TECHNICAL NOTE:

PAN-022901 : Sch 5 Notice Response - Groundwater Risk Assessment

Prepared for:	Anglesey Outdoors
Date issued	07/05/2024
Reference:	3490617 Anglesey Out Discharge \ TN Schedule 5 Notice Response
Revision:	REV01
Contents	12 pages, plus 1 appendix

Authors

	Name	Signed
Prepared by	James Dodds	
Checked by	Chris Woodhouse	
Approved by	James Dodds	

Midlands Office
The Bank Chambers
39 Market Place
Melbourne
Derbyshire
DE73 8DS

Tel: 01332 871 882
E mail: info@envireauwater.co.uk
Web: www.envireauwater.co.uk

1 INTRODUCTION

1.1 Background

Mouseloft Ltd (trading as Anglesey Outdoors) has submitted an application to Natural Resources Wales (NRW) (ref. PAN-022901) to regularise the regulatory position for their effluent discharge from the Anglesey Outdoors activity Centre at Holyhead, Anglesey ("the Site").

The Site was constructed around 1990 and has always been serviced by a Package Treatment Plant (PTP) to treat sewage effluent. The initial PTP was replaced in 2014 but the same discharge location has been maintained. The PTP is an Anua Platinum Wastewater Treatment Commercial System capable of accommodating a population equivalent of 100 with a maximum design flow of 15 m^3/day and organic load of 6 kgBOD/day. The existing discharge is a single piped discharge into a water filled ditch at the approximate National Grid Reference (NGR) SH 23941 80757. The effluent discharge point is approximately 55 m from the PTP and drains approximately 180 m into a pond.

In July 2022 Anglesey Outdoors submitted a Discharge Permit Application to NRW. On reviewing the application, NRW raised concerns and questions regarding groundwater pathways and, unable to answer the questions at the time, Anglesey Outdoors withdrew the application.

In April 2023, Envireau Water was engaged by Anglesey Outdoors to prepare a risk assessment for the discharge, to support a new Discharge Permit Application. An application was submitted on 9 August 2023, which was supported by a Discharge Risk Assessment (Envireau Water, 2023). That risk assessment concluded:

> *"The information present in this risk assessment indicates that there is no risk of the discharge having an adverse impact on the groundwater systems or on nearby potential receptors due to the absence of superficial deposits and the low permeability of the underlying bedrock.*
>
> *Of the potential receptors identified in the desk study, it was determined that the only receptor at risk from the discharge were the surface water flow pathways from the catchment area. The dilution factor of the combined catchments is 15.3.*
>
> *The analysis indicates that with appropriate management and maintenance of the PTP, that there is a low risk to the surface water features in the area.*
>
> *Due to the small scale of the discharge, and the fixed discharge quality by virtue of the PTP, a H1 risk assessment has not been undertaken."*

The application was duly made on 19 September 2023. Following a request for an update on progress on 7 February 2024, a request for further information was made by NRW. Following discussions with NRW a response was provided by Envireau Water on 14 February 2024 with further detail being provided on 23 February 2024. Following a discussion with NRW, a Schedule 5 Notice requesting a Groundwater Risk Assessment was received on 19 March 2024.

This report presents the requested Groundwater Risk Assessment.

1.2 Scope of Work

The Schedule 5 Notice (the Notice) states:

> "*The risk assessment submitted does not demonstrate that the risk posed to groundwater by the discharge activity is acceptable. As the point of disposal is seasonally dry then there is potential for impacts to groundwater through the bed of the watercourse, and further assessment of risk to groundwater will be required.*
>
> *Information that has not been included in the risk assessment includes, but is not limited to:*
>
> - *Seasonal variation in the flow of the receiving watercourse and details of when the watercourse dries up.*
> - *Depth to groundwater (when the receiving watercourse is dry) and it's seasonal variation.*
> - *Direction and mechanism of groundwater flow.*
> - *Consideration of groundwater itself as a receptor. We note that surface water features and private water supplies have been identified as potential receptors in Section 3 of the risk assessment. However, the groundwater resource itself has not been included. Groundwater in the underlying bedrock is designated a Secondary B aquifer and should be considered a receptor.*
>
> *Groundwater risk assessments should be carried out in accordance with Infiltration systems: groundwater risk assessments - GOV.UK (www.gov.uk).*"

The guidance provided by the link provided in the Notice sates that a tiered approach should be followed, with Tier 1 being a qualitative risk screening to investigate what the risks are, whether more detailed assessment is needed and, if so, what that would need to focus on (risk prioritisation).

Following a tiered approach means that the greater the risk of groundwater pollution, a more detailed assessment is undertaken. The guidance makes it clear that the risk assessment can stop at any stage if enough information is obtained to demonstrate that the activity does not pose a pollution risk to groundwater.

By adopting this method, the objective is to "ensure that the cost, time and effort you put into your risk assessment are proportional to the effort or measures needed to make the risks from an activity acceptable"[1].

The application is for a discharge rate of 15 m^3/day, and evidence has been provided that the actual discharge is less than this[2]. The Government guidance referred to by NRW states that for sewage discharges of up to 15 m^3/day only basic information needs to be submitted. It is also important to note that the application is for discharge to surface water and not for discharge to ground.

---

[1] https://www.gov.uk/guidance/groundwater-risk-assessment-for-your-environmental-permit#use-a-tiered-approach-to-your-risk-assessment

[2] Email to Mr Steve Bickerton (NRW) 23 February 2024 08:11

On this basis the scope of this work is a Tier 1 risk assessment, based on a desk study and appropriate interpretation. A conceptual hydrogeological model is described.

This risk assessment has been undertaken by James Dodds, a Chartered Hydrogeologist with over 30 years experience.

1.3 Data Sources

The information and assessment in this report are based on the information submitted in Envireau Water (2023) and other information submitted by email in response to questions. Where new information has been presented, this is highlighted in the text.

2 HYDROGEOLOGICAL SETTING

2.1 Geology

The geology at the Site is described at Section 2.4 of Envireau Water (2023), and Figure 2 of that report presents the local geological setting. In summary, a ribbon of glacial till, likely comprising clay with subordinate, silt, sand and gravel is present in the north of the Site and beyond the northern Site boundary along Porthdafarch Road. No superficial deposits are mapped in the centre and south area of the Site. BGS geological mapping clearly shows that the discharge point, and the watercourses that carry the discharge are not underlain by superficial deposits.

The bedrock geology beneath the Site comprises Cambrian age mica schist and psammite of the New Harbour Group and psammite and pelite of the South Stack Formation (part of the Holy Island Group). A north – south dyke striking through the centre of the Site comprises hard, crystalline gabbro, microgabbro and diorite. New Harbour Group lavas are present in the south west part of the Site. All these rock types are hard, crystalline or indurated. Other than where they are fractured, they have no, or very low porosity and essentially zero permeability (hydraulic conductivity).

2.2 Hydrogeological Conceptual Model

The hydrogeology relating to the Site is described in section 2.5 of (Envireau Water, 2023).

Where present, the glacial till is expected to be of low permeability due to the high clay content, and may contain thin saturated zones in coarser, moderately permeable horizons. While these deposits contains groundwater, due to the discontinuous nature of the geology, it is highly unlikely to represent a continuously transmissive system. It may, where present, support small, non-continuous, domestic level (< 20 m^3/day) abstractions. The groundwater level in the glacial till will be controlled by drainage to local ditches and streams, and as such will reflect a subdued form of the ground level. While no information is available on groundwater level, it is likely to range from ground level to 1 – 2 m below ground level.

Regionally, the low permeability of the clays within the glacial till inhibit rainfall recharge to bedrock, and springs are common at the base of the unconsolidated glacial till over the bedrock. Spring discharges from the glacial till-Cambrian bedrock contact across Anglesey typically yield less than 8 m^3/hr.

The Cambrian strata can be considered a zero primary permeability system, although groundwater is present in small quantities at shallow depth associated with near surface weathering and isolated fractures, which is a secondary permeability system. The Cambrian strata beneath the Site are classified as Secondary B Aquifers by NRW, although the unit is not exploited for abstraction locally. Secondary permeability will be poorly linked, discrete and non-continuous. Where groundwater exists at the contact between the glacial till and bedrock, it will behave and be controlled by the heads and flow in the more permeable parts of the glacial till. It is likely that, due to glacial and post glacial erosion, the weathered zone will be thin and limited to, at most,1 - 2 m. Where superficial deposits are absent, it is reasonable to expect the weathered zone to be minimal due to ongoing erosion.

Secondary B aquifers are mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers. While it is important to protect groundwater, the use and value of the groundwater is important. In this case Envireau Water 2023) demonstrates that:

- The Isle of Anglesey County Council has no registered Private Water Supplies (including wells and boreholes) within 1 km of the Site.
- There are no BGS water well records within 1 km of the Site.

In addition, the Site discharge point and watercourses are underlain by very low or no permeability bedrock. The occurrence of groundwater in the bedrock will be discrete and restricted.

No information is available of groundwater levels in the bedrock. Overall, any groundwater that is present will tend to flow toward the sea on a regional scale. However, actual flow direction on a local scale will be totally dependent on the distribution of fractures and their primary strike direction. Groundwater levels in the weathered zone are likely to be equilibrated with the head in the glacial till. Groundwater levels in the unweathered bedrock will be highly variable ranging from being equal to the head in the glacial till, to be disconnected and several metres below ground level. Seasonal and short duration changes in the bedrock groundwater level will be relatively large, due to the very low porosity (aquifer storativity).

The water in the watercourse upstream from the pond will be controlled by rainfall runoff, connection with the pond, and is likely to act as a drain for interflow (slow flow) from the local catchment soils and weathered bedrock. True groundwater inflow (or losses) will be negligible due to the low permeability of the local hydrogeological system.

The absence of private wells locally, and lack of any located on the bedrock, is a good indication of the lack of groundwater in this area.

In summary, the hydrogeological conceptual model comprises a watercourse flowing over bedrock strata, that may have a thin weathered zone. The weathered zone is connected to a wider glacial till dominated superficial cover which is absent at the discharge location (i.e., no superficial cover). The whole hydrogeological system has a very low or effectively zero primary permeability, with low or moderate primary permeability being found associated with coarser layers in the Till, and as secondary permeability in the bedrock associated with fractures. In all cases permeability will be laterally and vertically discontinuous and poorly connected. The bedrock unit is of little value locally, and there is no record of use in the vicinity of the discharge.

2.3 Surface Water

The discharge location is located in the headwaters of a catchment which drains south into a pond, and onward in a north easterly direction towards the town of Holyhead (Envireau Water, 2023). The catchment also drains surface water collecting over a small (approximately 0.11 km^2) area to the west of the Site. Additionally, 40 m downstream of the pond a secondary catchment to the south west of the Site with an approximate area of 0.17 km^2 confluences with the Pond Catchment. The total area of the two catchments is approximately 0.28 km^2.

There is no data on the variation in the flow in the receiving watercourse, but the photographs and maps provided to NRW on 14 February 2024 (Appendix A) clearly show that the watercourse is linked to the open body of water (the pond) and is expected to remain with water in it all year, although flows may be low. The presence of water all year at the discharge point has been confirmed by the applicant.

3 RISK ASSESSMENT

3.1 Assessment Methodology

A Hydrogeological Risk Assessment (HRA) has been carried out taking account of the Source-Pathway-Receptor (S-P-R) approach and the methodology described in the Environment Agency's (EA) technical guidance.

As discussed above, a Tier 1 assessment is considered an appropriate level of assessment in this case due to the relatively low discharge rate and that the discharge is to surface water and not to ground. The assessment method, scoring and risk calculation are presented in the following subsections.

3.2 Hazard Identification

The hazard associated with this risk assessment is:

- Discharge of treated sewage effluent up to 15 m^3/day into surface water.

3.3 Sources

The source associated with the identified hazard is:

- Treated sewage effluent.

3.4 Receptors

The potential receptors are:

- Drainage ditches, and downstream water courses; and
- Bedrock Secondary B aquifer.

3.5 S-P-R Linkages

Source-Pathway-Receptor linkages have been assessed for the hazards and receptors. In this case the linkages are straightforward, in that there is a single point of discharge of treated sewage effluent into the surface water system.

Theoretical links exist to groundwater if there is permeable substrate that links to an aquifer, together with flow in the surface water.

3.6 Risk Assessment

3.6.1 Methodology

A risk assessment has been carried out for the proposed activities based on the identified hazards in accordance with the methodology described in the following sub-sections.

The risk assessment considers the significance of a hazard occurring, based on receptor sensitivity and magnitude. The likelihood of a hazard occurring has been assigned, taking account of the embedded mitigation that is already present within the development and operation of the Site. Where appropriate, additional mitigation is proposed to further reduce potential risk of a particular hazard occurring.

In greater detail, the methodology involves the following:

- For each hazard (source) and receptor combination, evaluate whether a possible source-receptor-pathway linkage exists. If so, proceed with the assessment; if not the risk is *de facto* negligible or none for this combination of source and receptor.
- Assign each receptor a *sensitivity* (Table 1), largely based on its ecological status, its environmental "support" value, its water resource value (potable, industrial, agricultural) and/or its recreational value.
- Assign a *magnitude of impact* (Table 2) to each hazard scenario, depending on the ecological, societal, economic or resources value that stands to be lost. The hazard scenario will, in this context, typically be a contaminant spill or leakage but, in principle, can account for any hazard.
- Essentially multiply the *sensitivity* by the *magnitude of impact* to derive a potential *significance of effect* (Table 3) for each hazard scenario and receptor.
- Consideration is then given to mitigating factors - both engineered embedded mitigation (e.g. membrane, bunding, drilling methodologies:) and natural factors (e.g. low permeability strata) - to evaluate a *likelihood of occurrence* for each hazard and receptor (Table 4).
- A qualitative risk analysis, ranging from *none* to *very high* is then produced by effectively multiplying *likelihood of occurrence* by *significance of effect* (Table 5).

~~3.7.1~~3.6.2 Receptor Sensitivity

Receptor Sensitivity has been assigned in accordance with the methodology presented in Table 1.

Table 1 Receptor Sensitivity

Receptor Sensitivity	Description	Examples
Very High	Water resource with an importance and rarity at an international level with limited potential for substitution.	A water resource making up a vital component of an SAC or SPA under the EC Habitats Directive. A waterbody achieving a status of 'High status or potential' under the WFD. Principal aquifer providing potable water to a large population. EC designated Salmonid fishery.
High	Water resource with a high quality and rarity at a national or regional level and limited potential for substitution.	A water resource designated or directly linked to a SSSI. Principal aquifer providing potable water to a small population. A river designated as being of 'Good' status or with a target of 'Good' status or potential under the WFD. EC designated Cyprinid fishery.
Medium	Water resource with a high quality and rarity at a local scale; or water resource with a medium quality and rarity at a regional or national scale.	Secondary A aquifer providing potable water to a small population. An aquifer or surface water body providing abstraction water for agricultural or industrial use. A local nature reserve dependent on groundwater.
Low	Water resource with a low quality and rarity at a local scale.	Secondary B aquifer providing potable water to individual properties. A non 'main' river or stream or another waterbody without significant ecological habitat.

Based on the above:

- The bedrock Secondary B aquifer is assessed as having a Low sensitivity.
- The receiving watercourse is assessed as having a Low sensitivity.

~~3.7.2~~3.6.3 Magnitude of Impact

Magnitude of impact depends on the nature of the hazard and has been assigned following the methodology presented in Table 2.

Table 2 Magnitude of Impact

Magnitude of Impact	Description	Examples
High	Results in a loss of attribute and/or quality and integrity of the attribute. Following development, the baseline situation is fundamentally changed.	Loss of EU designated Salmonid fishery. Change in WFD classification of a waterbody. Compromise employment source. Pollution of potable source of abstraction.
Medium	Results in impact on integrity of attribute, or loss of part of attribute. Following development, the baseline situation is noticeably changed	Loss/gain in productivity of a fishery. Contribution/Reduction of a significant proportion of the effluent in the receiving river but insufficient to change its WFD classification. Reduction/increase in the economic value of the feature.
Low	Results in some measurable change in attribute's quality or vulnerability. Following development, the baseline situation is largely unchanged with barely discernible differences.	Measurable changes in attribute, but of limited size and/or proportion.
Very Low	The impacts are unlikely to be detectable or outside the norms of natural variation.	Physical impact to a water resource, but no significant reduction/increase in quality, productivity, or biodiversity. No significant impact on the economic value of the feature.

Based on the above:

- The magnitude of impact of contamination on the watercourse and the bedrock Secondary B aquifer is classed as Low because, although any impacts are unlikely to be detectable or outside the norms of natural variation (a Very Low magnitude), a conservative approach has been taken due to a lack of data, and the next magnitude category has been used.

~~3.7.3~~3.6.4 Significance of Effect

Significance of effect is the significance of a hazard occurring before consideration of the likelihood that it will occur. The potential significance of effect is defined by combining the receptor sensitivity and the magnitude of impact according to the matrix in Table 3.

Table 3 Potential Significance of Effect

Receptor Sensitivity	Magnitude of Impact			
	High	**Medium**	**Low**	**Very Low**
Very High	Major	Major	Moderate	Moderate
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Moderate	Minor	Negligible	Negligible

It follows that the significance of effect of all hazards occurring is:

- Drainage ditches and Secondary B bedrock aquifer - **negligible**

~~3.8~~3.7 Embedded Risk Mitigation

In this case the embedded risk mitigation is the PTP itself. The PTP comprises an Anua Platinum system, which meets the requirements of BS 6297 and Buildings Regulations Part H2, as well as EN 12566-Part 3 2005. Details are provided in Envireau Water (2023).

~~3.9~~3.8 Likelihood of Occurrence

In this case, the likelihood of a hazard occurring has been assigned based on the PTP failing with reference to Table 4 and takes account of the hydrogeological conceptual model, the surface water risk assessment presented in Envireau Water (2023) and embedded mitigation. The likelihood of occurrence for each hazard based on the below criteria.

Table 4 Qualitative Likelihood of Occurrence

Qualitative Likelihood of Occurrence	Description	Examples
Highly likely	High probability of occurrence	Spillage at a poorly maintained and operated facility. Uncontrolled activity in or on an aquifer, close to surface water. Uncontrolled unknown discharge.
Likely	On balance could occur	Controlled but un-mitigated activity. Complex process where failure of a part is likely to lead to release. Large area where 100% sealing cannot reasonably be expected.
Moderate	Equally likely/unlikely	Unmitigated low risk. Controllable activity. Partially contained site.

Qualitative Likelihood of Occurrence	Description	Examples
Unlikely	On balance wouldn't occur	Mitigated higher risk. Simple controllable activity. Underlain by poorly permeable strata. Existing contained site.
Very unlikely	Very low probability of occurrence	Essentially no risk. Extreme set of circumstances required to generate low probability. Fully mitigated low or medium risk.

On this basis, the likelihood of contamination of groundwater in the Secondary B aquifer is Very Unlikely. The likelihood of contamination of the surface watercourse is Unlikely.

~~3.10~~3.9 Risk Analysis

A qualitative risk analysis has been carried out in accordance with EA guidance. The qualitative risk assessment has been evaluated using the relationships in Table 5. Based on a Likelihood of Occurrence of 'Unlikely' and a Significance of Effect of Negligible, it shows that with the embedded mitigation the risk to the groundwater in the Secondary B aquifer and the surface water courses is None. Where the resultant risk associated with a given hazard is classified as 'None' this reflects that the risk is so small/negligible that there is essentially no risk to consider.

Table 5 Qualitative Risk Assessment

Qualitative Likelihood of Occurrence	Significance of Effect			
	Major	Moderate	Minor	Negligible
Highly likely	Very High	High	Medium	Low
Likely	High	Medium	Low	Very Low
Moderately Likely	Medium	Low	Very Low	None
Unlikely	Low	Very Low	None	None
Very unlikely	Very Low	None	None	None

4 CONCLUSIONS

The Schedule 5 Notice issued on 19 April 2024 states that the risk assessment submitted does not demonstrate that the risk posed to groundwater by the discharge activity is acceptable. It suggests that the point of disposal is seasonally dry and that there is potential for impacts to groundwater through the bed of the watercourse, and further assessment of risk to groundwater is required.

This assessment has provided information that shows:

- The receiving watercourse is not seasonally dry and is perennial;
- While there is no field data, expected groundwater level variations have been described based on experience of other, similar settings;
- The direction and mechanism of groundwater flow has been described
- The groundwater in the Secondary B bedrock aquifer has been assessed as a receptor

Using a standard source-pathway-receptor, Tier 1 assessment method, the qualitative risk to the Secondary B bedrock aquifer is 'None', due to the treatment of the effluent, the lack of permeability in the groundwater system, the lack of groundwater users and dilution in the surface water system.

REFERENCES

Envireau Water. (2023). *Discharge Risk Assessment.*

APPENDICES

Appendix A Query Figure Pack

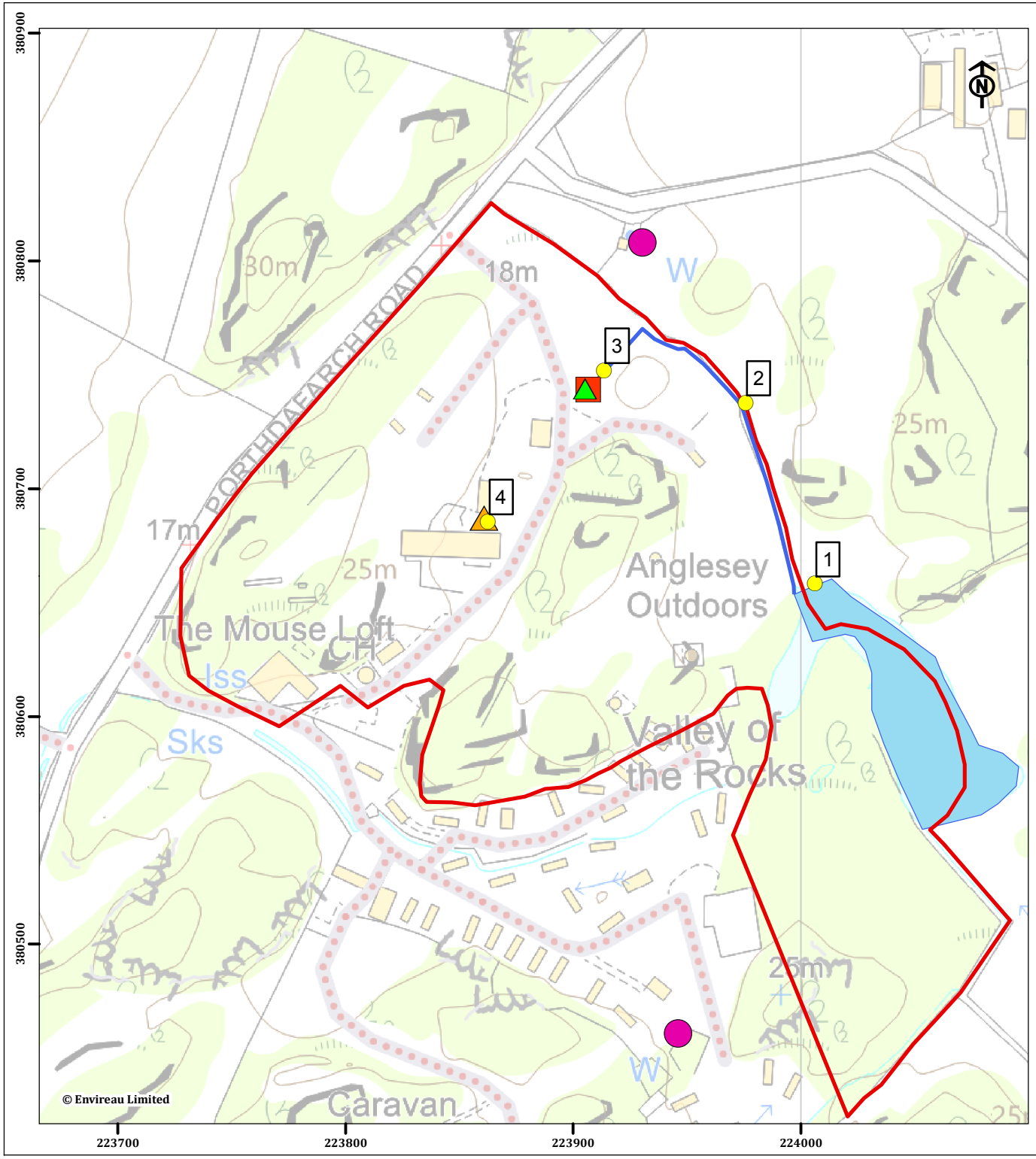


Figure: Photograph Locations

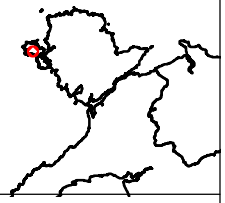
Holyhead,Anglesey

- Land Ownership Boundary
- Pond
- Unnamed Water Filled Ditch
- OS Map Wells
- Discharge Point
- Sampling Location
- Package Treatment Plant
- Photo Location

Notes:

Contains Natural Resources Wales information © Natural Resources Wales and Database Right. All rights Reserved.

For wider hydrological connections see Discharge Risk Assessment report ref. 3490617 Anglesey Out Discharge / TN Discharge Permit Application



0 25 50 75 100 Meters

Scale: 1:2,500 at A4

14 February 2024

NGR: 223,883 E / 380,662 N

Project No.	3490617
Client:	Mouseloft Ltd
Drawn by:	MT
Ref:	Photograph Locations

envireau WATER

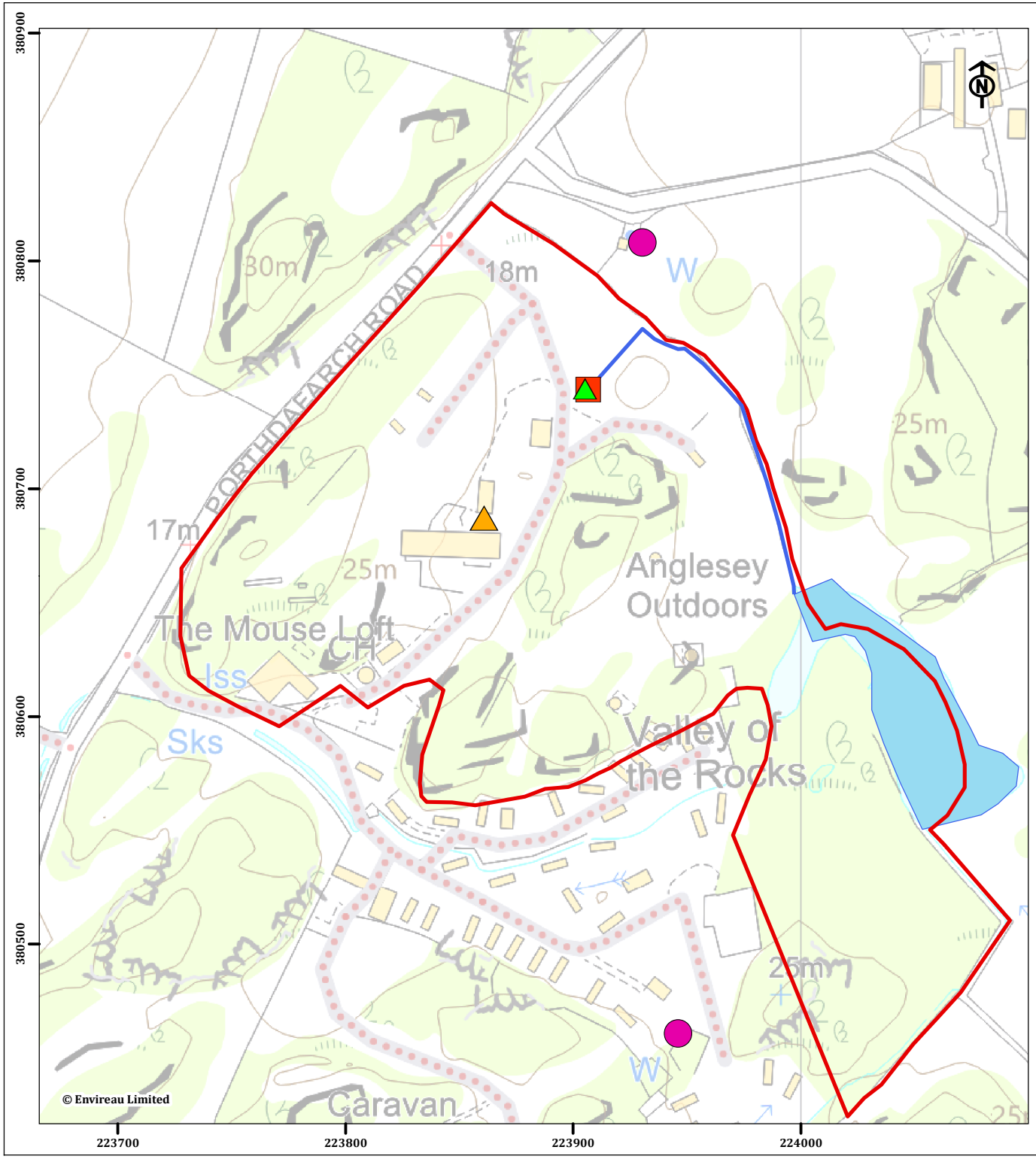


Figure: Site Plan

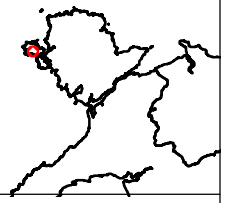
Holyhead,Anglesey

- Land Ownership Boundary
- Pond
- Unnamed Water Filled Ditch
- OS Map Wells
- Discharge Point
- Sampling Location
- Package Treatment Plant

Notes:

Contains Natural Resources Wales information © Natural Resources Wales and Database Right. All rights Reserved.

For wider hydrological connections see Discharge Risk Assessment report ref. 3490617 Anglesey Out Discharge / TN Discharge Permit Application



0 25 50 75 100 Meters

Scale: 1:2,500 at A4

14 February 2024

NGR: 223,883 E / 380,662 N

Project No.	3490617
Client:	Mouseloft Ltd
Drawn by:	MT
Ref:	Site Plan

envireau WATER

Figure: Photographs

Photo 1 - Pond looking south east

Photo 2
Ditch looking toward pond

Photo 3
Ditch toward discharge

Photo 4
Treatment Plant

Notes:

Date:	14 February 2024
Project No.	3490617
Client:	Mouseloft Ltd
Drawn by:	JED
Ref:	EW_Template_A3_Landscape_NoInset

envireau WATER