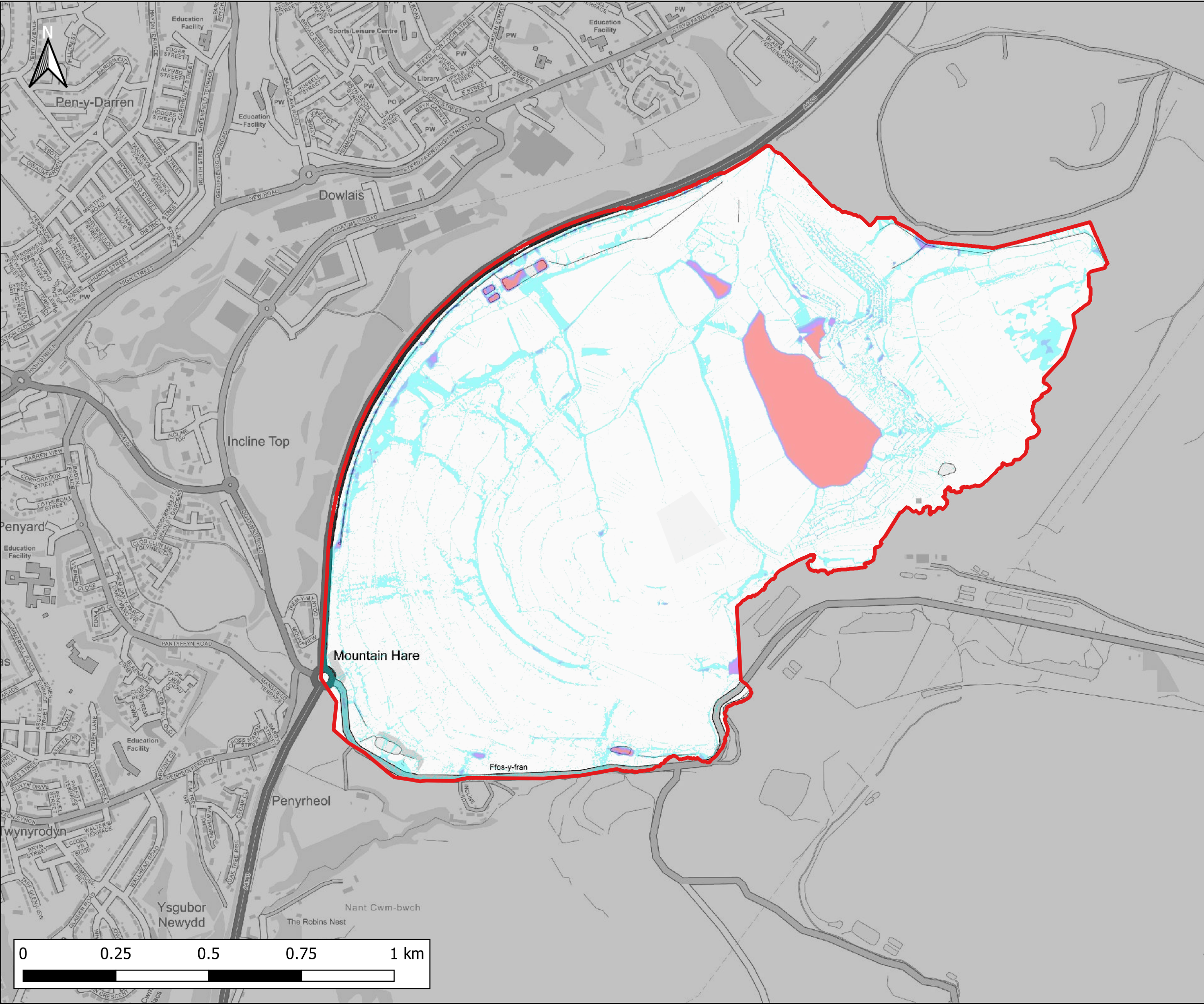
Notes:
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LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth
- <= 0.3m
 - 0.3m - 0.6m
 - 0.6m - 1.2m
 - 1.2m - 2.4m
 - > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 0.1% AEP Plus 40% Climate Change Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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PLOT NAME:			REVISION:
15840-FYF_R1000CC40_EXG_NC_005_d_Max_co			-



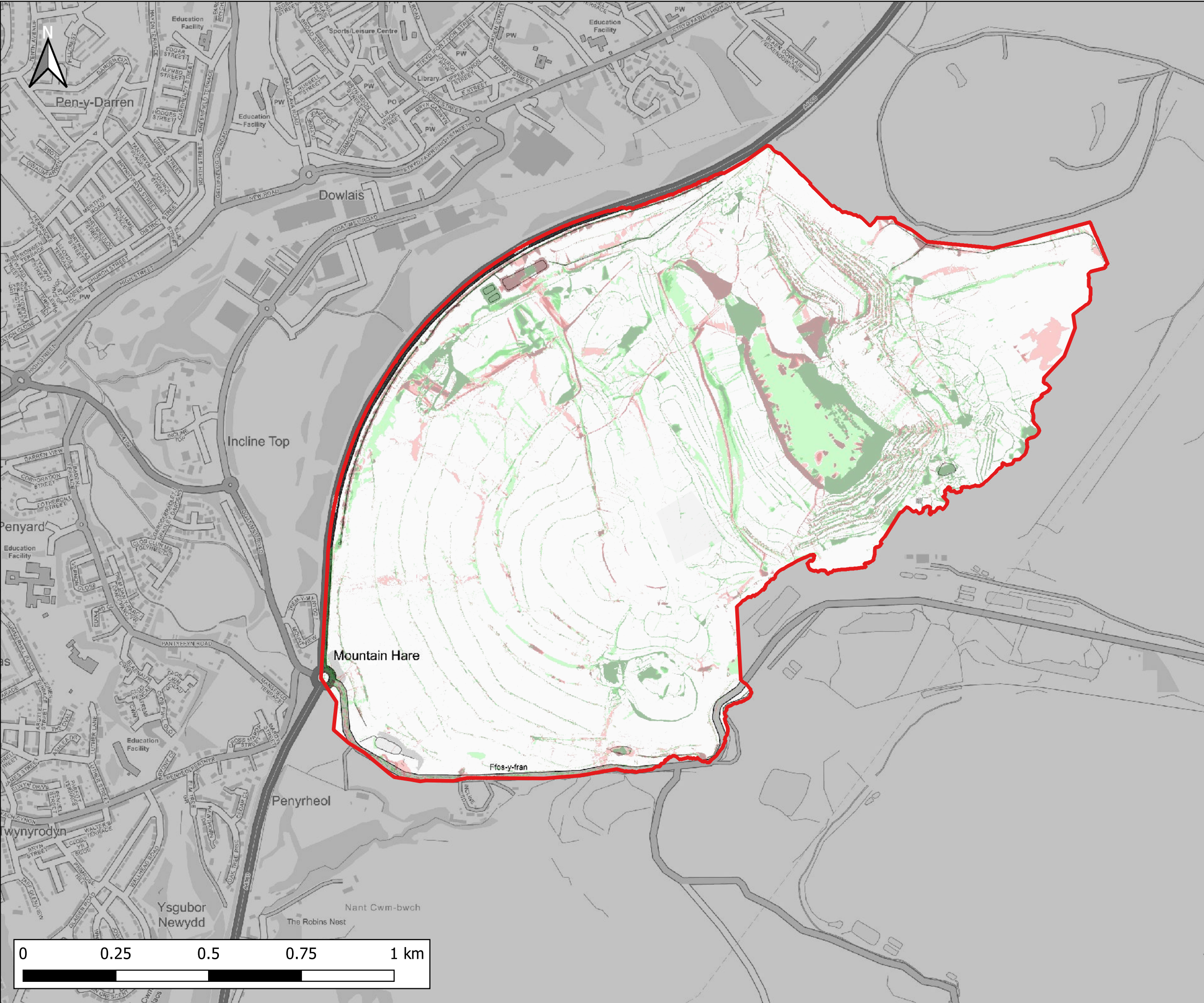
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LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth
- <= 0.3m
 - 0.3m - 0.6m
 - 0.6m - 1.2m
 - 1.2m - 2.4m
 - > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 0.1% AEP Plus 40% Climate Change Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R1000CC40_DEV_NC_005_d_Max_co			-



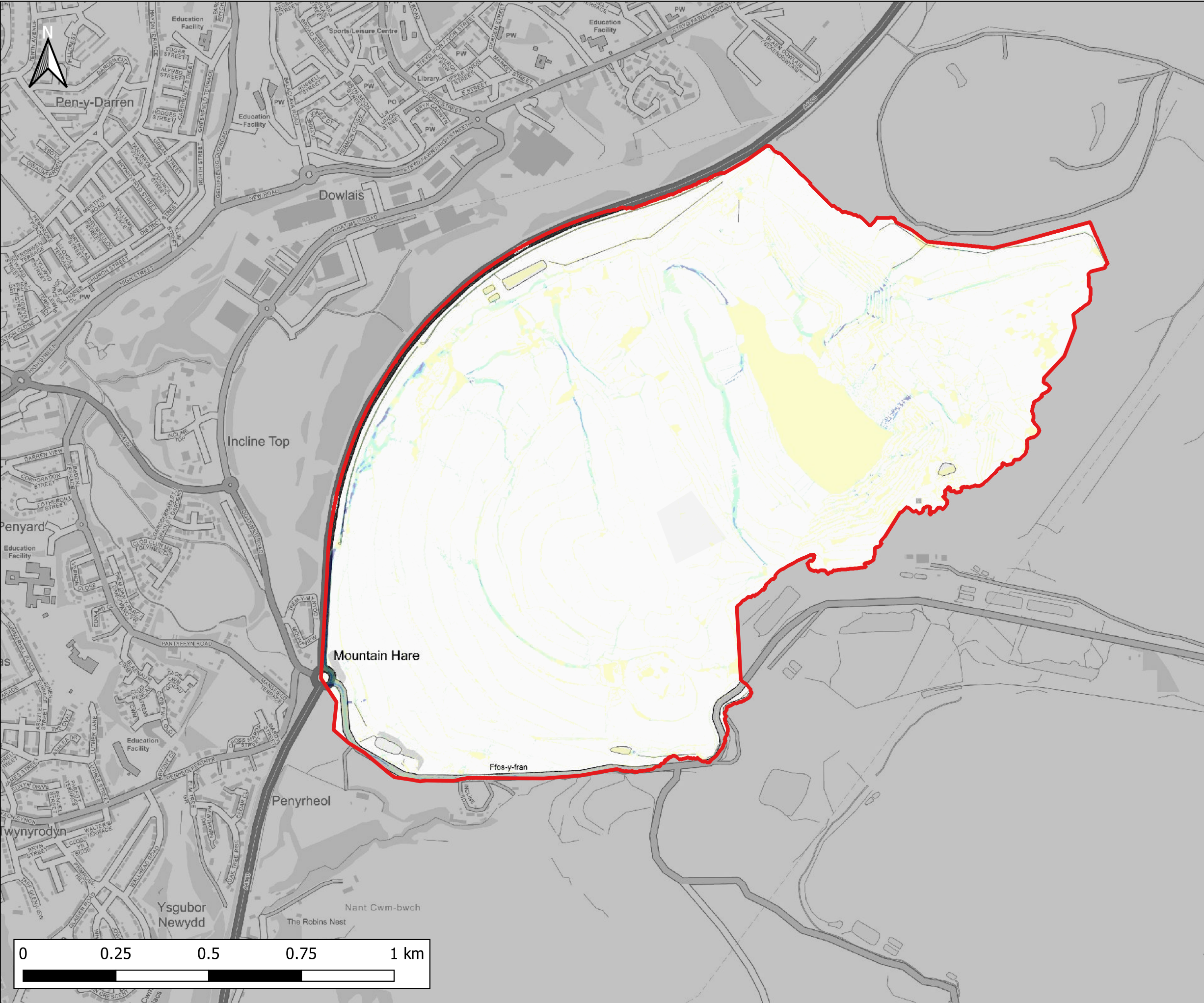
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LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth Difference
- > -100mm
 - 50mm to -100mm
 - 5mm to -50mm
 - No Change (+/- 5mm)
 - +5mm to +50mm
 - +50mm to +100mm
 - > +100mm



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth Difference 0.1% AEP Plus 40% Climate Change Pluvial Event DEV-EXG Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R1000CC40_DEV-EXG_NC_005_d-Diff_co			-



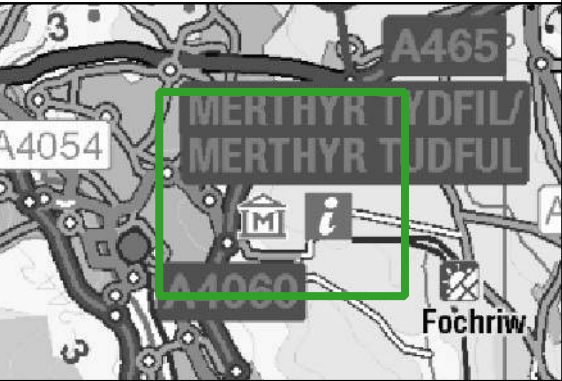
Notes:
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2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

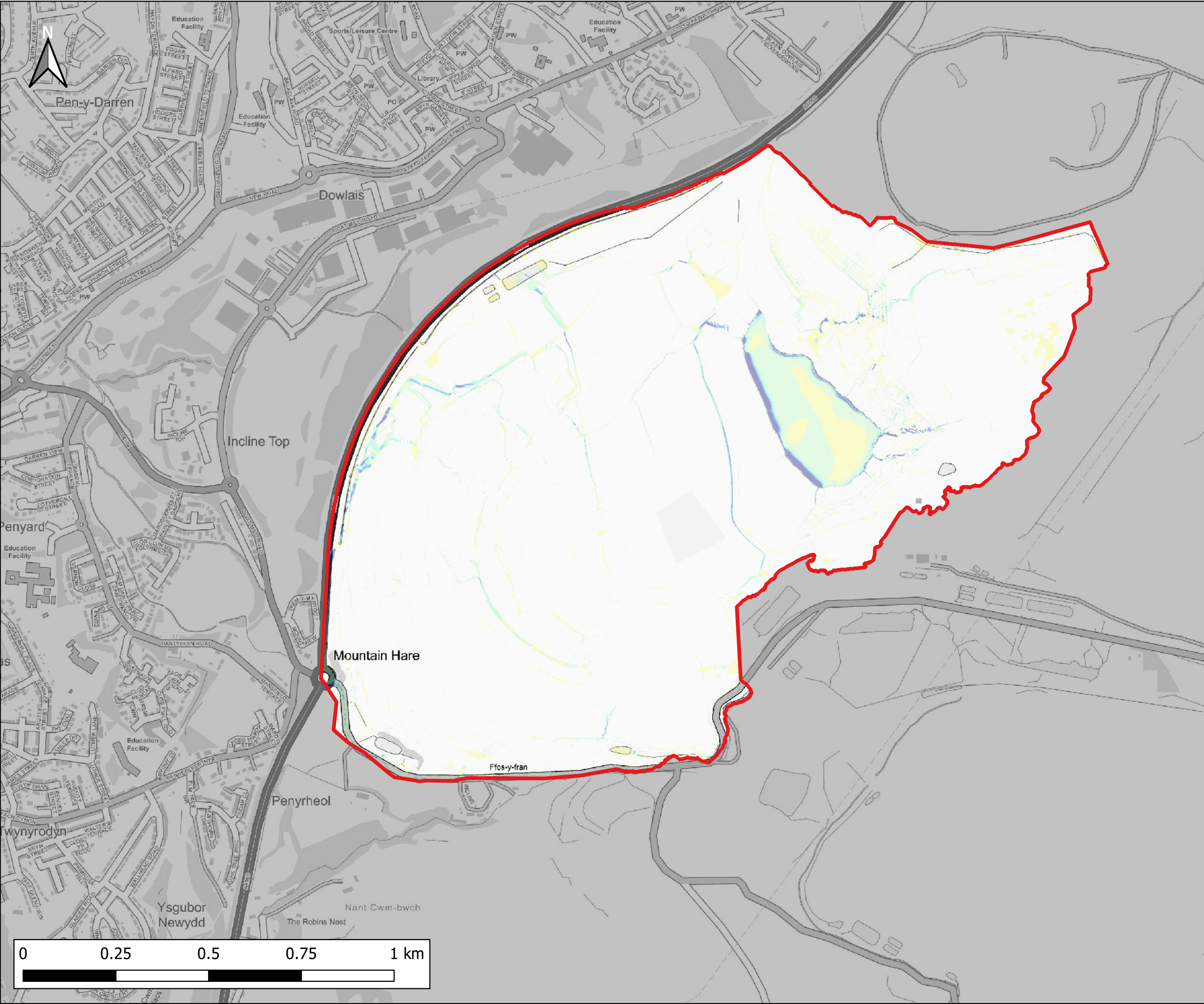
Site Boundary / 2D Model Extent

Maximum Flood Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 3.33% AEP Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R30_EXG_NC_005_V_Max_co			-



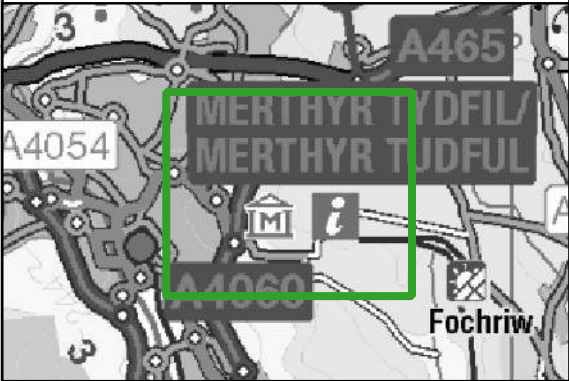
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

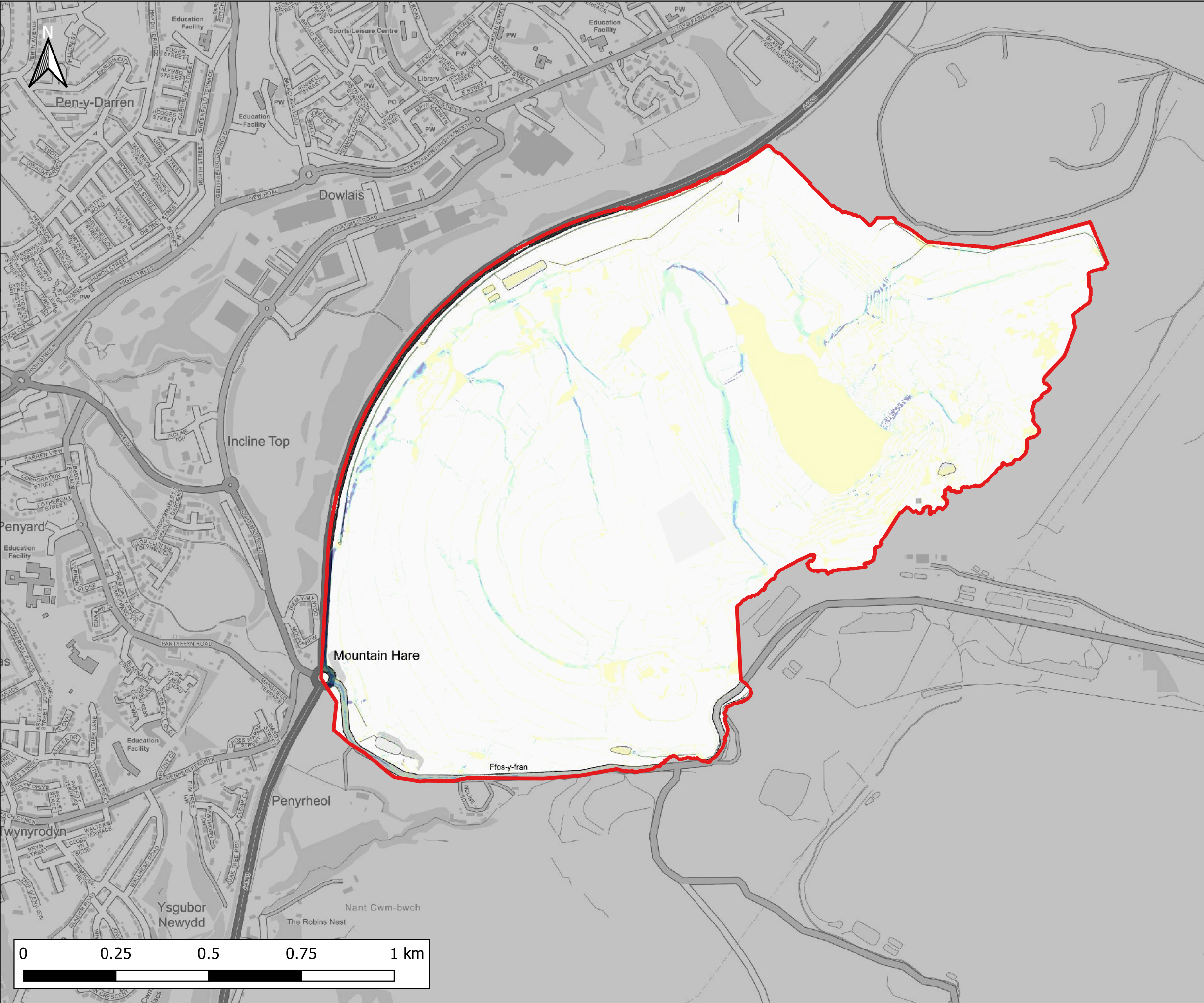
Site Boundary / 2D Model Extent

Maximum Flood Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Maximum Flood Velocity 3.33% AEP Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS: FINAL			DATE: 04-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R30_DEV_NC_005_V_Max_co			REVISION: -



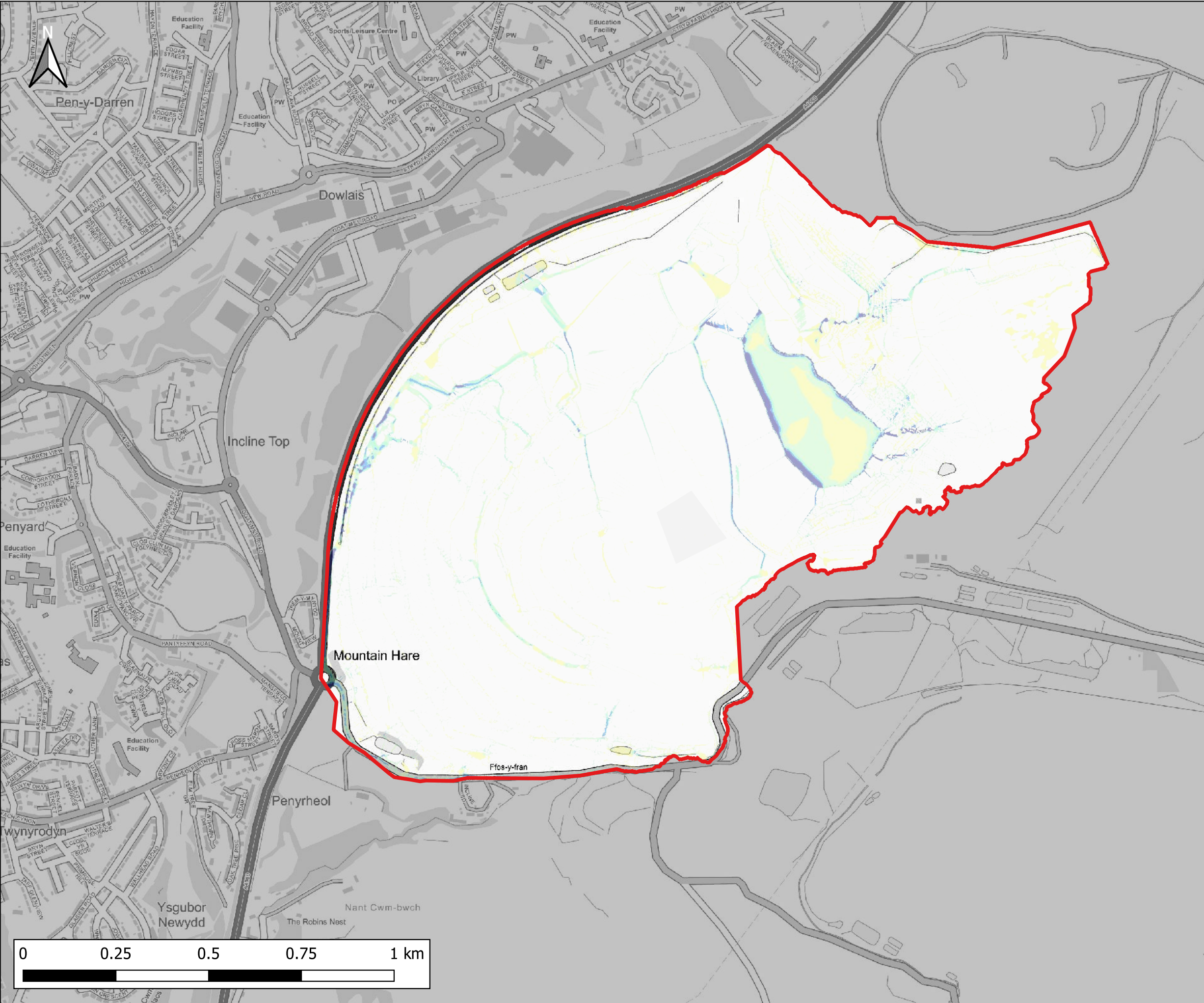
Notes:
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LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Velocity (m/s)
- 0.0 - 0.3
 - 0.3 - 0.6
 - 0.6 - 0.9
 - 0.9 - 1.2
 - > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 1% AEP Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R100_EXG_NC_005_V_Max_co			-



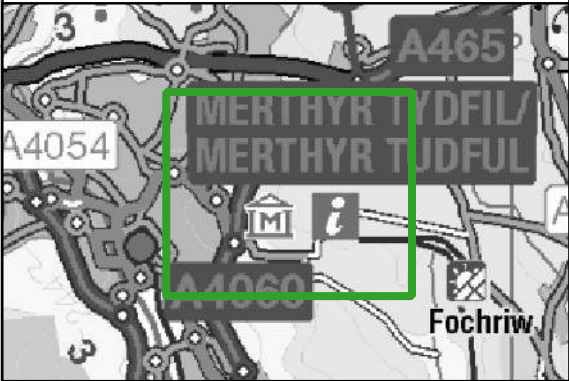
Notes:
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LEGEND

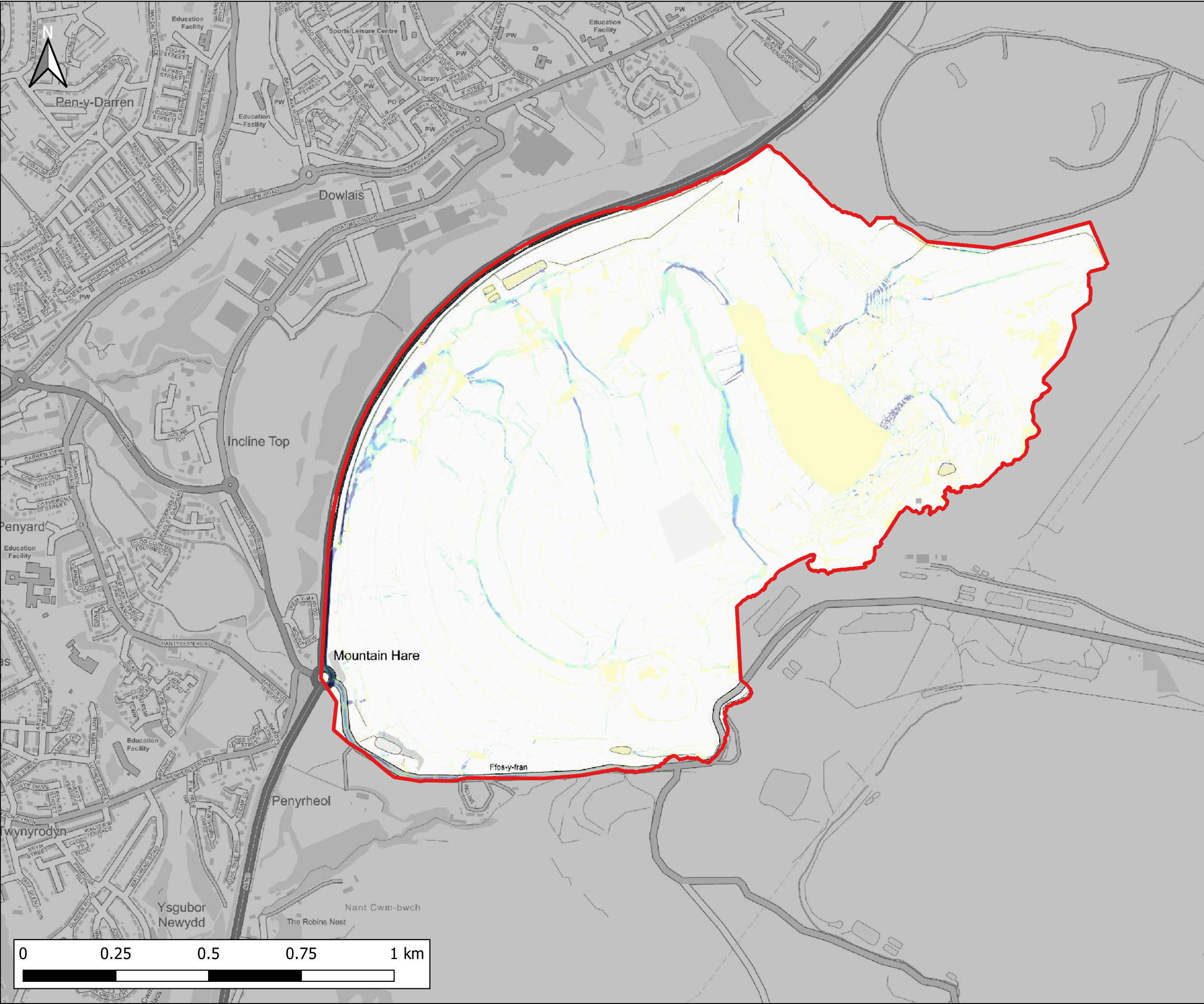
Site Boundary / 2D Model Extent

Maximum Flood Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 1% AEP Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R100_DEV_NC_005_V_Max_co			-



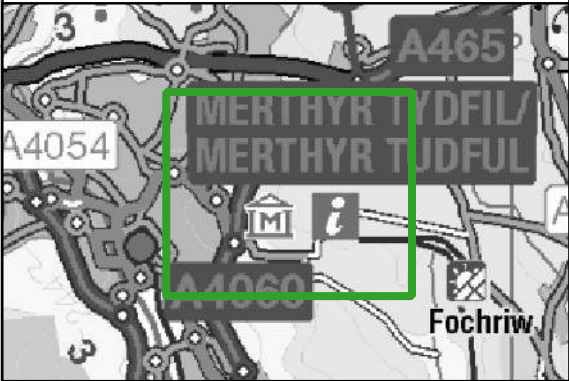
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LEGEND

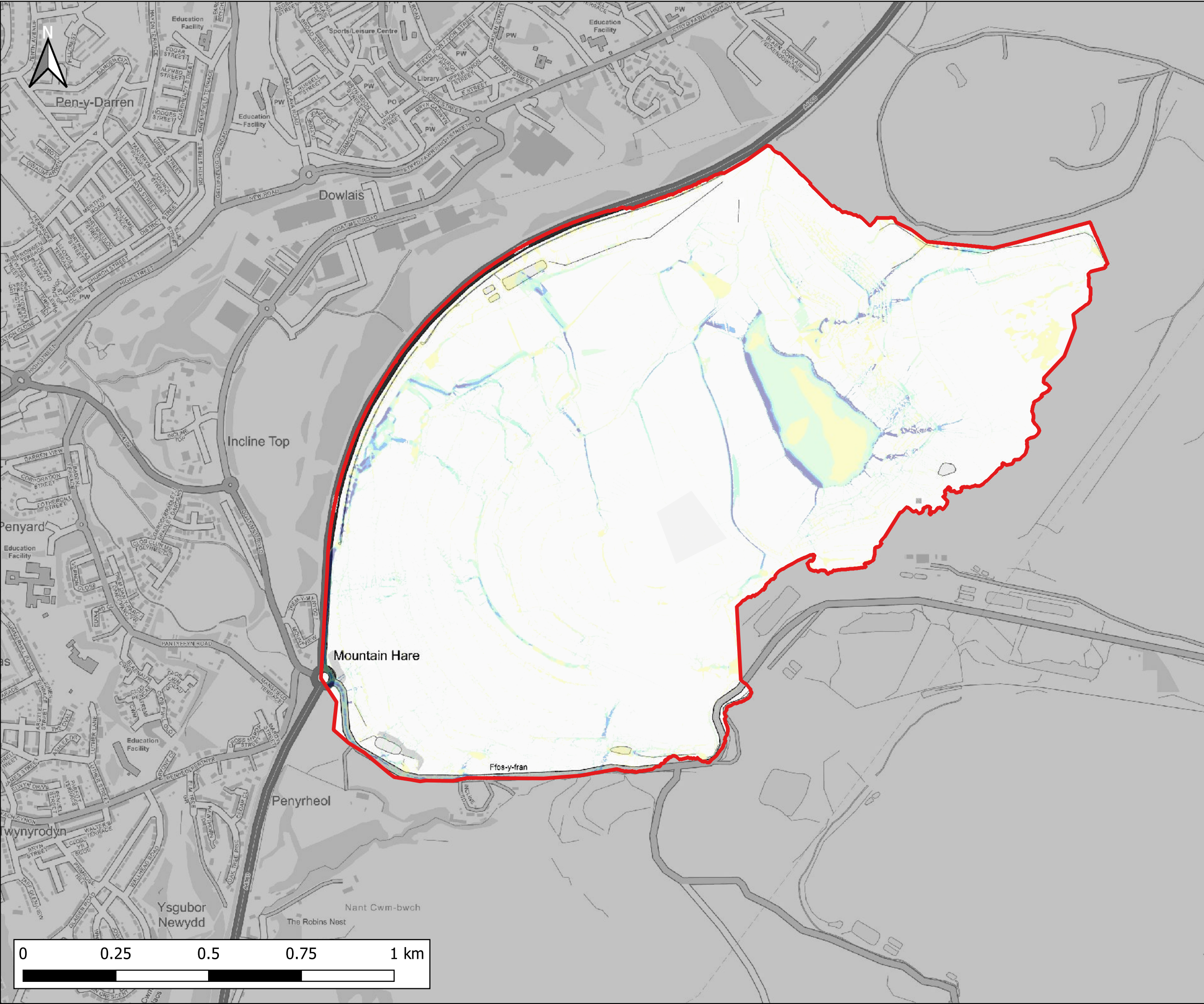
Site Boundary / 2D Model Extent

Maximum Flood Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 1% AEP Plus 40% Climate Change Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R100CC40_EXG_NC_005_V_Max_co			-



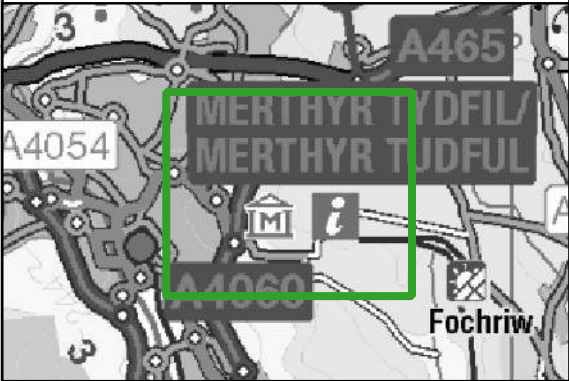
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LEGEND

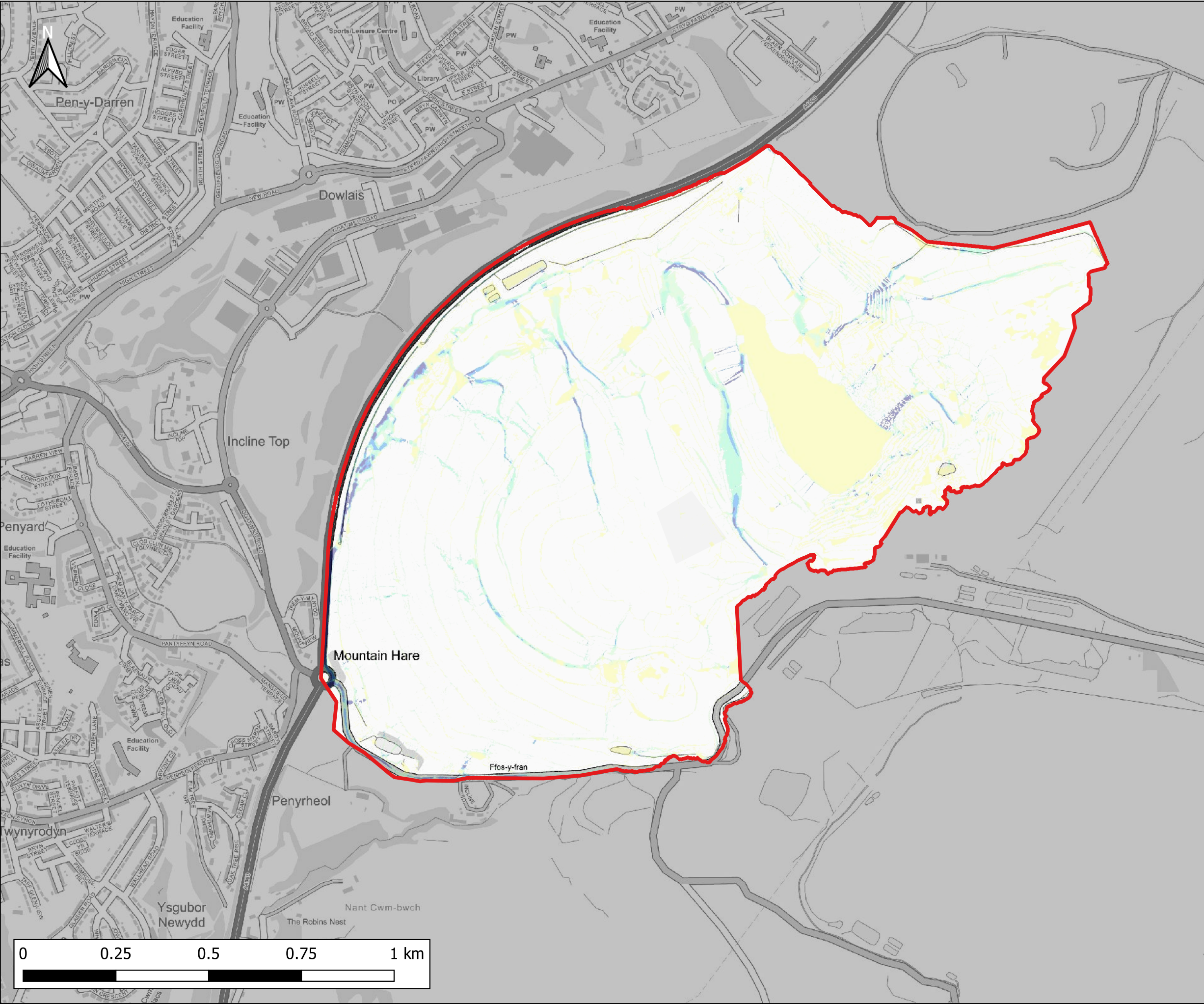
Site Boundary / 2D Model Extent

Maximum Flood Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 1% AEP Plus 40% Climate Change Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R100CC40_DEV_NC_005_V_Max_co			-



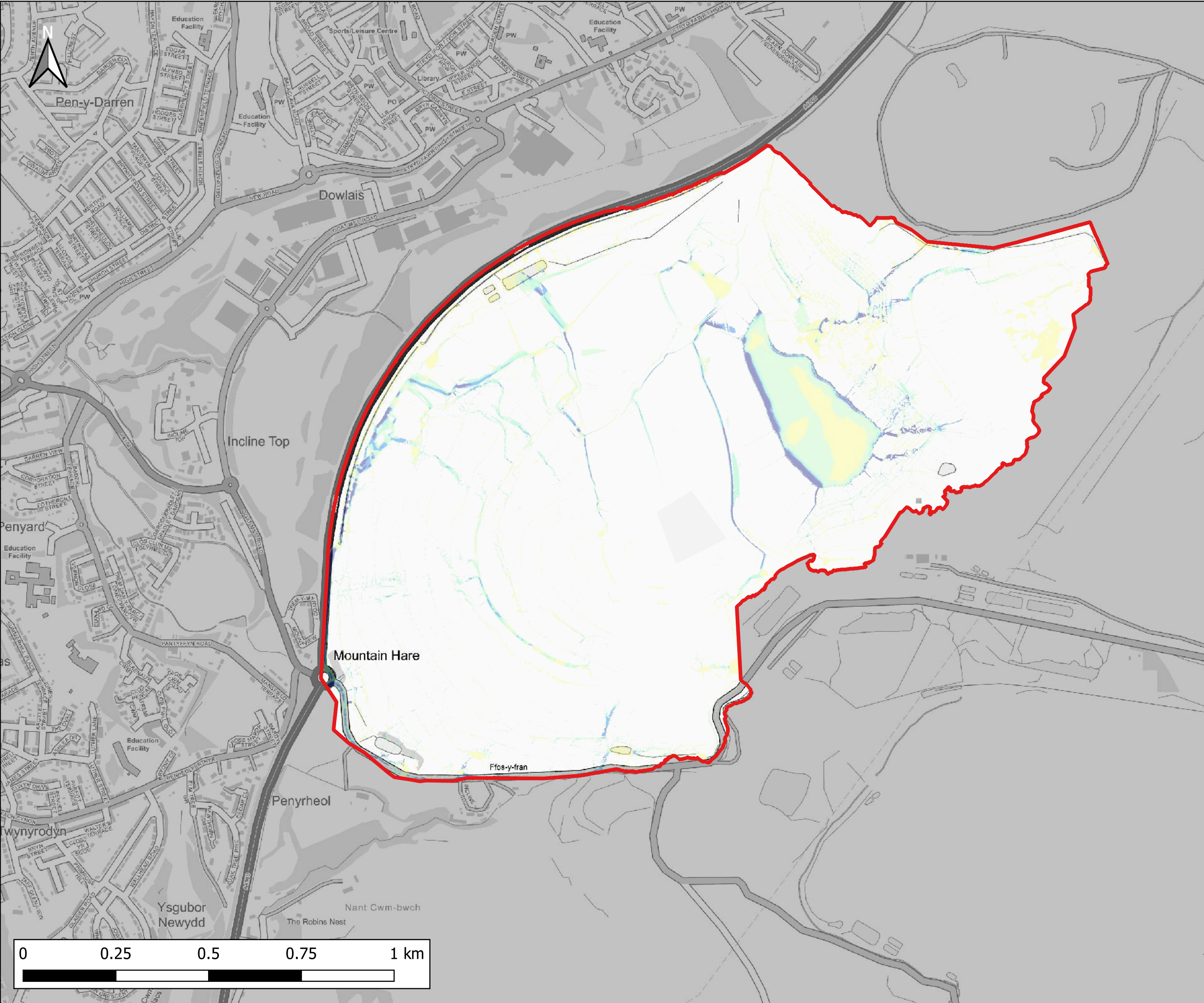
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LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Velocity (m/s)
- 0.0 - 0.3
 - 0.3 - 0.6
 - 0.6 - 0.9
 - 0.9 - 1.2
 - > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 0.1% AEP Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R1000_EXG_NC_005_V_Max_co			-



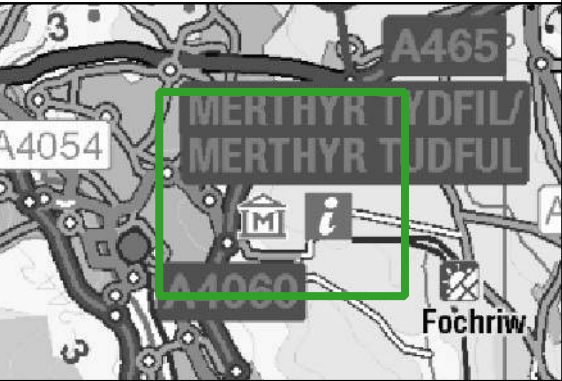
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LEGEND

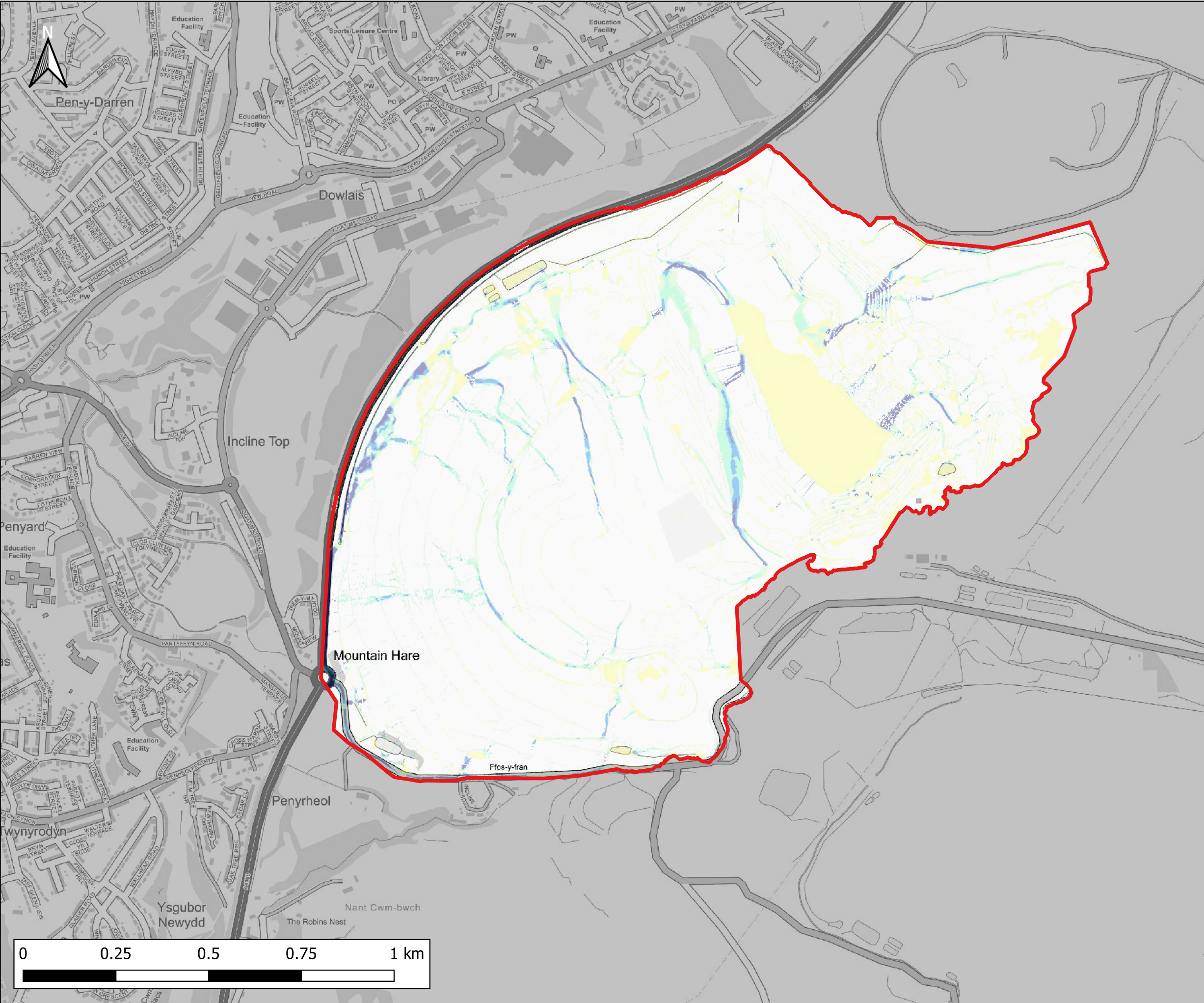
Site Boundary / 2D Model Extent

Maximum Flood Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Maximum Flood Velocity 0.1% AEP Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS: FINAL			DATE: 04-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R1000_DEV_NC_005_V_Max_co			REVISION: -



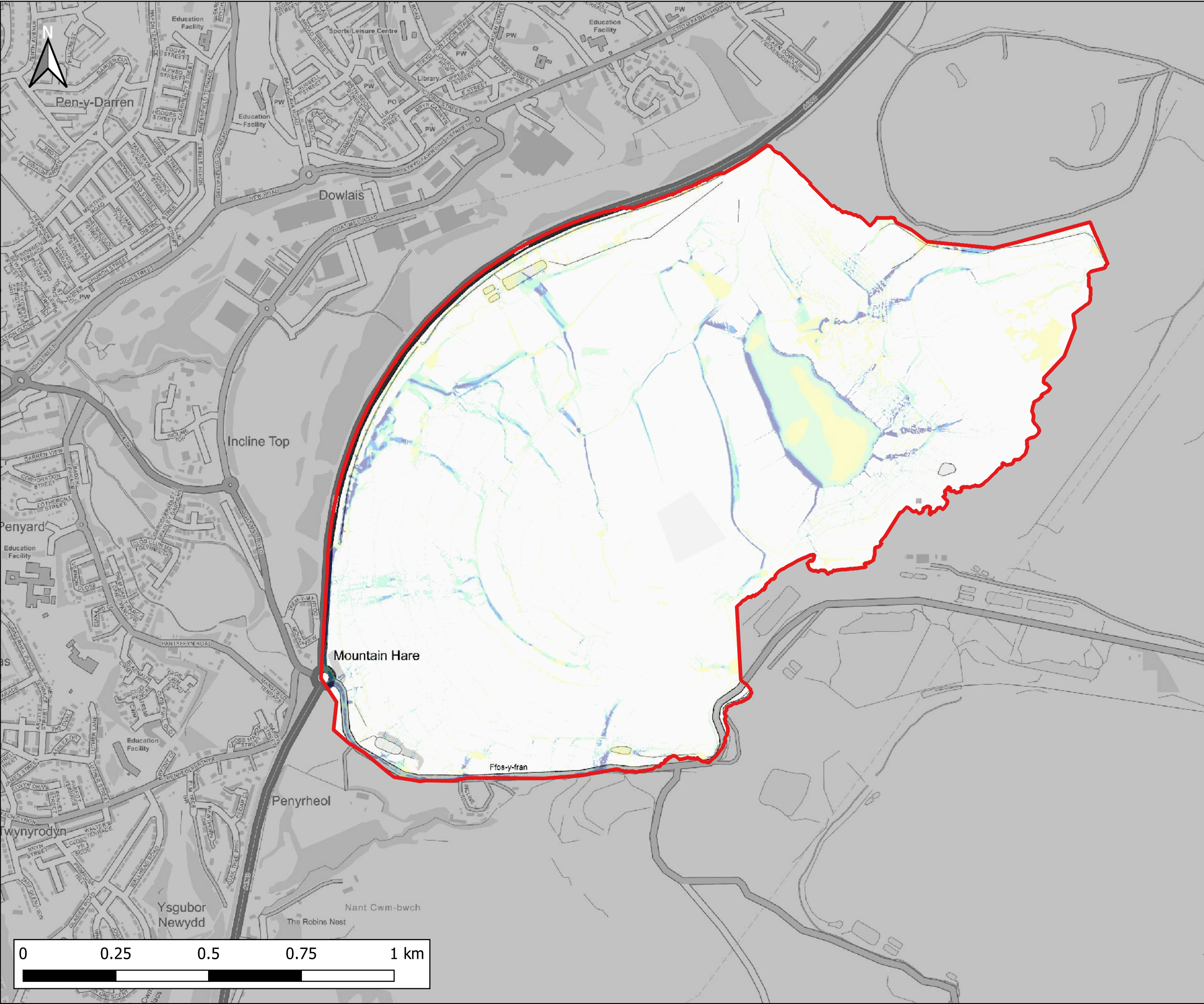
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LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Velocity (m/s)
- 0.0 - 0.3
 - 0.3 - 0.6
 - 0.6 - 0.9
 - 0.9 - 1.2
 - > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 0.1% AEP Plus 40% Climate Change Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R1000CC40_EXG_NC_005_V_Max_co			-



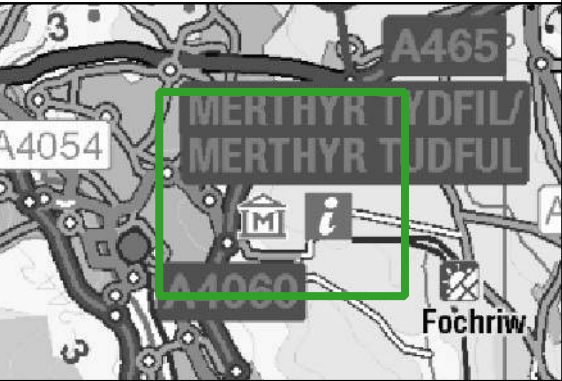
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LEGEND

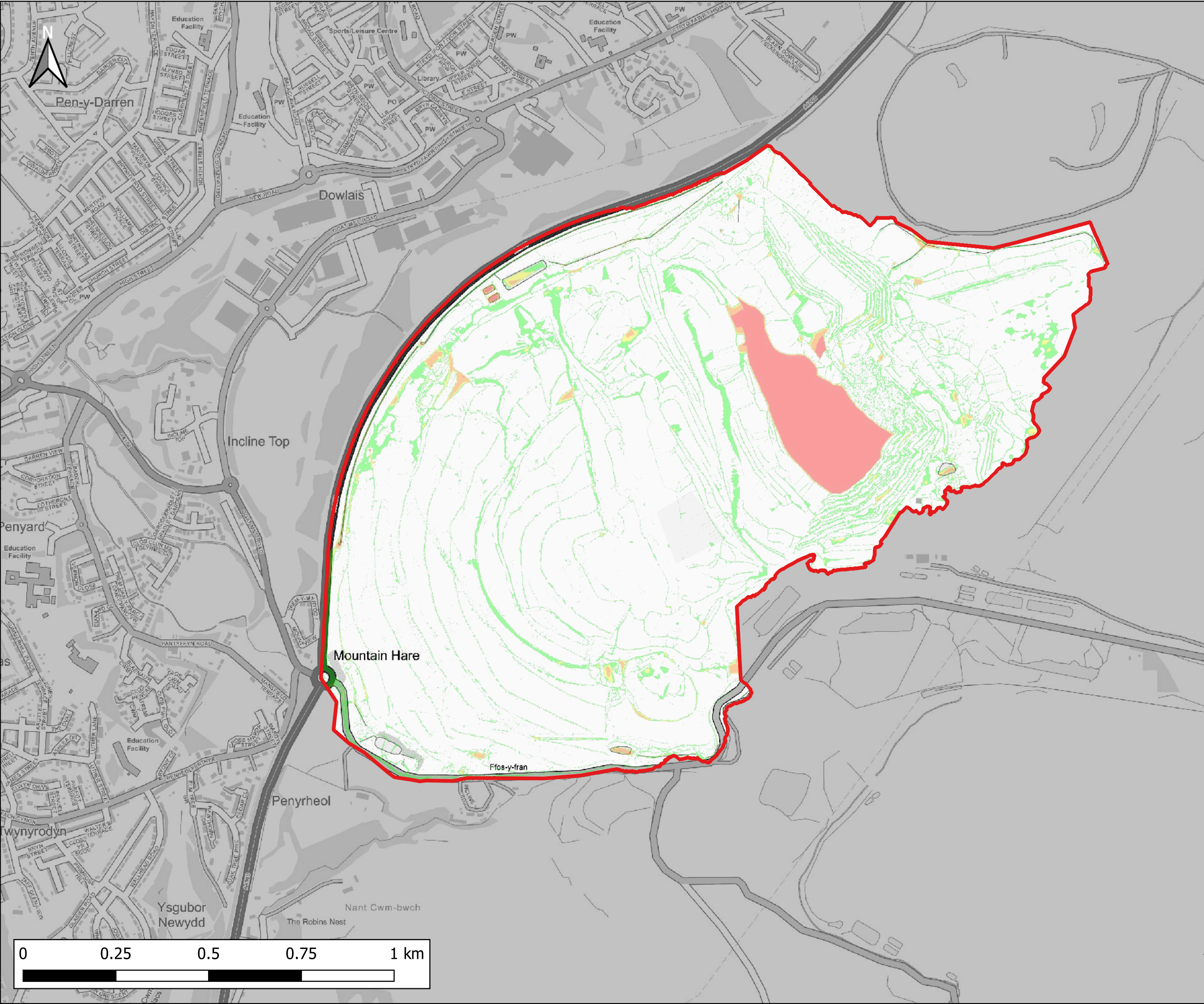
Site Boundary / 2D Model Extent

Maximum Flood Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
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SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 0.1% AEP Plus 40% Climate Change Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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PLOT NAME:			REVISION:
15840-FYF_R1000CC40_DEV_NC_005_V_Max_co			-



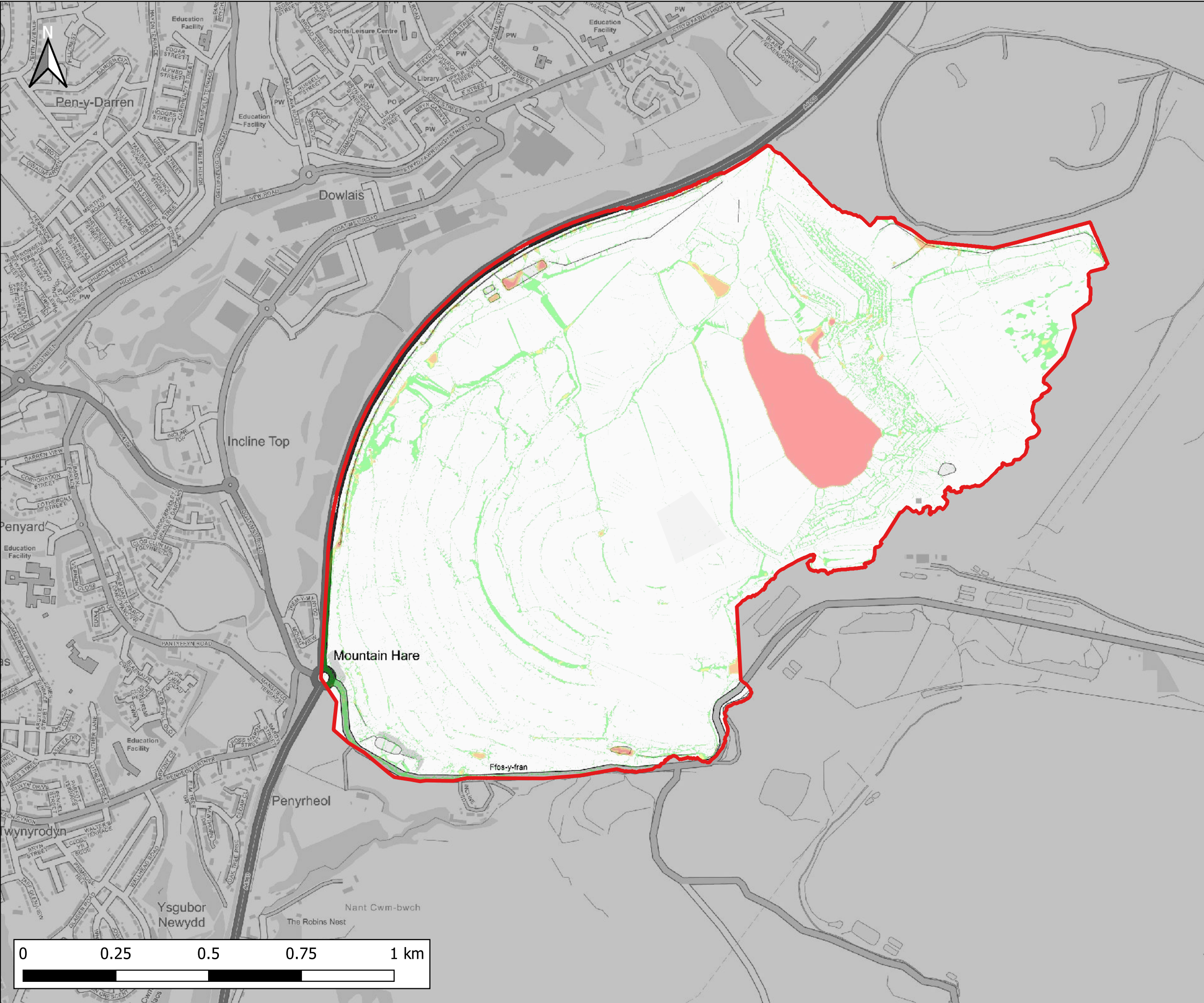
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LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
- Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



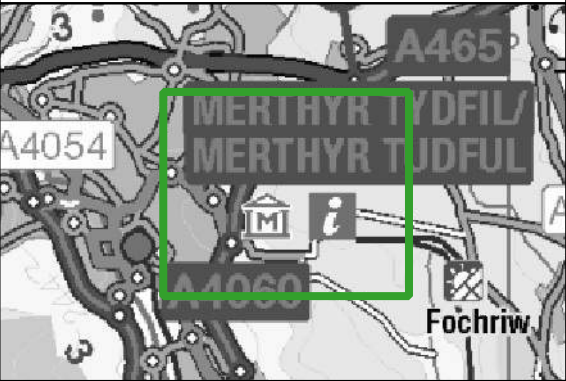
CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Flood Hazard Rating 3.33% AEP Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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PLOT NAME:			REVISION:
15840-FYF_R30_EXG_NC_005_ZUK2_Max_co			-



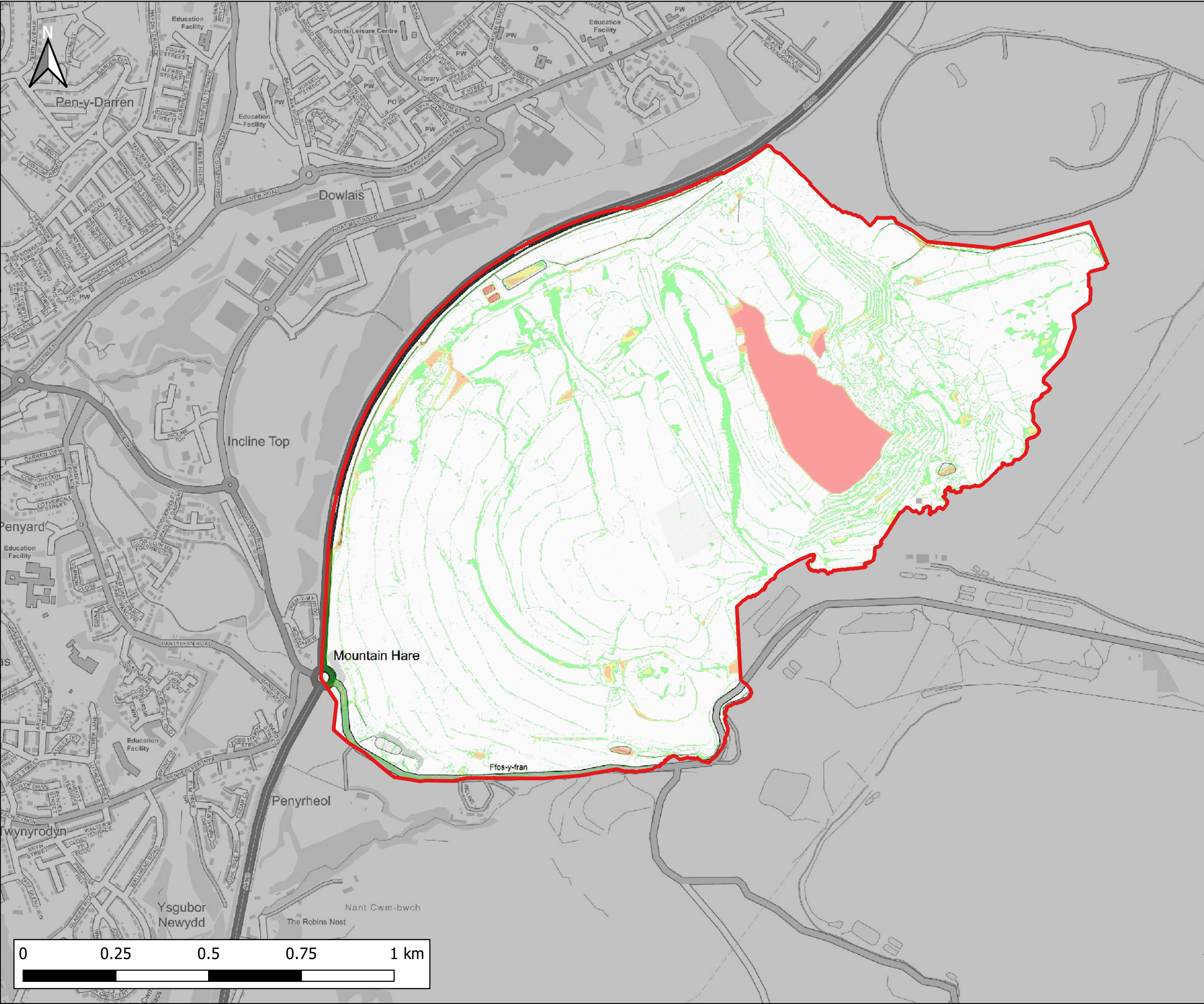
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LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
 - Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Flood Hazard Rating 3.33% AEP Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS: FINAL			DATE: 04-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R30_DEV_NC_005_ZUK2_Max_co			REVISION: -



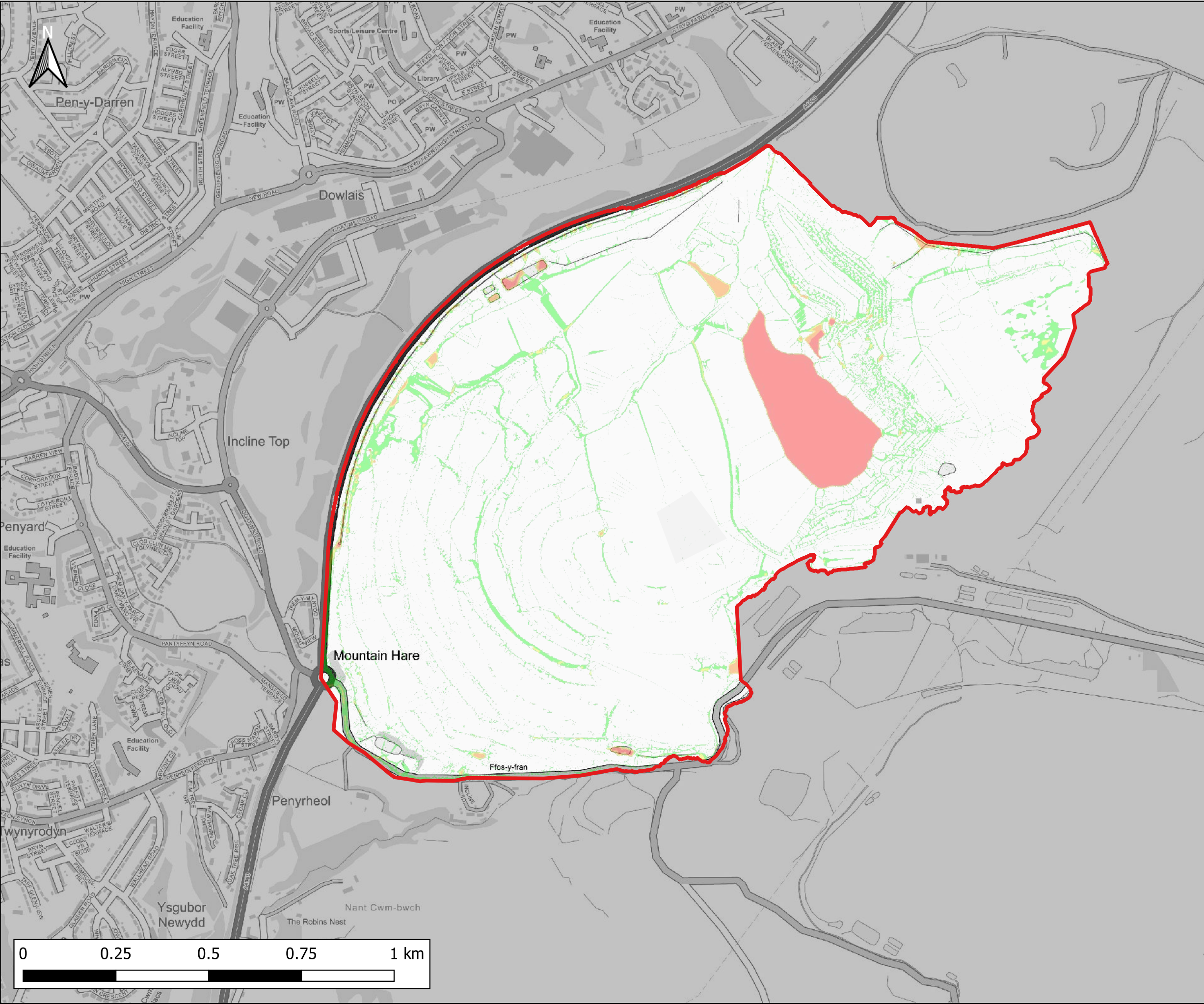
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LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
 - Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Flood Hazard Rating 1% AEP Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS: FINAL			DATE: 04-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R100_EXG_NC_005_ZUK2_Max_co			REVISION: -



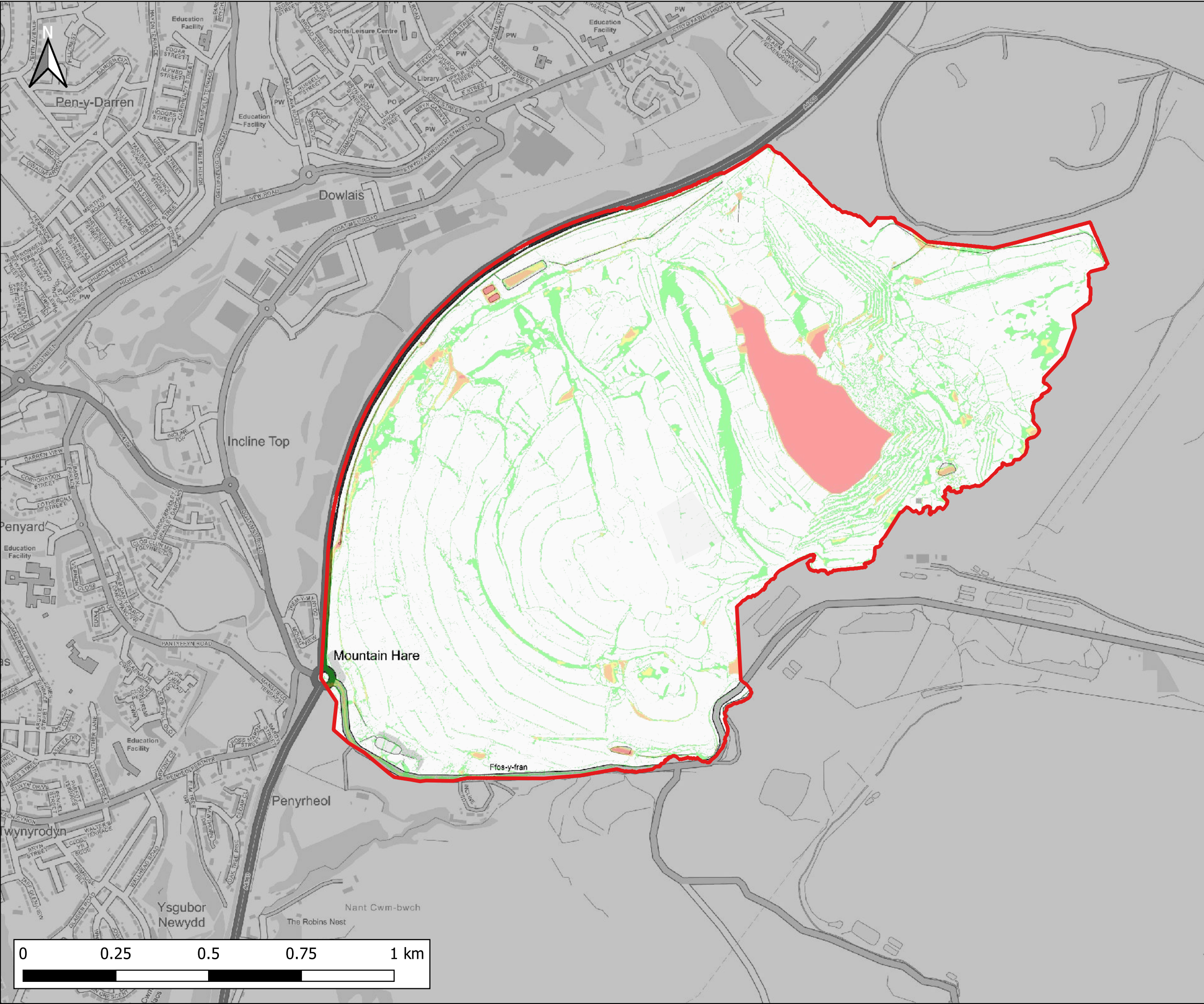
Notes:
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2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
 - Caution
 - Danger for Some
 - Danger for Most
 - Danger for All

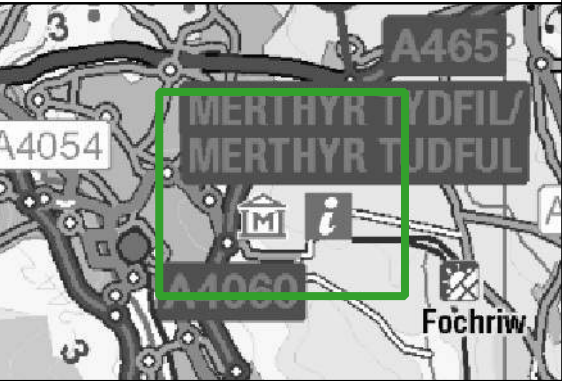


CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Flood Hazard Rating 1% AEP Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS: FINAL			DATE: 04-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R100_DEV_NC_005_ZUK2_Max_co			REVISION: -

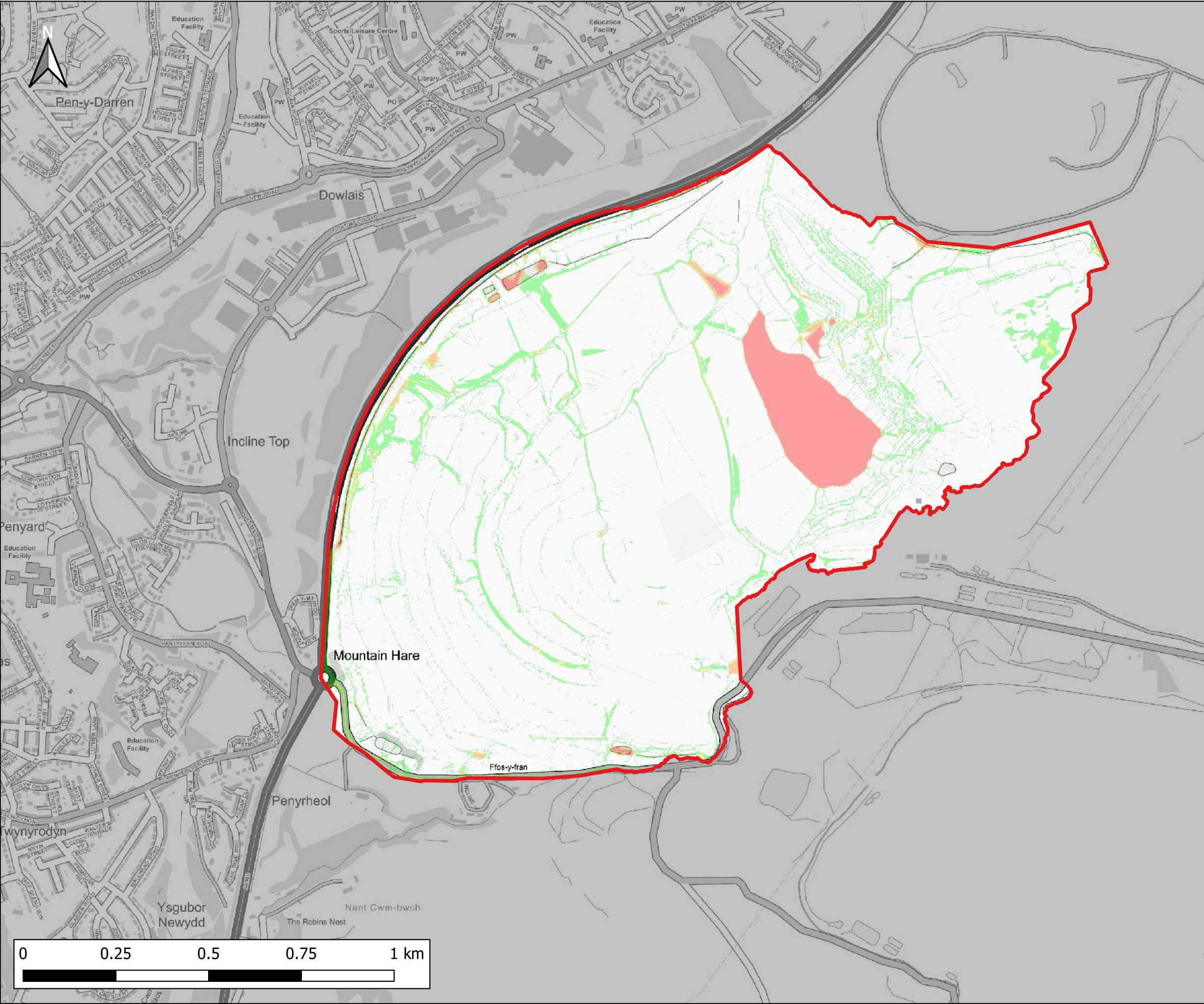


Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

- LEGEND**
- Site Boundary / 2D Model Extent
 - Flood Hazard Rating (FD2320)
 - Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Flood Hazard Rating 1% AEP Plus 40% Climate Change Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS: FINAL			DATE: 04-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R100CC40_EXG_NC_005_ZUK2_Max_co			REVISION: -



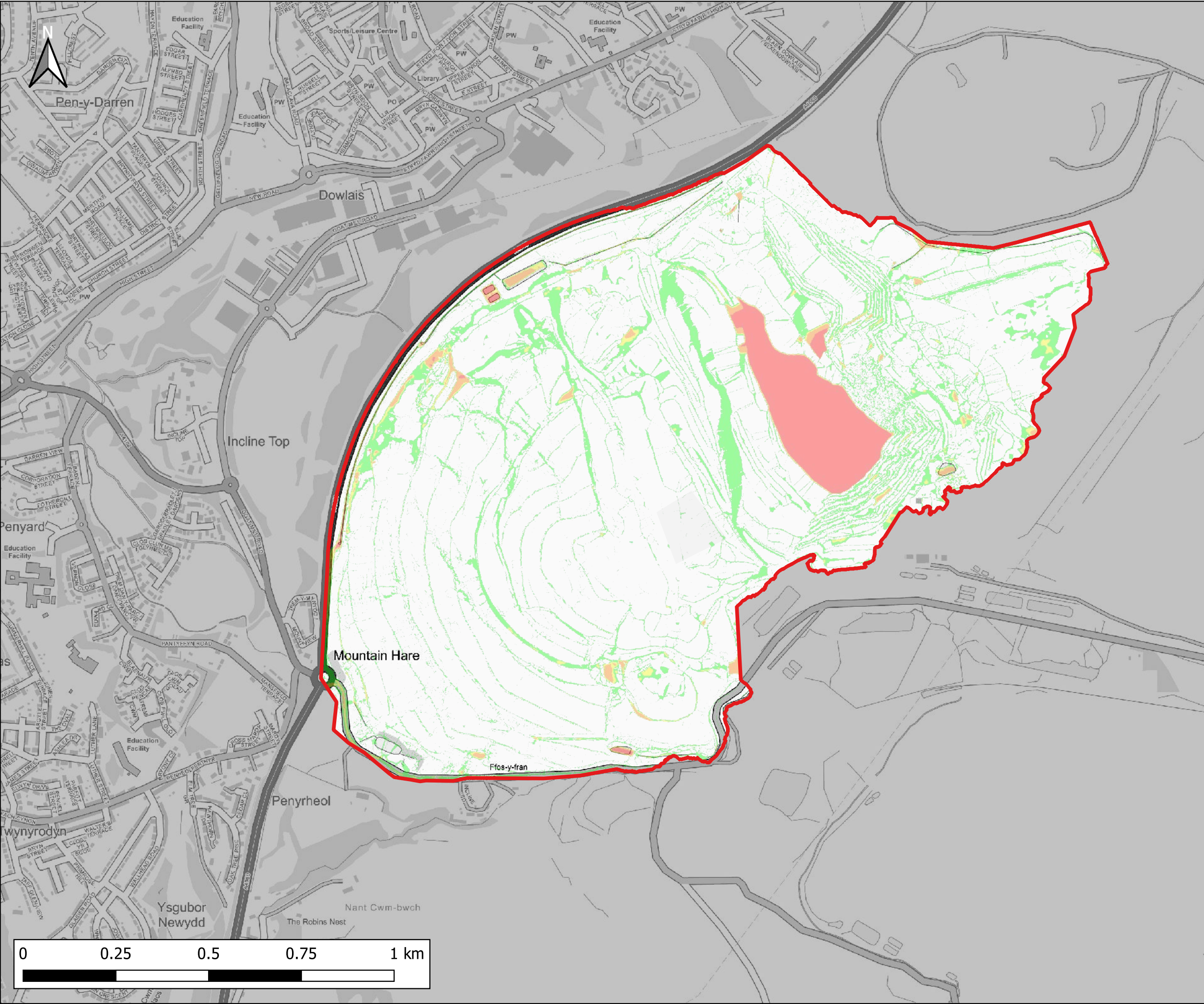
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
 - Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Flood Hazard Rating 1% AEP Plus 40% Climate Change Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS: FINAL			DATE: 04-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R100CC40_DEV_NC_005_ZUK2_Max			REVISION: -



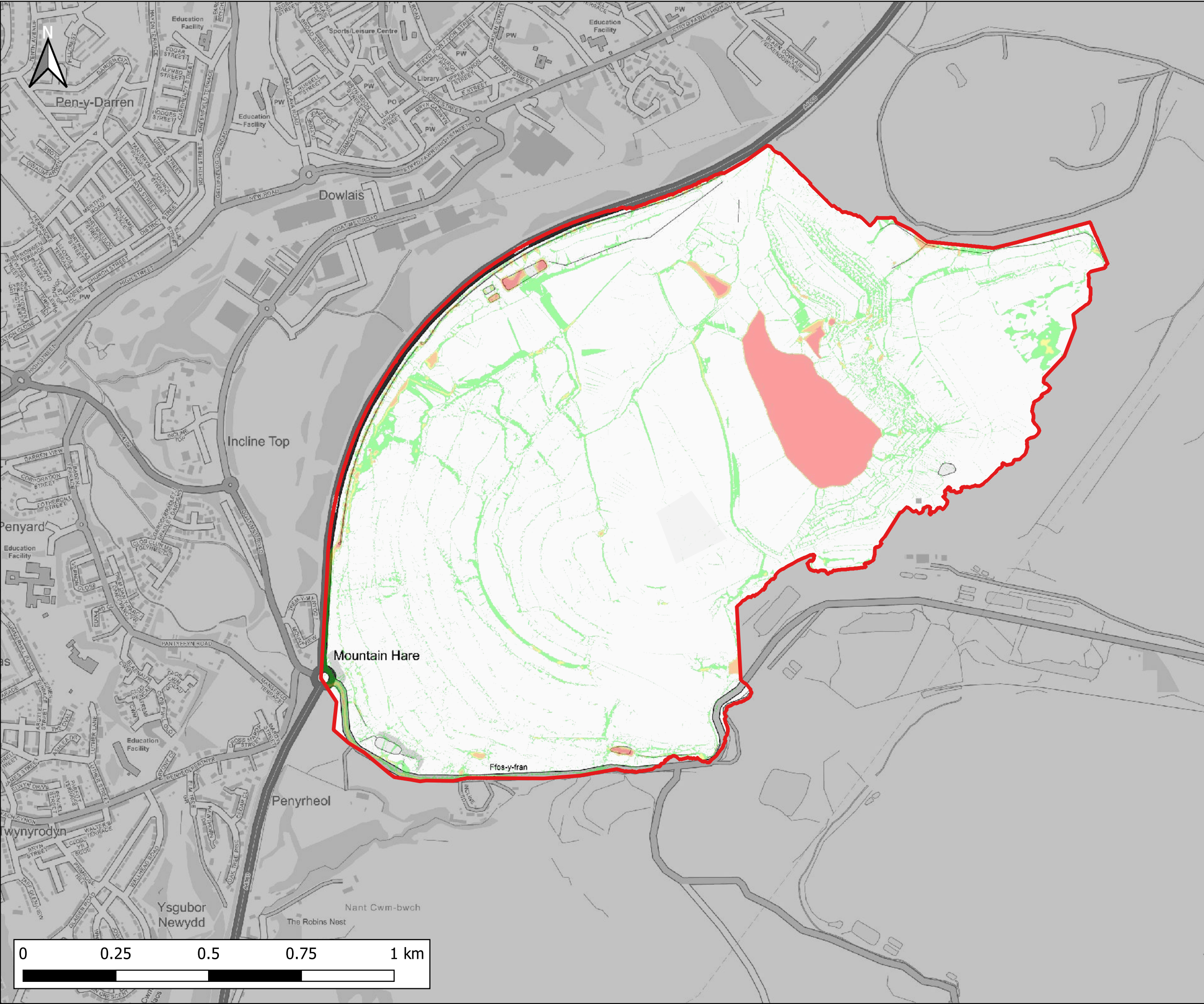
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
 - Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Flood Hazard Rating 0.1% AEP Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R1000_EXG_NC_005_ZUK2_Max_co			-



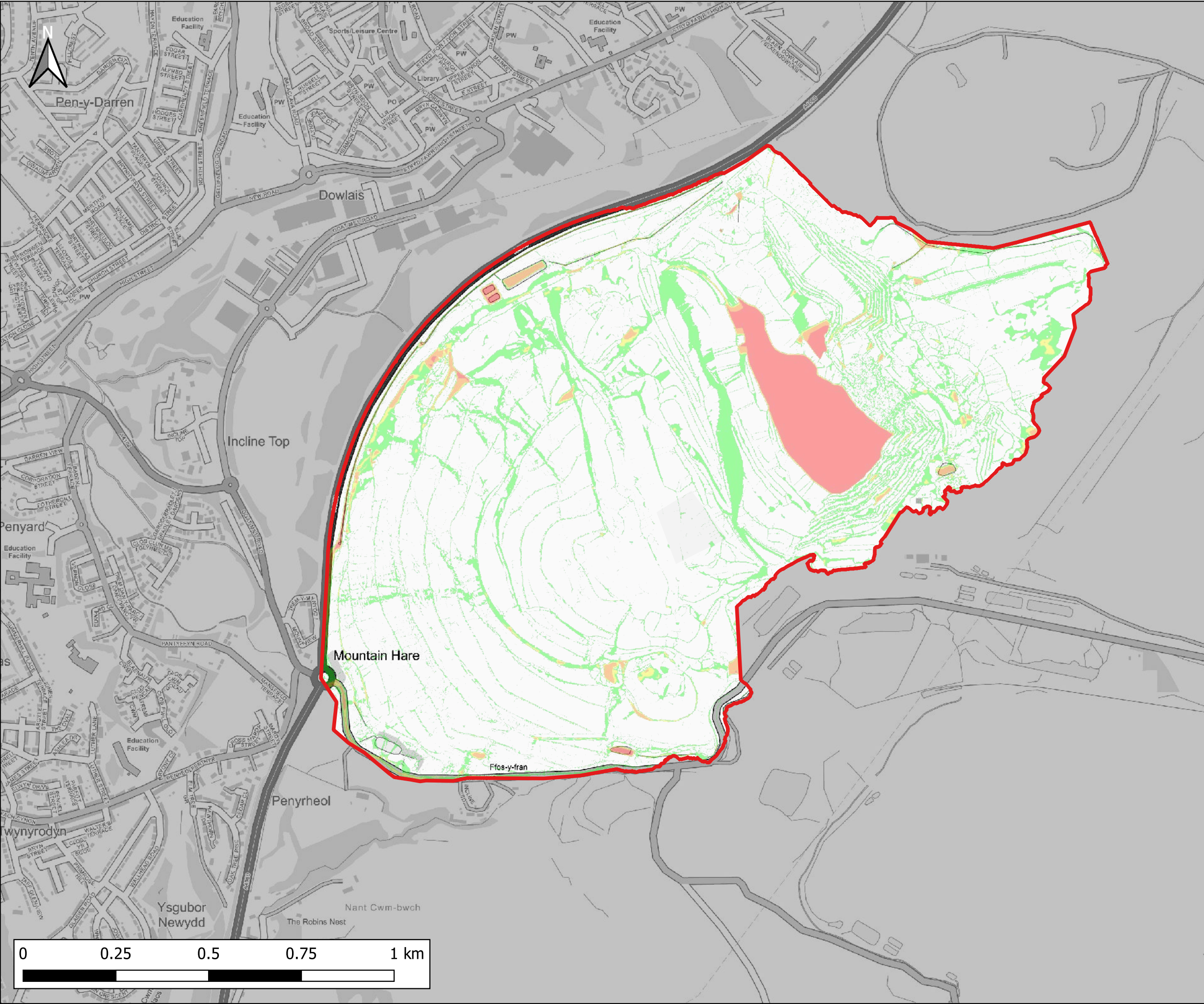
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
 - Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Flood Hazard Rating 0.1% AEP Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS: FINAL			DATE: 04-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R1000_DEV_NC_005_ZUK2_Max_co			REVISION: -



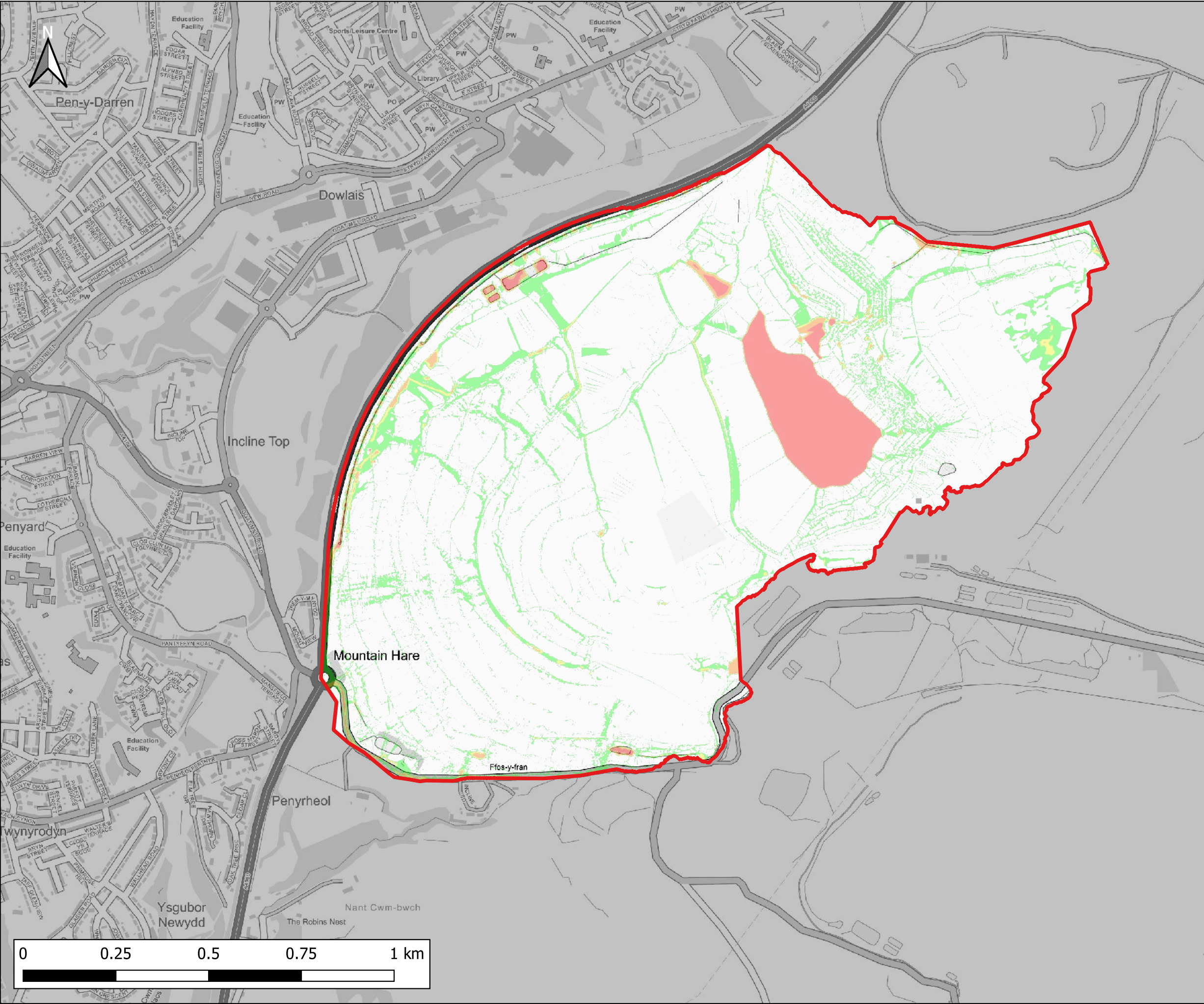
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
- Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Flood Hazard Rating 0.1% AEP Plus 40% Climate Change Pluvial Event Existing Scenario (EXG) Normal Conditions			
PLOT STATUS:			DATE:
FINAL			04-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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PLOT NAME:			REVISION:
15840-FYF_R1000CC40_EXG_NC_005_ZUK2_Max_co			-



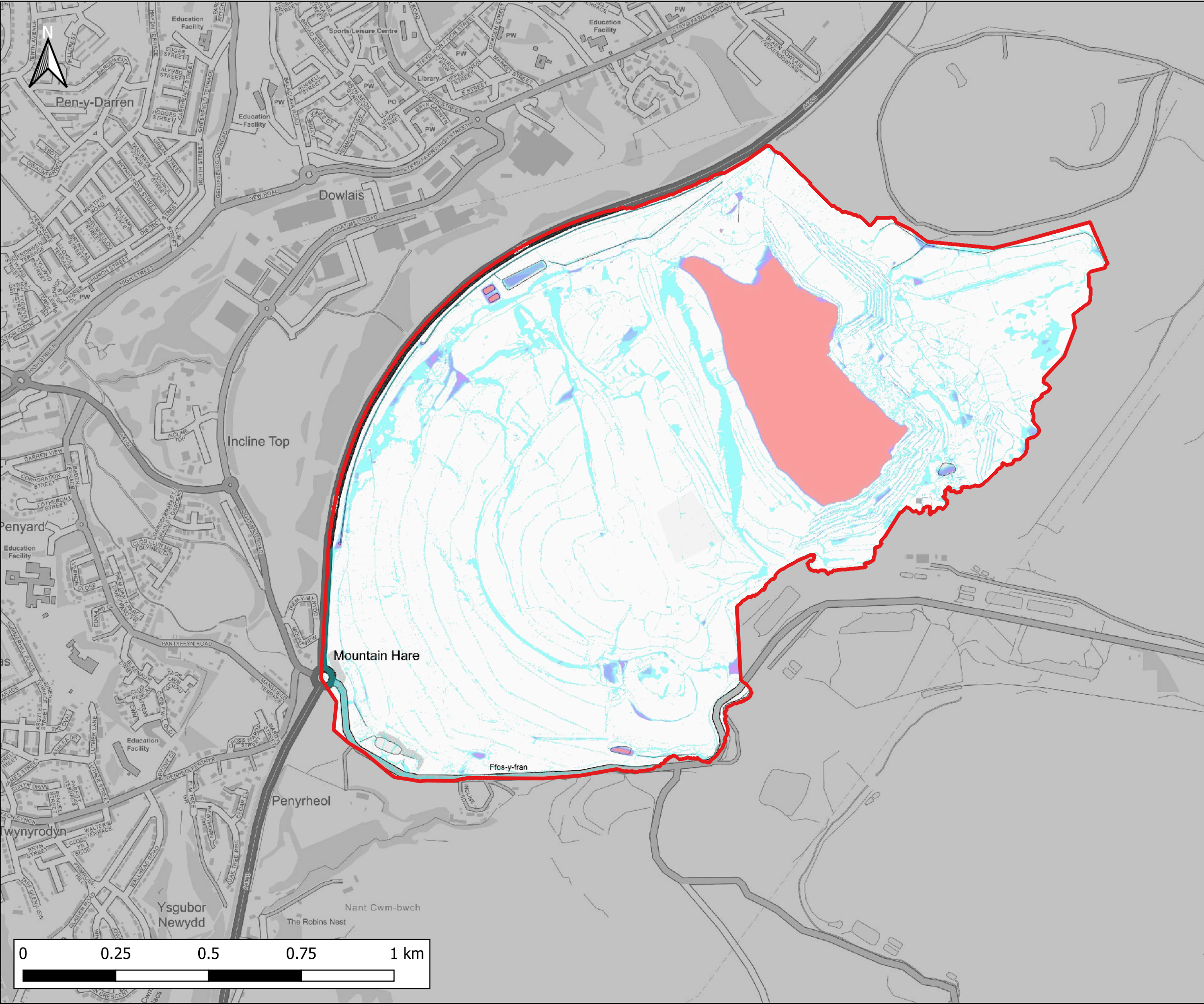
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
 - Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Flood Hazard Rating 0.1% AEP Plus 40% Climate Change Pluvial Event Proposed Development Scenario (DEV) Normal Conditions			
PLOT STATUS: FINAL			DATE: 04-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R1000CC40_DEV_NC_005_ZUK2_Max_co			REVISION: -



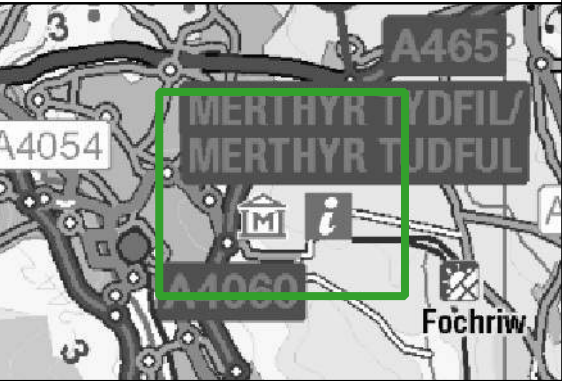
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

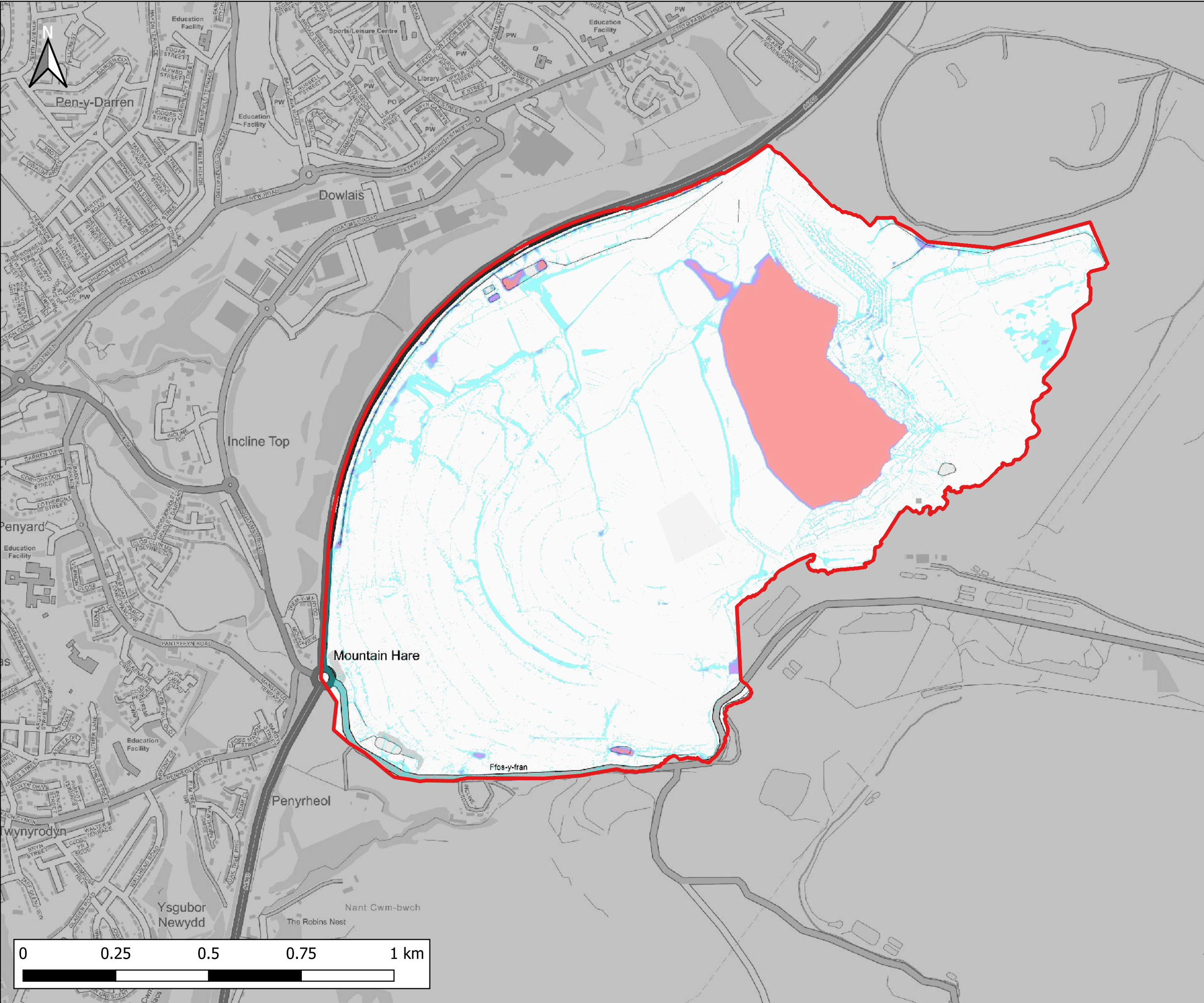
Site Boundary / 2D Model Extent

Maximum Flood Depth

- <= 0.3m
- 0.3m - 0.6m
- 0.6m - 1.2m
- 1.2m - 2.4m
- > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 1% AEP Plus 40% Climate Change Pluvial Event Existing Scenario (EXG) High Groundwater			
PLOT STATUS:			DATE:
FINAL			05-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R100CC40_EXG_HGW_005_d_Max_co			-



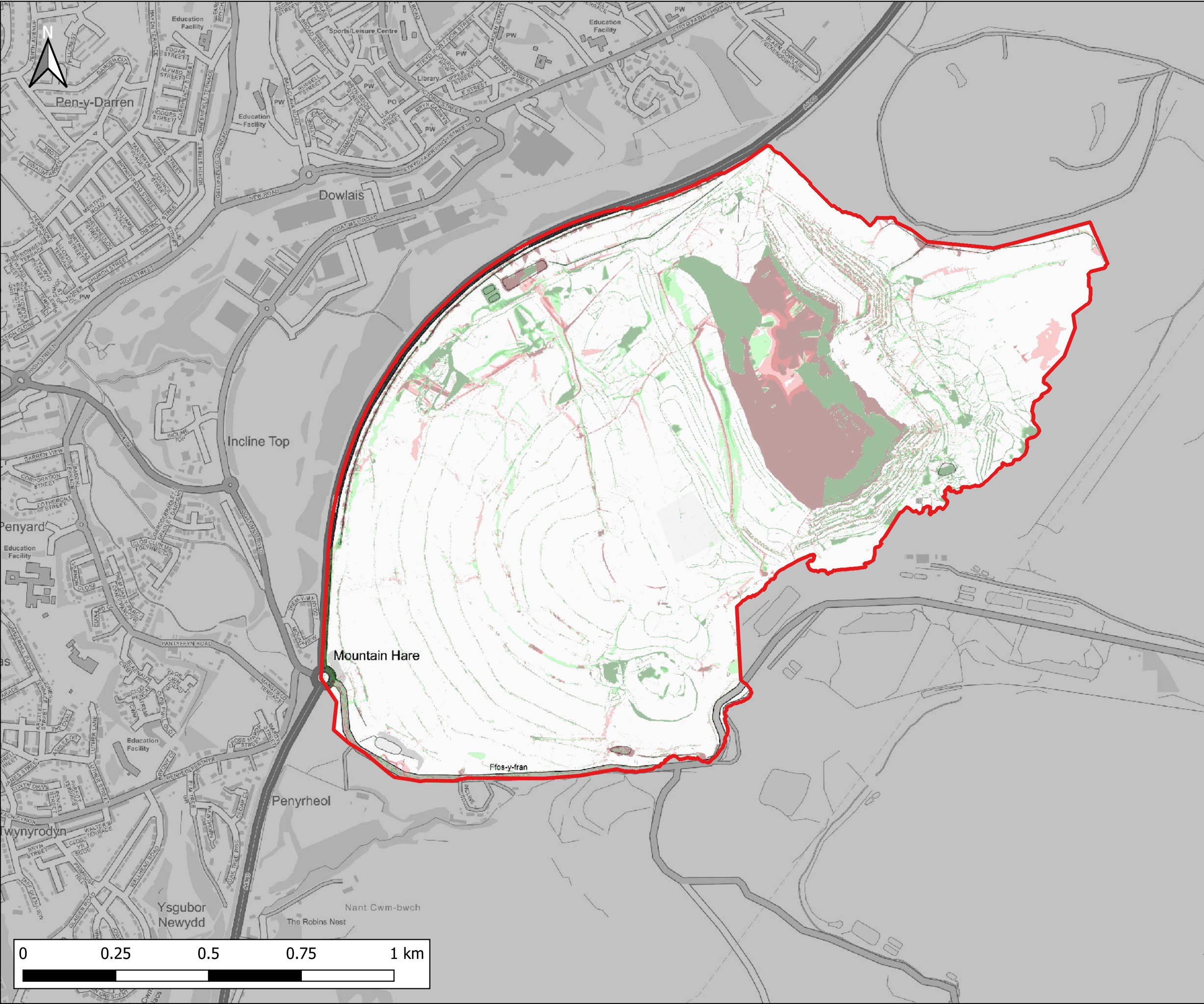
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
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LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth
- <= 0.3m
 - 0.3m - 0.6m
 - 0.6m - 1.2m
 - 1.2m - 2.4m
 - > 2.4m



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth 1% AEP Plus 40% Climate Change Pluvial Event Proposed Development Scenario (DEV) High Groundwater			
PLOT STATUS:			DATE:
FINAL			05-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R100CC40_DEV_HGW_005_d_Max_co			-



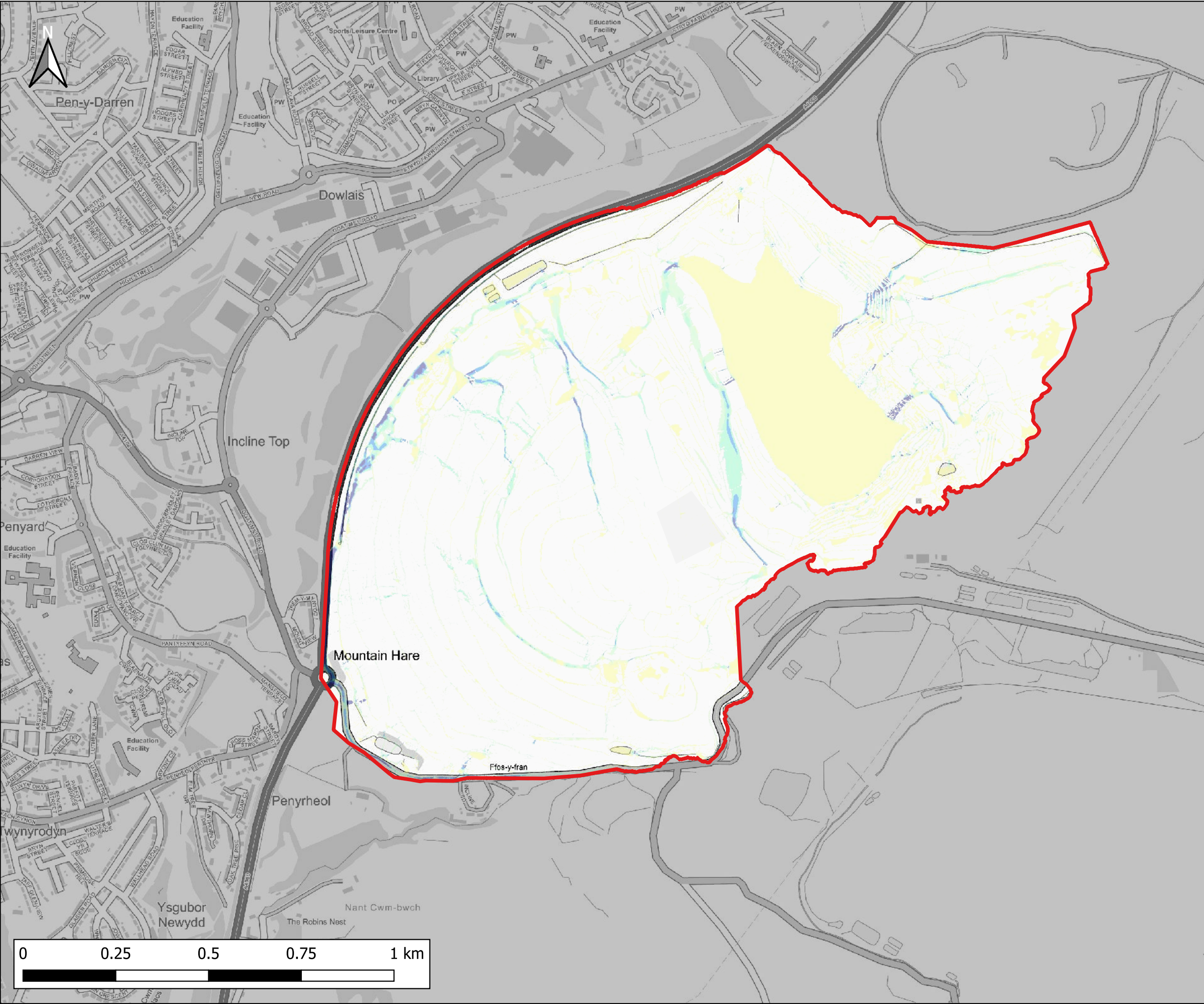
Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise
2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

- Site Boundary / 2D Model Extent
- Maximum Flood Depth Difference
- > -100mm
 - 50mm to -100mm
 - 5mm to -50mm
 - No Change (+/- 5mm)
 - +5mm to +50mm
 - +50mm to +100mm
 - > +100mm



CLIENT:			
Merthyr (South Wales) Ltd			
waterco www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Depth Difference 1% AEP Plus 40% Climate Change Pluvial Event DEV-EXG High Groundwater			
PLOT STATUS:			DATE:
FINAL			05-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R100CC40_DEV-EXG_HGW_005_d-Diff_co			-



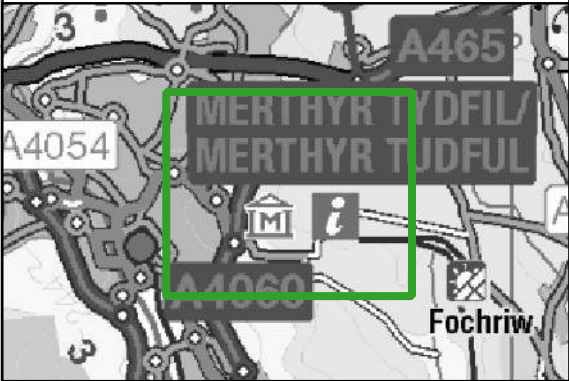
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LEGEND

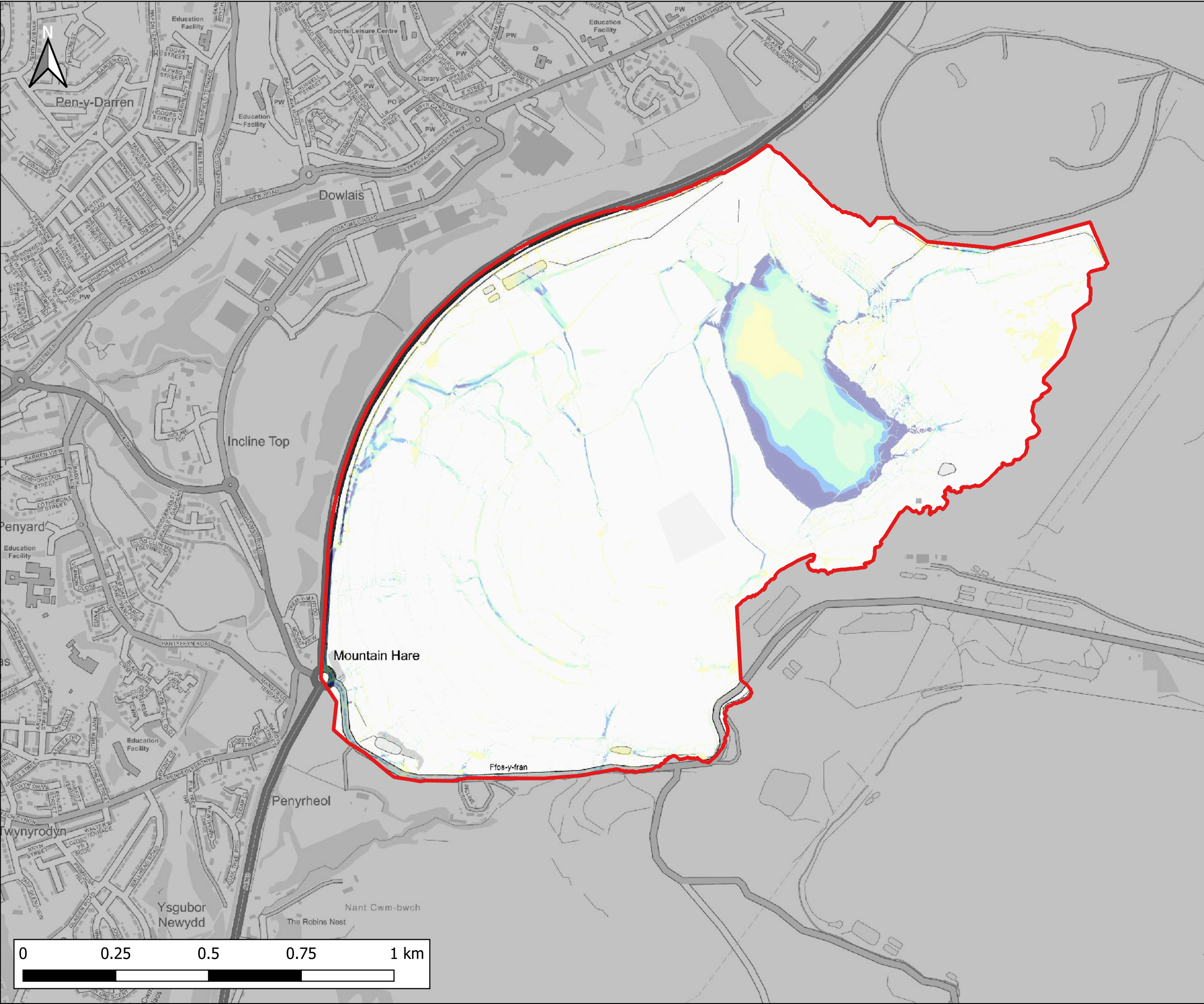
Site Boundary / 2D Model Extent

Maximum Flood Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 1% AEP Plus 40% Climate Change Pluvial Event Existing Scenario (EXG) High Groundwater			
PLOT STATUS:			DATE:
FINAL			05-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
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PLOT NAME:			REVISION:
15840-FYF_R100CC40_EXG_HGW_005_V_Max_co			-



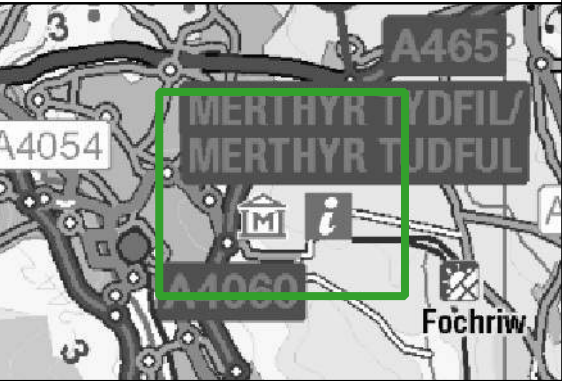
Notes:
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LEGEND

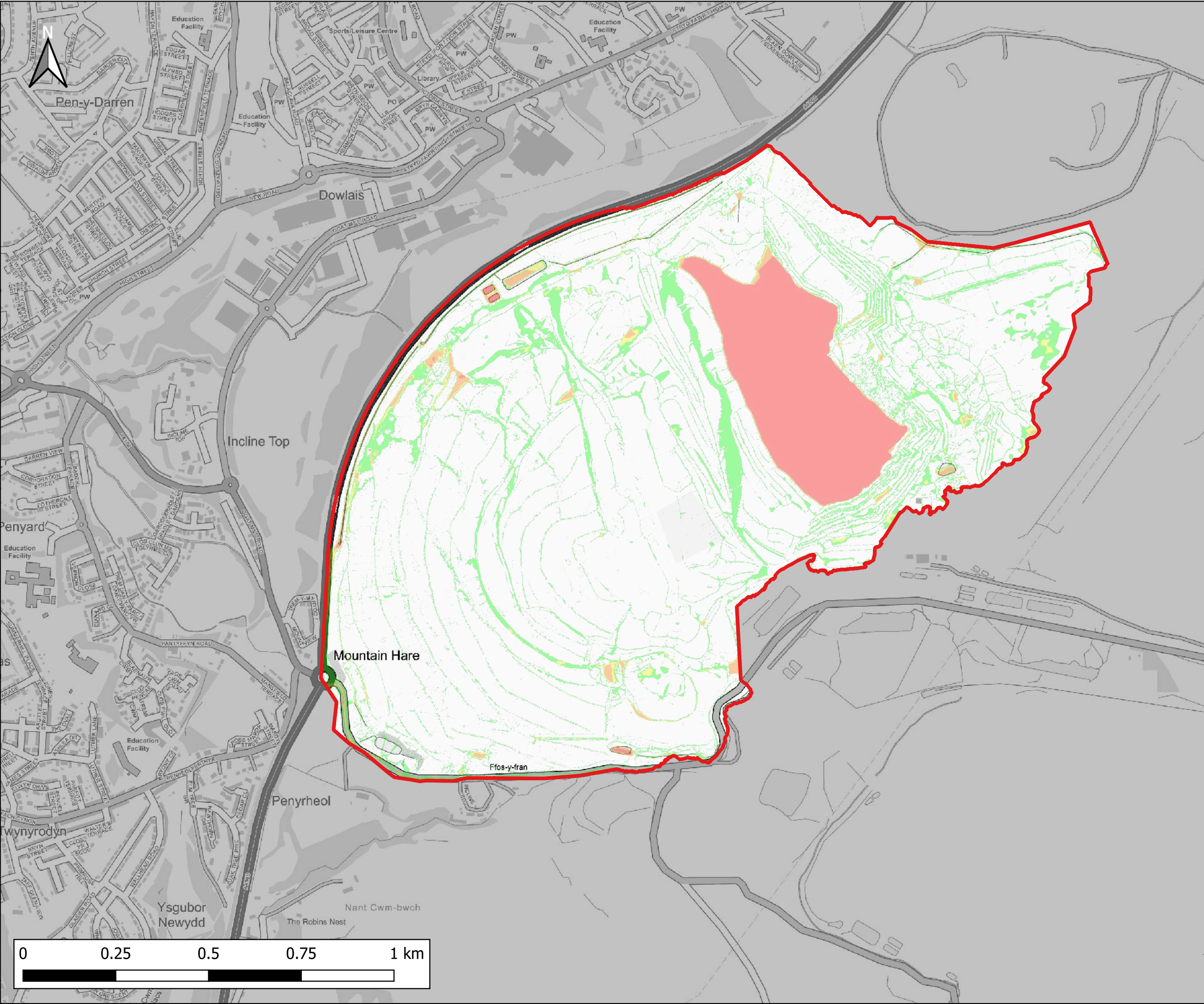
Site Boundary / 2D Model Extent

Maximum Flood Velocity (m/s)

- 0.0 - 0.3
- 0.3 - 0.6
- 0.6 - 0.9
- 0.9 - 1.2
- > 1.2



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Maximum Flood Velocity 1% AEP Plus 40% Climate Change Pluvial Event Proposed Development Scenario (DEV) High Groundwater			
PLOT STATUS:			DATE:
FINAL			05-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R100CC40_DEV_HGW_005_V_Max_co			-



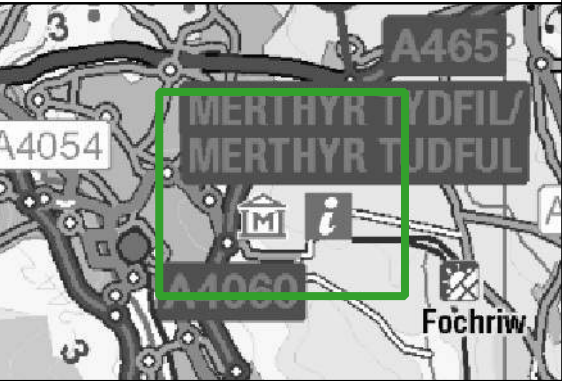
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2) As the model incorporates rainfall directly onto the 2D grid, cells where predicted depth is less than 20mm are not shown on the mapping for clarity. The first 20mm of water depth mainly comprises direct pluvial runoff, not flooding.

LEGEND

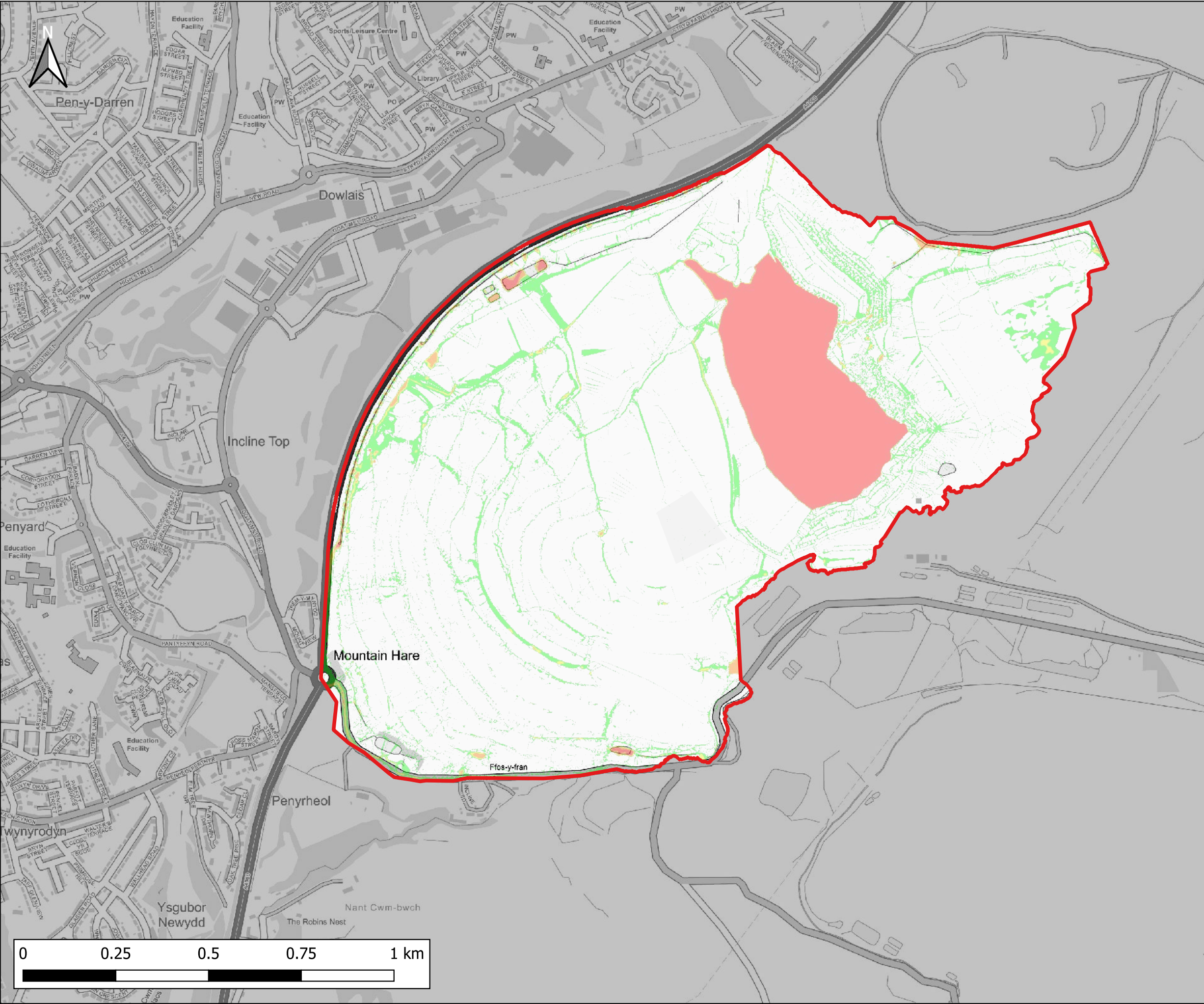
Site Boundary / 2D Model Extent

Flood Hazard Rating (FD2320)

- Caution
- Danger for Some
- Danger for Most
- Danger for All



CLIENT:			
Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME:			
Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE:			
Flood Hazard Rating 1% AEP Plus 40% Climate Change Pluvial Event Existing Scenario (EXG) High Groundwater			
PLOT STATUS:			DATE:
FINAL			05-12-2024
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
MH	AP	APR	1:10000
PLOT NAME:			REVISION:
15840-FYF_R100CC40_EXG_HGW_005_ZUK2_Max_co			-



Notes:
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LEGEND

- Site Boundary / 2D Model Extent
- Flood Hazard Rating (FD2320)
 - Caution
 - Danger for Some
 - Danger for Most
 - Danger for All



CLIENT: Merthyr (South Wales) Ltd			
 www.waterco.co.uk			
SCHEME: Ffos-y-Fran, Merthyr Tydfil			
PLOT TITLE: Flood Hazard Rating 1% AEP Plus 40% Climate Change Pluvial Event Proposed Development Scenario (DEV) High Groundwater			
PLOT STATUS: FINAL			DATE: 05-12-2024
DRAWN: MH	CHECKED: AP	APPROVED: APR	PLOT SCALE AT A3: 1:10000
PLOT NAME: 15840-FYF_R100CC40_DEV_HGW_005_ZUK2_Max_co			REVISION: -

Appendix L ReFH2 Runoff Estimates

DOCUMENT VERIFICATION RECORD	
Project:	15840 – Ffos Y Fran – Western Ditch
Client:	Merthyr (South Wales) Ltd
Report Title:	15840-FCA & Drainage Strategy - 02
Date:	31/01/2025

DOCUMENT REVIEW & APPROVAL	
Author:	Megan Williams BSc (Hons) MSc MCIWEM
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES – Western Ditch 8.53ha	
Return Period (Years)	As-rural Peak Flow (m ³ /s)
1	0.113
2	0.129
5	0.183
10	0.220
30	0.278
50	0.305
75	0.327
100	0.344
200	0.385
1000	0.498

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	15840 – Ffos Y Fran – BOAT Ditch
Client:	Merthyr (South Wales) Ltd
Report Title:	15840-FCA & Drainage Strategy - 02
Date:	31/01/2025

DOCUMENT REVIEW & APPROVAL	
Author:	Megan Williams BSc (Hons) MSc MCIWEM
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES – BOAT Ditch 9.23ha	
Return Period (Years)	As-rural Peak Flow (m ³ /s)
1	0.122
2	0.140
5	0.198
10	0.238
30	0.300
50	0.330
75	0.354
100	0.372
200	0.416
1000	0.538

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	15840 – Ffos Y Fran – Hillside Ditch
Client:	Merthyr (South Wales) Ltd
Report Title:	15840-FCA & Drainage Strategy - 02
Date:	31/01/2025

DOCUMENT REVIEW & APPROVAL	
Author:	Megan Williams BSc (Hons) MSc MCIWEM
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES – Hillside Ditch 2.51ha	
Return Period (Years)	As-rural Peak Flow (m ³ /s)
1	0.033
2	0.038
5	0.054
10	0.065
30	0.082
50	0.090
75	0.097
100	0.102
200	0.114
1000	0.147

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	15840 – Ffos Y Fran – Eastern Ditch
Client:	Merthyr (South Wales) Ltd
Report Title:	15840-FCA & Drainage Strategy - 01
Date:	11/12/2024

DOCUMENT REVIEW & APPROVAL	
Author:	Megan Williams BSc (Hons) MSc MCIWEM
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES – Eastern Ditch 15.545ha	
Return Period (Years)	As-rural Peak Flow (m ³ /s)
1	0.204
2	0.234
5	0.332
10	0.399
30	0.503
50	0.553
75	0.594
100	0.623
200	0.698
1000	0.902

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	15840 – Ffos Y Fran – Combined Ditch (excluding eastern ditch)
Client:	Merthyr (South Wales) Ltd
Report Title:	15840-FCA & Drainage Strategy - 02
Date:	31/01/2025

DOCUMENT REVIEW & APPROVAL	
Author:	Megan Williams BSc (Hons) MSc MCIWEM
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

ReFH2 RUNOFF RATES – Combined Ditch Catchment 28.22ha	
Return Period (Years)	As-rural Peak Flow (m ³ /s)
1	0.370
2	0.424
5	0.600
10	0.721
30	0.911
50	1.000
75	1.074
100	1.128
200	1.263
1000	1.632

*Runoff Rates printed from the ReFH Flood Modelling software package

DOCUMENT VERIFICATION RECORD	
Project:	15840 – Ffos Y Fran – Combined Ditch (void inflow)
Client:	Merthyr (South Wales) Ltd
Report Title:	15840-FCA & Drainage Strategy - 02
Date:	31/01/2025

DOCUMENT REVIEW & APPROVAL	
Author:	Megan Williams BSc (Hons) MSc MCIWEM
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Mike Wellington BEng (Hons) MSc CEng CEnv FICE FCIWEM C.WEM IMaPS MAPM

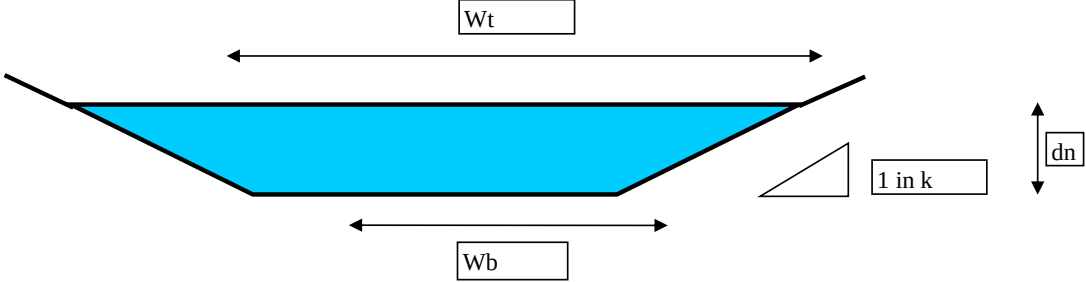
ReFH2 RUNOFF RATES – Combined Ditch Catchment 50.385ha	
Return Period (Years)	As-rural Peak Flow (m ³ /s)
1	0.657
2	0.754
5	1.067
10	1.281
30	1.617
50	1.776
75	1.907
100	2.003
200	2.242
1000	2.899

*Runoff Rates printed from the ReFH Flood Modelling software package

Appendix M Ditch Sizing Calculations

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref	15840
Scheme:	Ffos Y Fran	Prefix Page no.	1	
Section:	Western Ditch	Date:	31/01/2025	

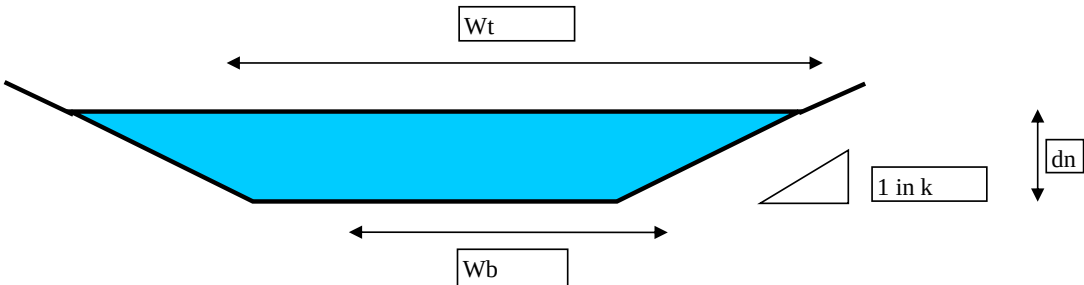
Trapezoidal Channel Flow
Output Discharge



<u>Manning Formula</u>	$V = (1/n) * R^{2/3} * S^{1/2}$	$Q = A * V$
Bottom width Wb (m)	0.300	
Side slope (1 in k)	2.000	
Bed slope (1 in x)	103.00	
Manning "n"	0.029	
Depth dn (m)	0.500	
Bed slope s (m/m)	0.009709	1 / x
Top width Wt (m)	2.300	$Wb + 2 * k * dn$
Area A (m ²)	0.650	$(Wb + Wt) / 2 * dn$
Perim P (m)	2.536	$Wb + 2 * dn * \sqrt{1 + k^2}$
Hyd Rad R (m)	0.256	A / R
Velocity V (m/s)	1.371	$1/n * R^{2/3} * S^{1/2}$
Discharge Q (m³/s)	0.8911	A * V

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref	15840
Scheme:	Ffos Y Fran	Prefix Page no.	1	
Section:	BOAT Ditch	Date:	31/01/2025	

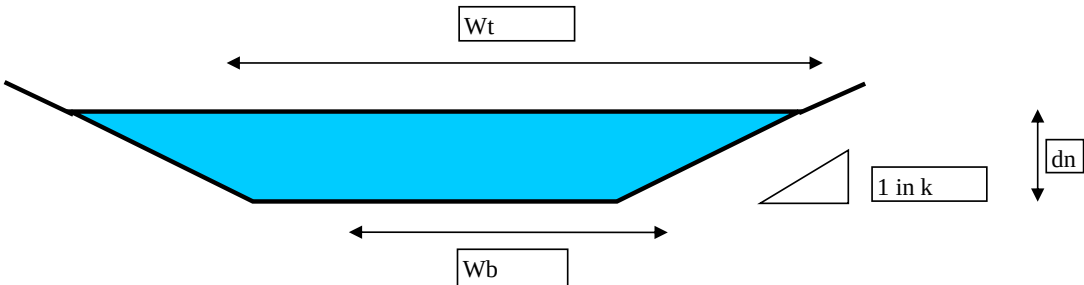
Trapezoidal Channel Flow
Output Discharge



<u>Manning Formula</u>	$V = (1/n) * R^{2/3} * S^{1/2}$	$Q = A * V$
Bottom width Wb (m)	0.300	
Side slope (1 in k)	2.000	
Bed slope (1 in x)	100.00	
Manning "n"	0.029	
Depth dn (m)	0.500	
Bed slope s (m/m)	0.010000	1 / x
Top width Wt (m)	2.300	$Wb + 2 * k * dn$
Area A (m ²)	0.650	$(Wb + Wt) / 2 * dn$
Perim P (m)	2.536	$Wb + 2 * dn * \text{SQRT}(1 + k^2)$
Hyd Rad R (m)	0.256	A / R
Velocity V (m/s)	1.391	$1/n * R^{2/3} * S^{1/2}$
Discharge Q (m³/s)	0.9044	A * V

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref	15840
Scheme:	Ffos Y Fran	Prefix Page no.	1	
Section:	Hillside Ditch	Date:	31/01/2025	

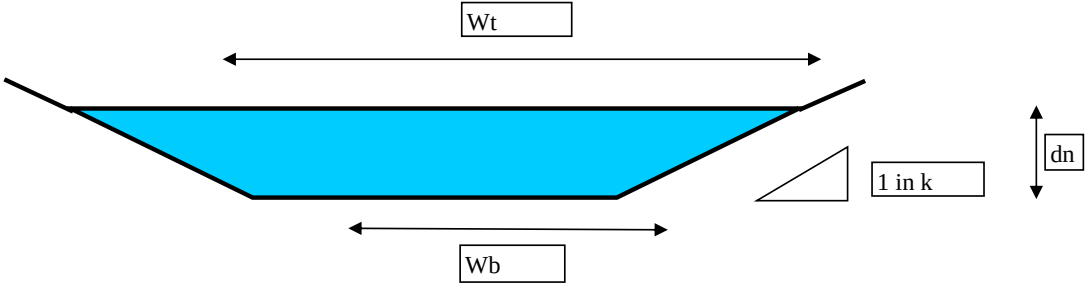
Trapezoidal Channel Flow
Output Discharge



<u>Manning Formula</u>	$V = (1/n) * R^{2/3} * S^{1/2}$	$Q = A * V$
Bottom width Wb (m)	0.300	
Side slope (1 in k)	2.000	
Bed slope (1 in x)	7.00	
Manning "n"	0.029	
Depth dn (m)	0.500	
Bed slope s (m/m)	0.142857	1 / x
Top width Wt (m)	2.300	Wb + 2*k*dn
Area A (m ²)	0.650	(Wb + Wt)/2)*dn
Perim P (m)	2.536	Wb + 2*dn*SQRT(1+k ²)
Hyd Rad R (m)	0.256	A / R
Velocity V (m/s)	5.259	$1/n * R^{2/3} * S^{1/2}$
Discharge Q (m³/s)	3.4182	A*V

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref	15840
Scheme:	Ffos Y Fran	Prefix Page no.	1	
Section:	Eastern Ditch	Date:	11/12/2024	

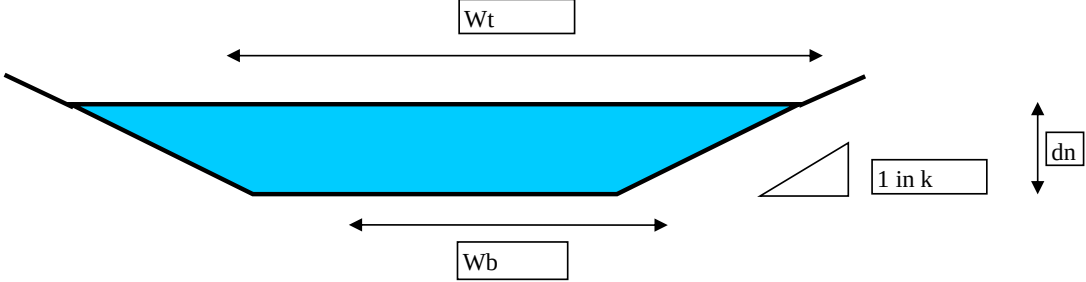
Trapezoidal Channel Flow
Output Discharge



<u>Manning Formula</u>	$V = (1/n) * R^{(2/3)} * S^{(1/2)}$	$Q = A * V$
Bottom width Wb (m)	0.300	
Side slope (1 in k)	2.000	
Bed slope (1 in x)	30.00	
Manning "n"	0.029	
Depth dn (m)	0.500	
Bed slope s (m/m)	0.033333	1 / x
Top width Wt (m)	2.300	$Wb + 2 * k * dn$
Area A (m ²)	0.650	$(Wb + Wt) / 2 * dn$
Perim P (m)	2.536	$Wb + 2 * dn * \text{SQRT}(1 + k^2)$
Hyd Rad R (m)	0.256	A / R
Velocity V (m/s)	2.540	$1/n * R^{(2/3)} * S^{(1/2)}$
Discharge Q (m³/s)	1.6512	A * V

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref	15840
Scheme:	Ffos Y Fran	Prefix Page no.	1	
Section:	Combined Ditch (Excluding Eastern Ditch)	Date:	31/01/2025	

Trapezoidal Channel Flow
Output Discharge



<u>Manning Formula</u>	$V = (1/n) * R^{2/3} * S^{1/2}$	$Q = A * V$
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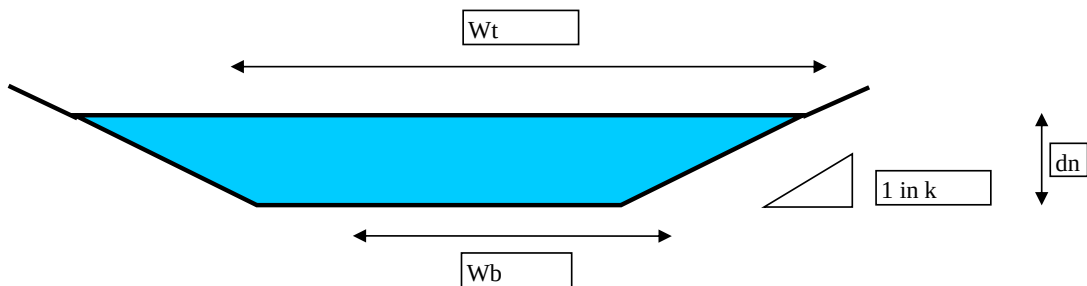
Bottom width Wb (m)	0.300	
Side slope (1 in k)	2.000	
Bed slope (1 in x)	100.00	
Manning "n"	0.029	
Depth dn (m)	0.700	

Bed slope s (m/m)	0.010000	1 / x
Top width Wt (m)	3.100	$Wb + 2 * k * dn$
Area A (m ²)	1.190	$(Wb + Wt) / 2 * dn$
Perim P (m)	3.430	$Wb + 2 * dn * \sqrt{1 + k^2}$
Hyd Rad R (m)	0.347	A / R

Velocity V (m/s)	1.702	$1/n * R^{2/3} * S^{1/2}$
Discharge Q (m³/s)	2.0259	A * V

	Eden Court, Lon Parcwr, Ruthin, 01824 702220	Calculations	ref	15840
Scheme:	Ffos Y Fran	Prefix Page no.	1	
Section:	Ditch into Quarry Void	Date:	31/01/2025	

Trapezoidal Channel Flow
Output Discharge



<u>Manning Formula</u>	$V = (1/n) * R^{2/3} * S^{1/2}$	$Q = A * V$
Bottom width Wb (m)	0.300	
Side slope (1 in k)	2.000	
Bed slope (1 in x)	18.00	
Manning "n"	0.029	
Depth dn (m)	0.600	
Bed slope s (m/m)	0.055556	1 / x
Top width Wt (m)	2.700	Wb + 2*k*dn
Area A (m ²)	0.900	(Wb + Wt)/2)*dn
Perim P (m)	2.983	Wb + 2*dn*SQRT(1+k ²)
Hyd Rad R (m)	0.302	A / R
Velocity V (m/s)	3.656	$1/n * R^{2/3} * S^{1/2}$
Discharge Q (m³/s)	3.2903	A*V

Appendix N Ditch Maintenance Schedule

Operation and Maintenance Requirements for Ditches

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass (applicable to grassed channels & bank) – to retain grass height within specified design range	Monthly (during growing season), or as required
	Manage other vegetation and remove nuisance plants	Monthly at start, then as Required
	Inspect culvert inlets, outlets for blockages, and clear if required	Monthly
	Inspect surfaces for ponding, compaction, silt accumulation, record areas where water is ponding for > 48 hours	Monthly, or when required
	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect culvert inlets and outlets for silt accumulation, establish appropriate silt removal frequencies	Half yearly
Remedial actions	Repair erosion or other damage	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Remove build-up of sediment	As required

The maintenance requirements detailed above are to be undertaken by the site owner.

Appendix O Concept Designers Risk Assessment

Project: Ffos Y Fran, Merthyr Tydfil
Client: Merthyr (South Wales) Ltd
Report Reference: 15840-FCA & Drainage Strategy-01

Project No: 15840

Prepared by:	Megan Williams	Date:	10/12/2024
Checked by:	Aled Williams	Date:	10/12/2024
Reviewed by:	Mike Wellington	Date:	11/12/2024

Requirement:

The Construction (Design and Management) Regulations 2015 (CDM 2015) place an obligation on the Designer to take all reasonable steps to provide, with the design, sufficient information about the design, construction or maintenance of the structure, to adequately assist the client, other designers and contractors to comply with their duties under CDM. The Designer has undertaken this assessment to identify any extra-ordinary risks, or those that would not be expected on this particular project by an experienced and competent Contractor. The aim is to avoid needless paperwork and bureaucracy and ensure the assessment is project specific, relevant and proportionate to the risk.

DRA Summary

Each of the following risk areas has been considered using the question below. Is a risk present which is considered to be **extra-ordinary or unexpected** in this instance?

If **YES** - A detailed risk assessment is required at design stage

If **UNKNOWN** - Insufficient information has been provided at concept design stage and the risks are unknown. Further consideration must be given at design stage(s)

If **NO** - No further action is required.

Hazard Ref.	Risk Areas	YES, UNKNOWN or NO	Comments
1	Ground Conditions	Yes	Former open cast coal mine
2	Hazardous Environment	Yes	Former open cast coal mine - steep rock faces and deep water
3	Existing Working Environment	Yes	Mining ceased, however vehicles remain on site
4	Existing Services	Unknown	To be considered at detailed design
5	Proximity to Other Structure(s)	Yes	Landfill to the north-east, A4060 to the north-west
6	Near Waterbody / flood risk	Yes	Quarry void lake - deep water body
7	Proximity to Other Activities	Unknown	To be considered at detailed design
8	Sequence of Construction	Unknown	To be considered at detailed design
9	Access	Unknown	Haul Roads within the site
10	Interfaces	Unknown	To be considered at detailed design
11	Confined Space Working	Unknown	To be considered at detailed design
12	Maintenance Considerations	Yes	Maintenance of culverts and ditches
13	Working at Height	Unknown	To be considered at detailed design
14	Steep Slopes	Yes	Steep slopes and rock faces
15	Demolition / Refurbishment / Repair	Unknown	To be considered at detailed design
16	Welfare	Unknown	To be considered at detailed design
17	Occupational Health	Unknown	To be considered at detailed design
18	Environmental Issues	Unknown	To be considered at detailed design
19	Other Significant Hazards not Identified Above	Unknown	To be considered at detailed design
20	Residual Risk to Future Users	Unknown	Deep body of water in quarry void