

Bromsberrow North Sandpit: Environmental Setting & Site Design



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Prepared for

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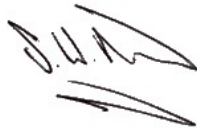
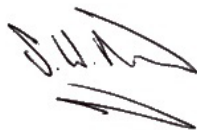
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Bromsberrow North Sandpit: Environmental Setting & Site Design

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Sensitive Receptors Plan	Drawing No. 331201261D2
Site Restoration Proposals	Drawing No. 21224.101 Rev A
Updated Quarry Development Plan – Floor at 36mAOD	Drawing No. 7873-005-D-002 Rev 02
Updated Quarry Development Plan – Floor at 36mAOD Cross Sections	Drawing No. 7873-005-D-004 Rev 03
Topographical Survey	Drawing No. ASG-2303-141/B
Updated 'Surface Water Management Pond' Design	Drawing 7873-005-005 Rev P01

APPENDICES

Appendix A	Planning Permissions
Appendix B	Waste Acceptance Procedures
Appendix C	Management Plan for Restoration and Aftercare
Appendix D	Noise Impact Assessment
Appendix E	Ecological Appraisal
Appendix F	Flood Risk Assessment (331201147R2)

1 Introduction

1.1 Report Context

Stantec UK Ltd (Stantec) has been instructed by Allstone Sands Gravels Aggregates Trading Co. Ltd ('Allstone') to prepare an Environmental Permit (EP, or 'Permit') application for inert landfill at Bromsberrow North Sandpit, Bell Lane, Bromsberrow Heath, Ledbury, Gloucestershire, HR8 1NX (the 'Site').

The **proposed EP activity** is the deposit of inert waste into or onto land which will allow for the progressive infilling of the void formed by the ongoing mineral extraction from the Site. The **proposed Operator** of the EP will be Allstone.

This Environmental Setting and Site Design (ESSD) report has been completed by Stantec on behalf of Allstone and addresses Appendix 2, Question 1 of Part B4 of the Environment Agency (EA) EP application forms (EPB4 Version 12, August 2020), which requires the provision of an ESSD report.

The aim of this report is to describe the regulated facility in relation to its environmental setting (Section 2) and conceptual site model (CSM), which identifies the sources of pollution (Section 3), pathways and receptors (Section 4).

The CSM presents the environmental setting of the Site and has been used as the basis for the supporting risk assessments and management plans:

- **Environmental Risk Assessment (ERA):** Required to consider the potential environmental impacts from the proposed EP activity (Stantec, 2024a);
- **Hydrogeological Risk Assessment (HRA):** Required to consider the potential hydrogeological impacts and risk to controlled waters from the proposed EP activity (Stantec, 2024b);
- **Landfill Gas Risk Assessment (LFGRA):** Required to consider potential risk posed by landfill gas from the proposed EP activity (Stantec, 2024c);
- **Stability Risk Assessment (SRA):** Required to consider the stability of the proposed activity (KeyGS, 2023);
- **Flood Risk Assessment (FRA):** Prepared in support of the planning application (Section 1.2) for the phased mineral excavation and restoration of the Site (Stantec, 2024g) and updated for this EP application (Appendix F); and
- **Dust and Emissions Monitoring Plan (DEMP):** Required to consider the management of dust and emissions during the proposed EP activity (Stantec, 2024d).

The ESSD also provides details on:

- the pollution control measures (Section 5) that need to be incorporated within the Site design to minimise the risks to the environment; and
- the proposed activity monitoring (Section 6).

1.2 Planning Status

There are currently three planning permissions relating to the Site for development consisting of the winning and working of minerals (G1209, G1209/A and G1209/C), dating from January 1953, July 1953 and October 1971, respectively. Copies of these permissions are included as **Appendix A**.

In summary, the permissions show the extent of the sand pit changing over time, particularly in relation to the development of the M50 motorway in the late 1950s and early 1960s. All permissions are for the winning of sand only and require topsoil and overburden to be retained on site, with the Site to be brought to an even surface and graded after extraction is complete. Later permissions require there to be no winning of sand from near site boundaries and the planting of tree screens, along with a number of other restrictions.

Bromsberrow Sand and Gravel Company Ltd (BSGC), a wholly owned subsidiary of Allstone, has applied to GCC for an Initial Review of planning conditions relating to the extraction of sand from the Site. The application Site extends to approximately 5 hectares (ha).

GCC, as the MPA, has a statutory duty to review what are commonly referred to as 'old' planning permissions for mineral working. The process of review is referred to by the acronym 'ROMP' – Review of Old Mineral (planning) Permissions.

The EP applied for, in accordance with the ROMP application (BSGC, 2022) would allow the progressive infilling of the quarry void with approximately 670,000m³ of imported inert materials.

A total of 27 new planning conditions are proposed by Allstone within the supporting statement included within the ROMP application, which is subject to approval by GCC.

The proposed conditions would replace the existing conditions and address the winning and working of minerals, the importation of inert materials for restoration purposes, alongside site access, operations, noise and dust management, material storage, restoration and aftercare, landscaping, ecology, permitted development rights and record keeping.

Allstone is actively engaging with Severn Trent Water (STW), the EA and GCC on the range of operational controls that may be acceptable to these key stakeholders in response to the concerns raised within their objections to the ROMP application (ref. 22/0031/FDROMP), as submitted in June 2022.

Central to the response to the key stakeholder comments is the Site Operating Plan (SOP). The SOP forms an integral part of this inert landfill EP application (Stantec, 2024e) and continues to be developed in line with the key stakeholder comments.

1.3 Pre-Application Advice for Environmental Permit (EP)

The Site has been subject to two requests to the EA for pre-application advice to assist with the preparation of an inert landfill EP application. The advice from the EA consists of the following:

- Basic pre-application advice reference EPR/LB3507FW/A001 received on 04 August 2022. The basic advice consisted of high-level generic advice for the preparation of an inert landfill EP as well as a Nature and Heritage Conservation Screen to identify proximate nature and heritage conservation sites (such as Local Wildlife Sites), protected species and protected habitats.
- Enhanced pre-application advice reference EPR/ZP3825SM/P001 received 08 November 2023. The main points highlighted in the enhanced pre-application advice are summarised as the following:
 - Advice on the required HRA modelling approach
 - Advice on the acceptable basal elevation

- Advice on the engineering requirements for the Site
- Advice on the level of stability risk assessment required.
- Advice on the monitoring plan for the Site including the suitability of borehole locations, frequency and number of baseline monitoring analyses required to support an EP application.
- Advice that a Noise Impact Assessment and Noise Management Plan would not be required as part of the EP application.

The issued advice has been incorporated into the documents associated with the EP application.

1.4 Data Sources

The information and assessments in this ESSD report are predominantly based on secondary data analysis associated with both the Site itself and the surrounding land area.

The main sources of data are summarised below:

- Phased mineral extraction and restoration details from the ROMP application;
- Previous reports for Bromsberrow South Sandpit (Stantec, 2019);
- British Geological Survey (BGS) mapping;
- Ordnance Survey mapping;
- Freely available data published by UK Government;
- Details of unlicensed private water abstractions from Forest of Dean District Council and GCC; and
- Data from the EA including water quality, rainfall, historic landfill data, LiDAR data, abstraction licences and discharge consents.

2 Site Overview

2.1 Site Details

A summary of Site details is provided in **Error! Reference source not found.**. The general location of the Site is shown in Figure 2.1.

Table 2.1 Site Details

Site address	Bromsberrow North Sandpit, Bell Lane, Bromsberrow Heath, Ledbury, Gloucestershire, HR8 1NX
NGR	SO 73896 33065
Site location and access	The Site is located in Bromsberrow Heath, Gloucestershire, approximately 4.5 km southwest of Ledbury and 7 km north of Newent, close to the village of Bromsberrow in Gloucestershire. Existing access to the Site is via Bell Lane, which runs along the northwestern boundary of the Site. Access to the Site is currently via Bell Lane which runs along the northwest boundary of the Site. The current access point to the Site is located at NGR SO 73760 33104. There is a proposal in place to change the main access point to the Site. The new access point is proposed to be located to the northeastern boundary of the Site at NGR SO 73935 33162, with access being gained from Wood End Street. The proposed site layout including the proposed site access is shown on Drawing 21-248-D-012 Rev02. Details of the site layout are included in the SOP (Stantec, 2024e).
Site classification	Proposed landfill for inert waste. Active sand quarry.
Site security	The northern and eastern boundaries of the Site are defined by 2.5m high security fencing in addition to native species trees and hedgerows. The southern and western boundaries are also defined with various mature trees and hedgerows. The hedgerows and fencing are designed to restrict access to the site, to prevent vehicular access and to discourage casual visitors. The entrance will be protected by metal gates. CCTV is utilised on the Site and covers all operational areas. CCTV is monitored during the operational hours by Site staff. Outside of operating hours monitoring of CCTV is provided by Glevum Security. There is also a system in place to access CCTV monitoring remotely via use of mobile phones.
Adaption of operations for climate change	It is understood that climate change adaptation planning now needs to be incorporated into the Site Environmental Management System (EMS), including how a changing climate might affect the Operator's ability to comply with the EP. It is noted that there is no longer a requirement for a climate change risk assessment for new bespoke waste and installation EP applications. However, Allstone have and will continue to consider the Site and Sector-based impacts from climate change and will plan for these accordingly. This includes, for example, the consideration of groundwater

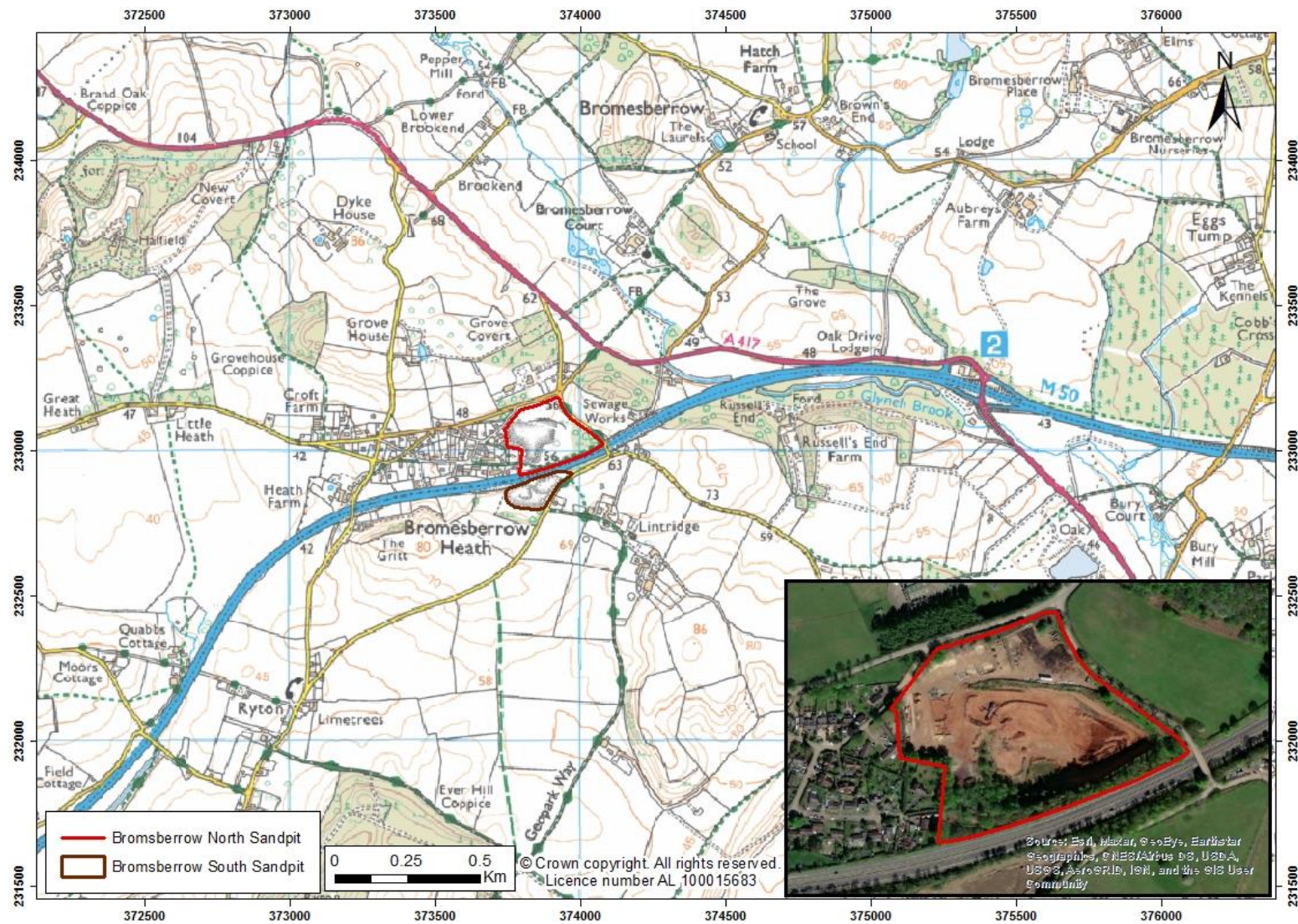
Site address	Bromsberrow North Sandpit, Bell Lane, Bromsberrow Heath, Ledbury, Gloucestershire, HR8 1NX	
	rebound within the HRA (Stantec, 2024b) and the availability of water for dust suppression purposes as presented in the DEMP (Stantec, 2024d). Increased variability in rainfall could mean more frequent and prolonged periods of high or low water levels. Predictive scenarios for the UK are available and a review has been carried out in the HRA (Stantec, 2024b) to understand whether these datasets can be utilised or whether a simple soil-moisture balance assessment can be carried out to derive some appropriate estimates. Attenuation requirements for the Site's drainage strategy will need to include an allowance for climate change in the future rainfall intensities. This uplift has been included in the runoff and attenuation requirements calculations set out in the FRA (Stantec, 2024g).	
Topography	The elevation of the perimeter of the Site ranges between 55 and 60 metres Above Ordnance Datum (mAOD), while the proposed extraction void will extend to 36 mAOD. The Site topography is generally consistent with the western surroundings; however, the land rises eastwards to form Bevanhill Coppice, to more than 75 mAOD. To the south the land also rises from the Site, ranging between 70 to 75 mAOD around Russellsend Coppice to the southeast. East and north of the coppices, the land falls to 50 mAOD in the Glynch Brook valley. The current topography of the Site is shown on Topographical Survey, Drawing No. 2303-141/B dated 14 May 2023.	
Previous land use	The Site has been predominantly a sandpit and woodland over the past 100 years. The Pre-application Nature and Heritage Conservation screening provided by the EA (EPR/LB3507FW/A001) shows a historic protected habitat, Grovehouse Coppice, within the Site boundary. This area of woodland no longer exists on the Site. Historic imagery shows the coppice disappearing between 2009 and 2013.	
Surrounding land use	North	Beach Lane runs along the northern boundary of the Site, with Bell Lane forming the northwestern boundary, from which the Site is currently accessed. The Bromsberrow Borehole BPS Public Water Supply (PWS), operated by Severn Trent Water (STW), is located to the immediate north of the Site, beyond Beach Lane. Willows Farm also lies to the north beyond Beach Lane. Further north the land use is predominantly agricultural, with large areas of polytunnels being observable from satellite imagery.
	East	Wood End Street runs along the eastern boundary of the Site, beyond which Bromsberrow (High Bank) Local Wildlife Site (LWS) is located. An additional LWS, Bromsberrow (M50), is located 20m east of the Site along northern boundary of the M50 motorway. The majority of the land use to the east of the site is agricultural with areas of woodland (including Bevanhill Coppice, located 75m from the Site).

Site address		
Bromsberrow North Sandpit, Bell Lane, Bromsberrow Heath, Ledbury, Gloucestershire, HR8 1NX		
	South	The southern boundary of the Site is adjacent to the M50 motorway which runs in a southwest-to-northeast direction, beyond which the complete and restored Ryton Road Sand Quarry Landfill is located, circa 35m from the Site's southern boundary (EP reference EPR/JP3698VP). Further south the land use is predominantly agricultural, with large areas of polytunnels being observable from satellite imagery.
	West	To the west of the Site is the residential area of Bromsberrow Heath, with the closest residential property located 10m from the Site boundary.

2.2 Environmental Permit (EP) Boundary

The proposed EP boundary is shown in green on the Site Location Plan, Drawing No. 21-248-D-010.

Figure 2.1 Site Location



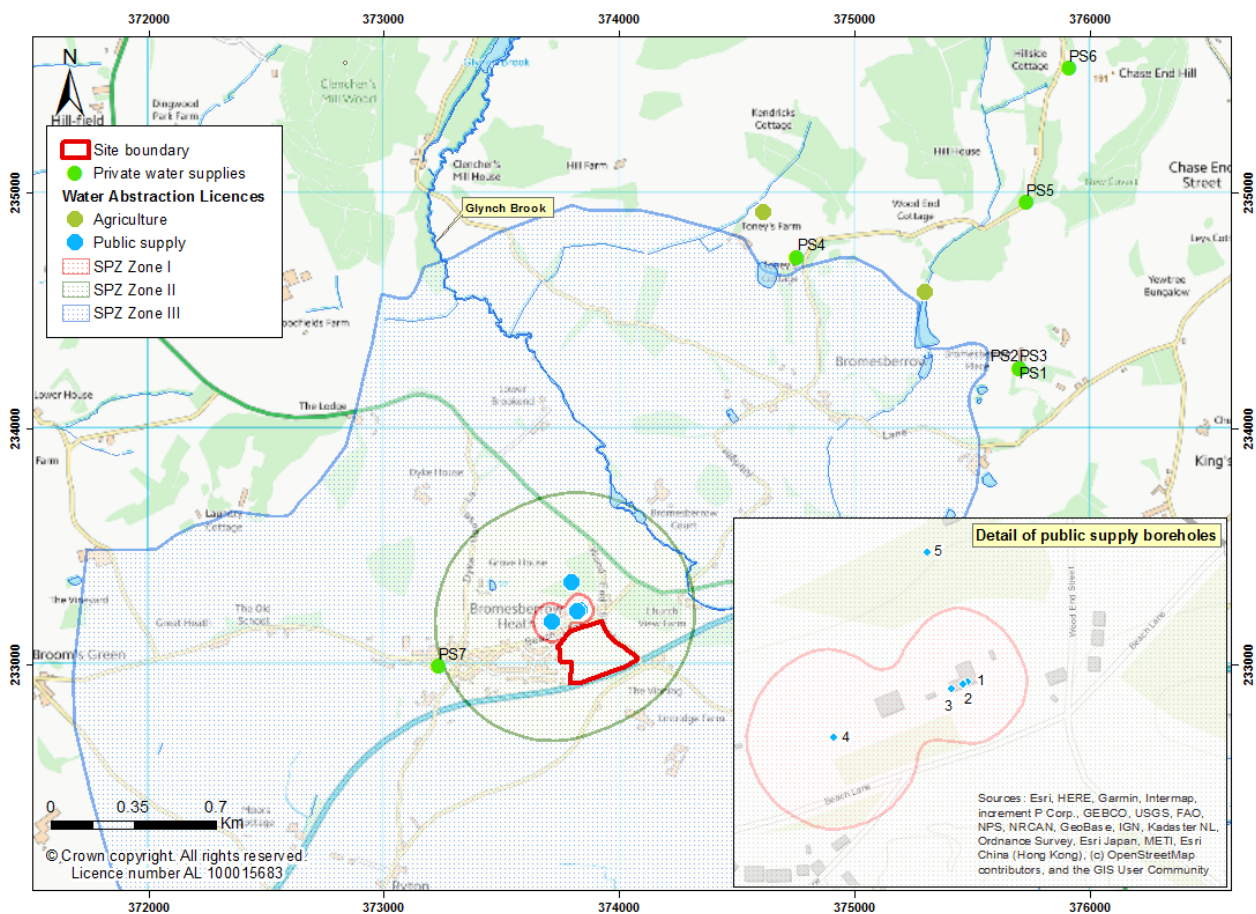
2.3 Groundwater Source Protection Zone

The entirety of the Site lies within Zone 2 of the groundwater Source Protection Zone (SPZ) for Bromsberrow PWS, with the northern boundary lying immediately south of Zone 1 (SPZ1).

SPZ1 is defined as the 50-day travel time from any point below the water table to the source (this zone has a minimum radius of 50 metres), whereas SPZ2 is defined by a 400-day travel time from a point below the water table.

Figure 2.2 shows the defined SPZ associated with the PWS boreholes situated in the vicinity of the Site. It also shows the locations of private water supply abstractions within the vicinity of the site, based on information provided by Forest of Dean District Council. These private water supplies are discussed further in Section **Error! Reference source not found.** of this ESSD.

Figure 2.2 Source Protection Zones and Neighbouring Water Supplies



The EA's Position Statement E1 (EA, 2018) states that:

"The Environment Agency will normally object to any proposed landfill site in groundwater SPZ1. For all other proposed landfill site locations, a risk assessment must be conducted based on the nature and quantity of the wastes and the natural setting and properties of the location. Where this risk assessment demonstrates that active long-term site management is essential to prevent long-term groundwater pollution, the Environment Agency will object to sites:

- *below the water table in any strata where the groundwater provides an important contribution to river flow, or other sensitive receptors*
- *within SPZ2 or 3*
- *on or in a principal aquifer”*

An inert landfill does not pose a potential hazard to groundwater. Therefore, it is not necessary to collect leachate and a drainage system is not required. In line with Position Statement E1, the EA will not object in principle to such a landfill on the basis of the location, unless the site falls within a SPZ1 (which it does not).

The HRA (Stantec, 2024b) submitted with the EP includes an assessment of risks from the proposed development, with its managed reduction through engineering and management controls.

3 Conceptual Site Model: Source

3.1 Source Identification

This CSM includes the potential sources of pollution identified from the proposed activity that could impact human health or the environment. It also includes other sources of potential contamination in the vicinity of the Site.

3.2 Site Development

The Site has been an operating quarry for 70 years as of 2023, following the implementation of the original planning permissions granted in January and June 1953. The Site has previously, and continues to be used for, sand quarrying and is to be infilled and restored for conservation and amenity in phases.

Aggregate storage bays are located along the northern boundary of the Site and used for the storage of mineral from the extraction operations prior to their removal off Site. The weighbridge, site office, welfare, refuelling and storage facilities associated with Site operations are currently located in the north-west of the site, adjacent to the current site access off Bell Lane, as shown on the Existing Site Layout Plan (Drawing 21-248-D-011).

It is proposed to move these facilities to the north-east of the site, adjacent to a new site access to be constructed off Wood End Street, as shown in the Proposed Site Layout Plan (Drawing 21-248-D-012). Further details of the proposed Site development are provided in the SOP (Stantec, 2024e).

A topographical survey of the Site from May 2023, Drawing No. 2303-141/B dated 14 May 2023 is provided with this ESSD to give an indication of current ground levels at the Site.

3.3 Historical Development

The historical development of the Site has been established by review of historic Ordnance Survey maps from 1888 to 1961 and is presented in Table 3.1.

Table 3.1 Historical Development

Mapping Date(s)	Commentary
1888-1913	This shows the Grovehouse Coppice occupying the northern third of the Site, with much of the remainder of the Site marked as heathland. - A small (~0.25ha) roughly square-shaped area is marked in the north-west of the Site as a 'Sand Pit'. - A footpath is marked running approximately west to south-east across the southern half of the Site. - The Site is bounded to the north-west, north and east by roads in the same alignment as the present day. - To the south, the land is also marked as heathland, with another Sand Pit marked in the location of the present day Ryton Road Sand Quarry Landfill.

Mapping Date(s)	Commentary
	- The village of Bromsberrow Heath is shown to the immediate west of the site, including a number of residential properties, wells, a 'Beer House' (e.g., Public House) and woodland/orchards. - To the north-east of the site an 'Old Gravel Pit' is marked, adjacent to the Bevanhill Coppice and associated nursery. - To the immediate east of the Site a 'smithy' is marked, along with another well. - To the south-east 'Little Lintridge' is marked, which appears to be a farm.
1912-1922	This shows the Grovehouse Coppice extending over the entire site, excluding the 'Old Sand Pit' in the west of the Site, which occupies an area of 0.632 acres (0.25ha) according to the mapping. - A hedge is marked running across the Site from the Old Sand Pit in the west to the smithy to the east. - A 'Pumping Station' (the modern Bromsberrow BPS) is now marked to the north of the Site, operated by Malvern Urban District Council.
Around 1949	This shows the removal of much of the Grovehouse Coppice from the Site, excluding an area in the east. The Old Sand Pit is still marked, and the Bevanhill Coppice has been expanded to the north-east of the Site to extend almost to the north-eastern corner of the Site.
1955-1961	This shows the alignment of the M50 motorway constructed to the immediate south of the Site. The smithy is no longer marked to the east of the Site.

Contemporary mapping, such as that included as Figure 2.1, shows the Site occupied by the modern sand pit with an area of woodland marked in the far east of the Site. A 'Sewage Works' is marked further to the east and Grove Covert to the north, beyond the Bromsberrow BPS. Workings associated with the Ryton Road Sand Quarry Landfill are marked to the south-west, beyond the M50 motorway.

There are records of an historic landfill site (referred to as Bromsberrow Pit/Land South of Grovehouse Coppice) occupying the same footprint as the Ryton Road Sand Quarry Landfill, to the south of the Site beyond the M50 motorway. The first inputs to this site are recorded in September 1957 and included inert and commercial wastes. Records indicate that the site was operated by S Gardner and Son (Transport) Limited and, given the timeframe, is anticipated to have been associated with the construction of the M50 motorway.

The permit application documents (ESI, 2010) for the Ryton Road Sand Quarry Landfill note that:

"a small amount of inert material was previously deposited at the site. This was in accordance with earlier planning permissions that were granted to restore the site to original levels but was never completed".

According to EA records, around 2007 and prior to quarry ownership by Allstone, the EA had to attend several reported pollution incidents at the Bromsberrow North site, notably including: leaking

above ground single skinned fuel/ oil tanks directly into bedrock; a skip full of waste hydrocarbon products including oily water and four 25 gallon drums near to Beach Lane (i.e. adjacent to the PWS); and a large quantity of contaminated soils and crushed waste materials in the south-west corner of the Site. A notice was issued at the time to remove the waste and deal with the spills, which was complied with. The composition of the 'tipped' materials in this area was confirmed by Allstone as comprising a thin layer of 'dirty sand overburden' which was subsequently used in the construction of the access road. This would seem to confirm that the contaminated soils and crushed waste materials have been removed as described previously.

3.4 Proposed Development

3.4.1 Phased Restoration by Inert Landfill

Further development and restoration of the quarry has been divided into eight phases according to the quarry development plans provided by Allstone. Details of the development and restoration by inert landfill are provided in the quarry development plans included with this ESSD:

- Bromsberrow Quarry: Updated Quarry Development Plan – Floor at 36mAOD. Drawing No. 7873-005-D-002 Rev 02.
- Bromsberrow Quarry: Updated Quarry Development Plan – Floor at 36mAOD Cross Sections. Drawing No. 7873-005-D-004 Rev 03.

The development will provide a total of 341,000 tonnes of mineral (red sand) extracted, equating to 155,000 m³ from 2023 through to the end of extraction. Based on current rates of extraction, the end of the sand extraction is expected in 2032.

The expected phasing volumes and timescales are presented in Table 3.2.

Table 3.2 Expected Phasing Volumes and Timescales

Extraction Phase	Commentary	Volume (m ³)	Date of completion
1	Remove original access ramp to 36m AOD	17,000	07/07/2024
2	Western area extracted down to 36m AOD	52,000	17/05/2027
3	Western area extracted down to 36m AOD and Northern extension to 39M AOD	18,000	12/05/2028
4	Completion of western extension to 36m AOD and Northern extension to 39m AOD. Form new access ramp to quarry floor.	24,000	06/09/2029
5	Northern extension extracted to 36m AOD	17,000	13/08/2030
6	Remove phase 4 access ramp to 36m AOD	27,000	06/02/2032
Extraction Total (from 2023)		155,000	

Restoration Phase	Commentary	Volume (m ³)	Date of completion
1	Extension of ramp onto quarry floor		01/08/2023
2	Stabilisation of Eastern boundary and creation of stocking area	88,000	18/05/2026
3	Southern boundary face stabilisation	76,000	16/10/2028
4	Enlargement of Southern Face tip	43,000	27/02/2030
5	South West corner - plant area	80,000	12/09/2032
6	Old ramp infill	24,000	18/06/2033
7	Central area	174,000	28/12/2038
8	Whole site overlay to original ground level	185,000	13/11/2044
Restoration Total		670,000	

It is proposed that the Site is progressively restored back to original ground levels by landfilling with inert materials alongside the extraction of mineral. It is estimated that a total of 670,000m³ of inert material will be imported to achieve this restoration, which is estimated to be completed by 2044.

Details of the proposed final landform and final use are presented in Section 3.4.5.

The proposed landfilling activity requires an EP under the Environmental Permitting Regulations (EPR) and will have to meet the criteria for inert landfills in the Landfill Regulations.

Inert material is defined by the Landfill Directive as material that does not undergo any significant physical, chemical or biological transformations. Inert material will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the inert material and the ecotoxicity of the water passing through it must be insignificant, and in particular not endanger the quality of surface water and/or groundwater.

3.4.2 Waste Quantities

Maximum Capacity of Operation

The maximum capacity of the restoration is 670,000 m³.

Annual Waste Deposition

The maximum quantity of imported waste accepted at the Site per year will not exceed 100,000 tonnes.

3.4.3 Proposed Permitted Wastes

The wastes listed in Table 3.3 are proposed to be accepted at the Site under the EP.

Table 3.3 List of Waste Codes

EWC Code	Description	Restrictions
10 11 03	Waste glass-based fibrous materials	Only without organic binders
15 01 07	Glass packaging Glass	
17 01 01	Concrete	Selected C & D waste only *
17 01 02	Bricks	Selected C & D waste only *
17 01 03	Tiles and ceramics	Selected C & D waste only *
17 01 07	Mixtures of concrete, bricks, tiles and ceramics	Selected C & D waste only *
17 02 02	Glass	
17 05 04	Soil and stones	Excluding topsoil, peat; excluding soil and stones from contaminated sites
19 12 05	Glass	
20 01 02	Glass	Separately collected glass only
20 02 02	Soil and stones	Only from garden and parks waste; Excluding top soil, peat
<i>*Selected construction and demolition waste (C & D waste): with low contents of other types of materials (like metals, plastic, soil, organics, wood, rubber, etc). The origin of the waste must be known.</i> - No C & D waste from constructions, polluted with inorganic or organic dangerous substances, e.g. because of production processes in the construction, soil pollution, storage and usage of pesticides or other dangerous substances, etc., unless it is made clear that the demolished construction was not significantly polluted. - No C & D waste from constructions, treated, covered or painted with materials, containing dangerous substances in significant amounts.		

3.4.4 Waste Acceptance Procedures

Strict waste acceptance procedures will be applied at the Site to ensure that only suitable wastes will be accepted under the EP. The HRA completed as part of the EP application has concluded that standard inert Waste Acceptance Criteria (WAC) limits will apply to the Site.

The proposed waste acceptance procedures are presented in the SOP (Stantec, 2024e) and are summarised in **Appendix B**.

Report Reference: 331201261R2

Report Status: Final

3.4.5 Proposed Final Landform and Final Use

Following completion of the landfill, the Site will be landscaped and returned to agriculture or amenity use, in accordance with the Management Plan for Restoration and Aftercare (**Appendix C**).

The proposed final landform is presented on Drawing No. 21224.101 Rev A within the Management Plan for Restoration and Aftercare (**Appendix C**). This includes a slightly domed landform, predominantly comprising an open meadow habitat to be seeded with wild flora and grass seed mix and woodland at the site boundaries.

3.5 Other Sources of Potential Contamination

Other sources of potential contamination are identified in Table 3.4.

Table 3.4 Other Potential Sources of Contamination

Source	Location	Commentary
Ryton Road Sand Quarry Landfill	35m from the Site's southern boundary	This is a restored inert landfill Site with an engineered geological barrier on the base and sidewalls and is subject to ongoing environmental monitoring. All of these factors will reduce the likelihood of the migration of any contaminants within the waste mass off-site.
Contaminated surface water runoff from adjacent public highways	Immediate north, east, north-west of Site; approximately 10m south of Site	Potential contaminants include hydrocarbons (fuels and oils), road salt (sodium chloride) and metals e.g. cadmium, copper, lead and zinc.
Agricultural land use	North, northeast and south of Site between 100m and 550m from Site boundary	Potential contaminants include nutrients (e.g. nitrogen and phosphorous), hydrocarbons (fuel and oils), heavy metals (e.g. cadmium, chromium, lead) and pesticides.

4 Conceptual Site Model: Pathways and Receptors

4.1 Pathway and Receptor Identification

This CSM includes the pathways that potential pollution may follow to travel away from the Site and the potential receptors that may be affected by it. Note that some pathways and receptors are both a pathway and receptor, such as groundwater.

4.2 Geology

4.2.1 Regional Geology

Bedrock

The bedrock geology is shown in Figure 4.1, taken from the 1:50,000 scale geological map of the area (BGS, 2012). Underlying the Site is the Permian Bridgnorth Sandstone Formation (sandstone), which is described as presenting cross-bedded aeolian sandstones, mainly brick-red, soft, medium-grained, with buff mottling common.

To the immediate south of the Site boundary, beyond the M50, the bedrock consists of Triassic Helsby Sandstone Formation (sandstone). This formation is described as fine- to medium-grained, locally micaceous, cross-bedded and flat-bedded sandstones, weathering to sand near the surface. Sandstones are of fluvial (sub-angular to sub-rounded grains) and aeolian (well-rounded grains) facies. Pebbles may be common, particularly near the base of the formation, and thin units of hard intraformational conglomerate occur in the south-west. Thin lenticular beds of reddish-brown siltstone and mudstone occur and may be common in fining-upward sequences; calcretes and rhizocretions occur at some horizons in the south-west (BGS, 2021).

Interbedded within the sandstone of the Helsby Sandstone Formation there are isolated beds of conglomerate, as shown in orange on Figure 4.2. Approximately 1.6 km east from the Site, beyond a faulted north-south boundary, lies the Sidmouth Mudstone Formation. To the northwest of the Site, approximately 1.3 km away, the Haffield Breccia Formation extends westwards. This formation comprises Lower Palaeozoic breccia-conglomerate.

There are two main faults at rockhead identified near the Site. To the east, one of these faults forms the boundary between the Bridgnorth Sandstone and Sidmouth Mudstone Formations. At 1 km west, a parallel fault crosses the Bridgnorth Sandstone Formation north to south. However, the closest mapped fault to Site is an inferred one approximately 150 m south, beyond the M50, extending west to east for approximately 280 m. Three additional minor faults, parallel to each other, are identified crossing the Helsby Sandstone Formation in a north-south direction, the closest one being approximately 720 m east from the Site.

Potential fracturing in the Bridgnorth Sandstone is discussed in the 'Fracture Protocol', Section 5.1.4 of this ESSD.

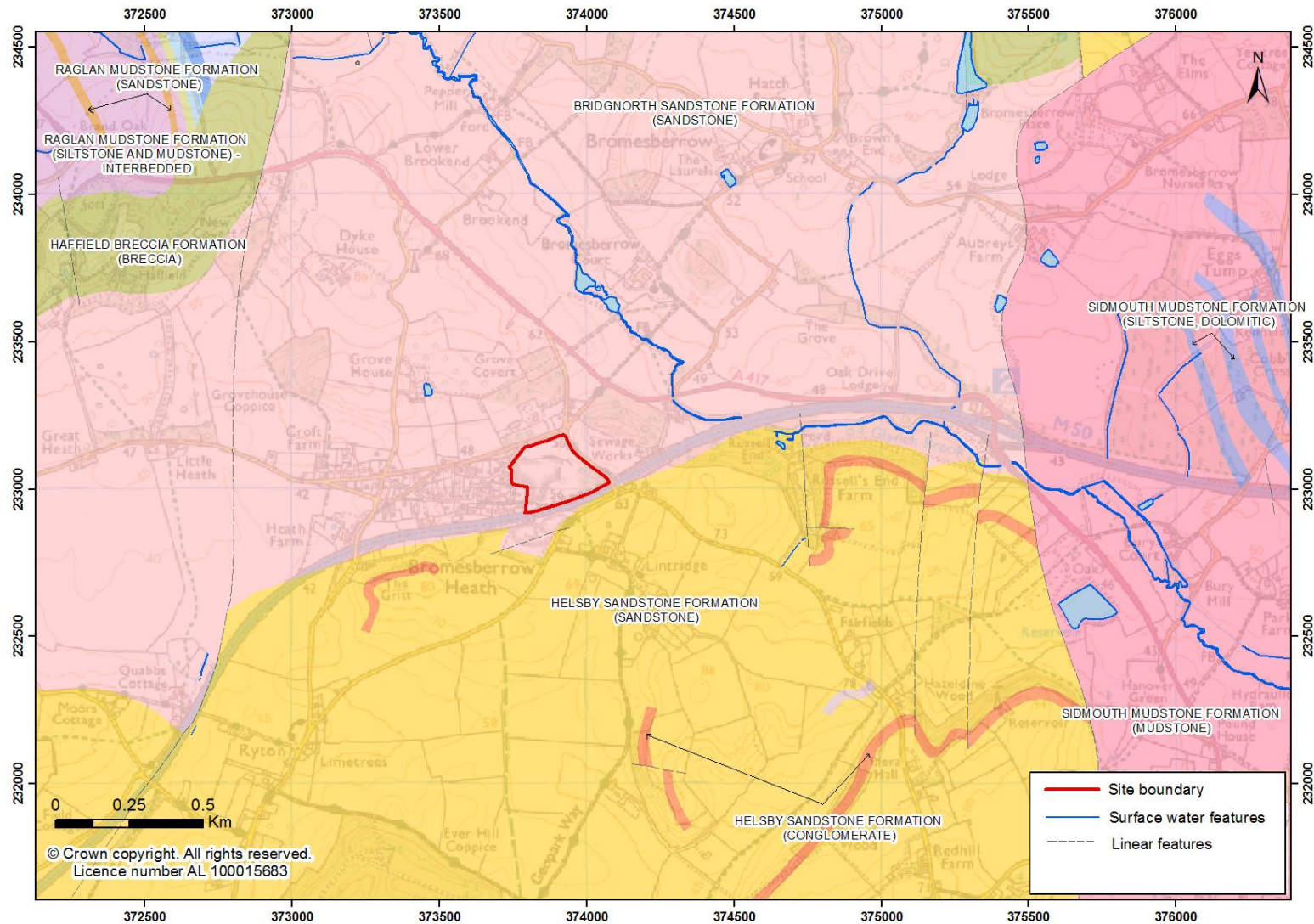
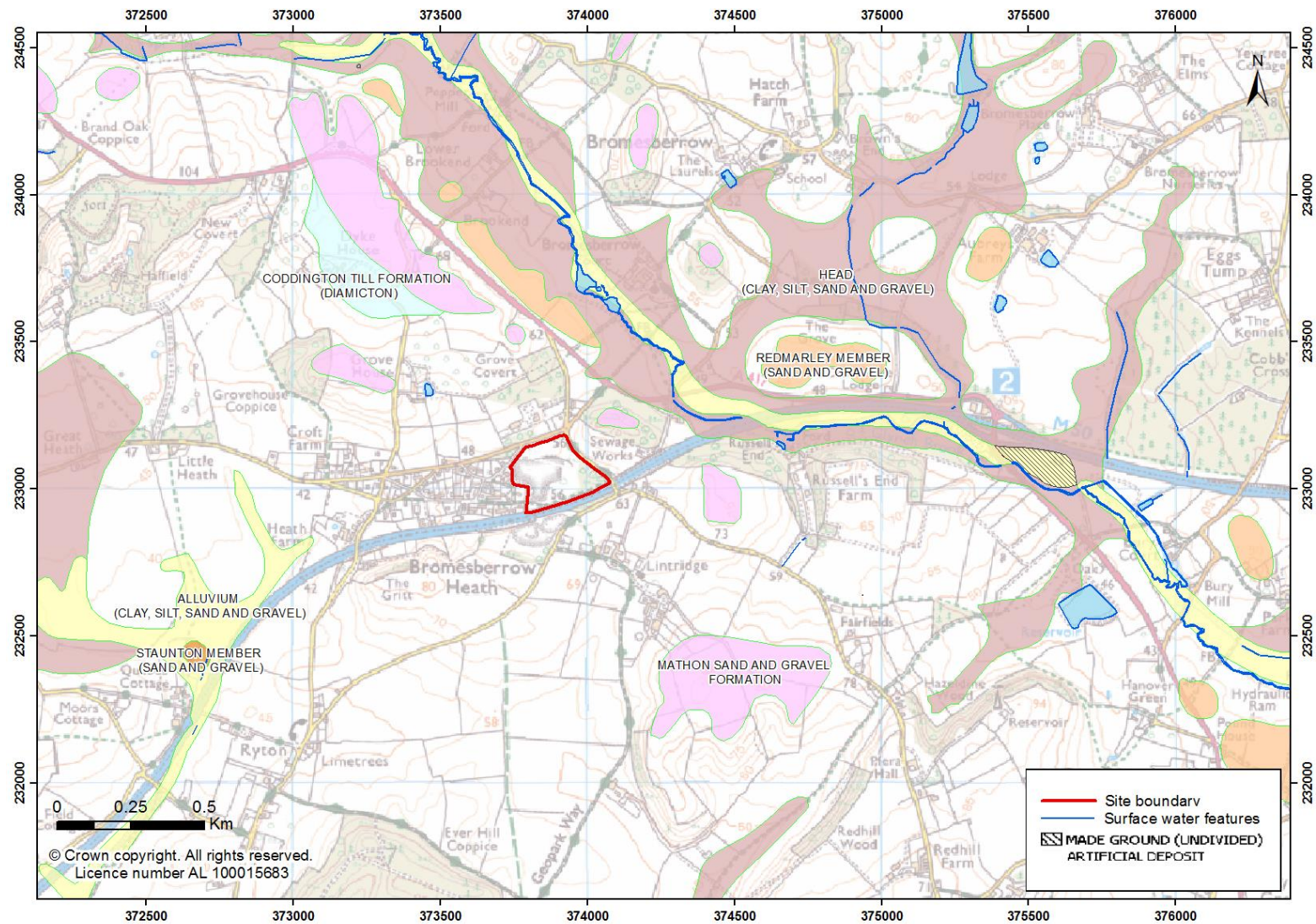
Figure 4.1 Bedrock Geology

Figure 4.2 Superficial Deposit Geology

Superficial Deposits

According to available mapping (BGS, 2021), there are no superficial deposits underlying the Site (Figure 4.2**Error! Reference source not found.**). The closest superficial deposits, defined as Mathon Sand and Gravel Formation, are found as isolated pockets, with the closest being approximately 200 and 400 m east of the Site. These date from the Anglian Stage and are described as basal gravels overlain by red cross-bedded sands with coal debris on foresets; locally overlain by an upper gravel. Sand and gravel, locally with lenses of silt, clay or peat.

Beyond this, Head deposits (clay, silt, sand and gravel) extends northwest to southeast, which is crossed by Alluvium (also clay, silt, sand and gravel) alongside the Glynch Brook. Other superficial deposits in the vicinity of the Site are the Redmarley Member and the Staunton Member, both comprised by sand and gravels, and the Coddington Till Formation (diamicton) at approximately 0.6 km northwest.

Artificial deposits (Made Ground) are identified approximately 1.5 km east to the Site, between the M50 junction and Glynch Brook. These are described as an area where the pre-existing (natural or artificial) land surface has been raised by artificial deposits. The purpose of the Made Ground is unspecified (variable composition).

4.2.2 Local Geology

Historical Borehole Logs

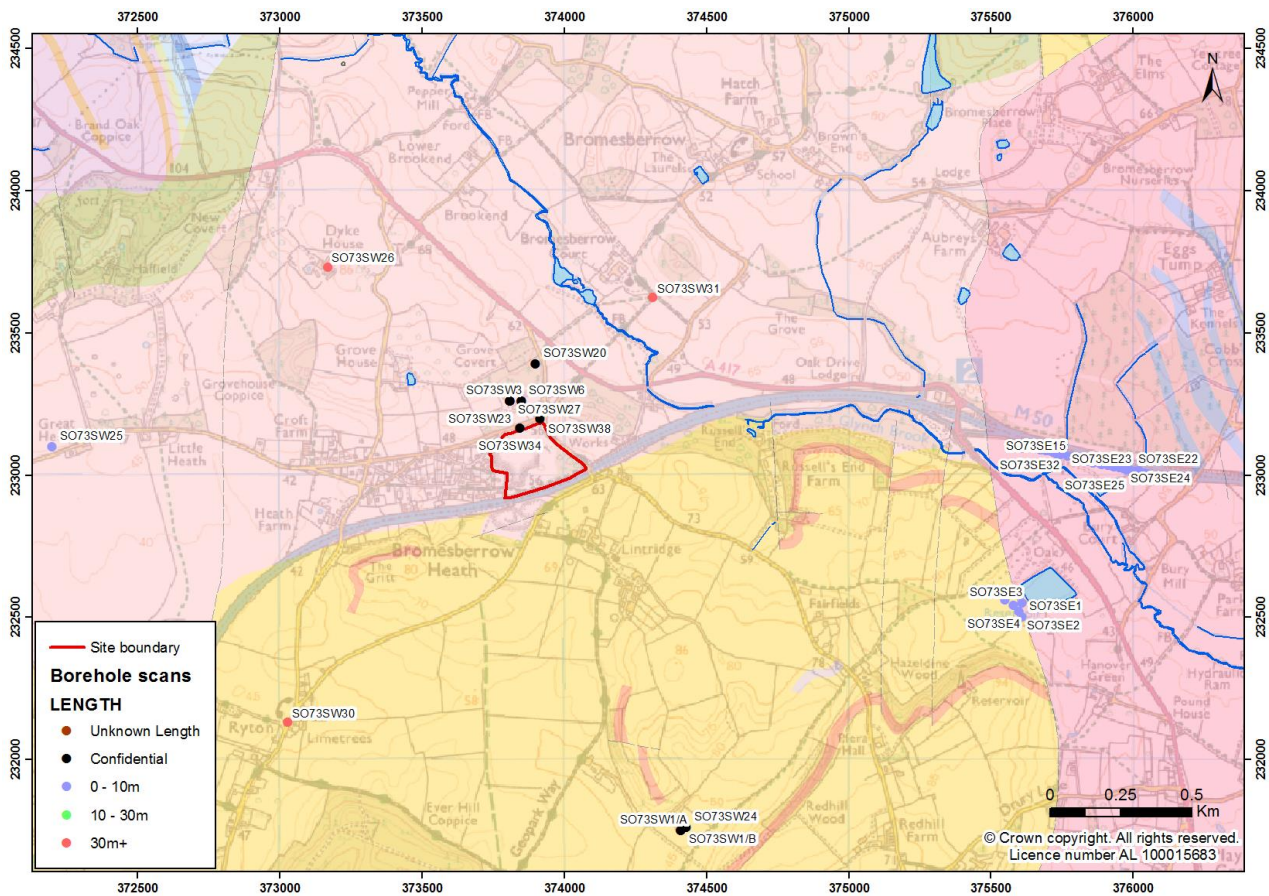
There are several records of historical BGS borehole logs near the Site (BGS, 2021); however, the closest ones adjacent to the north boundary are confidential and therefore no information can be retrieved. Near Bromsberrow Court, at approximately 0.60 km northwest of the Site boundary, there is an available record (ref. SO73SW31 on Figure 4.3) from 2013 which shows the geological strata detailed in Table 4.1.

Table 4.1 BGS Borehole Log (ref SO73SW31)

Depth from (m bgl)	Depth to (m bgl)	Description
0	0.3	Topsoil: Soft brown sandy silt with humus.
0.3	1.2	Brown slightly silty SAND with occasional medium sub angular gravels of sandstone.
1.2	6.0	Brick red SAND with occasional lithorelicts of sandstone. (Weathered Bridgnorth Sandstone).
6.0	50.0	Extremely weak, brick-red, fine- to medium-grained, thinly cross-bedded SANDSTONE (Bridgnorth Sandstone).

Note: m bgl (metres below ground level)

Groundwater was recorded as first struck at 21 m below ground and rose to 18.6 m bgl.

Figure 4.3 Historical Borehole Locations

4.2.3 Site Investigations

Monitoring boreholes were drilled in and around the Site in 2021 and 2022, as follows:

- A series of seven boreholes (BH01, BH01A, BH02, BH02A, BH03, BH04 and BH04A) were drilled and installed in August and September 2021 to provide groundwater and landfill gas monitoring capability around the perimeter of the Site as well as background monitoring data. The boreholes were drilled to depths of between 20 and 35 m bgl and generally encountered red SAND, overlain in some locations by up to 1.2m of Made Ground.
- A series of three boreholes (NB01, NB02 and NB03) were drilled and installed in December 2022, principally to provide additional background groundwater monitoring data. These boreholes were drilled to 10 m bgl and encountered red brown SANDSTONE throughout.

No visual or olfactory evidence of contamination was identified during the drilling works.

Locations of the site investigation boreholes are shown within the EMP (Stantec, 2024f). The EMP also includes copies of the drilling logs and installation records for these boreholes.

4.2.4 Infilled Ground/Landfilling

There is only one record for an authorised landfill (landfill sites that are currently authorised by the Environment Agency under Environmental Permitting Regulations) within 3 km of the Site¹. This landfill (the complete and restored Ryton Road Sand Quarry Landfill, EP reference EPR/JP3698VP) is categorised as inert and is located within the former Bromsberrow South Sandpit, circa 35m from the Site's southern boundary (EP reference EPR/JP3698VP).

The landfill is shown in Figure 4.4 and further details are provided in Table 4.2.

Figure 4.4 also shows neighbouring properties to the Site as well as main roads.

Figure 4.4 Historical and Operational Landfills within a 3 km Radius of the Site



Table 4.2 Historical and Operational Landfills within 3 km Radius of the Site

Landfill	Operator	Status	Distance from Site	Waste Accepted	Area (ha)
Ryton Road Sand Quarry Landfill	Terra Firma (Gloucestershire) LLP	Restored	c. 35 m south	Inert	c. 2.39

¹ Environment Agency data indicate a historical landfill at the same location.

4.3 Hydrology

4.3.1 Surface Water Courses

Surface watercourses within a within 2 km radius of the Site are shown in Figure 4.5. Each watercourse is described in more detail in Table 4.3.

The vast majority of the Site lies within the Glynch Brook catchment area (ID GB109054039620) which occupies an area of 45.69 km² (UK Centre for Ecology and Hydrology, 2021). However, a small area of the western boundary lies within River Leadon catchment area (ID GB109054032511), which occupies an area of 66.26 km².

The Site lies within the River Leadon operational catchment area and Severn Vale management catchment area. The Glynch Brook is the closest watercourse to the extraction area, which runs in a north-to-southeast direction approximately 400 m east of the eastern boundary of the Site.

The Glynch Brook headwaters rise at Eastnor Lake, Ledbury and it flows in a southerly direction until it joins downstream with Wynd Brook, near Lowbands, to finally confluence with the River Leadon approximately 6 km southeast of the Site. The Glynch Brook has a total length of 18.87 km.

According to the EA (EA, 2021) in 2019 this watercourse was classified as having a “Moderate” status with regard to its condition, meaning that a greater level of protection and management is needed if it is to improve to a good level of health. High levels of phosphate were identified within the watercourse, likely to be derived from continuous sewage discharge.

The River Leadon, categorised as a main river, runs near the Site. It is a tributary of the River Severn. It rises near the village of Evesbatch, Worcester and flows south and east past Dymock, Upleadon and Highleadon to join the Severn at Over, just west of Gloucester. The closest section of the river to Site is located c. 2.3 km southwest of the extraction area. The river is approximately 29 km long.

Table 4.3 Watercourses within 2 km of the Site

Name	Type	Distance from extraction area	Description
A	Drain / Ditch	c. 780 m southeast	Constructed along a path off Bromsberrow Road, located at the bottom of Wyevale Transplants. A tree line is identified along the length of the ditch.
B	Spring/ stream	c. 1.2 km southwest	Associated with Quabbs Cottage fields on the upper part and followed by trees. It is intersected by the M50, and presumably joins the motorway drainage.
C	Spring/ stream	c. 1.7 km west	Isolated stream between fields, c.50 m long, presumably runs into field drains.
D	Stream tributary of the River Leadon	c. 1.9 km northwest	It rises near Smallends Farm and flows westwards for approximately 2.1 km to its confluence with the River Leadon.
E	Spring / Stream tributary of the Glynch Brook	c. 1.7 km northwest	Likely to be a seasonal stream, as the majority of it appears dry on aerial photographs and it is levelled with the surrounding terrain. It splits in three overground sections with a spring between the further two sections. It flows approximately eastwards for 1.3 km to its confluence with the Glynch Brook.

Name	Type	Distance from extraction area	Description
F	Stream tributary of the Glynch Brook	c. 1.3 km north	It rises at Toney's Coppice where the terrain is more elevated and flows for approximately 1.7 km to confluence with the Glynch Brook.
G	Stream tributary of the Glynch Brook	c. 1.10 km northeast	This stream rises at Pendock's Grove woodland, where the terrain is more elevated, and flows in a southward direction forming a series of ponds in course until its confluence with the Glynch Brook. It also collects a few minor streams on its way. Its total length is approximately 3.4 km.
H	Ditch / stream tributary of the Glynch Brook	c. 1.7 km east	It borders Cobb's Cross woodland along the western side for approximately 600m downstream. It is crossed over by the M5, however there are no signs of this being culverted.

4.3.2 Other Water Bodies

The Site is located almost entirely within the catchment area of the Glynch Brook, and therefore the majority of the water bodies are associated with this stream or its affluents. The closest water body however appears to be man-made.

Figure 4.6 shows other surface waterbodies within a 2 km radius of the Site, which are described in more detail in Table 4.4.

Table 4.4 Waterbodies within 2 km of the Site

Name	Type	Size (area)	Distance from extraction area
I	Likely to be an artificial pond	c.1027 m ²	400 m northwest
J	Pond raised by a tributary of the Glynch brook	c.900 m ²	660 m east
K	Reservoir	c.12,800 m ²	1.6 km southeast
L	Spring	c.437 m ²	1.8 km south
M	A series of isolated ponds	Ranging from c.600 m ² to 1300 m ²	1.4 to 1.8 km northeast
N	Likely to be an artificial pond. Bordered by mature vegetation	c.800 m ²	1.0 km northeast
O	Reservoir	c 6900 m ²	1.6 km northeast
P	Ponds raised by a tributary of the Glynch brook (watercourse G)	c.14,370 m ²	1.8 km northeast

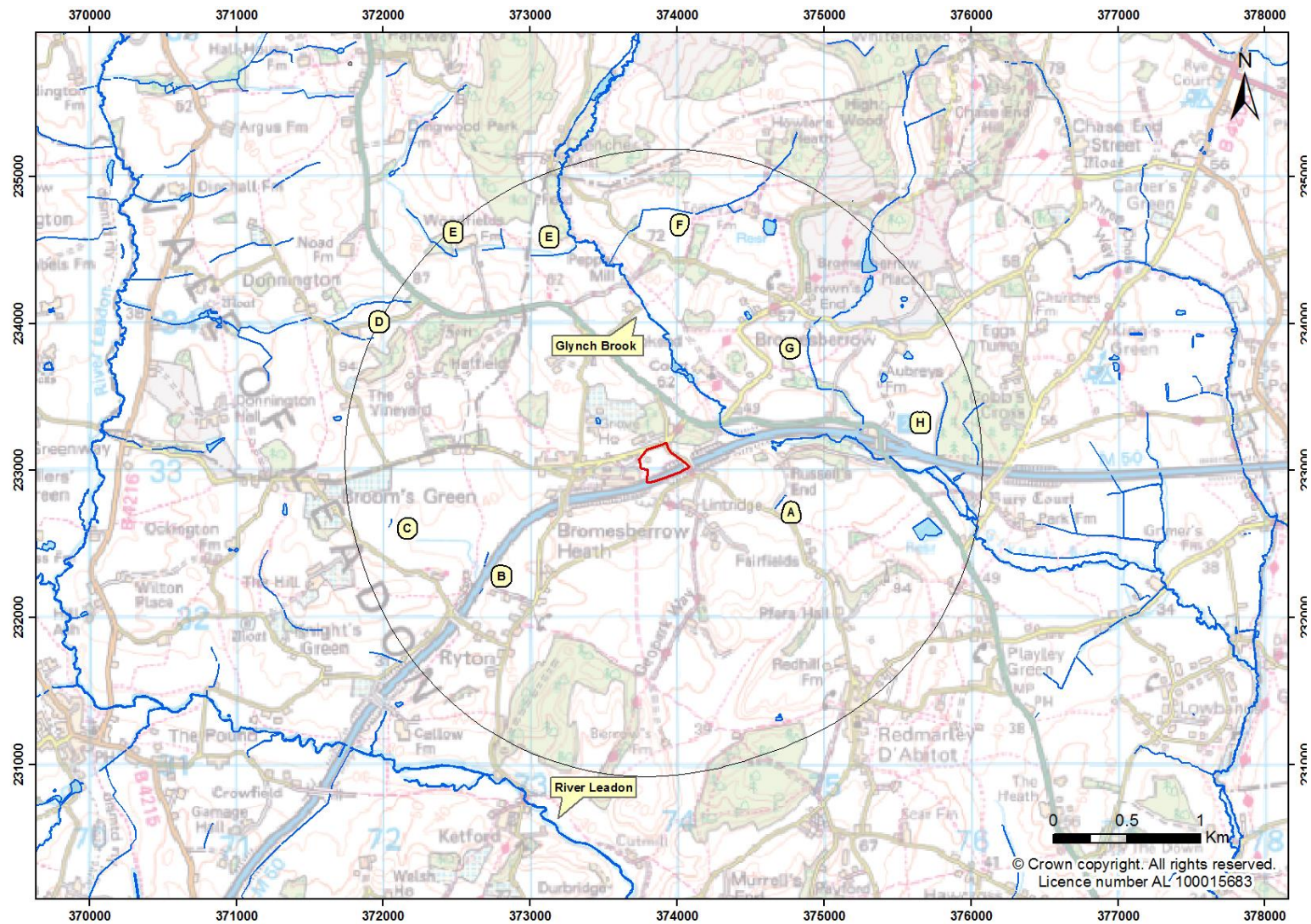
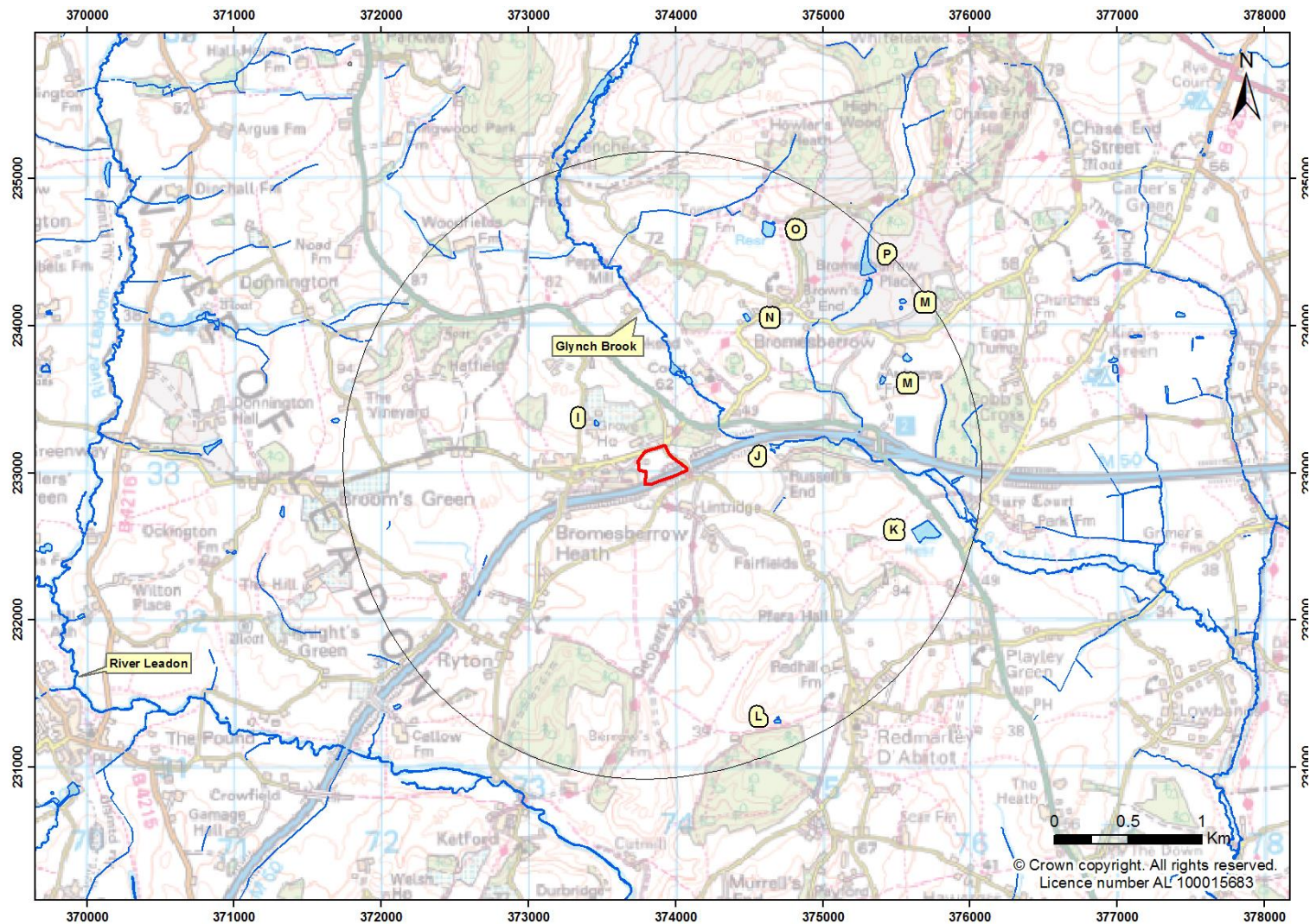
Figure 4.5 Surface Watercourses within 2km of the Site

Figure 4.6 Other Water Bodies within 2km of the Site

4.3.3 Flood Risk Assessment

An FRA was completed for the Site in support of the ROMP application (Stantec, 2024g). This has been updated to include within this EP application and is included as **Appendix F**.

The FRA concludes that:

- The Site lies within Flood Zone 1 and is therefore not at risk of flooding from rivers or the sea.
- The risk of surface water flooding for the Site is expected to be low. Areas of surface water flooding within the Site are created in the large depression of the quarry void; however, the high permeability of the sandstone will permit infiltration and reduce the risk of surface water flooding.
- The Site is not at risk of flooding as a result of reservoir failure and the risk of groundwater flooding in the area is low.
- A drainage scheme has been proposed for the operational phase of the quarry, where the quarry void provides a very large stormwater attenuation capacity. Attenuated water will be discharged to ground.
- Following restoration, runoff will attenuate in newly formed 'SuDS' features (infiltration basin and drainage trenches, refer to the Water Management Plan, Section 5.3 of this ESSD) located to the northwest of the Site. From the basin, water would infiltrate to the sandstone aquifer (in an area where no infill material has been deposited).

4.3.4 Discharge Consents

According to the EA's Public Register, there are five active discharge consents within 1km of the Site. Information regarding each discharge consent, including the reference, holder, site address and grid reference is included in Table 4.5.

There are no discharge consents currently registered with the EA for the Site.

Table 4.5 Active Discharge Consents within 1km of the Site

Discharge Consent ref.	Holder	Site Address	Site Grid Reference
MI/NPSWQD000469/003	Severn Trent Water Limited	Bromsberrow, Bromsberrow Source Nitrate Removal, Wood End Street, Bromsberrow Heath, Ledbury, Herefordshire, HR8 1NY	SO7391533272
MI/S/21/26809/SG/002	Mr P Sargeant	Lintridge Farm, , Bromsberrow Heath, Near Ledbury, Herefordshire, HR8 1PB	SO7405032800
MI/S/21/23091/O/001	Severn Trent Water Limited	Bromsberrow Pumping Station, Bromsberrow, Gloucestershire	SO7313033000

Discharge Consent ref.	Holder	Site Address	Site Grid Reference
MI/S/21/25805/R/003	Severn Trent Water Limited	Bromsberrow STW, Bromsberrow, Gloucestershire	SO7440033250
MI/EPRGB3398EA/001	Wyevale Nurseries Limited	Wyevale, Wyevale Transplants, Russells End Farm, Bromsberrow Heath, Ledbury, Hereford, HR8 1PB	SO7473833079

4.3.5 Private Water Supplies

The Forest of Dean District Council previously provided information on private water supply abstractions around the Site. The locations and details are shown Table 4.6 and they are included in Figure 2.2.

Table 4.6 Private Water Supplies

ID	Location NGR	Source	Abstraction Rate
PS1	E 375701, N 234256	Spring	<1 m ³ /day
PS2	E 375701, N 234256	Borehole	<5 m ³ /day
PS3	E 375701, N 234256	Borehole	<5 m ³ /day
PS4	E 374757, N 234727	Borehole	<1 m ³ /day
PS5	E 375732, N 234962	Well	<1 m ³ /day
PS6	E375914, N 235530	Borehole	<1 m ³ /day
PS7	E 373232, N 232993	Spring	Information not available
PS8	E 376162, N 231529	Well	Information not available

4.3.6 Licensed Groundwater Abstractions

As described in Section 2.3, an SPZ1, adjacent to the northern boundary of the Site, is associated with PWS boreholes operated by Severn Trent Water Ltd.

The borehole licences are all for abstractions up to a total of 2,821,000 m³/a. A detailed description of these PWS abstractions is presented in Table 4.7.

Table 4.7 Licenced Abstractions at Bromsberrow PWS

ID (figure)	1	2	3	4	5
Location name	BH1 - C	BH2 - D	BH3 - E	BH4 - F	BH5 - G
Distance from extraction area	71 m north	71 m northwest	70 m north	82 m north	196 m north
Licence No.	18/54/21/0116				
Description	Public Water Supply				
Use description	Potable Water Supply - Direct				
Source type	Groundwater				
Maximum Annual Quantity (m³)	2,821,000				
Maximum Daily Quantity (m³)	11,592				

Figure 2.2 shows the defined SPZ associated with the public water abstraction boreholes situated in the vicinity of the Site.

4.4 Hydrogeology

4.4.1 Aquifer Characteristics

The aquifer characteristics are discussed in detail in the HRA (Stantec, 2024b). The Bridgnorth Sandstone is a Principal Aquifer, with correspondingly high values for porosity and hydraulic conductivity. Groundwater flow occurs mainly via intergranular movement.

The location of the Site in relation to SPZs is discussed in Section 2.3 of this ESSD.

The location of licensed abstractions and private water supplies is presented in sections 4.3.5 and 4.3.6 of this ESSD, respectively.

4.4.2 Groundwater Flow

Groundwater flow including local and regional flow regimes is discussed in detail in the HRA (Stantec, 2024b). The groundwater flow direction is assumed to be from the Site towards Bromsberrow PWS. The Site is above the water table.

The HRA also presents:

- A summary of the ongoing groundwater level monitoring, including calculated hydraulic gradients; and
- An interpretation of groundwater movement in a wider context including groundwater/ surface water interaction and surface discharge.

4.4.3 Groundwater Quality

A summary of the ongoing groundwater quality monitoring is presented in the HRA (Stantec, 2024b).

4.5 Man-made Subsurface Pathways

Man-made subsurface pathways identified are identified in Table 4.8.

Table 4.8 Potential Man-made Subsurface Pathways

Pathway	Commentary
Buried services (water supply, foul sewer and electrical connections)	Gravel backfill around buried services can act as a preferential pathway for contaminant migration off-site.
Monitoring boreholes	Gravel backfill around monitoring boreholes can act as a preferential pathway for contaminant migration off-site.

4.6 Receptors and Compliance Points

4.6.1 Sensitive Receptors

A number of sensitive receptors have been identified and are shown on Drawing No. 331201261D2. The distance of these receptors from the Site boundary and their direction relative to the Site are detailed in Table 4.9.

Sensitive receptors in proximity to the Site include both human receptors and habitat / protected sites.

The groundwater receptors are at the edge of the Site and the nearby PWS. The receptor for hazardous substances is the water table directly below the AEGB ('water table'). There is no surface water in continuity with the groundwater beneath the Site.

Table 4.9 Sensitive Receptors in the Vicinity of the Site

Ref	Receptor	Receptor type	Distance (m)	Direction from nearest boundary
R0	Groundwater	Controlled waters	On site	-
R1	Public Highway: Bell Lane	Public highway (road)	<10	Northwest
R2	Public Highway: Wood End Street	Public highway (road)	<10	East
R3	Public Highway: Beach Lane	Public highway (road)	<10	North
R4	Public Highway: M50 Motorway	Public highway (motorway)	<10	South
R5	Bromsberrow High Bank LWS	Local Wildlife Site	<10	Northeast
R6	Bromsberrow Heath	Residential area	<10	West
R7	Bromsberrow LWS	Local Wildlife Site	20	East

Ref	Receptor	Receptor type	Distance (m)	Direction from nearest boundary
R8	Ryton Road Sand Quarry Landfill (Bromsberrow South)	Landfill site operated by Terra Firma	35	South
R9	Bevanhill Coppice	Nearest area of deciduous woodland to the Site	75	Northeast
R10	Bromsberrow BPS and Willows Farm	PWS and adjacent residential property	100	North
R11	Public Highway: A417	Public highway (road)	220	Northeast
R12	Lintridge Farm	Farm – agricultural buildings and land	200	South
R13	Ecasks	Barrel supplier	230	South
R14	Church View Farm	Farm – agricultural buildings and land	310	Northeast
R15	Grove House	Ponds	330	Northwest
R16	Glynch Brook	Surface water feature – stream	350	Northeast
R17	Bromesberrow Court	Farm – agricultural buildings and land	550	Northeast
R18	Foxbury Fields Vineyard & Winery	Vineyard	700	East
R19	The Poplars, Dyke House	Conference centre	820	Northwest

The Pre-application Nature and Heritage Conservation screening provided by the EA (EPR/LB3507FW/A001) shows a historic protected habitat, Grovehouse Coppice, within the Site boundary. This area of woodland no longer exists on the Site. Historic imagery shows the coppice disappearing between 2009 and 2013. Therefore, the Grovehouse Coppice is not considered further as part of this ESSD.

4.6.2 Groundwater Compliance Points

The groundwater receptors are at the edge of the Site and the nearby PWS. The receptor for the hazardous substances is the water table directly below the AEGB ('water table'). There is no surface water in continuity with the groundwater beneath the Site. The groundwater compliance monitoring locations are described in the EMP (Stantec, 2024f).

4.6.3 Surface Water Compliance Points

There will be no direct discharges to nearby surface water features from the Site and there is no surface water in continuity with the groundwater beneath the Site. Consequently, no surface water compliance points are identified.

4.6.4 Amenity (Nuisance and Health Issues)

Potentially sensitive receptors in the vicinity of the Site are identified in Table 4.9.

The local human population surrounding the Site includes residential dwellings, businesses and industrial premises.

An ERA (Stantec, 2024a) has been completed, that identifies and considers the potential hazards associated with the proposed activity, along with the receptors that are proximate to the Site, and could be reasonably affected by the activities.

The following sources included in the ERA are considered to have the potential to cause harm to the local population. Mitigation measures are outlined to show where risk can and will be reduced.

Safeguarded Aerodromes

The closest airfield to the Site is a private airstrip known as 'Berrow' or 'Aubreys Farm'), some 1.3km east of the Site. According to the UK Airfield Guide (UK Airfields and Airport, 2023), this airfield has been operational since the early 2000s and has a single 700m grass airstrip, orientated southwest to northeast.

This airstrip is not an officially safeguarded aerodrome as defined in 'The town and country planning (safeguarded aerodromes, technical sites and military explosives storage areas) direction 2002' (DFT, 2016) and as such has not been considered here in terms of the potential for birdstrike. Note that the materials received at the Site will not contain putrescible materials which may attract pests or vermin.

Dust and Particulates

Particulate emissions can arise from the unloading and on-site handling and placement of materials, handling of existing on-site materials and vehicle movements on-site and on potentially dusty roads.

A detailed Dust and Emissions Management Plan (DEMP) has been produced by Stantec to support this EP application. The DEMP (Stantec, 2024d) assesses the risks of dust generation from Site restoration activities, provides information on the operations to be carried out under the EP and sets out how Allstone intend to control and manage potential dust emissions.

Strict waste acceptance controls will ensure that only suitable materials will arrive on and be deposited at the Site, which will not include dry or dusty materials. Any rogue or dusty loads which may arrive on Site will either be rejected upon arrival or quarantined on-site with sheeting prior to off-site disposal.

The DEMP should be consulted for further information on how dust is managed at the Site in relation to the proposed waste operations.

The ERA (Stantec, 2024a) considers that there will be a '**low**' residual risk to the surrounding local human population as a result of dust and particulates from the proposed activity at the Site.

Noise

Noise has the potential to cause nuisance, loss of amenity and loss of sleep to the local human population.

A Noise Impact Assessment (NIA) (Ref R9694-1 Rev 0) has been prepared by 24Acoustics as part of the ROMP application for the Site (**Appendix D**). Noise and vibration associated with the proposed on-site activity will be restricted primarily to the movement and operation of Site plant and on-site mobile plant and equipment during operational hours defined by the planning consent. All plant will be fitted with appropriate and well-maintained silencers. All of the plant and equipment kept on the Site will be maintained in accordance with the manufacturer's recommendations. This results in a low likelihood of excessive noise from plant due to malfunction.

The enhanced service pre-application advice received from the EA (EA, 2023b) concluded that a NIA and Noise Management Plan (NMP) are not required for the EP application, based on an EA screening exercise and the assumptions made around the activity. Were any of the criteria above to change to increase the risk of noise, further advice would be sought from the EA as an NIA and NMP may be required to assess and manage this risk.

The ERA (Stantec 2024a) considers that there will be a '**low**' residual risk to the surrounding local human population from noise arising from the proposed activity at the Site.

Odour

Wastes to be imported to the Site will not contain putrescible materials and are highly unlikely to present any odour risk as they will consist only of materials suitable for the inert landfill activity. Strict waste acceptance criteria will be applied to incoming loads to ensure that they do not contain malodorous materials.

The ERA (Stantec 2024a) considers that there will be a '**low**' residual risk to the surrounding local human population from odour arising from the proposed activity at the Site.

Mud and Debris

The local human population may be sensitive to mud and debris along the highways around the Site. The mud and debris may have been tracked out of the Site by heavy goods vehicles. The waste types proposed to be permitted under the EP are considered to have a low potential to produce litter. A road sweeper will be utilised to reduce mud on local highways that may have been tracked out from the Site. A wheel wash will also be required to be used by heavy goods vehicles to prevent mud being tracked out of the Site.

The ERA (Stantec 2024a) considers that there will be a '**low**' residual risk of nuisance and loss of amenity to the local human population from mud and debris arising from the proposed activity at the Site.

Pests and Vermin

Materials received at the Site will not contain putrescible materials which may attract pests or vermin. Housekeeping and strict waste acceptance procedures will ensure that activities and materials that could attract vermin and pests are not undertaken or accepted onto the Site.

It is considered likely that there will be a naturally-occurring vermin population in the locality of the Site due to its agricultural setting.

The ERA (Stantec, 2024a) considers there to be a **'low'** residual risk of pests and vermin causing harm and nuisance to the local population from the proposed activity at the Site.

4.6.5 Habitats and Protected Sites

Potentially sensitive receptors in the vicinity of the Site, including habitats and protected sites, is presented in Table 4.8. Designated areas close to the Site are shown in Figure 4.7.

The entire Site and surroundings lie within a Nitrate Vulnerable Zone (NVZ). Areas of woodland are marked to the east, north and west of the Site. Regarding habitat designations, the Site lies within a Priority area for Countryside Stewardship measures addressing Lapwing habitat issues. There are no other designated areas within the Site boundaries relevant to this study.

In the surroundings, the Malvern Hills Area of Outstanding Natural Beauty (AONB) is identified c.250 m northeast of the Site. It extends northwards over an area of 107 km². Part of the AONB is also designated as a Site of Special Scientific Interest (SSSI) for its range of important habitat. The nearest point of the SSSI to the Site is Chase End Hill, located approximately 2.6 km northeast.

The Pre-application Nature and Heritage Conservation Screening Report provided by the EA (EPR/LB3507FW/A001) records the Bromsberrow (High Bank) LWS and Bromsberrow M50 LWS within 200m of the site. It also recognises that the Glynch Brook, is a protected fish migratory route for the European Eel and is a habitat for the Bullhead, a protected fish species.

As discussed elsewhere in this ESSD Report, the Pre-application Nature and Heritage Conservation screening also shows a historic protected habitat, Grovehouse Coppice, within the Site boundary. This area of woodland no longer exists on the Site. Historic imagery shows the coppice disappearing between 2009 and 2013. Therefore, the Grovehouse Coppice is not considered as a sensitive receptor in this ESSD.

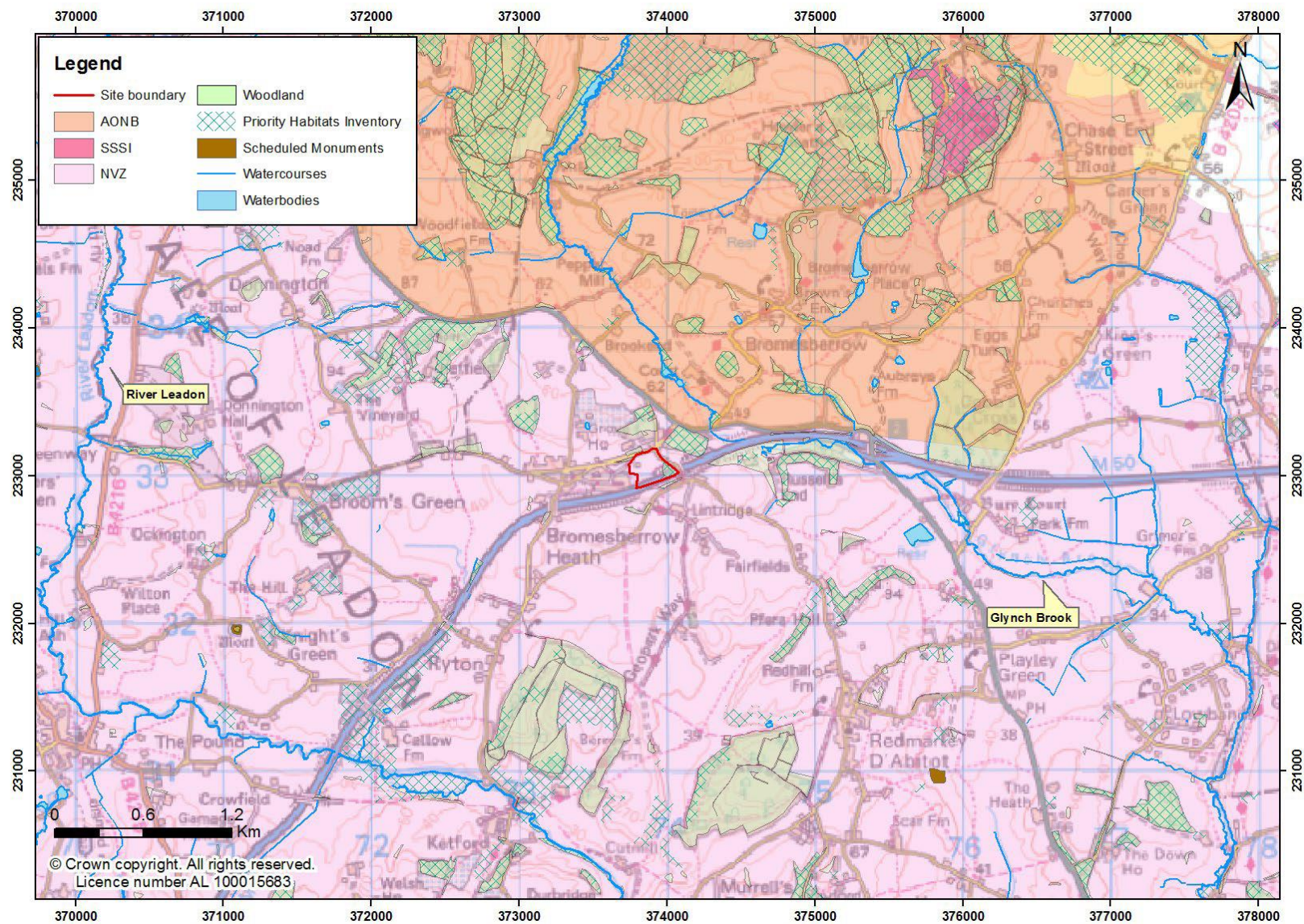
An ecological appraisal was carried out by AA Environmental Ltd to support the ROMP application for the Site (**Appendix E**). The findings of this ecological appraisal indicate that there are no statutory or non-statutory designated sites that would be directly affected by the proposals and no over-riding ecological constraints to the development proposals (including the proposed infill). Generic mitigation measures have been suggested as part of the report to reduce the impact of works during the infilling of the Site to local wildlife and increase the nature conservation value of the Site and surrounding area in the long term once the quarry has been fully restored, in accordance with Government guidance as set out in National Planning Policy Framework.

The risk from proposed Site activities to ecological receptors is considered to have been fully addressed as part of the planning process and the ERA (Stantec, 2024a) and as such it is not considered necessary to produce a more detailed risk assessment.

The ERA (Stantec, 2024a) considers there to be a **'low'** residual risk to natural habitats from the proposed activity at the Site.

The implementation of the SOP (Stantec, 2024e) should minimise the risk to protected sites in proximity to the Site.

Figure 4.7 Designated Areas in Relation to the Site



5 Pollution Control Measures

5.1 Site Engineering

5.1.1 Basal and Side Slope Engineering

Due to the inert nature of proposed fill, and in accordance with the Landfill Directive, there is no requirement to collect leachate at an inert landfill. Hence, no “artificial sealing liner” or leachate drainage layers are proposed.

It is, however, proposed that a minimum 1m thick artificially enhanced geological barrier (AEGB) will be constructed over the base and the sides of the excavation prior to the placement of inert waste.

The AEGB will be constructed following the requirements of the:

- Specification for highways works (National Highways, 2023). This sets out the acceptability of materials, layer thickness, compaction and testing; and
- EA guidance on earthworks in landfill engineering LFE4 (EA, 2014).

As there is no suitable material available on the Site, imported non-waste material (natural clay) will be used for the AEGB. The clay is proposed to come from Bishops Cleeve and is Charmouth Mudstone (formerly Lower Lias Clay). The AEGB will be formed from engineered clay with a maximum permeability coefficient of 1×10^{-9} m/s. The justification for this ‘enhanced’ permeability (over the maximum permeability equivalent to 1m at 1×10^{-7} m/s required under the Landfill Directive for inert landfill) is included in the accompanying HRA (Stantec, 2024b), which demonstrates that the proposed AEGB will provide sufficient attenuation to prevent a potential risk to soil and groundwater.

The side slope AEGB will be progressively built up in maximum 2m lifts; shortly after, inert waste will be backfilled against it to a similar elevation. This will achieve a ‘Christmas tree’ profile as shown in the typical cross section drawing included within the SRA (KeyGS, 2023) and reproduced as Figure 5.1.

The stability of the basal and side slope AEGB (‘lining system’) has been assessed in the SRA (KeyGS, 2023) as part of the waste mass analysis. The waste mass analysis incorporates analyses of the lining system (basal and side slope) since these components will play a role in waste mass stability. The SRA states that the:

“assessment of this component indicates that the stability of the final restoration design is acceptable in the short term. Ultimately the whole excavation area will be backfilled with inert waste and the final restoration contours are almost flat across the site, which will in turn ensure the long-term stability at the site”.

The basal and sidewall AEGB will comprise of clean imported clay and as such will not be contaminated with hazardous pollutants. Only cohesive materials that can achieve the required permeability in accordance with the approved CQA Plan will be used to construct the AEGB.

Before depositing material in any new area, any vegetation that exists within the former quarry will be stripped and composted. Should it not be possible to compost the vegetation, it will be disposed of offsite at a suitably licensed facility. Immediately prior to the commencement of construction, the

base of the quarry will be graded to a reasonably smooth profile using a dozer. Any accumulations of soft silt will be removed to provide a sound formation upon which to construct the AEGB.

5.1.2 Construction Quality Assurance - AEGB

A CQA Plan for the construction of the AEGB will be developed for approval by the EA prior to the construction works, that will include details of:

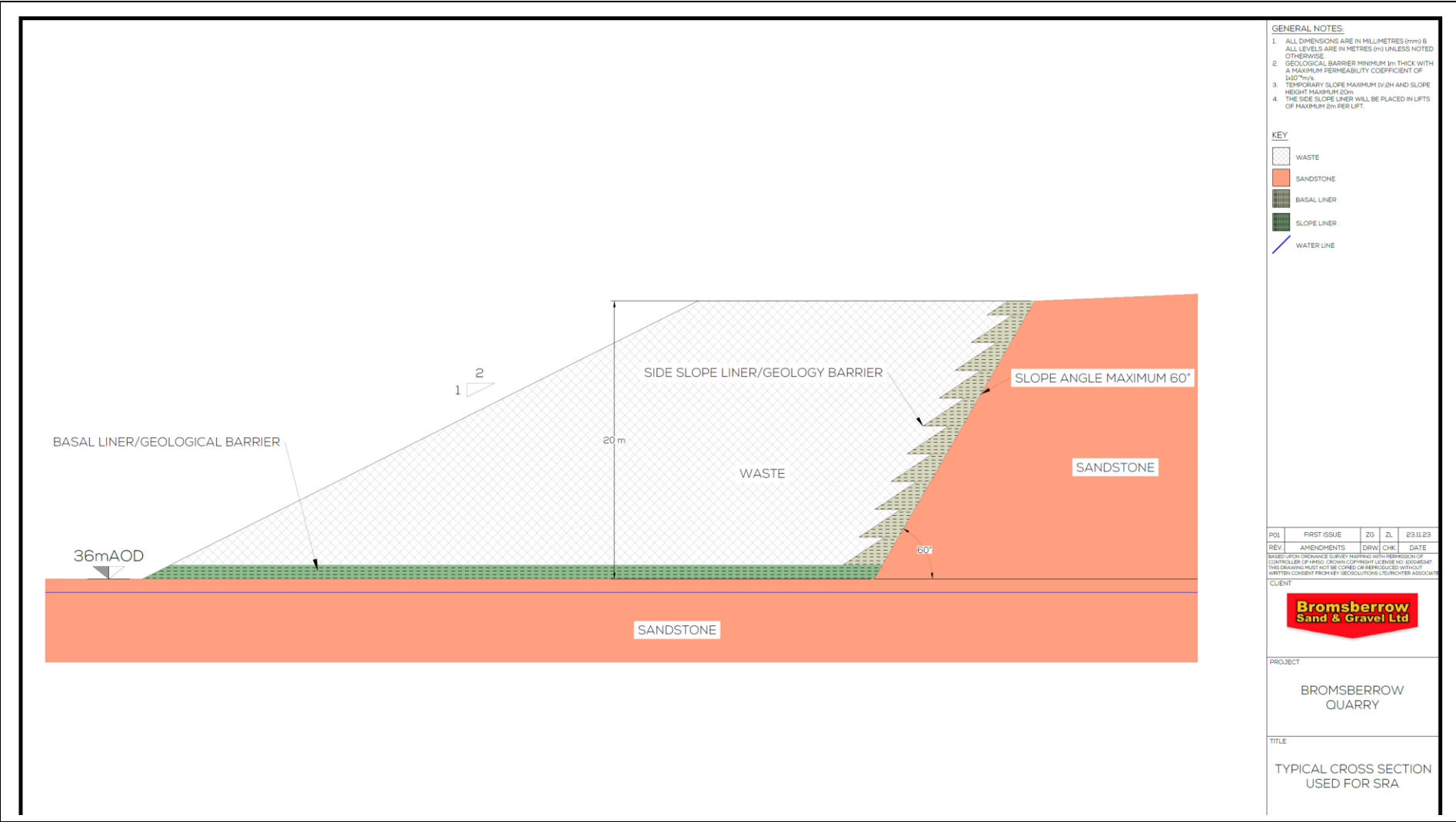
- The specification for the materials to be used in the construction of the AEGB (e.g., natural clays);
- The method by which the AEGB will be constructed (e.g., method statement);
- How site staff will record compliance with the construction method so that the records can be audited by the CQA Engineer or Inspector;
- CQA procedures to make sure that any material used in the geological barrier is physically and chemically suitable;
- CQA procedures to make sure appropriate compaction plant is used to form the geological barrier;
- How the thickness and permeability of the geological barrier will be validated; and
- How the as-laid thickness of the emplaced AEGB will be demonstrated (e.g., by trial pit, hole or survey).

CQA supervision of the AEGB construction will include a minimum one visit by the CQA Engineer for each week of engineering works, or one visit per 5,000m³ of material laid, whichever is the most frequent.

Competent people and resources will be used for all aspects of the landfill engineering and infrastructure works. The qualifications and experience of the nominated CQA personnel (e.g. CQA Engineer, CQA Inspector) will be sent to, and agreed with, the EA before works commence.

Following construction of the landfill engineering, a CQA Validation Report will be submitted to the EA before waste is disposed of in a new phase or development area. The Validation Report will provide the final 'as-built' construction and engineering details of the works.

Figure 5.1 Typical AEGB Cross Section (from KeyGS, 2023)



5.1.3 'Leachate' Containment

It is recognised that 'leachate' will be generated within the waste mass, principally from rainfall infiltration. This leachate should not, however, contain hazardous pollutants because the wastes accepted will be inert in nature and subject to strict waste acceptance procedures.

Nevertheless, and given the high environmental sensitivity of the Site with regard to groundwater, it is proposed that this leachate, along with runoff from the emplaced waste, is contained by the AEGB. It is expected that in managing this 'leachate', the EA and STW will remove their standing objections to the ROMP application.

Allstone will extend the AEGB over the entire basal area of the quarry that has been excavated to the maximum working depth and is to be filled. The AEGB will also extend up the side slopes as described previously, with the side slope AEGB placed on a temporary basis to approximately 2m above the base against the face of the next phase to be extracted, where this is the case.

With reference to the Updated Quarry Development Plan, and taking Phase 2 of the restoration as an example, this means that the AEGB will be placed across the entire basal area of the quarry (marked on the plan at 36mAOD) and against the eastern, south-eastern and south-western side slopes, with a 2m-high temporary side slope AEGB placed against the western and northern slopes, where further sand extraction is proposed. Therefore, at any time during the restoration, leachate and runoff would be contained by the basal and side slope AEGB.

The leachate and runoff will accumulate in the base of the quarry on the AEGB, and will be lost through evaporation along with some downward flux and attenuation through the AEGB. Were this to accumulate to a significant depth in the base of the quarry (e.g. >0.5m), it will be removed off-site to an appropriately permitted facility for treatment and/or disposal.

Proposals for surface water management are included in Water Management Plan (Section 5.3).

5.1.4 Fracture Protocol

Allstone have not identified any major fracture zones within the sandstone during their sand extraction operations at the Site to date, and none were evident during Stantec's walkovers of the site in August 2022 and September 2023. However, major fractures in the sandstone will have a permeability that is orders of magnitude greater than intact sandstone. These types of fracture zones can act as faster pathways increasing the risks of turbidity into the aquifer and so the operations at the quarry within these zones could mobilise more sediments towards the PWS.

Staff members will be trained on how to identify major fracture zones as mineral extraction takes place. Should a major fracture zone be uncovered, extraction operations will temporarily cease and the Site Manager will be informed. The Site Manager will decide the appropriate course of action to ensure the ongoing protection of groundwater.

Mineral extraction will progress in accordance with the order shown on the quarry development plans.

5.1.5 Other Landfill Engineering

Other proposed landfill engineering includes the construction of in-waste landfill gas and leachate monitoring wells, as well as the temporary 'leachate' containment bunding described previously.

Details of the surface water drainage system are provided in the Water Management Plan (Section 5.3 of this ESSD).

Borehole Construction

The in-waste monitoring wells will be dual purpose landfill gas and leachate monitoring installations. These will be retrofitted by vertical drilling upon completion in each phase of the landfill.

Detail of the in-waste monitoring installations is provided in the accompanying EMP (Stantec, 2024f). Details of the CQA of the proposed construction and installation of the in-waste monitoring wells is provided in the EMP.

Suitable measures will be taken to ensure that the basal and sidewall AEGB is not compromised during the drilling; this will include calculation of the required drill depths at each location based on the measured elevation at the surface and the known elevation of the top of the AEGB. The calculated drill depth will include an allowance for a stand-off of at least 0.5m above the top of the AEGB. Progress will be carefully monitored during drilling to ensure that the calculated drill depth is not exceeded.

Were the AEGB to be penetrated, which would be detected by the presence of engineered clay within the arisings, drilling will be stopped immediately and the AEGB reinstated by placement of bentonite grout or hydrated bentonite pellets back to 1m above the known elevation of the top of the AEGB.

A Validation Report will be submitted to the EA within 4 weeks of completing the construction and testing of the relevant infrastructure, or other time period agreed in writing with the EA.

Capping and Leachate Management Systems

Because the proposal is for an inert restoration scheme, no engineered cap, or leachate management system is proposed. The water balance calculations associated with the inert landfill proposals are presented in the HRA (Stantec, 2024b).

The completed landfill will however be restored as described in Section 5.4.2 of this ESSD (Restoration [Landscaping] and Future Use).

5.2 Pollution Prevention Measures

Pollution prevention measures are discussed in detail in the accompanying SOP (Stantec, 2024e) which includes the accident management plan.

Excluding the site engineering and waste acceptance measures described previously, these include:

- Staff will be trained in accordance with procedures within the EMS developed for the Site.
- The Site is manned during working hours, and outside of working hours is secure and monitored with CCTV. The Site is securely locked at the end of each working day.
- Plant and equipment is securely parked / stored at the end of each working day. Vehicles are locked when not in use.
- Regular visual inspections of recorded of plant and equipment.
- Movement of materials and vehicles/plant using safe techniques.
- Boundaries are inspected on regular basis for security checks. Damage to fences/boundaries when access could be gained is remedied at the earliest opportunity. Any damage that

exposes members of the public to significant risk or that allows unauthorised vehicular access to the site will be rectified with a temporary repair until a permanent repair can be made.

- All plant and equipment is maintained in accordance with manufacturer's recommendations.
- All fuels and oils used by Site plant will be brought to the facility by mobile bowser when required. Fuel and oil is stored on the Site in two 10,000 litre double-skinned tanks. Double-skinned tanks will have an outer skin with a capacity of 110% of the inner skin. The tanks are fitted with level gauges to ensure that they are not overfilled. The tank will have a system for checking for leaks in the inner skin and will be protected from vehicle damage by a metal impact bar or concrete bollards of appropriate height.
- Fuel storage tanks and vessels to be located within secondary containment facilities.
- Drip trays are also utilised to prevent spillage of fuel and oil. Plant and equipment are refuelled in designated areas within the Site boundary.
- Prior to commencing refuelling, the plant operator must check the level of fuel remaining in the tank and determine the amount to be delivered. During refuelling operatives must remain with the plant being refuelled and must not leave the delivery hose running unattended.
- Mobile screening plant will effectively be 'static' during the next stage of extraction, in its current location several meters above the base of the excavation. This will allow construction of an impermeable surface (concrete slab) upon which the screening plant will be placed, with a low bund around the edge of the concrete to prevent runoff of potentially contaminated surface water. The impermeable surface will prevent leaks or spills of fuels/oils, etc., from the operation and/or refuelling of the screening plant reaching groundwater beneath the site. Any contaminated water that collects in this area will be removed and disposed of appropriately.
- Mobile plant deployment is continually reviewed based on the latest technology and effectiveness. This will include the use of electrically powered equipment, which would serve to greatly reduce and in some cases eliminate the risk of leakages and spillages.
- All mobile plant will carry a fire extinguisher and will be inspected and maintained in accordance with the plant maintenance schedule to mitigate any potential fires.
- Landfill gas generation will be controlled through appropriate waste acceptance procedures which will ensure that no fill materials likely to generate landfill gas will be accepted.
- Monitoring of ground gases (including flow rates) and groundwater.
- Monitoring of weather conditions by way of reviewing weather forecast.
- Dust mitigation measures such as use of water suppression may be utilised in the event of high winds and lack of rainfall.

5.3 Water Management Plan

It is a requirement for inert landfill EP applications to include a water management plan. The following subsections comprise a summary of how water will be managed at the Site.

5.3.1 Surface Water Management

Based on the FRA (Stantec, 2024g) the risk of surface water flooding is not likely to be high owing to the permeability of the sandstone material of the catchment. This statement is supported by the lack of a quarry sump at the base of the void.

Rainfall that is unable to infiltrate into the ground generates overland flow which can lead to 'ponding' in localised topographical depressions before this runoff is able to enter the drainage system, as described in the following 'Operational Phases 1-6' section below.

The drainage strategy for the quarry is simple and does not include many complicated features because the quarry works remain above groundwater level. As such, the maintenance requirements for the Site will be low, and runoff will be the only source of water in the quarry void. The geometry of the quarry void and the position of the lowest point, to which internal runoff will drain, will be changing throughout the operational phases of the development. Drainage towards the lowest point will be managed as per the normal good management techniques for a sand quarry site, and the runoff will continue to infiltrate the floor of the quarry, away from areas where the AEGB has not been placed, as it does at present.

The FRA states that the 1 in 100-year storm event for a 6hr duration in 'greenfield' conditions requires a total runoff volume of 1,016 m³, well below the total volume of the quarry void. A void significantly larger than this volume will remain until the operations reach the final phases, and by this point the infiltration basin and connecting surface water trenches will have been constructed, as described in the following 'Operational Phases 7-8' section.

Operational Phases 1-6

The surface of the fill materials being worked at any time will be maintained in a dry condition by appropriate grading to encourage surface runoff and drainage to ground.

Runoff from the Site enters drains that discharge into the base of the quarry. Consequently, there is no discharge to nearby surface water features. As the quarry operations continue to develop with further mineral extraction, the geometry of the void changes and so does the alignment of the drains. As an example, Figure 5.2 shows the surface water drain that currently runs from the upper level of the Site into the base of the quarry, adjacent to the access road.

It is proposed that runoff will be allowed to infiltrate in the active quarry void during each of the operational phases 1 to 6, allowing settlement to occur before infiltrating to ground. There will be no dewatering occurring over the lifespan of the quarry.

Runoff from the emplaced wastes will, however, be contained as described in Section 5.1.3 so as to prevent groundwater contamination from potentially contaminated runoff. Furthermore, and as described in the SOP (Stantec, 2024e), drains on the Site would be blocked off and/or diverted to prevent any contaminated runoff entering the base of the excavation, with any impounded contaminated water being collected and disposed of appropriately offsite by a specialist contractor.

Figure 5.2 Surface Water Drainage (Ditch to Right of Road where Excavator Working)

Operational Phases 7 and 8

During operational phases 7 and 8, an alternative infiltration basin and drainage trenches ('SuDS features') will be developed. The indicative layout and cross-sections of these SuDS features is shown on Drawing 7873-005-005 Rev P01.

The general methodology and design considerations set out in the Industry Code of Practice on the sizing of surface water management systems (LGG, 2018) has been followed in designing the proposed SuDS features.

The infiltration basin will be located on the north-western side of the Site and the drainage trenches will be constructed to route surface runoff from the restored area, around the north, west and south of the remaining quarry, to the new basin. This alternative basin will remain in the longer term to take runoff from the restored Site surface so that, as before, no off-site discharge will be required.

The infiltration basin is located in an area outside the proposed landfill. From the basin, water would infiltrate to the sandstone aquifer. Discharge to ground from the infiltration basin will be via the bank and base of the features directly. Calculated off-site discharge (runoff and discharge from SuDS features) is presented in the FRA and is well below the calculated greenfield rates and volumes with all SuDS features able to attenuate and discharge receiving runoff to ground. This illustrates that the SuDS schemes would provide some betterment with regards to off-site flood risk.

Post Closure

Post closure there will be no pollution sources at the Site, on the basis of strict waste acceptance criteria. Therefore there should be no risk posed by the Site for water quality deterioration.

Infiltration to ground is unlikely to be feasible in the filled areas given the likely low permeability of the restoration material; however, flow control features will allow discharge to the drainage trenches along the northern, western and southern boundaries of the Site. These will be trapezoidal section channels, around 0.2 m deep by 0.2 m wide. The infiltration basin will attenuate and discharge runoff from the Site to the ground.

A 'MicroDrainage' model was created as part of the FRA to represent the proposed SuDS features. The storage volume of the infiltration basin was calculated and is above the storage volume required for a 1 in 100-year storm event for a 6hr duration in 'greenfields' conditions.

Based upon the calculations undertaken in the FRA, the restoration of the Site does have the potential to increase runoff relative to the greenfield scenario. This effect is mitigated by the proposed SuDS features. Although the SuDS features are largely for water quantity management as well as biodiversity and amenity benefits, they do offer this potential for water quality control by mitigating any potential sediment load within any off-site runoff. Further details of this are provided in the FRA.

Monthly checks of the SuDS features will be carried out to ensure that there is no visible oil or other pollutant entering the features.

Maintenance of the SuDS features during the post closure phase are presented in the FRA and include the following for the infiltration basin:

- Inspect and clear out - quarterly;
- Vegetation management - quarterly; and
- Remove sediment from bed - annually or every three years.

Drainage trenches require negligible maintenance once installed. An annual inspection to ensure the top of the feature is not becoming covered with debris will be undertaken.

An easement around the features will be maintained to allow access for maintenance. Invasive maintenance work such as vegetation removal would only be required intermittently, but it should be sympathetic to the requirements of wildlife.

5.3.2 Water Balance

The water balance is presented within the HRA (Stantec, 2024b).

5.3.3 Groundwater Dewatering

Groundwater dewatering is not proposed as part of development of the quarry or landfill.

5.4 Closure and Aftercare Plan

5.4.1 Site Closure

The Site will be considered as 'closed' once landfilling operations are complete to the agreed restoration plan (Section 3.4.1) and the Site has been landscaped in accordance with the Management Plan for Restoration and Aftercare (**Appendix C**).

5.4.2 Restoration (Landscaping) and Future Use

Following completion of the landfill, the Site will be landscaped and returned to agriculture or amenity use, in accordance with the Management Plan for Restoration and Aftercare (**Appendix C**).

In brief, the landscaping proposals include removal of an existing coniferous tree-line to enable construction of a 3.5m high bund and field ditch along the north boundary, management of the existing trees, scrub and hedgerows, tree planting of native species (to incorporate individual trees and an understory mix), planting of native species hedgerow mix along bund and a large area of open grassland/wildflower meadow. The management plan states that the Site will be supported by a 5 year maintenance and management plan to assist with the development of a range of varied habitats enhancing the biodiversity of the Site.

The Site will be restored to a landform compatible with the topography of its immediate surroundings. Topographical surveys will be undertaken periodically to ensure that the achieved profile is in accordance with the proposed restoration scheme.

When infilling in any area is nearing completion, profile boards will be established indicating the final restoration levels. The fill will be brought up to the final levels shown on the profile boards and graded using a bulldozer to achieve smooth contours.

The subsoil and topsoil will be placed by loose tipping using a tracked backhoe excavator to minimise compaction.

Each layer will be:

- Ripped using a winged, tined ripper at 800mm centres; ripped to a depth of approximately 400mm. Ripping will be carried out in transverse directions down slope.
- Stone picked following ripping; stones greater than 100mm will be removed.
- Trimmed to level using a low ground pressure dozer.

No indigenous subsoil or topsoil is available on the Site. As a consequence, suitable material will need to be either imported or manufactured to complete the restoration. The Management Plan for Restoration and Aftercare provides details of the proposals for the import, testing and laying of topsoil for the successful establishment of the proposed planting.

Samples of the subsoil will be taken by hand auger to verify the thickness, nature, and friability of each layer at a frequency of three per hectare; analyses will be visual to determine thickness and by hand to determine nature of soil and friability.

The Site restoration proposals are presented on Drawing No. 21224.101 Rev A within the Management Plan for Restoration and Aftercare. This drawing shows the ground elevation contours proposed for the final restoration.

5.4.3 Aftercare

As the material to be deposited within the landfill is inert, any settlement is expected to be largely concurrent with filling and any long term settlement is expected to be insignificant. Instability arising from excessive total or differential settlement of the fill materials is considered to be very unlikely. Any localised settlement features that do occur will be filled and restored during the aftercare period.

The landfilled wastes are not expected to produce potentially polluting leachate or landfill gas;

therefore further management leachate or landfill gas during the aftercare period is not expected. Aftercare will therefore be limited to post-closure (aftercare) monitoring, maintenance of the monitoring infrastructure and maintenance of the landscaping, as described in the following sections.

Aftercare Monitoring

Details of the proposals for post-closure (aftercare) monitoring are provided in the within the EMP (Stantec, 2024f) and include:

- Landfill gas monitoring;
- Leachate monitoring;
- Groundwater monitoring;
- Checks of the SuDS infiltration trenches and basin; and
- Settlement monitoring (topographical surveys).

Aftercare Maintenance

Maintenance of the monitoring infrastructure is described in the EMP and will continue throughout the aftercare period.

Maintenance of the landscaping will be undertaken in accordance with the maintenance matrices as set out in the Management Plan for Restoration and Aftercare (**Appendix C**).

Restored areas will be inspected in the first spring following restoration for signs of erosion, slippage or cracking. Any defects noted will be made good as soon as practicable. Any areas requiring remediation with additional soils will be undertaken in the appropriate season. Subsoil and topsoil will only be placed when in a dry and friable condition and in periods of dry weather. In unusually dry or windy conditions, soil handling would be suspended if it appears likely that dust may be carried towards any sensitive receptors. As a temporary measure the area will be secured from further access for future repair. The EA will be informed of any action taken.

No pesticides, herbicides, fertilisers are proposed to be applied at the Site as part of the planting process.

5.4.4 Financial Provision

This closure and aftercare plan has been used to inform the financial provision required for the landfill. The financial provision is detailed in the EP Application Document (Stantec, 2024h).

5.4.5 Completion Criteria

The completion criteria (i.e., the conditions when an EP surrender application can be made) for landfill gas, groundwater, settlement and slope stability are set out in the EMP and the corresponding LFGRA (Stantec, 2024c), HRA (Stantec, 2024b) and SRA (Key GS, 2023).

An EP surrender application will be made to the EA once the completion criteria have all been met.

6 Monitoring

6.1 Environmental Monitoring

The broad objectives of environmental monitoring are to:

- Demonstrate that the landfill is performing as designed and in accordance with the risk assessment predictions;
- Show that management and control systems are preventing pollution;
- Show compliance with the emission and compliance limits set in the EP;
- Identify where further investigation is needed and, where risks are unacceptable, the need for measures to prevent, reduce or remove pollution; and
- Identify when the Site no longer presents a risk of pollution.

An EMP (Stantec, 2024f) has been designed based on the conceptual site model, as set out in this ESSD report, and with reference to the requirements set out in the EA guidance on 'monitoring and report your performance' (EA, 2023c).

The EMP provides a summary of the methods, procedures and actions to be implemented at the site for the duration of the EP and up to the point of surrender, in order to meet the above objectives.

The plan will be reviewed and updated on a regular basis as the Site develops to ensure adequate controls are in place to meet the identified standards and objectives. Any changes will be agreed with the EA.

The EMP provides details of the procedures for monitoring:

- Landfill gas;
- Landfill leachate;
- Groundwater; and
- Restoration fill materials.

Details of the other proposed Site monitoring are presented in the following sections.

6.2 Amenity Monitoring

The Dust and Emissions Management Plan (DEMP) (Stantec, 2024d) for details of the Site dust monitoring and reporting proposed.

6.3 Weather Monitoring

6.3.1 Meteorological Information

Meteorological information will be obtained from the local Met Office station (Persnore College):

- Location: 52.1, -2.059
- Altitude: 37m above mean sea level
- Station type: Automatic

6.4 Rainfall

Standard average annual rainfall (SAAR) figures are available from Centre for Ecology and

Hydrology (CEH). For the Bromsberrow area, the 1961-1990 figure is in the band from 675 to 700mm/a.

Total and effective rainfall on Site are considered within the Site HRA (Stantec, 2024b).

6.5 Wind Direction and Frequency

The wind direction and percentage frequency from that direction over the past five years has been obtained from the Met Office is presented in Table 6.1. The data suggests that the prevailing wind direction at the Site is from the southwest and west-south-west.

Table 6.1 Wind Direction Distribution in Percent - Average from 2017-2022

Wind Direction	Frequency (%)
North	1.92
North North East	8.45
North East	8.2
East North East	4.23
East	3.19
East South East	1.82
South East	3.03
South South East	6.04
South	4.77
South South West	4.42
South West	15.8
West South West	15.4
West	4.42
West North West	0.94
North West	1.9
North North West	0

References

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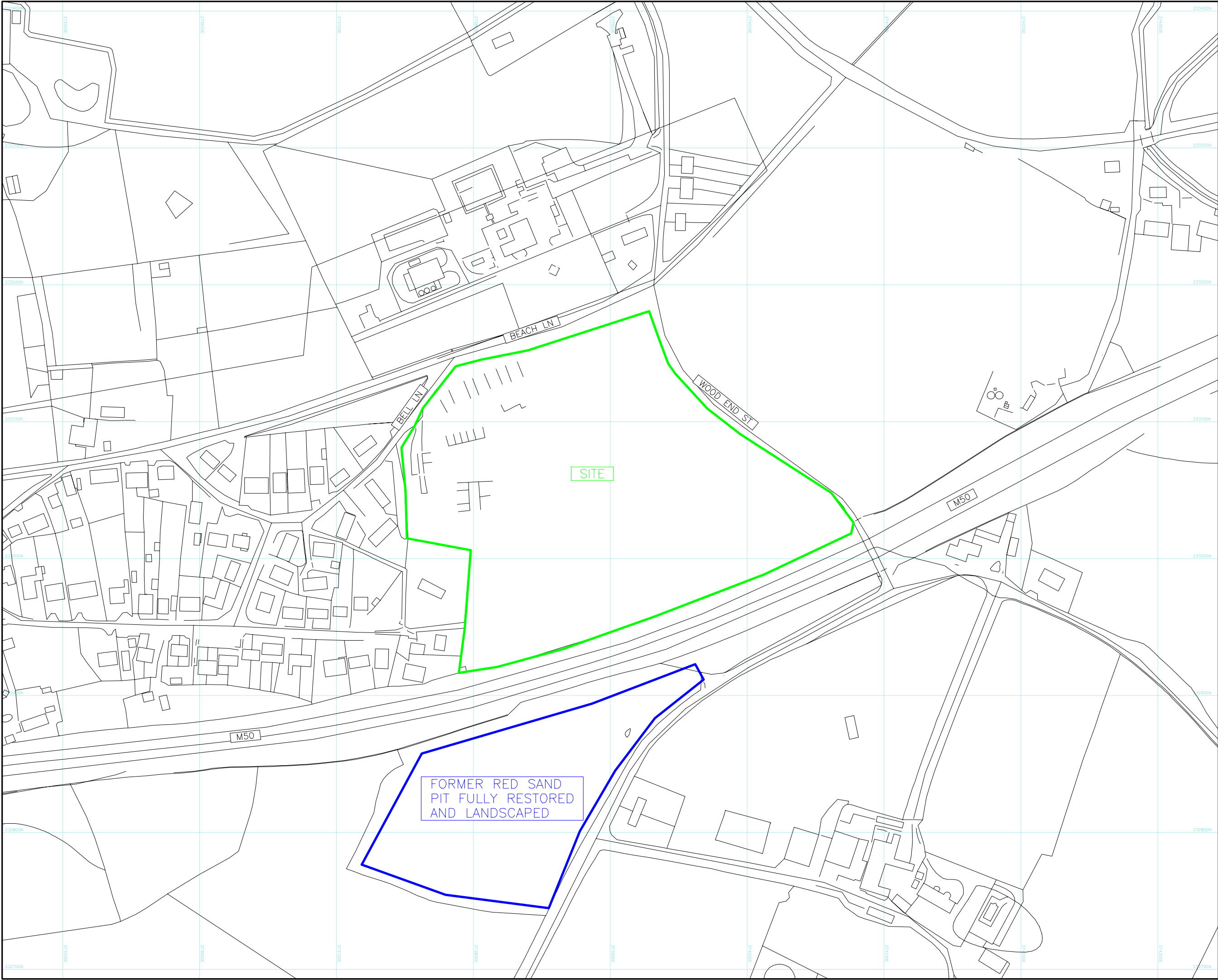
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DRAWINGS

Site Location Plan	Drawing No. 21-248-D-010 Rev02
Existing Site Layout Plan	Drawing No. 21-248-D-011 Rev02
Proposed Site Layout Plan	Drawing No. 21-248-D-012 Rev02
Sensitive Receptors Plan	Drawing No. 331201261D2
Site Restoration Proposals	Drawing No. 21224.101 Rev A
Updated Quarry Development Plan – Floor at 36mAOD	Drawing No. 7873-005-D-002 Rev 02
Updated Quarry Development Plan – Floor at 36mAOD Cross Sections	Drawing No. 7873-005-D-004 Rev 03
Topographical Survey	Drawing No. ASG-2303-141/B
Updated 'Surface Water Management Pond' Design	Drawing 7873-005-005 Rev P01



02	FORMER RED SANDPIT UPDATE	RB	07/11/23
01	FIRST ISSUE	RB	28/04/22
REV.	REVISION DETAIL	DRAWN	DATE

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CLIENT:
ALLSTONE SANDS
GRAVELS AGGREGATES
TRADING CO. LTD

PROJECT:
BROMSBERROW QUARRY

TITLE:
SITE LOCATION PLAN

DRAWN: RB	CHECKED: BD	DATE: NOV '23
SCALE: 1:2500	ORIGINAL SHEET SIZE: A3	STATUS: FINAL

DRAWING NO. 21-248-D-010	REVISION: 02
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E-MAIL: INFO@KEYGS.COM
WEB: WWW.KEYGS.COM

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02 Updated drawing with March'23 topo RB 07/11/23

01 First Issue RB 28/04/22

Rev. Revision Detail Drawn Date

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PROJECT:

BROMSBERROW QUARRY

TITLE:

EXISTING SITE
LAYOUT PLAN

DRAWN: RB

CHECKED: BD

DATE: NOV '23

SCALE: 1:500

ORIGINAL SHEET SIZE: A1

STATUS: FINAL

DRAWING NO. 21-248-D-011

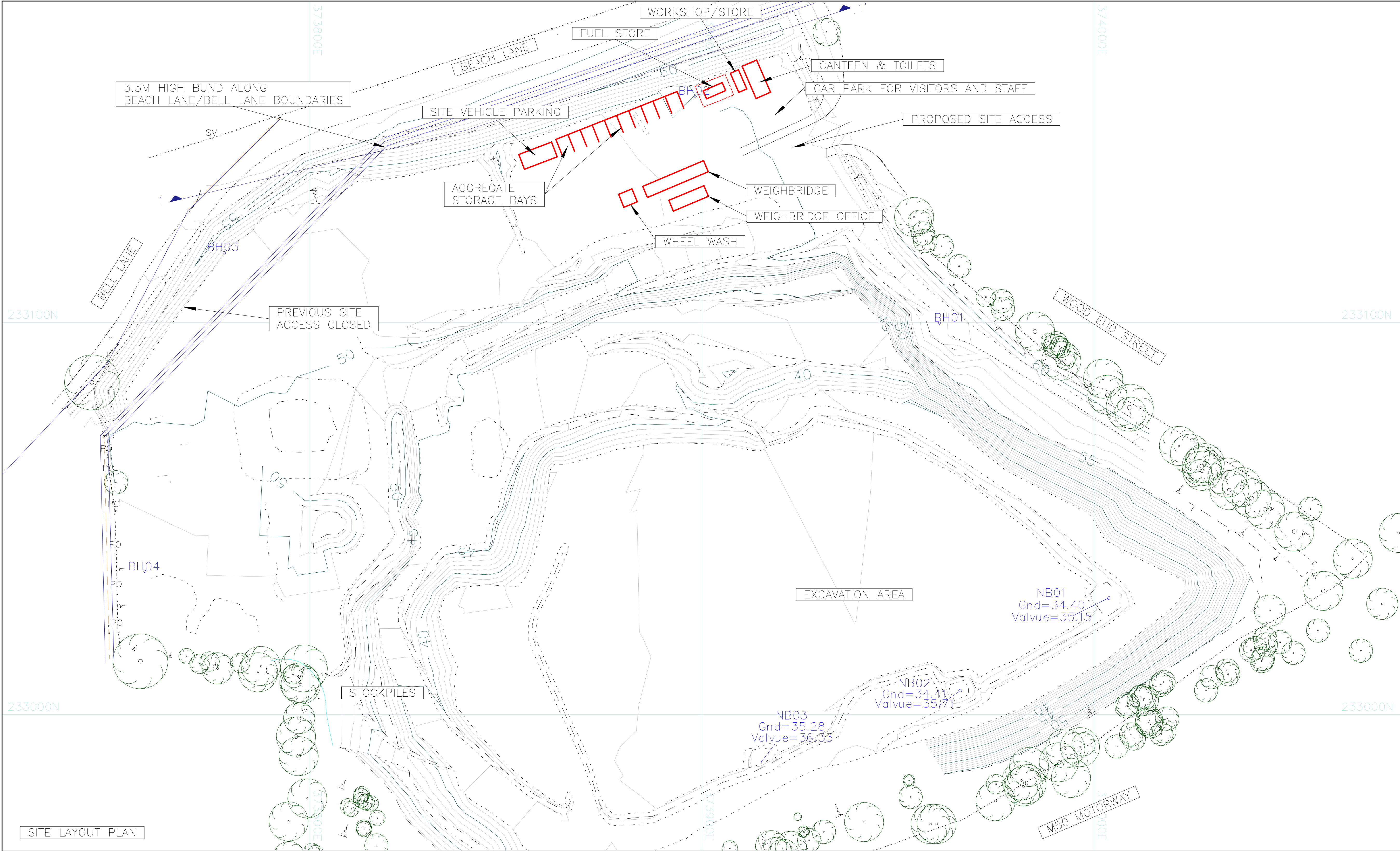
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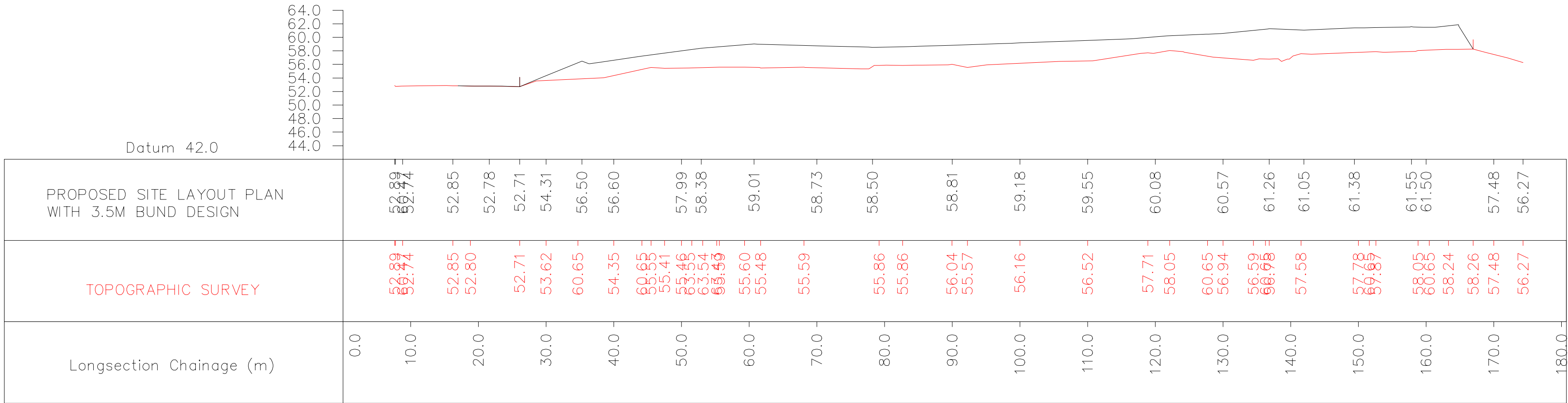
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SITE LAYOUT PLAN



SECTION THROUGH PROPOSED EARTH BUND ALONG 'BELL LANE' AND 'BEACH LANE' BOUNDARIES

02	Updated drawing with March'23 topo	RB	07/11/23
01	First Issue	RB	28/04/22
Rev.	Revision Detail	Drawn	Date

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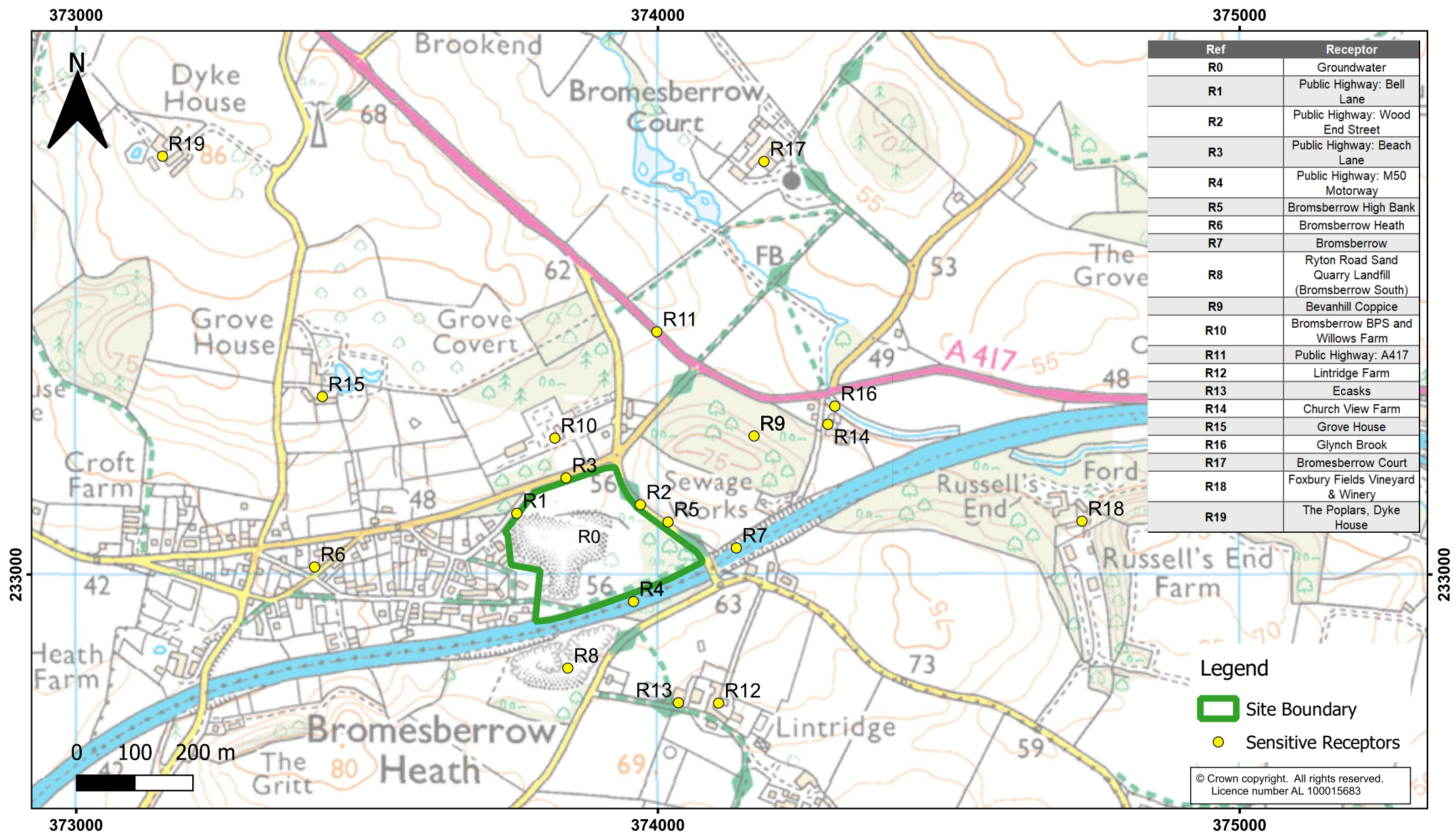
PROJECT:
 BROMSBERROW QUARRY

TITLE:
 PROPOSED SITE
 LAYOUT PLAN

DRAWN: RB	CHECKED: BD	DATE: NOV '23
SCALE: 1:500	ORIGINAL SHEET SIZE: A1	STATUS: FINAL
DRAWING NO. 21-248-D-012		REVISION: 02

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Drawing No. 331201261D2

Sensitive Receptors Plan

Date	2023	Drawn	CAB
Scale	As shown	Checked	GW
Original	A4	Revision	2
File Reference \\Gb1029-ppfss01\workgroup\3302\active\331201261\GIS\Map documents			



	Proposed tree planting
	Existing tree and vegetation to be removed
	Existing trees and vegetation to be retained
	Proposed woodland planting matrix
	Proposed bund hedgerow planting matrix
	Proposed new grassland
	Proposed field ditch
	Existing levels
	Proposed levels (Existing in brackets)

All stock to be supplied in accordance with the National Plant Specification from an HTA approved nursery.

All stock to be supplied in accordance with the National Plant Specification from an HTA approved nursery.

Ref	Species	Quality	Lifecycle Carbon Capture
AC	<i>Acer campestre</i>	90-120 cm height, feathered	2572 Kg
BP	<i>Betula pubescens</i>	90-120 cm height, feathered	3224 Kg
FS	<i>Fagus sylvatica</i>	90-120 cm height, feathered	4216 Kg
QR	<i>Quercus robur</i>	90-120 cm height, feathered	7500 Kg
TC	<i>Tilia cordata</i>	90-120 cm height, feathered	5019 Kg

All stock to be root dipped in Mycorrhizal Inoculant prior to planting.
Trees to be supplied from Oak Processionary Moth (OPM) free countries, from designated pest free areas including protected zones. Plant passports will be required.

(All stock to be supplied bare root unless stated otherwise)

Ref	Species	Quality
Cm	<i>Asperula</i>	1+1 transplant, 60-80 cm, min. 3 breaks
Cm	15% <i>Crataegus monogyna</i>	1+1 transplant, 60-80 cm, min. 3 breaks
Ca	25% <i>Corylus avellana</i>	1+2 transplant, 60-80 cm, min. 3 branches
Fs	5% <i>Fagus sylvatica</i>	1+1 transplant, 60-80 cm, branched
Il	10% <i>Ilex aquifolium</i>	2L, 40-60cm, leader and laterals
Ms	5% <i>Malus sylvestris</i>	1+1 transplant, 60-80 cm, branched
Qu	5% <i>Quercus robur</i>	1+1 transplant, 60-80 cm
Ro	5% <i>Rosa canina</i>	1+0 transplant, 40-50 cm
Vo	10% <i>Viburnum opulus</i>	1+2 transplant, 60-80 cm, min. 3 branches

Species to be planted on a 3.0 m grid system. Protect with spiral rabbit guards 60cm in height supported by cane.

(All stock to be supplied bare root unless stated)

%	Species	Quality
10%	Acer campestre	1+1 bareroot transplant, 60-80cm height
40%	Prunella monogyna	1+1 bareroot transplant, 60-80cm height
10%	Corylus avellana	1+1 bareroot transplant, 60-80cm height
10%	Cornus sanguinea	1+1 bareroot transplant, 60-80cm height
5%	Ilex aquifolium	3L container, 40-60cm height
5%	Ligustrum vulgare	1+1 bareroot transplant, 60-80cm height
5%	Malus sylvestris	1+1 bareroot transplant, 60-80cm height
5%	Prunella spinosa	1+1 bareroot transplant, 60-80cm height
10%	Viburnum opulus	1+1 bareroot transplant, 90-80cm height
Planting shall be carried out at 800mm centres ensuring around 2 plants per sq m.		
Protect with spiral rabbit guards 80cm in height supported by cane.		

(Seed supplied shall be British seed Houses WFG2 Flowering Meadow containing 20% Wild flora and 80% grasses to provide year round cover. Seed to be sown at a rate of 5 g/m²).

Agrostis githago	(Corn Cockle)
Anthemis arvensis	(Corn Chamomile)
Centaurea cyanus	(Cornflower)
Centaurea nigra	(Common Knawweed)
Chrysanthemum segetum	(Corn Marigold)
Digitalis purpurea	(Foxglove)
Hypericum perforatum	(Perforate St John's Wort)
Leucanthemum vulgare	(Ox-Eye Daisy)
Papaver rhoeas	(Poppy)
Silene alba	(White Campion)
Vicia sativa	(Common Vetch)
Agrostis castellana	(Common Bent)
Anthraxanthum odoratum	(Sweet Vernal Grass)
Festuca longifolia	(Hard Fescue)
Festuca ovina	(Sheeps Fescue)
Lolium corniculatus	(Rough Birdseeded Trefal)
Plantago lanceolata	(Ribwort Plantain)
Prunella vulgaris	(Selfheal)

All areas to be seeded unless shown as matrix understorey p.

All areas to be seeded unless shown as matrix understory planting.

All topsoiling to general planting and grass areas to be in accordance with BS3882. All topsoil supplied to site shall be free or pernicious weeds and roots, clay lumps, non-soil materials or other building materials. Topsoil shall be spread evenly over areas and settlement accounted for in depth calculations. Topsoil is to be spread in layers and firmed when the material is reasonably dry. All soil finishes should be married in with existing adjacent levels to form a consistent join.

Minimum topsoil depths are as follows;

Grass and Meadow areas 100 mm

Planting mix areas 400 mm

Hedges and Trees 600 mm

Within planting matrix diagram, species such as Oak, Crab Apple, Holly and Viburnum to be positioned to avoid excessive development within landscape and dominate habitat.

The site will be supported by a 5 year maintenance and management plan to assist with the development of a range of varied habitats enhancing the biodiversity of the site.

- 1) Do not scale directly from this drawing.
- 2) This drawing is to be read in conjunction with all other relevant MHP drawings and information supplied by other consultants.
- 3) Hatch patterns displayed on this drawing are indicative only and do not represent actual paving units or material sizes.
- 4) All tree planting in proximity to buildings to be checked by engineers to ensure foundation detailing is appropriate.

A	New entrance to Wood End Street included, bund proposed to Beach / Bell Lane. Planting amended to accommodate.	13/05/22	DAL	PSH
Rev:		Date	Drawn	Checked
Revisions:				

Project: Bromsberrow Red Sand Pit Restoration

Client: P J Duncliffe

Title: **Site Restoration Proposals**

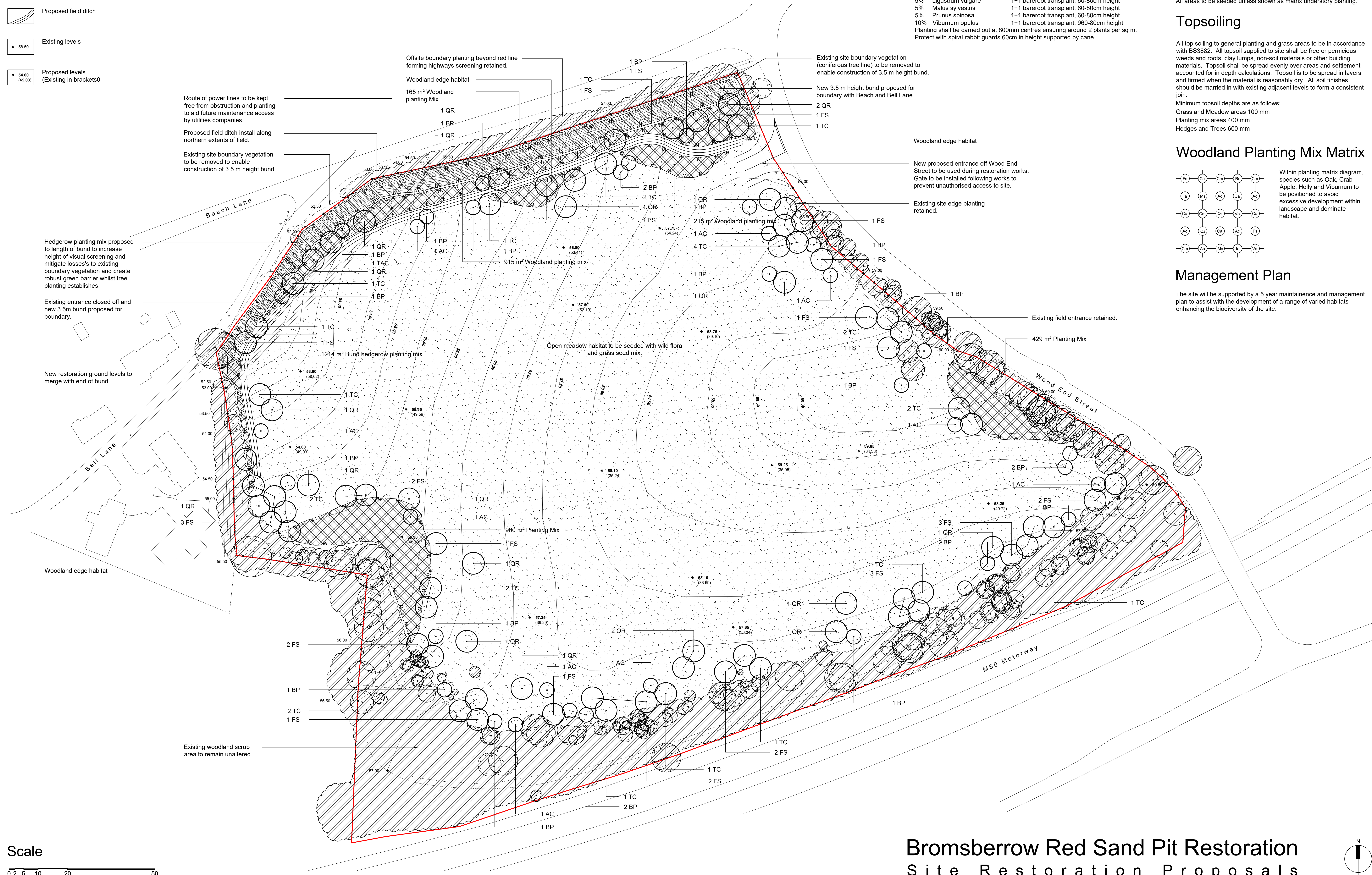
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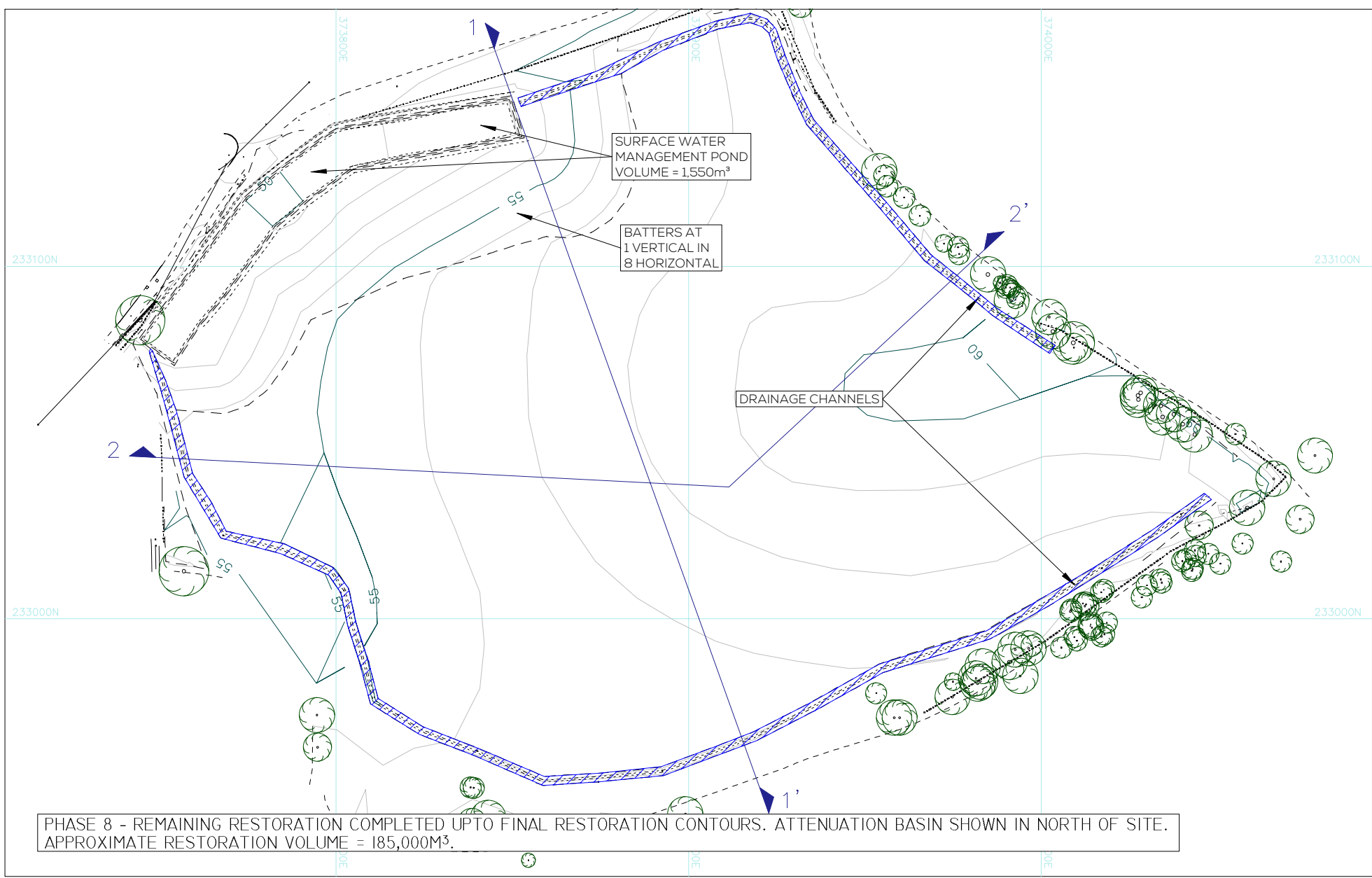
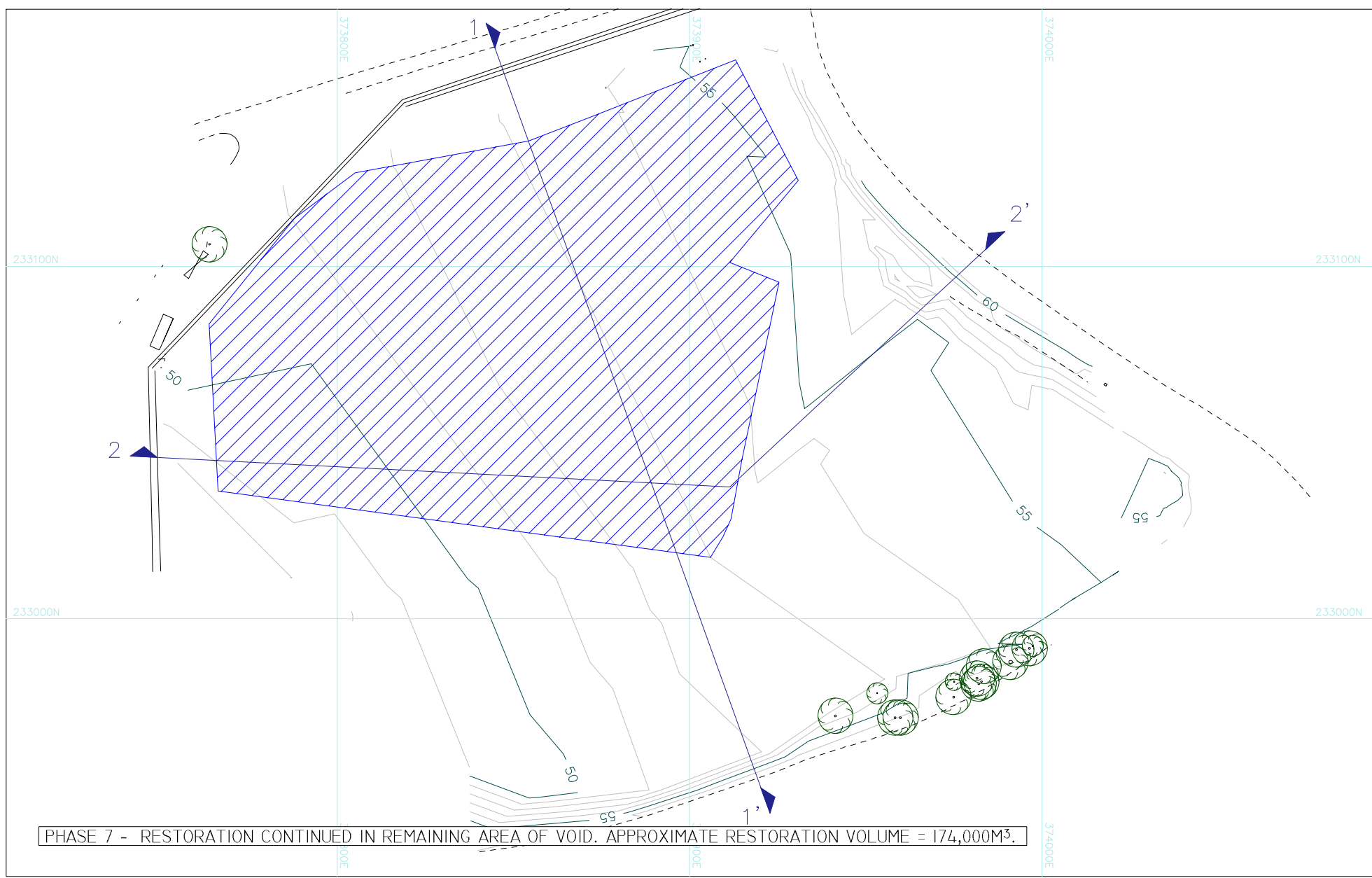
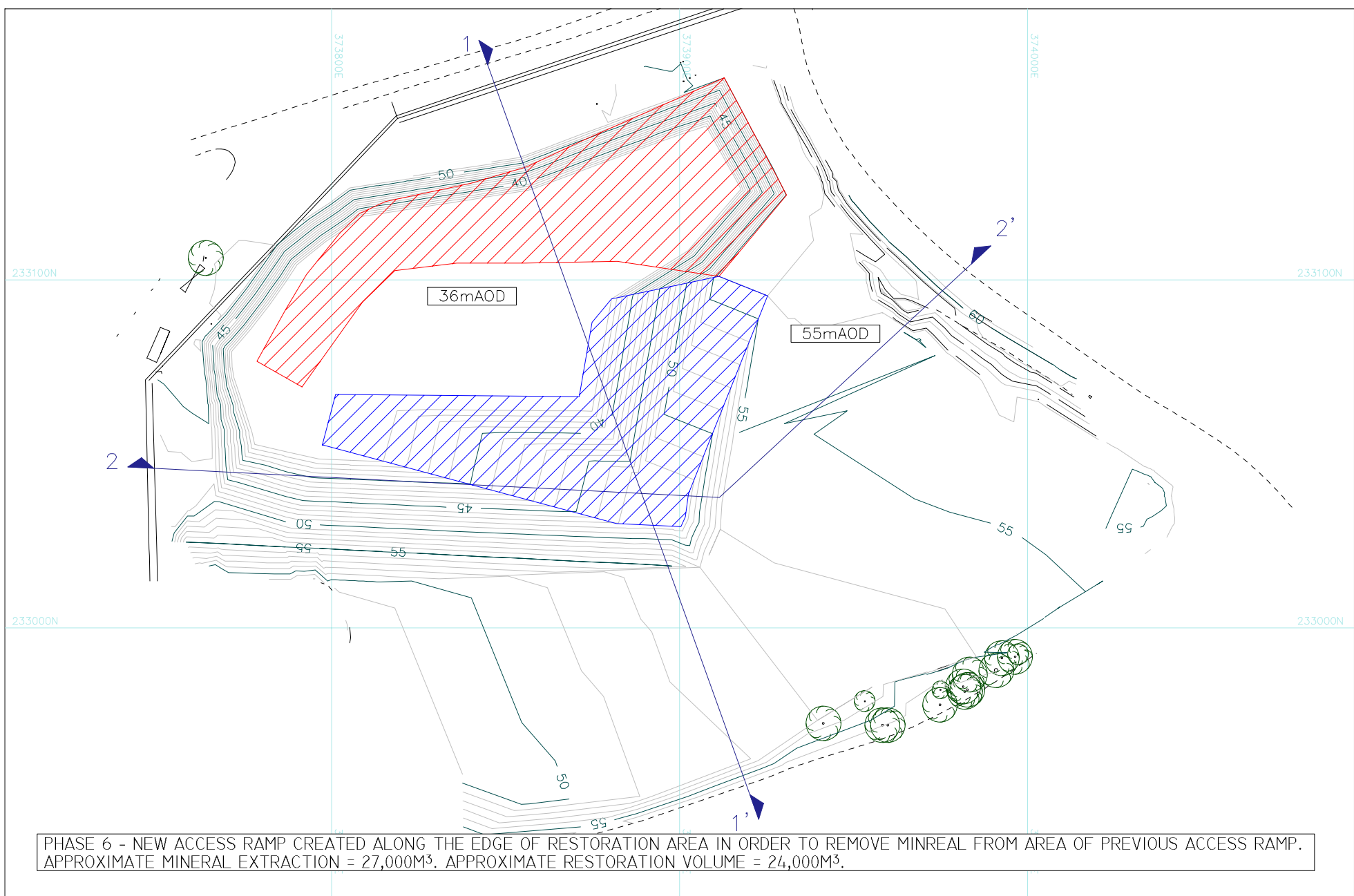
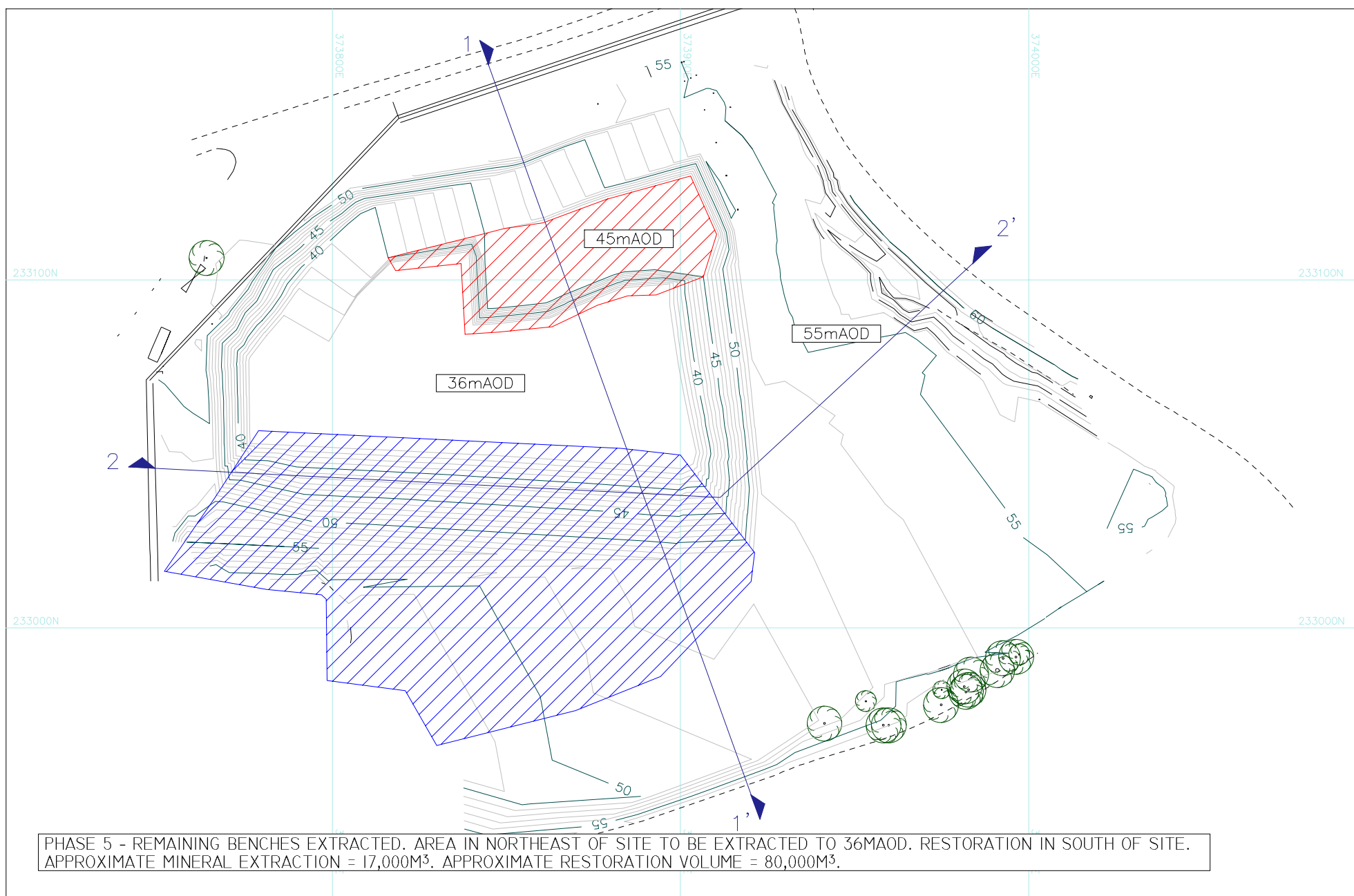
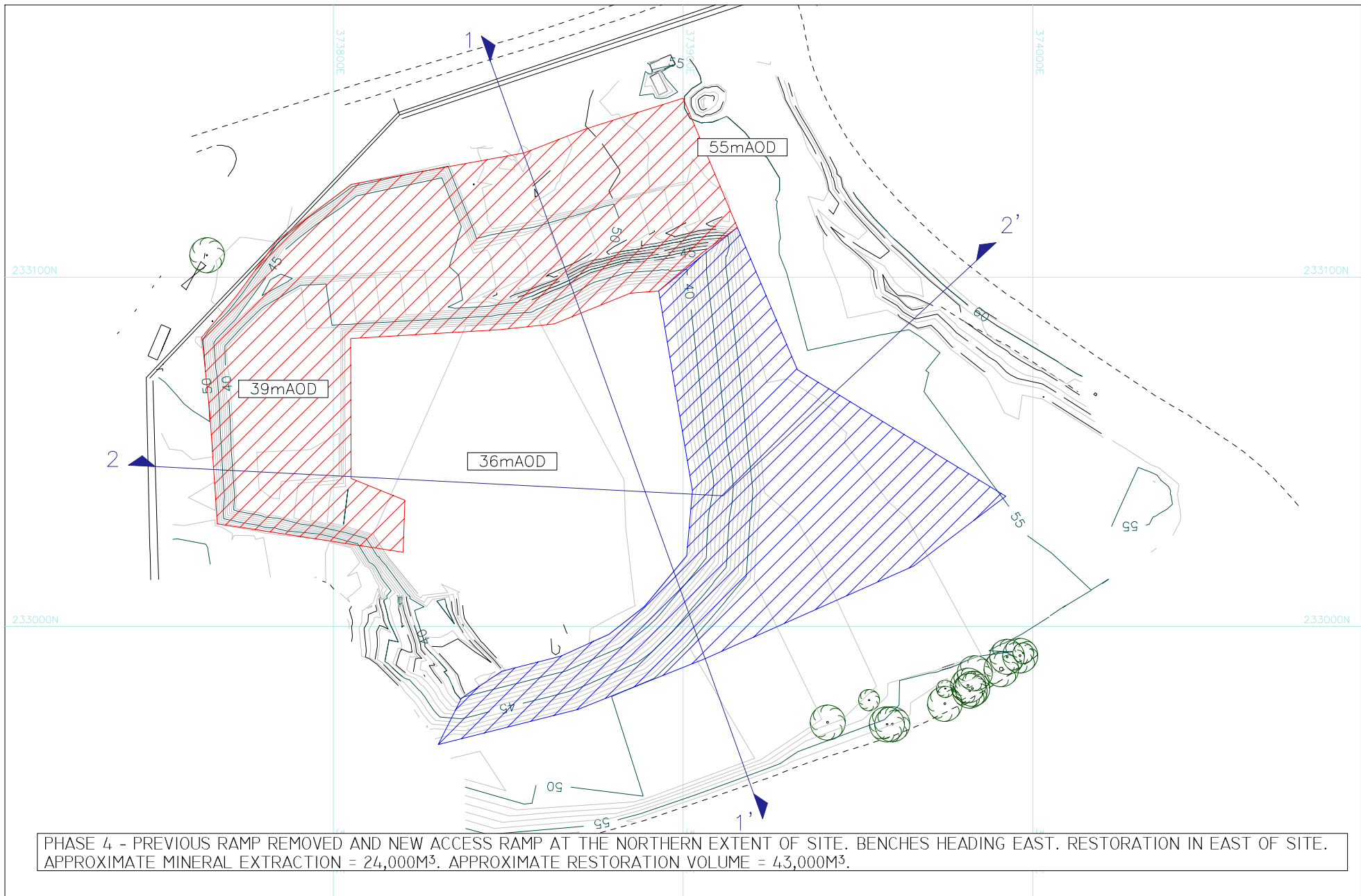
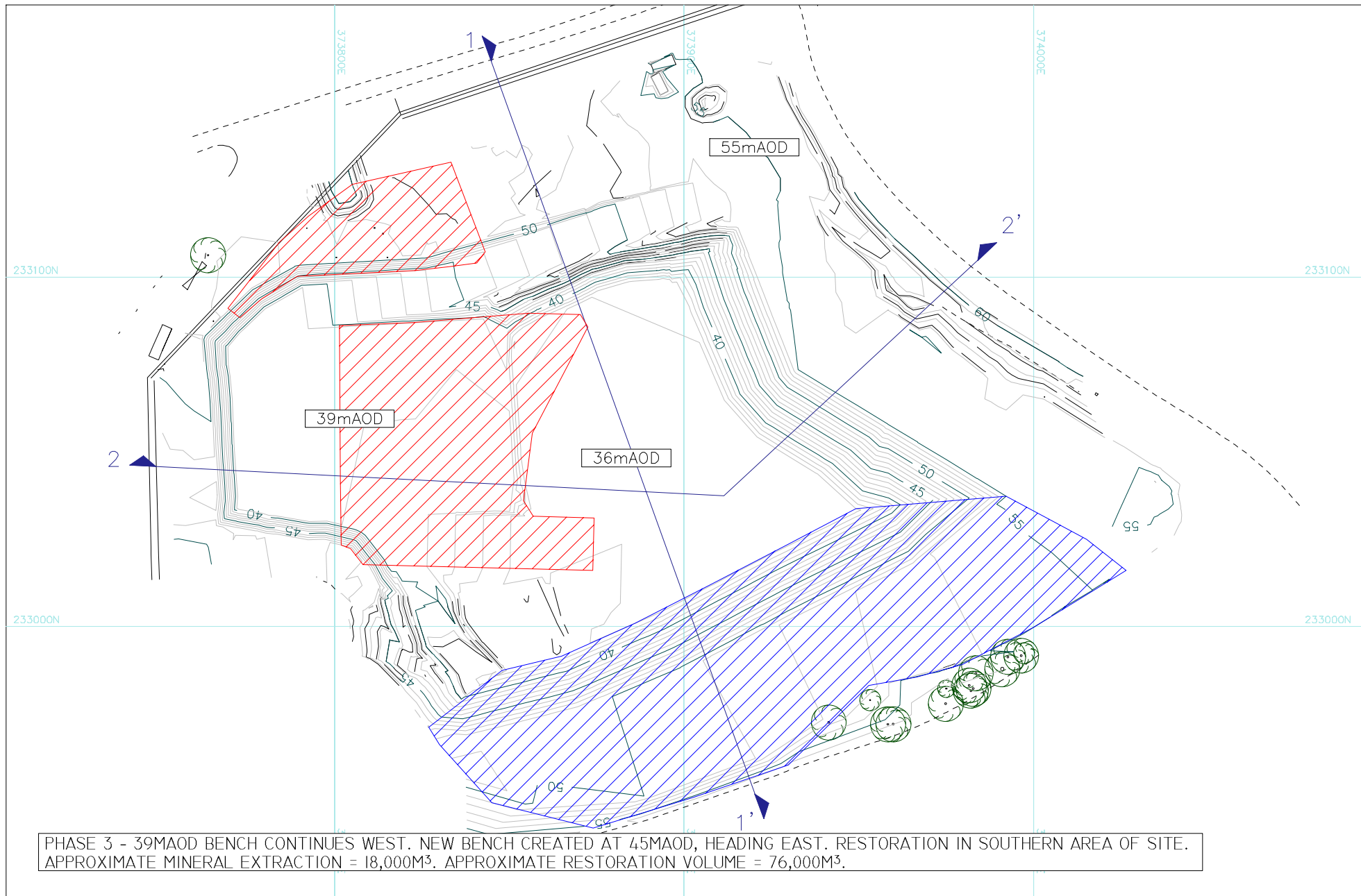
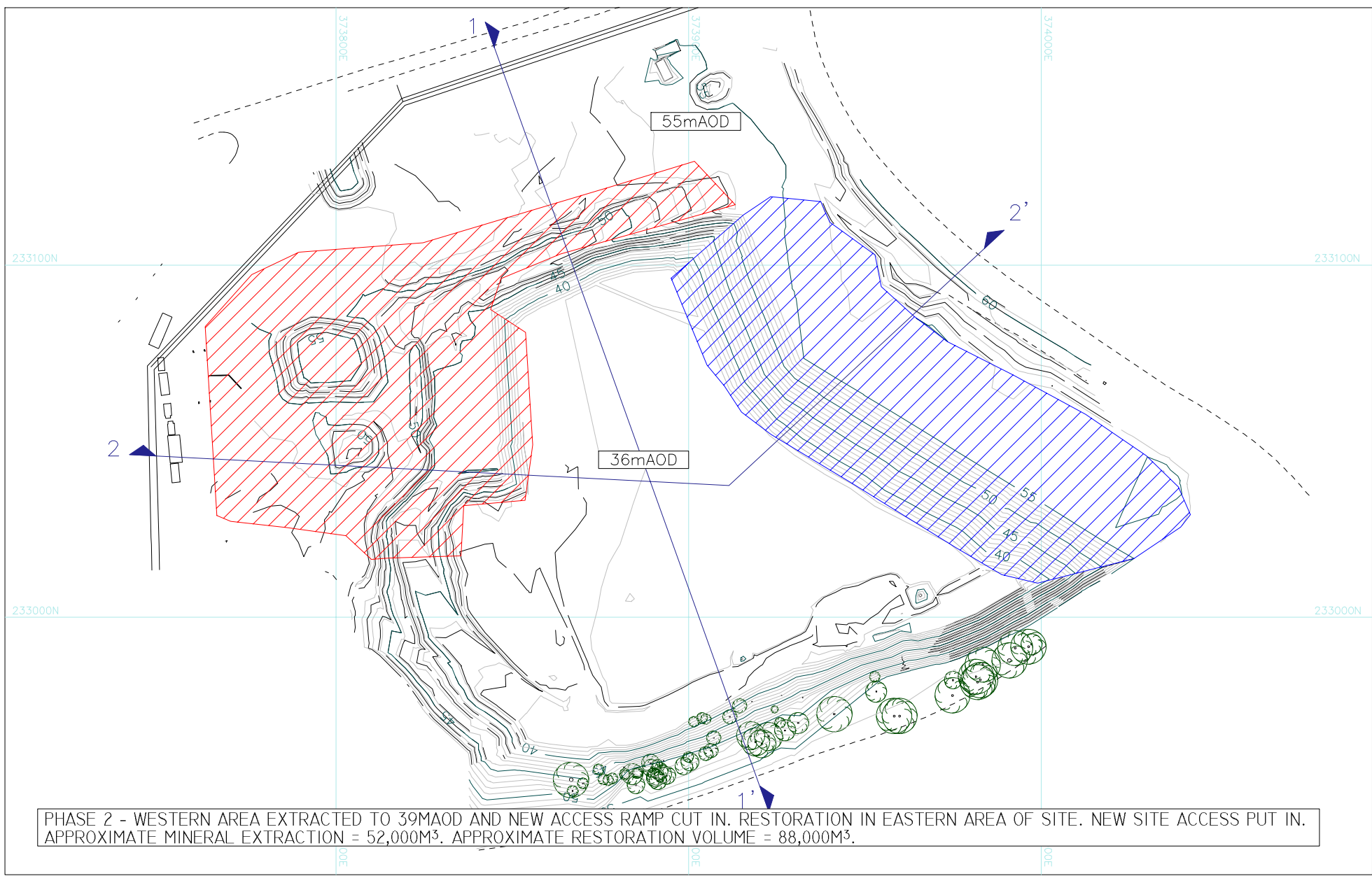
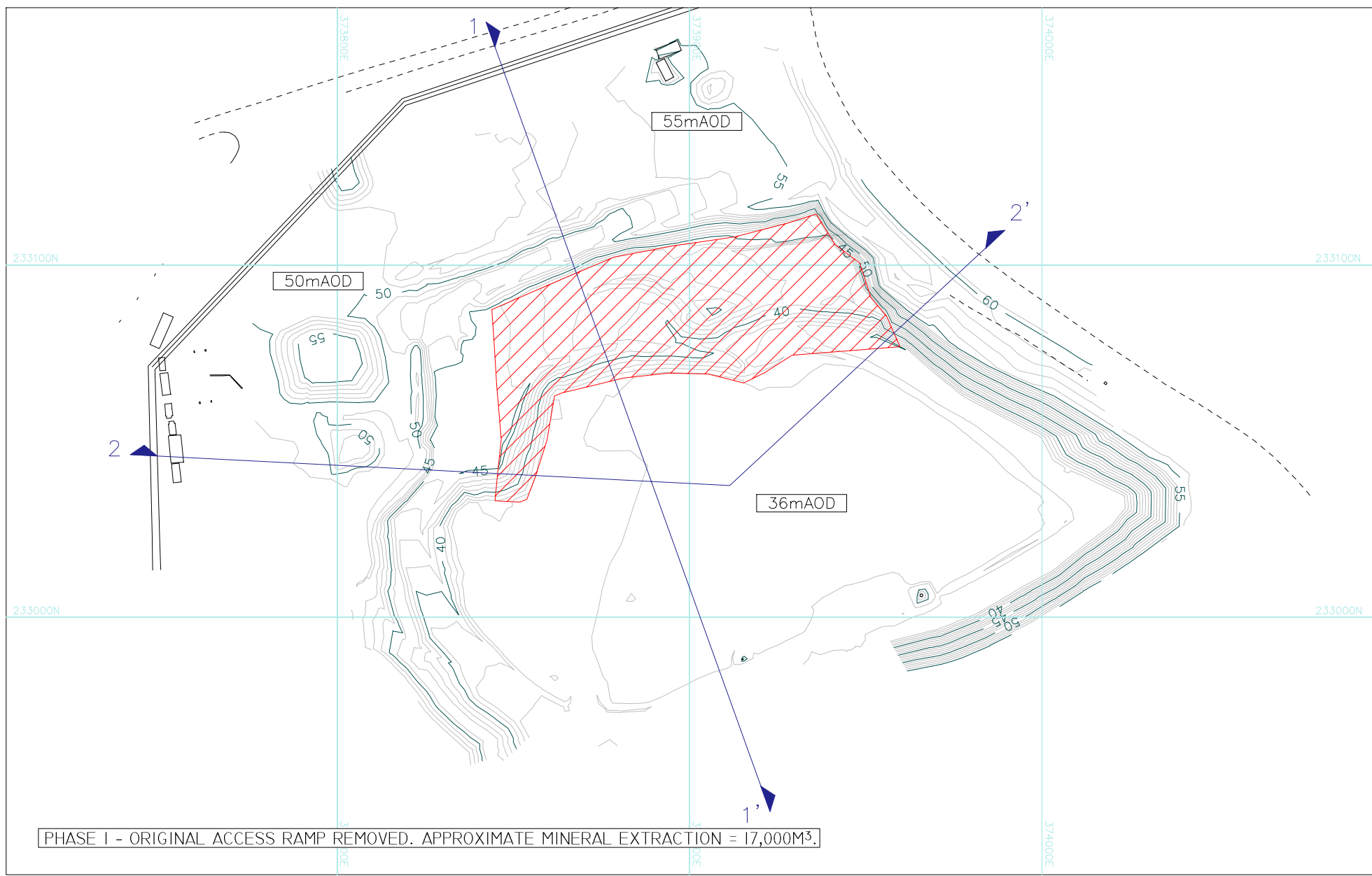
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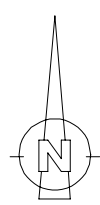
CHARTERED
LANDSCAPE
ARCHITECTS

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- NOTES
- AREAS OF MINERAL TO BE EXTRACTED ON A PHASED BASIS
 - AREAS OF RESTORATION TO BE PROGRESSED ON A PHASED BASIS



02	SURFACE WATER POND UPDATE	RB	30/11/23
01	FIRST ISSUE	RB	08/08/23
REV.	REVISION DETAIL	DRAWN	DATE

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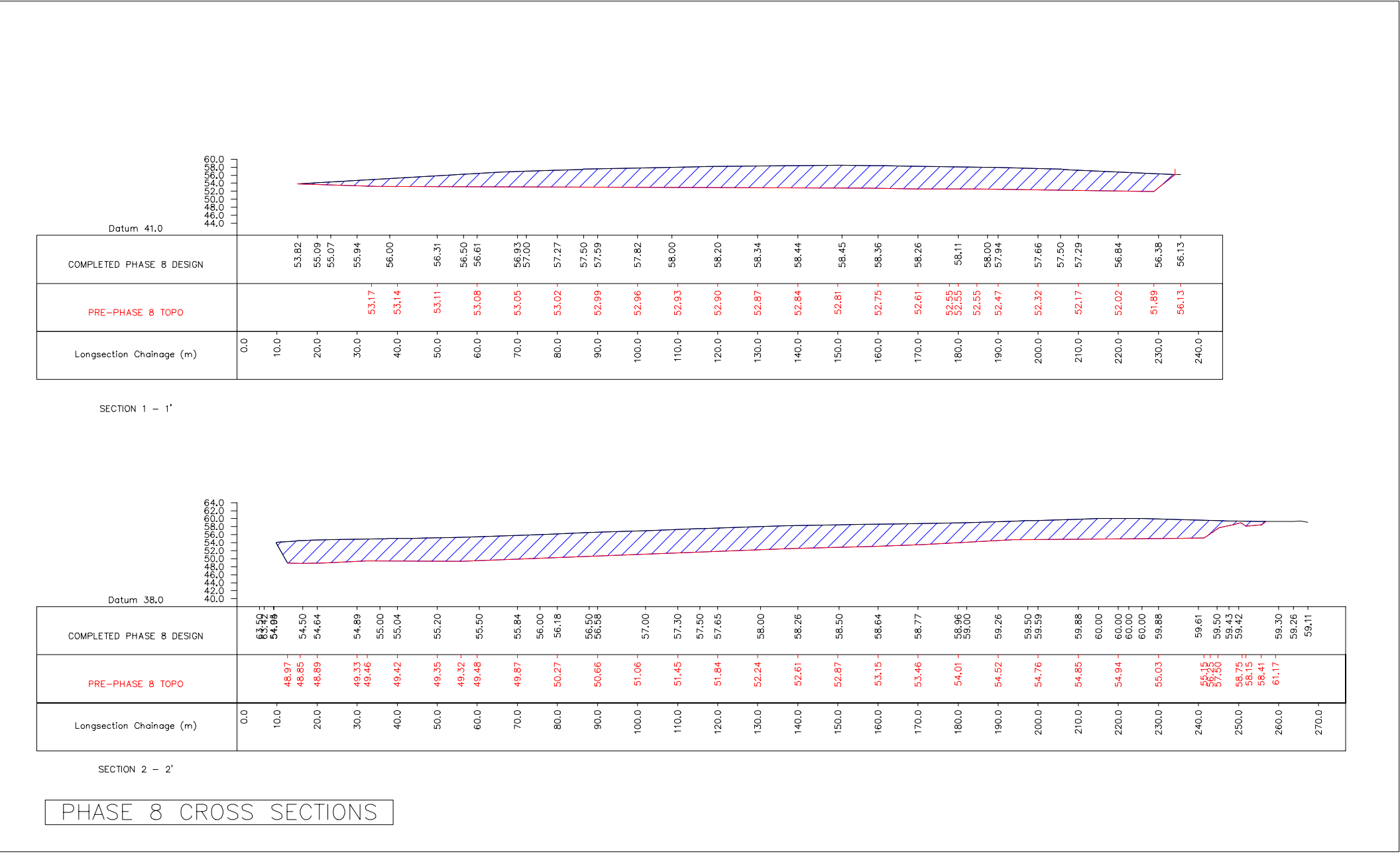
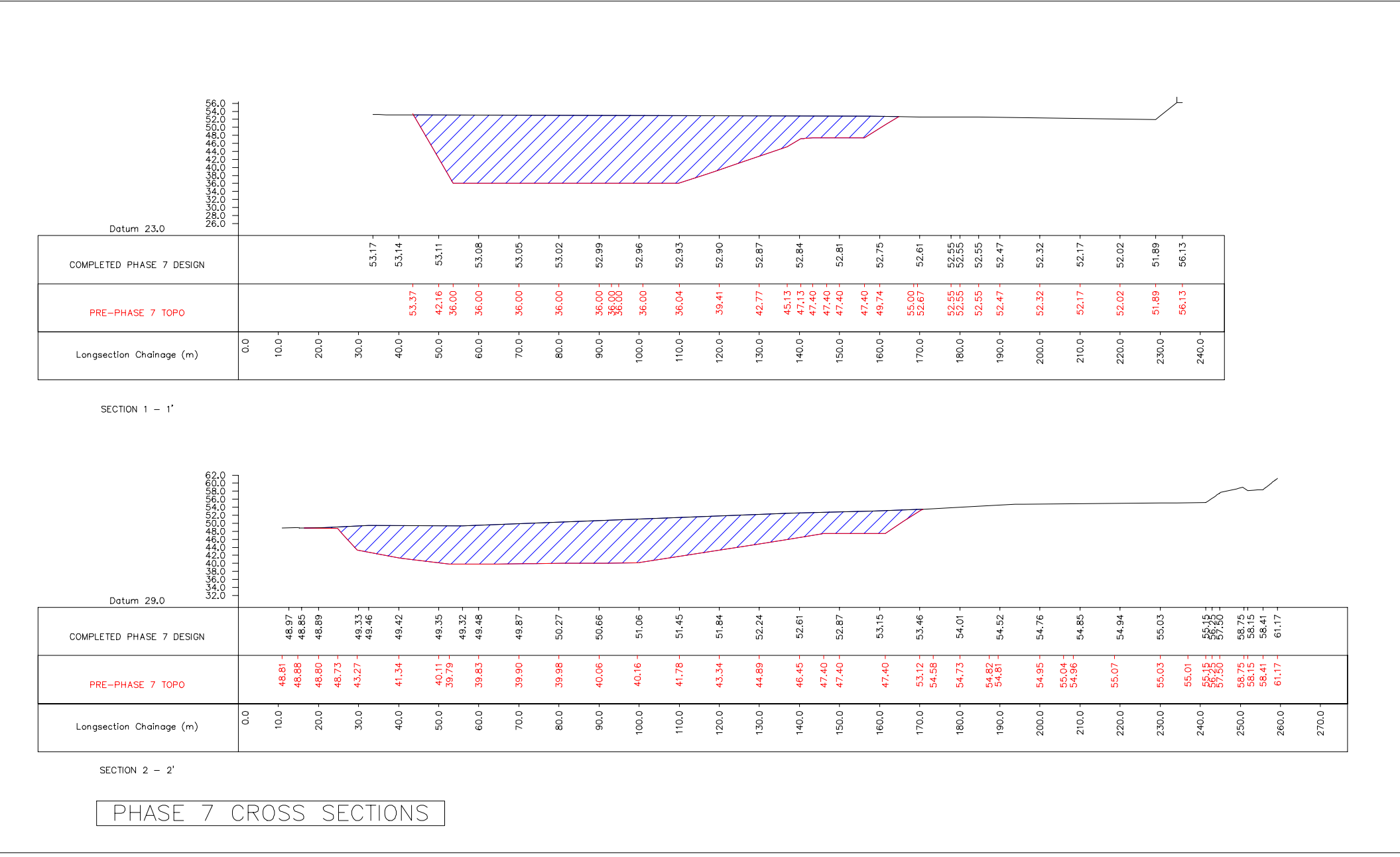
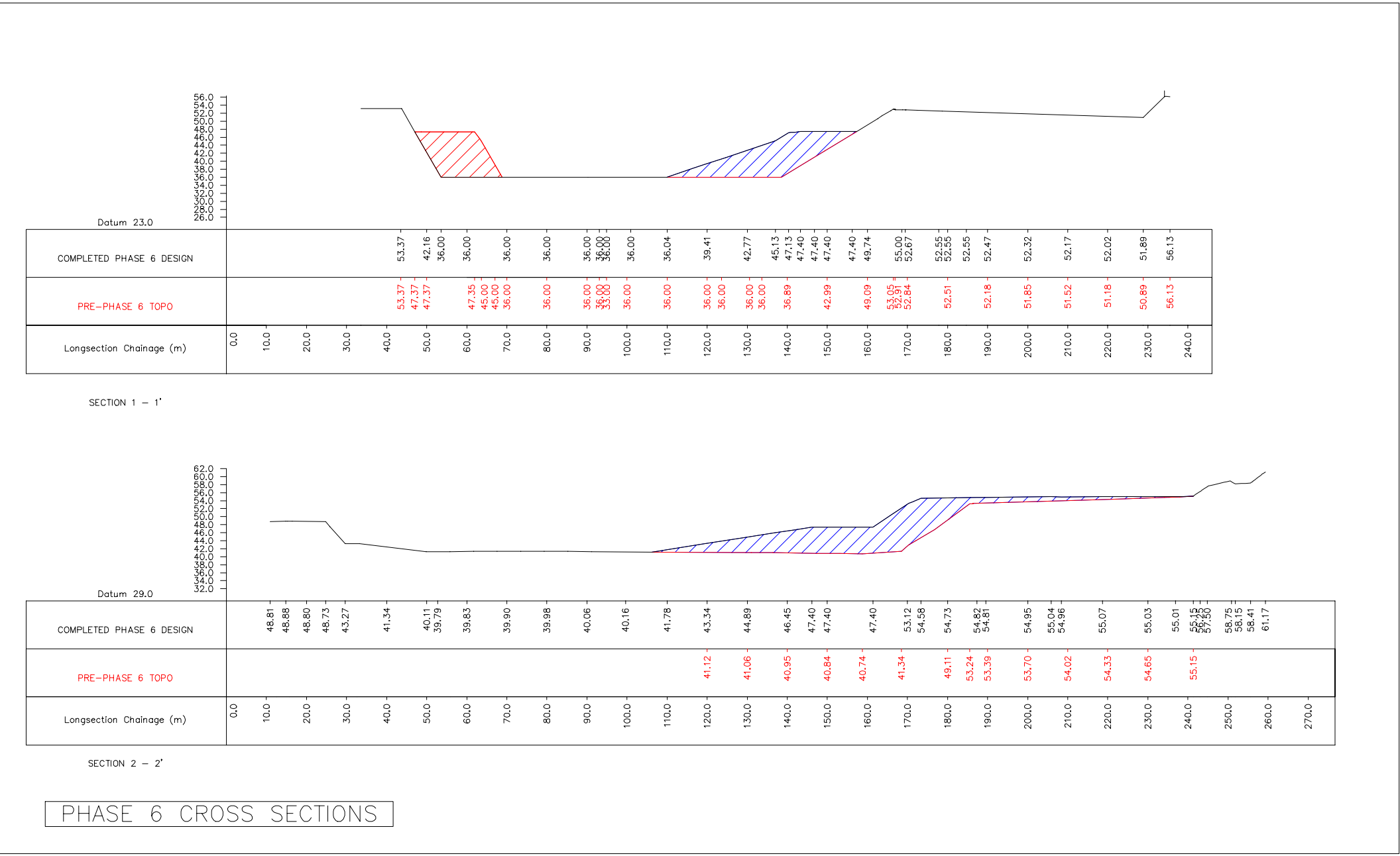
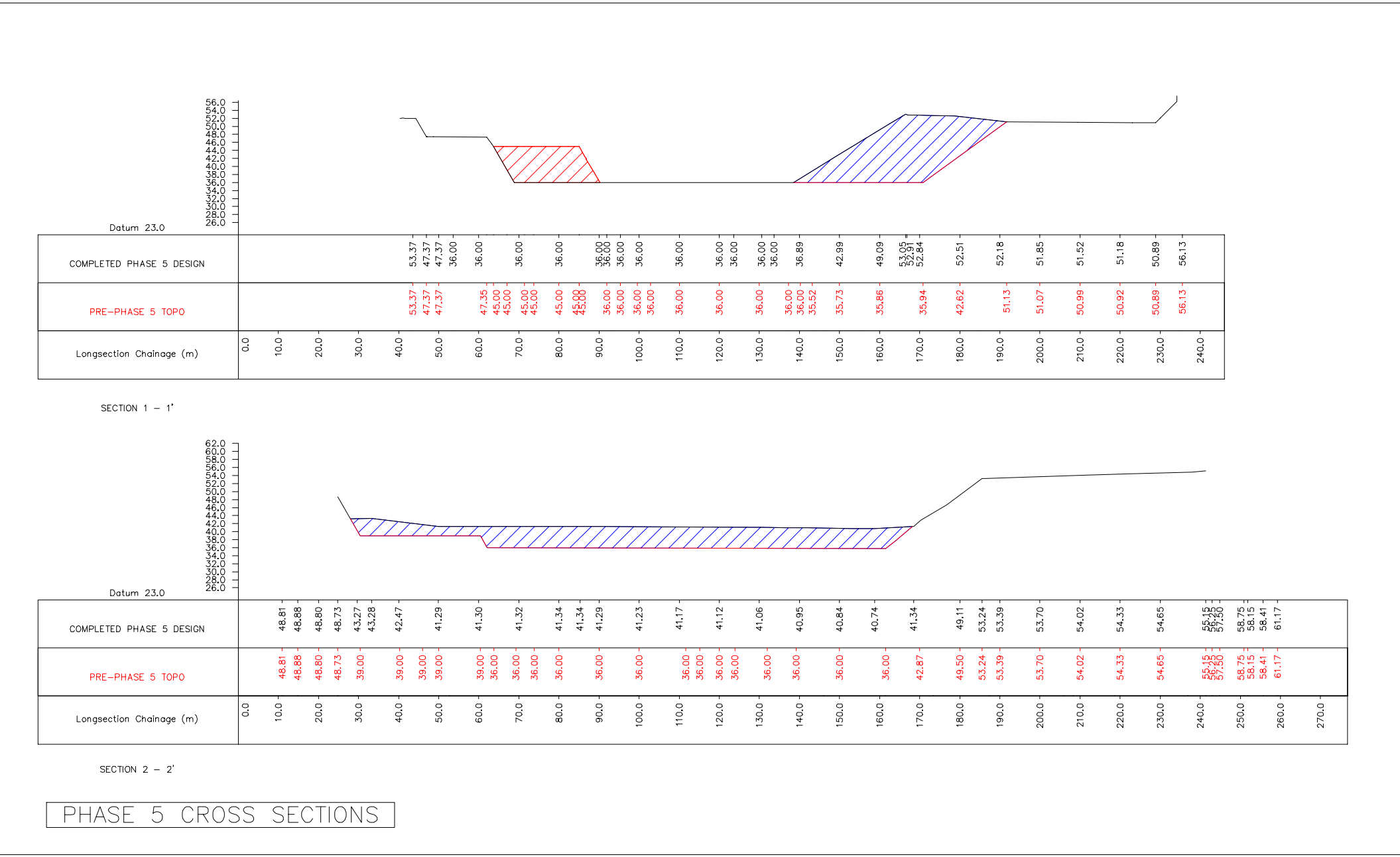
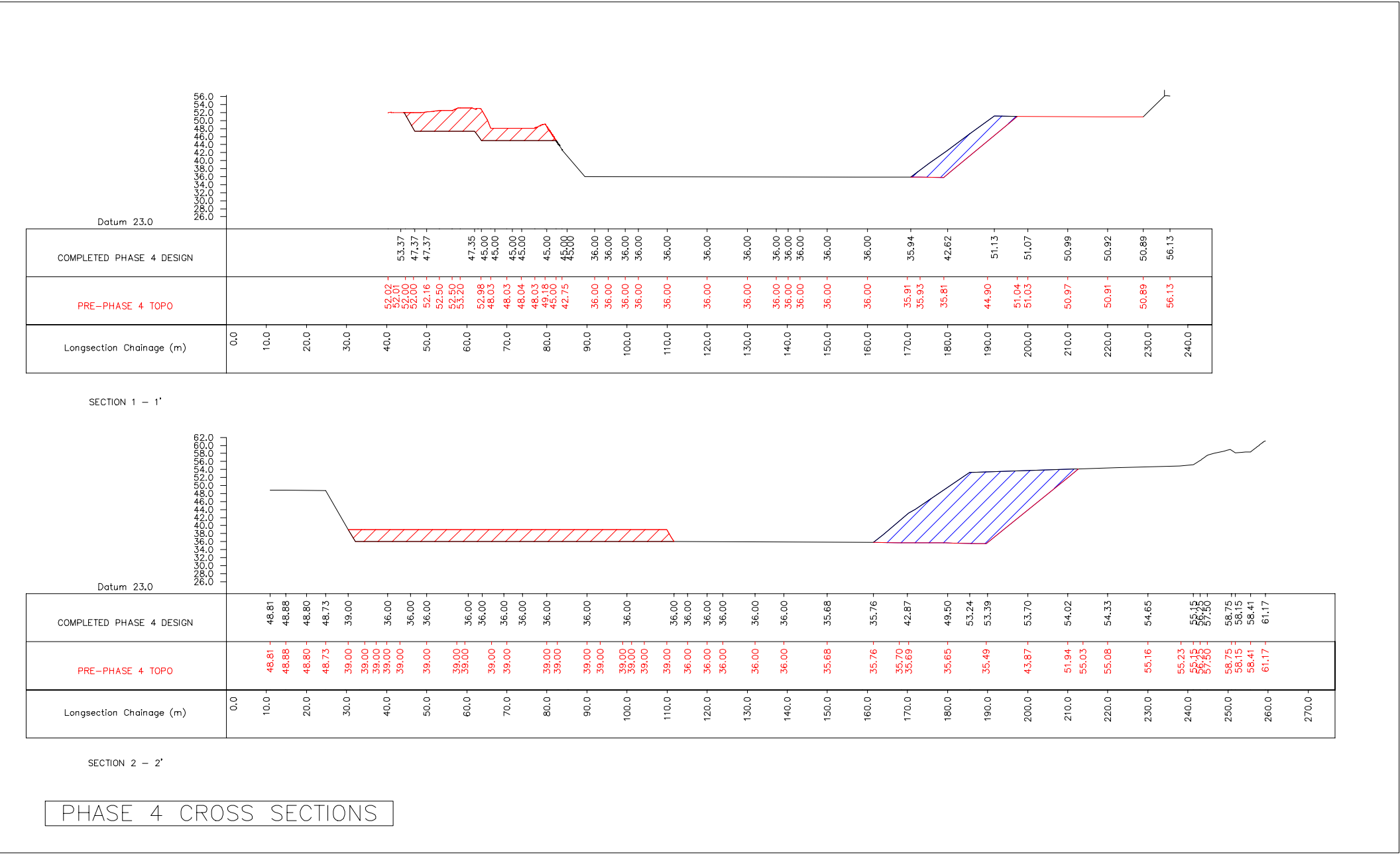
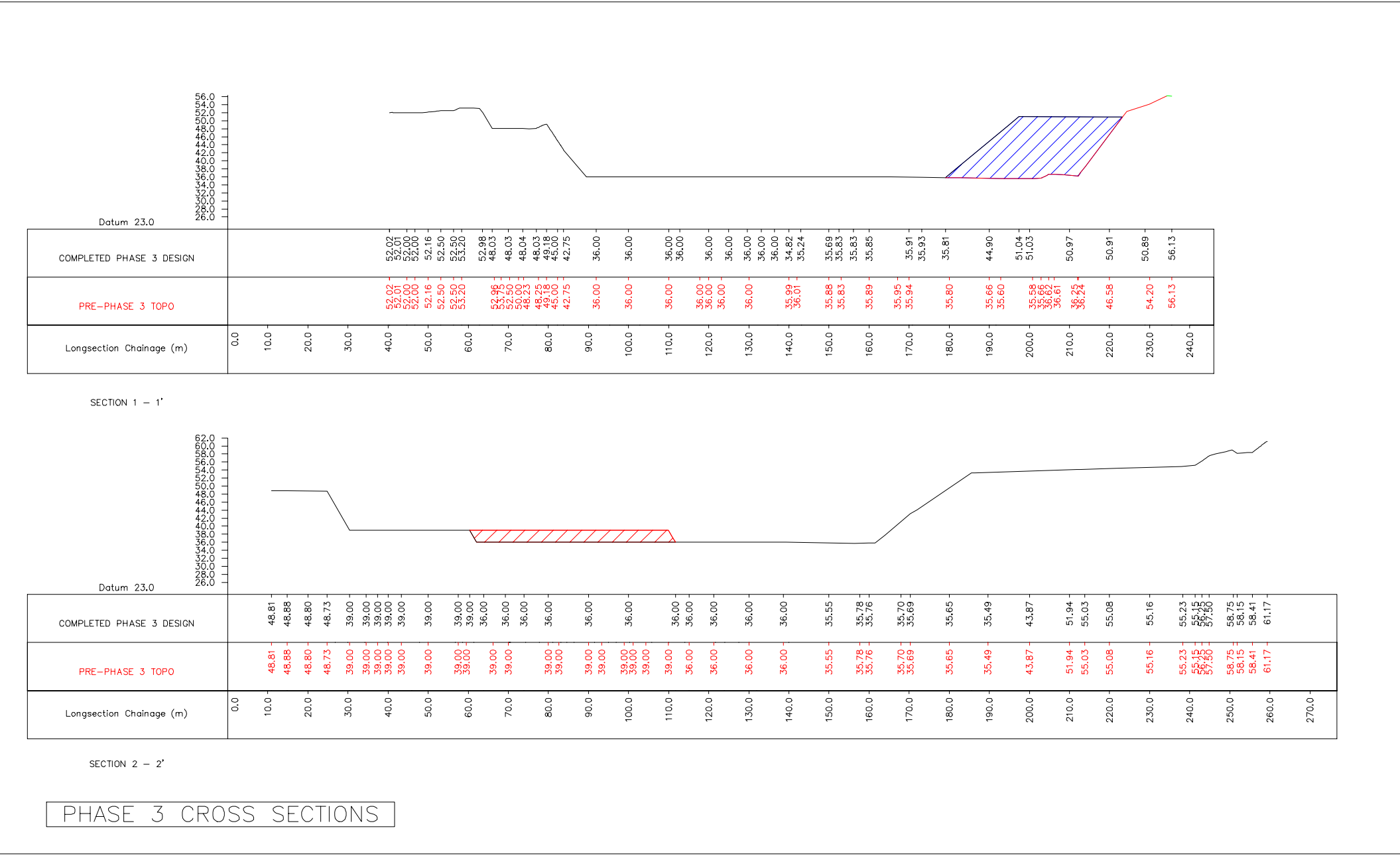
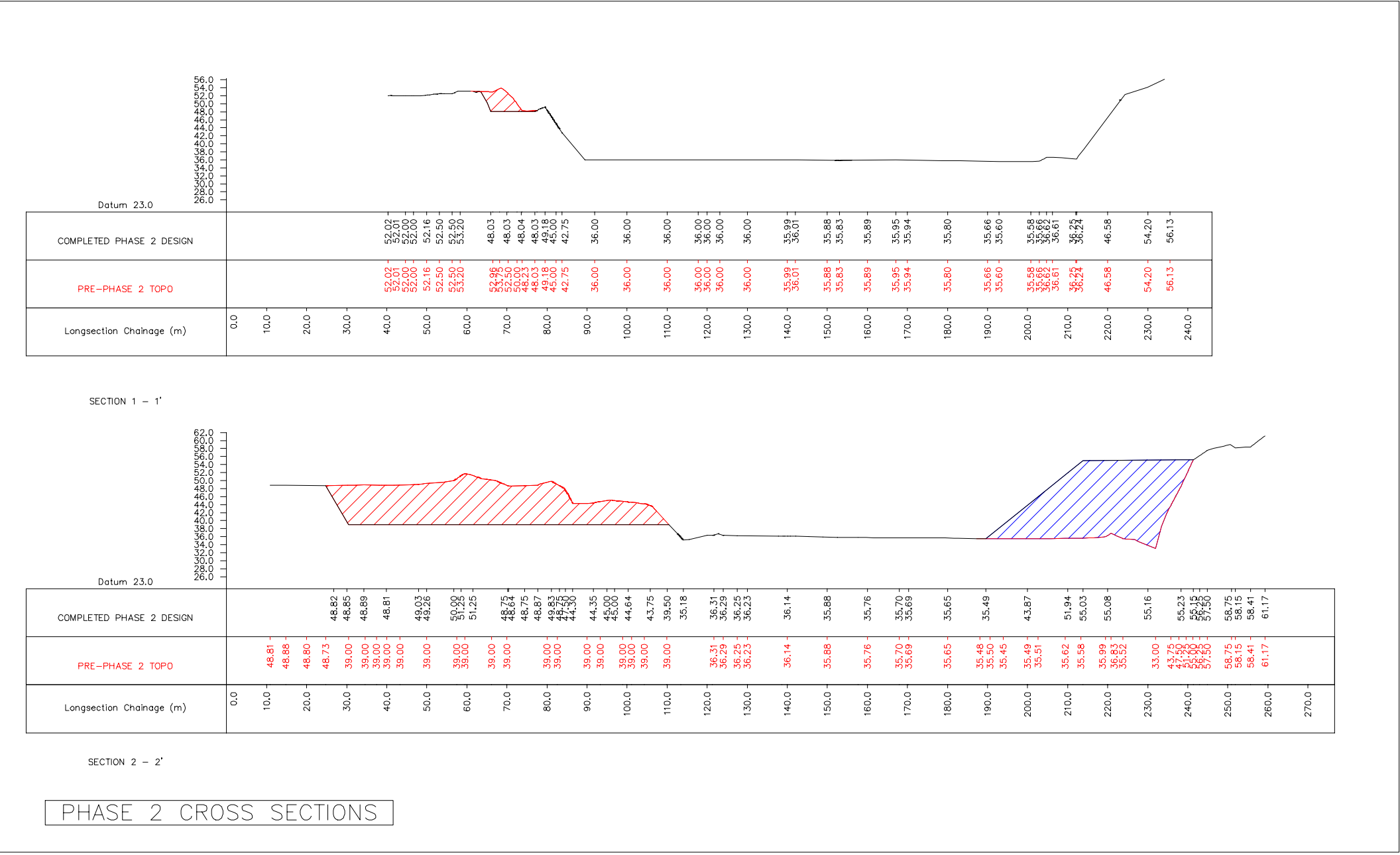
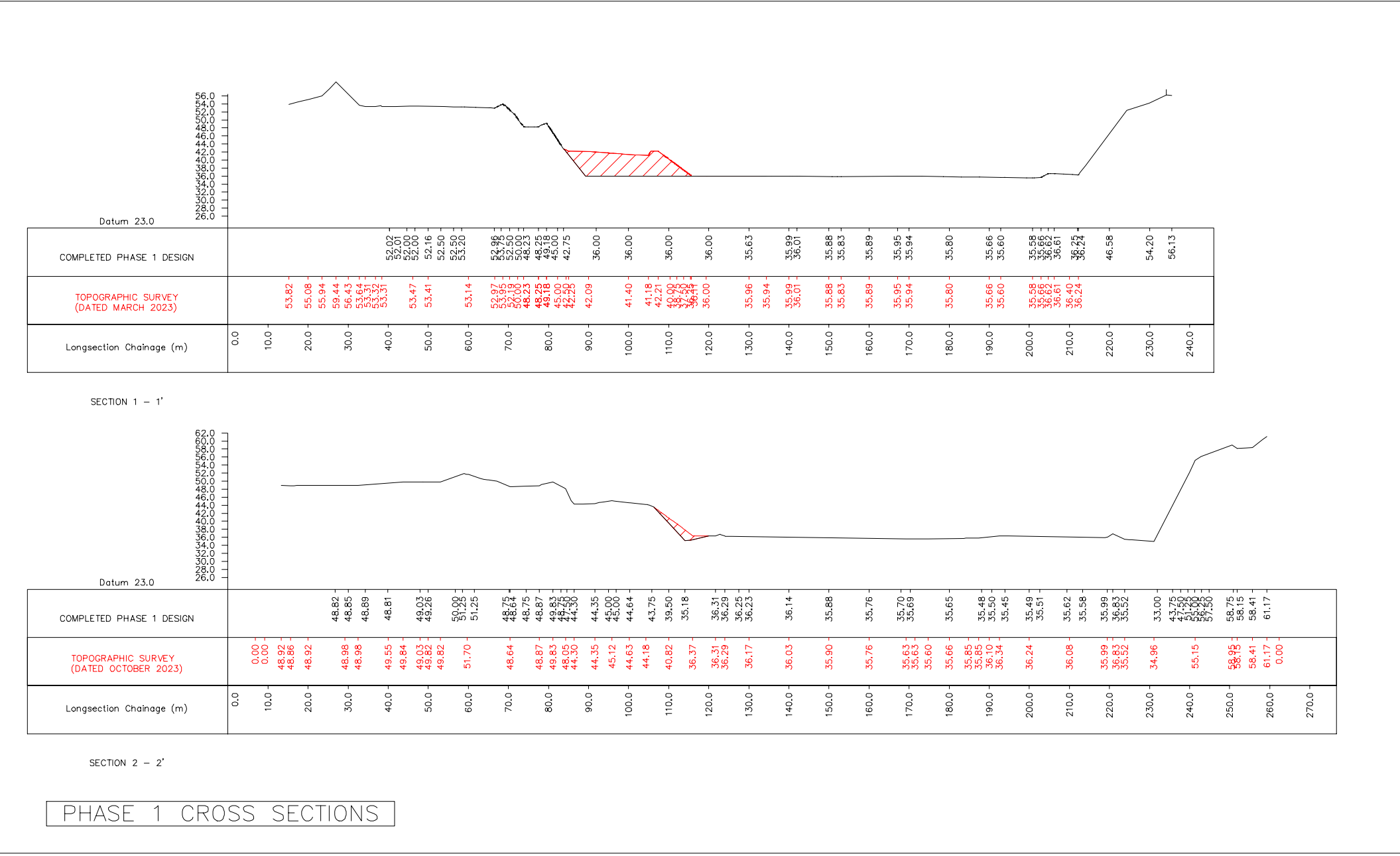
PROJECT:

BROMSBERROW QUARRY

TITLE:

UPDATED QUARRY
DEVELOPMENT PLAN -
FLOOR AT 36MAOD

DRAWN:	CHECKED:	DATE:
RB	BD	AUG '23
SCALE:	ORIGINAL SHEET SIZE:	STATUS:
1:1500	A1	FINAL
DRAWING NO.	REVISION:	
7873-005-D-002	02	



NOTES

AREAS OF MINERAL TO BE EXTRACTED ON A PHASED BASIS

AREAS OF RESTORATION TO BE PROGRESSED ON A PHASED BASIS

03 SURFACE WATER POND UPDATE RB 30/11/23

02 TOPOGRAPHIC SURVEYS UPDATED RB 07/11/23

01 FIRST ISSUE RB 09/08/23

REV. REVISION DETAIL DRAWN DATE

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PROJECT:

BROMSBORROW QUARRY

TITLE:

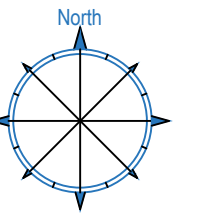
UPDATED QUARRY
DEVELOPMENT PLAN - FLOOR
AT 36MAOD CROSS SECTIONS

DRAWN: RB CHECKED: BD DATE: NOV '23

SCALE: 1:1250 ORIGINAL SHEET SIZE: AI STATUS: FINAL

DRAWING NO. 7873-005-D-004

REVISION: 03

[illegible]

APPENDICES

Appendix A

Planning Permissions

Gloucestershire County Council

TOWN AND COUNTRY PLANNING ACT, 1947

TOWN AND COUNTRY PLANNING GENERAL DEVELOPMENT ORDER 1950

To Mr. G. H. Morris,
12 Newtown Road, Hereford.

In pursuance of their powers under the above-mentioned Act and Order, the Council as Local Planning Authority HEREBY PERMIT the development described hereunder subject to the conditions hereunder stated.

Description of Land	Description of Development
Woodland and sand-pit to east of Bromsberrow Heath. O.S. Glos: X.11. 1923 Edition. Parcel No. 947 & 948. Dymock Parish. Newent R.D.	Use of land for winning of sand.

CONDITIONS ATTACHED TO CONSENT

- The development to be restricted to the winning of sand only.
- No excavations to take place south-east of the line shown in red on plan No. T.P.A. 887.
- The top soil and overburden to be retained within the area and the site brought to an even surface and graded when excavation is completed.

The reasons for the Council's decision to grant permission for the development, subject to compliance with the conditions hereinbefore specified are:—

- To safeguard the amenities of the area by limiting the uses to works required only in connection with the extraction of minerals, and ensuring that the site is left in a tidy condition on the completion of operations.
- To safeguard land required for the construction of a proposed motorway.

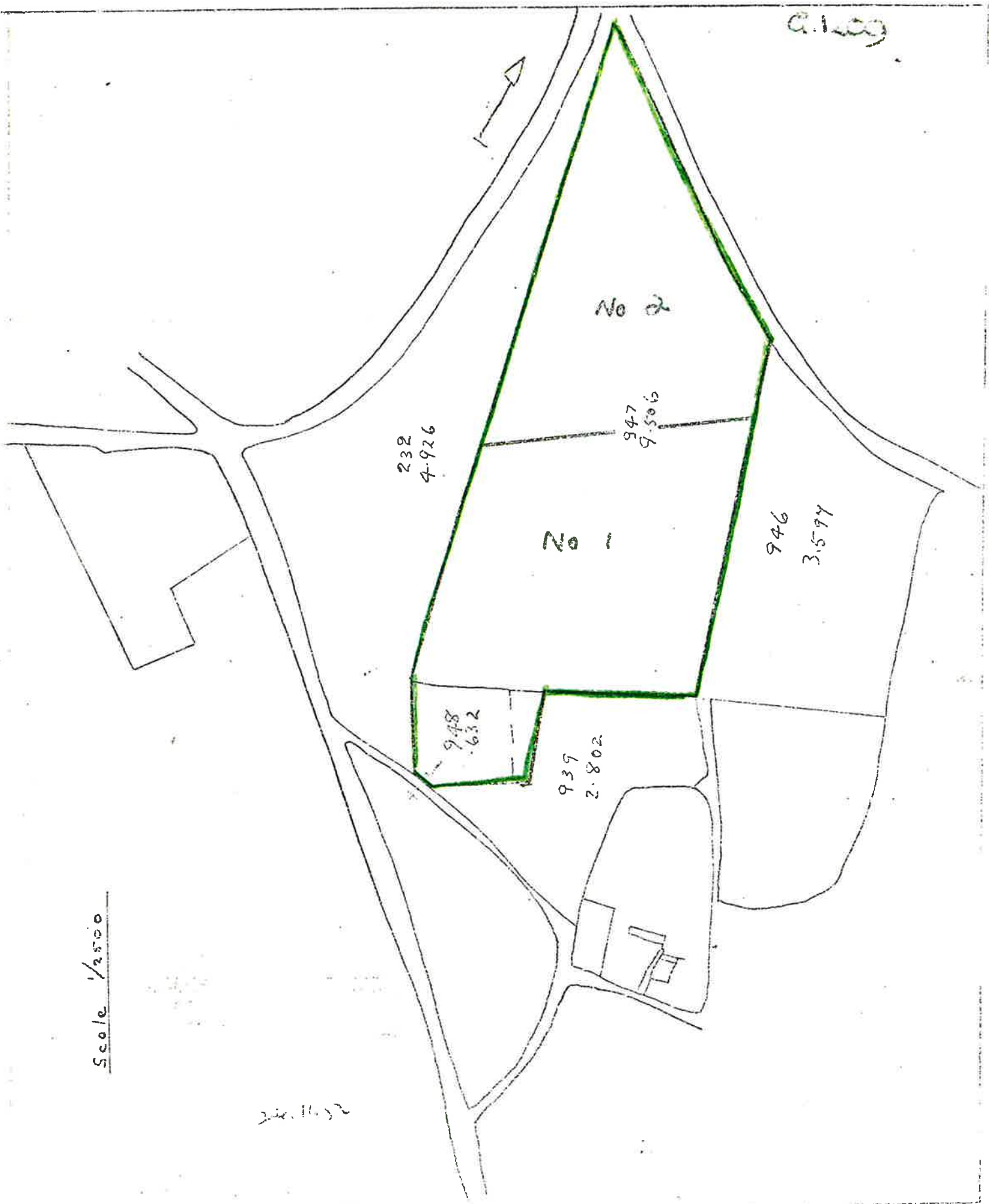
Dated 23rd day of January 1951

GUY H. DAVIS,
Clerk of the Council.

NOTES.

- If the applicant is aggrieved by the decision of the Local Planning Authority to refuse permission or approval for the proposed development, or to grant permission or approval subject to conditions, he may by notice served within one month of receipt of this notice, appeal to the Minister of Housing and Local Government in accordance with Section 16 of the Town and Country Planning Act, 1947. The appropriate form should be obtained from: The Principal Regional Officer, Ministry of Housing and Local Government, 19, Woodland Road, Bristol 8. The Minister has power to allow a longer period for the giving of a notice of Appeal and he will exercise his power in cases where he is satisfied that the applicant has deferred the giving of a notice because negotiations with the local planning authority in regard to the proposed development are in progress. The Minister is not, however, required to entertain such an appeal if it appears to him that permission for the proposed development could not have been granted by the Local Planning Authority, or could not have been so granted otherwise than subject to the conditions imposed by them, having regard to the provisions of Section 14 of the Act and of the Development Order and to any directions given under the Order.
- If permission to develop land is refused, or granted subject to conditions, whether by the Local Planning Authority or by the Minister of Housing and Local Government, and the owner of the land claims that the land has become incapable of reasonably beneficial use in its existing state and cannot be rendered capable of reasonably beneficial use by the carrying out of any development which has been or would be permitted, he may serve on the Council of the County District in which the land is situated a purchase notice requiring that Council to purchase his interest in the land in accordance with Section 19 of the Town and Country Planning Act, 1947.

In certain circumstances, a claim may be made against the Local Planning Authority for compensation, where a claimant is subject to conditions by the Minister on appeal or on a reference of the application to him. In such cases, compensation must be obtained from the Local Planning Authority.



Submitted with application

Gloucestershire County Council

TOWN AND COUNTRY PLANNING ACT, 1947

TOWN AND COUNTRY PLANNING GENERAL DEVELOPMENT ORDER 1950

To Mr. C. E. Morris, Kildonan, 19, Newtown Road, Hereford.

In pursuance of their powers under the above-mentioned Act and Order, the Council as Local Planning Authority HEREBY PERMIT the development described hereunder subject to the conditions hereunder stated.

Description of Land	Description of Development
Grovehouse Cottage, Bromsberrow Heath. S.S. Glouc. K. 11, 1923 Edition, Parcel Nos 289 & 289. Bromsberrow Parish. Hereford R.D.	Use of land for winning of sand.

CONDITIONS ATTACHED TO CONSENT

(a) The development to be restricted to the winning of sand only. (b) The top soil and overburden to be retained within the area and the site brought to an even surface and graded when excavation is completed. (c) No excavation to be carried out within 30 feet of the highway boundary or improvement line as indicated on plan No. TPA.899. (d) The excavations to be carried out at a slope not exceeding 1 in 1. (e) No excavations to take place south east of a line shown in red on plan No. TPA.899 as being the boundary of a proposed motorway reservation. (f) Tree screens to be planted to the satisfaction of the County Planning Officer in the position indicated on Plan No. TPA.899.

The reasons for the Council's decision to grant permission for the development, subject to compliance with the conditions herebefore specified are:-

(a)(b)(c) To safeguard the amenities of the area by limiting the uses to works required only in connection with the extraction of minerals, and ensuring that the site is left in a tidy condition on the completion of operations and is screened from view from the public highway. (d)(e)(f) To safeguard the existing highway and proposed improvements and to safeguard land required for the construction of a proposed motorway.

Dated 18th day of June, 1953.

GUY H. DAVIS.

Clerk of the Council.

NOTES.

1. If the applicant is aggrieved by the decision of the Local Planning Authority to refuse permission or approval for the proposed development, or to grant permission or approval subject to conditions, he may by notice served within one month of receipt of this notice, appeal to the Minister of Housing and Local Government in accordance with Section 16 of the Town and Country Planning Act, 1947. The appropriate form should be obtained from: The Principal Regional Officer, Ministry of Housing and Local Government, 19, Woodland Road, Bristol 8. The Minister has power to allow a longer period for the giving of a notice of Appeal and he will exercise his power in cases where he is satisfied that the applicant has deferred the giving of a notice because negotiations with the local planning authority in regard to the proposed development are in progress. The Minister is not, however, required to entertain such an appeal if it appears to him that permission for the proposed development could not have been granted by the Local Planning Authority, or could not have been so granted otherwise than subject to the conditions imposed by them, having regard to the provisions of Section 14 of the Act and of the Development Order and to any directions given under the Order.

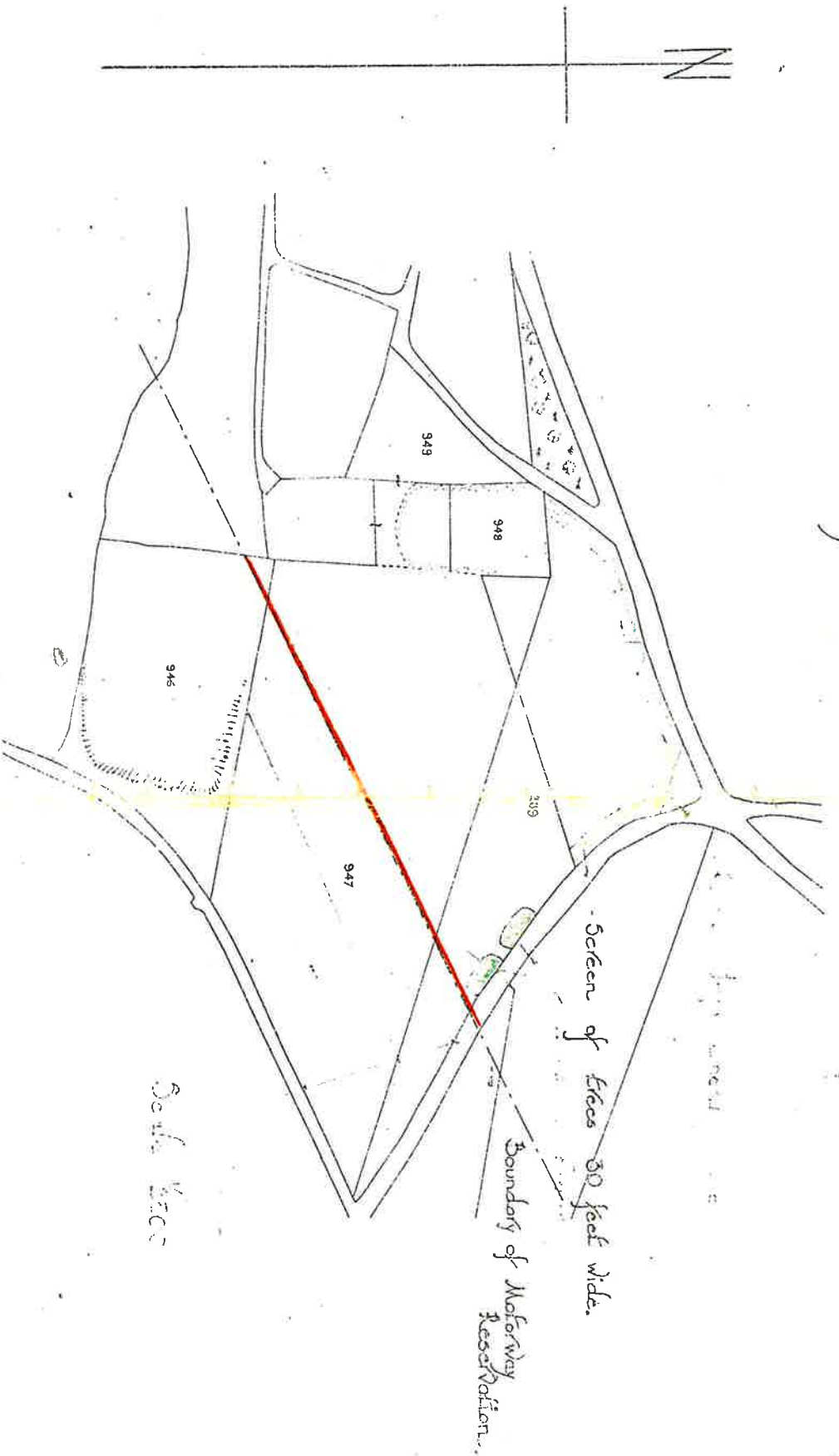
2. If permission to develop land is refused, or granted subject to conditions, whether by the Local Planning Authority or by the Minister of Housing and Local Government, and the owner of the land claims that the land has become incapable of reasonably beneficial use in its existing state and cannot be rendered capable of reasonably beneficial use by the carrying out of any development which has been or would be permitted, he may serve on the Council of the County District in which the land is situated a purchase notice requiring that Council to purchase his interest in the land in accordance with Section 19 of the Town and Country Planning Act, 1947.

3. In certain circumstances, a claim may be made against the Local Planning Authority for compensation, where permission is refused, or granted subject to conditions by the Minister on appeal or on a reference of the application to him. The circumstances in which such compensation is payable are set out in sections 20 and 79 of the Town and Country Planning Act, 1947.

4. This permission relates to planning control only. Any other statutory consent necessary must be obtained from the appropriate authority.

5. If any further information is required in connection with this decision it may be obtained from the County Planning Officer, Union Lane, Barnwood, Gloucester.

Sand Workings at Bromsberrow.



JPA 899
11 June 55. C.B.

Eric L. Higgins M.D. A.M. M.E.
County Planning Office,
Upton Lane, Barnwood,
Gloucestershire.

TOWN AND COUNTRY PLANNING ACTS, 1962-68

of their powers under the above mentioned Acts, the Council as Local Planning Authority
the development described hereunder in accordance with the submitted application and the
conditions, but subject to the conditions hereunder stated.
Kildonan, 19 Newtown Road, Hereford.
E. T. Booth, L.R.I.B.A., 5a King Street,

PLANNING REFERENCE No.
AND DATE OF APPLICATION
G.1209/C
28.7.71.

Description of Land

Land at Bromsberrow Heath.
S.O. 7432 & 7532, 7433 &
7533, 7232 & 7332, 7233 &
7333.
A Edition Parcel Nos. 0007
& 0003

Description of Development

Use of land for the winning of sand.

CONDITIONS ATTACHED TO PERMISSION AND REASONS THEREFOR

IX The development hereby permitted shall be begun not later than the expiration of five years beginning with the date of this permission.

The development to be restricted to the winning of sand only.

Prior to winning of sand from any part of the site, the top soil and overburden shall be stripped and all material shall be stored within the site and made available for subsequent respreading.

After completion of the extraction of sand, the site shall be brought to an even surface and graded followed by the respreading of the overburden and top soil.

No winning of sand shall take place within 50 feet (15.24 metres) of the southerly and easterly boundaries of the site and all trees and shrubbery within this area shall be retained.

winning of sand shall be restricted to a depth of 140 feet (42.67 metres). Above Ordnance Datum.

Only clean soil shall be deposited on the site.

Adequate precautions shall be taken to ensure that no materials or continued *

Reason:-

z To comply with the requirements of Section 65 of the Town and Country Planning Act, 1968.

(c) & (d) To safeguard the amenities of the area by limiting the uses to works required only in connection with the extraction of sand and ensuring that the land is left in a tidy condition on the completion of the operations and is screened from view from the adjoining highways.

(f) (g) & (h) To safeguard interference with the aquifer immediately adjacent to the Water Board's pumping station.

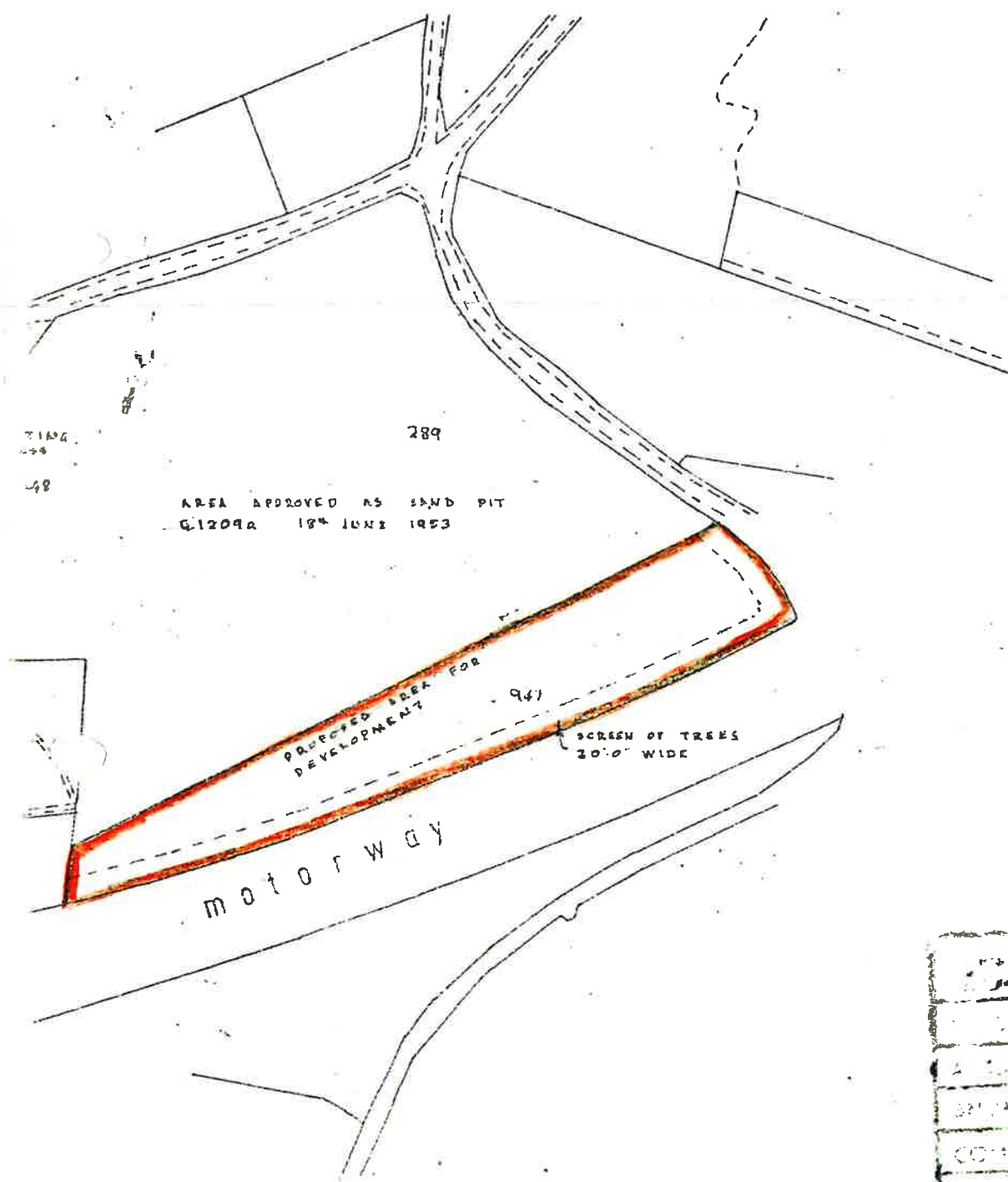
* LIQUIDS SHALL BE DEPOSITED ON THE SITE WHICH WOULD BE LIKELY TO INTERFERE WITH THE AQUIFER IMMEDIATELY ADJACENT TO THE WATER BOARD'S PUMPING STATION.

21st October 1971

Dated

COUNTY SOLICITOR

1
2500



Gloucestershire County Council
County Planning Dept.
Rec'd 30 JUL 1971
Ack'd

29 JUL 1971
SP/PLANNING
COMMITTEE
FILE NO.

REFERRED TO

a.r.tong

21-9-70

01719/1

Plans submitted with application G1209/c

Appendix B

Waste Acceptance Procedures

Waste Acceptance Procedure at Bromsberrow North Sandpit

1. Summary of Procedure

This document defines the responsibility and actions required of Allstone Sands Gravels Aggregates Trading Co. Ltd (Allstone) employees operating the Bromsberrow North Sandpit (the Site) in regard to the acceptance of waste under the inert landfill Environmental Permit (EP) at Bromsberrow North Sandpit, Bell Lane, Bromsberrow Heath, Ledbury, Gloucestershire HR8 1NX (the Site).

This waste acceptance procedure is in place to ensure that waste is only accepted under the EP that:

- is suitable for the activity;
- is allowed under the EP; and
- was considered in the risk assessments as part of the EP application.

The waste acceptance at the Site will be underpinned by the Allstone Environmental Management System (EMS) that will ensure that the procedures are effectively implemented, that non-conformance is identified, and appropriate remedial action is taken.

The EP for a site contains the list of waste types that are permitted to be accepted. Careful attention should be given to both the List of Waste (LoW) code (also known as the European Waste Catalogue (EWC) code) stated on the EP and the description assigned alongside those codes.

The consequence of not following this procedure may result in unsuitable waste being accepted on to the Site. This may constitute a breach in the conditions of the EP. A breach in conditions of the EP could cause the following consequences:

- Financial;
- Custodial;
- Reputational; and
- Environmental.

2. Waste Quantities under the EP

The Site will accept up to 670,000 m³ of waste during the lifetime of the EP to ensure that it is restored as per the planning permission.

The maximum quantity of imported waste accepted at the Site will not exceed 100,000 tonnes per annum.

3. Waste Types

The following European Waste Catalogue (EWC) / List of Waste (LoW) codes will be accepted under the EP.

Table 1 - List of Waste Codes

EWC / LoW Code	Description	Restrictions
10 11 03	Waste glass-based fibrous materials	Only without organic binders
15 01 07	Glass packaging Glass	
17 01 01	Concrete	Selected C & D waste only *
17 01 02	Bricks	Selected C & D waste only *
17 01 03	Tiles and ceramics	Selected C & D waste only *
17 01 07	Mixtures of concrete, bricks, tiles and ceramics	Selected C & D waste only *
17 02 02	Glass	
17 05 04	Soil and stones	Excluding topsoil, peat; excluding soil and stones from contaminated sites
19 12 05	Glass	
20 01 02	Glass	Separately collected glass only
20 02 02	Soil and stones	Only from garden and parks waste; Excluding top soil, peat
<i>*Selected construction and demolition waste (C & D waste): with low contents of other types of materials (like metals, plastic, soil, organics, wood, rubber, etc). The origin of the waste must be known.</i> - No C & D waste from constructions, polluted with inorganic or organic dangerous substances, e.g. because of production processes in the construction, soil pollution, storage and usage of pesticides or other dangerous substances, etc., unless it is made clear that the demolished construction was not significantly polluted. - No C & D waste from constructions, treated, covered or painted with materials, containing dangerous substances in significant amounts.		

Strict waste acceptance procedures will be implemented on the Site to ensure that:

- The accepted waste is on the list set out in Table 1;
- The waste is from a single source; and
- There is no suspicion that the material may be contaminated.

Potential incoming waste should be classified in accordance with Technical Guidance WM3 to assign the correct EWC / LoW code.

Accepted waste will be inert in nature and will not exceed inert WAC limits.

The waste types set out in Table 1 do not require WAC analysis to be provided prior to acceptance at inert landfill (as set out in the Landfill Directive) provided that the wastes:

- come from a single source
- are well characterised and described
- carry no risk of contamination, for example from a site that has not previously been developed.

The waste producer must test waste and provide the results of the analysis if the waste to Allstone if the waste has come from:

- land that has or may have been contaminated by previous use;
- a waste treatment or transfer facility; and
- any site where it is suspected that the waste may have been contaminated.

In case of suspicion of contamination (either from visual inspection or from knowledge of the origin of the waste) testing should be applied or the waste refused.

Materials that are identified as arising from multiple sources will not be accepted; neither will, for example, soils from the site of a former petrol station, since they may be contaminated with hydrocarbons.

Customers attention is drawn to these limitations and a prerequisite of acceptance is the signed declaration by the customer that the materials to be brought to the Site will comply with these requirements.

3.1 Acceptance and Control Procedures

3.1.1 Inquiry Stage

Wastes will only be accepted at the Site if they have been adequately characterised by the waste producer (Level 1, Basic Characterisation).

Allstone's acceptance and control procedures will be explained to all new customers, including the need to carry out the Basic Characterisation requirements of the Landfill Directive.

Both new and existing customers will be required to provide Allstone with the necessary Basic Characterisation information in advance, in the form of a signed declaration. Basic characterisation will include:

- Source and origin of the material;
- Information on the process producing the material (description including Standard Industry Classification (SIC) code and characteristics of raw materials and products);
- Description of any treatment applied in compliance with Article 6(a) of the Landfill Directive or a statement of reasons why such treatment is not considered necessary; data on the composition of the material and, where relevant, the leaching behaviour of the material;
- Appearance of the material (smell, colour, physical form);
- EWC / LoW code – with a waste classification having taken place in accordance with Technical Guidance WM3;
- Information to demonstrate that the material is not prohibited;
- The landfill class at which the material may be accepted; and
- Any additional precautions to be taken at the Site.

The customer will also confirm that the material:

- Cannot practically be recycled or received;
- Does not consist of or contain any materials that are described in Article 5 (3) of the Landfill Directive (banned wastes);
- Consists only of material that is in Table 1;
- Does not contain components/parameters that exceed standard inert WAC limits;
- Only comes from a single source;
- Does not contain material that is suspected of being contaminated; and
- Does not come from a stockpile where dilution or mixing of other unauthorised waste may have occurred.

If, after consideration of the basic characterisation information, the material is not considered acceptable the customer will be informed so that they can seek an alternative disposal site.

In either case, the Site Clerk will be informed so that they are aware that the material has been approved for acceptance (subject to its on-site verification at the reception area and tipping face) or rejected as being unacceptable for disposal at the site.

3.1.2 Reception at Site

Drivers of all vehicles delivering inert material for the restoration of the site must report to the site office to disclose the nature of the material they are carrying and provide the relevant documentation.

The site office is manned by the Site Clerk who will record the movement of vehicles to and from the site and identify the loads they are carrying. The Clerk will complete Transfer Notes and site dockets and is responsible for their safe storage. Waste Transfer Notes will be made available for inspection by representatives of the EA on request. In line with planning conditions for the Site, there will be no more than 60 heavy goods vehicle movements to and from the Site per operational day (30 incoming and 30 outgoing).

The Site Clerk will ensure that a fully completed Waste Transfer Note is received for every load (unless part of a multiple consignment) and includes the appropriate EWC/LoW code.

For each load of material delivered the delivery driver will be issued with a receipt.

Only authorised carriers and exempt authorities will be allowed on site. Any new carrier must provide evidence of registration (registration certificate or official copy certificate) before being allowed to deposit their loads of waste. In addition, occasional checks of carriers who regularly use the Site will be carried out to check that their registration is still current.

3.1.3 On-Site Verification

Reception area

All loads of inert materials delivered to the Site will be visually inspected at the reception area (where practicable) and again when the material is deposited at the tipping face. The objective of this inspection is to detect the presence of unauthorised materials.

Vehicles that arrive sheeted will normally be unsheeted at the reception area for inspection. A notice will be erected to tell drivers where vehicles must be unsheeted.

In windy conditions or where the nature of the load may give rise to wind-blown dust the vehicle will remain sheeted until it reaches the tipping face and the clerk will contact the dozer driver by radio with details of the vehicle, to ensure that the load is properly inspected at the tipping face.

Loads that appear acceptable after inspection at the reception area will be directed to the tipping face. If the Site Clerk's inspection detects any unauthorised material, it will be dealt with in accordance with the restoration material rejection procedures.

The Site Clerk and machine operator will use two-tray radios so that the visual inspection and cross-checking of any load can be carried out. The Site Manager or their nominee will also carry a radio so that they can be made aware of potential problems at the earliest opportunity. This might, for example, be the arrival of a delivery containing unauthorised materials. The Site Manager will then be able to ensure that such materials are handled safely and removed from site as soon as practicable.

After inspection of the load the Site Clerk will sign the Waste Transfer Note to confirm that the details are correct. If inspection is not possible in the reception area, the clerk will only sign the Waste Transfer Note when the vehicle returns to the reception area after the deposit of the material has taken place.

Tipping Face / Deposit Area

On arrival at the working area the load will be deposited as directed by the operative(s) at the face. The operative will observe every load as the waste is deposited from the delivery vehicle.

If the inspection detects any unacceptable material, it will be dealt with in accordance with the restoration material rejection procedures below.

3.1.4 On-Site Verification Testing (Level 3 Characterisation)

Only wastes that are listed in Table 1 and do not exceed standard inert WAC limits will be accepted under the inert landfill EP.

Allstone are required to sample and test the incoming waste periodically to ensure that the waste accepted is as described in the accompanying documentation. The frequency of such testing is set out below:

- For **homogeneous** waste (waste containing the same of similar components), each waste stream or waste source will be sampled and tested once a year.
- For **heterogeneous** waste (waste containing a range of different components) and **new** wastes, each waste stream or waste source must be sampled and tested three times a year.

If the gained testing results shows that the waste should not have been accepted under the EP, then Allstone must report this to the producer of the waste so that they can review and refine their basic characterisation. The waste must be removed from the site and the Site's local EA officer must be notified of failed samples. If the waste cannot be removed, then Allstone will provide an explanation to the EA what effect this waste will have to the local environment.

3.1.5 Multiple Consignments

Customers may use a "season ticket" to cover the delivery of multiple loads for a period of up to 12 months providing the material is from the same source and is consistently the same type (i.e. its composition does not change). Allstone requires that the haulier supply some form of documentation for each load of the multiple consignment that records the following information:

- Place of origin

- Description of the material
- Person delivering the material (and Vehicle Registration No.
- Date of the delivery.

This paperwork will be stored and attached to the multiple consignment note when the contract is completed.

3.1.6 Waste Rejection Procedure

If the Site Clerk finds that the material on the vehicle at the reception area does not comply with the conditions of the EP, the material will not be accepted. The driver will be issued with a Rejected Materials Form and asked to leave the site.

If during or after deposit, the operative observes the presence of a significant quantity of unacceptable material they will alert the driver and, if possible, reload the unacceptable material onto the delivery vehicle.

If the vehicle has left the working area, the operative will contact the reception area by portable radio and inform the Site Clerk who will detain the delivery vehicle at the site office if possible.

The Site Clerk will inform the Site Manager or their nominee who will then inspect the load with the delivery driver and, where practicable, ensure that the unacceptable material is returned to the producer.

Where the delivery vehicle has already left site, the unacceptable material will be isolated or moved to a temporary storage location if safe to do so. Unacceptable material is not to be covered with other material.

The carrier will then be offered the opportunity to remove the material. If the carrier is unable to collect the material, it will be re-loaded into a suitably safe container on their behalf. The material will then be consigned to an alternative disposal facility that is authorised to receive such material, using a registered (and reputable) waste carrier.

Materials that have been deemed unacceptable will be removed from the site within 5 calendar days of receipt.

Each load of material dispatched from the site will be accompanied by a Waste Transfer Note.

The Site Manager or their nominee will record the incident in the Site Diary and inform the producer and carrier with the issue of a Rejected Materials Form. Where unauthorised materials are received for a second time from the same producer a warning letter will be issued to the producer in addition to the Rejected Materials Form. Any further receipt of unauthorised material will result in the issue of a letter prohibiting the producer's use of the site.

Copies of Rejected Materials Forms and letters issued to customers will be stored securely and filed with other relevant contract documentation.

3.1.7 Duty of Care

Section 34(1) of the Environmental Protection Act 1990 imposes a Duty of Care on any person who imports, produces, carries, keeps, treats, or disposes of controlled waste, which includes the restoration materials to be used at the Site. The Duty of Care came into force on 1st April 1992 by way of The Environmental Protection (Duty of Care) Regulations 1991.

The Regulations require an adequate description of the materials to be provided and a Waste Transfer Note to be completed, signed and kept by the parties to a transfer. There are, however, some circumstances where a carrier will not provide a transfer note for each load (e.g. where the

load is part of a regular consignment). To ensure that each load received can be accounted for, Allstone will arrange the site receipt docket in a way that it duplicates the information required by the transfer note. The Duty of Care is therefore complied with in all respects providing an adequate description is received from the carrier, a site receipt docket is duly completed, and a copy given to the carrier.

Waste Transfer Notes and waste transfer information will be kept in a safe place for a period of at least two years, to allow inspection by the EA, in accordance with the Duty of Care Regulations.

The duty of care waste transfer note will state the:

- Name and address of the waste holder or producer
- The Standard Industry Code (SIC) of the producer
- Name and address and registration number of the waste carrier
- Name and signature of the person transferring the waste
- The contents/ type of the waste
- The weight of the waste (if appropriate)
- The EWC / LoW code
- A description of the waste
- Date of transfer
- The containment of the waste (e.g. Loose, sacks, drum)
- Duty to apply the waste hierarchy as required by Regulation 12 of the Waste (England and Wales) Regulations 2011.

The information required on a landfill receipt docket will be the:

- Name of the Site
- EP number
- Name of Licensing Authority
- Customers trading title and address
- Waste description and LoW code.
- Source of the waste by district
- Customers order number if available
- Transfer note number
- Date and time of delivery
- Name and signature of the company's representative (Name: The initials and surname of the person raising the ticket must be entered in block capitals. Signature: signature of the person raising the ticket).
- Vehicle owner (enter the full name of the vehicle owner if different from the customer.
- Vehicle registration number (enter the full vehicle registration number).
- Carrier's registration certificate number and registering authority. (Every haulage company must have their own registration number. Vehicles will not be allowed access to the site if they are found operating with another person's registration number. Care must be taken to ensure that only registered carriers are allowed on site and that genuine registration numbers are recorded).
- Quantity of waste deposited.
- Driver's name and signature – Enter the initials and surname of the driver in BLOCK CAPITALS. Ensure the person in charge of the vehicle signs the ticket.

3.1.8 Documentation Procedure

One receipt docket must be issued for every load deposited.

Only authorised carriers and exempt authorities will be allowed on site. A check must be made against the list of registered carriers where the owner of the vehicle is identifiable. Where the carrier is not listed and where the vehicle is not identifiable the original or authenticated copy of the registration must be seen, and the Site Clerk must satisfy her/himself that everything is in order before allowing the driver and vehicle to proceed.

The third copy of each ticket will be given to customers at the time of deposit. The top copy ticket will be sent to Allstone's head office with a completed daily record sheet leaving the second (carbon) copy on site.

3.1.9 Quarantine, Storage and Rejection of Materials

If the Site Clerk finds that the material on the vehicle does not comply with the conditions of the EP, the material will not be accepted on site. The driver will be asked to leave the Site and advised to deliver the material to a suitably licensed disposal facility.

If, during, or after deposit, the operative observes the presence of unacceptable material they will alert the driver and, if possible, reload the unacceptable material onto the delivery vehicle. Unacceptable material is not to be covered.

If the vehicle has left the working area, the operative will inform the Site Clerk who will detain the delivery vehicle at the Site office if possible.

The Site Clerk will inform the Site Manager or their nominee who will then inspect the load with the delivery driver and, where practicable, ensure that the unacceptable material is returned to the waste producer.

Where the delivery vehicle has already left site, the unacceptable material will be isolated or moved to a temporary storage location if safe to do so. A load holding area for unsuitable loads will be provided on site. The exact location of this area may vary depending upon factors such as current tipping areas and health and safety. The location of the load holding area will be notified to the EA.

The carrier will then be offered the opportunity to remove the material. If the carrier is unable to collect the material, it will be re-loaded into a suitably safe container on his behalf. The material will then be consigned to an alternative disposal facility that is licensed to receive such waste, using a registered (and reputable) waste carrier.

Materials that have been deemed unacceptable must be removed from the Site within five calendar days of receipt.

If a load is rejected, a load rejection record must be issued, and a copy of the record retained on site. The reason for rejection must be given. The rejection certificates shall be made available for inspection by the EA on request. The rejection of a load should also be recorded in the Site Diary.

Appendix C

Management Plan for Restoration and Aftercare

MANAGEMENT PLAN FOR RESTORATION AND AFTERCARE
FOR BROMSBERROW NORTH,
BELL LANE,
BROMSBERROW HEATH HR8 1NX

Prepared for Bromsberrow Sand & Gravel Company

Version 1: July 2022

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1. INTRODUCTION

- 1.1. MHP were instructed by P E Duncliffe Ltd in May 2022 to produce a landscape management plan for the restoration and aftercare of the Bromsberrow North Quarry, Bell Lane Nr. Ledbury, Gloucestershire HR8 1NX known as Bromsberrow North. The management plan is a requirement of an Initial Review of Planning conditions relating to the site.
- 1.2 The site has been an operating quarry for 68 years following the implementation of the original planning permissions granted in January 1953 and June 1953. The Site is not located within a 'sensitive area' as defined In Part1, Section 2 (Interpretation) of the ETA Regulations.
- 1.3 The site is located near the north western corner of the County of Gloucestershire and falls within the Forest of Dean District Council's administrative area.
- 1.4 The site has previously and continues to be used for sand quarrying and is to be in-filled and restored for conservation and amenity in phases. The purpose of the approved landscape proposals is to maintain, enhance and develop both landscape amenity and habitats on the site by management of the existing vegetation, planting of native trees and shrubs and, establishment of a species-rich meadow grass sward.
- 1.5 The site is subject to three separate planning permissions – G1209, G1209/A and G1209/C.
- 1.6 However, the current Review replaces the existing planning permissions and this Landscape Management Plan for Restoration and Aftercare has been prepared in support of the following proposed conditions:

Condition 3;

Condition 20 related to the progressive restoration of the site and the establishment of the restored landscape;

Condition 22. None of the existing site boundary hedgerows and perimeter landscape planting shall be removed, other than as required to create the new site access and earth bund adjacent to Beach Lane and Bell Lane as shown on the proposed site plan submitted with the application (drawing number 21-248-D-012 Rev 01, dated 28th April 2022;

Condition 23 Any tree or shrub planted, or any seeding undertaken as a requirement of this permission, which dies or becomes diseased or seriously damaged during a of 5 years from its planting, shall be replaced in the next planting with another of similar species or seed mix. A report with plan shall be submitted within 3 months of all areas planted with the number and species of plants by area listed.

- 1.7 This report should be used in conjunction with the document prepared by P E Duncliffe Ltd for Bromsberrow Sand and Gravel Company:

1995 Environment Act Growth and Infrastructure Act 2013

'Supporting Statement to accompany an application for an initial review (determination of planning conditions) of an old mineral Planning permission (ROMP)'

2. SITE DETAILS

2.1. General

2.1.1. Name: Bromsberrow North, Bell Lane,

2.1.2. Location: Bromsberrow Heath, Nr. Ledbury, Gloucestershire, HR8 1NX

2.1.3. Grid reference: E373891 N233063

2.1.4. Area: Approx 4.75 hectares

2.1.5. Aerial photograph: Please refer to Figure 1 in the Appendices.

3. SITE DESCRIPTION AND DESK STUDY

3.1. General description

- 3.1.1. The site comprises land used as a sand quarry, site offices, toilets and storage containers, weighbridge, access track, car parking and vegetation to the boundaries. The site is currently worked and managed.
- 3.1.2. The site adjoins the M50 Motorway on its southern boundary, Wood End Street on its east boundary, Beach Lane on its north boundary with Bell Lane and residential properties to the west.
- 3.1.3. The central, excavated area of the site is open and un-vegetated. The site boundaries are densely vegetated; made up of stretches of mature trees and scrub. Tree species predominately comprise oak with some ash, sycamore, aspen, birch, goat willow and conifer.
- 3.1.4. The northern and eastern boundaries of the Site are defined by 2.5m high dark green security fencing along with native species trees and hedge-lines. The southern and western boundaries are also defined with various mature trees and hedge-lines. The various boundary definitions/features (which also include sand bunds along the northern and eastern boundaries) ensure that the majority of the Site is particularly well screened from the adjoining public highway network.
- 3.1.5. Power lines diagonally cross the north west corner of the site from Bell Lane to Beach Lane.
- 3.1.6. A public right of way, aligned on an east-west axis, crosses the southern part of the Site adjacent to the M50 motorway (Bromsberrow Footpath 38 GBR38). Dark green security fencing exists adjacent to the PROW to ensure the appropriate safety protection for the footpath users.
- 3.1.7. The site is to continue to be utilised for sand extraction with restoration phases progressing alongside for nature conservation and amenity. The aim of the landscape proposals are to enhance and develop habitats which can support a variety of local, native wildlife. In order to achieve successful establishment of the proposed planting it will be necessary to cap the site and ensure an adequate cover of topsoil. This management plan also provides the recommendations for topsoil operations.

3.2. Vegetation

- 3.2.1. The centre of the site is largely un-vegetated with the only mature trees located along the site perimeter. The flat areas around the perimeter contains a range of vegetation including mature trees, semi-mature trees, a row of conifers to the north boundary, areas of woodland scrub to the south west and south, areas of nettles and brambles and also some grass sward. In and around the quarry pit there are several groups of small trees, including aspen, goat willow, sycamore and elm.

3.3. Geology and soil

- 3.3.1. Forest of Dean Local Plan Proposals map (February 2012) designates the site as a Regionally Important Geological Site (RIGS). The site is characterised by its sandy soil derived from the Permian Bridgnorth sandstone and Triassic Bromsgrove Sandstone below providing a light, free draining growing medium. Further to quarrying the amount of soil on site has been greatly reduced with only the flat land to the perimeter retaining a cover of natural topsoil to support the mature vegetation. In the worked areas natural succession has led to a slow establishment of plants. The sides of the quarry are steeply banked or sheer with some sandstone outcrops.

3.4. Access and buildings

- 3.4.1. Access to the sand works is currently from Bell Lane, at the north-west end of the site. This entrance is proposed to be closed and a new entrance from Wood End Street will be maintained during the remaining works period and ongoing construction and restoration period via a lockable gate. Access for on-going maintenance of the site will also be from this point. There is an existing track along the east side of the site, giving access to the base of the pit, this will be used by vehicles in- filling the pit; becoming obsolete as the scheme is completed.

4. SITE PROPOSALS

4.1. Aims of the Landscape Proposals

4.1.1. Landscape proposal drawings for the restoration of the site are provided for the planning Review. This management plan relates to the proposals shown on MHP drawings which can be found in the appendices:

- 21224.101 Site Restoration Proposals Rev A (& subsequent revisions)

4.1.2. In brief the landscape proposals include removal of an existing coniferous tree-line to enable construction of a 3.5m high bund and field ditch along the north boundary, management of the existing trees, scrub and hedgerows, tree planting of native species (to incorporate individual trees and an understory mix), planting of native species hedgerow mix along bund and a large area of open grassland/wildflower meadow.

4.2. Management objectives and actions

4.2.1. The biodiversity and visual amenity of the site can be maximised by the enhancement of existing habitats and creation of new ones. In accordance with the Landscape Proposals drawings the plantings have been divided as follows and are shown on Figure 2 in the appendices:

- H1: Woodland and individual trees
- H2: Hedgerows
- H3: Lowland meadow / neutral grassland

4.3. H1: Woodland and Main structure tree planting

4.3.1. The mature and semi mature trees on the south, west and east boundaries are to be retained. Further native species of field maple (*Acer campestre*), downy birch (*Betula pubescens*), beech (*Fagus sylvatica*), oak (*Quercus robur*) and lime (*Tilia cordata*) are to be planted to the boundaries.

4.3.2. A matrix of native tree and shrub species is to be planted on a 1m matrix in addition to the trees. Species will comprise; field maple (*Acer campestre*), hawthorn (*Crataegus monogyna*), hazel (*Corylus avellana*), holly (*Ilex aquifolium*), crab apple (*Malus sylvestris*), dog rose (*Rosa canina*), and guelder rose (*Viburnum opulus*). These plants will form an additional layer under the larger trees providing shelter and food sources. Larger tree species within the mix beech (*Fagus sylvatica*) and English oak (*Quercus robur*) will be allowed to mature.

The understory planting will be coppiced on a 5 year cycle to reduce competition with the woodland trees and retain the qualities of the shrub for shelter and food. It is important that this management is carried out to prevent the natural succession of

woody plants on to the adjoining grassland. Oak and Beech will be omitted from this regime unless self-seeded adjoining the grassland with woodland edge habitat being created along the north, south-east, south-west site edges.

Individual trees planted near the edges of the woodland are to be of the same species. Plants are to be native species of local provenance.

- 4.3.3. Mitigation: Loss of groups of semi-mature trees due to the infilling of the pit and the removal of the coniferous tree-line to facilitate bund construction, will reduce the available nesting habitat for birds. Although the new planting will far exceed the amount which is lost, in the short-term bird boxes are proposed to ensure there is no net loss of nesting habitat during establishment. (Specification in terms of type, location and quantity of boxes should be recommended by consulting ecologist).

4.4. H2: Hedgerows

- 4.4.1. The existing hedgerow (which includes mature trees) is to be managed to reduce the canopy and remove scrub vegetation, ivy and non-native species.
- 4.4.2. The proposed bund is to be planted with a hedgerow mix along its length to mitigate losses to existing boundary vegetation, increase the height of visual screening and create a robust green barrier whilst tree planting establishes.

4.5. H3: Meadow grassland

- 4.5.1. Following completion of the infill works the central area of the site will be returned to the original site level. This area is to be seeded and managed as open grassland. The seed mix has been selected as to contain a mixture of grasses and wild flowers to give year-round cover and nectar rich flowers. A scattering of native trees are proposed within the grassland to provide shelter and perches for birds.

4.6. Protection during works

- 4.6.1. In order to ensure that the established habitats on the boundaries are retained, undamaged during site work it is proposed that the vegetation in proximity of the groundwork and topsoiling work area is protected with fencing. The fencing shall be installed prior to any operations starting on site and shall remain in place until the end of the contract works. Protective fencing shall be chestnut pale or a similar fencing which can be securely fixed in position.
- 4.6.2. Vegetation clearance works and hedge management shall only be carried out outside the bird breeding season of 1st March to 31st August. Where urgent tree surgery is required or small areas of vegetation need to be removed for access a consulting ecologist must be present to check vegetation prior to removal.
- 4.6.3. In order to comply with the Wildlife and countryside Act 1981, the Conservation Regulations 1994 and/or the Protection of Badgers Act 1992 should any protected species be discovered on site in an area which would be effected by works on site the work in that locality should stop until a suitably qualified ecologist is contacted

and a procedure agreed before work is permitted to continue. Where bat boxes need to be checked and cleared this must be carried out by an ecologist who hold the appropriate certification for handling bats. Clearing and checking bird boxes should be carried out outside the bird nesting season.

5. TOPSOIL STORAGE AND ASSOCIATED OPERATIONS

5.1. Imported topsoil

5.1.1. Further to completion of the groundwork, laying of subsoil it will be necessary to provide topsoil for successful establishment of the proposed planting. Imported multipurpose topsoil shall be in accordance with BS3882:2007. The topsoil must be approved by the Contract Administrator prior to delivery to site. Please note that details any subsoil layer beneath topsoil are to be specified by others.

5.1.2. Imported topsoil shall be:

- Natural topsoil of local origin
- Medium loam with a pH value to match that on the site;
- Stone size to pass through a 40mm sieve, and stone content to be <10%
- Free of subsoil, perennial weed seed, rhizomes or poisonous substances;

5.1.3. Testing of topsoil: A Declaration of Analysis must be provided for approval. In order to be compliant with BS3882:2015, topsoil suppliers must get a sample tested for every 5000m³ of soil used. The declaration must include:

- Location of topsoil source, and previous and current land use
- Date of Sampling and Analysis
 - Test results including Contamination Parameters
 - Written confirmation of compliance with the relevant Topsoil Grade in BS3882:2015

6.1.4. Topsoil should be handled as little as possible to limit potential for compaction and contamination.

5.1.4. It is preferable for topsoil to be laid immediately after delivery. Where it is necessary to store topsoil it shall be tipped and stockpiled in low mounds, no higher than 1m and separated from other materials on site with Heras fencing. Where topsoil is to be stored for more than 8 weeks minimise soil erosion and weed establishment by sowing with a grass or legume. No topsoil should be stored within a 3m margin from trees and hedgerows

5.2. Laying topsoil

5.2.1. Topsoil shall be spread to provide the following minimum depths:

- Open grassland areas 150mm
- Tree planting areas 500mm
- Hedge-line areas 500mm

5.2.2. Topsoil shall be moved from the storage area to the place of use using appropriate machinery and equipment which limits damage to the subsoiled areas. Machines and equipment should be clean prior to moving topsoil to prevent contamination.

- 5.2.3. Topsoiling shall only be undertaken when ground conditions are firm to avoid excessive damage/compaction to works area.
- 5.2.4. Topsoil for grass areas can be spread in a single layer. Topsoil for areas of tree planting should be spread and gently consolidated in layers not exceeding 200mm. Topsoil shall be finished to ensure no dips or humps are present and that topsoil is finished to fall with the re-shaped gradient of the land. Any areas which show signs of compaction or tracking by vehicles or equipment shall be forked over to alleviate. No further works vehicles or equipment shall be permitted over finished areas.
- 5.2.5. All topsoiling is to be feathered into existing undisturbed areas allowing for 50mm natural settlement.

6. MAINTENANCE MATRICES

6.1. Objectives

- 6.1.1. The new landscape & habitats are to be managed and maintained to maximise their ecological and amenity value. As the new planting and seeding establishes it is important that the site is maintained to enable the habitats to be used to their full potential by a variety of species.
- 6.1.2. A management matrix is included below for each of the target areas (H1-H3) these recommend operations for the first five years following completion of filling operations and topsoiling to the quarry.
- 6.1.3. The landscape is continually evolving and changing. Although this management plan concentrates specifically on the first five years of the establishment the site will need on-going management for the habitats to be retained. At the end of the five year period those responsible for on-going management should assess whether the operations are appropriate and how the habitats can be best managed in the future.

7. MAINTENANCE MATRICES

H1) WOODLAND AND MAIN STRUCTURE TREE PLANTING

MAINTENANCE OPERATION	OBJECTIVE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Weed control	To assist successful establishment of all new tree and shrub planting	Control invasive pernicious weed growth	Control invasive pernicious weed growth	Control invasive pernicious weed growth	Control invasive pernicious weed growth	Control invasive pernicious weed growth
Selective vegetation clearance	To encourage establishment of new planting	Thin wooded areas in accordance with				
Tree replacement	To ensure any failed planting is replaced to establish intended species mix		Replace any trees which have failed	Replace any trees which have failed	Remove any trees which have died	Remove any trees which have died
Checking tree supports	To prevent damage to new trees	Check tree ties and tree stakes, replace any which are damaged	Check tree ties and tree stakes, replace any which are damaged	Check tree ties and tree stakes, replace any which are damaged	Check tree ties and tree stakes, replace any which are damaged, remove any which are no longer required	Remove all remaining tree supports
Debris collection	To ensure new habitats are not detrimentally affected by contaminated materials	Collect debris and any wind-blown litter/ rubbish	Collect debris and any wind-blown litter/ rubbish	Collect debris and any wind-blown litter/ rubbish	Collect debris and any wind-blown litter/ rubbish	Collect debris and any wind-blown litter/ rubbish

H2) HEDGEROWS

MAINTENANCE OPERATION	OBJECTIVE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Hedge cutting	To ensure a dense corridor of vegetation is maintained as a habitat	Maintain at a height of 3m and approx width of 4m		Maintain at a height of 3m and approx width of 4m		Maintain at a height of 3m and approx width of 4m
Weed control	To assist successful establishment of all new tree and shrub planting	Control invasive pernicious weed growth	Control invasive pernicious weed growth	Control invasive pernicious weed growth	Control invasive pernicious weed growth	Control invasive pernicious weed growth
Debris collection	To ensure new habitats are not detrimentally affected by contaminated materials	Collect debris and any wind-blown rubbish/litter	Collect debris and any wind-blown rubbish/litter	Collect debris and any wind-blown rubbish/litter	Collect debris and any wind-blown rubbish/litter	Collect debris and any wind-blown rubbish/litter

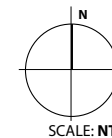
H3) MEADOW GRASSLAND

MAINTENANCE OPERATION	OBJECTIVE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Weed control	To assist successful establishment of desirable grass/wildflower species	Control invasive pernicious weed growth including brambles	Control pernicious weed growth in open areas established in year 1	Control pernicious weed growth in open areas established in year 1		
Grass cutting	To encourage natural regeneration of the sward from the natural seed bank. Prevent development of rank grassland and natural succession of scrub vegetation	Harrow or rake areas which have not successfully establish and overseed with specified seed mix	Cut to 50mm and remove all arisings from 30% of the grassland area during September to prevent development of rank grassland.	Cut to 50mm and remove all arisings from 30% of the grassland area during September to prevent development of rank grassland.	Cut to 50mm and remove all arisings from 30% of the grassland area during September to prevent development of rank grassland.	Cut to 50mm and remove all arisings from 30% of the grassland area during September to prevent development of rank grassland.
Vegetation clearance	To retain areas of open grassland habitat			Remove emerging young scrub from open grassland and tracks		Remove emerging young scrub from open grassland and tracks
Debris collection	To ensure new habitats are not detrimentally affected by contaminated materials	Collect debris and any wind-blown rubbish/litter	Collect debris and any wind-blown rubbish/litter	Collect debris and any wind-blown rubbish/litter	Collect debris and any wind-blown rubbish/litter	Collect debris and any wind-blown rubbish/litter

MANAGEMENT REVIEW

MAINTENANCE OPERATION	OBJECTIVE	YEAR 1	YEAR 2	YEAR 3	YEAR 4	YEAR 5
Site inspection	To ensure all specified maintenance operations have been carried out in correctly and in accordance with good working practices	Carry out visual inspection after/during work on site	Carry out visual inspection after/during work on site	Carry out visual inspection after/during work on site	Carry out visual inspection after/during work on site	Carry out visual inspection after/during work on site
Review of management plan	To highlight any additional management which may be required to achieve the habitat creation objectives		Carry out visual inspection and review establishment of new planting and hibernacula and report any requirements for additional maintenance works		Action any additional maintenance operations as highlighted in Year 2-3	Review site and establish on-going maintenance programme

8. FIGURE 1



Project Name:
Bromsberrow Red Sand Pit Restoration

MHP Reference:
Figure 1: Aerial photograph

Revision:	Status:	Date:
	DRAFT	11/07/2022

9. FIGURE 2

	Proposed tree planting
	Existing tree and vegetation to be removed
	Existing trees and vegetation to be retained
	Proposed woodland planting matrix
	Proposed bund hedgerow planting matrix
	Proposed new grassland
	Proposed field ditch
	Existing levels
	Proposed levels (Existing in brackets)

All stock to be supplied in accordance with the National Plant Specification from an HTA approved nursery.

WOODLAND PLANTING MIX MATRIX SPECIES MIX planting)		
(All stock to be supplied bare root unless stated)		
Ref	Species	Quality
Ac	20% Acer campestre	1+1 transplant, 60-80 cm, min. 3 breaks
Cn	15% Crataegus monogyna	1+1 transplant, 60-80 cm, min. 3 breaks
Ca	25% Corylus avellana	1+2 transplant, 60-80 cm, min. 3 branches
Fs	15% Fagus sylvatica	1+1 transplant, 60-80 cm, branched
Il	10% Ilex aquifolium	2L, 40-60cm, leader and laterals
Ms	5% Malus sylvestris	1+1 transplant, 60-80 cm, branched
Qr	5% Quercus robur	1+1 transplant, 60-80 cm
Rc	5% Rosa canina	+0 transplant, 40-50 cm
Vo	10% Viburnum opulus	1+2 transplant, 60-80 cm, min. 3 branches

Species to be planted on a 3.0 m grid system. Protect with spiral rabbit guards 60cm in height supported by cane.

BUND HERDROW PLANTING MIX	
(All stock to be supplied bare root unless stated)	
Species	Quality
10% Acer campestre	1/1 bareroot transplant, 60-80cm height
40% Crataegus monogyna	1/1 bareroot transplant, 60-80cm height
10% Corylus avellana	1/1 bareroot transplant, 60-80cm height
10% Cornus sanguinea	1/1 bareroot transplant, 60-80cm height
5% Ilex aquifolium	3L container, 40-60cm height
5% Ligustrum vulgare	1/1 bareroot transplant, 60-80cm height
5% Malus sylvestris	1/1 bareroot transplant, 60-80cm height
5% Mespilus alba	1/1 bareroot transplant, 60-80cm height
10% Viburnum opulus	1/1 bareroot transplant, 90-100cm height

Planting shall be carried out at 800mm centres ensuring around 2 plants per sq m.

Protect with spiral braked guards 80cm in height supported by cane.

(Seed supplied shall be British seed Houses WFG2 Flowering Meadow containing 20% Wild flora and 80% grasses to provide year round cover. Seed to be sown at a rate of 5 g/m²).

Species

<i>Agrostema lithago</i>	(Corn Cokle)
<i>Anthemis arvensis</i>	(Common Chamomile)
<i>Centaurea cyaneus</i>	(Cyanus Cowflower)
<i>Centaurea nigra</i>	(Common Knapweed)
<i>Chrysanthemum segetum</i>	(Common Marigold)
<i>Digitalis purpurea</i>	(Foxglove)
<i>Hypericum perforatum</i>	(Perforate St John's Wort)
<i>Leucanthemum vulgare</i>	(Oxeye Daisy)
<i>Papaver rhoeas</i>	(Poppy)
<i>Silene alba</i>	(White Campion)
<i>Vicia sativa</i>	(Common Vetch)
<i>Agrostis castellana</i>	(Common Bent)
<i>Alopecurus odoratum</i>	(Sweet Vernal Grass)
<i>Festuca longifolia</i>	(Hard Fescue)
<i>Festuca ovina</i>	(Sheeps Fescue)
<i>Lotus corniculatus</i>	(Common Birdfoot Trefoil)
<i>Plantago lanceolata</i>	(Ribwort Plantain)
<i>Prunella vulgaris</i>	(Sneezewort)

All areas to be seeded unless shown as matrix understorey p.

All areas to be seeded unless shown as matrix understory planting.

All topsoil to general planting and grass areas to be in accordance with BS3882. All topsoil supplied to site shall be free or pernicious weeds and roots, clay lumps, spread-on materials or other building materials. Topsoil shall be spread evenly over areas and settlement accounted for in depth calculations. Topsoil is to be spread in layers and firmed when the material is reasonably dry. All soil finishes should be married in with existing adjacent levels to form a consistent join.

Minimum topsoil depths are as follows;

Grass and Meadow areas 100 mm

Planting mix areas 400 mm

Hedges and Trees 600 mm

Within planting matrix diagram, species such as Oak, Crab Apple, Holly and Viburnum to be positioned to avoid excessive development within landscape and dominate habitat.

The site will be supported by a 5 year maintenance and management plan to assist with the development of a range of varied habitats enhancing the biodiversity of the site.

- 1) Do not scale directly from this drawing.
- 2) This drawing is to be read in conjunction with all other relevant MHP drawings and information supplied by other consultants.
- 3) Hatch patterns displayed on this drawing are indicative only and do not represent actual paving units or material sizes.
- 4) All tree planting in proximity to buildings to be checked by engineers to ensure foundation detailing is appropriate.

A	New entrance to Wood End Street included, bund proposed to Beach / Bell Lane. Planting amended to accommodate.	13/05/22	DAL	PSH
Rev:		Date	Drawn	Checked
Revisions:				

Project: Bromsberrow Red Sand Pit Restoration

Client: P J Duncliffe

Title: **Site Restoration Proposals**

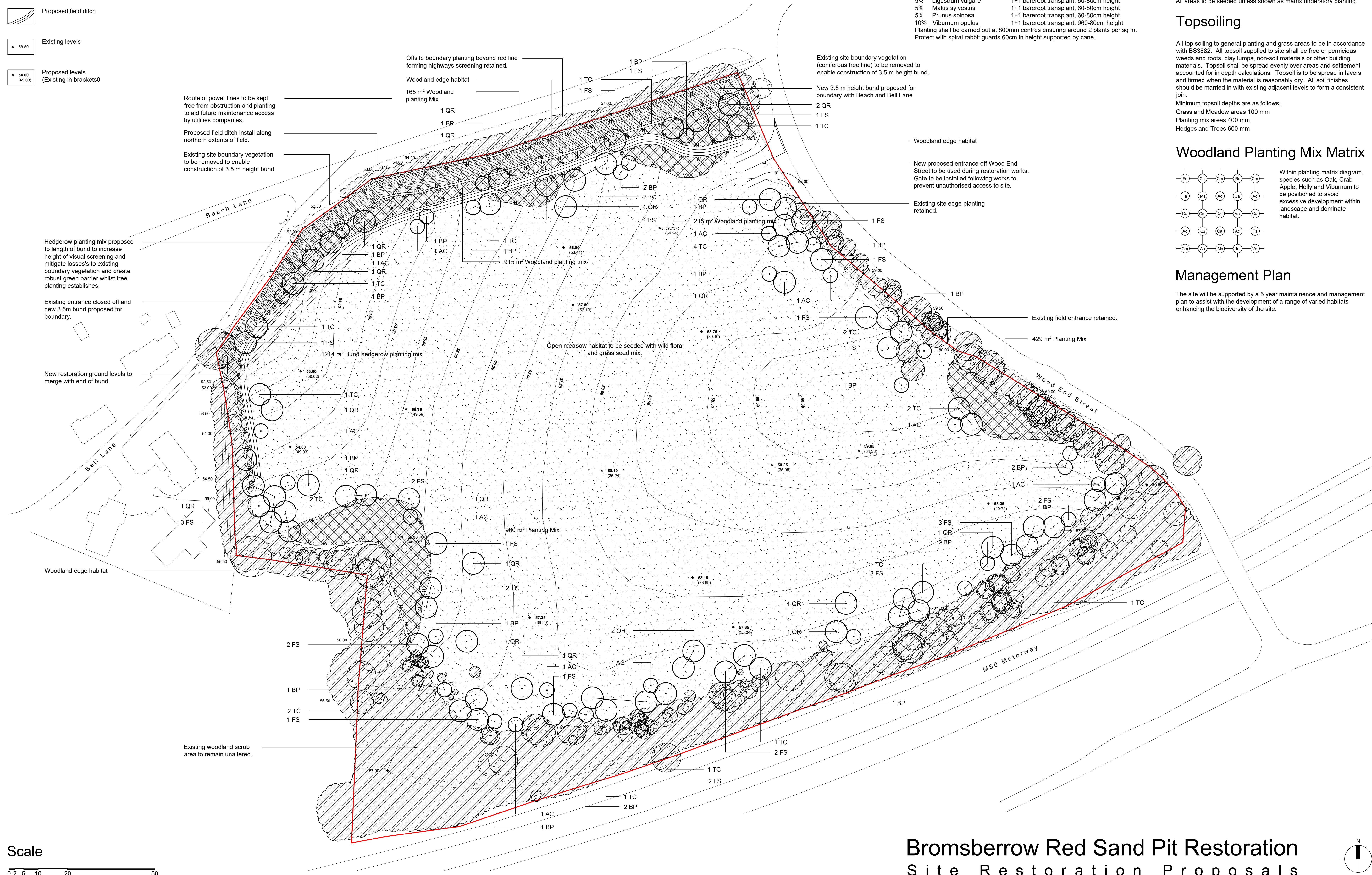
Drawing number: _____ Rev: _____

Status: **FOR INFORMATION**

Drawn By:	Checked By:	Date:	Scale @ A0:
DAI	PSH	23-11-21	1:500

CHARTERED
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Appendix D

Noise Impact Assessment



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BROMSBERROW QUARRY
REVIEW OF OLD MINERAL PERMISSIONS

NOISE IMPACT ASSESSMENT

Technical Report: R9694-1 Rev 0

Date: 19th August 2022

Bromsberrow Sand & Gravel Ltd
Bromsberrow Heath
Ledbury
HR8 1NX

24 Acoustics Document Control Sheet

Project Title: Bromsberrow Quarry- Review of Old Mineral Permissions
Noise Impact Assessment

Report Ref: R9694-1 Rev 0

Date: 19th August 2022

	Name	Position	Signature	Date
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For and on behalf of 24 Acoustics Ltd				

Document Status and Approval Schedule

Revision	Description	Prepared By	Reviewed by	Approved By
0	Approved for issue	Reuben Peckham	Aileen Reed	Aileen Reed

DISCLAIMER

This report was completed by 24 Acoustics Ltd on the basis of a defined programme of work and terms and conditions agreed with the Client. The report has been prepared with all reasonable skill, care and diligence within the terms of the Contract with the Client and taking into account the project objectives, the agreed scope of works, prevailing site conditions and the degree of manpower and resources allocated to the project.

24 Acoustics Ltd accepts no responsibility whatsoever, following the issue of the report, for any matters arising outside the agreed scope of the works.

This report is issued in confidence to the Client and 24 Acoustics Ltd has no responsibility of whatsoever nature to third parties to whom this report or any part thereof is made known. Any such party relies upon the report at their own risk.

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EXECUTIVE SUMMARY

24 Acoustics Ltd has been retained by Bromsberrow Sand & Gravel Ltd to undertake a noise impact assessment in relation to a Review of Old Mineral Permissions (ROMP) at Bromsberrow Quarry in Bromsberrow, near Ledbury.

This report presents a noise assessment, following site visits, subjective observations and noise surveys undertaken during August 2022.

The assessment has been carried out following background noise surveys undertaken at locations representative of the closest residential properties to the site and following acoustic modelling of the proposed operations.

The following revised noise limits are proposed to ensure compliance with current guidance and legislation in relation to mineral workings.

- For extraction operations a noise limit equivalent to the $L_{A90,1 \text{ hour}}$ background noise level + 10 dBA;

The assessment has indicated that the level of noise impact for the operation of Bromsberrow Quarry at the nearest properties will be within the levels suggested for surface mineral workings within the technical guidance of the Planning Practice Guidance and is therefore acceptable.

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1.0 INTRODUCTION

- 1.1 24 Acoustics Ltd has been retained by Bromsberrow Sand & Gravel Ltd to undertake a noise impact assessment in relation to a Review of Old Mineral Permissions (ROMP) at Bromsberrow Quarry in Bromsberrow, near Ledbury.
- 1.2 This report presents a noise assessment, following site visits, subjective observations and noise surveys undertaken during August 2022.
- 1.3 All sound pressure levels quoted in this report are in dB relative to 20 μ Pa. All sound power levels are quoted relative to 10^{-12} W. A glossary of the acoustic terminology used in this report is provided in Appendix A.

2.0 SITE DESCRIPTION AND PROPOSED OPERATION

- 2.1 The quarry is located off Bell Lane on the eastern fringe of the village of Bromsberrow in Herefordshire. Red sand is quarried from the site, processed and graded and the sold to the trade and public. In addition, aggregate is also retailed from the site.
- 2.2 Plant used on site comprises a Terex sand screen, two Volvo wheeled loaders and a Doosan 360 loader. In addition HGVs and smaller wagons visit the site regularly to collect the final product and deliver aggregate.
- 2.3 The nearest residential receptors to the site are located to the west of the quarry and include houses off Bell Lane, Little Oaks and Sandpits Lane. In addition there are also houses to the north located off Beach Lane and Wood End Street.
- 2.4 Figure 1 shows an aerial image of the site and nearest receptors.
- 2.5 It is understood that it is proposed to formalise the hours of operation to between 07:00 and 18:00 Monday to Saturday with no works on Sundays or bank holidays.
- 2.6 It is understood that the existing minerals permission for the quarry does not include any noise restrictions. It is, however, proposed to recommend site noise limits as part of this review.

2.7 Figures 2-3 show the proposed phases of workings for future quarry operations.

3.0 ASSESSMENT CRITERIA

3.1 Whilst not strictly applicable to a ROMP assessment, the following represents current relevant planning policy and guidance in relation to mineral extraction.

National Planning Policy Framework and Noise Policy Statement for England

3.2 The National Planning Policy Framework (NPPF) [Reference 1] states that planning policies and decisions should ensure that new development is appropriate for its location taking into account the likely effects of pollution on health, living conditions and the natural environment, as well as the potential sensitivity of the site or the wider area to impacts that could arise from the development. In doing so they should:

- Mitigate and reduce to a minimum, potential adverse impacts resulting from noise from new development- and avoid noise giving rise to significant adverse impacts on health and quality of life;
- Identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason.

3.3 The NPPF refers to the Noise Policy Statement for England (NPSE) [Reference 2] which is intended to apply to all forms of noise, including environmental noise, neighbour noise and neighbourhood noise. The NPSE sets out the Government's long-term vision to 'promote good health and a good quality of life through the effective management of noise within the context of Government policy on sustainable development' which is supported by the following aims.

- Avoid significant adverse impacts on health and quality of life;
- Mitigate and minimise adverse impacts on health and quality of life.

3.4 The NPSE defines the concept of a 'significant observed adverse effect level' (SOAEL) as 'the level above which significant adverse effects on health and quality of life occur'. The following guidance is provided within the NPSE:

"It is not possible to have a single objective noise-based measure that defines SOAEL that is applicable to all sources of noise in all situations. Consequently, the SOAEL is likely to be different for different noise sources, for different receptors and at

different times. It is acknowledged that further research is required to increase our understanding of what may constitute a significant adverse impact on health and quality of life from noise. However, not having specific SOAEL values in the NPSE provides the necessary policy flexibility until further evidence and suitable guidance is available.”

- 3.5 The Planning Practice Guidance (PPG) is written to support the NPPF with more specific planning guidance. The PPG reflects the NPSE and states that noise needs to be considered when new developments may create additional noise and when new developments would be sensitive to the prevailing acoustic environment. It also states that opportunities should be taken, where practicable, to achieve improvements to the acoustic environment. The PPG states that noise can over-ride other planning concerns but should not be considered in isolation from the other economic, social and environmental dimensions of the proposed development.
- 3.6 The PPG expands upon the concept of SOAEL (together with Lowest Observable Adverse Effect Level, LOAEL and No Observed Effect Level, NOEL) as introduced in the NPSE and provides a table of noise exposure hierarchy for use in noise impact assessments in the planning system.
- 3.7 In general terms it is considered that a noise impact with an effects level which is lower than SOAEL is acceptable (providing the effect is mitigated to a minimum). There is currently, however, a discontinuity between the above guidance and objective technical criteria for use in planning noise impact assessments. For this site it is considered that the appropriate (technical and objective) standards for use in assessing the noise impact is the government guidance on minerals which forms part of the Planning Practice Guidance (see below).

Guidance on the planning for mineral extraction in plan making and the application process

- 3.8 Government guidance relating to planning applications for mineral extraction sites [Reference 4] states that those making mineral development proposals, should carry out a noise impact assessment, which should identify all sources of noise and, for each source, take account of the noise emission, its characteristics, the proposed operating locations, procedures, schedules and duration of work for the life of the operation, and its likely impact on the surrounding neighbourhood.
- 3.9 It states that mineral planning authorities should take account of the prevailing acoustic environment and in doing so, consider whether or not noise from the proposed operations would:

- give rise to a significant adverse effect;
- give rise to an adverse effect; and
- enable a good standard of amenity to be achieved.

- 3.10 This would include identifying whether the overall effect of the noise exposure would be above or below the significant observed adverse effect level and the lowest observed adverse effect level for the given situation.
- 3.11 The guidance states that mineral planning authorities should aim to establish a noise limit, through a planning condition, at the noise-sensitive receptors that does not exceed the background noise level $L_{A90,1\text{hour}}$ by more than 10 dBA during normal working hours between 07.00 and 19.00 hours. Where it will be difficult not to exceed the background level by more than 10 dBA without imposing unreasonable burdens on the mineral operator, the limit set should be as near that level as practicable. In any event, the total noise from the operations should not exceed 55 dB $L_{Aeq, 1\text{ hour}}$ (free field). For operations during the evening (19.00 - 22.00 hours) the noise limits should not exceed the $L_{A90, 1\text{ hour}}$ background noise level by more than 10 dBA and should not exceed 55 dB $L_{Aeq, 1\text{ hour}}$ (free field). For any operations during the period 22.00 – 07.00 noise limits should be set to reduce to a minimum any adverse impacts, without imposing unreasonable burdens on the mineral operator. In any event the noise limit should not exceed 42 dB $L_{Aeq,1\text{ hour}}$ (free field) at a noise sensitive property at night.
- 3.12 Activities such as soil-stripping, the construction and removal of baffle mounds, soil storage mounds and spoil heaps, construction of new permanent landforms and aspects of site road construction and maintenance can cause temporary increases in noise level. On this basis increased temporary daytime noise limits of up to 70 dB $L_{Aeq 1\text{ hour}}$ (free field) for periods of up to 8 weeks in a year at specified noise-sensitive properties should be considered to facilitate essential site preparation and restoration work and construction of baffle mounds where it is clear that this will bring longer-term environmental benefits to the site or its environs.

4.0 ASSESSMENT METHODOLOGY

4.1 The following assessment methodology has been used:

- i. A background noise survey has been undertaken to determine existing levels of background noise at the nearest residential properties to the site;
- ii. Source-term noise measurements of the plant operating on site have been undertaken;
- iii. An acoustic model of the operations at the quarry has been developed using the source-term data recorded above. This takes into account the proposed phasing and topography changes. This has predicted the operational noise level at the nearest residential properties;
- iv. An assessment of the likely noise impact associated with the proposals has been undertaken, based upon the technical guidance contained within the PPG. Noise from the site operations will occur during the day and there will be no tonal elements and on this basis it is considered that ideally the following noise limits should apply:
 - For extraction operations the $L_{A90,1 \text{ hour}}$ background noise level + 10 dBA or 55 dB $L_{Aeq,1 \text{ hour}}$ (if greater), if achieving the former would place an unreasonable burden on the mineral operator;
 - For final site restoration works only an increased limit of 70 dB $L_{Aeq, 1 \text{ hour}}$ for up to 8 weeks of the year.

5.0 NOISE SURVEYS

Source-term Noise Levels

5.1 Plant source-term noise levels were recorded during a visit to the site on 12 August 2022. Measurements of all operating plant were undertaken at a range of distances in order to determine the plant sound power levels. The following instrumentation was used:

- Norsonic Nor-118 sound level meter;
- Bruel and Kjaer Type 4231 acoustic calibrator.

5.2 The sound level meter was calibrated before and after the survey in accordance with the manufacturer's instructions. No drift was recorded. The weather during the morning of the survey was still and dry with an ambient temperature of approximately 23 degrees C.

5.3 The derived plant sound power levels are shown in Table 1 below.

Plant	Overall	Octave Band Frequency, Hz and Sound Power Level, dB							
	A	63	125	250	500	1 k	2 k	4 k	8k
Volvo L120G Wheeled Loader	93	103	96	92	93	87	83	75	66
Terex Final 693+ Supertrack Screen	106	109	111	104	102	101	98	95	94
DoosanDX225c Wheeled Loader	93	106	96	90	91	88	85	79	73
HGV	98	106	100	97	94	93	92	86	80

Table 1: Plant Sound Power Levels

Background Noise Surveys

5.4 Background noise surveys were undertaken in the vicinity of the quarry during the period 12th to 18th August 2022. Measurements were undertaken at locations considered acoustically representative of the nearest noise sensitive receptors, but unaffected by noise from the current quarry operations, as described below:

Location 1. The north-east site boundary, acoustically equivalent of 'The Willows'

Location 2: Western site boundary with 3 Little Oaks.

5.5 The microphones were at a height of 1.2 m above ground level and were fitted with environmental windshields. The measurement locations are shown in Figure 1.

5.6 The sound level meters were configured to monitor five-minute samples (using fast time weighting) in terms of the overall A-weighted L_{eq} and L_{90} sound pressure levels.

5.7 The following instrumentation was used during the survey:

- Rion NL31 precision grade sound level meter;
- Rion NL32 precision grade sound level meter;
- Bruel & Kjaer acoustic calibrator, Type 4231.

- 5.8 Calibration was checked before and on completion of the measurements and no drift was recorded. The weather throughout the survey was generally dry with wind speeds below 5 m/s. Noise measurements were made in accordance with BS 7445: 1991 'Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use' [Reference 5].
- 5.9 The results of the background noise survey are presented graphically in Appendix B and are summarised below in Tables 2 and 3 for the periods of operation respectively.

Day and Date	Noise Level, dB L _{A90} , 1 hour	
	Range	Typical
Friday 12 August	41-50	40
Saturday 13 August	38-42	39
Monday 15 August	42-49	42
Tuesday 16 August	40-43	41
Representative, weekday		41
Representative, Saturday		39

Table 2: Background Noise Levels- Location 1, 'The Willows'

Day and Date	Noise Level, dB L _{A90} , 1 hour	
	Range	Typical
Friday 12 August	45-49	46
Saturday 13 August	42-49	43
Monday 15 August	41-47	43
Tuesday 16 August	44-48	45
Representative, weekday		44
Representative, Saturday		43

Table 3: Background Noise Levels- Location 2, Little Oaks

- 5.10 Measurements at the northern end of the site, near to Location 1 were affected by activities from a scrap clearance company on 17 and 18 August and therefore this has been disregarded from the analysis.
- 5.11 It should be noted that 24 Acoustics' interpretation of the 'representative' background noise level is average of the range of values less one standard deviation.

6.0 NOISE IMPACT ASSESSMENT

Proposed Operations

- 6.3 The plant used on site will include the wheeled loaders for transporting material and for 'ripping' sand during the extraction process, a 360 loader which will be used for restoration and the screening plant. In addition, it assumed there will be a maximum of 6 HGV movements in and out of the site during an hourly assessment period.

Acoustic Model

- 6.4 The source-term noise data shown in Section 5 has been used to populate an acoustic model of the site. IMMI v2017 noise mapping software has been used. The software has used the calculation methodology of ISO 9613 [Reference 6] to determine the noise level from each source at each receptor location, taking into account the effects of geometric divergence, screening and ground and atmospheric absorption. As a worst case assessment, it is assumed that all plant other than HGVs operate 100% of the time. The model has assumed 100% soft ground effects, an ambient temperature of 10 degrees C and relative humidity of 70%.
- 6.5 Four scenarios have been considered in the acoustic model to represent the likely noise emission over the life of the quarry as follows:
- Phase 1 excavation and initial restoration;
 - Phase 2 excavation and further restoration- incorporating the relocation of the site entrance
 - Phase 5 excavation and further restoration
 - Phase 8 final restoration
- 6.6 The acoustic model for each of the identified phases of operation has calculated the noise level from each phase at each of the identified residential receptors. Table 4 below summarises the results of the calculations for each phase considered with acoustic contours shown in Figures 3-6.

Receptor Property	Predicted Noise Levels, dB L _{Aeq} , 1 hour
Phase 1	
The Willows	49
3 Little Oaks	44
Phase 2	

The Willows	44
3 Little Oaks	43
Phase 5	
The Willows	45
3 Little Oaks	46
Phase 8	
The Willows	43
3 Little Oaks	49

Table 4: Calculated Noise Levels – Noise from Quarry Operations

Noise Impact Assessment

- 6.7 The assessment and calculations show that the operational noise level at all receptors will be lower than 55 dB $L_{Aeq, 1 \text{ hour}}$. On this basis it is considered that the noise levels at all receptors will fall within the constraints of the government's mineral planning guidance.
- 6.8 A comparison of the predicted operational noise levels, relative to the prevailing typical background noise level at each receptor has also been carried out for completeness and this is shown in Table 5 below.

Receptor Property	Typical Background Noise Level, dB $L_{A90, 1 \text{ hour}}$	Range of Operational Noise Levels, dB $L_{Aeq, 1 \text{ hour}}$	Difference with Background Level, dB
Monday – Friday 07.00 – 18.00			
The Willows	41	43-49	-2 to +8
Little Oaks	44	43- 49	-1 to +5
Saturday 07.00 – 18.00			
The Willows	39	43- 49	+4 to + 10
Little Oaks	43	43- 49	0 to +6

Table 5: Comparison of Predicted Operational Noise Levels with Background Noise Levels

- 6.9 The assessment has indicated that the level of noise impact for the proposed scheme at the nearest properties will be within the levels suggested for surface mineral workings within the technical guidance of the Planning Practice Guidance. It is anticipated that for all phases, noise levels will be no greater than 10 dBA above the prevailing L_{A90} background noise level.
- 6.10 The following noise condition is recommended to ensure compliance with current guidance:

The level of noise emitted from extraction and restoration operations, including vehicles on the quarry haul road, shall not exceed the prevailing background noise

level at the nearest noise sensitive properties by more than 10 dBA as per the following noise limits:

Mon – Fri 07.00 – 18.00

The Willows:

51 dB $L_{Aeq,1\text{ hour}}$;

Little Oaks

54 dB $L_{Aeq,1\text{ hour}}$.

Saturday 07.00 – 18.00

The Willows:

49 dB $L_{Aeq,1\text{ hour}}$;

Little Oaks:

53 dB $L_{Aeq,1\text{ hour}}$."

7.0 CONCLUSIONS

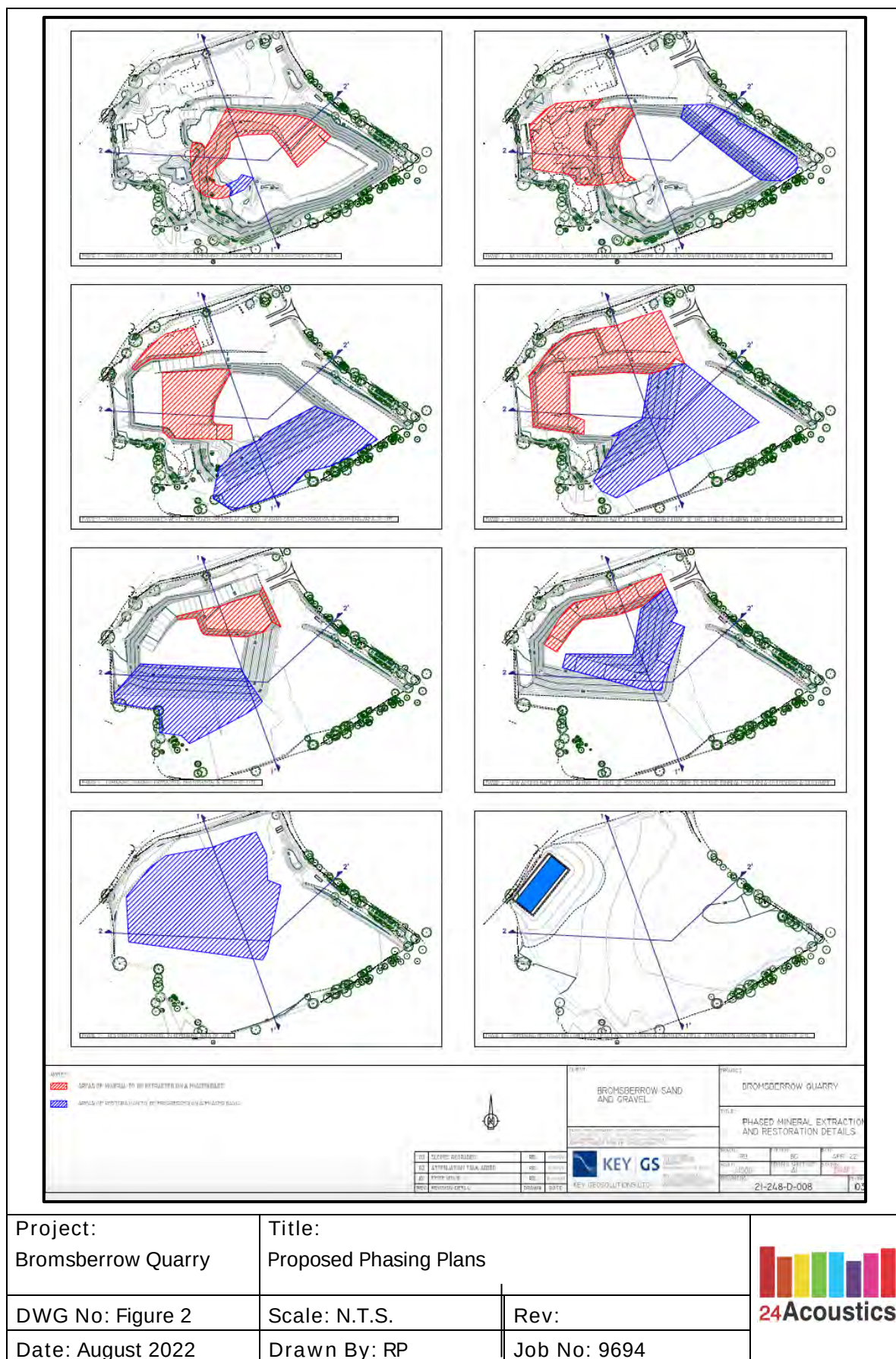
- 7.1 24 Acoustics Ltd has been retained by Bromsberrow Sand & Gravel Ltd to undertake a noise impact assessment in relation to a Review of Old Mineral Permissions (ROMP) at Bromsberrow Quarry in Bromsberrow, near Ledbury.
- 7.2 This report presents a noise assessment, following site visits, subjective observations and noise surveys undertaken during August 2022.
- 7.3 The assessment has been carried out following background noise surveys undertaken at locations representative of the closest residential properties to the site and following acoustic modelling of the proposed operations.
- 7.4 The following revised noise limits are proposed to ensure compliance with current guidance and legislation in relation to mineral workings.
- For extraction operations a noise limit equivalent to the $L_{A90,1\text{ hour}}$ background noise level + 10 dBA;
- 7.5 The assessment has indicated that the level of noise impact for the operation of Bromsberrow Quarry at the nearest properties will be within the levels suggested for surface mineral workings within the technical guidance of the Planning Practice Guidance and is therefore acceptable.

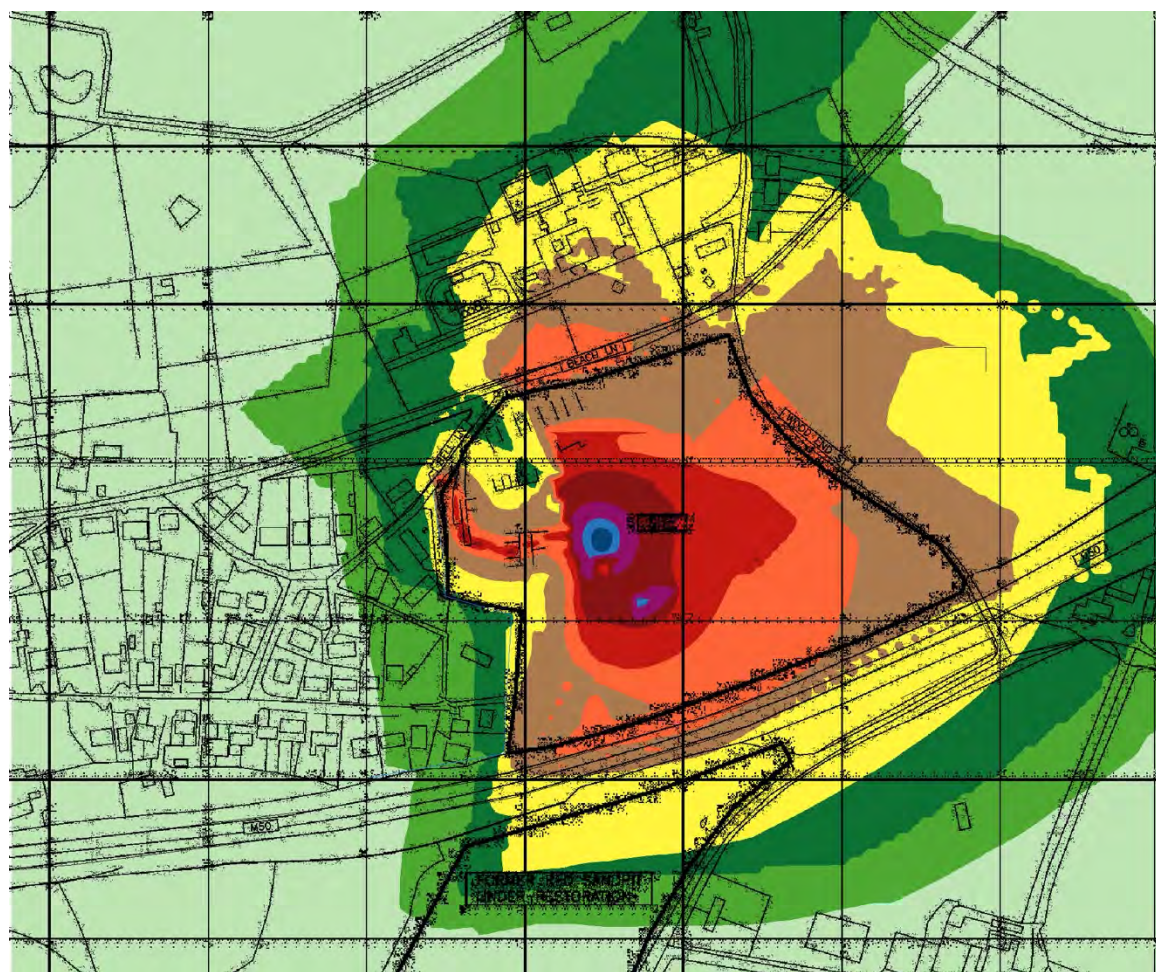
REFERENCES

1. National Planning Policy Framework, Department for Communities and Local Government, updated July 2021.
2. Noise Policy Statement for England, Defra, March 2010.
3. Planning Practice Guidance, Department of Communities and Local Government, revised July 2019.
4. Guidance Minerals, Guidance on the planning for mineral extraction in plan making and the application process, Ministry of Housing, Communities & Local Government, 17 October 2014.
5. British Standards Institution. BS 7445: 'Description and measurement of environmental noise Part 2 - Acquisition of data pertinent to land use' 1991.
6. International Standards Organisation. ISO 9613. Acoustics - Propagation of Environmental Noise, 1997.

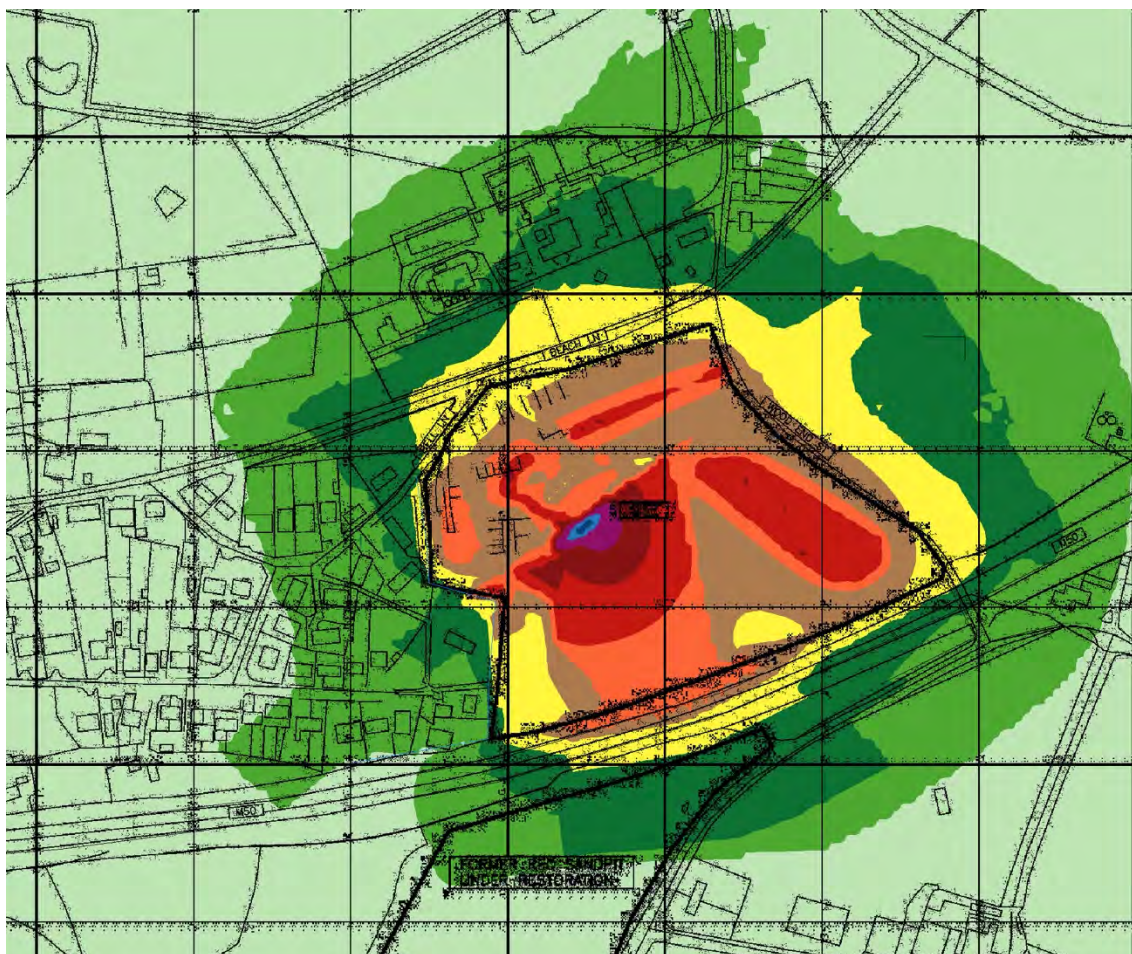


Project: Bromsberrow Quarry	Title: Site and Ambient Noise Survey Locations		
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Date: August 2022	Drawn By: RP	Job No: 9694	

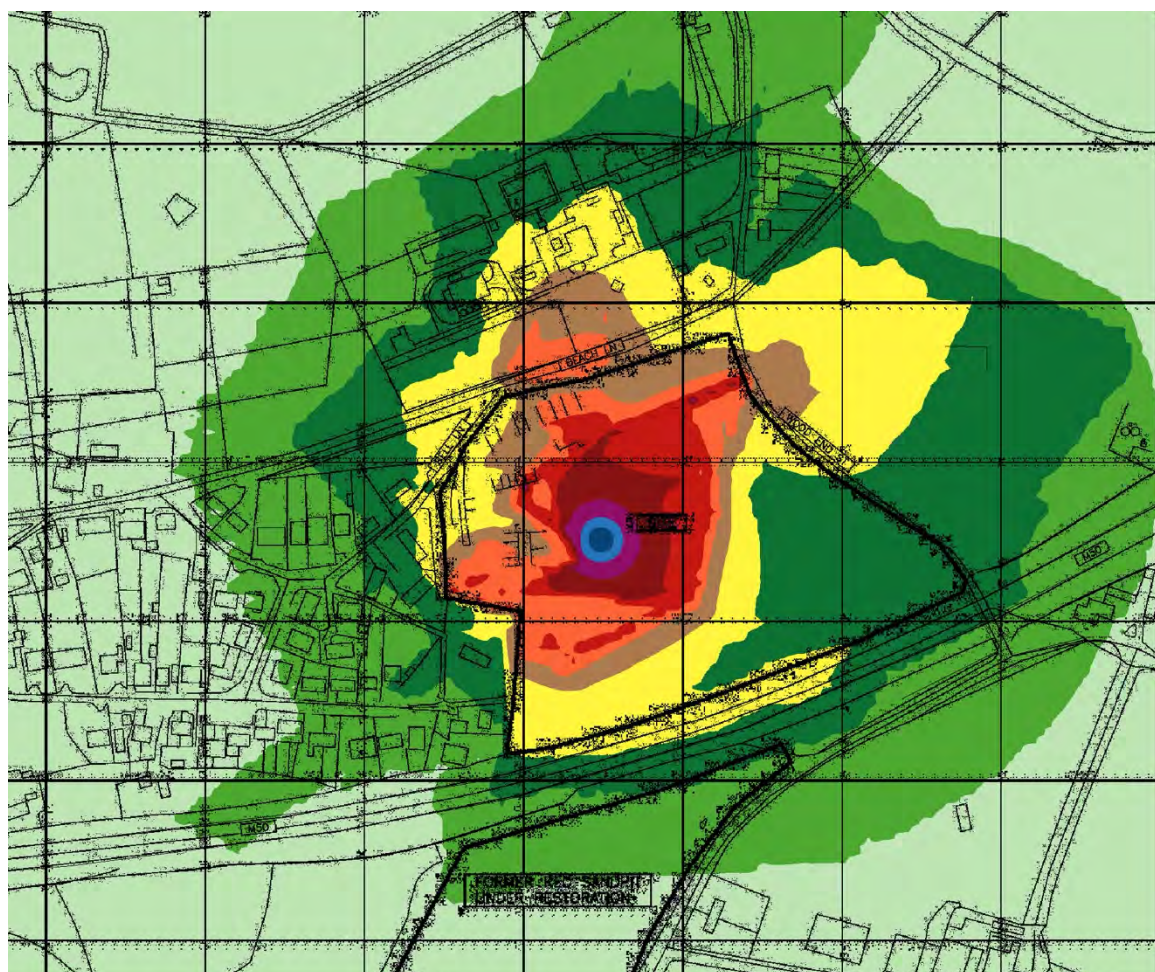




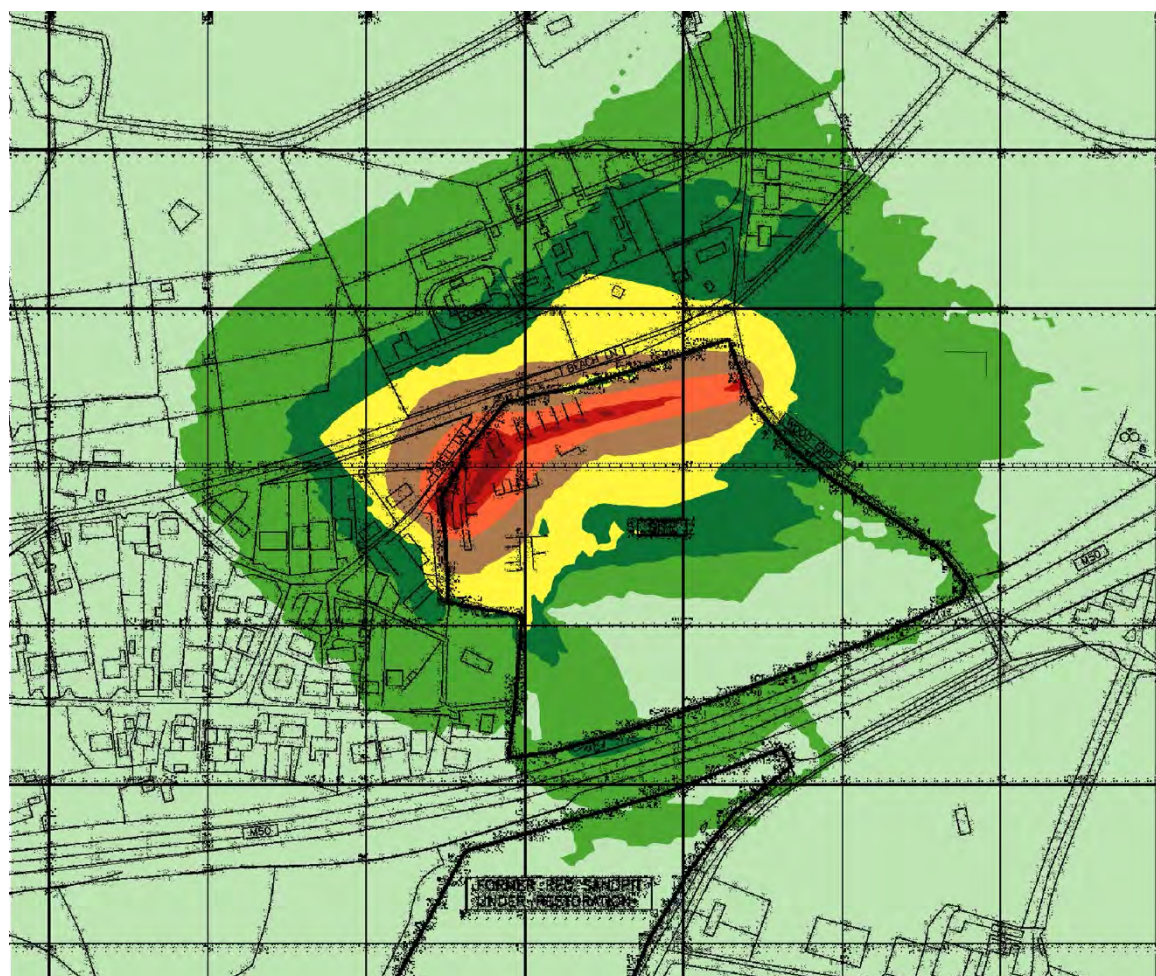
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Date: August 2022	Drawn By: RP	Job No: 9694	



Project: Bromsberrow Quarry	Title: Operational Noise Contours: Phase 2		 24Acoustics
DWG No: Figure 4	Scale: N.T.S.	Rev:	
Date: August 2022	Drawn By: RP	Job No: 9694	



Project: Bromsberrow Quarry	Title: Operational Noise Contours: Phase 5		 24Acoustics
DWG No: Figure 5	Scale: N.T.S.	Rev:	
Date: August 2022	Drawn By: RP	Job No: 9694	



Project: Bromsberrow Quarry	Title: Operational Noise Contours: Phase 8		 24Acoustics
DWG No: Figure 6	Scale: N.T.S.	Rev:	
Date: August 2022	Drawn By: RP	Job No: 9694	

APPENDIX A – ACOUSTIC TERMINOLOGY

Noise is defined as unwanted sound. The range of audible sound is from 0 to 140 dB. The frequency response of the ear is usually taken to be around 18 Hz (number of oscillations per second) to 18000 Hz. The ear does not respond equally to different frequencies at the same level. It is more sensitive in the mid-frequency range than the lower and higher frequencies and because of this, the low and high frequency components of a sound are reduced in importance by applying a weighting (filtering) circuit to the noise measuring instrument. The weighting which is most widely used and which correlates best with subjective response to noise is the dBA weighting. This is an internationally accepted standard for noise measurements.

For variable sources, such as traffic, a difference of 3 dBA is just distinguishable. In addition, a doubling of traffic flow will increase the overall noise by 3 dBA. The 'loudness' of a noise is a purely subjective parameter, but it is generally accepted that an increase/ decrease of 10 dBA corresponds to a doubling/ halving in perceived loudness.

External noise levels are rarely steady, but rise and fall according to activities within an area. In attempt to produce a figure that relates this variable noise level to subjective response, a number of noise indices have been developed. These include:

i) The L_{Amax} noise level

This is the maximum noise level recorded over the measurement period.

ii) The L_{Aeq} noise level

This is "equivalent continuous A-weighted sound pressure level, in decibels" and is defined in British Standard BS 7445 [1] as the "value of the A-weighted sound pressure level of a continuous, steady sound that, within a specified time interval, T, has the same mean square sound pressure as a sound under consideration whose level varies with time".

It is a unit commonly used to describe construction noise and noise from industrial premises and is the most suitable unit for the description of other forms of environmental noise. In more straightforward terms, it is a measure of energy within the varying noise.

iii) The L_{A10} noise level

This is the noise level that is exceeded for 10% of the measurement period and gives an indication of the noisier levels. It is a unit that has been used over many years for the measurement and assessment of road traffic noise.

iv) The L_{A90} noise level

This is the noise level that is exceeded for 90% of the measurement period and gives an indication of the noise level during the quieter periods. It is often referred to as the background noise level and is used in the assessment of disturbance from industrial noise.

APPENDIX B – BACKGROUND NOISE SURVEY RESULTS

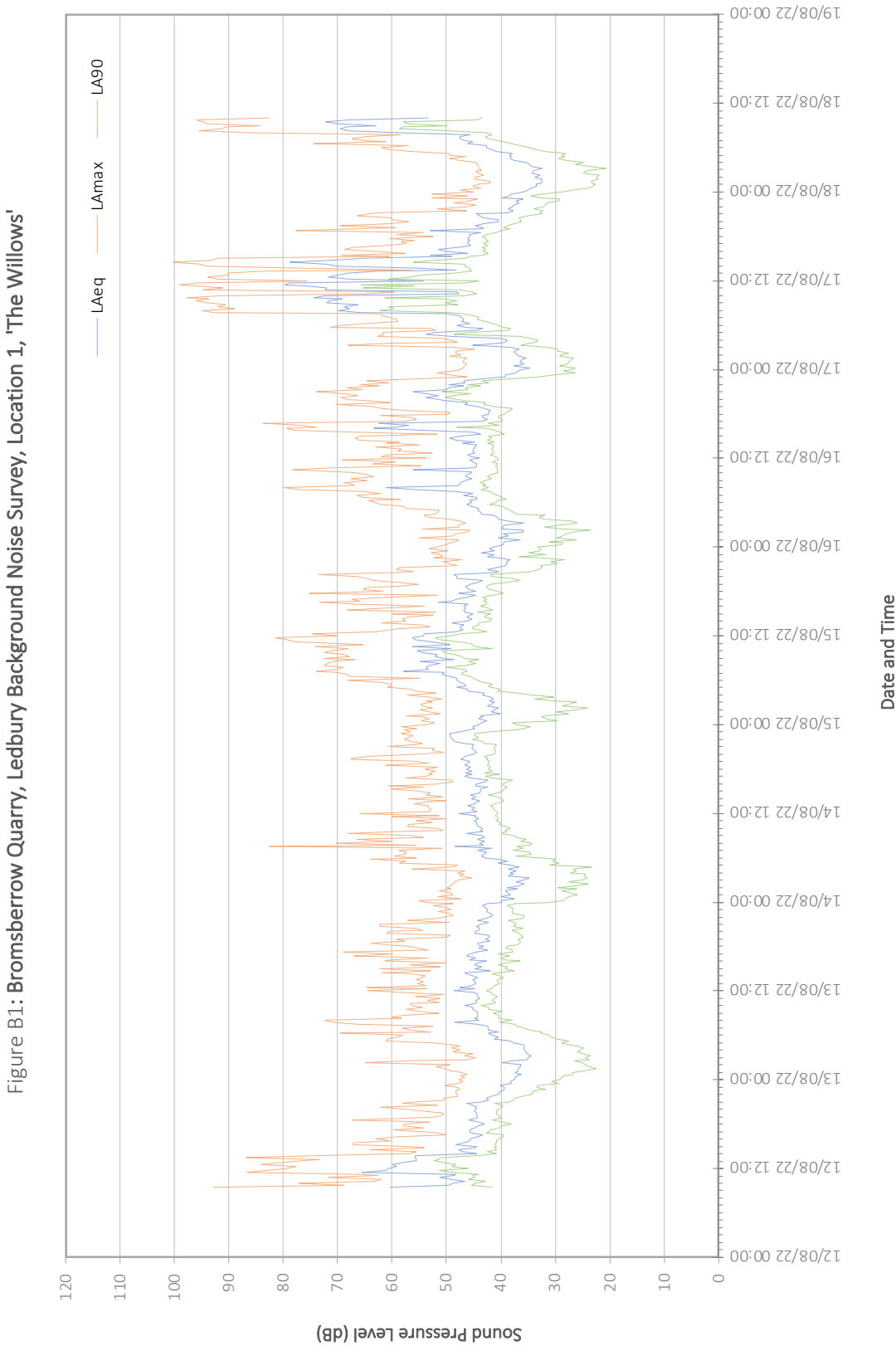
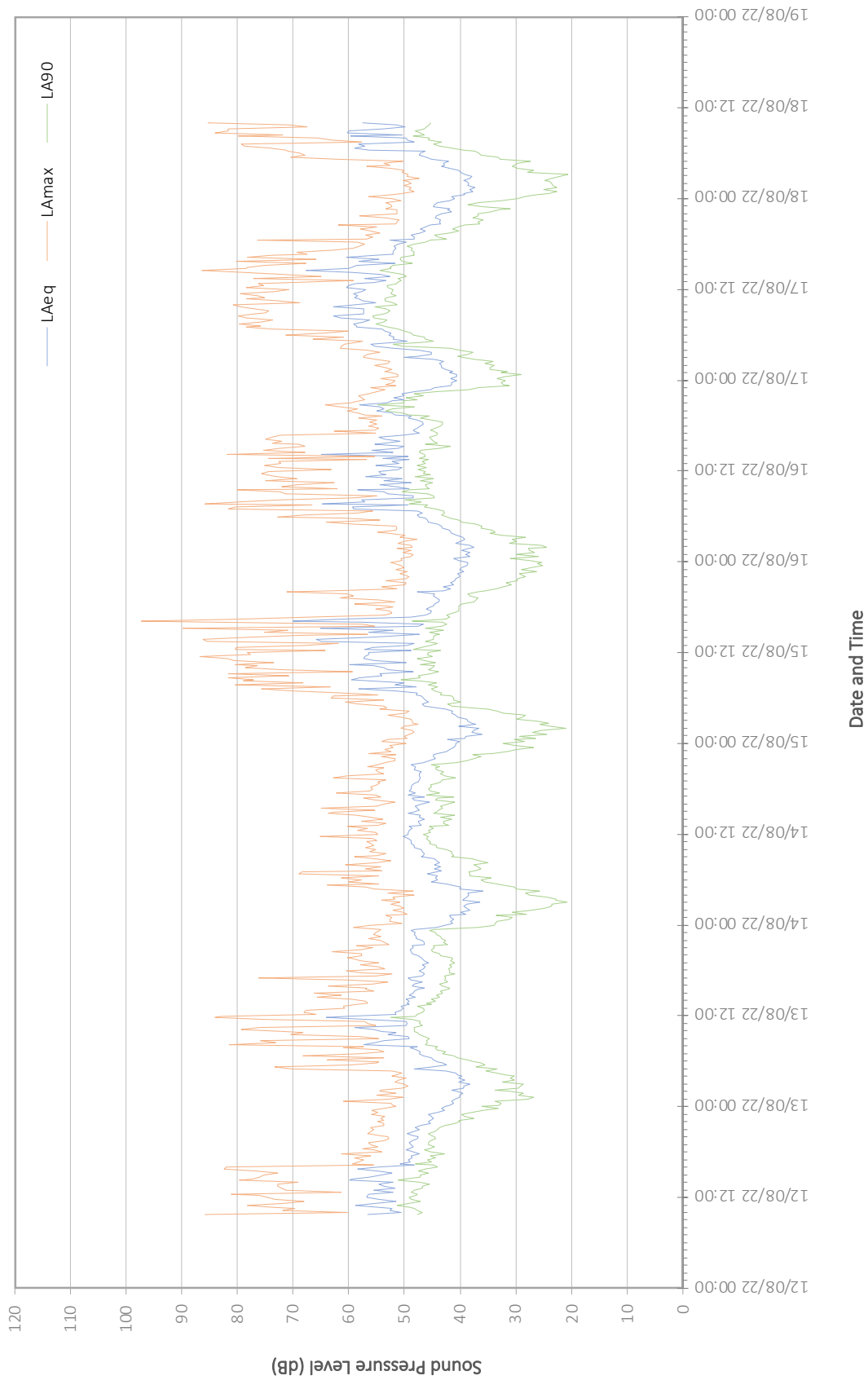


Figure B2: Bromsberrow Quarry, Ledbury Noise Survey, Location 2, Little Oaks



APPENDIX C – PROPOSED PHASES OF OPERATION

Mineral Extraction Phases

Phase 1

Initially work is required internally to reorient the quarry in relation to the new site access off Wood End Lane by creating a new temporary internal vehicle ramp running along the northern working face and removing the present access ramp which has previously used to access the quarry floor. Estimated to be completed by May 2025.

Phase 2

Extraction of mineral under the current weighbridge/office location and the area presently being used to stockpile processed sand. This will result in a significant loss of operational area and can only occur if restoration along the eastern face is sufficiently advanced to move activities onto this newly created working area. This phase will initially extract mineral to circa 39m AOD and is estimated to be completed by December 2028.

Phase 3

Operations continue to work the western end of the Site down to the 33m AOD level and begin to create a new access road along the northern side of the quarry which will be the long-term access to the quarry floor. Estimated to be completed by June 2030.

Phase 4

Completion of extraction in the western side of the Site to the 33m AOD level and commence working the mineral on the northern side of the Site to the 39m AOD level. During this phase the new access decline will be completed so that the long-term quarry floor access is transferred onto the northern boundary. Estimated to be completed by August 2032.

Phase 5

Extraction of the remaining reserves along the northern boundary to the 33m AOD level. Estimated to be completed by end January 2034.

Phase 6

Final phase of mineral extraction is the removal of the access ramp along the northern boundary. Exact timing for this is linked to the quarry restoration as the ramp needs to remain in position until tipping is sufficiently advanced so that it is not needed to access the quarry floor. Estimated to be completed by February 2035.

Restoration Phases

Phase 1

Restoration material will initially be used to form a ramp off the 39m AOD level to the quarry floor to facilitate the restoration in subsequent phases as these are constructed from the bottom up in 2 metre layers. Estimated to be completed by January 2023.

Phase 2

Restoration in this area is a necessary to form a working area alongside the new weighbridge installation so that when the current stockpile areas are removed during phase 1 extraction there is an area for stocking processed sand prior to sale. Estimated completion by August 2024.

Phase 3

Restoration in this area results in the restoration of the quarry faces alongside the southern boundary – parallel to the M50 motorway. This is considered a high priority as it results in stabilisation of the historic, high quarry face. Estimated to be completed by end of July 2027.

Phase 4

Restoration to continue against the southern boundary but progressing towards the north into the quarry void. During this restoration phase mineral from phase 4 extraction needs to be completed to ensure continuity of operations and the ongoing availability of restoration space. Restoration cannot progress too far ahead of extraction otherwise it will impact on the toe of the new access ramp before the additional restoration area is established. Estimated to be completed by February 2031.

Phase 5

Restoration will now follow mineral extraction in the south-west corner underneath the current weighbridge area. Estimated to be completed by February 2033.

Phase 6 and 7

Restoration fills the void left in the middle utilising the ramp on the northern boundary which will be gradually extracted as the Site extends laterally and in height. Again, this is a key stage of the operation as ramp removal and restoration must be done in conjunction to ensure that access is retained at all times for restoration and sand does not become sterilized. Estimated to be completed by June 2040.

Phase 8

Final restoration is completed with an overlay of the whole Site to bring it back to original ground level. Areas will be progressively restored as soon as the final levels are attained. Estimated to be completed by Sept 2042.

Appendix E

Ecological Appraisal

Allstone Sand & Gravel Aggregates Trading Co. Ltd

**Bromsberrow Quarry
Ledbury**

Ecological Report

**Job No: 223326
December 2023**



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**Bromsberrow Quarry
Ledbury****Issued by**

.....
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Issue Date	Issue
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11 December 2023	Final
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Company No. 8474322**Table of Revisions**

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FIGURES

- Figure 1 Site Location Plan
- Figure 2 Phase 1 Habitat Plan

APPENDICES

- Appendix A Summary of the Ratcliffe Criteria
- Appendix B Plant Species List
- Appendix C Photograph Record Sheet

1.0 INTRODUCTION

Overview

- 1.1 AA Environmental Limited (AAe) has been commissioned by Allstone Sand & Gravel Aggregates Trading Co. Ltd to carry out an ecological survey of the proposed restoration of Bromsberrow Quarry, Ledbury. The aims of the survey were to:
- provide a description of the existing habitat types;
 - determine the existence and location of any ecologically valuable areas; and
 - identify the presence of any protected species.
- 1.2 This information will serve to assess the ecological impact of the proposals and identify any ecological constraints and/or mitigation measures required and also identify any enhancement measures that may be available.
- 1.3 The proposed development relates to the construction of facilities for the infill operation including the construction of a new site entrance and office/welfare facilities away from the nearby properties. After the existing voids have been filled then the site will be restored to recreate habitats previously found on site including woodland, hedgerow and grassland. It is anticipated that the majority of the trees and boundary vegetation will be retained and protected during the works.

Site Description

- 1.4 The site is located off Bell Lane, Ledbury centred at National Grid Reference: SO 738330 and covers approximately 5.5 hectares. The site is an active sand and gravel quarry approximately 15 m deep. The site was dominated by bare ground with some hedgerow, scrub, individual trees, broad-leaved woodland and a few buildings also present. The site is bordered by Beach Lane to the north, Wood End Street to the east, line of established vegetation with the M50 beyond to the south, residential homes & associated gardens to the west (Figure 1).

2.0 METHODOLOGY

General

- 2.1 The study comprised two key phases: a desk-top study; and a walk-over field survey. The study was undertaken with reference to the Institute of Environmental Assessment's '*Guidelines for Baseline Ecological Assessment*' (1995), Chartered Institute of Ecology and Environmental Management (CIEEM) '*Guidelines for Preliminary Ecological Appraisal*' (2017) and BS 42020: 2013 '*Biodiversity - Code of practice for planning and development*'.

Desk-top Study

- 2.2 Gloucestershire Centre for Environmental Records (GCER) was consulted to obtain baseline data held for the site and the surrounding 2 km area.
- 2.3 In addition, as certain baseline data is now readily available on the internet, the Multi-agency website (<http://magic.defra.gov.uk/>) was consulted to determine whether any part of the site or nearby habitats have been statutorily or otherwise designated and a review of Google Earth's satellite imagery (http://www.google.co.uk/intl/en_uk/earth/index.html) was completed to determine past land uses of the site and surrounding land.

Field Survey

- 2.4 It was necessary to supplement the information obtained from the desk-top study with a walk-over field survey, in order to:

- ascertain whether, while the site itself or nearby habitats might not be covered by any ecological designations, they could be of ecological interest and/or contain protected species; and
- establish the ecological value of the site in order for the overall disturbance to ecosystems within the area to be fully evaluated.

2.5 The walk-over survey of the site was carried out on Thursday 1 September 2022. The dominant plant species were recorded and habitats classified according to their vegetation types and presented in the standard Phase 1 habitat survey format (Joint Nature Conservation Committee, 2010). The weather conditions at the time of survey were: 100% cloud cover; wind speed 1 (Beaufort scale); temperature 22°C; and no precipitation.

Habitat Evaluation

2.6 By applying recognised criteria produced by Ratcliffe (1977), the following seven-point scale was used to rank the importance of the habitat types and species they support. The value of each habitat was ranked according to its importance in a local context (a summary of the Ratcliffe criteria is attached at Appendix A):

- low value;
- low to intermediate value;
- intermediate value;
- intermediate to high value;
- high value (Local/District importance);
- very high value (County importance e.g. Site of Importance for Nature Conservation (SINC), County Wildlife Site); and
- exceptional value (National importance e.g. Site of Special Scientific Interest (SSSI)).

Fauna

2.7 Particular attention was paid to record the presence of/ or suitable habitat for badgers, bats and herpetofauna (amphibians and reptiles) that may be present on the site or within adjacent habitats, in accordance with the following survey methodologies:

Badgers

2.8 Badgers (*Meles meles*) and their setts are protected by *The Protection of Badgers Act 1992*, under which it is an offence to harm badgers or their setts. A sett is defined as “*any structure or place which displays signs indicating current use by a badger*”. Natural England has provided the following guidance on the interpretation of current use:

A sett is defined as such (and thus protected) as long as signs indicative of ‘current use’ are present. Thus, a sett remains protected by the Act until such times as the signs (i.e. ‘field signs’) have deteriorated or decayed to such an extent that they indicate that the sett is no longer in ‘current use’.

2.9 A thorough survey of the whole site and adjacent habitats, where access was available, was carried out. Particular attention was paid to dense areas of vegetation to check for any evidence of badger activity, which is usually detected by any one or more of the following signs:

- presence of holes with evidence of badger such as footprints, discarded hair, etc.;
- presence of dung pits and latrines;
- presence of well used runs with subsidiary evidence of badger activity; and
- presence of other indications of badger activity, such as signs of foraging and footprints.

Bats

- 2.10 Currently there are 17 species of bat known to breed in the UK. All species and their roosts are protected under Regulation 41 of *The Conservation of Habitats and Species (Amendment) Regulations 2012*. As a signatory to the *Bonn Convention* (Agreement on the Conservation of Bats in Europe) the UK is also required to protect their habitats. This legislation makes it illegal to kill, injure, capture or disturb bats or to obstruct access to, damage or destroy bat roosts. Under the law, a roost is any structure or place used for shelter or protection.
- 2.11 A visual survey of the site was completed to record any evidence of bats or features that could provide potential roosting opportunities. The survey was carried out following the guidelines provided by the Bat Conservation Trust¹ and by an experienced and licensed ecologist². A thorough internal and external examination of the existing buildings on the site was carried out, with any potential access points inspected for evidence of bats.
- 2.12 In addition, a careful inspection of each tree on the site was carried out to identify those features that are important for roosting bats. Surveying trees presents particular problems at any time of the year as bats will use a wide variety of roost sites in cavities, splits, cracks, knotholes and under loose bark, many of which are not easily detected from the ground. Each tree was assessed in accordance with the following criteria:
- **Negligible** – negligible habitat features likely to be used by roosting bats.
 - **Low** – a tree of sufficient size and age to contain potential roosting features (PRFs) but with none seen from the ground or features seen with only very limited roosting potential.
 - **Moderate** – a tree with one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status.
 - **High** – a tree with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a more regular basis and potentially for longer periods of time due to their size, shelter, protection, conditions and surrounding habitat.
- 2.13 The surrounding habitat was also surveyed to identify any important features such as mature trees with suitable features for roosting bats and any established lines of vegetation that might provide important flightlines.
- 2.14 Evidence of bats is usually detected by any one or more of the following signs:
- the presence of bat droppings, which tend to accumulate under established roost sites or at roost entrances;
 - the accumulation of large numbers of moth wings, which have been discarded by feeding bats;
 - areas of staining by urine or from fur rubbing; and
 - the presence of bats themselves or their corpses.
- 2.15 The visual survey was facilitated by the use of binoculars, ladders, powerful torches (1M candlepower) and a Ridgid micro CA-350 inspection camera endoscope. A heterodyne bat detector (Pettersson D200) was also utilised to record any bat calls during the survey.

Herpetofauna

Amphibians

- 2.16 All amphibian species have some level of protection under *The Wildlife and Countryside Act 1981 (as amended)*. Great crested newts (*Triturus cristatus*) are protected under *The Wildlife and Countryside Act 1981 (as amended)* and *The Conservation of Habitats and Species*

¹ Collins, J. (ed) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edition). The Bat Conservation Trust, London.

² The lead surveyor was Alan Beaumont, BSc (Hons), MSc. MCIEEM.

Regulations 2010 (as amended). The intentional or reckless killing, injury or taking, and intentional or reckless disturbance of great crested newts whilst occupying a 'place used for shelter or protection', is prohibited, as is the destruction of these places.

Reptiles

- 2.17 All reptile species are protected at some level under Schedule 5 of the *Wildlife and Countryside Act 1981 (as amended)* and *The Conservation of Habitats and Species Regulations 2010 (as amended)*. The more common species of reptiles, which include slow-worm (*Anguis fragilis*), common or viviparous lizard (*Zootoca vivipara*), adder (*Vipera berus*) and grass snake (*Natrix helvetica*) are protected by the *Wildlife and Countryside Act 1981 (as amended)* by part of Section 9(1) and all of Section 9(5). This means that they are protected against intentional or reckless killing and injuring (but not 'taking') and against sale and transporting for sale.
- 2.18 An assessment of the site was carried out to determine its suitability for herpetofauna by recording the habitats present. In addition, any natural/artificial refugia present on the site was lifted to check for any sheltering animals or evidence of animals, such as sloughs (shed skins).

Other Species

- 2.19 In accordance with good practice, the site was checked for any evidence of other protected species or species of particular note.

3.0 RESULTS

Desk-top Study

- 3.1 A summary of the baseline data obtained from GCER has been provided and detailed in Table 1; due to sensitivity of the data the report produced by GCER cannot be reproduced but the Local Planning Authority can request the information.
- 3.2 There are no ecological statutory designated sites located on or directly adjacent to the site, or within 2 km of the site. There are a number of non-statutory designated sites located within the 2 km search area, the nearest being Bromsberrow Heath Sand Pit Regionally Important Geological Site (RIGS), located on the site³. A full list of designated sites within the 2 km study area is provided in Table 1.
- 3.3 GCER returned no records of protected species on the site itself but there are a number of records within the 2 km study area, as detailed in Table 1.
- 3.4 According to the Multi-agency website there is an area of Habitat of Principal Importance (HPI) on the site, being an area of Deciduous Broadleaved Woodland was located within the east of the site.
- 3.5 Historic satellite imagery shows that the site has been dominated by the quarry and associated bare ground since at least 1999. The eastern section of the site, noted as Deciduous Woodland, was dominated by woodland in 1999, with the woodland cleared to leave bare ground sometime between 2009 and 2014.

Table 1: Summary of Data Search Results (GCER)

Non-Statutory Designated Sites		
Description	Protection/designation	Distance/direction
Bromesberrow Heath Sand Pit	RIGS	0 km to the site
Bromsberrow (High Bank)	LWS	0.1 km to the E
Bromesberrow Heath Pit	RIGS	0.15 km to the S
Bromsberrow (M50)	LWS	0.2 km to the W

³ This is noted for geological importance and not for ecological reasons.

Bromsberrow Court	Conservation Road Verge	0.72 km to the NE
Ryton Coppice	LWS	1.31 km to the SSW
Hazeldine Wood	LWS	1.41 km to the SE
Bromesberrow Lane Cutting	RIGS	1.66 km to the NE
Callow Farm Daffodil Meadows	LWS	1.72 km to the SW
Whites Farm Meadow	LWS	1.84 km to the W
Grove Copse	LWS	1.91 km to the SSE
Protected/notable Species (Specific Grid References)		
Description	Protection/designation	Distance/direction
Tower Mustard (<i>Arabis glabra</i>)	Priority Species	0.11 km to the NNE
Hobby (<i>Falco subbuteo</i>)	Protected Species	0.15 km to the SSE
Stag Beetle (<i>Lucanus cervus</i>)	European Protected Species, Protected Species (against sale) & Priority Species	0.16 km to the W
West European Hedgehog (<i>Erinaceus europaeus</i>)	Priority Species	0.29 km to the WSW
Brown Long-eared Bat (<i>Plecotus auritus</i>)	European Protected Species, Protected Species & Priority Species	0.55 km to the WNW
Common Pipistrelle (<i>Pipistrellus pipistrellus</i>)	European Protected Species & Protected Species	0.55 km to the WNW
House Sparrow (<i>Passer domesticus</i>)	Priority Species	0.55 km to the WNW
Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>)	European Protected Species, Protected Species & Priority Species	0.55 km to the WNW
Soprano Pipistrelle (<i>Pipistrellus pygmaeus</i>)	European Protected Species, Protected Species & Priority Species	0.55 km to the WNW
Unidentified Bat (<i>Myotis</i>)	European Protected Species, Protected Species	0.55 km to the WNW
Long-eared Bat species (<i>Plecotus</i>)	European Protected Species, Protected Species	0.63 km to the NNE
Natterer's Bat (<i>Myotis nattereri</i>)	European Protected Species & Protected Species	0.63 km to the NNE
Pipistrelle Bat species (<i>Pipistrellus</i>)	European Protected Species, Protected Species	0.63 km to the NNE
European Otter (<i>Lutra lutra</i>)	European Protected Species, Protected Species & Priority Species	0.69 km to the NNE
Great Crested Newt (<i>Triturus cristatus</i>)	European Protected Species, Protected Species & Priority Species	0.72 km to the WSW
Common Frog (<i>Rana temporaria</i>)	Protected Species (against sale)	0.76 km to the WSW
Daubenton's Bat (<i>Myotis daubentonii</i>)	European Protected Species & Protected Species	0.76 km to the WSW
Palmate Newt (<i>Lissotriton helveticus</i>)	Protected Species (against sale)	0.76 km to the WSW
Smooth Newt (<i>Lissotriton vulgaris</i>)	Protected Species (against sale)	0.76 km to the WSW
Brown Hare (<i>Lepus europaeus</i>)	Protected Species, Priority Species	1 km to the WSW
Dunnock (<i>Prunella modularis</i>)	Priority Species	1.06 km to the SSE
Fieldfare (<i>Turdus pilaris</i>)	Protected Species	1.06 km to the SSE
Linnet (<i>Linaria cannabina</i>)	Priority Species	1.06 km to the SSE
Redwing (<i>Turdus iliacus</i>)	Protected Species	1.06 km to the SSE
Skylark (<i>Alauda arvensis</i>)	Priority Species	1.06 km to the SSE
Song Thrush (<i>Turdus philomelos</i>)	Priority Species	1.06 km to the SSE
Starling (<i>Sturnus vulgaris</i>)	Priority Species	1.06 km to the SSE
Eurasian Badger (<i>Meles meles</i>)	Badgers Act (1992)	1.11 km to the E
Noctule Bat (<i>Nyctalus noctula</i>)	European Protected Species, Protected Species & Priority Species	1.18 km to the ESE
Polecat (<i>Mustela putorius</i>)	Priority Species	1.19 km to the W
Peregrine (<i>Falco peregrinus</i>)	Protected Species	1.38 km to the SSW
White-letter Hairstreak (<i>Satyrion w-album</i>)	Protected Species & Priority Species	1.66 km to the NNE
Red Kite (<i>Milvus milvus</i>)	Protected Species	1.8 km to the SSW
Small Heath (<i>Coenonympha pamphilus</i>)	Priority Species	1.93 km to the SE
Bullfinch (<i>Pyrrhula pyrrhula</i>)	Priority Species	2.05 km to the SSE

Yellowhammer (<i>Emberiza citrinella</i>)	Priority Species	2.05 km to the SSE
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NB: All distances are calculated from the centre of the site, National Grid Reference: SO 738330

LWS = Local Wildlife Site; RIGS = Regionally Important Geological Sites.

European Protected Species = species listed under *The Habitats Directive* Annexes II and IV.

Protected Species = species listed under the *Wildlife and Countryside Act 1981 (as amended)* Schedules 1, 5 and 8.

Priority Species = species listed under the *Natural Environment and Rural Communities (NERC) Act 2006* Section 41

Field Survey

Introduction

- 3.6 The results of the survey are presented as a series of habitat descriptions for each of the areas on the site. The Phase 1 Habitat Plan is shown on Figure 2 and the habitat descriptions should be read in conjunction with this Plan. An indicative plant species list is attached at Appendix B (nomenclature follows Stace, 2019) and a series of site photographs is attached at Appendix C.

Habitat Types and Evaluation

Bare Ground

- 3.7 The site was dominated by bare ground from the current quarrying activities. The lack of any established vegetation and regular disturbance from heavy machinery provides very limited shelter/habitat for any wildlife.

Habitat value: Low

Tall Ruderal

- 3.8 Tall ruderal was located around the edges of the quarry and was sparsely vegetated. Species present included horsetail (*Equisetaceae* sp.), evening-primrose (*Oenothera* sp.), Yorkshire-fog (*Holcus lanatus*), butterfly-bush (*Buddleja davidii*), Canadian fleabane (*Conyza canadensis*), scarlet pimpernel (*Anagallis arvensis* ssp. *arvensis*), scentless mayweed (*Tripleurospermum inodorum*), common nettle (*Urtica dioica*), broom (*Cytisus scoparius*), gorse (*Ulex europaeus*), red fescue (*Festuca rubra*), cock's-foot (*Dactylis glomerata*), poppy (*Papaver* sp.), redshank (*Persicaria maculosa*), mullein (*Verbascum* sp.), hemlock (*Conium maculatum*), creeping buttercup (*Ranunculus repens*), yarrow (*Achillea millefolium*), goldenrod (*Solidago virgaurea*), red campion (*Silene dioica*), prickly lettuce (*Lactuca serriola*), wild teasel (*Dipsacus fullonum*), perforate St John's-wort (*Hypericum perforatum*) and great willowherb (*Epilobium hirsutum*), with wild privet (*Ligustrum vulgare*) and silver birch (*Betula pendula*) and willow (*Salix* sp.) saplings also present.

- 3.9 Although these areas have become colonised with a number of species, which provide a food resource for pollen and/or nectar dependent insect groups, the species present are common and typical early colonisers of disturbed land and found in similar habitats throughout the UK.

Habitat value: Low to intermediate

Broadleaved Woodland

- 3.10 There were areas of broadleaved woodland around the southern and eastern edges of the site. Sycamore (*Acer pseudoplatanus*), silver birch and willow dominated the canopy, which was similar age and dense restricting the established of any understorey and/or ground flora. Gorse, butterfly bush, pendulous sedge (*Carex pendula*), bramble (*Rubus fruticosus* agg.) and common nettle present.

- 3.11 The woodland provides some shelter and foraging opportunities for various species and bird nesting habitat and consequently of some ecological value.

Habitat value: Intermediate to high

Scrub

- 3.12 There was an area of scrub on the north and north-western boundary of the site. Bramble was dominant with bracken (*Pteridium aquilinum*), mugwort (*Artemisia vulgaris*), spear thistle (*Cirsium vulgare*), cleavers (*Galium aparine*), burdock (*Arctium sp.*), docks (*Rumex spp.*), Canadian fleabane, willowherb (*Epilobium sp.*) and woody nightshade (*Solanum dulcamara*) also present.
- 3.13 The scrub provides some shelter and foraging opportunities for wildlife along with some bird nesting habitat but their restricted size and relative isolation reduces their ecological value.

Habitat value: Low to Intermediate

Individual Trees

- 3.14 The majority of the trees were recorded around the site boundaries. Semi-mature and mature species present included Oak (*Quercus sp.*), sweet chestnut (*Castanea sativa*), sycamore, silver birch and regenerating elm (*Ulmus sp.*).
- 3.15 The trees provided shelter and foraging opportunities for various species and bird nesting habitat and are consequently of some ecological value.

Habitat value: Intermediate to high

Hedgerow

- 3.16 There was a hawthorn (*Crataegus monogyna*) hedgerow along the western boundary of the site. Other woody species included blackthorn (*Prunus spinosa*), dog-rose (*Rosa canina* agg.), snowberry (*Symphoricarpos albus*), with common ivy (*Hedera helix*), herb-robert (*Geranium robertianum*) and field bindweed (*Convolvulus arvensis*) also present.
- 3.17 The hedgerow provides some shelter and foraging opportunities for various species and bird nesting habitat and its restricted size limits its overall ecological value.

Habitat value: Intermediate

Buildings

- 3.18 There were a number of temporary buildings on the site. All of which were single storey and lacked any separate roof voids. The buildings were either used as offices/welfare facilities or for general storage/maintenance purposes.
- 3.19 The buildings due to construction type provide limited shelter for wildlife.

Habitat value: low

Fauna

Badgers

- 3.20 No evidence of badgers or their setts was recorded on or adjacent to the site. A number of mammal runs were recorded but these were confirmed to be used by foxes (*Vulpes vulpes*) with both prints and hair found. The nearest badger record provided by the local records centre is located over 1 km away.

Bats

- 3.21 No evidence of bats was recorded during a thorough external and internal check of the various buildings. Due to the construction type, being well-sealed and lacking any separate roof voids and/or crevice dwelling opportunities for bats, were assessed to provide **negligible** roosting opportunities for bats. The majority of the trees recorded on the site, either due to their age and/or species, lacking any PRFs were assessed to provide **negligible** roosting opportunities for bats. The more mature oak trees around the site boundaries were assessed to provide **low** to **moderate** roosting opportunities.

- 3.22 The site being dominated by bare ground, provides limited foraging opportunities but the established boundary vegetation will provide some sheltered foraging habitat for bats.

Herpetofauna

- 3.23 There were no ponds on the site which could provide breeding opportunities for amphibians. The site, dominated by bare ground and regularly disturbed does not provide suitable terrestrial habitat for any species of herpetofauna. In addition, despite a careful search of the site, no species of herpetofauna was found sheltering under any refugia lifted. The nearest record for GCN returned by the local records centre is over 700 m away and there are no records of any reptiles within the 2 km study area.

Other Wildlife

- 3.24 Apart from fox already mentioned and a few common species of birds, either recorded on the site or flying overhead no other species of note was recorded during the survey. Please note that pers. Comm. With site operatives recorded Peregrine Falcon (*Falco peregrinus*) nesting on the site and white washing on a number of ledges on the exposed face of the quarry was recorded.

4.0 DISCUSSION AND RECOMMENDATIONS

- 4.1 The proposed development relates to the construction of facilities for the infill operation including the construction of a new site entrance and office/welfare facilities away from the nearby properties. After the existing voids have been filled then the site will be restored to recreate habitats previously found on site including woodland, hedgerow and grassland. It is anticipated that the majority of the trees and boundary vegetation will be retained and protected during the works.
- 4.2 Although there are considered to be no over-riding ecological constraints to the works, a series of specific and generic mitigation measures, as detailed below, will be implemented to reduce any impact the development proposals would have on local wildlife. In addition, a range of enhancement measures will be incorporated so as to increase the biodiversity value of the site in accordance with Government guidance as set out in in National Planning Policy Framework (NPPF) 2023⁴.
- 4.3 Prior to the commencement of development, the site operator shall submit for the agreement of the Minerals Planning Authority a management plan for the protection of any peregrine falcons nesting in the vicinity of the site. This plan shall include any necessary revisions to the restoration plan for the quarry to facilitate the creation of appropriate and safe nesting locations within the quarry for peregrine falcon.
- 4.4 It should be noted that all species of wild bird and their nests are protected under the *Wildlife and Countryside Act 1981 (as amended)*. Therefore, in order to avoid contravention of current legislation, any site works likely to affect potential bird nesting habitat should be timed to avoid the main bird nesting season, which, in general, runs from March to August inclusive. If this is not possible, a check should be carried out prior to any clearance works to ensure there are no active nests present.
- 4.5 Although the existing established trees are scheduled to be retained, in the event that any of the more mature trees require felling then a further assessment may be required (such as a tree climbing inspection) to determine presence/absence of bats, with appropriate mitigation implemented, as necessary.
- 4.6 In order to protect any established boundary vegetation to be retained, suitable fencing may be required at certain locations to reduce the possibility of any damage that could be caused during

⁴ Ministry of Housing, Communities and Local Government (2023). *National Planning Policy Framework*. London.

the works. To minimise accidental damage, any overhanging branches should be pruned back to suitable live growth points. All works should be undertaken by a suitably qualified and experienced specialist contractor and should conform to current industry best practice, i.e. BS 3998: 2010 '*Tree Work - Recommendations*'. The retention of these features will maintain existing habitat currently utilised by local wildlife.

- 4.7 Any new boundary treatment should be designed to promote permeability of the site to minimise fragmentation and allow free movement of wildlife throughout the site, for example by strengthening/enhancing the existing boundary vegetation, planting up a series of new hedgerows and/or installing post and rail fences.
- 4.8 The creation of new habitats on the site and sensitive ongoing management will enhance and benefit local biodiversity resulting in an overall benefit. A summary of the range of habitats to be created have been provided below:
- supplementary planting using native species of local provenance to the existing woodland and established boundary vegetation to create new woodland and woodland edge type habitat;
 - new species rich hedgerows;
 - new species rich grassland seeded on areas of the site, which should be cut once annually in Autumn to maintain species diversity;
 - swales will be included within the surrounding habitat to augment the site drainage , these will be designed to have a range of plant species present; and
 - ongoing sensitive management of the site to maximise the ecological value of the range of habitats present.
- 4.9 In addition, further enhancement measures will include the provision of new roosting, nesting and sheltering opportunities for a range of species and the creation of new wildlife habitats, such as some of those recommended by the Chartered Institute of Ecology Environment and Management's recently published Biodiversity Net Gain Good Practice Guidance, and listed below:
- Nest boxes
 - Bug hotels
 - Hedgehog houses
 - Bat boxes
 - Log piles
- 4.10 The effects of lighting on plants and animals are difficult to assess, but it is thought that lighting can adversely affect invertebrates, birds and bats. No new lighting will be introduced to the site resulting in no change in the current situation.

5.0 CONCLUSIONS

- 5.1 The proposed development relates to the construction of facilities for the infill operation including the construction of a new site entrance and office/welfare facilities away from the nearby properties. After the existing voids have been filled then the site will be restored to recreate habitats previously found on site including woodland, hedgerow and grassland. It is anticipated that the majority of the trees and boundary vegetation will be retained and protected during the works.
- 5.2 An ecological survey has been carried out, supplemented by obtaining available baseline data from GCER. The findings from the survey and review of baseline data have provided sufficient information to fully assess the impact of the proposals on species and/or features of ecological/biodiversity value.
- 5.3 There are no statutory or non-statutory designated sites that would be directly affected by the proposals. Aside from the Individual trees and broadleaved woodland, most of which is scheduled to be retained, the site is of overall limited ecological value, with the species recorded

described as common or abundant and are found in similar places across much of Britain. Although no specifically protected species was recorded during the survey, Peregrine Falcon has been recorded nesting on the site.

- 5.4 Overall the findings of this ecological appraisal would indicate that there are no over-riding ecological constraints to the development proposals to preclude planning permission being granted subject to appropriately worded conditions. A range of generic mitigation/enhancement measures have been suggested and, if implemented effectively, would reduce the impact of the works on local wildlife during the filling exercise and increase the nature conservation value of the site and surrounding area in the long term once the quarry has been fully restored, in accordance with Government guidance as set out in National Planning Policy Framework.

223326/ARB

AA Environmental Limited

December 2023

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Figures



KEY	
Site Boundary:	
2 km Study Area:	
© Crown Copyright. All Rights Reserved. Licence Number 100038323.	
UK Location: 	

Rev.	Details					Drawn	Date
						Chkd.	
 AA Environmental Ltd Units 4-8 Cholswell Court Shippon, Abingdon Oxon OX13 6HX T: 01235 536042 F: 01235 523849 info@aae-ltd.co.uk www.aae-ltd.co.uk		Project 223326 Bromsberrow Quarry Ledbury			Title Site location Plan		
		Scale As shown	Date 11.12.23	Drawn NAB	Chkd. ARB	Drg. No. Figure 1	Rev.



KEY

- Site Boundary (Indicative)
- Tall Ruderal
- Buildings and Hardstanding
- Individual Tree
- Scrub
- Hedgerow
- Bare Ground
- Broadleaved Woodland

Rev.	Details	Drawn Chkd.	Date
Project 223326 Bromsberrow Quarry Ledbury			
Title Phase 1 Habitat Plan			
 Environmental Consultants		AA Environmental Ltd Units 4-8 Cholswell Court Shippon Abingdon Oxon OX13 6HX T: (01235) 536042 F: (01235) 523849 info@aae-ltd.co.uk www.aae-ltd.co.uk	
Scale As shown	Date 11.12.23	Drg. No. Figure 2	Rev.

Appendix A

Summary of Ratcliffe Criteria

Fragility – some habitats, communities and species are particularly sensitive to environmental change and as such tend to be rare.

Rarity – the threat of loss of a particular habitat or species lends value to the organism and the site it occupies. Whether a species has rarity value is largely dependent upon the context, as a species or habitat can be internationally rare, but relatively common locally or nationally. Likewise, a nationally rare species can in some circumstances be more common at internationally level.

Size (area or extent) – size does play an important part in determining the ecological interest of an area, but is also a relative concept. For example, a 30 acre woodland or a one acre meadow could have a similar degree of nature conservation importance.

Diversity – the diversity of a site can be expressed in a number of ways and both low and high diversity can have a high nature conservation value under different circumstances.

Potential value – some sites have the potential to provide greater nature conservation interest than presently exists.

Position within the Ecological/Geographical Unit – a site which is near or adjacent to other similar habitats may have a higher nature conservation value than an isolated one because the range of fauna can be greater.

Typicalness – certain habitats have become important as they are good examples of what is, or has historically been, typical of the area. Efforts have been made to safeguard representative areas to prevent what was once common becoming fragmented or rare.

Recorded history – a well-documented site with detailed biological and/or natural history records presents a valuable insight into the ecology of a site. Such information is important for current and future management.

Naturalness – this is a measure of the degree to which an area has been modified by human activity. In England unmodified habitats are extremely rare being restricted to remote, inaccessible areas such as cliffs, and some saltmarshes. The bulk is either semi-improved, improved or artificial.

Intrinsic Appeal – this refers to value in a popular rather than ecological sense, and highlights the fact that value is also derived from society's preferences for landscape and other aesthetic features and is not just based on ecological considerations.

Appendix B

PLANT SPECIES LIST

<i>Acer pseudoplatanus</i>	Sycamore
<i>Achillea millefolium</i>	Yarrow
<i>Anagallis arvensis</i> ssp. <i>arvensis</i>	Scarlet pimpernel
<i>Arctium</i> sp.	Burdock
<i>Artemisia vulgaris</i>	Mugwort
<i>Betula pendula</i>	Silver birch
<i>Buddleja davidii</i>	Butterfly-bush
<i>Camellia</i> sp.	Camellia
<i>Carex pendula</i>	Pendulous sedge
<i>Castanea sativa</i>	Sweet chestnut
<i>Chenopodium</i> sp.	Goosefoot
<i>Cirsium vulgare</i>	Spear thistle
<i>Conium maculatum</i>	Hemlock
<i>Convolvulus arvensis</i>	Field bindweed
<i>Conyza canadensis</i>	Canadian fleabane
<i>Crataegus monogyna</i>	Hawthorn
<i>Cytisus scoparius</i>	Broom
<i>Dactylis glomerata</i>	Cock's-foot
<i>Dipsacus fullonum</i>	Wild teasel
<i>Epilobium hirsutum</i>	Great willowherb
<i>Epilobium</i> sp.	Willowherb
<i>Equisetaceae</i> sp.	Horsetail
<i>Festuca rubra</i>	Red fescue
<i>Foeniculum vulgare</i>	Wild fennel
<i>Galium aparine</i>	Cleavers
<i>Geranium robertianum</i>	Herb-robert
<i>Hedera helix</i>	Common ivy
<i>Holcus lanatus</i>	Yorkshire-fog
<i>Hypericum perforatum</i>	Perforate St John's-wort
<i>Juncus effusus</i>	Soft rush
<i>Lactuca serriola</i>	Prickly lettuce
<i>Ligustrum vulgare</i>	Wild privet
<i>Matricaria chamomilla</i>	Scented mayweed
<i>Oenothera</i> sp.	Evening-primrose
<i>Papaver</i> sp.	Poppy
<i>Persicaria maculosa</i>	Redshank
<i>Prunus spinosa</i>	Blackthorn
<i>Pteridium aquilinum</i>	Bracken
<i>Quercus</i> sp.	Oak
<i>Ranunculus repens</i>	Creeping buttercup
<i>Rosa canina</i> agg.	Dog-rose
<i>Rubus fruticosus</i> agg.	Bramble
<i>Rumex</i> spp.	Docks
<i>Salix</i> sp.	Willow
<i>Silene dioica</i>	Red campion
<i>Solanum dulcamara</i>	Bittersweet nightshade
<i>Solidago virgaurea</i>	Goldenrod
<i>Symphoricarpos albus</i>	Snowberry
<i>Taraxacum</i> agg.	Dandelion
<i>Tripleurospermum inodorum</i>	Scentless mayweed
<i>Ulex europeaeus</i>	Gorse
<i>Ulmus</i> sp.	Elm
<i>Urtica dioica</i>	Common nettle
<i>Verbascum</i> sp.	Mullein
<i>Veronica</i> sp.	Speedwell

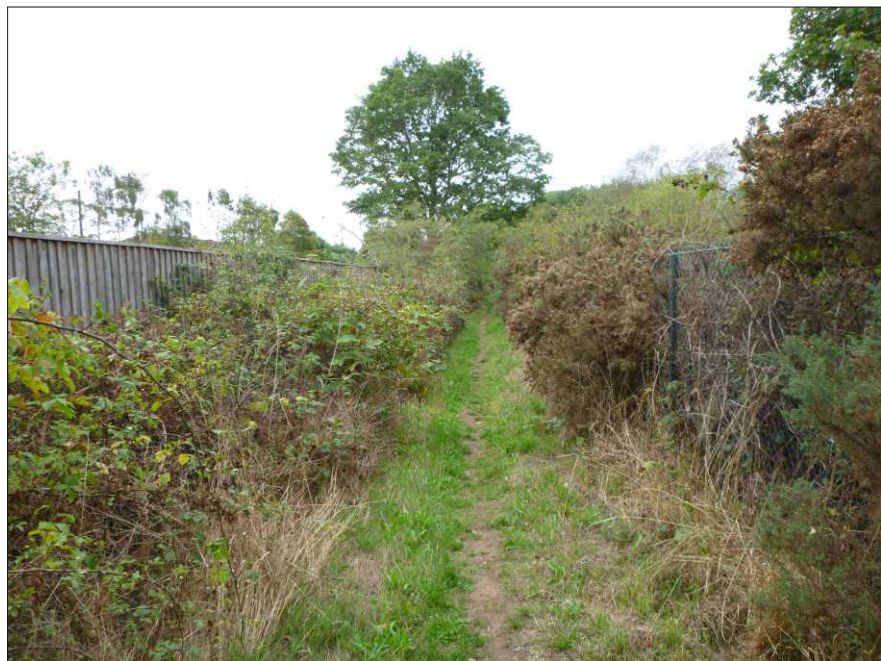
Appendix C



Photograph 1: Showing the quarry and broadleaved woodland.



Photograph 2: Showing the bare ground of the worksite.



Photograph 3: Showing the scrub.



Photograph 4: Showing the white washing from the peregrine falcon.

Rev.	Details	Drawn Chkd.	Date
PROJECT 223326 Bromsberrow Quarry Ledbury			
TITLE Photograph Record Sheet			
		AA Environmental Ltd Units 4-8 Cholswell Court Shippon Abingdon Oxon OX13 6HX T: 01235 536042 F: 01235 523849 info@aae-ltd.co.uk www.aae-ltd.co.uk	
Scale	Date	Drg No.	Rev.
NTS	11.12.23	Appendix C	
	Drawn NAB	Chkd. ARB	



Appendix F

Flood Risk Assessment (331201147R2)

Bromsberrow North Sandpit: Flood Risk Assessment



31 January 2024



Bromsberrow North Sandpit: Flood Risk Assessment

Prepared for Allstone Sands Gravels Aggregates Trading Co. Ltd (Allstone)

Report reference:

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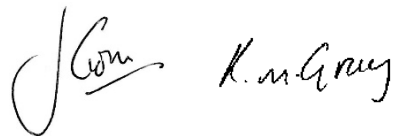
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Bromsberrow North Sandpit: Flood Risk Assessment

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1 Introduction

1.1 Background

Bromsberrow Sand and Gravel Company (BSGC), a wholly owned subsidiary of Allstone Sands Gravels Aggregates Trading Company Limited (Allstone) submitted an application to Gloucestershire County Council (GCC) in 2022 for an Initial Review of planning conditions relating to the extraction of sand from Bromsberrow North Sandpit at Bell Lane, Bromsberrow Heath, near Ledbury, Gloucestershire, HR8 1NX ('the Site')¹, which is operated by BSGC. The application Site extends to approximately 5 ha.

GCC is the determining Minerals Planning Authority (MPA) and it has a statutory duty to review what are commonly referred to as 'old' planning permissions for mineral working. The process of review is sometimes referred to by the acronym 'ROMP' – Review of Old Mineral (planning) Permissions.

Allstone has contracted Stantec UK Ltd (Stantec) to provide hydrogeological and hydrological support on the impacts of quarrying and restoration at the Site and the risk of flooding during both operational and restoration phases. These outputs will support the ROMP application and, in addition, the Environmental Permit (EP) application for the restoration of the Site by inert landfill.

Further development of the quarry has been divided into eight phases according to the development plans provided by Allstone and this will provide a total of 341,000 tonnes of mineral (red sand) to be extracted during the period up until February 2032.

In addition to the phased extraction of the remaining mineral reserve, Allstone proposes a joint programme of phased restoration to either agricultural or amenity use, using imported inert material to re-establish original ground levels. It is estimated that a total of 670,000 m³ of inert material will be imported for the restoration which will comprise filling the void progressively. Allstone is applying for an EP for this restoration of the quarry by inert landfill.

Details of the proposed development are set out in the updated quarry development plan drawings, included as Appendix A.

Operations at the Site will not involve extracting sand below the groundwater level, therefore there is no need for the Site to be dewatered, and hence there is no need to assess impacts on groundwater levels from pumping at the quarry, nor any off-Site discharges with the exception of runoff water.

Based on current rates of extraction the end of the quarrying extraction is expected to be in February 2032, while the subsequent restoration is estimated to be completed by November 2044.

¹ The Site is referred to elsewhere as Bromsberrow Quarry, or Bromsberrow Sandpit. In this report we refer to it as Bromsberrow North Sandpit, to distinguish it from Bromsberrow South Sandpit nearby (see Section 2.1).

This report constitutes a Flood Risk Assessment (FRA) that has been prepared on behalf of Allstone, in support of the ROMP and EP applications for continued sand extraction and progressive restoration by inert landfill, respectively. A Hydrogeological Impact Assessment (HIA) was also produced as a separate document (Stantec, 2021) to support the ROMP application. A hydrogeological risk assessment (HRA) has also been developed to support the EP application (Stantec, 2024a).

Figure 1.1 shows the Site boundaries and the surrounding area.

1.2 Scope of work

This report constitutes an FRA that has been prepared on behalf of Allstone in support of the ROMP and EP applications for phased mineral excavation and restoration of the Site by inert landfill.

This FRA has been written in line with the National Planning Policy Framework (NPPF) (Department for Levelling Up, Housing & Communities, DLUHC, 2023) and the 'Flood risk and coastal change' planning guidance (DLUHC, 2022) to satisfy both the Environment Agency and the lead local flood authority (GCC) that all potential flood risks to and from the proposed development have been considered.

This assessment includes site-specific calculations to estimate surface water runoff for the restored Site to ensure the proposed restoration plans remain viable. These calculations also account for the effect of climate change using appropriate advice given in the NPPF.

1.3 Data sources

The information and assessments in this report are predominantly based on secondary data analysis associated with both the Site itself and the surrounding land area. The main sources of data are summarised below:

- Phased mineral extraction and restoration details provided as updated quarry development plan drawings by Allstone (Appendix A);
- Previous reports for Bromsberrow South Sandpit (Stantec, 2019);
- British Geological Survey (BGS) mapping;
- Ordnance Survey mapping;
- Freely available data published by UK Government;
- Forest of Dean District Council Strategic Flood Risk Assessment (Halcrow Group, 2008);
- Gloucestershire County Council Strategic Flood Risk Assessment (Halcrow Group, 2008);
- Rainfall and catchment characteristics /rainfall data from the Centre for Ecology and Hydrology (CEH, 2021); and
- Environment Agency flood risk data.

1.4 Report structure

This FRA includes the following sections:

- a description of the Site conditions and proposed development (Section 2);
- an outline of the proposed development (Section 3);
- an assessment of flood risk to the development (Section 4);

- an assessment of the site's suitability for the development with regards to planning policy (Section 5);
- an assessment of flood risk from the development to the surrounding area (Section 6);
- a summary of flood risk considerations (Section 7); and
- the proposed drainage strategy for the Site to alleviate any potential increase in flood risk (Section 8).

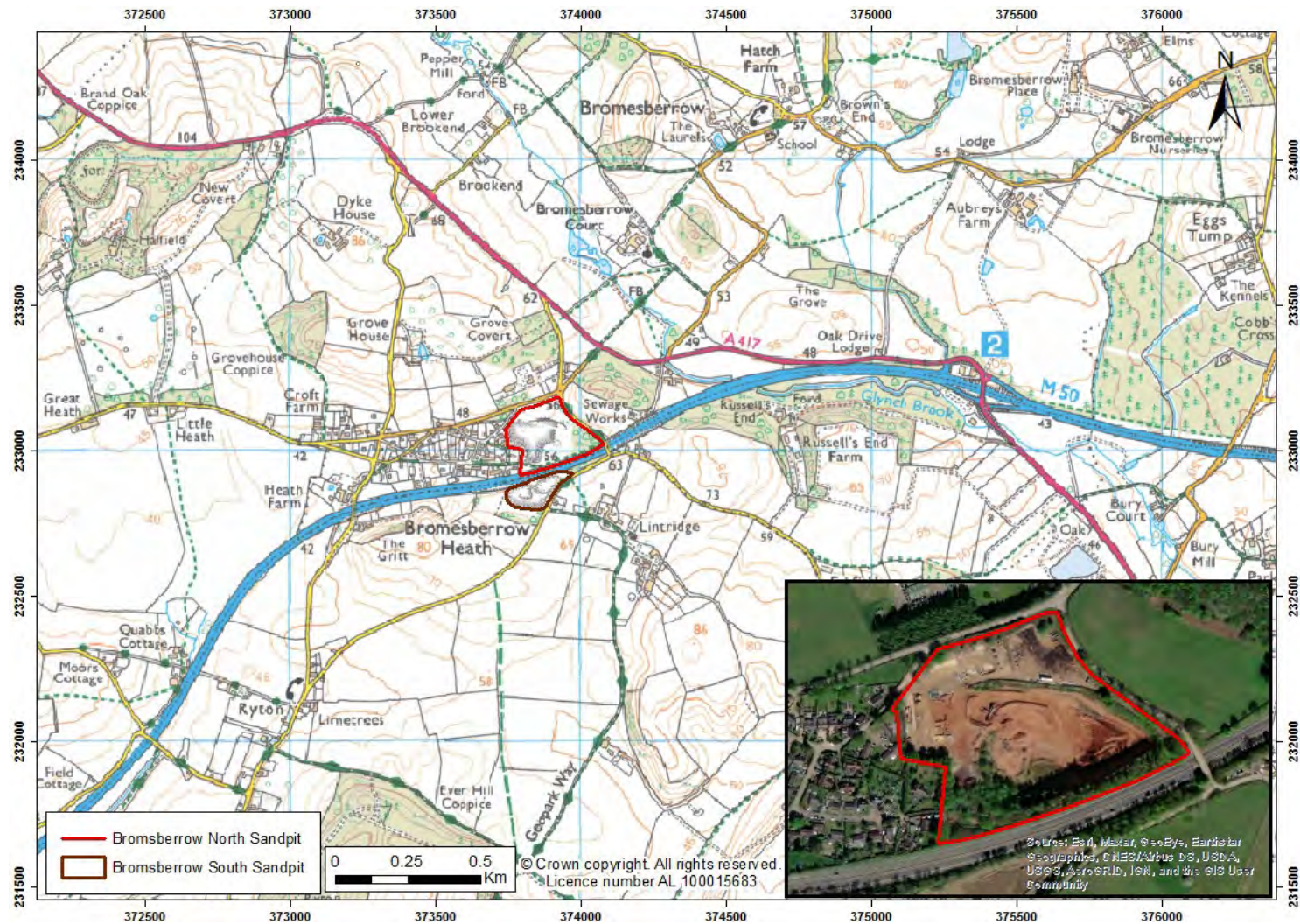


Figure 1.1 Site location showing topography and surrounding area

2 Site description

2.1 Site setting and surrounding area

The Site is located in Bromsberrow Heath, Gloucestershire, approximately 4.5 km southwest of Ledbury and 7 km north of Newent, close to the village of Bromsberrow, Gloucestershire (approximate NGR SO 73896 33065). The nearest postcode is HR8 1NY.

The south boundary of the Site is adjacent to the M50 which runs in a southwest-to-northeast direction, beyond which Bromsberrow South Quarry has now been restored by inert landfill (Figure 1.1). Bromsberrow Heath residential area extends to the western Site boundary. Beyond the north boundary there is the Bromsberrow Public Water Supply (PWS) Borehole Pumping Station (BPS). To the east lies agricultural land and a sewage works.

Apart from the residential development to the west, the surrounding land is predominantly agricultural, with polytunnel fields identified on aerial photographs to the south of the Site, beyond Bromsberrow Lane at approximately 250 m, and to the north of the Site beyond the pumping station, at approximately 240 m.

The elevation of the perimeter of the Site ranges between 55 and 60 mAOD, while the proposed extraction void will extend to 36 mAOD. The Site topography is generally similar to the land to west; however, the land rises eastwards to form Bevanhill Coppice, to more than 75 mAOD. To the south, the land also rises to elevations between 70 to 75 mAOD around Russellsend Coppice to the southeast. To the east and north of the coppices, the ground level falls to 50 mAOD in the Glynych Brook valley.

2.2 Geology & hydrogeology

The solid geology underlying the Site comprises the Bridgnorth Sandstone Formation, which is described as presenting cross-bedded aeolian sandstones, mainly brick-red, soft, medium-grained, with buff mottling common. The reported thickness of the Bridgnorth Sandstone Formation is between 183 and 250 m (BGS, 2021). To the south of the Site, beyond the M50, the bedrock consists of Helsby Sandstone Formation.

According to available mapping (BGS, 2021), there are no superficial deposits underlying the Site. The closest superficial deposits, defined as Mathon Sand and Gravel Formation, are found as isolated pockets, with the closest being approximately 200 and 400 m east of the Site. Beyond this, Head deposits (clay, silt, sand and gravel) extends northwest to southeast, which is crossed by Alluvium (also clay, silt, sand and gravel) alongside the Glynych Brook. Refer to the HRA (Stantec, 2024a) for more detailed description.

The Bridgnorth Sandstone Formation is classed as a Principal Aquifer by the Environment Agency, and as such, it may support water supply and/or river baseflow on a strategic scale. The entire extraction area of the Site lies within Zone II of the Source Protection Zone (SPZ) for Bromsberrow PWS, with the northern boundary lying immediately next to SPZ Zone I. Therefore, it is considered likely that the PWS abstraction will influence groundwater levels and flow directions in the vicinity of the Site.

Groundwater levels at Bromsberrow South vary between 32 and 37 mAOD with an average groundwater level from BH1 and BH2 of 34.3 mAOD. Stantec (2021) presents a value of 27.1mAOD for the mean groundwater level at the PWS, which results in a hydraulic gradient of 0.022 between the Site and the PWS. Further commentary on groundwater levels and hydraulic gradients is presented in the HRA (Stantec, 2024a).

2.3 Hydrology

2.3.1 Rainfall

Standard average annual rainfall (SAAR) figures are available from CEH (2021). For the Bromsberrow area the 1961-1990 figure is in the band from 675 to 700 mm/a.

2.3.2 Surface water features

Watercourses

Surface watercourses within a 2 km radius of the extraction area are shown in Figure 2.1. Each watercourse is described in more detail in Table 2.1.

The vast majority of the Site lies within the Glynch Brook catchment area (ID GB109054039620) which occupies an area of 45.69 km². However, a small area of the western boundary lies within River Leadon catchment area (ID GB109054032511), which occupies an area of 66.26 km².

The Site lies within the River Leadon operational catchment area and Severn Vale management catchment area. The Glynch Brook is the closest watercourse to the extraction area, which runs in a north-to-southeast direction approximately 400 m east of the eastern boundary of the Site. Glynch Brook headwaters rise at Eastnor Lake, Ledbury and it flows in a southerly direction until it joins downstream with Wynd Brook, near Lowbands, to finally confluence with the River Leadon approximately 6 km southeast of the Site. The Glynch Brook has a total length of 18.87 km.

According to the Environment Agency (2021a) in 2019 this watercourse was classified as having a “Moderate” status with regard to its condition, meaning that a greater level of protection and management is needed if it is to improve to a good level of health. High levels of phosphate were identified within the watercourse, likely to be derived from continuous sewage discharge.

The River Leadon, categorised as a main river, runs near the Site. It is a tributary of the River Severn. It rises near the village of Evesbatch, Worcestershire, and flows south and east past Dymock, Upleadon and Highleadon to join the Severn at Over, just west of Gloucester. The closest section of the river to Site is located c. 2.3 km southwest of the extraction area. The river is approximately 28.7 km long.

Table 2.1 Watercourses within 2 km of the Site

Name	Type	Distance from extraction area	Description
A	Drain / Ditch	c. 780 m southeast	Constructed along a path off Bromsberrow Road, located at the bottom of Wyevale Transplants. A tree line is identified along the length of the ditch.
B	Spring/ stream	c. 1.2 km southwest	Associated with Quabbs Cottage fields on the upper part and followed by trees. It is intersected by the M50, and presumably joins the motorway drainage.
C	Spring/ stream	c. 1.7 km west	Isolated stream between fields, c.50 m long, presumably runs into field drains.
D	Stream tributary of the River Leadon	c. 1.9 km northwest	It rises near Smallends Farm and flows westwards for approximately 2.1 km to its confluence with the River Leadon.
E	Spring / Stream tributary of the Glynch Brook	c. 1.7 km northwest	Likely to be a seasonal stream, as the majority of it appears dry on aerial photographs and it is levelled with the surrounding terrain. It splits in 3 overground sections with a spring between the further two sections. It flows approximately eastwards for 1.3 km to its confluence with the Glynch Brook.
F	Stream tributary of the Glynch Brook	c. 1.3 km north	It raises at Toney's Coppice where the terrain is more elevated and flows for approximately 1.7 km to confluence with the Glynch Brook.
G	Stream tributary of the Glynch Brook	c. 1.10 km northeast	This stream raises at Pendock's Grove woodland, where the terrain is more elevated, and flows in a southward direction forming a series of ponds in course until confluences with the Glynch Brook. It also collects a few minor streams on its way. Its total length is approximately 3.4 km.
H	Ditch / stream tributary of the Glynch Brook	c. 1.7 km east	It borders Cobb's Cross woodland along the western side for approximately 600m downstream. It is crossed over by the M5, however there are no signs of this being culverted.

Other water bodies

The extraction area is located almost entirely within the catchment area of the Glynch Brook, and therefore the majority of the water bodies are associated with this stream or its affluents. The closest water body however appears to be man-made.

Figure 2.2 shows other surface waterbodies within a 2 km radius of the Site. They are described in more detail in Table 2.2.

Table 2.2 Waterbodies within 2 km of the Site

Name	Type	Size (area in m ²)	Distance from extraction area
I	Likely to be an artificial pond	c.1027	400 m northwest
J	Pond raised by a tributary of the Glynch brook	c.900	660 m east
K	Reservoir	c.12,800	1.6 km southeast
L	Spring	c.437	1.8 km south
M	A series of isolated ponds	Ranging from c.600 to 1300	1.4 to 1.8 km northeast
N	Likely to be an artificial pond. Bordered by mature vegetation	c.800	1.0 km northeast
O	Reservoir	c 6900	1.6 km northeast
P	Ponds raised by a tributary of the Glynch brook (watercourse G)	c.14,370	1.8 km northeast

2.3.3 Surface water flow and levels

The River Leadon and the Glynch Brook have a mostly natural regime. Flows are not measured anywhere within close proximity to the Site. Based on data published by the CEH (2021), the closest Environment Agency surface water flow monitoring station (Ref. 54017: Leadon at Wedderburn Bridge - SO776233) is located next to the River Leadon in the village of Highleadon, which is approximately 10.5 km south of the Site. The average daily flow is 2.203 m³/s with a range between 0.067 and 127 m³/s in the period October 1962 to September 2020, reaching the peak in July 2007 (UK Centre for Ecology and Hydrology, 2021).

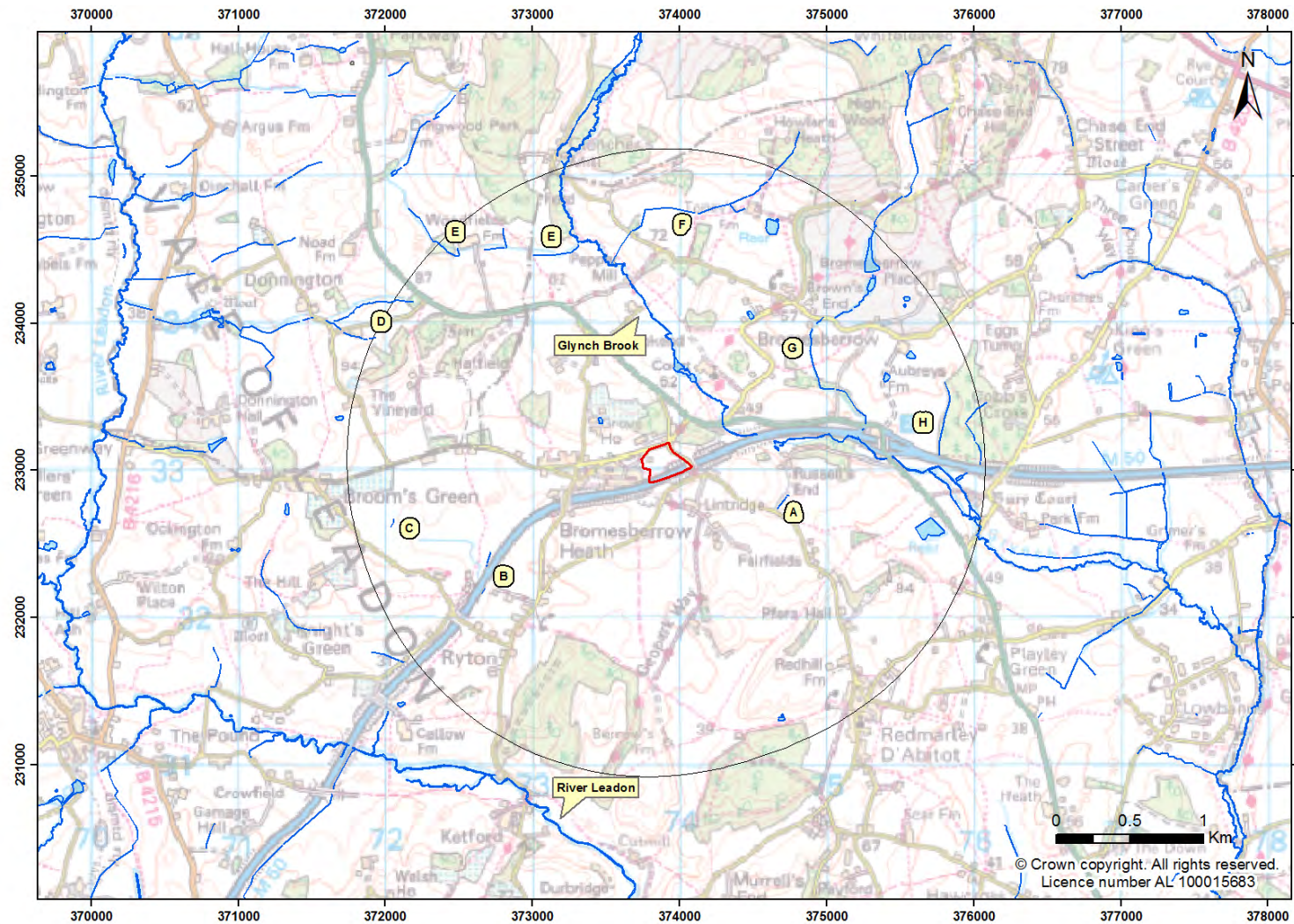


Figure 2.1 Surface watercourses within 2 km of the Site

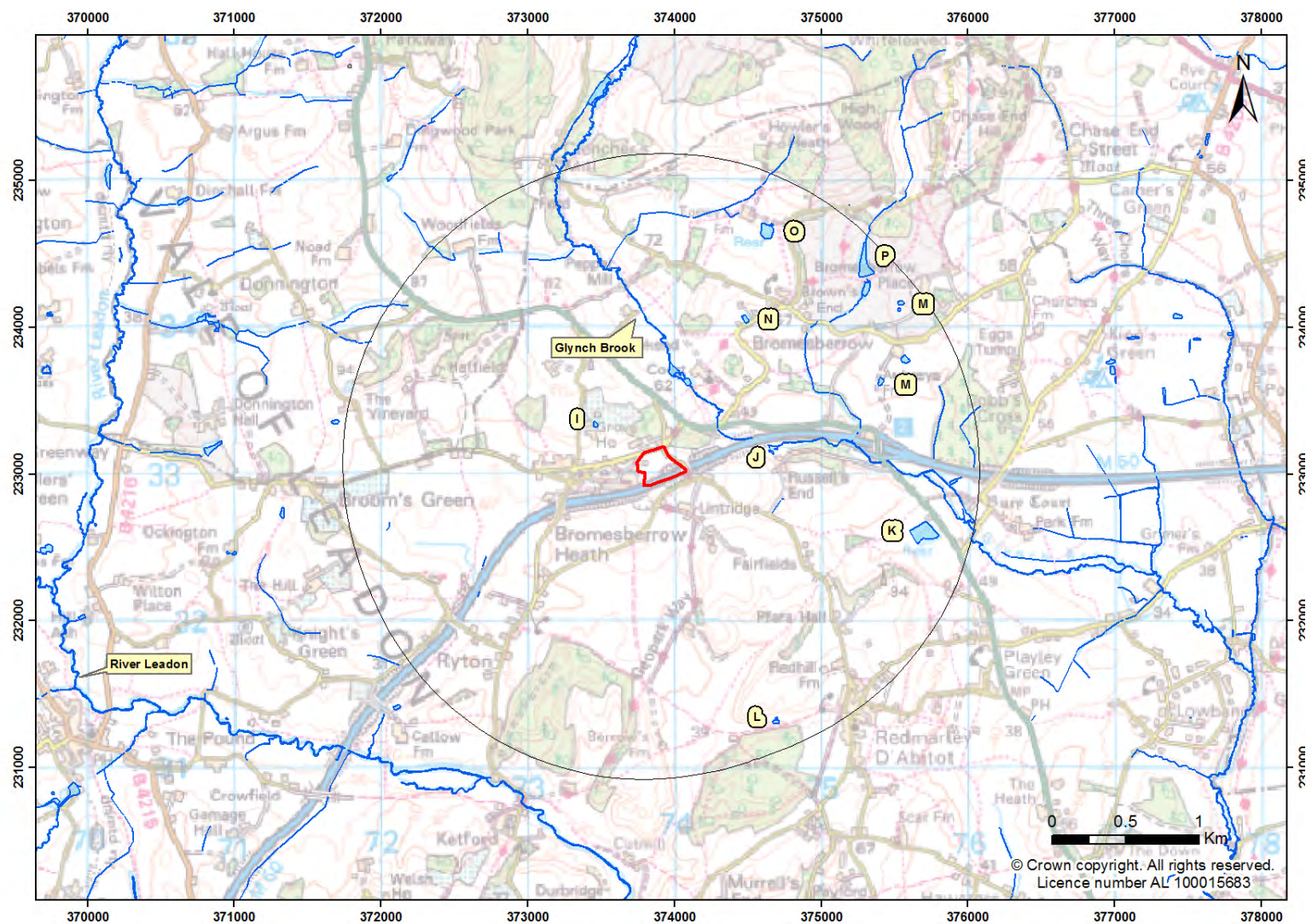


Figure 2.2 Other water bodies within 2 km of the Site

3 Proposed development

3.1 Operational stage

The operational development is shown in a series of drawings presented in Appendix A. The drawings show six progressive phases of expanding the existing approved quarry through to 2032, which are summarised in Table 3.1.

During development water management will continue as at present; surface water entering the quarry will be allowed to soak into the ground and no off-Site discharge will be required.

Table 3.1 Phased development details

Phase	Description	Approximate quantity (m ³)
Phase 1	Remove original access ramp to 36m AOD	17,000
Phase 2	Western area extracted down to 36m AOD	52,000
Phase 3	Western area extracted down to 36m AOD and Northern extension to 39m AOD	18,000
Phase 4	Completion of western extension to 36m AOD and Northern extension to 39m AOD. Form new access ramp to quarry floor.	24,000
Phase 5	Northern extension extracted to 36m AOD	17,000
Phase 6	Remove phase 4 access ramp to 36m AOD	27,000
Total	155,000	

3.2 Restoration stage

Restoration at the Site will be worked in conjunction with mineral extraction; worked out areas will be restored in lockstep with extraction over a period of 20 years to the original ground level and the Site will be returned to agricultural or amenity use. Eight phases of restoration are described by the drawings in Appendix A and summarised in Table 3.2.

Table 3.2 Phased restoration details

Phase	Description	Approximate quantity (m ³)
Phase 1	Extension of ramp onto quarry floor	-
Phase 2	Stabilisation of Eastern boundary and creation of stocking area	88,000
Phase 3	Southern boundary face stabilisation	76,000
Phase 4	Enlargement of Sothern Face tip	43,000
Phase 5	South West corner - plant area	80,000
Phase 6	Old ramp infill	24,000
Phase 7	Central area	174,000
Phase 8	Whole site overlay to original ground level	185,000
Total	670,000	

Further details of the proposed development are presented in the supporting planning document submitted with the ROMP and the Environmental Sitting and Site Design (ESSD) submitted with the EP application (Stantec, 2024b).

Surface water will continue to be allowed to soak into the quarry floor during the joint operational and restoration stages. During Phases 7 and 8 of restoration, an alternative soakage basin will be developed (described in Section 8 – Drainage Strategy) on the north-western side of the Site and a surface water drain will be constructed to route surface runoff from the restored area, around the north, west and south of the remaining quarry, to the new basin. This alternative basin will remain in the longer term to take runoff from the restored Site surface so that, as before, no off-Site discharge will be required.

4 Flood risk to the Site

4.1 Flood map for planning

The Site is located in a Flood Zone 1 (see Figure 4.1) which means it has a low probability of flooding from rivers.

4.2 Flood defences

According to the Environment Agency data for the area, flood defences are in place for the River Leadon (Figure 4.1); however, no flood defences are in place for the Glynch Brook.

4.3 Groundwater flooding

Groundwater flooding occurs when the water table rises above the ground surface or into man-made ground.

Groundwater flood risk at the Site is considered to be low given the depth of the groundwater table below the surface (ESI, 2008; P.E Duncliffe, pers. com.).

Operations at the Site will be undertaken above the water table, to a maximum depth of 36 mAOD, while the (July 2023) groundwater level for the Site is around 30-32 mAOD.

4.4 Surface water (pluvial) flooding

Surface water (pluvial) flooding is usually associated with extreme rainfall events but may also occur when rain falls on land that is already saturated or has a low permeability. Rainfall that is unable to infiltrate into the ground generates overland flow which can lead to flooding or 'ponding' in localised topographical depressions before the runoff is able to enter the drainage system or watercourse.

Areas of high risk of surface water flooding are found within the Site boundary due to the large depression created by quarrying activities (Figure 4.2); nevertheless, it is expected that the risk of surface water flooding is not likely to be high owing to the permeability of the sandstone material of the catchment. This statement is supported by the lack of a quarry sump at the base of the void or ponds being generated after rain events.

4.5 Flooding in the event of reservoir failure

The Site is not at risk of flooding as a result of reservoir failure as there are no reservoirs in the locality.

4.6 Historical flooding

The Site is not thought to have experienced flooding historically according to Environment Agency data and the Forest of Dean District Council.

4.7 Climate change

The minimum ground elevation of the Site is 36 mAOD (final depth of quarry). The estimated elevation of Flood Zone 2 at the most proximal location to the east is c.50 mAOD (estimated from LiDAR data). However, land elevations to the east and southeast separate the quarry from the Glynch Brook flooding area with elevations between 55 and 75 mAOD of the Bevanhill

Coppice and the Russellsend Coppice. This is well above any expected extreme of peak river height in the area even when considering allowances for climate change (Environment Agency, 2021b).

Moreover, according to the Forest of Dean District Council (2008), "the current fluvial Flood Zone 2 can be considered an estimate of the extent of fluvial Flood Zone 3 within 100 years". Zone 2 areas are not found near the Site.

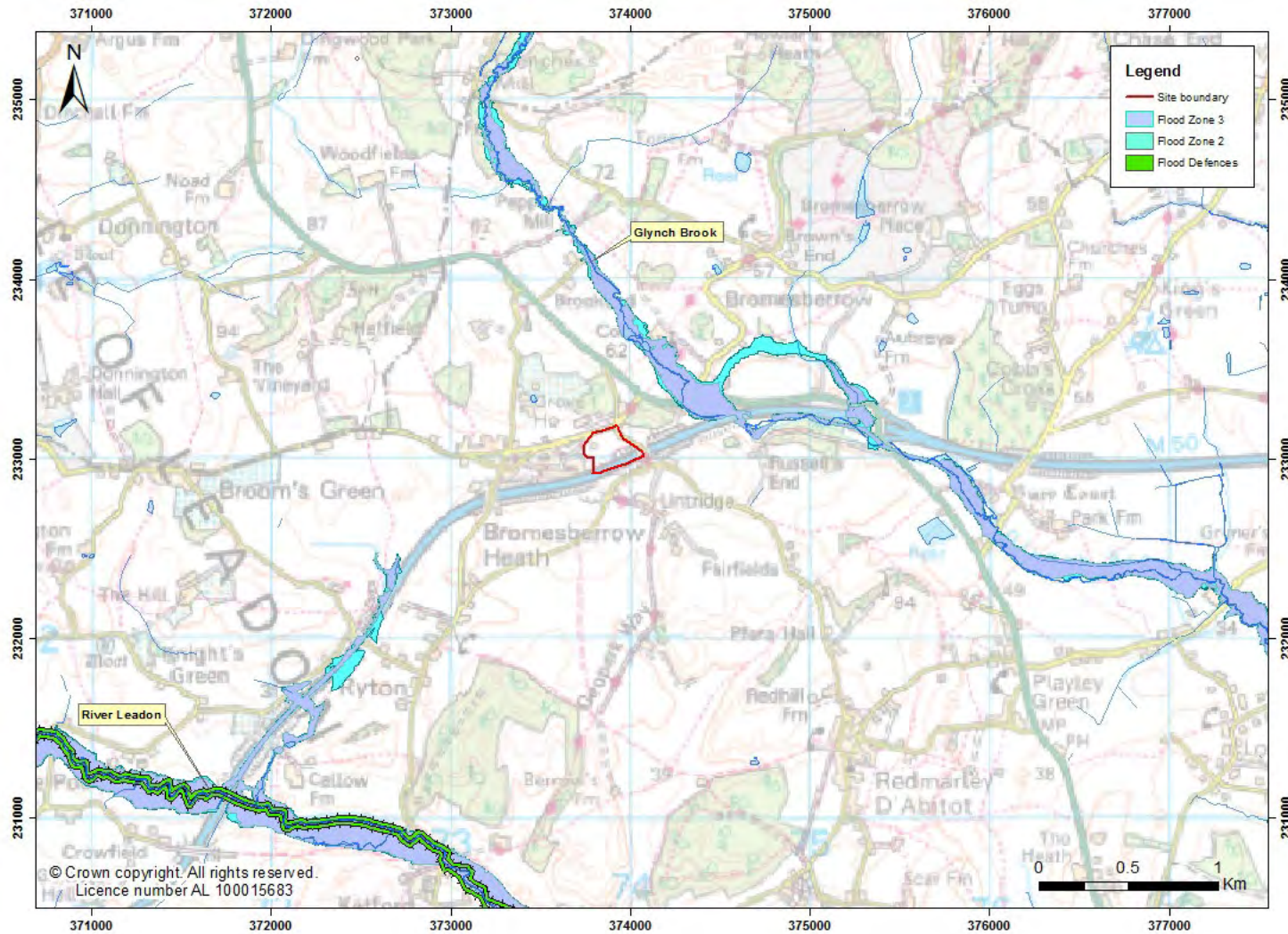


Figure 4.1 Flood risk

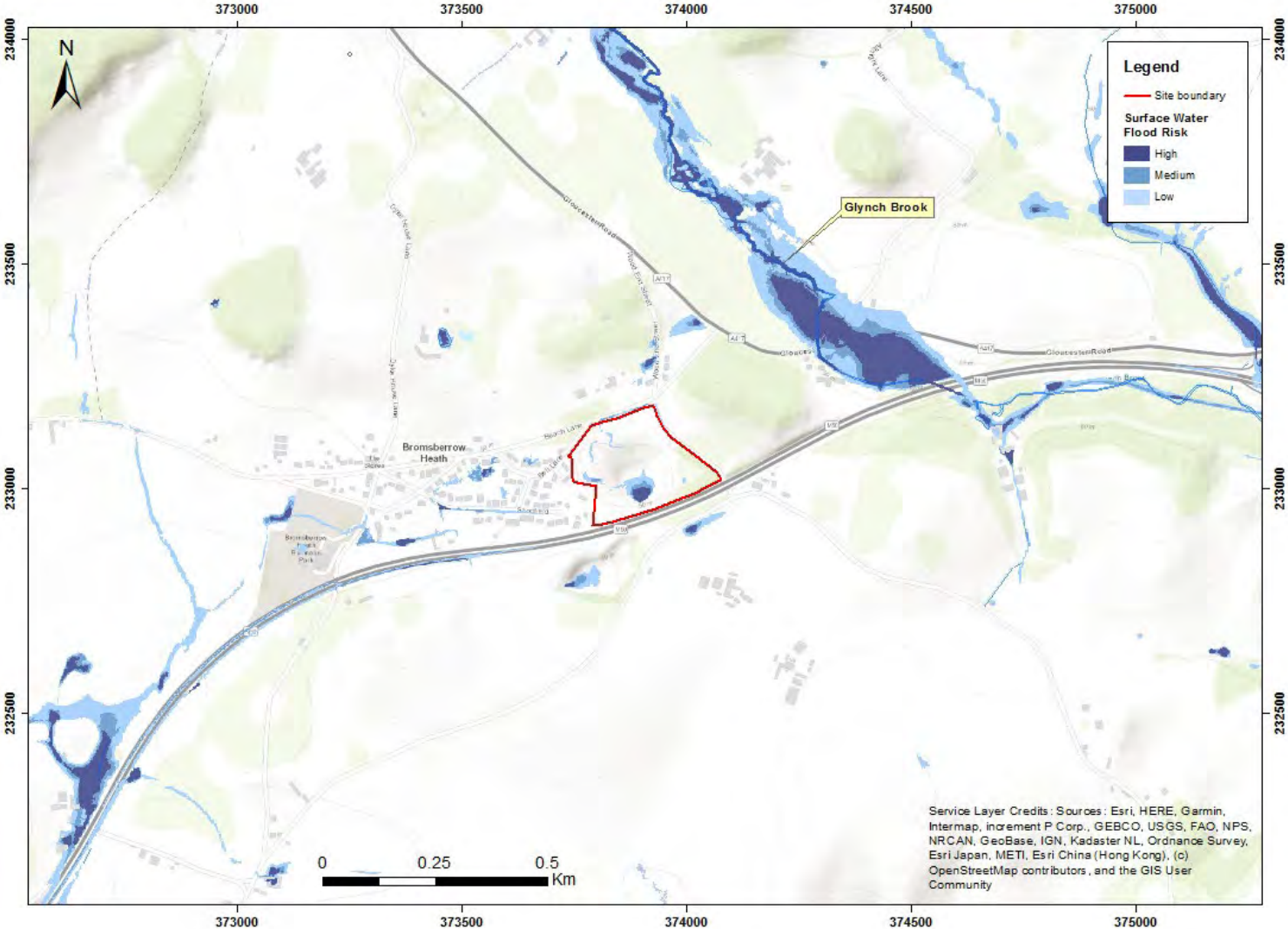


Figure 4.2 Risk of flooding from surface water

5 Planning policy guidance

5.1 Proposed land use vulnerability classification

Sand quarrying is considered to be a “water compatible” land use and the proposed development is considered to be appropriate for this location, as shown in Table 5.1.

5.2 Exception and sequential tests

The Sequential Test, outlined in (DLUHC, 2022), identifies that development should be directed to areas at the lowest probability of flooding. The Site is classified by the Environment Agency as being located within Flood Zone 1 and is therefore an appropriate location for the proposed development with regards to flood risk.

Table 5.1 Flood risk vulnerability and flood zone compatibility

Flood risk vulnerability classification		Essential infrastructure	Water compatible	Highly vulnerable	More vulnerable	Less vulnerable
Flood zone	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	x	Exception Test required	✓
	Zone 3b functional floodplain	Exception Test required	✓	x	x	x

✓Development is appropriate.

x Development should not be permitted.

Data source: DLUHC, 2022.

6 Flood risk to the surrounding area

6.1 Nearby receptors

Potential receptors in the vicinity of the Site are given below. The proposed development should not increase flood risk to any of the receptors identified.

Property

- Residential properties to the west of the Site along Bell Lane, Sandfields and cul-de sacs from them.
- The Bromsberrow BPS PWS to the north of the Site.
- Agricultural land and a sewage works to the east of the Site.
- Agricultural land of Lintridge farm to the south of the Site.

Infrastructure

- The M50 road lies on the southern boundary of the quarry.
- Beyond the M50, the Bromsberrow South quarry.

Water features

- Glynch brook east of the Site.

6.2 Climate change

Guidance included within the NPPF recommends that the effects of climate change are incorporated into FRAs. Projections of future climate change in the UK suggest that short-duration, high-intensity rainfall and periods of long duration rainfall will become more frequent. This needs to be accounted for when considering the impacts of a given development on off-site flood risk.

Recommended precautionary sensitivity ranges for peak rainfall intensities and peak river flows have been calculated (Environment Agency, 2021b). The recommended national precautionary sensitivity ranges for peak rainfall intensity are shown in Table 6.1. The operational period of the proposed development is anticipated to continue until February 2032, while the restoration is expected to be finished by November 2044.

Table 6.1 Climate change allowances for rainfall intensity

Return Period (yrs)	2015-2039	2070-2115
Central band	5%	20%
Upper end	10%	40%

Climate change allowances for peak flow are not applicable in this assessment given that the Site is defined as being “Water Compatible” (see Section 5.1) and is not within a floodplain.

Future climate change has been accounted for in runoff calculations with an increase of +10% applied to the rainfall in accordance with the Technical Guidance of NPPF for an anticipated duration of mineral extraction until February 2032. Following the restoration phase, where the quarry void will be filled to the original formation level, future climate change has been accounted for with an increase of +40% applied to the rainfall. Runoff calculations are set out in the next Section.

6.3 Surface run-off calculations

6.3.1 Run-off calculation methodology

The proportion of rainfall diverted to overland flow is a function of several key factors including slope gradient, soil type, and land cover type. There are numerous methodologies for calculating runoff rates and volumes for a given catchment and the suitability depends upon the catchment characteristics. The loH124 method (Institute of Hydrology, 1994) is specific to establish runoff rates and volumes for both greenfield and developed sites in small catchments.

The loH124 method calculates a peak runoff rate (Q_{BAR}) for a given standard annual average rainfall (SAAR) and a soil runoff coefficient (SPR). This allows for total runoff volumes to be calculated for different rainfall intensity return periods.

The values of SAAR and SPR used in the runoff calculations have been taken from the hydrological point descriptors for the Site (Table 6.2).

Table 6.2 Hydrological point descriptors (CEH, 2021)

Descriptor	Abbreviation
NGR	SO 73896 33065
SAAR	673
SPR	0.3

6.3.2 Runoff destinations

Greenfield

Figure 6.1 shows the inferred surface water sub-catchment areas within the Site boundary under the Greenfield (pre-quarry) conditions. Based on a review of historical maps and surrounding topography, it appears that the Site drained previously to the west, into the River Leadon catchment.

The runoff catchments have been labelled with a “G” for identification in the following rainfall runoff calculations.

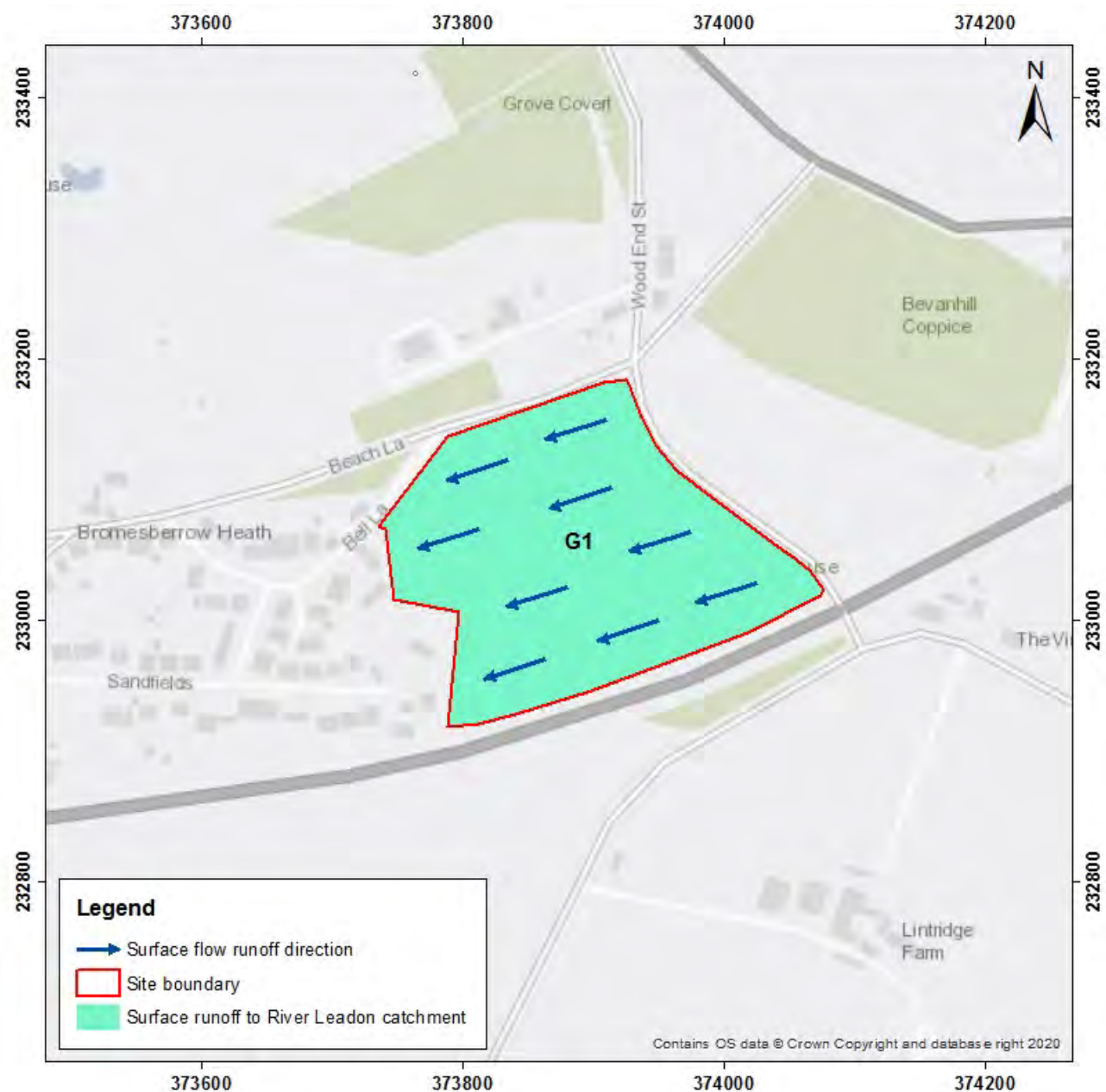


Figure 6.1 Surface water runoff catchment – Greenfield

Operational Phase

The topography was altered by excavations and bunds. The runoff regime of the Site is in a state of change as it is progressively developed and restored. Sub-catchments associated with the excavations will be enlarged over the Operational Phase.

Through Phase 1 to Phase 6, runoff around the Site will be directed to the active quarry void (which will be present throughout the Site as operations continue). Once runoff enters the void, it will either infiltrate into the underlying sandstone or evaporate.

The operational runoff catchment area (prefixed “O”) is presented in Figure 6.2. The figure indicates the expected catchment area at Phase 2, which has been used as a snapshot to represent the Site during the operational period.

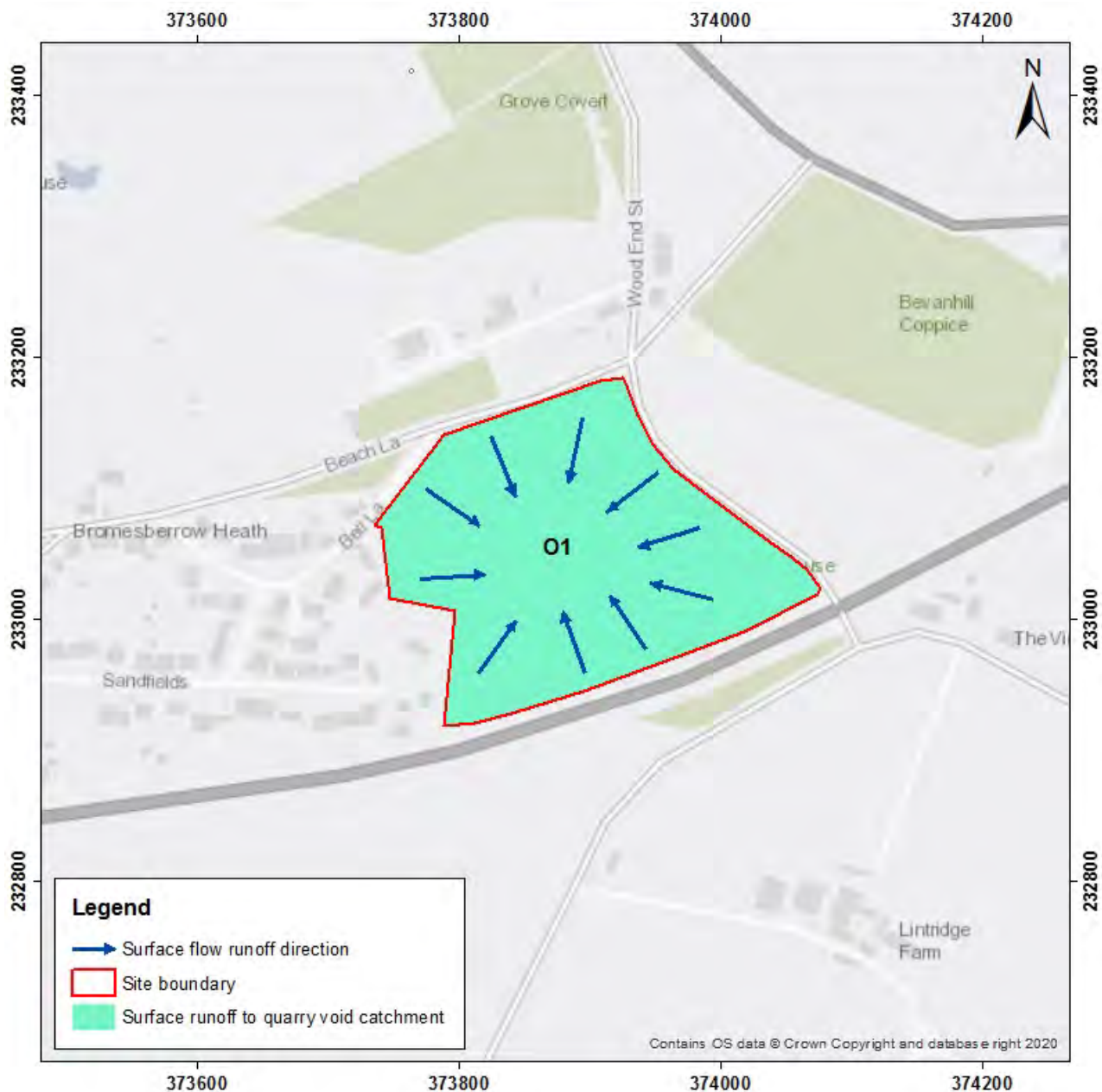


Figure 6.2 Runoff catchment – Operational phase

Restoration Phase

As shown in the restoration plans (Appendix A), land for agriculture or amenity will be created across the quarry area. The lower permeability infill material utilised is expected to increase runoff; therefore, appropriately designed SuDS features will be created on the Site during Phase 7 of the phased mineral extraction and restoration details (see Appendix A), with the aim to replace natural infiltration to the aquifer, and to reduce runoff and downstream flood risk. The SuDS will include drainage trenches and an infiltration basin (as described in Section 8.3). Losses from the Site catchment will be via evaporation, and via increased infiltration to ground owing to the SuDS. No off-Site runoff is expected.

The runoff catchment area for the restored site (prefixed “R”) is shown in Figure 6.3.

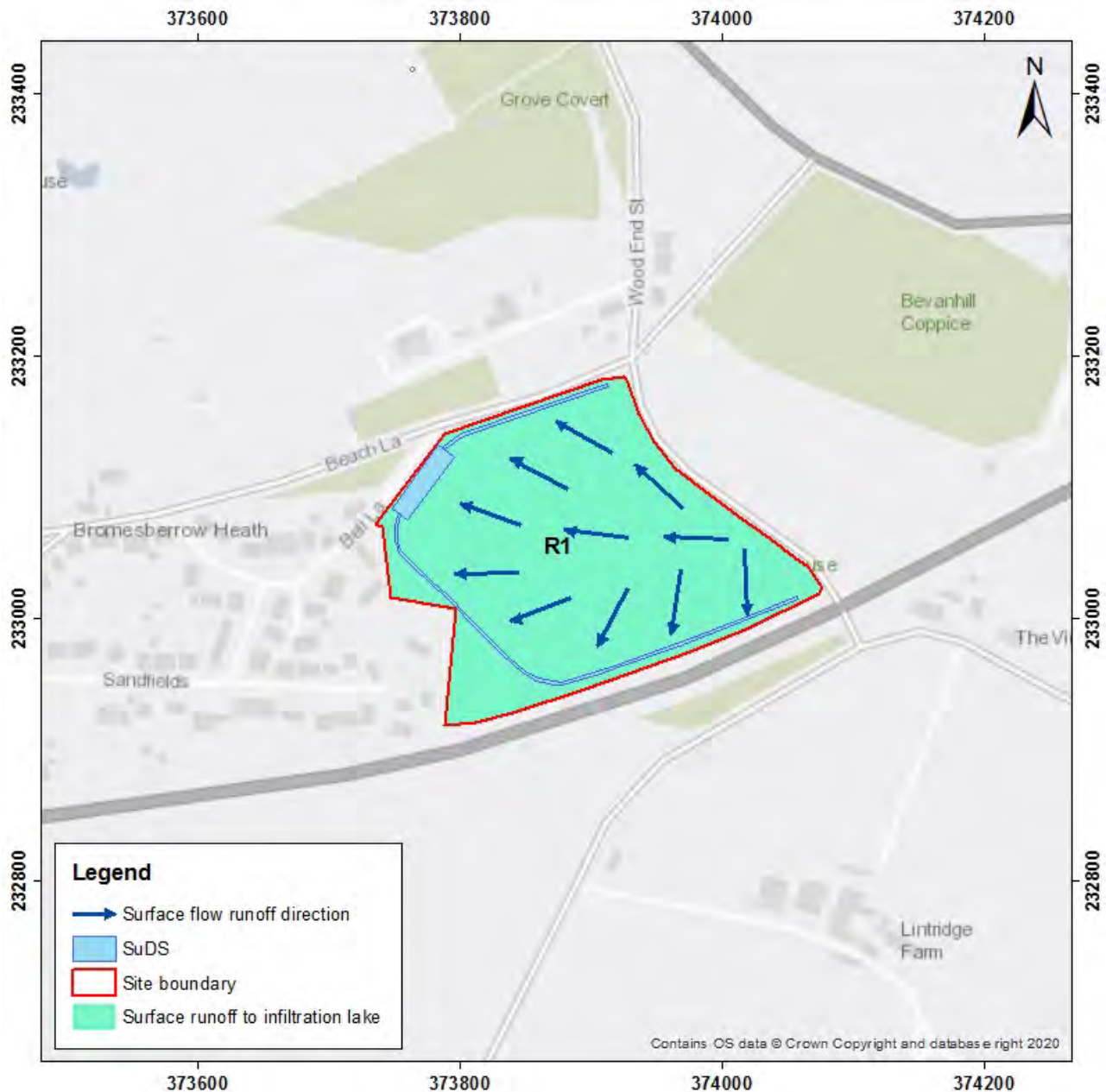


Figure 6.3 Surface water runoff catchment – Restoration phase

Summary

A summary has been provided below of the catchment areas over the lifetime of the development and post restoration. A prefix of “G”, “O” and “R” has been used to denote catchment areas within the greenfield, operational and restored phases of the development.

As evident from a review of Table 6.3, only one catchment will be formed for each phase of development. Nevertheless, surface water flow direction will change for each phase.

Table 6.3 Site catchment areas over time

Phase	Catchment	Area (ha)	Notes
Greenfield	G1	5.13	Catchment draining to the west.
Operational	O1	5.13	Catchment draining to the quarry void.
Restoration	R1	5.13	Catchment draining to the northwestern basin.

6.3.3 Predicted run-off - greenfield

Table 6.4 details the calculated greenfield runoff for catchment G1 for a 6-hour storm duration event. These are output data from loH124 method, with raw data included in Appendix B.

The DEFRA (2015) non-statutory guidance for SuDS design stipulates that the greenfield runoff rates and volumes for the 1 in 1-year and 1 in 100-year storm events should not be exceeded post development.

Table 6.4 Greenfield runoff

Event	6-hour rainfall (mm)	Site peak rate (l/s)	Total runoff volume (m ³)
1 in 1-year	21.6	7.59	332
1 in 30-year	50.3	17.14	774
1 in 100-year	66.03	22.95	1,016

6.3.4 Predicted run-off – operational & restored sites

The attenuation storage volume is the required storage to manage additional runoff caused by a development compared with the greenfield scenario.

Table 6.5 to Table 6.7 compare the predicted off-Site runoff for the operational and restored phases with the greenfield runoff for the 1 in 1-year, 1 in 30-year and 1 in 100-year, 6-hour storm event plus 10% (operational phase) and 40% (restoration phase) climate change allowances. Calculations are explained in Appendix B.

Operational phase

The SAAR and area variables used in the runoff calculations (Table 6.2) have been retained as per the greenfield calculations. A 10% increase in rainfall intensity was included to account for climate change, and the SPR was reduced to 0.1 in order to account for the increased permeability from sandstone material.

Restored phase

Surface runoff in the restoration phase will be directed to an infiltration basin in the northwest of the Site. Calculations to validate the capacity to manage all runoff under this phase are included in Section 8.3.

Table 6.5 Predicted future runoff (1 in 1-year event)

Catchment	Scenario	Peak runoff rate (l/s)	Change in rate (l/s)	Runoff volume (m ³)	Change in volume (m ³)
G1	Greenfield Runoff	7.59	N/A	332	N/A
O1	Operational inc. CC (10%)	0.77	-6.82	122	-210.54

Table 6.6 Predicted Predicted future runoff (1 in 30-year event)

Catchment	Scenario	Peak runoff rate (l/s)	Change in rate (l/s)	Runoff volume (m ³)	Change in volume (m ³)
G1	Greenfield Runoff	17.14	N/A	774	N/A
O1	Operational inc. CC (10%)	1.74	-15.40	284	-490

Table 6.7 Predicted Predicted future runoff (1 in 100-year event)

Catchment	Scenario	Peak runoff rate (l/s)	Change in rate (l/s)	Runoff volume (m ³)	Change in volume (m ³)
G1	Greenfield Runoff	22.95	N/A	1,016	N/A
O1	Operational inc. CC (10%)	2.33	-20.62	373	-644

The results above show that off-site runoff is expected to decrease over the operational phase, as expected, given the large increase in soil permeability (reduction of SPR).

6.4 Flood risk during operational phase

Given that off-site runoff rates and volumes are predicted to decline during the operational phase, for the reasons stated above, and the change in flow direction, there will be no increase in off-site flood risk over this time.

The introduction of the quarry void provides a significant reduction in off-site storm runoff rates and volumes. The performance of these features during storm events is assessed in Section 8.2.

6.5 Surface water runoff

The Site is located on 'brownfield', previously developed land; quarry operations have been ongoing at the Site since 1953. The addition of impermeable surfaces at the Site (such as access roads/ cabin rooftops) and infill material of lower permeability, will have the potential to increase runoff post development.

It is a requirement of the NPPF that runoff rates and volumes are not increased post development. A drainage strategy is required to manage rainfall run-off post development. This would limit off-site runoff rates and volumes and attenuate a degree of these on-site until a given storm has passed.

7 Flood risk considerations

7.1 Local policy

The Site lies within an 'Adopted MLP Mineral Safeguarded/Consultation Area' as defined explicitly in the Gloucestershire Minerals Local Plan (MLP) (Gloucestershire County Council, 2020).

7.2 Key considerations

To meet (or exceed) the NPPG requirements, '*Water compatible*' land use such as that proposed at the Site will be considered allowable for location within Flood Zone 1 provided it does not increase the volume and rate of surface water runoff leaving the Site over its intended design lifetime. This point is addressed in Section 8.

7.3 Climate change

Attenuation requirements for the Site's drainage strategy will need to include an allowance for climate change in the future rainfall intensities. This uplift has been included in the runoff and attenuation requirements calculations set out in Sections 6.3 and 8.3.

8 Drainage strategy

8.1 Performance requirements

Runoff rates and volumes from the Site under the greenfield and developed/operational scenarios have been calculated in Section 6.3, while the restored scenario runoff rates and volumes are calculated in Section 8.3 using a MicroDrainage model. These calculations are based on a six-hour storm duration and are appropriate for considering flood risk downstream since six hours has been found to be a typical duration that can cause fluvial flooding.

The total flow from the Site (sum of outflow from features included in the SuDS strategies and direct rainfall runoff) must not exceed the greenfield scenario runoff rates such that off-site flood risk would be increased. The SuDS features included in the scheme should operate adequately well under storm conditions such that on-site flood risk does not present a risk to site staff and visitors.

As discussed and quantified above, off-site runoff will reduce during the quarry operational phase (relative to greenfield runoff) as site material is excavated and the closed sub-catchment within the boundary is enlarged. Given the above, there are no specific requirements to provide additional attenuation capacity on Site. The quarry void itself will provide a great deal of stormwater attenuation capacity (quantified below).

After the restoration phase, surface runoff will be directed to an infiltration basin in the northwest of the Site, where infiltration to the aquifer will be encouraged and the storage capacity would avoid the majority of the off-Site runoff.

8.2 Operational phase

8.2.1 Proposed drainage strategy – operational phase

It is proposed that water (rainfall runoff) will be allowed to infiltrate in the active quarry void during each operational phase (Phases 1 to 6), allowing settlement to occur before infiltrating to ground. There will be no dewatering occurring over the lifespan of the quarry.

The 1 in 100-year storm event for a 6hr duration in greenfield conditions requires a total runoff volume of 1,016 m³, well below the total volume of the quarry void. A void significantly larger than this volume will remain until the restoration reaches its final stage, and by this point the restoration SuDS will have been installed, as described in Section 8.3.

8.2.2 Residual flood risk

The calculations above demonstrate that the quarry void can easily store stormwater runoff prior to infiltration. On-Site flood risk will therefore be negligible over the operational phase. Off-Site runoff will be reduced relative to the greenfield scenario, and the development will provide betterment with regards to off-Site flood risk.

8.2.3 Water quality

There is no prospect of runoff leaving the main part of the Site during the operational phase, as discussed above, and therefore no potential for impact on surface water quality outside the Site.

The faces of perimeter bunds will be seeded with grass to prevent erosion and minimise sediment transportation.

8.3 Restoration phase

8.3.1 Proposed drainage strategy – restored phase

An illustrative design is shown in Figure 8.1, which provides an outline strategy for management of surface water at the Site post-restoration. The restored Site will eventually be covered with imported inert material to have an agricultural or amenity use.

Much of the Site will drain to the new SuDS features within the Site boundary (see Section 6.3.2). Infiltration to ground is unlikely to be feasible in the filled areas given the likely low permeability of the restoration material; however, flow control features will allow discharge to drainage trenches along the northern, western and southern boundaries of the Site. These will be trapezoidal section channels, around 0.2 m deep by 0.2 m wide. The infiltration basin will be positioned in the northwest of the Site, outside of the fill area, to attenuate and discharge runoff from the Site to the ground. The final location of the infiltration lake will need to be reassessed during the restoration phase to have it sit wholly on undeveloped land.

In-situ soakaway testing is recommended in due course to validate the water balance calculations undertaken in this assessment. This can be undertaken as part of the detailed drainage design work.

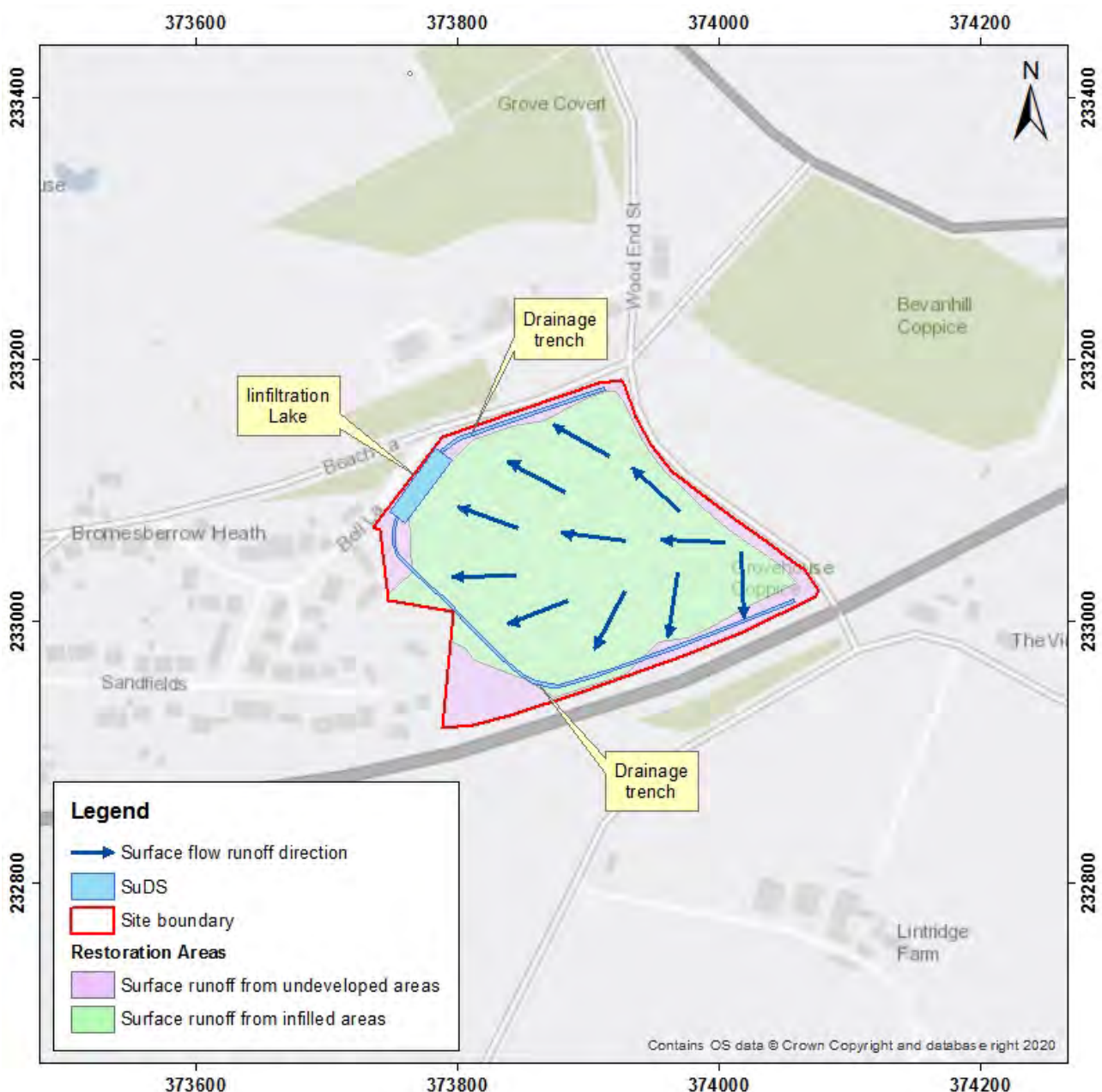


Figure 8.1 Proposed drainage strategy (restored phase)

8.3.2 Performance calculations

A MicroDrainage model has been created to represent the features in the restored site SuDS scheme. The methodology and results are presented below. A model was created for the SuDS features.

Geometry

The geometry of the proposed SuDS features and other pertinent information used in the MicroDrainage calculations is summarised in Table 8.1. The drainage trenches have been modelled as fairly level single features for simplicity at this stage.

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Report Status: Final

Inflows

The RefH method was used via the MicroDrainage additional hydrograph module to generate storm hydrographs restored catchments under the 1 in 100-year event for a range of storm durations including a 40% uplift in rainfall intensity for climate change. Simulations were run for storm durations from 15 minutes to 10,080 minutes.

The BFI value used in the runoff calculations was reduced using a weighted mean approach using the 0.854 value for the undeveloped part of the catchment and a value of 0.518 for the restored part of the catchment as per the operational phase calculations. The utilised BFI value is included in Table 8.1.

Using the IoH124 method for the Restored Site, a Peak Site runoff rate of 60 l/s is expected for a 100-year return period. To account for climate change, a 40% increase was included, and the final SPR value for the catchments was achieved using a weighted mean approach using a 0.3 value for the undeveloped part of the catchment and a value of 0.472 for the restored part of the catchment, resulting in a SPR of 0.4.

A trench of dimensions 0.2 m x 0.2 m will be able to conduct a flow of 102 l/s, which should provide an ample margin for runoff from the Site. See Flow in Open Channel calculation in Appendix C.

Infiltration

An infiltration coefficient of 1 m/hr has been applied for the weathered sandstone, in line with industry standard values (Innovyze, 2021). This was applied to the walls and bed of the infiltration basin.

Results

The MicroDrainage results for this scenario are presented in Appendix C and have been summarised in Table 8.2. The storage volume calculated is above the storage volume required for a 1 in 100-year storm event for a 6hr duration in greenfields conditions. Moreover, the maximum volume required for a 100-year return period, including a 40% increase due to climate change, is 800 m³ for a 120-minute storm event, as shown in the MicroDrainage calculations in Appendix C.

Table 8.1 Dimensions of principal SUDS features (Restored phase).

Feature(s)	Catchment area (ha)	BFI*	Bank elevation (m AOD)	Feature invert level (m AOD)	Feature Depth (m)	Area of base (m ²)	Surface area at bank (m ²)	Storage volume (m ³)	Outfall
SuDS infiltration basin	5.13	0.66	50	47	3	200	905.7	1531.3	None

* Calculated using weighted mean approach

Table 8.2 Performance of restored phase SuDS features under a 1 in 100-year + 40% storm event.

Feature/catchment	Critical duration (mins)	Max. water level (m AOD)	Min. freeboard remaining (m)	Half drain times (min)
SuDS infiltration basin	120	49.04	0.96	c.52

8.3.3 Exceedance flows

In the rare event that the capacity of the SuDS features described here are exceeded, exceedance flows would be to the northwest, as per the new runoff regime after restoration with the drainage trench around the Site. This is illustrated in Figure 8.2.

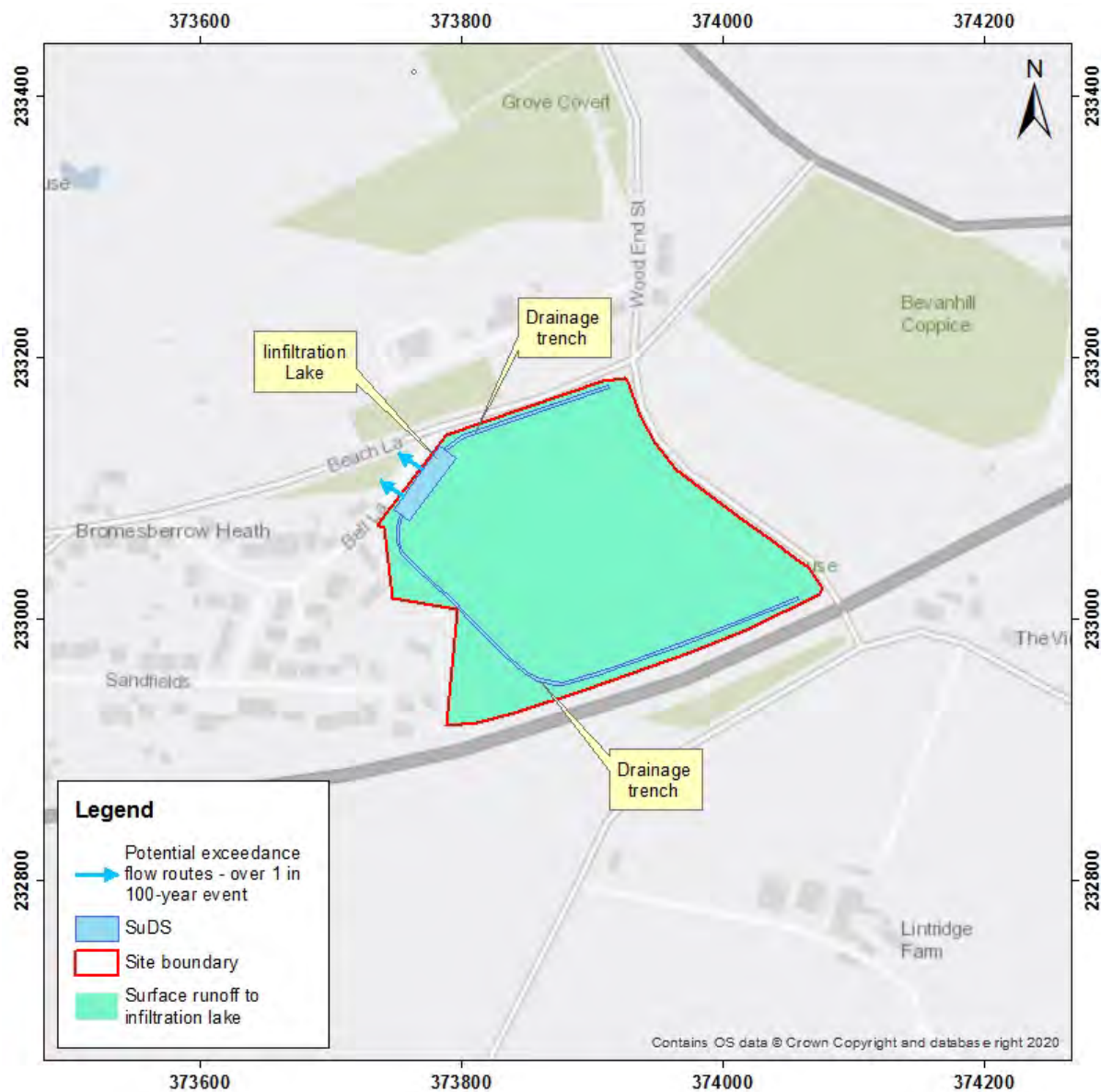


Figure 8.2 Potential exceedance flow routes

8.3.4 Residual flood risk

The residual flood risk is that remaining after taking into consideration the measures set out in the SuDS scheme. The performance calculations for the SuDS features demonstrate that they would be capable of attenuating all incoming runoff from a 1 in 100-year plus 40% storm event without surcharging water off-site. Off-site runoff would therefore be limited to the residual areas around the SuDS features – this area is far smaller in extent and would result in a large net reduction in runoff rates and off-Site flood risk.

8.3.5 Water quality

Post-restoration there will be no pollution sources at the Site, on the basis of strict waste acceptance criteria for the restoration material and attenuation layers, if required. Therefore there should be no risk posed by the Site for water quality deterioration. The SuDS features included in the restoration phase SuDS scheme (see below) are largely for water quantity management as well as biodiversity and amenity benefits, although they do offer this potential for water quality control.

The SuDS features will mitigate any potential sediment load within any off-Site runoff. Removal indices are included in the brackets adjacent to each feature type as follows.

- Ponds (0.7), and
- Drainage trenches (0.4).

A combination of one or more drainage trenches and an infiltration basin have been included in the restored Site SuDS strategy which will provide some water treatment functionality to the restored Site.

8.4 Flood risk post-restoration

Based upon the calculations undertaken in this assessment, the restoration of the Site has the potential to increase runoff relative to the greenfield scenario. This effect is mitigated by the restoration phase SuDS strategy included in Section 8.3.

8.5 Maintenance

8.5.1 Plan details – operational phase

The drainage strategy for the operational Site is simple and does not include many complicated features because the quarry works remain above groundwater level. As such, the maintenance requirements for the Site will be low, and runoff water will be the only source of water in the quarry void. The geometry of the quarry void and the position of the lowest point, to which internal runoff will drain, will be changing throughout the operational phase of the development. Drainage towards the lowest point will be managed as per the normal good management techniques for a sand quarry site, and the runoff will continue to infiltrate the floor of the quarry, as it does at present.

8.5.2 Contact information

The Site Manager will be responsible for the SuDS scheme. Contact details for the Site Manager are provided in the Site Operating Plan (SOP) (Stantec, 2024c).

8.5.3 Plan details - post restoration

The proposed requirements for the scheme are set out below for the restored Site SuDS features:

Ponds & infiltration basin

- inspect and clear out - quarterly;
- vegetation management - quarterly; and

- remove sediment from bed - annually or every three years.

Drainage trenches require negligible maintenance once installed. An annual inspection to ensure the top of the feature is not becoming covered with debris should be undertaken.

An easement around the features will be maintained to allow access for maintenance. Invasive maintenance work such as vegetation removal would only be required intermittently, but it should be sympathetic to the requirements of wildlife.

8.6 Biodiversity and amenity

The restoration scheme presents an opportunity to enhance habitat for wildlife on Site, with the aim of improving biodiversity in the vicinity. Pools and infiltration basins are landscape assets that have amenity value and improve the aesthetics more than conventional drainage systems. Ecological diversity will be maximised through the restoration strategy for creating a range of habitat types.

9 Conclusions

Allstone is proposing to extract sand from the Bromsberrow North Sandpit, 5 km southeast of Ledbury, Gloucestershire. The Site would be progressively worked and restored by inert landfill under an EP back to levels comparable with the current topography, and used for agricultural or amenity purposes. The Site would be worked above the groundwater level, with no dewatering employed.

Quarrying has been ongoing at the Site since 1953 and Allstone is currently undertaking a Review of Old Mineral Permissions (ROMP) to allow works to continue with new planning conditions which meet modern environmental standards.

Stantec has reviewed the potential flood risk to the Site and from the proposed development to neighbouring receptors. The Site lies within Flood Zone 1 and is therefore not at risk of flooding from rivers or the sea. Sand extraction is considered to be a water-compatible land use and the proposed development is therefore appropriate for this location with no Exception Test required.

The risk of surface water flooding for the Site is expected to be low. Areas of surface water flooding within the Site are created in the large depression of the quarry void; however, the high permeability of the sandstone will permit infiltration and reduce the risk of surface water flooding.

The Site is not at risk of flooding as a result of reservoir failure and the risk of groundwater flooding in the area is low.

A drainage scheme has been proposed for the operational phase of the quarry, where the quarry void provides a very large stormwater attenuation capacity. Attenuated water will be discharged to ground.

Following restoration, runoff will attenuate in newly formed SuDS features (infiltration basin and drainage trenches) located in the northwest of the Site. From the basin, water would infiltrate to the sandstone aquifer (in an area where no infill material has been deposited). Discharge to ground from the infiltration basin will be via the bank and base of the features directly. Calculated off-Site discharge (runoff and discharge from SuDS features) is well below the calculated greenfield rates and volumes with all SuDS features able to attenuate and discharge receiving runoff to ground. This illustrates that the SuDS schemes would provide some betterment with regards to off-site flood risk. Further in-situ soakaway testing is recommended in due course to validate the water balance calculation undertaken in this assessment.

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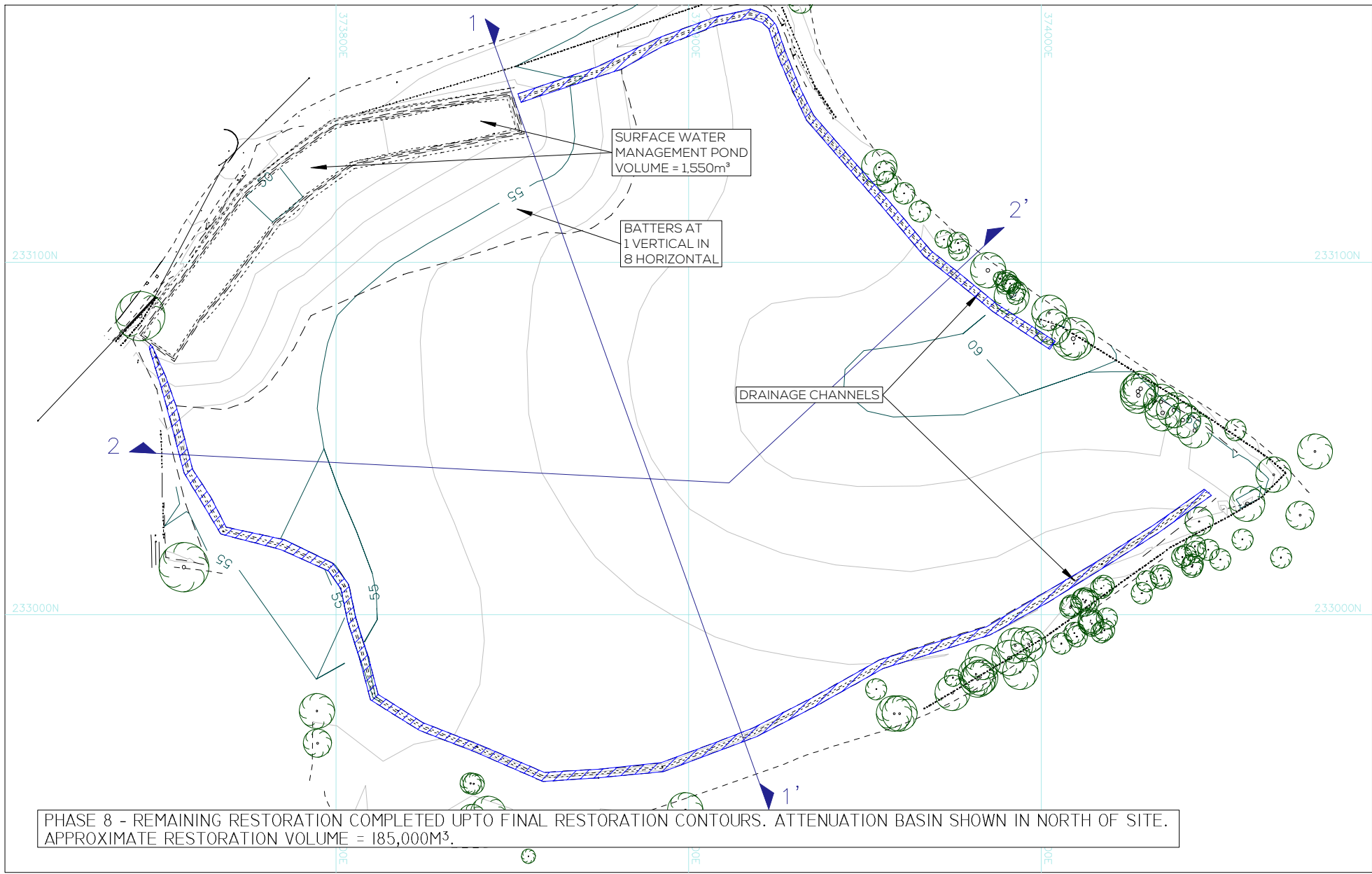
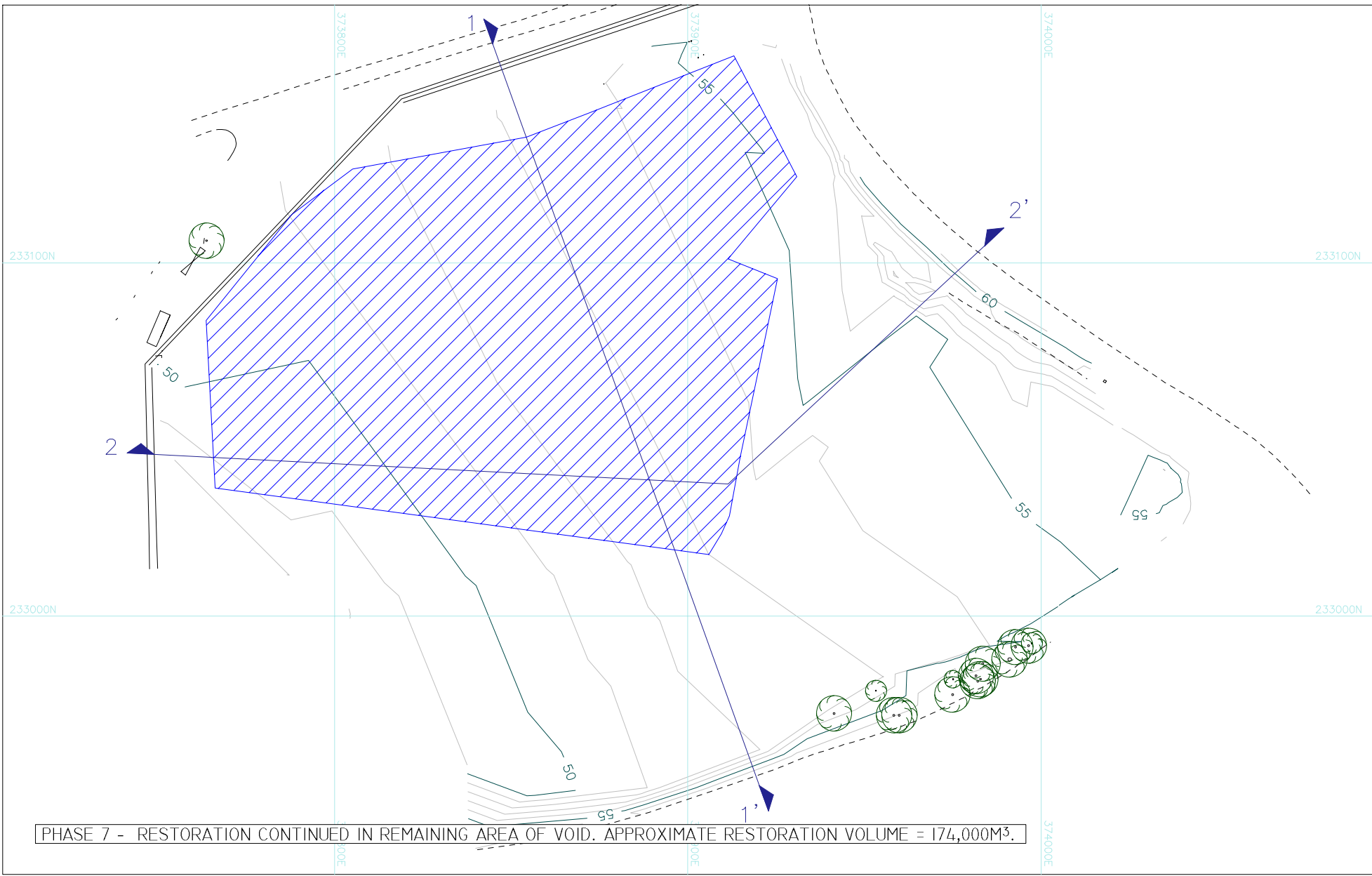
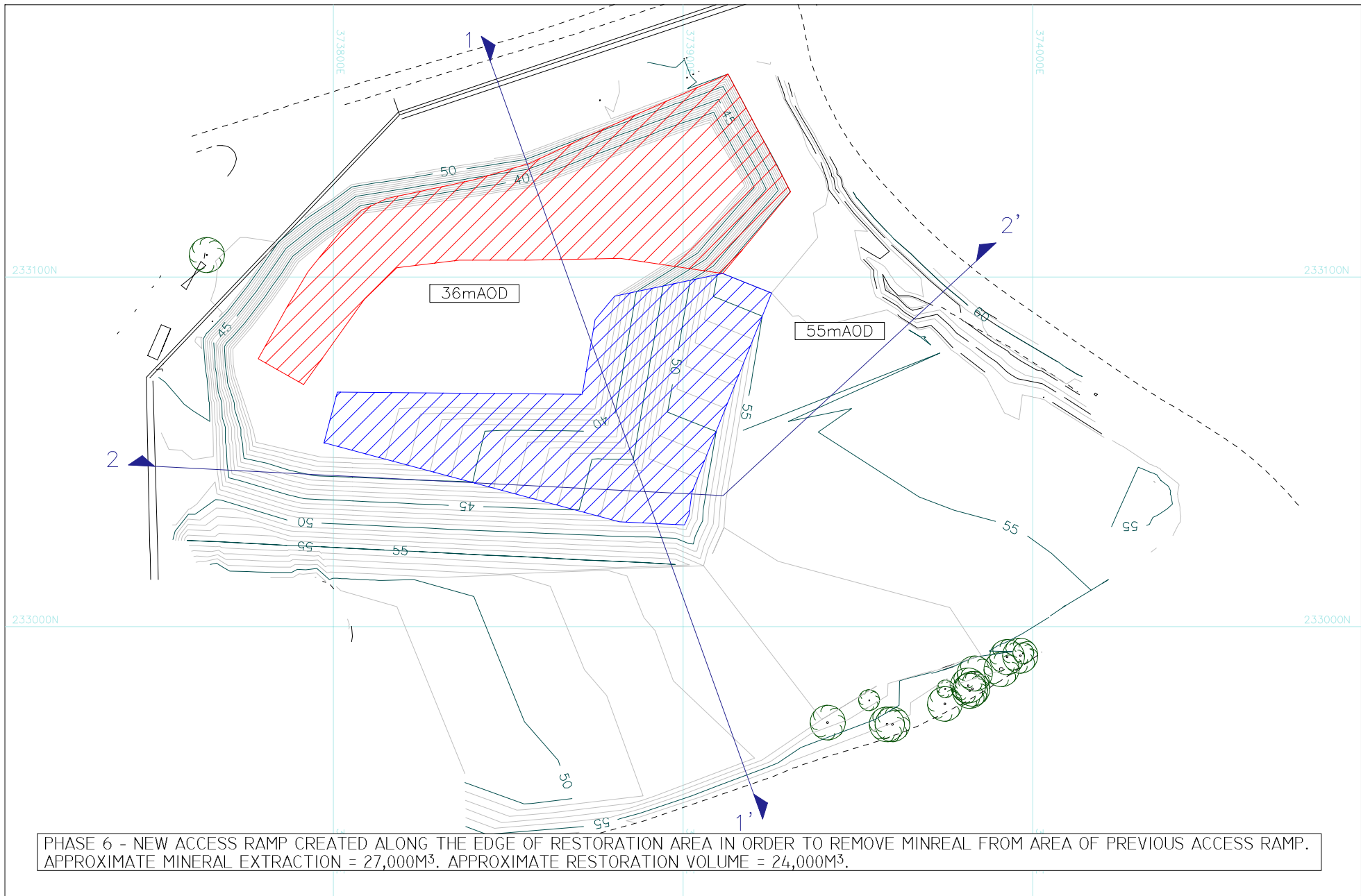
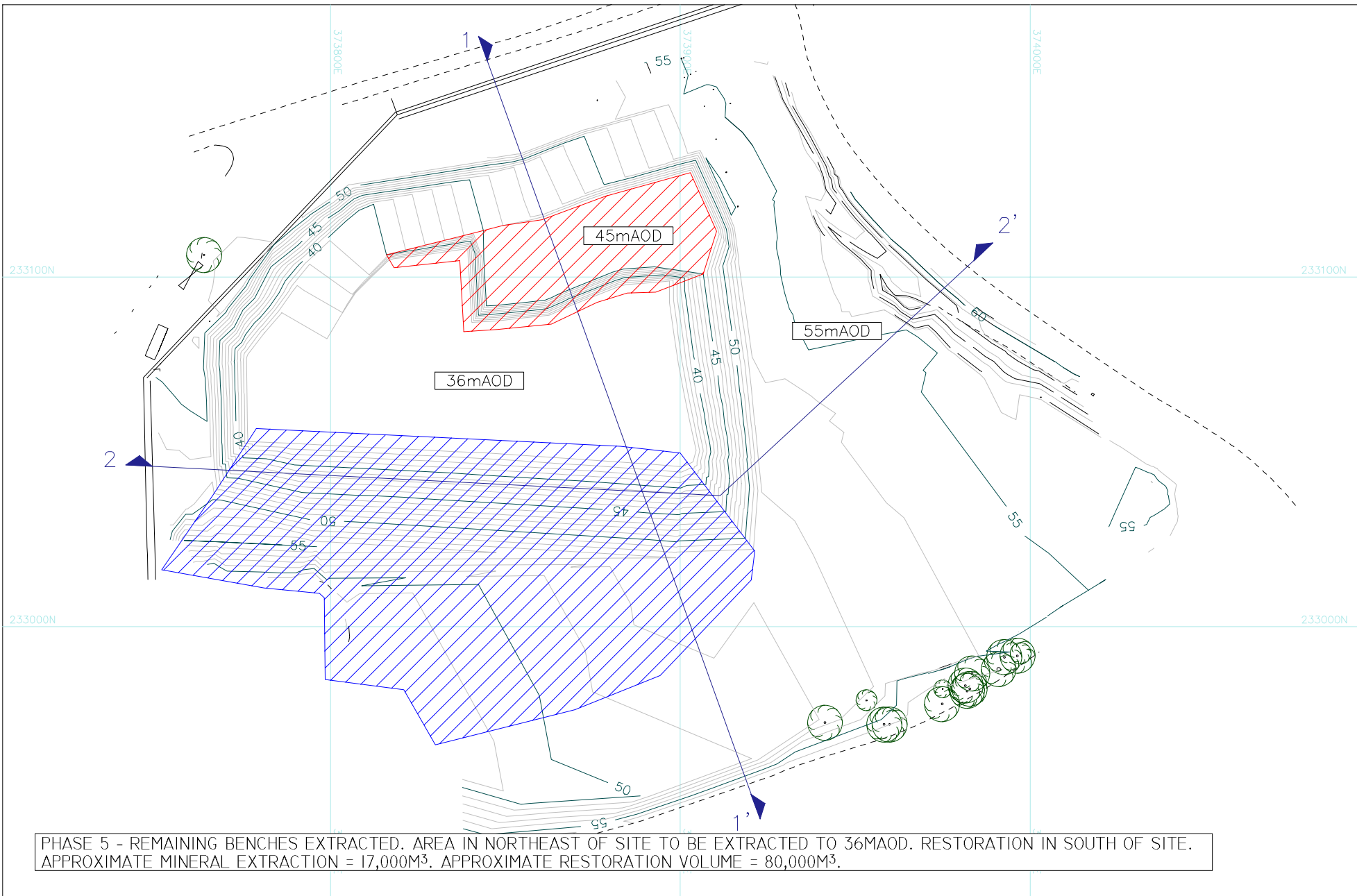
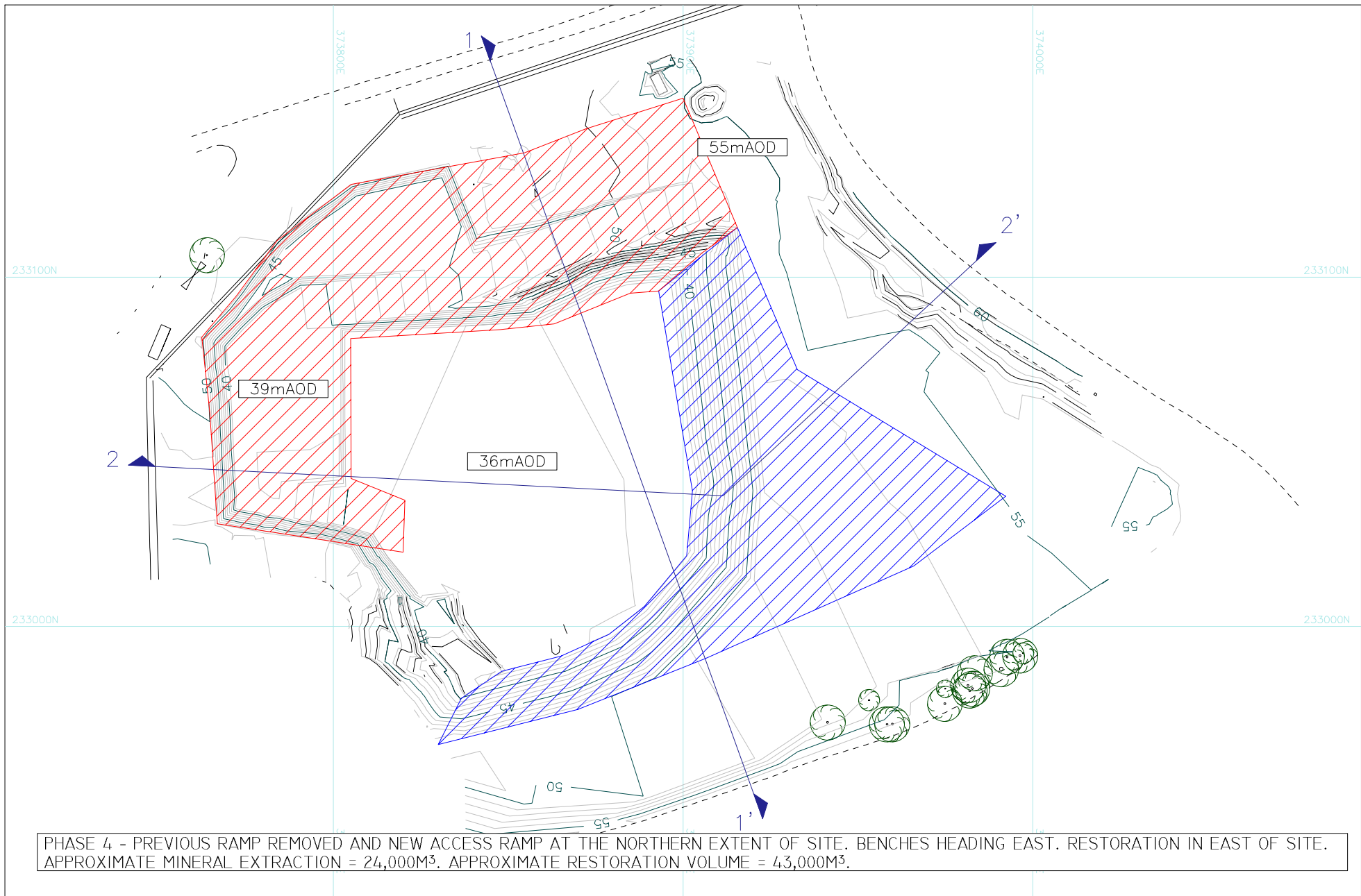
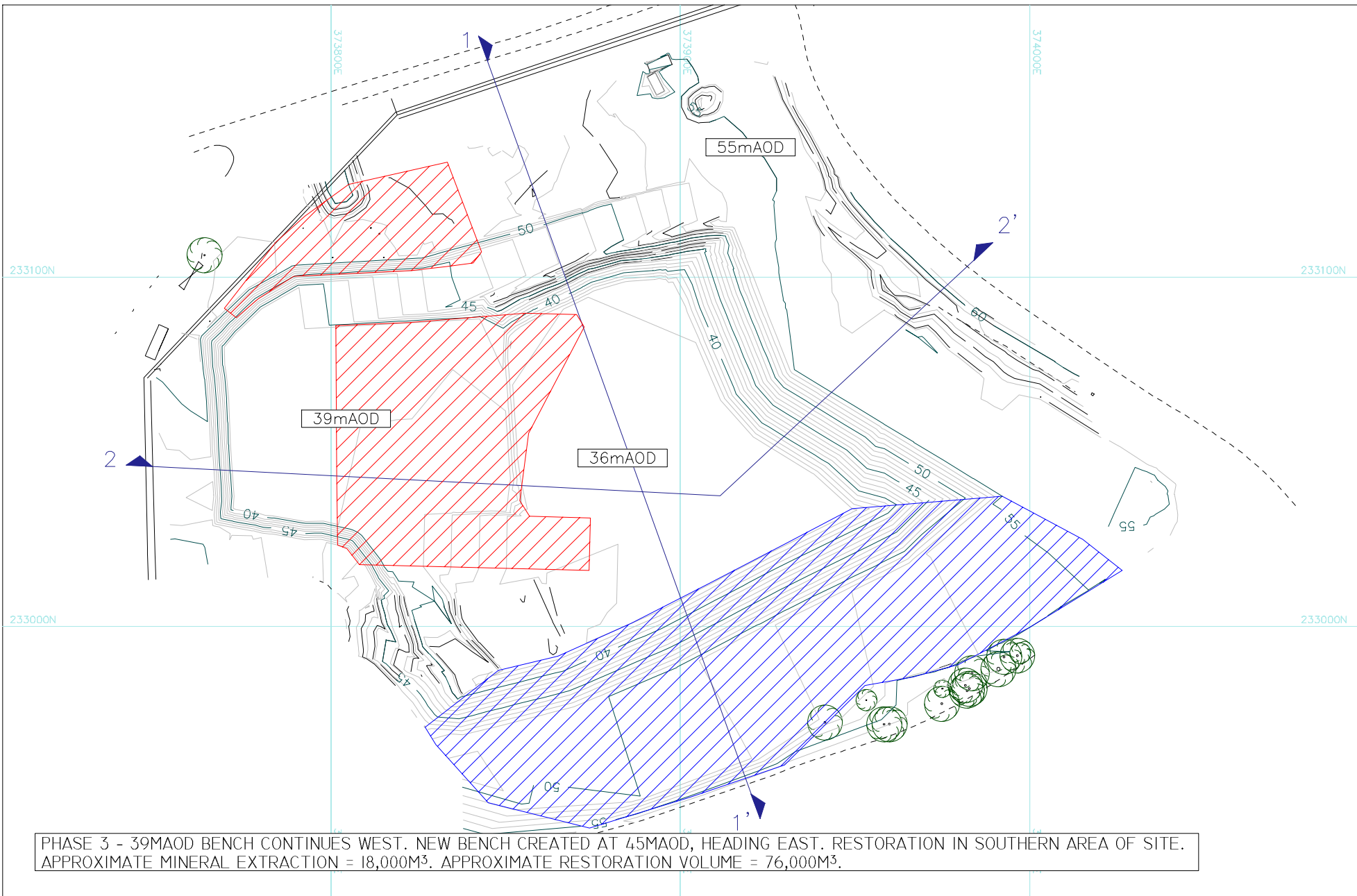
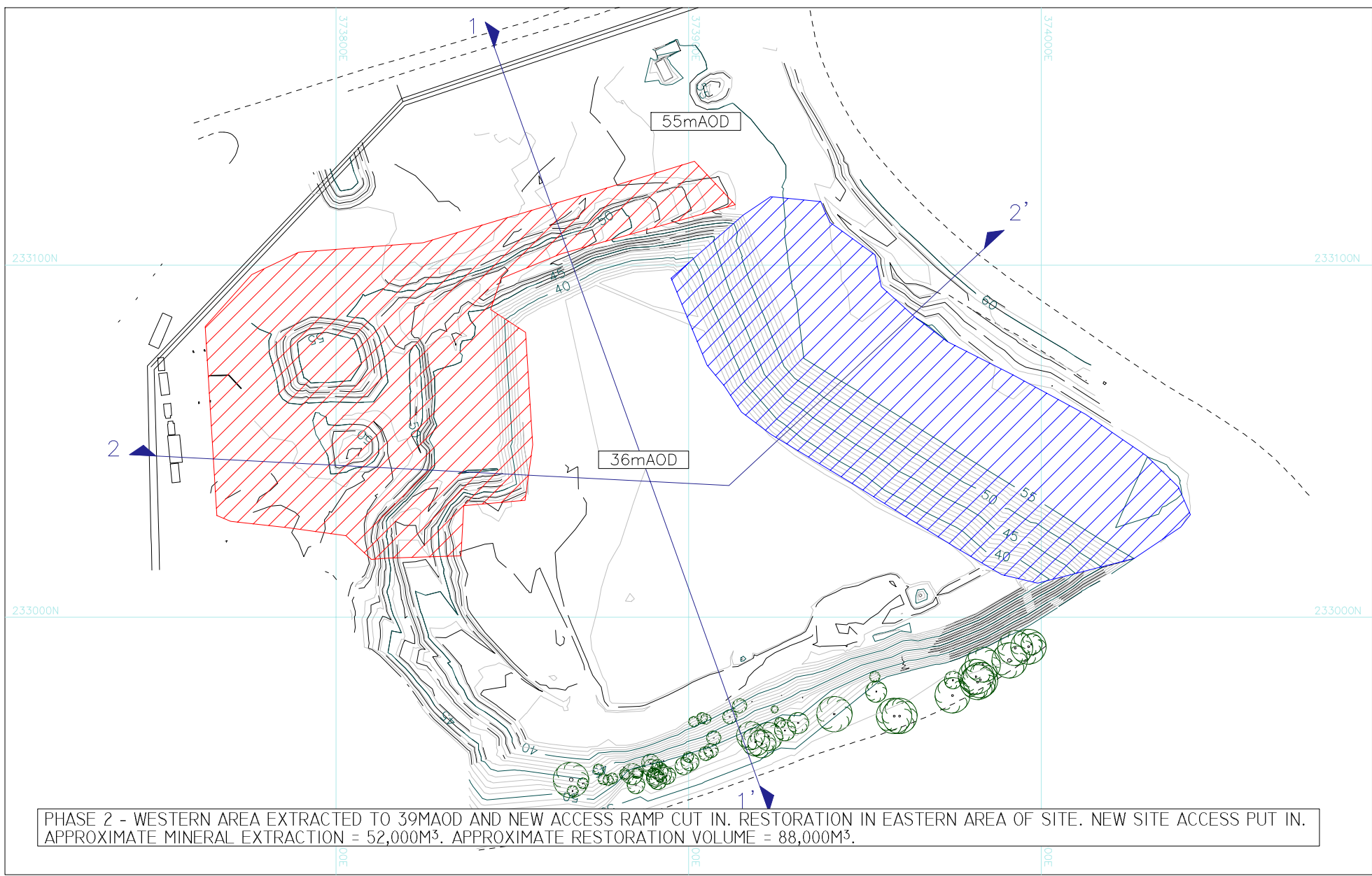
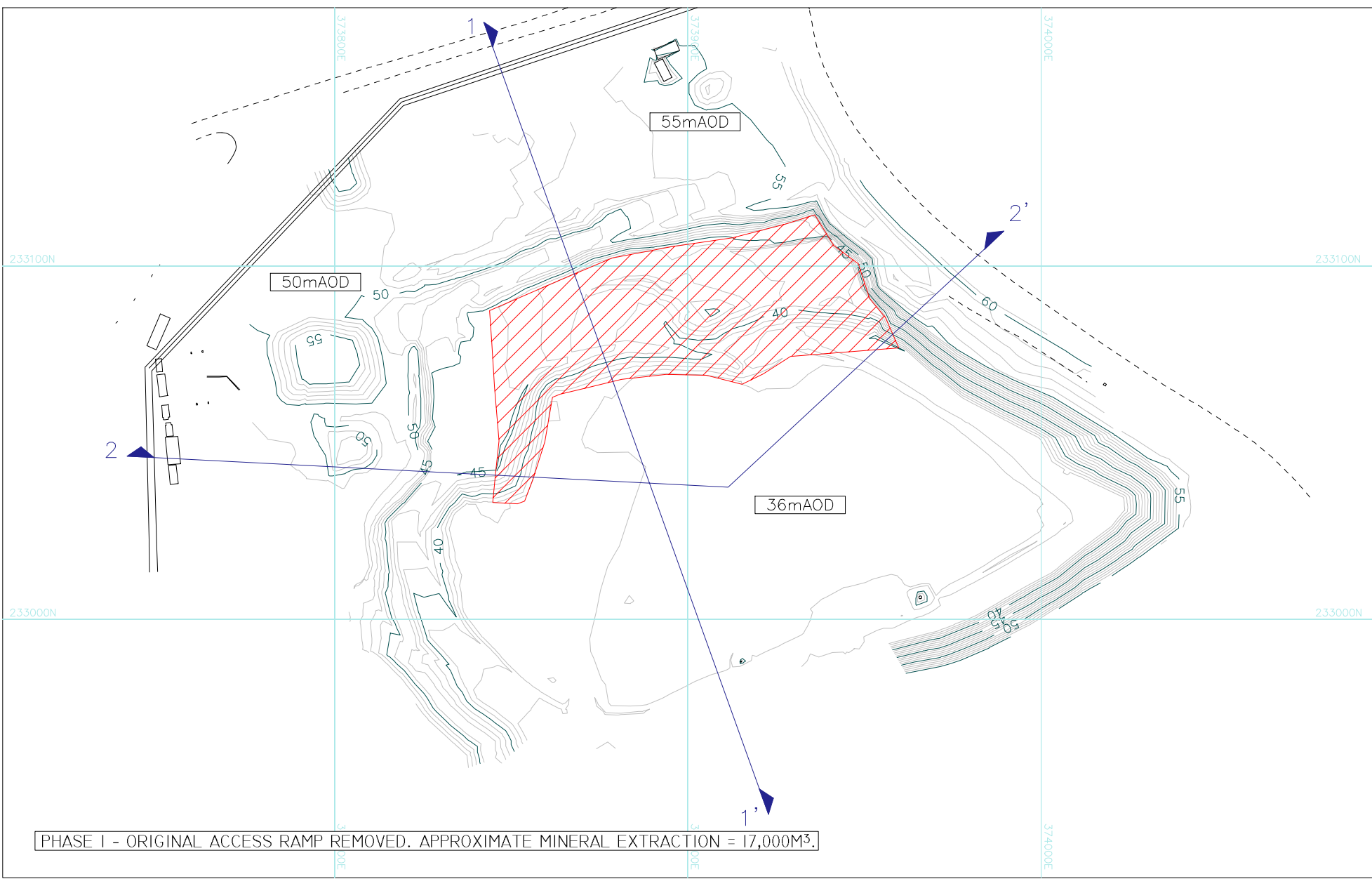
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Report Status: Final

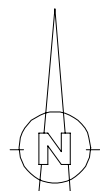
APPENDICES

Appendix A

Phased Mineral Extraction and Restoration Details



- NOTES
- AREAS OF MINERAL TO BE EXTRACTED ON A PHASED BASIS
 - AREAS OF RESTORATION TO BE PROGRESSED ON A PHASED BASIS



02	SURFACE WATER POND UPDATE	RB	30/11/23
01	FIRST ISSUE	RB	08/08/23
REV.	REVISION DETAIL	DRAWN	DATE

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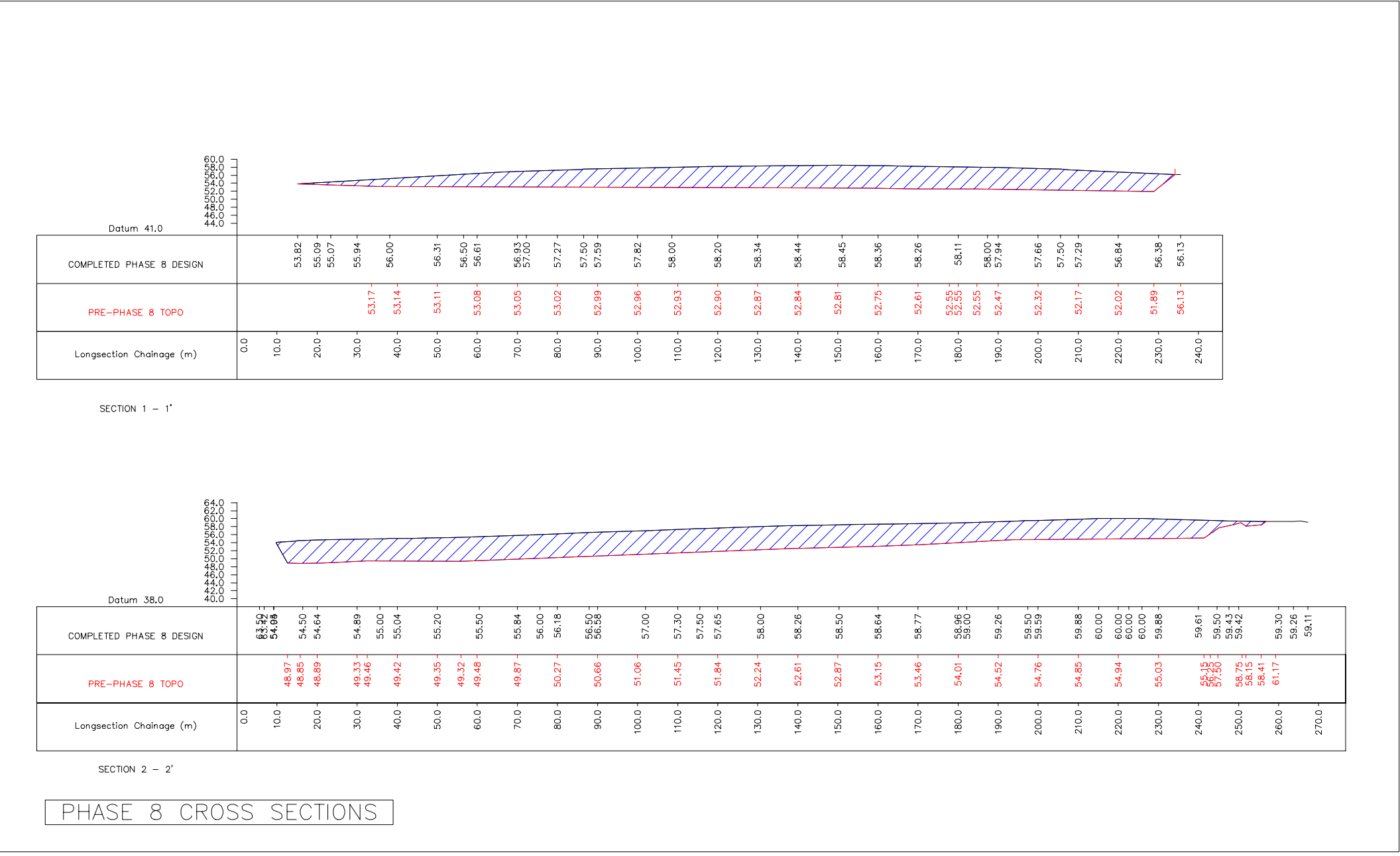
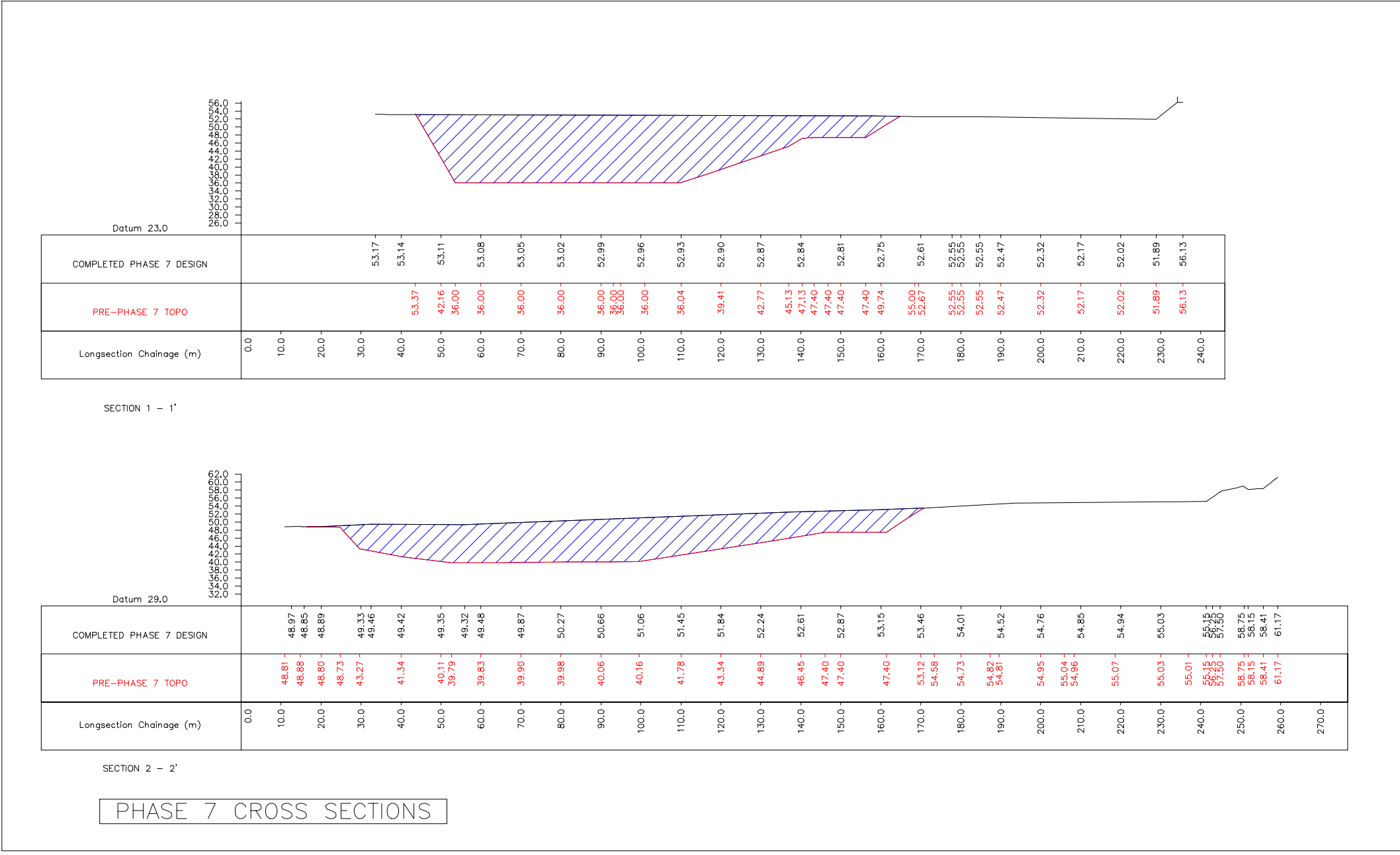
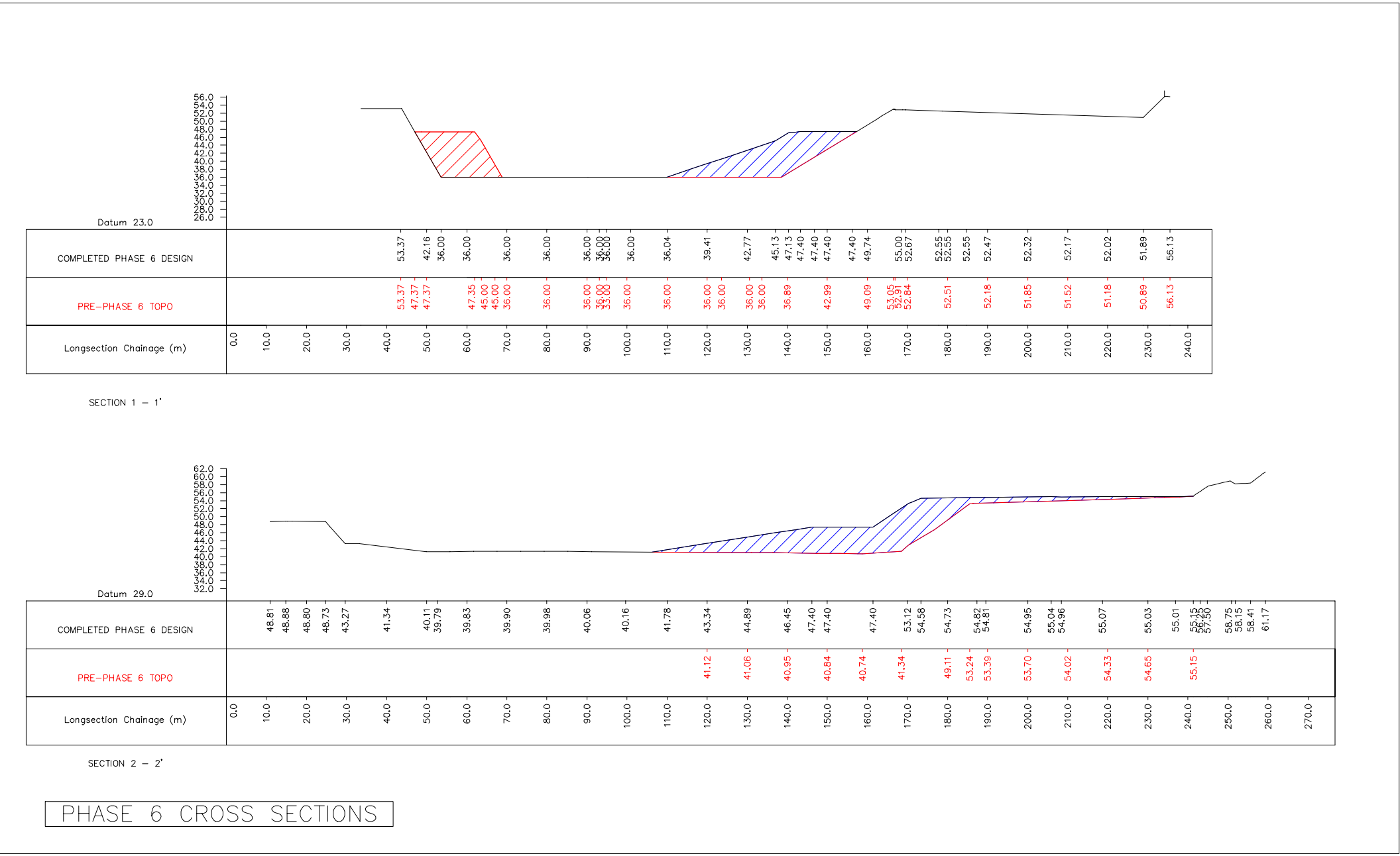
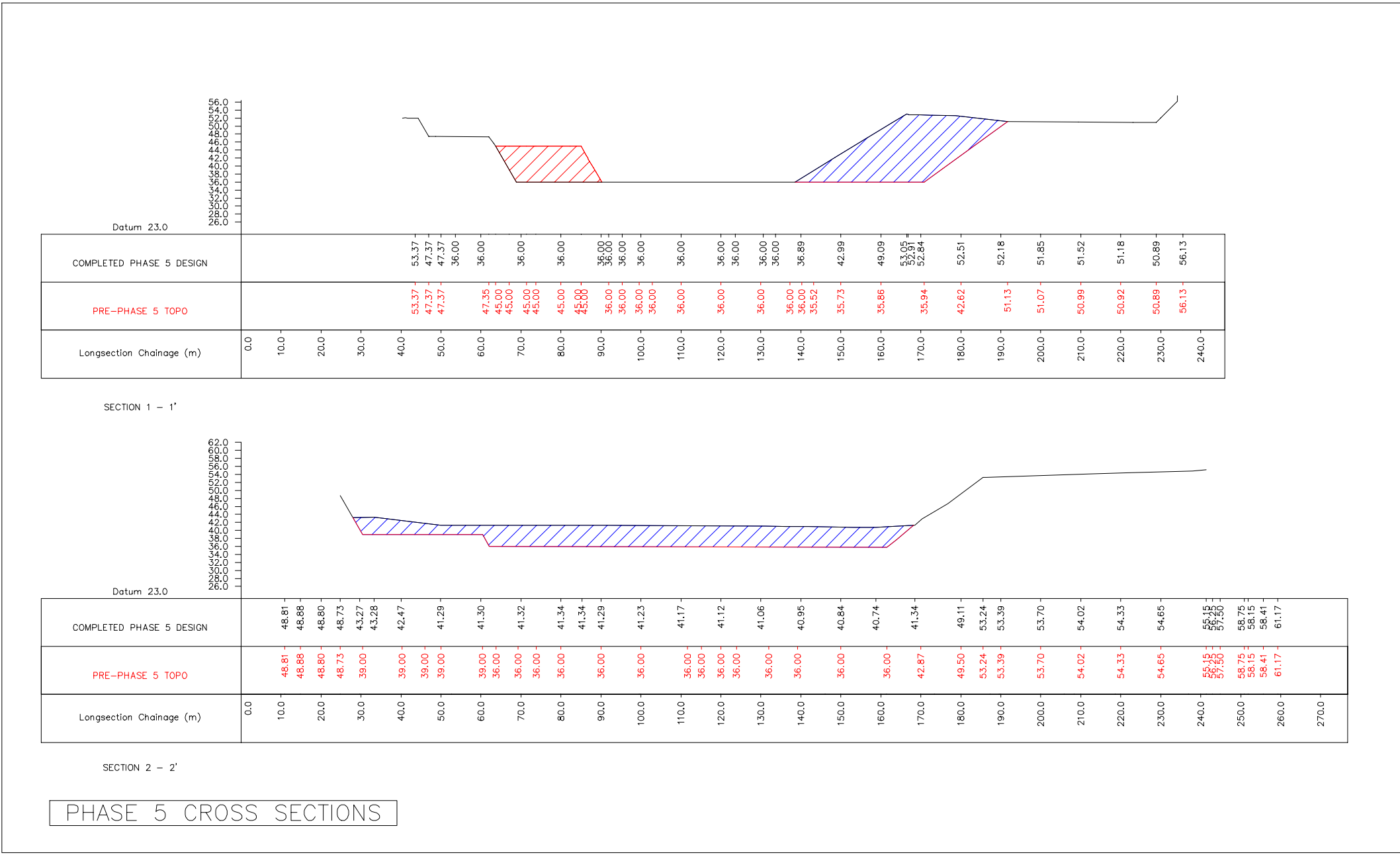
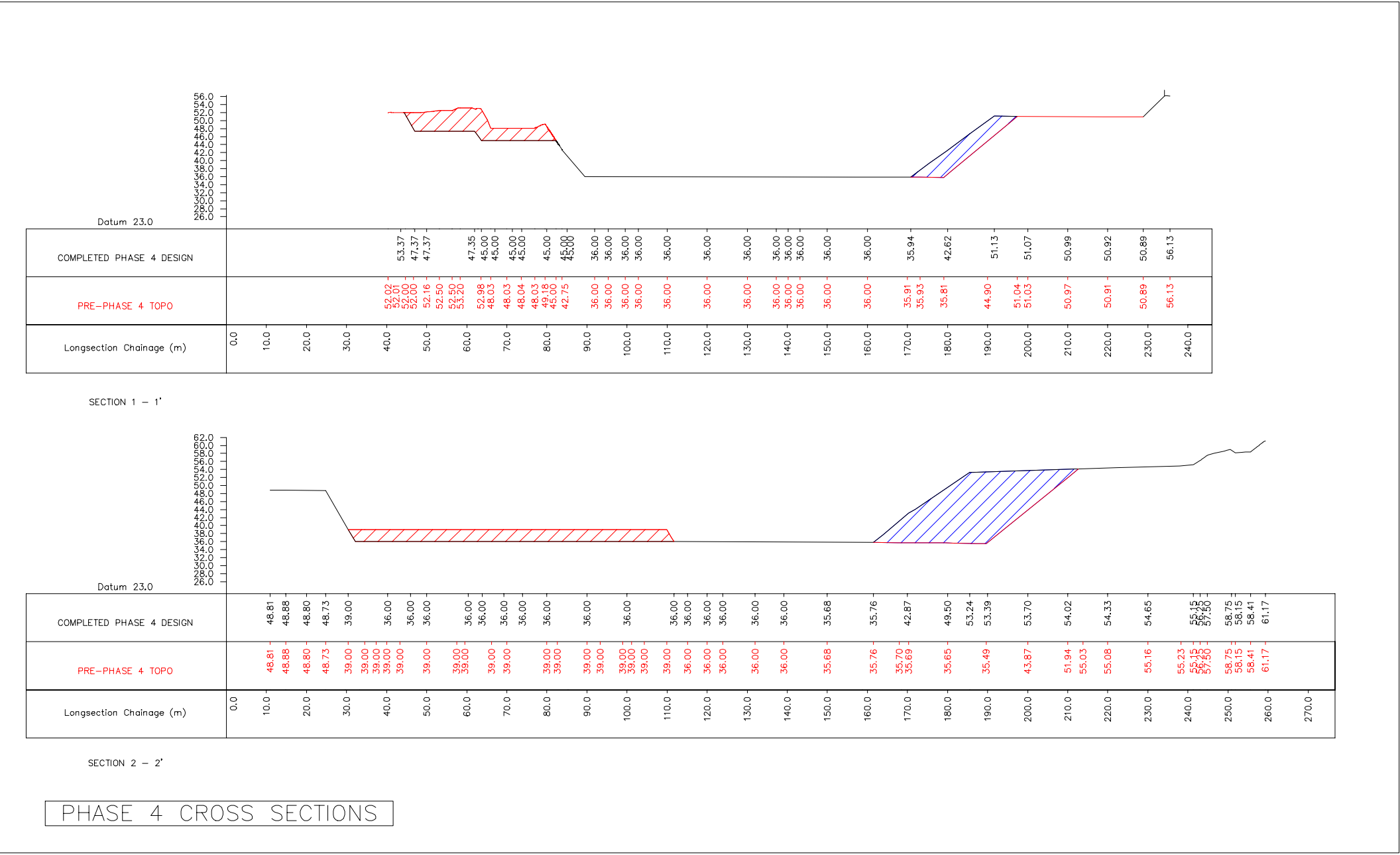
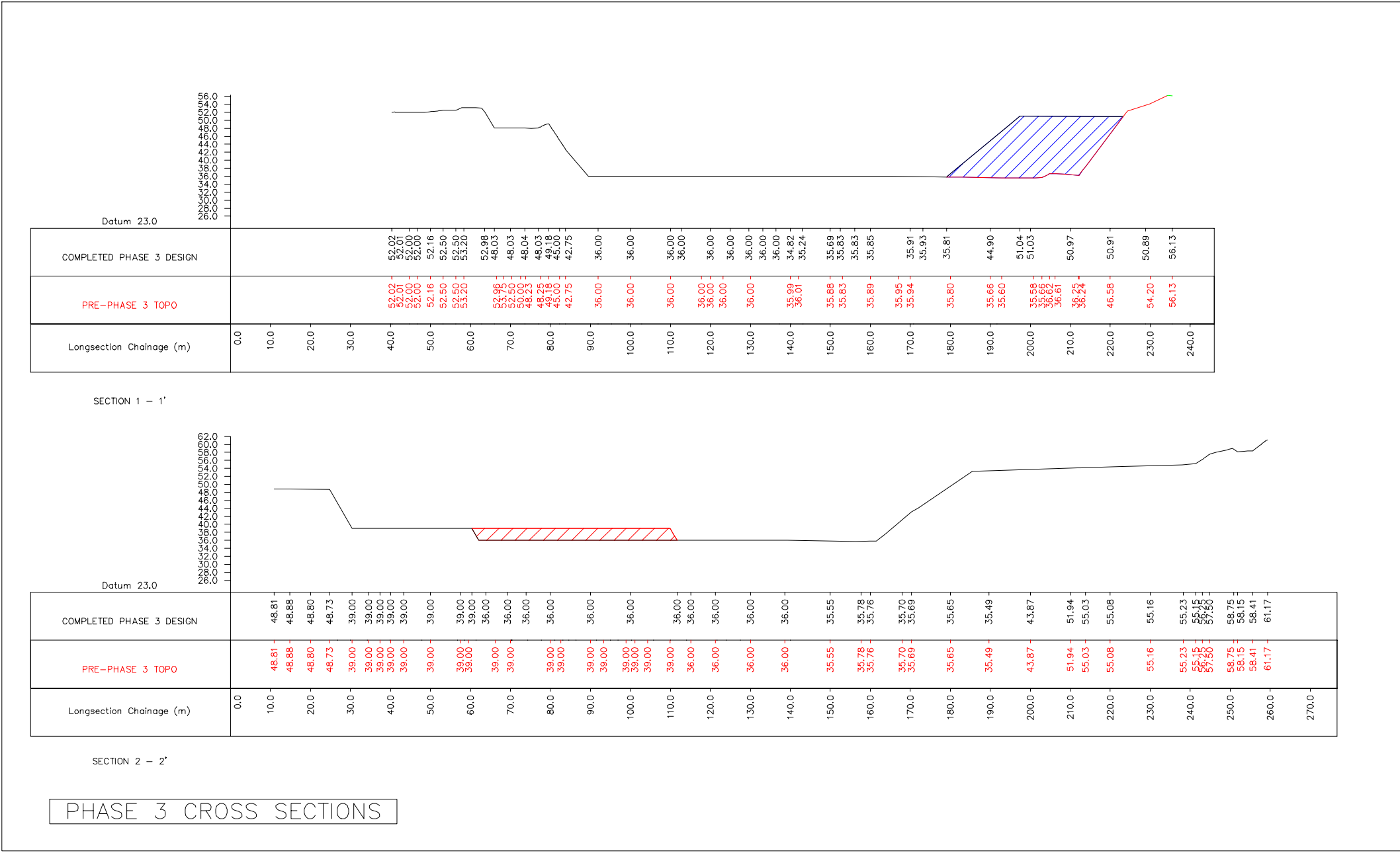
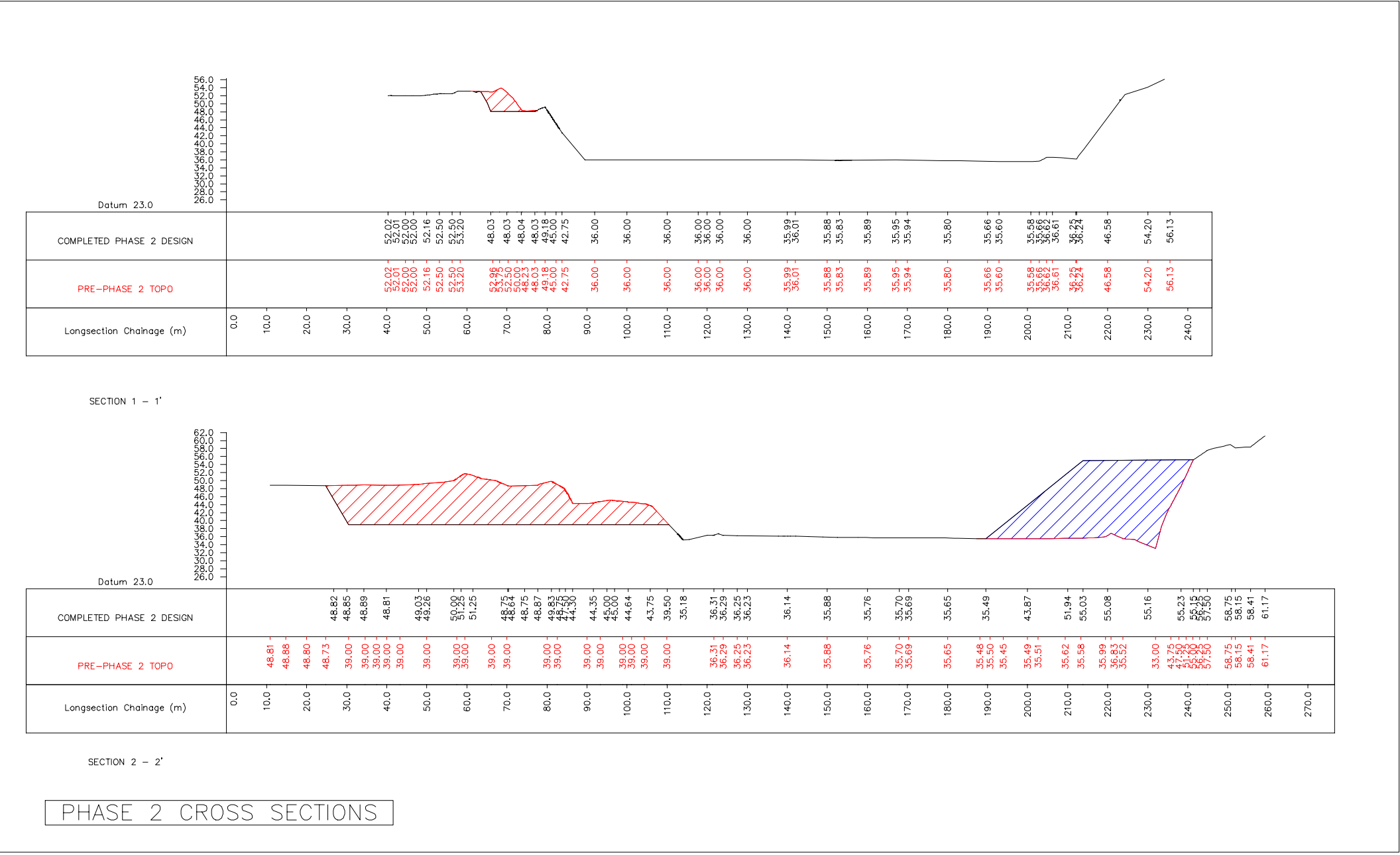
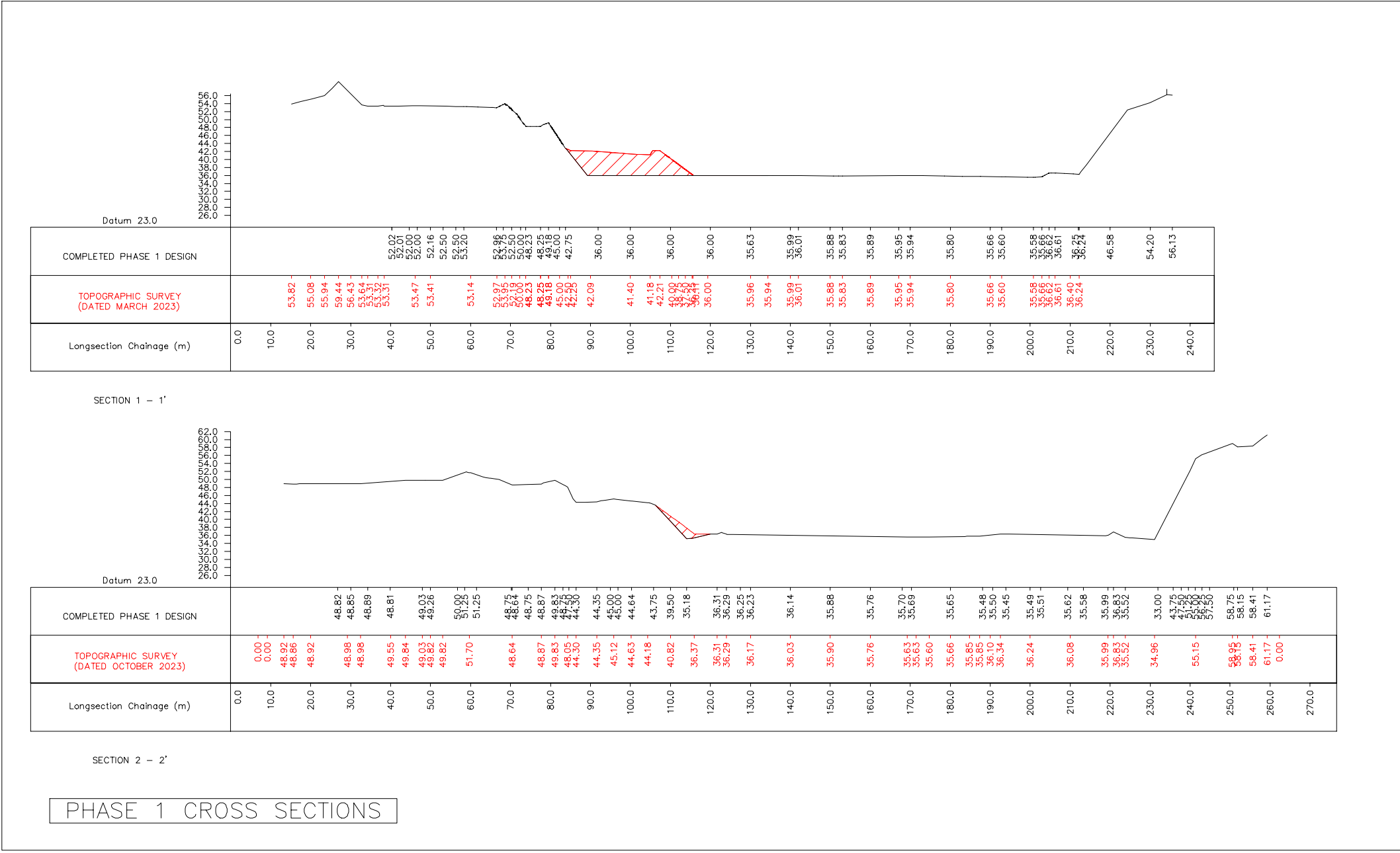
TITLE:

UPDATED QUARRY
DEVELOPMENT PLAN -
FLOOR AT 36mAOD

DRAWN: RB
SCALE: 1:1500
CHECKED: BD
ORIGINAL SHEET SIZE: AI
DATE: AUG '23
STATUS: FINAL

DRAWING NO. 7873-005-D-002

REVISION:
02



NOTES

AREAS OF MINERAL TO BE EXTRACTED ON A PHASED BASIS

AREAS OF RESTORATION TO BE PROGRESSED ON A PHASED BASIS

03 SURFACE WATER POND UPDATE RB 30/11/23

02 TOPOGRAPHIC SURVEYS UPDATED RB 07/11/23

01 FIRST ISSUE RB 09/08/23

REV. REVISION DETAIL DRAWN DATE

CLIENT:

ALLSTONE SANDS
GRAVELS AGGREGATES
TRADING CO. LTD

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PROJECT:

BROMSBORROW QUARRY

TITLE:

UPDATED QUARRY
DEVELOPMENT PLAN - FLOOR
AT 36MAOD CROSS SECTIONS

DRAWN: RB CHECKED: BD DATE: NOV '23

SCALE: 1:1250 ORIGINAL SHEET SIZE: AI STATUS: FINAL

DRAWING NO. 7873-005-D-004

REVISION: 03

Appendix B

loH124 method for surface runoff calculations

	Project:	331201147		By:	
	Calculation:	Manning Formula - Flow in Open Channel		JFR	
	Sheet Number:	1	Date:	Sep-21	Approved:

Shape of Channel	Trapezoidal	
Dimensions		
Width (W)	0.2	m
Depth (D)	0.2	m
Side Slopes (G)	100	%

Hydraulic Gradient (S)	3	%
Roughness Coefficient (n)	0.03	

$$Q = \left\{ \frac{1}{n} + \left(\frac{A}{P} \right)^{2/3} + S^{1/2} \right\} A$$

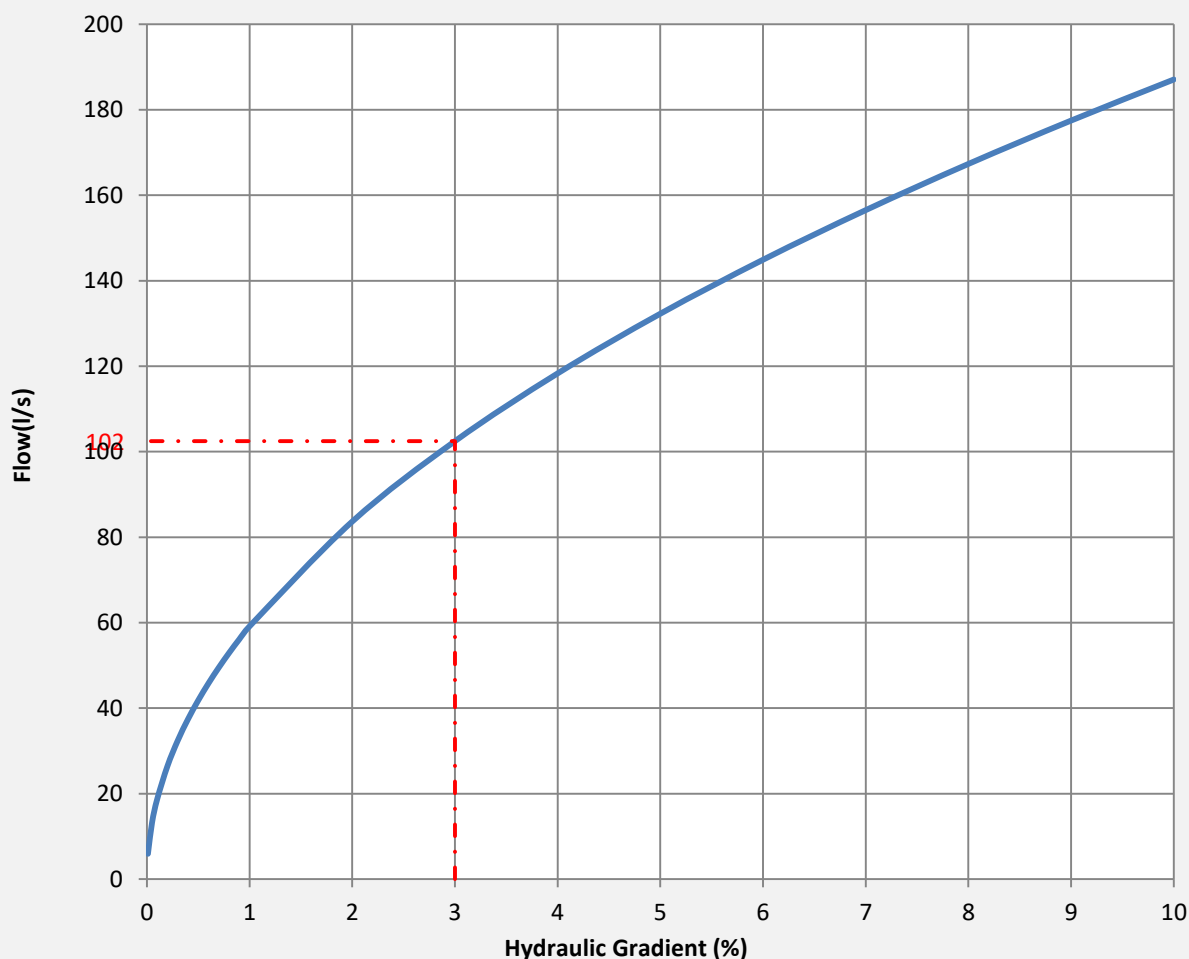
Results		
Velocity (v)	1.28	m/s
Flow (Q)	102	l/s

= 1.00 m/m

or 1 in 1

= 0.03 m/m

or 1 in 33.3



Greenfield Site Run-Off Calculations using the loH124 method

Greenfield peak run-off rate (QBAR):

Parameters	Input	Units	Comments
Area	50	ha	minimum 50ha
SAAR	673	mm	FEH online portal
SPR	0.30	N/A	Soil run-off coefficient
Region	4	N/A	Region on Hydrological area map
CC Allowance	0%		

QBAR

$$Q_{\text{BAR(rural)}} = 1.08 \text{AREA}^{0.89} \text{SAAR}^{1.17} \text{SPR}^{2.17}$$

Where:

$Q_{\text{BAR(rural)}}$	is the mean annual flood (a return period of 2.3 years) in l/s
AREA	is the area of the catchment in km ² (minimum of 0.5km ²)
SAAR	is the standard average rainfall for the period 1941 to 1970 in mm
SPR	is the soil run-off coefficient

$Q_{\text{BAR(rural)}}$ can be factored by the UK Flood Studies Report regional growth curves to produce peak flood flows for any return period.

$Q_{\text{BAR(rural)}}$	=	87.02	l/s for 50ha site
Divided by 50 to scale down	=	1.74	l/s/ha
Actual area of the catchment	=	5.13	ha

Return Periods (Growth curves obtained from DEFRA report)

Return Period		Growth Factor	Peak site run-off rate	
			l/s/ha	(l/s)
1	$Q_{\text{BAR(rural)}} \times$	0.85	1.48	7.59
2	$Q_{\text{BAR(rural)}} \times$	0.89	1.55	7.95
5	$Q_{\text{BAR(rural)}} \times$	1.23	2.14	10.98
10	$Q_{\text{BAR(rural)}} \times$	1.49	2.59	13.30
25	$Q_{\text{BAR(rural)}} \times$	1.87	3.25	16.70
30	$Q_{\text{BAR(rural)}} \times$	1.92	3.34	17.14
50	$Q_{\text{BAR(rural)}} \times$	2.2	3.83	19.64
100	$Q_{\text{BAR(rural)}} \times$	2.57	4.47	22.95
200	$Q_{\text{BAR(rural)}} \times$	2.98	5.19	26.61

Operational Site Run-Off Calculations using the loH124 method

Greenfield peak run-off rate (QBAR):

Parameters	Input	Units	Comments
Area	50	ha	minimum 50ha
SAAR	673	mm	FEH online portal
SPR	0.10	N/A	Soil run-off coefficient
Region	4	N/A	Region on Hydrological area map
CC Allowance	10%		

QBAR

$$Q_{\text{BAR(rural)}} = 1.08 \text{AREA}^{0.89} \text{SAAR}^{1.17} \text{SPR}^{2.17}$$

Where:

$Q_{\text{BAR(rural)}}$	is the mean annual flood (a return period of 2.3 years) in l/s
AREA	is the area of the catchment in km ² (minimum of 0.5km ²)
SAAR	is the standard average rainfall for the period 1941 to 1970 in mm
SPR	is the soil run-off coefficient

$Q_{\text{BAR(rural)}}$ can be factored by the UK Flood Studies Report regional growth curves to produce peak flood flows for any return period.

$Q_{\text{BAR(rural)}}$	=	8.82	l/s for 50ha site
Divided by 50 to scale down	=	0.18	l/s/ha
Actual Area of the entire Site	=	5.13	ha

Return Periods (Growth curves obtained from DEFRA report)

Return Period		Growth Factor	Peak site run-off rate	
			l/s/ha	(l/s)
1	$Q_{\text{BAR(rural)}} \times$	0.85	0.15	0.770
2	$Q_{\text{BAR(rural)}} \times$	0.89	0.16	0.81
5	$Q_{\text{BAR(rural)}} \times$	1.23	0.22	1.11
10	$Q_{\text{BAR(rural)}} \times$	1.49	0.26	1.35
25	$Q_{\text{BAR(rural)}} \times$	1.87	0.33	1.69
30	$Q_{\text{BAR(rural)}} \times$	1.92	0.34	1.738
50	$Q_{\text{BAR(rural)}} \times$	2.2	0.39	1.99
100	$Q_{\text{BAR(rural)}} \times$	2.57	0.45	2.33
200	$Q_{\text{BAR(rural)}} \times$	2.98	0.53	2.70

Restored Site Run-Off Calculations using the IoH124 method

Greenfield peak run-off rate (QBAR):

Parameters	Input	Units	Comments
Area	50	ha	minimum 50ha
SAAR	673	mm	FEH online portal
SPR	0.40	N/A	Soil run-off coefficient
Region	4	N/A	Region on Hydrological area map
CC Allowance	40%		

QBAR

$$Q_{\text{BAR(rural)}} = 1.08 \text{AREA}^{0.89} \text{SAAR}^{1.17} \text{SPR}^{2.17}$$

Where:

$Q_{\text{BAR(rural)}}$	is the mean annual flood (a return period of 2.3 years) in l/s
AREA	is the area of the catchment in km ² (minimum of 0.5km ²)
SAAR	is the standard average rainfall for the period 1941 to 1970 in mm
SPR	is the soil run-off coefficient

$Q_{\text{BAR(rural)}}$ can be factored by the UK Flood Studies Report regional growth curves to produce peak flood flows for any return period.

$Q_{\text{BAR(rural)}}$	=	227.45	l/s for 50ha site
Divided by 50 to scale down	=	4.55	l/s/ha
Actual Area of the entire Site	=	5.13	ha

Return Periods (Growth curves obtained from DEFRA report)

			Peak site run-off rate	
Return Period		Growth Factor	l/s/ha	(l/s)
1	$Q_{\text{BAR(rural)}} \times$	0.85	3.87	19.836
2	$Q_{\text{BAR(rural)}} \times$	0.89	4.05	20.77
5	$Q_{\text{BAR(rural)}} \times$	1.23	5.60	28.70
10	$Q_{\text{BAR(rural)}} \times$	1.49	6.78	34.77
25	$Q_{\text{BAR(rural)}} \times$	1.87	8.51	43.64
30	$Q_{\text{BAR(rural)}} \times$	1.92	8.73	44.806
50	$Q_{\text{BAR(rural)}} \times$	2.2	10.01	51.34
100	$Q_{\text{BAR(rural)}} \times$	2.57	11.69	59.97
200	$Q_{\text{BAR(rural)}} \times$	2.98	13.56	69.54

Appendix C

MicroDrainage calculations

Stantec UK		Page 1																																																																																																																																																																																																																					
Dominion House Warrington																																																																																																																																																																																																																							
Date 10/09/2021 09:02 File		Designed by hekelly Checked by																																																																																																																																																																																																																					
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<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 52 minutes. <table><thead><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr></thead><tbody><tr><td>15 min Summer</td><td>48.544</td><td>1.544</td><td>122.1</td><td>522.8</td><td>0 K</td></tr><tr><td>30 min Summer</td><td>48.748</td><td>1.748</td><td>136.0</td><td>629.6</td><td>0 K</td></tr><tr><td>60 min Summer</td><td>48.936</td><td>1.936</td><td>149.2</td><td>737.6</td><td>0 K</td></tr><tr><td>120 min Summer</td><td>49.039</td><td>2.039</td><td>156.5</td><td>800.2</td><td>0 K</td></tr><tr><td>180 min Summer</td><td>49.019</td><td>2.019</td><td>155.0</td><td>787.9</td><td>0 K</td></tr><tr><td>240 min Summer</td><td>48.974</td><td>1.974</td><td>151.8</td><td>760.0</td><td>0 K</td></tr><tr><td>360 min Summer</td><td>48.871</td><td>1.871</td><td>144.6</td><td>699.4</td><td>0 K</td></tr><tr><td>480 min Summer</td><td>48.769</td><td>1.769</td><td>137.5</td><td>641.1</td><td>0 K</td></tr><tr><td>600 min Summer</td><td>48.671</td><td>1.671</td><td>130.7</td><td>588.3</td><td>0 K</td></tr><tr><td>720 min Summer</td><td>48.580</td><td>1.580</td><td>124.5</td><td>541.1</td><td>0 K</td></tr><tr><td>960 min Summer</td><td>48.452</td><td>1.452</td><td>115.9</td><td>477.9</td><td>0 K</td></tr><tr><td>1440 min Summer</td><td>48.235</td><td>1.235</td><td>101.6</td><td>379.7</td><td>0 K</td></tr><tr><td>2160 min Summer</td><td>47.993</td><td>0.993</td><td>86.2</td><td>282.2</td><td>0 K</td></tr><tr><td>2880 min Summer</td><td>47.817</td><td>0.817</td><td>75.2</td><td>218.8</td><td>0 K</td></tr><tr><td>4320 min Summer</td><td>47.542</td><td>0.542</td><td>58.6</td><td>132.0</td><td>0 K</td></tr><tr><td>5760 min Summer</td><td>47.367</td><td>0.367</td><td>48.4</td><td>83.9</td><td>0 K</td></tr><tr><td>7200 min Summer</td><td>47.247</td><td>0.247</td><td>41.5</td><td>54.1</td><td>0 K</td></tr><tr><td>8640 min Summer</td><td>47.158</td><td>0.158</td><td>36.5</td><td>33.5</td><td>0 K</td></tr><tr><td>10080 min Summer</td><td>47.090</td><td>0.090</td><td>32.7</td><td>18.6</td><td>0 K</td></tr><tr><td>15 min Winter</td><td>48.544</td><td>1.544</td><td>122.1</td><td>522.8</td><td>0 K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>5.600</td><td>0.0</td><td>88</td></tr><tr><td>30 min Summer</td><td>2.800</td><td>0.0</td><td>97</td></tr><tr><td>60 min Summer</td><td>1.400</td><td>0.0</td><td>114</td></tr><tr><td>120 min Summer</td><td>0.700</td><td>0.0</td><td>150</td></tr><tr><td>180 min Summer</td><td>0.467</td><td>0.0</td><td>182</td></tr><tr><td>240 min Summer</td><td>0.350</td><td>0.0</td><td>212</td></tr><tr><td>360 min Summer</td><td>0.233</td><td>0.0</td><td>274</td></tr><tr><td>480 min Summer</td><td>0.175</td><td>0.0</td><td>336</td></tr><tr><td>600 min Summer</td><td>0.140</td><td>0.0</td><td>398</td></tr><tr><td>720 min Summer</td><td>0.117</td><td>0.0</td><td>460</td></tr><tr><td>960 min Summer</td><td>0.088</td><td>0.0</td><td>584</td></tr><tr><td>1440 min Summer</td><td>0.058</td><td>0.0</td><td>826</td></tr><tr><td>2160 min Summer</td><td>0.039</td><td>0.0</td><td>1188</td></tr><tr><td>2880 min Summer</td><td>0.029</td><td>0.0</td><td>1548</td></tr><tr><td>4320 min Summer</td><td>0.019</td><td>0.0</td><td>2268</td></tr><tr><td>5760 min Summer</td><td>0.015</td><td>0.0</td><td>2984</td></tr><tr><td>7200 min Summer</td><td>0.012</td><td>0.0</td><td>3704</td></tr><tr><td>8640 min Summer</td><td>0.010</td><td>0.0</td><td>4432</td></tr><tr><td>10080 min Summer</td><td>0.008</td><td>0.0</td><td>5160</td></tr><tr><td>15 min Winter</td><td>5.600</td><td>0.0</td><td>89</td></tr></tbody></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	48.544	1.544	122.1	522.8	0 K	30 min Summer	48.748	1.748	136.0	629.6	0 K	60 min Summer	48.936	1.936	149.2	737.6	0 K	120 min Summer	49.039	2.039	156.5	800.2	0 K	180 min Summer	49.019	2.019	155.0	787.9	0 K	240 min Summer	48.974	1.974	151.8	760.0	0 K	360 min Summer	48.871	1.871	144.6	699.4	0 K	480 min Summer	48.769	1.769	137.5	641.1	0 K	600 min Summer	48.671	1.671	130.7	588.3	0 K	720 min Summer	48.580	1.580	124.5	541.1	0 K	960 min Summer	48.452	1.452	115.9	477.9	0 K	1440 min Summer	48.235	1.235	101.6	379.7	0 K	2160 min Summer	47.993	0.993	86.2	282.2	0 K	2880 min Summer	47.817	0.817	75.2	218.8	0 K	4320 min Summer	47.542	0.542	58.6	132.0	0 K	5760 min Summer	47.367	0.367	48.4	83.9	0 K	7200 min Summer	47.247	0.247	41.5	54.1	0 K	8640 min Summer	47.158	0.158	36.5	33.5	0 K	10080 min Summer	47.090	0.090	32.7	18.6	0 K	15 min Winter	48.544	1.544	122.1	522.8	0 K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	5.600	0.0	88	30 min Summer	2.800	0.0	97	60 min Summer	1.400	0.0	114	120 min Summer	0.700	0.0	150	180 min Summer	0.467	0.0	182	240 min Summer	0.350	0.0	212	360 min Summer	0.233	0.0	274	480 min Summer	0.175	0.0	336	600 min Summer	0.140	0.0	398	720 min Summer	0.117	0.0	460	960 min Summer	0.088	0.0	584	1440 min Summer	0.058	0.0	826	2160 min Summer	0.039	0.0	1188	2880 min Summer	0.029	0.0	1548	4320 min Summer	0.019	0.0	2268	5760 min Summer	0.015	0.0	2984	7200 min Summer	0.012	0.0	3704	8640 min Summer	0.010	0.0	4432	10080 min Summer	0.008	0.0	5160	15 min Winter	5.600	0.0	89
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Stantec UK			Page 2		
Dominion House Warrington					
Date 10/09/2021 09:02 File		Designed by hekelly Checked by			
Innovyze		Source Control 2020.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	48.747	1.747	135.9	629.2	0 K
60 min Winter	48.934	1.934	149.0	736.1	0 K
120 min Winter	49.029	2.029	155.8	794.0	0 K
180 min Winter	48.992	1.992	153.2	771.4	0 K
240 min Winter	48.922	1.922	148.2	729.0	0 K
360 min Winter	48.766	1.766	137.3	639.7	0 K
480 min Winter	48.613	1.613	126.8	557.9	0 K
600 min Winter	48.474	1.474	117.4	488.1	0 K
720 min Winter	48.349	1.349	109.1	429.8	0 K
960 min Winter	48.171	1.171	97.5	352.2	0 K
1440 min Winter	47.901	0.901	80.4	248.0	0 K
2160 min Winter	47.635	0.635	64.2	159.8	0 K
2880 min Winter	47.463	0.463	54.0	109.5	0 K
4320 min Winter	47.224	0.224	40.2	48.8	0 K
5760 min Winter	47.086	0.086	32.5	17.8	0 K
7200 min Winter	47.046	0.046	27.8	9.3	0 K
8640 min Winter	47.040	0.040	24.3	8.2	0 K
10080 min Winter	47.036	0.036	21.5	7.3	0 K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	2.800	0.0	97		
60 min Winter	1.400	0.0	114		
120 min Winter	0.700	0.0	150		
180 min Winter	0.467	0.0	184		
240 min Winter	0.350	0.0	216		
360 min Winter	0.233	0.0	280		
480 min Winter	0.175	0.0	346		
600 min Winter	0.140	0.0	410		
720 min Winter	0.117	0.0	472		
960 min Winter	0.087	0.0	596		
1440 min Winter	0.058	0.0	838		
2160 min Winter	0.039	0.0	1196		
2880 min Winter	0.029	0.0	1556		
4320 min Winter	0.019	0.0	2272		
5760 min Winter	0.015	0.0	2984		
7200 min Winter	0.012	0.0	3616		
8640 min Winter	0.010	0.0	4344		
10080 min Winter	0.008	0.0	5056		
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Stantec UK		Page 4								
Dominion House Warrington										
Date 10/09/2021 09:02 File	Designed by hekelly Checked by									
Innovyze	Source Control 2020.1									
Model Details Storage is Online Cover Level (m) 50.000 Infiltration Basin Structure Invert Level (m) 47.000 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 1.00000 Porosity 1.00 Infiltration Coefficient Side (m/hr) 1.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>200.0</td><td>3.000</td><td>905.7</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	200.0	3.000	905.7
Depth (m)	Area (m²)	Depth (m)	Area (m²)							
0.000	200.0	3.000	905.7							
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