



**St. Modwen Developments (Llanwern) Ltd**

**Glan Llyn**

**Surface Water Discharge Activity Environmental Permit Application  
Non-Technical Summary**

January 2022

Project Ref: 02554/HH



## Contents

Section	Page
<b>1 Introduction</b>	<b>4</b>
<b>2 Site Description</b>	<b>4</b>
2.1 Location	4
2.2 Residential Development	4
2.3 Geology	4
2.4 Hydrology	4
2.5 Designated Sites	5
<b>3 Proposed Surface Water Discharge</b>	<b>5</b>
3.1 Current Site Drainage	5
3.2 Planning Approval	5
3.3 Surface Water Discharge Activity	5
3.4 Discharges Excluded from Surface Water Discharge Activity Permit Application	6
3.5 Alternative Discharge Options	6
<b>4 Relevant Legislation</b>	<b>7</b>
<b>5 Relevant Guidance</b>	<b>7</b>
<b>6 Treatment</b>	<b>8</b>
6.1 SuDS	8
<b>7 Emissions</b>	<b>9</b>
7.1 Flow Rates	9
7.2 Water Quality	9
<b>8 Environmental Risk Assessment</b>	<b>11</b>
8.1 Introduction	11
8.2 H1 Risk Assessment	11
<b>9 Monitoring</b>	<b>13</b>
9.1 Introduction	13
9.2 Monitoring Locations	13
9.3 Monitoring Frequency	13
9.4 Methodology	13
9.5 Laboratory Analysis	14



9.6	Assessment Criteria	14
10	Environmental Management Systems .....	14
11	Provision of Further Information .....	14

**List of Tables**

Table 7-1	Exceedances of Water Quality Standards in Monks Lake.....	10
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**Appendices**

Appendix A	Drawings.....	
Appendix B	DCWW Correspondence 2007 .....	
Appendix C	Application Forms .....	
Appendix D	HI Risk Assessment .....	
Appendix E	Water Quality Laboratory Analytical Data.....	
Appendix F	Environmental Management Procedure.....	



## **I Introduction**

PJA Engineering Ltd has prepared this report on behalf of St. Modwen Developments (Llanwern) Limited (St. Modwen) to support St. Modwen's application to Natural Resources Wales (NRW) for a surface water discharge activity environmental permit for the Glan Llyn residential development.

The permit application is made under the Environmental Permitting (England and Wales) Regulations 2016.

## **2 Site Description**

### **2.1 Location**

The Glan Llyn residential development is located off the A4810 Queensway at the former Llanwern steelworks, approximately 4km to the east of Newport, South Wales. Centred on approximate National Grid Reference 336820, 186442, the Glan Llyn residential development covers approximately 200 hectares.

### **2.2 Residential Development**

Comprising 834 occupied houses as of June 2021, a primary school and Western Park, Glan Llyn is being constructed under outline planning decision notice 06/0471 and will ultimately comprise approximately 4,000 homes with a second school, a local centre and a series of lakes.

Reclamation, remediation and construction of Glan Llyn is being undertaken on a phased basis generally from west to east across the site. Developed and occupied areas in the west of Glan Llyn comprise buildings, areas of external hardstanding such as driveways, car parking, pavements and highways, and residential gardens, grass verges and public open space. Undeveloped areas in the east of Glan Llyn generally consist of bare ground and stockpiles of material.

### **2.3 Geology**

A cover of Made Ground containing slag was placed at the site as part of construction of the Llanwern steelworks which was excavated to remove residual obstructions, validated for use and re-engineered to the required ground levels. The underlying natural ground comprises Tidal Flat Deposits (clay, silt, sand and peat) and bedrock of the Mercia Mudstone Group.

### **2.4 Hydrology**

Monks Ditch, a main river, passes from north to south directly to the east of the Glan Llyn residential development in a deep piled concrete channel which is approximately 7m wide and 3m deep. The artificial channel is understood to have been constructed during development of the steelworks



and is currently hydraulically isolated from Glan Llyn. Monks Ditch flows in a natural channel to the north and south of Glan Llyn.

The River Usk is located approximately 2km to the west of Glan Llyn.

The site currently drains via the historical Tata Surface Water Drainage System. Water from this system is pumped into the Severn estuary. St Modwen Developments Ltd do not have the legal right to discharge surface water from the developed areas of the site through the Tata system.

## **2.5 Designated Sites**

The Gwent Levels Site of Special Scientific Interest (SSSI) is located approximately 500m to the south of Glan Llyn and extends approximately 3.6km to the south to the Severn Estuary.

# **3 Proposed Surface Water Discharge**

## **3.1 Current Site Drainage**

The Glan Llyn site is characterised by two surface water drainage systems, one which is a legacy of the historical Llanwern steelworks and a second which has been and continues to be newly constructed as part of the residential development.

The legacy drainage system is located in the undeveloped area of the site and discharges off-site to the south via a series of north-south aligned ditches which are culverted between the A4810 Queensway.

At present, the new drainage system is located in and around the developed area in the west of Glan Llyn, comprising a series of north-south aligned reens and an east-west aligned reen passing towards and alongside Monks Ditch into a settlement lagoon known as Monks Lake.

As construction of Glan Llyn progresses eastwards, the remaining legacy ditches will be removed and the remainder of the new reens and associated lakes will be formed.

## **3.2 Planning Approval**

The Glan Llyn drainage strategy was approved with conditions under planning decision notice 16/1295.

## **3.3 Surface Water Discharge Activity**

The permit application relates solely to surface water in the reens which have been constructed as part of the new drainage system to drain the developed area of Glan Llyn.

The surface water discharge activity comprises rainfall-dependent site drainage, with the reens in the new drainage system receiving the following inflows:



- surface water run off from the completed residential development;
- base flow from the engineered fill and natural ground surrounding the reens; and
- surface water run-off from land to the north of Glan Llyn.

The approved Glan Llyn drainage strategy requires discharge of this surface water via a settlement lagoon and surface water pumping station 1 (SWPS1) to Monks Ditch, at National Grid Reference 336762, 186783, as outlined in green on Drawing 02554-HH-001 in Appendix A.

### **3.4 Discharges Excluded from Surface Water Discharge Activity Permit Application**

Surface water run-off and base flow from undeveloped areas of Glan Llyn is excluded from this application and will continue to discharge off-site to the south via the legacy drainage system.

Water arising from construction activities at Glan Llyn, such as dewatering, is excluded from this application and will be discharged to the legacy drainage system.

The remediation of the site is expected to be completed by autumn 2025. At this point it is proposed that all surface water will be discharged via Monks Ditch.

### **3.5 Alternative Discharge Options**

The nearest sewer is immediately adjacent to Surface Water Pumping Station No 2 on the east side of Monks Ditch. This pumping station has recently been constructed to take flows from the Business Park. The capacity of this pumping station is 14.70 l/s.

The nearest gravity sewer is approximately 3.05km away at the southwest corner of the site. This sewer is a 225mm sewer which does not have sufficient capacity for the site foul sewage.

The existing sewer along Meadows Road is to be upgraded by DCWW to take the flows from the foul drainage on the site. This sewer would not have sufficient capacity to take surface water from the site.

The only viable point of connection would therefore be the Nash Treatment Works which is approximately 5.5km from the site. Estimates for foul connections to this point were estimated at between £5.5 to £10m in 2007. This did not include upgrading of the treatment works.

The volume of water over a year from the site and the interconnected flows from the hills to the north is estimated at around 1,800,000cum. This excludes any breach flows from Monks Ditch which can enter the site via the culverts from the north of the site. Monks Ditch currently breaches north of Llanwern village, for floods of 1:50 year events and higher, this then floods the village, and the water then flows through a drainage system into the Glan Llyn system. This could add another 250,000cum per year depending upon storm events.



The discharge from Glan Llyn has been agreed at 750 l/s after a storm and 250 l/s for normal flows.

DCWW were approached in 2007 regarding foul water discharge from the site. The correspondence is included in Appendix B.

## 4 Relevant Legislation

The following legislation is considered to be relevant to the proposed surface water discharge activity:

- Environmental Protection Act 1990;
- Water Resources Act 1991;
- Environment Act 1995;
- Water Framework Directive (2000/60/EC);
- Environmental Permitting (England and Wales) Regulations 2016; and
- The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017
- The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015.

## 5 Relevant Guidance

The following guidance has been used in preparing the permit application and supporting information:

- Environmental permitting application form B2 guidance;
- Environmental permitting application form B6 guidance;
- Environmental permitting application form F2 guidance;
- Environmental Permitting Core Guidance, DEFRA, March 2020;
- How to comply with your environmental permit, Natural Resources Wales, October 2014;
- How to comply with your environmental permit: additional guidance for water discharge and groundwater (from point source) activity permits (EPR 7.01), Natural Resources Wales, 2014;
- LIT 10419 Modelling: surface water pollution risk assessment, Environment Agency, 2014;
- H1 Software Tool User Guide Version 2.78, Environment Agency, April 2017;
- H1 Annex D – Basic Surface water discharges, Environmental Agency;
- Surface water pollution risk assessment for your environmental permit, Environment Agency and DEFRA, February 2016 (updated August 2021);
- NRW Gwent Levels Briefing Note: Advice on Water Quality Standards to be used for Impact Assessment of the M4 Relief Road on the Gwent Levels Ditch System, December 2016;



- Establishment of a list of Predicted No Effect Concentrations (PNECs) for naturally occurring substances in produced water (OSPAR Agreement 2014-05);
- European Chemicals Agency <https://echa.europa.eu/>;
- NORMAN database <https://www.norman-network.com/nds/>.

## 6 Treatment

### 6.1 SuDS

The drainage strategy for the Glan Llyn residential development adopts a sustainable drainage system (SuDS) to minimise the impacts from the development on the quantity and quality of the runoff and maximise amenity and biodiversity opportunities. In seeking to sustainably drain surface water from the site the “Management Train” methodology as set out in CIRIA C753 has been adopted, consisting of the following components:

- Prevention – good site design and upkeep to prevent runoff and pollution (e.g. limited paved areas, regular pavement/car park sweeping, clear adoption and maintenance programme of SuDS);
- Source Control – runoff control at/near to source (e.g., permeable paving, swales);
- Site Control – water management from different onsite compartments (e.g. route water from roofs, impermeable paved areas to one infiltration/holding site); and
- Regional Control – integrated runoff management from a number of sites (e.g. into a detention/settlement pond).

The main strategic attenuation features providing the necessary site control include a network of reens (blueways), greenways, online ponds/pools and offline lakes. In order to deliver the treatment train philosophy the Glan Llyn residential development also incorporates a combination of source control SuDS techniques to replicate, as closely as possible, the natural drainage from the site before development.

It is proposed that the following parameters are considered as a single treatment train:

- 25m of reen/swale;
- A pond with a width and length greater than 5 and 10 (respectively) times the adjacent swale width;
- A trapped gully (when in conjunction with a reen/swale);
- Permeable paving; and
- Filter trench 10m in length.



The new drainage system in the Glan Llyn residential development currently includes approximately 4.5km of reens naturally vegetated with reeds and rushes, and a final settlement pond. These incorporated SuDS features will allow for passive treatment of surface water in the new drainage system through attenuation, filtration and settlement.

## **7 Emissions**

### **7.1 Flow Rates**

The drainage strategy for Glan Llyn is based on intermittent discharge of water from SWPS1. The duration of pumping will depend on the volume of water in the new drainage system and the volume of water in Monks Ditch, both of which are rainfall-dependent.

In accordance with the approved Glan Llyn drainage strategy, a flow meter installed downstream in Monks Ditch will determine when flows in Monks Ditch are at a sufficiently low level to enable SWPS1 to operate. Surface water will therefore be stored in the new drainage system during intervals between pumped discharge.

NRW has specified that surface water runoff from the Glan Llyn residential development be attenuated and discharged at a maximum discharge rate of 3.5l/s/ha up to and including a 1 in 100yr + climate change event, which equates to a peak discharge rate of 750l/s. SWPS1 has therefore been designed and constructed to achieve a maximum flow rate of 0.75m<sup>3</sup>/s after storm events, however the typical average flow rate during intermittent daily discharge will be 0.25m<sup>3</sup>/s.

### **7.2 Water Quality**

Extensive and comprehensive water quality monitoring has been undertaken in the new drainage system since its construction, together with water quality monitoring which has been carried out since 2019 in the settlement lagoon, Monks Lake.

Laboratory analysis has been undertaken for a range of substances including metals (total and dissolved) and other inorganics, phenols, polycyclic aromatic hydrocarbons (total and dissolved), total petroleum hydrocarbons criteria working group, semi-volatile organic compounds and volatile organic compounds.

A dataset for 57 surface water samples obtained from Monks Lake over a period of 20 months has been used to establish representative water quality for the purposes of the permit application.

Data have been screened against relevant water quality standards (WQS) comprising:

- UK Freshwater annual average (AA) Environmental Quality Standards (EQS) and maximum allowable concentration (MAC) EQS;



- Predicted No Effect Concentrations (PNEC) calculated using the Metals Bioavailability Assessment Tool (M-BAT);
- Phys-Chem Standards (WFD Schedule 3 Part 1 ‘Moderate’ for under 80m);
- Gwent Levels SSSI WQS;
- OSPAR PNEC;
- ECHA PNEC; and
- NORMAN PNEC.

The WQS are presented above generally in the order of priority. Where both the ECHA and NORMAN databases present a freshwater PNEC for a substance, the lower, more conservative PNEC has generally been applied.

Substances with recorded concentrations above LOD with exceedances of the respective WQS are summarised in Table 7-1.

**Table 7-1 Exceedances of Water Quality Standards in Monks Lake**

Substance	Source of Water Quality Standard	Water Quality Standard	Recorded Average	Recorded Maximum	90 <sup>th</sup> %tile	95 <sup>th</sup> %tile
pH	EQS (a)	5 <sup>th</sup> percentile >= pH6 95 <sup>th</sup> percentile <=9	9.69	11.6	-	11.5
Ammonia as N	EQS (a)	1,100 µg/l	1312 µg/l	2767.44 µg/l	2455.81 µg/l	-
Barium	NORMAN PNEC (d)	5.8 µg/l	56.302 µg/l	83.3 µg/l	-	-
Manganese	M-BAT PNEC (b)	123 µg/l	13.283 µg/l	152 µg/l	-	-
Zinc	M-BAT PNEC (b)	28.18 µg/l	9.661 µg/l	134 µg/l	-	-
Lead	EQS (c)	1.2 µg/l	2.192 µg/l	8.07 µg/l	-	-
Fluoranthene	AA-EQS (c)	0.0063 µg/l	0.049 µg/l	0.138 µg/l	-	-
Chrysene	OSPAR PNEC (e)	0.007 µg/l	0.0125 µg/l	0.0656 µg/l	-	-
Pyrene	OSPAR PNEC (e)	0.023 µg/l	0.0321 µg/l	0.122 µg/l	-	-
Benzo(a)anthracene	OSPAR PNEC (e)	0.0012 µg/l	0.0116 µg/l	0.0518 µg/l	-	-
Benzo(a)pyrene	AA-EQS (c)	0.00017 µg/l	0.0082 µg/l	0.0496 µg/l	-	-
Benzo(b)fluoranthene	MAC-EQS (c)	0.017 µg/l	0.0159 µg/l	0.0819 µg/l	-	-
Dibenzo(a,h)anthracene	OSPAR PNEC (e)	0.00014 µg/l	0.0054 µg/l	0.0114 µg/l	-	-
Benzo(g,h,i)perylene	MAC-EQS (c)	0.0082 µg/l	0.0108 µg/l	0.0472 µg/l	-	-
Benzo(k)fluoranthene	MAC-EQS (c)	0.017 µg/l	0.0087 µg/l	0.0309 µg/l	-	-

(a) WFD Schedule 3 Part 1

(b) <https://www.wfduk.org/sites/default/files/Media/Environmental%20standards/MBAT%20UKTAG%20Method%20Statement.pdf>

(c) WFD Schedule 3 Part 3

(d) NORMAN database

(e) OSPAR background document



For several substances included in the analytical suite, the LOD exceeds the WQS but no concentrations have been recorded above the LOD. These substances are not presented in Table 7-1 but the screening is presented in the laboratory analytical data spreadsheet referenced in Appendix E.

WQS are not available via the established sources of EQS and PNEC for a limited number of substances - nine phys-chem parameters, three metals, three non-metals, total petroleum hydrocarbon aliphatic and aromatic fractions, six semi-volatile organic compounds, and eight volatile organic compounds. These are labelled in the laboratory analytical data spreadsheet referenced in Appendix E.

## 8 Environmental Risk Assessment

### 8.1 Introduction

An assessment of the risks associated with the surface water discharge activity has been carried out by using the Environment Agency H1 risk assessment tool in accordance with guidance published by DEFRA and the Environment Agency, <https://www.gov.uk/guidance/risk-assessments-for-your-environmental-permit>.

### 8.2 HI Risk Assessment

The H1 risk assessment, referenced in Appendix D and presented as a Microsoft Access file, and laboratory analytical data referenced in Appendix E and presented as a Microsoft Excel file, shows that at the concentrations recorded, the majority of substances do not pose an unacceptable risk to the receiving water.

The following substances may require further assessment or detailed modelling based on the recorded concentrations above the respective LOD and respective WQS and the outcomes of water impact tests 1 to 4:

- ammoniacal nitrogen;
- benzo(b)fluoranthene;
- benzo(g,h,i)fluoranthene;
- benzo(k)fluoranthene;
- benzo(a)anthracene;
- chrysene;
- dibenzo(a,h)anthracene;
- barium;
- copper;
- fluoranthene;



- indeno(1,2,3-cd)perylene;
- pyrene;
- lead;
- nickel;
- phenol;
- selenium;
- sulphate;
- total suspended solids; and
- zinc.

PNEC sourced via OSPAR, ECHA and NORMAN were manually inputted to the H1 assessment tool as long term (or annual average) EQS with the exception of the respective PNEC for chrysene, pyrene and benzo(a)anthracene which are stated to relate to acute (short term) rather than chronic (long term) risk.

It is noted that the established, accredited detection limits for free cyanide, cadmium, chromium VI, trichlorobenzenes, hexachlorobenzene, hexachlorobutadiene, hexachlorocyclopentadiene, hexachloroethane, trichlorophenols, pentachlorophenol, bromochloromethane, carbazole, dibenzofuran, azobenzene, and 4-chloroaniline are above the respective WQS and detailed modelling may therefore be required if the available accredited detection limits are not considered to be sufficiently low to be protective of the controlled waters receptor.

It is noted that the detection limit on two occasions for a number of volatile organic compounds was insufficiently low in relation to the respective WQS which has skewed the average and maximum concentrations inputted to the H1 tool. However, the detection limit in the remainder of the dataset for these substances was lower than the WQS and therefore the discharge is not considered 'liable to contain' these substances. As such there may be no requirement for detailed modelling of these substances.

Detailed water quality modelling has not been undertaken for these substances as part of this permit application for the following reasons:

- Rather than a continuous discharge, the surface water discharge activity will comprise rainfall-dependent, intermittent pumped discharge for which there is no clear approach to detailed modelling set out in NRW or Environment Agency guidance.
- It is understood that it will be necessary for NRW to undertake detailed modelling for the purposes of deriving water quality permit emission limits in line with the Environmental Permitting (England and Wales) Regulations 2016 taking into account the risks to the Monks Ditch receiving water.



## **9 Monitoring**

### **9.1 Introduction**

As summarised in Section 7.2, an established water quality monitoring regime has been undertaken at the Glan Llyn residential development for a number of years, the aim of which is to assess water quality at specified locations in the reens across the new drainage system and in the settlement lagoon.

The surface water discharge activity will also be subject to water quality monitoring, the proposals for which are summarised in Sections 9.2 to Section 9.6 .

It is acknowledged that monitoring proposals will need to be agreed with NRW.

### **9.2 Monitoring Locations**

It is proposed that the principal sampling location for monitoring the quality of the surface water discharge in relation to Environmental Permit conditions is the chamber within SWPS1 directly at the outfall to Monks Ditch.

Surface water sampling will also be undertaken in Monks Lake and in the reens across the new drainage system to provide information on local water quality fluctuations within the reen network, to determine the ongoing effectiveness of the passive SuDS treatment train, and to inform an assessment of longer term trends in the operational drainage system. However, laboratory analytical data obtained from this wider programme of monitoring will not be used to assess permit compliance.

The principal sampling location is shown on Drawing 02554-HH-002, presented in Appendix A.

### **9.3 Monitoring Frequency**

It is proposed that a water sample is taken weekly from the SWPS1 chamber for the first month of operation, and on a monthly basis thereafter. Sampling will be dependent on the requirement for operation of SWPS1 which will be subject to prevailing weather conditions on the basis that the discharge is rainfall-dependent.

The wider programme of monitoring in the new drainage system will continue to be undertaken.

### **9.4 Methodology**

Sampling will be carried out from the SWPS1 chamber via a tap using the specified sampling containers provided by the laboratory appropriate for the analytical suite in general accordance with BS EN ISO 5667:2006 and in accordance with a task-specific health and safety risk assessment



and method statement. This location allows for the surface water discharge to be sampled as it flows out via SWPS1.

Sampling in the wider new drainage system will be carried out using a telescopic sampler, taking care not to disturb sediment on the base of the reens and Monks Lake.

Samples will be stored in coolboxes packed with ice blocks and dispatched to the laboratory on the day of sampling.

## **9.5 Laboratory Analysis**

The analytical laboratory will have UKAS accreditation and use MCERTS-accredited analytical methods where possible. Laboratory analysis of surface water samples will be carried out on a standard five-day turnaround for each substance which has a numeric limit specified by NRW in the permit which permits the surface water discharge.

Analytical results will be issued by the laboratory in MCERTS PDF and Microsoft Excel format.

## **9.6 Assessment Criteria**

Laboratory analytical data for the SWPS1 sampling location will be compared against the emission limits specified in the environmental permit.

Additional laboratory analytical data obtained from the wider surface water drainage system will be assessed against emission limits, where available, and against freshwater EQS set out in the Water Framework Directive.

Should assessment of the SWPS1 analytical data show there to be non-compliances, these will be reported in accordance with the procedures and timescales stipulated by NRW together with proposals to rectify the non-compliance.

## **10 Environmental Management Systems**

St. Modwen's in-house Environmental Management Procedure is presented in Appendix F and an outline pumping station management plan has been provided under separate cover.

## **11 Provision of Further Information**

It is proposed that an agreed maintenance plan is implemented to manage the new reen system and settlement lagoon. Maintenance activities will include management of vegetation and removal of silt.

Surface water pumping station SWPS1 will be operated and maintained in accordance with an operation and maintenance manual.

## Appendix A Drawings

## **Appendix B      DCWW Correspondence 2007**

## **Appendix C    Application Forms**

## **Appendix D      HI Risk Assessment**

## **Appendix E      Water Quality Laboratory Analytical Data**

## **Appendix F      Environmental Management Procedure**