RICHARDS

MOOREHEAD & LAING LTD

SEIONT BRICKWORKS AND QUARRY

Waste Recovery Plan

for

JONES BROS RUTHIN CO LTD

Rev.2 MAY 2018

Permit Reference Number: PPN-00007

3030/11/EP

RICHARDS
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ENGINEERING, ENVIRONMENTAL and LANDSCAPE SPECIALISTS

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QUALITY ASSURANCE PROCEDURES: QP4

Prepared by:	Andrew Sumner	Date:	21st December 2016
Checked by:	David Richards	Date:	31st March 2017
Approved by:	Andrew Sumner	Date:	6th April 2017
Revised by	Shan Wyn Jones	Date	24th May 2018
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1 INTRODUCTION

1.1 Outline

1.1.1 This Waste Recovery Plan (WRP) is intended to accompany an application for a Bespoke Environmental Permit for the use of wastes for construction and land restoration purposes.

1.1.1 The application is submitted on behalf of Jones Bros. Ruthin (Civil Engineering) Co. Ltd.

1.1.2 The WRP has been prepared following guidance in the Environment Agency Guidance 'Waste Recovery Plans and Permits', published 18th October 2016; '*How to Apply for a waste recovery environmental permit to permanently deposit waste on land*' A checklist of how these 2016 requirements are addressed in this report is set out in Table 1.1.

Table 1.1: requirements of the 2016 Waste Recovery Plan guidance

Requirement	Discussed in sections:
Demonstration that a waste recovery operation is proposed	1.2, 1.3, 2.1 – 2.4, 3.2
Demonstration that if a waste is not available work would be done with non-waste.	3.2, 4.1 – 4.3, & 5.1
Financial gain by using non-waste materials: evidence	Not applicable
Funding to use non-waste: evidence	Not applicable
Obligations to do work: evidence: Specific and general obligations	4.1 – 4.3
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Waste acceptance procedure	7.1
Planning Permission	1.3

Abbreviations

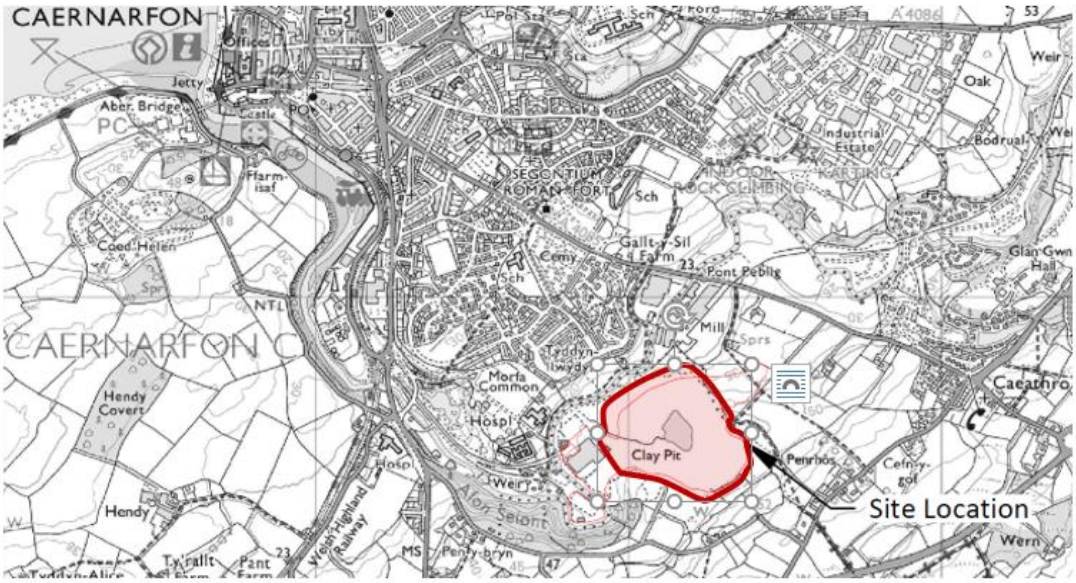
1.1.2 The following abbreviations are used for this WRP:

Term used	Explanation	Available with this report?
The 'extant' 2007 ROMP'.	This is a *'Review of Mineral's Permission'* issued on the 10 May 2007 for the site, by the former Mineral's Planning Authority, Gwynedd County Council, reference number C00A/0441/14/MW. This permission formalised working conditions as required by the Environment Act 1995 Review of Mineral Sites. Full details of the ROMP for the site is available on the Gwynedd Council Planning Portal. The site remains with this 'extant' ROMP and this means that the extraction of minerals can continue to take place on the site until 2042.	Copy of the permission document included in **Appendix A**.
The 2017 planning permission	Planning permission granted (under reference number C17/0011/19/MW) by Gwynedd Council, on behalf of the North Wales Minerals and Waste Services, for the site for engineering works and use of land relating to the construction of the recently approved proposed A487 Caernarfon to Bontnewydd Bypass and the extant ROMP. The permission includes the importation of residual 'waste' specific to the construction of the bypass. The site owner (Cambrian Quarries Ltd) submitted a planning application to Gwynedd County Council for an integrated programme of developments, which long-term site uses to remain once the bypass is completed: Full details of the 2017 permission for the site is available on the Gwynedd Council Planning Portal.	Copy of the permission document included in **Appendix B**, together with the relevant Planning Committee Report
Cambrian Quarries Ltd	A company part owned by Jones Bros (Civil Engineering) Co Ltd, Ruthin which is the landowner of the site.	
Cambrian Quarry	This is a quarry located at Gwernymynydd, Flintshire. Details approved for this site includes a recent permission	Copy of the permission document

	for the importation of insert waste for site restoration purposes.	included in **Appendix C**
Hanson's	Previous site owner and operator	
The site	This is the brick clay quarry and brickworks at Seiont Quarry and Bickworks on the southern outskirts of the town of Caernarfon, Gwynedd	
Proposed bypass	This relates to the Caernarvon to Bontnewydd proposal which has recently received approval following the outcome of a Local Public Inquiry.	
The LPA	The Local Planning Authority, represented in this case by Gwynedd Council.	

2.1.3 The site is the former brick clay quarry and brickworks (Seiont Brickworks) on the southern outskirts of the town of Caernarfon (see Figure 1.1). Restoration of the site is a requirement of the condition attached to the ROMP and to the 2017 planning permissions, as detailed in Section 1.2.1 of this document.

Figure 1.1 Site Location



1.2 Objective of the works requiring a permit

1.2.1 The permit is required to allow the use of inert wastes derived from the works for the approved A487 Caernarfon to Bontnewydd Bypass for the following purposes at the site:

1. Infill the hazardous deep, steep-sided, water-filled quarry sump.
2. Backfill the quarry void to provide support to alleviate instability identified in the existing quarry slopes.
3. Restoration of the finished landform with soil for vegetation to be established for future amenity and nature conservation use.

Definition of the recovery operation

1.2.3 The objectives of the site restoration (linked to the related planning permissions (see table in 1.1.2 of this report) are to:

a) prepare the site for new uses, as set out in Section 2.1 (as approved under the 2017 planning permission) by removing instability and deep water;

b) improving the visual amenity for local residents;

c) the ecological improvement of part of the site, through regrading and the establishment of vegetation for visual amenity and nature conservation.

A key part of preparing the site for *new use* is the re-engineering of the current quarry sump to remove the present deep water and its steeply-shelving profile.

As part of the extant 2007 ROMP for the site (Appendix A), mineral extraction reached an elevation of approximately 0.00m AOD in the floor of the quarry sump. Pumping from a sump in the floor of the quarry maintained a dry working area, but pumping ceased when mineral working was suspended by Hanson (the previous site owner and operator) in/around 2008. Presently there is a static depth of water of some 12m, which presents both a hazard to persons (visitors and workers) to this part of the site. Significantly, it serves as an attraction to unauthorised access for swimming. Experience at other quarries, where deaths have occurred, shows the attraction of water, particularly to young people. Securely fencing extensive quarries is not a reliable option and so re-engineering this quarry profile to remove the water attraction is essential.

1.2.4 The operation is therefore defined in accordance with Annex IIB of the Waste Framework Directive 2006/12/EC as a 'Recovery Operation R5 Recycling or reclamation of other inorganic materials'.

1.3 Current planning status

1.3.1 *The Review of Minerals Permission (ROMP)granted in 2007 (Appendix A)*

The site remains with an 'extant' ROMP for brick clay extraction. Condition 2 of this ROMP controls the mineral working process and requires that the site is restored. Below is an extract from the ROMP decision document:

> Unless otherwise required by planning condition or agreed in writing by the mineral planning authority the winning and working of the mineral, tipping operations and the restoration and aftercare of the site shall be carried out only in accordance with the application ref. no. C00A/0441/14/MW, accompanying statement and the Ecological Species Survey dated December 2002, and more particularly;
> - Plans C 22/6A, C 22/6B, C 22/6C, C 22/6D, C 22/6E, and C 22/6F [Phases]
> - Figures 06a, 06b and 06c [Sections], Figure 07 [interim restoration], Figure 08 [Conceptual Restoration] and Figure 09 [stream diversion]
> - Plan No. 01307 /001 [Proposed Stockpile Base] dated 14 /09/01.

1.3.2 In *2017 a new planning permission was issued for engineering works and use of land relating to the construction of the proposed A487 Caernarfon Bontnewydd Bypass and the existing minerals permission (LPA code reference* C17/0011/19/MW)

The new site owner ~~and operator~~ (Cambrian Quarries Ltd) submitted a planning application to Gwynedd County Council in 2017 for an integrated programme of developments, which include engineering works, connected with the construction of the recently approved A487 bypass and long-term site uses to remain once the bypass is completed.

RML submitted the details which accompanied the '2017 planning permission' and the proposal successfully presented to the Gwynedd Planning Committee. A copy of the Planning Committee report is also included in **Appendix B.** The committee report sets out the context of the proposal in detail and provides a review of relevant planning matters. As part of its reference to the relevant material planning considerations, the Planning Committee report sets out the national and local planning policy approach and technical context for waste minimisation and recovery processes and the extent that the proposal successfully deals with these matters.

The 2017 planning permission includes specific conditions which control and limit the works conditional on the proposed bypass achieving permission and construction. Following a Local Public Inquiry, a final decision on the proposed Caernarvon bypass has recently been issued (May 2018).

1.3.3 The temporary site works consist of:

- Creating haul routes to serve the propose A487 bypass construction;
- Further mineral extraction (within the extant ROMP) for material for the bypass construction;
- processing material excavated from the bypass, to make specific engineering aggregates and concrete aggregates for use in the bypass;

- Processing construction and demolition materials arising from the works, for recycling and to generate restoration material for the site, until final restoration can be completed.
- removing existing instability of the site quarry faces, recognised in geotechnical reports and anecdotally in geological observations, by placing recovered construction and demolition materials to create shallower gradients;

1.4 Appropriate technical expertise

Ecology and landscape expertise

1.4.1 This document has been prepared by the staff of Richards, Moorehead & Laing Ltd who are professionally qualified.

The ecological benefit statement has been prepared by **Andrew Sumner BA (Hons), DipLA(Glos)CMLI[1], Landscape Architect**, who has experience in the field of land reclamation, ecology and landscape design in North Wales for over 36 years.

Specialist support has been provided by **Stephen Blunt BSc (Hons), MSc, CMLI, Landscape Manager,** who is experienced in the field of land reclamation, waste management, soil handling, slope stability, vegetation management and ecology. The Ecology Benefit Statement is provided in Section 7.4.

Both of the above specialists were previously involved in preparation of the planning application for the 2017 permission.

Geotechnical expertise

1.4.2 The geotechnical specification for the recovery of wastes comprising unacceptable soil materials has been prepared by **Huw Littler-Jones B.Sc, M.Sc a geotechnical engineer with e-Geo Solutions Ltd** and with over 30 years' experience in ground engineering, site remediation and land reclamation. E-Geo Solutions Ltd have undertaken geotechnical investigations within and adjacent to the Seiont Quarry and Brickworks for the 2017 planning permission and for preconstruction design purposes and have an understanding of the ground conditions and properties in the area. The Geotechnical report, '*Borrow Pit Area at the Former Seiont Brickworks and Quarry, Caernarfon, Gwynedd– Geological Ground Investigation Report*' e-geo Solutions Feb 2016 (ref E0756.GGI.R1) is to be found in Appendix D and is included in the full Environmental Permit Application documents digitally and hard copy.

[1] CMLI Chartered Member of the Landscape Institute

2 RESTORATION PROPOSALS

2.1 Proposed permanent land uses

2.1.1 The permanent land uses proposed at the site are:

- Agricultural grazing;
- Nature conservation;
- Landscape re-integration in the form of woodland planting;
- Grassland and scrub vegetation to protect steep slopes against erosion and weathering;
- Maintenance access (tracks, footpaths etc) on reasonable gradients;
- Series of shallow linear waterbodies with marginal vegetation, which were put forward as a suitable contribution to manage surface water run-off from the site;
- Marginal vegetation to maintain water quality.

Drawings: plans

2.1.2 The quarry restoration will follow a period of mineral extraction. Whilst an extant ROMP remains in place. The final, proposed new restoration scheme is subject to the more recent, 2017 planning permission.. The new restoration scheme is shown in Figure 7.1 to 7.4 later in this document. The full planning set of approved 2017 plans is included in Appendix E. These demonstrate how the quarry void will be made larger than is currently the case and then restored with the recovered construction waste.

2.1.4 The site Restoration Plan approved as part of the 2017 permission is shown in Drawing 3030/16. This shows the proposed uses of the restored land. Extracts from these drawings, with additional annotation, are in Figures 7.1-7.4.

Drawings: cross sections

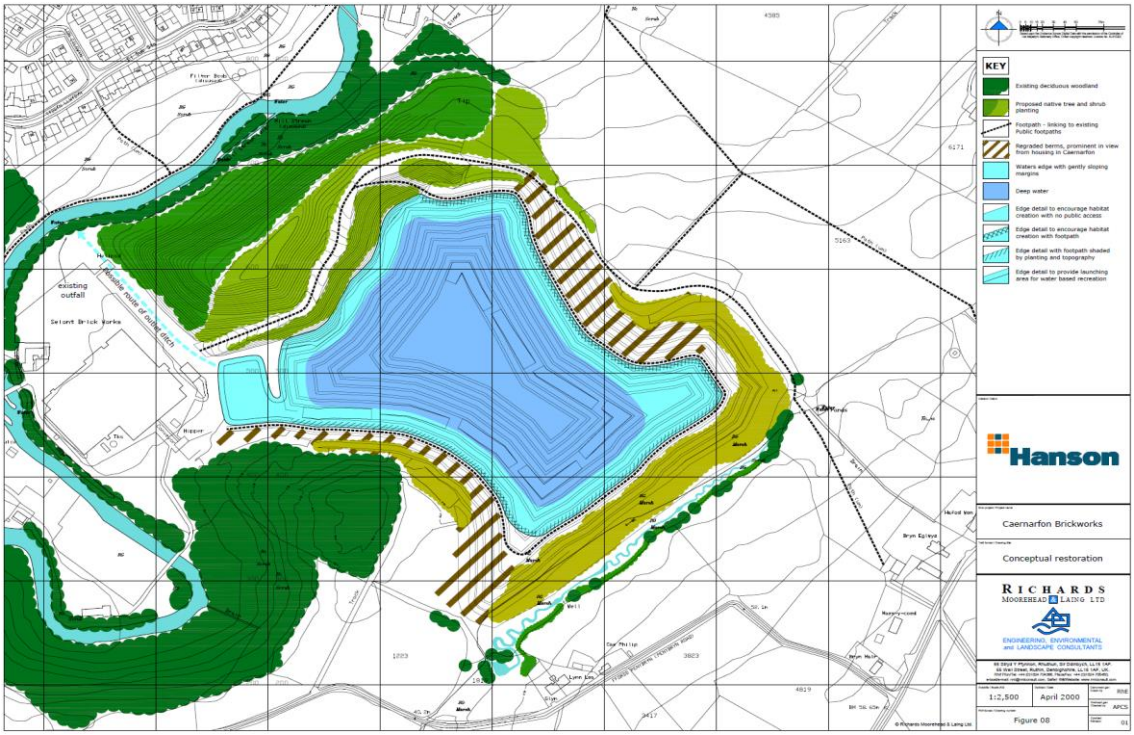
2.1.5 Cross sections through the quarry, before restoration are shown in Drawings 3030/17A and after restoration, in 3030/17B.

Summary description of the overall scheme for the quarry

2.1.6 During the continued mineral extraction at the quarry, temporary haul roads would be constructed to link the floor and sides of the quarry and former brickworks to the proposed bypass construction site. The routes would carry construction plant as well as empty and laden bulk haulage vehicles for the duration of the bypass construction contract. Construction would include reforming the existing quarry slopes to provide a stable road surface and safe width and alignment. The haul routes would remain is use

until construction is completed. Parts would remain for permanent use, for access and maintenance access, as shown in Figure 2.1 shows the 2007 ROMP approved restoration scheme which is supplemented by the 2017 Restoration scheme which is shown in Figures 7.2 to 7.4.

Figure 2.1: The Conceptual Restoration Scheme (drawing dated 2000) agreed under the 2007 ROMP Permission. Quarrying under the permission was planned to be complete by 2042 with the steep benched slopes and large quarry pool.



2.2 Boundary of proposed working and restoration

2.2.1 The 2017 permission include further mineral working within the permitted area, to provide up to 400,000m^3 of useful material for the bypass construction. The result of the proposed extraction is shown in Drawing 3030/13B.

2.2.2 The 2007 ROMP envisaged the restoration of the slopes of the quarry using the original overburden from the site, because this material was not suitable for brick-making. Much of the overburden was placed in a large screening mound on the north side of the site, completed around the year 2000, to provide a visual and acoustic barrier. This mound is now under established tree plantations which contribute to the screening of the quarry. The remaining overburden contains a range of materials that have a commercial value and will be used in construction of the bypass, so a revised restoration scheme that does not use overburden is needed for the permitted working area.

2.2.3 The site's previous owner (Hanson) long-term quarrying plans included the removal of further material, deepening the void to around 30 metres below OD, and extension of the overall area to be quarried into fields to the south-east and south of the current void. Whilst the extension would have increased the quantities of overburden available for use in restoration, it would also have resulted in much steeper side slopes and a deeper and larger pool in the sump. As mentioned earlier in the report, the 2007 ROMP allows extraction for the site to continue until 2042, a further 26 years.

2.2.4 Closure of the on site brickworks, before all the additional extraction was completed, has meant that no further overburden has been made available and the water-filled sump has not been finished, which formed part of the 2007 ROMP.

The following sections (2.3 and 2.4) provide a summary of the current difficulties of instability and deep water within the quarry, while Section 3 explains why imported material is needed.

2.3 The flooded quarry sump

2.3.1 The quarry is deep void in the side of Pen y bryn Hill with sides that drop steeply into the flooded sump. This 2.12-hectare waterbody in the sump is over 12 metres deep with steeply shelving banks formed by the flooded benches. This waterbody formed in a few years after pumping ceased (around 2008)

The waterbody is considered to be a hazard with steep slopes descending to the edge of the water and a shelving shoreline. While there is no formal public access to the quarry, it is clear that members of the public, including unsupervised children, do visit the site. The Applicant is concerned about the health and safety risks associated with the waterbody and proposes to infill the sump. Further detail about this is set out in Section 4.

2.4 Current instability in quarry faces

2.4.1 The quarry and the land associated with it has a history of instability, first noted in the 1980s and still present today.

In the year 2000, during the preparation of the ROMP submission, two areas of instability were noted on opposing sides of the quarry, in the north east and south west faces.

2.4.2 Further excavation (in accordance with the 2007 ROMP) will permanently steepen the slopes of the quarry risking further instability.

Excavation of the unstable slopes can be made good by placing imported fill at more gentle slopes against the unstable faces. This approach was granted planning permission at Cambrian Quarry, in Gwernymynydd, Flintshire[2].

A copy of the LPA'S January 2014 Planning Committee report conclusion for the Gwernymyndd Quarry restoration with the importation of inert waste material is quoted below:

> **8.00 CONCLUSION**
>
> 8.01 The proposal involves the importation of inert waste material to be used in the restoration of Cambrian Quarry to ensure that the quarry faces are safe and a stable landform is created. The applicant has demonstrated that the site needs to be restored to for stabilisation and for landscape reasons with the minimum amount of material necessary for an acceptable landform which is in line with national policy. The restoration would be ensuring a beneficial use of waste material that cannot be recycled and reused elsewhere. Re-usable inert material that could be used offsite would be exported to be used as a resource elsewhere. This is supported by the waste hierarchy, the national waste strategy and national landfill diversion targets. Whilst landfilling of inert waste material is generally unacceptable, the applicant has demonstrated exceptional circumstances and it is considered to be acceptable at this site to ensure that the quarry faces are stabilised and that an acceptable landform is achieved with the minimum amount of material. Furthermore, national policy recognises that there will still be some need for landfill capacity for inert construction and demolition waste in which the region is currently lacking. As the Welsh Government targets to require more recycling increase, suitable sites will be required. It is accepted that quarry sites are appropriate locations for waste management activities and subject to compliance with the other policies in the development plan should be approved.

Details of restoration for the site are set out in Section 4.2.

[2] http://committeemeetings.flintshire.gov.uk/documents/g2987/Public%20reports%20pack%2015th-Jan-2014%2013.00%20Planning%20Development%20Control%20Committee.pdf?T=10&LLL=0 and Appendix C of this WRP

3 NEED FOR IMPORTED MATERIALS

3.1 Materials balance

Continued extraction from the quarry

3.1.1 The quarry currently contains large reserves of unquarried brick clay, stockpiles of clay that were extracted for the purpose of brickmaking, together with stockpiles of bricks. The southern slope of the previously stacked overburden also contains hard materials in the form of boulders, gravel and sand. The raw clay will provide construction fill and the stockpiles of bricks are suitable, or can be processed to become suitable, for specific construction uses on the proposed bypass.

3.1.2 The proposed bypass has been designed to achieve the optimum cut and fill balance, with excavated rock and soils from cuttings used to form embankments. Whilst a large quantity of construction materials will be generated within the bypass construction site, these will not meet the full requirement of the scheme and more material will need to be imported. Furthermore, some excavated material will be unacceptable for use as fill.

3.1.3 Extracting additional material from the quarry will generate brick clay and better-quality overburden for construction use, together with subsoil and a small volume of topsoil; the latter would be retained for use in the restoration of the quarry. Some of the extracted brick clay is suitable for the construction of internal haul roads and the mineral processing area.

3.1.4 Under the current ROMP 2007 permission for the quarry, Hanson were to extend quarrying (refer to paragraph 2.2.2) over a wider area of unquarried land to the south and east and removing the high ground to the south east. The new, current owners and operators have considered the option to extend the quarry south and eastwards and so remove the slope instability by reducing slope gradients but have discounted it because a large area of field, a hedgerow and the top of Pen-y-Bryn Hill would be destroyed, with all the associated landscape and ecological impacts this would cause. The operator's preferred alternative is to continue extraction by deepening and steepening the existing quarry, within the existing limits. A small lateral extension into an adjacent field is required to form a cutting for a haul road to the adjacent bypass.

3.1.5 On completion of any extraction, the operators plan to import waste to be recovered for engineering purposes. The details of this are provided in Section 4. The plan in Figure 7.1 and cross section in Figure 7.3 show the quarry when extraction is complete under the 2017 permission.

3.2 Uses of imported material

3.2.1 The requirement for imported materials to the site is generated by the following works which form part of the proposed restoration of the site but cannot be achieved using site-won material only:

- Filling the base of the quarry to a new level to remove the flooded sump, for safety and management;
- Placing material against the steepest quarry faces to provide support and to generate easier gradients for restoration.
- Regulating the 'slope and bench' quarry faces to assist in access and reduce visual intrusion.
- Providing a suitable depth of rooting medium for all planted and seeded restoration areas, including those for nature conservation and agricultural grazing.

3.2.2 The site restoration plan approved in connection with the new, 2017 planning permission(shown in Figures 7.2 and cross section in Figure 7.4) has been designed with slopes suitable for safe machine working to allow maintenance and access. Guidance has been taken from CIRIA publication C708 (pub 2007) regarding safe maintenance of slopes and pedestrian access, and from *BT Countryside for All* published by BT and Fieldfare Trust.

3.2.3 Preliminary calculations indicate that filling and re-engineering the quarry pool to the levels proposed in the application, and reshaping other parts of the site to achieve the 2017 approved restoration scheme, requires that a shortfall of some 260,000m^3 of material will have to be made up with imported waste for recovery. The volume necessary to achieve the project objectives should come from construction of the A487 Caernarfon to Bontnewydd bypass, which will pass through the perimeter of the existing quarry.

3.2.4 The weight of imported material required will depend on the composition (sands, clay, etc) and moisture content of each load, the volume of stone and aggregate that can be recycled in construction, and the degree of compaction needed to ensure a stable landform. Assuming an average finished in-situ dry density of 1.3 - 1.5 t/m^3 the weight imported would be between 338,000 t (260,000 m^3 at 1.3 t/m^3) and 390,000 t (260,000 m^3 at 1.5 t/m^3).

4 THE WASTE RECOVERY EVIDENCE: '*OBLIGATIONS TO DO THE WORK*'

4.1 The Obligations:

1 to restore the quarry with a naturalistic landform (see Section 4.2);
2 the stabilise the slopes of the quarry (see Section 4.3);
3 to infill the quarry sump to remove deep water (see Section 4.4).

4.1.1 All of these obligations can be fulfilled by waste recovery with a positive purpose. By using inert waste, the quarry operator will avoid the need for extensive quarrying of virgin restoration materials by extending the existing quarry or opening a new quarry.

4.2 Existing restoration planning conditions

4.2.1 Under the extant 2007 ROMP permission some restoration conditions remain to be implemented and would not be completed for many years, as extraction of clay is permitted until 2042. By that stage, the quarry would be considerable larger in extent, deeper, and with consistently steep sides and a larger, deeper flooded quarry sump. Hanson's (the quarry owner and operator at the time), who obtained the 2007 ROMP intended a scheme of restoration of the quarry benches using suitable site-won topsoil and suitable overburden. The details included permanent 9-hectare recreational lake with a depth of over 30 metres. This is considerable more than the 2017 planning permission (which relates to this WRP) which is 2.12 hectare, 13-metre deep, flooded sump.

4.2.2 Several conditions attached to the 2007 ROMP intended to control restoration and to ensure that, for example, the restored quarry integrated with the surrounding landscape.

Several planning conditions relevant for waste disposal and recovery are attached to the extant ROMP permission. These are:

Waste disposal:

(5) *Tipping operations generally shall be directed towards the production of final land forms Indicated on the submitted plans and shall more specifically be undertaken so as to avoid conical tip forms, horizontal or straight tip profile or regular or horizontal benches;*

(6) *Only mineral waste derived from operations hereby permitted shall be deposited within the site. Except for soils, subsoils or other plant growing media, which shall not be imported without the prior written consent of the mineral planning authority, no refuse or waste materials of any description from within or outside the site shall be disposed of or deposited therein;*

> ***(10)*** *Notwithstanding the 'Conceptual Restoration' plan [Figure 08] approved under condition 2 of this permission, not less than 3 years before any part of the final quarry face is developed, detailed plans shall be submitted for the approval of the mineral planning authority indicating the design and treatment thereof. The final landform shall be designed and constructed to reflect the natural landforms of the surrounding area and shall have regard to the geological & geomorphological integrity of the designated RIGS site.*

4.2.3 The following paragraphs explain why these ROMP planning conditions cannot be fulfilled in the current circumstances.

A shortage of restoration materials

4.2.4 The safe method of quarrying is to excavate benches (steps) so that plant and personnel can traverse slopes in safely.

The quarry currently has benches around the southern slopes. Any further working under the extant ROMP will require these benches to be extended to all areas that are to be worked. The resulting unnatural stepped landform will not be in compliance with Condition 10, which requires the final landform to be designed to reflect natural landforms in the surrounding area. Forming natural-looking landforms will require the placing of soils on the benches to cover the angular slope profiles. Due to instability of some slopes further infilling is required (see Section 4.2).

4.2.5 Overburden and topsoil reserves available for restoration at the time of the determination of the ROMP planning application were subsequently used to form a large screen bund adjacent to the River Seiont. The north slope of the bund, which formed part of an agreed interim mitigation scheme, was planted with native woodland species to form a permanent landscape feature. The quarry operator had planned to make up the shortfall by storing overburden and topsoil arising from the planned lateral quarry extension so that they could be used in final restoration. The lateral extensions of the quarry were never implemented and are no longer considered appropriate. As a consequence, very little restoration material is stockpiled for use within the quarry.

4.2.6 The 2017 planning permission for the site will resume mineral extraction under the extant 2007 ROMP, for use in the proposed bypass construction. This includes clay, gravels and other materials from the existing slopes of the quarry, to be taken with no significant further lateral extension. As a consequence, no new restoration materials will become available during extraction and there will be inadequate material to satisfy ROMP Conditions (5) and (6). If the quarry were extended laterally, to provide more restoration materials, the environmental impact of the scheme would be considerable greater as a consequence of removing the crest of Pen y Bryn Hill to the south east.

Considerations for raw clay as a restoration material

4.2.7 An alternative source of restoration materials would be to use the existing exposed clay surface as surface soil. There are two main reasons why this is considered not appropriate:

1 *Steep benches are a hazard*: once extraction is completed the quarry will have steep sides, which will be considerable steeper than the existing benched slopes. Each bench consists of a narrow terrace with a near-vertical slope of 3 or more metres height down to the next terrace. The terraces invite public access, permitted or otherwise. Restoring the existing surface by removing the benches would result in a continuous steep gradient which would also be hazardous. Reducing the gradient of the slopes would reduce that hazard.

2 *Poor establishment of vegetation:* experience shows that the raw clay provides a harsh substrate that does not support good vegetation growth. Observations of the exposed raw clay in the benches over a number of years have shown that vegetation is very slow to establish. Flat slopes of the benches become saturated and puddled in wet conditions and arid in dry conditions. The near-vertical slopes of the benches shed water freely and provide few opportunities for seeds to rest and germinate or for roots to penetrate. Without vegetation cover the exposed slopes are suffering from surface water erosion with scouring evident. These adverse conditions are less severe where loose, weathered material has gathered from slumping of the quarry slope. In these circumstances the regeneration of vegetation is better.

3 Lessons to be learned from the slow process of natural regeneration are:

- The successfully vegetated surfaces of the wooded bund have been prepared using topsoil and selected overburden;
- In the decade since 2006, the extent of vegetation on the quarry slopes has not extended from the old quarried surfaces to the fresh cut benches of the post ROMP planning permission (2007);
- Extracted and processed clay was last excavated in 2008, just before the quarry was closed, and has remained in stockpiles since then. In 8 years, virtually no vegetation has become established, despite the clay being weathered;
- Where suitable material has been placed on the surface of restored areas some thin vegetation has become established;
- Photographs of the quarry taken in 2015 show that some poor quality herbaceous growth, mainly of pioneering annuals, has become established on

accumulated weathered clay that has been washed to the foot of the benches. This has taken around 10 years to develop.

4.2.8 Natural regeneration of vegetation is often considered a desirable means of restoring quarry slopes. Where the mineral is either hard or granular and free draining natural regeneration will occur with some speed, but the raw clay at Seiont Quarry has not developed any vegetation cover in 10 years and so additional material to provide a suitable surface for rooting is essential to achieve restoration and soil stability in a reasonable timescale. Imported soils are required to make up for the limited soil-forming material available on site.

Figure 4.1: 10-year-old benches in the south face of the quarry. The foreground vegetation is a mix of annual and perennial herbaceous plants growing on bare, weathered overburden, while growth on the benches (left) only occurs in accumulated wash-off from the steep slopes. The background slopes to the right have been formed without benches and are developing woodland cover on very old weathered clay and overburden. The trees on the upper quarry slopes are on overburdens that have been exposed to weathering for in excess of 16 years.

In accordance with ROMP Condition (6), consent to import restoration materials was submitted to the North Wales Minerals and Waste Planning Service in 2017, as part of a new planning permission for the site. The 2017 planning permission provides confirmation and support forthe importation of waste to take place at the site as part of the final restoration programme.

4.2.9 Restoration would require the regular and angular form of the benches to be broken down and the placing of restoration materials to sufficient depth to soften the unnatural landform and to provide rooting depth. Achieving a naturalistic landform will require the

import of large volumes of suitable restoration materials. Moreover, the depth of restoration materials is subsumed within the obligation to stabilise the quarry slopes.

Restoration of the quarry benches

4.2.10 The formation of benches within the more recently excavated areas has left an unnatural landform that would not meet Condition 10, of the 2007 ROMP which requires that:

> *'The final landform shall be designed and constructed to reflect the natural landforms of the surrounding area ……..'*

4.3 Stabilising the slopes of the quarry

4.3.1 Evidence of instability today is visible on the surface across the east and north east side of the quarry (see Figure 4.2). Anecdotal evidence is available that the instability was recognised and reported to the mineral planning authority as part of the 2000 'Review of Old Planning Permissions' (ROMP) submission for the site[3]. The geological study of the quarry (carried out by Geoplan Ltd), also raised concerns about groundwater and ground conditions on the same slopes. Dr Ken Addison[4], a geologist with the RIGS Group, has reported being on site and observing a landslip occur. He explained that these events seemed to occur when quarrying exposed lenses of liquefying clay in the excavated face which become more mobile in wet conditions, this process is known as liquefaction.

Figure 4.2: Tension crack on the eastern slopes of the quarry

Taken in February 2016, this photograph illustrates the tension cracking which results from movement of unstable material. These cracks are now serving as cut-off drains collecting surface water. This water is able to percolate deeper into the slope.

4.3.2 As a result of the Geoplan study in 2000, proposals were incorporated in the quarrying proposals, and subsequently into the current planning permission[5], to remove a substantial volume of overburden and brick clay from the steep eastern slopes. This was to be implemented as the phases progressed and as the benches become available[6] and

[3] Richards, Moorehead & Laing Ltd landscape and ecological advisors to Hanson 2000.

[4] Email communication from Dr Ken Addison of St Peter's College Oxford, and Stewart Campbell of NRW to Andrew Sumner of RML; dated February 2016

[5] Planning Application Ref. Nº. C00A/0441/14/MW, awarded 2007.

[6] Interim Restoration Proposals (April 2000)

included removal of part of the remaining high point of Pen-y-Bryn and regularising the broken eastern face to form contoured benches.

4.3.3 A further geotechnical study of the quarry in 2015 confirmed that the problems with slope stability are still present. A Geotechnical specialist undertook a visual inspection of the land and quarry slopes and observed signs of instability in 2015. These included significant evidence of recent and ongoing slope instability with slumped soils, tension cracks, slips and scarp faces extending down the slope (see Figure 4.2). The area of instability appears to extend across a face of approximately 160 metres on the northeast side of the quarry bowl. Further evidence is set out in the geotechnical report[7], included in Appendix A. The report concludes that, *'there is a high risk of landslides associated with the former clay pit and quarry immediately to the south of the area of investigation'.*

4.3.4 Further evidence of the problem of instability associated with the area around the quarry was highlighted in the recent Inspector's Report for the A487 Caernarfon to Bontnewydd Bypass. He responded to an Objection (OB67) raised by Mr J.R. and Mrs H. Jones of Rhyddallt Bach[8], located due south of the quarry and beside Pen-y-Bryn Road:

> 9.51 The particular concern raised over ground stability is understandable given the movement of land that the Jones' have observed on that part of the holding which lies close to Caernarfon Quarry and the structural instability which led to the recent demolition of their farm outbuilding. However, I am satisfied that this is a matter that has been considered by technical specialists in designing the route of the Scheme and would be further analysed in the detailed design work. The other concerns raised are matters of accommodation works to be negotiated at the appropriate time [6.15, 7.14].

4.3.5 To maximise the value of the mineral available within the existing quarry, extraction will continue by steepening the sides of the void and removing the unstable mass that forms the eastern slope. Much of this is clay, but there is some overburden, both of which are considered to be minerals of value in the construction of the bypass. Imported waste will be recovered as engineering materials to be placed against the final benches to form shallower stable slopes.

The restored stable slopes will be formed at gradients of between 1 in 3 and 1 in 5, which are considered safe for access by mowers and some agricultural equipment and also accessible by pedestrians and grazing animals (see Figure 4.3).

4.3.6 Geotechnical assessments of the materials around the quarry and along the bypass route have been made, with the objective of determining suitable restored gradients for

[7] Geological Ground Investigation Report February 2016; e-gio Solutions; rpt ref E0756.GGI.R1

[8] Report: APP/Q6810/17/516226, page 108, response to Objection from paragraph 9.49 to 9.51. Copies of all LPI Inspectors Reports can be found at https://www.gov.uk/appeal-planning-inspectorate

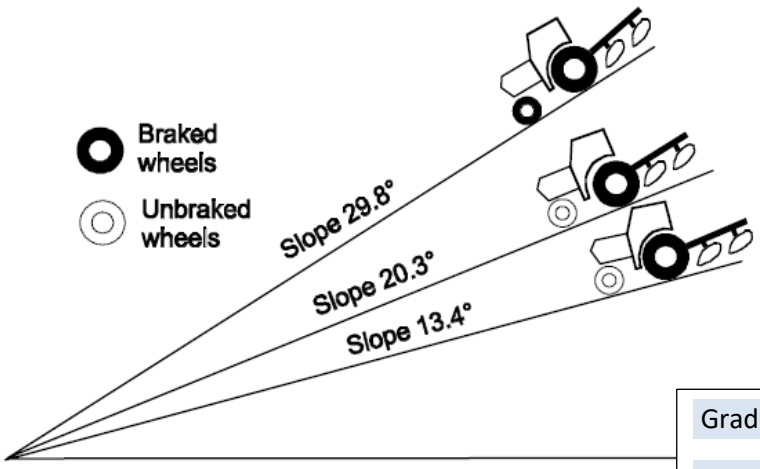
engineered slopes. Boreholes show that the bypass excavation will require excavation of Glacial Till and Glaciofluvial deposits of varying characteristics from soft to stiff including sandy gravel, gravel, gravelly clay and sandy silts. These materials are suitable for use in embankments with sides slopes of 1:2. The majority of these 'wastes' derived from these excavations will be seasonally wet soils that cannot be adequately engineered within the time available under the bypass construction programme, for use in forming stable, settlement-free highway embankments.

4.3.7 While saturated soils are not adequate to form stable road embankments with 1:2 slopes, they can be engineered by tipping and compacting to form 1:3 to 1:5 gradients, where a degree of settlement is allowable. The bypass will also provide a substantial, volume of surplus topsoil, which will be a valuable resource for restoration.

Tractor	*Maximum safe slope (degrees)* [3]	*Mean safe slope (degrees)*	*Minimum safe slope (degrees)* [4]	*Tractor and plough weight (tonnes)*	*Axle load ratio*
Small 2-wheel drive	20	16	13	2.45	22/78
Medium 2-wheel drive	19	17	14	3.09	22/78
Medium 4-wheel drive 1	19	17	17	4.16	27/73
Medium 4-wheel drive 2	30	25	20	4.16	27/73

[1] Front wheel drive disengaged
[2] Front wheel drive engaged
[3] Good site conditions
[4] Poor site conditions

Source: N.J. Coppin I.G. Richards (2007) Use of vegetation in civil engineering, C708, CIRIA, London (ISBN: 978-0-86017-711-1). www.ciria.org



Gradient conversion

29.8° = 1:1.8 = 60%

20.3° = 1:2.6 = 37%

13.4° = 1:4 = 24%

Figure 4.3: safe working on slopes for two-wheeled drive and four-wheeled drive tractors with an implement attached (Box 4.13 after SCAE, 1979)

4.4 Making safe the flooded quarry sump

4.4.1 The quarry is deep void in the side of Pen y bryn Hill with sides that drop steeply into the flooded sump, which is now a pool of deep water with steeply shelving margins which presents a hazard to people who venture into the cold water or fall in accidentally. The 2.12-hectare body of water is over 12 metres deep with steeply shelving banks formed by the flooded benches. The waterbody has formed since pumping ceased around 2008. While there is no formal public access to the quarry, it is clear that the members of the

public, including unsupervised children, do visit the site. The Applicant wishes to address the health and safety risks associated with the waterbody and proposes to infill the sump.

Figure 4.4: the flooded sump around 12 metres deep with steeply-shelving sides

4.4.2 Deep water in quarries in North Wales is recognised as an attraction to swimmers, divers and fishermen. Sadly, there have been a number of deaths in recent years in quarry pools. While access can be restricted in a working quarry, it cannot be prevented in an inactive quarry with extensive boundaries.

4.4.3 The proposed continuation of extraction of clay will deepen the sump around the fringes resulting in deeper water at the shoreline. The proposed scheme of filling at the site will remove the hazard of waterbody making the site less dangerous than would be the case with the permitted Hanson Conceptual Restoration which retained the quarry benches.

4.4.4 In January 2017 Cambrian Quarries completed the purchase of the property from Hanson and so are responsible for the waterbody and for public safety. It is considered that the opportunity to fill the sump, displace the waterbody and form dry land and shallow quarry slopes is a responsible solution that will result in a better, safer restoration scheme.

4.4.5 The sump would be filled with the recovered waste. The material will be compacted as it is placed to improve stability. Water driven from the material will flow into the quarry silt lagoons in the base of the sump. As filling progresses the silt lagoons will be reformed in the new floor. The final layers of material will be placed to a gentle crossfall without heavy compaction so that the finished surface of topsoil or soil-making materials will drain westwards.

5 THE WASTE SUBSTITUTION TEST

5.1 The requirement for fill for quarry restoration

5.1.1 The site is capable of receiving up to 400,000m3 of material (600,000 tonnes).

As detailed in the accompanying 2017 planning permission for the site, the applicant has undertaken an examination of alternative sources of the above fill including materials from local quarries:

- limestone or granite aggregate;
- sands and gravels;
- slate or slate waste;
- excavation of clay;
- Purchased topsoil.

5.1.2 Alongside the opportunities to purchase these materials from suppliers, the options to extend the existing quarry, or open a new quarry specifically for the purpose of providing restoration materials were considered.

Significantly, for both of these options the environmental impacts were considered substantially greater than using recovered waste.

If the existing quarry were extended laterally, to provide overburden and soils, the top of Pen-y-bryn Hill would be removed and a minor watercourse would be adversely affected. Opening a new quarry would merely fill a void while creating another. Using costly and high-quality materials from other quarries would be wasteful of primary aggregates. Based on this, the substitution of virgin minerals as restoration materials with suitable recovery of wastes would be preferable.

5.1.3 The alternative sources of material for restoration of the quarry have been considered and are set out in Table 5.1.

5.1.4 On the basis of the obligations set out previously in Section 4, the recovery of waste in accordance with the new October 2016 EA guidelines, is considered appropriate.

Table 5.1: consideration of alternative sources of restoration materials

Alternative sources of fill considered	Reasons for using / not using									Balance
	Viability				Fulfilling obligations					
Key XX Major negative reason (-2) X Negative reason (-1) Y/X Neither negative or positive reason (+1 &-1=0) Y Positive reason YY Major positive reason	Cost of purchase	Haulage cost/distance	Sustainability	Adequacy of supplies	Suitability as fill	Suitability as soil	Appropriate in landscape	Appropriate for local diversity	Creates environmental impact at source	
Limestone or granite aggregate	XX	XX	XX	X	YY	XX	X	X	X	-11
Sands and gravels	XX	XX	XX	XX	YY	X	Y	Y	X	-6
Slate waste	X	XX	X	YY	YY	XX	X	X	X	-4
Excavated clay/ subsoil from a borrow pit	X	Y/X	XX	Y/X	YY	YY	YY	YY	XX	+3
Extend quarry laterally into adjacent fields	X	Y/X	X	YY	YY	YY	XX	Y/X	XX	-0
Purchase topsoil for use with quarried aggregate	XX	Y/X	Y/X	XX	XX	YY	Y	Y	Y/X	-2
Use of recovered construction waste	YY	Y/X	YY	YY	Y	YY	Y	Y	X	+10

6 OTHER EVIDENCE THE WASTE IS SUITABLE

6.1 Types of waste

6.1.1 The proposal assumes that most of the waste accepted for recovery is likely to be derived from construction activity within 10km of the site consisting of inert waste. The conditions attached to the 2017 planning permission specifically control and limit the inert waste for the site.

All waste will comply with the EWC codes 01 01 02; 01 04 08 and 01 04 09; and 17 05 04. These are shown in the EA guidance publication RGN 13: '*Defining Waste Recovery: Permanent Deposit of Waste on Land'* Appendix 2, reproduced in Table 6.1. (NB codes coloured grey will not be used in this project)

Table 6.1: Defining Waste Recovery

Waste Code	Description
01	**WASTES RESULTING FROM EXPLORATION, MINING, QUARRYING, AND PHYSICAL AND CHEMICAL TREATMENT OF MINERALS**
01 01	**Wastes from mineral excavation**
01 01 02	Wastes from non-metalliferous excavation
01 04	**Wastes from physical and chemical processing of non-metalliferous minerals**
01 04 08	Waste gravel and crushed rocks other than those containing dangerous substances
01 04 09	Waste sand and clays
17	**CONSTRUCTION AND DEMOLITION WASTES (INCLUDING EXCAVATED SOIL FROM CONTAMINATED SITES)**
17 05	**Soil (including excavated soil from contaminated sites) stones and dredging spoil**
17 05 04	Soil and stones other than those mentioned in 17 05 03
19	**WASTES FROM WASTE MANAGEMENT FACILITIES, OFF-SITE WASTE WATER TREATMENT PLANTS AND THE PREPARATION OF WATER INTENDED FOR HUMAN CONSUMPTION AND WATER FOR INDUSTRIAL USE**
19 12	**Wastes from the mechanical treatment of waste (for example sorting, crushing, compacting, pelletising) not otherwise specified**
19 12 12	Soil substitutes other than that containing dangerous substances only

Waste Code	Description
20	**MUNICIPAL WASTES (HOUSEHOLD WASTE AND SIMILAR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL WASTES) INCLUDING SEPARATELY COLLECTED FRACTIONS**
20 02	**Garden and park wastes (including cemetery waste)**
20 02 02	Soil and stones

Types of material that are expected to arrive as waste that will be accepted

6.1.2 An assessment of the geological conditions and soils in the region, from which waste materials would be excavated, shows that much of the area around the quarry is underlain by Glacial Till, a predominantly clayey stratum.

6.1.3 Around the Afon Seiont there is a Glaciofluvial Sheet, River Terrace and Alluvium deposits. The solid geology comprises geology from the Precambrian through to the Carboniferous periods that include granitic rocks, sandstone, siltstone and limestone. These deposits make up the material that would be excavated by construction works in the area. The majority the material considered to be waste would be clayey glacial till, river terrace materials and alluvial deposits that overly the solid geology. These will contain cobbles, sand and gravel alongside clays and silts. Whilst some excavated rock might also be available, the most abundant source of hard materials will be demolition waste, including bricks, concrete and stone arising from drystone walls and hedge banks.

6.1.4 The recovery of waste will include processing, using various techniques:

- Hard rock, sand, gravel, cobble, bricks, concrete and masonry stone separated, crushed and prepared for reuse as construction materials.
- Dry excavated clayey and silty subsoils taken directly for use in the restoration scheme.
- Engineering 'Unacceptable' materials, de-watered before being used in the restoration scheme or compacted to extract water;
- Topsoil stockpiled for use in the final surfaces to be restored;
- Peat to be stockpiled for incorporated within topsoil and other soil-making materials for restoration.

6.2 Anticipated sources of imported material

6.2.1 The Geotechnical investigations of the area by Geoplan and Geo-solutions have provided useful data for consideration in the development of the restoration scheme for the site. This includes the likely character of the waste that can be expected to be brought to the quarry for restoration.

6.2.2 The quarry restoration works will be able to take restoration materials from the A487 Caernarfon to Bontnewydd Bypass construction because a large volume of excavated material will not be of sufficient engineering quality to be used in the highway earthworks. This engineering 'Unacceptable'[9] material will be discarded because either its geotechnical properties or its water content at the time of excavation mean that it cannot be engineered to create stable embankments of the required form. If wetter conditions prevail during the earthworks phase of any construction works in the area, then more 'Unacceptable' will arise and will need a site for disposal.

Figure 6.1: Extract from the Specification for Highways Works Volume 1 defining 'Unacceptable Materials: Series 600, Earthworks; National Alterations of the Overseeing Authority of Wales: 601W, Classification and Uses of Earthworks Materials. Within Class U1B some categories of material (material susceptible to spontaneous combustion and logs and stumps will be excluded. Peat will be stored separately for use in restoration.

(02/16) **Unacceptable Materials**

2 (02/16) Unacceptable material Classes U1A and U1B:

(i) unacceptable material Class U1A shall be:

(a) material which does not comply with the permitted constituents and material properties of Table 6/1 and contract specific Appendix 6/1 for acceptable material; and

(b) material, or constituents of materials, composed of the following unless otherwise described in contract specific Appendix 6/1:

- peat, materials from swamps, marshes and bogs;
- logs, stumps and perishable material;
- materials in a frozen condition;
- clay having a liquid limit determined in accordance with BS 1377: Part 2, exceeding 90 or plasticity index determined in accordance with BS 1377: Part 2, exceeding 65;
- material susceptible to spontaneous combustion except unburnt colliery spoil complying with sub-Clause 15 of this Clause;

6.3 Suitability of the materials for engineering purposes in restoration of the quarry

6.3.1 The geotechnical investigations for the proposed bypass have identified the suitability of local rock and soils for use as engineering fill and for aggregate. The analysis of the Cohesive Glacial Till and the Granular Glacial Till for use in engineered slopes, undertaken in accordance with BS EN 1997-1 and BS EN 1990, have shown that un-reinforced earthworks (formed by tipping and compacting the fill, should be no steeper

[9] 'Unacceptable' is the term used in the Specification for Highway Works Series 600, to cover material excavated from a construction site 'which shall not be used in the permanent works' because it does not meet contractual and specification requirements. The class of material which would be accepted for restoration falls within Class U1A as set out in Appendix 601W which is applicable in Wales only, although perishable material (logs, stumps and perishable material) will not be accepted unless used for planned nature conservation or soil improvements. See Figure 5.1.

than 1:2. The geotechnical analysis has shown that cuttings, formed of the same Glacial Till, but in their natural condition would need to be cut to 1:2.5 to avoid slope failure.

6.3.2 A large proportion of the waste that will be recovered for restoration of the quarry will be 'Unacceptable' due to its high moisture content. A geotechnical specification for Wastes Used as Fill, prepared by the geotechnical specialist (details and qualifications of the geotechnical specialist are provided in Section 1.4) is set out in the following Section 6.4.

6.4 Geotechnical specification for wastes used as fill

(prepared by Huw Littler-Jones B.Sc, M.Sc Geotechnical Engineer)

Source of the Wastes

6.4.1 Unsuitable materials derived and generated during the construction of the proposed bypass will be classed as 'wastes'. The soil wastes will be cohesive, classed as unsuitable for use in A487 bypass earthworks and embankments construction, and comprise silty soils with inadequate plasticity and strength characteristics, or waterlogged soils with a high moisture content.

Intended Use of the Wastes

6.4.2 The cohesive soil wastes comprising silts and clays will be used as fills, following recovery, to fill the quarry sump and to stabilise the quarry side slopes. Some granular soil wastes comprising sands, gravel, cobbles and rock will, if possible, be used as construction materials following recovery, crushing and screening.

Classification of Unsuitable Cohesive Soil Wastes

6.4.3 Excavated soil material will be classified at source and unacceptable material identified where it fails to meet the requirements of limits specified in Series 600 Specification for Highway Works Appendix 6/1 Requirements for Acceptability of Testing of Earthworks Materials Table 6/1, Table 6/2, Table 6/3.

6.4.4 Cohesive soil material will be classified and unacceptable material identified where it fails to meet the requirements of Table 6/1 and Appendix 1/5. The unsuitable cohesive material will be classified as Class U1 but only cohesive material with a moisture content greater than 90% and plasticity index greater than 65% will be directed for stockpiling, recovery and use as fills in the quarry sump. No material containing peat, wood, bio-degradable, metal, contamination of frozen materials will be subjected to recovery.

Stockpiling, Processing and Recovery of Soil Wastes

6.4.5 Soil wastes imported into the quarry will be placed on a prepared platform at the base of the northern quarry face slope for processing and recovery. The platform will contain basal drainage to assist dewatering and drying of the unsuitable waterlogged soils with

drainage water directed into settlement lagoons. Temporary drainage will also be provided where stockpiles abut against the quarry slope face to prevent ponding of drainage water.

6.4.6 Where possible the soil wastes will be placed in an un-compacted condition to assist the drainage of pore waters and drying of the soil materials. Waterlogged soils will be spread out over the platform with open ditches cut into the placed soils to assist water removal. To facilitate the drying out the soils will be periodically 'disked' by agricultural methods to break-up and aerate and be tracked with a 'sheepsfoot' roller to assist aeration and drying. (At this stage the use of lime for drying has not been proposed).

6.4.7 When soil wastes with properties of significantly high or low plasticity are identified at source they will be stockpiled in separate areas to allow future mixing and creation of a soil mix with more uniform and acceptable soil properties to be created during final placing.

6.4.8 The waterlogged soil wastes will remain in the stockpiles in the recovery area until the soils have dried and the moisture content reduced. Classification tests will be carried out on the soils when processing and recovery is complete to confirm that the soil properties have improved or have changed sufficiently for the soils to be reclassified as General Cohesive Fill Class 2A Wet Cohesive Fill or Class 2B Dry Cohesive Fill or Class 2D Silty Cohesive Fill.

Re-Use of Recovered Soil Wastes

6.4.9 When reclassification of the recovered soil wastes indicates that the soils are suitable for use as general fill materials the waste soils will be removed from the stockpiles and reprocessing areas and used to backfill the quarry sump and stabilise the quarry sides.

6.4.10 Where the recovered waste soils meet the soil property limits specified in Series 600 Specification for Highway Works Appendix 6/1 Requirements for Acceptability of Testing of Earthworks Materials Table 6/1, Table 6/2, Table 6/3, they will be placed and compacted in accordance with the compaction requirements specified in Clause 612. Table 6/4 Method 1, Method 2, Method 3, which specifies compaction method, layer thickness and number of passes.

6.4.11 Placement and compaction of the recovered waste soils to a 'method compaction' will ensure the recovered soil will achieve its maximum density for any given moisture content. With the recovered wastes soils placed to ensure maximum density the optimum un-drained shear strength will be achieved, and it will be possible for the placed soils to be placed to create stable slopes at the required gradient.

6.5 The volume of material required for restoration

6.5.1 The volumes of material calculated to be necessary to complete restoration are shown in Table 6.2. However, there will be a net import of 240,000m3

Table 6.2: Capacity at the quarry for importation for restoration

Specific use of material	Nature of material	Capacity within quarry for using fill for restoration, if available.	
		Import to quarry m^3	Approx. weight (tonnes)
Fill engineered to construct new profile in place of the quarry sump	Fill which can be tracked in or allowed to dry out adequately before profile is completed. The sump will be pumped dry before filling commences and silt lagoons will be receiving silt water that arises from imported wastes.	248,000	*372,000*
Fill to support quarry faces and improve gradients	Fill which can be tracked in to achieve stability.	107,300	*160,950*
Low fertility rooting medium for planting and seeding on the south facing slopes.	Root-permeable subsoil and low grade non-agricultural sub-soil of moderate pH and some peat.	20,000	*30,000*
Selected topsoil	Surplus topsoil, subsoil and selected material with reasonable soil structure	24,700	*37,050*
Total import to quarry for restoration		**400,000**	***600,000***

6.6 Consideration of alternative proposals using less waste

Table 6.3: seven alternative restoration schemes

Alternative proposals considered	Reasons for consideration/rejection
1. Purchase clay for bypass from quarry owner and extract from quarry under existing planning permission leaving the site to be restored by owners in 2042.	This would not achieve a restored site any earlier than 2042 and would leave the site with less amenity value than is currently the case and without solving the instability problems and the hazardous flooded quarry sump and steep slopes.
2. Once extraction of clay for bypass is complete, under existing planning permission, leaving the site to be fully restored by owners in 2042. Complete an interim restoration by seeding the raw clay surfaces until a further reason for extraction arises.	A cheap option that would seed the raw clay. This would not be a satisfactory means to establishing vegetation. A considerable period would be required before the quarry would be properly vegetated and would leave the site with an only slightly improved visual amenity, but with the instability problems and hazardous flooded quarry sump and steep slopes remaining.
3. Purchase quarry, and once extraction is completed, place a minimal quantity of suitable recovered waste for seeding on the flat surfaces and seed.	A cheap option that would leave the site with a slightly improved appearance, but with the instability problems, hazardous flooded quarry sump and steep slopes remaining. Erosion would be a problem on the slopes. The flat benches would remain wet, with near vertical slopes, suffering scour from surface water erosion. Pedestrian access along benches possible, although the near vertical intermediate slopes would be a hazard. The benched slopes would be angular and would not integrate well with the surrounding landscape.
4. Purchase quarry and carry out rough grading out of benches with some infilling using recovered waste.	A demanding and intensive restoration task that would achieve improved vegetation establishment and an improved landform. While less material would be required for restoration, the slopes would still be steep and unstable, less accessible for pedestrians and too steep for maintenance vehicles than previous options. Erosion would be a problem on the slopes. Flooded sump would remain as

Alternative proposals considered	Reasons for consideration/rejection
	a permanent hazard to Third Parties. While the slopes would be less angular, they would be rather too steep to integrate with the surrounding landscape.
5. Purchase quarry and Infill the quarry sump with recovered waste. Grading out of benches with some infilling using recovered waste.	As previous option, but safer with the flooded sump filled.
6. Purchase quarry and carry out infilling as proposed in this Waste Recovery Plan with shallow slopes.	Larger volumes of recovered waste required, but there would be demand for the space if the A487 bypass is constructed. Addresses all the stability and safety hazards with relatively shallow slopes accessible by pedestrians and vehicles, easily vegetated with lower risk of scour by surface water. Can be maintained safely and can be grazed if required. The shallower slopes would be sufficiently similar to those in the surrounding landform to integrate with the landscape setting.
7. Infilling of the whole quarry void to replicate pre-quarrying landform.	Estimated as around 400% of the waste required for the proposed restoration. This large volume of suitable waste is unlikely to arise in the area in sufficient time to complete restoration within a similar timetable. Addresses all the stability and safety hazards with shallow slopes accessible by pedestrians and vehicles, easily vegetated with lower risk of scour by surface water. Can be maintained safely and can be grazed if required. The shallower slopes would be sufficiently similar to those in the surrounding landform to integrate with the landscape setting.

7 MEETING QUALITY STANDARDS

7.1 How we will control the importation of waste

Managing quality of material imported

7.1.1 To control the quality of the imported waste, no delivery of waste to the site will be accepted for recovery without prior arrangement with the operator.

7.1.2 If waste is brought to the quarry for recovery from the A487 bypass construction site the carrier will be required to work to an agreed specification for the types and qualities of waste that will be recoverable.

7.1.3 The producer or other holder of the waste will be required to provide the operator with sufficient information to classify the waste and determine its acceptability at the site. This information will include:

- The location and nature of the waste source (e.g. excavation in green field / excavation for foundations at *site name and address*);
- A description of the waste material including its geological, mineral or construction origin (e.g. site engineer's description or SI report, trial pit logs);
- Confirmation that there is no suspicion of contamination of the waste;
- Or, to provide the results of test which confirm that the waste is not contaminated.

7.1.4 The producer or other holder of the waste will be required to provide the operator with details of the anticipated quantity to be delivered and period over which deliveries will be made so that suitable stockpile areas and capacity within the area being restored for permanent placement of the recovered waste.

7.1.5 A sign will be displayed at the site entrance instructing all delivery drivers to report to the site operator before tipping. The site operator will make a visual inspection to identify the type of waste carried and to confirm that it is in conformity with the waste description provided by the producer and with the conveyance note. If the waste is then confirmed as acceptable by reference to the working plan, the waste will be tipped in the designated tipping area at the direction of the site operator. If the waste is identified as being unacceptable, or its identity cannot be confirmed, then the site operator will instruct the delivery driver that the waste may not be tipped and must be removed from the site.

7.1.6 The site operator will instruct the delivery driver to place waste in the appropriate location for the recovery operation to commence.

As dug subsoils, clays and silts

7.1.7 The majority of imported waste will be recovered for use as fill for the quarry sump, or for stabilising the quarry slopes and would be used in the 'as received' condition. Material of this category that is considered 'Unacceptable' for engineering purposes would be placed in a location to dry out sufficiently before being recovered as fill for the restoration.

As dug sands, gravels, cobble and rock

7.1.8 Loads of waste that are considered to contain sufficient hard materials for recovery and recycling but have been rejected because of its waterlogged condition would be directed to stockpiles for drying out and sorting. When adequately dry, it will be recovered by screening (and crushing if necessary) to produce construction materials. These will be stockpiled for export and use in construction.

Topsoil

7.1.9 Loads of topsoil will be placed in stockpiles located in preparation for the final stages of restoration. As the restoration works progress areas of the site will be completed ready for soiling.

Peat

7.1.10 Whilst there are no major reserves of peat in the area, this material can arise in shallow deposits associated with water courses and saturated ground. Small quantities can be expected as waste from excavations. When this material arises, it will be stockpiled for restoration for use in habitat creation measures.

Liaison with the contractor for the proposed A487 Caernarfon Bypass project

7.1.11 As indicated previously, the proposed A487 bypass scheme would pass to the south and east of the quarry and this scheme could provide substantial volumes of waste for recovery for use in the restoration scheme. Waste from this source is highly desirable because it has similar characteristics as the soils in the area of the quarry. Furthermore, the quarry operator would be made aware of the construction programme and could agree with this single supplier:

- what types of wastes can be accepted;
- the sequence in which various types of waste would arrive;
- the volumes of material would be arriving at the quarry
- both operator and waste supplier could jointly prepare the Site Waste Management Plan (SWMP).

7.1.12 The Environmental Statement for the A487 Caernarfon and Bontnewydd Bypass indicates that the contractor for that scheme will prepare a Site Waste Management Plan (SWMP) before construction commences to facilitate the principles of the waste

hierarchy and minimise the production of waste from the outset of the Scheme. Such measures are to be incorporated into the scheme through design and implemented during construction. This will be achieved by ensuring that, wherever possible, materials on site are reused. Where waste cannot be reused or recycled, it would be disposed of in accordance with the Landfill Directive (1999/31/EC) and Landfill (England and Wales) Regulations 2002. Reference will be made to the Waste and Resources Action Programme (WRAP) which provides guidance on reducing waste and using resources efficiently. WRAP has specific, web-based tools to enable construction projects to minimise waste and uses five key principles, namely:

- Design for reuse and recovery;
- Design for off-site construction;
- Design for materials optimisation;
- Design for waste efficient procurement; and
- Design for deconstruction and flexibility.

7.1.13 In developing the restoration proposals, liaison with the project team has indicated, (see Table 7.1) that the expected waste stream can be into categorised to indicate which of these wastes would be used for restoration.

Table 7.1: The recoverable waste streams generated by the bypass construction project

Waste stream	Waste classification	Destination
Excess excavated material unacceptable for engineered fill	**Inert waste**	**Seiont Quarry restoration**
Structures waste – rubble and building materials	**Inert waste/non-hazardous waste**	**Seiont Quarry for processing and recycling for use in bypass construction**

Table 7.2: The waste streams from the bypass construction to be taken to a licenced landfill

Waste Stream	Waste Classification
General non-putrescible waste	Non-hazardous waste
General putrescible waste	Non-hazardous waste
Contaminated soil from spills of fuels, oils and lubricants	Hazardous waste
Waste oil and lubricants	Hazardous waste
Green waste from vegetation removal and construction timber	Non-hazardous waste
Solid and liquid waste from temporary ablution facilities	Non-hazardous waste

7.2 How the work will be carried out

Design

7.2.1 The restoration scheme has been designed in sufficient detail for a planning application to be submitted. The drawings form a set that show the sequence of operations. The Working Plan for Construction and Operation of the quarry are Drawings 3030/13A and 3030/13B respectively and these are included to demonstrate how the quarry void will be larger than is currently the case. The indicative Restoration Plan (2016) is shown in drawing 3030/16. This last shows the proposed uses of the restored land.

7.2.2 Cross sections through the quarry before restoration are shown in Drawings 3030/17A and after restoration in 3030/17B. These are provided in an appendix, although they cover the full scheme at the quarry which is more extensive than the quarry restoration proposal. To provide clarity, extracts of the most relevant plans and sections are included here in Figures 7.1, 7.2, 7.3 and 7.4.

7.2.3 Temporary haul roads would be constructed to link the floor and sides of the quarry to allow waste to be imported. The roads would remain is use until construction is completed. Parts would remain to provide maintenance access.

7.2.4 A platform will be constructed against the north slope of the quarry where imported waste requiring processing will be stockpiled for recovery. Imported waste that does not require processing for recovery will be taken immediately for use in the filling of the quarry sump or the stabilising of the quarry slopes. Processing on the platform will include drying out of saturated waste and screening of sands, gravels and cobble and any coarse material crushed. Any screened or crushed material will be recycled for construction use.

7.2.5 The existing silt lagoons in the sump will be brought back into use to contain site drainage which will include the full extent of the restoration scheme. As the sump is filled the lagoons will be reformed at the higher level. Water from the lagoons will pumped out periodically, using a further silt lagoon in the south west corner of the overall quarry site before discharge to a watercourse. The quality of water will be monitored to avoid pollution of the River Seiont.

7.2.6 Recovered waste would be deposited in the sump and on the sides of the quarry to be spread in layers and compacted by tracked vehicles to improve future slope stability. As each area is completed to the required slope profile the final layers of subsoil and topsoil will be placed to provide a rooting layer for the proposed seeding and planting scheme. Typical proposed soil sections are shown in Table 7.3. A summary of the soil handling method is shown in Table 7.3.

7.2.7 Illustrative cross sections (Figures 7.3 and 7.4) show how recovered wastes will be placed in the restoration scheme and demonstrate that the material would be used to serve the new purpose of the land. All materials brought on to the site will comply with the limitations set out in the Environmental Permit which is being sought.

The proposed quarry restoration scheme

7.2.8 The various activities described previously will contribute to a completed restored landscape that will include:

- Removal of the hazardous deep water and steep slopes of the flooded quarry sump;
- Stabilisation of the unstable steep quarry slopes;
- Cessation of further permitted clay extraction;
- improvements to the quality of the local landscape and views from residential properties and public areas,
- Habitat creation measures and enhancements.

7.2.9 The importation of large volumes of fill material will allow the base of the quarry to be raised so that there will no longer be a water-filled void.

7.2.10 The east, west and south quarry slopes will be covered in a sufficient depth to form shallow gradients of around 1:4, although some variation of between 1: and 1:5 could occur. The large volume of fill will help to stabilize the slopes and will be sufficiently gentle for pedestrian access, to be mown or grazed by sheep. These slopes will be finished with topsoil or soil-making materials to provide a surface for productive seeding and planting of vegetation.

7.2.11 The northern slope, which is formed of previously quarried overburden will be restored with low-fertility material such as boulder clay, to have a finished gradient of around 1:3. No topsoil will be spread to avoid increasing soil fertility, although some peat material and selected species rich grassland soils might be spread in some locations to create diversity across the slope. The slope will be seeded with a low-fertility grass seed mix incorporating grassland species found locally, to stabilise the soil surface and encourage the development of a diverse sward. The seed will be spread at a low seeding rate to encourage natural colonisation by self-sown species. This sheltered, dry, low-fertility, south-facing slope should provide a valuable habitat for reptiles and invertebrates. A minimal maintenance regime is proposed, although periodic grazing might occur if sheep are used for grazing the other slopes. The objective of maintenance on this slope is to maintain diversity and allow the development of scrub as a medium-term objective.

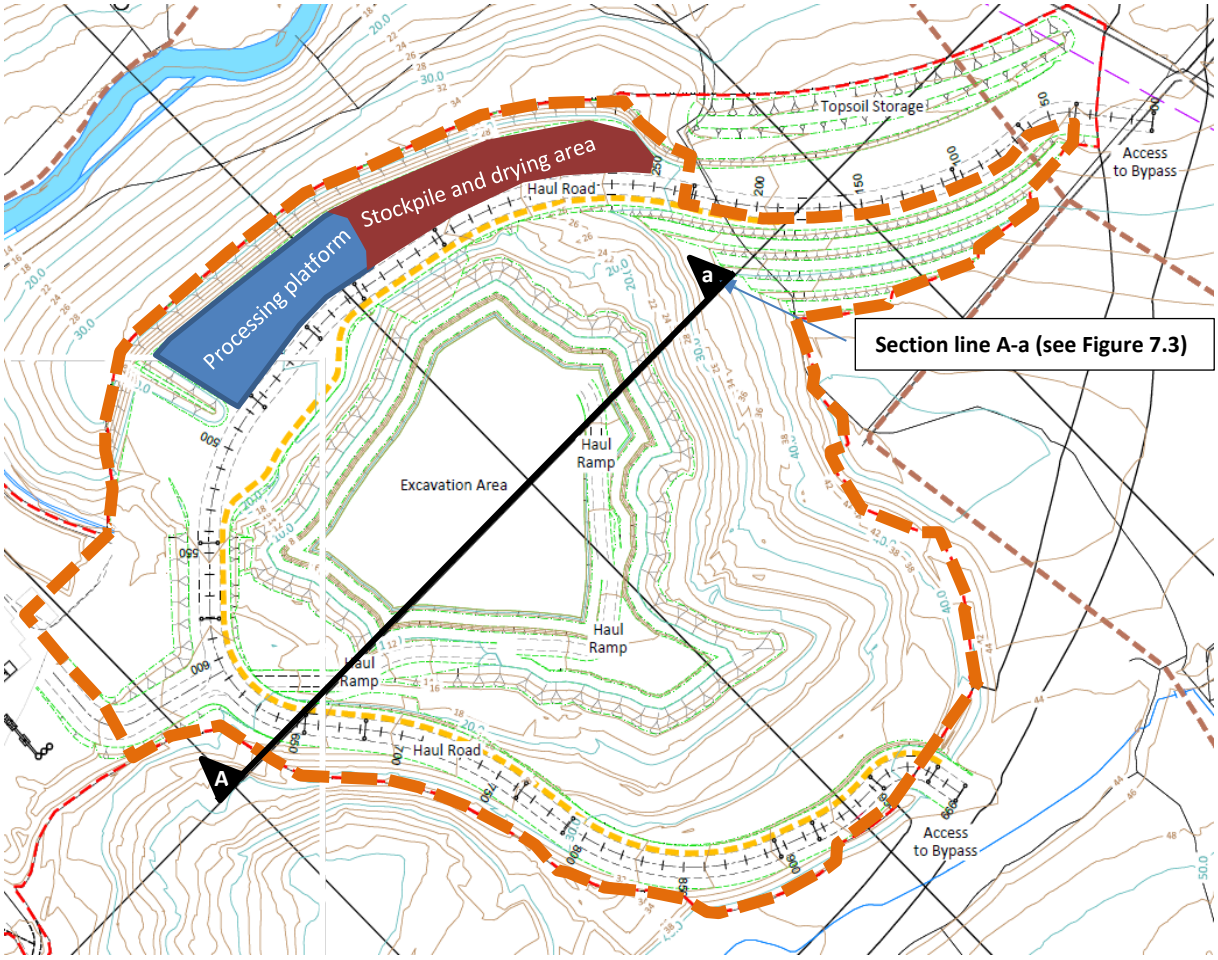
7.2.12 The generally flat area in filled quarry void will be separated from the surrounding slopes by a wide waterbody. This chain of pools will be fed by surface water draining from the

restored quarry slopes. The intention is that this ditch will have varied width, from 2 to 3metres with weirs and short lengths of dry channel 1.5m wide) linking them into a complete ring of wetland habitat. Water would be up to 600mm deep but with large areas of very shallow water and marginal habitat. These wetland areas would be allowed to develop vegetation cover by natural regeneration. If suitable some peaty material will be placed within some of the pools and dry ditches.

7.2.13 Cut-off ditches along the north-eastern haul road will catch surface water and discharge into the linear wetland at the base of the slopes. Water in the wetland will discharge into an open channel 270 metres long which in turn will discharge into the river via the existing silt attenuation basin at the south end of the quarry. This channel will be a deep ditch excavated to provide further shallow water.

7.2.14 Sometime between 1999 and 2008 a drainage channel was excavated to traverse the slope of the quarry and discharge into the River Seiont. The channel provided a route for water from a spring, which was also discovered during quarrying, high on the south west side of the quarry. This channel will be retained in the restoration scheme providing a route that bypasses the floor of the quarry.

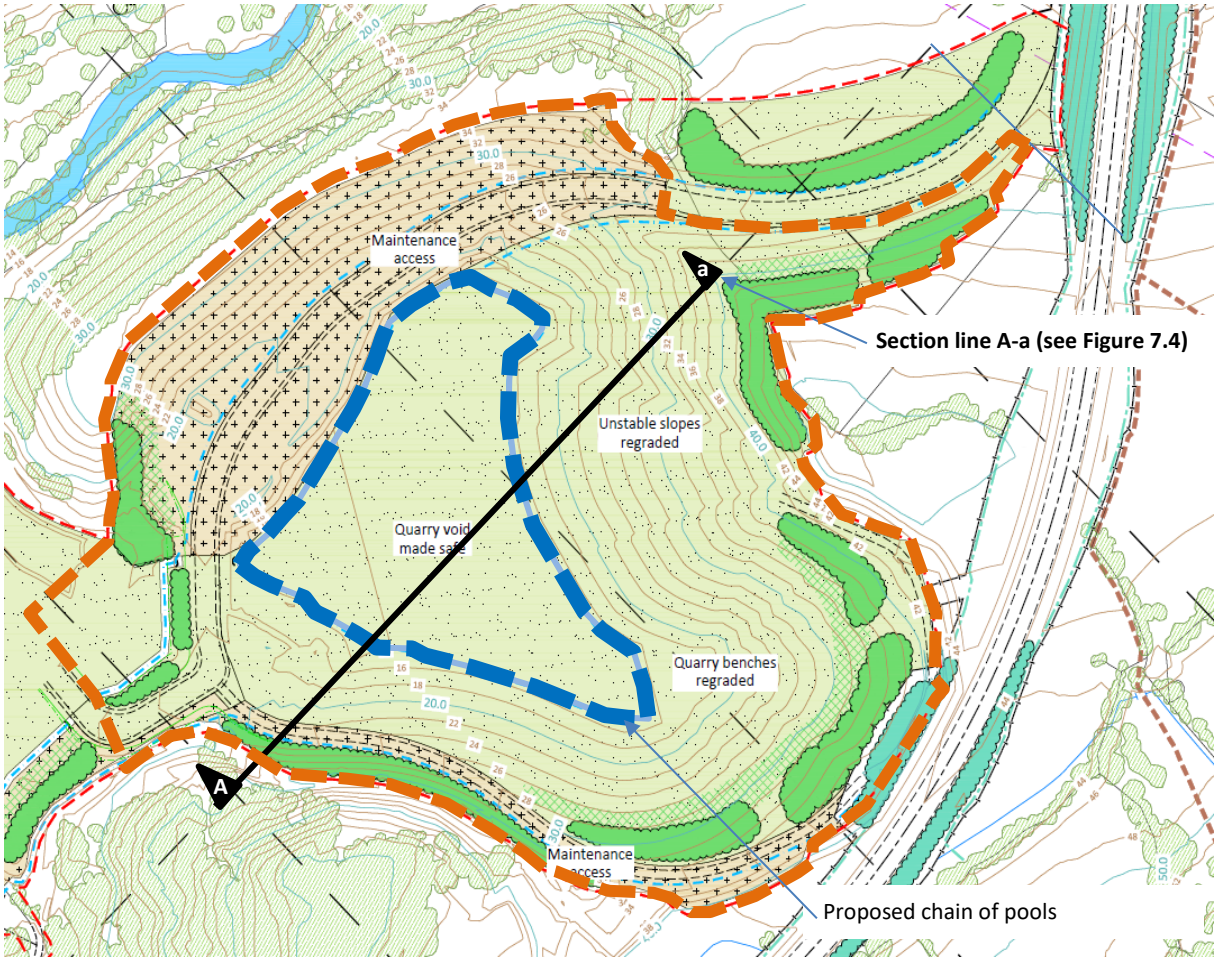
Figure 7.1: Proposed full extent of extraction under current 2017 planning proposal



Key

- Approximate boundary of restoration scheme
- Planning Application Boundary
- Existing Right Of Way
- Safety Berm
- Proposed Surface Contours (2 m interval)

Figure 7.2: Proposed restoration scheme



Key

- Approximate boundary of restoration scheme
- Planning Application Boundary
- Established Vegetation (existing)
- Proposed Woodland Planting
- Proposed Scattered Trees and Scrub Planting
- Grassland
  Area finished with topsoil and seeded with a low maintenance mixture
- Low Fertility Grassland
  Area finished with subsoil or left bare to allow natural colonization of herb and shrub species
- Waterbody / Pond
- Drainage Ditch
- Proposed Surface Contours (2.0 m interval)
- Public Right Of Way
- Proposed Bypass Hedgerow Planting
- Proposed Bypass Woodland Planting

Figure 7.3 Illustrative sections through scheme (A: existing, superseded and proposed extent of excavation)

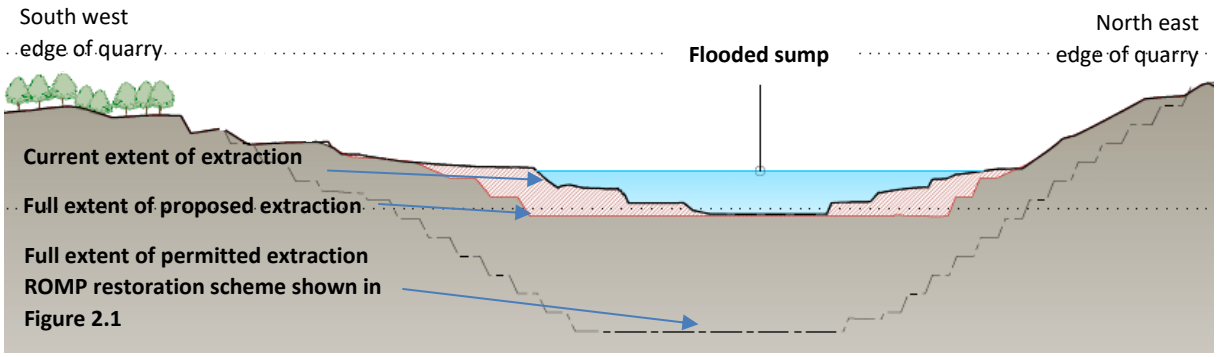
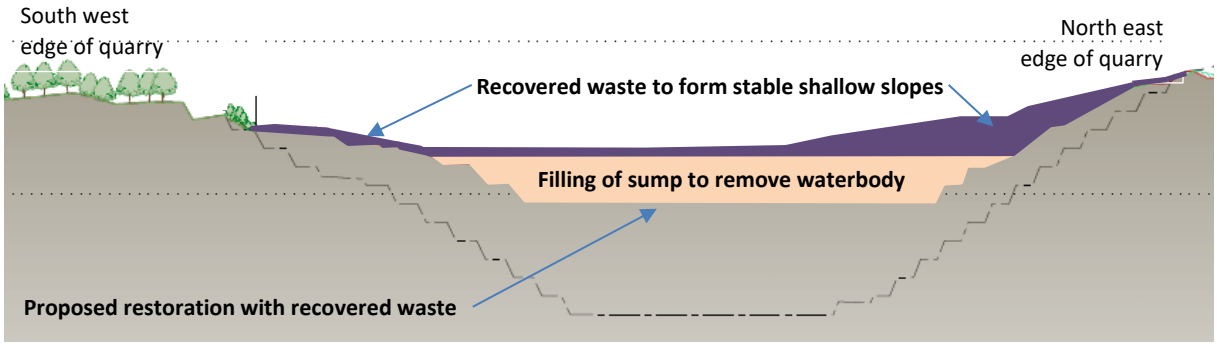


Figure 7.4 Illustrative sections through scheme (B: proposed restoration scheme)



7.3 Summary of surface soil handling method

7.3.1 The Caernarfon area, from which most waste will be derived, stands on glaciofluvial fluvial and glacial soils. These are of two main forms, Wick 1 and Brickfields 2 Subgroups:

Wick 1 **Arrow and Newport Series** derived from Glaciofluvial and river terrace drift; these are deep, well drained coarse loamy and sandy soils, locally over gravel. Some areas are affected by groundwater with a slight risk of soil erosion. These soils absorb water well in winter and do not suffer greatly from compaction due to their high sand and gravel content. Due to the geological origin of these soils, in the uplands of north west Wales, they tend to be slightly to moderately acidic.

Brickfields 2 **Nercwys and East Keswick Series** derived from drift from Palaeozoic and Mesozoic sandstone and shale; these are slowly permeable seasonally waterlogged fine loamy soils. Associated with some deep, better drained fine loamy soils. Droughting can occur if these clay rich soils are compacted and root growth becomes limited. Due to the geological origin of these

soils, in the uplands of north west Wales, they tend to be moderately acidic.

7.3.2 While the Arrow and Newport Series tend to be easy to handle and restore due to their lighter qualities, the handling of the Nercwys and East Keswick Series will present greater problems with compaction and loss of structure and drainage in these more clayey soils. Arriving as construction wastes, it will be difficult to separate these soils for different uses. It would be preferable to have the lighter better draining topsoils of the Arrow and Newport Series for the flatter areas, while the more clayey, more erosion-resistant soils could be employed on the steeper slopes and to form the material from which drainage channels are cut. The lighter subsoils would be useful for low-fertility dry grassland creation.

7.3.3 The character and quality of soils that will be available for surface restoration, and the timing of delivery, will depend upon what is brought to the quarry for recovery. Wastes recovered for use in filling the sump and in slope stabilisation will be transported by dump truck following defined routes, to avoid impeding drainage and will be compacted to reduce moisture content and to improve stability.

7.3.4 Topsoil is expected to form part of the recovered waste and will be stockpiled where necessary or placed directly on completed areas of the proposed landform. Where conditions are unacceptable (too wet) for spreading the soils, they will be loosely tipped into temporary storage mounds close to the area of use and left until conditions are suitable for spreading. Stockpiles will be limited to no more than 2 metres depth and will not be compacted, although the tops to be shaped as ridges or domes to shed water.

7.3.5 Wastes to be recovered because they are suitable for use as surface soils (e.g. topsoil) will be loose-tipped and graded out to the required depth using a light tracked bulldozer or tracked excavator only in conditions which are sufficiently dry to avoid soil compaction. If soil placement has to proceed in conditions when the soils are wetter, a modified system will be adopted. Subsoil and topsoil will be transported by dump truck following defined routes and tipped close to a 360° excavator which will place the soils in their final position and cultivate the wheel tracks from the dump trucks. In this way, no vehicle will traverse cultivated areas or the soils.

7.3.6 The completed landform will be prepared, seeded and planted as necessary to fulfil obligations. The benefits of this are set out in the following section.

Table 7.3: Typical soil sections for restored land

Proposed soil layers	Settled depth of material used for restoration		
	Slopes on north side of quarry bowl (south-facing)	All other grassed areas typical depth	Tree planting areas (except those on the north side)
Recovered Topsoil Spread and levelled with minimum necessary compaction and prepared as a seedbed/planting area by surface cultivation to allow drainage and rooting.	0.0m **(*None used*)**	**(*Final surface*)** 0.15m – 0.3m Depth to vary with proposed surface vegetation	**(*Final surface*)** 0.3m – 0.6m
Recovered Subsoil, Spread, levelled with minimum compaction and prepared as a seedbed/planting area by surface cultivation to allow drainage and rooting.	**(*Final surface*)** 0.3m-0.6m To provide a low-fertility substrate	0.0m **(*None used*)**	0.0m **(*None used*)**
Other recovered waste used for general fill Placed and compacted to engineering requirements to provide an adequately stable landform.	Depth required to achieve required restoration landform in the quarry sump and around the slopes and other areas.		

7.3.7 The soil types from which the surface soils will be derived will range from relatively free-draining to poorly drained, depending upon the clay content. Careful compaction-free handling is recommended but following placement these soils will require cultivation to assist in creating soil structure and natural drainage paths and also to prepare for seeding. During dry conditions the relevant areas of land will be cultivated and seeded with a grass seed mix that will stabilise the surface and re-establish soil structure. Only in circumstances where soils have been heavily compacted with deep ripping or total cultivation by excavator be considered.

7.4 The ecological and geological benefits of the restoration scheme

7.4.1 Restoration is an obligation under planning conditions and is intended to integrate the finished quarry landform into the local landscape for amenity purposes. Other obligations arise from the presence of a RIGS site, protected species, such as bats and otter in the woodland and Afon Seiont corridor that could benefit from habitat provided

within the restored site. The Applicant has consulted with Natural Resources Wales and the Local Authority Biodiversity Officer to fully understand the concerns for biodiversity conservation. The restoration scheme would also provide a range of habitats that would support biodiversity, including Gwynedd Biodiversity Action Plan Priority species and habitats.

Table 7.4: Areas of habitat provided

Habitats to be provided in the restoration	Total of habitat	Value for biodiversity
Slow flowing water	140m (linear)	Aquatic and emergent plant species, amphibians, aquatic invertebrates, birds and eels, also providing foraging habitat for lesser horseshoe bats and otter.
Shallow water (200 to 600mm)	950m^2	
Marginal habitat (0 to 200mm)	1,900m^2	
Pastureland seeded on clay, sandy and silty clay topsoils.	56,700m2	Birds, invertebrates and small mammals
Open mosaic habitat formed on south facing clays and silts	24,000	Reptiles, dry grassland plants, bryophytes, invertebrates, birds, small mammals
Plantations of native trees and shrubs	9,900m2	invertebrates, small mammals, birds, also providing connectivity and foraging habitat for lesser horseshoe bats, cover for otter, badger
Land exposed to show RIGS	2,800m2	No value unless allowed to form open mosaic habitat
Total area of habitats created	**96,300m^2**	

Regionally Interesting Geodiversity Site (RIGS)

7.4.2 An area on the southeast edge of the quarry is designated as a RIGS. The rarity of the site made it a strong contender for statutory designation as a Site of Specific Scientific Interest (SSSI), but the location within a working quarry pre-empted such a high level of designation and it was agreed instead to notify the site as a RIGS and that the quarry owners at the time (Hanson), the scientific investigators and the Countryside Council for Wales (CCW), would work in collaboration to facilitate scientific investigations during active quarrying.

7.4.3 The proposed restoration scheme for the quarry includes a commitment that any remaining organic deposits in the RIGS site will be retained as exposures for continuing study. No soils will be placed over the exposures, while tree planting and grass seeding will be excluded from the areas of chief interest.

Low-fertility dry grassland: open mosaic habitat

7.4.4 Rather than cover the quarry slopes entirely with woodland and fertile pastureland, the restoration will prepare the south facing slopes of the quarry, which lie on the north side of the void, to provide suitable conditions for '*open mosaic habitat*' (OMH). Areas of this habitat exist in the quarry but will be lost to continued working. Selected planting and seeding will be carried out and natural re-colonisation will be allowed to regenerate the habitat, which the JNCC (2011)[10], define as having the characteristics of at least 0.25ha in extent, with a known history of disturbance at the site, with vegetation comprising early successional communities consisting of stress-tolerant species indicative of low nutrient status or drought. The habitat could contain areas of un-vegetated, loose bare substrate and pools and will show spatial variation and a range of plant communities in transition with one another.

7.4.5 Using low fertility subsoils from recovered waste will be used to cover the area. The slopes will have finished gradients ranging between 1:3 and roughly flat, with an overall south facing orientation. The soils will be roughly finished without compaction to leave a rough undulating surface. With full sun, low fertility soil, and a rough surface, the soil and microclimatic conditions will provide a wide range of conditions that will encourage the development of biodiversity.

7.4.6 Some limited seeding and planting with locally indigenous grass species may be required to stabilise some steeper slopes and to encourage the development of the scrub component of the habitat. The location and extent of these treatments will be determined by RML specialists once the slope is nearing completion.

7.4.7 The value of this habitat is in the rare plants, mosses, lichens and invertebrates, especially bees, wasps and beetles, which the habitat supports. Between 12% and 15% of all nationally-rare and nationally-scarce insects are recorded from OMH sites including 30 UK Biodiversity Action Plan invertebrate species (Lush et al., 2013)11. Specific habitat features are incorporated into the proposed restoration plans including:

- early successional habitats and ruderal vegetation;
- more established habitats such as grassland and woodland;
- patches of dense scrub and patches of scattered scrub;
- ponds, ditches, ephemeral and permanent wet features;

[10] Joint Nature Conservation Committee (2011) UK Biodiversity Action Plan Priority Habitat Descriptions UK. Available from http://jncc.defra.gov.uk/PDF/UKBAP_PriorityHabitatDesc-Rev2011.pdf

[11] Lush, M.J., Kirby, P. and Shepherd, P. (2013) Open Mosaic Habitat Survey Handbook

- bare ground and rock piles.

Grazing land

7.4.8 Pasture is proposed because a light grazing regime will maintain the amenity grassland and encourage the development of natural species diversity in the turf. Pasture would be formed on all slopes except the south facing slopes. In total an area of approximately 7 hectares of pastureland on level ground and on slopes no steeper that 1:3, but more typically 1:4 to 1:5. With a good depth of topsoil these areas should have a natural fertility that, following several years of aftercare, could be as productive as the surrounding agricultural land.

Tree planting

7.4.9 A number of plantations are shown in the restoration scheme, mainly around the fringes of the quarry, to integrate the new landscape with the surrounding woodland and hedgerows. Native pioneer tree and shrub species will be planted to provide a woodland framework for other tree species to colonise. The species list would include: Birch, Hazel, Goat and Grey Willow, Rowan, some Alder on wetter ground and a small number of grouped Oak and Cherry to provide a future seed source for colonisation. Ash will not be planted due to concerns about Ash Dieback Disease. Sycamore will not be planted because of its non-native status. These species will be planted at small sizes to allow better establishment and faster growth. The plantations will link with established woodlands and provide habitat for invertebrates, cover and nesting opportunities for birds and small mammals and flightlines for locally present Lesser Horseshoe bats.

Wetland

7.4.10 The loss of the flooded sump by pumping out and infilling with recovered waste will cause the loss of temporary aquatic habitat, although the steep sides of the sump and the depth of water provide only limited shallow water habitat. The restoration will provide replacement water features. In particular, a ditch or linear water body with pools and weirs, providing shallow water habitats of value to birds, invertebrates and amphibians, as well as European Eels, will be formed around the perimeter of the filled sump to catch and hold surface water draining off the restored slopes. The alignment of these ditches and pools is shown in Figure 7.2. Selected clay from the recovered waste or from the quarry will be available to use in the formation of watertight channels, if these are found to be necessary.

7.5 Avoiding environmental problems of the restoration

Soil erosion

7.5.1 Soil erosion occurs on steep slopes because the existing quarry benches show signs of scouring and deposition of the raw clay. Measures are included in the proposed restoration to limit erosion and to remove silt from any erosion that does occur:

- The gradients of the restored slopes will be shallow so as to reduce the velocity of surface water movement and so reduce surface erosion. While there will be some slopes as steep as 1:3, the average will be 1:4, with large areas of flatter land. Refer to Figures 7.1 to 7.4.
- As soon as the slopes are completed they will be prepared and seeded with vegetation which will attenuate the flow of surface water and encourage absorption of water by the roots and soils. Seeding will be completed at the first suitable season following completion of any area of slope.
- Use of cut-off ditches at the top of the new slopes to divert surface water; from descending the slope;
- A ring ditch at the foot of the slopes to receive surface water and silt to allow stilling of the flow and sedimentation of eroded clays and silts.
- Use of settling lagoons during the period of waste recovery and quarry restoration to contain silt before water enters the River Seiont.
- Use of a silt lagoon for the aftercare period following restoration. This will be monitored and dredged as necessary until such time as the vegetation stabilises and erosion is reduced to background levels.

7.5.2 Experience of previous civil engineering projects, including quarry restorations, demonstrates that erosion is not a problem if the measures listed are carried out and properly maintained to ensure the surfaces are stable and silt contained.

Increased Risk of flooding in the surrounding area

7.5.3 A Flood Consequences Assessment (FCA) has been prepared for the restoration scheme by Waterco and this has been submitted in full with the planning application.

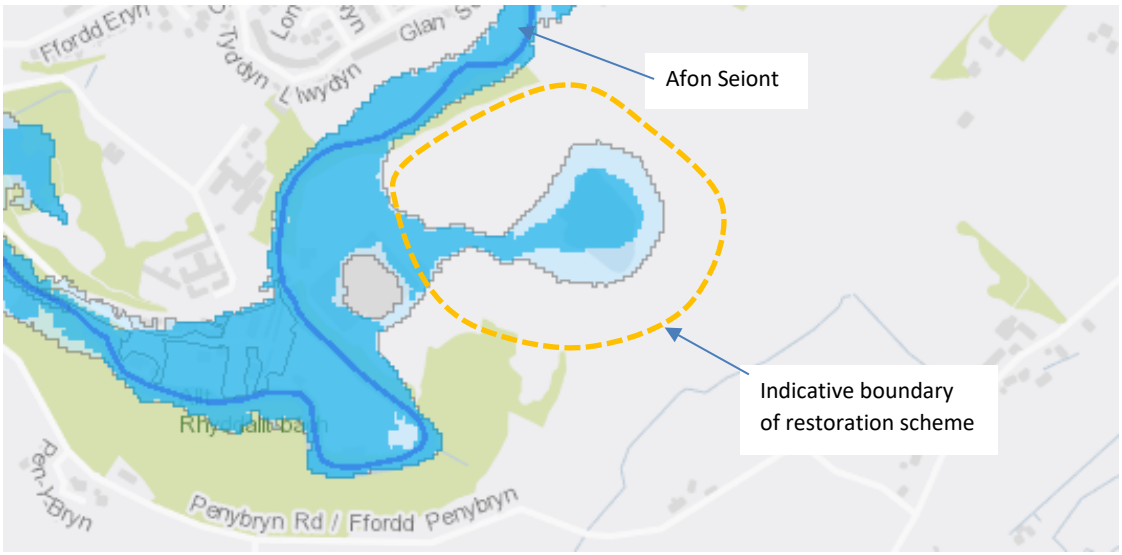
7.5.4 The impacts of flood risk to the site have been assessed from a range of sources including fluvial, tidal, surface water, sewer, groundwater and flooding from artificial sources. The potential impacts on flood risk elsewhere as a result of the development have also been assessed. The full assessment is included in the Environmental Statement (ES) that was submitted with the planning application. The conclusions set out in the FCA and the ES are summarised here.

7.5.5 The site is partially located within Flood Zone C2 on the Welsh Government Development Advice Map – an area considered to be at risk of flooding from fluvial or

tidal sources, without significant defence infrastructure, with a 0.1% (1in1000) chance or greater of occurrence in any given year. The remainder of the site is located within Flood Zone A – an area considered to be at little or no risk of fluvial or coastal / tidal flooding.

7.5.6 The north-western extent of the site is shown within Flood Zone 3 on the Natural Resources Wales (NRW) Flood Risk (including defences) map – an area at flood risk with a 1% (1 in 100) chance or greater of fluvial flooding in any given year. The north-western extent of the site is also shown within Flood Zone 2 – an area at risk with between a 1% and 0.1% chance of fluvial flooding in any given year. The remainder of the site is located outside of the extreme extent of flooding, with a less than 0.1% chance of fluvial flooding in any given year.

Figure 7.5: NRW 2016 Flood Map (Ref: Natural Resources Wales July 2016 maps).



7.5.7 The nearest major watercourse is the Afon Seiont, located immediately north and west of the site. NRW advised that there was no detailed flood level data available and so a 2-Dimensional (2D) hydraulic modelling of the Afon Seiont has been undertaken by Waterco Consultants in January 2016 (updated April 2016) to estimate flood levels, extents, depths and velocities for the site.

7.5.8 The NRW 'Risk of flooding from surface water' map identifies a flow route from an unnamed land drain to the quarry void. This land drain is a ditch cut specifically to receive overflow water from the flooded quarry void. The risk associated with this flow route is low, meaning it has between a 0.1% and 1% chance of flooding in any given year. The quarry void is shown to flood with depths exceeding the TAN15 guidelines. Hydraulic modelling, undertaken in April 2016 has determined that the quarry void is not connected to the Afon Seiont during the 0.1% AEP flood event and does not provide flood storage, therefore any filling within the void will not impact on flood risk

elsewhere. During restoration, the quarry void will be backfilled to a minimum level of 15m AOD, which is above flood level. The proposed development is not considered to be within the functional floodplain and so will not reduce flood storage capacity. The proposed quarry restoration will therefore not increase the risk of fluvial flooding elsewhere and is located outside of the 0.1% AEP flood extent and is therefore compliant with Tables A1.14 and A1.15 of TAN15.

7.5.9 The results of the hydraulic modelling are shown in Figures 7.6 to 7.8. The quarry sump is shown to be unconnected with the river in the 0.1% and 1% AEP events.

Figure 7.6: Maximum Flood Depth in the 1% AEP event

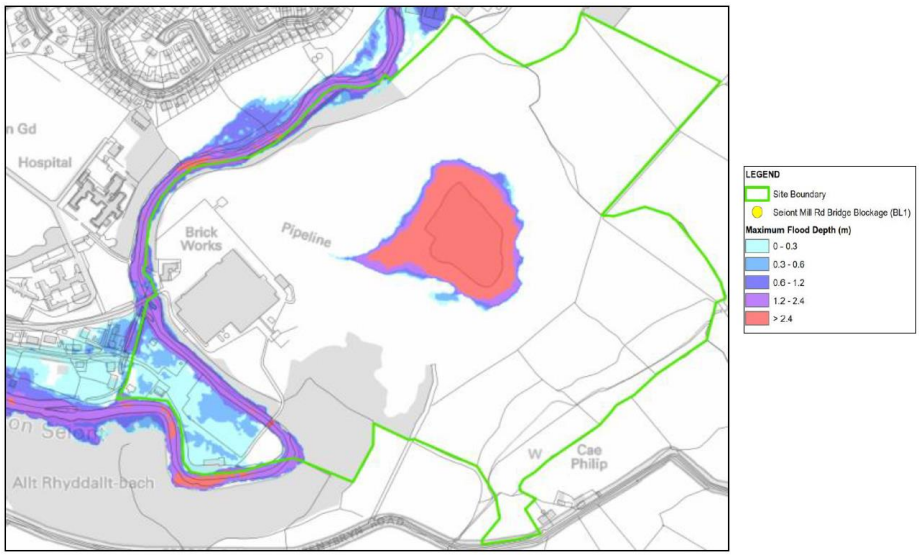


Figure 7.7: Maximum Flood Depth in the 1% AEP event with a 66% blockage of Seiont Mill Road Bridge

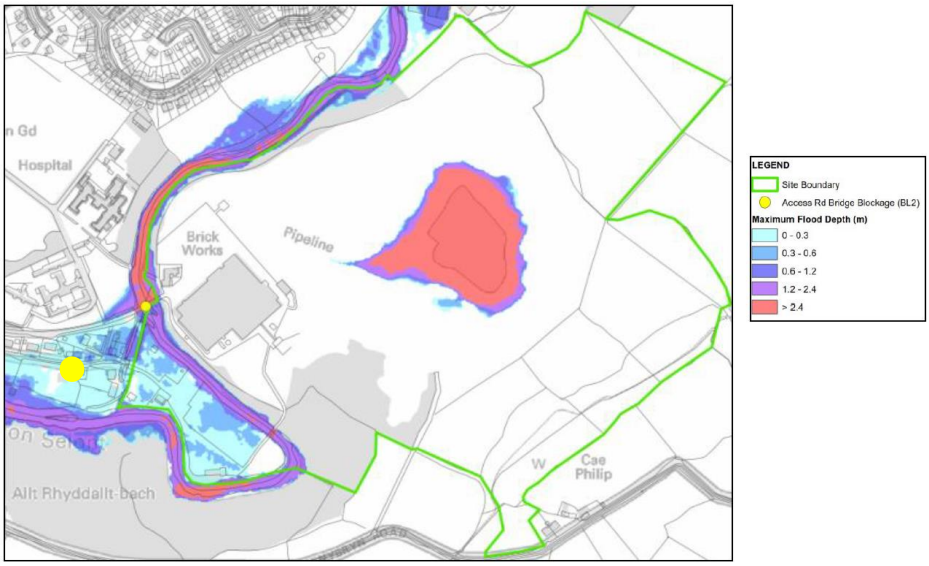
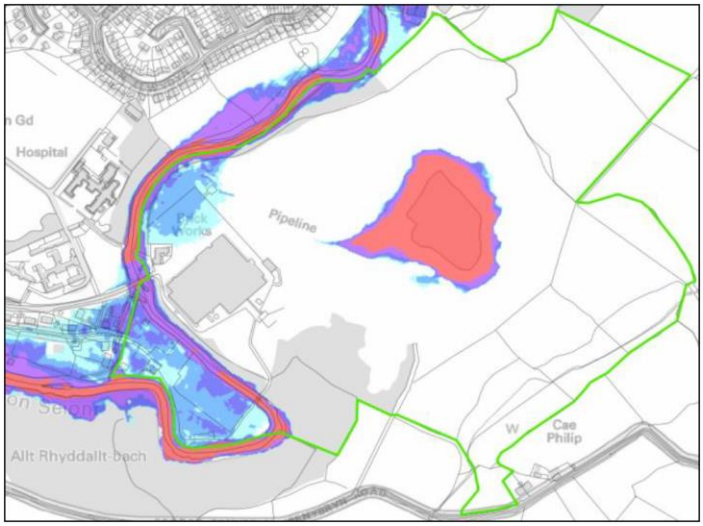


Figure 7.8: Maximum Flood Depth in the 0.1% AEP event



7.5.10 The existing waterbody in the quarry void will be pumped out into the Afon Seiont before any restoration commences and the additional water in the Seiont has the potential to cause an increase in flood risk downstream. Pumping is likely take a number of weeks, maintaining a steady flow. To reduce the risk of flood from the river the flow from the pump will be managed to avoid discharging into the river during high flow conditions.

7.5.11 The approved 2017 restoration scheme will not change the impermeable area within the quarry, nor increase surface water runoff rates or volumes.

Pollution

7.5.12 Pollution could arise from a range of activities associated with earthmoving and processing of the waste. There is potential for contaminants to be introduced to the environment during activities such as transportation, vehicle refuelling, importing and processing waste and from maintenance and storage of plant and equipment. The main receptors could be local residents, the River Seiont, groundwater and local biodiversity, such as protected species or designated habitats. Table 7.5 sets out these on the basis of;

Source-pathway-receptor/risk and mitigation

7.5.13 A full assessment of pollution risk has been carried out for the planning application and reported in a statutory Environmental Statement.

Table 7.5

Source	Pathway	Main receptor(s)	Risk, management and mitigation
Manmade contaminants brought to site with the waste.	Surface water and atmosphere Recovered wastes recycled as construction materials	River Seiont Local residents Local biodiversity Groundwater	Sampling and chemical test results required to demonstrate to operator that wastes brought to site by carriers are within safe parameters for use in the recovery operation.
Natural contaminants in waste released from waste as a result of exposure to the air, water. E.g. aluminium salts released from clays due to changed pH in surface water.	Surface water and atmosphere		The character and source of wastes to be provided to operator by carrier so that high risk materials can be handled appropriately and pollution risk reduced.
Fine particles separated as a result of earthmoving activities.	Suspended silt in surface water Dust carried by atmosphere	River Seiont Local residents	High risk of suspension in water in periods of intense rainfall. All surface water in restoration area fed into silt lagoons for separation by settlement. High risk of dust generation in periods of high wind velocity in dry conditions. Site handling of wastes and traffic on bare soils minimised when these high-risk conditions exist. Dust limited by cleaning and wetting of traffic surfaces when necessary.
contaminants such as fuels, hydrocarbons, oil, and chemicals arising from spillage on site.	Suspended or dissolved in surface water or ground water. Vapour carried in atmosphere	River Seiont Local residents Local biodiversity	All such materials in bunded storage with designated bunded refuelling areas. Plant maintained to high standard. Spill kits available. Only fuel and lubricant used within restoration area. All pollutants in surface water fed into silt lagoons for separation and recovery if required.
Noise from plant and equipment.	Atmosphere	Local Residents Local biodiversity	Noise assessment and modelling carried out for scheme by acoustic specialist. Plant maintained to high standard to minimise noise. Existing landform and proposed noise bund provided as mitigation. Predicted noise at receptors within acceptable limits.

Appendix A

Details of the 'extant' 2007 ROMP'.

See separate pdf files

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Appendix B

Planning permission details for the site for engineering works and use of land relating to the construction of the proposed A487 Caernarfon to Bontnewydd Bypass and the extant ROMP. This permission includes the importation of residual 'waste' specific to the construction of the bypass.

See separate pdf files

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Appendix C

Planning permission details for Cambrian Quarry, Gwernymynydd, Flintshire

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Appendix D

'Borrow Pit Area at the Former Seiont Brickworks and Quarry, Caernarfon, Gwynedd LL55 2YL – Geological Ground Investigation Report' e-geo Solutions Feb 2016 (ref E0756.GGI.R1)

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Appendix E

3030 Series Drawings

Approved Plans and Cross-Sections for 2017 planning permission

See separate pdf files

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