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**GROUNDWATER ABSTRACTION LICENCE RENEWAL,
ENVIROWALES LTD, RASSAU INDUSTRIAL ESTATE, EBBW VALE**

HYDROGEOLOGICAL IMPACT APPRAISAL

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1.0 INTRODUCTION

1.1 Project Introduction and Objectives

Environmental Compliance Ltd., on behalf of EnviroWales Ltd., has commissioned NSugg Ltd. to prepare a Hydrogeological Impact Appraisal (HIA) to support the renewal of the EnviroWales groundwater abstraction licence at Rassau Industrial Estate, Ebbw Vale, Gwent.

This HIA has been prepared in accordance with the Environment Agency's 2007 guidance¹, as recommended by Natural Resources Wales (NRW), using published reports, site-specific data and following discussions with Sarah Senior, NRW.

The HIA has the following format:

- Section 1: Introduction and licence details
- Section 2: Reviews the regional water resource status
- Section 3: Presents the Hydrogeological Conceptual Site model and identifies potential receptors through a Water Features Survey
- Section 4: Assesses the borehole performance and reviews the available monitoring data; recommendations for future monitoring and actions are also presented.

1.2 NRW Water Abstraction Licence Details

This HIA supports the renewal of the following NRW water abstraction licence:

Licence Number: WA/056/0046/0005

Licence Holder: EnviroWales Ltd

Point of Abstraction: Groundwater of South Wales Lower Coal Measures at Rassau Industrial Estate, Ebbw Vale. NGR: SO 15359 12850.

Use: Industrial

Abstraction Limits: 3.87m³/hr
92.88m³/day
33901.2m³/year

The licence was granted on 17th May 2019 and expires 17th May 2022.

¹ Environment Agency, April 2007, Hydrogeological impact appraisal for groundwater abstractions. Science Report – SC040020/SR2

2.0 REGIONAL WATER RESOURCE STATUS AND LICENSING POLICY

2.1 Regional Groundwater Resource Availability

The EnviroWales groundwater abstraction borehole is located within the South East Valleys Catchment Abstraction Management Strategy (CAMS) Area. Review of the 2017 licensing strategy for the South East Valleys CAMS² confirms the following water resource status:

- **Groundwater Resource Availability:** *There is limited data on groundwater levels and flow within the South East Valleys CAMS area. Groundwater resource availability will be assessed on a case by case basis on application for a groundwater abstraction licence.*

Review of NRW's online mapping³ confirms that the South East Valleys Carboniferous Coal Measures aquifer, in the region of the groundwater abstraction, has a 2015 Water Framework Directive (WFD) Groundwater Quantitative status of 'Good'.

A 'Good' groundwater quantitative status means that the available groundwater resource is not exceeded by the long-term annual average rate of abstraction.

2.2 Regional Groundwater Abstraction Licensing Policy

The licensing strategy for the South East Valleys CAMS states:

- **Groundwater Licensing Policy:** *Due to the low numbers of existing groundwater abstractions and low demand for new abstractions within the South East Valleys catchments, there isn't a separate groundwater licensing policy and each application is treated on a case by case basis.*

There is the presumption of renewal for time limited licences, subject to the three renewal criteria (environmental sustainability, continued justification of need, and efficient use of water) and local considerations such as connectivity to watercourses and wetland sites, however:

- *existing conditions may be replaced with more restrictive terms and conditions to protect the environment e.g. as a result of a WFD assessment,*
- *renewals may be subject to minor changes including the addition of water efficiency conditions,*
- *we will also take into account any objections received to the renewal of the licence, and*
- *where connectivity to a watercourse is a factor and the recent actual flows have fallen below the Environmental Flow Indicator (EFI), we may seek to reduce licensed quantities as part of the renewal process,*
- *where connectivity to a watercourse is a factor and the full licensed flows have fallen below the EFI, we may seek to reduce unused portions of licensed quantities as part of the renewal process.*

² NRW, November 2017, South East Valleys Abstraction Licensing Strategy, A licensing strategy to manage water resources sustainably.

³ NRW, Water Watch Map (www.waterwatchwales.naturalresourceswales.gov.uk/en/)

The licensing strategy confirms that abstractions are managed to protect the environment and WFD objectives. The strategy also confirms that since 2001 all new licences have had a time limit imposed, with all time limited licences having a common end date; the current common end date for the South East Valleys CAMS is 31st March 2029.

3.0 HYDROGEOLOGICAL CONCEPTUAL MODEL

This section of the report presents the local hydrogeological conceptual model for the EnviroWales groundwater abstraction. The geological and hydrogeological setting are described, based on published mapping and reports, together with information from the abstraction borehole log and testing data. Potential water features susceptible to groundwater flow impacts (receptors) are then identified via a water features survey approach.

The search radius for the water features survey has been set at 1.5km from the abstraction borehole; this is considered worse-case, with the recommended survey radius for abstractions in the range 20m³/day-100m³/day (the current licence limit is 92.88m³/day) being 250m¹. However, it is recognised that the search radius should be increased where sensitive features are located just beyond the specified radius, the aquifer is confined or where there is a high degree of uncertainty about the aquifer characteristics.

During the 2017 borehole pumping tests, NRW requested monitoring of surface water features located up to 1.2km distance from the abstraction borehole; therefore, a search radius of 1.5km is considered appropriate and worse case in this instance.

3.1 Borehole Location and Local Topography

The abstraction borehole is located at EnviroWales Ltd.'s site within Rassau Industrial Estate, Ebbw Vale, Blaenau Gwent, NP23 5SD at NGR: SO 15359 12850, as indicated below on Figure 1. The wider site setting is presented on Drawing 1.

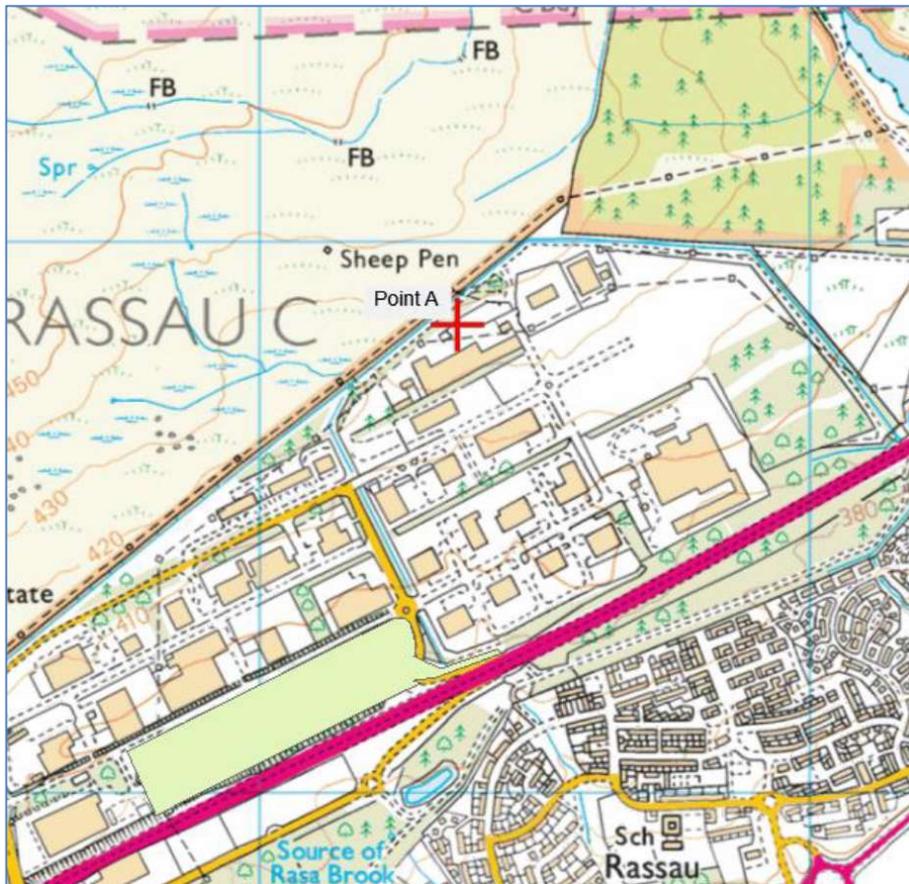


Figure 1. Borehole Location (Point A) (extracted from NRW abstraction licence)

The local topography rises steeply away from the site to the north-west, onto Mynydd Llangynidr of the Brecon Beacons and falls in a south-easterly direction into Rassau and the wider Ebbw Vale.

The abstraction borehole is located at an elevation of approximately 425mAOD, based on Ordnance Survey mapping.

3.2 Geology

Review of the British Geological Survey's online mapping confirms that the borehole is located within an area of superficial Glacial Till overlying sandstone bedrock of the Carboniferous South Wales Lower Coal Measures Formation. The Lower Coal Measures Formation is described as grey, productive coal-bearing mudstones/siltstones, with seatearths and minor sandstones.

The Lower Coal Measures Formation locally overlies the Twrch Sandstone Formation (of the Millstone Grit Group), which in turn overlies the Carboniferous Dowlais Limestone Formation; successively older geological strata outcrop to the north-west, due to the direction of geological dip and topography.

The EnviroWales abstraction borehole is located on the northern limb of the broad, South Wales Coalfield Basin, a structurally complex, trough-shaped geological structure⁴, with the local geological strata dipping towards the south-south-east.

The British Geological Survey's hydrogeological report of Wales⁵ includes a screenshot from a geological model confirming contours on the base of the South Wales Lower Coal Measures Formation. This indicates the base of the Lower Coal Measures Formation is approximately 375mAOD in the vicinity of the EnviroWales abstraction borehole, indicating an aquifer thickness of approximately 50m (based on a ground level of 425mAOD).

An extract of the regional bedrock geology, from the British Geological Survey website, is presented as Figure 2 below.

⁴ Natural Resources Wales, March 2014, National Landscape Character, South Wales Valleys.

⁵ British Geological Survey, 2015, Hydrogeology of Wales.

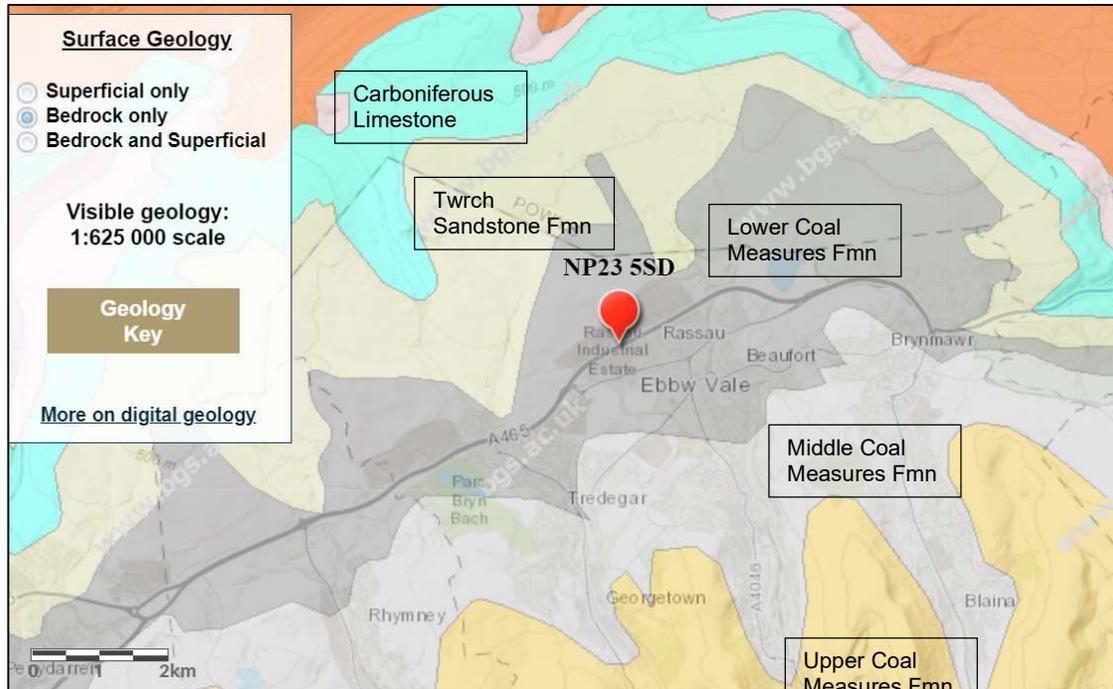


Figure 2. Regional Bedrock Geology (extracted from British Geological Survey mapping)

The geological log from the installation of the EnviroWales abstraction borehole in September/October 2016 is reproduced as Figure 3 below and in summary, confirms the following geological sequence:

Made Ground: to 1.0m below ground level (mbgl)

Superficial Glacial Till (predominantly Clay): 1.0mbgl to 14.0mbgl

Lower Coal Measures Formation (interbedded coal, sandstone and mudstone): 14.0mbgl to 48.0mbgl

Twrch Sandstone Formation (quartz sandstones and conglomerates): 48.0mbgl to 66mbgl (base of borehole)

Geological log:	Thickness (metres)	Depth (mbgl)
MADE GROUND ON ROCK	1.00	1.00
CLAY	0.50	1.50
ROCK	0.50	2.00
CLAY / SAND / GRAVEL	0.70	2.70
CLAY	10.30	13.00
ROCK	0.50	13.50
CLAY	0.50	14.00
COAL	0.50	14.50
SANDSTONE GREY	3.50	18.00
COAL	1.00	19.00
MUDSTONE	5.00	24.00
SANDSTONE / MUDSTONE	3.00	27.00
SANDSTONE – GREY	21.00	48.00
HARD ROCK – GREY WITH WHITE ROCK	18.00	66.00

Figure 3. Abstraction Borehole Geological Log (extracted from 2017 Pumping Test Report⁶)

The borehole was completed with a slotted screen response zone from 30mbgl to 64mbgl (with an end plain section from 64mbgl to 66mbgl). Plain casing was installed from 0mbgl to 30mbgl and cement grout seal from 29mbgl to ground surface. Therefore, based on the above geological log, the borehole response zone is within sandstone and 'hard rock' of the Lower Coal Measures Formation and Twrch Sandstone Formation.

Published borehole logs from the Yuasa Battery boreholes (depths: 80m and 93m), located 1.1km to the south-west of the EnviroWales borehole, are included as Appendix A; whilst these are general driller's logs only, they confirm a similar geological sequence.

3.3 Hydrogeology

This section of the report describes the local hydrogeology of the South Wales Lower Coal Measures Formation in terms of aquifer characteristics, local abstractions, groundwater levels and flow and groundwater quality.

3.3.1 Aquifer Characteristics

Review of NRW's online Interactive Map Viewer and the British Geological Survey's hydrogeological report of Wales⁵ confirms the following aquifer characteristics for the geological strata intercepted by the abstraction borehole:

⁶ B.A. Hydro Solutions Ltd, August 2017, EnviroWales Rassau, Pumping Test Report.

Geological Strata	Aquifer Designation	Description
Glacial Till (13m thickness of predominantly clay)	Secondary (undifferentiated)	Low permeability; will inhibit recharge to underlying aquifer. Groundwater limited to more permeable (sand) horizons, which may be hydrogeologically isolated.
Lower Coal Measures Formation (35m thickness of interbedded mudstone, sandstone and coal seams)	Secondary A	Relatively low permeability carbonaceous mudstones and sandstones with subordinate siltstones and coal seams. Groundwater flow is predominantly via secondary fractures; coal mining activity can locally enhance secondary permeability. Groundwater within the more permeable fractured sandstone units is likely to flow down-dip over less permeable (mudstone) units, often emerging as springs.
Twrch Sandstone Formation (hard quartz sandstone / conglomerate)	Secondary A	Sandstones with low porosity and low intergranular permeability; groundwater flow is dependent on secondary fractures. Fracture density reduces away from outcrop and with depth. Overall permeability and yields are generally comparable to the Coal Measures sandstones.

The aquifer designations are defined as follows:

Secondary undifferentiated: aquifers where it is not possible to apply either a Secondary A or B definition because of the variable characteristics of the rock type.

Secondary A: permeable layers that can support local water supplies, and may form an important source of base flow to rivers

Regionally, the South Wales Coal Measures Formation aquifer is described as⁷:

Coal Measures sandstones are very well cemented, extremely hard and dense and in consequence possess very little primary porosity or intergranular permeability. Sandstone permeability is directly related to the distribution and size of fractures present in the sandstone horizons. Under natural conditions they act as individual aquifers separated by intervening impermeable argillaceous horizons and constitute a complex multi-layered aquifer system. This condition has however largely been disrupted by mining subsidence which has created hydraulic continuity between water bearing layers and in some locations between aquifer horizons and mine workings.

Details of pumping tests undertaken on the abstraction borehole in 2017 are presented below in Section 4.

⁷ British Geological Survey / Environment Agency, 2000, The Physical Properties of Minor Aquifers in England and Wales. Environment Agency R&D Publication 68.

3.3.2 Groundwater Levels and Flow

Groundwater within the Lower Coal Measures Formation and Twrch Sandstone Formation flows locally to the south-south-east, in the direction of geological and topographic dip, towards the Ebbw River and its tributaries, as indicated on Drawing 1.

Rest groundwater levels are presented as metres below datum, within the 2017 Pumping Test Report⁶ for the EnviroWales abstraction borehole and the Yuasa Battery boreholes located 1.1km to the south-west (further details below). These rest groundwater levels have been converted to approximate mAOD values below:

Borehole	Rest Groundwater Level (m below Datum)	Ground Level after OS mapping	Inferred Rest Groundwater Level
EnviroWales abstraction borehole	16.3	425mAOD	409mAOD
Yuasa Borehole 1	24.6	395mAOD	370mAOD
Yuasa Borehole 2	23.4	395mAOD	372mAOD

The above inferred rest groundwater levels are presented on Drawing 1 and concur with a south-south-easterly groundwater flow direction and the local hydraulic gradient is relatively steep, reflecting the local topography and geological dip.

Due to the depth of the EnviroWales and Yuasa Battery boreholes, and significant borehole response zones, they are inferred to represent the regional groundwater table of the Lower Coal Measures Formation / Twrch Sandstone Formation. Review of the rest groundwater levels against the topography at local watercourses (refer to Drawing 1), indicates that groundwater is likely to contribute baseflow to local watercourses. The springs and minor watercourses indicated on elevated ground to the north of the EnviroWales abstraction borehole will be sourced from rainfall-runoff and perched groundwater emerging via fractures, or as springs where the geological boundary between more permeable sandstone layers and underlying less permeable units outcrops. These are up-gradient and considered hydrogeologically isolated from the underlying regional aquifer supporting the abstraction borehole.

A review of the potential impact of the groundwater abstraction on local groundwater levels is presented below in Section 4.

Regionally, groundwater levels and flow within the Coal Measures Formation have been historically altered by mining activities (dewatering) and although likely to now be stable, local areas may still be recovering².

3.3.3 Abstractions and Discharges

This section presents a summary of local groundwater and surface water abstractions and discharges and groundwater source protection zones; relevant details are presented on Drawing 1.

Licensed Abstractions from Groundwater and Surface Water

The South East Valleys Abstraction Licensing Strategy² states:

All of the groundwater abstractions (private and licensed) are from a variety of geological strata within the catchment and can range from shallow abstractions from the drift and the weathered zone to deep bedrock boreholes. Overall, the differing nature of the aquifers across the area, from fractured limestones to mudstones, to drift deposits means that the volume of water that can be abstracted from the strata will be highly variable.

Review of NRW's online public register⁸ confirms that the only licensed abstraction from groundwater or surface water within 1.5km of the abstraction borehole is:

- Licence: WA/056/0064/002
- Licence Holder: Yuasa Battery UK Ltd.
- Address: Yuasa Battery Manufacturing (UK) Ltd., Unit 22, Rassau Industrial Estate, Ebbw Vale, NP23 5SD
- Location: 1.1km south-west of the EnviroWales Ltd abstraction borehole
- Date Issued: 02/04/2019

No further details are available from the public register; however, the Yuasa Battery boreholes were used as observation points during the pumping tests undertaken in 2017 on the EnviroWales abstraction borehole. The test pumping report⁶ confirms that the Yuasa Battery abstraction comprises two boreholes at NGR: 314740 211970, and the borehole logs (Appendix A) confirm borehole depths of 80mbgl and 93mbgl. The Yuasa Battery boreholes also abstract groundwater from the Lower Coal Measures Formation / Twrch Sandstone Formation.

Private Water Supplies

Blaenau Gwent County Borough Council has provided details of local private water supplies (unlicensed abstractions of <20m³/day)⁹. There are no single private water supply abstractions identified within a 3km radius of the abstraction borehole.

Groundwater Source Protection Zones

Review of NRW's online Geo-Portal for Wales¹⁰ confirms that the EnviroWales abstraction borehole is located approximately 190m south-west of a Groundwater Source Protection Zone (merged) associated with public water supply abstraction(s), as indicated on Drawing 1. The Source Protection Zone (SPZ) is extensive and crosses a variety of bedrock geological formations; however, it is assumed that the SPZ is associated with public water supply abstraction(s) from the Carboniferous Limestone Principal Aquifer of this area, which underlies the Coal Measures Formation / Twrch Sandstone Formation and outcrops to the north (refer to Figure 3 above). Therefore, it is inferred that the public water supply abstraction(s) associated with the local SPZ is hydrogeologically isolated from the EnviroWales abstraction borehole. Further assessment of the potential impacts of the EnviroWales abstraction on local groundwater levels is provided in Section 4.4.

⁸ <https://nrwregulatory.naturalresources.wales/Permits>

⁹ Email dated 6th September 2021 from Information Governance Team, Blaenau Gwent County Borough Council.

¹⁰ www.lle.gov.wales/map

Discharges to Groundwater or Surface Water

Review of the NRW online public register⁸ confirms there are no water discharge activity permits identified within a 1.5km radius of the abstraction borehole.

3.3.4 Groundwater Quality

Groundwater within the South Wales Coal Measures Group is typically less mineralised than groundwater found within other British coalfields. Shallow groundwater is generally a calcium bicarbonate type water, rich in calcium and magnesium, with mineralisation (salinity) increasing with depth and age⁵.

Groundwater quality data are available from a sample collected from the EnviroWales abstraction borehole in October 2016, after borehole installation. The data are included as Appendix B and confirm a near-neutral pH (pH7.41) and low mineralisation (chloride: 6mg/l, sulphate: 10mg/l, sodium: 6.57mg/l, calcium: 40mg/l). The electrical conductivity provides an indication of total dissolved solids / salinity, and was recorded at 320µS/cm, significantly below the UK Drinking Water Standard of 2500µS/cm.

3.4 Hydrology

The EnviroWales abstraction borehole is located within the surface water catchment of the Ebbw River; the closest tributary watercourses rise as springs on the moorland immediately to the north. The source of the Ebbw River is Llangynidr Reservoir, located approximately 1.2km north of the abstraction borehole.

Nant Melyn flows in a southerly direction, passing approximately 400m west of the abstraction borehole, and discharges into Rasa Brook in Rassau. The source of Rasa Brook is near Trevil Farm, Rassau, approximately 900m south-south-west of the abstraction; the brook flows east, discharging into the Ebbw River in Carmelton.

Drawing 1 presents the local hydrological setting and the five surface water monitoring points used during the 2017 borehole test pumping, as requested by NRW. These include two locations on Nant Melyn, the source of Rasa Brook and two minor tributaries of the Ebbw River. The potential impact of the abstraction borehole on these surface water courses, and other potential local water features is discussed further in Section 4.

3.5 Water Framework Directive Water Bodies

Review of NRW's online Water Watch Wales mapping confirms that the abstraction borehole is located within the following Water Framework Directive (WFD) waterbodies:

Groundwater Body: South East Valleys Carboniferous Coal Measures
Waterbody ID: GB40902G201900
Overall Status: Poor
Quantitative Status (2015): Good
Chemical Status (2015): Poor

A 'Good' groundwater quantitative status means that the available groundwater resource is not exceeded by the long-term annual average rate of abstraction. In addition, the groundwater abstractions must not cause failure of good ecological status in dependent surface water bodies, significant damage of dependent wetlands (groundwater dependent terrestrial ecosystems) or saline or other intrusions.

River Water Body: River Ebbw (source to confluence with Ebbw Fach River)
Waterbody ID: GB109056032900
Overall Status: Moderate
Ecological Status (interim 2018): Moderate
Chemical Status (interim 2018): Good

It is noted that the River Ebbw (source to confluence with Ebbw Fach River) is a targeted waterbody, with a 2021 target of 'good'.

The groundwater abstraction must not impact the WFD status of these waterbodies, and this is discussed further in Section 4.

3.6 SSSIs etc.

Review of NRW's online Interactive Map Viewer confirms that there are no designated nature conservation sites (e.g. SSSIs, SACs, RAMSAR sites) within a 1.5km radius of the abstraction borehole.

3.7 Water Features Survey

The local hydrogeological and hydrological setting of the EnviroWales abstraction borehole is summarised above and can be used to identify potential water features susceptible to flow impacts.

During the period of borehole test pumping in 2017 (detailed in Section 4), NRW identified five local surface water features that required monitoring for potential impacts. These are highlighted on Drawing 1 and can be summarised as follows:

1. The source of Rasa Brook (1.2km south/downstream of EnviroWales borehole)
2. Nant Melyn downstream of A465 (800m south/downstream of EnviroWales borehole)
3. Tributary of River Ebbw near Rowan Way (800m south-east/downstream of EnviroWales borehole)
4. Tributary stream in woodland (920m north-east of EnviroWales borehole)
5. Nant Melyn upstream of industrial estate (510m west of EnviroWales borehole)

It is noted that monitoring location 4 was not accessible during the test pumping due to boggy and unsafe ground conditions in the area.

Review of the conceptual site model and Drawing 1 indicates that the closest surface water features potentially susceptible to flow impacts due to the EnviroWales abstraction are Nant Melyn and Rasa Brook, which were included within NRW's 2017 monitoring locations.

The impact of the groundwater abstraction on these water features is discussed in Section 4, based on observations during the test pumping and during the subsequent period of licensed groundwater abstraction.

As discussed in Section 3.3.2, the minor tributary watercourses and springs rising to the north (up-gradient) of the EnviroWales abstraction borehole are sourced from shallow, perched groundwater and rainfall-runoff and are considered hydrogeologically isolated from the regional aquifer supporting the abstraction borehole.

4.0 ABSTRACTION BOREHOLE PERFORMANCE

4.1 Introduction

This section of the report reviews the monitoring data available from the abstraction borehole, both during the period of test pumping prior to licence approval and the subsequent abstraction monitoring records.

In summary, the borehole was drilled in September/October 2016, test pumping was undertaken in April/May 2017 and the abstraction licence granted by NRW in May 2019.

EnviroWales has subsequently abstracted groundwater in accordance with the licence, but abstraction rates have been significantly restricted due to issues with both the borehole infrastructure and the recycling plant (end use).

Historical issues with the abstraction borehole have included: siltation of the base of the borehole requiring replacement of the filter media and borehole flushing and inadequate pump equipment requiring replacement. These issues have now been rectified, the borehole is now performing as designed, with adequate water quantity and quality.

4.2 Test Pumping

Prior to licence approval, B.A. Hydro Solutions Ltd. undertook a programme of test pumping in May 2017, in accordance with NRW consent to investigate a groundwater source reference PAN-00115. The test pumping methodology and results are documented within the August 2017 Pumping Test Report⁶ and in summary comprised:

- Step test followed by a recovery test (1st May 2017): five stepped abstraction rates were attempted, for approximately two hours per step, with increasing abstraction rates of 2.90m³/hour, 5.98m³/hour, 8.78m³/hour, 11.89m³/hour and 13.67m³/hour. The pumping test report notes that the rate of drawdown during steps 4 and 5 continued to increase throughout the step, suggesting steady state conditions were not achieved. The water level at the end of step 5 was approximately 45m below datum (mbdat) and the borehole was allowed to recover overnight.
- Constant Rate tests: a 48-hour constant rate test at an average abstraction rate of 7.497m³/hour was held on 3rd to 5th May 2017, followed by a period of recovery and a further 24-hour constant rate test on 8th to 9th May at an average abstraction rate of 5.351m³/hour. The initial constant rate test commenced at an abstraction rate of approximately 12m³/hour, but this was not sustainable with the groundwater level continuing to decline and the abstraction rate was progressively stepped down until a sustainable rate of 6m³/hour was identified. Therefore, the second, 24-hour test was undertaken at a lower (sustainable) abstraction rate.

Unfortunately, the data gathered during the 2017 pumping tests was limited and difficult to interpret due to the nature of the testing.

However, during the pumping tests monitoring of the following locations was undertaken:

- water level within the Yuasa Battery boreholes;
- water level and flow rate within Yasa Brook (monitoring location 1 on Drawing 1); and
- water level and flow rate within Nant Melyn upstream of the industrial estate (monitoring location 5 on Drawing 1).

The impact of the EnviroWales groundwater abstraction on these water levels / flow rates is discussed below in Section 4.4.

4.3 Groundwater Abstraction Monitoring Records

The borehole licence includes conditions requiring water level monitoring on an hourly basis and daily water abstraction monitoring, with records maintained and submitted to NRW as an annual return.

Monitoring of water abstraction rates has been limited and data records difficult to reconcile, with reliable data (monthly totals) only available for the period January to July 2021. The available groundwater abstraction data are summarised below:

Month (2021)	Jan	Feb	March	April	May	June	July
Meter Reading	1478	1902	2406	2873	3186	3525	3832
Volume of Water Abstracted (m ³)	160	424	504	467	313	339	307
Daily Average Abstraction Rate (m ³ /day)	5.2	15.1	16.3	15.6	10.1	11.3	9.9
Licence Limit – Daily abstraction limit	92.88m ³ /day						
Hourly Average Abstraction Rate (m ³ /hour)	0.2	0.6	0.7	0.6	0.4	0.5	0.4
Licence Limit – hourly abstraction limit	3.87m ³ /hour						

The monthly abstraction totals have been used to derive average daily and hourly abstraction rates above. It is apparent that the actual abstraction rates, during the period January to July 2021, were significantly below the licence limits. The abstraction rates also remained below the 20m³/day limit that triggers the requirement for an abstraction licence.

EnviroWales has confirmed that groundwater abstraction rates have been limited by a reduced demand from the plant, due to technical issues. EnviroWales has also confirmed that unknown quantities of excess water abstracted from the borehole, which could not be utilised on site, was drained back down the borehole; therefore, overall net abstraction rates would be even lower than those presented above.

An automatic 'Well Watch' water level monitor is installed at the borehole and records the water level on an hourly basis as a depth below ground level. The reliability and calibration of the monitoring system is uncertain, with data only reported to the nearest metre below ground level.

It is recognised that the existing monitoring records are limited and reliability is uncertain; therefore, new borehole instrumentation is proposed and due to be installed and commissioned by the end of November 2021 (further details are provided in Section 4.5 below).

4.4 Hydrogeological Impact Appraisal

The hydrogeological conceptual model presented in Section 3 identified a number of local water features potentially sensitive to the EnviroWales abstraction borehole, with the closest water features being: Nant Melyn (approximately 500m south-west) and Rasa Brook (approximately 1.2km south). The potential impact of the abstraction on local groundwater

levels has also been monitored at the Yuasa Battery boreholes, approximately 1.1km south-west.

Observed groundwater levels, stream levels and stream flows from the 2017 test pumping are presented as Figure 4 below. As detailed within the Test Pumping Report and on Figure 4, groundwater abstraction from the EnviroWales borehole had no discernible impact on flows within Rasa Brook or Nant Melyn, or on groundwater levels within the (pumped) Yuasa borehole.

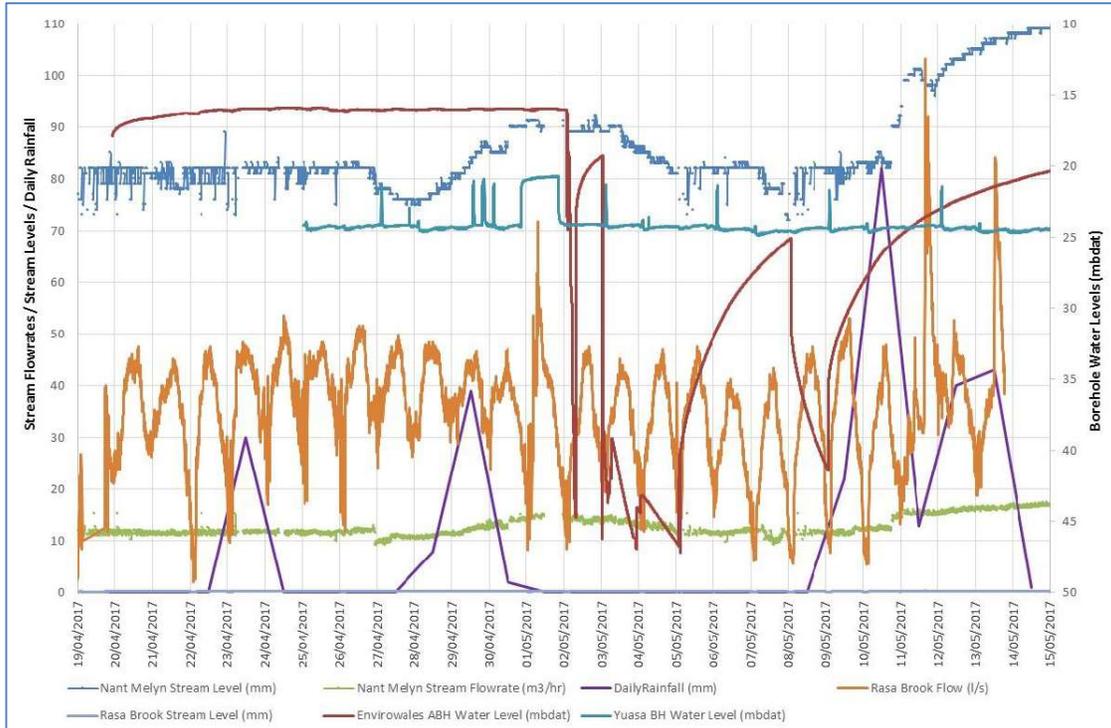


Figure 4. Monitoring Records From 2017 Test Pumping (extracted from 2017 Test Pumping Report⁶)

The 2017 dataset confirmed that flows in Rasa Brook recorded a clear diurnal fluctuation, presumably due to upstream discharge(s) and/or abstraction(s), although no current consented discharges or licensed abstractions have been identified in the vicinity. Flows in Rasa Brook ranged from approximately 5l/s to approximately 100l/s during the monitoring period. They remained elevated above those recorded within Nant Melyn (typically: 15m³/hour, equivalent to 4l/s), which has a significantly greater catchment area, reflecting the impact of the unknown discharge(s) / abstraction(s) on Rasa Brook.

EnviroWales has confirmed that the flow in Nant Melyn, which rises as a spring on moorland to the north and flows through Rassau Industrial Estate, fluctuates seasonally but there has been no visual deterioration in flow rate during operation of the abstraction borehole.

It is recognised that the Coal Measures Formation and Twrch Sandstone Formation intercepted by the abstraction borehole include fractured aquifer units, with groundwater yield and flow dependent on the density and connectivity of fractures intercepted. It is therefore difficult to predict the radius of influence of the abstraction, and field monitoring/observations provide the only reliable data. The 2017 test pumping confirmed no discernible impact on groundwater levels at 1.1km distance, within the Yuasa Battery borehole; thus implying a radius of influence of <1.1km. No private water supply abstractions or licensed abstractions have been identified within a 1km radius of the

abstraction borehole. The outer edge of the public water supply groundwater Source Protection Zone (SPZ) is approximately 190m north-east of the abstraction borehole (Drawing 1) and therefore potentially within the radius of influence of the EnviroWales abstraction. However, as outlined in Section 3.3.3, the public water supply abstraction is assumed to be hydrogeologically isolated from the EnviroWales abstraction borehole and abstracting from the deeper Carboniferous Limestone Principal Aquifer. If the radius of influence of the EnviroWales abstraction extends into the groundwater SPZ any impact on local groundwater levels would be limited and localised, and any potential impact on groundwater flow to the public water supply abstraction negligible due to the extent of the SPZ and presumed depth of abstraction from the limestone aquifer.

Therefore, based on the available data, the EnviroWales abstraction borehole has no discernible impact on the identified local water features including the WFD waterbodies.

4.5 Proposed Borehole Monitoring Regime

EnviroWales Ltd. recognises the deficiencies within the existing borehole monitoring records and are committed to improving the monitoring regime moving forwards. Therefore, the following actions are being taken, with the new instrumentation due to be installed and commissioned by the end of November 2021:

Groundwater Level Monitoring

The existing 'well watch' instrumentation is to be replaced with an upgraded system (WW 670) capable of logging to a remote, central location which will provide the ability to interrogate the data remotely. Technical specifications:

Features

- Units – English (ft & in) or Metric
- Resolution – .05 ft (1 cm)
- Accuracy – .1 ft (3 cm)
- Range – 10 to 7000 ft (3 to 2100M)
- Update time – ~1 sec @ 500 ft (150M)

Input/Outputs

- 4-20mA output (to allow communication to a remote system)
- 0-5V Analog output
- 5V Alarm output
- USB

Abstraction Rate Monitoring

Two, Kobold MIM compact magnetic inductive flowmeters have been ordered with the following specification.

- Accuracy: +/- 2% of Measuring Value, + 0.5% of Full Scale
- Max. Viscosity: 70mm²/s
- Min. Conductivity: > 20 uS/cm
- Power Supply: 19-30 VDC
- Max.Temp: -20 Deg C to +70 Deg C
- Max. Pressure: PN16
- Flow Range: 1.5 to 350 L/Min

Remote Data Access and Control

Following installation and commissioning (end of November 2021), the above instrumentation will provide reliable monitoring of both groundwater level and abstraction rate, in accordance with the licence requirements.

The outputs from the monitoring devices and any required alarms will be directly wired into a Programmable Logic Controller (PLC) that is capable of reading and storing these values/inputs. A cloud-based service will be configured to read the data from the PLC. Custom web pages will deliver specific data to concerned parties i.e. engineering, Environmental department staff etc. These web pages will be available for remote access and be secured by user authentication.

4.6 Proposed Actions and Recommendations

This report presents a summary of the hydrogeological conceptual site model, borehole history and HIA in support of an abstraction licence renewal. It is recognised that a number of constraints with the borehole infrastructure, borehole monitoring equipment and plant performance have limited the data available to support this HIA. However, the information presented above, including evidence from the 2017 test pumping and ongoing observations during the period of licensed abstraction support a renewal of the existing abstraction licence conditions until the South East Valleys CAMS end date of 31st March 2029.

EnviroWales has a continued long-term requirement for the water supply at their plant and this HIA demonstrates the environmental sustainability of the abstraction based on available data; therefore the abstraction meets the licence renewal criteria of the South East Valleys CAMS.

EnviroWales has recently invested in advanced monitoring equipment to ensure appropriate future monitoring of the borehole groundwater level and abstraction rate. The borehole and plant are now operating as designed and it is recommended that, once the monitoring infrastructure has been commissioned in November 2021, the monitoring datasets be reviewed routinely (minimum monthly) to identify any potential data gaps or discrepancies at an early stage. It is critical that reliable data for both groundwater level and abstraction rate are obtained, in accordance with the licence conditions, to assess and support continued groundwater abstraction. Therefore, all monitoring equipment should be maintained and calibrated in accordance with the manufacturer's recommendations.

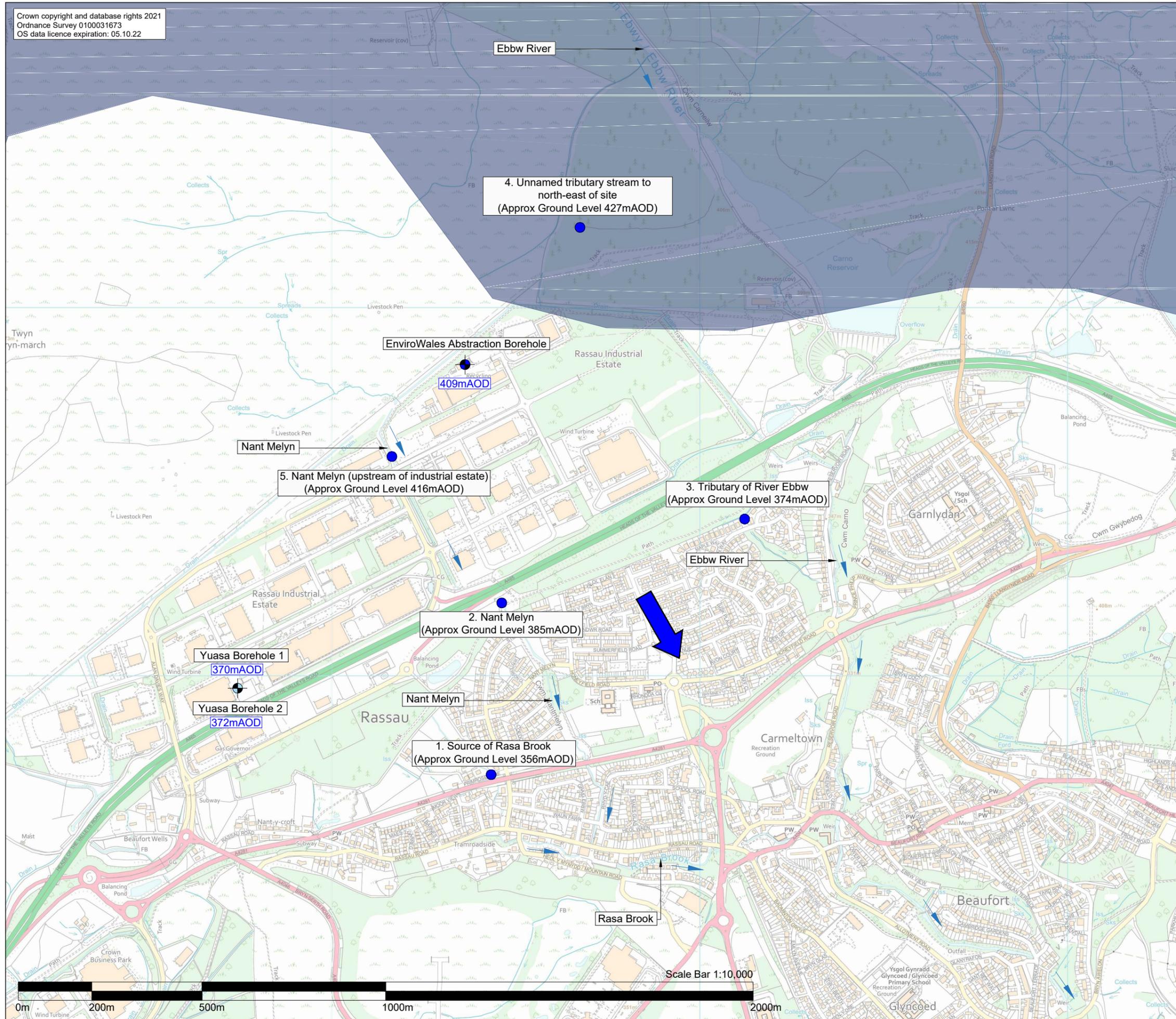
Following a period of sustained abstraction and monitoring (minimum 4 months), it is recommended that EnviroWales review the borehole performance and the plant water requirements to assess the continued efficacy of the current licence conditions.

5.0 CLOSURE

This report has been prepared by Nicola Sugg (trading style of NSugg Limited) with all reasonable skill and care, and in accordance with the services agreed with Environmental Compliance Ltd. Relevant information provided by Environmental Compliance Ltd. and EnviroWales Ltd. has been accepted in good faith as being accurate and valid. This report is based on the relevant guidance and legislation in force at the date of the report and should be reviewed if such guidance and legislation are amended or superseded.

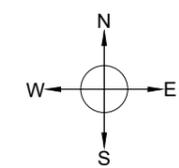
This report is for the exclusive use of Environmental Compliance Ltd. and EnviroWales Ltd.; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from Nicola Sugg.

DRAWINGS



NOTES
 1. Groundwater Source Protection Zone (merged) after Natural Resources Wales online LLe Map Browser

- LEGEND**
- Abstraction Borehole
 - Yuasa Battery Licensed Abstraction Borehole
 - 409m AOD Approximate Rest Groundwater Level
 - Groundwater Source Protection Zone
 - Surface Water Monitoring Sites During 2017 Test Pumping (approximate elevation, m AOD)
 - Inferred direction of groundwater flow within the Lower Coal Measures Formation



SITE
 EnviroWales Abstraction Borehole, Rassau Industrial Estate, Ebbw Vale

PROJECT
 Hydrogeological Impact Appraisal

DRAWING TITLE
 Local Hydrological & Hydrogeological Setting

DRAWING NUMBER 1	REVISION 0
SCALE 1:10000 @ A3	DATE 04.10.2021

J Davey CAD Ltd
 T: 07952 794076 jdaveycadltd@gmail.com

APPENDIX A



C. STRATA LOG

Description of Strata	Thickness(m)	Depth(m)
Soft overburden	1	1
Brown, Soft gravels	2	3
Yellow sandy marl – Soft	1	4
Grey clay & gravels – Med	6	10
Grey marls – Med	9	19
Grey shale/limestone – Med	54	73
Grey limestone & quartz – Hard	3	76
Grey limestone – Med	4	80

Other Comments (e.g. gas encountered, saline water intercepted, etc.)

Gravel Pack Quantity: 75 bags	Temp Steel Casing
Rig & Crew: R Skam, Phil Stokes	Depth and Diameter: 8.5m x 250mm



AC 47926

SO11/15

ENVIRONMENT AGENCY

Form WR - 38 Agency No.

BOREHOLE RECORD

A. SITE DETAILS - PRODUCTION BOREHOLE NUMBER 1

WELSH EA	232	SO11SW1
Borehole drilled for: YUASA BATTERY UK LTD (HOLE 2)		
Location: RASSAU IND. EST. EBBW VALE		
N.G.R.:	SO 1475 1210	Ground Level (if known): SURFACE
Drilling Company: W.B. & A.D. MORGAN LTD., PRESTEIGNE, POWYS. LD8 2UF		
Date of Drilling:	Commenced: 10/9/98	Completed: 23/9/98

B. CONSTRUCTION DETAILS

Borehole datum (if not ground level).....	GROUNDLEVEL
(point from which all measurements of depth are taken e.g. flange, edge of chamber, etc.)	
Borehole drilled diameter.....	254 mm from Surface to 93 m/depth
	mm from to m/depth
	mm from to m/depth
Casing material	u.P.V.C.
and type (e.g. plain steel, plastic slotted)	153 diameter mm from Surface to 93m/depth
	SCREEN diameter mm from 103 to 34.8 m/depth
	u.P.V.C. diameter mm from 34.8 to Surface m/depth
	SCREEN diameter mm from to m/depth
	u.P.V.C. diameter mm from to m/depth
Grouting details.....	12m TO SURFACE
Water struck at.....	12,37.5, 80, 90m (depth below datum - mbd)
Rest water level on completion.....	m (depth below datum - mbd)



C. STRATA LOG

Description of Strata	Thickness(m)	Depth(m)
Overburden	1	1
Gravels	9	10
Grey Clay and Marls	10	19
Grey limestone shale	64	93
Other Comments (e.g. gas encountered, saline water intercepted, etc.)		
Gravel Pack Quantity: 90 bags	Temp Steel Casing	
Rig & Crew: R Skam, Phil Stokes	Depth and Diameter: 11m x 254mm	

APPENDIX B



Teckna Group
Saddle Hill Farm
277 Preston Road
Standish
Lancashire
WN6 0NZ

TEST CERTIFICATE

Date Received : 05.10.16
 Date Reported : 07.10.16
 PA Ref : C 39958

Sample Ref.		Water Sample : Envirowales
Lab Ref.		C 43398
	Units	
Aluminium	mg/l	0.07
Ammonia	mg/l	0.17
Cadmium	mg/l	<0.05
Calcium	mg/l	40
Chloride	mg/l	6
Chromium	mg/l	<0.05
Copper	mg/l	<0.05
Electrical Conductivity	µS/cm	320
Total Hardness as CaCO ₃	mg/l	153
Temporary Hardness as HCO ₃	mg/l	26
Total Iron	mg/l	1.31
Dissolved Iron	mg/l	0.55
Iron in Suspension	mg/l	0.76
Lead	mg/l	<0.01
Magnesium	mg/l	13.14
Manganese	mg/l	0.31
Mercury	mg/l	<0.001
Nickel	mg/l	<0.05
Nitrate	mg/l	0.7
Nitrite	mg/l	0.02
pH	----	7.41
Potassium	mg/l	4.88
Sodium	mg/l	6.57
Sulphate	mg/l	10
Turbidity	FTU	30.4

For and on behalf of
PRECISION ANALYSIS (NW) LIMITED

M. Hope MSc CChem MRSC AIEMA
 Laboratory Manager

J. Whitter AIEMA
 Laboratory Supervisor



Nicola Sugg
Consultant Hydrogeologist
& Hydrologist

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