H Fraser Consulting
Contaminated Land and Hydrogeology

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Cyfoeth Naturiol Cymru (Natural Resources Wales)
South East Wales

19 September 2025

By email

Our ref: 31040 NRW01 H1 assessment

Dear Steve

**RE: PAN-029406: GLAN LLYN H1 ASSESSMENT**

Further to submission of our report presenting an H1 assessment of the proposed discharge to Monks' Ditch from the Glan Llyn residential development (30937 R5) and subsequent discussion between you and Chris Wilson of Rodgers Leask Ltd (RLL), you replied by email to Chris (22 July 2025) with some questions. This letter provides a response to those questions.

**Pumping arrangements**

You asked: *"Can the submersible pumps be used in tandem combining the 750l and the 250l flow rate."*

The pumping station consists of two submersible pumps (the main pump with capacity to pump at a flow rate of 750 l/s and a standby pump at 250 l/s), which are designed to discharge through ductile iron internal pipework into Monks Ditch. The pumps are situated within a wet well, with a separate valve chamber accommodating non-return valves, gate valves and pipework connecting it to Monks Ditch.

Inclusive of the adjacent Business Park, two pumping stations are being provided, one serving the Glan Llyn residential area (west of Monks Ditch), and one serving the commercial area (east of Monks ditch). A combined pumping rate of 750 l/s would be provided, based on a greenfield runoff of 3.5 l/s/ha across the 214-ha development site. This will be provided by duty (750 l/s) and standby (250 l/s) pumps on both sides of the river (one for each of the residential and commercial developments).

It is intended that either the commercial pumping station, or the residential pumping station, operate at a given time. The use of both discharges in parallel will be avoided where possible.

The system (inclusive of both the residential and commercial pumping stations) has been designed to be managed and adapted over time. The pumps are programmable not only to vary the pumping rates, but also modify the trigger levels and thresholds and even add or remove operating rules.

Trials will be undertaken to test and optimise the pumping stations and pumping rates. Each pumping station would be capable of discharging 1,000 l/s in case of emergency – with the duty and standby pumps. However the maximum reasonable discharge during normal functionality rate should be considered to be 750 l/s.

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Full operational details relating pumping station discharge rates are presented within the Atkins Technical Note titled Impact of Proposed Pumped Surface Water Discharge into the Monks Ditch, which is attached at Appendix A.

**H1 assessment: flow rates**

You asked: *"In the H1 why have you used the current effluent discharge flow rate rather of 0.047m3/s than the proposed discharge flow rate."*

The H1 assessment process is designed to assess the potential impacts of discharges from an industrial process to the environment – in this case a discharge of drain water to Monks' Ditch. Usually, industrial processes operate more or less independently of weather conditions, and it is appropriate to examine the impact of the maximum likely discharge rate during conditions of low flow in the receiving waterway. The Glan Llyn discharge is not derived from such an industrial process and, in contrast to those, will be heavily dependent on weather conditions.

Monks' Ditch catchment is relatively small and local, and we consider that weather conditions in the Monks' Ditch catchment and across the Glan Llyn site are likely to be very similar. It is therefore appropriate to compare similar percentiles of site discharge and receiving water flow. When flow is low in Monks' Ditch the site discharge will be naturally reduced; when a larger discharge is required from site then Monks' Ditch flows will be high.[1]

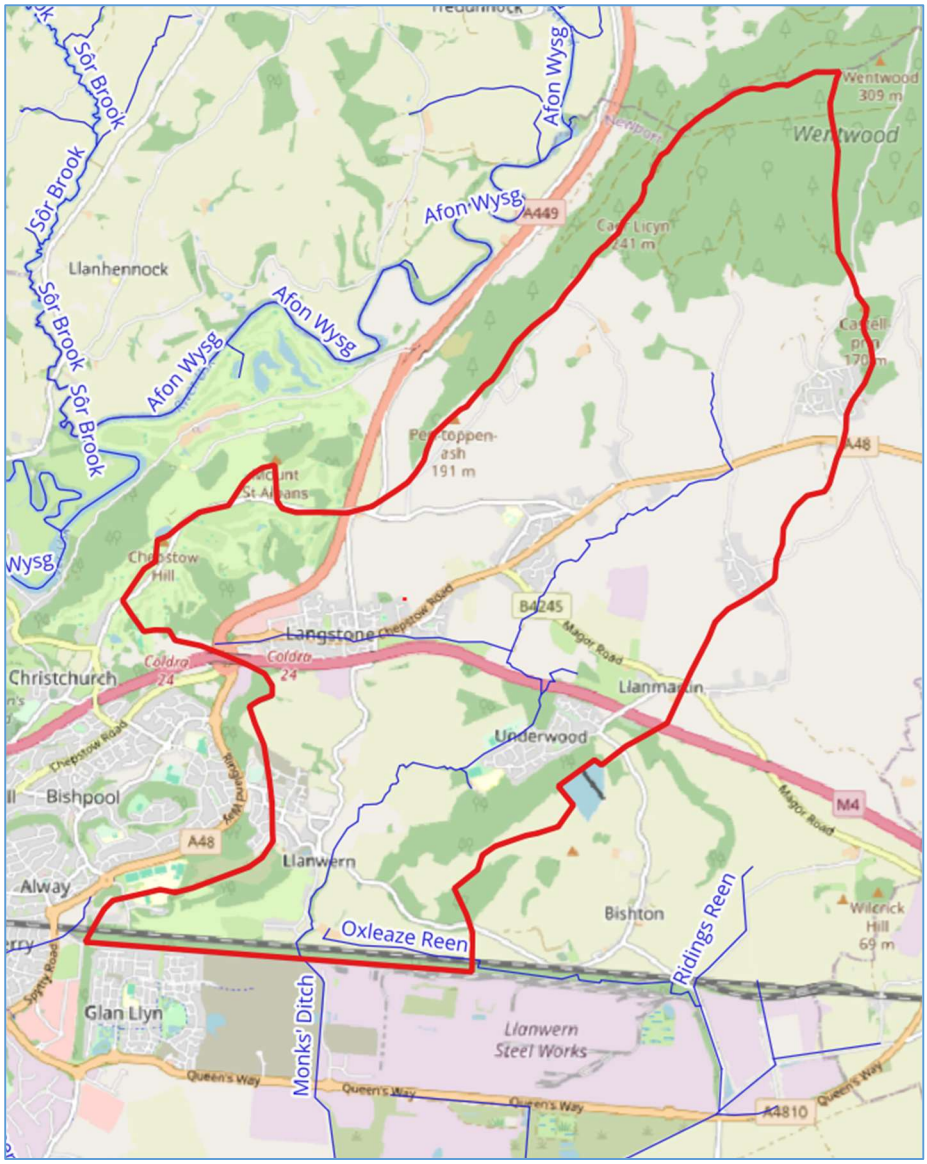
We therefore selected the mean flows for both the discharge and the waterway as appropriate inputs for this assessment.

You asked: *"Can you clarify why the estimated flow rates were used for monks ditch rather than requesting hydrology data."*

As you are aware from discussion, NRW was unable to provide hydrology data. However, we have now calculated flow rates using LowFlows2 software and have applied the mean annual flow that results from that. The catchment boundary used for the calculation is shown for your information in the figure below.

The calculated mean flow (302 l/s) is smaller than the estimated flow that was previously applied (537 l/s). The calculated value has been used in the updated H1 assessment calculations that are attached as Appendix B.

[1] Note that there will be limits on the timing of releases from the site to Monks' Ditch, based on the condition and flow in Monks' Ditch, such that downstream flooding is avoided. The internal drainage system at Glan Llyn is designed to allow for significant temporary storage to cope with flood conditions.




**H1 assessment: substances assessed**

You asked: "*All the substances that breach EQS are usually included in a H1 this doesn't appear to be the case in the submission, can this be amended.*"

We excluded a number of substances that had recorded a breach of the EQS, as discussed in our report. The exclusions applied to substances that had breached EQS in fewer than 1% of the many hundreds of analyses available for each determinand. We feel that it is in principle reasonable to exclude significant outliers of this nature. However, we have added them to the updated spreadsheet as requested, to provide further context. The 29 additional substances are listed in Table 1.

## Table 1 Statistics for determinands exceeding screening values

| Determinand | Units | No. sample | No. detects | No. exceed | % exceed | Max | Min | Ave | MD ave* |
|---|---|---|---|---|---|---|---|---|---|
| Chloride | mg/l | 1068 | 1068 | 4 | 0.4% | 510.00 | 3.10 | 58.14 | 30.42 |
| Cyanide (Free) | mg/l | 1068 | 9 | 9 | 0.8% | 0.29 | <0.05 | <0.05 | <0.05 |
| Cadmium (Dissolved) | µg/l | 1068 | 9 | 6 | 0.6% | 1.70 | <0.11 | 0.12 | 0.11 |
| Iron (Dissolved) | µg/l | 1068 | 1031 | 1 | 0.1% | 1200.00 | <2.30 | 36.69 | 21.22 |
| Lead (Bioavailable) | µg/l | 1068 | 1068 | 4 | 0.4% | 29.17 | 0.03 | 0.10 | 0.16 |
| Zinc (Bioavailable) | µg/l | 1068 | 1068 | 7 | 0.7% | 87.66 | 0.25 | 2.09 | 2.92 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Aliphatic TPH >C5-C6 | µg/l | 1068 | 4 | 4 | 0.4% | 18.00 | <0.10 | 0.15 | <0.10 |
| Aliphatic TPH >C6-C8 | µg/l | 1068 | 2 | 1 | 0.1% | 170.00 | <0.10 | 0.27 | 0.66 |
| Aliphatic TPH >C8-C10 | µg/l | 1068 | 5 | 4 | 0.4% | 920.00 | <0.10 | 1.33 | 121.68 |
| Aliphatic TPH >C10-C12 | µg/l | 1068 | 4 | 4 | 0.4% | 1300.00 | <0.10 | 1.90 | 201.15 |
| Aliphatic TPH >C12-C16 | µg/l | 1067 | 4 | 4 | 0.4% | 840.00 | <0.10 | 1.71 | 136.83 |
| Aliphatic TPH >C16-C21 | µg/l | 1067 | 6 | 6 | 0.6% | 370.00 | <0.10 | 0.82 | <0.10 |
| Aliphatic TPH >C35-C44 | µg/l | 1068 | 1 | 1 | 0.1% | 140.00 | <0.10 | 0.23 | <0.10 |
| Aromatic TPH >C5-C7 | µg/l | 1068 | 3 | 3 | 0.3% | 39.00 | <0.10 | 0.19 | <0.10 |
| Aromatic TPH >C8-C10 | µg/l | 1068 | 1 | 1 | 0.1% | 140.00 | <0.10 | 0.23 | 25.68 |
| Aromatic TPH >C10-C12 | µg/l | 1068 | 3 | 3 | 0.3% | 170.00 | <0.10 | 0.33 | 119.36 |
| Aromatic TPH >C12-C16 | µg/l | 1068 | 4 | 2 | 0.2% | 140.00 | <0.10 | 0.29 | 72.37 |
| Aromatic TPH >C16-C21 | µg/l | 1068 | 5 | 5 | 0.5% | 370.00 | <0.10 | 0.98 | <0.10 |
| Aromatic TPH >C21-C35 | µg/l | 1068 | 9 | 9 | 0.8% | 2400.00 | <0.10 | 4.20 | 1.89 |
| Aromatic TPH >C35-C44 | µg/l | 1068 | 2 | 2 | 0.2% | 390.00 | <0.10 | 0.68 | <0.10 |
| Trichloromethane | µg/l | 429 | 4 | 4 | 0.9% | 12.00 | <1.00 | 1.06 | <0.10 |
| Tetrachloroethene | µg/l | 429 | 1 | 1 | 0.2% | 21.00 | <1.00 | 1.05 | <0.10 |
| Bis(2-Ethylhexyl)Phthalate | µg/l | 427 | 2 | 2 | 0.5% | 14.00 | <0.50 | 0.54 | <0.50 |
| Acenaphthylene | µg/l | 1068 | 2 | 2 | 0.2% | 2.50 | <0.10 | <0.10 | <0.10 |
| Acenaphthene | µg/l | 1068 | 2 | 2 | 0.2% | 1.30 | <0.10 | <0.10 | <0.10 |
| Phenanthrene | µg/l | 1068 | 3 | 3 | 0.3% | 7.80 | <0.10 | 0.11 | <0.10 |
| Anthracene | µg/l | 1068 | 2 | 2 | 0.2% | 8.30 | <0.10 | 0.11 | <0.10 |
| Fluoranthene | µg/l | 1068 | 4 | 4 | 0.4% | 0.58 | <0.10 | <0.10 | <0.10 |
| Total Phenols | mg/l | 1067 | 7 | 5 | 0.5% | 0.64 | <0.03 | <0.03 | <0.03 |

*Mean concentration in Monks' Ditch

### Updated H1 assessment and discussion

Appendix B contains the updated assessment calculations. The reduction in Monks' Ditch flow from the previous estimate to the flow calculated by LowFlows2 was substantial. Applying the reduced flow to the data set from the Glan Llyn site results in a failure on Test C for both biochemical oxygen demand (BOD) and chromium. This is further discussed below.

Of the 29 occasionally detected contaminants that have been added (Table 1), 23 are organic chemicals or hydrocarbon bands. Two of the six inorganic contaminants, cyanide and cadmium fail the H1 tests. Of the organic contaminants, five PAH species fail. The results are summarised in Table 2, which also includes BOD and chromium.

## Table 2 H1 results for contaminants failing the tests

| Determinand | Units | No. sample | No. exceed | % exceed | RC | BC | Pass MAV* | Recent mean | Recent detects |
|---|---|---|---|---|---|---|---|---|---|
| Biochemical Oxygen Demand | mg/l | 1067 | 193 | 18.0% | 5.34 | 4.61 | 4.83 | 5.17 | 208 |
| Cyanide (Free) | mg/l | 1068 | 9 | 0.8% | 0.05 | <0.05 | 0.00074 | <0.05 | 0 |
| Cadmium (Dissolved) | µg/l | 1068 | 6 | 0.6% | 0.12 | 0.11 | 0.11 | 0.11 | 2 |
| Chromium (Dissolved) | µg/l | 1068 | 207 | 19.4% | 2.64 | 2.17 | 2.52 | 1.12 | 310 |
| Acenaphthylene | µg/l | 1068 | 2 | 0.2% | 0.1 | <0.1 | 0.00013 | 0.10 | 1 |
| Acenaphthene | µg/l | 1068 | 2 | 0.2% | 0.1 | <0.1 | 0.00013 | 0.10 | 1 |
| Phenanthrene | µg/l | 1068 | 3 | 0.3% | 0.11 | <0.1 | 0.00013 | 0.11 | 2 |
| Anthracene | µg/l | 1068 | 2 | 0.2% | 0.11 | <0.1 | 0.074 | 0.11 | 2 |
| Fluoranthene | µg/l | 1068 | 4 | 0.4% | 0.1 | 4.61 | 0.005 | 0.10 | 3 |

* RC is the Release Concentration (the mean value in the discharge monitoring); BC is the Background Concentration (the mean value in Monks' Ditch); Pass MAV is the maximum permissible value of the RC to pass Test 3, for comparison with the RC value.

The last two columns of Table 2 indicate the mean value and the number of detections of each species in the last two years of available data, since June 2023. During this period 559 samples were analysed.

In considering these results, we believe that it is important to keep in mind the site context and the nature of the data. The site is still under redevelopment and large-scale earthworks have been undertaken over the course of the collection of surface water data. The data set starts in May 2021, more than four years ago.

The mean values and statistics on the data set have been calculated in a manner that is very conservative for determinands that are not frequently detected. This is because we have used the detection limit as the assumed value in the case of non-detections. This is why, for example, the mean free cyanide concentration is essentially equal to the detection limit. In practice, many of the non-detects are likely to contain significantly lower cyanide concentrations.

We are also aware that the surface water quality has improved over time, as the site has been progressively developed and exposure of worked Made Ground has reduced. We therefore looked at the average concentrations and detection frequency during the last two years' worth of data – i.e. from June 2023 (see Table 2), to compare with the full data set.

In the last two years, BOD has remained at very similar concentrations to the average for the whole data set. However, chromium concentrations have reduced from an average 2.64 µg/l for the whole data set to 1.12 µg/l (which is below the average concentration in Monks' Ditch). Chromium is frequently detected in the discharge, but applying the recent mean chromium concentration means that chromium no longer fails the H1 test. We note that the recent mean value from the discharge is below the background Monks' Ditch mean concentration.

In the case of cyanide, there have been no detections of free cyanide since June 2023. The EQS is so low, however, that the detection limit is above the EQS and the calculated mean value is also at that value (as described above).

This is the same case for the five PAH species, which have been detected a maximum of three times in the 559 samples since June 2023.

In the case of cadmium, six detections in the full data set, with a maximum value of 1.7 µg/l, are still enough to raise the mean value high enough to fail the H1, given that all the non-detects are counted at the detection limit of 0.1 µg/l, which is slightly lower than the EQS. Two of these detections have occurred since June 2023, with a mean value in that period of 0.11 µg/l (the same value as is calculated for Monks' Ditch).

We also believe that it is likely that all of these contaminants will reduce further in concentration in the discharge as the site development is completed, regular flow through the reen system is established, soils are no longer being reworked, and the exposure of Made Ground to the external environment is minimised. This includes BOD, which is expected to reduce due to increased oxygenation when the drainage system is fully established. Oxygenation will increase due to the flow through the system (driven by the normal water level of 3.4 m aOD at the discharge pumping station), maintenance to remove dead vegetation and the installation of a piano key weir at the outlet from the central lakes.

Yours sincerely

**Joe Gomme**
**Associate Director**

Attachments: Appendix A –Atkins Technical Note on the proposed pumped discharge
Appendix B – updated H1 assessment spreadsheet
Appendix C – updated analytical chemistry data spreadsheet (with additional statistics for the last two years of data)