

**FFOS-Y-FRAN
FINAL RESTORATION STRATEGY**

**Supplementary Environmental Information (SEI)
SEI Appendices**

For

**MERTHYR
(SOUTH WALES) LTD**

November 2025

3274-11

**FFOS-Y-FRAN
FINAL RESTORATION STRATEGY**

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**MERTHYR
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QUALITY ASSURANCE PROCEDURES: Qp4, QP7.3Doc6

Prepared by: Jon Stoddard Date: November 2025
Checked by: Rhodri Edwards Date: November 2025
Approved by: Jon Stoddard Date: November 2025

Issue Record

Rev	Date	Description	Prepared by	Checked by
1	07/11/2025	Draft for Submission to MTCBC	J. Stoddard	Rh. Edwards
2	08/12/2025	Re-submission to MTCBC	J. Stoddard	R. Jones



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Ein cyf/Our ref: CAS-261856-N7M9
Eich cyf/Your ref: n/a

David Cross
Merthyr Tydfil County Borough Council
Unit 5 Triangle Business Park
Pentrebach
CF48 4TQ

Dyddiad/Date: 09 September 2024

Annwyl David/Dear David,

BWRIAD/PROPOSAL: SCOPING OPINION FOR REVISED RESTORATION STRATEGY

LLEOLIAD/LOCATION: FORMER SURFACE MINE, FFOS Y FRAN, MERTHYR TYDFIL

Thank you for consulting Cyfoeth Naturiol Cymru (CNC)/Natural Resources Wales (NRW) on the above project, which we received on 2 August 2024.

We have considered the document titled 'Ffos y Fran Final Restoration Strategy: Environmental Impact Assessment (EIA) Scoping Report for Merthyr (South Wales) Ltd.' dated July 2024, Ref: 3274-11 and prepared by Richards Moorhead & Laing Ltd.

The Environmental Statement (ES) for this project should include sufficient information to enable the planning authority to determine the extent of any environmental impacts arising from the proposed scheme on matters included on our checklist, Development Planning Advisory Service: Consultation Topics (September 2018), which is published on our [website](#).

We are commenting because we consider that the proposals are likely to give rise to significant effects. We advise that the likely significant effects are assessed by the applicant and we consider that the following matters should be 'scoped in' to any future Environmental Statement (ES).

Hydrology and Hydrogeology

Baseline Conditions

We note that with regards to hydrology, hydrogeology and hydrochemical considerations, the baseline conditions were taken from November 2023, when the mine had ceased mining. We are aware that historical data is available from approximately 10 years ago. We strongly advise this information should be used, unless it can be justified that this information is not suitable. If possible, the baseline data should be taken from the period prior to mining operations commencing, however we appreciate there may be limited data from this period.

We consider that reference should be made to what studies or investigations have been carried out to assess the impact of the Dowlais fault removal and replacement with backfill on the groundwater flow.

We note under Section 4.4.10, it is stated that mining activity 'has generally not disturbed the existing underground drainage systems'. The ES should include evidence to support this conclusion or findings.

Options Appraisal

We note that the scoping report references two separate restoration options, however in this case only Option 2 is being considered. We consider any ES should consider the full range of alternatives and provide details as to why Option 2 is considered the preferred option.

Consideration should also be given to the decommissioning of Rhas Las Pond and the relevant implications relating to this.

We note that monitoring is referred to under the Ecology and Air Quality sections of the document (Sections 9 and 12 respectively), however it is not clear what monitoring of surface water in terms of water quality and water resources, as well as the monitoring of groundwater, are to be carried out in the future. This should be scoped into the ES.

We have concerns with regards to potentially significant amounts of surface water being funnelled into the void. The ES should clarify the likely retention time within the waterbody, what the impact on the water catchment will be (if any), the likely impact during dry weather periods and whether there will be an impact on flow variability within the downstream watercourses. We also advise that a map is included plotting the position of all free drainage routes which are referred to in Section 4.4.9 of the Scoping Report.

Please note, all data, assessments and reports referred to should be included as appendices within any ES.

Hydrogeology

We have undertaken previous discussions with the applicant regarding the revised restoration strategy. We are satisfied these have mostly been incorporated into the scoping report. However, the following outstanding matters should be scoped into any ES.

Firstly, the conceptual model should be presented with a written description along with maps, diagrams and cross sections of the site with the geology, hydrogeology and details of the current restoration phases. The cross sections can be schematic drawings (rather than engineering drawings) showing groundwater flow paths and level.

We would also request sufficient details on the Free Drainage System(s) around the site (Morlais and Merthyr have been mentioned in the scoping report). This should include the location of the drainage system adits, leats and ponds and how this relates to the void and restoration plans and groundwater flows and levels within and around the site, along with the discharge points from the drainage system. The ES should use this information to assess the likely significant effects from the project, offering mitigation where necessary.

Hydrology

In paragraph 4.4.14 of the scoping report, we note reference of the standalone assessments which will inform the EIA:

- Flood Consequences Assessment
- Water Framework Directive Assessment
- Acid Mine Discharge Risk Assessment

We agree these should be included as appendices in the ES. We advise a full Water Framework Directive assessment for both the surface water bodies impacted and the groundwater body, for all aspects of the project and its stages. This should include the decommissioning of any permanent or semi-permanent bodies of water, such as the attenuation ponds / lagoons and Rhas las pond proposed as part of the restoration / remediation. These waterbodies are:

- GB40902G201900 - SE Valleys Carboniferous Coal Measures – Poor status
- GB109057033150 - Nant Morlais - source to conf R Taff – moderate status
- GB109057033100 - Taff - conf Taf Fechan to conf R Cynon – moderate status
- GB109057033140 - Taff Bargoed - moderate status
- GB109057027240 - Taff - conf R Cynon to conf Rhondda R – moderate status
- GB109057027270 - Taff - conf Rhondda R to Castle Street – moderate status
- GB109057033120 - Nant Bargod Rhymni - source to conf Rhymney R – poor status
- GB109057027190 - Rhymney R - Nant Bargod Rhymni to conf Nant Cylla – good status
- GB109057027280 - Rhymney R - conf Nant Cylla to Chapel Wood – moderate status

The WFD assessment should include:

- Surface water modelling - range of flows impacted; seasonality; impact on low flows of water retention etc.
- Water quality impacts – water quality within the void and groundwater; potential mine water discharges; impact on sediment mobilisation (geomorphology); fish migration (alteration of flows and physical environment); freshwater invertebrates; impacts on dilution capacity etc.
- How this relates to aims for improvements to / management of the waterbodies as set out in the RBMP and WFD mitigation measures.

A monitoring programme will be required during and post restoration to ensure that both water quality and water quantity aspects of the scheme are appropriately considered to identify any issues that require action.

Ecology

We would expect the ES to include an aspect of the following aspects of the project on ecological receptors:

- The physical characteristics of the project
- Location, size and configuration of the project
- Maintenance requirements of structures
- Arrangements for maintenance and management of any habitats within the site
- Artificial lighting requirements, including likely intensity and location of light spill on green infrastructure

European protected species

In terms of European protected species (EPS), we note that bats, great crested newt, and otter are scoped into the assessment.

Bats

We note that an initial assessment of trees and buildings took place in winter 2024/2025. Structures to be demolished were noted to be classified as 'having negligible – moderate BRP. Trees were classified as having negligible – PRF1 suitability.'

We welcome that further surveys are to take place and concur with the activity surveys at buildings as proposed. However, we note that it is considered that no emergence/return to roost surveys are required at trees. We advise that trees identified to be of moderate or higher potential for bats which are likely to be impacted by the scheme (directly or indirectly) are subject climbed, endoscope inspections of any potential roost features present.

Great Crested Newt

The site is known to support Great Crested Newts (GCN) with an EPS licence granted by Welsh Government some years ago to facilitate previous working. We advise that the ES includes the long term commitments associated with previous licences for this site and provides an assessment of how these will align with the project and any new mitigation necessary.

We welcome the eDNA surveys undertaken in 2024. We advise that surveys for GCN cover all waterbodies within 250m of the development. It is not clear from the scoping document whether this is the case. We note that 2024 eDNA surveys confirmed the presence of GCN in 17 out of the 30 ponds sampled, including within the redline boundary and CES. We welcome the intention to update presence/absence surveys in Spring 2025 and advise a suite of traditional surveys following published best practice guidance is undertaken where eDNA survey results indicate presence of the species or are inconclusive.

The ES should include a detailed assessment of the impacts of the scheme on great crested newt aquatic and terrestrial habitat, together with proposals to avoid, to mitigate or to compensate for them. Where possible, it would be expected that important features for GCN would be retained and their function for GCN protected.

Notwithstanding any waterbodies required to be delivered in mitigation as part of the project, we advise that the final restoration strategy commits to creating additional ponds to support this species. We also advise that the final restoration strategy and long-term management incorporates the ponds created in the Central Ecological Area (SINC), Cwm Bargoed Disposal Point and Cwm Golau Ecological Areas which formed part of previous commitments and the EPS licence for this site.

Otter

We note that no evidence of otter was found within the site. We welcome that 'Pre-works walkovers as required' and advise that these take place at regular intervals during the restoration period.

EPS Impact Assessment

Should European protected species be confirmed, information must be provided identifying the species-specific impacts in the short, medium and long term together with any mitigation and compensation measures proposed to offset the impacts identified.

We advise comprehensive descriptions of the habitats affected are included to support robust conclusions about their significance for the species. We advise that ES considers significance (both alone and in combination) and where applicable conservation status. In respect of conservation status, we advise consideration is given to the current conservation status of the relevant species.

The ES must demonstrate that there will be no detriment to maintenance of favourable conservation status (FCS) of the species during construction, operation and where relevant decommissioning phases of the scheme. We advise that the ES sets out how the long-term mitigation or compensation will be secured, including management and monitoring information and long term financial and management responsibility. Where the potential for significant impacts on protected species is identified, we advocate that a Conservation Plan is prepared for the relevant species and included as an Annex to the ES.

Other protected species

Table 5 of the scoping report refers to proposed survey requirements. Based on the known existing habitat present on the site, as a minimum, we would recommend surveys for both breeding and wintering birds, invertebrates and reptiles.

It is noted that the scoping report does not deem invertebrate surveys as necessary, however we would advise that the requirement for these surveys is dependent on the type and nature of habitat identified during any initial habitat survey work. EIA scoping is an iterative process, as such, the applicant may be required to re-scope once initial habitats survey work is available.

We advise that the development incorporates robust green infrastructure that will remain unlit to allow protected species to continue to inhabit the site and move through it. It is vital that the design of the development avoids narrow green infrastructure corridors through it and avoids breaks in those corridors.

We have no comments to make on badgers.

Survey guidance

We advise that the site and where necessary land adjacent to the site is subject to assessment to determine the likelihood of protected species being present and affected by the proposals. Targeted species surveys should be undertaken for all species scoped in which:

- i. are undertaken by qualified, experienced and where necessary, licensed ecologist(s) and,
- ii. comply with current best practice guidelines. In the event that the surveys deviate from published guidance, or there are good reasons for deviation, full justification for this should be included within the ES.

We note that initial surveys have taken place with updated surveys proposed in 2025

Habitats and biodiversity

The ES should include a broad assessment of the existing habitats across the site and a consideration of the potential for habitats and their management to improve biodiversity. Reference is made to a Phase 1 Habitat Survey carried out in 2023, however no detail has been provided. This should be submitted and appended to the ES

The scoping report currently references the proposed fencing-off of areas of coal spoil from grazing and tree planting, however this would not be conducive to providing the open coal spoil habitat which is favoured by invertebrate communities on other spoil tip sites across south Wales.

In terms of aftercare, we agree a monitoring period will be necessary and advise a monitoring plan should be agreed to assess the success of restoration in terms of habitat creation and management.

Other Matters

We would expect the applicant to contact other relevant people/organisations for biological information/records relevant to the site and its surrounds during the EIA process. These include the relevant Local Records Centre and any local ecological interest groups (for example, bat groups, mammal groups).

Our advice is made without prejudice to comments we may subsequently wish to make when consulted on any planning application, the submission of more detailed information or an Environmental Statement.

The developer and their contractors should be aware of our different consents, registrations, permits and authorizations which may be required for all stages of the project. Further details can be found [here](#).

If you have any queries on the above, please do not hesitate to contact us.

Yn gywir / Yours faithfully

Eleanor Sullivan

Cynghorydd - Cynllunio Datblygu/Advisor - Development Planning
Cyfoeth Naturiol Cymru/Natural Resources Wales

E-bost/E-mail: southeastplanning@cyfoethnaturiolcymru.gov.uk

Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi./Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.



f.a.o. Mr Jon Stoddard
Richards, Moorehead & Laing Ltd

(Via email: j.stoddard@rmlconsultant.com)

Dyddiad/Date: 4th October 2024

Ein Cyf / Our ref: P/08/0316 FYF Scoping
Eich Cyf / Your ref:

Gofynnwch am / Please ask for: David Cross
Llinell Uniongyrchol / Direct Line: 07761330349
e-bost / e-mail: David.cross@merthyr.gov.uk

Dear Mr Stoddard

**Proposed Ffos-y-Fran Final Restoration Strategy
The Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017:
Regulation 14 Scoping Request**

Thank you for the scoping report dated July 2024.

The Local Planning Authority has carried out a scoping exercise and considers that the topics listed below should be covered in any Environmental Statement submitted in relation to the proposed development. In reaching this opinion the Local Planning Authority has had regard to the specific characteristics of the particular development, the specific characteristics of development of the type concerned and the environmental features likely to be affected by the development.

1. **Hydrology (Section 6)** – The proposed scope of the assessment is set out in section 6.2 of the scoping report. The scope of the assessment would be to undertake the following of the area defined as Phase 3 and its associated pathways:

- Overland Surface Water Run-Off Modelling
- Flood Consequence Assessment (FCA) and Drainage Strategy
- Water Framework Directive (WFD) Compliance Assessment

The Assessment Methodology is set out in section 6.5 but further specific advice on the scope of the hydrological chapter is provided by Natural Resources Wales in their letter dated 9th September 2024, a copy of which is attached to this letter. Assessment should also consider climate change effects.

2. **Hydrogeology (Section 7)** - The proposed scope of the hydrogeological work to be addressed for the EIA is set out in Section 7.2 of the scoping report and confirms the ES will include both consideration of direct hydrogeological impacts that may result from completion of the proposed reclamation scheme, and provision of inputs to the assessment of potential impacts associated with other disciplines, such as hydrology and water quality.

The Assessment Methodology is set out in section 7.5 but further specific advice on the scope of the hydrogeological chapter is provided by Natural Resources Wales in their letter dated 9th September 2024, a copy of which is attached to this letter. Assessment should also consider climate change effects. Any assessments of impact on water supply and quality must include impact upon private water supplies.

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3. **Hydro-Geochemistry (Section 8)** – The proposed scope of the Hydro-geochemistry work to be addressed in the ES is set out in section 8.2 of the scoping report. The main purpose of the hydro-geochemical assessment is to detail likely impacts of the restoration scheme on surface water and groundwater quality in receiving waterbodies. The geochemical risk of any remaining exposed rock or soil will also be considered. One of the main outcomes will include an assessment of the likely future water quality of the waterbody formed in the pit void. The scope of the assessment also includes development of an acid mine drainage risk assessment to cover the pit void and overburden sites.

The Assessment Methodology is set out in Section 8.5 but further specific advice on the scope of the hydro-geochemistry chapter is provided by Natural Resources Wales in their letter dated 9th September 2024, a copy of which is attached to this letter. Assessment should also consider climate change effects. The geochemical analysis of the five samples taken on 11th July 2024 should be presented as part of the final report as per section 8.4.5.

4. **Ecology and Biodiversity (Section 9)** – The Assessment methodology is set out in section 9.5 of the scoping report but further specific advice on the scope of the ecology chapter is provided by Natural Resources Wales in their letter dated 9th September 2024 and in an Internal Memorandum from the Council Ecologist dated 14th August 2024, copies of which are attached to this letter.
5. **Landscape and Visual Impact (Section 10)** – The scope of the assessment is set out in section 10.2 of the scoping report. Key landscape impacts and effects to be considered include the direct physical change to the landscape in terms of landform and surface elements, fragmentation of landscape features or designated areas and the cessation of mining activities. Indirect effects on the character and quality of the landscape would be considered in terms of change in the perception of the landscape through changes to landscape elements such as buildings and vegetation. Key visual impacts will cover direct day time effects to the amenity of visual receptors in terms of change in view. Indirect effects on views and visual receptors would also be covered, in terms of change to public attitude and behaviour towards the use of a place. The assessment method must be in accordance with Guidelines for Landscape and Visual Impact Assessment 3rd Edition (Landscape Institute and IEMA 2013) (GLVIA3), Visual Representation of Development Proposals (Landscape Institute 2019) and Environmental Colour Assessment (Landscape Institute 2018), as set out in section 10.5 of the scoping report.
6. **Cultural Heritage and Historic Environment (Section 11)** - Chapter 11 of the scoping report explains the methodologies that will be used to assess the impact of the proposed restoration works on the cultural heritage and CADW agree that these are appropriate.

It should however be noted that The Historic Environment (Wales) Act 2023 will be enacted on 4th November 2024. This will replace The Ancient Monuments and Archaeological Areas Act 1979; The Historic Environment (Wales) Act 2016 and The Planning (Listed Building and Conservation Areas) Act 1990.

7. **Air Quality and Greenhouse Gases (GHG) (Section 12)** - The proposed scope of the assessment is set out in section 12.2 of the scoping report. It acknowledges that the proposed development may give rise to aerial emissions, which could give rise to potential impacts and resulting effects on local human and ecological receptors. The proposed development may give rise to a range of GHGs both directly, with Non-Road Mobile Machinery (NRMM) and any on-site power generation and indirectly through the consumption of materials and water use.

Pollutants of primary concern from the scheme are dust, including particulates resulting from movement of material around the site. NO₂ is also of concern resulting from NRMM and generators used on site, although this is to a lesser extent than dust/PM. Although particulates and nuisance dust may be reduced

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in comparison to the original remediation strategy, there remains potential for both to affect nearby receptors in addition to issues from fugitive dust. Sensitive receptors should be mapped, and the assessment methodology outlined in para 12.5 of the report should be comprehensive and detailed in terms of monitoring and mitigation for the duration of the scheme, in accordance with IAQM guidance documents for mineral dust impacts and demolition & construction dust.

8. **Human Health (Section 13)** - The scope of the assessment as set out in section 13.2 of the scoping report, focusing on the potential effects the proposed restoration scheme would have on human health, is acceptable. The assessment should follow Health Impact Assessment: A practical guide produced by WHIASU.
9. **Noise** - Assessment of the likely differences between the consented scheme and the alternative restoration proposals is required. The scope of the ES should include 'Noise' and be considered having regards to the current Planning Guidance (Wales), Technical Advice Note (Wales)11, Noise – October 1997, with baseline levels at nearest noise sensitive receptors and potential impacts from restoration activities to be assessed at sensitive receptors, with a mitigation plan provided, if necessary.
10. **Geology and Geotechnical Appraisal** – The ES must demonstrate that the restored ground profile is stable over the longer term and that there is no instability that can be reasonably predicted. A soil handling methodology should also be provided to demonstrate the best use of soil given that it is a scarce natural resource.
11. **Restoration and Aftercare** - It should be clearly demonstrated that the land can be returned to a beneficial after-use. Opportunities to improve the environment and to create biodiverse habitat should be maximised and demonstrated. The appropriate monitoring of the restored areas to ensure its long-term success should be clearly set out, along with identifying any responsibilities and the measures to be put in place for its management.
12. **Cumulative Effects (Section 15)** – The proposed scope of the cumulative effects shall takes into account both the intra-project and inter-project effects and shall take into account all receptors and effects identified in each of the ES topics. The scope and methodology to review the cumulative effects is accepted.

It is stated in para 5.3.4 that overburden mounds OB2 and OB3 shall be scoped out of the assessment. Whilst these area of the site may largely be retained as existing, they nonetheless form an integral part of the wider restoration works and should not be scoped out of any of assessments. Reference has also been made to the potential use of OB3 to accommodate a motocross facility, which would need to be the subject to a separate planning application. Therefore, the assessment must also consider the restoration of OB3 in the absence of an approved alternative after-use of the land.

Please consider this letter as constituting the scoping opinion of the Local Planning Authority in accordance with the provisions of paragraph 14 of the Town and Country Planning (Environmental Impact Assessment) (Wales) Regulations 2017.

Yours sincerely



JUDITH JONES
DIRECTOR OF NEIGHBOURHOOD SERVICE

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Ein cyf/Our ref: CAS-275294-H0Z5
Eich cyf/Your ref: P/25/0037

Hugh Towns
Merthyr Tydfil County Borough
Council
Unit 5 Triangle Business Park
Pentrebach
CF48 4TQ

Dyddiad/Date: 17 April 2025

Annwyl Hugh/Dear Hugh,

BWRIAD/PROPOSAL: Variation of conditions 4 (Duration of Restoration), 6 (Approved Plans) and 50 (Restoration Strategy) of planning permission APP/U6925/A/10/2129921 involving a revision to the restoration scheme.

LLEOLIAD/LOCATION: Ffos Y Fran, Merthyr Tydfil.

Thank you for consulting Cyfoeth Naturiol Cymru (CNC)/Natural Resources Wales (NRW) about the above, which we received on 21 February 2025.

We have reviewed the following documents:

- Environmental Statement (ES) Volume 1 – Technical Report by Richards Moorehead & Laing Ltd Dated January 2025 (Rev 2, Ref: 3274-11).
- Environmental Statement Volume 3 – Appendix 8: Ffos-Y-Fran Final Restoration Scheme – Hydrogeology Technical Report. Dated: 24/01/2025.
- Environment Statement Volume 3 – Appendix 10B: Baseline and Preliminary Water Framework Directive (WFD) Assessment.
- Ffos-y-Fran Final Restoration Strategy 2025. Environment Statement – Non Technical Summary. By Richards, Moorehead and Laing Ltd. Rev V1, dated 07/02/2025.
- Ecological Impact Assessment (EclA) by Richards, Moorehead and Laing Ltd. December 2024. Rev 0.
- Ffos-y-Fran Final Restoration Strategy 2025 - Green Infrastructure Statement. Dated February 2025.
- Drawing number 3274-RML-DR-L-54: Restoration and Aftercare. Dated January 2025.
- Figure 11C titled *GCN Surveys Pond Location Plan* dated June 2024.

We have concerns with the application as submitted because inadequate information has been provided in support of the proposal. To overcome these concerns, you should seek further information from the applicant regarding land contamination,

pollution prevention and European protected species. If this information is not provided, we would object to this planning application. Further details are provided below.

We also advise that based on the information submitted to date, conditions regarding land contamination and pollution prevention should be attached to any planning permission granted. Without the inclusion of these conditions we would object to this planning application.

Land Contamination

Geotechnical Engineering

From the information provided, we note that the extension of the originally permitted mine workings has brought the eastern sidewall boundary closer to the active Trecatti Landfill site. Sections of the eastern and southern sidewalls will now be exposed with revised reprofiling restoration works to the sidewalls and spoil tip OB1. Therefore, we advise that a stability risk assessment is provided as part of the restoration plan to consider potential impacts of the proposed restoration works and finished profile to the short and long term stability of Trecatti Landfill.

Hydrogeology

Section 11.9.9 of the ES proposes a reduction of the pit lake level via pumping, 'before pushing soil forming material down the bank slopes to partially fill the base.' However no further details are provided within the ES or supporting Hydrogeology Technical Report. Further details should therefore be provided regarding how the pumping will be resumed within the void from the pit lake. This should include, but not be limited to, abstraction rate, pumping duration, monitoring of the groundwater levels around the site (i.e. water features and piezometers) as well as discharge points.

The ongoing maintenance of the pit lake level and groundwater modelling of the site relies heavily on the presence of Dowlais Free Drainage System (DFDS), which we assume drains the whole area by a network of adits (although this is not clear). There is little information presented on how the underdrainage works and where connections are present. There are discharge points noted, but it is unclear how connected these are. A plan showing the discharge points with flows, elevations and cross sections with the pit void should be provided to understand the potential or relative connections. An assessment of the risk of the DFDS failing should also be considered. Therefore, we advise that a risk assessment is provided to understand the risk of a blow out occurring, and what effect this would have on the pit lake/local water features and how the ongoing success of the DFDS will be monitored during the aftercare phase.

The groundwater level or piezometer data should be presented in hydrographs, either individually or as a full record on one hydrograph. A timeline graphic showing when each piezometer is active should also be provided, as well as details on the depths of the piezometers (monitored screened sections and the ground units intersected) and what information was used in the modelling.

Clarification is also required regarding the calibration of the groundwater levels with the piezometer data. Section 8.5.6 of the ES states 'a one year period where there is no pit void to generate an initial distribution of groundwater heads'. This suggests that the simulated

baseline condition reflects the pre-quarrying condition. Confirmation is required on how ground water levels for the pre-quarrying condition were derived. Calibration representations should be provided in graphical form (e.g. measured vs simulated groundwater levels).

The aftercare phase, post restoration, is only a 5 year period. Further detail regarding the ongoing monitoring of the site is required, including groundwater levels, pit lake levels, stream flow (spot gauging or regular monitoring with data loggers) and water quality sampling. Monitoring locations, frequency and details of conditions (e.g. elevated above baseline) which would trigger mitigation or contingency actions to be put in place. We advise your authority to secure the ongoing monitoring of the site, particularly with regards to the pit lake level and discharge points from the DFDS to any permission granted, through a condition on the new consent, or another appropriate planning control mechanism.

General Comments on ES

There are a number of inconsistencies within the ES and supporting reports which the applicant may wish to resolve. This includes incorrect references to Water Resources Act 2001 (which should be 1991) and the Groundwater Regulations 2009 (which were superseded by the Environmental Permitting Regulations 2016 under Schedule 22).

Please note, any plans submitted with the ES should be a sufficient file size to allow for closer inspection.

Pollution Prevention

We previously advised, during the scoping stage of the application (response ref: CAS-261856-N7M9, dated 9th September 2024), a number of points which still remain outstanding as part of the current application. We have detailed these below.

- No further details provided regarding post restoration monitoring – please refer to comments above regarding the need for planning control in relation to this. We note that the sampling undertaken on site has identified elevated concentrations of some heavy metals and ammonia in the void and in water around the site, which are said to be treated by the onsite lagoons. It is therefore crucial that these lagoons are managed and monitored into the future, or a suitable alternative is proposed.
- Concerns remain regarding the 2023 baseline used within the ES. There have already been substantial changes to the ecology, hydrology and hydrogeology of the site prior to this date as a result of mining activities. We are aware that historical data is available from approximately 10 years ago. We strongly advise this information is used, unless it can be justified that this information is not suitable. If possible, the baseline data should be taken from the period prior to mining operations commencing.
- Site drainage has not been adequately addressed within the application. From the information submitted, we have concerns regarding a potentially significant amount of surface water being funnelled into the void. Details should be provided on the retention time of the waterbody, whether this surface water will be lost within the catchment if it is to sit within the void, and what the impact of this would be for the catchment during dry weather periods and what impacts this will have on flow variability within the downstream watercourses.

General Comments on Final Restoration Strategy

- Further detail should be provided on how the operator intends to reduce the water level in the pit void for the proposed restoration works. The operator should be aware that this is likely to require a change to their abstraction licence or discharge permits.
- We note reference within the EclA to issues with ochre from the historic mining on site, however no detail is provided within the submission on how this will be managed going forward.
- We note the proposal to expand a naturally forming shallow waterbody on top of OB2. We have concerns that this could cause integrity issues in the future and potentially lead to a slip. Further details regarding this should be provided.
- We note the suggestion of a Construction Environment Management Plan (CEMP) for the restoration works. We advise that submission and approval of a final CEMP is secured through condition on any planning permission granted.

Water Framework Directive (WFD) Assessment

- Insufficient information has been provided on impact to flows, water quality and biology as a result of the change to the surface water drainage catchment.
- Insufficient information on the impact of the poor groundwater quality of the void and runoff and how this will impact surface water quality and biology. Please note, any mitigation proposal should be supported by a management/maintenance programme.
- The assessment states that there would be 'reduced contaminants' in the waterbodies, but has not detailed how the restoration programme would achieve this.
- No consideration has been given to the in-combination impacts of reduced flow (as a result of diverted drainage) and poor water quality (from run off and the void) on the surface water quality and biology.

European Protected Species (EPS)

With regards to EPS on site, the EclA states that eDNA results from 2024 indicate presence of GCN in 17 of the 30 ponds sampled. Desk studies also found records of otters south of the site and the EclA states that '*as the species has been recorded in the river catchment, travel routes could theoretically include animals wandering up into the site when crossing between watercourses*' (Table 10, Page 52).

Legislation and Policy

Great crested newts and otters, as well as their breeding sites and resting places, are protected under the Conservation of Habitats and Species Regulations 2017 (as amended). Where these species are present and where a development proposal is considered likely to contravene the legal protection they are afforded, the development may only proceed under licence issued by Natural Resources Wales, having satisfied the three requirements set out in the legislation. A licence may only be authorised if:

- i. The proposed works to be authorised satisfy an appropriate derogation purpose, which in the case of development are for the purposes of preserving public health or safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment;
- ii. There is no satisfactory alternative; and
- iii. The action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in its natural range.

Paragraph 6.3.7 of Technical Advice Note 5: Nature Conservation and Planning (TAN5) states that your Authority should not grant planning permission without having satisfied itself that the proposed development either would not impact adversely on any EPS on the site or that, in its opinion, all three tests for the eventual grant of a licence are likely to be satisfied. Please note, for the purposes of providing advice at the planning application stage, our comments are limited to compliance with the third test only.

Great Crested Newts (GCN)

As part of our previous scoping advice, we advised a number of points with regards to GCN which do not appear to have been included as part of the submitted ES. We have detailed these below:

- Reference to the previous long-term commitments in respect of GCN associated with the previous licences for this site and an assessment of how these will align with the project and any new mitigation necessary.
- Clarification as to whether the GCN surveys have included all waterbodies within 250 meters of the site.
- Updated presence/absence surveys, following positive eDNA results. We previously advised that these should follow best practice guidance.
- Detailed assessment of the impacts of the scheme on GCN aquatic and terrestrial habitat and mitigation proposals.
- Proposal does not appear to make provision for additional water bodies required to be delivered as mitigation to support GCN.
- Long term management of site with regards to GCN. This should incorporate ponds created in the Central Ecological Area, Site of Importance for Nature Conservation (SINC), Cwm Bargoed Disposal Point and Cwm Golau Ecological Areas, which formed part of previous commitments and the EPS licence for this site.

We welcome that ponds with positive eDNA samples will be retained, protected and where required, enhanced. With regards to Ponds 1 to 9, we note the following:

- Pond 1 is noted as being most at risk of negative impacts as a result of proximity to proposed earthworks. Whilst negative for eDNA in 2024, the pond is located within close proximity to a number of other ponds for which eDNA samples were positive. Given its proximity, we consider it probable that GCN will use the pond at times, as well as the terrestrial habitat between pond 1 and these other eDNA positive ponds. Therefore any impacts to the pond or its surrounding terrestrial habitat could lead to harm to GCN.
- Pond 9 returned a positive eDNA result. We note that the proposed removal workshops and heavy plant storage units are within 30 meters of the pond and therefore could impact GCN, especially during their terrestrial phase.

In considering the above, we advise that a fence, trap and clear scheme is devised and implemented ahead of any operations which could adversely affect GCN at these locations.

Furthermore, we advise that a Conservation Plan for GCN is submitted prior to determination of the application. We advise that the Conservation Plan includes (but is not limited to) the following:

- An assessment of impacts of the development. This assessment should include:
 - o Tabulated review of the extent, distribution and quality of GCN habitat to be removed, retained, enhanced and created, supported by drawings as appropriate; and
 - o Risks of incidental injury or killing.
- Submission of further details concerning GCN mitigation and compensation, including avoidance measures; extent of habitat retention and creation; and details of timing, phasing and duration of restoration activities and conservation measures.
- Submission of the principles of a long-term site management plan that seeks to manage appropriate parts of the restoring and restored site for GCN, particularly the ponds. We advise this includes: defined aims and objectives; habitat management prescriptions; surveillance; contingency measures if fish or invasive non-native species (INNS) are detected; licensing requirements; current and any proposed changes to tenure of the site; persons or bodies responsible for undertaking management and surveillance; long-term financial considerations; reporting requirements and proposed dates for updating or revising the plan.

We advise that the Conservation Plan includes the long-term commitments associated with previous licences for this site and provides an assessment of how these will align with the project and any new mitigation necessary.

Otters

Given the likely use of the site by otters crossing between watercourses, we advise that pre-works surveys are carried out during restoration. The EclA should propose when these should be undertaken and therefore secured through the approved plan if permission is granted.

Other Matters

Our comments above only relate specifically to matters included on our checklist, *Development Planning Advisory Service: Consultation Topics* (September 2018), which is published on our [website](#). We have not considered potential effects on other matters and do not rule out the potential for the proposed development to affect other interests.

We advise the applicant that, in addition to planning permission, it is their responsibility to ensure they secure all other permits/consents/licences relevant to their development. Please refer to our [website](#) for further details.

If you have any queries on the above, please do not hesitate to contact us.

Yn gywir / Yours faithfully

Eleanor Sullivan

Cynghorydd - Cynllunio Datblygu/Advisor - Development Planning
Cyfoeth Naturiol Cymru/Natural Resources Wales

E-bost/E-mail: southeastplanning@cyfoethnaturiolcymru.gov.uk

Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi./Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.

INTERNAL MEMORANDUM

To: Hugh Towns
From: Matt Davies (Ecologist)
Ext: 5278
Memo number: 1
Date of previous memo: -
Date: 02/04/2025

SUBJECT: P/25/0037 | Variation of conditions 4 (Duration of Restoration), 6 (Approved Plans) and 50 (Restoration Strategy) of planning permission APP/U6925/A/10/2129921 involving a revision to the restoration scheme. | Ffos Y Fran Land Reclamation Scheme East Of A4060 Slip Road Merthyr Tydfil CF48 4AE

DOCUMENTS SUBMITTED IN SUPPORT OF THE ABOVE APPLICATION

1. Ecological Impact Assessment (EcIA). Ffos-y-Fran Final Restoration Strategy prepared by Richards, Moorehead + Laing Ltd on behalf of MERTHYR (SOUTH WALES) LTD. 3274/11. Rev 0. Approved 05/12/2024.
2. Ffos-y-Fran Final Restoration Strategy 2025. Green Infrastructure Statement – February 2025. V1, dated: 19/02/2025 *prepared by* Richards, Moorehead + Laing Ltd.
3. Ffos-y-Fran Final Restoration Strategy 2025. Environmental Statement – Non-Technical Summary – January 2025 prepared by Richards, Moorehead + Laing Ltd.
4. Ffos-y-Fran Final Restoration Strategy. Environmental Statement (ES) Technical Report – January 2025 *prepared by* Richards, Moorehead + Laing Ltd on behalf of MERTHYR (SOUTH WALES) LTD.
5. ES Volume 3 – Appendix 11 – Hydrology Appendix 11C – Ponds Figure 11C. Received 07/02/2025.
6. ES Volume 3 – Appendix 11 – Ecology Appendix 11B – Pond HSI Table. Received 07/02/2025.
7. ES Volume 3 – Appendix 11 – Ecology Appendix 11A – 3274 Figure 11A Phase 1. Received 07/02/2025.
8. Restoration Aftercare Drawing No. 3274-RML-DR-L-54 Rev 01. Received 07/02/2025.
9. Environmental Impact Assessment (EIA). Ffos-y-Fran Final Restoration Strategy Scoping Report *prepared by* Richards, Moorehead + Laing Ltd *on behalf of* MERTHYR (SOUTH WALES) LTD. 3274/11. Rev 2. Date: 19/07/2024.

OTHER RELEVANT DOCUMENTS / E-MAILS

- A. E-mail from LPA Ecologist to Dr Matthew Robson (Principal Ecologist, RML), dated 28/09/2023 @11:45.
- B. Internal Memorandum (#1) from LPA Ecologist to Mr David Cross (Group Leader Development Control, MTCBC) Dated 14/08/2024.
- C. E-mail from LPA Ecologist to Mr Hugh Towns (Carmarthenshire County Council), dated 24/02/2025 @16:19.

COMMENTS

General

These comments are purely made regarding the proposed revised restoration scheme as presented in this application. It is worth noting however that a Net Benefit for Biodiversity (NBB) in comparison with baseline conditions could be achieved *whether or not* the overburdens are removed and used to infill the void.

Document 1 (EcIA)

Central Ecological Area (CEA)

Document 1 refers to the Central Ecological Area (CEA). There have been several requests for the CEA to be included within the restoration plan (see for example, Documents A and B). To re-iterate comments from e-mail A - including the CEA would be of benefit to demonstrate protection of the CEA and its connections/relationship with the rest of the restored site.

Bats (example excerpts below)

Document 1, page 48

“The main buildings on site, comprising the coal washing plant, workshops, and offices, were considered unlikely to support roosting bats due to the materials used in their construction and generally open aspect.”

Document 1, Table 10, page 52

“Negligible suitable foraging and community habitat within the redline boundary. No trees would be impacted which have the potential to support bat roosts. Buildings have negligible to moderate potential to support bats. Suitable habitat within the CES. There is limited connectivity to the SAC which has lesser horseshoe bats are a feature of interest. The site lies to the north of the Heads of the Valley road.”

There is insufficient detail/evidence regarding these conclusions. One example, was a PRA undertaken of the buildings? If so, could this be included in the reporting? In general, more details/information/justification for all conclusions reached in the document regarding bats are required.

Ponds

Document 1, page 57

“There is also the potential to enhance existing ponds for biodiversity.”

All measures need to be definite. It needs to be clear what will be done, rather than stating the potential.

Document 1 includes several references to Pond 8 being removed. Is there to be an equivalent pond added in compensation?

Document 1, pages 65 + 66

*“Those remaining ponds closest to the majority of the earthworks will remain fenced off from the works and this is expected to provide **a sufficient buffer** to any potential pollution events resulting from machinery or run-off from dust-suppression water spraying.”*

Further details of the **buffer(s)** are required?

Monitoring

Document 1 refers to monitoring, specifically for example, regarding restored habitats (e.g., trees, grassland), GCN and birds. Monitoring of other species/groups of species should be included, e.g., bats, reptiles, invertebrates.

Overburdens

Document 1, page 6

*“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.**”*

Document 3, Figure 1 shows OB3 as a proposed Lapwing nesting area.

The motorcross track on OB3 is shown on the Phase 1 habitat map and target noted, however, there is no other reference to it within the document. As set out, if OB3 is retained, it must be returned to an area of upland grassland with areas of woodland planting and heathland on the flanks and lower slopes. It must also be made suitable for nesting Lapwing.

Lighting – all works will be undertaken in daylight hours removing any need for Artificial Light At Night.

Document 2 (GIS)

This document is acceptable dependent upon the details that will be provided by the long-term management plan.

Overburden 3

Figure 1 shows OB3 as a proposed Lapwing nesting area.

Document 3, page 10

“The two overburden mounds OB2 and OB3 would remain largely as they appear today, and the lower slopes grass seeded and planted with native tree species.”

To re-iterate the comments made with reference to Document 1 – ‘... if OB3 is retained, it must be returned to an area of upland grassland with areas of woodland planting and heathland on the flanks and lower slopes. It must also be made suitable for nesting Lapwing.’

REQUIREMENTS

Issues as set out in comments above to be addressed.

E-mail C above requested the ecological reports regarding the following:

- o *Phase 1 habitat survey*
- o *Great Crested Newt*
- o *Otter*
- o *Badger*

These are still required.

Comments within e-mail A (above) included several issues (age of data, bat surveys, bird surveys, reptile surveys, invertebrate surveys, pond/scrape additions, modification of the existing man-made ponds, inclusion of the Central Ecological Area within the restoration plan, GIS, long-term management plan). NB aside from the modification of existing ponds and the provision of a GIS, these issues have not been addressed. This is required.

The local authority must be assured that the proposed restoration plan will be viable. As such, all documentation relevant to the planning application in terms of ecology must be submitted for consideration pre-determination. This includes the following:

- o A long-term habitat maintenance, management and monitoring plan (termed a ‘Restoration + Aftercare Management Plan’ within the supporting documentation)
- o Construction Environmental Management Plan - Biodiversity (CEMP-B)
- o Precautionary Working Method Statement (PWMS) for all relevant habitats and species

NB Document 1 describes a 5-year period of aftercare from 2028 onwards returning the site to urban common for grazing and public amenity thereafter. The habitat management plan must be a *long-term strategy*, preferably in perpetuity, but for at least 30 years following the restoration of habitats. In addition, the funding mechanism for the management must be established and must anticipate rising costs over time.

As set out in e-mail C:

A long-term habitat management and monitoring plan is required to accompany the GIS as per PPW12. This should include:

- o Details of retained landscaping/habitat/green infrastructure;
- o Details of newly proposed landscaping/habitat/green infrastructure;
- o A planting plan. NB all species will be native and of local (if not Welsh) provenance;
- o The immediate and long term (for a scheme of this scale – in perpetuity or at least 30 years) maintenance and management measures for all onsite landscaping/habitat/green infrastructure (both retained and new). NB this must include the Central Ecological Area (CES);
- o Details of any other ecological measures if relevant, e.g., bat boxes, bird boxes, hibernacula, etc;
- o Monitoring post-development for all onsite landscaping/habitat/green infrastructure/ and other ecological measures;
- o Details of the funding mechanisms to meet the maintenance, management and monitoring objectives plus details of those responsible. NB the funding mechanism must anticipate and take account of costs rising over time;
- o How a net benefit for biodiversity will be achieved within as short a time as possible and be locally responsive and relevant to local circumstances.



TECHNICAL NOTE 001

DATE:	15 April 2025	CONFIDENTIALITY:	Confidential
SUBJECT:	Geotechnical and Proposed Restoration Stability		
PROJECT:	Ffos y Fran	AUTHOR:	K D Power
CHECKED:	A Hale	APPROVED:	R Grainger

SUMMARY

The documents, reports and plans, provided on the planning portal with respect to the geotechnical aspects of the proposed restoration and the ongoing long-term stability of the tips and slopes at Ffos-y-Fran have been reviewed. The documents do not provide confidence that the tips and slopes will remain stable and will not pose an ongoing risk to residents of Merthyr Tydfil and a potential financial burden to Merthyr Tydfil County Borough Council and their successors.

INTRODUCTION

Merthyr Tydfil County Borough Council retained WSP UK Ltd to review and provide comment on the geotechnical and ground stability matters for a proposed change to the restoration proposals for the former Ffos-y-Fran Open Cast Coal Mine. The review has been undertaken on those documents lodged as part of the planning application; P/25/0037 - Variation of conditions 4 (Duration of Restoration), 6 (Approved Plans) and 50 (Restoration Strategy) of planning permission APP/U6925/A/10/2129921.

The following documents were reviewed

- Ffos-y-Fran Final Restoration Strategy 2025 Environmental Statement – Non-Technical Summary – January 2025.
- Ffos-y-Fran Restoration Strategy Environmental Statement (ES) ES Volume 1 – Technical Report, January 2025.
- ES Volume 3 Appendix 7A to 7J.

It is noted that no detailed geotechnical report has been submitted to support the planning application and the only details with respect to any geotechnical assessment or design is contained within Section 7 of the Ffos-y-Fran Restoration Strategy Environmental Statement.

SIGNIFICANT OBSERVATIONS

A review of the submitted documents gives rise to a number of significant observations, as set out below:

- It is noted that there are three overburden tips constructed during the mining operation, tips OB1, OB2 and OB3. The Environmental Statement (ES) indicates that these were initially assessed, for stability, in accordance with code and practices current at the time for temporary tips. These overburden tips are noted to contain glacial till, colliery spoil and sedimentary rock; mudstone, siltstone and sandstones, in addition, although not described, they are likely to include other materials including ironstone and seat-earths. No records have been supplied indicating the volumes or locations of where these materials were deposited within the overburden tips. Further, no records have been supplied indicating if any compaction has been applied to the materials within the tips. It is assumed that as these were constructed as temporary earthworks and that they were

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constructed by tracking the material into place, as they were temporary earthworks, rather than being compacted to any engineering specification.

- Tip OB1 failed in 2022 on its western side, the ES notes that this was due to the toe being excavated but no documentation is provided to support this and there appears, based upon the evidence supplied, to have been no further investigation into the failure. While the ES also states that further earthworks are required to ensure long-term stability, there are no records of any ground investigations being undertaken to inform stability analysis undertaken. Therefore, the stability analysis may not reflect the medium to long-term performance of tip OB1.
- The ES states with respect to the stability analysis of the north, east and south sides of tip OB1 that they will remain stable in the long-term based upon the fact that the design undertaken prior to them being tipped indicated them to be so. Furthermore, the ES provides factors of safety against failure for these slopes of between 1.19 and 1.23. Current British Standards, in place since 2004, do not adopt a lumped factor of safety approach, the now withdrawn *BS 6031: 1981 Code of Practice for Earthworks* did so. This, withdrawn standard, requires for permanent slopes a factor of safety of 1.3 to 1.4 for a first-time slide, although this is based upon a good standard of investigation and information being available. The factors of safety proposed appear from the information supplied to be based upon analysis undertaken by Miller Argent (South Wales) Ltd prior to the development of the open cast mine. The ES suggests the following:
 - That Tip OB1 was designed as a temporary tip.
 - That there are no records of how and where the various materials were placed within the tip.
 - That there are no records of the materials being compacted to any engineering specification.
 - That the factors of safety against slope instability are low compared with design standards.
- It is concluded that the medium to long-term stability of tip OB1 in the permanent situation cannot be relied upon and may represent a significant ongoing risk.
- With respect to tips OB2 and OB3, the ES notes that they have suffered small scale instabilities, but these are considered to have no significance, the basis of this statement is unclear. The ES states that they were constructed to the approved design, although this does appear to be designed for temporary tips. It further provides factors of safety for tips OB2 and OB3 of 1.18 to 1.26 and 1.18 to 1.35, respectively. As with OB1, no information has been provided as to the construction of the tips, no investigations have been undertaken to determine the structure of the geological materials and groundwater within the tip and provide geotechnical parameters for the materials. Given this and the low factors of safety, the medium and long-term stability of OB2 and OB3 must be questioned and the long term stability cannot be relied upon and may represent a significant ongoing risk.
- It is noted that the ES states on a number of occasions that the overburden tips have remained stable through the life of the opencast mine, even though failures of various sizes have been

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reported within the tips, and it is suggested that for this reason they can be considered stable in the long-term. This does not consider the ongoing long-term impact of climate change and the likely weathering of soils and rock within the tips, particularly as there are no records of the material being compacted to an engineering standard.

- The ES proposes that Backfill slope BF1 is re-engineered and provides limited stability analysis. It is noted that this analysis has been undertaken on a lumped factor of safety approach. This analysis does not appear to have been based upon any geotechnical investigation to provide information on the structure and physical characteristics of the materials within the slope or the groundwater regime. No information has been provided on the actual approach to the re-engineering of the slope or the source of the proposed compacted material within the toe, a critical element of the design. The soil strength parameters adopted for the “*general fill*” forming the side slope of BF1 and the compacted fill supporting the toe within the slope analysis are unrealistic and overly optimistic, therefore the medium to long-term stability of this slope cannot be relied upon.
- The proposed restoration includes the retention of parts of the open cast side walls; the stability of the exposed faces is discussed in terms of the stability analysis undertaken, prior to the mine being developed, by Miller Argent (South Wales) Ltd. There does not appear to have been any review of these results following on from the mining operations when a better understanding of the geology, its structure and the geotechnical parameters may have been attainable. The ES does discuss a number of ongoing risks and potential mitigation, but it does not address the overall stability, with respect to the southern side wall it notes that the original analysis identified small scale failures/features that were “*...only of possible significance as a safety consideration during the mining operational phase*”. If such features remain exposed, they will continue to represent an ongoing health and safety risk. With respect to the eastern sidewall, the ES reports various instabilities that occurred during the mining operations, including some large-scale spalling. It also states that “*rock gutters*” will be installed to mitigate the risk from rockfalls, while these are shown on a number of sketches the basis of size selection, where shown, is unclear and there is no evidence of any analysis or assessment being undertaken to determine the likely sizes, frequency or location of rockfalls. In addition, one of the sketches indicates that there is an abandoned adit within the face, it is not clear if this will be or has been treated to prevent collapse within the length that may have an impact upon the rock faces above.
- A scree slope developed below the east side wall during the mining operations as a result of large-scale spalling, based upon the documents it is proposed to retain the scree slope and possibly add further material. No apparent assessment of the stability of this slope has been undertaken to confirm the ongoing stability.
- The lagoons and water treatment areas constructed as part of the mining operations that are to remain are stated to have remained stable during the site operations and will continue to do so “*...in*

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perpetuity” providing they are not impacted by any engineering works; no evidence or justification to support this has been provided.

- The ES appears to dismiss the impact upon climate change, particularly on OB2 and OB3. Given the recent history of a number of tip failures across South Wales as a result of high rainfall events these appear to be an optimistic view, which is not likely to borne out in time.

CONCLUSIONS AND RECOMMENDATIONS

The submission does not adequately consider the stability of the proposed slopes and rockfaces for the proposed restoration scheme. There is insufficient evidence that a rigorous assessment of the soil parameters and groundwater regime has been undertaken. It is considered that based on the scheme proposals contained within documents submitted to support the planning application there will remain a significant risk of slope instability in the medium to long term.

Based upon the documents provided on the planning portal there is little evidence that the tips and slopes that will be left following restoration will be stable in the medium to long-term and they may continue to remain at risk of failure. With respect to the overburden tips, an almost total reliance has been placed upon work undertaken prior to the development of the mine and the overburden tips, their actual construction and the materials placed within them does not appear to have been considered.

The impact of the side wall faces that it is proposed to leave exposed does not appear to have been fully considered, particularly as it is acknowledged that further rockfalls may occur.

The stability of the scree slope below the east sidewall does not appear to have been considered.

The impact of climate change on the ongoing stability of the tips and slopes does not appear to have been considered, and in some cases the impacts have been dismissed with no supporting evidence.

Based upon the evidence in the documents supplied, from a geotechnical perspective, the proposed restoration does not appear to leave a site that will be stable in the long term.

In order to support the restoration plan, it is recommended that the works are supported by detailed geotechnical works, including but not limited to:

- Sufficient ground investigations of tips OB1, OB2 and OB3 to determine their make-up, their condition and to provide information on the geotechnical characteristics of the materials and groundwater within them. This should be used to develop a ground model to support medium and long-term stability analysis. This should also take into account the impacts of ongoing climate change.
- Ground investigation of backfill slope BF1 to determine its condition and to provide information on the geotechnical characteristics of the materials and groundwater within. This will allow the

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development of a more reflective ground model and allow realistic geotechnical parameters to be determined to adopt in slope stability analyses. Again, the impacts of climate change should be considered, particularly with respect to groundwater and surface water management.

- The exposed rock faces in the side slopes should be subject to more rigorous assessment and a better understanding of the risk of rockfall developed. This will allow a better understanding of the adequacy and acceptability of the mitigation measures to be made.
- The long-term impact of climate change should be considered for all elements of the proposed restoration.



f.a.o. Jon Stoddard
Richards, Moorehead & Laing Ltd

(Via email: j.stoddard@rmlconsult.com)

Dyddiad/Date: 13th June 2025

Ein Cyf / Our ref: P/25/0037

Eich Cyf / Your ref:

Gofynnwch am / Please ask for: Hugh Towns

Llinell Uniongyrchol / Direct Line: 01558 825373

e-bost / e-mail: ahtowns@cardamarthenshire.gov.uk

Dear Mr Stoddard

RE: Variation of conditions 4 (Duration of Restoration), 6 (Approved Plans) and 50 (Restoration Strategy) of planning permission APP/U6925/A/10/2129921 involving a revision to the restoration scheme.

I refer to your planning application for the above and having reviewed the information provided and the consultation responses received to date, I would like to raise the following points:

1. A copy of the consultation response from Natural Resources Wales (dated 17 April 2025) is attached for your consideration. You will note from the contents that they are seeking additional information to be submitted in order to fully consider the merits of the proposal, which will need to be provided in order to progress the application.
2. I attach 'Technical Note 001' in relation to geotechnical and stability matters, which has been produced by WSP on behalf of the Council. Within the 'Conclusions and Recommendations' there are a number of matters that will need to be addressed. There is also reference in the ES to the reprofiling of the slopes around OB2 and OB3, however there appears to be no assessment as to whether such works would destabilise the outer faces and what environmental/amenity benefits/losses there would be from doing that. I would assume that you have the data available and the points raised can be suitably addressed by your geotechnical consultant, which may require further investigation and boreholes where necessary.
3. I attach the response of the Councils Ecologist, which provides comment in respect of the reports submitted and seeks further information and clarification on a few areas. A request has also made to have sight of other reports that have been referred to in the submission which have not been included. Points are also raised in respect of the long-term management of the proposal that will need to be addressed.
4. In the Scoping Opinion issued by the LPA on 4 October 2024 it requested that an assessment of the likely differences between the consented scheme and the alternative restoration proposals be provided, which should have included 'Noise' and be considered having regards to the current Planning Guidance (Wales), Technical Advice Note (Wales)11, Noise – October 1997, with baseline levels at nearest noise sensitive receptors and potential impacts from restoration activities to be assessed at sensitive receptors, with a

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mitigation plan provided, if necessary. There is no section in the ES dealing with noise which needs to be addressed.

Given the diminished operations now taking place on site, it should be straight forward to directly compare and assess the noise monitoring data already collected and the assumed data for the proposed scheme.

5. The current planning application includes surface water drainage proposals for only 50.385Ha of the western side as indicated by the blue area. The proposals detailed in the 2015 Phase 1 planning application have not yet been implemented and need to be reviewed further. Composite surface water drainage proposals are required to include the entire site. It is acknowledged that a meeting with the Council's engineers has already taken place to review the drainage scheme for Phase 1 and that your drainage engineers are reviewing this further.
6. One of the recommendations of the Flood Consequences Assessment & Drainage Strategy produced by Waterco was to undertake detailed design of the proposed ditches and culverts. It is recognised that further work on this has been undertaken since the submission of the planning application, but this does not yet form part of submission. Full construction details for all contour drains should be provided along with Micro Drainage calculations confirming the capacity of any new drains to cater for the Q100 +40% climate change. The type of construction should be referenced to the relevant drainage runs on the layout plan. The details should also clarify the drainage proposal for Phase 1 and 2 and how this links to the wider site.
7. A table should be provided identifying the land uses proposed in the approved restoration strategy compared to the land uses now proposed. This would assist in identifying Net Biodiversity Benefits.
8. It has been set out in the ES that the current application has been put forward as an alternative to the original strategy, which would include a number of notable differences, particularly the retention of a body of water and the retention of OB2 and OB3. These are significant changes that deviate considerably from the approved scheme, which would achieve a more 'naturalistic' final land form.

The ES refers (at paras 1.7.3 and 1.7.4) to a report commissioned by the Welsh Government that identified potential risks to the restoration of the site due to insufficient funds being set aside. The ES suggests (at para 1.7.6) that the necessary bulk earth works to deliver the approved restoration scheme would be "financially prohibitive", which implies that the approved restoration strategy is not deliverable. However, no information has been provided to date as part of the application to demonstrate the viability (or otherwise) of the approved restoration scheme. There appears to be a reliance (in para 4.3.1 of the ES) on the Escrow account funds being the only funds available to complete the restoration of the site, following the cessation of coal extraction. However, it is understood that this Escrow account was merely intended to supplement the progressive restoration works. Condition 4 of the current 2011 planning consent requires that the final restoration of the site be achieved by December 2024, irrespective of the availability of Escrow account (or other funding). Obviously, that has not yet happened, but compliance with Condition 4 is the Council's default expectation unless/until there is an approval for any alternative restoration scheme. Further justification is required to demonstrate

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what the anticipated costs are for the delivery of the approved restoration strategy and why this cannot be reasonably met. This is likely to be an important consideration in considering the acceptability (or otherwise) of any alternative restoration proposals. In this regard, it is understood that, outside of the Escrow account funds, the most recently published company accounts for the applicant (March 2025) include provision of some £91.2 million for meeting the requirements of the approved restoration scheme. The applicant is therefore requested to provide clear and transparent information to support the suggestion that the costs of the approved restoration scheme are financially prohibitive, having regard to the full resources available to the applicant.

9. Section 6 in Part 2 of the Mid Glamorgan County Council Act 1987 sets out a mechanism in which a bond or such other means as may be approved can be required when granting planning permission towards securing the performance of any conditions relating to landscaping or the preservation, restoration or reinstatement of land, including its aftercare. Similar arrangements can also be made by a conventional planning obligation under section 106 of the Town & Country Planning Act 1990. It needs to be demonstrated that the revised restoration scheme is viable and can be fully delivered for the amount of money in the bond or any alternative security (such as the Escrow account) that is relied on, including aftercare. If there is any shortfall, consideration would need to be given to the provision made being supplemented. In a similar manner to what was agreed as part of the Phase 2a restoration works, it would be appropriate for a schedule of works to be set out, together with the anticipated costings to deliver the revised restoration scheme, which should also take into account any agreed costings for the restoration works currently being progressed. It is understood that this information is currently being prepared and shall be available in due course for consideration.
10. In light of the points raised about seeking further information and clarification on the proposal, may I suggest that an extension of time for determination of the application be agreed until the end of October 2025.

There does not appear to be any insurmountable issues, provided that the additional information requested is provided in a suitable form, and once you have had the opportunity to review the above comments, it may be helpful to set up a meeting to go through any of the points.

Yours sincerely



JUDITH JONES
DIRECTOR OF NEIGHBOURHOOD SERVICES

pp

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3274/01 Letters Out/2025-07-07

If telephoning please ask for: Jon Stoddard

David Cross
Group Leader Development Control,
Merthyr Tydfil County Borough Council,
Unit 5 Triangle Business Park,
Pentrebach,
Merthyr Tydfil,
CF48 4TQ

Monday 7th July 2025

By e-mail to: david.cross@merthyr.gov.uk

Dear David,

RE: Ffos-y-Fran - Variation of conditions 4 (Duration and Restoration), 6 (Approved Plans) and 50 (Restoration Strategy) of planning permission APP/U6925/A/10/2129921 involving a revision to the restoration scheme.

We are in receipt of your letter dated 13th June 2025 that refers to the above planning application and the consultation responses that you have received to date. Your letter contains ten points and also refers to other consultee responses by the following parties:

- MTCBC Internal Memorandum: Dated 02/04/2025
- Natural Resources Wales: NRW Reference CAS-275294-H025
- Technical Note 001 – WSP dated 15th April 2025

Please see below our response to your letter of 13th June 2025 that is set out in two parts:-

Part 1 – On behalf of our client the Applicant Merthyr (South Wales) Ltd (MSW), we set out our response as follows to each of the ten points in your letter and then to the points raised in the Internal Memo from the County Ecologist.

Part 2 – MSW response to points raised in Natural Resources Wales

A separate response to the Technical Note 001 by consultants WSP (dated 15th April 2025) is currently being prepared by geotechnical specialists James Associates and will be forwarded to MTCBC under separate cover.



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Part 1 – Response to MTCBC.

The planning application was validated on 19th February 2025 and included a statutory EIA that had been prepared over a number of months following the submission of a Scoping Report in July 2024. During that time, MSW have convened a number of Technical Working Group (TWG) meetings (3No.) that were well attended by the statutory consultees including MTCBC and NRW and hosted (by MSW) at Cwmbargoed Disposal Point. At the TWG meetings, there was opportunity for the parties to clarify any aspect of the planning application including the scope of the EIA that was in process, and the results of the ongoing work presented by the technical specialists at the meetings. It is therefore disappointing to receive the consultation response to aspects of the application and assessment that could have been raised and agreed at the TWG meetings, rather than now causing unnecessary delays in determination of the application. We also note the dates of the responses (April 2025), in that it would have been helpful if we had received these responses earlier in order to address any issues prior to the target determination date of mid-June 2025.

We are also disappointed to see that out of the ten points you raise in your letter, two relate to the funding of the restoration works and the ESCROW account. We do not believe these to be material planning considerations and have no bearing on planning policy or legislation and therefore are of no merit. We now respond to each of the ten points as follows:-

1. NRW Consultation Response (17th April 2025)

NRW are requesting additional information to be submitted to fully consider the merits of the proposal which MTCBC need to be provided to progress that application. NRW state that they have concerns about the application because inadequate information has been provided regarding land contamination, pollution prevention and European Protected Species (EPS). If these concerns had been raised at any of the TWG meetings, then perhaps these concerns could have been addressed much earlier, especially as some of the issues raised relate to seasonally constrained matters such as EPS. We are also concerned that some of the content in NRW's response appear to demonstrate a fundamental misunderstanding about the intent of the restoration proposals. It is also worthy of note that the site has been the subject of many reports and investigations over the past 30 years and a significant amount of data has already been collected, including previous environmental statements and public inquiries at which the hydrogeology and hydrology was debated at length by experts with the NRW (and its predecessors) before planning permission was eventually approved by the Planning Inspector. This included consideration of the hydrogeology of the site on restoration which we believe has not been fundamentally changed by the mining operations or our alternative proposals for restoration, as demonstrated by the rebound in the groundwater levels. In addition, a vast amount of data has also been gathered by MSW under the conditions of the existing planning consent regarding water quality both on and off-site all of which has been considered by our experts in preparation of our application. A full response to the points raised by NRW are set out on **Part 2** of this letter below.

2. Technical Note 001

The Technical Note has been prepared by WSP and the response of MSW's geotechnical expert James Associates is currently being prepared and will be forwarded under separate cover. Whilst we respect and note the opinion given by your consultant this appears to be based on a desk-top assessment of Ffos-y-Fran, made without the benefit of any site visit, technical discussions with the applicant or a knowledge of the vast amount of 'other' background and supporting information gathered over the last 30 years.



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As a result, we are concerned that whilst this opinion has been given in good faith, it has not taken account of all the available information, and through no fault of their own it raises questions about WSP's current level of understanding about the site on which their judgement is based in the Technical Note. For example, the following sentence raises serious concerns: -

"The documents do not provide confidence that the tips and slopes will remain stable and will not pose an ongoing risk to residents of Merthyr Tydfil".

We are not sure as to the context in which this statement is raised, without knowledge of all available information or the scope of services requested by MTCBC from the consultant. At the very least, this statement alone could cause considerable concern and alarm to decision makers, statutory environmental bodies, the residents of Merthyr Tydfil and indeed MSW, particularly in light of the sensitivity and public debate currently ongoing regarding coal tips in South Wales. Overburden mounds (OB) are distinctly different structures to coal tips in the Valleys which generally consist of washery discard, weak rock and seat earths containing high levels of moisture, loosely tipped onto unprepared and unconsolidated ground on the side of a hill or mountain, with no design, considerations for drainage, inspection regimes or maintenance (until recently).

In contrast, OB are designed engineered structures following site investigation work, signed off and inspected by a Geotechnical Specialist under the Quarries Regs 1999, in full knowledge of the rock and other materials contained within, which are placed in 4 – 5 metre layers transported directly from the mine and compacted by fully laden 160 tonne dump trucks and bulldozers, onto prepared ground with underdrainage as recommended. As an added benefit, the construction of the OB at Ffos-y-Fran were overseen by a resident full-time Geotechnical Specialist. In light of this information, there is considered to be no ongoing risk to the residents of Merthyr Tydfil, a fact which could be reinforced by a site visit due to the geographical location and topography of the site and surrounding area relative to the OBs.

These are all issues which would have been debated and considered elsewhere recently in the decisions of other Local Authorities in South Wales (and elsewhere) to approve similar proposals to incorporate OB into the final restored landscape. Such examples can be seen at East Pit, Margam, Selar and Nant Helen opencast sites, some of which include OB significantly larger than at Ffos-y-Fran. All of these mounds would have been constructed in a similar way as Ffos-y-Fran and contain similar materials. Full responses to the points raised by WSP will be undertaken by geotechnical advisors James Associates and forwarded to MTCBC under separate cover.

3. Internal Memorandum from the County Ecologist

The Internal Memorandum (IM) dated 2nd April 2025 opens with the general comment:

"It is worth noting however that a Net Benefit for Biodiversity (NBB) in comparison with baseline conditions could be achieved *whether or not* the overburden mounds are removed and used to infill the void".

This statement does not consider the wider environmental benefits of retaining the overburden mounds as set out in the Green Infrastructure Statement and Environmental Statement. It merely states that the two alternatives have the potential to contribute to a NBB status.



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Central Ecological Area (CEA)

As you will be aware the CEA falls outside the red line boundary of the S73 application and MSW have previously responded to this matter in a response to the scoping opinion letter dated 14th October 2024 that states: -

The Central Ecological Management Plan was prepared in 2009 by RPS Planning & Development on behalf of Miller Argent (the previous operator of the mine before it came into the ownership of Merthyr (South Wales) Ltd) to discharge condition 50 of planning permission APP/U6925/A/10/2129921. The ecological management plan was for the period 2009-2024. It is considered therefore that the period of long-term management has now ended, and therefore all obligations of the landowner regarding the SINC have been met. The SINC will be unaffected by the final restoration strategy and lies outside the red line boundary of the application site.

MSW maintain their position on this matter. Should MTCBC wish to discuss the matter of the CEA separately, we would invite them to do so outside the remit of this application.

Bats

The IM requires more information about the presence of bats in the buildings and for a Preliminary Roost Assessment (PRA) to be undertaken of the buildings to be removed. The IM refers to page 48 of the ECIA that states

“None of the trees within the surveyed area were of suitable size or suitability for bat roosting potential. The main buildings on site, comprising the coal washing plant, workshops, and offices, were considered unlikely to support roosting bats due to the materials used in their construction and generally open aspect.”

The report was authored by a licenced bat ecologist and therefore we maintain our position on this matter and do not consider further survey work is required or would result in any change to our current position. Please note that the document referred to in the IM does not form part of the planning application and was issued to the County Ecologist for information.

Ponds

More detail on the proposed works to the ponds are currently being prepared and can be found in Appendix A to this letter and will form part of a specification for landscape and ecology.

Monitoring

The ES makes several recommendations for monitoring of various environmental elements in each chapter. May we suggest that the County Ecologist reviews the relevant ES Chapter 11 Ecology for proposed monitoring measures. A monitoring schedule for all environmental elements could be prepared as a condition to the approval of the application.

OB3

It is the intention of MSW to submit a planning application for a permanent motocross track on OB3. Should the application not come forward or is refused, then the area would be returned to upland grassland suitable for nesting Lapwing as shown on the proposed Restoration & Aftercare plan (Figure 4.1 of the ES).

Ecological Reports

The IM requests various ecological reports to be made available. The ES Chapter 11 Ecology includes survey information, and an Ecological Impact Assessment (ECIA) has also been previously provided to the County Ecologist.



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Pre-Determination Documents

The IM requests that the following documents should be provided pre-determination: -

- A long-term habitat, maintenance and monitoring plan (termed a Restoration + Aftercare Management Plan within the supporting documentation)
- Construction Environmental Management Plan (CEMP)
- Precautionary Working Method Statement (PWMS) for all relevant habitats and species

Long Term Management Plan

MTCBC request that a long-term management plan to cover a minimum period of 30 years is prepared and should include a funding mechanism for the management that would anticipate rising costs over time.

This would need to be prepared in consultation and agreement with the Gelligaer and Merthyr Commoners Association (GMCA) and could take a significant amount of time to prepare and agree with the various interested parties. For this reason, and to allow for the progressive restoration of the site to continue unheeded, may we suggest that all the documents above could be a condition of the planning consent with suitable timescales put in place for each.

MSW would be willing to prepare a five-year management plan, in line with previous schemes which required a five-year aftercare plan, but not a minimum period of 30 years as this time period may be outside the control of MSW and ultimately be the responsibility of the GMCA.

4. Noise

You refer to the Scoping Opinion issued by the LPA on 4th October 2024 and request an assessment of the likely differences between the consented scheme and the alternative restoration proposals noise levels. We have previously responded to this subject of noise in our letter to you dated 14/10/2024 item 9. In essence noise, was considered to be an important environmental factor during the operational phase only when the mine was active. The ES refers to noise in several locations and specifically under the heading Noise in Chapter 15 Human Health covering paragraphs 15.6.5 – 15.6.13. Please confirm if this, in your opinion, adequately addresses issues surrounding potential noise nuisance during restoration operations. MSW consider the issue of noise nuisance highly unlikely, particularly given that the plant to be used in restoration is significantly smaller and less in both quantity and volume than during mining operations (which used PC3000 excavators & Cat 777 dump trucks) and given the extremely low numbers of noise complaints received in the last 5 years of mining. MSW would be happy to accept the current levels of noise permitted by Condition 17 of the Appeal decision dated 06/05/11 which incidentally permits increased noise levels during removal of soil mounds.

5. Surface Water Drainage

The planning application to vary conditions did not specifically consider and comment on the area referred to as Phase 1 on the western flank of the site that we had assumed was complete. An assessment of the proposed surface water drainage was undertaken by Waterco, which did include flood risks in Phase 1, and is reported in Appendix 10A of the ES and includes a Flood Consequence Assessment and Drainage Strategy. The recent matter raised by MTCBC regarding the Phase 1 drainage proposals not being totally implemented is now being considered as a separate matter by our consultants and should not affect the determination of the planning application to vary conditions.

This is being progressed by MSW with MTCBC engineers as a separate matter to the planning application, in particular, the projected flow rates through the Nant Morlais culverts under the A4060 during intense storm events (i.e. 1 in 100-year storm + 40% for climate change).

6. Proposed Drainage and Culverts

Construction details of drainage and culverts are being prepared for each works package as each phase comes forward and this is currently ongoing and being managed by MSW, in consultation with MTCBC engineers and planning officers. Drainage calculations have been modelled using 2D TufLOW model, ReFH2 rainfall assessment and Mannings formula approach to size the proposed drainage ditches. Micro Drainage is better suited to designing formal drainage systems (i.e. piped systems, as opposed to ditches).

The proposed contour drains and drainage ditches have been included in the model and the surface water catchments modelled with direct surface water flows (rainfall) having minimal impact on the levels of water contained in the lake during intense storm events. In addition, because of this, no impact is anticipated within the downstream watercourses compared with the existing situation. Full details and the results are reported in ES Appendix 10A – FCA and Drainage Strategy and ES Appendix 10C – Hydraulic Modelling Summary Note prepared by Waterco.

7. NBB Biodiversity Benefits Table

MTCBC have requested that a table should be prepared that compares land uses proposed in the alternative restoration scheme with the approved scheme that would assist in identifying Net Biodiversity Benefits (NBB). This table can be prepared and inserted into the Green Infrastructure Statement (GInfS) and re-issued.

8. Notable Differences

You state in the first paragraph that the current application has been put forward as an alternative to the original strategy, which would include a number of notable differences, particularly the retention of a body of water and the retention of OB2 and OB3. For clarity, the retention of a body of water is an incorrect description and misleading. It infers that the water is contained by a dam or other structure that is used to retain the waterbody. Previous debates about whether the waterbody is classified as a reservoir, have been concluded by a Panel Engineer who adjudged that the waterbody is not a reservoir. Fundamentally, the water which forms the lake is simply exposed groundwater revealed by excavation of overburden and coal from the main void. Had the void been filled in with overburden above the level of around 280 metres AOD, that groundwater would still have been there except it would have existed in the voids and pores between the rocks forming the backfill.

The ES paragraphs 1.7.3 – 1.7.6 were intended to put the Ffos-y-Fran restoration in context with other restoration proposals in South Wales.

The remaining points you raise in item 9 of your letter refer to the ESCROW account and various funding issues that we do not consider appropriate to comment on any further as we believe the focus of this letter should be to address the consultation responses relating to planning matters only. MSW have responded separately to matters relating to funding and the ESCROW account.

9. Costings to deliver the revised restoration scheme

Detailed costings to deliver the alternative restoration scheme and the subject of the S73 Application are currently being prepared by MSW and will be submitted to MTCBC in due course.

10. Extension of Time

You have requested an extension of time for determination of the application until end of October 2025 to allow for further information to be provided by MSW (and its experts) and clarification of the proposals. Whilst this is disappointing given the delays highlighted, MSW are agreeable to the extension of time but would appreciate further timely discussions as to exactly what, if any, outstanding information or clarifications are required before determination, and/or could be reasonably agreed as potential conditions to any planning consent being granted.

Part 2 – MSW response to NRW

NRW have responded to MTCBC in a letter dated 17th April 2025 stating they have concerns regarding land contamination, pollution prevention and European protected species. The alternative restoration put forward in the S73 planning application has significant less environmental risk to all these factors than the approved scheme. Please be reminded that the advantages of the alternative scheme over the approved scheme are clearly set out in Chapter 19 of the Environmental Statement and summarised in table 19.1. Please also be reminded that NRW have been in attendance at all the Technical Working Group (TWG) meetings and therefore have had chance to request further information or clarification of matters on several occasions.

We will now respond to the individual points raised by NRW as follows: -

Land Contamination

Geotechnical Engineering

NRW state that the extension of the originally permitted mine working has brought the eastern sidewall boundary closer to the active Trecatti Landfill site. The eastern sidewalls remain a significant distance away from Trecatti Landfill and have been designed to parameters specified by a geotechnical specialist. We therefore consider the risks to the short- and long-term stability of Trecatti to be negligible, as was concluded by James Associates report “Land Reclamation Extension” dated February 2020 that concluded: -

“Using the derived Mohr-Coulumb parameter values and adopting the proposed slope geometry and limit of excavation at surface should lead to stable excavation slopes being achieved which will maintain the structural integrity of the A4046 highway and the Biffa Landfill site located to the north east of the proposed extension”.

Hydrogeology

Pit Lake

A temporary reduction in pit lake levels is required for engineering works to stabilise the backfill on the western side of the void. This was not included in the ES as at the time of preparation it was not considered a requirement. The operation would be very similar in nature to the dewatering undertaken when the mine was operational to maintain low levels of water within the base of the void. MSW will prepare a similar dewatering plan to include an abstraction rate, pumping duration, monitoring of groundwater levels and discharge points.



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Dowlais Free Drainage System

NRW state that the ongoing maintenance of the pit lake level and groundwater modelling of the site relies heavily on the Dowlais Free Drainage System (DFDS) and that a risk assessment of the DFDS failing and a blow-out occurring should be undertaken. While the history of the site is well documented and researched, the full extent and condition of the DFDS is not known with complete accuracy or detail, as is the case with similar old workings and drainage networks the length and breadth of the South Wales coalfield. It is worth remembering that the previous ES relating to the currently accepted planning application explicitly assumes that the DFDS controls groundwater levels in the site area and will continue to do so post-closure, as reflected by the rebound of groundwater to similar pre-mining levels. As such the assumptions put forward in the current ES with respect to the DFDS do not present a departure from what has previously been accepted and agreed by other experts and NRW (and its predecessors). In addition, the flow of groundwater is also controlled by the fact that over 95 million m³ of backfill has been placed as part of Ffos-y-Fran, in addition to the backfill on the other side of the A4060 at the former Great White Tip and Incline Top sites. It seems that the most appropriate approach would be to propose a suitable monitoring regime that could be shared and agreed between the interested parties.

Hydrographs

Hydrographs are presented in Appendix 2 of the technical hydrogeological report. These also include observed / vs simulated levels. Table 8 in the technical report provides a summary of all known piezometers, as well as the date of the first and last readings. Depths and screened lithology are not provided but can be included if required.

Calibration of groundwater levels

NRW require clarification regarding the calibration of groundwater levels with the piezometer data. They refer to section 8.5.6 of the ES and reference ‘a one year period where there is no pit void to generate an initial distribution of groundwater heads’.

Paragraph 8.5.6 describes how the predictive groundwater model has been structured and used for the assessment. Impact is calculated by comparing output from a model in which the restoration scheme is implemented, and another that is not. “The one-year period where there is no pit void” does not represent the baseline condition.

The calibration approach, and justification for use of observed data, are discussed in detail in Section 4.3.1 of the Technical Hydrogeological report in ES Appendix 8A.

Post Restoration Aftercare Phase

NRW require further detail regarding the ongoing monitoring of the site. As stated above, it seems that the most appropriate approach would be to propose a suitable monitoring regime detailed in an Environmental Management Plan (EMP) that could be shared and agreed between the interested parties. This could be prepared and agreed prior to determining the application or a condition to be discharged prior to the post restoration phase commencing. It is worth noting that the site has operated for around 17 years with no major issues arising, during which time a significant volume of monitoring data has already been collected and analysed.

Pollution Prevention

NRW raise a number of points relating specifically to:

- Post Restoration Monitoring
- Baseline Year
- Site Drainage



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Post Restoration Monitoring Plan

The need for post restoration monitoring has been identified in ES Chapter 18 Environmental Management Plan and also within individual chapters of the ES. There is also a recommendation for a Construction Environmental Management Plan (CEMP) (also in ES Chapter 18) that would be prepared and implemented during the restoration phase. NRW have suggested that this could be secured through condition on any planning permission granted.

Baseline Year

The baseline year for the purposes of undertaking the EIA for the alternative restoration scheme has been discussed with NRW during the preparation of the restoration proposals and at TWG. It has been previously agreed that the baseline year should be 2023 when the operational phase of coal extraction ceased and significant changes to environmental factors on site came to an end. Refer to ES Chapter 3 and paragraphs 3.1.2 and 3.1.3. Where appropriate, historical data has been used to further inform the baseline conditions.

Site Drainage

Site drainage and surface water has been assessed in ES Chapter 10 and appendices 10A, and 10C.

Water Framework Directive (WFD) Assessment

NRW have made several comments on ES Appendix 10B WFD Assessment prepared by consultants Waterco relating to :-

- Insufficient information on impact to flows, water quality and biology as a result of change to the surface water catchment
- Insufficient information on the impact of the poor groundwater quality of the void and runoff and how this will impact surface water quality
- No details of how the restoration programme would achieve reduced contaminants
- No consideration to the in-combination impacts of reduced flow and poor water quality

The findings of the WFD assessment are that following the cessation of mining and the restoration of the site to urban common will improve water quality and subsequent biology and the mechanisms have been detailed in the WFD. Water quality and runoff will be improved compared to the baseline scenario. The restoration would have negligible impact on the rainwater catchment i.e. the areas draining to the quarry void will be near identical before and after restoration.

The quarry void water level is groundwater influenced, with direct surface water flows (rainfall) having minimal impact, and run off reporting the pit is expected to remain broadly similar to present baseline conditions. As a result of this, no impact is anticipated within the downstream watercourses. Monitoring data is available to quantify the rise and fall in the quarry void. This is already discussed in the ES and Appendices. Monitoring measures are proposed in each of the ES Chapters where considered appropriate.

Should any further clarifications or information be required, may we suggest a meeting with NRW, and the EIA consultant team involved with the water environment as there seems to be recurring issues that we would have hoped to be concluded. It seems that there remains some fundamental misunderstanding of what effects the alternative scheme would have in comparison to implementation of the approved scheme. This also applies to European Protected Species (EPS).

European Protected Species (EPS)

NRW have advised MTCBC that a Conservation Plan for GCN should be submitted prior to the determination of the application and that this should include: -

- An assessment of impacts of the development
- Submission of further details concerning GCN mitigation and compensation
- Submission of the principles of a long-term site management plan

MSW accept the need to prepare a Conservation Plan for GCN but would suggest that MTCBC could consider this as a condition of planning consent as the EIA has already considered the potential impact of the alternative restoration proposals. Furthermore, although NRW welcome the fact that ponds with positive eDNA samples will be retained and protected, there is no acknowledgement that the approved scheme would result in a far greater impact than the alternative if implemented as currently consented. Please also note that currently MSW currently have no plans to undertake any further presence absence surveys of the ponds unless consent of the alternative scheme is granted. Please also be reminded that any future survey work that is may be requires is seasonal and a major constraint to any other programme dependencies.

NRW have requested that long term management plans be prepared that include land outside the planning application boundary and further afield in Cwm Golau. While there may be merit in requesting this, any land outside the ownership of MSW cannot be included in any wider management plans on land they have no control of.

We hope that you find the contents of this letter fair and reasonable and clearly explain the position of MSW on these issues. We would also hope that we can continue to work together and negotiate a reasonable solution to determining the application in the near future. In the interests of delivering a sustainable restoration strategy and maintaining the good progress so far, MSW would be willing to meet face to face with MTCBC and NRW to agree a way forward that is acceptable to all parties.

Yours sincerely,

Jon Stoddard

Jon Stoddard
Principal Landscape Architect
RICHARDS, MOOREHEAD AND LAING



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FFOS-Y-FRAN LAND RECLAMATION SCHEME - ALTERNATIVE RESTORATION PROPOSALS

RESPONSE AND COMMENTS TO THE WSP TECHNICAL NOTE 001 (Dated 15th April 2025).

The following comments refer to bullet points listed under the ‘*Significant Observations*’ section and follow the bullet point sequence in the document *WSP Technical Note 001 (WSP 001)*.

- **Bullet point 1.**

WSP 001 - *No details of material types contained within the tips has been provided, nor the method of construction.*

The overburden mounds (OBs) were constructed to the approved designs in compliance with the requirements of The Quarries Regulations 1999 (QR 1999) and monitored by a full-time geotechnical specialist based at the site from the date of commencement, 2007 to 2013 with responsibility for this site alone. Thereafter, the OBs were inspected in accordance with the QR 1999.

Construction details and survey information (in LSS) for the base preparation to include stripping of topsoil, subsoil, un-suitable materials and sub-tip drainage, along with construction methodology are available.

It should be noted that some areas beneath OB2 and OB3 were excavated down to solid measures around the Hafod Coal Seam.

- **Bullet Point 2.**

The western side of OB1 failed in 2022 as a direct consequence of the western facing toe of the mound being re-excavated to a temporary profile as part of preparatory works to extend the mining operations. Cracks were noticed in the excavated slopes and all machinery and personnel were withdrawn from the area to a safe location. The slope then failed over the weekend of 30th July 2020. A further monitoring and inspection scheme was implemented and documentary evidence comprising pre-failure and post failure survey data along with a series of field notes compiled by the appointed geotechnical specialist confirm the reason for the failure.

The temporary profile in this case was never intended to be a final restored slope and it is accepted that a detailed engineering specification is necessary for the remediation of this mound which will include regrading the western slopes to around 1 in 3.

No further site investigation works are proposed. The original SI is considered to be adequate and can be provided if required.

- **Bullet Point 3.**

A detailed assessment of site records for the construction phase may enable a zonation of the materials contained within the mound to be defined though it would be considered 'conservative' to assume the mound to comprise mudstones and siltstone which will form the vast proportion of the mound, as is typical of opencast sites in South Wales, some of which have retained OB's as part of the approved restoration design (e.g. Celtic Energy Sites at East Pit, Margam, Nant Helen & Selar).

Due to the nature of the construction method the tipped material can be expected to be effectively homogenous on a large-scale. This can be confirmed by an assessment of the extensive borehole data which covers the majority of the site and sub-divides the sequence of measures into specific lithological units.

- **Bullet Point 4.**

We would dispute the fact that OB1 represents a significant ongoing risk particularly due to its construction, content, and its geographical location in relation to its surroundings. By adopting conservative parameter values for the materials contained within the OB, and with appropriate engineering design for the re-construction of the western face, the likelihood of OB failure can be absolutely minimised. In the highly unlikely event that OB failure ever occurred in the future, in our opinion it would not be catastrophic and at worst, would only involve slow moving creep with an extremely low consequence of failure.

We would propose reviewing site records again, before undertaking a further review of stability analyses to confirm the long-term stability of OB1.

- **Bullet Point 5.**

The observed failures are of minimal scale and of no significance with respect to overall tip stability. They have occurred due to the localised effects of surface drainage or minor excavation works undertaken at the toe of slopes and have been inspected, monitored, and remediated. In addition, in excess of 95 million m³ of overburden has been placed in backfill tips during the operation of the site with no instances of any significant instabilities being observed. Further information can be provided indicating the location of the failures, their scale and form along with the likely cause.

As set out above, given the available information regarding the construction, content, supervision, and geographical locations, we would dispute the fact that OB2 & OB3 represent any significant long term stability risks and present extremely low consequences of failure.

- **Bullet Point 6.**

Details of previous instabilities can be provided along with the justification for considering them to be insignificant.

Due to their size & nature OBs would never be compacted to an engineering standard as required for example by a Civil Engineering project, which is what WSP 001 appears to imply is necessary. However, an OB can be described as a designed engineered structure which is constructed following site investigation work, signed off and inspected by a Geotechnical Specialist under the Quarries Regs 1999, in full knowledge of the rock and other materials contained within, which are transported directly from the mine and placed in 4 – 5 metre layers

and compacted by fully laden 160 tonne dump trucks and bulldozers, onto prepared ground with underdrainage as recommended.

- **Bullet Point 7.**

As stated above, in excess of 95 million m³ of overburden has been placed in backfill during the operation of the site with no instances of any significant instabilities being observed.

It is accepted that a method statement is required to include a detailed programme of de-watering the lake before the lower slope of backfill is reprofiled to its final slope, with particular emphasis on the toe to ensure long term stability. Further detailed stability analyses will be undertaken adopting a range of parameter values based on site records of the materials being tipped along with a sensitivity analysis before finalising this method statement.

The Coal Remediation Authority have actively monitored the site on an annual basis throughout mining operations and several times since the cessation of operations to check that the site has been operated in a responsible manner and left in a safe state in compliance with the conditions as defined in the Coal License. This includes the safe removal (and capping if necessary) of any shafts, adits, and old mine workings in the sites 'Area of Responsibility.'

- **Bullet Point 8.**

The proposals for remedial works for the residual rock sidewalls [southern and eastern] are based upon a firm understanding of the structural geological conditions and presence of abandoned underground coal and ironstone workings, along with extensive experience of the response of strata to the mining process.

Significant archival information relating to previous mining activity along with extensive borehole information for the site is available which have confirmed the geological model with a high degree of confidence.

From the point of commencement, the site has been continually monitored, initially by the resident geotechnical engineer then by the appointed geotechnical specialist in accordance with the requirements of QR 1999.

Two large -scale instabilities have occurred on the site the first at which the NNW /SSE trending Dowlais Fault intersected the southern sidewall and the second, a nominal scale displacement NNW/SSE trending fault which intersected the final advance excavation panels.

The first was excavated through several years ago under the guidance and approval of the Geotechnical Specialist and has subsequently been fully concealed by opencast backfill.

The second structure was initially intercepted at the southern end of the eastern advance excavation panels and resulted in the large-scale spalling of rock from the western 'free' rock faces. The maximum extent of spalling was the actual fault plane beyond which the strata has remained in place. As excavation panels advanced to the east, the fault migrated up the cuts towards the north and resulted in a continuation of strata spalling. Remedial works undertaken in the affected area have secured the sidewall with all works in this area taking place under a Safe Systems of Work.

The proposal to install rock gutters in areas which may be accessible to the general public, will be based upon the results of more detailed rockfall modelling.

There are no known recorded untreated adits remaining on the site. Any abandoned roadways which were exposed in residual excavation faces have been treated by compacting backfill material into the opening and then grading material up against the structure.

As has been observed throughout the working of this site, where several un-recorded adits and roadways have been encountered in excavation faces, the collapse of strata above the opening's chokes-off and rarely exceeds more than a few metres. The filling with backfill and buttressing of opencast material against the openings have secured them.

- **Bullet Point 9.**

The scree slope which has formed against the southern half of the final eastern sidewall is a result of major spalling from the fault affected sidewall plus additional material which has been excavated from the upper level of faces to remove significantly dilated strata.

The angle of the scree represents the friction angle of the materials [which it can be considered to have no cohesion] contained within the slope. The slope can be considered to have a Factor of Safety of around unity. Naturally formed slopes as can be observed in the 'natural environment' can be assumed to have a Factor of Safety of around unity.

The potential does exist for future creeping movements, which taking into account the location of the scree slope, i.e., immediately to the east of the proposed lake structure, will not pose a threat to public safety as the consequences of failure are very low.

- **Bullet Point 10.**

Further details of the lagoons, their location and nature of the ground upon which they are located will be supported by any available SI. The lagoons have all been inspected in accordance with the QR 1999 throughout the life of operations and there have been no recorded instabilities.

- **Bullet Point 11.**

Relating the documented tip failures in South Wales is a case of comparing 'apples and pears.' Colliery tips significantly differ from opencast backfill and OB in the following ways.

Colliery Tips.

1. Generally, are located on steep hillsides.
2. Most (if not all) do not have adequate pre-tip preparatory works or any associated SI or geotechnically based designs.
3. The materials will be dominated by mudstones, seatearths, lagoonal deposits, generally 'weak' materials which occur in close proximity to coal seam horizons. Many of these materials are tipped as washery discard with significantly elevated moisture contents.
4. Are likely to have been deposited by conveyor tipping with little or no compactive works having been undertaken.

Opencast Backfill and Overburden Mounds.

1. Are generally constructed on level or near level ground, gradients beneath the Ffos-y-Fran mounds were formed on ground with gentle gradients.
2. In the case of OB2 and OB3, parts of the mounds were formed on solid measures above the Hafod Coal Seam (OB2 in particular).

-
3. OB1 was formed on glacial till deposits and involved the installation of an extensive sub-drainage system.
 4. The stripping of 'unsuitable' materials and the installation of sub-tip drainage systems was undertaken [records available].
 5. Materials comprised a mixture of Glacial Till, Mudstones, Siltstone, Sandstone, and Claystone Seatearths, excavated and transported directly to OB.
 6. The mounds were constructed by layer tipping involving cone tipping and dozing in layers using CAT D9 / D10 dozers with extensive tracking by fully laden CAT 777 160 tonnes dump trucks.

SUMMARY OF REQUIREMENTS (to be agreed by MTCBC).

1. ROCK FACES.

- Details of the instability which affected the east wall.
- Details on geological conditions
- Review of initial pre-commencement stability analyses and their relevance to the proposed restoration works.
- Comments on Adits/ abandoned roadways treatment and rock gutter provision, referring to specific locations.
- Review of climate change impact.
- Assessment of consequences of any slope degradation.

2. LAGOONS.

- Details of the locations and geometries of each set of lagoons.
- Relevant background SI
- Assessment of stability of each structure

3. OB1.

- Details of the geological / geotechnical information to include original topographical gradients, rockhead contours, Drift isopachyte etc. plus any laboratory test data.
- Details on the construction of the tip to include base preparation and tipping methodology.
- Supply of pre-failure and post failure survey information and provision of geotechnical field notes (July 2022 failure).
- A design for the re-construction of the tip with stability analyses.
- Review of climate change impact.
- Assess consequences of any potential instability

4. IN PIT BACKFILL.

- Methodology for the re-grading of the lower backfill tip and construction of the toe area.
- Stability analyses assuming a range of parameter values
- Assume various groundwater conditions to reflect 'climate change.'
- Assess consequences of any potential instability.
- Review of climate change impact.

5. OB2 AND OB3.

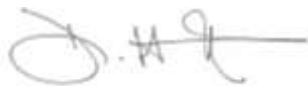
- Review previous SI. To include original surface, rockhead gradient, drift isopachyte and any lab test data.
- Review construction method, sub-tip preparatory works and operational details.
- Undertake sensitivity analysis varying parameter values and groundwater conditions [assumed].
- Assess consequences of any potential instability.
- Review of climate change impact.

6. COMPARISONS.

Provide examples of South Wales opencast coal sites where large overburden mounds have been left as a part of the final restoration.

Good examples are;

- **Celtic Energy East Pit** – large OB with only cosmetic restoration works, in place for 30 years [on an inclined hillside] and still stable.
- **Celtic Energy – Margam**, several OBs in place for in excess of 20 years -stable and remaining as a part of the final restoration.
- **Celtic Energy – Nant Helen**, large OB in place for in excess of 20 years, stable and is a part of the final site restoration.
- **Celtic Energy Selar**- Large OB, in place for 20 years, little alteration by restoration works. Stable. Lies adjacent to the ‘Parish Road,’ a public right of way.



D A B Higgins.

MSc. D.I.C. BSc.[Hons.].

[Geotechnical Specialist].

8th July 2025

Ein cyf/Our ref: CAS-286263-P6X2
Eich cyf/Your ref: P/25/0037

Merthyr Tydfil County Borough Council
Unit 5 Triangle Business Park
Pentrebach
CF48 4TQ

Dyddiad/Date: 07 October 2025

Annwyl Syr/Madam/Dear Sir/Madam,

BWRIAD/PROPOSAL: Variation of conditions 4 (Duration of Restoration), 6 (Approved Plans) and 50 (Restoration Strategy) of planning permission APP/U6925/A/10/2129921 involving a revision to the restoration scheme.

LLEOLIAD/LOCATION: Ffos Y Fran, Merthyr Tydfil.

Thank you for consulting Cyfoeth Naturiol Cymru (CNC)/Natural Resources Wales (NRW) about the above, which we received on 07 August 2025.

We continue to have concerns with the application as submitted because inadequate information has been provided in support of the proposal. To overcome these concerns, you should seek further information from the applicant regarding land contamination and pollution prevention. If this information is not provided, we would object to this planning application. Further details are provided below.

We also advise that based on the information submitted to date, conditions regarding European protected species should be attached to any planning permission granted. Without the inclusion of these conditions we would object to this planning application.

We have reviewed the submitted response letters by Richard Moorehead & Laing Ltd dated 7th July 2025 and James Associates (undated). The following advice is also informed by discussions had during the most recent meeting between the applicant, Merthyr County Borough Council and NRW on 23rd September 2025.

Land Contamination

Further to the meeting undertaken on 23rd September 2025, we note that further information is to be submitted to address our concerns which were raised in our previous response (ref: CAS-275294-H0Z5, dated April 2025). We welcome this and will await consultation on this further information.

From the recent rebuttal letters submitted to us (Richard Moorehead & Laing Ltd, dated 7th July 2025 and James Associates, undated), we note that a dewatering management plan has been suggested by the applicant to be submitted and to include the details we have requested with regards to proposed resumption of dewatering from the pit lake. We welcome this approach and advise this is included as part of the application. We also wish to point out that any resumption of dewatering will need to adhere to the conditions of the existing abstraction licence.

Regarding the Dowlais Free Drainage System (DFDS), we acknowledge the proposal to undertake site monitoring. While we support this approach, the submission should clearly specify which features are being monitored, along with the rationale for their selection. Ideally, known discharge points from DFDS would be a good starting point for any monitoring. Other details should include frequency and type of monitoring, triggers for actions and mitigation if problems occur. Details and timeframes for ongoing monitoring following completion of the restoration scheme should also be provided.

We note that the applicant has suggested the production of an Environmental Management Plan to either be agreed during the application process or to be conditioned to any grant of planning permission. We would be open to either option, however please note that any Environmental Monitoring Plan should include the following:

- Location of monitoring site and type of feature being monitored.
- Frequency and method of measurements – e.g. logger collection, manual measurement, observation. Monthly/quarterly etc.
- Triggers to action mitigation and contingency measures if there is risk of impact on the local environment.
- Mitigation and contingency measures.
- Duration of the monitoring.

All other comments remain as previously submitted under the 'Land Contamination' heading within our previous response (ref: CAS-275294-H0Z5, dated April 2025).

Pollution Prevention

We refer to our previous advice (ref: CAS-275294-H0Z5, dated April 2025) with regards to pollution prevention.

European Protected Species (EPS)

The information submitted to date has identified that Great Crested Newts (GCN) are material to the application site. Surveys have confirmed the presence of the species within ponds located within and around the application site.

The proposal has the potential to kill, injure, disturb GCN, or damage or destroy their breeding sites and resting places. GCN and their breeding sites and resting places are protected under the Conservation of Habitats and Species Regulations 2017 (as amended) and Schedule 5 of the Wildlife and Countryside Act 1981. Where GCN are present and a development proposal is likely to contravene the legal protection, they are afforded, the development may only proceed under licence issued by Natural Resources Wales, having satisfied the three requirements set out in the legislation. A licence may only be authorised if:

- I. The development works to be authorised are for the purpose of preserving public health or safety, or for other imperative reasons of overriding public interest, including those of a social or economic nature and beneficial consequences of primary importance for the environment;
- II. There is no satisfactory alternative; and,
- III. The action authorised will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in its natural range.

Please note, for the purposes of providing advice at the planning application stage, our comments are limited to compliance with the 3rd test “demonstration of no detriment to the maintenance of the favourable conservation status of European protected species”. We advise that before any consent is given, as informed by the provisions of Regulation 9 of the Conservation of Habitats and Species Regulations 2017 (as amended) the LPA satisfy itself as to whether the scheme satisfies the other two tests, namely a relevant Habitats Regulations purpose and whether there is no satisfactory alternative to the proposal.

Whilst we consider that submitted ecological reports provides an adequate basis upon which to consider the potential impacts of the scheme on this species, aspects of the proposed scheme will require further development. However, we are satisfied that this further information can be provided via a suitably worded conditions and obligations, included on the decision notice.

Consequently, for the purposes of demonstrating no detriment to the maintenance of the favourable conservation status of the local population of the species planning conditions and obligations will be required.

We therefore advise the following conditions in respect of GCN is included on any permission granted:

Condition:

No development, including site clearance, shall commence until a Great Crested Newt (GCN) Conservation Plan has been submitted to and approved in writing by the Local Planning Authority. The Conservation Plan should build upon the principles outlined in the ecology reports include, but not necessarily be limited to:

1. The submission (to include proposed timescales and reporting requirements) of further details and associated plans concerning GCN avoidance and mitigation measures including, but not limited to:
 - fence specifications, locations, construction and maintenance (one-way amphibian fence, prior to and throughout the duration of construction operations)
 - considerations of access issues (including PROW if applicable)
 - monitoring and maintenance requirements and supervised removal.
2. The submission of further detail of on site habitat retention, enhancement and creation proposals associated with terrestrial and aquatic habitats.
3. Details of timing, phasing and duration of construction activities and conservation measures.
4. Post-construction monitoring and record dissemination for a period of not less than 25 years. Methodology shall include annual GCN abundance counts and Habitat Suitability Index (HSI) assessments. All ponds to be added to the Wales GCN

Monitoring Scheme, with individuals/bodies being identified as being responsible for monitoring and reporting works

The Conservation Plan shall be carried out in accordance with the approved details.

Justification: To ensure that GCN are protected by the development.

We also reiterate that we would welcome land located outside the red line boundary being subject to appropriate long-term management. We suggest this is subject to a planning obligation (Section 106 Agreement). See further details below.

Planning Obligation:

A Planning Obligation Section 106 Agreement will be required. We advise that in respect of any such agreement, provisions relating to ecology must include:

- Location of land subject to the agreement (red and blue land including.
- Ring-fenced index-linked annual funding for habitat management, monitoring and wardening.
- Delivery of management.
- Regular liaison meetings.
- Management plan review, every years unless agreed in writing by the LPA.
- Transfer of legal tenure (lease) of defined ecology area(s) to an organization that accords with the definition of “responsible body” under Part 7 of the Environment Act 2021 and which has internal skills, competencies and European protected species licences for undertaking management and surveillance to the written satisfaction of the Local Planning Authority within 6 months of completion of site restoration proposals.

Works should be carried out under licence. We refer you to the Chief Planning Officer’s letter dated 1 March 2018 which advises Local Planning Authorities to attach an informative regarding licence requirements to all consents and notices where European Protected Species are likely to be present on site.

Please note that any changes to proposals between planning consent and the licence application may affect the outcome of a licence application.

Condition

Within 12 months of the date of the consent, a Landscape and Ecological Management Plan (LEMP) for the provision, management and maintenance of the landscape and ecological features at the site has been submitted to and approved by the Local Planning Authority. The Plan shall include, but not be limited to:

The submission of a long-term site management plan (not less than 25 years) that includes:

- Details of habitats and ecological features present or to be created, both in written form and shown on appropriate drawings, including planting plans.
- Defined aims and objectives (including defined key performance indicators for long term monitoring indicators).
- Location, including geographical information system shapefiles.
- Details of the desired condition for each habitat and criteria to determine when habitats have achieved this.

- Details of short and long-term habitat management prescriptions to both achieve and maintain the desired condition.
- Details of monitoring methodologies for species.
- Details of scheduling and timings of activities.
- Current and any proposed changes to the tenure of ecology area(s) (tenure of the ecology and heritage area to be approved by the Local Planning Authority).
- Demonstrate how any issues with the site being designated as common land will be addressed post site restoration.
- Persons or bodies responsible for undertaking management and surveillance together with required skills and competencies.
- Site liaison and wardening.
- Licensing requirements for management surveillance and other defined activities.
- Biosecurity measures which consider invasive non-native species and specific diseases (e.g., Chytrid) to prevent the introduction of and where present control, removal or for the long-term management of invasive species both during construction and operation.
- Details of reporting, review and update of the plan (informed by monitoring) at specific intervals as agreed

Justification: A LEMP is required for the purposes of demonstrating the population great crested newts is being restored/maintained to its favourable conservation status in the long term.

In addition to the above, we advise that any future consent also includes a condition that requires the submission and implementation of an approved Ecological Compliance Audit (ECA) scheme to the satisfaction of the LPA.

The purpose of the ECA is to evidence compliant implementation of all ecological avoidance, mitigation and compensation works. The Audit shall identify Key Performance Indicators (KPI's) that are to be used for the purposes of assessing and evidencing compliant implementation of proposals.

Other Matters

The advice in this letter relates to matters which are included on our [consultation topics list](#). We do not rule out the potential for the proposed development to affect other environmental interests that are not included on this list.

We advise the applicant that, in addition to planning permission, it is their responsibility to ensure they secure all other permits/consents/licences relevant to their development. Please refer to our [website](#) for further details.

If you have any queries on the above, please do not hesitate to contact us.

Yn gywir / Yours faithfully,

Eleanor Sullivan

Cynghorydd - Cynllunio Datblygu/Advisor - Development Planning
Cyfoeth Naturiol Cymru/Natural Resources Wales

E-bost/E-mail: southeastplanning@cyfoethnaturiolcymru.gov.uk

Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi./Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.

Appendix B – Dowlais Free Drainage System

B1 - GGAT – A788 East Merthyr Reclamation Scheme

B2 - Geotechnical Note – James Associates

B3 - Hydrogeological Assessment Report – Groundwater Science



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Richard Roberts

East Merthyr Reclamation Scheme, Phase III, Merthyr Tydfil: archaeological field survey

February 2003

A report for Miller Argent Ltd
by Richard Roberts BA and
Martin Lawler BA MIFA



Contracts Division



Field survey on part of the Dowlais Free Drainage System in October 2002 © GGAT

GGAT report no. 2002/075
Project no. A788
National Grid Reference: SO 089 066

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Summary

Planning consent has been granted to Miller Argent (South Wales) Ltd to carry out reclamation work on an area of moorland to the east of Dowlais, Merthyr Tydfil, as part of the works for the proposed Ffos-y-fran opencast site. This area is part of Phase III of the East Merthyr Reclamation Scheme.

The archaeology of the area is principally characterised by a complex of ponds and connecting leats referred to as the Dowlais Free Drainage System, which dates to the 19th century.

As part of the mitigatory strategy for the Phase III development, the Glamorgan-Gwent Archaeological Trust (Contracts Division) was commissioned by Miller Argent to carry out a field survey of the known archaeological interests which would be directly affected. The field survey was carried out during October and November, 2002.

The survey work was undertaken using a combination of Total Station survey, photography, the recording of profiles and machine excavation. A total of twenty nine previously identified sites were recorded, including twenty two leats, five ponds and three pit sites. In addition, recording was undertaken on a further eleven sites, which had not been previously identified.

This report presents the results of the field survey.

Recommendation for protection of Tair Carreg

One site has been identified on the margin of the development which it is felt would merit preservation, if this can be achieved. Tair Carreg (literally 'three stones') consists of a group of upright stones centred on SO 08740 07192) (see Figures 2 and 3). The stones themselves are probably part of the natural outcrop, rather than a man-made feature. However, the group has served as an historic boundary feature, probably since the Middle Ages. It divided the ancient parishes of Merthyr and Gelligaer and their common pastures, and lies close to the site of Twynywaun Fair, whose charter was granted in 1140. The Roman military road from Gelligaer Fort to Penydarren Fort is believed to have passed along the east side of the Phase III area, possibly on the line of the present road, close to Tair Carreg. More recently, the Tair Carreg stone group has served as a marker for the parliamentary, borough and urban district boundaries.

Such features are an important component of the historic landscape, and should, if possible, be retained. The site lies on the edge of the intended line of the overburden dumps and it may be feasible to vary the line by a few metres to protect it.

SECTION 1: PROJECT BACKGROUND

Planning history and commission

Planning consent has been granted to Miller Argent (South Wales) Ltd to carry out reclamation work on an area of moorland at Dowlais, Merthyr Tydfil, as part of the works for the proposed Ffos-y-fran opencast site. The archaeology of the area is principally characterised by a complex of ponds and connecting leats referred to as the Dowlais Free Drainage System, which dates to the 19th century.

The former Mid Glamorgan County Council granted planning consent for Phases II and III of the East Merthyr Reclamation Scheme in 1998. Phase II (to the north) has already been completed. The impact of the scheme (Phases II and III) on archaeological interests was assessed by a desk-based study carried out by the Glamorgan Gwent Archaeological Trust, Contracts Division (GGAT Contracts) in 1993¹, and the results of that assessment were incorporated within an Environmental Assessment.²

In 2001 (GGAT Contracts) was commissioned by Leek and Weston Ltd, on behalf of their clients CLH Ltd, to undertake the archaeological component of the Environmental Statement (ES). In July 2001, GGAT Contracts produced a desk-based assessment of the proposed scheme.³ This study included the area previously consented under Phase III of the East Merthyr Reclamation Scheme, which amounted to approximately half the ES study area.⁴ The application area lies within the Merthyr Tydfil Landscape of Outstanding Historic Interest (HLW (MGL) 2). An historic landscape character study was subsequently undertaken by GGAT Contracts to provide further information on the significance of the landscape of the application area and the effects of the proposals, following discussions between CLH Ltd, Cadw: Welsh Historic Monuments and GGAT Contracts.

In 2002, Miller Argent (South Wales) Ltd commissioned GGAT Contracts to carry out a field survey of the directly affected sites within the area consented under Phase III of the East Merthyr Reclamation Scheme, as part of the mitigation strategy in advance of topsoil stripping. This report presents the results of the field survey.

Survey

The fieldwork for the survey was carried out in October and November 2002. This consisted of a combination of photographic recording, detailed survey of certain areas with a total station, and the recording of profiles across individual leats. Some features were also examined by trial trenching.

Report

This report contains an historical background to the Dowlais Free Drainage System, extracted from Appendix 13 of the ES (Section 2) and an account of the methodology used together with a table of the surveyed features (Section 3). The main body of the report (Section 4) is a descriptive catalogue of the surveyed features, which are grouped into areas. Individual sites are referred to either by their Primary Reference Numbers (PRN), for sites first listed in the Glamorgan Sites and Monuments Record, or by their National Primary Record Number (NPRN) for sites first listed in the National Monuments Record. Some additional features, first recorded during the present survey, have been given ad hoc descriptive

¹ Page N 1993a *East Merthyr land reclamation scheme: desk-based assessment* GGAT report no 93/004 (Jan 1993)
Page N 1993b *East Merthyr land reclamation scheme: desk-based assessment* GGAT report no 93/048 (Revision of report no 93/004) (July 1993)

² British Coal Opencast *East Merthyr Phase III Reclamation Scheme: Environmental Statement*.

³ Roberts R 2001 *Proposed Ffos-y-fran opencast, Merthyr Tydfil: archaeological assessment* GGAT report no 2001/057 prepared for CLH Ltd.

⁴ The main index and data will be included as Appendix 13 of the ES.

names, DFD1, DFD2 etc (for Dowlais Free Drainage System); these will be incorporated into the Regional Sites and Monuments Record. A photographic catalogue is provided as Appendix 1.

The report includes extracts from the 1875 1st edition of the Ordnance Survey 6" map (Sheets 12 NE and 12 NW), and portions of the following air photographs:

Sortie No	Date flown	Scale	Photo type	Print Nos
H010	01-08-1991	1:10000	Colour	14991: 026 & 027

Acknowledgements

The project has been managed for GGAT Contracts by Andrew Marvell (Principal Archaeological Officer), Martin Locock (Project Manager) and Richard Roberts (Assistant Project Manager). The fieldwork was undertaken by Richard Roberts and Martin Lawler (Project Officer). The report was prepared by Martin Lawler and Richard Roberts. Paul Jones (Senior Illustrator) and Colin Green (Project Assistant) undertook the illustrations. Particular thanks are due to David Mason (Miller Argent) for his ready co-operation and assistance.

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SECTION 2: HISTORICAL BACKGROUND

Since its original identification by Owen (1973), the historical background to the development of the Dowlais Free Drainage System has been mentioned in several studies, and discussed specifically by Roberts (2001 and 2003)⁵ and Locock (2002)⁶. The relevant section of the latter study is reproduced here.

Extract from the Ffos y Fran Environmental Statement

Appendix 13: Archaeology and historic landscape

Appendix D: Description of the Dowlais Free Drainage System

D1 Introduction

The supply of water to the Dowlais ironworks was provided by an elaborate network of reservoirs, ponds, leats and culverts. This 'free' drainage system (relying on gravity rather than pumping) extended well to the north, south and east of the works, on land of Merthyr Common. The system of drainage was first identified as an entity by John A Owen in his 1973 book *The History of the Dowlais Iron Works, 1759-1970* (pp. 67-68) (1st edition; 2nd edition 1977). There has been no detailed account.

In 1993, RCAHMW undertook limited field survey in the area of the Phase 3 proposal and identified many surviving drainage features, including those feeding into the ironworks and those draining to the south (Malaws and Wakelin 1993).⁷

In 2001, GGAT visited all identifiable elements in the Ffos-y-fran area as part of the walkover survey for the desk-based assessment for the Phase IIIa proposal.

Following the recognition that water features formed a significant part of the archaeological resource in the affected area, additional documentary searches were undertaken in order to establish as far as possible their history and significance; the Dowlais Iron Company records held by the Glamorgan Record Office, Cardiff, were searched for material relating to water management. Since ponds were the best-recorded elements in maps and documents, a database was created bringing together the various sources.

D2 Dowlais Iron Company and water supply

In 1759 the Dowlais Iron Company was formed to construct the 'Merthyr Furnace' (later called the Old Works). John Guest (from Staffordshire) became manager in 1767, and there followed the building of cottages alongside the works.

"There were difficulties with establishing a consistent water supply to power the 'air engines' ... overcome in 1798 when Dowlais became the first works in Wales to install a Boulton and Watt double acting steam engine to supply air for the furnaces" (Thomas 1981, 282-3).

The Ifor Works was begun in 1839, and was operating to capacity by 1842 (Thomas 1981, 284).

⁵ Roberts R 2001 *Proposed Ffos-y-fran opencast, Merthyr Tydfil: archaeological assessment* GGAT report no 2001/057 prepared for CLH Ltd.

Roberts R 2003 *Historic landscape characterisation: Merthyr Tydfil/Merthyr Tudful Part 1 and 2: landscape characterisation and management* GGAT report no 2003/009 for Cadw: Welsh Historic Monuments (GGAT Project No 61).

⁶ Locock M 2002 *Appendix 13: archaeology and historic landscape* (Ffos-y-fran opencast site, Environmental Statement) GGAT report.

⁷ Malaws B and Wakelin P 1993 *East Merthyr opencast/reclamation Phase III: report of fieldwork by Brian Malaws and Peter Wakelin 9/3/1993*.

Cholera outbreaks in Merthyr in 1832 and 1849 led to the formation of Merthyr Board of Health, but no progress had been made by 1854, when a further outbreak occurred. Lady Charlotte Guest, then managing the Dowlais Iron Company, estimated that £1,900 was needed for the supply to the settlement of Dowlais, and after negotiations with the Board of Health, an *Act for the Construction of Merthyr Tydfil Water Works* was passed in 1858. A reservoir was built by 1862, serving standpipes throughout the town, but cholera re-appeared in 1866. In 1867–8, more than 160km of sewers were constructed (Jones 1987, 118–120).

Steelmaking commenced in 1865. In 1901 the company merged with the Patent Nut and Bolt Company of Birmingham, and in 1902 became Guest, Keen and Nettlefold (later GKN).

“Penydarren [iron works] experienced difficulty with its water supply. This resulted from the fact that the Dowlais works was sited nearby on higher ground and was able to control many local streams at will” (Thomas 1981, 295).

D3 *Development of the drainage system*

Despite these comments of historians mentioning the role of water in the industrial development of Merthyr, the drainage activities of the Dowlais Iron Company are poorly represented in documentary sources. There is no single account of a ‘system’; rather, the documents reflect continuing modification over a period of 50 years as required. Since management of water was part of the internal operations of the Company, relatively few external documents were prepared (in contrast to the works associated with the supply of water to the settlement of Dowlais, which generated a much larger body of correspondence, legal documents etc.).

Thus the documentation falls into two groups: map sources showing the drainage pattern at various times (notably 1847 (GRO D/D x 429, tithe map), 1875 (1st edition Ordnance Survey 6” to 1 mile), 1905 (Ordnance Survey 2nd edition), 1918 (Ordnance Survey 3rd edition); and Dowlais Iron Company documents from the Surveyor’s Department listing pond names, size and volumes, lengths of culverts etc. (GRO D/D G/F 8/39: a list of ponds in 1862, an estimate for costs for completing New Pond in 1862, and two lists of ponds and an inventory of culverts and drains in 1920). The map sources give very few names, but all of the major features in the documents have been identified.⁸

Sarn Howell pond, Roadside Pond and Fish Pond are shown on the 1847 tithe map; no other ponds are marked, although presumably Coedcae and perhaps Cae Harris ponds are also in place at this time. In 1862, Pantywain Big Pond, Pantywain Pond and Pitweld Pond are complete, and New Pond is under construction. Longtown Pond, Soap Vein, Raslas Pond, Penydarren, Fochrhiw and Isaac Morgan’s Pond are also in place; the capacity of ‘Dowlais Ponds’ was recorded as 642,369 tons. Smaller ponds include No. 4 pit, Brickyard Pond and Tunnel Pit Pond; the large Roadside Pond is unlocated. By the 1st edition OS map in 1876, Shepherd’s Pen, Twyn-y-waun and Penydarren Pit ponds have been added. Jepsons and Saints had been added by 1891. In 1889 the total capacity of the Dowlais Iron Company ‘clean water ponds’ was recorded as 135.88 million gallons (566,979 tons). Pitweld Pond is shown as drained and ‘disused’ on the 1919 Ordnance Survey map, but is included as in use in the 1920 Dowlais documents, at

⁸ Additional evidence for the early development of the system is contained in the following:

1814 Ordnance Surveyors Drawing No. 192 E; unpublished series, photocopy in GRO (CR0 10/19L), originals in the British Library Map Department 1: 63,360 2-inch to the mile (this shows none of the ponds but indicates principal drovers’ trackways and natural watercourses)

1826 (1825–27) Ordnance Surveyors Drawings, Glamorgan, revised edition. plan 33, sheet 36; unpublished series, photocopy of original held in the British Library Map Department (provided by S Hughes RCAHMS) 1: 63,360 2-inch to the mile (shows additional trackways and natural streams and also the Scheduled Monument Sarn Howell Pond (88051) with a feeder leat to the east)

which time the capacity of 'reservoirs at Dowlais Works' was recorded as 337,114 tons and 'Ponds connected with Dowlais Collieries' as 107,805 tons there is some overlap between the two lists).

Documentary evidence for the leats (surface drains) and culverts is limited to a list of Dowlais Works water mains and culverts from 1920, supplemented by field survey, aerial photograph and map evidence for surface features. There are no identifiable culverts shown on the mining maps. Owen (1977, 68) states that the underground drainage system 'all gravitated to the Old Works as this was the main water user'.

The list of Dowlais Works water mains is set out by dimensions (24", 18", 12", 10", 9", 8", 6", 5", 4", 3"), totalling 12.7km in length. The longest mains are Rhaslas Main (just over 2km in length) and Jepsons Main (880m). The use of pumps is implied by the existence of a 9" pipe from Coedcae Pond to Big Hill and 8" 'return pipes from Big Hill to Coedcae Pond'.

The list of 'Culverts in Dowlais Works' is again set out by dimensions (3' x 2', 3' x 3', 6' x 3', 5' x 4', 6' x 6', 8' x 8' and 10' x 10' (main pipe culvert), totalling 11.3km. Very few of the culverts can be identified with located features. Owen notes the characteristic 'Dowlais pattern' of culvert, with a U-shaped channel on the floor of the culvert.

The list of 'Reservoirs and Watercourses at Dowlais Works' ends with the note 'water courses 27 miles 70 chains = say 28 miles' (42km), presumably referring to the open leats connecting the various ponds (this figure is very close to the 'over thirty miles of leats' mentioned by Malaws and Wakelin (1993)⁹).

D4 Discussion

Owen describes 'the Dowlais "Free" drainage system' as a single system, one that had been 'perfected by the year 1868' (Owen 1977, 67). The source of this comment has not been located in the published and unpublished letter-books of the Dowlais Iron Company or other documents.¹⁰ It is not clear from the documents whether it was thought of at the time as a single system or a group of related features, and if it were a system whether its purpose was solely or mainly to provide water to the ironworks, or whether the removal of unwanted water and the supply of water to mines for balance pits were part of its function (Malaws and Wakelin 1993). The supply of water was critical to the operation of an ironworks: the supremacy of Dowlais and the Cyfarthfa works (on a riverside site) over the rival Plymouth and Penydarren complexes is largely explained by this factor.

The technology involved was not particularly complex or radical: ponds, sluices and leats had been mastered for milling purposes in the medieval period. The scale of the enterprise is exceptional, however. The construction of the culverts is perhaps the single most notable feature, although the elaborate construction of aqueducts to maintain the water flow through the leat system as new roads, tramways and railways were built also reflect clear-sighted design.

⁹ Malaws B and Wakelin P 1993 *East Merthyr opencast/reclamation Phase III: report of fieldwork by Brian Malaws and Peter Wakelin 9/3/1993*.

¹⁰ Elsas, M, *The Dowlais Iron Company Letters* (1960), GRO D/D G Letter Book, Volumes 1-3 (incoming), 1868

The long development (from a few isolated ponds in 1847, to an integrated complex in 1868, further additions in 1870, and numerous later changes) and variety of functions implies that it was not a single designed entity; rather it was a counterpart to the spread of coal working on Merthyr Common.¹¹

¹¹ The presence of the Sarn Howell Pond by 1826 (as shown in the OS surveyors drawings) indicates a rather longer timescale than previously thought. Few of the leats were recorded before the 1st ed OS plan of 1873/5 but these are clearly integral to the water management system. It seems likely that at least some of the visible earthworks within the present survey area were in place by the middle of the 19th century.

SECTION 3 : METHODOLOGY

Objectives

The principal objective was to record the features which had been previously identified as being components of the Dowlais Free Drainage System and its associated workings, and which would be directly affected by the development. Most of these are located within a triangular area on the east side of the Phase III site, lying between the roads on the south and east and the line of pylons on the west. This area will be affected by the soil and overburden dumps and smaller scale opencasting. An additional feature to the west of this triangle, Pond 85992, will also be directly affected by the construction of a water treatment facility. The survey areas are shown in Figure 1.

In practice, as may be expected, several additional features were encountered during the course of the fieldwork and these were also recorded. These additional sites have been given temporary names and will in due course be incorporated into the Regional Sites and Monuments Record.

Methodology

The fieldwork was undertaken over a four week period between 9th October and 1st November 2002.

A: The initial stage was a walk-over survey, during which the sites and their recording needs were identified. Observations and sketch drawings were recorded in a site notebook. Spot co-ordinate readings were taken with a GPS, providing accuracy to within 10m. Initial photographs were taken at this time, and continued throughout the fieldwork.

B: The second stage consisted of a total station survey of selected features, notably the ponds, significant leat junctions and all features that did not appear on OS plans.

C: The third stage of recording was a series of 27 drawn profiles across the leats, including all of the features, which would be directly affected by the development. In some cases, profiles were recorded at more than one part of a particular leat where there were significant changes in form. Profiles were recorded at scales of 1:20 or 1:50, depending on the scale of the feature.

D: The final stage consisted of the machine excavation of trenches across selected leats, to record the original profiles of these features. A total of seven trenches were excavated, across six leats. The trench sections were photographed and drawn, and the trenches backfilled. No artefacts were recovered during the excavations.

Certain factors influenced results. The weather deteriorated during the latter part of the survey, causing problems for the fieldwork and recording. Dense fog on occasions made the total station survey impractical. Rain affected the photography and made the terrain difficult to negotiate. In particular, the trial trench excavations across active leats, carried out on 30th October, were severely disadvantaged by the copious flows. On the positive side, it was possible to see the free drainage system in full operation!

Survey

The total station survey was carried out using a Nikon DTM300, equipped with a built-in data logger. Data were downloaded at the beginning of each day using the Fastmap survey programme supplied by Survey Supplies Ltd. These tables were copied to an Access 97 database and transferred to Mapinfo 5.

The fixed station points used for the survey were the centres of the bases of three of the adjacent pylons, using OS data supplied by Miller Argent. These station points referred to the tops of the pylons; values

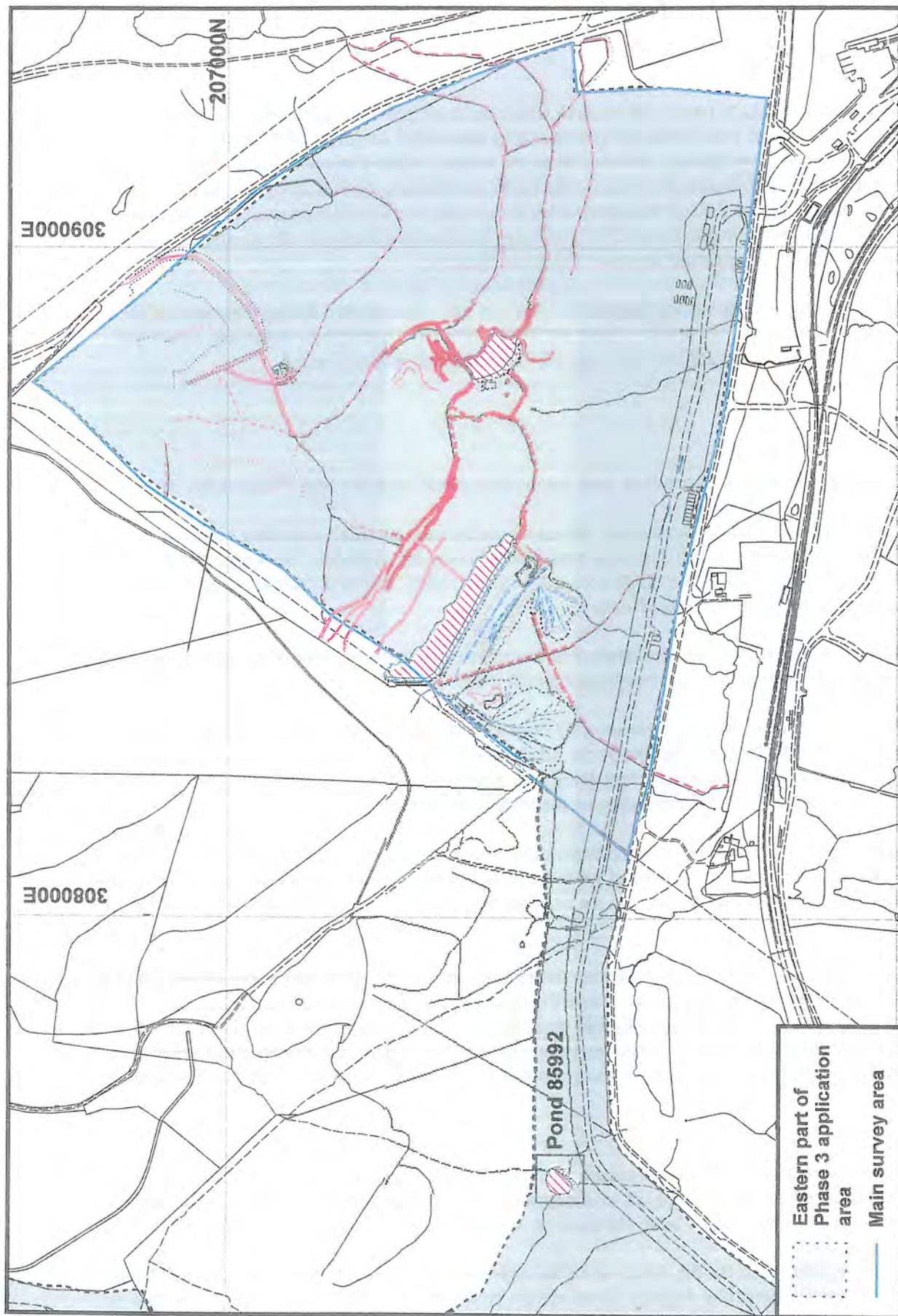


Figure 1: General plan

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for the bases were derived by internal triangulation. Grid pegs marked temporary station points during the course of the survey. The values for the fixed station points (centre bases of pylons) used were as follows:

OS name	Easting	Northing	Height
Pylon 8	308761.41	207286.00	434.060
Pylon 9	308614.32	207086.89	425.020
Pylon 10	308503.70	206937.50	417.746

Archive

The field survey records consist of the following:

- 1: Site notebook
- 2: Survey data, in digital form
- 3: Original profile and trench section drawings
- 4: Photographs (colour transparency and digital)

These are retained within the GGAT Contracts site archives, under the Project Number A788. A copy of the archive index will be deposited with the National Monuments Record, RCAHM(W), Aberystwyth; a copy of the report will also be deposited with the Regional Sites and Monuments Record.

Table 1: Summary of surveyed features, listed by survey area and site name, in the order they are described in Section 4, showing method of recording.

Area	Site name	TS survey Y/N	Profile Y/N	GPS plots Y/N	Photographs Y/N	Excavation Y/N
Area 1: Tair Carreg	A: Tair Carreg Stone group	Y				
	B: Earthwork banks	Y				
	C: Rectangular earthwork	Y				
Area 2: Twynywaun Pond and surrounds	A: Pond 85523	Y			Y	
	B: 'Area B'	Y			Y	
	C: Pit 88021/88022	Y			Y	
	D: Small shaft	Y				
	E: Leat 88023		Y	Y	Y	Y
	F: Leat 88024		Y	Y	Y	
	G: Leat 88014	Y	Y	Y	Y	Y
	H: Leat 88020	Y		Y	Y	
	I: Pond 85524				Y	
Area 3: Central west section	A: Leat 88025	Y	Y	Y	Y	Y
	B: Leat 88015	Y	Y	Y	Y	
	C: Leat 88029	Y	Y	Y	Y	
	D: Leat 88018	Y	Y	Y	Y	
	E: Leat DFD1		Y	Y	Y	
Area 4: Shepherds Pond	A: Pond 85526	Y			Y	
	B: Leat 85575 (west section)	Y	Y		Y	Y

<i>Area</i>	<i>Site name</i>	<i>TS survey Y/N</i>	<i>Profile Y/N</i>	<i>GPS plots Y/N</i>	<i>Photographs Y/N</i>	<i>Excavation Y/N</i>
Area 4: Shepherds Pond (cont)	C: Leat 88015 (east section)	Y	Y		Y	
	D: Leat 88028	Y	Y	Y	Y	
	E: Rectilinear gullies	Y				
	F: Rectangular platform	Y				
Area 5: Soap Vein Pond	A: Pond 85525	Y			Y	
	B : Area F leats	Y				
Area 6: Pits 85558 and 88033	A: Pit 85558	Y	Y		Y	
	B: Tips 88032	Y				
	C: Tramroad terrace	Y				
	D: Soap Pit Houses & shaft	Y				
	E: Soap Pit Pond	Y				
	F: Tips 88035	Y				
	G: Leat 88036	Y	Y		Y	
	H: Leat 4255m	Y	Y		Y	
	I: Leat DFD3		Y		Y	
Area 7: Southeast leats and Pond 85527	A: Leat 88017		Y	Y	Y	Y
	B: Leat 85575	Y	Y	Y	Y	Y
	C: Leat 88016		Y		Y	
	D: Leat 88013		Y		Y	
	E: Leat 85942		Y		Y	
	F: Pond 85527	Y				
Area 8 : Pond 85992	A: Pond 85992	Y	Y			

SECTION 4: SURVEY SITE DESCRIPTIONS

Area 1 : Tair Carreg

(See plans on Figures 2 and 3)

Summary

This survey area contains the following features:

A: Tair Carreg stone group (SO 08740 07192)

B: Earthwork banks to the north and northeast of Tair Carreg (SO 08708.7 07262.5)

C: Rectangular earthwork structure to the south of Tair Carreg (SO 08748.7 07165.2)

Description

The northern apex of the triangle which forms the eastern side of the Phase 3 application area contains a cluster of prominent outcropping rocks known as Tair Carreg, which is likely to be a natural feature. However, the group of stones (more than the three suggested by the name 'Tair Carreg') has also served as a major boundary marker in antiquity, separating Merthyr Tydfil and Gelligaer ecclesiastical parishes and commons and, latterly, the parliamentary, borough and urban district divisions. A natural boundary marker of this type is an important component of the historic landscape, and should, if possible, be retained within the context of the development.

The main cluster of upright stones is centred at SO 08740 07192, and occupies an area of approximately 8m square. It forms a nodal point of the boundary line, which is otherwise undefined. To the northeast lies a earthen bank, on an alignment approximately parallel to the boundary but some 31m from its line. The bank also has a bend, marked by a pocket of rubble, centred at SO 08754 07222; it continues northwest to the modern fence line, where it merges into the reclaimed Twynywaun area. A second bank, traced for about 10m, forms an offset to this, and lies close to the fence line (centred at SO 08708.7 07262.5). This smaller bank lies on approximately the line of the southeast side of the former upland racecourse shown on the Merthyr Tydfil tithe map. It could not be traced, however, further to the northeast of the longer bank, and the banks should probably be interpreted as part of a relict stock enclosure. Careful attention should also be paid to the disturbance in this area caused by the construction of the adjacent pylons (Pylons 8 and 9); this has altered much of the surrounding landform.

To the south-of the main stone cluster is a small rectangular earthwork structure, measuring 7m x 6m. This feature has been partly disturbed by the modern vehicle track which crosses it from east to west.

Survey

The group of upright stones, rubble pockets, earthen banks and rectangular structure were all surveyed by total station. No photographs were taken of these features during the present survey.

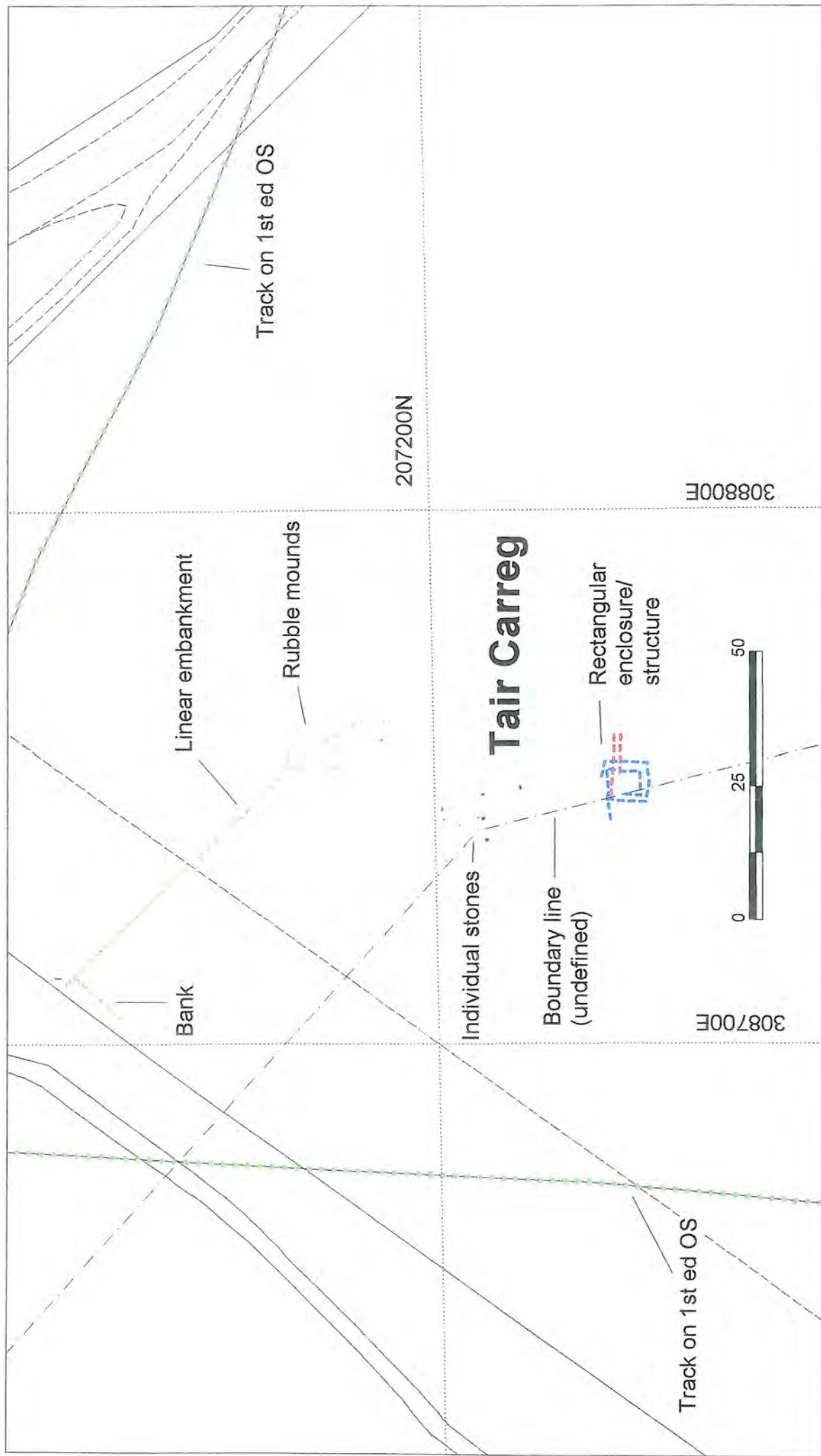


Figure 2: General plan of Area 1 (Tair Carreg). See also Figure 3 for detailed plan of individual upright stones at Tair Carreg.

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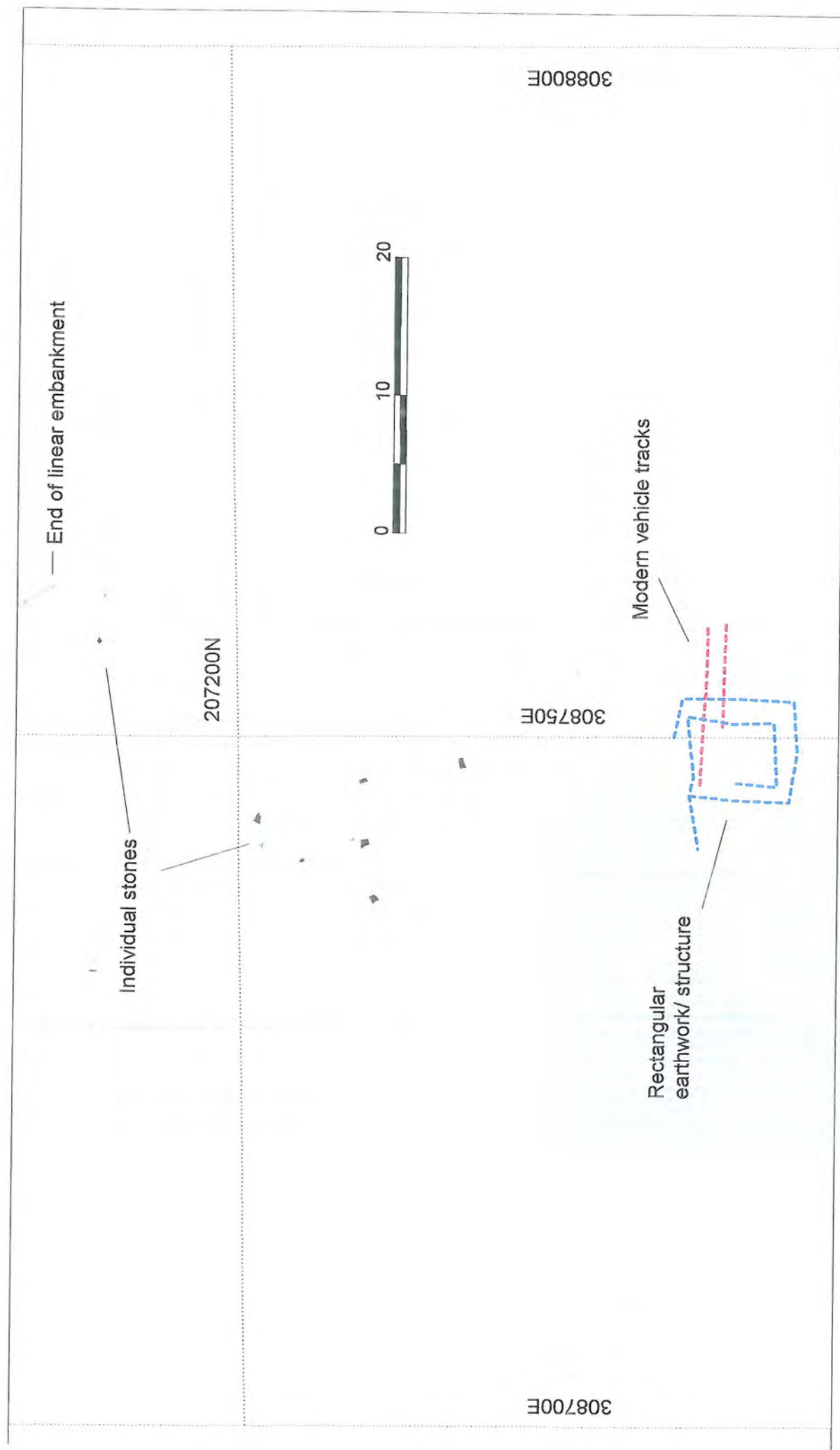


Figure 3: Tair Carreg, detail plan of individual upright stones and rectangular earthwork.

Area 2 : Twynywaun Pond (85523) and surrounds

(See plans on Figures 4, 5 and 6)

Summary

The second survey area lies to the south of Tair Carreg and includes the following:

- A: The more northerly of the two Twynywaun ponds (85523) (SO 08850 07000)
- B: A group of previously unrecorded tracks, earthworks and a leat to the north of the pond, described for the present study as 'Area B' (SO 0830 0750)
- C: A pit complex (88021/88022) with shaft, structure and waste tips (SO 08820 06910)
- D: A previously unrecorded small shaft and tips lying to the northwest (SO 08644 07118)
- E: Leat 88023 (centred on SO 08668 07094)
- F: Leat 88024 (centred on SO 08747 06982)
- G: Leat 88014 (centred on SO 08930 06840) (west part shown on plans)
- H: Leat 88020 (centred on SO 08822 06940)
- I: Pond 85524 (SO 09080 06910) (not included in present field survey)

Description

A: Twynywaun Pond (Pond 85523)

The larger of the Twynywaun ponds consists of a three-sided dam fed by leats to the north and northeast, with outfall sluices on its west side. Like the other dams, it was open on its northern (upslope) side, attracting flow from small streams. Air photographs suggest that it may have been sited on the line of a natural stream line from the northeast, though the position in relation to a natural stream bed was much less apparent than at Shepherd's Pond (85526) to the south, or the small dam 85592 to the southwest.



Plate 1: Pond 85523, showing detail of stone revetment on inner south wall, looking SW

The dam measures almost 200m northeast to southwest, and 130m northwest to southeast; the dam walls are stone-revetted on their inner edge, most noticeably on the long south side. The two sluice positions on the west side of the dam lead to Leat 88014 (north sluice) and Leat 88020 (south sluice).

The north sluice site, at the junction of the main dam wall and the extended wall, is just an open break in the dam; it is uncertain whether it was always simply an open overflow channel. The 1st ed OS sheet shows that only the southern part of the dam held water in 1875, though the presence of the extended west side of the dam (to north of leat 88014), suggests that a larger body of water may originally have been contained. (This is also indicated by the surveyed line of the inner pond margin, which extends further to the north of the 1875 line on its west side). Alternatively, the extended dam wall may simply have been intended to direct the natural water catchment from the northeast into the pond, and there may not have been a sluice at the outfall to Leat 88014.

The dam wall over the south sluice channel in the southwest corner of the dam is still largely intact, though there were no visible features of the sluice.

The pond was recorded by detailed total station survey and photography. See Appendix 1 for details of photographs.

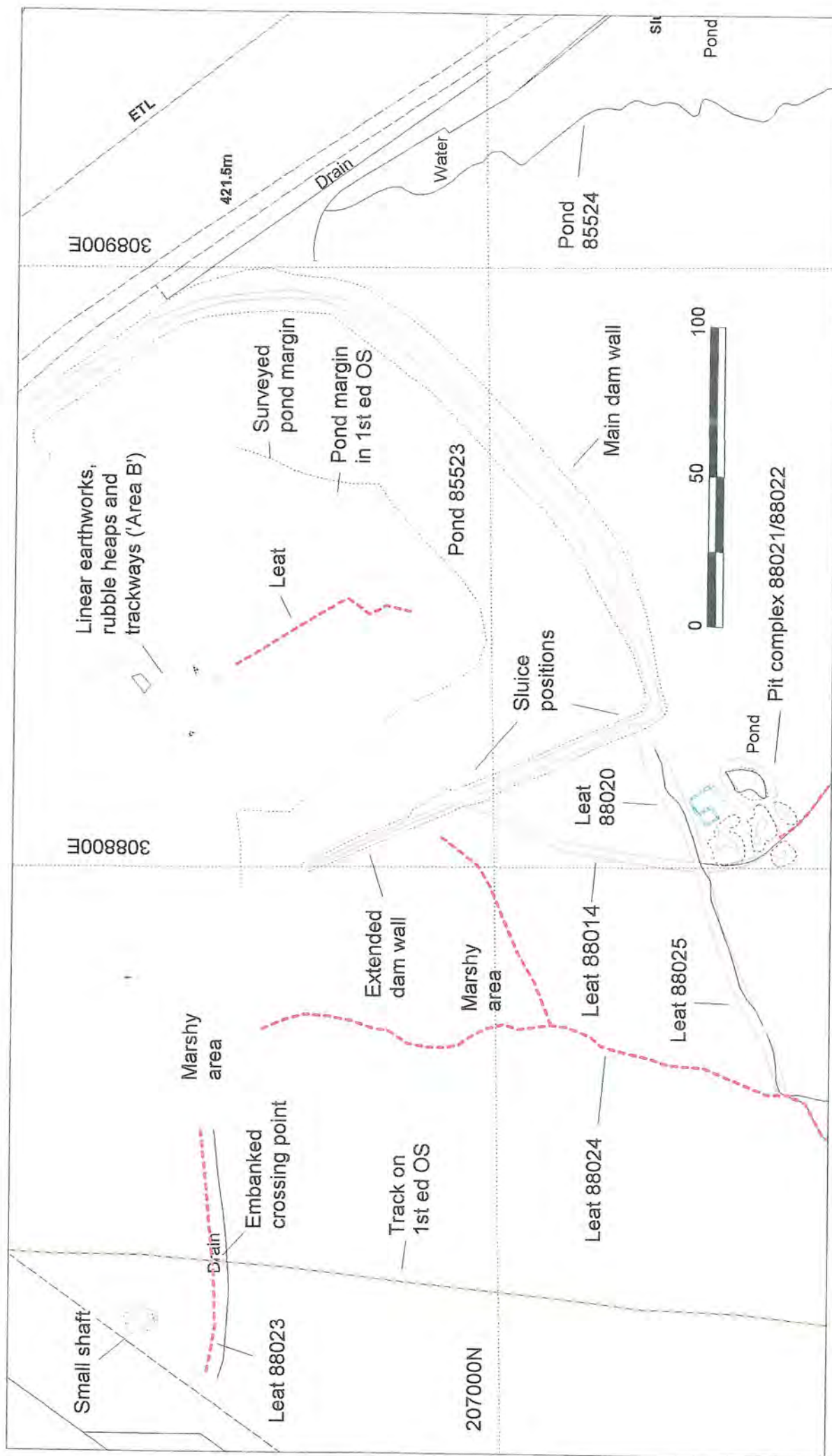


Figure 4: General plan of Area 2: Twynywaun Pond (85523) and surrounds. See also Figures 5 & 6 for detail plans. Features recorded by TS survey indicated by parallel lines. Features plotted from GPS and tracings shown as broken lines.

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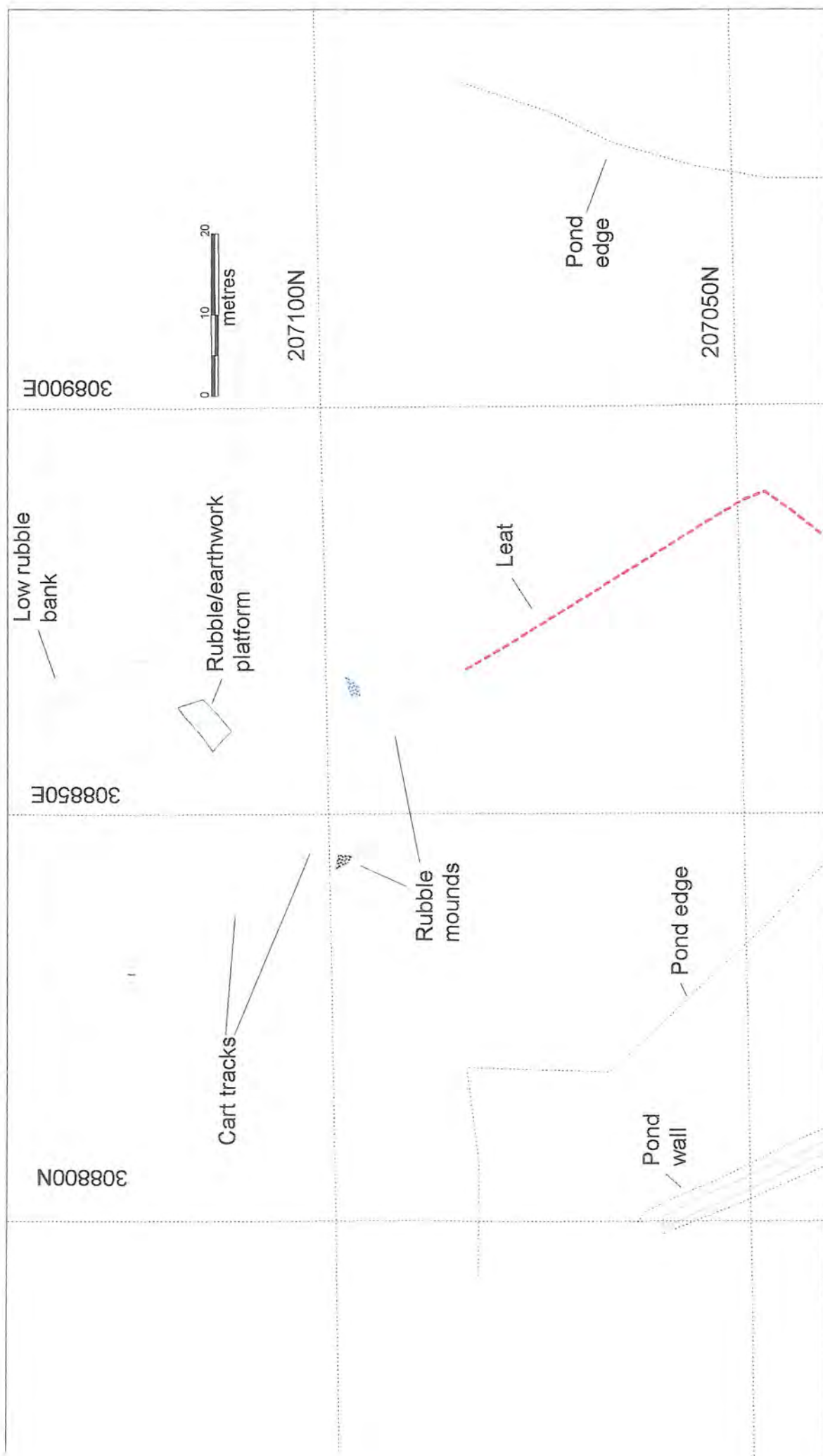


Figure 5: Detail plan of 'Area B', on the north side of Twynywaun Pond (85525). All features recorded by TS survey.

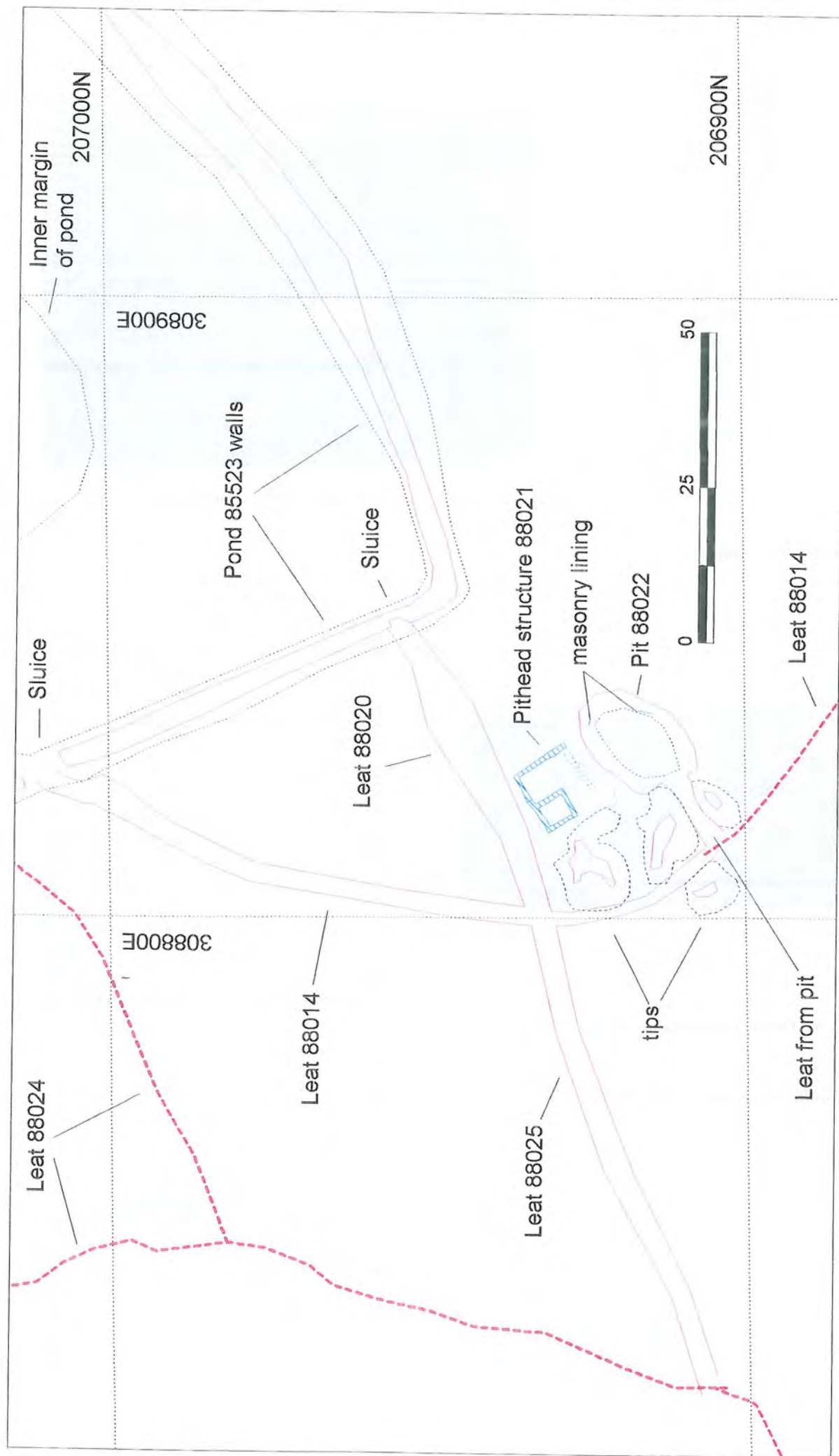


Figure 6: Detail plan of Pit 88021/88022 and surrounds.
Features recorded by TS survey indicated by parallel lines. Features plotted by GPS and tracings shown as broken lines.

B: 'Area B' features

To the north of the dam is a group of features including parallel trackways (interpreted as cart tracks), small mounds of rubble and shallow linear earthworks and a irregular earthen/rubble platform. These features are described collectively as 'Area B' for the present survey. It is possible that they relate to the construction of the dam; the rubble mounds alongside the trackways suggest the collection of material for the stone revetting. Alternatively, these features may be the remains of some form of stock enclosure.

RECORD: The 'Area B' features were recorded by detailed total station survey and photography. See Appendix 1 for details of photographs.



Plate 2: A rubble mound in 'Area B', looking NW

C: Pit complex 88021/88022



Plate 3: Rectangular structure 88021 with Pond 85523 in background, looking NW

This site lies to the southwest of the dam, at the junction of Leats 88020 and 88014. The pit is an oval shaft (88022), 17.5m x 13.4m, now filled with water, with some rough stonework visible on its northeast and southeast sides. A channel extends from the shaft southwest to Leat 88014, and seems to be respected by the adjacent tips. Occupying a platform on the northwest side of the shaft is a rectangular structure of drystone walling (88021), open on its southeast side, but with an enclosed room in one corner. This is presumably a balance pit, with a general arrangement similar to that of Pit 85558 near Soap Vein Pond. The small scale of the tips, notably close to the shaft itself, suggests that it may have been a short-lived operation.

RECORD: The pit complex was recorded by detailed total station survey and photography. See Appendix 1 for details of photographs.

D: Small shaft (previously unrecorded)

This feature lies at a distance of 267m to the northwest of Pit 88022, and 23m to the north of Leat 88023. It is a circular shaft, 6.3m in diameter, with a narrow band of tip material fringing its west and southwest (downslope) side. It is presumably a trial shaft.

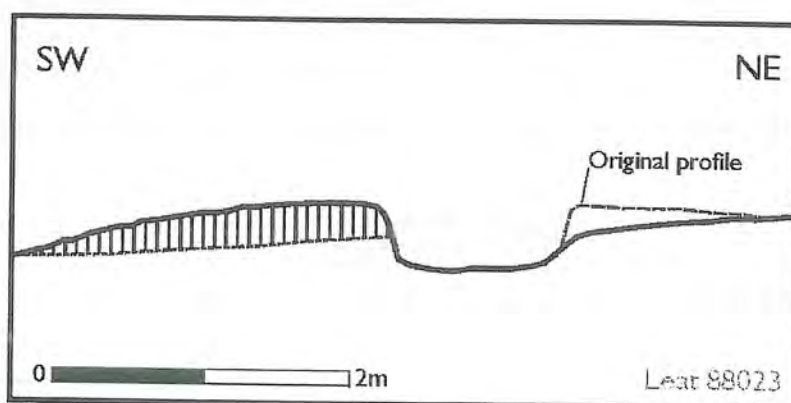
RECORD: The shaft was recorded by detailed total station survey. No photographs were taken for the present survey.

E: Leat 88023

This leat is shown on the early OS sheets as an extensive feature, crossing the northern part of the survey area from east to west and draining into Twynywaun Pond. The western section of the leat was removed

during the Trecatti reclamation scheme. Of the remaining portion, only a section of some 84m length was visible during the survey; to east of this section the leat merged into the marshland lying to the northeast of Pond 85523. At SO 08668 07094, the leat is crossed by the line of a track shown on the 1st ed OS; the track is visible as an embankment at this point and the leat may originally have been culverted.

Figure 7: Profile of Leat 88023 at SO 08634 07906



RECORD: The line of the leat was traced from GPS spot co-ordinates and the air photograph. A drawn profile of the leat was recorded near its west end at SO 08634 07096. A machine excavation through the leat was undertaken at approximately SO 08654 07092. See Appendix 1 for details of photographs.

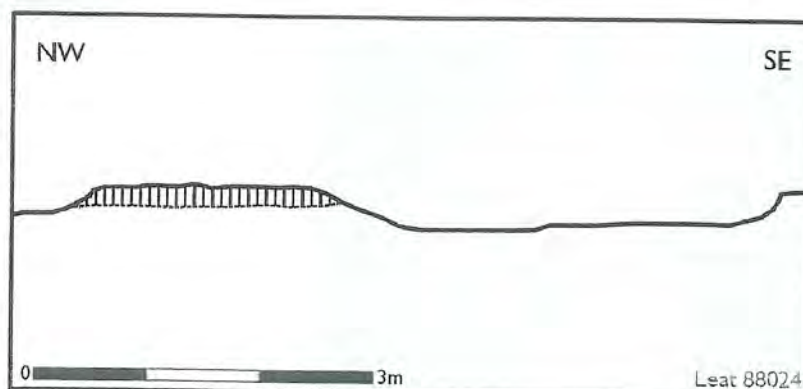
Plate 4: Machine-cut section of Leat 88023, looking W

F: Leat 88024

The leat extends on a north-south axis to the west of Pond 85523; it drains to the junction with Leats 88025 and 88018. The northern part of the leat was indistinct and may be one or more natural streams. At SO 08747 06981 (72m to north of the junction), the leat becomes a shallow, reed-filled depression, 2.5m in width and 0.5m in depth.

RECORD: The line of the leat was traced from GPS spot co-ordinates and the air photograph. A drawn profile of the leat was recorded at SO 08733 06932. See Appendix 1 for details of photographs.

Figure 8: Profile of Leat 88024 at SO 08733 06932



G: Leat 88014

As defined in the NMR record, the leat extends in a broad arc between the two Twynywaun ponds, from the west side of Pond 85523 to the west side of Pond 85524, interrupted by the junction with Leats 88020/88025. The 3rd ed OS sheet of 1915 suggests that these are really two separate leats, each draining west from their respective ponds towards the Leat 88020/88025 junction. The general contour lines of this area indicate a more likely flow direction towards Pond 85524 rather than away from it but it remains unclear. The recorded profiles of the two sections of the leat are markedly different.

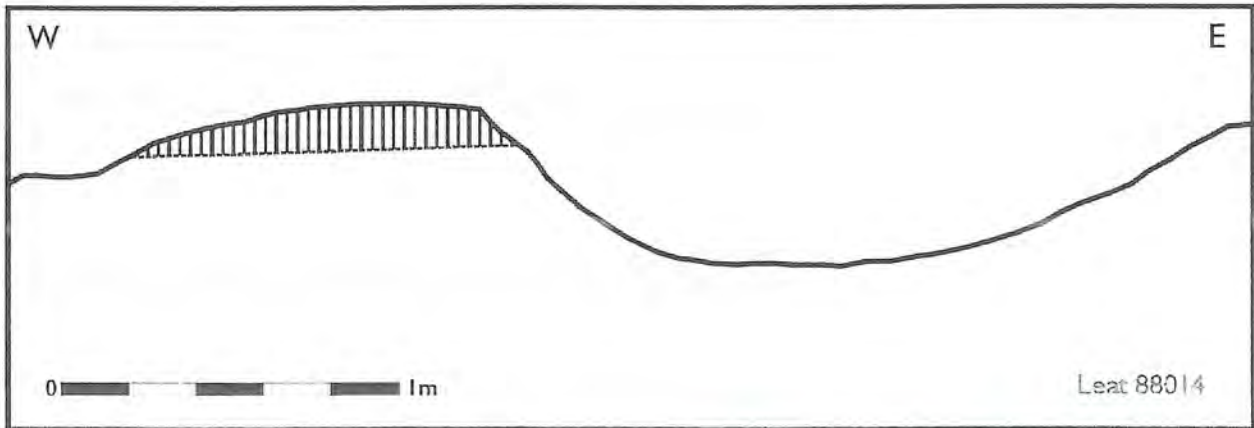


Figure 9: Profile of the eastern part of Leat 88014 at SO 08943 06820

At the point where the smaller western section of Leat 88014 issues from Pond 85523, it follows a pronounced dog-leg; the feature narrows sharply to west of this feature. Excavation showed that the narrower portion of the leat was originally 0.75m in depth and 1.2m in depth, with a bank on its east side. Rubble fragments noted during excavation along the west side of the infilled leat may have been some sort of revetting, though this was uncertain.

RECORD: The western part of the leat, in the vicinity of Pond 85523, was recorded in detail by total station. Spot GPS co-ordinates at intervals were taken along the remaining length. A profile was drawn across the longer east part at SO 08943 06820. A machine-cut section was undertaken across the shorter west part at SO 08803 06966. See Appendix 1 for details of photographs.

Figure 10: Machine-cut section across the western part of Leat 88014 at SO 08803 06966

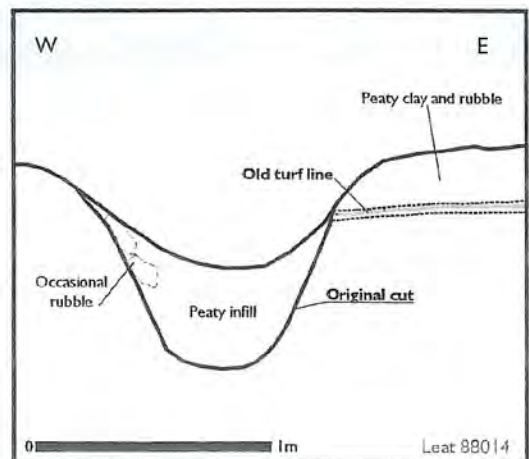


Plate 5: Leat 88014, at position of profile shown in Figure 8, looking NW

H: Leat 88020

This is a short section of leat extending southwest from the southwest corner of Pond 85523 to a junction with Leats 88014 and 88025. It may be regarded as the eastern section of Leat 88025.

RECORD: The course of the leat was recorded in detail by total station survey. No profile was drawn of this leat, though a profile drawn through the adjacent section, listed as Leat 88025, is generally characteristic of 88020. See Appendix 1 for details of photographs.



Plate 6: Leat 88020, looking SW from Pond 85523. Figure is standing on platform for Pit structure 88021

I: Pond 85524

The southern of the two Twynywaun ponds lies adjacent to the present road. It will not be affected by the proposed scheme, and was not included in the present survey. The pond is an extensive feature, with earthen dam walls on its east and south-east sides and an open west (upslope) side. It is fed by leat 88014 from its south corner.



Plate 7: Pond 85524, S end, with Leat 88014 on right, looking NE towards Rhaslas Pond

RECORD: See Appendix 1 for details of photographs.

Area 3 : Central west section

(See plans on Figures 12 and 13)

Summary

This area covers the zone on the west side of the survey area between the two main converging east-west leat lines: Leat 88025 on the north side (which flows to the west) and Leats 88015 and 88029 on the south side (flowing to the east). It includes the following:

- A: Leat 88025 (centred on SO 08605 06846)
- B: Leat 88015 (centred on SO 08600 06715)
- C: Leat 88029 (centred on SO 08533 06749)
- D: Leat 88018 (centred on SO 08800 06800)
- E: A previously unrecorded leat between Leats 88025 and 88015, described here as 'DFD1' (centred on SO 08585 06800)

Description

A: Leat 88025

One of the major lines of the system, this leat extends west from Pond 85523 over a distance of some 440m to a junction with Leat 88015 near the west edge of the survey area. The eastern section of the leat, between Pond 85523 and the junction with Leat 88014, is recorded as Leat 88020 (see separate description in Area 1). Leat 88015, which is shown on the 1st ed OS sheet of 1875, is contemporary with the upper Twynywaun Pond (85523), and probably also with the lower Twynywaun Pond (85524).

The leat profile varies somewhat along its length. At SO 08682 06866, to the east of the major natural stream junction, the leat is 2.4m in width and 0.45m in depth, with a bank 0.9m in width on its south side. A similar (but deeper) profile was recorded to the east of the junction with Leat 88014 (where the leat is described as 88020). At SO 08548 06856, immediately to west of a crossing point for a track shown on the 1st ed OS, the leat is considerably wider, 5.70m in width and 0.75m in depth, with rubble along its lower (south) side but no distinct bank.

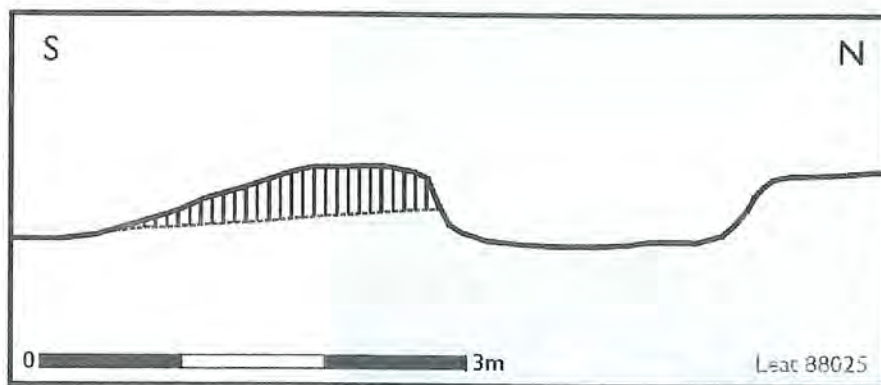


Figure 11: Profile of Leat 88025 at SO 08667 06861

At SO 08640 06845 the east-west leat is carried across the main natural north-south stream line. This junction is a complex zone of meandering streams and recut leat sections over a length of some 95m (see Figure 13). To the north of this area, the natural marshy stream pattern has been adapted by a series of parallel ditches connecting with the main leat. A junction with a secondary leat (described in this survey as 'DFD1') shows where the original leat has been blocked and diverted to a new course slightly further to the north. This complex area is also shown on the 1st ed OS plan to have been one of the crossing

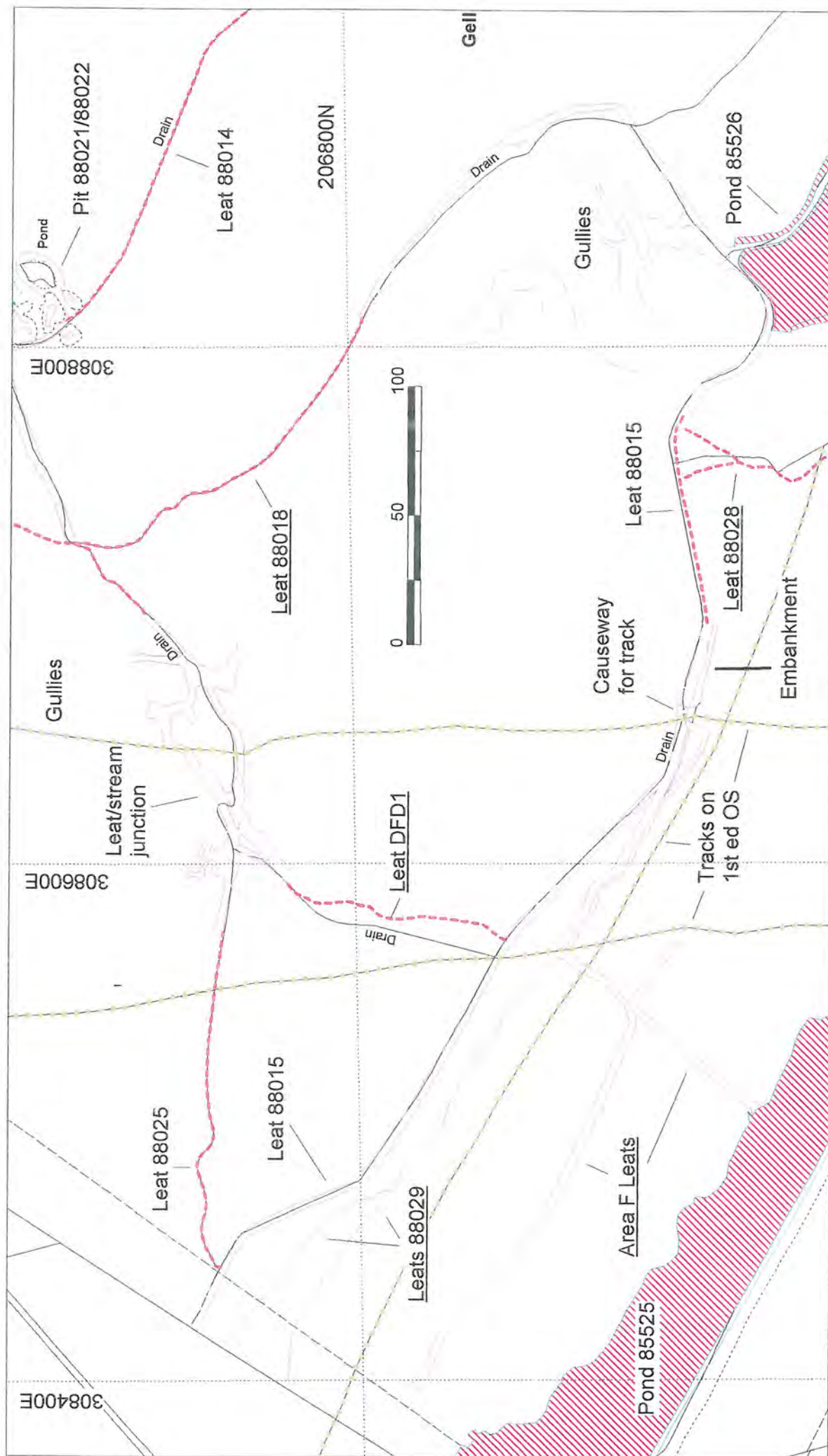


Figure 12: General plan of Area 3: Central west area

Features surveyed by TS indicated by parallel lines. Features plotted from GPS and tracings shown as broken lines.

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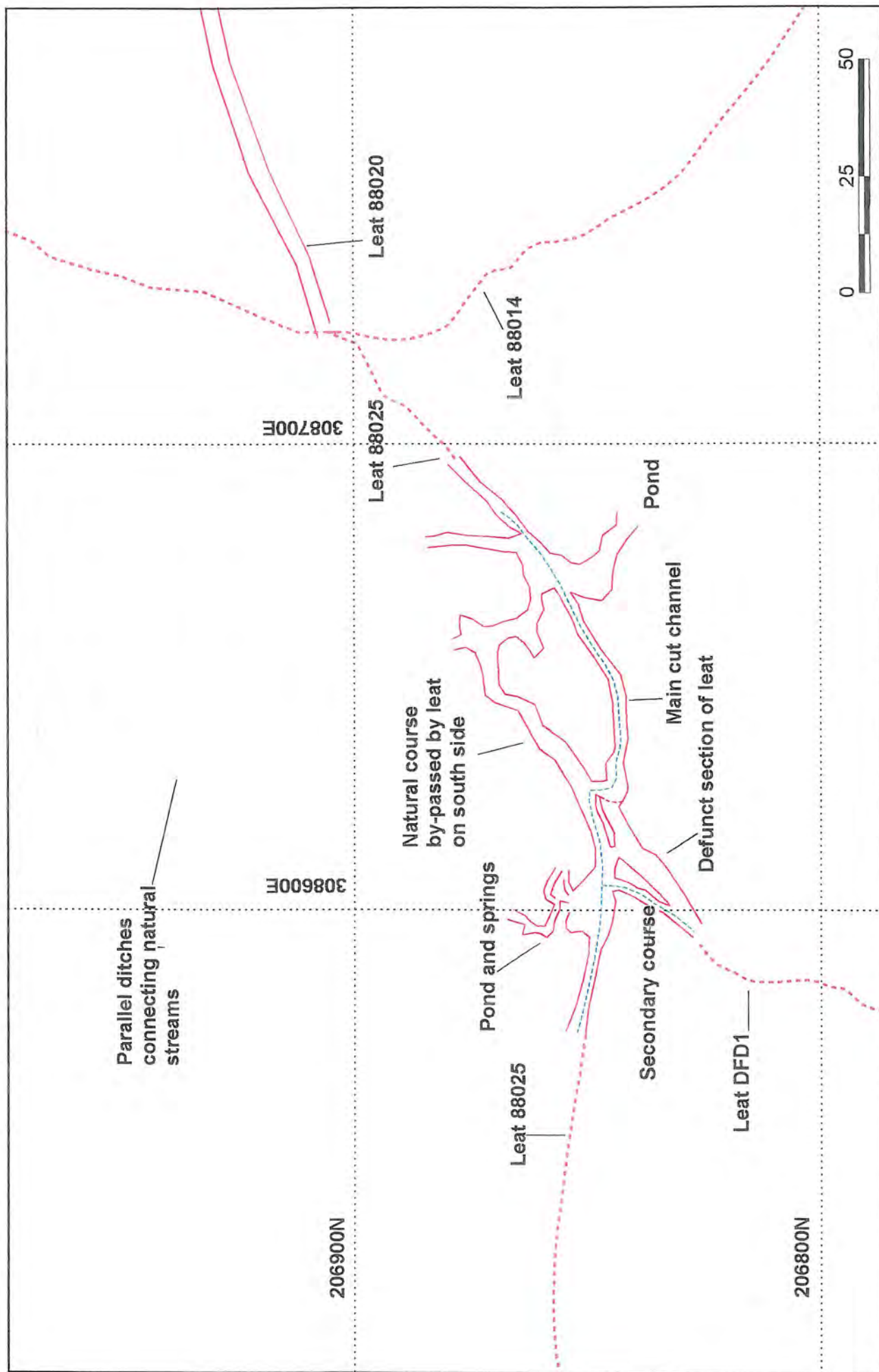


Figure 13: Leat 88025; detail plan of junction with natural stream course and Leat DFD1. Features recorded by TS indicated by parallel lines. Features plotted from tracings shown as broken lines.

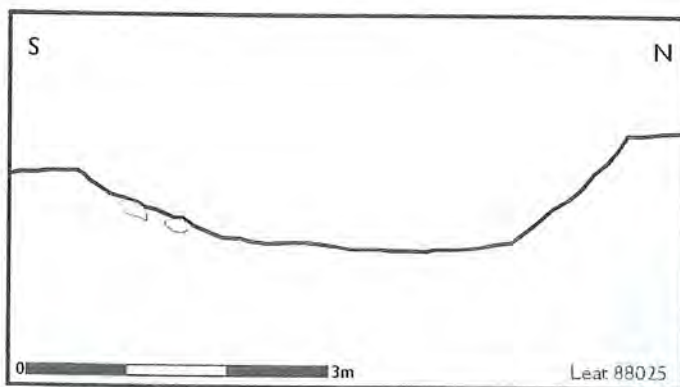


Figure 14: Profile of Leat 88025 at SO 08548 06856

RECORD: The eastern section of the leat (described as Leat 88020) was recorded in detail by total station survey. A second area of detailed survey was undertaken on the junction with the natural stream course. The remainder of the leat was plotted from spot GPS co-ordinates and the air photograph.. Three drawn profiles were recorded at SO 08760 06929, SO 08682 06866 and SO 08548 06856. A machine-cut section was recorded at SO 08690 06875. See Appendix 1 for details of photographs, under Leats 88025 and 88020.

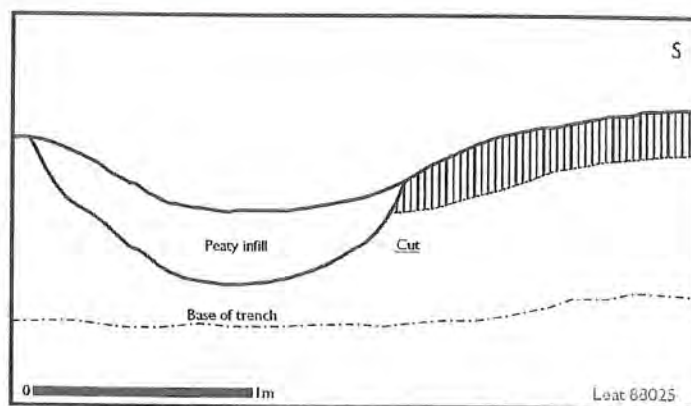


Figure 15: Machine-cut section through Leat 88025 at SO 08690 06875

B: Leat 88015

The second of the two main leat courses extends east from a point to the west of the survey area (now reclaimed) and extends to Pond 85526, where it becomes Leat 85575. In practice, Leats 88015 and 85575 appear to be the same feature; the pond marks the point where the west-east leat is carried across the north-south stream line by an embanked aqueduct. At its western end, Leat 88015 is quite broad, ranging from 3.75m to 5m in width and 1.5m in depth; it becomes a narrower feature, 2.6m in width and 1.5m in depth where it reaches the pond.

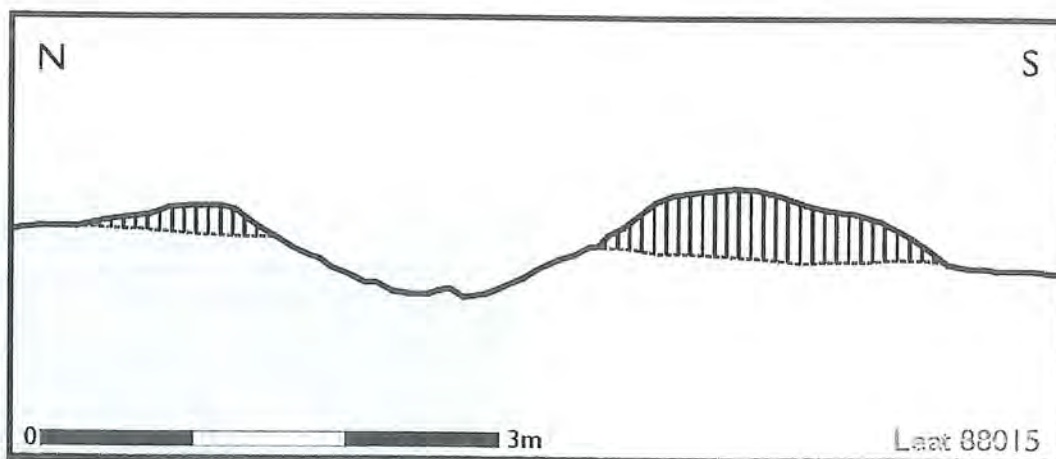


Figure 16: Profile of Leat 88015 near Pond 85526 at SO 08804 06642



Plate 8: Leat 88015, showing crossing point for trackway shown on 1st ed OS plan, looking E

At SO 08656 06674 the leat is crossed by a trackway shown on the 1st ed OS sheet. This is one of the most impressive of the trackway crossing points. The bank on its south side rises to 2m in height, and becomes a prominent, broad earthwork for several metres on each side of the crossing point. The crossing itself was over a stone causeway, now culverted. The raised embankment seems to be a way of funnelling stock to the causewayed part of the crossing, rather than as some form of water catchment. A smaller ditch has been cut on the lower (south) side of the bank. Slightly to west of the crossing point, leat 88015 is joined by a second leat, 88029; the latter feature is, in turn, fed by a secondary ditch further upstream to the west. Between the causeway and the major natural stream course marked by Pond 85526, the leat

crosses a smaller natural stream line, and bends markedly upslope at this point. A small north-south leat, 88028, follows the line of this stream course from 88015.

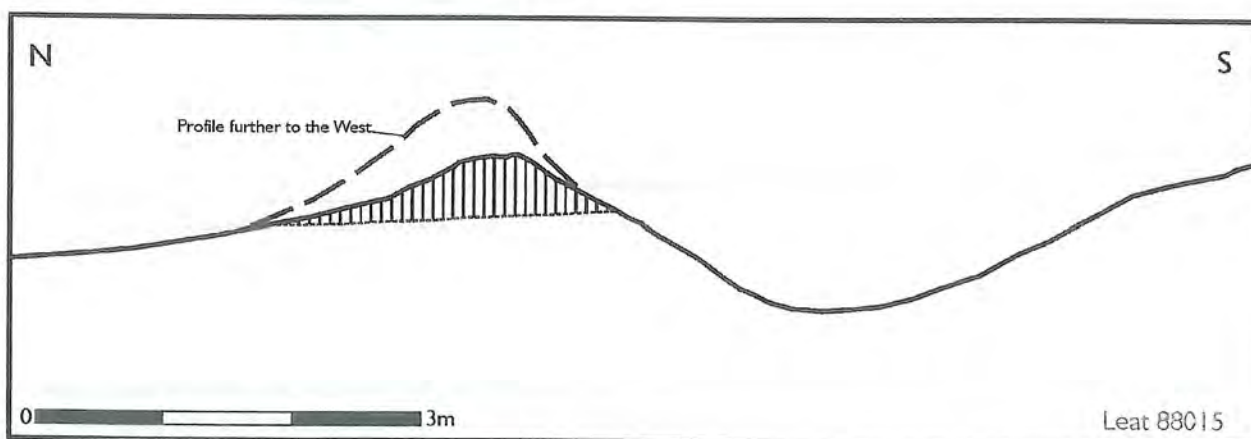


Figure 17: Profile of Leat 88015 on the east side of the crossing point at SO 08669 06678, showing the embankment

RECORD: The eastern section of Leat 88015 was surveyed by total station as part of the Pond 85526 survey. Most of the remainder of the leat to the west of Leat 88028 was also surveyed by total station, with particular attention paid to the embanked crossing point and leat junctions. Drawn profiles were recorded at SO 08611 06718 and SO 08475 06809 (both of these including the lower leat line 88029), at SO 08669 06678 (to the east of the crossing point) and at SO 08804 0642 (listed as part of the Pond 85526 area earthworks). See Appendix 1 for details of photographs.



Plate 9: Junction of Leats 88015 (foreground) and 88029 (left), looking SW

C: Leat 88029

This feature follows an east-bound course parallel with 88015 and on the south (downslope) side of it, reaching a junction with the latter at SO 08629 206682. A secondary leat feeds into 88029 from the north at SO 08472 206787. Thus, to the west of this point, there are three east-bound leats running roughly parallel with one another: Leat 88015, a central leat and Leat 88029. Leat 88029 is crossed by the line of a trackway shown on the 1st ed OS plan. This area is marshy and overgrown by reeds, and it was not possible to examine the crossing point in the field. At the same point there is also a junction with a lower line of leats (described here as 'Area F Leats'), which feed into Pond 85525.

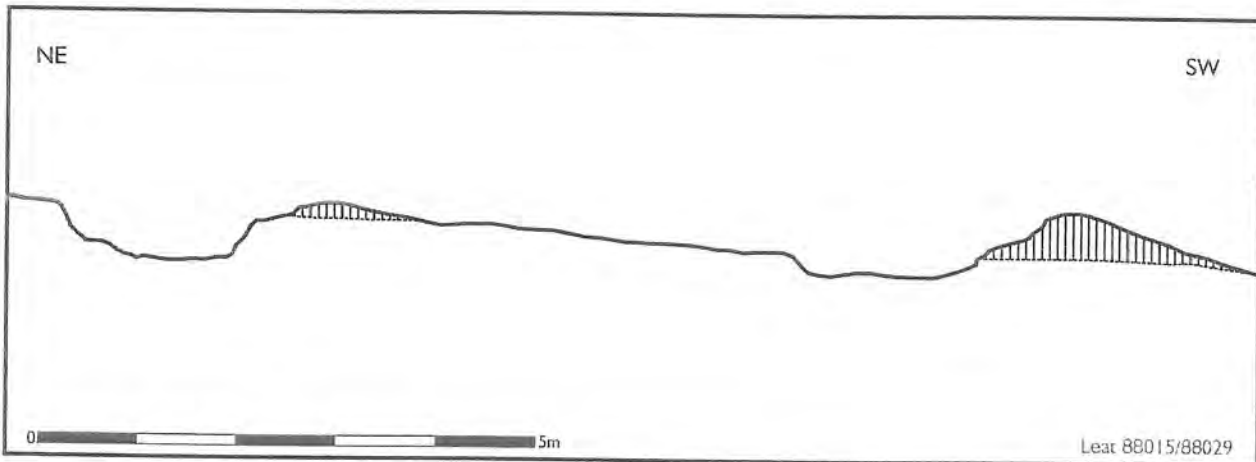


Figure 18: Profile across Leats 88015 (left) and 88029 (right) at SO 08611 06718

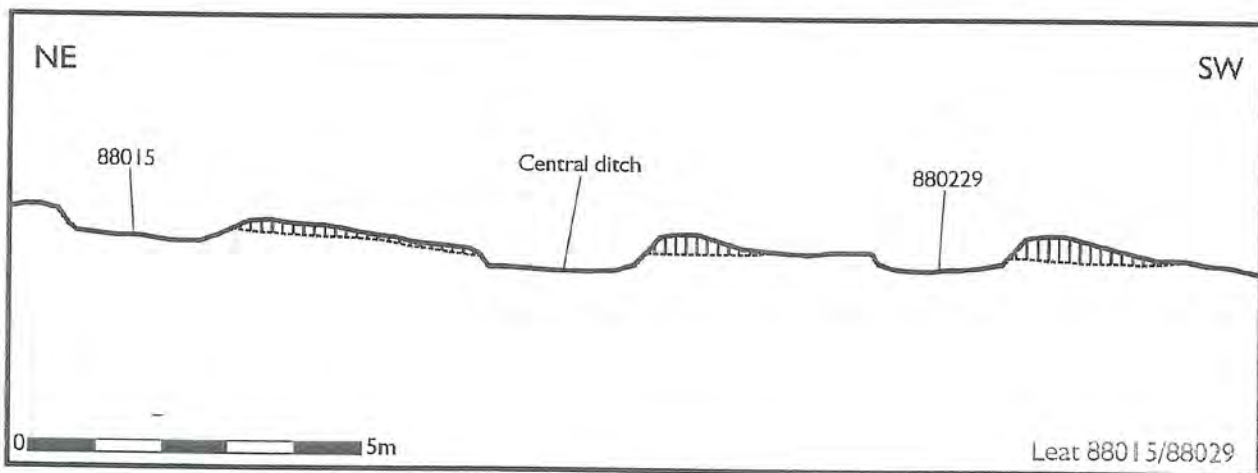


Figure 19: Profile across Leats 88015 and 88029 at SO 08475 06809, to west of Figure 18 (above), showing central ditch between the leats



RECORD: The leat was recorded in detail by total station survey. Drawn profiles were recorded at SO 08611 06718 and SO 08475 06809 (both of these including the upper leat line 88015). See Appendix 1 for details of photographs.

Plate 10: Leats 88029 (left) and 88015 (far right) at position of joint profile in Figure 18, looking W

D: Leat 88018

This feature extends southwest from a junction with Leat 88025 to join Leat 88015/85575 on the north side of Pond 85526. It is one of several leats in the central and eastern area which appear to have been created at some time after the 1st ed OS plan of 1875. It is shown on the 2nd ed sheet of 1905. The leat is a fairly broad ditch, 2m in width and 0.45m in depth, with a wide bank on its west (downslope) side.

At SO 08890 06696 the leat divides; the main branch continuing southwest to the pond and the second extending east to become Leat 88017.

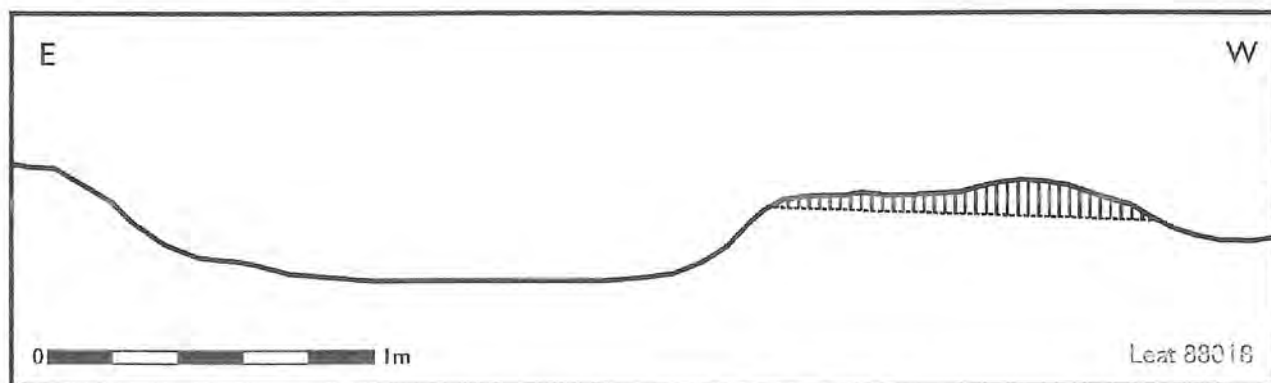


Figure 20: Profile of Leat 88018 at SO 0897 06813

RECORD: The south half of the leat was recorded in detail by total station survey. The course of the north half was defined by GPS spot co-ordinates and air photograph plots. A drawn profile was recorded as SO 08797 06813. See Appendix 1 for details of photographs.

E: Leat DFD1

This previously unrecorded feature runs south between Leat 88025 and 88015, occupying what was probably the line of a natural stream course. It consists of a broad, flat ditch, 5.2m in width and 0.7m in depth, becoming narrower to the south. A smaller gully with banks extends from Leat 88025 to join DFD1 on its west side.

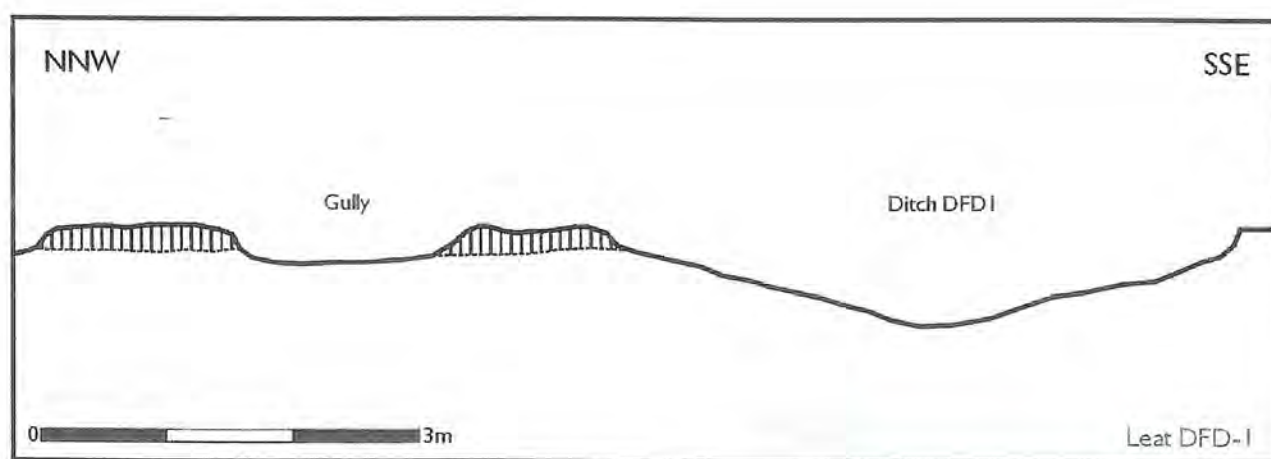


Figure 21: Profile of Leat DFD1, with smaller gully to left, at SO 08601 06843

RECORD: The course of the leat was plotted from GPS spot co-ordinates and the air photograph. A drawn profile through the leat and the smaller accompanying ditch was recorded at SO 08601 06843. See Appendix 1 for details of photographs.

Area 4: Shepherds Pond (85526) and surrounds

(See plan on Figure 22)

Summary

This area includes Shepherds Pond (Pond 85526) with its surrounding drainage features:

- A: Pond 85526 (centred on SO 08840 06605)
- B: Leat 85575 (western section) (centred on SO 08878 06604)
- C: Leat 88015 (eastern section) (centred on SO 08763 06676)
- D: Leat 88028 (centred on SO 08758 06616)
- E: Rectilinear gully complex draining to Leat 88018 (SO 08842 06660)
- F: Rectangular platform on the southwest side of Pond 85526 (centred on SO 08800 06615)

Description

A: Shepherds Pond (Pond 85526)

This pond is located on the line of the largest of the natural drainage courses in the survey area. It is also the most complex of the dams, with an embanked aqueduct conveying an east-bound leat across the upslope side of the pond, while the pond itself drains to the west. The name 'Shepherds Pond' is shown on the 1st ed OS 25" sheet of 1873, and is applied both to Pond 85526 and also Pond 85527 (NMR data).



Plate 11: Pond 85526, SW embankment, looking SE. Stone sluice at base of dam on left edge of photograph

The pond is an approximate rectangle in plan, aligned on a northwest – southeast axis across the line of the natural channel, and measuring 74.8m x 37.3m in area. The southwest side of the dam is a broad embankment. Unusually, there are also substantial earthen banks on the upslope northeast, northwest and east sides, which allow leats to be carried around the pond. The pond is fed from the northeast by Leat 88015. A stone-walled sluice is located at the base of the main southwest embankment, draining to a dogleg outfall channel to the southwest, which forms the first part of Leat 88027. At the southeast corner of the dam is an opening to an overflow course which curves to the southeast

RECORD: The pond and its feeder and outfall courses were recorded in detail by total station survey. See Appendix 1 for details of photographs.

B: Leat 85575 (western section)

This section is described separately from the remainder of the leat because it is closely integrated into the construction of Pond 85526. The leat drains eastwards from a junction with Leat 88015. It is carried

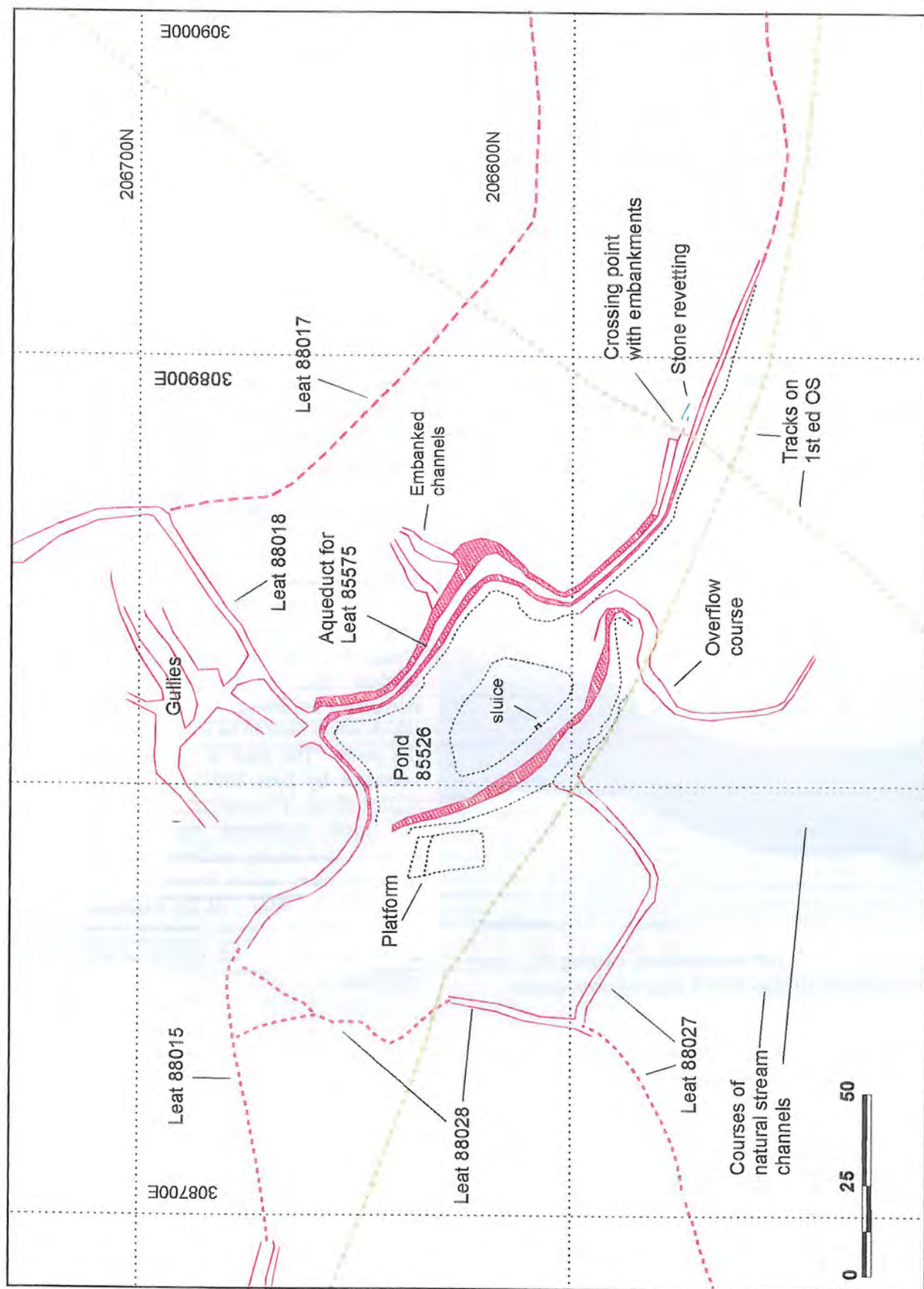


Figure 22: General plan of Area 4: Shepherd's Pond (85226) and surrounds. Features recorded by TS survey indicated by parallel lines. Features plotted by GPS and tracing shown as broken lines. Stream channels plotted from air photograph

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around the north and west sides of the dam by a substantial earthen aqueduct, with banks on each side. Two smaller embanked channels feed into the leat from the northeast at SO 08878 06624. At SO 08917 06553, the leat is crossed by a trackway, shown on the 1st ed OS. At this point, the bank is raised and widened; there are traces of stone revetting along the bank to the east of the crossing point. (This feature is similar in construction to the 1st ed OS trackway crossing points on Leats 88025 and 880299). In contrast, where the line of the same trackway, 73m to the northeast, crosses Leat 88017 (which was constructed after the 1st ed OS), there is no embanked crossing point. It appears that the provision of substantial embanked causeways for crossing points over the leats may have been abandoned by the later stages in the development of the leat system, and the interrupted trackway in this case presumably became or was already defunct.

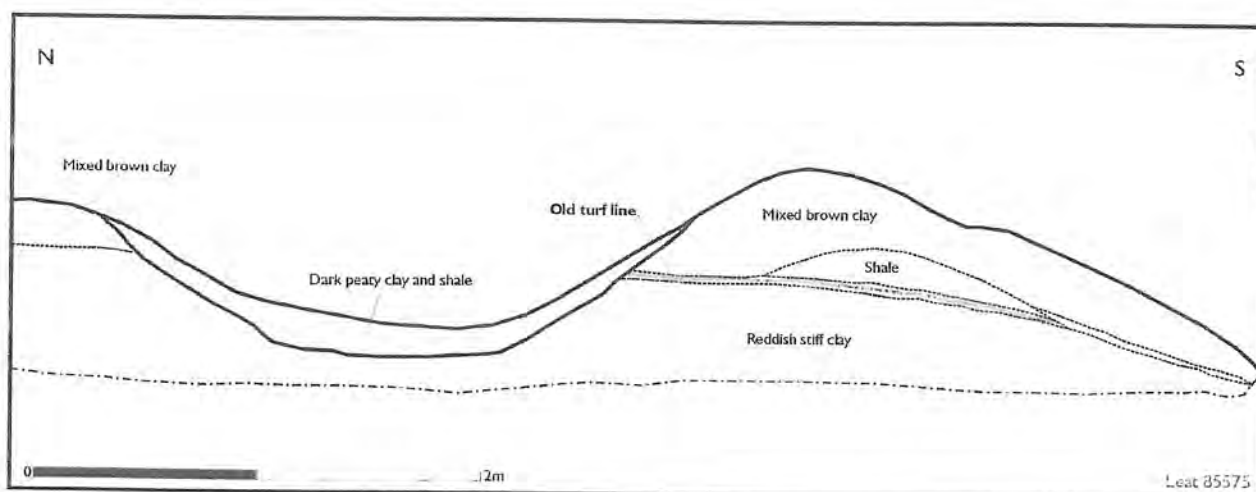


Figure 23: Machine-cut section across Leat 85575 at SO 08871 06581

RECORD: The western section of the leat was recorded in detail by total station survey. An excavated section was machine-cut across the aqueduct at SO 08871 06581, near the southeast corner of the dam, at a point where it had been breached by previous erosion. See Appendix 1 for details of photographs, listed under Leat 85575.



Plate 12: Machine-cut section across Leat 85575 at SO 08871 06581 (as Figure 23 above), looking E

C: Leat 88015 (eastern section)

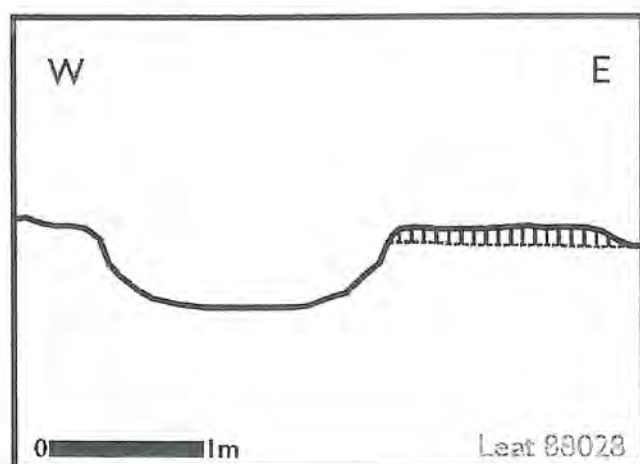
As with the respective section of Leat 85575 (above), this part of Leat 88015 forms an integral part of the dam, and has been described separately from the remainder of the leat. The leat extends east to a junction with Leats 85575 and 88018 above the north corner of Pond 85526. It is carried past the northwest side of the dam by a substantial bank, which leads into the aqueduct for Leat 85575. The 1st ed OS suggests that Leats 88015 and 85575 originally formed a single major course across the survey area, extending east around the north side of the dam to Rhaslas Pond. Leat 88018, which marks the division between Leats 88015 and 85575, does not appear on plan until the 3rd ed OS. The recorded profiles of Leats 88015 and

85575, at opposite ends of the dam, are similar, with a leat 2.6m in width and between 0.5m and 0.85m in depth; these leats should probably be regarded as part of the same earthwork.

RECORD: The eastern section of the leat in the vicinity of the pond was recorded in detail by total station survey. A profile was drawn across the embanked portion of the leat at SO 08804 06642, at the northwest corner of the pond. See Appendix 1 for details of photographs, listed under Leat 88015.

D: Leat 88028

This is a short leat extending south from Leat 88015 to Leat 88027. It is not shown on the 1st or 2nd ed OS plans, but appears on the 3rd ed OS sheet of 1915. The leat follows the line of a natural stream course, and is probably a rationalization of an existing natural feature. It is a shallow ditch, 1.9m in width and 0.5m in depth.



RECORD: The south part of the leat was recorded in detail by total station; the north end was plotted from GPS spot co-ordinates and an air photograph. A profile was drawn across the leat at SO 08758 06612. See Appendix 1 for details of photographs.

Figure 24: Profile across Leat 88028 at SO 08758 06612

E: Rectilinear gully complex draining into Leat 88018

Leat 88018, which drains from the northern leats 88025 and 88024 to the southern leats 88015 and 85575, seems one of the several late features in the central area; it first appears on the 2nd ed OS sheet of 1905. It is described in the section for Area X. Close to its junction with the southern leats and the pond, the leat is fed by a complex of smaller gullies, centred on SO 08842 06660. This group was traced over an area of about 75m x 50m but may have been more extensive. It drains a low-lying, marshy area on the east side of the main north-south stream channels. The arrangement of parallel gullies and meandering natural streams is rather similar to that recorded further to the north in Area 3, draining into Leat 88025. In both cases the effect is a modification of a natural feature, improving and directing the natural drainage of a marsh into the adjacent leats.

RECORD: A representative sample of the gully complex was recorded in detail by total station. It was not photographed as part of the present survey.

F: Rectangular platform on the southwest side of Shepherds Pond

A small earthwork platform or enclosure lies to the southwest of the pond, close to the base of the dam. It forms an irregular rectangle, 10m in width and 20m in maximum length, and 0.35m in height. A smaller compartment or division occupies the north side of the feature. Its function is uncertain, though it may have been a sheep fold; the name Shepherds Pond is of interest in this respect. The platform lies close to the line of a trackway shown on the 1st ed OS sheet. These trackways are of particular interest as they suggest where the lines of droveways across the commons intersect with the leats.

RECORD: The earthwork was recorded in detail by total station survey. It was not photographed for the present survey.

Area 5: Soap Vein Pond (85525) and surrounds

(See plan on Figure 25)

Summary

This area on the west side of the main survey area includes the major reservoir Pond 85525 with its secondary feeder courses. The features on the lower terrace, to the southwest of the pond, are described separately as part of Area 6. The area includes the following:

A: Pond 85525 (centred on SO 08450 06650) with a stone feeder sluice 88030

B: An area of previously unrecorded leats described here as 'Area F' (centred on SO 08545 06671)

Description

A: Soap Vein Pond (Pond 85525) and Sluice 88030

This feature, the largest of the ponds within the survey area, is formed by an open-sided dam with a long south side of some 235m and a shorter west side of 80m. A feeder leat is shown on the 1st ed OS plan, joining the northwest corner of the dam (the leat has been removed as part of the Trecatti reclamation scheme). A stone-lined sluice (described as 88030) feeds into the pond through the west dam wall at SO 08358 06744. Secondary leats feed into the pond from its open northeast side at SO 08379 06761 and SO 08504 06650.



Plate 13: Stone-lined outfall sluice 88030 at NW corner of Pond 85525, looking W

The outfall sluices are at the southeast corner of the dam. The main course runs southwest into Leat 88027, which has a prominent embankment on its south side that forms a continuation of the dam wall itself. A second outfall leat extends southeast towards Shaft 85558.

The water margin is close to that shown on the 1st ed OS plan. Heavy rain in the days before the survey had raised the pond level somewhat, and the water margin shown on plan is probably higher than that at other times of the year.

RECORD: The pond was recorded in detail by total station survey. See Appendix 1 for details of photographs.

B: Area F leats

The marshy area on the northwest (upslope) side of the pond, between the pond and Leat 88029, contains some previously unrecorded leats (not shown on the early OS plans) which feed into Pond 85525. This is described as 'Area F' for the present survey. Two principal leats were recorded; there was probably a third on the northwest side of the area, as indicated by an inlet into the pond near its northwest corner, though the third leat was hard to trace in the reed-filled marsh and could not be recorded.

RECORD: The two visible leats in Area F were recorded in detail by total station survey. No photographs were taken of these features.

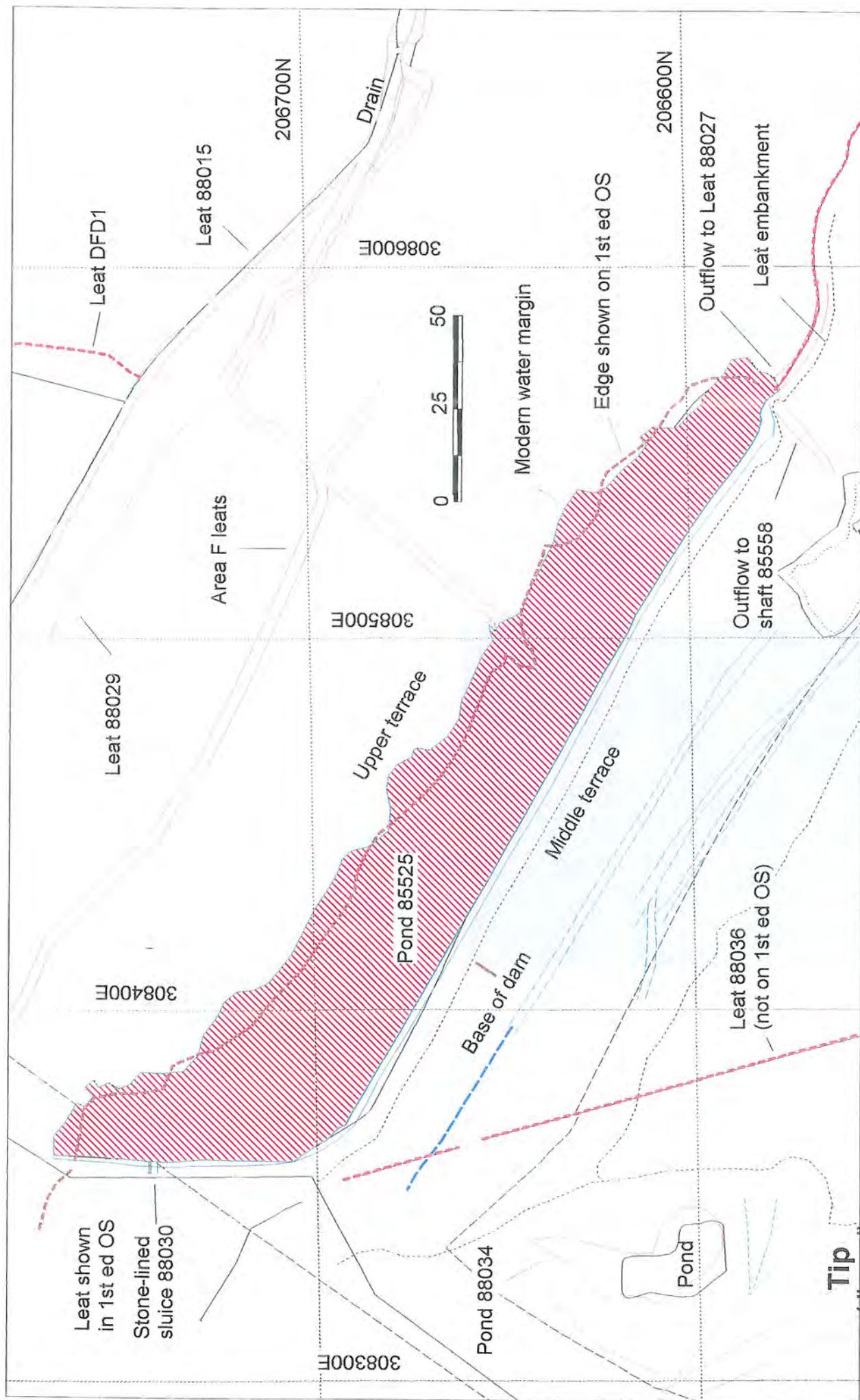


Figure 25: General plan of Area 5: Soap Vein Pond (85525) and surrounds. Features recorded by TS survey indicated by parallel lines. Features plotted by GPS and tracing shown as broken lines. Based on the Ordnance Survey map with the permission of The Controller of Her Majesty's Stationary Office. Crown Copyright reserved. Glamorgan Gwent Archaeological Trust Ltd. Licence No AL 10005976.

Area 6: Southwest pits 85558 and 88033

(See plans on Figures 26, 27 and 28)

Summary

This area includes the pit sites, tramroads, waste tips, embankments and leats occupying the southwest corner of the main survey area. It includes the following:

- A: Pit 85558 (centred on SO 08520 06547)
- B: Waste tips 88032 (centred on SO 08470 06520)
- C: Raised terrace with tramroads and sidings (centred on SO 08433 0600)
- D: Soap Pit Houses and shaft 88033 (centred on SO 08315 06647)
- E: Soap Pit pond 88034 (centred on SO 08328 06610)
- F: Waste tips 88035 (centred on SO 08290 06570)
- G: Leat 88036 (centred on SO 08380 06600)
- H: Leat 4255m (centred on SO 03840 06525)
- I: A previously unrecorded leat described in this survey as DFD3 (centred on SO 08488 06438)

Description

A: Pit 85558

The pit is set within a level hollow, 43m x 23m in area, surrounded by levelled tips and embanked leats. The shaft is oval, 6.7m x 5.15m, with lining stonework on its northwest and northeast sides. An aperture in the stonework on the northwest side is in line with the position of a track shown on the 1st ed OS plan. Holding-down bolts mark the position of part of the superstructure, probably for the frame of a balance wheel.



At a distance of 7.6m to the northwest of the shaft is a rectangular earth and rubble structure measuring 3m x 2.25m, aligned with the cross axis of the shaft and holding-down bolts. Leats extend from Pond 85525 towards the pit on its east and northeast sides.

Plate 14: Pit 85558, looking NW towards tramroad terrace. Note stone lining at back and right of shaft

RECORD: The pit was recorded in detail by total station survey. See Appendix 1 for details of photographs.

B: Waste tips 88032

This area of prominent lobed tips extend to the southwest from the site of Pit 85558, covering an area of 70m x 100m. The tips in their present form seem to be much as they were shown in the 1st ed OS plan.

RECORD: The tips were recorded in detail by total station survey. No photographs were taken specifically of the tips.

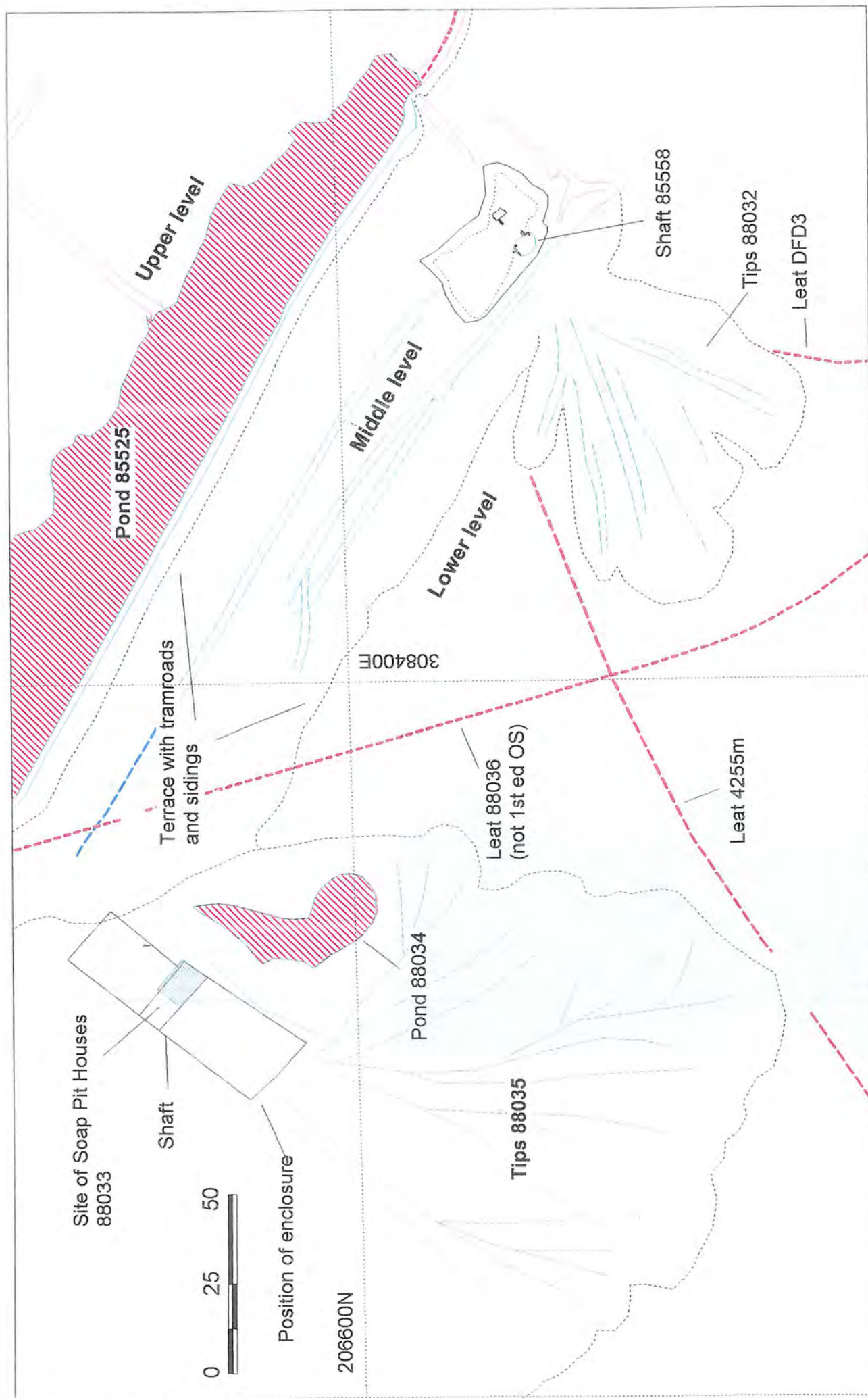


Figure 26: General plan of Area 6: Pits 855589 and 88023. Soap Pit Houses site and enclosure traced from 3rd ed OS.

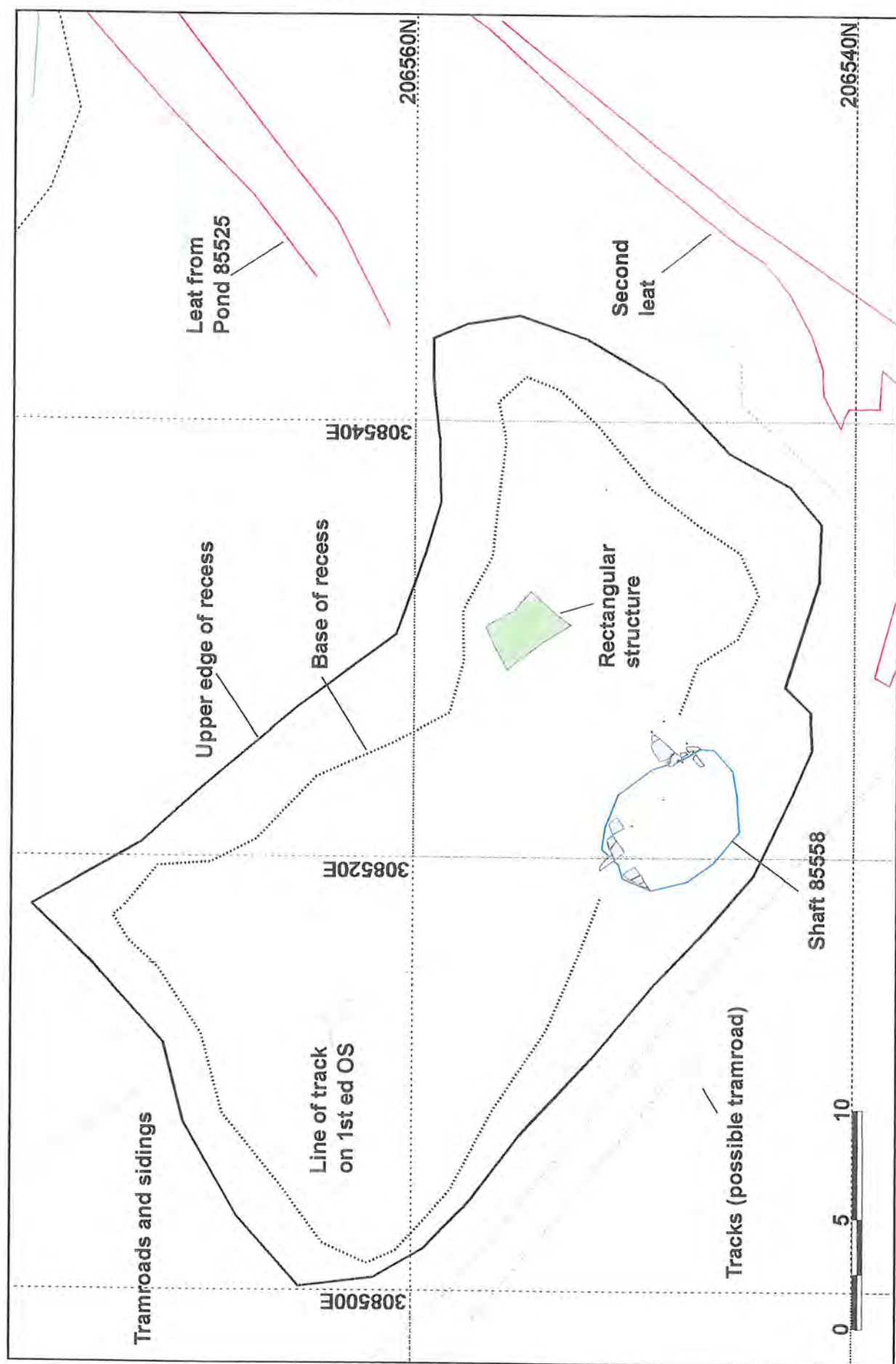


Figure 27: General layout plan of Pit 85558. See also Figure 28 for detail plan of shaft.

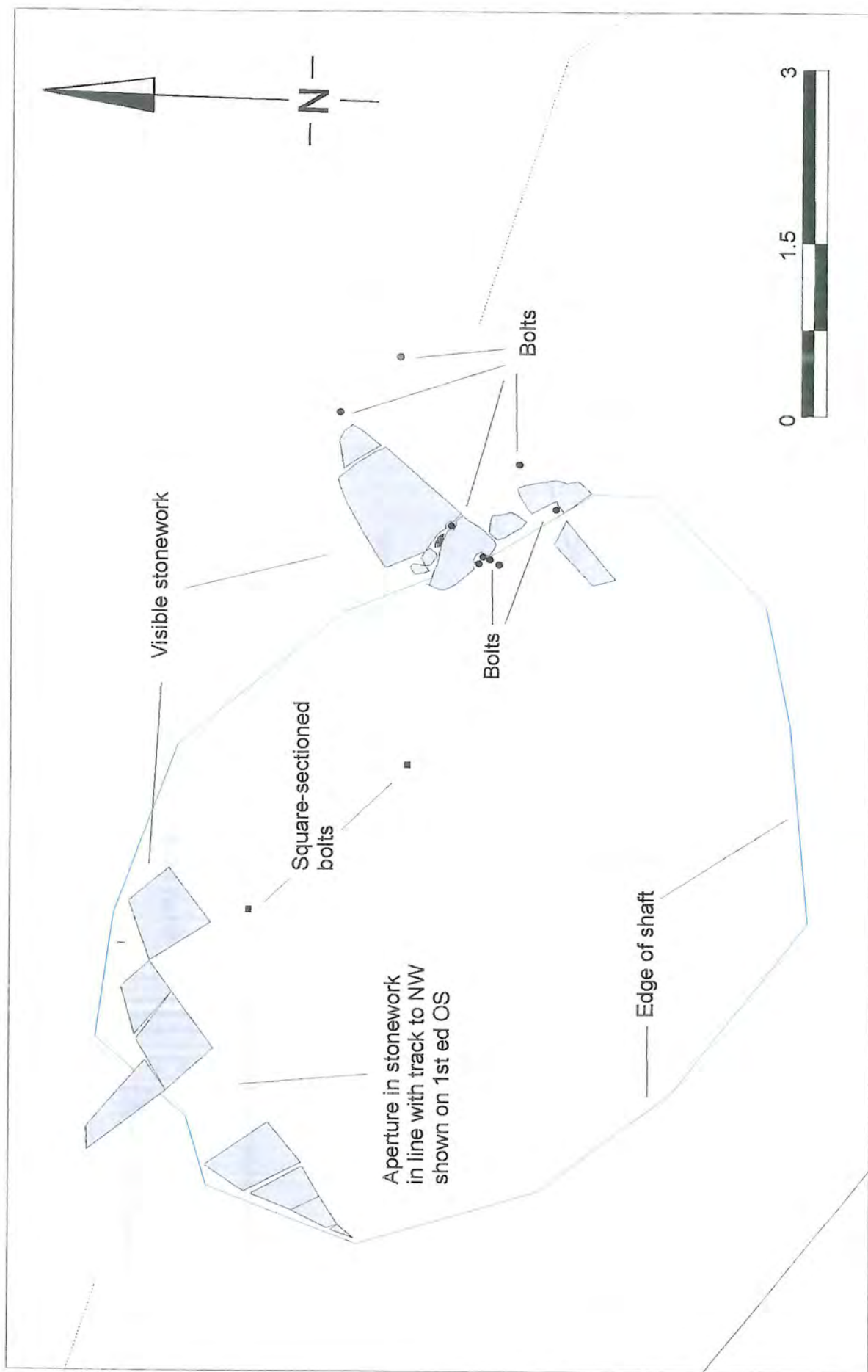


Figure 28: Pit 85558, detail plan of shaft. See also Figure 27 for general layout of pit site.

C: Raised terrace with tramroads and sidings

This forms a raised terrace, 50m in width, at a level below that of the pond. The lines of several tramroads are visible along the length of the terrace, connecting Pit 85558 with the Soap Pit complex (88033) and a shaft in the reclaimed land to the northwest.



Plate 15: Detail of air photo showing Area 6. Pond 85525 is at the top right, with the tramroad terrace to the SW of it. Waste tips 88035 are on the left and tips 88032 on the right. Compare with 1st ed OS plan in Figure 29 (below)

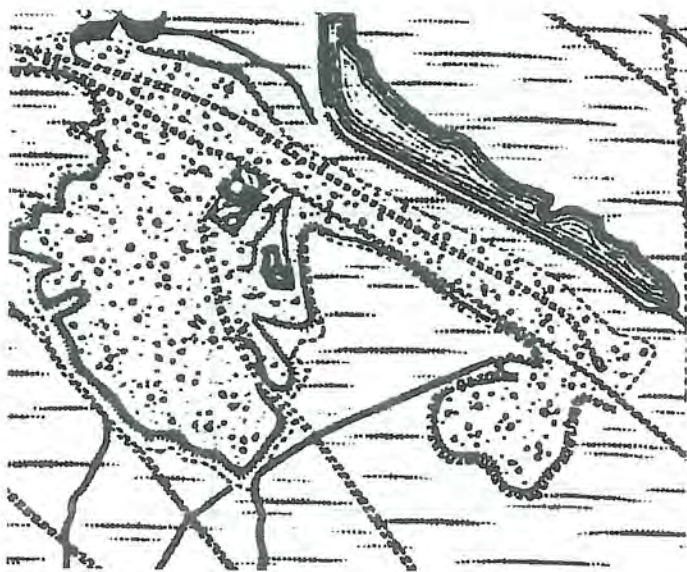


Figure 29: Detail of 1st ed OS 6", sheet 12NE (1875), showing similar area to Plate 15 (above). Note the tramroad terrace to the SW of Pond 85525 and the sites of Soap Pit Houses and Soap Pit Pond on the tips on the left

RECORD: The raised terrace and the relict tramroad lines were surveyed in detail by total station. No specific photographs were taken of this area for the present survey.

D: Soap Pit Houses and shaft 88033

This pit site is shown on the 1st ed OS sheet as a rectangular enclosure with a roofed building at its centre. The enclosure had been enlarged by the 2nd ed OS plan of 1905. The demolished remains of a structure at the position of the roofed building on the early OS plan are visible; these are described as Soap Pit Houses. The line of the enclosure can also be traced on the ground. To the northwest of the demolished building is an oval shaft with the remains of a stone lining and holding-down bolts.

It seems likely that Soap Pit Houses represents a domestic re-use of a former pit site, and it is possible that the building itself was part of the pit complex. The Soap Pit Houses site lies within the 30m corridor along the line of the adjacent pylons, and it should not be directly affected by the development.

RECORD: The shaft position was recorded by total station. No photographs or other record were undertaken on this site for the present survey.

E: Soap Pit Pond 88034

This pond, shown on the 1st ed OS plan, is a kidney-shaped feature nestling in the waste tips on the southeast side of the Soap Pit Houses site. The pond is some 50m in length and 17m in maximum width. A gully on its southeast side is possibly an overflow course. The pond seems to be fed from its north end, though the source was unclear.

The purpose of the pond is unknown. It may be a flooded pit, with a similar arrangement to that of Pit 85558.

RECORD: The pond was recorded in detail by total station survey. No photographs were taken specifically of this feature for the present survey.

F: Waste tips 88035

This area of lobed tips extends from the south side of the Soap Pit Houses site, but may also have derived from a second shaft further to the north (beyond the main survey area). The tips were originally more extensive than at present, but have been reclaimed on their west side as part of the adjacent Trecatti reclamation scheme. The surviving area of tips within the main survey area are essentially the same as that shown on the 1st ed OS plan.

RECORD: The east side of the surviving area of tips was recorded by total station. The remaining area was plotted from the air photograph.

G: Leat 88036

This leat extends southeast from a source to the west of Pond 85525, crossing the raised terrace. It intersects Leat 4255m at SO 08401 06527. The leat is not shown on the 1st ed OS plan.

RECORD: The course of the northern part of the leat was plotted by total station survey. A profile was recorded by total station survey at SO 08381 06600. See Appendix 1 for details of photographs.

H: Leat 4255m

This leat extends southwest from a source at the base of Tips 88032, continuing past the south edge of Tips 88035, which partly overlies the leat.

RECORD: The course of the eastern part of the leat was plotted by total station survey. See Appendix 1 for details of photographs, listed under Leat 88036.

I: Leat DFD3

This previously unrecorded leat extends southeast from a source at the base of Tips 88032. It consists of a main ditch, 0.9m in width and 0.45 in depth, with banks on each side. A second ditch runs parallel on the east (upslope) side of the main one, at a distance of 2m from it.

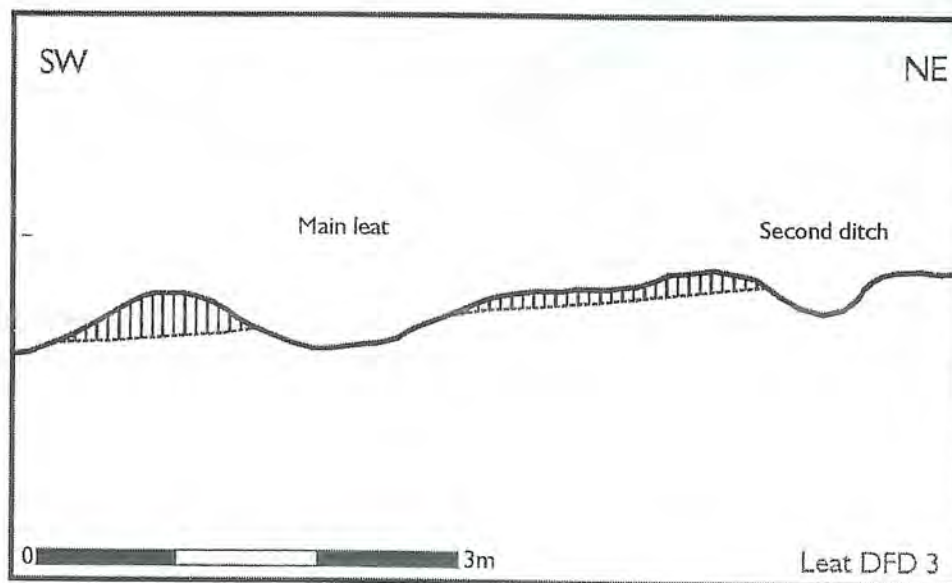


Figure 30: Profile of Leat DFD3 and accompanying ditch at SO 08488 06438

RECORD: The leat was plotted from the air photograph. A drawn profile across both ditches was recorded at SO 08488 06438. See Appendix 1 for details of photographs.

Area 7: Southeast leats and Pond 85527

(See plan on Figure 33)

Summary

The southeast corner of the main survey area includes the area between Pond 85526 and Pond 85527. It includes the following features:

- A: Leat 88017 (centred on SO 09050 06597)
- B: Leat 85575 (centred on SO 09000 06528)
- C: Leat 88016 (centred on SO 09161 06545)
- D: Leat 88013 (centred on SO 09200 06700)
- E: Leat 85942 (centred on SO 09105 06459)
- F: Pond 85527 (centred on SO 09300 06450)

Description

A: Leat 88017

This feature extends eastwards from a junction with Leat 88018, following the curving contour of the hillslope towards Rhaslas Pond. It is not shown on the 1st ed OS plan. The 2nd ed OS plan of 1905 shows the leat extending east only as far as SO 09139 06446, where it turns south on the line of Leat 88016 to join Leat 85575. By the time of the 3rd ed OS plan of 1915, the leat had been continued directly to Rhaslas Pond, in its present arrangement. The initial stage of the leat (on the west side of the junction with Leat 88016) is a ditch of 2m width and 1m overall depth. The second stage, on the east side of the junction, is a narrower feature, only 1.2m in width, but with a similar broad, shelving bank on its north (upslope) side.

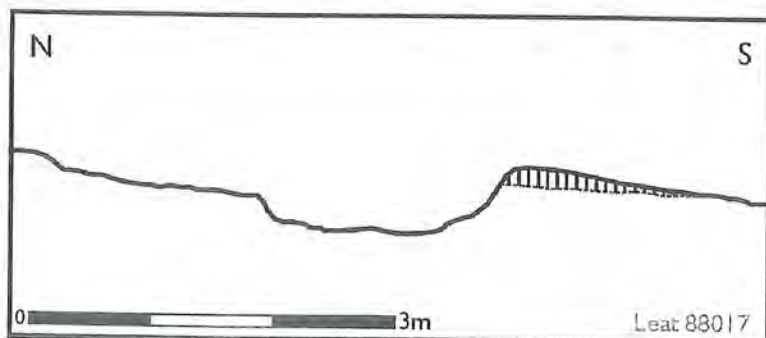
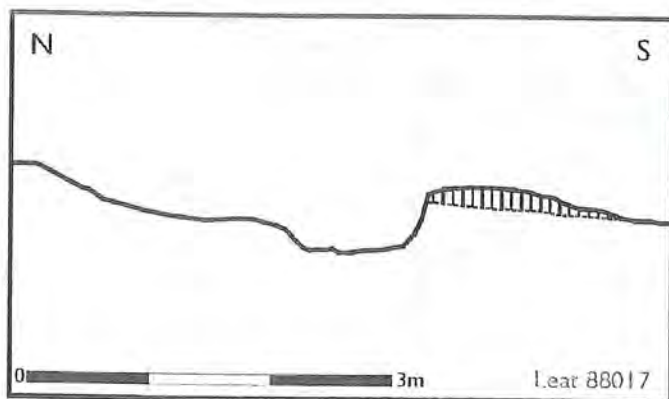


Figure 31: Profile of Leat 88017 at SO 09110 06598, to the west of the junction with Leat 88016



RECORD: The course of the leat was plotted from GPS spot co-ordinates and the air photograph. Drawn profiles were recorded at SO 08937 06632, SO 09110 06598 and SO 09158 06597. A machine-cut trench was excavated at SO 09050 06597. See Appendix 1 for details of photographs.

Figure 32: Profile of Leat 88017 at SO 09158 06597, to the east of the junction with Leat 88016

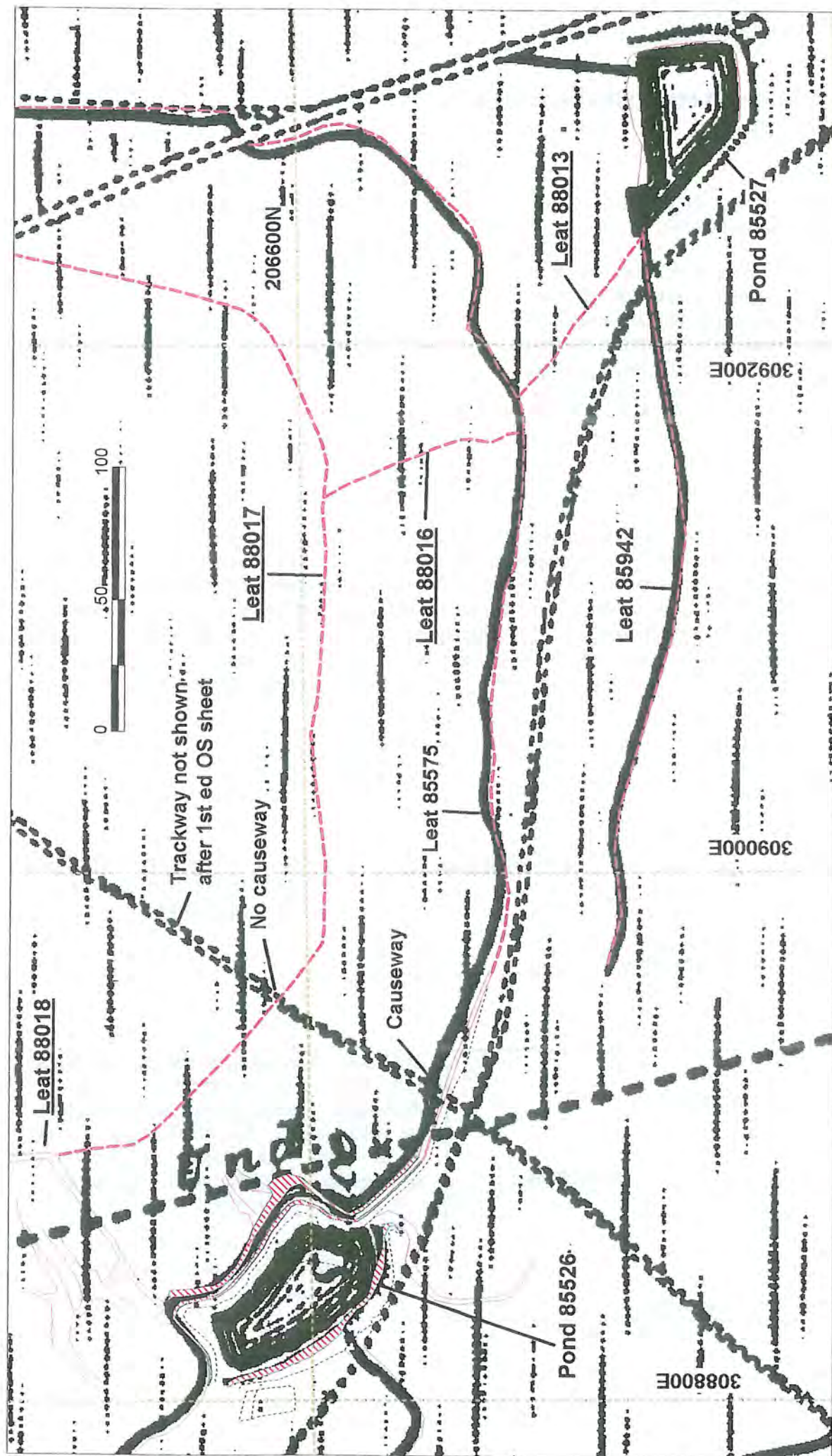


Figure 33: Area 7: general plan of southeast leats and Pond 85527, overlain on the 1875 1st ed OS, sheet 12NE. Features recorded by TS survey indicated by parallel lines. Broken lines show features plotted from GPS and modern OS map tracing.

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B: Leat 85575



This leat is the eastwards continuation of Leat 88015; it extends from Pond 85526 towards Rhaslas Pond, downslope of Leat 88017. The western part of this course has been described above as part of the features surrounding Pond 85526 (Area 4). The leat is shown essentially in its present form on the 1st ed OS plan, though it has been joined by Leat 88016. The ditch varies along its length, but is an average of 2m in width and 0.8m in depth.

Plate 16: Leat 85575, near trackway junction (in background), looking W

RECORD: The western part of the leat, in the vicinity of Pond 85526, was recorded in detail by total station survey. The remaining part within the main survey area was plotted by from GPS spot co-ordinates and the air photograph. Drawn profiles were recorded at SO 09142 06520 and SO 09192 06526. A machine-cut section was recorded on the east side of Pond 85526 at SO 08871 06581 (described above in Area 4). See Appendix 1 for details of photographs.

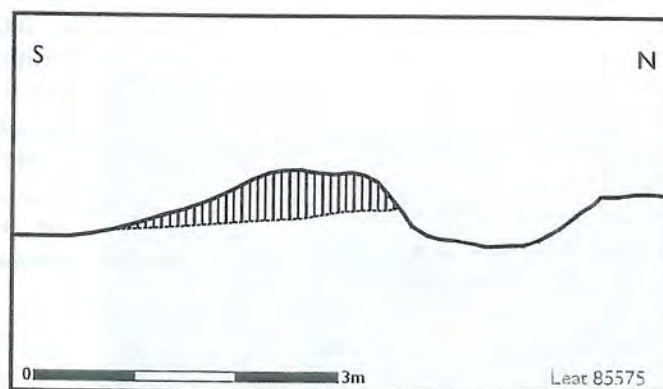


Figure 34: Profile of Leat 85575 at SO 09142 06520

C: Leat 88016



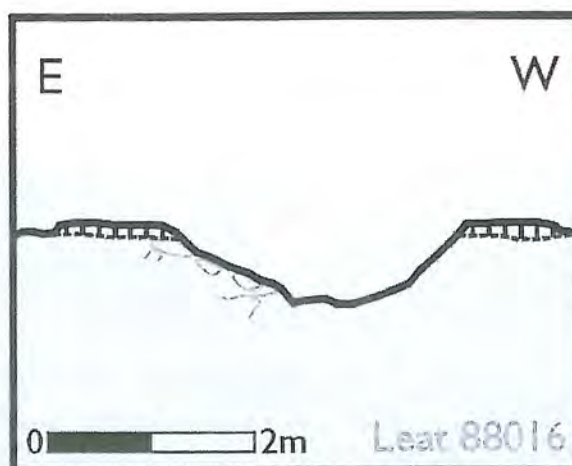
This feature is part of a group of leats in this area which do not appear on the 1st ed OS plan. In its original role, as shown in the 2nd ed OS plan of 1905, it formed the east end of the shorter Leat 88017, joining this leat to Leat 85575. By the 3rd ed OS plan of 1915, Leat 88017 had been extended directly to Rhaslas Pond, and Leat 88016 became a secondary course.

Plate 17: Junction of Leat 88017 (foreground) with Leat 88016 (background), looking SE

The leat is a substantial feature, 3m in width and 0.85m in depth, with shallow banks on each side and traces of rubble on its east (downslope) side. It probably follows the general course of a natural stream.

RECORD: The course of the leat was plotted from the modern OS sheet and the air photograph. A drawn profile was recorded at SO 09170 06552. For photograph details see Appendix 1.

Figure 35: Profile of Leat 88016 at SO 09170 06552



D: Leat 88013

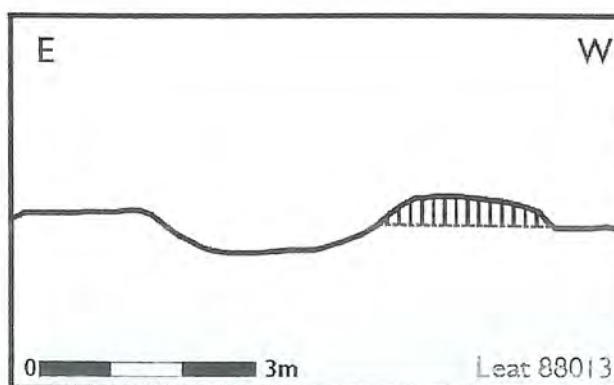


This is also one of the group of features which seem to have been created after the 1st ed OS plan. It extends southeast from Leat 85575 to the northwest corner of Pond 85527. As with Leat 88016, which is located further upslope and shares the same general alignment, this leat probably lies on the line of a natural stream. The leat is a fairly broad feature, ranging from 2.3m to 3.3m in width and 0.5m depth, with a bank on its west (downslope) side.

Plate 18: Leat 88013 near junction with Pond 85527, looking SE

RECORD: The course of the leat was plotted from the modern OS sheet and the air photograph. Drawn profiles were recorded at SO 09203 06510 and SO 08911 06666. For photograph details see Appendix 1.

Figure 36: Profile of Leat 88013 at SO 09203 06510

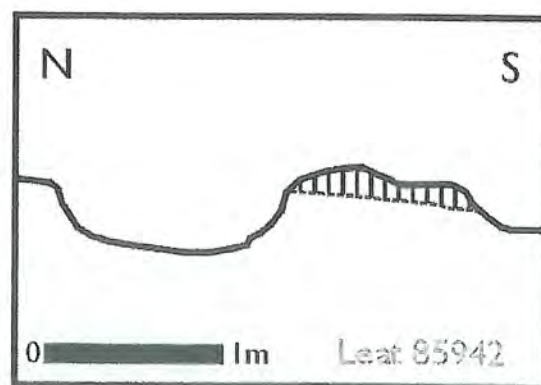


E: Leat 85942

This leat, which is shown on the 1st ed OS plan, extends east to Pond 85527. The leat is a fairly narrow feature, 1.4m in width and 0.45m in depth, with a shallow bank on its south (downslope) side. It attenuates towards its west (source) end. The leat is crossed near the pond by the line of a track shown on the 1st ed OS plan. It was not possible to discern any traces of the crossing point.

RECORD: The course of the leat was plotted from the modern OS sheet and the air photograph. Drawn profiles were recorded at SO 09114 06464 and SO 08997 06489. For photograph details see Appendix 1.

Figure 37: Profile of Leat 85942 at SO 09114 06464



F: Pond 85527

The pond is a well-preserved feature lying close to the main road. It will not be directly affected by the intended development. It consists of a three-sided earthen dam, 64m x 37m, with an open north side. The pond is fed by a sluice at its northwest corner, at the confluence of Leats 85942 and 88013. A second sluice position (presumably the outfall sluice) is located at the northeast corner, with a leat extending northeast towards the road.

RECORD: The pond was recorded by total station survey. No photographs were taken specifically of this feature during the present survey, but it is shown in the photograph of Leat 88013 (Plate 18).

Area 8: Pond 85992

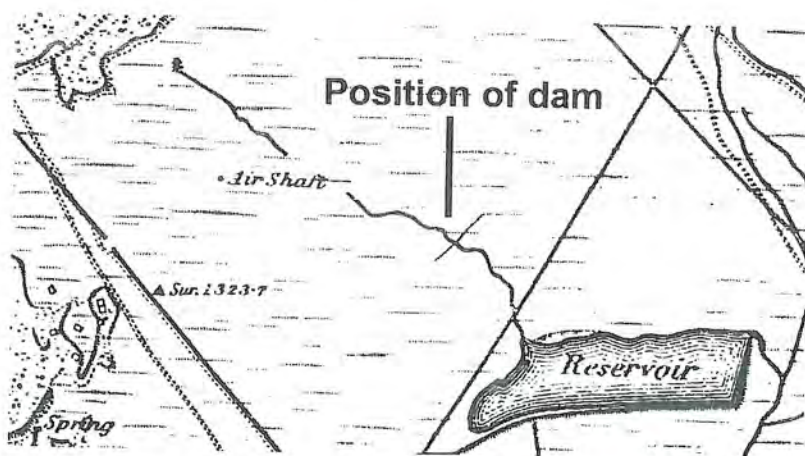
(See plan on Figure 39)

Summary

This pond lies to the west of the main survey area, close to the modern haulage road, centred on SO 07625 06500. It will be affected by the construction of a water treatment facility.

Description

The pond lies on the line of one of the main natural drainage courses, which extends to southeast across the line of the modern road. It consists of an earthen dam across the line of the natural channel, with scarped sides on its northeast and southwest sides. A break in the centre of the dam (presumably marking the position of a former sluice) leads to an outfall leat to the southeast. A shallow earthwork of uncertain purpose follows the inner edge of the dam wall.



In the 1st ed OS plan (Figure 38, left) the pond is not shown as a water-filled feature, but the line of the dam itself is visible. The outfall leat extended southwest to the adjacent reservoir (Penydarren Pond: Pond 85989), on the south side of the modern road.

Figure 38: Detail of 1st ed OS 6", sheet 12NW, showing position of dam for Pond 85992

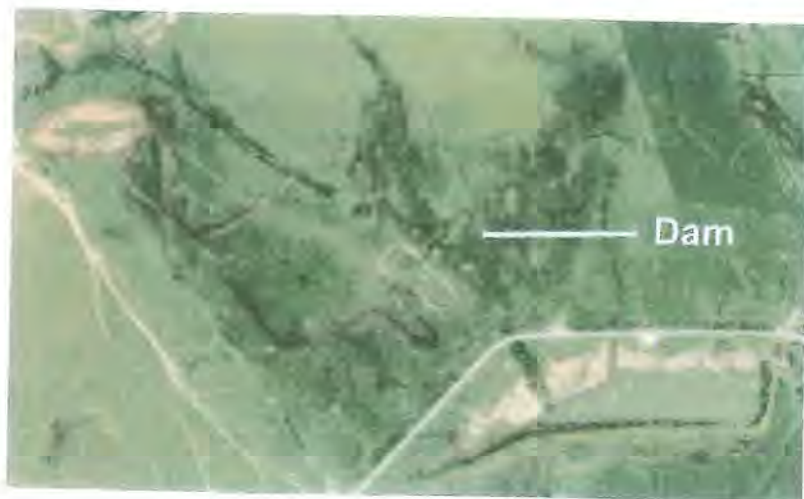


Plate 19: Detail of air photograph, with similar view to Figure 38 (above), showing position of dam for Pond 85992

RECORD: The pond was recorded in detail by total station survey. Dense fog at the time prevented the local survey from being fixed to the station points, but it was tied in to the road and fenceline, and subsequently plotted from this. No photographs were taken of this feature during the present survey.

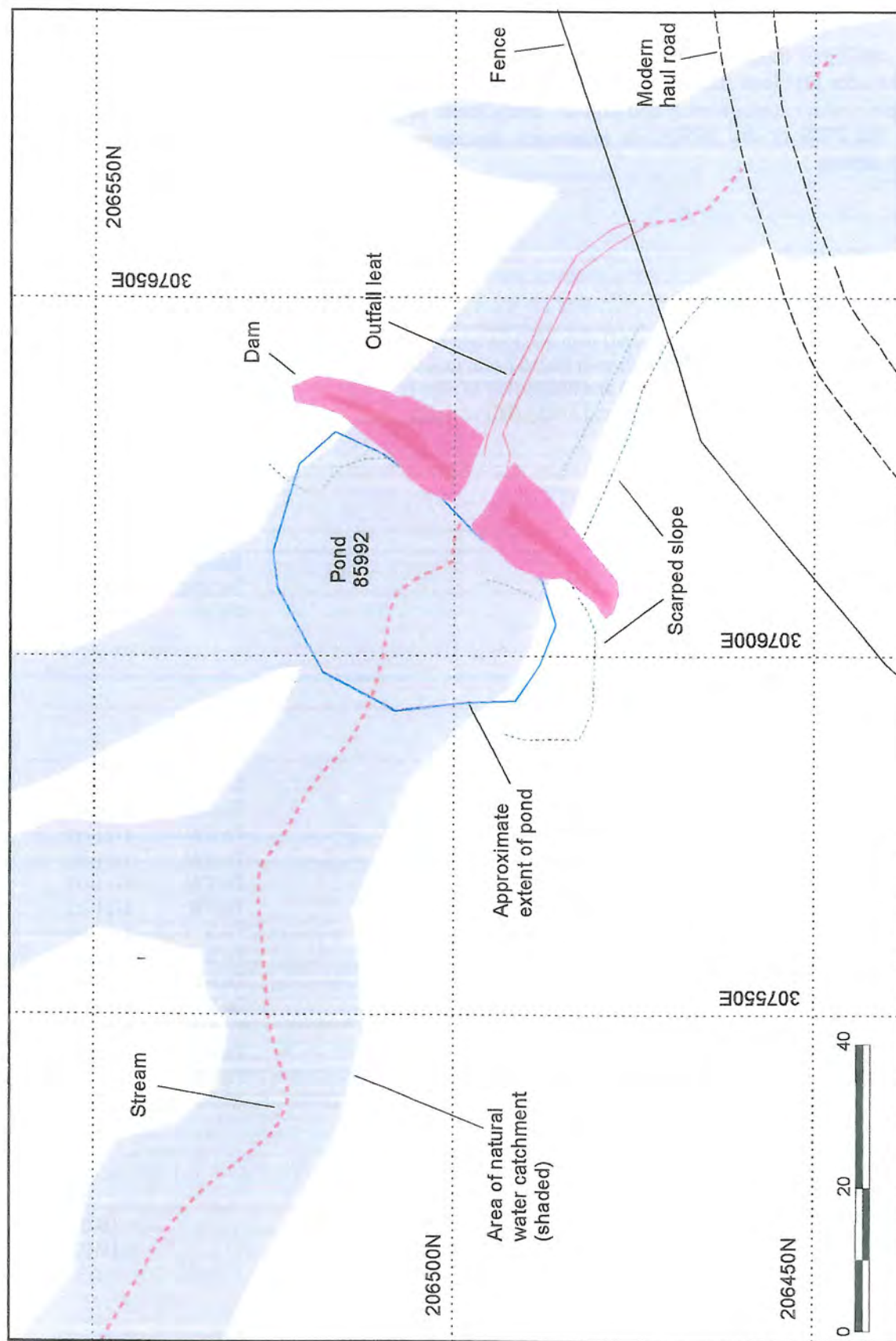


Figure 39: General plan of Area 8: Pond 85992. Features recorded by TS survey indicated as parallel lines. Features plotted from tracings shown as broken lines.

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Appendix 1: Photographic catalogue

The following catalogue describes the photographs taken for the present survey. It does not list the photographs taken for previous stages of work in the area. The photographs taken for the present study were of two types: colour transparency and digital. Each frame is grouped by the site primary reference number (either the PRN or the NPRN) or temporary descriptive term by which the sites have been described in this report.

4255m

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
3080	Junction of leat 4255m (foreground) with 88036 (right to left)	To WSW	1-11-02
3081	Junction of leat 4255m (foreground) with 88036 (right to left)	To WSW	1-11-02
3084	Junction of leat 4255m (foreground) and 88036 (left to right)	To NE	1-11-02
3085	Junction of leat 4255m (foreground) and 88036 (left to right)	To NE	1-11-02

4257m

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
2974	4257m	To NNE	9-10-02
2975	4257m	To SE	9-10-02

85523

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
2960	Rubble mound on NW side of pond 85523	To NNE	8-10-02
2961	Rubble mound on NW side of pond 85523	To NE	8-10-02
3058	Pond 85523, detail of inner side, SE embankment	To SW	1-11-02
3059	Pond 85523, detail of inner side, SE embankment	To SW	1-11-02
3060	Pond 85523, detail of inner side, SE embankment	To SW	1-11-02
3061	Pond 85523, detail of inner side, SE embankment	To SW	1-11-02
3062	Pond 85523, detail of inner side, SE embankment	To S	1-11-02
3063	Pond 85523, detail of inner side, SE embankment	To S	1-11-02
3064	Pond 85523, top of SE embankment	To NE	1-11-02
3065	Pond 85523, top of SE embankment	To SW	1-11-02
3066	Pond 85523, top of SE embankment	To SW	1-11-02
3067	Pond 85523, top of SE embankment	To SW	1-11-02
3068	Pond 85523, top of SE embankment	To NE	1-11-02

COLOUR TRANSPARENCY

Film 001

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
032	Rubble mound 1 (detail) in Area B, on NW side of pond 85523	To NE	8-10-02
033	Rubble mound 2 (detail) in Area B, on NW side of pond 85523	To SE	8-10-02

85524

DIGITAL

2962	Pond 85524 with leat 88014	To E	9-10-02
2963	Pond 85524 with leat 88014	To E	9-10-02

85525

COLOUR TRANSPARENCY

Film 002

026	General view of pond 85525, from leat 88015	To SW	11-10-02
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85526

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
3012	Pond 85526, general view	To SW	11-10-02
3013	Pond 85526, general view	To SW	11-10-02
3014	Pond 85526, general view	To SW	11-10-02
3017	Pond 85526, SW embankment	To SE	11-10-02

COLOUR TRANSPARENCY

Film 001

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
000	Pond 85526, detail of internal stone sluice in SW embankment	To SSW	11-10-02
001	Pond 85526, detail of internal stone sluice in SW embankment	To S	11-10-02
002	Pond 85526, detail of internal stone sluice in SW embankment	To S	11-10-02
003	Pond 85526, general view	To SE	11-10-02
004	Pond 85526, general view	To SW	11-10-02
005	Pond 85526, general view	To SW	11-10-02
006	Pond 85526, general view	To SW	11-10-02

Film 002

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
031	Pond 85526 (N half) with leat 88015	To E	11-10-02
033	Pond 85526, SW embankment	To SE	11-10-02
034	Pond 85526, SW embankment	To SE	11-10-02
035	General view of pond 85526 (without scale)	To SW	11-10-02
036	General view of pond 85526 (without scale)	To SW	11-10-02

85558

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
3094	Shaft 85558	To NW	1-11-02
3095	Shaft 85558	To NW	1-11-02
3096	Shaft 85558	To N	1-11-02
3097	Shaft 85558	To NNE	1-11-02
3098	Shaft 85558	To NE	1-11-02
3099	Shaft 85558	To SE	1-11-02
3100	Shaft 85558	To E	1-11-02
3101	Shaft 85558	To SSW	1-11-02
3102	Shaft 85558, detail of W side	To SW	1-11-02

85575

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
2979	85575, near junction with 88013	To W	9-10-02
2980	85575 at junction with 88013 (on left)	To W	9-10-02
2981	85575, showing 'borrow ditch' below bank	To E	9-10-02
2982	85575	To W	9-10-02
2983	85575, at junction with 88013 (on left) and 88016 (on right)	To W	9-10-02
2984	85575, at junction with 88016 (on right)	To W	9-10-02
2985	85575 at junction with 88016	To WNE	9-10-02
2987	85575	To W	9-10-02
2988	85575, towards W end, near Pond 8526	To WNW	9-10-02
3045	85575, excavated section face (bank)	To SE	30-10-02
3046	85575, excavated section face (bank)	To SE	30-10-02
3047	85575, excavated section face (bank)	To SE	30-10-02
3048	85575, excavated section face (bank and ditch)	To SE	30-10-02
3049	85575, excavated section face (ditch)	To SE	30-10-02
3050	85575, excavated section face (bank and ditch)	To SE	30-10-02
3051	Excavated section face of small superseded ditch to S of 85575	To E	30-10-02
3052	Excavated section face of small superseded ditch to S of 85575	To E	30-10-02
3053	Excavated section face of small superseded ditch to S of 85575	To E	30-10-02

COLOUR TRANSPARENCY

Film 001

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
017	Leat 85575, west end (near pond 85526)	To WNW	9-10-02
018	Leat 85575, west end (near pond 85526)	To E	9-10-02
019	Leat 85575, west end (near pond 85526)	To W	9-10-02

Film 002

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
000	85575, excavated section face (general)	To NW	30-10-02
001	85575, excavated section face (detail of ditch)	To NW	30-10-02
002	85575, excavated section face (general)	To NW	30-10-02
003	85575, excavated section face (detail of ditch)	To NW	30-10-02
004	85575, excavated section face (detail of bank)	To NW	30-10-02
005	85575, excavated section face (detail of bank)	To NW	30-10-02

85942

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
2977	85942, towards Pond 85527	To E	9-10-02
2978	85942, looking away from Pond 85527	To W	9-10-02
2989	85942	To E	10-10-02
2991	85942, west end	To W	10-10-02
2992	85942, near west end	To E	10-10-02
3054	85942, excavated section face	To E	30-10-02
3055	85942, excavated section face	To E	30-10-02
3056	85942, excavated section face	To E	30-10-02
3057	85942, excavated section face (detail of bank)	To E	30-10-02

COLOUR TRANSPARENCY

Film 001

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
016	Leat 85942, showing ditch and bank	To E	10-10-02

88013

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
2976	88013 with Pond 85527	To SE	9-01-02

88014

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
2941	88014 (outlet from pond 85523)	To NW	8-10-02
2942	88014	To W	8-10-02
2943	88014 at junction with pond 85523 bank	To S	8-10-02
2944	88014 at junction with pond 85523	To SE	8-10-02
2945	88014 at junction with pond 85523 bank	To SSE	8-10-02
2946	88014 at junction with pond 85523 bank	To S	8-10-02
2947	88014 at junction with pond 85523	To WNW	8-10-02
2948	88014 at junction with 88020	To NNE	8-10-02
2949	88014 at junction with 88020	To W	8-10-02
2964	Shallow linear hollow from 88014 to 85575	To N	9-10-02
2965	88014 at point where profile was drawn	To NW	9-10-02
2966	88014, eroded section with rubble	To SE	9-10-02
2967	88014, as 2966, detail of revetting or foundation on inside of bank	To SE	9-10-02
3037	88014, excavated section face (detail)	To NW	30-10-02
3038	88014, excavated section face (detail)	To NW	30-10-02
3039	88014, excavated section face	To N	30-10-02

COLOUR TRANSPARENCY

Film 001

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
022	Leat 88014, showing stone revetting/foundation in eroded section	To S	9-10-02
023	Leat 88014, showing ditch and bank	To N	9-10-02

Film 002

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
008	88014, excavated section face (general)	To N	30-10-02
009	88014, excavated section face (general)	To N	30-10-02
010	88014, excavated section face (detail)	To N	30-10-02

88015

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
3015	88015, at NW corner of Pond 85526	To NW	11-10-02
3016	88015, at NW corner of Pond 85526	To SE	11-10-02
3018	Leats 88015 (foreground and right) and 88029 (left), with ranging rod at junction	To W	11-10-02
3019	Junction of 88015 (foreground and right) and 88029 (left)	To W	11-10-02
3020	Junction of 88015 (foreground and right) and 88029 (left)	To W	11-10-02
3021	88015, showing cutting through bank for recent track	To E	11-10-02
3022	Junction of 88015 (foreground and right) and 88029 (left), without ranging rod	To W	11-10-02
3023	88015 (detail), at position of joint profile	To NW	11-10-02
3024	88015, at position of joint profile	To SE	11-10-02

COLOUR TRANSPARENCY

Film 002

Frame	Description	Direction	Date
024	88015, showing cutting through bank for recent track	To E	11-10-02
025	88015, showing cutting through bank for recent track	To E	11-10-02
027	Leats 88015 (foreground and right) and 88029 (left), with ranging rod at junction	To W	11-10-02
028	Junction of 88015 (foreground and right) and 88029 (left)	To W	11-10-02
029	Junction of 88015 (foreground and right) and 88029 (left)	To W	11-10-02
032	88015 with pond 85526 in background	To SE	11-10-02

88016

DIGITAL

Frame	Description	Direction	Date
2986	88016 at junction with 8575	To SSE	9-10-02

88017

DIGITAL

Frame	Description	Direction	Date
2971	88017 at point of Section	To SE	9-10-02
2972	88017 at point of Section	To SE	9-10-02
2973	88017, east end	To ENE	9-10-02
3006	88017, at point near Stn 1	To SE	11-10-02
3007	88017	To SE	11-10-02
3008	88017, W of junction with 88016	To E	11-10-02
3009	88017, W of junction with 88016	To W	11-10-02
3010	88017, E of junction with 88016	To E	11-10-02
3011	88017, E of junction with 88016 (on left)	To WNW	11-10-02
3042	88017, excavated section face (detail)	To SW	30-10-02
3043	88017, excavated section face (detail)	To SW	30-10-02
3044	88017, excavated section face (detail)	To SW	30-10-02

COLOUR TRANSPARENCY

Film 001

Frame	Description	Direction	Date
007	88017, at point near Stn 1, showing ditch and bank	To SE	11-10-02
008	88017, at point near Stn 1, showing ditch and bank	To SE	11-10-02
020	88017 (east end), looking towards road	To ENE	9-10-02
021	88017, at point of intended section	To SE	9-10-02

Film 002

Frame	Description	Direction	Date
006	88017, excavated section face	To N	30-10-02

88018

DIGITAL

Frame	Description	Direction	Date
2968	88018, detail, area of Section 2	To S	9-10-02
2969	88018, area of Section 2	To S	9-10-02
2970	Small gully issuing into 88018 from E, GPS Point M	To E	9-10-02

88020

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
2952	88020 (with 88021 on left)	To SW	8-10-02

88021

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
2950	Structure 88021	To NE	8-10-02
2951	Structure 88021	To E	8-10-02

COLOUR TRANSPARENCY

Film 001

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
035	Structure 88021, viewed from adjacent tips	To E	8-10-02
036	Structure 88021, viewed from adjacent tips	To E	8-10-02

88022

COLOUR TRANSPARENCY

Film 001

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
034	Pit 88022, with leat 88021 in foreground: general view	To SE	8-10-02

88023

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
2940	88023	To W	8-10-02
3032	88023, excavated section face	To NW	30-10-02
3033	88023, excavated section face	To NW	30-10-02
3034	88023, excavated section face	To NW	30-10-02
3035	88023, excavated section face	To NW	30-10-02
3036	88023, excavated section face	To NW	30-10-02

COLOUR TRANSPARENCY

Film 001

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
014	Leat 88023, showing ditch and bank	To NW	10-10-02

Film 002

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
011	88023, excavated section face (detail)	To NW	30-10-02
012	88023, excavated section face (general)	To NW	30-10-02
013	88023, excavated section face (general)	To NW	30-10-02

88024

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
3001	88024	To NNE	10-10-02

COLOUR TRANSPARENCY

Film 001

Frame	Description
013	Leat 88024, showing ditch and bank

Direction	Date
To NNE	10-10-02

88025

DIGITAL

Frame	Description
2953	88025
2954	88025
2955	88025
2956	88025 (at point NE of 88018)
2957	88025 near junction with 88018
2958	88025 at junction with 88018
2959	88025 at junction with 88018
2999	88025
3000	88025
3005	88025, near W end
3040	88025, excavated section face (detail)
3041	88025, excavated section face (detail)

Direction	Date
To ENE	8-10-02
To ENE	8-10-02
To NE	8-10-02
To NNE	8-10-02
To E	8-10-02
To N	8-10-02
To N	8-10-02
To ENE	10-01-02
To ENE	10-10-02
To NE	10-10-02
To E	30-10-02
To E	30-10-02

COLOUR TRANSPARENCY

Film 001

Frame	Description
009	88025
010	88025

Direction	Date
To E	10-10-02
To E	10-10-02

Film 002

Frame	Description
007	88025, excavated section face (detail)

Direction	Date
To E	30-10-02

88027

DIGITAL

Frame	Description
2995	88027
2996	88027
2997	88027, W of view in 2996
2998	88027, W of view in 2996

Direction	Date
To S	10-10-02
To SW	10-10-02
To W	10-10-02
To W	10-10-02

COLOUR TRANSPARENCY

Film 001

Frame	Description
015	Leat 88027, showing ditch and bank

Direction	Date
To W	10-10-02

88028

DIGITAL

Frame	Description
2993	88028
2994	88028

Direction	Date
To N	10-10-02
To S	10-10-02

88029

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
3025	88029, at position of joint profile	To NW	11-10-02
3026	88029, at position of joint profile	To SE	11-10-02

88036

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
3077	88036	To NW	1-11-02
3078	88036	To NW	1-11-02
3079	88036	To SE	1-11-02
3080	Junction of leat 88036 (foreground) and 4255m (left)	To S	1-11-02
3083	Junction of leat 88036 (left to right) and 4255m (upper left to lower right)	To SSE	1-11-02
3086	Junction of leat 88036 (foreground) and 4255m (left to right)	To NNW	1-11-02
3087	Junction of leat 88036 (foreground) and 4255m (left to right)	To SSE	1-11-02
3088	Junction of leat 88036 (foreground) and 4255m (left to right)	To SSE	1-11-02
3089	Junction of leat 88036 (left to right) and 4255m (upper left to lower right)	To WNW	1-11-02
3090	Junction of leat 88036 (left to right) and 4255m (upper left to lower right)	To WNW	1-11-02
3091	Junction of leat 88036 (lower left to upper right) and 4255m (upper left to lower right)	To WNW	1-11-02
3093	Junction of leat 88036 (left to right) and 4255m (upper left to lower right)	To WNW	1-11-02
3094	Leat 88036, general view of upper end (left of frame)	To NW	1-11-02

DFD1

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
3002	Leat described as DFD1	To NE	10-10-02
3003	Leat described as DFD1 (detail)	To NE	10-10-02
3004	Gully to NW of DFD1	To NE	10-10-02

COLOUR TRANSPARENCY

Film 001

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
011	Leat DFD1, with gully to NE of DFD1	To ENE	10-10-02
012	Leat DFD1 (vertical scale)	To NE	10-10-02

DFD3

DIGITAL

<i>Frame</i>	<i>Description</i>	<i>Direction</i>	<i>Date</i>
3069	DFD2 (double ditched feature SE of tips 88032)	To NW	1-11-02
3070	DFD2 (double ditched feature SE of tips 88032)	To NW	1-11-02
3071	DFD2 (double ditched feature SE of tips 88032)	To SE	1-11-02
3072	DFD2 (double ditched feature SE of tips 88032)	To NW	1-11-02
3073	DFD2 (double ditched feature SE of tips 88032)	To NW	1-11-02
3074	DFD2 (double ditched feature SE of tips 88032)	To NW	1-11-02
3075	DFD2 (double ditched feature SE of tips 88032)	To SE	1-11-02
3076	DFD2 (double ditched feature SE of tips 88032)	To SE	1-11-02

East Merthyr Reclamation Scheme Phase III
Archaeological field survey

REPORT NUMBER 2002/075

February 2003

Report prepared by..... Martin Lawler

Position..... Project Officer

Signature..... Martin Lawler Date 19-02-03

Report checked by..... Kate Howell

Position..... Assistant Project Manager

Signature..... Kate Howell Date 19-02-03

Report issue authorised by..... Kate Howell

Position..... Assistant Project Manager

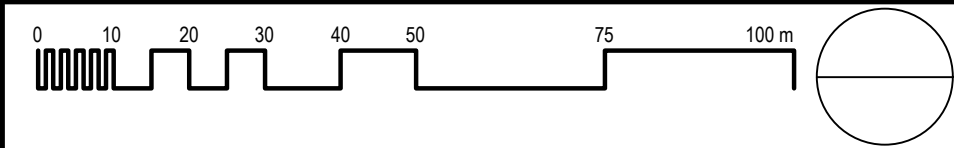
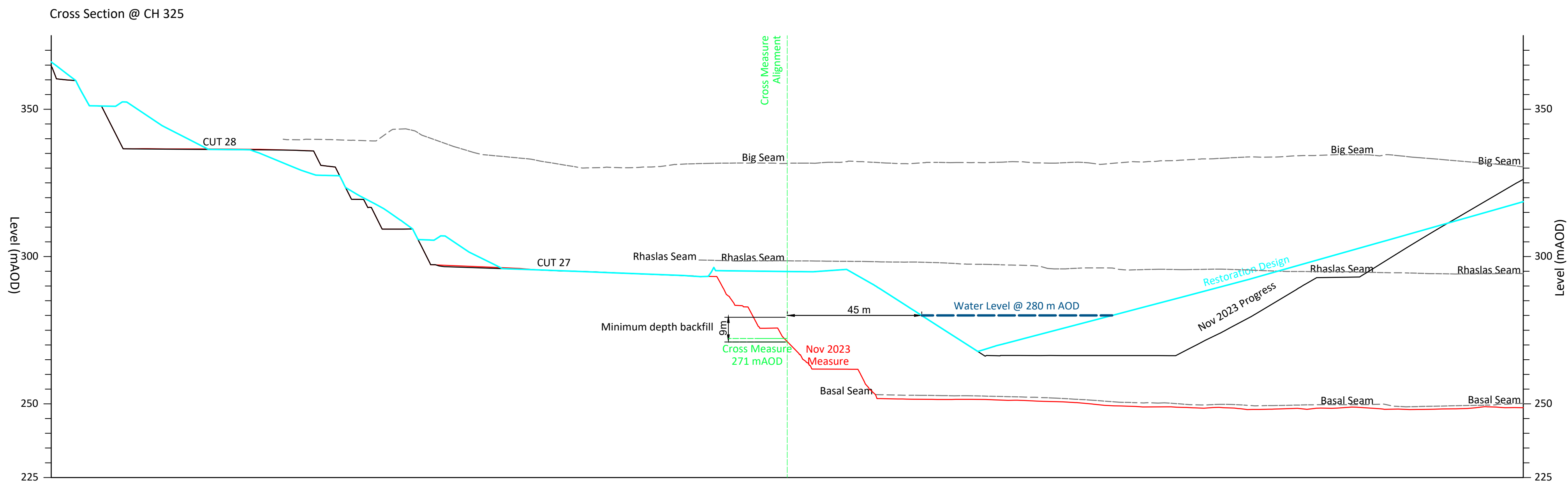
Signature..... J.K. Howell Date 19-02-03

As part of our desire to provide a quality service we would welcome any comments you may wish to make on the content or presentation of this report.



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- Eglurhad / Key:
- Ground profile (Nov 2023)
 - Proposed restoration profile (Dec 2024)
 - As dug profile (no backfill included)
 - Coal seam
 - Water level (@280 m AOD)

01	12/11/2025	For information only	RhE	JS	JS
Cywl. Rev.	Dyddiad Date	Disgrifiad Description	Gan By	Gwirwyd Checked	Cymer. Appro.

Cleient / Client:

MERTHYR
(SOUTH WALES) LTD

Enw project / Project name:

FFOS-Y-FRAN
FINAL RESTORATION STRATEGY

Tittl lluniad / Drawing title:

Dowlais Free Drainage System
Cross Section (Cross Measure CH 325)

Darparwyd gan / Prepared by:



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Graddfa / Scale (A1): 1:1,100 @ A1	Dyddiad / Date: Nov 2025	Darfuwyd gan: RhE
Rhif lluniad / Drawing number: 3274-RML-DR-L-64		Gwirwyd gan: JS
		Cywirad: 01

FFOS-Y-FRAN LAND RECLAMATION SCHEME [FLRS].

DOWLAIS FREE DRAINAGE SYSTEM.[DFDS].

14TH of November 2025.

Background.

The mining operations on the FLRS has involved the extraction of coal seams from surface to the Lower Four Feet Seam.

The site is underlain by a significant mines drainage system which formed part of the Dowlais Free Drainage System (DFDS) which was constructed to drain the major ironstone workings [which ceased in the late 1800's] over a significant geographical area.

The system involved the construction of drainage tunnels, which within the FLRS site excavation area are shown on the plans as cross-measures ('DFDS Underground Drain Layout Plan').

Towards the northern end of the site, opencast operations involved excavation through a section of the recorded drainage system. This is shown in the June 2023 progress plan and involved excavation carried out down to the basal Lower Four Feet (BA) seam. Following excavation of the seam the area was backfilled across the disturbed section using largely argillaceous rocks of which the excavation sequence largely comprises, as is shown in the November 2023 progress plan.

The November 2023 progress plan shows a significant section along the original route of the drainage system, extending for approximately 205 metres where the drainage tunnel has been completely excavated and the area subsequently backfilled. A depth of fill of up to approximately 40 metres is recorded.

The fill was delivered and tipped by Cat 777 dump trucks and dozed by Cat D9 bulldozers, the passage of which would have led to a reasonable degree of compaction. In addition to this, further compaction will have occurred due to the self-weight of the backfill material.

With reference to the 'DFDS Longitudinal Section', there is a length where the drainage tunnel has been excavated and fully removed. At its southeastern end the tunnel disappears into the highwall slope and has subsequently been covered by backfill. At the northwestern end, the tunnel disappears beneath the pavement of the Lower Four Feet seam which has also been covered by backfill. Further regrading and backfilling of this area will take place as part of the proposed alternative restoration scheme, details of which are shown in the final restoration drawings.

Northwestern end of removed DFDS

Assuming a lake Rest Water Level (RWL) of 280m AOD there will be approx. 50 metres length of consolidated backfill (approx. 10m thick) on top of the remaining section of drainage tunnel

at its intersection with the Lower Four Feet Seam pavement. There was no open adit recorded at this location during site operations suggesting that the tunnel had collapsed and may only be open further to the north. Similarly, at a RWL = 285m AOD there will be a length of approximately 30 metres of consolidated backfill on top of the remaining section of the drainage tunnel.

Southeastern end of removed DFDS

A perpendicular 'DFDS Cross Section' constructed through the lake shows that, assuming a lake Rest Water Level (RWL) of 280m AOD there will be a distance of approx. 45 metres length of consolidated backfill (> 10m thick) to the remaining drainage tunnel at its intersection with the highwall. Similarly, at a RWL = 285m AOD there will be >38 metres length of consolidated backfill to the highwall.

Conclusions

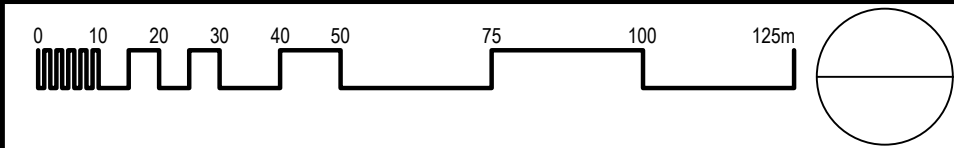
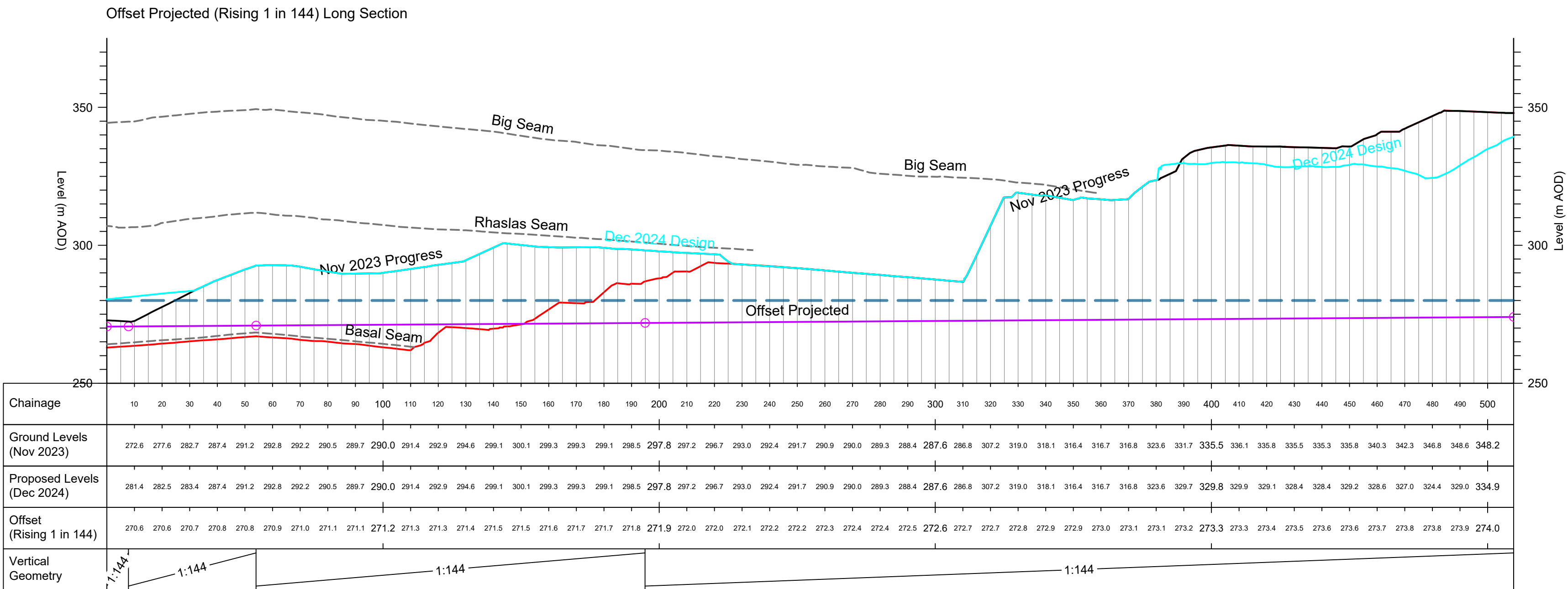
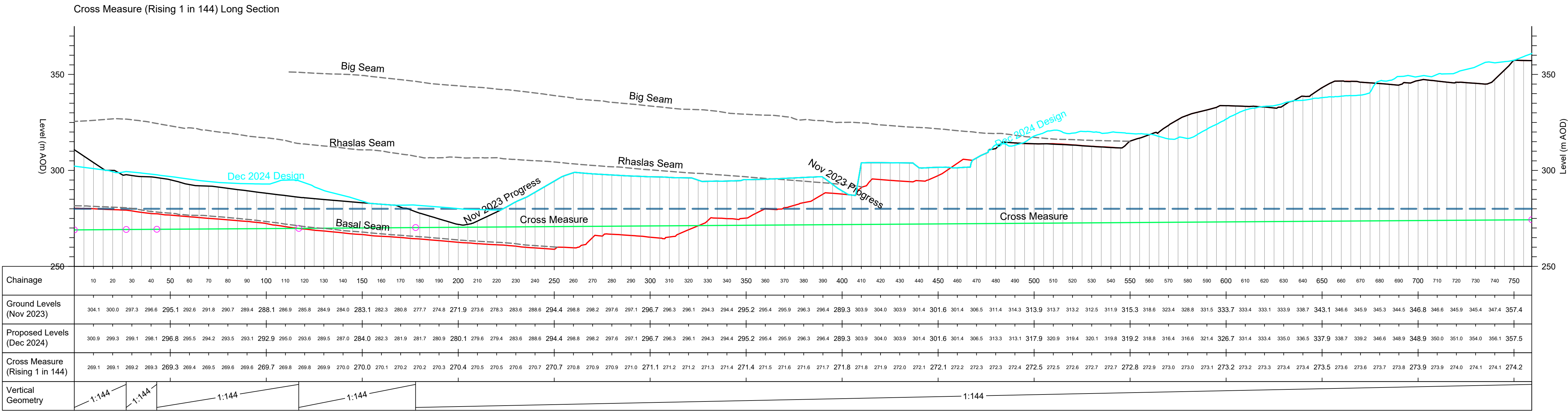
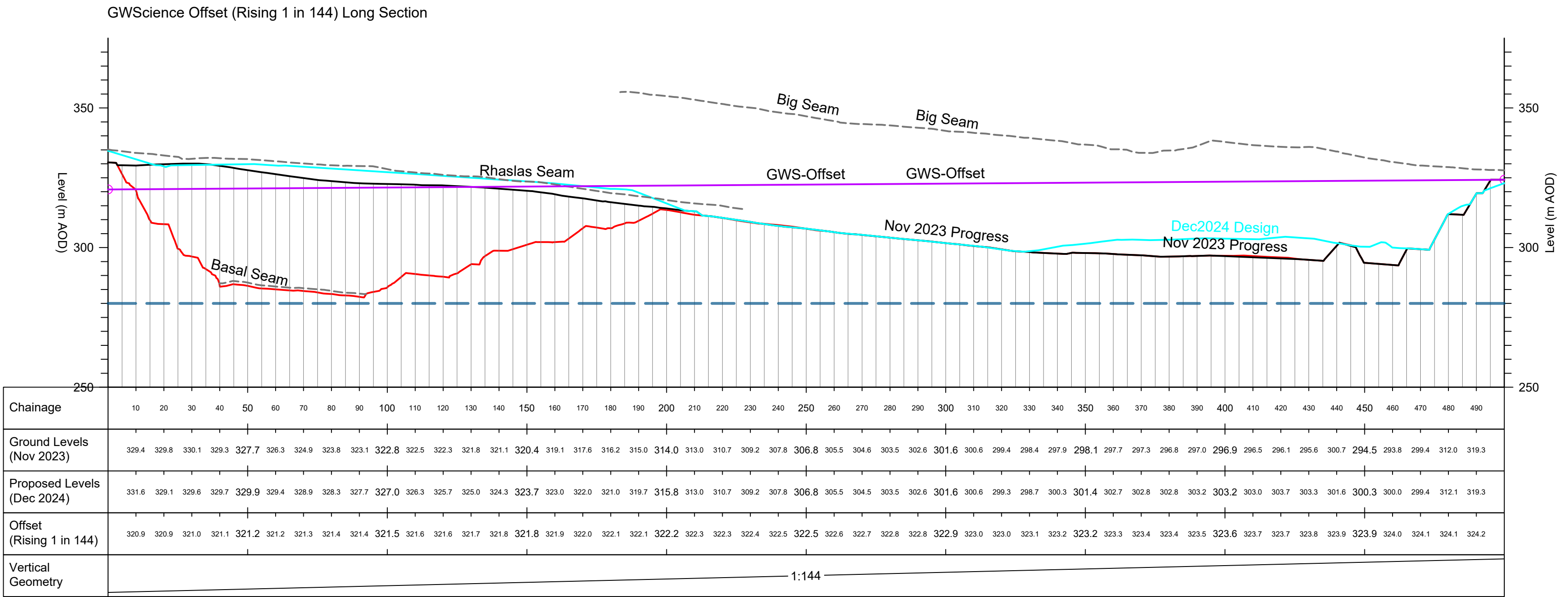
Given these parameters, the current situation would be highly unlikely to provide any direct route for water to rapidly flow from the lake to link into the continuation of the DFDS towards either the northwest or southeast. Instead, it is more likely that the groundwater would continue to percolate through the backfill material and find its way into the DFDS or other underlying drainage / abandoned mineworkings networks in a controlled and similar manner as existed pre-FLRS mining operations.



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Attachments.

DFDS Underground Drain Layout Plan
DFDS Longitudinal Section
DFDS Cross Section (Cross Measure CH 325)



Eglurhad / Key:

	Ground profile (Nov 2023)
	Proposed restoration profile (Dec 2024)
	As dug profile (no backfill included)
	Coal seam
	Cross Measure (1 in 144)
	Offset drain (assumed)
	Groundwater (@280 m AOD)

03	03/11/2025	As dug profile added	RhE	JS	JS
02	21/10/2025	Basal seam and restoration profiles added	RhE	JS	JS
01	29/09/2025	For information only	RhE	JS	JS
Cywl. Rev.	Dyddiad Date	Disgrifiad Description	Gan By	Gwiriwyd Checked	Cymer. Appro.

Cleient / Client:

MERTHYR
(SOUTH WALES) LTD

Enw project / Project name:
FFOS-Y-FRAN
FINAL RESTORATION STRATEGY

Tittl lluniad / Drawing title:
Dowlais Free Drainage System
Longitudinal Section

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FFOS-Y-FRAN FINAL RESTORATION SCHEME

DFDS Hydrogeological Assessment Report

Date:
05/12/2025

QUALITY CONTROL

Project Name	Ffos-y-Fran Final Restoration Scheme Hydrogeology EIA
Project No	GS270
Report Reference	GS270C002

Revision	Date	Description	Author	Check	Review
V0	05/12/2025	Draft	SD	AB	AB
V1	05/12/2025	Final	SD	AB	AB

Authors: Stuart Daley, Alastair Black

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1. INTRODUCTION

1.1 Purpose and rationale

The Dowlais Free Drainage System (DFDS) consists of a network of underground drainage adits and surface drainage features built in the 19th century to supply to Dowlais Iron works with fresh water, and to control groundwater level in the Coal Measures. The presence of cross-cutting drainage adits and tunnels such as the DFDS, as well as the presence of extensive historical workings and shafts, means that localised, cross-measure drainage of groundwater at the site occurs to the north and west towards the Nant Morlais and Taff catchments, as well as to the Rhymney and Bargoed valleys. This drainage system continues to contribute to the control of groundwater levels at the site.

Whilst the impact on discharges from the DFDS to surface water associated with implementation of the proposed restoration scheme has been assessed and reported in the 2024 ES, NRW have made a recommendation to investigate the potential impact of blockages occurring within the DFDS system. Specifically, there is a desire to:

1. Quantify the potential discharge from DFDS egress points following release of a blockage. The scope of this objective also included an assessment of the likelihood of a direct connection forming between the pit lake and the DFDS.
2. Provide an indicative outline of possible change to groundwater levels and discharge rates to surface water from the DFDS associated with any blockage.

This document outlines the findings of a study undertaken to investigate these concerns.

1.2 Approach

The approach to Item 1) involved an assessment of the potential for existing or future direct connectivity between the pit lake and elements of the DFDS, completed by geotechnical

specialists at James Associates. Following this, the Darcy-Weisbach formulation was used to quantify discharge rates from the DFDS following release of a blockage under worst case scenario conditions.

Item 2) was addressed using the regional groundwater model of the site to assess to what extent groundwater levels and groundwater discharges to surface water may be affected by blockages occurring at discrete points in the DFDS system. Three scenarios were considered, in which water is prevented from draining to the location of the three known egress points to surface water. Furthermore, the change in discharge rate from each of these egress points was extracted from the model for each of these scenarios, and the potential impact on receiving surface waters was evaluated.

2. DFDS BLOCKAGE RELEASE CALCULATION

2.1 Description of the DFDS and discharge locations

The layout of the DFDS, as interpreted from plans and available data, is shown in Figure 1. Based on known adit gradients, invert levels and spotflow accretion surveys on receiving water bodies, it is thought that this network of adits discharges to three general locations. The adits associated with each of these general discharge points are labelled as zones in Figure 1. Zone 1 comprises the most extensive network of adits and is believed to discharge to the Nant Morlais predominantly via the Pennydarren watercourse (Edwards R 2002), as well as to the River Taff via the Nant Cwm Blacs. Zone 2 comprises part of the DFDS situated to the east of the site (Lowest Free on Big Coal) that drains towards the River Rhymney, primarily via the Bute Watercourse and Nant Llesg. Finally, Zone 3 drains the area coinciding with Trecatty landfill and appears most likely to discharge to the Dowlais Culvert via the Waun Braut drain. There is uncertainty relating to the exact location and condition of the DFDS adits shown in Figure 1. Given the age of the structure, access difficulties and extensive development in and around the site it is impractical, if not impossible, to survey the full network. It is therefore assumed in this study that the network presented in Figure 1 reflects the true layout of the DFDS, although it is possible that other adits and tunnels associated with the network exist.

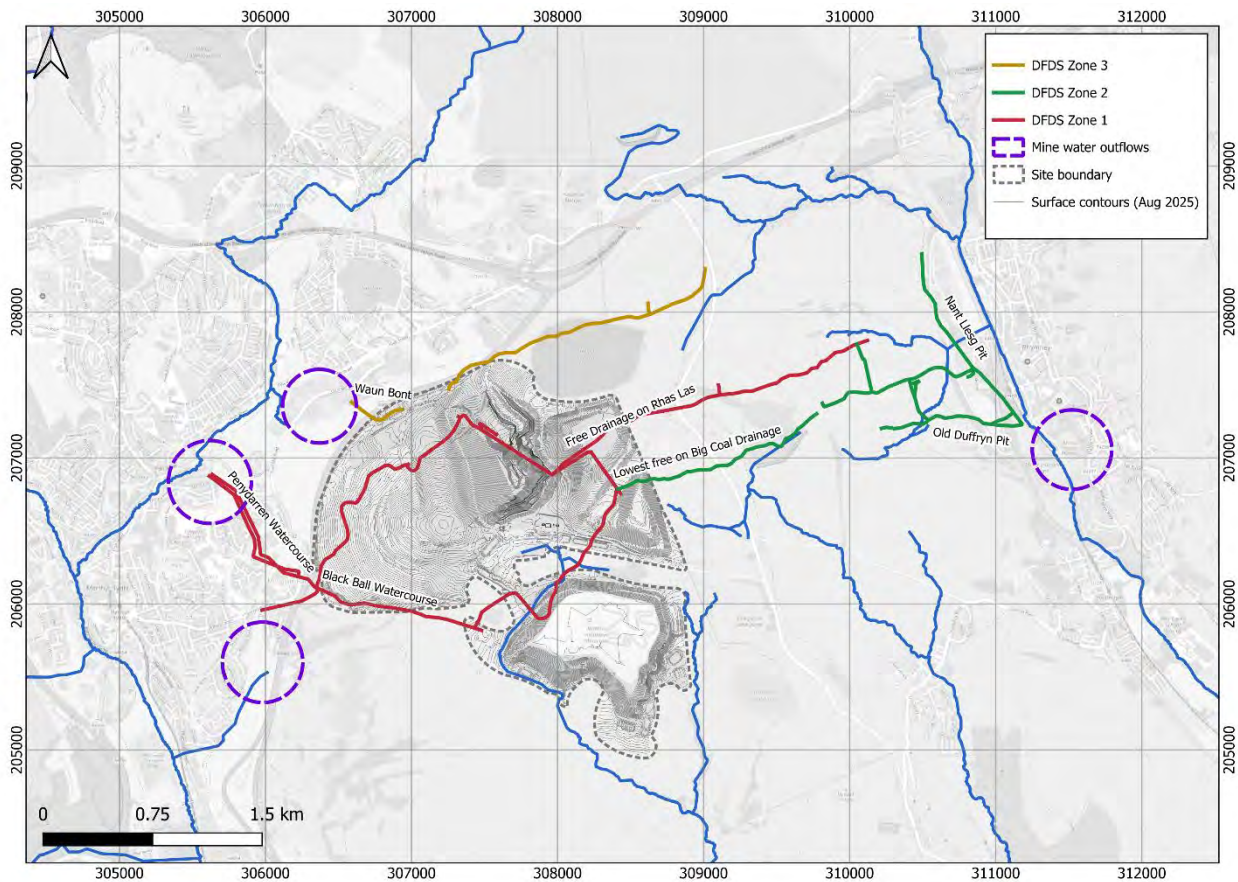


Figure 1: Layout of DFDS and grouping of adits based on discharge location

2.2 Assessment of connectivity between the pit void and DFDS

Whilst the exact location and elevation of the DFDS is not known for certain, information is available from old working plans and previous expert reports that has been used to generate a 3D model of the system. A plan view of the layout in the pit void area is shown in Figure 2, highlighting a cross-measure drainage drive that transects the pit void footprint from north-northwest to south-southeast. Offset from this is a short secondary adit. A dashed line indicates a line extrapolated from a tunnel excavated during operations, at the same gradient as the drainage drive. This tunnel was not mapped on any existing documentation prior to being encountered during mining and may have been constructed to drain a localised area to allow

ing to take place. Where this can be determined, arrows on the adits show the direction of
er flow through the system.

The question of potential connectivity between the pit lake water body and the DFDS was considered in detail by James Associates (James Associates, 2025) in a geotechnical assessment. The study concluded that the current and future configuration of the pit void would be unlikely to provide any means for water to flow directly from the lake into the DFDS. It is instead more likely that groundwater would continue to percolate through the backfill material and find its way to the DFDS and other existing mine workings in a controlled manner similar to the pre-mining conditions.



Figure 2: Layout of the known DFDS network in the pit void area.

2.3 Water release scenarios from DFDS

The Darcy-Weisbach formulation was used to estimate a theoretical maximum discharge rate for each zone assuming a blockage was suddenly removed. The following assumptions and constants were applied:

- All adits associated with each zone discharge to a single outlet / pipe.
- The pipe at the point of discharge is full.
- Conservatively, the head gradients reflect the differential between maximum groundwater head that overlaps with each zone under blocked conditions, and the elevation of the known egress points.
- Absolute roughness ϵ of 0.003 m, equivalent to that of a rough concrete pipe.
- Kinematic viscosity of water ν at 12°C.
- Pipe length is equivalent to the longest continuous path to an egress point.
- Torricelli's law was used to determine an initial fluid velocity at the pipe exit.
- No transient effects (due to reduction in hydraulic head) were considered.

The results are compiled in Table 1 for three circular adit dimensions ranging from 0.5m to 1.5m. The exact dimension of adits and pipes related to the DFDS are not known with certainty but should be similar to contemporaneous mine infrastructure. For example, Harker (1961) notes in a reflection on 18th and 19th century mine dewatering in Cornwall that “the average size of drainage levels in Cornwall was 6ft (1.8m) and 2ft 6 ins (0.76m) wide”. In the Coal Measures, Scranton, P.A. (1897) notes that drifts and headings were 1.2m to 1.8m in height, typically just large enough for a single man to pass through. The available evidence suggests that consideration of a nominal circular adit from 0.5m to 1.5m in diameter is reasonable in the absence of site-specific information.

Table 1: Darcy-Weisbach theoretical maximum discharge rate from each zone

	Discharge rate (m ³ /s)		
Zone	Pipe diameter 0.5 m	Pipe diameter 1 m	Pipe diameter 1.5 m
1	0.4	2.7	7.9
2	0.4	2.8	8.1
3	0.2	1.2	3.6

It is important to stress that these discharge rates are independent of how the site is restored. For example, were the pit void to be backfilled to surface topography, a blockage in the DFDS as modelled in this exercise would still result in broadly similar adjustments to groundwater heads, and backing up of water within the DFDS. Used in the Darcy-Weisberg formulation, these parameters would yield similar discharges rates to what is presented in Table 1.

3. SIMULATION OF DFDS BLOCKAGE

3.1 Introduction

Three scenarios were considered in this assessment. In each of these a single DFDS network zone was removed from the groundwater model simulation to mimic the effect of a blockage near the egress point (For example, zone 1 is removed in scenario 1). This effectively removes the effect of these drains from the simulation. The scenarios were run with the proposed restored landform. The adits removed in each of these scenarios are shown in Figure 1.

It is important to state that these scenarios are highly conservative because they assume a blockage forms a perfect seal on the drains, and that there are no other adits or drains in the DFDS beyond what is represented in the model. In reality, both assumptions are likely to be invalid: Any collapse leading to a blockage within the adit would still allow some water to percolate through the collapsed material, and excavation of the mine void has demonstrated that old mine workings and adits are common within the coal measures and would be likely to act as an alternative means for groundwater drainage to occur.

The model represents a simplification of a complex reality based on conceptual understanding of the setting. As such changes to groundwater level and spatial distribution of the piezometric surface presented here should be considered as conservative estimates and indicative only.

3.2 Groundwater rise

Projected groundwater rise in all scenarios is shown relative to baseline heads for a wet period, as this is when the groundwater table is highest and therefore impact is greatest. The baseline scenario includes all DFDS drains.

Scenario 1

Figure 3 shows the projected rise in groundwater associated with the removal of all nodes in DFDS zone 1 (which as stated previously is highly unlikely in reality), while Figure 4 shows the groundwater table elevation. The DFDS is understood to be a controlling factor in the distribution of groundwater heads in the local area, and the removal of these drains in the groundwater model results in an extensive readjustment of the piezometric surface. Groundwater rise exceeds 10m relative to baseline heads across much of the mine site. This includes the pit area, where heads rise to 295 mAOD compared with 283 mAOD in the baseline run with all DFDS drains active. This is over 35 metres below the void breach water level of 333.7 mAOD. The extent of a projected 1m rise encompasses the Nant Morlais valley and the River Taff and River Rhymney to the West and East respectively.

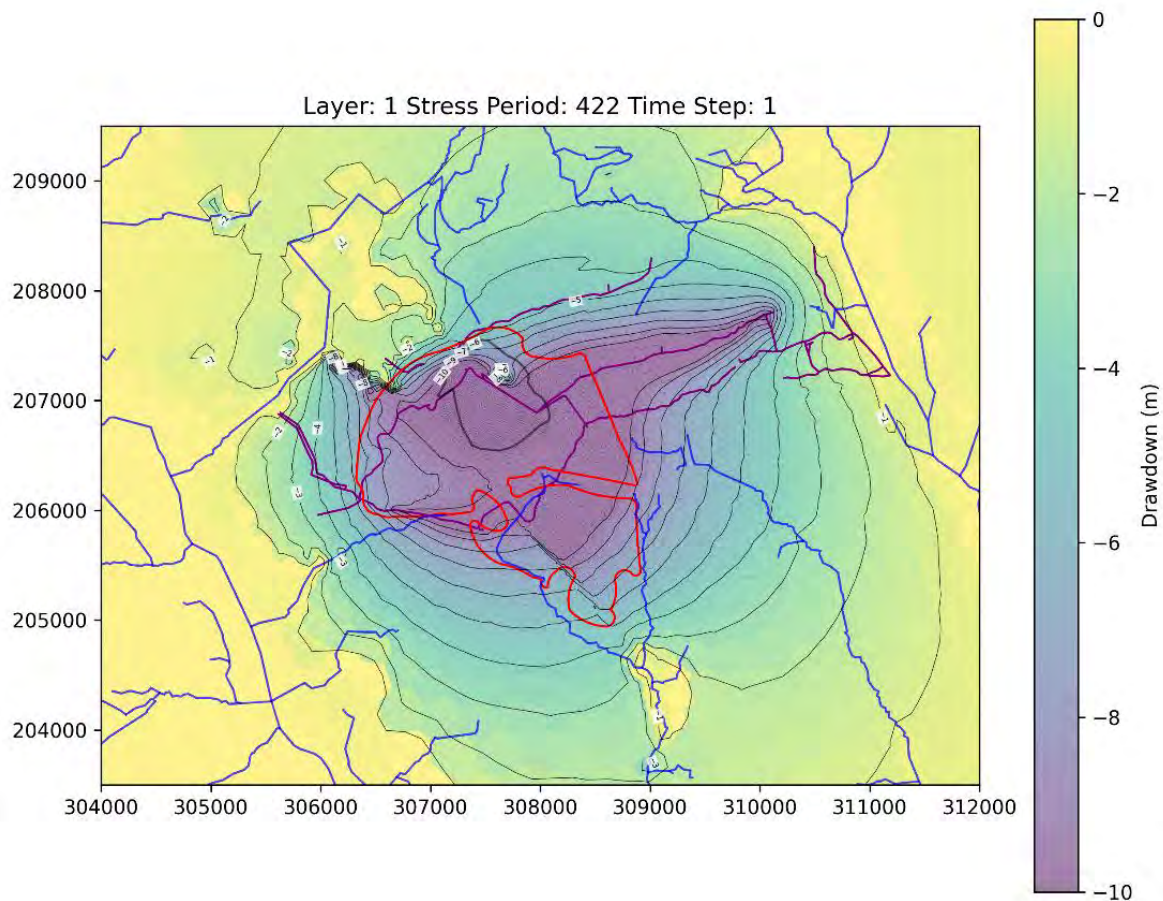


Figure 3: Groundwater rise during wet period relative top baseline, Scenario 1

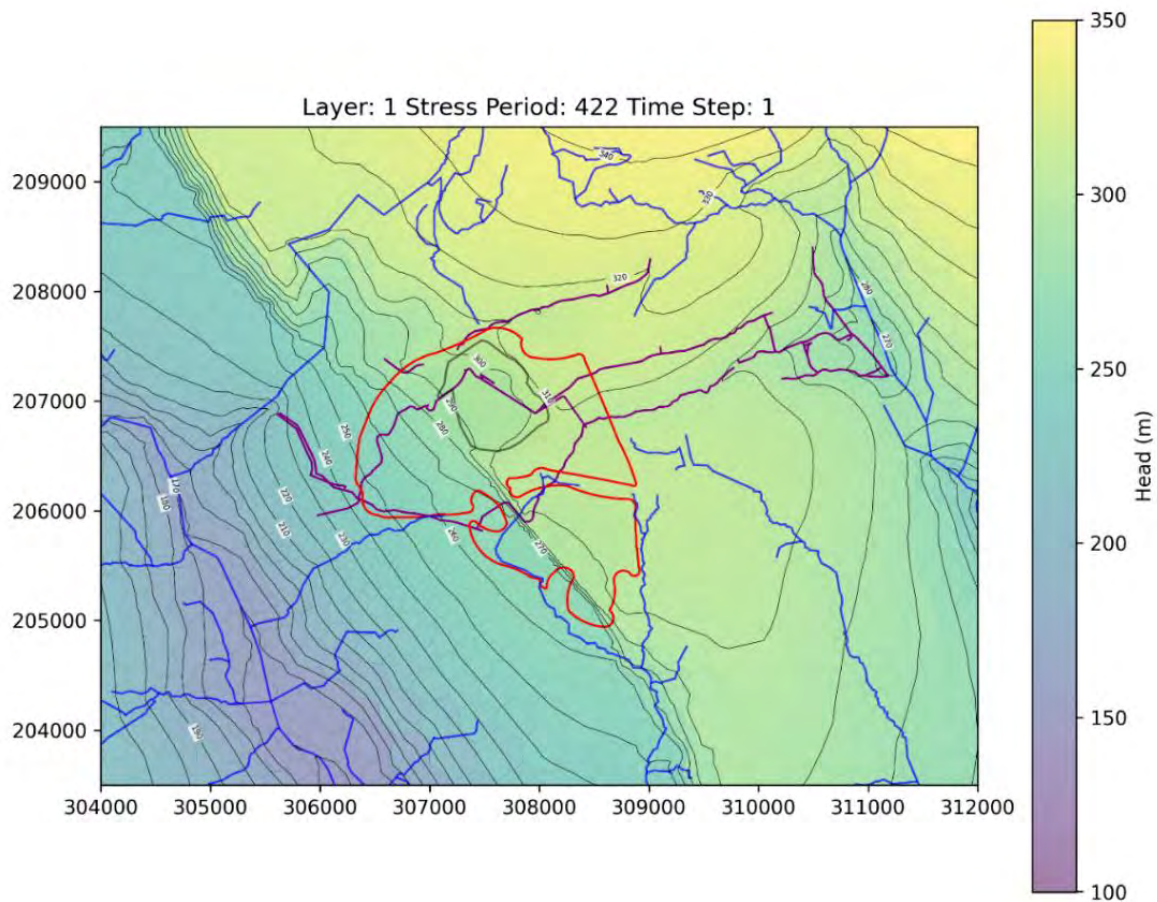


Figure 4: Groundwater table during wet period, Scenario 1

Figure 5 shows a spatial plot of depth to water in the local area for the wet period, which demonstrates that groundwater head is below surface throughout much of the site area despite the simulated rise in groundwater level projected by the model. Exceptions to this include the Nant Morlais valley, which would likely result in an increased risk of groundwater emergence relative to the baseline conditions. It is important to note that, despite the projected increase in groundwater level, the extent of the area over which groundwater heads are projected to be above surface level does not increase much relative to the baseline scenario, where DFDS drains are active. This is illustrated in Figure 6, which shows the extent of the Nant Morlais catchment in which the groundwater heads are projected by the model to be above ground surface in both

Scenario 1 and the baseline. It is possible that existing drainage infrastructure would intercept any rise in groundwater level, as it appears to do presently in the absence of extensive groundwater flooding. For example, the area south of the Penydarren Fault is substantially under drained by a manmade cross-measure drainage system that has a primary outfall in the Nant Morlais Valley associated with the outcrop of the Garw coal seam (Edwards, R. 2002).

Groundwater heads also exceed ground surface elevation adjacent to the River Taff and River Rhymney, although the spatial distribution of these areas compares very closely to that generated by the baseline model. Groundwater rise in these areas would likely manifest in an increase in baseflow contributions to the river channels, and potentially groundwater egress at springs.

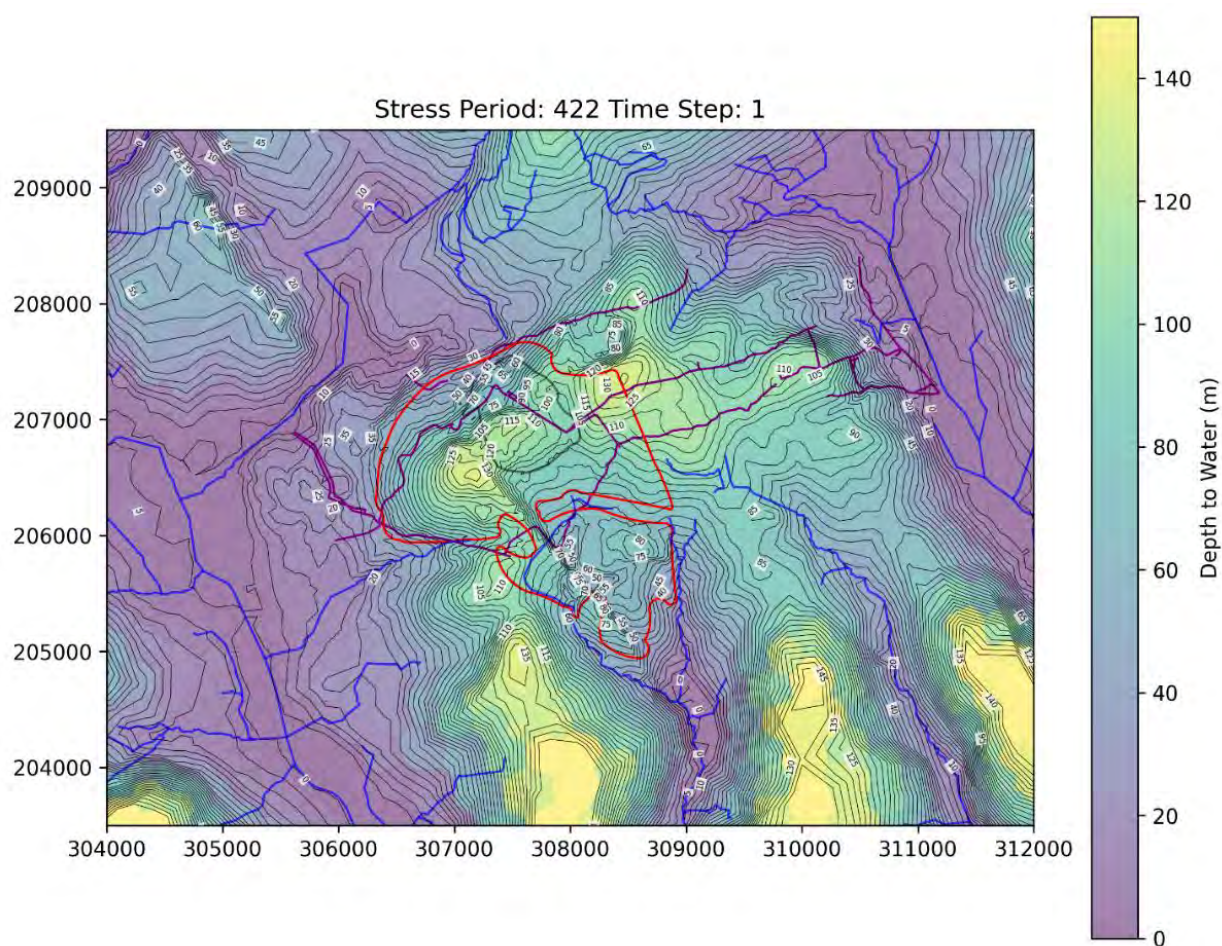


Figure 5: Depth to water during wet period, Scenario 1

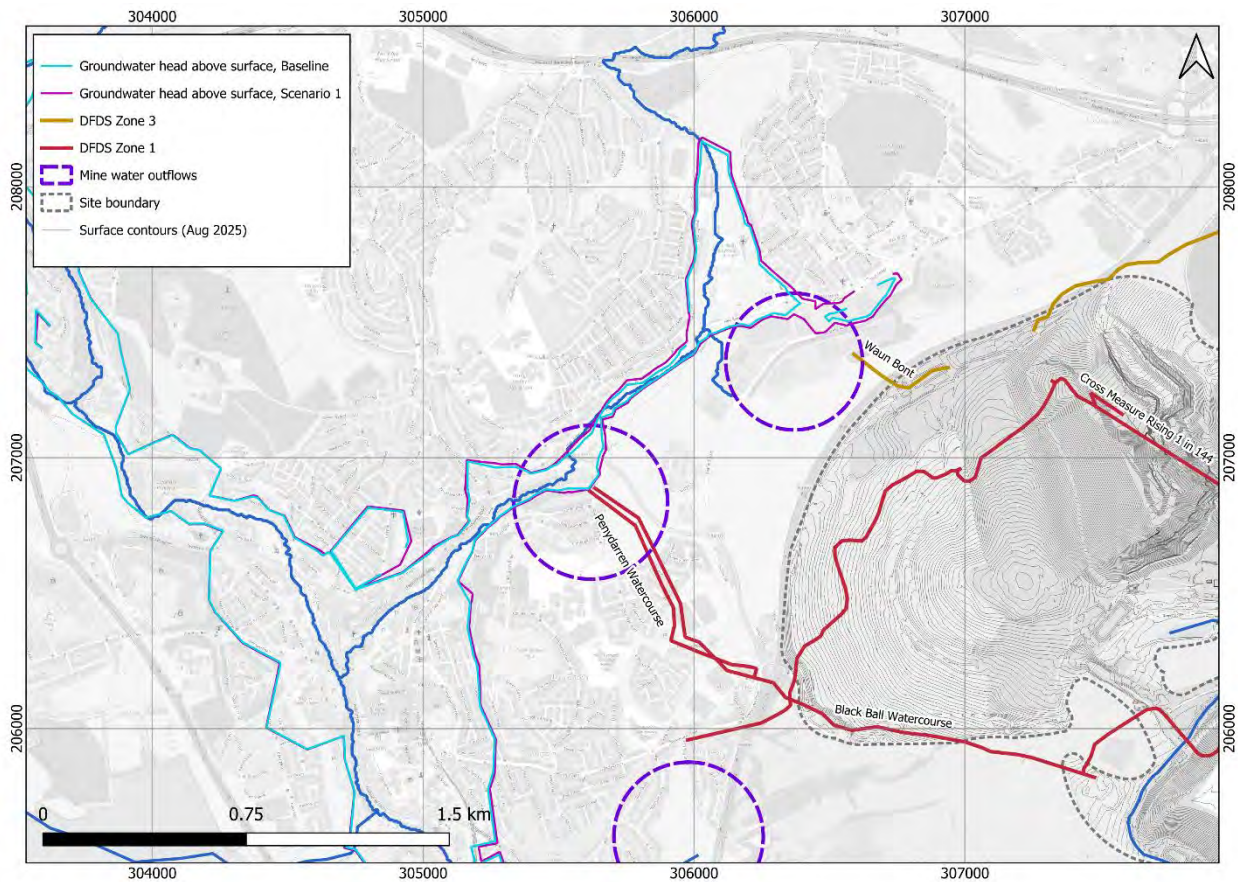


Figure 6: Comparison of projected wet period groundwater heads above surface extents for baseline and Scenario 1, Nant Morlais.

Scenario 2

Figure 7 shows the worst-case projected rise in groundwater associated with the removal of all nodes in DFDS zone 2. This highlights that the projected increase in groundwater level is mainly constrained to the immediate area adjacent to the zone 2 DFDS adit. The magnitude and extent of the groundwater rise is less than in Scenario 1. Figure 8 shows the projected Scenario 2 groundwater surface.

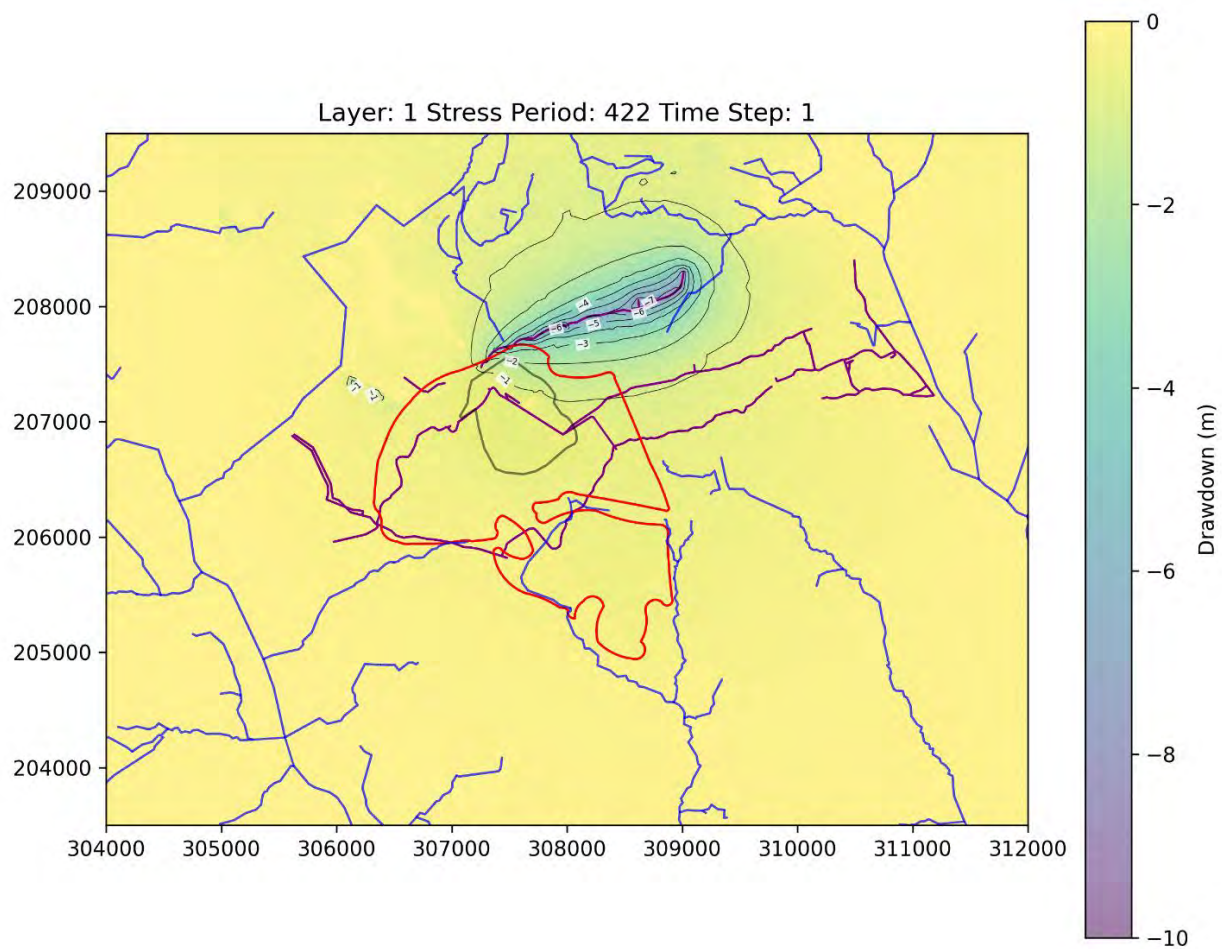


Figure 7: Groundwater rise during wet period relative top baseline, Scenario

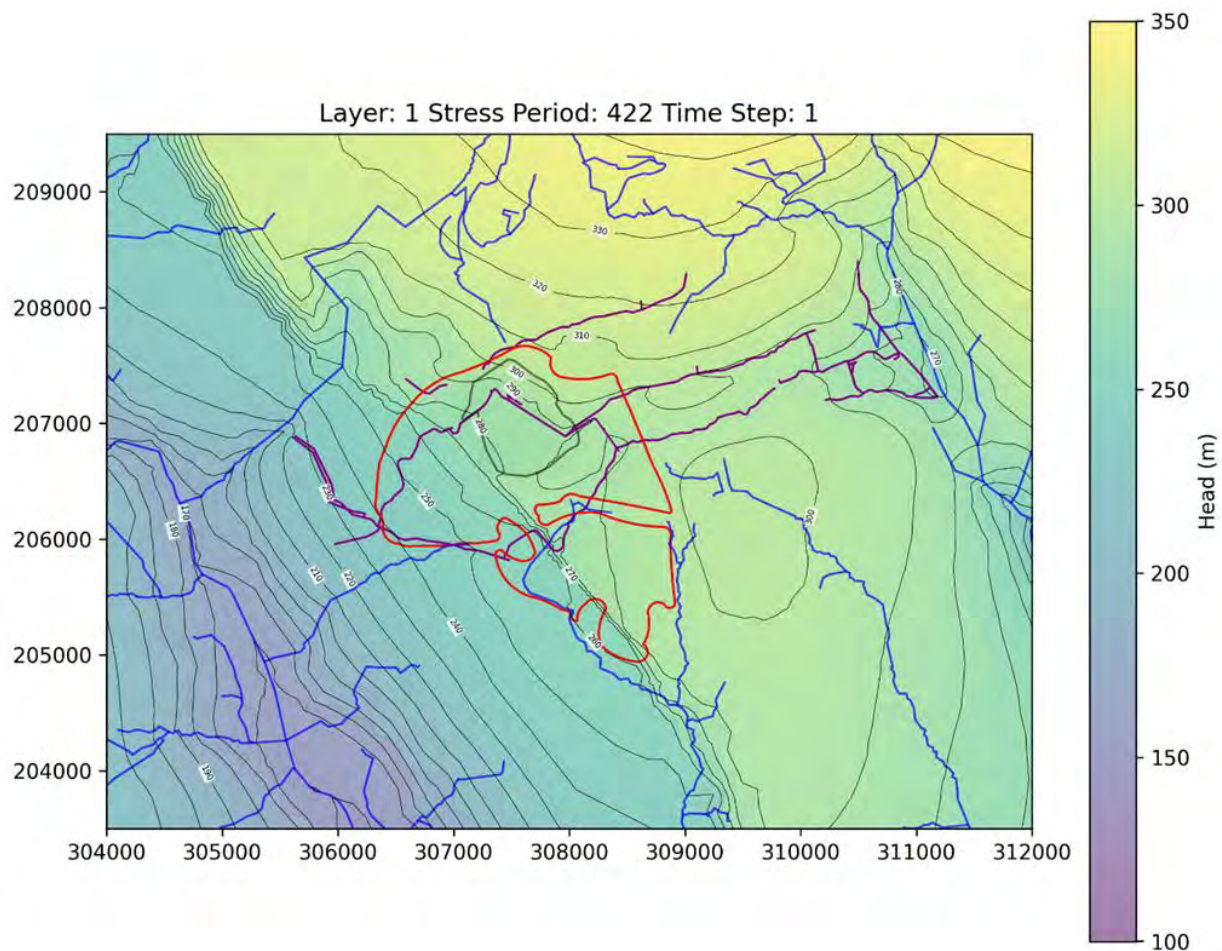


Figure 8: Groundwater table during wet period, Scenario 2

Scenario 3

Figure 9 shows the projected rise in groundwater associated with the removal of all nodes in DFDS zone 3. This results in an increase in groundwater levels centred on the area between the mine site and the River Rhymney. The extent of projected groundwater levels above ground surface along the River Rhymney valley has increased but remains broadly comparable with the baseline model. These areas are plotted in Figure 10 for reference. Groundwater rise may increase the possibility of groundwater emergence relative to the baseline conditions, as well the volume of baseflow reporting to the river. The magnitude of any volumetric or spatial change is

groundwater discharge is challenging to quantify due to the complex nature of the terrain, drainage infrastructure and long history groundwater and surface water control for mineral exploitation.

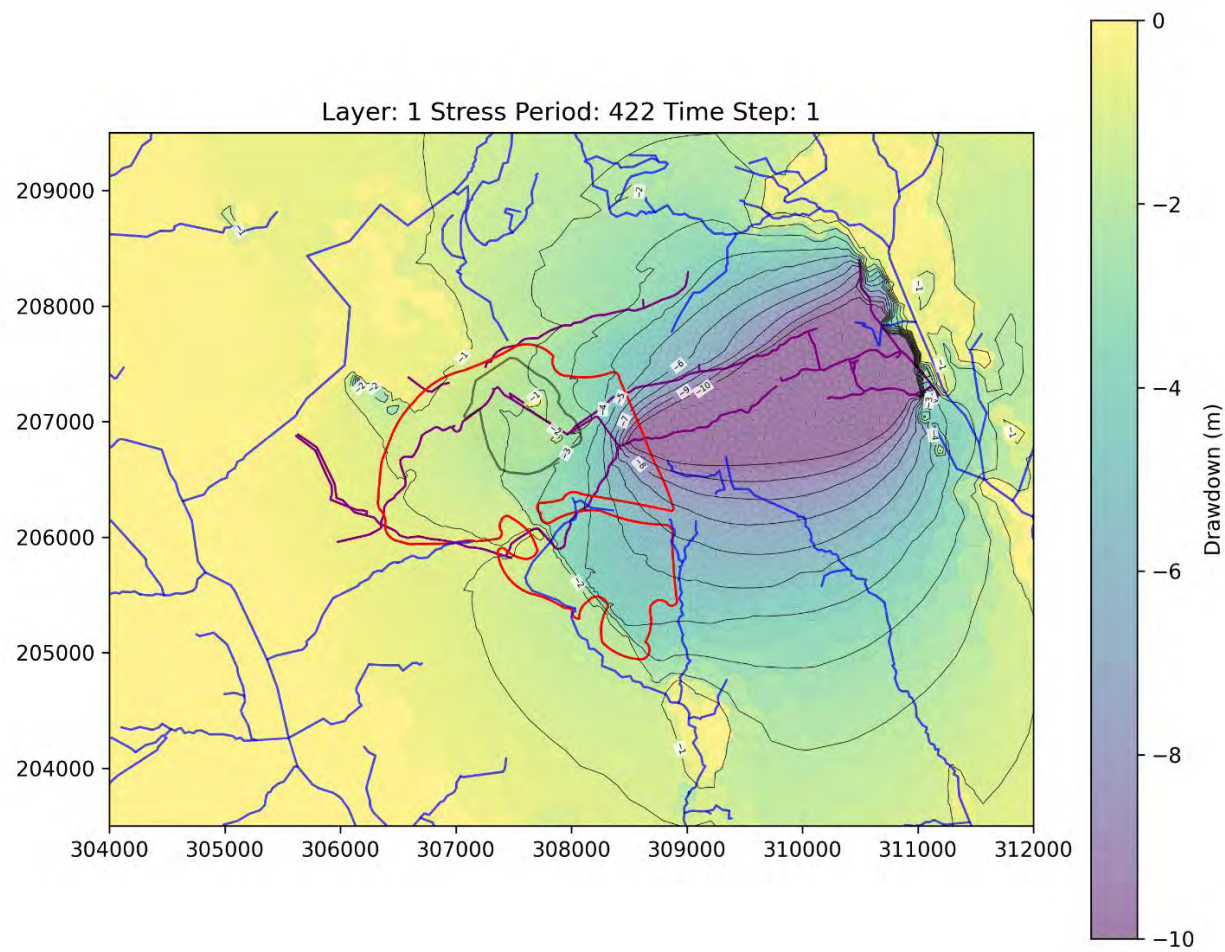


Figure 9: Groundwater rise during wet period relative top baseline, Scenario 3

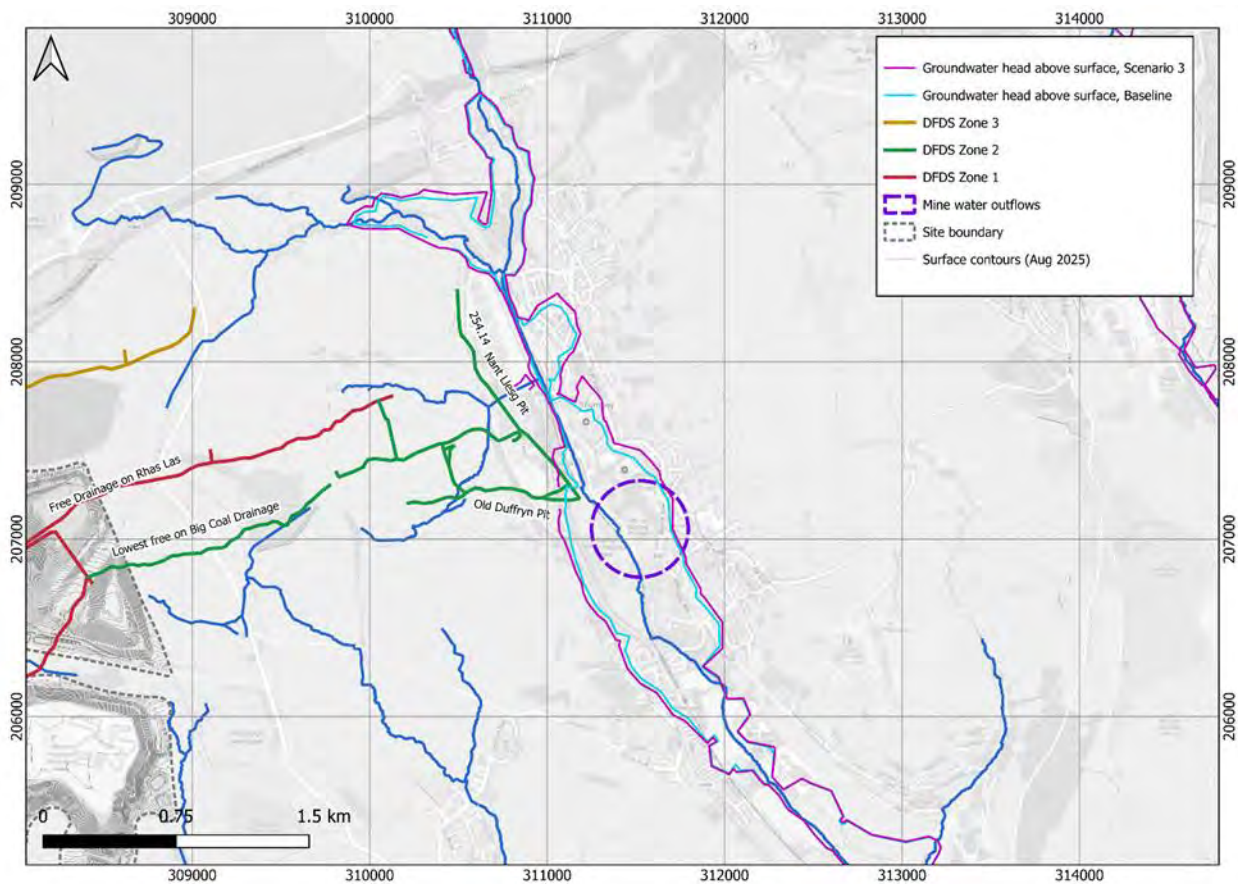


Figure 10: Comparison of projected wet period groundwater heads above surface extents for baseline and Scenario 3, River Rhymney.

3.3 Change to discharge from the DFDS

The effect of DFDS drain removal on discharge rates through the drainage network is presented in Figures 11 to 13. These show the change in discharge rate through each of the 3 defined zones within the DFDS (Figure 1) relative to the baseline scenario, as well as the cumulative change to total discharge.

All scenarios result in a net reduction in the projected rate of discharge from the DFDS. The magnitude of change is greatest for Scenarios 1 and 3, since these involve the removal of more extensive elements of the adit network than in Scenario 2. The model output shows that the removal or blockage of a DFDS zone results in an increase in discharge rate from the other, active zones, although not enough to compensate fully for the reduction in total flow rate.

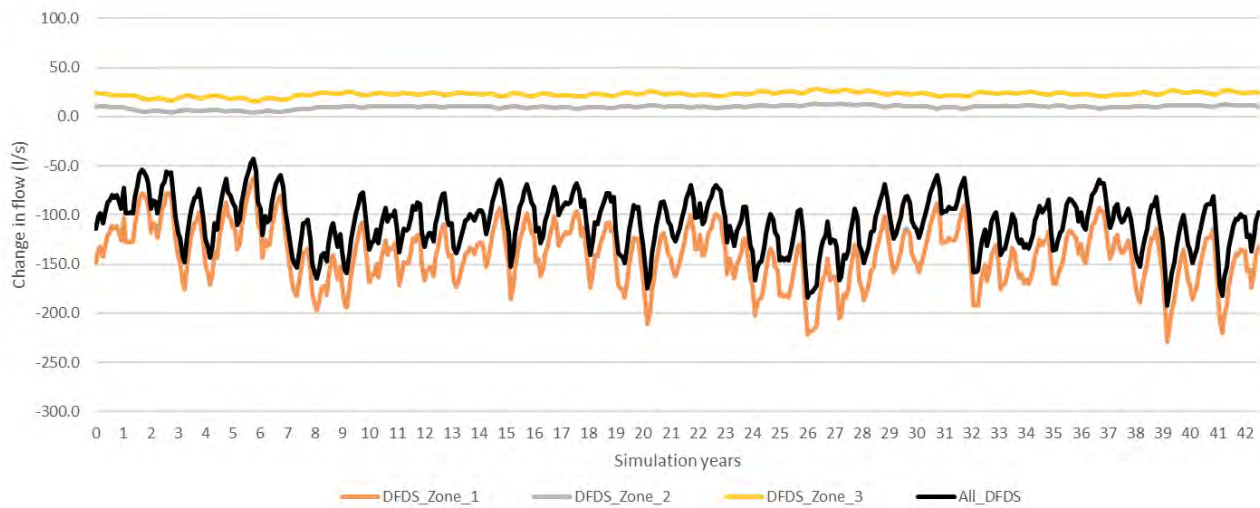


Figure 11: Discharge from DFDS relative to baseline, Scenario 1

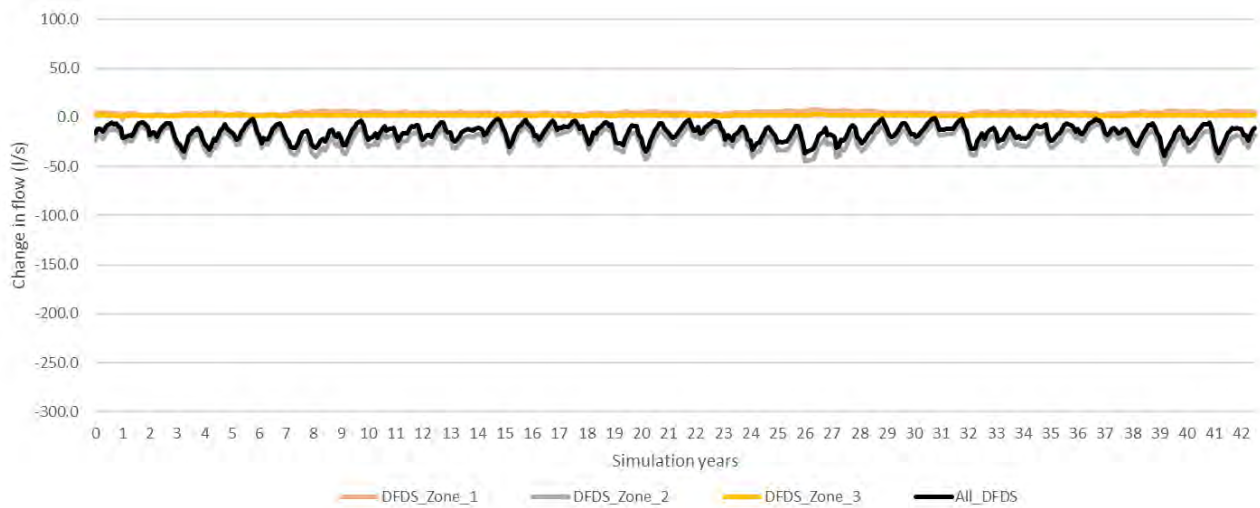


Figure 12: Discharge from DFDS relative to baseline, Scenario 2

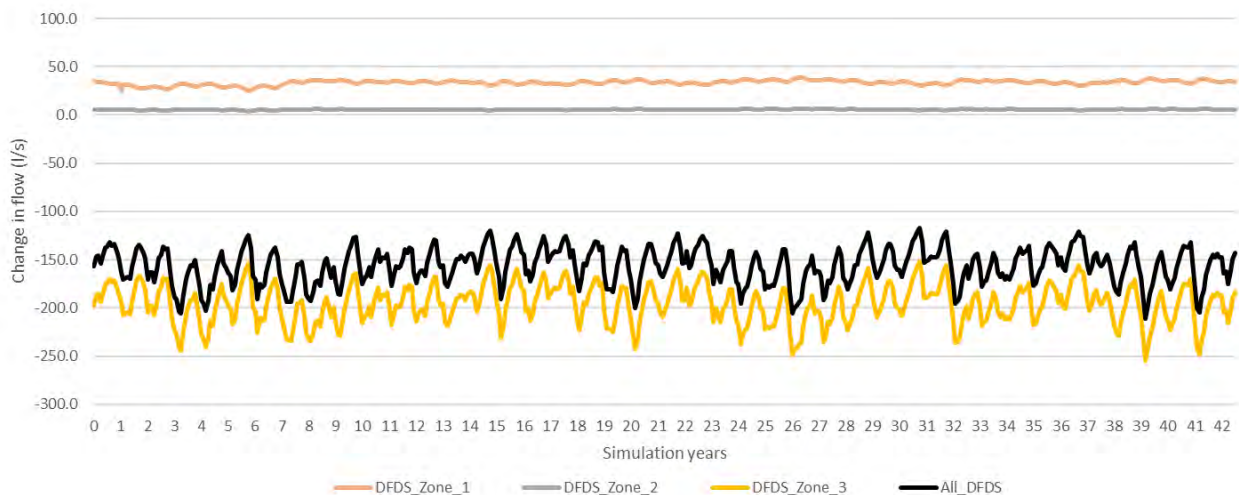


Figure 13: Discharge from DFDS relative to baseline, Scenario 2

3.4 Change to groundwater discharge to surface water

The impact of DFDS collapse and blockage on groundwater discharge to nearby surface water has been assessed for each scenario relative to the baseline. The change in groundwater discharge to the River Taff, River Rhymney, Nant Morlais and Bargod Taff is presented in Figure 14 to 16. The groundwater model suggests that groundwater discharge to surface water bodies increases in all scenarios in response to the rise in local groundwater head when elements of the DFDS are removed.

- In Scenario 1, groundwater discharge to the Morlais increases by up to 17% relative to the baseline. The River Rhymney and River Taff experience a lesser increase of approximately 2%. There is also an increase of up to 4% to the Bargod Taff.
- There is a smaller increase in groundwater discharge to surface water bodies projected in Scenario 2, owing to the more limited impact the removal of zone 2 DFDS drains has on the groundwater system. Groundwater discharge to the Nant Morlais increases by up to 2% in this scenario, and up to 0.5% for other watercourses.

- The largest increase in groundwater discharge projected in Scenario 3 is to the River Rhymney, where it increases by up to 10% relative to the baseline. This reflects how the area that experiences the most groundwater rise in this scenario is located within the River Rhymney catchment. There are smaller increases in groundwater discharge to the Nant Morlais of up to 6%, as well as increases of up to 4% and 2% to the Bargod Taff and River Taff respectively.

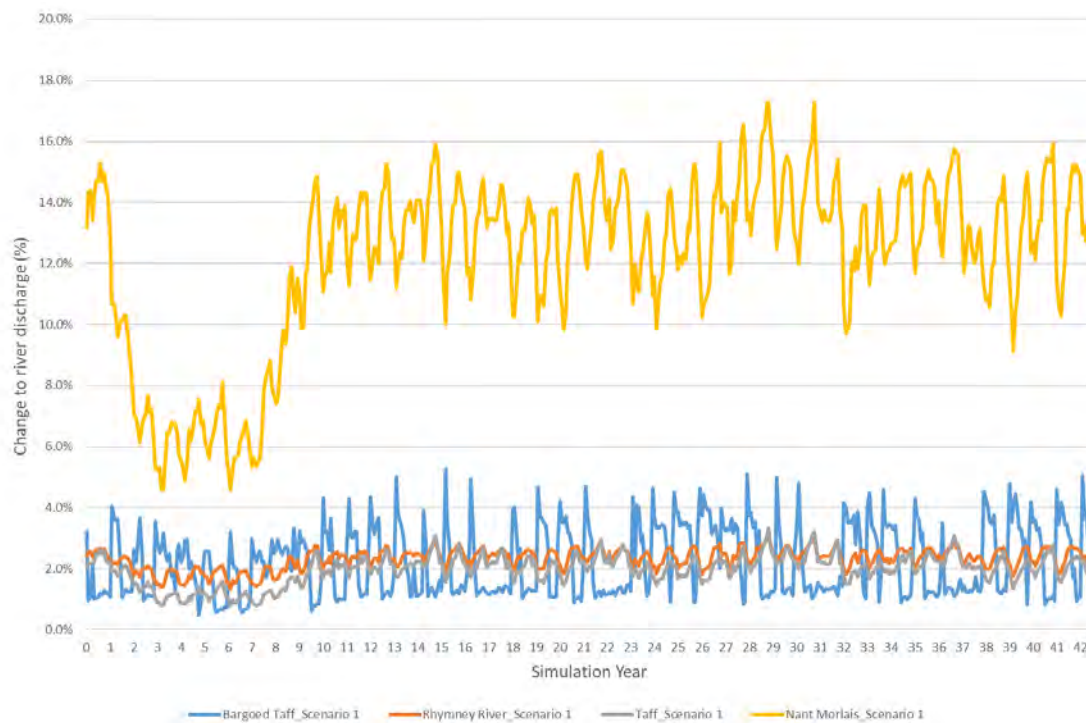


Figure 14: Simulated change in groundwater discharge to nearby surface water bodies, Scenario 1

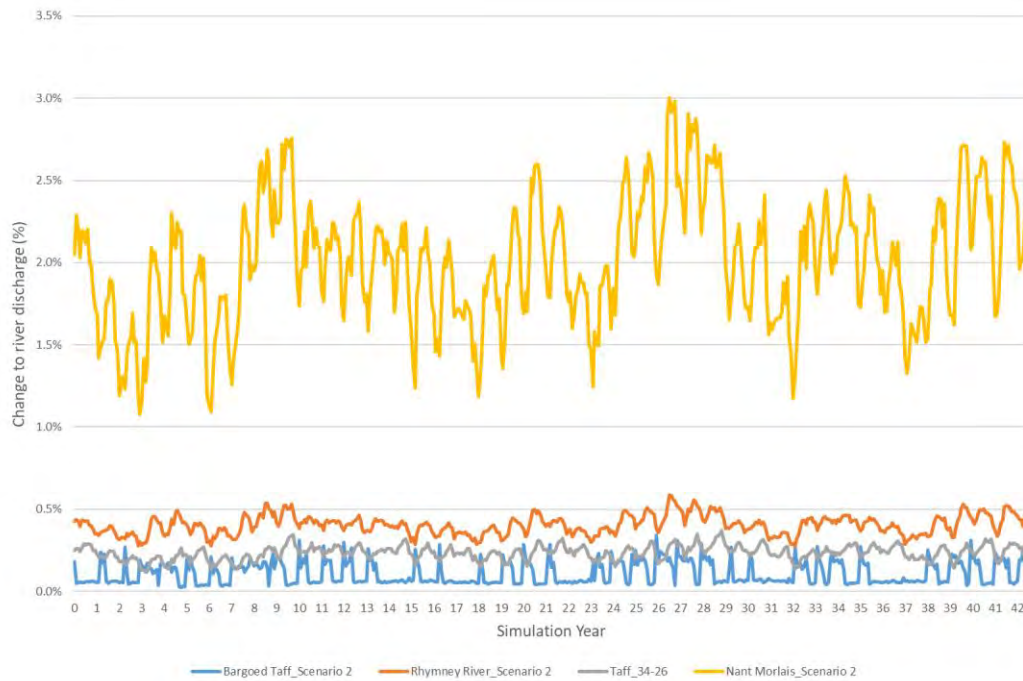


Figure 15: Simulated change in groundwater discharge to nearby surface water bodies, Scenario 2

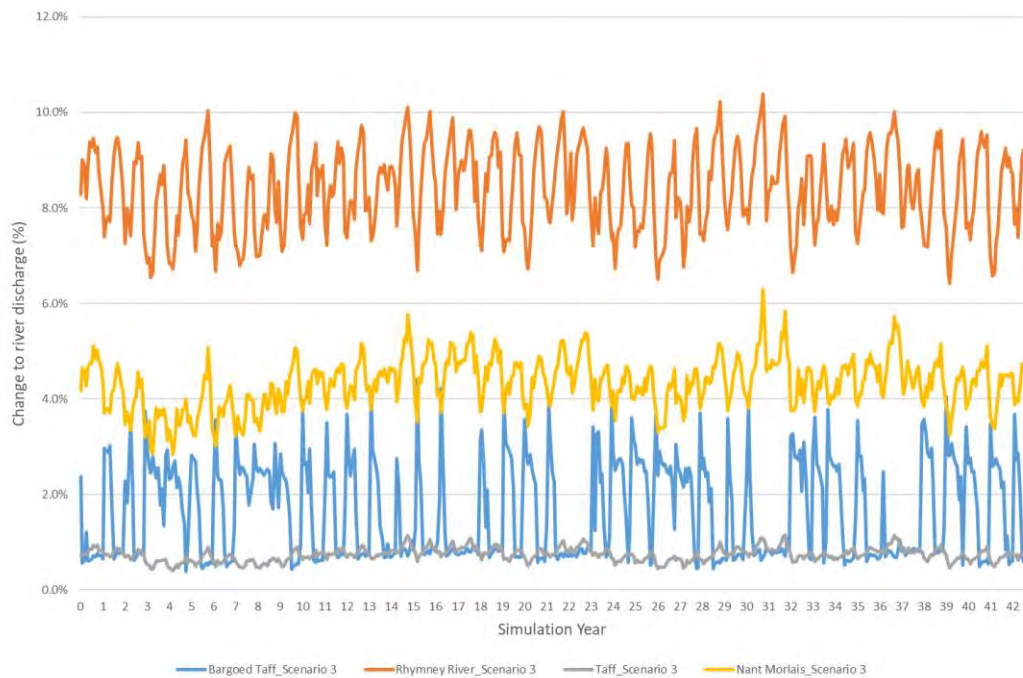


Figure 16: Simulated change in groundwater discharge to nearby surface water bodies, Scenario 3

3.5 Cumulative change to surface water flow

The cumulative impact of change to surface water flow to the River Rhymney and Nant Morlais considering both the change in discharges from the DFDS network and direct groundwater discharges to surface water were considered for each scenario. Cumulative changes to both water bodies are shown in Figures 17 and 18 respectively.

- River Rhymney: There is an increase in overall discharges to the river projected in Scenario 1 (up to 5% relative to baseline) and Scenario 2 (approximately 5% relative to baseline). In Scenario 3 there is a net reduction in discharges to the river of up to 9%, despite the relative increase in groundwater discharges highlighted in Figure 17.
- Nant Morlais: The model projects a decrease in net discharge to the Nant Morlais in Scenarios 1 and 2. The reduction in Scenario 1 is between 50 and 60% relative to the baseline, and highlights that the loss of inflow owing to the removal of DFDS drains in zone 1 is not balanced by a reciprocal increase in groundwater discharge as the water table rises. There is a net increase in discharges projected in Scenario 3 as the drains in zone 1 captures water that would otherwise have reported to the drains situated in zone 3.

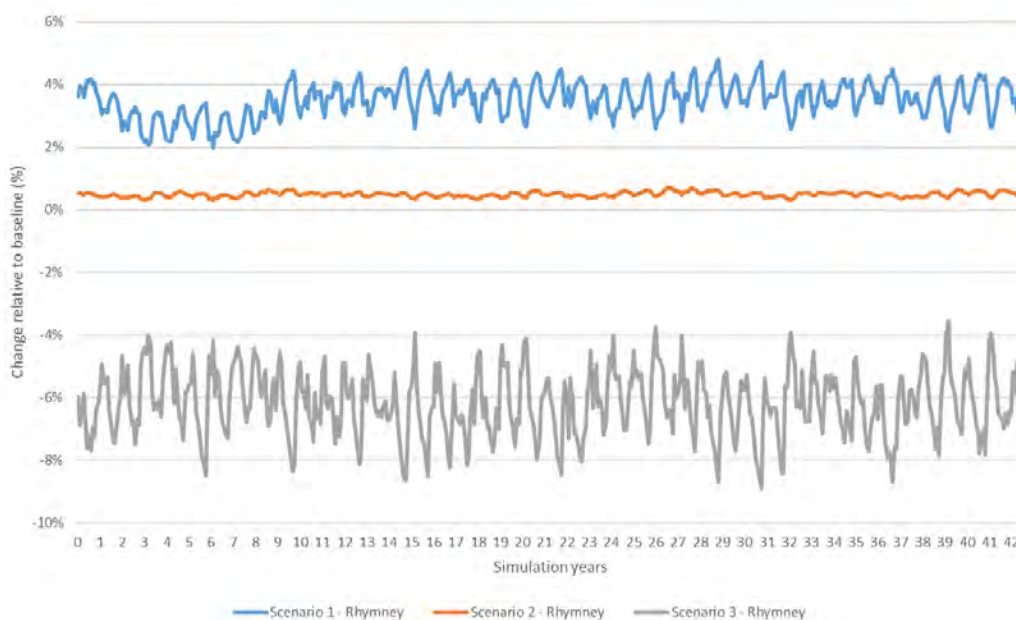


Figure 17: Cumulative projected change to surface water flow, River Rhymney

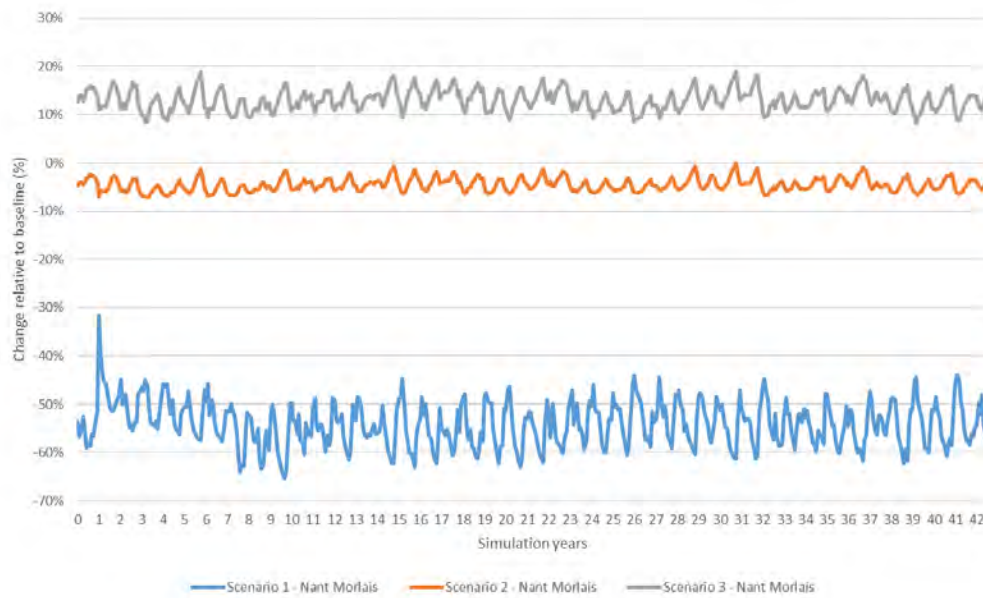


Figure 18: Cumulative projected change to surface water flow, Nant Morlais

4. CONCLUSIONS

The main objectives of the study were to:

1. Quantify the potential discharge from DFDS egress points following release of a blockage. The scope of this objective also included an assessment of the likelihood of a direct connection forming between the pit lake and the DFDS.
2. Provide an indicative outline of possible change to groundwater levels and discharge rates to surface water from the DFDS associated with any blockage.

The study has considered the highly conservative situation in which parts of the DFDS network suffer a complete idealised blockage, resulting in the backup of water within the adit network and change to surrounding groundwater levels and discharges to groundwater. It is considered to be highly unlikely that any part of the DFDS could suffer a complete blockage of the type as modelled in this study, since water would simply back up and disseminate via other pathways, such as the extensive network of old mine workings, and emplaced backfill. The blockage itself, if consisting of a collapsed portion of adit, would most likely be permeable to some degree and allow some through-flow. In this instance, the water would probably bypass the blockage and find its way back into the main drainage route further downstream. As such the modelling exercise presented here should be considered mainly as theoretical, and potential discharge rates and simulated impact of blockage on the groundwater system and surface water should be recognised as worst-case outcomes.

4.1 Main findings and discussion

4.1.1 *DFDS blockage and release*

- The geotechnical assessment undertaken by James Associates (James Associates, 2025) has concluded that the current and future configuration of the pit void would be unlikely to provide any means for water to flow directly from the lake into the DFDS. It is instead more

likely that groundwater would continue to percolate through the backfill material and find its way to the DFDS and other existing mine workings in a controlled manner similar to the pre-mining setting.

- Discharge rates from parts of the DFDS have been calculated assuming a blockage is released, and for pipe diameters of 0.5 m, 1 m and 1.5 m under conservative assumptions. The calculated flow rate range for individual zones are:
 - o Zone 1 (predominantly to Nant Morlais): 0.4 m³/s to 7.9 m³/s
 - o Zone 2 (thought to discharge to Dowlais Culvert): 0.4 to 8.1 m³/s
 - o Zone 3 (Discharge to River Rhymney): 0.2 to 3.6 m³/s
- Calculated discharge rates are most sensitive to the diameter of the adit or pipe through which it discharges. Therefore, this range could be better constrained by surveying known egress points where these are accessible.
- Discharge would occur at the maximal rate until the hydraulic head within the adit begins to reduce. This is a function of the volume held in storage within the adit, and the rate at which water flows into it from surrounding sources.
- Calculated discharge rates, as well as the risk of a blockage / release scenario occurring, are independent of the final restoration scheme design. For example, were the pit void to be backfilled to surface topography, a blockage in the DFDS as modelled in this exercise would still result in broadly similar adjustments to groundwater heads, and backing up of water within the DFDS adits and other associated mine workings. Used in the Darcy-Weisberg formulation, these parameters would yield similar discharges rates to what is presented in Table 1.

4.1.2 Impact of DFDS blockage on the water environment

- Blockage of egress points from the DFDS results in localised groundwater level rise.

- In Scenarios 1 and 2 this leads to a modest expansion of the simulated areas where groundwater levels exceed ground surface along the Nant Morlais and River Rhydney, although the extents remain comparable to the baseline simulation where DFDS drains are active.
- Blockage of elements of the DFDS would impact groundwater and DFDS discharges to surface water bodies around the site, resulting in changes to the stream flow regime.
- These scenarios represent the worst possible case as they assume a blockage forms a perfect seal on the drains, and that there are no other adits or drains in the DFDS beyond what is represented in the model. Both assumptions are likely to be invalid as any collapse within the adit would still allow some water to percolate through the collapsed material, with old mine workings, backfill and adits acting as an alternative means for groundwater drainage to occur.
- The DFDS and related drainage features are inaccessible owing to their age, condition and absence of suitable access points. Furthermore, these features were for the most part undisturbed by mining activities at the site. For these reasons, it is reasonable to state that no party is responsible for, nor is able to prevent, future collapse or blockage of the DFDS, or any other main drainage route beneath the pavement of the excavations, and that the risk of such an event occurring in the future will not have been increased meaningfully through mining activities at the site.

4.2 Recommendations

This study provides an indicative assessment of the potential effects of blockages within the DFDS, including potential scale and distribution and rise in groundwater level, change to the DFDS and groundwater discharges to surface water, and the potential discharge rate under a blockage release type situation. The following recommendations would be helpful for the purposes of monitoring the performance of the DFDS and better constrain the calculations presented in this document. As the Lead Local Flood Authority, MTCBC are responsible for managing flood risk and may be well placed to consider and address these recommendations.

- Flow monitoring on receiving water bodies to check for any anomalous behaviour that may be attributable to a change in the drainage regime. The proposed monitoring regime and approach is described within the surface water monitoring plan.
- Survey of egress points, measurement of pipe diameters at egress points/ discharges, monitoring of pipe discharge rates where egress points are identified.

REFERENCES

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Harker, R. (1961) The House of Water, Transactions, Vol.1., No 1, pp23-27

James Associates (2025) Dowlais Free Drainage System [DFDS], 14/11/2025

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Scranton, P.A. (1897) An Elementary Textbook on Coal Mining: Shafts, Slopes and Drifts, Methods of Working Coal Mines, Mine Surveying and Mine Machinery, International Textbook Company, Burr Printing House, Frankfort and Jacob Street, New York

Appendix C – Surface Water Monitoring Plan

C1 - GS270_C001_SW_monitoring



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2025 SURFACE WATER MONITORING PLAN

Site: Ffos-Y-Fran

Date: 30/10/2025

1. Purpose

The purpose of this document is to set out a surface water flow monitoring plan designed to monitor environmental flows at several identified key locations in the vicinity of the site both during and after the Ffos-y-Fran land restoration scheme.

2. Objectives & required accuracy

Specific objectives for the plan are to:

- Instrument the main receiving surface watercourses of relevance to the site to measure flow and indicate any long-term, hydrological changes that may be associated with enactment of the proposed reclamation scheme.
- Assist in constraining the site water balance, including aspects related to former mine workings and surface drainage.
- Provide datasets of relevance to ongoing monitoring and assessment of surface water quality.
- Complement the existing NRW streamflow monitoring network in the region.

Although there is no fixed accuracy target for surface water flow gauging stipulated by regulators in the UK, the Environment Agency (EA) guidance for permanent surface water gauging stations (Lamb et al (2003)) states that, under typical flows where a rating curve has been well defined, the accuracy of stream flow measurements should ideally be within 5%. Given the aspiration that these sites will form part of the wider National Resources Wales (NRW) hydrometric network in the future, it is proposed that this accuracy target is adopted for the design and implementation of the surface water monitoring scheme described in this document.

3. Site description

The following site description is adapted from Chapter 10 of the Ffos-y-Fran Restoration Scheme ES. Figure 1 shows the location of the main watercourses in the vicinity of the site and assumed layout of underground mine drainage infrastructure.

The site is intersected by a network of surface water drainage ditches and leats. Some of these are historical workings from previous mining activity, forming part of the Dowlais Free Drainage System

(DFDS), which provided water to the Dowlais Ironworks. The DFDS is also associated with a network of underground adits and channels that were used to control groundwater levels during mining. These are believed to drain to nearby surface watercourses.

Bargod Taff and its tributary the Nant Gyrawd are the nearest watercourses; these flow southwards and are tributaries of the Afon Taff. The Afon Taff is located approximately 1.5 km 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. Cae Harris, Nant Bargod Rhymney, River Rhymney, Nant Carno and Nant Morlais are the other watercourses in the area.

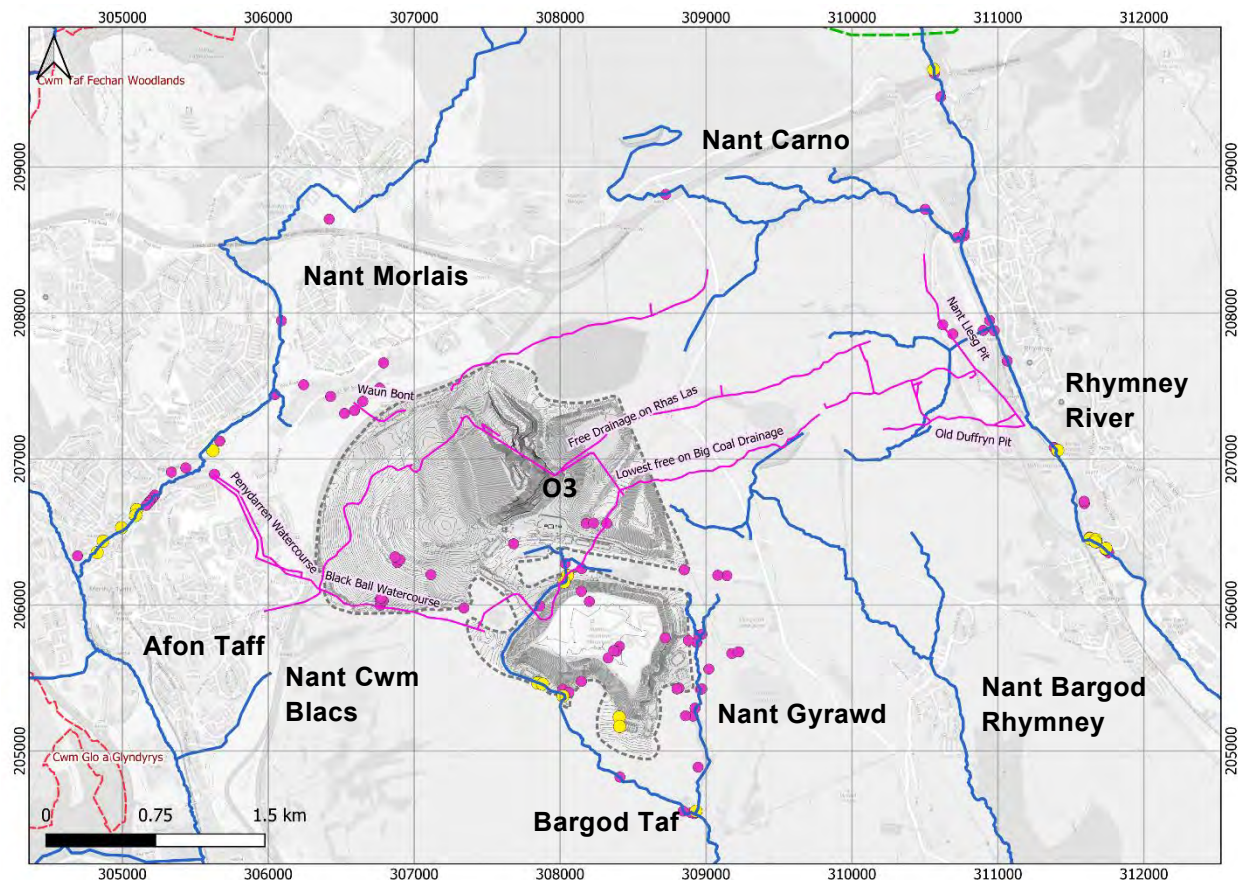


Figure 1: Overview of surface water drainage and DFDS adits (Dowlais Free Drainage System). Existing spotflow monitoring points are shown as pink (July 2024) and yellow (June 1996) dots. Purple lines denote the underground Dowlais Free Drainage System

Nant Morlais

The Nant Morlais is a tributary of the Afon Taff. It arises to the north of the site on the flanks of Twyn Pwll Morlais and flows through Merthyr Tydfil along a network of engineered channels and culverts. Spotflow surveys in 1996 and 2024 suggest that the channel is likely to receive direct discharges from adits associated with the DFDS and old mine workings, as well as from the Dowlais Culvert.

Nant Cwm Blacs

The Nant Cwm Blacs catchment is relatively limited in extent. On site, it can be seen that the stream effectively rises at the head of the railway cutting and drains to the west, underneath Bogey Road via a small culvert, into a small wetland. From this area of wetland, surface water either flows back under Bogey Road or out of the western edge of the wetland, where it flows down slope in a westerly direction to a lagoon situated in the south of the site. The lagoon is assumed to have an outfall to Cwm Blacs watercourse.

Bargod Taff

Ditches in the eastern and south-eastern extents of the site flow south and discharge to the Bargod Taff off site, either directly or via the Nant Gyrawd, which is situated to the east of OB3. To the west of OB3 water discharged from water treatment area WC1 flows south into the Bargod Taff which has been permanently diverted around the toe of OB3.

River Rhymney

This river flows on a southerly course and is situated to the east of the site. It is thought that this watercourse receives discharges associated with the DFDS and old mine workings.

Nant Bargod Rhymney

This tributary of the River Rhymney arises to the east of the site. The surface water catchment is not expected to be modified as part of the restoration scheme, and there is no evidence to suggest that this stream receives mine discharges. As such this watercourse is omitted from the proposed surface water monitoring scheme.

Nant Carno

This tributary of the River Rhymney drains a surface water catchment to the east of the Trecatty Landfill site. Similarly to the Nant Bargod Rhymney, the surface water catchment is not expected to be modified as part of the restoration scheme, and there is no evidence to suggest that this stream receives mine discharges. As such this watercourse is omitted from the proposed surface water monitoring scheme.

4. Proposed monitoring locations

Approximate surface water monitoring locations are shown in Figure 2. In combination they would measure stream flow contributions from surface and groundwater catchments that coincide with the

site extent and may be affected by the proposed restoration scheme. The rationale for each location is explained below.

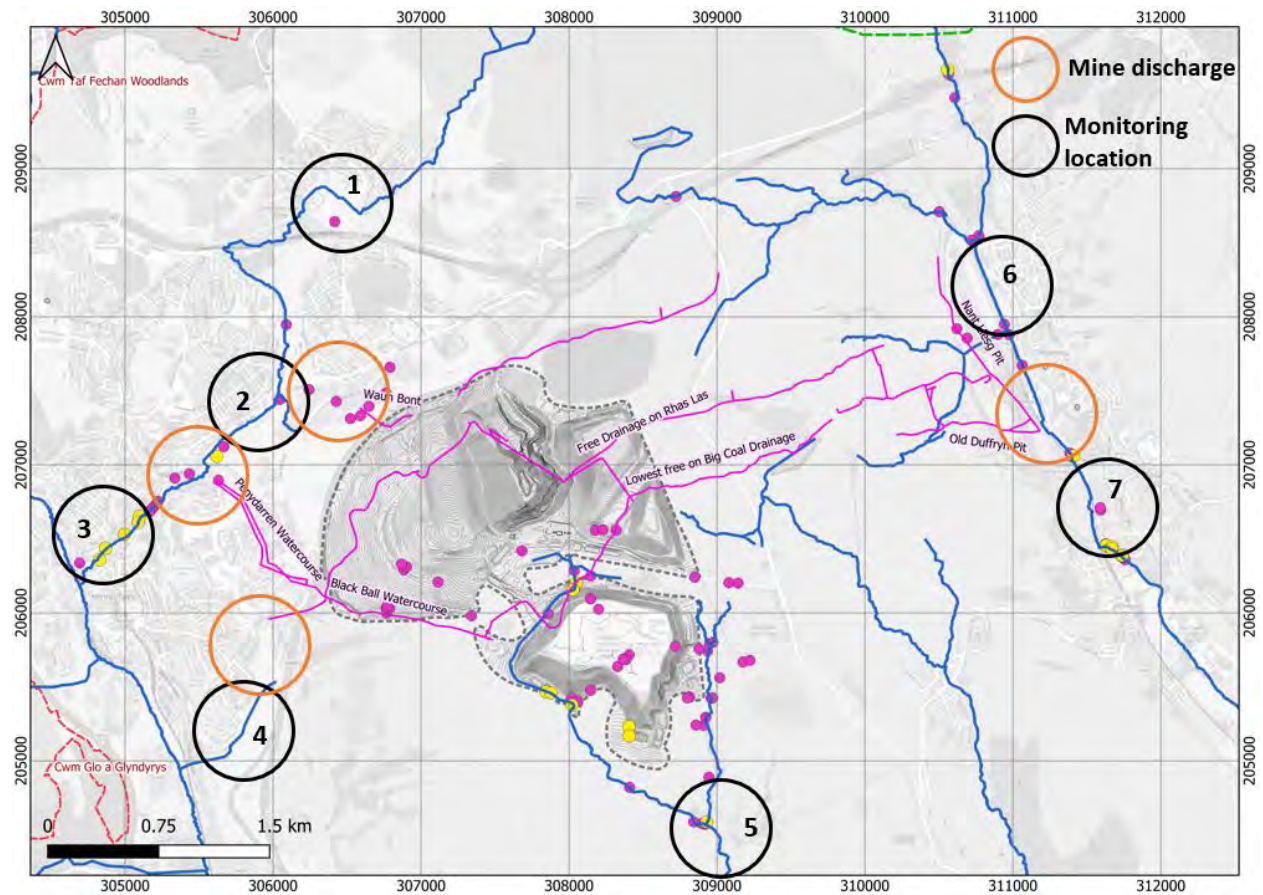


Figure 2: Suggested stream flow monitoring locations

- **Site 1:** On the Nant Morlais, upgradient of where mine discharges are thought to occur. This will provide a reference point for the calculation of mine discharges to the Nant Morlais from the site. This site coincides with water sampling point MA1.
- **Site 2** is situated downgradient of Site 1 and the Dowlais Culvert on the Nant Morlais. It is located near water sampling point MA2. The aim of this site is to quantify accretion to stream flow gained through drainage from the mine site to the Dowlais Culvert.
- **Site 3** is located downstream of where inflows from the Penndarren and Black Ball watercourses are thought to discharge to the Nant Morlais. Much of the water collected within the DFDS across the mine site may drain through these watercourses. A site survey will attempt to better constrain the location of outfalls so that the gauging station is positioned downstream of these.

- **Site 4** would measure flow along the Cwm Blacs watercourse, which is thought to arise as a spring from the mine site around Sarn Howell Pond and discharges to the Afon Taff.
- **Site 5** is located downstream of the confluence of the Bargod Taff and Nant Gyrawd. The site would measure a combination of mine drainage from the southern part of the site, surface water runoff and baseflow contributions from the local groundwater system.
- **Site 6** is situated on the River Rhymney upgradient of the approximate location of suspected mine water discharges. This point would serve as a reference point to Site 7.
- **Site 7** is located downstream of the suspected mine discharge points to the River Rhymney. By comparing stream flows measured at Site 6 and 7 we can constrain the contributions from potential mine water sources.

5. Instrumentation

Each site would be instrumented using a **low-range, high-specification level sensor**, combined with a **telemetry unit** (such as a Wildeye 4G IoT Logger), providing mm scale accuracy. This approach is suitable for a range of channel types and is highly accurate, provided that a rating curve is well defined and the channel geometry does not change.

Measured stream levels would be uploaded wirelessly to an online database, in which a stage / flow rating curve for each site would be used to convert water levels to flow rates (refer to Section 7 for further detail on rating curve definition).

An initial site survey would be undertaken to identify suitable gauging locations along the stream / river reaches of interest. Furthermore, this survey would assist in confirming the installation approach for each site.

A diagrammatic representation of the completed installation is shown in Figure 3.

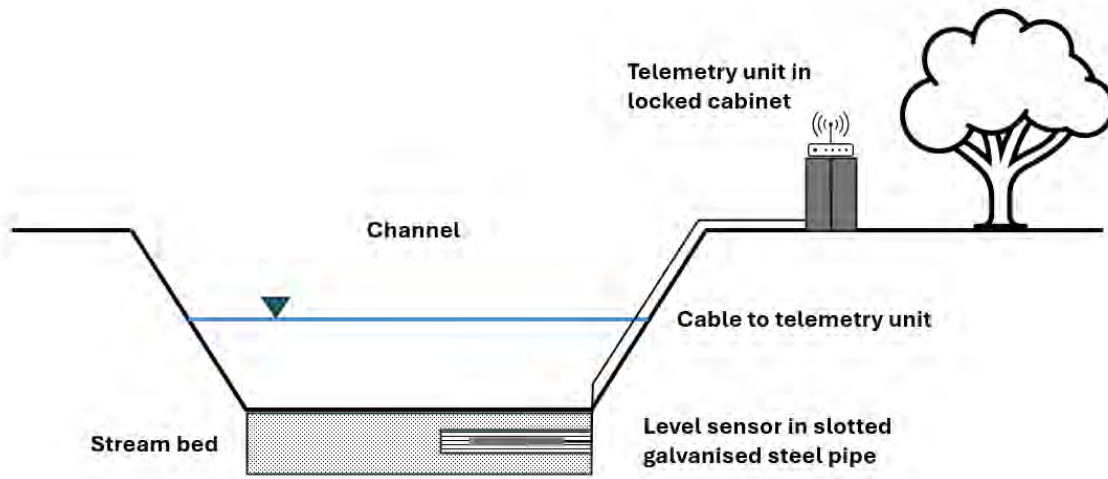


Figure 3: Long-term stream flow monitoring installation

6. Measurement frequency

Measurement frequency will be sub-hourly, preferably at 10 minute intervals, to monitor stream flow response to short duration events.

7. Stage/flow rating curve development plan

Ratings curves would be generated for each site using a temporary installation, consisting of a **Duratracker** portable logger unit (Figure 4) and **AV (Area Velocity) meter** (Figure 5). These will be kept in place sufficiently long to characterise the rating curve over the full stream flow regime. The length of time required for this will depend on climatic conditions. It is recommended that monitoring for rating curve development would start during the winter period to capture high flow conditions, and continue into the spring and early summer to capture low flow conditions however this is dependent on when planning approval is received.



Figure 4: ISCO DuraTracker area-velocity flowmeter and Wildeye 4G Telemetry Datalogger assembly



Figure 5: ISCO Area-Velocity AV350 doppler sensor

8. QA/QC and maintenance

Both the temporary rating curve development installation and permanent installation will require ongoing maintenance, with site checks at the following frequency to identify any issues that may detrimentally impact measurement accuracy:

- Rating curve development installation: every 3 months, to include re-calibration if necessary.
- Permanent installation: annual.

Stream flow data collected at all sites would be reviewed on at least a monthly basis to check for any erroneous readings, drifting of readings or unusual offsets.

9. Data handling & reporting (file formats, responsible persons)

Data from all sites will be uploaded continuously to an online portal via a telemetry unit, where the data can also be visualised.

Furthermore, data will also be downloaded and stored within a hydrometric database (MS Access / Excel) as a backup to this online system.

10. Safety & permitting

A full risk assessment to include the suitability of each location would be carried out prior to any work taking place, including landowner approval where necessary, site surveys, installation of monitoring equipment and maintenance visits. This should also be complemented by a point-of-work risk assessment mainly to consider access arrangements, weather conditions and river flow conditions (i.e. is the river in flood).

Some sites (2 and 3 for example) may be difficult to access, and as such any risk assessment should ensure that safe means of entrance and egress are available. This should be an important consideration when siting the gauging stations.

Consent for the installation of gauging stations will be sought from the appropriate authorities, including MTCBC and NRW, as well as landowners if outside the site boundary.

It is proposed that flow monitoring would continue during the 5 year aftercare period after which, subject to final review, discussions would be held with the local authority, NRW and any other relevant statutory bodies to adopt the monitoring stations as part of their own network in the area.

Similarly, it is recognised that the information obtained from these monitoring locations will immediately add value to the records collected by these statutory bodies, and MSW would welcome discussions to investigate whether any support could be offered to either install, check and/or collect & monitor the results obtained.

REFERENCES

Lamb, R., Zaidman, M.D., Archer, D.R., Marsh, T.J., Lees, M.L. (2003) River Gauging Station Data Quality Classification (GSDQ), R&D Technical Report W6-058/TR, Environment Agency

Appendix D – Pit Lake De-Watering

D1 - Dewatering Proposal Pit Void

D2 - Dewatering Procedure

D3 - Dewatering Plan

D4 - Pumping Plan – Pit Void to WB Settlement Lagoons

D5 - Pit Void Dewatering Log



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Ffos-y-Fran Restoration Programme Spring / Summer 2026 Dewatering Proposal Pit Lake Void

To comply with the proposed revised restoration strategy for the Ffos-y-Fran site, the Company (Merthyr South Wales Ltd) will have to dewater the pit lake void, by lowering the water level from approximately 281m AOD to 265m AOD to be able to back fill the void to allow formation of safe and stable graded slopes as the first phase of restoration programme of works.

Two pumps will be deployed with a combined maximum rated capacity of 278 l/s (1,000 m³/hr), to pump water to the WB Water Settlement Lagoons, to comply with the conditions of Abstraction Permit Licence Serial No WA/057/0022/0004

Water will be pumped from the void under the Companies Dewatering - Operating Procedure to discharge into the WB Settlement Lagoons, water will then subsequently discharge to the Nant Morlais A Culvert and Off-site Watercourse.

Amec Foster Wheeler were commissioned by the Company in 2015 to undertake a hydraulic capacity assessment of the off-site drainage functions associated with the Nant Morlais A and B catchment areas (Ref; Appendix A – Design Capacity of Culvert & Watercourse)

The pen stock control valve on the WB settlement lagoon is rated at a discharge rate of 100 l/s (360 m³/hr), with the storm overflow conditions rated as greater than the 100 l/s (360 m³/hr) from the lagoon, to ensure water levels in the pit void were retained at a safe working level to sustain site operations. Also, to comply with conditions in Table 3.1 of the discharge Permit EPR/DB3131AF.

Operational practice during storm conditions has been to deploy a second pump thus increasing the total volume being pumped through the WB Settlement Lagoons to greater than 100 l/s, until such time that the attenuation pond reached its maximum capacity.

A maximum dewatering rate of 265 l/s (954 m³/hr) will be required, to reduce the pit lake void water level at a controlled rate. A nominal rate of 265 l/s is the equivalent of 10.6% and 40.6% of the Nant Morlais A Culvert and Offsite Watercourse design capacity, respectively.

A gauge board will be installed to monitor and manage water flows through the culvert and the offsite watercourse.

It is estimated that it will take between 7 to 9 weeks at a dewatering rate of 265 l/s to reduce the water level in the pit void to 265m AOD, therefore, it's critical, to be able to progress the restoration works to reduce the pit void water level within the 7 to 9 week window. Particularly as the backfilling works can only be undertaken during a "window of opportunity" in the drier months of the year, predominantly late spring and summer.

Initially, during Week 1 of the dewatering works one pump will be deployed, on a 24/7 basis, at a set pumping rate of 100 l/s (360 m³/hr) to allow the settlement lagoons and watercourse to stabilise, lagoons and watercourse will be routinely monitored by the Company's C&M (Care & Maintenance) Team.

Provided there are no issues with the water quality and no detrimental impact on the receiving watercourse, the pumping operation from Week 2 will be increased to two operational pumps, operating on a 24/7 basis, delivering 265l/s to the WB Lagoon for the duration of dewatering period.

Analytical data, based on a quarterly sampling regime, since the cessation of pumping from the Pit Lake Void in August 2023. A seven-sample suite collected through 2023, 2024 & 2025 indicates an Average pH 8.1 (Range 7.8 – 8.2), Suspended Solids Average 6.5 mg/l (Range 5 – 8 mg/l) and Iron as Fe 0.414 mg/l (Range 0.01 – 2.36 mg/l), with no visible oil & grease recorded. All determinates comply with their consent levels detailed in Table 3.1 of the discharge permit EPR/DB3131AF.

The Iron (Fe) result of 2.36 mg/l reported on 22nd. November 2023 appears to be an anomaly, with the six samples collected since indicating a range of 0.01 – 0.52 mg/l, representing an average of 0.097 mg/l.

Based on the analytical data, it is anticipated that provided the dewatering process is undertaken at the specified controlled rate to comply with the discharge consent limits there will be minimal impact on the receiving watercourse and the local environment.

Similarly, with the planned dewatering to be undertaken during the “spring & summer months” this will also minimise the potential impact of additional storm water runoff impacting on the Nant Morlais A Culvert and Watercourse specified capacity.

However, in the event of prevailing storm conditions during the dewatering period, the pumping rate will be reduced accordingly to manage and stabilise flows in the offsite watercourse.

Therefore, the Company propose that NRW consider varying the current permit EPR/DB3131AF to allow the WB Settlement Lagoon storm water overflow capacity to discharge an additional 165 l/s. I.e., 100 l/s through the pen stock valve and 165 l/s through the storm overflow, thus increasing the total discharge capacity from the WB Settlement Lagoons to the Nant Morlais A watercourse to 265 l/s

Ffos-y-Fran Restoration Programme Spring / Summer 2026

Operating Procedure - Dewatering Pit Lake Void

Prior to commencing the dewatering procedure C&M (Care & Maintenance) Team members will be fully briefed on their roles and responsibilities under the dewatering programme.

C&M Team members will be responsible for controlling water pumping rates to ensure discharges from the WB Lagoon comply with NRW consent parameters, while reducing Pit Lake Void water level, to a safe working level.

Under the supervision of C&M Team Leader, operatives will then be stationed at the Pit Lake Void pumping base and at the WB Settlement Lagoon, communicating via handheld two-way walkie-talkies.

An instantaneous spot sample of water will be taken from the void to check for compliance with the WB discharge consent limits and subsequently recorded in Void Dewatering Log.

Initially the pump will be set at a rate of 25 l/s (90 m³/hr), to stabilise the flow through the lagoons and to ensure the water quality complies with the discharge consent limits.

Operator 1, located at the Pit Lake, will inform Operator 2, located at WB Lagoons, that the pump has been primed and commenced pumping at a reduced rate.

Once a controlled flow has established through the lagoons and a spot sample of water will be taken to ensure compliance with the WB discharge consent limits and recorded in the log

Provided there are no issues with the water quality, Operator 2 will request Operator 1, to gradually increasing the pumping rate in 25% increments to 100 l/s (360 m³/hr)

Both Operating stations will be continuously manned and monitored for the first 8 hours to ensure flows have stabilised and the water quality is within discharge consent limits.

Simultaneously, a C&M Team member will also routinely monitor the Nant Morlais A Culvert & off-site watercourse to ensure there is no detrimental effect on the culvert or watercourse

Subsequently, a nominated Team Member will be responsible for controlling and routinely monitoring both the pumping and the lagoon operation a 24/7 basis, supported as required by other members of the C&M Team and the 24/7 on-site Security Team.

In support of the visual observations of the water quality, spot samples will be taken at WB Lagoon discharge point every 4 hours and recorded in the log.

Field tests will be undertaken to ensure compliance with permit consent parameters

A gauge board will be installed to monitor flows through the culvert and the offsite watercourse. Similarly, the gauge board will be utilised in the event of storm conditions to manage and stabilise flows through the culvert and the offsite watercourse

Also, provided there are no issues, the Culvert & Watercourse will be inspected daily.

As stated, during Week 1 of the dewatering works one pump will be deployed, on a 24/7 basis, provided there are no issues with the water quality and no detrimental impact on the receiving watercourse, the pumping operation from Week 2 will be increased to two operational pumps.

In the event of a perceived breach of the consent limits or a potential pollution of the Nant Morlais A watercourse, the Duty Team Member will immediately switch off the Pit Lake Void pumps and inform the C&M Team Management or Team Leader. (Ref: Appendix A List of Contact Numbers)

Pumps must not be restarted until the cause of the problem has been established and the necessary course of action taken to prevent a recurrence.

Pumps will then be restarted as previously described, under the supervision of C&M Team Leader, on a controlled basis to re-establish flows through the lagoons to comply with the discharge consent limits.

Once the water level has been lowered to 265m AOD the pumping rate will be adjusted accordingly to retain that level. Work will then continue to backfill into the base of the void compacting infill as necessary to stabilise the ground.

Upon completion of the works the pumps will be withdrawn allowing the ground water to recharge to its natural level.

Note: Spill Kit`s will be located at the Pumping station and the Site Workshop

Ffos -y-Fran - Pit Lake Void Dewatering Log

Date	Time	Pumping Rate l/s	Discharge Rate l/s	Visible Oil & Grease	pH Consent 5-9	Iron Consent 3mg/l	SS Consent 50mg/l	Comment

Field Testing SS – Suspend Solids measured as Turbidity (NTU)

Appendix A

Ffos-y-Fran Restoration Programme Spring / Summer 2026

Ref; Pumping Plan – Pit Void to WB Settlement Lagoons

WB – Discharge Consent Permit No. EPR/DB3131AF

- Suspended Solids - 50 mg/l
- Iron as Fe - 3 mg/l
- pH 5 – 9
- Visible Oil & Grease – No Visible Trace Present

* Abstraction Permit – Dewatering Void – Licence Serial No. WA/057/0022/0004

Discharge Capacity`s - Culvert & Watercourse

- (Ref Amec-Foster Wheeler Report December 2015)
- Morlais A Culvert (Goat Mill) Design Capacity 2,500 l/s – 9,000 m³/hr
- Watercourse Max. Discharge Capacity 652 l/s – 2,347 m³/hr
- Morlais B Culvert (Bradley Gardens) Design Capacity 3,400 l/s – 12,240 m³/hr
- Watercourse Max. Discharge Capacity 845 l/s – 3,042 m³/hr
- Pen Stock Valve Max. Capacity 100 l/s – 360 m³/hr
- Storm Water Overflow Capacity > 100 l/s – 360 m³/hr
- Varied Capacity Void Dewatering – Restoration 2026 265 l/s – 954 m³/hr

Nant Morlais A

Dewatering Rate @ 265 l/s = 10.6% of the Culvert Design Capacity

Dewatering Rate @ 265 l/s = 40.6% of the offsite watercourse max. discharge capacity.

Annual Pit Void Water Level Range 274m – 281m AOD

Pit Lake Void Water Level - Lowered to 265 m AOD

Notes:

*Abstraction Permit States: 2 Submersible Pumps

Storm Water Overflow capacity is designated as greater than the 100 l/s through the Pen Stock Valve; however, this consent only currently applies under storm water conditions.

C&M Team Emergency Contact Numbers

Restoration Manager	Chris Barber	07850 638015
Restoration Officer	David James	07885 452876
Team Leader	Ron Phillips	07894 968869
Team Leader	Andrew Stewart	07834 765042
Team Leader	Lee Phillips	07383 966681
Security Officer	24/7 Contact	07525 912602

Appendix E - Water Quality Monitoring Plan (WQMP)

E1 - FF 2025 Monitoring Program review Draft R2



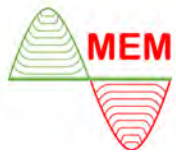
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Memorandum

Project no	036/001
Date	10 October 2025
Subject	Fros-y-Fran 2025 Water Quality Monitoring Program Review
Revision No.	02

Merthyr (South Wales) Ltd (MSW) have commissioned Mine Environment Management (MEM) to complete a review of the environmental water quality (WQ) monitoring requirements and activities to support possible changes to the Environmental Monitoring Program as the site continues to transition from operations to into the definite restoration phase (monitoring, maintenance and management). MEM understands that the surface mine operations (coal extraction) ceased in November 2023 and monitoring has continued on site during restoration activities as part of the care and maintenance programme. Monitoring data has been used as part of the Ffos-y-Fran Final Restoration Scheme Acid and Metalliferous Drainage (AMD) Risk Assessment (MEM, 2025), which has been provided as an appendix to the Environmental Statement (RML, 2025) for the Restoration Scheme.

Background

The site has a relatively complex history of mineral resource activities (coal and iron ore). Mining activities have been recorded on site as early as the 1800s, with numerous shafts, adits and spoil across the area (CEL, 1996), during coal excavation 46 known shafts and 39 known adits related to previous iron ore and coal workings were found and removed as part of operations.

The Ffos-y-Fran site lies approximately 1.5 km east of Merthyr Tydfil town centre. To the East and within approximately 2km are Fochriw, Pontlloftyn and Rhymney. The site sits within the South East Valleys catchment area, where the status of the receiving surface water environments ranges from good to poor, see Figure 1. The groundwater status below the site has been defined as poor by NRW, see Figure 2.

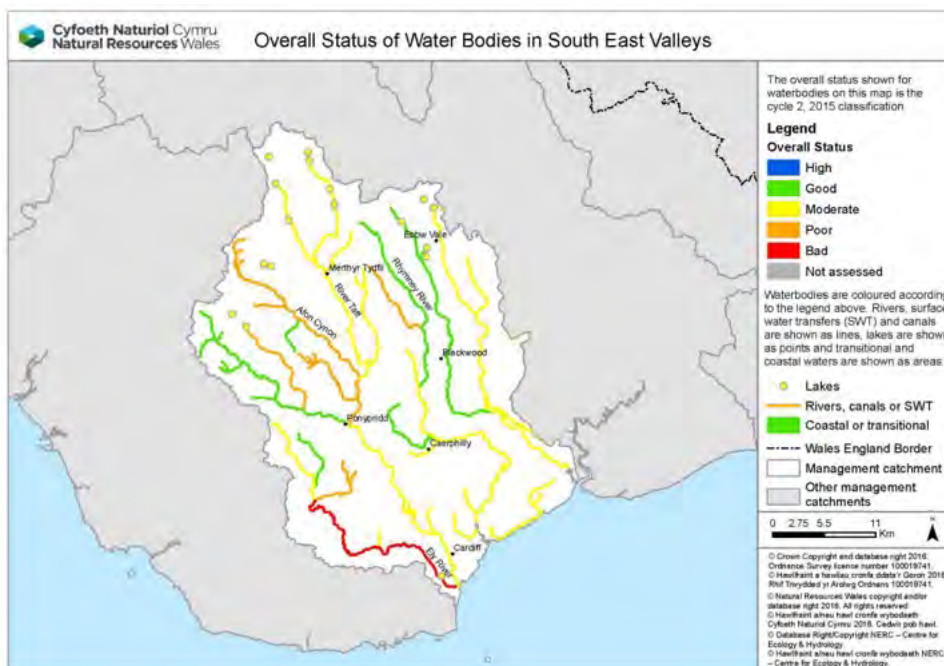


Figure 1 River Status (NRW)

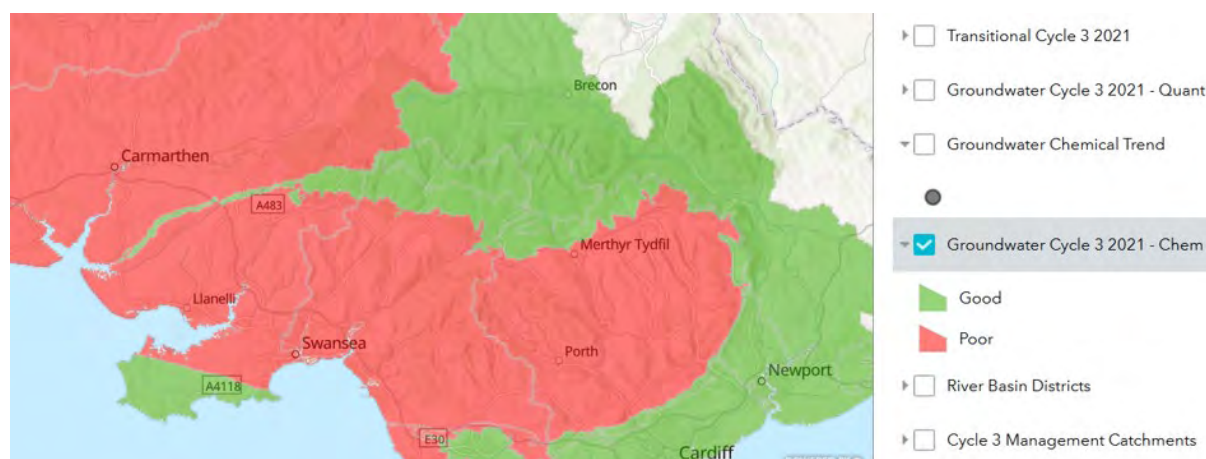


Figure 2 Groundwater (GW) Status (NRW)

Site restoration is defined within the Ffos-y-Fran Final Restoration Strategy and rehabilitation activities are ongoing (RML, 2025). At the current time the environmental monitoring routine undertaken on site has remained unchanged from the period prior to the cessation of operations, and is carried out in accordance with Condition 44 of the planning permission.

Scope

The purpose of this technical memo is to provide a review of the surface and groundwater quality monitoring programs, including analysis of data, to assess the suitability of the program post restoration phase. The data reviewed was provided by MSW and any verification, such as confirmation against certificates of analysis for specific points, was not within scope. However, we were informed that all testing was carried out by a UKAS accredited laboratories (mostly SOCOTEC UK LTD). Where issues such as anomalies were identified and a cause could be identified such as a change in limits of detection

(LOD) for analysis, then these were highlighted within the analysis. This review does not assess or comment on compliance requirements other than referring to them where appropriate.

Objectives

The objectives of this monitoring review are:

- Identify where existing monitoring requirements should be continued as current to support the restoration phase
- Identify where locations, frequency and parameters could be amended to better support the restoration phase

Monitoring program summary

The water quality monitoring program consists of two water classifications; surface water (SW) and groundwater (GW). The program was developed to consider both compliance monitoring and aspects of operational monitoring. Compliance monitoring is currently conducted as defined in the two environmental permits and Condition 44 (MEM, 2025). However, MEM understands that some sampling locations are no longer included in the program as they are no longer available to sample. These locations have either been removed by operations (boreholes) or are inaccessible due to Health and Safety issues or physical barriers. A summary of the listed water quality monitoring locations are listed in Table 1.

Table 1 Monitoring Program summary

Monitoring requirements	Water Type	Monitoring Point (Permit reference)	Monitoring Point Ref.	Co-ordinates	Status
AE2013403	SW	A1	C	SO 09200 05660	
V003	SW	A2	C1	SO 09210 05660	
EPR-DB3131AF-V005	SW	A2	M1 (WC1)	SO 08029 06433	NRW discharge monitoring location
	SW	A3	M2	SO 08031 06425	
	SW	A4	M3 (WA)	SO 06706 05979	NRW discharge monitoring location
	SW	A5	M4	SO 06699 05973	
	SW	A6	M5 (WI)	SO 07926 05493	NRW discharge monitoring location
	SW	A7	M6	SO 07856 05487	
	SW	A8	M7 (WB)	SO 06720 07250	NRW discharge monitoring location
	SW	A9	M8	SO 06780 07290	
	SW	A10	M9 (WC)	SO 07616 06214	NRW discharge monitoring location

Monitoring requirements	Water Type	Monitoring Point (Permit reference)	Monitoring Point Ref.	Co-ordinates	Status
	SW	A11	M10	SO 07586 06332	
	SW	A12	M11 (WG)	SO 08780 05477	NRW discharge monitoring location
	SW	A13	M12	SO 08791 05555	
	SW	A14	M13 (WF)	SO 08399 05056	NRW discharge monitoring location
	SW	A15	M14	SO 08395 05102	
Condition 44	SW	1	MA1	306444E 208673N	Operational Nant Morlais culvert
	SW	2	MA2	305624E 207060N	Non-Operational ceased monitoring Apr 2020 Nant Morlais culvert
	SW	3	MA3	305211E 206725N	Non-Operational ceased monitoring Apr 2020 Nant Morlais
	SW	4	MA4	306160E 206000N	Non-Operational Nant Cwm Blacs
	SW	5	MA5	306696E 205960N	Operational Site Discharge Point Nat Cwm Blacs
	SW	6	MA6	308015E 205341N	Operational Site Discharge Point Bargod Taf (end of pipe)
	SW	7	MA7	308927E 204580N	Operational Nant Gyrawd
	SW	8	MA8	308945E 204560N	Operational Nant Bargod
	SW	9	MA9	310985E 207855N	Operational Rhymney Culvert
	SW	10	MA10	311760E 206360N	Operational Pontlloftyn Bridge
	GW	11	5808	N/A	Non-Operational ceased monitoring Apr 2009. BH5808A sampling ceased Apr 2018. BH dry 2018-2020 then monitoring ceased
	GW	12	5817	N/A	Non-Operational

Monitoring requirements	Water Type	Monitoring Point (Permit reference)	Monitoring Point Ref.	Co-ordinates	Status
	GW	13	5821	N/A	Non-Operational
	GW	14	5823	N/A	Non-Operational
	GW	15	5824	306396 206062	Operational
	GW	16	SC1	N/A	Non-Operational Replaced by BH5812 in 2012
	GW	17	SC2	N/A	Non-Operational Replaced by BH5808 in 2011
Additional monitoring sites	SW (GW at surface)	Pit Lake	Pit Lake	TBD	Pit Lake water, operational monitoring
	WF1-6	WF1-6	WF1-6	Various	Operational monitoring drainage south of OB3

An updated, single monitoring location map was developed by MEM (MEM, 2025) and is reproduced below.

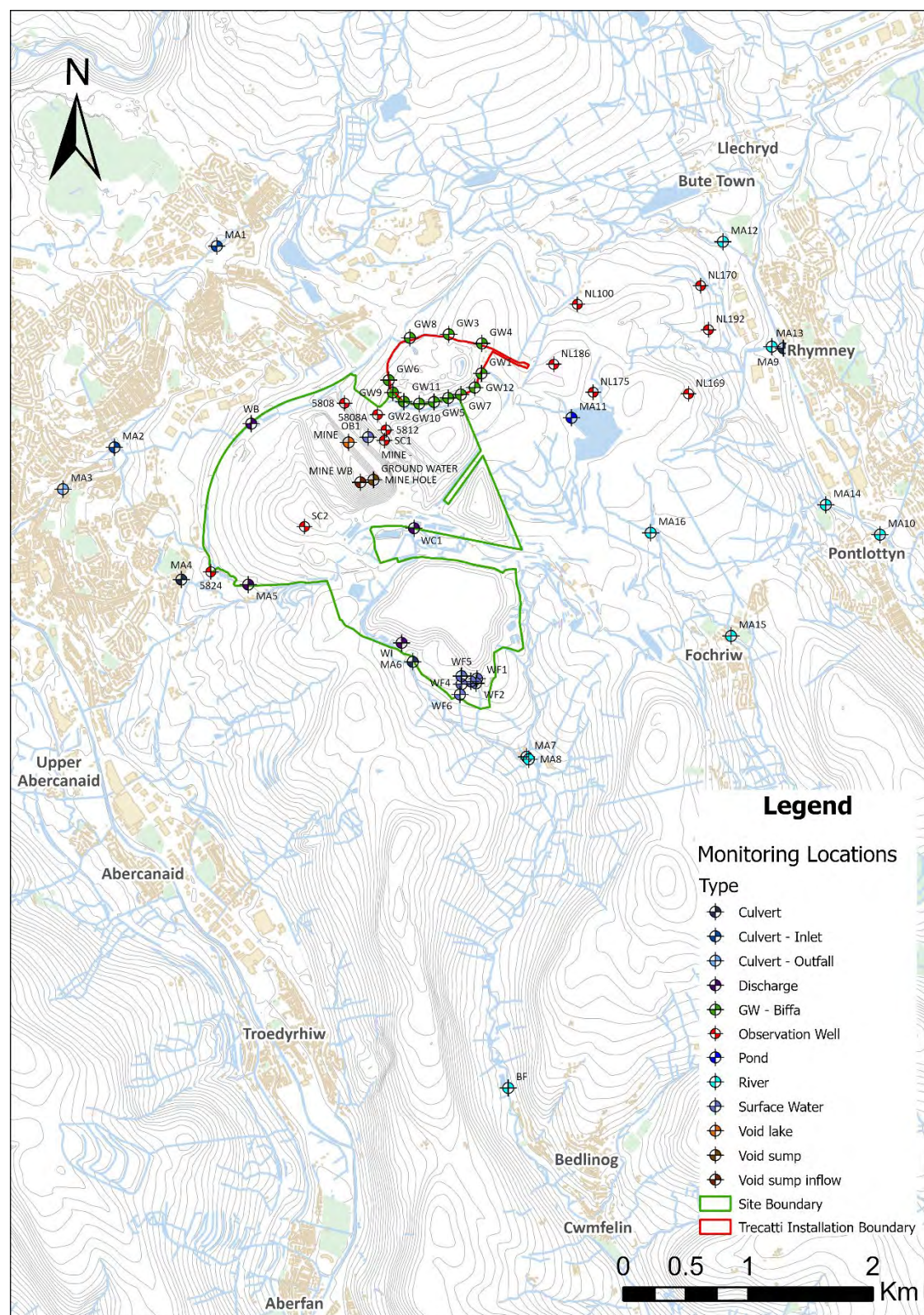


Figure 3 Sampling Point Locations (MEM, 2025)

The two permits identified apply to SW monitoring, and with both listing the same parameters for analysis:

- Suspended solids
- pH
- Iron (Fe)
- Visible oil

The requirements of Condition 44 are greater than the two permit conditions, with 44 parameters listed for analysis which apply to both GW and SW. The 44 parameters listed in Condition 44 includes the parameters detailed in the two permits:

- Primary parameters:
 - o pH, EC, TSS, BOD, COD, TOC
 - o Ca, Mg, K, Na, NH₃, Fe (total)
 - o Alkalinity, SO₄, Cl, NO₂ and NO₃ as N
 - o Total volatile fatty acids (VFA)
- Secondary parameters:
 - o DO
 - o Ba, B, Al, Mn, Cu, Pb, Zn
 - o S, F, P
 - o Total PAHs, Total PCBs, Phenols
- Tertiary parameters:
 - o As, Hg, Se, Mo, Cd, Cr, Ni
 - o VFAs suite, PAHs suite, PCBs suite, OCPs, OPPs

Condition 44 requires that groundwater water quality samples are taken on a quarterly basis, although should trigger levels for parameters be breached sampling frequency increases to monthly. Surface water quality is monitored quarterly, but also required after specific dry periods or storm events for the River Taff, Bargoed Taf, River Rhymney and culvert locations in sample points 1 – 10. The additional monitoring program focuses on the potential risk of the toe seepage from OB3 and characterising and monitoring the water quality in recently formed pit lake.

Post Closure Environmental Water Quality Monitoring

Methodology

This review examines the existing receiving environment SW sampling locations and groups them by river/streams. Each site's data was analysed, by reference to the Ffos-y-Fran Restoration Scheme AMD Risk Assessment (MEM, 2025) using data from the monitoring period 2004-2024. In addition, the Certificate of Analysis from April 2025 sampling was provided.

With reference to water quality criteria values it is important to note that while the Water Framework Directive (WFD) provides some environmental quality standards (EQS) that can be used as a general reference point to assess the quality of surface waters, MEM understands that Condition 44 was developed to account for local water quality objectives. Water quality criteria values presented in

Condition 44 are defined as Pollution Alert Values (PAV). MEM understands that the PAVs were determined using historic data to define an expected baseline range for water quality, and thus determine the suitable trigger values (PAV) to identify when pollution may be occurring in the raw waters around Ffos-y-Fran. The higher values for PAVs for some species developed under Condition 44, compared to some of the WFD EQS values, therefore likely relate to a number of local factors, such as surface waters taking on the characteristics of the local soil and rock in this mineralised region and other anthropocentric activities that have likely impacted the water catchment and water body status (Figure 1).

The WFD has limited number of parameters with EQS as both annual averages (AA) and maximum allowable concentrations (MAC). Those parameters listed in Condition 44 with AA-EQS and MAC-EQS are shown in Table 2. The PAV from Condition 44 for those parameters have also been included for comparison along with current UK drinking water guideline values as a further point of reference (it is noted that arsenic and cadmium PAV are the same as drinking water guideline values). Current PAVs for the site are shown in Table 3.

Table 2 EQS compared against Condition 44 PAVs and DWG

Parameter	Units	Condition 44 PAV	AA-EQS	MAC-EQS	UK drinking water guidelines
pH	pH units	6.5-8.5	6.0-9.0	NIL	NIL
Chloride as Cl	mg/l	250	250	NIL	NIL
Arsenic as As	mg/l	0.01	0.05	NIL	0.01
Boron as B	mg/l	0.3	2	NIL	2.4
Cadmium as Cd	mg/l	0.005	0.00008	0.00045	0.005
Total Chromium as Cr	mg/l	0.03	0.0034	NIL	0.05
Copper as Cu	mg/l	0.2	0.001	NIL	2
Iron as Fe	mg/l	1	1	NIL	NIL
Lead as Pb	mg/l	0.0012	0.014	NIL	0.01
Manganese as Mn	mg/l	0.25	0.123	NIL	0.08
Mercury as Hg	mg/l	0.001	N/A	0.00007	0.006
Nickel as Ni	mg/l	0.1	0.004	0.034	0.07
Total Sulphur as SO ₄	mg/l	400	400	NIL	NIL
Zinc as Zn	mg/l	0.1	0.0109	NIL	NIL
Pentachlorophenol	µg/l	0.5	0.4	1	9

Table 3 Current site pollution alert values (PAVs)

Parameter	Unit	Pollution Alert Value (PAV)
pH	s.u.	6.5 - 8.5
EC	µS/cm	2,000
TSS	mg/L	50
BOD	mg/L	6
DO	mg/L	<5
Ca	mg/L	250
Mg	mg/L	100
K	mg/L	40
Na	mg/L	170
Fe	mg/L	1
As	mg/L	0.01
Hg	mg/L	0.001
Se	mg/L	0.01
Ba	mg/L	0.5
B	mg/L	0.3
Al	mg/L	0.5
Mn	mg/L	0.25
Cu	mg/L	0.2
Pb	mg/L	0.1
Zn	mg/L	0.1
Se	mg/L	0.01
Mo	mg/L	0.05
Cd	mg/L	0.005
Cr	mg/L	0.03
Ni	mg/L	0.1
Alkalinity	mg/L CaCO ₃	
SO ₄	mg/L	400
Cl	mg/L	250
N	mg/L	5
Ammoniacal N	mg/L	0.5
S	mg/L	0.03
F	mg/L	1.5
P	mg/L	0.2
VFA	mg/L	40
PAH (totals)	ug/L	0.2
PCB (totals)	ug/L	1
Phenols (monohydric)	mg/L	0.5
VFAs species	ug/L	5
PAHs species	ug/L	0.2
PCBs species	ug/L	0.01
OCPs species	ug/L	0.01
OPPs species	ug/L	1

In the absence of any other defined and agreed water quality objectives at this time, MEM have used the existing approved PAV issued as part of Condition 44 as the reference site defined criteria values for water quality. This approach provided a qualifiable method by which to assess WQ that is consistent with the current site compliance requirements. Given that the PAVs are being used as a trigger level rather an AA or a MAC, where the average values are below the PAV then water quality objectives could be considered as having been achieved. Where elevated results are above the PAV, professional judgment was used to draw conclusion on which elements at specific locations achieved water quality objectives.

It is noted that because the pit lake is a new and man made water feature, its development post dates the development of PAV values and is not specified in Condition 44. The pit lake is not expected to discharge into (and thus impact) surrounding surface waters, however it is expected to act hydraulically as a flow through lake with groundwater both flowing into the pit lake, and pit lake water flowing out into groundwater on the downgradient side. As such the main receiving water body (i.e. recipient) for water migrating from the pit lake is downgradient groundwater, and the main control over pit lake water quality is the quality of upgradient groundwater flowing into the pit.

As such the pit lake can be considered in these terms as the surface expression of groundwater. Alternative indicators for the water quality of the pit lake could look at grazing or recreational water guidelines internationally (as UK regulation in this area is limited), such as those in Australia. Here for example the recreational water guideline for manganese is 0.5 mg/l, and for grazing 10 mg/l (ANZG, 2023, ANZG, 2008).

But, where the results at a specific monitoring point are below the PAV for that parameter location, then water quality objectives can be considered to have been achieved. As an example, Figure 4 shows the result for pH at MA01. Here the results are within the PAV for the period of the monitoring program, >20 years, so MEM would conclude that the water quality objectives for pH at MA01 are achieved.

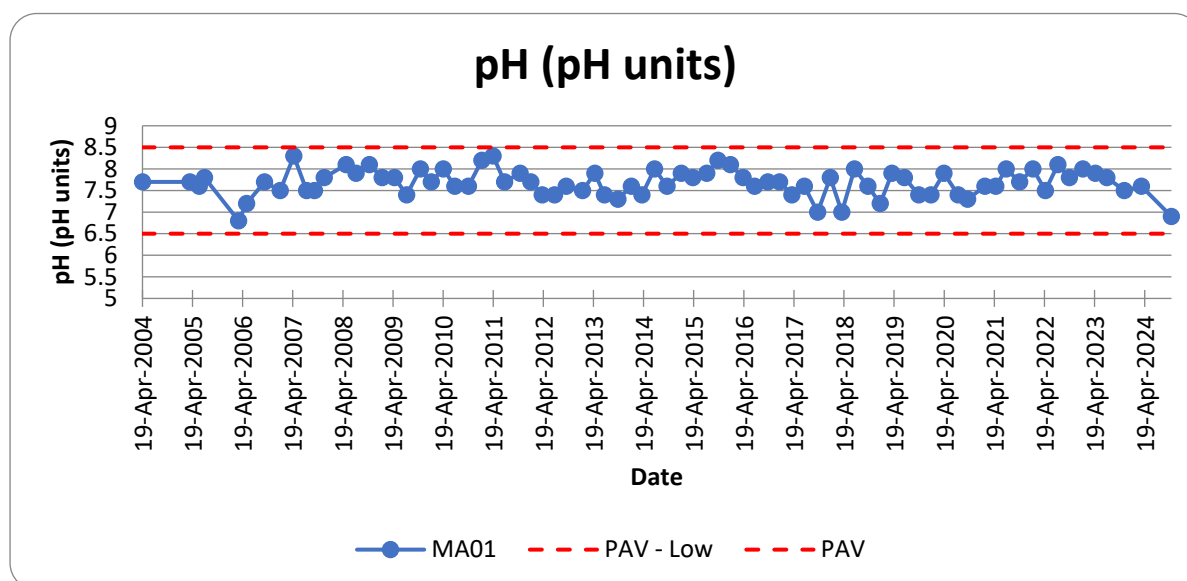


Figure 4 pH at MA01

The data was analysed to identify obvious anomalous values. Where these were identified MEM have discounted the outlier results as not been representative of the water quality and would consider the parameter to have achieved water quality objectives. For example, see Figure 5, the result for sulfate (SO_4) at sampling location MA01.

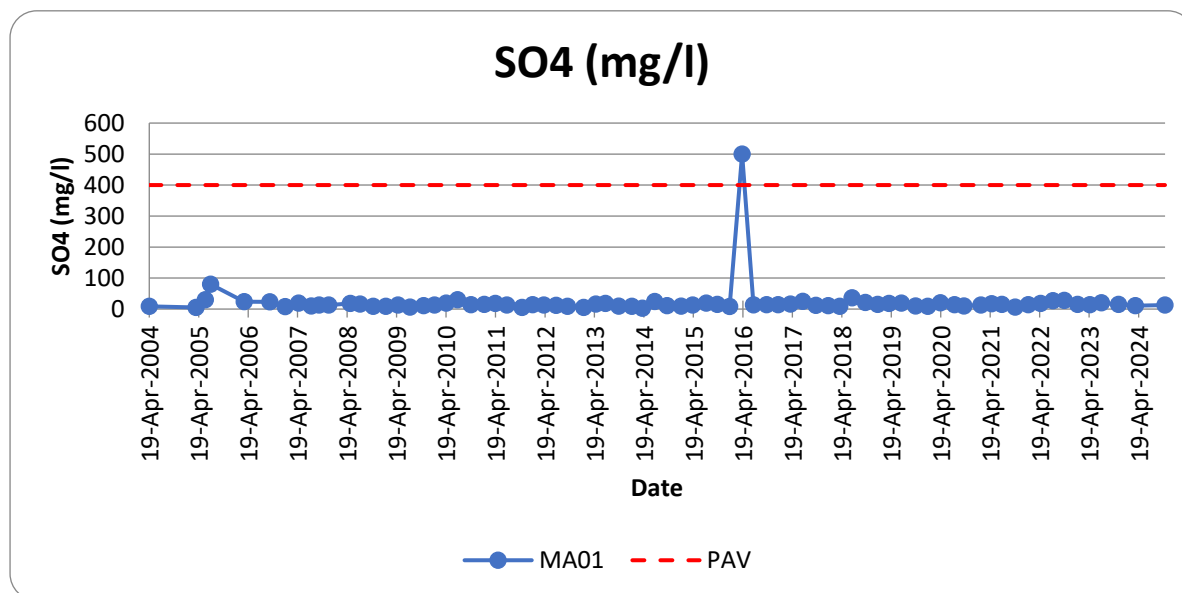


Figure 5 Sulfate at MA01

In addition, where historic results have been elevated, but since 2018, they have been with PAV limits, then MEM would consider that water quality objectives achieved. For example, the result for Fe (iron) at MA01, see Figure 6. Here the averages were also calculated to ensure that the values remained below the PAV.

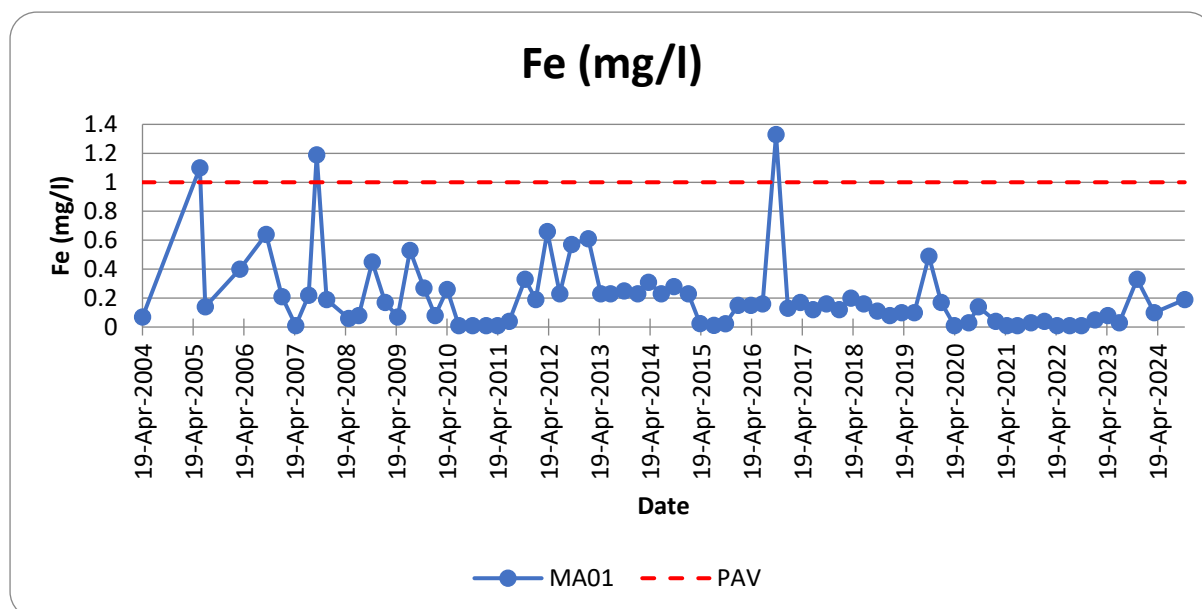


Figure 6 Iron at MA01

Where results were elevated above the PAV since 2018, then the data was analysed. Several PAV was at or close to the laboratory's limit of detection (LOD), which can cause issues with the accuracy of the results and distort the results. This was potentially compounded by the site adopting a conservative

approach in the data reporting, in that all LOD result (reported as less than) were reported as that value, thereby distorting the values upwards. MEM took the approach that this method of reporting introduces a high degree of conservatism into the analysis.

Discussion

Change from operational to restoration activities

The site was operational during the period of the monitoring program reviewed, from June 2007 to November 2023. During this period operations changes in land use resulting in changes to accessing some monitoring site being removed, i.e covered or excavated, due to operational requirements. In particular some boreholes listed in Condition 44 were within the footprint of the expanding mine overburden heaps (OB1, 2 and 3).

The potential sources of pollution for water quality have also changed following the move from operational to restoration activities. During operations large plant, ancilliary vehicles and explosives were used on site. During restoration the use of large plant and vehicles will reduce significantly, and explosives use has ceased. As such, certain parameters which were typically monitoring the risk from fuel use on site, i.e. certain organic suites, may no longer be pertinent to monitor given the change of activities on site.

Data gaps

With the exception of OCP and OPP suites minimal data gap were identified. MEM did identify the that the LOD for some parameters had changes over time, particularly for the organic suites. Where this was an issue in determining if water quality objectives are achieved then this was commented on against the relevant parameter and location.

No results for OCPs and OPPs were found by MEM to analyse. It was assumed by MEM that these parameters were not of concern (pesticides are not currently used on site) and so were removed from monitoring suites. When soils are replaced during restoration, the soils are cultivated and seeded and have one application of Triple 16 fertiliser at a rate of 500 kg/ha.

Review of current program

MA09 and MA10

For the two sites, MA09 and MA10, located on the Rhymney River, 39 of 41 parameters (OCPs and OPPs not included) listed in Condition 44 were tested and analysed. It is noted that as these monitoring points are on the main river other land uses in the area will also contribute to the water quality at these points. Given analysis of dissolved oxygen (DO) was conducted at the laboratory the values were not included for analysis. Of those parameters, Ca, Cd, Cl, Cu, Cr, Hg, Pb, Mg, Na, Se, Zn, Sulfate, EC, Arsenic, pH, B, Ba, VFA and PAH species since monitoring commenced in 2004 had not been outside the PAV levels.

Thus, 19 parameters were in limits (PAV) at all sites, plus four anomalous out of limits, nine elevated results above PAV, but none in last five years. Five parameters elevated above PAV at one or more of the three monitoring locations:

- Iron (Fe)
- Potassium (K)
- Manganese (Mn)
- Nitrogen (N)
- PCB Species

Iron

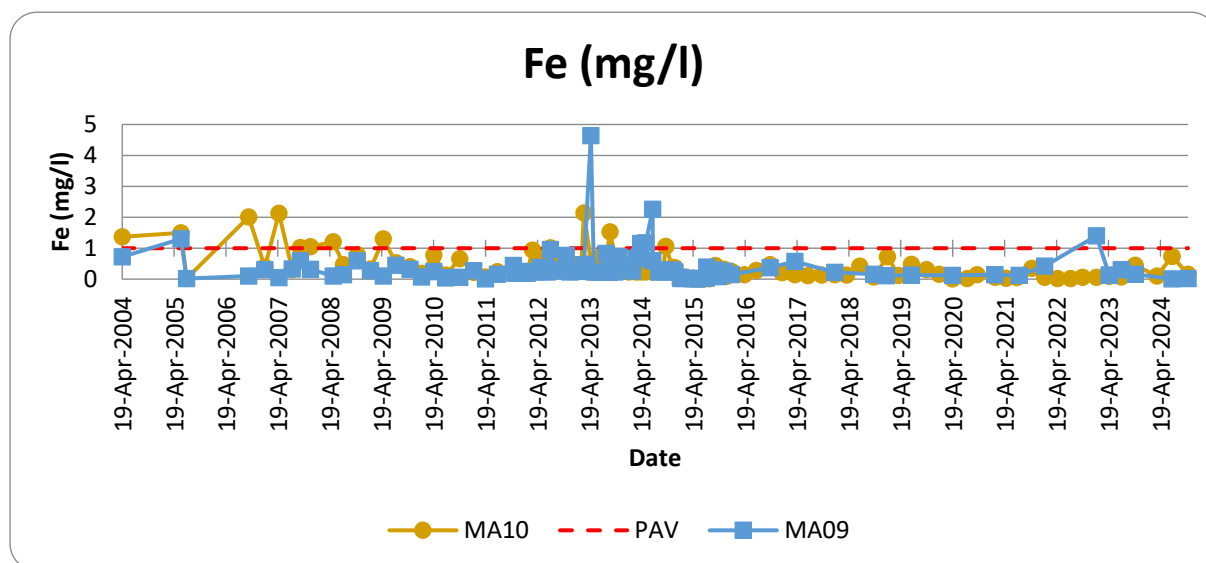


Figure 7 Iron at MA01 and MA10

Given the single elevated result at both locations since 2014, see Figure 7, and the improved average concentrations, borne out by recent results, the river could be considered as achieving water quality objectives for iron.

Potassium

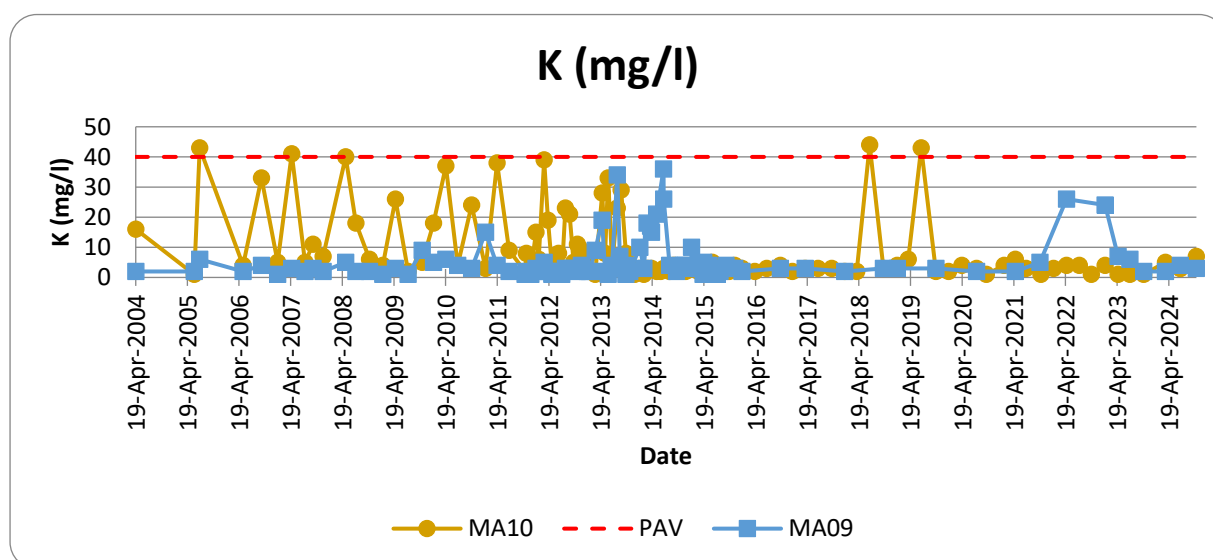


Figure 8 Potassium at MA09 and MA10

The only elevated results were at MA10, see Figure 8. At MA09 the improving, and within limits, average over the period of the monitoring program, the river could be considered as achieving water quality objectives for potassium.

Manganese

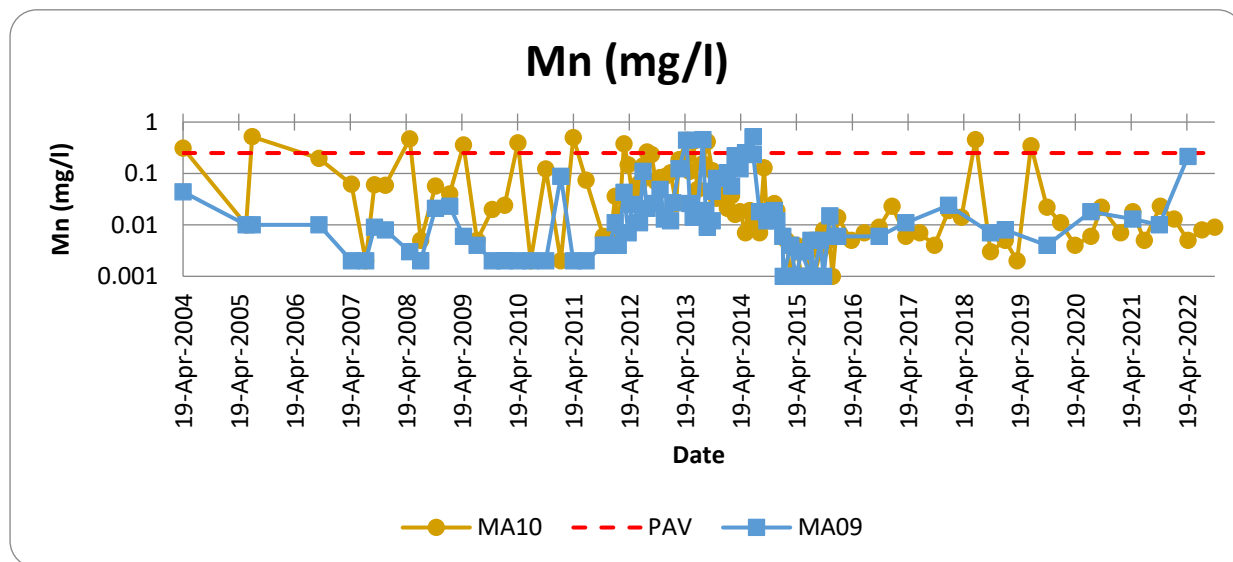


Figure 9 Manganese at MA09 and MA10

Given the improved water quality for manganese over the monitoring period, particularly over the last six years of monitoring (2017-2022), see Figure 9, the results could be considered as achieving water quality objectives for manganese.

Nitrogen

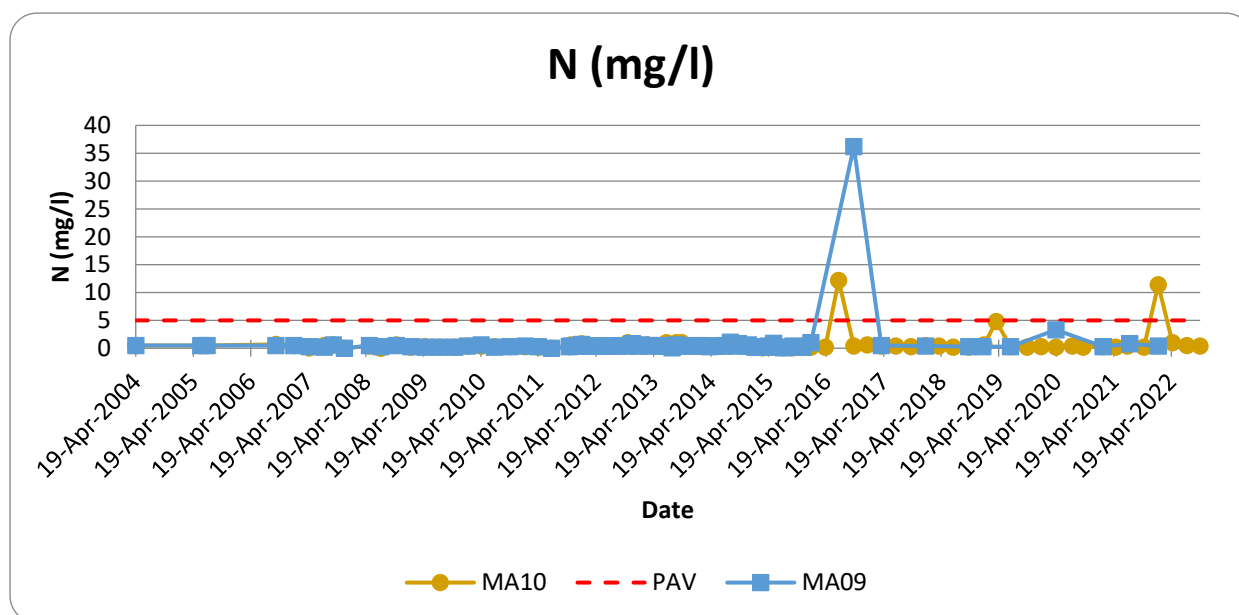


Figure 10 Nitrogen at MA09 and MA10

With limited elevated events over the monitoring period and the average over the period of the monitoring program combined with and positive results since operations have ceased, see Figure 10, the river could be considered as achieving water quality objectives for Nitrogen.

PCB Suite

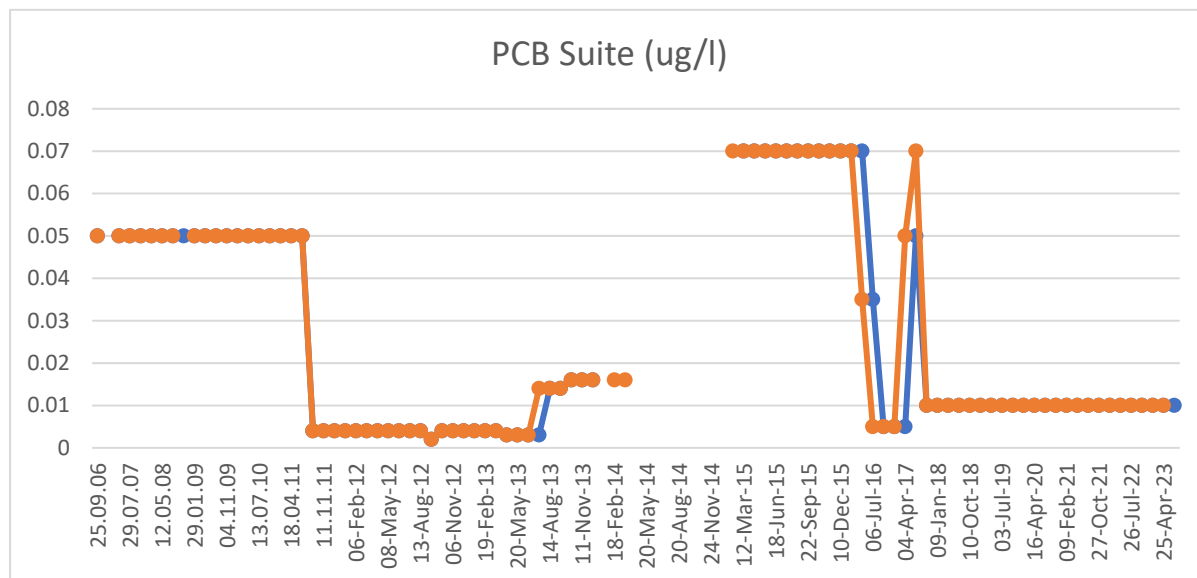


Figure 11 PCB Suite at MA09 and MA10

Since 2017 all results returned values at LOD, see Figure 11, which is the same as the PAV, 0.01ug/l. The elevated results prior to 2017 are likely to be a combination of changes in LOD and inconsistency in methods of calculating the values from combining the results from the individual species. The methodology seems to be overly conservative resulting in values that are greater than the PAV, when in reality this may not be the case. MEM would propose that sample that returns at below the LOD is compliant. Following removal of any equipment on site after operations ceased (i.e. electrical equipment) it is likely there will be no PCBs remaining on site in the future. As such, monitoring of PCBs in the future is unlikely to be required as the source risk will be removed.

Conclusion

Examination of the water quality data, with particular focus on relatively recent results indicates that the monitoring dataset could generally be considered to meet water quality objectives (i.e. below PAVs). Also the dataset, and reduced operational activity on site, potentially supports reducing the organic suites monitored at these locations (such as VFA, PCBs and PAHs).

MA06, MA07 and MA08

For the three sites, MA06, MA07 and MA08, located on the Bargoed Taff, 39 of 41 parameters (OCPs and OPPs not included) listed in Condition 44 were analysed. Given analysis of dissolved oxygen (DO) was conducted at the laboratory the values were not included in this review. Of those parameters, Ca, Cd, Cl, Cu, Cr, Pb, N, Na, electrical conductivity, As, VFA and other organic species had not been outside the PAV levels since monitoring commenced in 2004. Also, the additional parameter, TOC, was

also analysed. These monitoring points are downstream of seepage from the toe of OB3, and thus are important indicator sites for the success of the restoration phase.

Thus, 12 parameters were within limits at all sites, plus six anomalous out of limits, three elevated results above PAV, but none in last five years and 16 parameters elevated above PAV at one or more of the three monitoring locations.

- Ammonia
- Iron (Fe)
- Potassium (K)
- Magnesium (Mg)
- Manganese (Mn)
- Nickle (Ni)
- Selenium (Se)
- Sulfur (S)
- Zinc (Zn)
- Suspended solids (SS/TSS)
- Sulfate
- Biological Oxygen Demand (BOD)
- Secondary organics
- PCB Suite

Ammonia

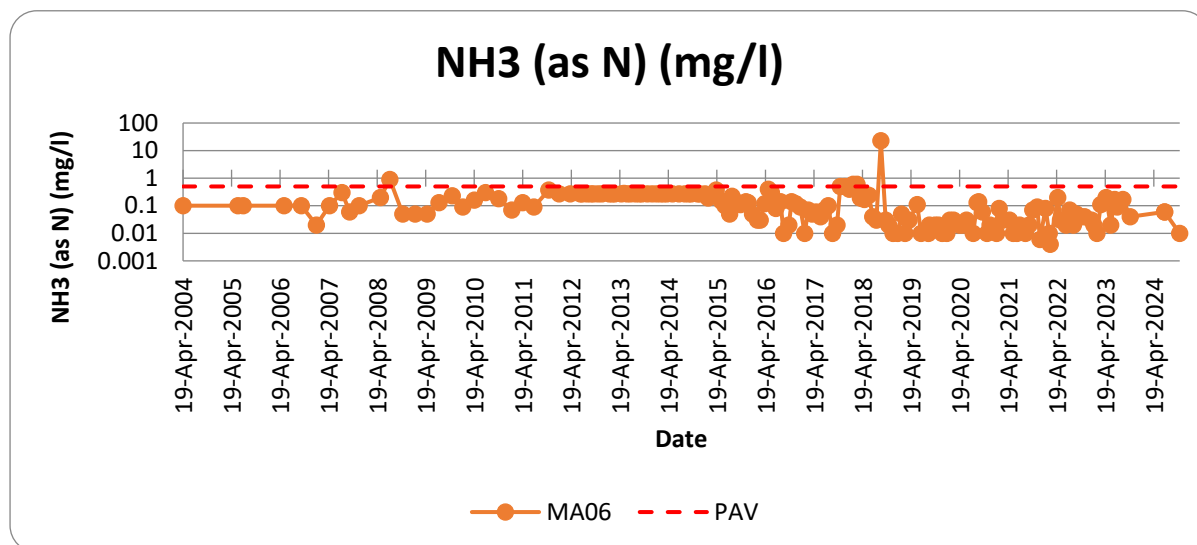


Figure 12 Ammonia at MA06

With two elevated results above PAV, the most recent being in September 2018 at 23mg/l against a PAV of 0.5mg/l, see Figure 12, and lower than PAV averages it can be concluded that water quality objectives for ammonia as nitrogen at MA06 are being achieved.

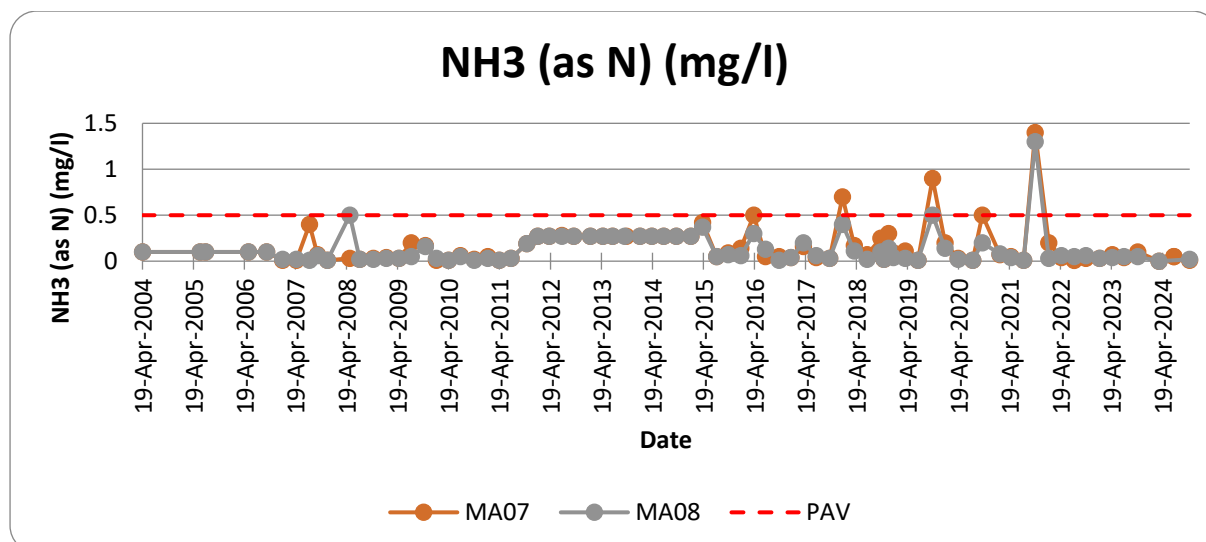


Figure 13 Ammonia at MA07 and MA08

With low averages and a single spike at MA07 and MA08 since 2018, see Figure 13, it can be considered that the water quality objectives for Ammonia as nitrogen are currently being achieved.

Iron

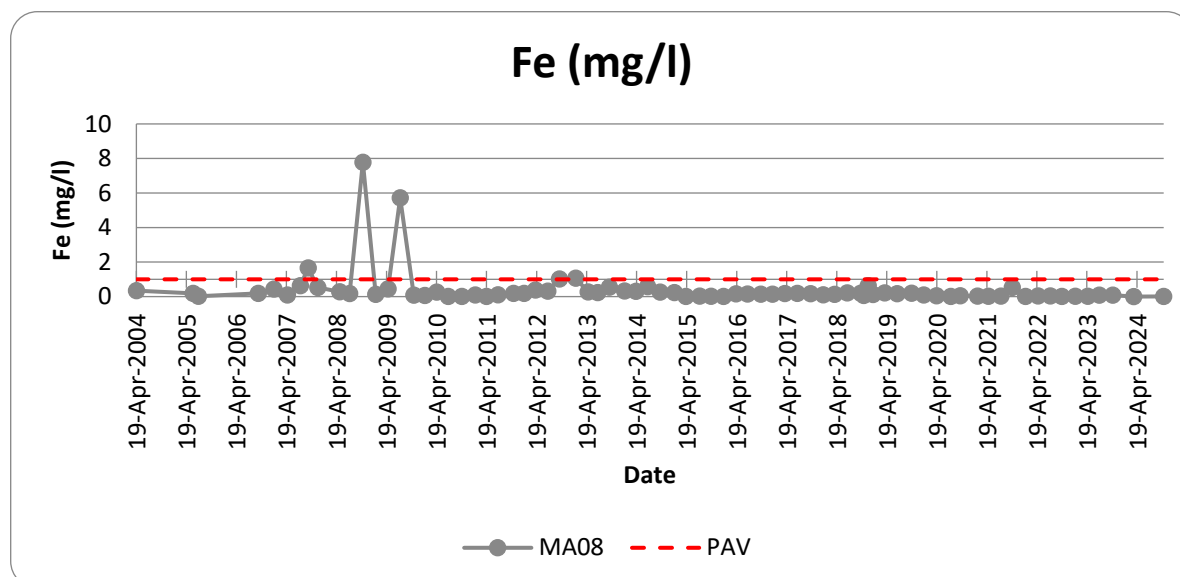


Figure 14 Iron at MA08

Given the ten years at MA08 since any result was elevated above the PAV and consistent average concentrations of 0.11mg/L (Figure 14). The monitoring dataset suggests the water at this point is currently achieving water quality objectives for iron at MA08. The more inconstant nature of the results at both MA06 and MA07 required more discussion:

MA07

- Ten elevated results above PAV July 2024 at 1.03mg/l against a PAV of 1mg/l.
- For the 6 year 2004-2024 the average result is 0.67mg/l which had increased to 0.82mg/l for the period 2018-2024
- Most recent, 2025 samples returned a result of 0.01mg/l

MA06

- Five elevated results above PAV with the most recent in July 2024 at 1.07mg/l against a PAV of 1mg/l.
- Both the six year and 2004-2024 average results were 0.11mg/l
- In addition, the most recent, 2025 samples returned a result of 0.01mg/l

Iron concentrations are one of the indicators of the impact of seepage from the base of OB3. The measures described in the AMD assessment (MEM, 2025) for management of seepage from the base of OB3 will need to be implemented during the restoration phase. As such, iron will be required to be monitored in this watercourse for a short period of time (~5 years) to ensure the measures in place are mitigating any potential impacts.

Potassium

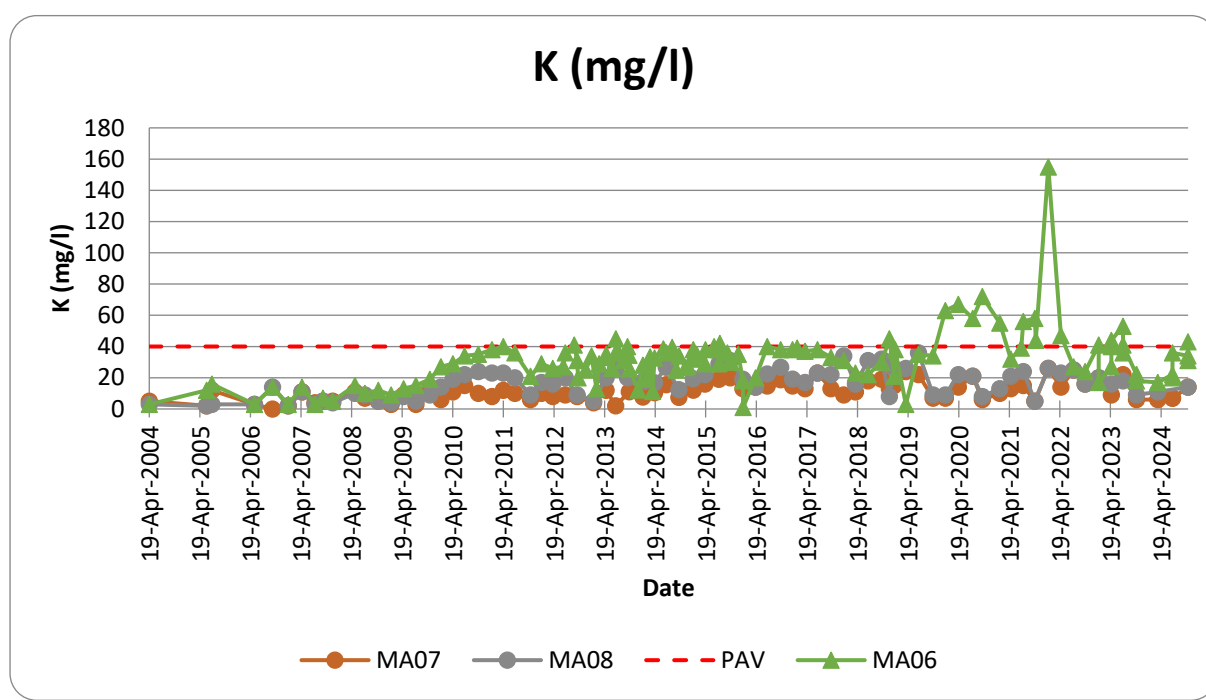


Figure 15 Potassium at MA06, MA07 and MA08

For locations MA07 and MA08 it can be concluded that the water quality objectives for Potassium are acceptable (Figure 15). However, at MA06 though the averages are under the PAV, the frequency of sample results being elevated above the PAV it can not be concluded, on the data alone, that the water quality objectives are being achieved. Again, as these are the locations downgradient of seepage from OB3 the mitigation measures described in the AMD assessment (MEM, 2025) should be implemented and then monitored to continue to manage any potential risks.

Magnesium

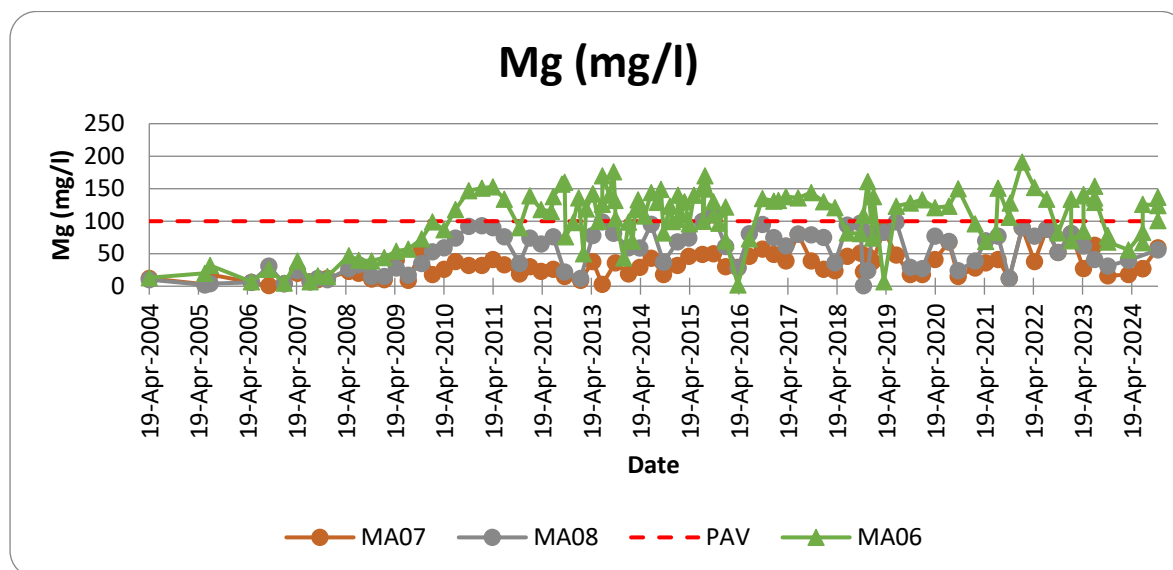


Figure 16 Magnesium at MA06, MA07 and MA08

For locations MA07 and MA08 it can be concluded that the ESQ for magnesium has been reached. However, at MA06 the averages are above the PAV and thus it can not be concluded on the data alone, see Figure 16, that the water quality objectives for magnesium has been reached. Again, as these are the locations downgradient of seepage from OB3 the mitigation measures described in the AMD assessment (MEM, 2025) should be implemented and then monitored to continue to manage any potential risks.

Manganese

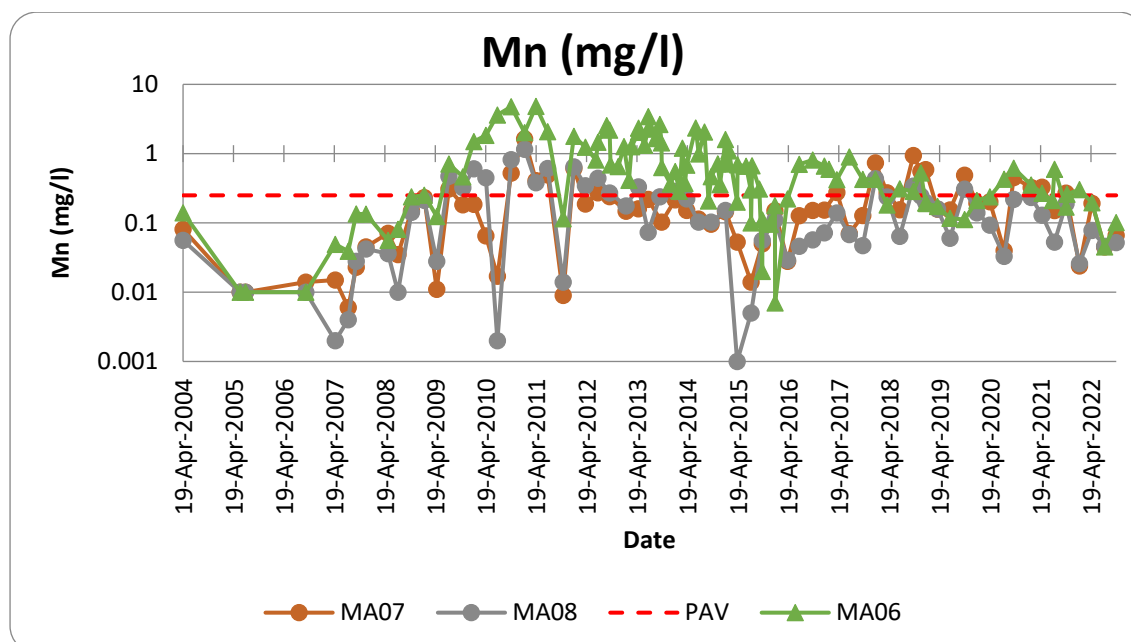


Figure 17 Manganese at MA06, MA07 and MA08

For locations MA06, MA07 and MA08 an elevated Mn concentration is seen (averages greater than the PAV) and thus it can be concluded that the water quality objectives for Manganese are not being reached. Again, as these are the locations downgradient of seepage from OB3 the mitigation measures described in the AMD assessment (MEM, 2025) should be implemented and then monitored to continue to manage any potential risks. Mn is one of the indicator parameters for seepage at these locations.

Nickel

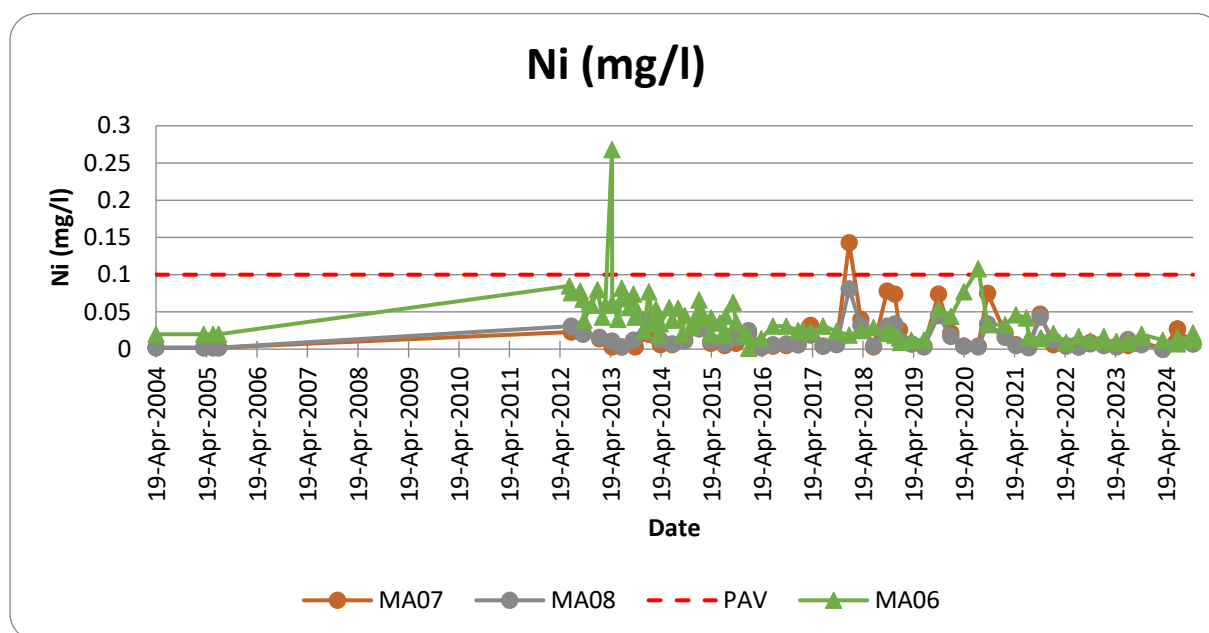


Figure 18 Nickel at MA06, MA07 and MA08

With low averages and a single spikes at MA06 and MA07 since 2004, no elevated results at MA08, see Figure 18, it can be considered that the water quality objectives for Nickel are being achieved.

Selenium

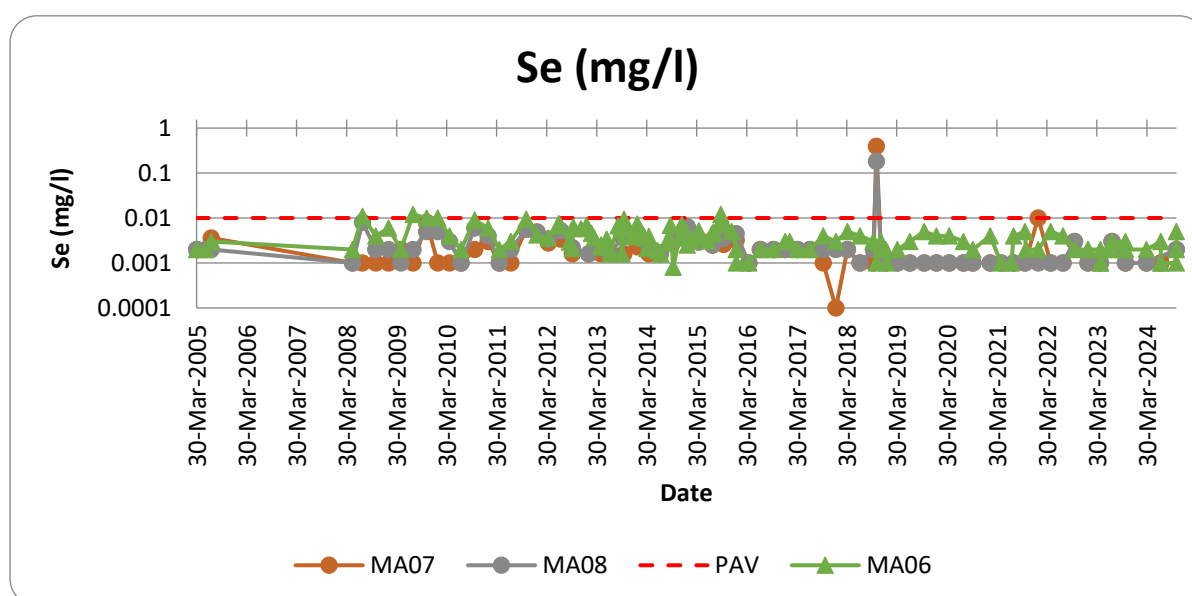


Figure 19 Selenium at MA06, MA07 and MA08

Low averages at MA07 and MA08 were calculated and only four elevated values above the PAV were noted, all before 2019, see Figure 19. At MA08 the averages were distorted by a possible single elevated anomaly (0.393mg/l). The possible anomaly was late 2018 and no results above PAV have been returned since. With low averages selenium is considered to be within water quality objectives for these locations.

Zinc

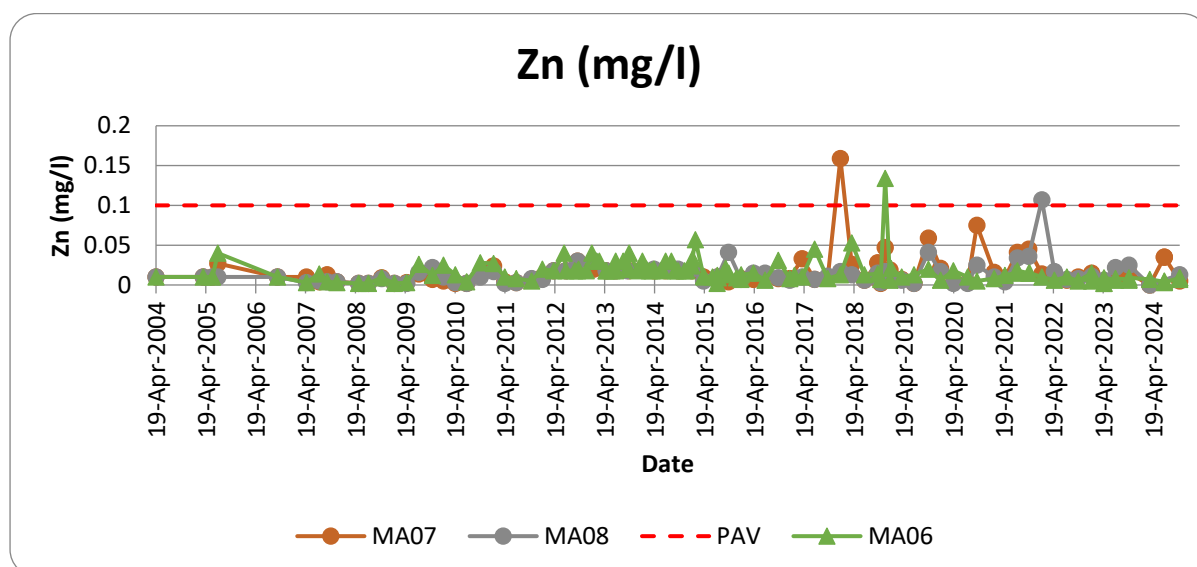


Figure 20 Zinc and MA06, MA07 and MA08

Given the elevated results were limited and the averaged results are below PAV, see Figure 20, and is borne out by recent results, the monitoring dataset suggests the water quality objectives are being met for zinc.

Suspended solids

Low, within limits, averages were calculated for all three sites. In addition, the last elevated value above the PAV, at all three sites was in 2018. Thus, it can be concluded that the water quality objectives are being achieved for MA06, MA07 and MA08 for suspended solids.

Sulfate

With the exception of MA06 the average concentrations are below the PAV, see Figure 21. With the frequency of elevated results within the last five years at all three sites, it is concluded that the water quality objectives for sulfate is not being achieved. Again, as these are the locations downgradient of seepage from OB3 the mitigation measures described in the AMD assessment (MEM, 2025) should be implemented and then monitored to continue to manage any potential risks. Sulfate is one of the indicator parameters for seepage at these locations.

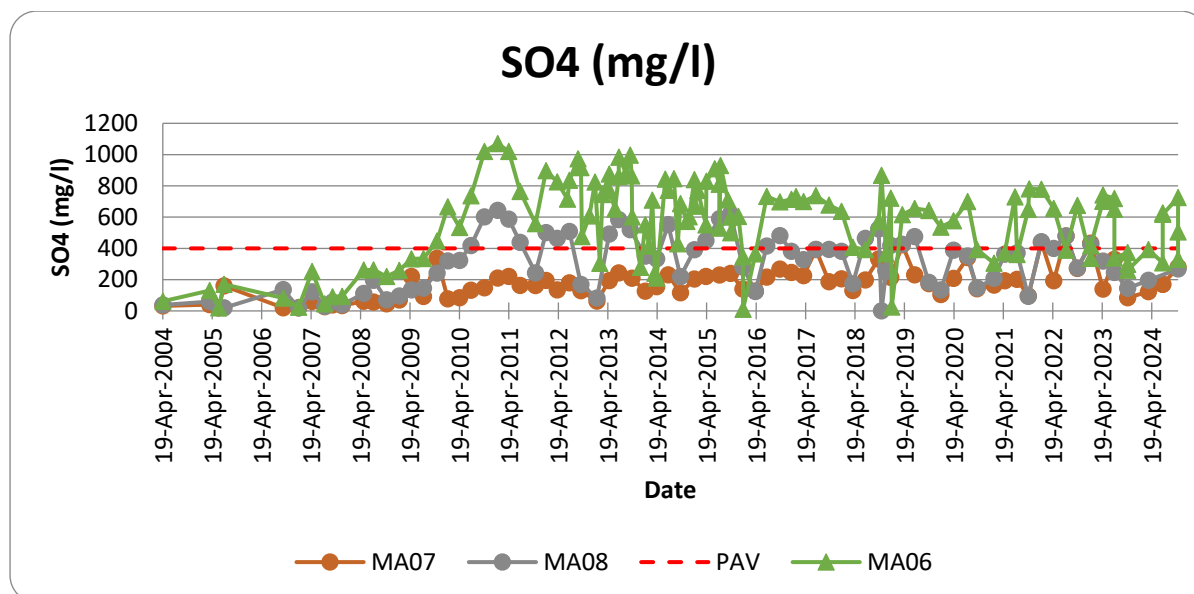


Figure 21 Sulfate at MA06, MA07 and MA08

Biological Oxygen Demand (BOD)

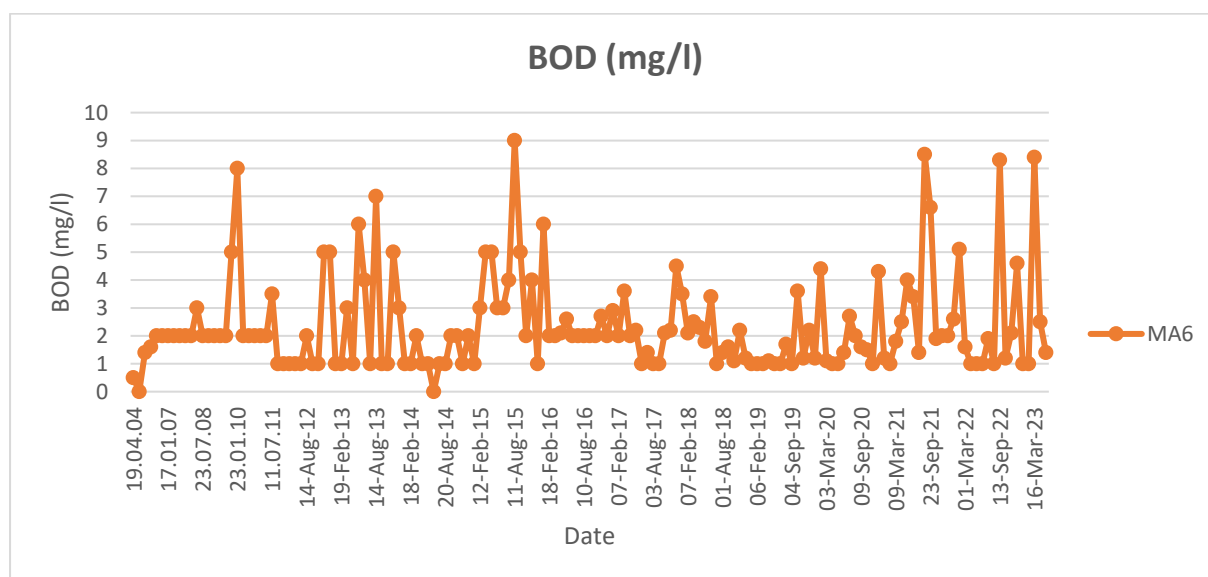


Figure 22 BOD at MA06

MA06 averages have been below the PAV (6mg/l) average, but frequent recent elevations above PAV mean that it can not be concluded that water quality objectives are being achieved, see Figure 22. The most recent BOD result is recorded as less than detection limit (<0.1 mg/l). However, at both MA07 and MA08, since 2004 all result have been below the PAV, thus it can be considered that the water quality objectives for BOD is being achieved at these locations. The seepage mitigation actions (MEM, 2025) may help to mitigate BOD at MA06 and this parameter should continue to be monitored here.

Secondary Organics (PCB, Phenol, PAH)

PCB Suite

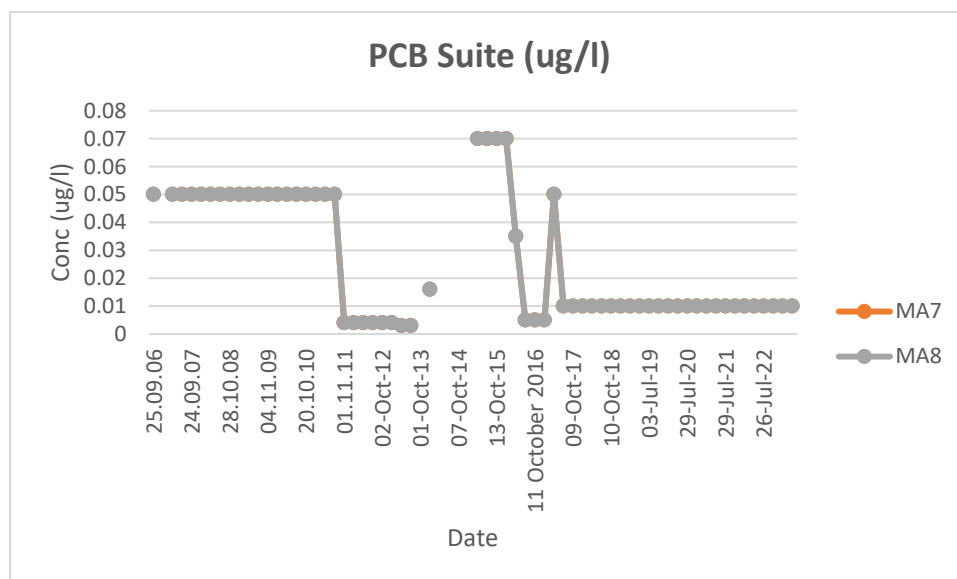


Figure 23 PCB Suites at MA07 and MA08

The results from the two locations, MA07 and MA08 are identical to each other, see Figure 23. This appears to reflect the LOD of each analysis, and variations to the usual LOD by the laboratory so suggests no PCB detected at these locations. The elevated results prior to 2017 are likely to be a combination of changes in LOD and inconsistency in methods of calculating the values from combining the results from the individual species. The methodology seems to be overly conservative resulting in values that are greater than the PAV, when in reality this may not be the case. MEM would consider that samples that returns at below the LOD are complaint. The most recent 2025 result returned <0.01ug/l for all species. All phenol and PCB results at MA06, MA07 and MA08 were below PAV for the period 2004-2023.

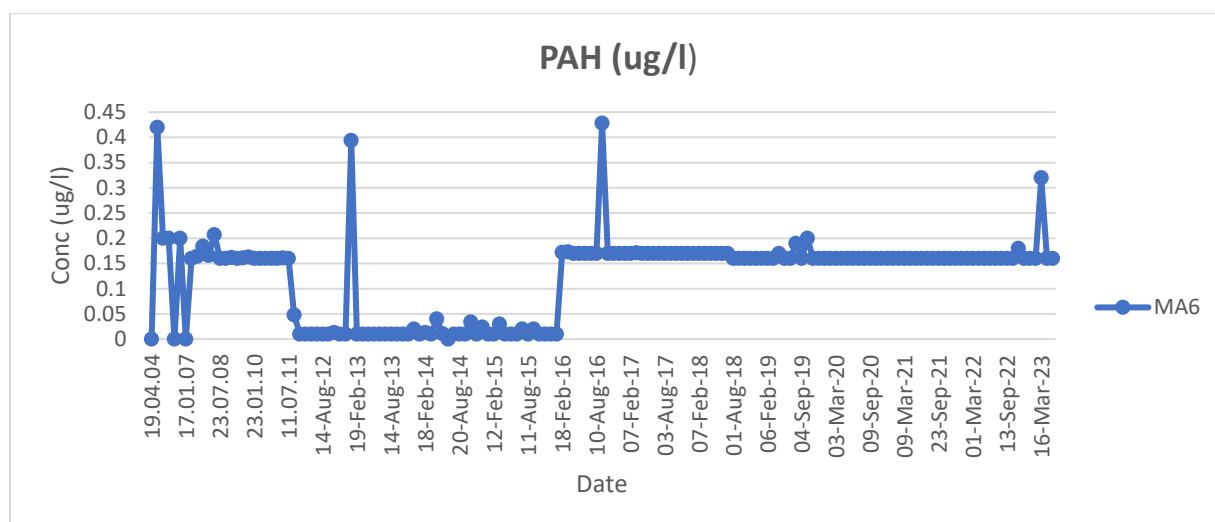


Figure 24 PAH at MA06

PAH results at MA06 (Figure 24):

- Four elevated results above PAH, none since 2018
- The six year average is 0.17ug/l compared to the PAV of 0.2ug/l, which is understood to be due to an increase in the laboratory LOD
- Recent 2025 results returned <0.16ug/l

PAH results at MA07:

- Two elevated results above PAV since 2007, most recent was January 2013.
- The 2004-2023 average is 0.15ug/l, with six year average of 0.17ug/l
- Most recent 2025 results returned <0.16ug/l

Since 2013 all result at MA08 have been below PAV, except for the result of 0.21ug/l in October 2019. In summary, it can be concluded that the water quality objectives for phenols, PAHs and PCBs are being achieved. As the likely sources of these pollutants will not be present during the restoration and closure phase the monitoring of these parameters could be reduced.

Bargoed Taf Ecological Assessment

An ecological assessment of the Bargoed Taf was conducted in two phases in 2014 and 2015 (MEM, 2025). The purpose of the assessment was to assess the water quality and any impact of discharges from the Ffos-y-Fran Land Reclamation Scheme on the watercourse, see the sampling locations at Figure 25.

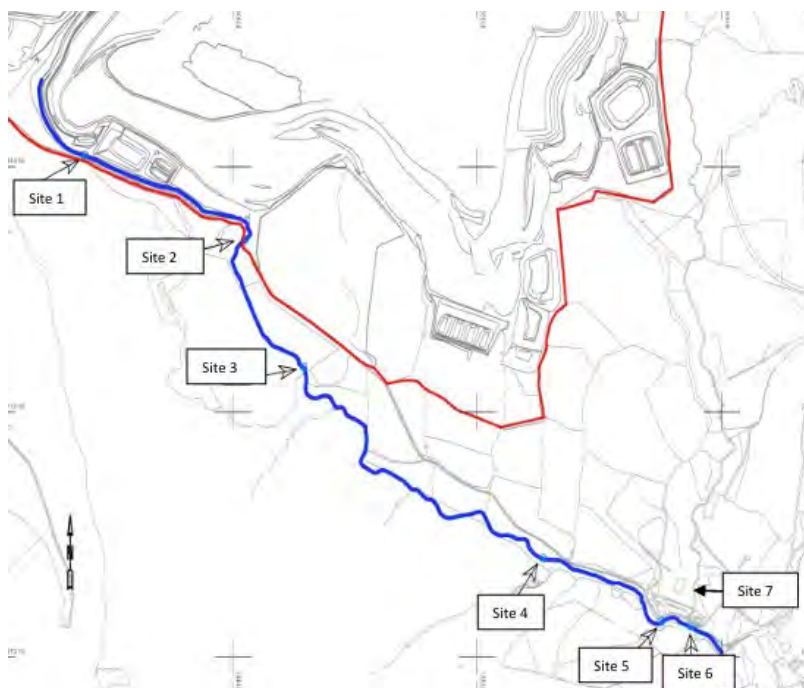


Figure 25 Ecological assessment sample locations

Over the two sampling periods only one site did not show an improvement, but all sites achieved a classification of Good, and site 4 achieving Very Good. The report concluded that, the results were all comparable and consistent with each other and suggest that although there may be elevated levels of certain elements in the discharge waters, these having minor impact and the watercourse continues to recover from past impacts.

Conclusion

At each of the three locations on the Bargoed Taf at least one parameter is elevated above water quality objectives. At MA08, the most downstream site this was for sulfate only. At MA07 the elevated parameters were sulfate and manganese.

The most upstream site, MA06 had five parameters where it could not be concluded that the water quality objectives had been achieved; potassium, magnesium; manganese; sulfate; and BOD.

Given these results and it is recommended that monitoring of along this stretch of the receiving environment (Bargoed Taf) is continued at least into the short term. In particular, the continued monitoring supports the establishment of seepage mitigation measures from OB3 for indicator parameters such as iron, manganese and sulfate. However, some parameters, such as the organic suites, could be considered for removal from the program in their current form as the source risk has been reduced or removed following restoration, and the results of these parameters are mostly at the laboratory LODs.

MA01

For the site, MA01, located on the Nant Morlais to the north and upgradient of many of the discharges from site, 39 of 41 parameters (OCPs and OPPs not included) listed in Condition 44 were tested. Given analysis of dissolved oxygen (DO) was conducted at the laboratory the values were not included for discussion. Of those parameters, P, Ca, Cd, Cl, Cu, Cr, Hg, K, Pb, Mg, Mo, N, Na, Ni, Se, Zn, pH, EC, As, F, VFA and PAH Species since monitoring commenced in 2004 had not been outside the PAV levels. The additional parameter, TOC, was also analysed.

Thus, 23 within limits at all sites, plus six anomalous out of limits, five elevated results above PAV, but none in last five years and two parameters elevated above PAV:

- Ammonia
- Sulfur

Ammonia

Given three elevated results, all before 2021 and the improved average concentrations, see Figure 26. This low average is also supported by recent results, thus the river at this location appears to be achieving water quality objectives.

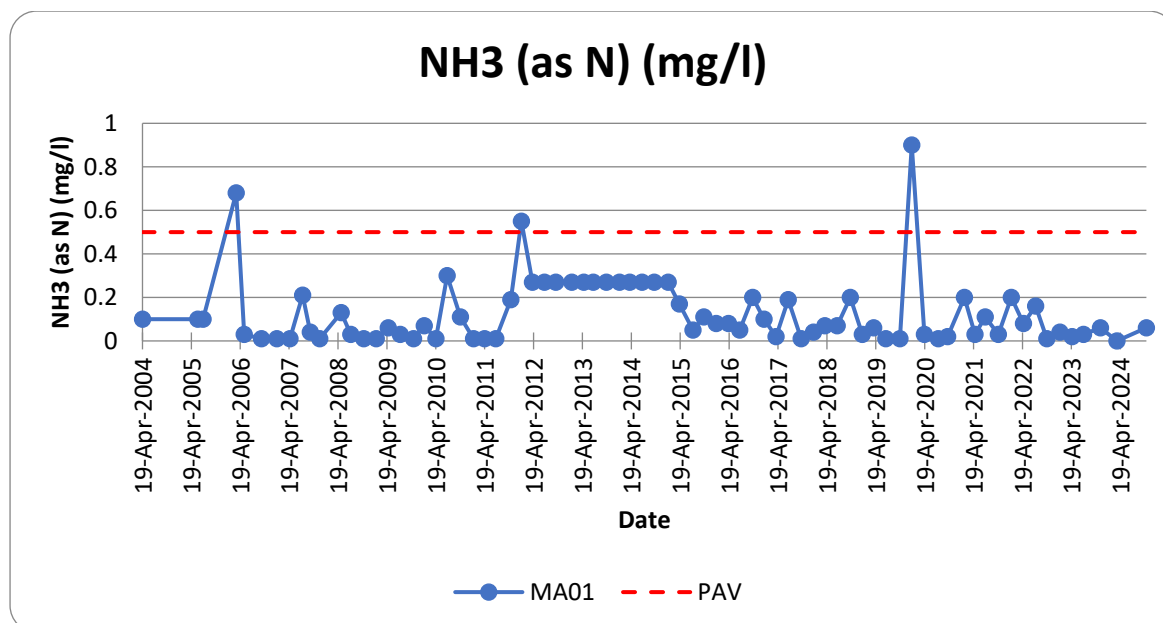


Figure 26 Ammonia at MA01

Sulfur

Given the two elevated result above PAV (0.03 mg/l) since 2020 and the concentration average over the last six years, see Figure 27, it should be considered that water quality objectives are being achieved for sulfur, particularly as sulfate has not been found to be above the PAVs in the monitoring dataset at this location.

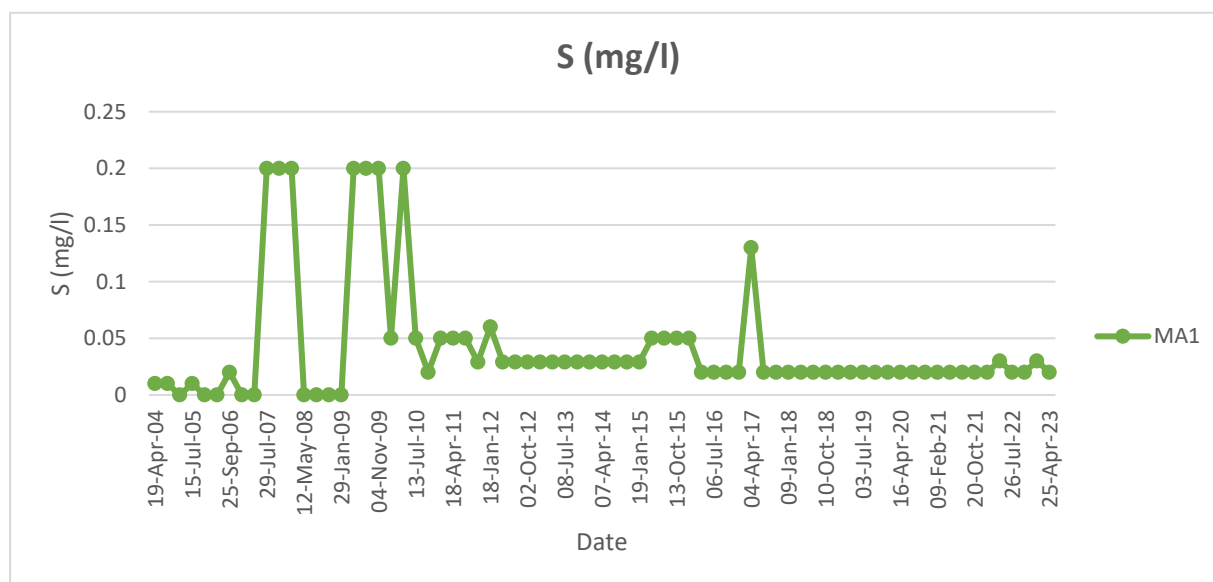


Figure 27 Sulfur at MA01

Conclusion

Examination of the data, with particular focus on relatively recent results indicates that the water quality objectives could be considered as being met. In particular, during the period of site operations the 2018 to 2023/2024 average concentrations, overall show the PAVs have been achieved.

Analysis as part of the AMD assessment (MEM, 2025) suggests that this location is mostly upgradient of any potential discharge locations. As such, monitoring at this location could be reduced given the relative stability of most parameters, and that other land uses in the area are likely impacting water quality.

MA05

For the site, MA05, located on the Nant Cwm Blacs, 39 of 41 parameters (OCPs and OPPs not included) listed in Condition 44 were tested. MA05 is downgradient of the open pit void waterbody in terms of groundwater flow. Given analysis of dissolved oxygen (DO) was conducted at the laboratory the values were not included for analysis. Of those parameters, ammonia, F, Ca, Cd, Cl, Cu, Cr, Hg, Pb, Na, Ni, Zn, EC, As, VFA and VFA species, secondary organics, PHA Species and PCB Species since monitoring commenced in 2004 had not been outside the PAV levels.

Thus, 21 In limits at all sites, plus seven anomalous out of limits, seven elevated results above PAV, but none in last five years and two parameters elevated above PAV:

- Potassium (K)
- Sulfur (S)

Potassium

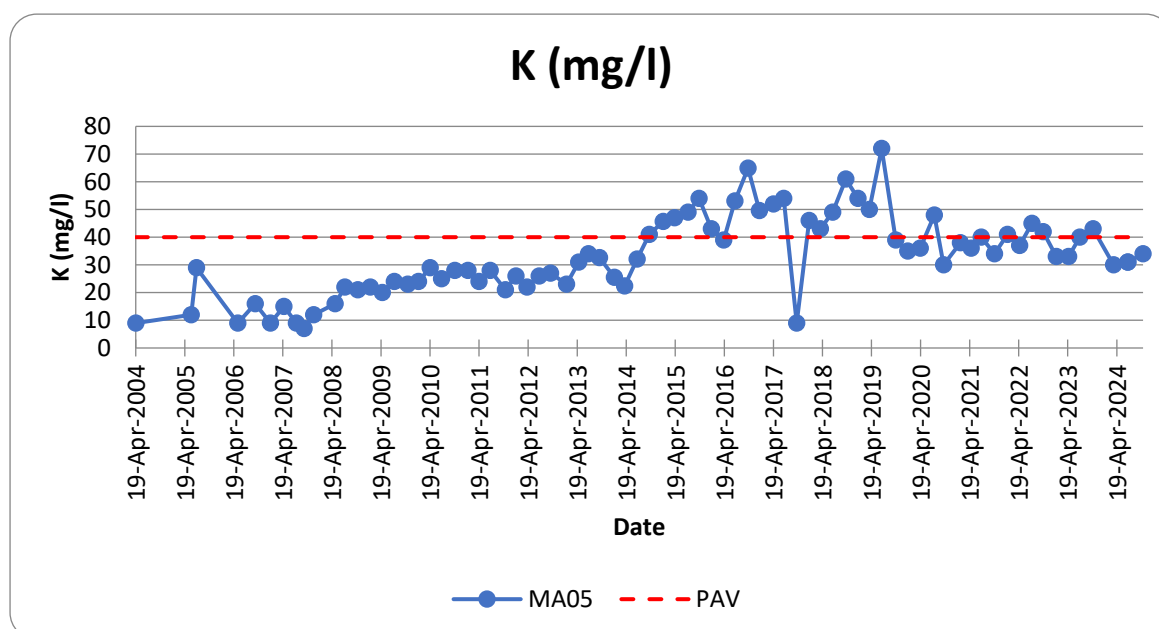


Figure 28 Potassium at MA05

The average of the periods 2014-2018 is greater than the overall average, and above the PAV. Following 2018 the average remained relatively high and occasionally above PAVs, see Figure 28. As

such it could not be concluded on the data alone that the water quality objectives for Potassium has been reached.

Sulfur

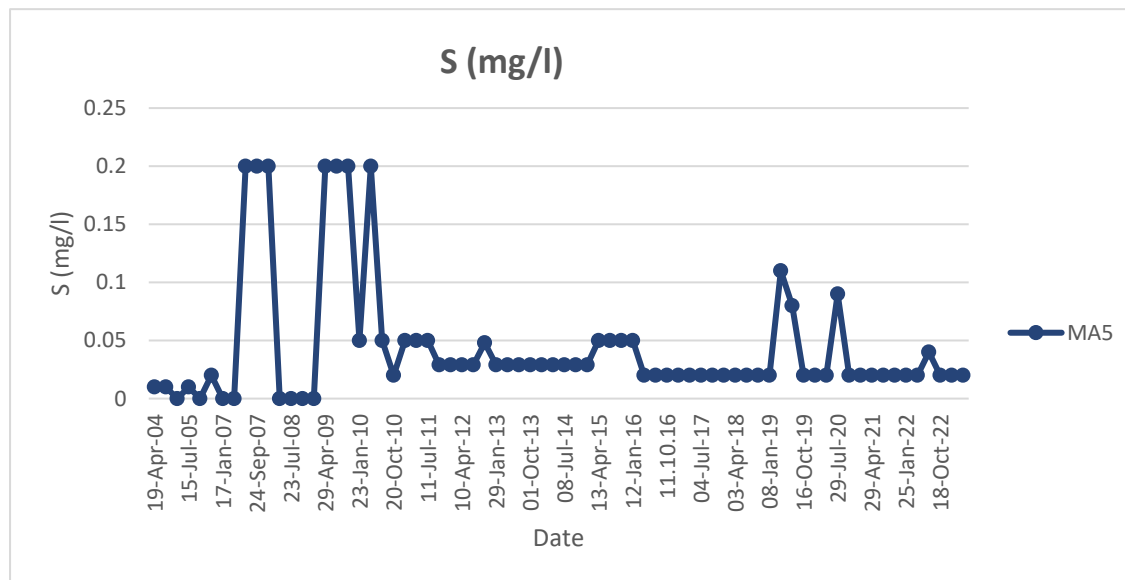


Figure 29 Sulfur at MA05

MEM believe that an input error may have occurred in the data entry from 2004 to 2010, where values of >0.2mg/l have been entered; it is likely that this should have read <0.02mg/l. Since 2010 four results, the most recent in July 2022, has been above the PAV (0.03 mg/l), see Figure 29. For the six year 2018-2023 the average result is 0.03mg/l. 2004-2023 the average result is 0.05mg/l. In addition, the most recent, 2025 samples returned a of <0.02mg/l.

Given the two elevated results since 2019 and the concentration averages remaining below the PAV and sulfate also is not found above PAVs, it should be considered as achieving water quality for sulfur.

Conclusion

Examination of the water quality data, with particular focus on relatively recent result indicates that the water quality should be considered to have met the water quality objectives. Whilst potassium was the exception, this single element was relatively stable in recent years.

Groundwater

Currently the sole monitoring point on site is BH5824. This monitoring location is downgradient of the pit void, and can be taken as representative of the groundwater flow in that direction. The water collecting in the pit void is thought to mostly represent groundwater from upgradient of the site (RML, 2025), where the daylighting groundwater also mixes with surface water runoff. Discharge from the pit void is back into groundwater. The pit void is currently monitored and can be used as another indicator of groundwater at the site. A comparison of data from BH5824 and BH5812 was completed, relative to information from monitoring boreholes at the landfill. BH5824 is located on the edge of the waste facilities (overburden) downgradient of the pit to the west and BH5812 sits to the east downgradient of

the landfill (BH5812) but upgradient of the overburden and pit void. From the data in Table 2A of Condition 44, MEM understands the screen within the BH5812 to be approximately 20m lower than the screen in BH5824 and it is assumed that the same aquifer is intersected by both boreholes.

A comparison of Chloride in the boreholes can be seen in Figure 30. Chloride concentrations in BH5812 are much higher than in BH5824. This is potentially due to impacts from the neighbouring landfill operation, which is upgradient in groundwater flow to BH5812. The chloride concentrations measured in boreholes around the perimeter of this landfill site are shown in Figure 31, with several being an order of magnitude higher than those in BH5824 downgradient of the pit void. This trend is also seen in magnesium with elevated results at BH5812 and the majority of landfill monitoring sites, yet relatively low at BH5824, see Figure 32 and Figure 33.

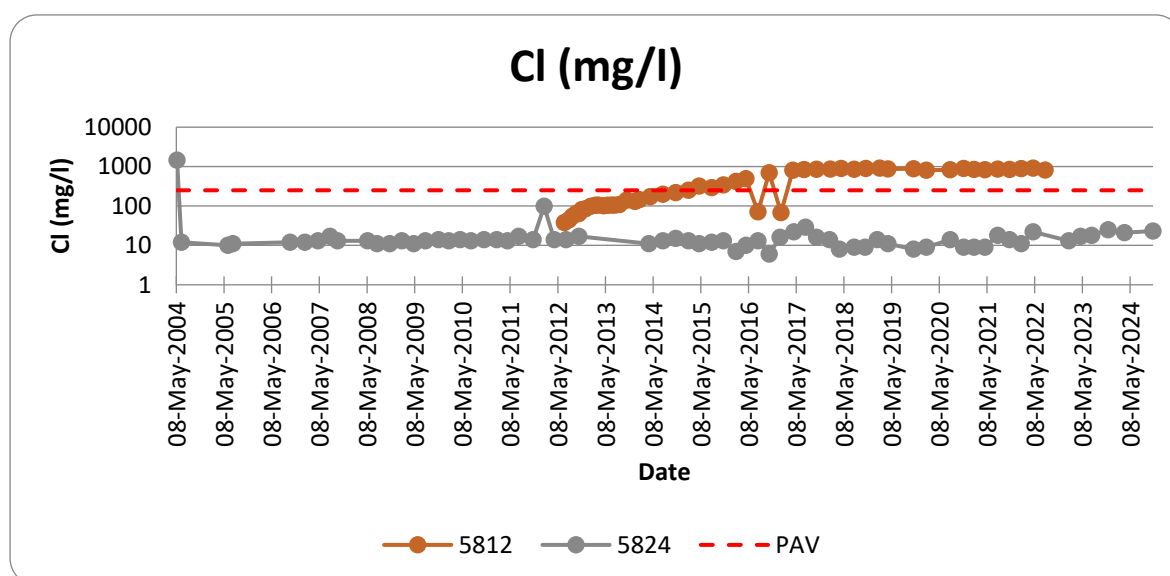


Figure 30 Chloride at BHs 5812 and 5824

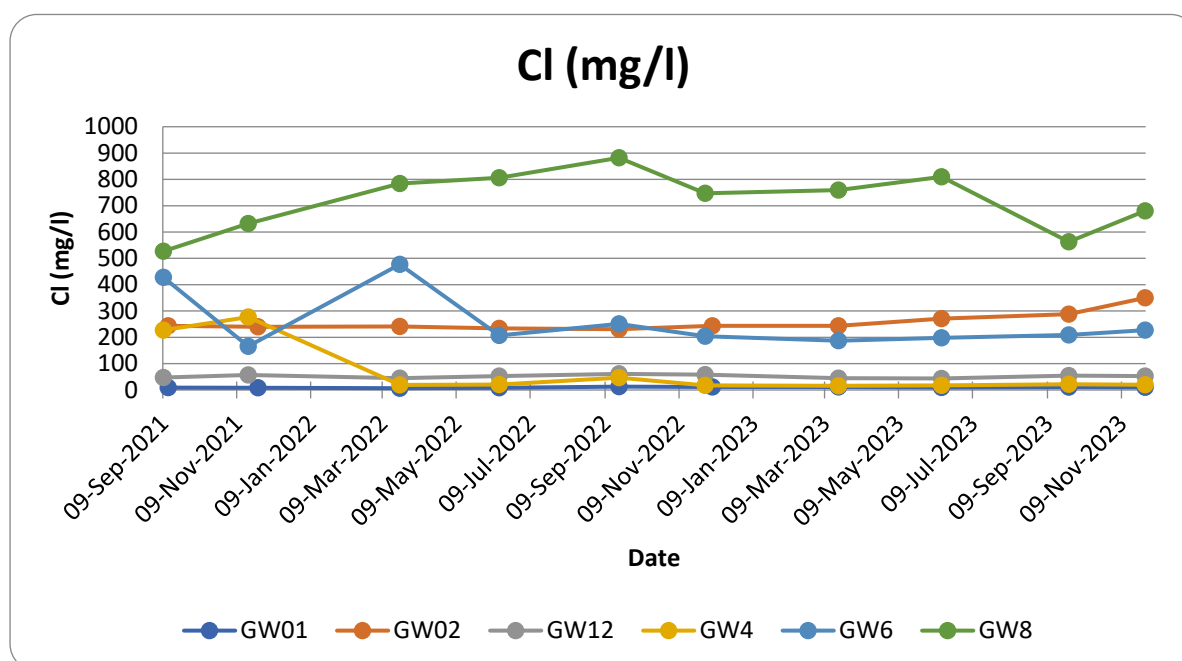


Figure 31 Chloride at Biffa sites

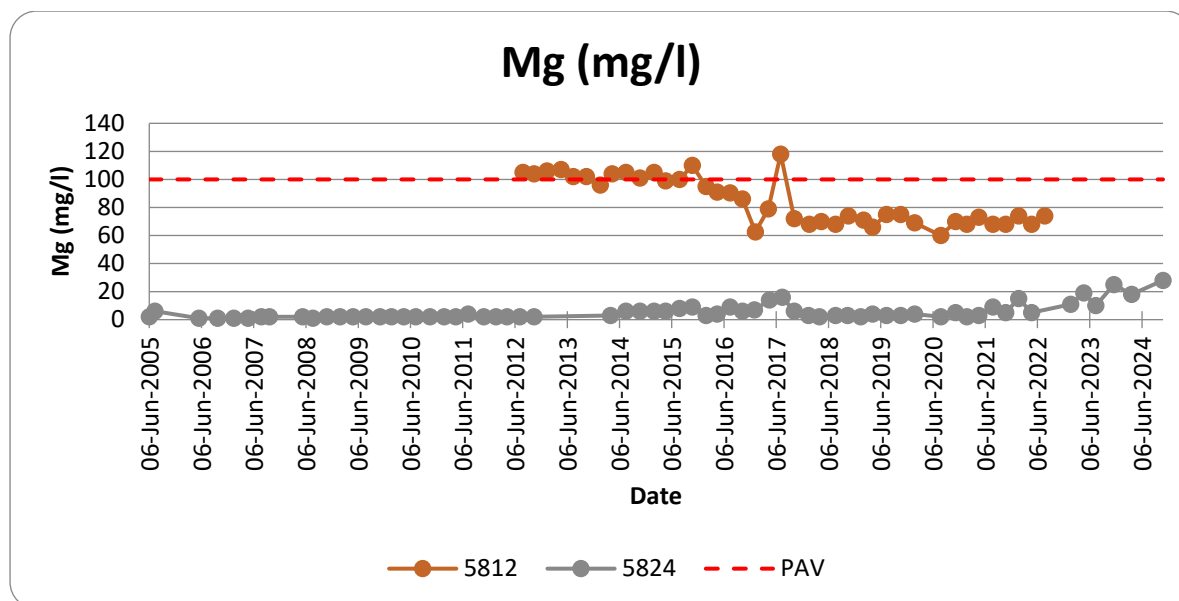


Figure 32 Magnesium at BHs 5812 and 5824

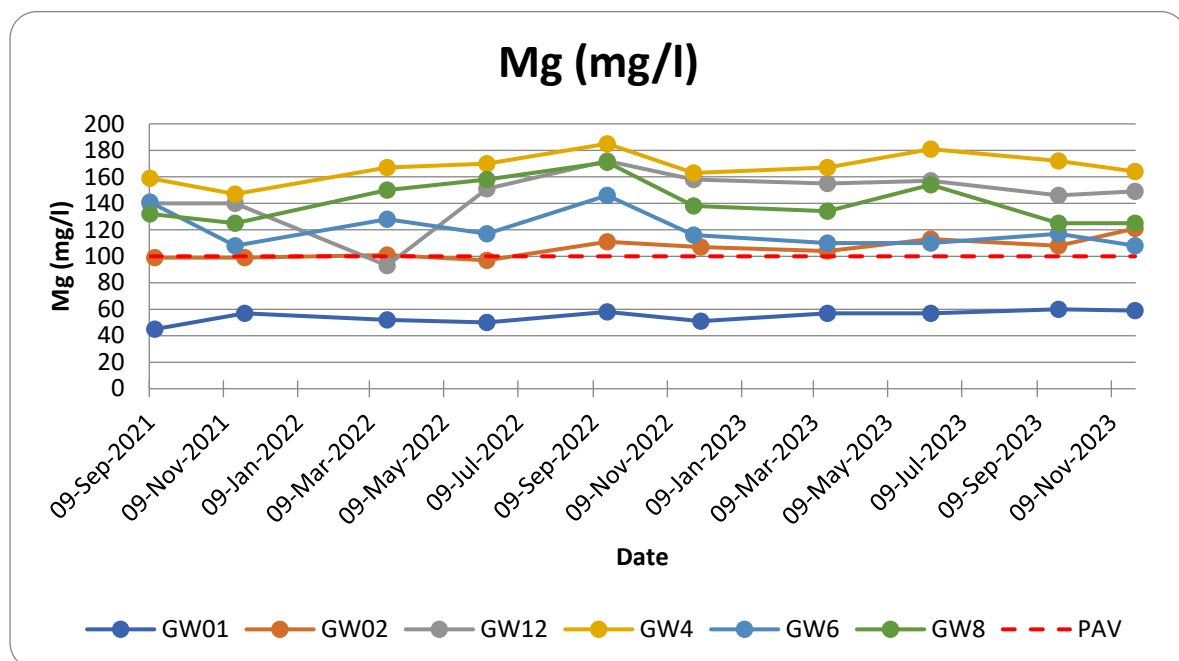


Figure 33 Magnesium at Biffa sites

Ammonia is also a potential indicator of the impact of potential discharges from the landfill site impacting groundwater quality upgradient of the Fros-y-Fran site, as seen in Figure 34 and Figure 35.

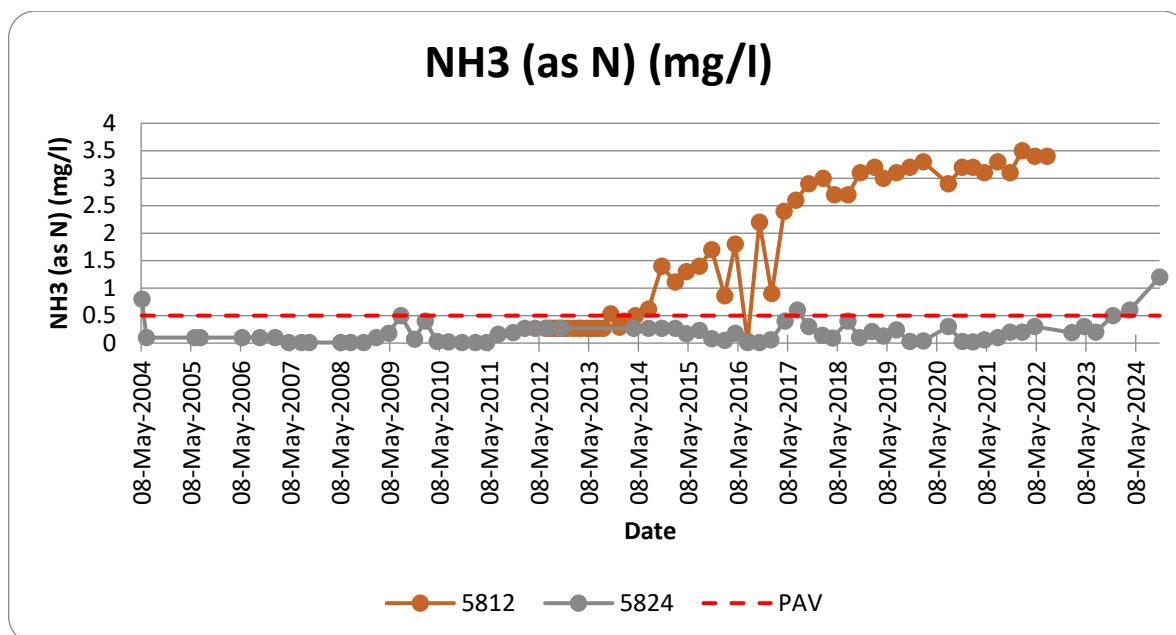


Figure 34 Ammonia at BHs 5812 and 5824

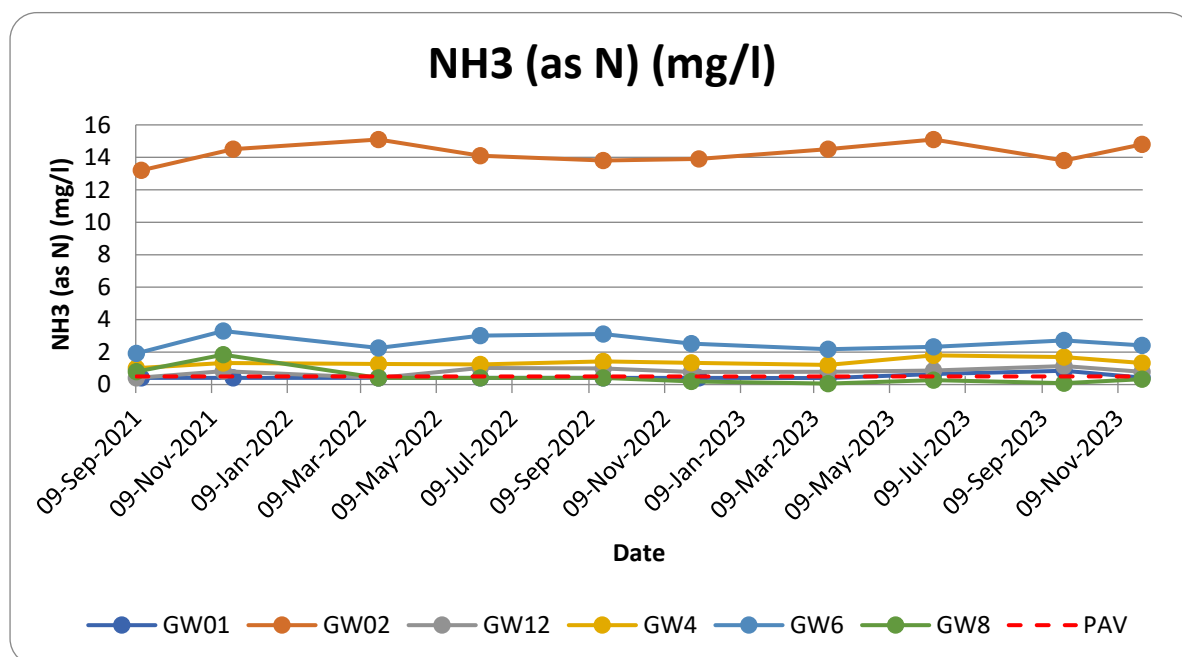


Figure 35 Ammonia at Biffa sites

Discussion

BH5824 is a suitable monitoring location for groundwater downgradient of the pit void. It will need to be continued to be monitored to ascertain that potential impacts from the site post restoration phase are minimal. The pit mine void waterbody is also an indicator of groundwater which is monitored at the site, although this is also mixed with surface water. The groundwater monitoring from the edge of the landfill site likely shows the upgradient quality flowing into the main Ffos-y-Fran area, and this could be included in monitoring reviews of groundwater for the remediation phase. It is recommended that as well as a suite of parameters to monitor potential impacts from Ffos-y-Fran at BH5824 and in the pit void indicator parameters for the landfill site are also included.

It is recommended that additional monitoring points could be considered in the main flowpaths or groundwater discharge areas from site, i.e. at surface water locations which could be linked to surface water gauging expected to be monitored at the site. This would include a point on the River Taff where the flowpath of groundwater suggests is a key discharge point from the Ffos-y-Fran site (MEM, 2025).

Additional monitoring

As the pit void waterbody has only recently developed it is recommended that monitoring at this location is continued with a suite to enable the ongoing characterisation and trends in water quality of the waterbody, likely defined by the mineralisation of the waste materials.

In addition, the monitoring program at OB3 and onsite water storage locations should also be continued with the parameters and frequency that are defined by a suitable risk assessment. As operations have mostly ceased the frequency could be decreased over time reflecting the stabilisation of the site and water bodies.

Recommendations

Organic parameters

The review of the results from all water quality monitoring data found that in most cases organic parameters were measured at limits of detection or below PAVs. As operations and activities on site have mostly ceased the source of organic pollutants is likely no longer present. Here the organic parameters refers to:

- VFA
- PAH (total)
- PCB (Total)
- Phenols (monohydric)
- VFA Species
- PAH Species
- PCBs Species

As such, some or all of these organic species could be reduced or removed from the monitoring schedule across the site.

Also, from the data analysed, BOD did not present as a parameter of concern at many sites. Thus, BOD could be removed from the lists of required parameter. One site where it could be useful to maintain the BOD measurement is along the Bargoed Taf below the OB3 seepage discharge locations. Alternatively, given the length the monitoring program has been in operation, a COD to BOD ratio could be established, with a COD PAV set that is in line with the existing BOD PAV.

Monitoring locations

On site monitoring of the pit void waterbody, seepage and onsite water storage should be continued and developed as appropriate to the assessed risk. An additional monitoring location on the River Taff

would be recommended, as well as reviewing data from the landfill monitoring boreholes to the east of the site.

Monitoring points which could be reduced, as they may not show any impacts to the site include MA01. As the parameters monitored at this location appear to be stable over time. Monitoring on the River Rhymney could also potentially be reduced, as the majority of the drainage appears to go to the south and west of the site and there do not appear to be any significant issues relating to these locations over the monitoring period.

Managing onsite monitoring through an adaptive management process such as a site management plan rather than the permitted operational monitoring would allow control and adjustment of monitoring based on changes in risk as the site transitions during the restoration and post-restoration phases.

Environmental permits (AE2013403 and EPR-DB3131AF)

It is recommended that the compliance monitoring required by both permits is continued and reviewed in three to five years post cessation of operations. MSW to continue to review requirements for discharge consents as necessary during the restoration phase.

Condition 44

MEM understands that the monitoring requirements detailed in Condition 44 are derived from the Planning Permission Ref. No P/03/0225 dated 2nd May 2003 (discharged by MTCBC on 21/11/2005). Thus, a review of the monitoring requirements could be expected, particularly as several monitoring sites have been lost, regardless of change in the operations. But given that mining has ceased then a review of the requirements would be appropriate.

Groundwater (GW)

The Fros-y-Fran operation should continue to monitor the current groundwater quality borehole downgradient of the site but also review the groundwater environment using the model produced as part of the ES (RML, 2025) to enable the following:

- The assessment impact from the neighbouring landfill site. Review of the landfill monitoring and pit lake quality could also be included in this
- Review the suitability of the current groundwater monitoring point
- Identify a downgradient location along a river to enable monitoring of groundwater discharge

Removal of the organic parameters as described above could be considered. The main indicator parameters for any potential impacts from the site post-restoration are likely to be metal(oids), sulfate and pH. It is recommended that major ions and nutrient species are maintained however to allow for assessment of the characterisation of the groundwater. The groundwater suite should also consider parameters that would show any potential impacts from the upgradient landfill site.

Surface water (SW)

At MA09 and MA10 the 2018 to 2024 average concentrations overall show the PAVs are being achieved along this stretch of the Rhymney River. Given these results, the fact that operations have ceased and the monitoring program is not detecting any potential impacts from the site, it is recommended that the location be removed or monitoring reduced in the monitoring program.

The analysis of data from monitoring locations MA06, MA07 and MA08, located on the Bargoes Taf, identified some parameters that remain above the PAV. These locations are also downgradient of the discharge point of seepage from OB3. As such it is recommended that monitoring of water quality at these points is continued and reviewed in the short term. However, some parameters, such as the organic suites, could be considered for removal from the program as discussed above.

Furthermore, the Bargoes Taf ecological assessment returned a result of 'Good' regarding the ecological health of the stream. An opportunity exists to update the monitoring approach in the future to assess ecological health as the water quality objectives rather than chemical monitoring in the medium to long term.

At locations MA01, as discussed above, the monitoring data suggests that water quality objectives are being achieved at this location and conditions are stable. Given the results, the fact that the operations have ceased it is recommended that the location be removed from the monitoring programme. in its current form with no change to the risk.

Revised Environmental Water Quality Monitoring Program

Whilst the review of the monitoring data provides a useful technique in identifying the relevance of the programme based on past data, any updated monitoring program must consider the existing risk, particularly from AMD post final restoration of site. An assessment of the risk following the restoration phase is provided in the AMD risk assessment report (MEM, 2025). Table 4 provides a summary and overview of a recommended monitoring program for during and following the restoration phase. Monitoring data should be reviewed annually to ensure any changes in risk are captured. Review of this programme should be undertaken at least at years two and five following the finalisation of the restoration scheme, and ideally annually including aiming for a final assessment and review of monitoring results in year five. Review should consider ongoing potential risks as well as assess the data collected.

Table 4 Monitoring programs overview

Monitoring requirements	Current Classification	Monitoring points	Parameters	Potential Impact	Mitigation / Monitoring required	Frequency
Environmental permits (AE2013403 and EPR-DB3131AF)	Compliance	All	As before	Likely reduced following restoration phase implementation	Continue to monitor to establish a closure baseline and any changes post-restoration phase	As required by the permit (recommended this could be reduced to quarterly from monthly)
Condition 44	Compliance	MA01	N/A	Monitoring program has not detected impacts from site at this location, and post-remediation impacts are not expected	With risk from discharge reducing following cessation of activities, it is recommended that the location be removed as a compliance monitoring point	Only if a new risk or impact is noted
	Compliance	MA05	Major ions, nutrients, metal(loids), sulfate, pH, alkalinity	Monitoring program has not detected impacts from site but the point is potentially downgradient of overburden areas	Continue to monitor to establish a closure baseline and any changes post-restoration phase	Quarterly, to potentially be reduced to biannually/annually in regular reviews, with final review of monitoring and requirements at 5 years
	Compliance	MA06, MA07, MA08, (Bargoed Taf)	Major ions, nutrients, metal(loids), sulfate, pH, alkalinity, BOD	Ongoing seepage noted in AMD risk assessment from OB3	Continue to monitor to establish a closure baseline and any changes post-restoration phase and potential impact of seepage from OB3	Quarterly Potentially review changing to assess ecological health rather than water

Monitoring requirements	Current Classification	Monitoring points	Parameters	Potential Impact	Mitigation / Monitoring required	Frequency
						quality in the future, with final review of ecological health at year 5
	Compliance	MA09, MA10 (River Rhymney)	N/A	Monitoring program has not detected impacts from site at this location, and post-remediation impacts are not expected	With risk from discharge reducing following cessation of activities, it is recommended that the one or both of these locations be removed as a compliance monitoring point	Only if a new risk or impact is noted
	Compliance	BH5824 (GW)	Major ions, nutrients, metal(oids), sulfate, pH, alkalinity, potential parameters of concern from landfill drainage	Downgradient of the pit void and also the neighbouring landfill.	Where possible continue to review Trecatti landfill monitoring information of potential upgradient impacts on an annual basis	Quarterly, to be reduced to biannually or annually following review with final review of monitoring and requirements at 5 years
Additional Monitoring	Operational	Pit void water body	Major ions, nutrients, metal(oids), sulfate, pH, alkalinity, parameters of concern from landfill drainage	Based on modelling results there is not likely to be a significant change in water quality in the pit void in the post restoration period relative to current conditions as a result of the restoration program of works. It is noted that upgradient impacts from offsite sources such as the landfill may be	Continue monitoring the pit void water quality, PAV's not suitable for pit lake, monitoring to develop water characteristics and risk.	Quarterly, to be reduced to biannually or annually following review and adequate baseline agreed with final review of monitoring and requirements at 5 years

Monitoring requirements	Current Classification	Monitoring points	Parameters	Potential Impact	Mitigation / Monitoring required	Frequency
				influencing certain parameters (e.g. ammonia) and these are outside the control of the site and so remain as a risk for water quality objectives		
	Operational	OB3 monitoring (WF4, WF5 and WF6) (TBC by risk assessment)	Major ions, metal(loids), sulfate, pH, alkalinity (TBC by risk assessment)	Ongoing seepage noted in in ARD assessment from OB3	Enhancement of the pond and wetland area in these locations (TBC by risk assessment)	Quarterly, to be reduced to biannually or annually following review and adequate baseline agreed (TBC by risk assessment)

Post Restoration Phase Water Quality Management

The above recommendations could be consolidated into one over-arching monitoring plan rather than as separate permits and conditions in the post-restoration phase. The establishment of an updated monitoring program aims to ensure risk is managed by collecting adequate datasets to ensure a post-restoration phase baseline can be established and to ensure any mitigation measures are working. The monitoring plan should also adequately monitor for any potential impacts in the receiving water environment.

The establishment of closure success criteria is a requirement for the monitoring program to consider being aligned with international good practice, and may be considered an improvement on the existing basic approach of PAVs.

It is recommended, particularly for the Bargoed Taf, that future development of a monitoring program could consider the ecological assessment of the receiving water body as monitoring indicators. Here the use of ecological assessment, as conducted on the Bargoed Taf (Aquilina Environmental Water Quality, 2015) could be considered as an alternative to ongoing sampling of the watercourses once a sufficient baseline has been established and reviewed. The ecological monitoring could then replace the existing surface water Condition 44 and permit requirements in this location. Here, data suggests that that MSW discharges, have not negatively impacted aquatic fauna and flora (Aquilina Environmental Water Quality, 2015). This is in line with regulatory guidance (How to comply with your environmental permit. Additional guidance for: Mining waste operations (NRW, EPR 6.14)).

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MEM, 2025, Ffos-y-Fran Final Restoration Scheme Acid and Metalliferous Drainage (AMD) Risk Assessment, 036-001-0125

RML, 2025, Ffos-y-Fran Final Restoration Strategy Environmental Statement (ES) for Merthyr (South Wales) Ltd, 3274-11

Appendix F - Trecatti Landfill Site

- F1 - Excavation wall adjacent to the Trecatti Landfill Site
- F2 - Geotech Report 01 - Reclamation Scheme Extension
- F3 - Extension Sections 202510 - Location Plan
- F3 - Extension Sections 202510 - Section



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MERTHYR [SOUTH WALES] LIMITED.

FFOS-Y-FRAN LAND RECLAMATION SCHEME [FLRS].

EXCAVATION WALL ADJACENT TO THE TRECATTI LANDFILL SITE-

23RD of October 2025.

Introduction.

At the request of Merthyr [South Wales] Limited, James Associates was commissioned to undertake a Geotechnical Assessment of a proposal to extend excavation by a further three cuts which would place the final limit of excavation at surface closer than originally proposed to the active Trecatti Landfill Site.

The proposal involved the excavation of an additional three NW / SE orientated panels identified as cuts 26, 27 and 28] extending from a defined stand-off between the A4060 and northern limit of excavation at surface. The proposed southern limit of the panels was defined by a stand-off from the site coal washery plant. Excavation was proposed to extend from surface to the Lower Four Feet basal coal seam.

An assessment of the exiting extensive site information including borehole data and experience gained during operations on the site was undertaken. Details of the assessment are contained in the James Associates report 'Land Reclamation Extension' reference JA.M[SW]FYF.01.20 dated February 2020.

The Assessment concluded that the proposed extension would not have any adverse impact upon the structural integrity of the A4060 or the southwest wall of the Trectti Landfill Site.

Operations.

It was initially assumed that the extension would involve the excavation of three cuts the locations of which is defined above, extending from surface to the Lower Four Feet Seam. This was not achieved, and the actual operation involved the following:

- Cut 26 was excavated for the full design length as was initially proposed from surface down to the Lower Four Feet Seam level.
- Cut 27 involved the excavation of the northern half of the proposed cut down to the Bute Seam as opposed to the Lower Four Feet Seam.
- Cut 28 was excavated to the same length as Cut 27 and extended down to the Big Seam.

Stand-offs between the limit of excavation at surface and southwest wall of the Trecatti Site is as that specified in the above assessment report, i.e., 224 metres and at least 65 metres from the A4060

The above details are shown in the November 2023 topographical Site Survey which was undertaken following the final stage of excavation on the site.

Comments on Stability.

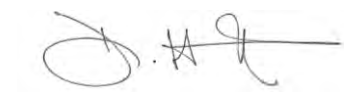
The structural geology between the north eastern limit of excavation on the site and Trecatti Landfill site is simple, comprising strata with negligible inclination [less than 5°] towards the southeast, i.e., approximately parallel to the orientation of the excavation face.

As such it is highly improbable that bedding plane related translational sliding movement which could impact upon the structural integrity if the Trecatti Site is likely to occur either in the short or long term.

The only variation to the originally interpreted geological model is the occurrence of an approximately north / south orientated fault with a downthrow towards the west, which is present at the Big Seam bench horizon. At the point of intersection there has been limited localised instability in the excavation face which has been stabilised by minor grading works.

The presence of the fault structure will have no impact upon the stability of the ground between the site and adjacent landfill site.

Stability analyses, details of which are contained in the 2020 report, assumed a significantly larger excavation that has been undertaken and as such the conclusions in the report still remain valid.



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Attachment.

November 2023 Site Survey.

MERTHYR (SOUTH WALES) LTD

MERTHYR (SOUTH WALES) LTD

FFOS-Y-FRAN LAND RECLAMATION SITE

LAND RECLAMATION EXTENSION

February 2020

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DRAWINGS

Site Survey	Drawing No. JA-074-001-013
Generalised Vertical Section	Drawing No. JA-074-001-014
Site Plan	Drawing No. JA-074-001-015
Cross-Sections	Drawing No. JA-074-001-016

APPENDIX

Stability Print-outs

1. BACKGROUND

The Ffos-y-Fran Land Reclamation Scheme (FFLRS) has involved the excavation of a section of Lower and Middle Coal Measures strata containing coal seams extending from the Eighteen Inch ('R' Coal) down to the Lower Four Feet Seam ('BA' coal, which is the basal seam) covering a vertical distance of approximately 125 metres. The seam indexing adopted is specific to the site and used in place of the geological names.

The current site operates north west / south easterly orientated excavation panels which are progressively developed towards the north east.

Excavation panels vary in width up to approximately 60 metres. Excavated face height on the advancing profile similarly varies and is largely determined by the levels at which various coal seams occur.

2. PROPOSAL

It is proposed to undertake a small extension to the site involving the excavation of an additional three panels, the numbering of which follows on from the existing site system, which ends at Cut 25. The additional cuts, 26, 27 and 28, will be contiguous with, and a continuation of the existing system of mining, i.e. north west / south east orientated panels which are advanced towards the north east. The proposal will involve the re-excavation of a portion of the south western end of overburden mound OBM1 to enable access to the various seams to be achieved.

3. SITE LOCATION

The extension site is located approximately 2kms east of Merthyr Tydfil at the northern end of the existing Ffos-y-Fran site, is defined along its north western boundary by the A4060 trunk road and its north eastern boundary by open moorland leading to the Trecatti Landfill Site which lies some distance away.

The stand-off at surface from the curtilage of the A4060 to the proposed limit of excavation at surface is at least 65 metres, and from the closest rim position of the Trecatti site is 224 metres.

4. HYDROLOGY

The open moorland falls towards the north west at gradients of between approximately 1 in 12 to as steep as 1 in 5 and comprises rough grazing land with no tree cover. Beyond the Ffos-y-Fran boundary in this area the land associated with the adjacent landfill site is drained by several contour grips which pick up surface water flows, directs them towards the north east and ultimately into a tributary of the Nant Morlais.

Within the proposed extension area there is no evidence of any groundwater emergence points being present.

Meteoric rainfall is currently intercepted by the northerly trending ditch which directs the run-off into culverting beneath the A4060 and into a tributary of the adjacent Nant Morlais watercourse.

The run-off from the currently undisturbed ground which will ultimately be removed by excavation cuts 26, 27 and 28, will fall directly into the void. This water will be collected and pumped via an internal drainage ditch which will be formed to the rear of the north western limit of excavation at surface. The water will be directed into the site water treatment lagoons which are located on ground to the west and beyond the present site's limit of excavation at surface. Ultimately, this water will be discharged via a culvert beneath the A4060 and into a tributary of the Nant Morlais watercourse.

To reduce the additional amount of water which will be handled by the site water treatment system a drainage interceptor ditch will be excavated to the north east and behind the proposed limit of excavation at surface. This ditch will direct water to the north west and into a residual section of the existing surface drainage channel.

The potential impact of the extension on the water balance in the area will be insignificant.

All diverted / treated surface water run-off and direct rainfall will remain within the catchment of the Nant Morlais.

5. HYDROGEOLOGY

The hydrogeology of the current site has been, other than moderately significant inflows at the south eastern end of the operating site arising from workings below the HB seam, relatively simple comprising minor seepages from various horizons or abandoned pillar and stall type old workings.

The Coal Measures are generally classified as a non-aquifer having no importance as a significant groundwater resource. The principal source of significant water makes from within the Coal Measures is almost always associated with abandoned underground mineworkings. Whilst the current site has worked through several seams which have been previously worked by underground mining methods, there are no records available which show that any abandoned workings occur in seams located within Cuts 26, 27 or 28. (Though it should be noted that there is a distinct possibility that un-recorded abandoned mine workings will occur.)

The benefit of Cut 26 being contiguous with Cut 25 is that if any unrecorded water-bearing abandoned mine workings are encountered they are likely to have been drained.

Extensive inter-connected flooded abandoned mine workings are not expected to be intersected in the proposed extension area.

The operations associated with the proposed extension will have no impact upon any groundwater resources within the area.

6. GEOLOGY

6.1 Stratigraphy

Drift

Within the existing site the Glacial Drift deposits have been shown by exploratory drilling to thin rapidly as followed towards the north from approximately 13 metres to as little as 1 metre at the northern end.

Shallow level excavations associated with surface drainage works in the proposed extension area have demonstrated solid strata to lie, in places, at less than 1 metre beneath ground level. It is not expected that any significant thickness of drift will be encountered in the proposed extended excavation area.

Due to the insignificant thickness of drift deposits which is expected to occur, the impact of the rockhead interface characteristics will be of no great relevance (other than potentially at a very localised scale) with respect to the potential for translational sliding-type instabilities developing along it.

Solid Measures

The sequence of strata which will be excavated on the site extends from the Eighteen Inch Seam down to the Lower Four Feet, and comprises coal seams, mudstones, siltstones, mudstone seatearths and subordinate sandstone units. Within the proposed extension area, the Two Feet Nine, Upper Four Feet and Big Seams are indicated to crop out or form incrops close to surface, with a broadly north east / south west trend.

The generalised vertical section which covers the excavation sequence is shown in Drawing No. JA-074-001-014 - Generalised Vertical Section.

6.2 Structural Geology

The site is located on the northern rim of the South Wales Coalfield syncline where the strata have an overall inclination towards the south.

The structural geology of the current site is, relative to elsewhere in the coalfield, simple, comprising strata which strike approximately north east / south west, with a bedding inclination of between 3° and 7° towards the south east. This produces broadly north east / south west orientated outcrops / incrops of the various coal seams across the area.

Structural continuity of the strata is commonly disrupted by low angle thrust dislocations which have a generally North East / South West strike orientation. In addition, a number of normal faults have been encountered during operations the largest being the north west / south east trending Dowlais Fault, which caused major disruption to the stability of the highwall (south eastern face). A generally simple structural regime is expected to be present in the proposed extension area.

There are a number of boreholes within the proposed extension area which, from an assessment of the seam contour digital terrain models (DTMs), indicates the strata to have structural uniformity with no evidence of any folding, faulting, areas of steeply inclined bedding or abandoned un-recorded mine workings to be present. Whilst the borehole information does show there to be structural uniformity it is highly possible that small-scale thrust faulting may be encountered.

Thrust faults tend to be low angle planar features along which 'packets' of strata have been pushed over one another producing a repetition in the sequence. They commonly have low shear strength characteristics (residual) and are often the focus of further sliding movements when exposed in excavation faces. In association with thrust faults small scale intense folding of the strata occurs, which can also lead to generally localised small-scale instabilities developing in excavated faces.

Thrust faulting has been a common occurrence within the existing site and where encountered has occasionally led to small scale localised instability in some excavated faces.

Typically, failures have been extremely limited in extent affecting faces extending laterally less than 15 metres and rarely completely removing the overlying intermediate safety benches.

In addition to occasional thrust faulting, none of which has been identified in exploratory drilling, the strata can be expected to be broken by the uniform orthogonal joint sets and random steeply inclined planar surfaces which have occasionally occurred in the current site. Such features when intersected in excavation faces either have no impact, or, if they do, the impact tends to give rise to the development of small-scale wedge, toppling or translational sliding-type failures generally affecting an insignificant area, and never extending beyond a few metres behind the crests of individual slopes.

Typically, modes of failure which affect stratiform deposits such as the Coal Measures, other than in the immediate sub-surface weathered zone, or collapse zones associated with abandoned mine workings tend to involve movements which are controlled by the presence, orientation, spacing and characteristics of planar discontinuities contained within the rockmass and their relationship with excavated face geometry / orientation. Examples of planar discontinuities are bedding planes, faults, rockhead surfaces and jointing.

7. PREVIOUS SURFACE MINeworkINGS

7.1 Previous Opencast Coal or Ironstone Workings

No areas previously worked by opencast mining technique will be encountered within the extension area.

7.2 Abandoned Underground Mine Workings

The general geographical area has been affected by extensive underground mine workings dating back to before the eighteenth century for both coal and ironstone. Worked coal seams include Lower Four Feet, Little Vein, Rhaslas, Big, Upper Four Feet and Two Feet Nine Seams.

The principal ironstone workings are beneath the base of the proposed excavation occurring between the Lower Four Feet and Garw Seams.

No underground mine workings for either of the minerals are any longer operational, nor is such activity likely to be resumed.

Within the existing site area abandoned underground coal mineworkings in several seams have been encountered with no great impact on excavated face stability being experienced other than minor localised collapse and strata deflection extending to generally less than 5 metres above the roof level of the worked seam.

Within the proposed extension area there is no evidence from either abandonment plans or exploratory boreholes of any previous abandoned underground or surface opencast mineworking activity. This does not preclude un-recorded workings being encountered.

It should be noted that the very earliest mine workings were un-recorded and present as small opencast patchwork or shallow bell pits, particularly occurring where the surface glacial drift cover is thin, i.e. less than say 1 to 2 metres. Such workings are from experience in the general area commonly encountered occurring close to the Big Seam crop position and may be present in the proposed site area, which will contain the Big Seam outcrop / incrop.

8. PROPOSED DEVELOPMENT

It is proposed to extend operations towards the north east by developing a further three excavation panels, as shown in Drawing No. JA-074-001-015 - Site Plan. The panels will be up to approximately 60 metres in width and approximately 600 metres long.

The maximum depth of the excavation will be approximately 110 to 115 metres below original ground level.

Within the solid measures the proposed overall slope profile will be at a gradient of 1 vertical to 1 horizontal, formed as a stepped wall with intermediate safety benches at various intervals but spaced such that individual faces remain below 15 metres in height. Individual face inclination will be approximately 1 vertical to 0.5 horizontal.

Through glacial drift and significantly weathered bedrock of any thickness above 3 metres a 1 vertical to 2 horizontal excavation slope will be excavated with a bench of nominal width formed at the rockhead interface.

The 'actual' face profile will be continually reviewed as geological / geotechnical conditions become apparent.

The proposed extension area is defined along its north eastern boundary by a stand-off of at least 224 metres from the Trecatti Landfill Site, and along its north western boundary by a stand-off of at least 65 metres from the A4060 highway.

The geology of the site, which can be seen to be simple is shown in cross sections A to E, the locations of which are shown in Drawing No. JA-074-001-016 - Cross- Sections locations.

As noted elsewhere in this document, the strata inclination out from the north western sidewall will be approximately 7° to 8° towards the south east, and from the north eastern sidewall is essentially flat lying, i.e. effectively zero apparent dip.

9. STABILITY ANALYSES

Instability of any significance, should it occur and impact upon either of the external sidewalls, would be controlled by bedding plane inclination and orientation. Therefore, stability analyses have focussed upon an assumption of translational sliding type movements occurring along / in the vicinity of coal seam bedding planes which will be located at various levels within the proposed excavation sidewalls.

9.1 Stability Assessment

Four selected cross-sections have been analysed to evaluate excavated slope stability for the for the proposed extension design in relation to the following structures:

- BIFFA Landfill x1 No. section (Section B)
- NW faces for the stability of the adjacent A4060 road x3 No. sections (Sections C, D and E).

The locations are as shown on the attached plan, Drawing No. JA-074-001-015 - Site Plan.

9.2 Strength Parameters

Since accurate strength data is not available for the rock mass, sensitivity analysis has been applied based on historical site data and data gained from extensive opencast mining operations in the South Wales Coalfield. The following basic Mohr-Coulomb parameters have been used in the various analyses:

Table No. 1 - Mohr Coulomb Parameter Values

Material	Cohesion c' (kPa)	Angle of Friction Φ' (Degrees)	Bulk Density (kN/m³)
Glacial Till	10	30	20
General Coal Measures	0-400	35	23
Seatearth (Peak strength)	10	15	23
Seatearth(Residual strength)	0	11	23

(The use of the term "Coal Measures" or Mudstone is for simplification recognising that actual strata will comprise mudstone, shale, siltstone, sandstone, coals and associated seatearths.)

The initial sensitivity analyses were undertaken on Sections C, D and E on the north wall of the pit. The historical Mohr-Coulomb parameters for the Coal Measures in particular appear to be conservative values and therefore a sensitivity analysis has been undertaken for Sections C, D and E and on these sections cohesion (c') has been varied from 0-400kPa. (Using the RocScience Roclab software to derive Hoek-Brown parameters allows equivalent Mohr-Coulomb parameters to be derived. In this case, for the applicable stress range for a 65m slope suggests cohesion of 460kPa and friction angle of 37°).

The proposed excavation slopes are relatively high (significantly greater than 65m) and it is considered that use of the Hoek-Brown failure mechanism is appropriate and has therefore been used in addition to the traditional Mohr-Coulomb parameters for Sections C, D and E. The following input parameters have been used for the Hoek-Brown analyses:

Table No. 2 - Hoek-Brown Parameter Values

Parameter	Value	Condition
Unconfined Compressive Strength	35 MPa	Moderately Strong
Geological Strength Index GSI	50	Very blocky, four joint sets
Intact Rock Constant	4	Claystone
Disturbance Factor	0.7	Good Blasting

9.3 Water Levels

There is no water level data available for the strata within the proposed excavation area. Current slopes within the operating site are essentially dry and have previously been modelled using dry slope conditions in analyses undertaken along sections of the same northern sidewall further to the west.

However, analyses have been undertaken to assess the sensitivity of the slopes to water levels, which are presumed to be below the base of the BIFFA landfill site which is located to the north east of the proposed extension area.

9.4 BIFFA Landfill

Two cross-sections through the landfill have been constructed, A and B, of which the most critical, with the BIFFA landfill at its deepest is Section B and therefore Section A has been considered as not needing to be assessed.

Slope instability simulating a potential failure along the K Coal has been assessed. The proposed north eastern excavation slope is assumed to be dry down to this level since the base of the landfill lies approximately at this level which is similarly assumed to be dry.

Bedding is almost horizontal with effectively zero apparent inclination out of the proposed excavation face and therefore the overall integrity of the slope between the landfill and the pit is unlikely to be compromised by the development of translational sliding type failure.

Assuming that the coal seam is dipping at approximately 1° towards the proposed excavation slope and a residual shear strength value for the Seatearths (11° friction angle), the Factor of Safety will be approximately 11. However, an analysis of a section along the Coal has been considered and returns a Factor of Safety of 1.55 for a critical surface (i.e. rear release crack) some 200m from the edge of the landfill as shown in Fig. 1.

It can be concluded that the proposed excavation will have no impact upon the structural integrity of the Biffa Landfill site.

9.5 A4060 Sections

Three cross-sections C, D and E have been constructed perpendicular to the trend of the proposed north eastern excavation boundary, the locations of which are shown in Drawing No. JA-074-001-015 - Site Plan.

Bedding is indicated to be inclined towards the south east and out of the proposed excavation face at an angle of 7° to 8° . Strata will therefore 'daylight' in the proposed excavation face.

Commonly, within stratiform deposits planar discontinuities, such as bedding planes, the inclination of which is often the most critical factor, will control the stability of the slopes.

Coals HA, D and BA all 'daylight' in the excavation face with the BA Coal forming the pavement. Although several analyses were undertaken for the upper coals the pavement coal BA proved to be the most critical. In each case the strata beneath the coal has been modelled as seatearth, the weakest of the modelled units. (It should be noted that the seatearths will be much thinner than are shown as modelled.)

The crest of the slope (limit of excavation at surface) in Sections C and D are between 72 and 65m from the adjacent A4060 highway whereas the proposed excavation limit in the vicinity of Section E is 61 metres from the road. Adopting this stand-off, the Factor of Safety will be inadequate when using the derived input parameters in analyses. For the various analyse, the stand-off between the A4060 and proposed limit of excavation at surface has been extended to 65 metres.

The Rocscience Limit Equilibrium computer programme SLIDE v6 has been used in the analyses. The method of analysis uses the "Block Search" function to simulate failure along the seatearths which are assumed to occur beneath coal horizons behind the toe, with various paths analysed through the overlying strata. Searches have been limited extending to the edge of the A4060. The Janbu method of slice analysis was used in each case.

Due to the uncertainty of the strength parameters, a sensitivity analysis looking at the effect of variations in the cohesion has been considered, the results of which are presented in Figures 2 to 7.

For each section the Figures illustrate the FoS for the mean of the range analysed (200 kPa) and a plot of the FoS against cohesion showing the intercept for a FoS of 1.3.

The following cohesion values have been derived which produce a Factor of Safety of 1.3:

Table 3 - Cohesion in Coal Measures for Factor of Safety of 1.3

Section	Cohesion Required for FoS = 1.3 (kPa)
C	146
D	63
E	152

A cohesion value of 150 kPa can be considered to be a realistic, though conservative value for this type of strata and has therefore been used in the subsequent analyses details of which are shown in Figures 8-10.

For the Hoek-Brown analysis the General Coal Measures Strata have been modelled using the Hoek-Brown strength criteria but the seatearth and glacial drift have been modelled using conventional Mohr-Coulomb strength parameters.

The results of the analyses are as shown in Table No. 4

Table No. 4 - Parameter and Computed Factor of Safety Values

Section	Factor of Safety for $c = 150\text{kPa}$ in Mudstone at Edge of A4060	Factor of Safety for Hoek-Brown Parameters in Mudstone
B	-	-
C	1.31	1.48
D	1.49	1.69
E	1.30	1.48

The Hoek-Brown analyses return satisfactory Factors of Safety as shown in Figures 11 to 13.

The Hoek Brown analysis was subject to a sensitivity to water level in the slope, varying from totally saturated to dry above the pavement level. The results are presented in Figures 14 and 15 and indicate that for this strength criteria water levels should be no greater than approximately $\frac{2}{3}$ of the face height.

10. CONCLUSIONS AND RECOMMENDATIONS

10.1 Conclusions

Using the strength parameter values derived from a consideration of the sensitivity of these slopes to variations in the cohesion value adopted in analyses, it was concluded that a cohesion value of 150KPa and angle of friction value of 35° are appropriate in Coal Measures strata.

Using the derived Mohr-Coulomb parameter values and adopting the proposed slope geometry and limit of excavation at surface should lead to stable excavation slopes being achieved which will maintain the structural integrity of the A4060 highway and the Biffa Landfill site located to the north east of the proposed extension.

Using the Hoek-Brown method of analysis similarly indicates that stable excavated slopes as proposed can be achieved.

10.2 Recommendations

It is recommended that as the slope adjacent to the A4060 is excavated its stability is carefully evaluated by undertaking regular routine visual inspections.

As has been noted in section 6.2, thrust faulting is a common feature in the current site and may well be a feature which is encountered in the proposed extension site. The north east / south west strike orientation of the thrusting is approximately parallel to that of the north western sidewall of the excavation. This may result in localised areas of steep bedding and / or the presence of low shear strength planar discontinuities (thrust planes) which 'daylight', i.e. are inclined at a shallower angle than the excavation face and therefore dip into the working void.

Slope monitoring is recommended along the north western wall adjacent to the A4060. This could take the form of, say, three rows of monitoring pins arranged in a line perpendicular to the trend of the sidewall.

In addition, rigorous daily visual inspections of the excavated faces and also the ground behind the crest of the overall sidewall slope are also necessary.

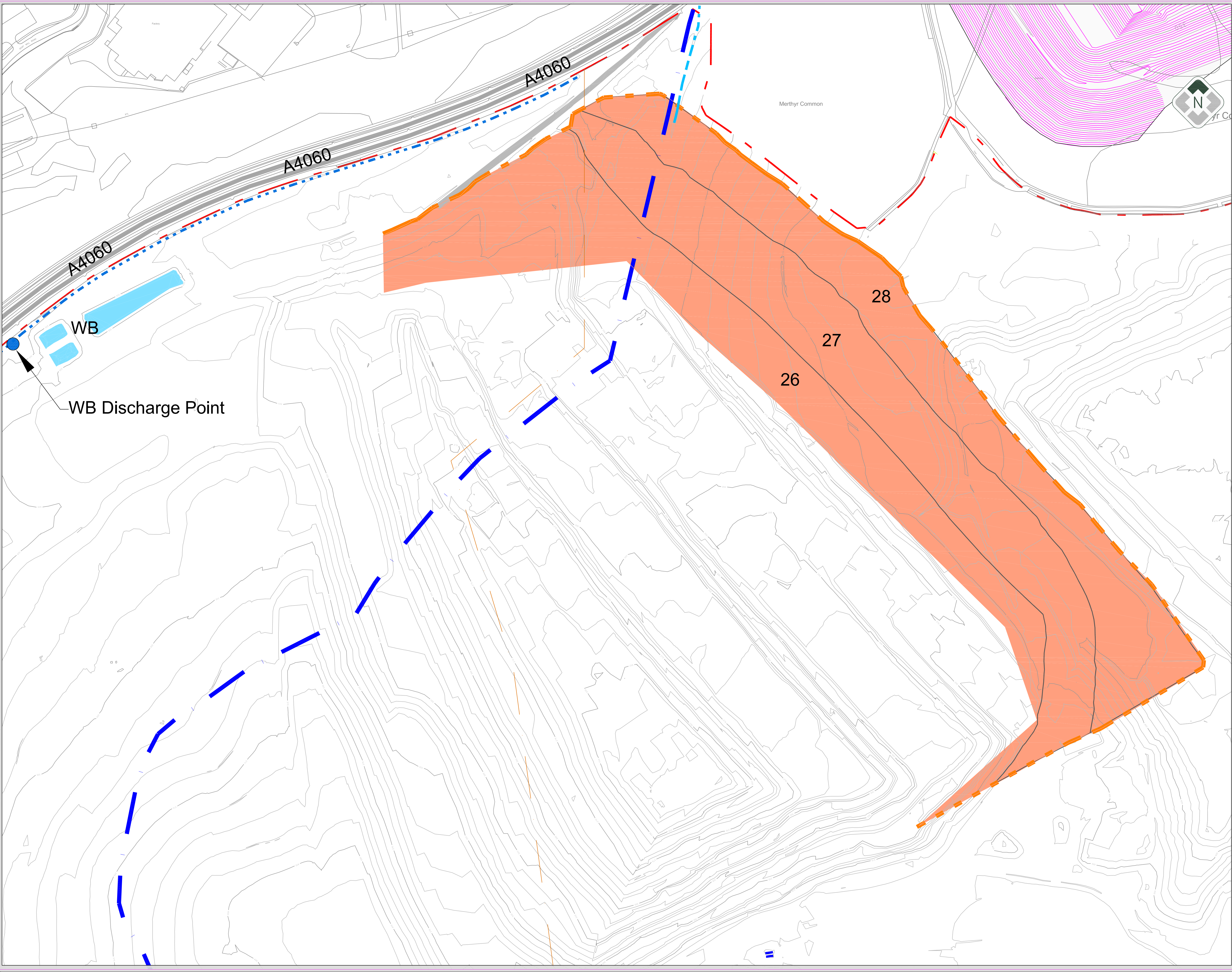
In the various analyses it has been assumed that the slopes are dry, which is considered to be a realistic assumption based on the experience gained in the current excavation (with the exception of the inflow from strata below the HB Seam workings, which is occurring at the southern end of the site).

However, any significantly elevated water pressure within the slope could cause instability, and therefore appropriate surface drainage behind the slope should be installed and maintained throughout the operation. In particular, the integrity of any surface drains associated with the A4060 highway should, if possible, be established and their efficiency maintained.


.....
D A B HIGGINS. MSc, BSc, FGS, DIC, CGeol
19 February 2020.

DRAWINGS

Site Survey	Drawing No. JA-074-001-013
Generalised Vertical Section	Drawing No. JA-074-001-014
Site Plan	Drawing No. JA-074-001-015
Cross-Sections	Drawing No. JA-074-001-016



LEGEND

- Removed Water Main
- Site Boundary
- 5m Contour Lines
- 1m Contour Lines
- Limit Of Excavation
- Extension Area
- Cut Lines at Original Ground Level
- Perimeter Ditch to Cae Harris - Biffa discharge (FYF doesn't discharge into)
- Perimeter Ditch to Nant Morlais
- WB Discharge Point

NOTES:
Based on site survey dated 00-00-0000 supplied by
LSS ref:

CLIENT:
MERTHYR
(SOUTH WALES) LTD

SITE:
FFOS Y FRAN LAND
RECLAMATION SCHEME

PLAN:
SITE SURVEY

1:@A1 22/01/2020

JA - 074 - 001 - 013
Client No. Project No. Drawing No.

JAMES
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Top seam Extracted Excavation Area

Base of Excavation

Average
Interseam
Interval

29 m

13 m

4 m

10 m

3 m

6 m

7 m

6 m

17 m

7 m

8 m

9 m

15 m

GORLLWYN (T Seam)

CEFN COED MARINE BAND

TWO FEET NINE RIDER 'A' (R Seam)

TWO FEET NINE RIDER (Q Seams)

TWO FEET NINE (P Seam)

UPPER FOUR FEET (N2/ N1 Seams)

BLACK (M Seam)

BIG RIDER (LD Seam)

BIG (L Sequence of seams)

RED (K Seam)

RHASLAS UPPER LEAF (HC Seam)

RHASLAS MIDDLE LEAF (HB Seam)

RHASLAS LOWER LEAF (HA Seam)

BUTE (G Seam)

THREE COALS RIDER (F Seam)

THREE COALS (E Seams)

LITTLE VEIN RIDER (D Seams)

LITTLE VEIN, UPPER (CB Seam)

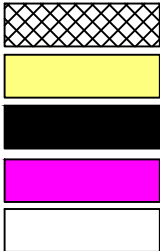
LITTLE VEIN, LOWER (CA Seam)

LOWER FOUR FEET, UPPER (BC Seam)

LOWER FOUR FEET, MIDDLE (BB Seam)

LOWER FOUR FEET, LOWER (BA Seam)

LEGEND



Ironstone
Sandstone
Coal
Marine band (usually claystone)
Predominantly claystones

NOTES:
Based on site survey dated 00-00-0000 supplied by
LSS ref: _____.

CLIENT:
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(SOUTH WALES) LTD

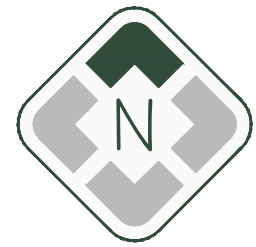
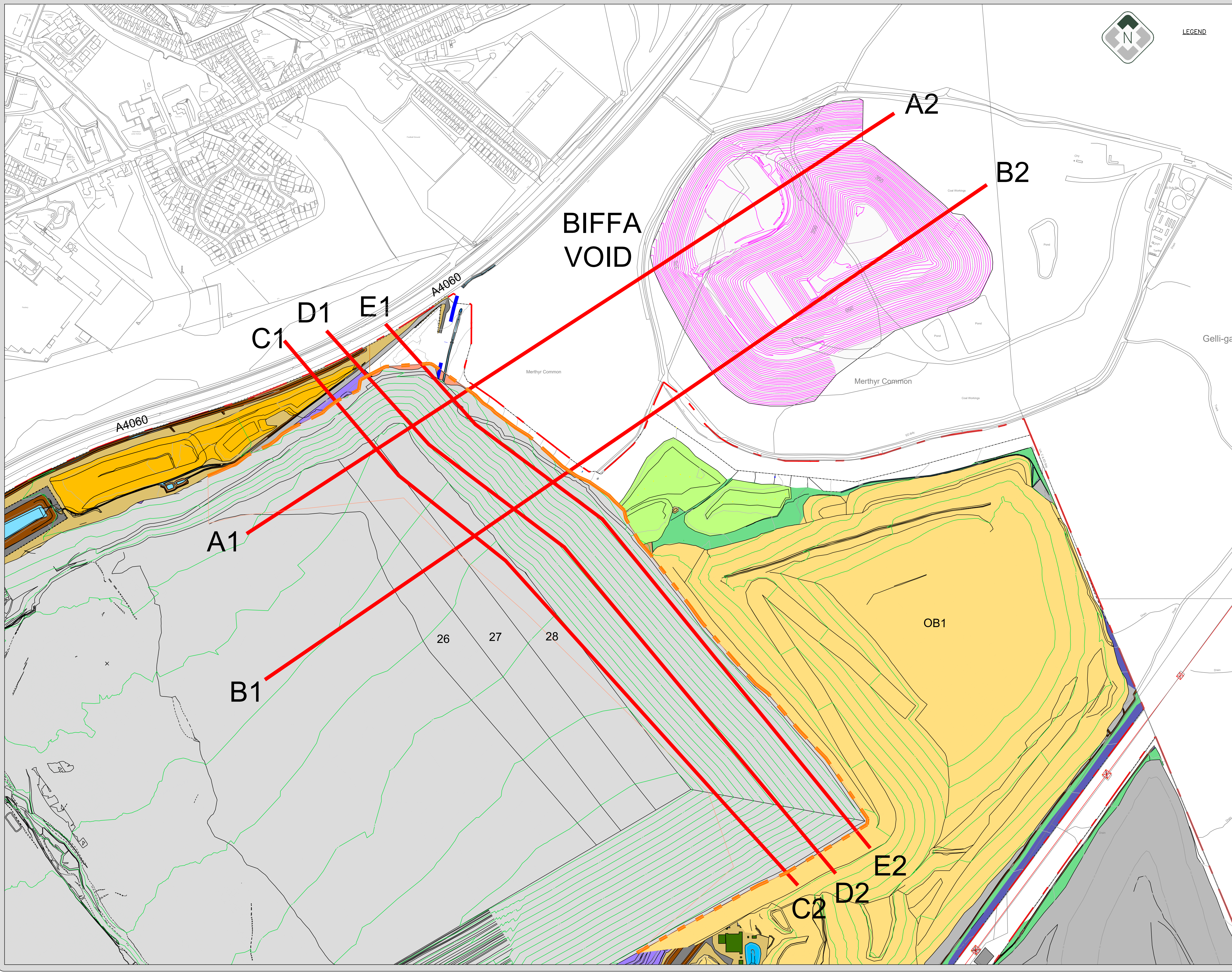
SITE:
FFOS Y FRAN LAND
RECLAMATION SCHEME

PLAN:
GENERALISED
VERTICAL SECTION

Scale: 1: @ A1 22/01/2020

JA - 074 - 001 - 014
Drawn By: Project No: Drawing No:

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LEGEND

LEGEND

- Removed Water Main
- Site Boundary
- 5m Contour Lines
- 10m Contour Lines
- Section Lines
- 1m Contour Lines
- Limit Of Excavation

NOTES:
Based on site survey dated 00-00-0000 supplied by
LSS ref: _____

CLIENT:
**MERTHYR
(SOUTH WALES) LTD**

SITE:
**FFOS Y FRAN LAND
RECLAMATION SCHEME**

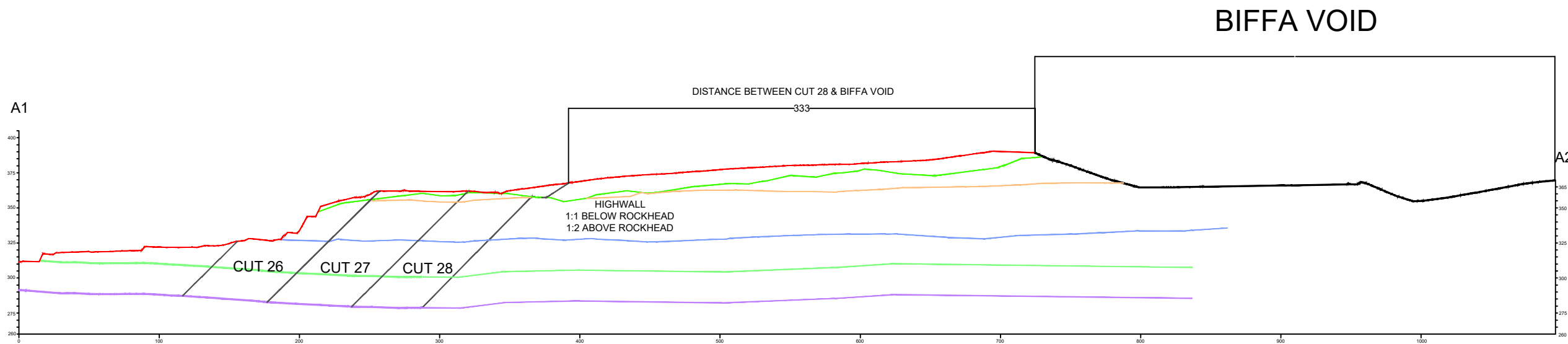
PLAN:
SITE PLAN

Scale: 1: @ A1 22/01/2020

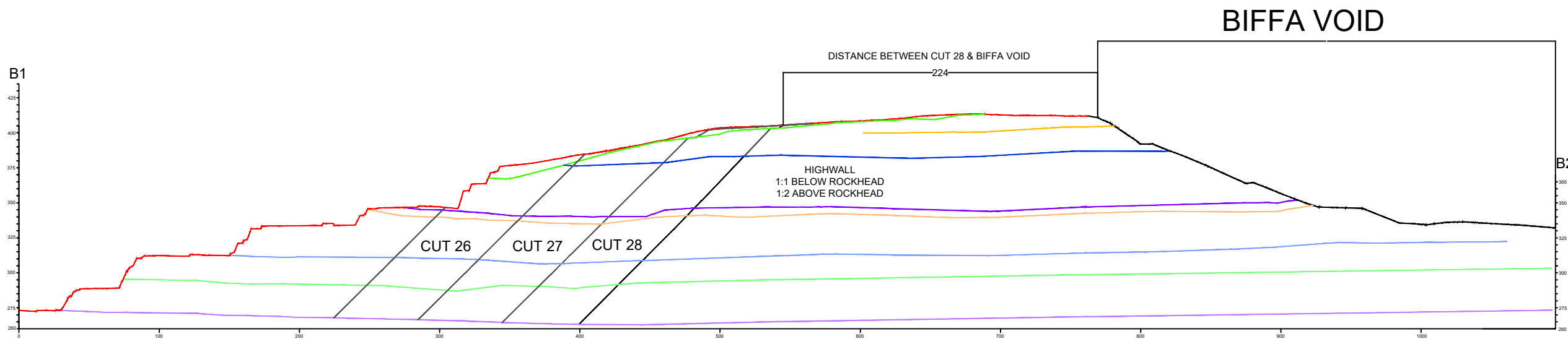
JA - 074 - 001 - 015
Drawn By: Checked By: Approved By:

JAMES
association
Geologist, Mining and Development Consultants

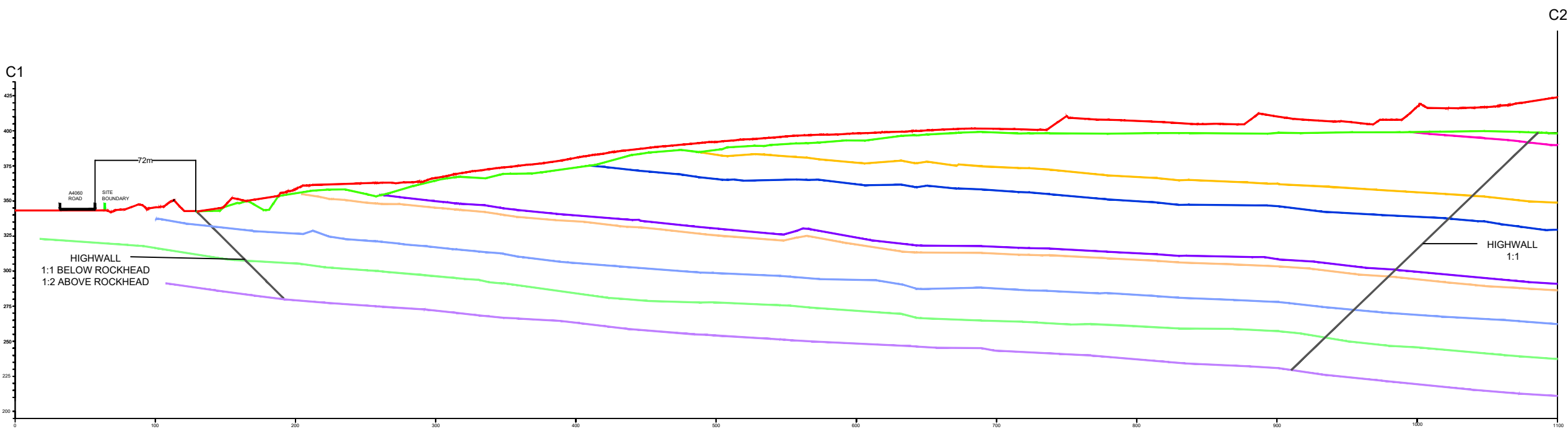
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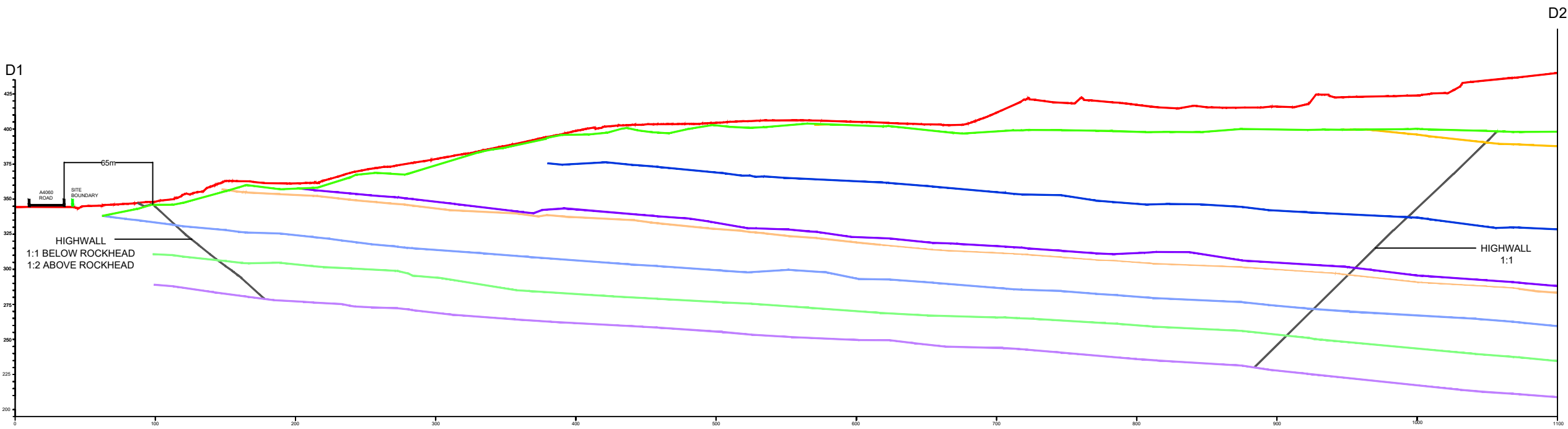
SECTION A1 - A2



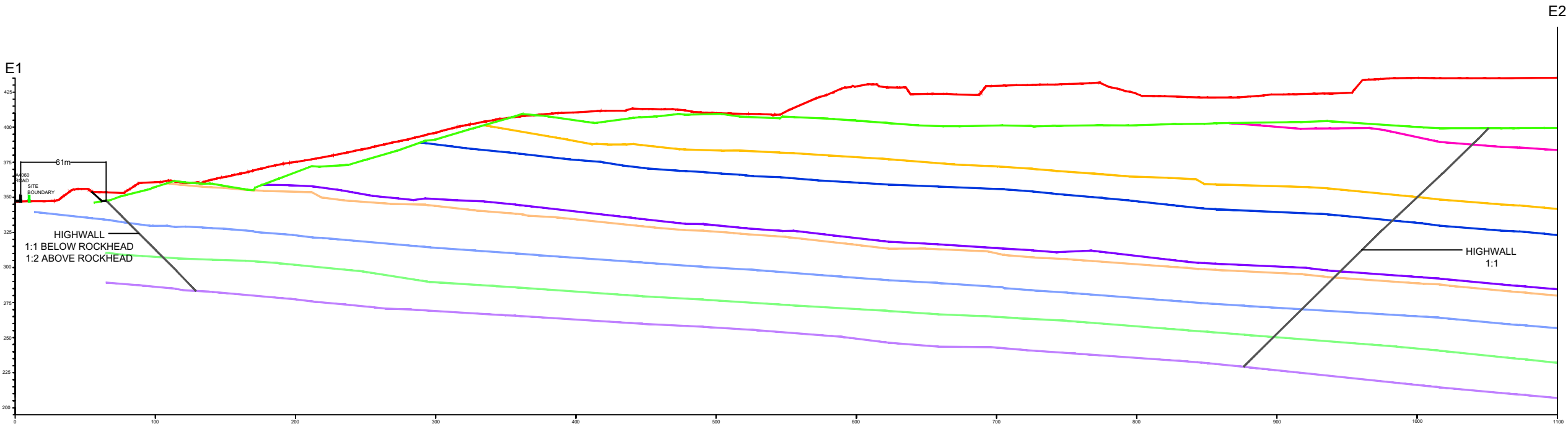
SECTION B1 - B2



SECTION C1 - C2
CUT 26



SECTION D1 - D2
CUT 27



SECTION E1 - E2
CUT 28

LEGEND

- Ffos Y Fran Profile
- Rockhead
- Biffa Void Profile
- Cut Lines

Coal Seam Bases

- T Coal Base
- R Coal Base
- P Coal Base
- LA Coal base
- K Coal Base
- HA Coal Base
- D Coal base
- BA Coal base

NOTES:

Based on site survey dated 00-00-0000 supplied by _____.

135 ref:

CLIENT:

MERTHYR
(SOUTH WALES) LTD

SITE:

FFOS Y FRAN LAND
RECLAMATION SCHEME

PLAN:

CROSS SECTIONS

Scale: 1: @ A1

22/01/2020

JA

074

001

016

JAMES
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APPENDIX

PRINT-OUTS

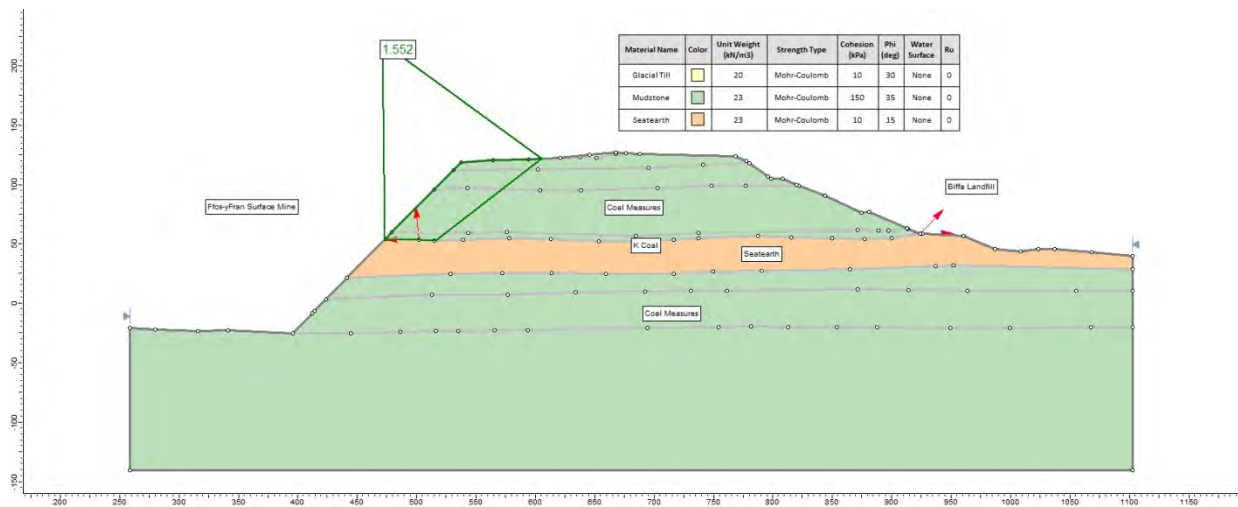


Fig 1 - Section B, Cohesion in Coal Measures 150kPa Factor of Safety = 1.55

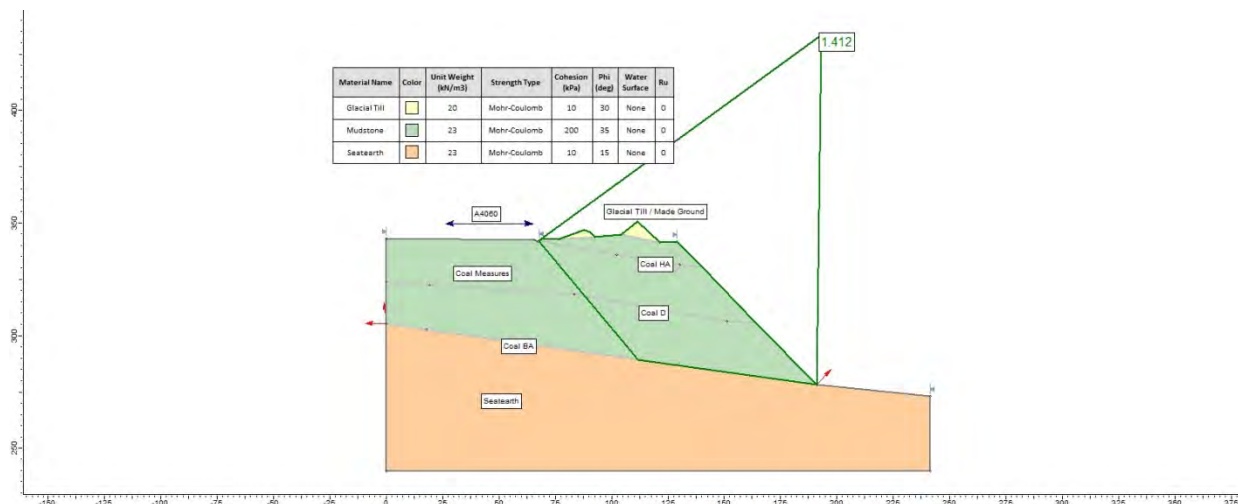


Fig 2 - Section C, Sensitivity - Cohesion in Coal Measures 200kPa

Factor of Safety = 1.41

(Note this is the average cohesion of the range considered)

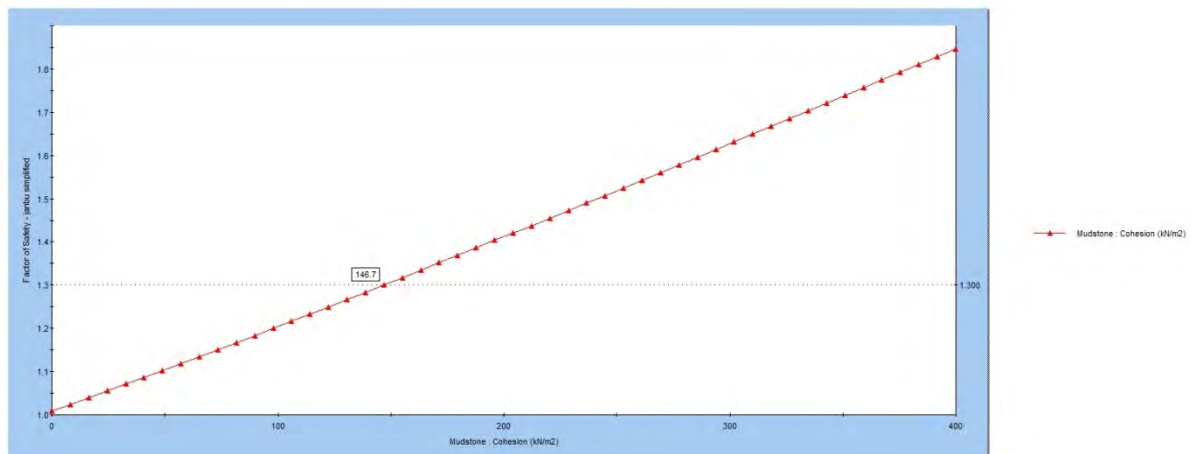


Fig 3 - Section C, Variation of Factor of Safety with Cohesion in Coal Measures

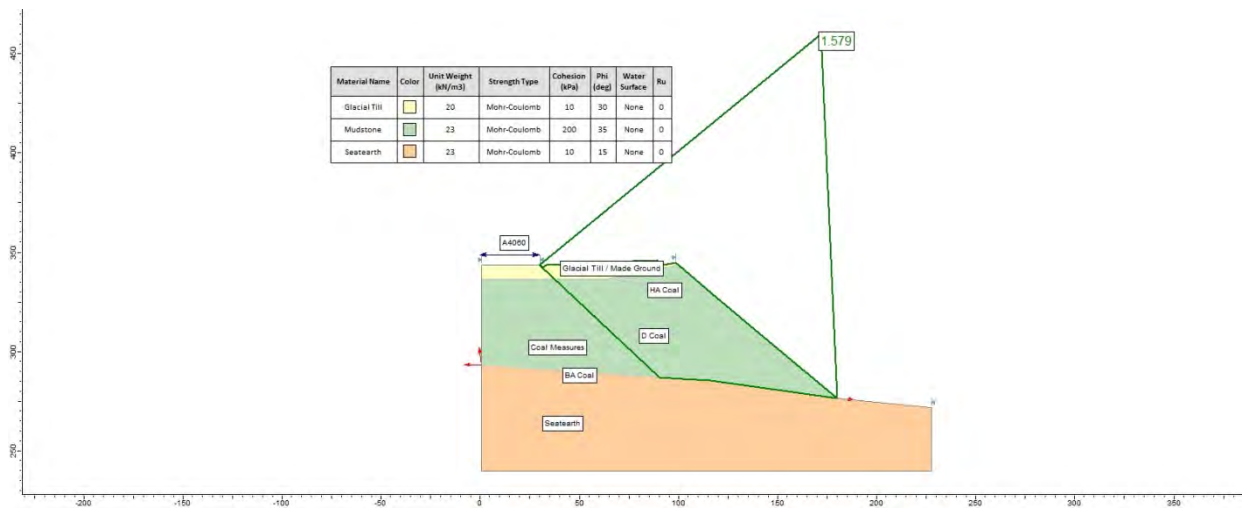


Fig 4 - Section D, Sensitivity - Cohesion in Coal Measures 200kPa
Factor of Safety = 1.58
 (Note this is the average cohesion of the range considered)

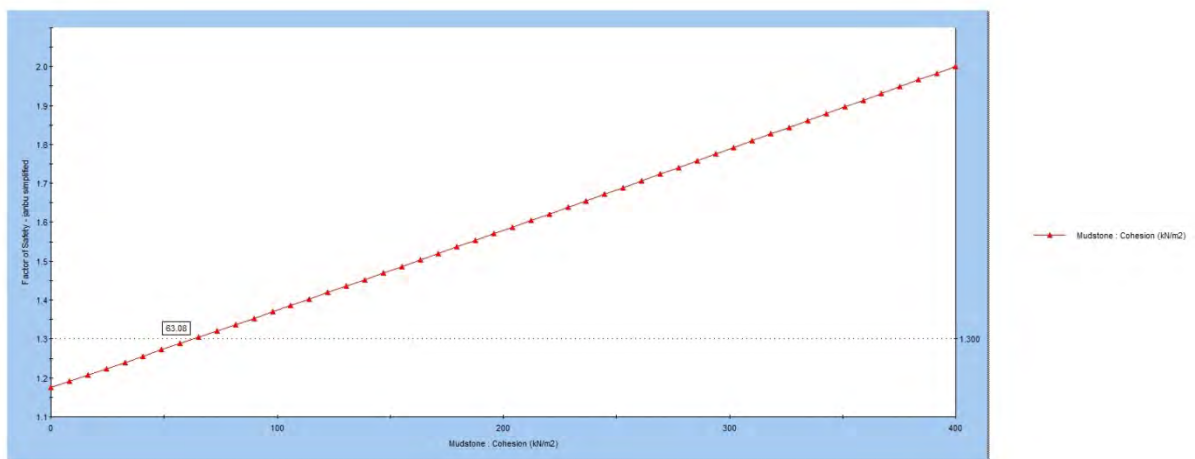


Fig 5 - Section D, Variation of Factor of Safety with Cohesion in Coal Measures

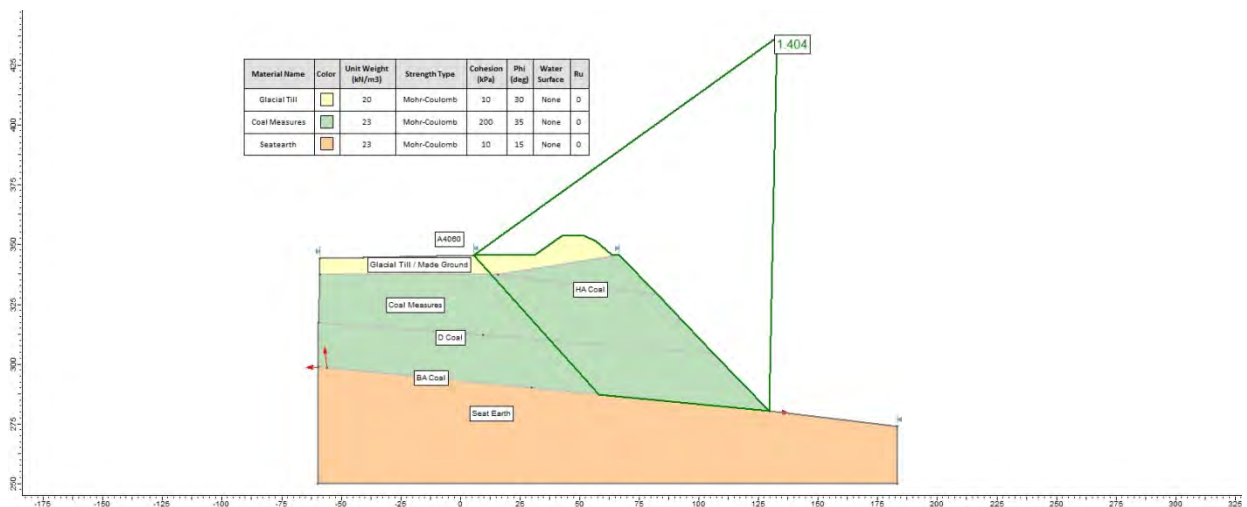


Fig 6 - Section E, Sensitivity - Cohesion in Coal Measures 200kPa
Factor of Safety = 1.40
 (Note this is the average cohesion of the range considered)

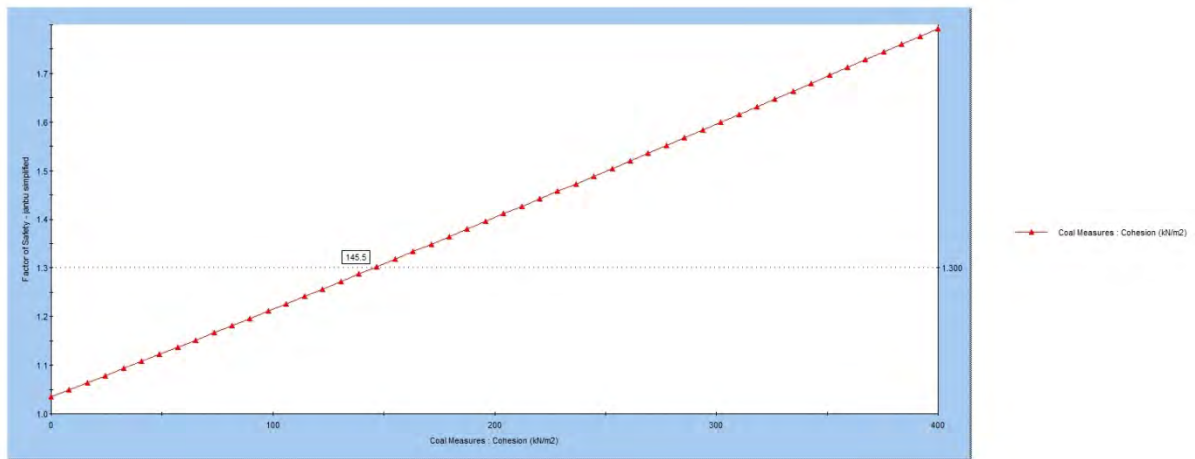
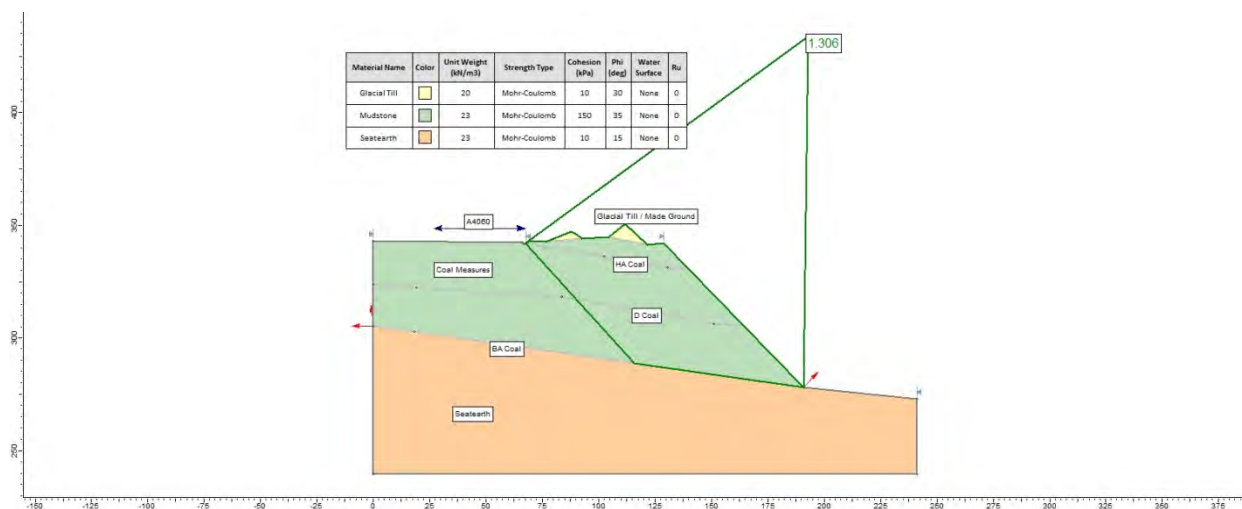
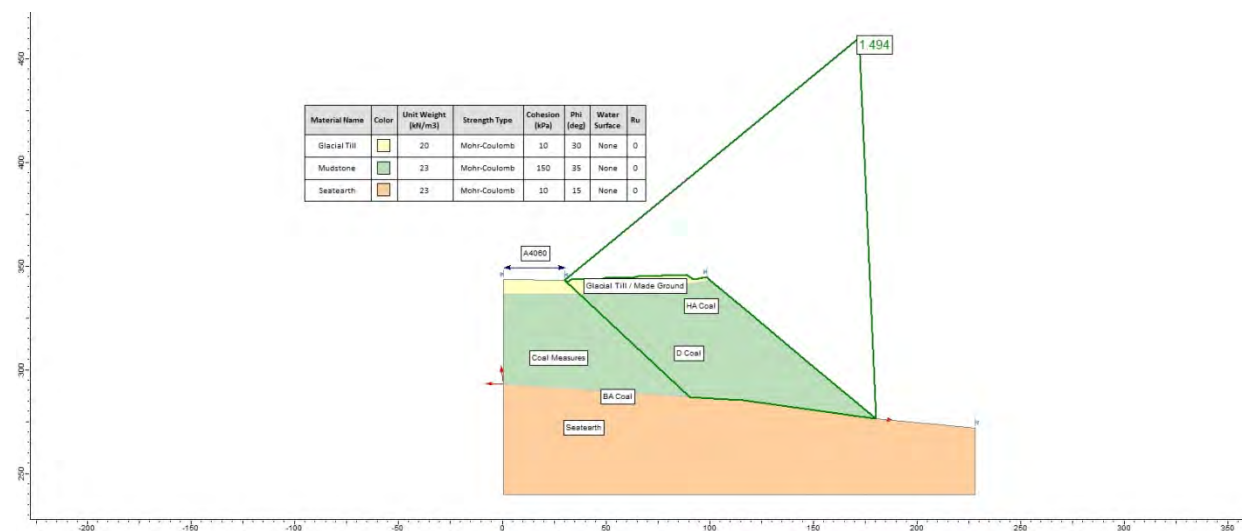


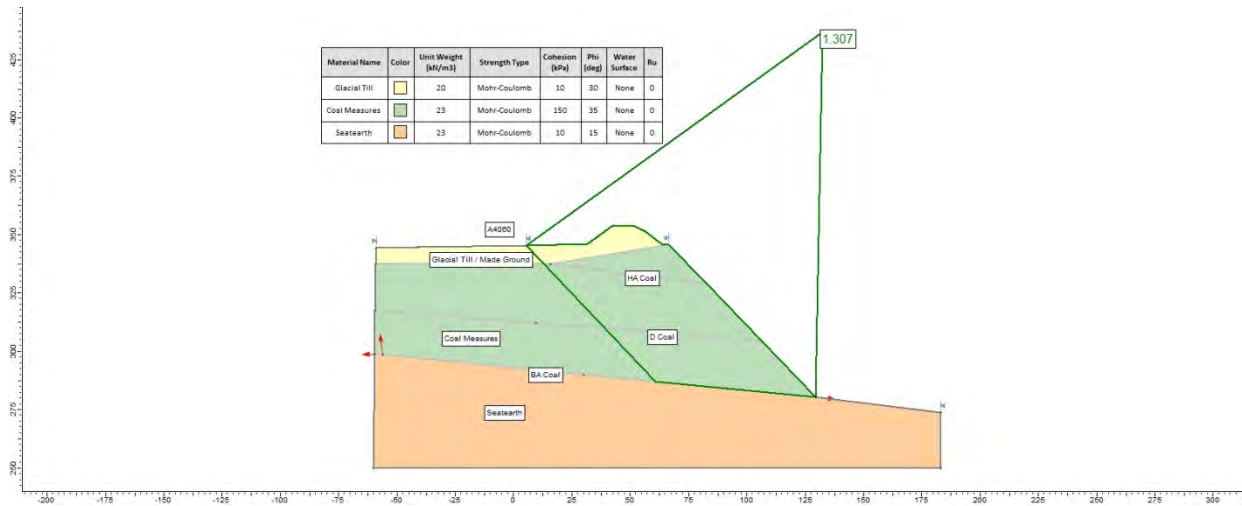
Fig 7 - Section E, Variation of Factor of Safety with Cohesion in Coal Measures



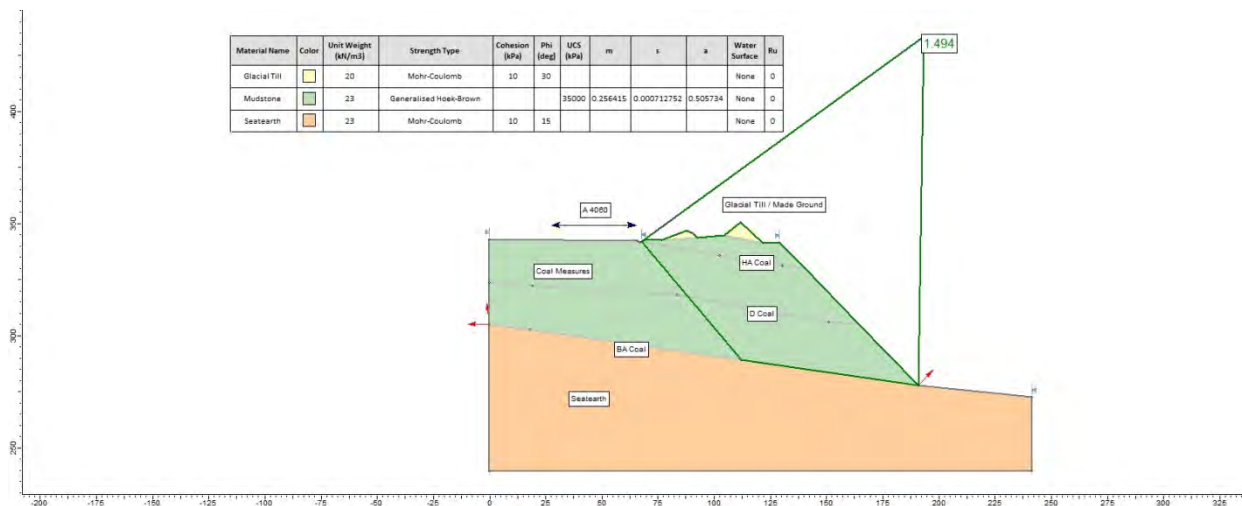
**Fig 8 - Section C, Cohesion in Coal Measures 150kPa
Factor of Safety = 1.31**



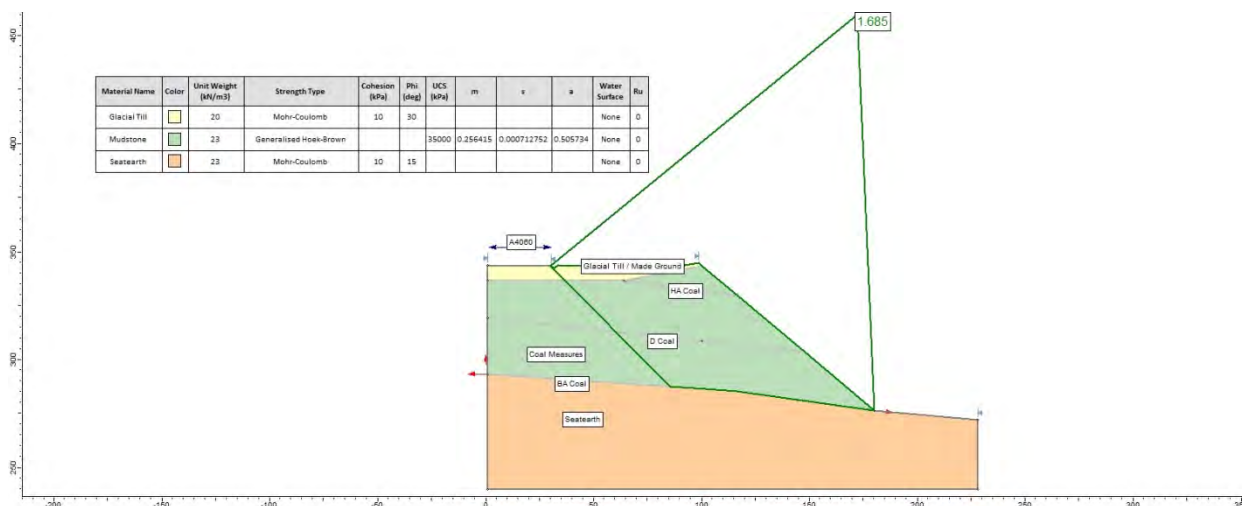
**Fig 9 - Section D, Cohesion in Coal Measures 150kPa
Factor of Safety = 1.49**



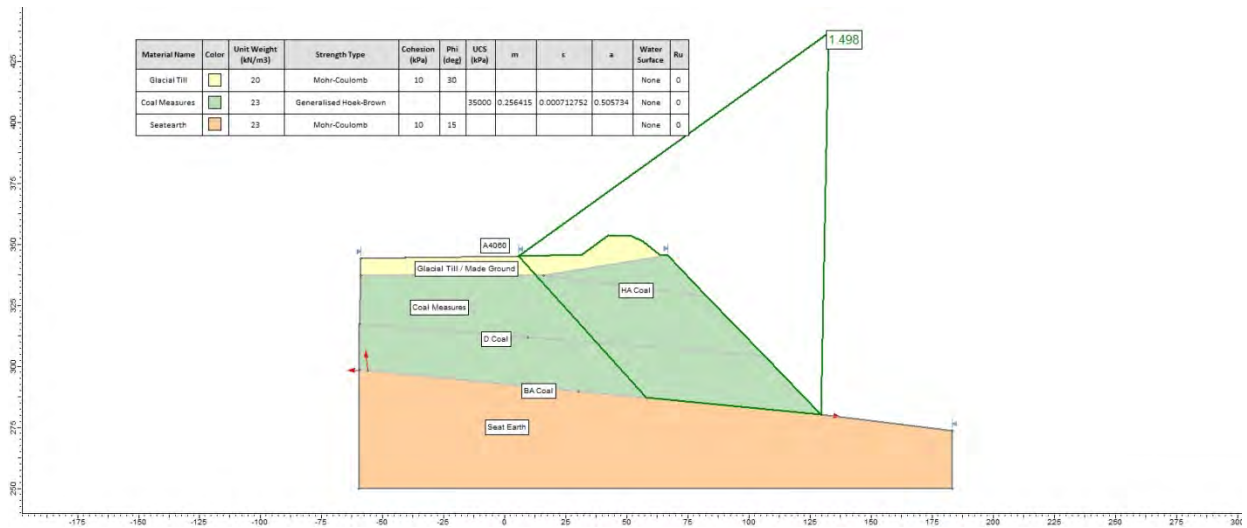
**Fig 10 - Section E, Cohesion in Coal Measures 150kPa
Factor of Safety = 1.31**



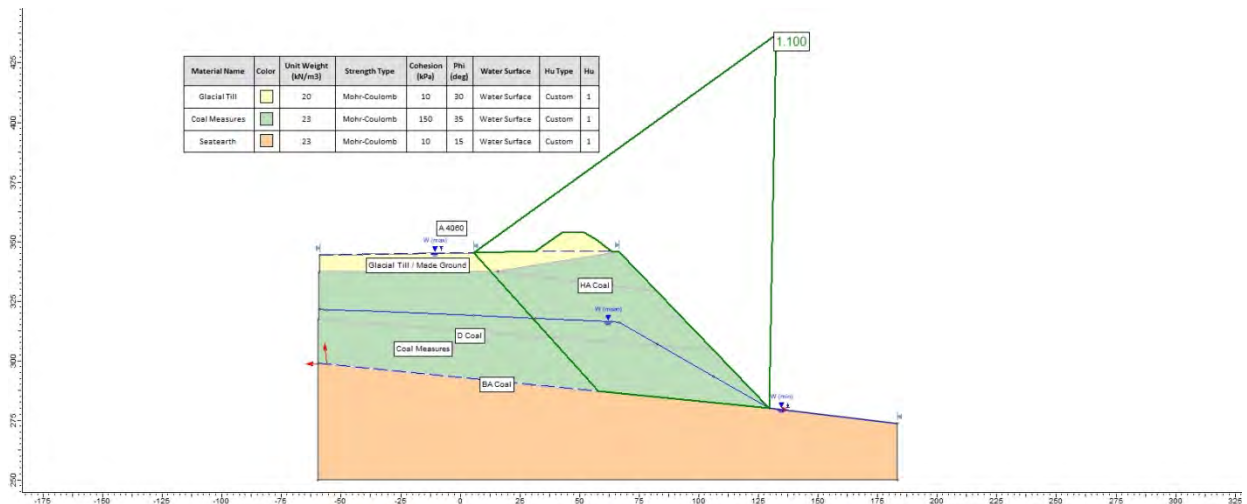
**Fig 11 - Section C, Hoek-Brown Parameters in Coal Measures
Factor of Safety = 1.49**



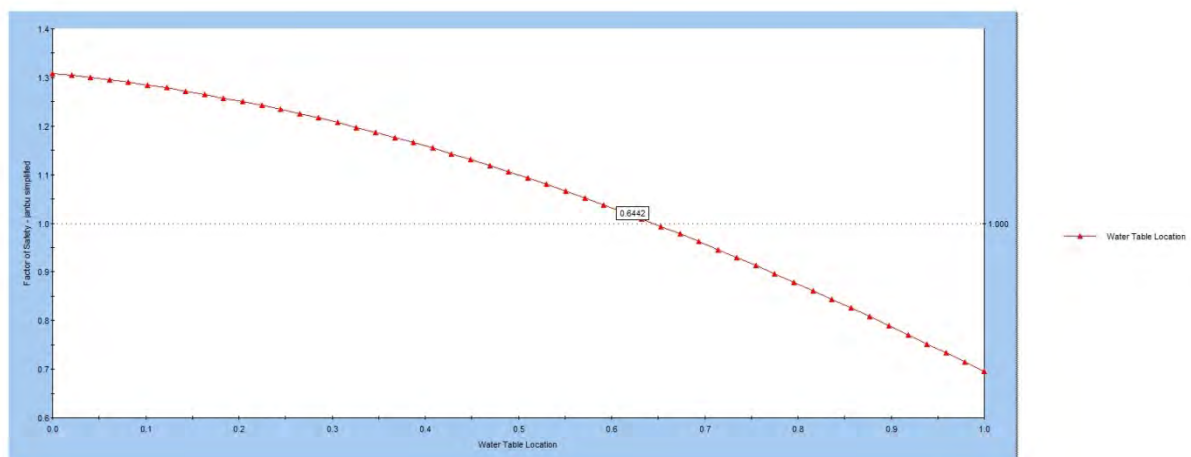
**Fig 12 - Section D, Hoek-Brown Parameters in Coal Measures
Factor of Safety = 1.69**



**Fig 13 - Section E, Hoek-Brown Parameters in Coal Measures
Factor of Safety = 1.50**



**Fig 14 - Section E, Cohesion 150kPa in Coal Measures, Variable Water Table
Factor of Safety = 1.10 (Average Level)**



**Fig 15 - Section E, Cohesion 150kPa in Coal Measures
Variation of Factor of Safety with Water Level**

Revision

Drawing No.



LEGEND

- Section Lines
- Site Boundary
- 1m Contour Lines

Rev	Description of revision	Auth	Chkd	App	Date

Merthyr (South Wales) Limited
Cwmbaroged Disposal Point
Fochriw Road
Merthyr Tydfil
South Wales
CF48 4AE
Tel: 01685 844381
Fax: 01685 845029

**FFOS-Y-FRAN LAND
RECLAMATION SCHEME**

TITLE
**EXTENSION SECTIONS
THROUGH BIFFA VOID**

CONSULTANT

Designed	Drawn	Checked
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CAD/Dos filename:

Scale 1:2,500	Size A1	Date 30/10/2025
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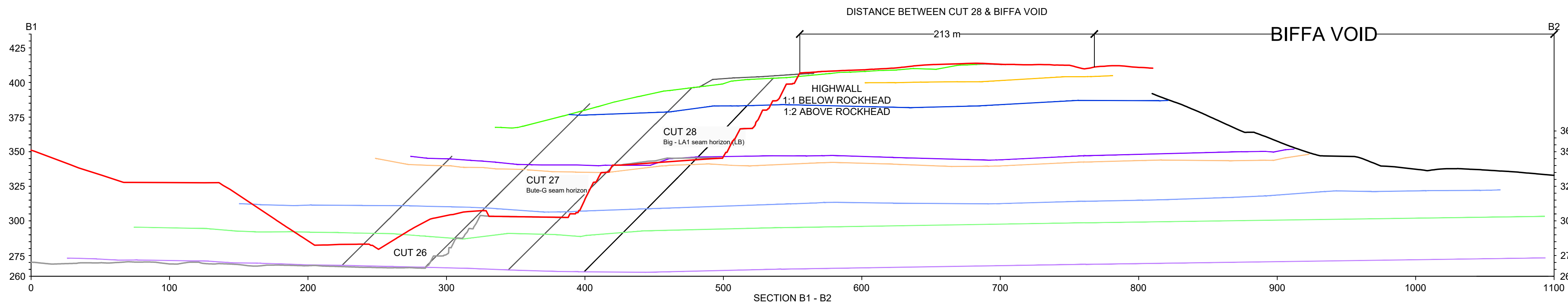
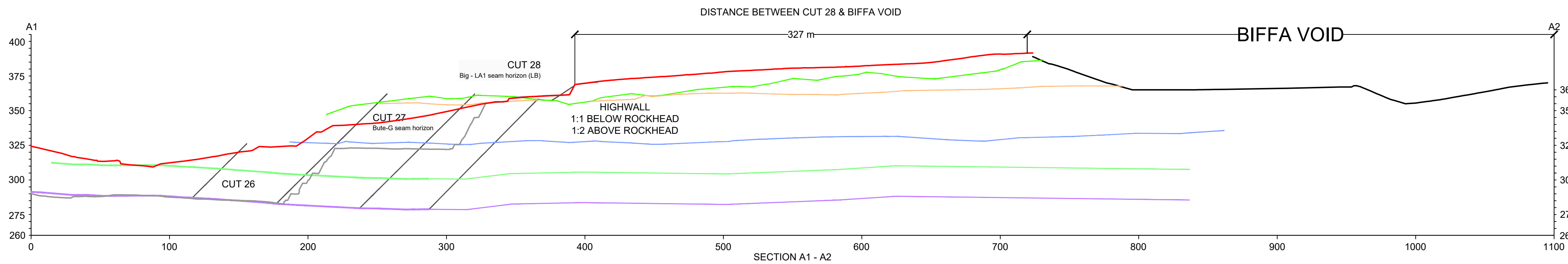
Drawing No.	Rev.	Contract Drawing No.
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Revision

Drawing No.



LEGEND

- Ffos Y Fran Profile As Existing
- Rockhead
- Biffa Void Profile
- Cut Lines
- Nov 2023 Measure Profile

Coal Seam Bases

- R Coal Base
- P Coal Base
- LA Coal base
- K Coal Base
- HA Coal Base
- D Coal base
- BA Coal base

Rev	Description of revision			Auth	Chkd App Date
Merthyr (South Wales) Limited Cwmbargeed Disposal Point Fochriw Road Merthyr Tydfil South Wales CF48 4AE Tel: 01685 844381 Fax: 01685 845029					
FFOS-Y-FRAN LAND RECLAMATION SCHEME					
TITLE Extension Sections Through BIFFA Void					
CONSULTANT					
Designed		Drawn		Checked	
CAD/Dos filename:					
Scale 1:2,000	Size A1	Date 30/10/2025			
Drawing No.		Rev.		Contract Drawing No.	
MERTHYR (SOUTH WALES) LTD					
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FFOS-Y-FRAN FINAL RESTORATION SCHEME - SECTION 73 APPLICATION
SUPPLEMENTARY ENVIRONMENTAL INFORMATION (SEI) APPENDICES



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