Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Hyder

SKANSKA

Dŵr Cymru Welsh Water

Bryn Cowlyd Water Treatment Works, Dolgarrog

Environmental Report

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Dŵr Cymru Welsh Water

Bryn Cowlyd Water Treatment Works, Dolgarrog

Environmental Report

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1 SUMMARY

1.1 Introduction

This Environmental Report (ER) has been prepared on behalf of Dŵr Cymru Welsh Water (DCWW) to support a planning application for a proposed extension to the existing Bryn Cowlyd Water Treatment Works (WTW) (the ‘proposed Development’), which is situated on the eastern side of the B5106 road, approximately 500m to the south east of Dolgarrog within Conwy County Borough Council (CCBC) in North Wales.

DCWW have engaged its Capital Delivery Alliance (CDA) Partners, Skanska and Hyder Consulting, to design and construct the proposed Development.

The existing WTW process utilising ozone and high pressure Granular Activated Carbon Filtration to reduce the colour of the treated water and has the additional benefit of eliminating the requirement for costly re-pumping, which is a unique process in Wales.

Raw water quality is gradually deteriorating through increased levels of total organic carbon (TOC) and colour. Short term increases of TOC and colour also occur throughout the year as a result of inter-reservoir transfers by the reservoir owner, National Power. The existing process is at the limit of treatment capability and occasionally unable to remove the level of TOC being encountered. Therefore, the works is failing to meet the drinking water standards as set by The Drinking Water Inspectorate.

As a result of the WTW failing to meet quality standards, The Drinking Water Inspectorate have issued a formal improvement notice under Regulation 29(4) of the Water Supply (Water Quality) Regulations 2010. This requires DCWW to “*Complete construction, installation, and commissioning of the appropriate coagulation process and improvements to the filtration process by 31st December 2017*”.

The improvement works are complementary to the existing water treatment processes at Bryn Cowlyd and it is essential, therefore, that the proposed Development is located in the immediate vicinity of the existing WTW and at the confluence of the existing raw water and distribution mains.

1.2 Summary of Proposed Development

The proposed Development comprises a new Dissolved Air Flotation (DAF) process followed by a single stage of new Rapid Gravity Filters (RGF). The pressure would be broken at the head of the works and a 900kW hydroelectric turbine installed to utilise the available energy. The water would gravitate through the new treatment units to a high lift pumping station. Water would be then pumped from the water treatment works to the offsite clear water tank.

Vehicular and pedestrian access to the proposed Development from the public highway would be gained from the B5106, via the existing access to the WTW.

1.3 The Environmental Report

This ER provides information to assist CCBC in determining the planning application for the proposed Development and for consultees to be informed about the potential environmental effects with respect to ecology, archaeology and cultural heritage, hydrology, landscape and visual, transport and access and noise. Details of the proposed Development are set out further in Chapter 3 Description of the Development.

2 INTRODUCTION

2.1 Background

This Environmental Report (ER) has been prepared on behalf of Dŵr Cymru Welsh Water (DCWW) to support a planning application for a proposed extension to the existing Bryn Cowlyd Water Treatment Works (WTW) (the 'proposed Development'), which is situated on the eastern side of the B5106 road, approximately 500m to the south east of Dolgarrog within Conwy County Borough Council (CCBC) in North Wales (see Figure 2.1 Site Location Plan).

DCWW have engaged its Capital Delivery Alliance (CDA) Partners, Skanska and Hyder Consulting, to design and construct the proposed Development.

2.2 Overview of Existing Operations and Land Use

Bryn Cowlyd WTW was commissioned in 1998 and supplies up to 46 Mega Litre per day (Ml/d) to around 98,700 people in the Conwy Valley and North Wales coast. The existing site layout is shown on Figure 2.2.

Raw water is supplied to Bryn Cowlyd from Llyn Cowlyd, a high level impounding reservoir located in the Carneddau mountain range of the Snowdonia National Park. Following treatment at the WTW the water is currently conveyed under high pressure to an off-site treated water reservoir on the eastern side of the Conwy Valley.

The existing operational area is 2.31 hectares (ha). The fields located to the east and south east of the existing operational area are used for grazing and are under ownership by DCWW. The field immediately to the south of the existing WTW is currently used for grazing and is tenanted by DCWW.

Current WTW infrastructure includes a large building that houses the Granular Activated Carbon (GAC) process. There is also a lagoon, swale, wash water tank and standby generator (see Figure 2.2 Existing Site Layout). A flood defence bund (comprising a mixture of earth embankment and plastic piles) is set at 7.0m AOD. The bund was constructed to reduce the risk of flooding to on site infrastructure from both the Afon Ddu and Afon Conwy. There are areas of soft landscaping around the site and mature trees along boundary fence lines and adjacent to the access road from the B5106. An agricultural access track runs from the current WTW access point from the B5106 to the south of the lagoon and then on to fields to the east of the WTW.

The inner site boundary has a palisade security fence perimeter. This surrounds the main building structures and the surface water swale. Access is through double gates along the site access road where there is CCTV. The lagoon and flood bund perimeter has a chain link security fence. The remainder of the site has stock proof fencing and hedging around the boundary lines.

The existing WTW process utilises ozone and high pressure GAC filtration to reduce the colour of the treated water and has the additional benefit of eliminating the requirement for re-pumping, which is a unique process in Wales. The GAC process is located within a building which has a twin-pitched gable ended roof, with peak heights of 17.3m above ground (22.65m AOD) and a height of 6.75m from ground level to the underside of the eaves (12.1m AOD), for the majority of the building. The building has a dark cream cladding to its externals, with slate block-work finishing features on the corners and mid-points. The building has low level security lighting.

There are two pumping stations located externally to the main treatment building. The pumping station located to the south of the main treatment building serves the site's foul drainage. The pumping station located to the north is associated with the lagoon and backwash settling tank. There are two structures associated with a transformer and standby generator with footprints of 60m^2 and 50m^2, respectively.

The foul drainage from the treatment building drains to the foul drainage pumping station. Sewage is treated before draining via a 150mm diameter final effluent pipeline. The final effluent pipeline combines with the surface water drainage network serving the eastern and southern area of the site. A 300mm diameter pipeline serving the combined flows discharges to an existing drainage ditch, which drains to the Afon Ddu.

Surface water drainage generated from the northern edge of the site drains to a 300mm diameter pipeline tapering to a 600mm diameter pipeline, which discharges to the Afon Ddu.

An existing outfall structure located on the Afon Ddu allows the discharge of surface water flows via a 600mm diameter pipeline and a 450mm diameter pipeline serving the swale and overflow from the lagoon.

The adjacent fields are served by a network of drainage ditches. These run in a west to east direction towards the Afon Conwy.

There are currently eight staff based at the WTW.

2.3 Need for the Proposed Development

Raw water quality is gradually deteriorating through increased levels of total organic carbon (TOC) and colour. Short term increases of TOC and colour also occur throughout the year as a result of inter-reservoir transfers by the reservoir owner, National Power. The existing process is at the limit of treatment capability and occasionally unable to remove the level of TOC being encountered. Therefore, the works is failing to meet the drinking water standards as set by The Drinking Water Inspectorate.

As a result of the WTW failing to meet quality standards, The Drinking Water Inspectorate have issued a formal improvement notice under Regulation 29(4) of the Water Supply (Water Quality) Regulations 2010 (Ref 2-1). This requires DCWW to "*Complete construction, installation, and commissioning of the appropriate coagulation process and improvements to the filtration process by 31st December 2017*".

2.4 Site Location and Description

The proposed Development is located on the eastern side of the B5106, adjacent to Snowdonia National Park, approximately 500m to the south east of Dolgarrog in Conwy County Borough Council (CCBC) in North Wales. The site is located at approximate NGR SH 775 663 as shown on Figure 2.1 Site Location Plan.

The B5106 road forms the western site boundary, providing access between Conwy and Llanrwst to settlements on the western side of the Conwy Valley. To the west of the B5106 is Coed Dolgarrog National Nature Reserve (NNR), situated 120 metres west of the site at its closest boundary, comprising woodland on the steep western side of the valley. Tu Hwnt i'r Afon which contains the Conwy Valley Maze is located to the west the proposed Development site, on the western side of the B5106. The Afon Ddu forms the northern boundary of the proposed Development site.

The planning application boundary comprises an area of approximately 6.1ha. Included within this is the area required for a temporary construction compound which would be approximately 1.6ha. The operational area associated with the proposed Development would be 4.5ha. The planning application boundary includes the existing operational area of the WTW.

The proposed Development site is at the bottom of a north flowing river valley which has steep gradients to the west and east rising to 300m AOD to the west and 200m AOD to the east of the Afon Conwy. The general local topography across the site is generally level with a slight down gradient towards the east within the main operations area.

The proposed Development site comprises the operational WTW and some undeveloped land. The majority of the site is hard standing with some soft standing areas to the north and south of the existing WTW.

Areas of scrub and trees lie along the western site boundary between the B5106 and the proposed Development site, with woodland extending into the surrounding area to the west (leading to Coed Dolgarrog NNR), whilst fields extend to the north, east and south of the site. There are no Public Rights of Way (PRoW) within or adjacent to the proposed Development site.

2.5 Background to the Environmental Report

This ER provides information to assist CCBC in determining the planning application for the proposed Development and for consultees to be informed about the potential environmental effects. Details of the proposed Development are set out further in Chapter 3 Description of the Development.

2.6 Requirements for Environmental Assessment

A formal Environmental Impact Assessment (EIA) Screening Opinion was requested from CCBC on 19 June 2015. This request was to determine whether the proposed Development would require a formal EIA and Environmental Statement under the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999, as amended (Ref 2-2). A response was received on 10 July 2015 which confirmed the proposed Development is not deemed EIA development. A copy of the EIA Screening Opinion is provided in Appendix 2.1.

The introductory chapters and environmental topics of this ER comprise the following:

- Chapter 1: Summary;
- Chapter 2: Introduction;
- Chapter 3: Description of the Proposed Development;
- Chapter 4: Ecology;
- Chapter 5: Archaeology and Cultural Heritage;

- Chapter 6: Hydrology;
- Chapter 7: Landscape and Visual;
- Chapter 8: Transport and Access; and
- Chapter 9: Noise.

2.7 Cumulative Effects

Construction of the Surf Snowdonia development in Dolgarrog is to be completed in summer 2015, prior to the proposed construction of the Development. There are no other planned or proposed schemes in the vicinity of the proposed Development or immediate surrounding area which are considered likely to result in cumulative effects. Cumulative effects have therefore not been considered in this assessment.

2.8 References

Ref 2-1 Water Supply (Water Quality) Regulations 2010.

Ref 2-2 Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 (SI 1999 No. 293), as amended by the Town and Country Planning (Environmental Impact Assessment) (Amendment) Regulations (SI 2008 No. 2093).

3 DESCRIPTION OF THE PROPOSED DEVELOPMENT

3.1 Introduction

This Chapter of the ER provides a description of the proposed Development forming the basis of the assessments presented in Chapters 4 to 9. It provides a description of the physical characteristics of the proposed Development and the land use requirements during construction and operation.

The proposed Development comprises the construction of new buildings to accommodate the WTW processes, tanks and associated infrastructure summarised below and illustrated on Figure 3.1 Proposed Development Site Layout:

- New access roads to new WTW buildings and associated infrastructure;
- Dissolved Air Flotation (DAF) process building (this would include flocculation and DAF lanes and saturator system);
- Rapid Gravity Filters (RGF) process building (this would include a high lift pumping station and well);
- Generator building;
- District Network Operator (DNO) transformer station;
- Transformer building;
- Chemical storage buildings, including Centrate building and Chlorine building;
- Below ground storm tanks and air surge vessels (for suppression system);
- High Pressure water main diversions;
- Services (high and low pressure mains, sample lines, dosing lines, cable runs, building services);
- Flood defence bund; and
- Temporary construction compound.

Only the proposed chlorine building and DNO transformer station are located within the footprint of the existing WTW. All other elements listed above are located outside of the footprint of the existing WTW.

3.1.1 Interaction with Existing WTW

The new WTW front end process of DAF would receive untreated water diverted from the inlet of the existing WTW process. Before the diversion, the water would be sampled for various water quality parameters, such as colour, turbidity and temperature. This feed to the proposed Development treatment processes would be achieved by a new pipework connection inside the existing process GAC process building and a 600mm pipeline between here and the process buildings associated with the proposed Development.

Following clarification and filtration of the water by the new processes associated with the proposed Development, the water would be returned to the inlet of the existing GAC process building, allowing further treatment and sampling to be carried out. This water would be transferred under pressure through another 600mm diameter pipeline between the two buildings. The existing GAC process would be retained as a final stage of filtration. Final chemical dosing, such as pH correction and disinfection, would continue to be provided within the existing building, as would the final water sampling. As such the use of the existing WTW building would be unchanged.

3.1.2 Access

Vehicular and pedestrian access to the proposed Development from the public highway would be gained from the B5106, via the existing access road that currently serves the WTW. This would form the only access and egress point for the site during the operational period. A new internal access road and hardstanding areas are proposed which would link the existing site access road to the RGF and DAF process buildings and other surrounding infrastructure.

The proposed development would require a diversion of the agricultural access track that currently runs from the WTW access point from the B5106 to the south of the lagoon and then on to fields to the east of the WTW. The route of the new agricultural access track would be run from the same access point from the B5106 but would run around the southern and eastern sides of the flood defence bund.

3.1.3 DAF Process Building

The DAF process building would house the first stages of water treatment. It would contain three processes, namely coagulation, flocculation and clarification. Coagulation involves adding a chemical to the raw water (coagulant) which causes any small particles contained within the water to cling together. The particles build into larger masses which are easier to remove, this process is called flocculation and would take place in large open tanks with stirrers. The clarification process proposed at Bryn Cowlyd WTW is Dissolved Air Flotation (DAF). This process concentrates the flocculated particles into a sludge by floating them to the top of a tank using small bubbles of air. The sludge is removed from the process for further dewatering and disposal. The DAF process building would have a pitched roof and have plastic coated steel sheet elevations. Its dimensions would be 44.8m (length) x 42.4m (width) x 11m (height).

The building walls would comprise of reinforced concrete construction, with light grey colour below 7.9m AOD and dark green coloured galvanised sheeted steel above 7.9m AOD. The roof would comprise a dark grey galvanised sheet steel.

3.1.4 Rapid Gravity Filtration (RGF) Process Building

The Rapid Gravity Filtration (RGF) process building would contain the filtration process and an inter-stage pumping station. RGF involves passing the clarified water down through a bed of fine sand which traps any particles remaining from the clarification process. Clean filtered water is collected from the bottom of the filter and is passed forward to the next process. The water would be pumped under pressure from the RGF building to the existing filtration plant. The RGF process building would have a pitched roof and have plastic coated steel sheet elevations. Its dimensions would be 49.5m (length) x 26m (width) x 11.3m (height).

The building walls would comprise of reinforced concrete construction, with light grey colour below 7.9m AOD and dark green coloured galvanised sheeted steel above 7.9m AOD. The roof would comprise a dark grey galvanised sheet steel.

The south facing roof pitch of the RGF building would carry solar PV panels.

The ridge of the proposed RGF building would be 14.8m AOD, which is approximately 1.3m lower than the ridge of the existing GAC process building.

3.1.5 Generator Building

The generator building would house standby power generation plant. This would consist of two diesel powered engines driving electricity generating alternators. It would also contain a fuel storage tank for supplying diesel to the engines. These generators would be used in the event of a power failure to the site.

The generator building dimensions would be 15.1m (length) x 16.m (width) x 9m (height).

The lower building walls would comprise of reinforced concrete construction, with light grey colour and dark green coloured galvanised sheeted steel upper wall and the roof would comprise a dark grey galvanised sheet steel.

3.1.6 DNO Transformer Station

The DNO Transformer station would house electrical switch gear associated with the electrical power supply to the site. The equipment contained would be under the ownership and control of the Distribution Network Operator (DNO) which is Scottish Power.

The DNO Transformer building dimensions would be 4m (length) x 4m (width) x 4m (height).

The lower building walls would comprise of reinforced concrete construction, with light grey colour and dark green coloured galvanised sheeted steel upper wall and the roof would comprise a dark grey galvanised sheet steel.

3.1.7 Transformer Building

The Transformer building would contain an oil filled electrical transformer. This transformer would reduce the voltage supplied by the electrical distribution company of 11kV to a lower 415V for distribution throughout the site.

The Transformer building dimensions would be 4m (length) x 4m (width) x 9m (height).

The lower building walls would comprise of reinforced concrete construction, with light grey colour and dark green coloured galvanised sheeted steel upper wall and the roof would comprise a dark grey galvanised sheet steel.

3.1.8 Chlorine Building

The Chlorine building would contain the equipment associated with the storage and dosing of chlorine gas. Chlorine is widely used by water treatment works for the disinfection of filtered water. The chemical also provides protection against bacteria as the water travels through the distribution system.

The Chlorine building dimensions would be 15m (length) x 10m (width) x 7.5m (height).

The lower building walls would comprise of reinforced concrete construction, with light grey colour and dark green coloured galvanised sheeted steel upper wall and the roof would comprise a dark grey galvanised sheet steel.

A small bund up to 1m in height would be constructed around the Chlorine building.

3.1.9 Tanks

The proposed Development would require construction of above and below ground tanks. Above ground tanks would include sludge thickening tanks, thickened sludge storage and clean backwash water tank. Below ground tanks would include dirty waste water storage, supernatant return and centrate tanks. All these tanks are associated with the treatment and dewatering of the solids removed from the raw water as it passes through the DAF and RGF processes.

There would also be air surge suppression vessels used for smoothing of pressure transients from the pressurised pipework.

The below ground dirty wash water / supernatant tank dimensions would be 17.1m (length) x 14.8m (width) x 3.5m (deep).

The colour of the dirty wash water / supernatant tank walls would be light grey.

The sludge tanks dimensions would be 7.7m (length) x 7.1m (width) x 3.5m (height).

The colour of the sludge tanks would be dark green.

3.1.10 Hydroelectric Turbine

It is proposed to install a 900 kW hydroelectric turbine. The water would gravitate through the new treatment units to a high lift pumping station (located within the RGF). It is proposed to install the hydroelectric turbine within the DAF process building.

3.1.11 Drainage

A number of measures have been incorporated into the design of the proposed Development to minimise adverse impacts on the water environment. Surface water runoff would be managed. The proposed drainage system would comprise of a sustainable surface water attenuation swale, with discharge flows limited to that of existing runoff rates. Under normal conditions rainfall runoff discharge flows would gravitate to the existing south eastern drainage ditch via attenuation. Should the drainage ditch and external area be flooded, discharges would be prevented by means of a non-return valve. Flows would then back-up to the nearby new stormwater pumping station, whereby flows would be pumped to the existing site drainage system to the north, whereby they would discharge via the existing stormwater system to the Afon Ddu. There is no intention to provide new foul drainage and therefore discharge from the site, as the current site foul drainage system is sufficient and can be utilised.

Internal access roads and other impermeable areas of the proposed Development site would be drained utilising appropriate sustainable drainage techniques. These techniques would include for example, runoff collected by the existing swale feature.

3.1.12 Permanent Flood Defence Bund

The proposed Development would be set, approximately, at existing ground level (3.5m AOD) and would be contained within a new 360m flood protection bund with a crest level of approximately 6.8m AOD connected into the existing bund around the current WTW. This new flood defence bund would have a natural embankment appearance to resemble the existing flood defence bund, with tie in points where the new site links to the existing. The new flood defence bund would be constructed from arisings from the excavation works where possible, to prevent the need for the import of off-site materials.

3.1.13 Fencing, Landscaping and Parking

The perimeter fence would comprise a 425m long 2.4m high single skin green welded mesh with barbed wire on top. This would be connected to the existing security fence.

Planting is proposed around the perimeter of the site and existing tree cover would be retained, insofar as reasonably practicable.

Additional vehicle parking spaces are not proposed. Parking facilities located adjacent to the existing GAC process building would remain as part of the proposed Development.

3.1.14 Lighting / Security

The proposed Development would have a series of signs to provide directions and also information on health and safety. There would also be low level external security lighting within work areas for new buildings within the proposed Development and CCTV installed at the entrance of the new road linking the existing site access to the RGF and DAF process buildings.

3.2 Construction Phase

3.2.1 Construction Programme

The construction phase would commence in January 2016 and is anticipated to last until December 2017 (inclusive of six months commissioning).

Typical construction working hours/days would be 06:00hrs to 18:00hrs on Monday to Friday and by exception 06:00hrs to 18:00 Saturday and Sunday. Construction works outside of the above times would be with prior agreement of CCBC.

3.2.2 Construction Compound and Construction Access

It is intended that the field located within the southern area of the proposed Development site would be used as a temporary construction compound.

All construction traffic would enter and leave the proposed Development site via the existing Bryn Cowlyd WTW site access onto the B5106. This would form the only access and egress point for the site during construction. Construction staff parking would be within the construction compound.

A stabilisation method would be implemented on the construction compound site, which would minimise the need for stone to be imported. Off-site pre-fabrication would also reduce the potential number of construction vehicles.

3.2.3 Construction Activities

Construction activities would include material excavation, ground improvement works and localised earth movement, permanent flood defence bund construction, temporary compound flood defence bund construction, construction of reinforced concrete walls, casting reinforced concrete foundations, erection of simple steel framed buildings with single skin cladding and access road and footway surfacing.

3.2.4 Temporary Flood Defence Bund

A temporary 290m long flood bund with a crest level of approximately 5.7m AOD would be constructed to protect the construction compound area. This would be removed up on completion of construction works. The temporary flood defence bund would be constructed from arisings from the excavation works where possible, to prevent the need for the import of off-site materials.

3.2.5 Construction Security

Temporary fencing surrounding the proposed Development site during construction works would be required in order to provide the necessary on-site security. The fencing would comprise typical ‘herras’ type fencing. Temporary CCTV would also be installed at the construction site access point.

3.2.6 Construction Working Practices

Pollution prevention measures would be managed through the implementation of a construction environmental management plan (CEMP). Further details regarding pollution prevention measures are included in Chapter 6 Hydrology.

3.2.7 Materials Management

A Site Waste Management Plan would be prepared for the proposed Development. Construction works are not anticipated to generate excess material. Where possible all excavated material would be reused on site as part of the flood defence bund and landscape screening. Any material surplus to requirements would be disposed of to a licenced facility.

Topsoil would be removed and stockpiled on site and would be re-used on site for bund construction and general reinstatement landscaping following the completion of the construction phase.

3.2.8 Utility Diversions

Statutory undertaker diversions would require the diversion of existing 11kV and 33kv cables located on the eastern side of proposed Development site. Due to the size and voltage of these cables, it is likely these would require an over ground diversion route by the utility provider. Where possible the new route would be within the site boundary. There would also be a requirement to install two additional transformers.

3.2.9 Construction Staff

It is anticipated that the total likely number of construction staff to be on site at any one time would not exceed 40. Details regarding construction traffic are considered in further detail within Chapter 8 Transport and Access.

3.2.10 Welfare Facilities

Construction staff welfare facilities would be located within the construction compound. These would comprise office space, toilet and washing facilities. Waste water would be disposed of to a licensed facility.

3.3 Operational Considerations

3.3.1 Vehicle Movements

Following completion of the proposed Development, it is anticipated that there would be no change in the type and number of operational vehicle movements over and above those presently generated by the operation of the existing WTW.

3.3.2 Operating Hours

The WTW would be operational 24 hours a day, 7 days a week. The WTW would however only be manned from 08:00 to 16:00 hours Monday to Friday. There would therefore be no change to current operational hours.

4 ECOLOGY

4.1 Introduction

This Chapter presents the findings of the Ecology and Nature Conservation assessment.

A full description of the proposed Development is given in Chapter 3: Description of the proposed Development and illustrated in Figure 3.2

This Chapter presents the methodology used to assess the potential for significant ecological effects of the proposed Development. Details of consultations undertaken are described, followed by baseline conditions and a summary of regulatory/planning policy relevant to the ecological receptors. The Chapter assesses the potential effects of the proposed Development on the ecological receptors and provides details of mitigation and enhancement measures in order to minimise potential effects and provide a net biodiversity gain across the proposed Development. A summary of the assessment together with relevant conclusions, a list of references and a glossary of terms complete the Chapter.

The Ecology and Nature Conservation assessment has been carried out in accordance with the guidance set out in the Institute of Ecology and Environmental Management's (IEEM) Guidelines for Ecological Impact Assessment (2006) ('the IEEM Guidelines') (Ref 4-1), in order to provide Conwy County Borough Council (CCBC) with "clear and concise information about the potential significant ecological effects associated with the project". It is noted that since publication of these guidelines, IEEM is now known as the Chartered Institute of Ecology and Environmental Management (CIEEM).

The surveys that underpin the ecology and Nature Conservation assessment were undertaken during the 2015 survey season.

4.2 Methodology

In accordance with the IEEM Guidelines, an assessment was carried out to collate all existing baseline information through a desk-based study and field surveys, and predicts all of the significant effects of the proposed Development on 'Key Ecological Receptors', with mitigation in place. Where significant adverse effects are predicted, the measures to mitigate these effects have been developed such that the residual impacts of the Development would not be significant.

In addition, measures have been developed to address the legislative and policy requirements associated with those species and habitats for which significant impacts are not expected, but which nevertheless warrant mitigation. Measures to enhance biodiversity in the area affected by the proposed Development and those which help to deliver Action Plan and local policy targets are also recommended.

The proposed Development also provides opportunities for habitat creation and enhancement, incorporating ecological features of benefit to species already present within the proposed Development, and habitats and species which have currently not been recorded but for which an overall benefit can be provided. This would ensure that a net gain in local biodiversity is provided by the proposed Development, and is a key component of the proposal. This approach is considered to represent best practice.

4.2.1 Obtaining Baseline Information

The approach outlined below has been followed to obtain baseline information:

- Identification of Study Area(s) in consideration of the proposed Development site;
- Issues raised through consultation with interested parties;
- Professional judgement and best practice/guidance.

Study Area

The ecological Study Area is shown on Figure 4.1 Extended Phase 1 Habitat Survey.

Desk Studies

A desk study was undertaken to collate all available existing records from the proposed Development site and surrounding environs (within an area of 2km from the proposed Development site) from the North Wales Environmental Information Service (COFNOD). Records of statutory and non-statutory designated sites, including the citations of non-statutory Sites of Importance to Nature Conservation (SINCs) were obtained as well as records of protected species and other species of conservation concern. Bat roost records from within 2km of the proposed Development site were also requested.

Site Visits (Surveys)

Detailed methodology for each survey is provided within Appendix 4.1 Extended Phase 1 Habitat Survey Report.

Field surveys were undertaken in 2015 and consisted of the following:

- Extended Phase 1 Habitat Survey (April 2015);
- Protected Species Walkover Survey (April 2015); and
- Protected Species Surveys including dormouse and reptile presence/ absence surveys (ongoing until September 2015).

Although the results of ongoing protected species surveys are not yet known the impact assessment, mitigation and enhancement measures are based on a precautionary approach and likely requirements should these species be confirmed present.

Consultation

The CCBC Ecologist was contacted in early April 2015 to discuss the proposed approach to ecology surveys. They were contacted again on the 1 June 2015 with a request for information on local nature conservation sites and Tree Preservation Orders (TPO) within 1km and 200m respectively of the proposed Development site.

4.2.2 Assessing Potential Effects, Identifying Mitigation Measures and Assessing Residual Effects

The approach outlined below has been followed to assess likely significant effects, identify outline mitigation measures and assess likely residual effects:

- Consideration of best practice/guidance;
- Professional judgement;
- Consideration of the baseline information obtained, the proposed Development site and issues raised through consultation with interested parties;
- Prediction of potential effects based on baseline information and the proposed Development;
- Identification of effects which, in particular, could be considered to be potentially significant;
- Quantification of potential effects;
- Identification of appropriate mitigation measures; and
- Prediction of residual effects based on baseline information, the proposed Development details and mitigation measures.

The criteria that have been used to determine the assessment of effects follows the approach recommended by CIEEM for Ecological Impact Assessment (Ref 4-1), with the focus on those activities that could potentially generate significant ecological effects on ‘Key Ecological Receptors’ on site. In accordance with the British Standard BS42020:2013 Biodiversity Code of Practice for Planning and Biodiversity (Ref 4-2), this assessment has followed the IEEM guidelines.

The habitats and features within the Zone of Influence (ZoI) of the proposed Development site are known as the ‘ecological receptors’. The nature conservation importance/value of each of the ‘ecological receptors’ considers the protected species and species of conservation concern that they may support, to avoid pseudo-replication. For example, the importance for species associated with the woodland areas (breeding birds, bats and dormice) has been taken into account as part of categorising the overall importance/value of the woodland. Where possible, animal species and their populations have been valued on the basis of a combination of their rarity, status and distribution, using contextual information where it exists. Habitats and plant communities are evaluated against existing selection criteria, wherever possible (such as those developed to aid the designation of SSSIs or non-statutory designated sites).

The following geographic frame of reference has been used to determine the importance of ecological receptors: International; National; Regional/ County/Borough; District; and Parish/ Neighbourhood, as set out in in Table 4-1 below.

Table 4-1 Determining the Importance / Sensitivity of Resource

Importance/ sensitivity of resource or receptor	Criteria
Very High	A statutory designated site of International or European importance for nature conservation: for example, an SAC, SPA or Ramsar site, or site that supports a population of a mobile species that, whilst not designated, is deemed to be functionally-linked to a statutory designated site of International or European importance, or a species population or assemblage that is considered to be of International or European importance.
High	A statutory designated site of National importance for nature conservation such as a SSSI or a species population or assemblage of National importance.
Medium	A non-statutory designated site of Regional/County/District/Borough importance to nature conservation: this would include Conservation Target Area (CTAs), Sites of Importance for Nature Conservation (SINCs) and Local Wildlife Sites (LWSs). It would also include species populations and assemblages of Regional, County or District importance.
Low	A site or species assemblage of Parish/Neighbourhood importance. Whilst such sites are not are not considered sufficiently important to be material in decision-making, they do contribute to the biodiversity value of a site.
Negligible	A site of limited importance to nature conservation comprising common species which are not restricted to particular habitats.

Source: Hyder Consulting.

The results of the ecological valuation process are presented in Sections 4.3, 4.5 and 4.7 (below). These Sections summarise the results of the desk study and field surveys, and identify which of the resources are ‘Key Ecological Receptors’, which are ‘Other ecological receptors requiring mitigation’, and those which have been scoped out of the assessment altogether. It is important to note that the selection of ‘Key Ecological Receptors’ has been informed by an assessment not only of nature conservation value but also of the likely impacts upon them.

Once the ecological receptors within the ZoI have been identified and valued, it is then necessary to investigate potential effects on those receptors in order to understand how they might be affected by the proposed Development.

The Ecology and Nature Conservation assessment has been based on an understanding of the likely activities associated with the proposed Development, the biophysical changes that could be predicted as a result of these activities, and the area over which such effects might be experienced by different receptors. These effects have been considered for the construction and operational phase of the proposed Development.

Limitations and Assumptions

The ecological baseline for this assessment has largely been informed by surveys undertaken in April 2015 and on-going surveys up to July 2015. It was accepted by the CCBC ecologist that ongoing surveys at the proposed Development site would refine the detail of the mitigation measures proposed.

4.3 Results and Assessment

Detailed description of the results and associated Target Notes (TN) are provided in Appendix 4.1 Extended Phase 1 Habitat Survey and summarised in sections 4.5 and 4.6 below.

4.4 Local Plan Policies and Biodiversity Action Plans

Local Plans

The Eryri Local Development Plan (LDP) (end data 2022) was adopted by Snowdonia National Park Authority in July 2011 and reinforces the National Park's purpose in conserving and enhancing the areas natural beauty, wildlife and cultural heritage and providing a clear statement of the statutory responsibilities and role of National Park Authority to promote opportunities for the understanding and enjoyment of the 'Special Qualities' of the area by the public.

The Conwy LDP (adopted 2013) requires through Strategic Objective 12 that all developments seek to safeguard and enhance the character and appearance of the undeveloped countryside, sites of landscape/ conservation importance, and features of archaeological, historic or architectural interest and ensure the conservation of biodiversity and protected species.

Policy

Planning policy at the International, National, and Regional/Local levels that is relevant to ecology and nature conservation and which applies to the Development have been reviewed as part of this assessment. A summary of the relevant policies is provided below.

One Wales: One Planet. Sustainable Development Scheme of the Welsh Assembly Government 2009

Chapter 5 (Sustaining the Environment) of the *One Wales: One Planet Sustainable Development Scheme for Wales* (Welsh Assembly Government, 2009) sets out an Environment Strategy which aims to create healthy, functioning ecosystems that are biologically diverse, productive and managed sustainably.

Planning Policy Wales 2014

The statutory planning process requires that full account should be taken of nature conservation, in accordance with International and National law. *Planning Policy Wales* 7th *Edition* (Ref 4-3) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs). Policy relating to ecology and nature conservation is set out in Section 5 of *Planning Policy Wales: 'Conserving and Improving Natural Heritage and the Coast'* (Ref 4-4) Of particular relevance to the Development is the section entitled '*Development Plans and the Conservation and Improvement of the Natural Heritage*', which describes how biodiversity and landscape considerations must be taken into account in determining individual applications and contributing to the implementation of specific projects. Specific guidance for Wales is set out in the revised *TAN 5* (see below).

Technical Advice Note 5: Nature Conservation and Planning (2009)

Technical Advice Note 5: Nature Conservation and Planning (2009) (*TAN 5*) (Ref 4-4) provides advice about how the land use planning system should contribute to protecting and enhancing biodiversity. *TAN 5* ensures that full account is taken of biodiversity, in accordance with international and national law, and particularly with Section 40(1) of *NERC Act 2006*. *TAN 5* sets out the manner in which planning authorities should comply with their duty under section 40 of the *NERC Act 2006* in order to safeguard biodiversity through the planning process.

Section 42 of the Act requires the Secretary of State to publish a list of habitats and species which are of principal importance for the conservation of biodiversity in Wales. The list was drawn up in consultation with the Countryside Council for Wales (now part of Natural Resources Wales), as required by the Act.

The Section 42 list is used to guide decision makers such as public bodies, including local and regional authorities, in implementing their duty under section 40 of the NERC Act, which requires them to have regard to the conservation of biodiversity in Wales while carrying out their normal functions.

4.5 Plants and Habitats

Most of the proposed Development site supported marshy grassland and species-poor semi-improved grassland. Several belts of planted broad-leaved woodland occur within the proposed Development site, with patches of tall ruderal herbs located adjacent to existing tracks and areas of hardstanding.

The belts of broad-leaved woodland were connected to strips of woodland adjacent to the Afon Ddu which forms the northern border of the proposed Development site. There are several drainage ditches that border fields within the proposed Development site link that drain to the Afon Ddu.

There are four Statutory Designated Sites within 2km of the proposed Development site: Coed Dolgarrog Woodlands Site of Special Scientific Interest (SSSI) to the west, Morfa Uchaf, Dyffryn Conwy SSSI to the north east, Plas Maenan SSSI to the east and Mwyngloddiau a Chreigiau Gwydyr SSSI to the south west.

These nationally notified sites are of **High** nature conservation importance.

Semi-improved grassland

The species-poor semi-improved grassland appeared to be infrequently mown. Plants recorded included Common Bird’s-foot-trefoil (*Lotus corniculatus*), Perennial Rye-grass (*Lolium perenne*), Red Clover (*Trifolium pratense*), Creeping Buttercup (*Ranunculus repens*), Creeping Thistle (*Cirsium arvense*), and White Clover (*Trifolium repens*). Oxeye Daisy (*Leucanthemum vulgare*) was present in a small area to the north of the existing settlement lagoon.

It was concluded that the semi-improved grassland within the proposed Development site was, at most, **Low** ‘Parish/Neighbourhood’ nature conservation importance.

Marshy grassland

The marshy grassland within the proposed Development site contains predominantly Soft-rush (*Juncus effusus*), with smaller patches of Hard Rush (*Juncus inflexus*) and Sedge species (Carex spp.). The areas were heavily grazed.

It was concluded that the marshy grassland within the proposed Development site was at most, **Low** 'Parish/Neighbourhood' nature conservation importance.

Broad-leaved woodland

The planted woodlands areas on the proposed Development site comprised Alder (*Alnus glutinosa*), Ash (*Fraxinus excelsior*), Silver Birch (*Betula pendula*), Hazel (*Corylus avellana*), White Willow (*Salix alba*), Pedunculate Oak (*Quercus robur*), Hawthorn (*Crataegus monogyna*) and Sycamore (*Acer pseudoplatanus*), with a field layer comprising Bramble (*Rubus fruticosus* agg.) and Common Nettle (*Urtica dioica*). Details of species present in each of the planted areas is summarised in Appendix 4.1 Extended Phase 1 Habitat Survey and Figure 4.2. The consultation process confirmed absence of TPOs within 200m of the proposed Development site.

It was concluded that the small areas of planted broad-leaved woodland within the proposed Development site was at most, **Low** 'Parish/Neighbourhood' nature conservation importance.

Watercourses and waterbodies

The Afon Ddu forms the northern boundary of the proposed Development site. The river at this location is approximately 10m wide, with vertical mud and rocky banks, and varied substrate of gravel, boulders and cobbles, with pools and riffles. The river is bordered by mature broad-leaved woodland on both banks, providing moderate shading to the channel, and a number of overhanging tree roots.

The ditches within the proposed Development site had a gravel substrate, pooled areas, and small areas of macrophyte coverage (small areas of Water-starwort (*callitriche* spp.) cover).

The settlement lagoon was observed from the margins of this feature and did not appear to contain any aquatic vegetation, and no ecological records were available. The lagoon is not obviously hydrologically connected to any of the watercourses on the proposed Development site or surrounding area, with the exception of the controlled discharge to the Afon Ddu to the west of the proposed Development site via a hanging outflow pipe.

It was concluded that the waterbodies within the proposed Development site were of, at most, **Low** 'Parish/Neighbourhood' nature conservation importance.

Notable plants/habitats

No plant species or habitats listed under Section 42 of the NERC Act (Ref 4-5) were identified within the survey area.

The data search returned one record of a scarce or rare plant within the search area which was the leafy liverwort Pale Scalewort (*Radula voluta*) located approximately 360m from the proposed Development site. This liverwort is more commonly associated with damp shaded rocks near waterfalls and so unlikely to be present on the proposed Development site or within the Afon Ddu.

It was concluded that the plants and habitats identified were of, at most, **Low** ‘Parish/Neighbourhood’ nature conservation importance.

Invasive species

Indian Balsam (*Impatiens glandulifera*) was prevalent across the proposed Development site along the edge of the existing tracks.

4.6 Protected Species and Species of Conservation Concern

Terrestrial Invertebrates

The habitat within the proposed Development site provided suitable habitat for invertebrates, with the lagoon, ditches, grassland, and woodland areas.

The desk study confirmed records of small heath (*Coenonympha pamphilus*) and pearl-bordered fritillary (*Boloria euphrosyne*) butterflies together with shaded broad-bar (*Scotopteryx chenopodiata*) moth within 1km of the proposed Development site. The species-poor grassland and marshy grassland areas within the site are unlikely to support these species.

The semi-natural woodland within close proximity of the Afon Ddu is likely to be of more value for invertebrates, as the habitat is more established, and relatively species-rich in comparison to the grassland areas.

Overall, the survey area was considered to be of **Low** ‘Parish/Neighbourhood’ Importance to terrestrial invertebrates.

Amphibians

The desk study provided no records of great crested newt (*Triturus cristatus*) within 2km of the proposed Development site and the CCBC Ecologist confirmed that it is unlikely that this species occurs within the proposed Development site. In addition, the habitats on site were assessed as sub-optimal for this species, with a lack of suitable breeding locations and limited foraging habitat. Nevertheless, the habitat on the proposed Development site does support a limited foraging resource for common amphibian species.

Overall, the survey area was considered to be of **Low** ‘Parish/Neighbourhood’ Importance to amphibians.

Reptiles

The desk study revealed records of common lizard (*Zootoca vivipara*), and grass snake (*Natrix natrix*) within 2km of the proposed Development site. In addition, the local authority ecologist referenced a site located 1.2 km away which supports a good population of three reptile species, though these species were not specified.

Reptile surveys are in progress, in accordance with standard methodological guidance (Ref 4-6). However, no reptiles have been identified during the on-going surveys (at the time of writing in July 2015). The habitat on the proposed Development site was considered suitable for reptiles including common lizard, slow-worm (*Anguis fragilis*) and grass snake, with suitable habitat present across the site for hibernation, and a mosaic of habitats and structures suitable for foraging.

Given the extent of activity that has occurred on the proposed Development site as a whole, and the availability of suitable reptile habitat in the wider area, any reptile assemblages are likely to be small populations.

Overall, the survey area was considered to be of **Low** 'Parish/Neighbourhood' Importance to reptiles.

Birds

The grassland and woodland areas within the proposed Development site are likely to provide areas for nesting birds, particularly common passerine species.

The desk study confirmed records of black grouse (*Tetrao tetrix*), kingfisher (*Alcedo atthis*), redwing (*Turdus iliacus*), fieldfare (*Turdus pilaris*), lapwing (*Vanellus vanellus*), lesser redpoll (*Acanthis cabaret*), bullfinch (*Pyrrhula pyrrhula*), willow tit (*Poecile Montana*), spotted flycatcher (*Muscicapa striata*), and Cetti's warbler (*Cettia cetti*) within 2km of the proposed Development site.

Habitat adjacent to the Afon Ddu is potentially suitable for nesting kingfisher, with sections containing steep muddy banks. These areas would be unaffected by the proposed Development site and screened from disturbance by the broad-leaved woodland adjacent to the river, which would also be unaffected.

The proposed Development site contains small areas of species-poor grassland, marshy grassland, and immature woodland, unlikely to provide suitable habitat to support a significant population of birds in the local area, although possibly forming part of their foraging range.

Overall, due to the limited extent of suitable habitat for foraging, and nesting within the proposed Development site, it is considered to be of **Low** 'Parish/Neighbourhood' Importance to breeding and wintering birds.

Bats

The desk study confirmed records of a lesser horseshoe (*Rhinolophus hipposideros*) bat roost and an unknown species bat roost within 146m and 200m from the proposed Development site, respectively. Records were provided for soprano pipistrelle (*Pipistrellus pygmaeus*), brown long-eared bat (*Plecotus auritus*) and several unknown species of bat foraging in the wider area.

The predominantly young planted woodland within the proposed Development site is unlikely to provide suitable habitat for supporting significant populations of roosting and foraging bats. The planted trees within the proposed Development site, connecting to the wider woodland areas provide suitable foraging and commuting routes but unlikely to be important for sustaining populations in the wider area.

Due to the presence of foraging and commuting habitat, and potential areas for roosting, the proposed Development site is considered to be of **Low** 'Parish/ Neighbourhood' Importance to bats.

Badger

The desk study confirmed records of badger (*Meles meles*) within the search area (1km from the proposed Development site) and the site contains suitable foraging habitat for badger.

Due to the presence of suitable foraging habitat, the proposed Development site is considered to be of **Low** 'Parish/ Neighbourhood' Importance to badger.

Otter

The desk study confirmed records of otter (*Lutra lutra*) within the search area. The banks of the Afon Ddu contained suitable resting places for otter, and the data consultation confirmed presence of salmonids within this section of the river, confirming presence of suitable prey for otter.

No signs of otter were observed during the survey.

Due to the presence of suitable habitat immediately adjacent to the proposed Development site, it is considered to be of **Low** 'Parish/ Neighbourhood' Importance to otter.

Water Vole

The desk study confirmed records of water vole (*Arvicolar amphibius*) within 1km of the proposed Development site and the survey confirmed presence of suitable habitat for water vole within the watercourses on site, including slow flowing sections of watercourse with suitable marginal vegetation. Potential water vole burrows were observed along the banks of the drainage ditch on site but there was no definitive evidence suggesting water vole presence.

Due to the presence of suitable habitat on the proposed Development site, it is considered to be of **Low** 'Parish/ Neighbourhood' Importance to water vole.

Dormouse

The data consultation confirmed records of dormouse (*Muscardinus avellanarius*) within 200m of the proposed Development site. The habitat within the proposed Development site is considered sub-optimal for dormouse, with the exception of areas of the site connecting with the mature woodland along the river corridor to the north. Surveys to confirm dormouse presence/absence are on-going at the proposed Development site, in accordance with the dormouse survey guidance (Ref 4-7).

Due to the presence of suitable habitat along the margins of the proposed Development site, it is considered to be of **Low** 'Parish/ Neighbourhood' Importance to dormouse.

Other Mammals

The data consultation confirmed records of red squirrel (*Sciurus vulgaris*), polecat (*Mustela putorius*), weasel (*Mustela nivalis*), European hedgehog (*Erinaceus europaeus*), stoat (*Mustela erminea*) and hare (*Lepus europaeus*) within 2km of the proposed Development site.

The survey concluded that the habitats present on proposed Development site were suitable for potentially supporting weasel, stoat, polecat, and European hedgehog. No mammal signs were observed during the survey, but the habitat on site is considered suitable for these species which are known to inhabit a variety of habitats including woodland and grassland habitats which are present on the proposed Development site.

Due to the presence of suitable habitat the proposed Development site is considered to be of **Low** 'Parish/ Neighbourhood' Importance to other mammal species.

4.6.1 Aquatic Ecology

The Water Framework Directive (WFD) monitoring report (Ref 4-8) confirmed the presence of salmonids on the Afon Ddu, which flows adjacent to the proposed Development site to the north and west.

The drainage ditches on proposed Development site contained potentially suitable habitat for fish, with varied substrate and shading along much of their length and hydrologically connected to other watercourses including the Afon Ddu. However, the low flows within the drainage ditches mean that they are unlikely to support any significant populations of fish or aquatic invertebrates, and hydrological sampling undertaken along these watercourses indicated pollution/ enrichment and low oxygen levels (see Chapter 6: Hydrology). As such, it is unlikely that the watercourses within the proposed Development site support significant populations of fish.

The ditches within the proposed Development site are considered unsuitable habitat for white-clawed crayfish (*Austropotamobius pallipes*) and resting places for otter, with a lack of suitable tree root cavities and rock spaces. They are slow flowing, with some macrophyte cover, and with marginal vegetation and banks potentially suitable for water vole.

There is no obvious passage route for fish to enter the lagoon from the river channel. The lagoon may support small population of invertebrates and aquatic plants.

Due to the presence of suitable habitat the proposed Development site is considered to be of **Low** 'Parish/ Neighbourhood' Importance for aquatic ecology.

4.7 Summary of Results and Assessment

The proposed Development site contains suitable habitat for supporting species of conservation concern. Whilst no definitive signs of protected species have been observed on the proposed Development site to date, it would be necessary to ensure that appropriate mitigation measures are incorporated, in order to minimise residual impact upon flora and fauna on the proposed Development site.

Ecological receptors are summarised in Table 4-2 below, including 'Key Ecological Receptors' which are considered further in this assessment.

Table 4-2 Summary of Ecological Receptors

Ecological receptor	Associated species/habitats	Nature conservation importance	Summary of Potential significant impact
Key Ecological Receptors			
Waterbodies (drainage ditches on the proposed Development site) and Afon Ddu downstream of site (receiving potential run-off)	Aquatic invertebrates; fish, reptiles; foraging and commuting bats, otter	**Low** Parish/ Neighbourhood	Habitat loss: vegetation removed to facilitate construction. The ditch within the central area of the proposed Development site would be lost to the proposed Development. Habitat degradation: construction phase pollution. Potential for pollution/degradation of waterbodies within and downstream of the site. Habitat fragmentation: of waterbodies on site corridors by construction. Species disturbance: foraging and commuting bats along the ditches, reptiles, aquatic species within the channel, otter downstream/adjacent to the proposed Development site.
Planted broad-leaved woodland	Bats, invertebrates, birds, badger, dormice	**Low** Parish/ Neighbourhood	Habitat loss: vegetation removed to facilitate construction would involve the loss of most of the planted broad-leaved woodland. Habitat fragmentation: fragmentation of planted woodland areas, reducing habitat connectivity with woodland areas within and outside of the proposed Development site. Disruption of foraging and commuting habitat for range of species potentially present on site. Species disturbance: to bats and birds through land take, illumination and noise. Direct mortality of species during felling operations in the absence of suitable mitigation measures being in place.
Marshy grassland	Invertebrates, reptiles, amphibians	**Low** Parish/ Neighbourhood	Habitat loss: vegetation removed to facilitate construction, resulting in loss of habitat for associated species. Habitat fragmentation: fragmentation of suitable habitat for invertebrates, reptiles and amphibians. Direct mortality of species during clearance and construction.

Ecological receptor	Associated species/habitats	Nature conservation importance	Summary of Potential significant impact
Key Ecological Receptors			
Semi-improved grassland	Invertebrates, reptiles, amphibians	**Low** Parish/ Neighbourhood	Habitat loss: vegetation removed to facilitate construction, resulting in loss of habitat for associated species. Habitat fragmentation: fragmentation of suitable habitat for invertebrates, reptiles and amphibians. Direct mortality of species during clearance and construction.
Breeding and overwintering birds	Grassland, woodland	**Low** Parish/ Neighbourhood	Habitat loss: Marshy grassland and semi-improved grassland habitat would be lost, along with areas of planted woodland, all potential habitat for nesting birds. Species disturbance: noise and visual disturbance during felling and construction could disturb nesting birds. Direct mortality of species/ nests/eggs during clearance and construction.
Reptiles	Waterbodies, grasslands	**Low** Parish/ Neighbourhood	Potential for mortality of species during construction. Habitat loss and habitat fragmentation limiting species range within and adjacent to the proposed Development site.
Dormice	Woodland	**Low** Parish/ Neighbourhood	There is potential for dormouse to be present in woodland areas, particularly in areas where the planted woodland within the proposed Development site is connected with areas of more mature woodland along river corridor, such as to the north and west of the site. Habitat loss could result in loss of foraging and nesting habitat. Direct mortality and disturbance during construction operations. Disturbance through construction phase noise and lighting.

Ecological receptor	Associated species/habitats	Nature conservation importance	Summary of Potential significant impact
Key Ecological Receptors			
Water voles	Waterbodies on the proposed Development site (drainage ditches)	**Low** Parish/ Neighbourhood	Surveys to date indicate water vole is absent from the proposed Development site. Burrows are present on the ditches on site, but no definitive signs of water vole have been observed. The ditch systems contain low coverage of macrophyte cover, are slow flowing, and contain suitable marginal habitat for water vole. Habitat loss could result in loss of nesting and foraging habitat. Direct mortality during construction operations. Disturbance through construction phase noise and lighting.
Badgers	Woodland, grasslands.	**Low** Parish/ Neighbourhood	Potential loss of foraging habitat. No signs of badger activity recorded on the proposed Development site. Disturbance through construction phase noise and lighting.
Otters	Watercourses	**Low** Parish/ Neighbourhood	No definitive signs of otter were observed on the proposed Development site, but the Afon Ddu provides suitable foraging and resting places for otter. As such there is potential for disturbance to otter during the construction operations. Disturbance through construction phase noise and lighting. Habitat loss: potential loss of foraging habitat along the ditches to be impacted within the proposed Development site (although the Afon Ddu adjacent to the site is most suitable habitat for otter in this area, and would be unaffected by the proposed Development).
Aquatic invertebrates and fish	Waterbodies	**Low** Parish/ Neighbourhood	Direct and indirect effects on water quality that might affect aquatic species are considered under the section on waterbodies.

Ecological receptor	Associated species/habitats	Nature conservation importance	Summary of Potential significant impact
Key Ecological Receptors			
Other mammals	Woodland, grasslands, watercourses	**Low** Parish/ Neighbourhood	Potential loss of foraging habitat. No signs of other mammals recorded on the proposed Development site.
Ecological Receptors not Considered Further			
Invertebrates	Field margins; woodland	**Low** Parish/ Neighbourhood	Loss of habitat used by invertebrates during construction is covered within the grassland section above.
SSSIs within 2km of the proposed Development site	Various	**High** National	No direct effects or no indirect effects that would lead to significant impacts predicted.
SINCs within 2km of the proposed Development site	Various	**Medium** County/Regional	No direct effects or no indirect effects that would lead to significant impacts predicted.

4.8 Potential Effects and Mitigation

Potential effects are based on the description of the proposed Development outlined in Chapter 3: Description of the Proposed Development as illustrated on Figure 3.2.

Loss of habitat has the potential for resulting in direct mortality of species, and causing species disturbance, and impact upon foraging and commuting routes.

The proposed Development would include the loss of broad-leaved woodland plantation, marshy grassland and semi-improved grassland areas. Overall, these areas are of limited ecological value, being species-poor. The more mature woodland around the perimeter of the proposed Development site would not be affected.

The margins of the planted woodland connect to more mature semi-natural woodland located outside the proposed Development site, to the west and north. As such, the potential for suitable habitat linkages for species such as dormouse, should they be present, would be reduced following felling and clearance.

Habitat fragmentation could potentially impact upon the species range within the proposed Development site and surrounding area. For example a loss of linear tree line could potentially restrict the range of species such as dormouse, and foraging routes for bats, and removal of the ditch would reduce the foraging range of fish species, and water vole.

Felling/ site clearance and construction operations have the potential to cause habitat degradation, particularly upon receiving watercourses, via pollution and run-off.

Protected species surveys are ongoing at the proposed Development site and as such a precautionary approach would be taken. In the absence of mitigation, there is potential for direct mortality of species during the construction phase.

Indian Balsam is present within the proposed Development site and would require appropriate management. It is an offence under Section 14 of the Wildlife and Countryside Act 1981 (as amended) (Ref 4-9) to encourage the spread of plants listed under Schedule 9 of the Act this includes Indian Balsam.

The following mitigation measures proposed which are based on:

- Avoidance - through relocation, re-design or changes in construction programme;
- Reduction - involving lessening the severity of a potential impact which cannot be avoided; and
- Compensation - through habitat creation or enhancement.

The mitigation measures described pertain to the potential ecological impacts identified with the survey area.

Mitigation measures would be put in place in order to avoid adverse effects on water quality within the Afon Ddu and connecting watercourses within the proposed Development site. Details of best practice mitigation measures would be outlined within the Construction Environmental Management Plan (CEMP) and appropriate Pollution Prevention and Control.

Construction operations close to the Afon Ddu and drainage ditches would be managed so that all input of sediment and potential contaminants is avoided. This would be achieved through undertaking construction operations following a Pollution Control Strategy in accordance with best practice guidelines. Further details on mitigation measures to protect water quality are outlined in Chapter 6: Hydrology.

Prior to felling and construction commencing, a walkover survey would be undertaken across the proposed Development site to check for any new signs of protected species, including dormouse, badger, otter, water vole, and breeding birds.

Vegetation clearance is likely to take place during the bird breeding season which is generally accepted to be between 1 March and 31 August inclusive. Consequently, prior to site clearance a walkover survey would be carried out by a qualified ecologist to confirm the absence of nesting birds. If nesting birds are found, works within the vicinity of the nest have to be delayed until the chicks have fledged. This typically takes 4 to 6 weeks depending on the state of the chick’s development.

It is considered unlikely that any of the trees within the proposed Development site would support roosting bats, nevertheless as a precaution, prior to any felling operations taking place, a licenced bat worker would undertake a tree inspections to check for presence of bats within the trees to be felled, following standard survey guidance (Ref 4-10). Should bats be identified in any of the trees identified for felling, then appropriate licencing applications would be submitted to Natural Resources Wales (NRW) and felling operations put on hold until appropriate development licences are approved by NRW.

The field ditches contain potentially suitable substrata for supporting aquatic invertebrates and fish. The low flows are likely to limit fish migration/ usage of these ditches, but for the purposes of the assessment, it is assumed that a small population of fish are present within the drainage ditches on proposed Development site. As such, catch and release operation would be undertaken prior to vegetation clearance and construction commencing, within the ditch to be directly impacted by the works (in the central area of the proposed Development site). All fish captured, would be released to a suitable location downstream of the proposed Development site, and prevented from moving back in to the site whilst the works are progressing.

Reptile surveys are ongoing. Should the presence of reptiles be identified a suitable receptor site would need to be identified to which the reptiles can be captured and moved to. A potential area has been identified on the landscape plan (Figure 7.16) to the west of the existing building. This area has suitable connections to larger areas of suitable habitat. Whether it is considered appropriate to create habitat suitable for reptiles within the proposed Development site or to move the reptiles to a suitable receptor site off-site would depend on the size of the reptile population. The area identified on Figure 7.16 would only be suitable for a small population. If a large population is present on the proposed Development site a suitable receptor area would need to be identified. This strategy would be subject to agreement with the CCBC to ensure that the proposed Development does not have an adverse effect on reptiles.

If survey work does not confirm the presence of reptiles, then no corresponding mitigation measures would be required.

In order to prevent the spread of invasive species Indian Balsam, a management plan would be put in place prior to the commencement of construction works. This may involve the appointment of a specialist contractor to carry out an eradication and control programme.

4.9 Enhancement Measures

The landscaping proposals (see Figure 7.16) include the provision for creation of an area to receive translocated reptiles (if present), broad-leaved tree planting to improve habitat diversity and connectivity, a bat roost structure suitable for use by lesser horseshoe bats and creation of reptile refugia. Reptile refugia habitat would be improved by leaving a number of trees on the proposed Development site once they have been felled.

Broad-leaved tree planting would mitigate for areas of woodland lost, but also add additional benefit through improved species mix, and a higher density of planting. This would ensure that the proposed Development results in an enhancement in its value for biodiversity in accordance with planning guidance and in keeping with the principals of sustainable development. The trees removed would be replaced with a similar mix of species, and more varied where possible, in order to increase species diversity. Additional areas would be planted, in order to improve connectivity with the surrounding landscape. This planting would provide habitat for a range of species potentially present in the local area including nesting birds, dormouse, badger and bats.

Trees and shrubs that have been found to be of value to wildlife and in particular dormice, that should be included in the final landscape proposals where practicable, include: Hazel (*Corylus avellana*), oak, Honeysuckle (*Lonicera periclymenum*), Bramble, Sycamore, Ash, Wayfaring-tree (*Viburnum lantanum*), Yew (*Taxus baccata*), Hornbeam (*Carpinus betulifolia*), Broom (*Cytisus scoparius*), Grey Willow (*Salix cinerea*), birch (*Betula* spp.), Sweet Chestnut (*Castanica sativa*), Blackthorn (*Prunus spinosa*), Hawthorn (*Crataegus monogyna*), cherry (*Prunus* sp.), Crab-apple (*Malus sylvestris*), Holly (*Ilex aquifolium*) and Ivy (*Hedera helix*).

A bat box structure suitable for use by lesser horseshoe bats would be installed alongside new broadleaf planting areas in the north east portion of the proposed Development site (see Figure 7.16). Lesser horseshoe bats are known to be present in the local area, in the woodland areas to the west.

Lesser horseshoe bats require a roost which is at a minimum 2.8m in height and 5m in length and width, with an entrance of 300mm wide and 200mm high. To protect from disturbance it is possible to install grilles across the entrance but the air gap between each bar must be 15cm. In addition, installing a porch over the entrance would increase the suitability of the roost for this species.

Once the new structures have been built, any remaining areas of bare ground, following tree planting, would be seeded with a mix of wildflower species to encourage invertebrate diversity within the proposed Development site.

Prior to construction the landscape plan would be developed in more detail with consultees to include details regarding plant species and planting densities.

4.10 Summary and Conclusions

Assuming the successful implementation of the mitigation and enhancement measures identified in Sections 4.8 and 4.9 respectively, it is considered that the proposed Development would not result in any significant effects upon ecological receptors.

4.11 References

Ref 4-1. Institute of Ecology and Environmental Management's (IEEM) Guidelines for Ecological Impact Assessment (2006) ('the IEEM Guidelines').

Ref 4-2. British Standard BS42020:2013 Biodiversity Code of Practice for Planning and Biodiversity.

Ref 4-3. Welsh Government (2014) Planning Policy Wales 7th Edition. Welsh Government, Cardiff.

Ref 4-4. Welsh Assembly Government (2009). Technical Advice Note 5: Nature Conservation and Planning. National Assembly for Wales, Cardiff.

Ref 4-5. The Natural Environment and Rural Communities Act 2006, HMSO.

Ref 4-6. David Sewell et al, 2013: Survey protocols for the British herpetofauna.

Ref 4-7. Paul Bright et al, 2006: The Dormouse Conservation Handbook Second Edition. English Nature.

Ref 4-8. Water for life and livelihoods-River Basin Management Plan Western Wales River Basin District - Annex B: Water body status objectives, Environment Agency 2009 (updated 2011).

Ref 4-9. The Wildlife and Countryside Act 1981 as amended. HMSO.

Ref 4-10. Bat Conservation Trust, 2012: Bat Surveys: Good Practice Guidelines Second Edition.

4.12 Glossary

CEMP – Construction Environment Management Plan.

CIEEM – Chartered Institute of Ecology and Environment Management.

COFNOD – North Wales Environmental Information Service.

CTA – Conservation Target Area.

DCWW – Dŵr Cymru Welsh Water.

JNCC – Joint Nature Conservation Committee.

MAGIC – Multi-Agency Geographic Information for the Countryside.

NERC – Natural Environment and Rural Communities.

NRW – Natural Resources Wales..

RBMP – River Basin Management Plan.

SAC – Special Area of Conservation.

SSSI – Site of Special Scientific Interest.

SPA – Special Protection Area.

SINC – Sites of Importance to Nature Conservation.

TPO – Tree Preservation Order.

UDP –Unitary Development Plan.

WFD – Water Framework Directive.

ZOI – Zone of Influence.

5 ARCHAEOLOGY AND CULTURAL HERITAGE

5.1 Introduction

This chapter presents the results of a cultural heritage desk-based assessment of the proposed Development. The assessment identifies the known and potential cultural heritage resource (heritage assets) within a predefined study area and predicts the effects to heritage assets associated with impacts from the development. Impacts may be direct physical impacts that alter or totally remove an asset or impacts to the setting of an asset, such that the significance of that asset is changed.

5.1.1 Assessment Methodology

This assessment has been undertaken with regard to the Standards and guidance (Ref 5-1) and Code of Conduct (Ref 5-2) documents published by the Chartered Institute for Archaeologists (CIfA) and follows consultation with Cadw and the Gwynedd Archaeological Trust (GAT) regarding the scope of the assessment and any requirements for further assessment works. The assessment fulfils the requirements of Chapter 6 of Planning Policy Wales (Ref 5-3).

The assessment has collated data on known designated and non-designated assets within a radius of 1km from the centre of the application boundary. In addition to this, high value designated heritage assets that lie outside the study area and may be subject to impacts to their setting have also been considered.

Data was obtained from GAT, Cadw and the National Monuments Record of Wales and research undertaken at Conwy Archives, Llandudno. A site walkover survey was undertaken on 9 June 2015.

Table 5-1 presents details of the consultation undertaken during the preparation of this appraisal.

Table 5-3 Summary of Consultation

Consultee	Date of Consultation	Consultation Response	Project Response
Ashley Batten, Senior Planning Archaeologist GAT	30 January 2015	There are no special requirements for the assessment but Cadw will need to be consulted on the potential requirement for an ASIDOHL2. Potential for impacts to the scheduled monuments at Maenan and Ardda will need to be considered.	Cadw consulted on potential requirement for ASIDOHL2 and scheduled monuments at Maenan and Ardda included in assessment.
Suzanne Whiting, Casework Manager Cadw	09 June 2015	An ASIDOHL2 will not be required in respect of the proposed Development.	No ASIDOHL2 undertaken as part of the assessment.

5.1.2 Planning Policy

National planning policy relating to cultural heritage and development is contained in Planning Policy Wales: Chapter 6: Conserving the Historic Environment (Ref 5-3). Welsh Office Circulars 60/96 (Ref 5-5) and 61/96 (Ref 5-6) give more detailed information on planning and the historic environment in relation to duties and responsibilities for archaeology and historic buildings.

Further local planning policy is contained with the Conwy Revised Deposit Local Development Plan 2007-2022 (Ref 5-4). Relevant content and policies relating to cultural heritage are reproduced below.

The LDP contains the following Cultural Heritage Strategic Statement:

'*Historic areas play a key role in fulfilling the objectives of the Local Development Plan, whether they form commercial or shopping centres, visitor attractions, or attractive places to live. The Council is keen to ensure that such assets are protected from inappropriate development, and will take the opportunity to enhance historic areas and buildings where this is needed.*

Laws and detailed national planning guidance specifically concerning the protection of the historic environment and sites of archaeological importance apply, however the importance of adopting a holistic view to the protection of heritage assets should not be underestimated. Heritage assets such as historic landscapes, parks and gardens and buildings and structures of local importance do not benefit from statutory designation, although these contribute significantly to the interest and distinctive character of a place.

This LDP, therefore, includes strategic level polices relating to development and historical assets and details with management proposals to suit the characteristics and meet the challenges of each individual area provided within supplementary planning guidance.'

Strategic Policy CTH/1 – Cultural Heritage states that:

'*The Council is committed to protecting and, where appropriate, enhancing its cultural and heritage assets. This will be achieved by:*

a) Ensuring that the location of new development on both allocated and windfall sites within the Plan Area will not have a significant adverse impact upon heritage assets in line with Policies CTH/2 – Development Affecting Heritage Assets, DP/3 – Promoting Design Quality and Reducing Crime and DP/6 – National Planning Policy and Guidance.

b) Recognising and respecting the value and character of heritage assets in the Plan Area and publishing Supplementary Planning Guidance to guide development proposals in line with Policy DP/7 – Local Planning Guidance.

c) Seeking to preserve and, where appropriate, enhance conservation areas, Conwy world Heritage Site, historic landscapes, parks and gardens, listed buildings, scheduled ancient monuments and other areas of archaeological importance in line with Policies DP/6 and DP/7.

d) Protecting buildings and structures of local importance in line with policy CTH/3 – Buildings and Structures of Local Importance and supplementary planning guidance.

e) Enhancing heritage assets through heritage and regeneration initiatives.

f) *Preserving and securing the future of heritage assets by only permitting appropriate enabling development in line with policy CTH/4 – Enabling Development*'

Policy CTH/2 – Development Affecting Heritage Assets states that:

'*Development proposals which affect a heritage asset listed below (a-f), and/or its setting, shall preserve or, where appropriate, enhance that asset. Development proposals will be considered in line with Policy DP/6, where applicable, Policy DP/3 and supplementary planning guidance.*

a) *Conservation Areas.*

b) *Conwy World Heritage Sites.*

c) *Historic Landscapes, Parks and Gardens.*

d) *Listed Buildings.*

e) *Scheduled Ancient Monuments.*

f) *Sites of archaeological importance.*

Development should be sensitive to the preservation of archaeological remains and national policies. Consultations with Clwyd-Powys Archaeological Trust and Gwynedd Archaeological Trust have revealed that some of the proposed strategic allocations may require archaeological assessments or evaluation prior to any development taking place. Consultation responses such as these will be taken into account when producing development briefs for these sites or when assessing developers' proposals.

Scheduled ancient monuments form only a small portion of the total number of archaeological and historic sites. When considering proposals on unscheduled archaeological sites, the Council will consult with the Clwyd-Powys / Gwynedd Archaeological Trusts, and take into account the interest and importance of the sites and their settings. Where necessary the Council will require that sites are properly assessed and evaluated before deciding on whether to grant planning permission. Planning permission will be refused if the archaeological site is of sufficient interest to merit protection from disturbance altogether. Preservation and recording of sites may also be secured through the use of planning conditions and agreements. An SPG will be produced to guide development proposals on these matters.'

5.2 Historic Environment Record

A search of the Gwynedd Historic Environment Record (GHER) within the study area was undertaken as part of this assessment and the results are presented below. GHER entry identification numbers are given in bold type and their location is shown on Figure 5.1 Cultural Heritage Assets. None of the assets described below would be subject to direct physical impacts as a consequence of the proposed Development. Of those that lie with the Zone of Theoretical Visibility (ZVI, Figure 7.1 Designations, Zone of Theoretical Visibility and Viewpoints), none are considered to be at risk of having their significance altered by the presence of the proposed Development and would not be subject to visual impacts to their settings.

5.2.1 Prehistoric (pre AD 43)

The GHER records the findspot of a polished stone axe (**35**) approximately 750m to the south west of the site. No indication is given as to when the find was located, but the earliest reference dates to AD 1910. Polished stone axes generally date to the Neolithic (4,000 BC to 2,500 BC). Whilst findspots are not heritage assets in themselves, they can give some indication of archaeological potential. Prehistoric settlement and burial sites have been identified in the surrounding area, but these lie some distance outside the study area. From this evidence, it is likely that the river valley in general was exploited during the prehistoric period from at least the Neolithic, although there is no evidence for this within the site itself.

5.2.2 Roman (AD 43 to AD 410)

The GHER contains no entries dating to the Roman period within the study area. There is little evidence for Roman period activity within the surrounding area although a Roman fort was located at Caerhun, approximately 3.5 km to the north of the site. It has also been suggest that the current A5106 follows the line of a Roman road between the fort at Caerhun and the fort at Bryn y Gefeiliau, although this remains unproven.

5.2.3 Early Medieval (AD 410 to AD 1066)

The GHER contains no entries dating to the medieval period within the study area. There is also no evidence for the surrounding area.

5.2.4 Medieval (AD 1066 to AD 1540)

The GHER records a number of entries dating to the medieval period within the study area, although none are located within the site itself. The site of a medieval period fulling mill (**34**) is recorded approximately 50m to the west of the site. Whilst the GHER entry described the mill as having a medieval origin, it does concede that the first reference to a mill on the site dates to 1575. The fulling mill was replaced by a woollen factory in the early 19th century, which is also no longer extant. It has been suggested that the mill was owned by Cistercian Abbey of Aberconwy at Maenan, approximately 1.5km to the south east of the site (see Section 5.3). The site of the proposed Development would have formed part of the lands owned by Aberconwy Abby during the medieval period.

A modern footpath thought to follow the line of a medieval track is also recorded (**8**, **4** and **27**), the start of which also lies approximately 50m to the west of the site. The track would have led to the medieval settlement at located at Ardda, located to the west, at the top of the escarpment. The GHER records quiet extensive evidence of medieval settlement at Ardda and the surrounding area, comprising the remains of long huts, long hut platforms, field boundaries and ridge and furrow cultivation (**1**, **2**, **24**, **25**, **30**, **31** and **44**), all of which lie between 500m and 1km to the west and south west of the site. Many of these features remain undated and may have origins in the Roman or early medieval periods.

5.2.5 Post Medieval (AD 1540 to 1901)

The GHER records a number of entries dating to the post medieval period within the study area, although none are located within the site itself. Five relate to the locations of former farmhouses identified from early 19th century mapping (**3**, **5**, **6**, **7**, **9** and **37**) and remains of former field boundaries and other agricultural features located during previous field surveys (**10**, **13**, **18**, **19**,

29, **32**, **33**, **38** and **39**). The closest of these lie approximately 100m to the west of the site. A former barn known as The Stables, dating to the early 19th century is located approximately 50m to the west of the site (**40**). Remains of structures and other features associated with mining and quarrying during the later post medieval period are also recorded (**11**, **12**, **14** and **22**), located between 500m and 1km to the south and west of the site. A possible ‘rock cannon’, used to fire reports during celebratory occasions is recorded approximately 900m to the west of the site (**22**). There is also a post medieval trackway and later 19th century road and rail bridge located approximately 750m to the north east of the site.

5.2.6 Modern (AD 1901 to present)

The GHER records three entries dating to the modern period within the study area, although none are located within the site itself. A quarry-related incline (**28**) is located approximately 300m to the south west of the site, and a drainage tunnel (**21**) and footpath (**26**) approximately 1km to the west of the site.

The GHER also records two entries of unknown date, both of which are approximately 750m to the south east of the site: an area of coppice woodland (**15**) and relict walls (**16**).

5.3 Scheduled Monuments

Whilst there are no scheduled monuments within the study area, two are located just outside of the 1km study area and have been considered in terms of potential to be at risk of visual impacts to their settings as a consequence of the construction of the proposed Development and are considered in this assessment due to their high value. Scheduled monument identification numbers are given in bold type, prefixed ‘SM’ and their location is shown on Figure 5.1 Cultural Heritage Assets.

The medieval period Tyddyn Wilym Deserted Rural Settlement (**SM1**) is located a little over 1km to the south west of the site. The scheduled monument would not be subject to any direct physical impacts from the proposed Development and as it lies outside the ZVI, it would not be subject to impacts to its setting.

The site of the former Cistercian Abbey of Aberconwy (**SM2**) is located at Maenan, approximately 1.5km to the south east of the site. The abbey was constructed at the end of the 13th century following relocation from Conwy by Edward I to enable the building of Conwy Castle. The buildings were demolished at the time of the Dissolution and the site is now occupied by a hotel constructed in the 19th century. The scheduled monument would not be subject to any direct physical impacts from the proposed Development. Whilst the scheduled monument does lie with the ZVI, any impacts to the setting of the monument are limited as it consists of below ground archaeological remains under and around a later 19th century building. The visibility of the proposed Development would also be reduced by the presence of matures trees within the river valley which would limit or filter any views, even during the winter. As such the impact to the significance of the scheduled monument is considered to be negligible.

5.4 Other Designations

There are no World Heritage sites, registered parks and gardens of special historic interest, registered battlefields, conservation areas or Areas of Special Archaeological Sensitivity as defined by the Local Development Plan (Ref 5-4) within, or near to, the study area.

Two listed buildings and structures are located within the study area (**LB2** and **LB3**) and a third (**LB1**) is located approximately 100m from the search area boundary. As with the scheduled monuments, the third listed structure is included as it lies just beyond the study area to consider the potential for risks of visual impacts to its setting as a consequence of the construction of the proposed Development. All three are considered to be of medium value. Listed building identification numbers are given in bold type, prefixed 'LB' and their location is shown on Figure 5.1 Cultural Heritage Assets.

Pont Dolgarrog (**LB3**) is located within 50m of the site and is Grade II listed. The bridge was constructed in the 18th century, possible AD 1777 when the road was turnpike, with later alterations and carries the B5106 over the Afon Ddu. It is listed as it is an example of an unusually long three-span vernacular road bridge. Whilst the bridge lies within the ZVI, it would be shielded from views of the proposed Development by the existing buildings on the site and there would be no impact to its setting.

A Grade II listed milestone (**LB2**) lies just less than 1km to the south of the site, although it was not possible to locate it during the site visit. Despite the milestone lying within the ZVI, it is not considered to be at risk of impacts to its setting due to the very limited predicted inter-visibility between the milestone and the proposed Development, and the nature of the assets setting which is arguable limited to the immediate vicinity of the carriageway.

The late 18th or early 19th century Grade II listed Old Bath House (**LB1**) is located approximately 100m to the south of the study area boundary. Whilst the building does lie within the ZVI and as a former Gwydir Castle estate building its setting could be argued to be relatively extensive, it is not considered to be at risk of impacts to its setting due to the very limited predicted inter-visibility between it and the proposed Development.

5.5 Site Visit

A site visit was conducted on 9 June 2015 to undertake a visual inspection of the area within the application boundary and to visit designated assets such as scheduled monuments and listed buildings to aid assessment of the potential for settings impacts. Nothing indicating the presence of archaeological features or other heritage assets was noted within the site.

5.6 Historic Maps

The 1847 Dolgarrog tithe map shows no detail for the site area, which is contained within an area labelled 'Abbey land extra parochial'. The historic Ordnance Survey maps show the site as open land until the construction of the current Water Treatment Works in the 1990s.

5.7 Landmap

The site lies within the Lower Conwy Valley Landscape of Outstanding Historic Interest in Wales (Ref: HLW (Gw) 4), which is described as a '*topographically diverse landscape straddling the lower Conwy valley and adjacent uplands on the north and eastern flanks of the Carneddau ridge in north Snowdonia, containing extensive and well-preserved relict evidence of land use, communications and defence from the prehistoric period onwards. The area includes: Neolithic chambered tombs; Bronze Age funerary and ritual monuments; Iron Age hillforts; settlements and field systems; a Roman fort and road; medieval motte, settlements and field systems; Parliamentary enclosures; an early hydro-electric power station and aluminium works.*'.

Cadw was consulted on the potential requirement to undertake an Assessment of the Significance of Impacts of Development on Historic Landscape (ASIDOHL2) exercise on 11 May 2015. Cadw responded on 9 June 2015 with the following statement: '*This proposed extension to an existing water treatment works facility is situated within the Lower Conwy Valley registered landscape of Outstanding Historic Interest (Ref: HLW (Gw) 4). In general the valley floor is sensitive to landscape change due to its natural topography which provides long views and vistas, particularly from the surrounding uplands. However, in this instance the proposal lies within close proximity of a significantly altered part of the valley, just to the south of the former Anglesey Aluminium works, now the site of Surf Snowdonia. As such this proposal is unlikely to be considered as having a more than local impact and ASIDOHL would not be considered an appropriate assessment tool in this instance.* '.

An assessment of the impact of the proposed Development on landscape character and visual amenity is contained within Chapter 7: Landscape and Visual.

5.8 Summary and Conclusions

Whilst the cultural heritage assessment has identified a number of heritage assets ranging in date from the prehistoric to modern periods within the study area, none are located within the site itself. Given that the site lies within the valley floor and that most of the assets are located on the higher ground of the valley side and the top of the escarpment, the potential for archaeological remains of any period to be present on site is considered to be low.

Of the three identified Grade II listed buildings within or near the boundary of the study area, none are considered to be at risk of impacts to their setting as a consequence of the proposed Development.

The Tyddyn Wilym Deserted Rural Settlement scheduled monument does not lie within the ZVI and is not considered to be at risk of impacts to its setting as a consequence of the proposed Development. Whilst the Aberconwy Abbey scheduled monument is within the ZVI, any impacts to its setting as a consequence of the proposed Development are considered to be negligible.

5.9 References

Ref 5-1 *Standard and guidance for historic environment desk-based assessment* (Chartered Institute for Archaeologists, 2014).

Ref 5-2 *Code of Conduct* (Chartered Institute for Archaeologists, 2014).

Ref 5-3 *Planning Policy Wales* (Welsh Government, 2014).

Ref 5-4 *Conwy Revised Deposit Development Plan 2007-2022* (Conwy Borough Council, 2011).

Ref 5-5 *Welsh Office Circular 60/96: Planning and the historic Environment: Archaeology* (Welsh Office, 1996).

Ref 5-6 *Welsh Office Circular 61/96: Planning and the Historic Environment: Historic Buildings and Conservation Areas* (Welsh Office, 1996).

6 HYDROLOGY

6.1 Introduction

This Chapter of the ER presents information on the likely significant effects of the proposed Development on local hydrology and surface water receptors.

A full description of the proposed Development is given in Chapter 3: Description of the Proposed Development.

This Chapter firstly presents a summary of relevant legislation, policy and guidance, then describes the methodologies used to assess the potential significant effects of the proposed Development. Details of consultations undertaken are also provided. Baseline conditions are described and potential effects are then discussed taking into consideration embedded design measures. A summary of the assessment together with relevant conclusions is then provided and a list of references completes the Chapter.

6.2 Legislation, Policy and Guidance

Legislation

The Water Resources Act 1991 (Ref 6-1), as amended, sets out the regulatory regime under which water abstraction and impounding is licensed by Natural Resources Wales (NRW).

The Pollution Prevention and Control Act 1999 (Ref 6-2) provides for a unified system of environmental permitting. Within this, the Environmental Permitting (England and Wales) Regulations 2010 (as amended) (Ref 6-3) detail the environmental permitting regime encompassing water discharge activities, groundwater activities, waste management activities and some activities associated with mines and quarries, including waste mining operations. An environmental permit is required for specified activities. Certain activities may benefit from an exemption from the environmental permitting regime, provided that they fulfil the conditions set by NRW.

The Water Drainage Act 1991 (Ref 6-4) together with the Water Resources Act 1991 (Ref 6-1) provides for NRW to prevent the obstruction of any watercourse or any Main River through the construction of any flow control structures, culverts or any other structure in a watercourse or Main River. Where culverting or other works have a potential to affect the flow regime on ordinary watercourses, consent is required from the Lead Local Flood Authority (LLFA) under the Flood and Water Management Act 2010 (Ref 6-5).

Directive 2000/60/EC of the European Parliament (the Water Framework Directive) (Ref 6-6) introduced a single system of water management across the European Union (EU), which is based on the principle of river basin management. In order to achieve the Directive's objectives, Member States are required to identify 'River Basin Districts' (RBDs) and produce 'River Basin Management Plans' (RBMPs) for each of the respective RBDs.

The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (Ref 6-7) implement the WFD in Wales and England. These Regulations identify the RBDs and the process that the responsible authorities for the implementation of the Directive should follow in order to produce the necessary RBMPs, identify bodies of water within each RBD which are used or intended to be used for the abstraction of drinking water and produce a register of 'protected areas' within each RBD.

Policy

Planning Policy Wales (PPW) 2014 (Ref 6-8) sets out the land use planning policies of the Welsh Government. It is supplemented by a series of Technical Advice Notes (TANs). The TAN applicable to this assessment is TAN15: Development and Flood Risk (Welsh Government, 2004) (Ref 6-9). This advises on development and flood risk and provides a framework within which risks arising from both river and coastal flooding, and from additional surface water run-off from development in any location, can be assessed.

Conwy County Borough Council (CCBC) has prepared and adopted a Local Development Plan (LDP) (CCBC, 2013) (Ref 6-10). The LDP constitutes the development plan that guides development within the County Borough until 2022. The following polices are relevant to this assessment:

Strategic Policy DP/1 Sustainable Development Principles (CBBC LDP, 2013), advises that: *"Development will only be permitted where it is demonstrated that it is consistent with the principles of sustainable development. All developments are required to… (F) Take account of and address the risk of flooding and pollution…Development proposals should also, where appropriate: (H) Protect the quality of natural resources including water, air and soil in line with Strategic Policy NTE/1."*

Strategic Policy NTE/1 The Natural Environment (CBBC LDP, 2013) highlights: *"in seeking to support the wider economic and social needs of the plan area, the council will seeks to regulate development so as to conserve and, where possible, enhance the Plan Area's natural environment, countryside and coastline. This will be achieved by… (I) preventing, reducing or remedying all forms of pollution including air, light, soil and water..."*

Guidance

A number of standards and non-statutory guidelines which provide details of assessment methodologies and mitigation techniques have also been referred to, including:

- Pollution Prevention Guidance Notes (Environment Agency (EA), various publication dates) (Ref 6-11);
- C650 Environmental Good Practice on Site (Construction Industry Research and Information Association (CIRIA), 2005) (Ref 6-12);
- C532 Control of Water Pollution from Construction Sites (CIRIA, 2001) (Ref 6-13);
- Code of Practice for Earthworks (BS6031) (British Standards Institute (BSI), 2009 (Ref 6-14);
- Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, part 10 (HD 45/09) (Highways Agency, 2009) (Ref 6-15);
- WAT-RM 30 Regulatory Method for Water Features Surveys (Environment Agency Wales, 2006) (Ref 6-16);
- Guidance on sampling from rivers and streams (International Standards Organisation (ISO), 2005 (Ref 6-17); and
- General Sampling of the Aquatic Environment (ES001) (Environment Agency, 2009) (Ref 6-18).

6.3 Methodology

The assessment has consisted of a desk based study informed by published and internet-based information sources, supplemented with responses to direct consultation requests. In addition, a number of field surveys have been carried out, including a site walkover survey and water quality sampling.

Potential impacts have initially been identified in the absence of mitigation, but considering the embedded design components of the development as outlined in section 6.6.

Study Area

The study area for the hydrology assessment is outlined below and illustrated in Figure 6.2.

The study area for the field surveys (including the water quality sampling undertaken) consisted of the land draining to several drainage ditches that are located within the proposed Development site (see WR1 to WR6 on Figure 6.1) and also included a reach of the Afon Ddu to the north of the proposed development.

A wider spatial scope was adopted for the desk study, where the study area was defined as the extent of the proposed Development site, in addition to the wider catchments of surface water bodies potentially affected by the proposed Development, up to a distance of 1km. Water quality and pollution incidences were also identified within a 1km radius from the proposed Development site.

The above study areas have been determined through a combination of the guidance outlined in Section 6.2 and consultation with various stakeholders. They are considered to be sufficient for the inclusion of all potentially affected surface water receptors.

Temporal Scope

In the absence of the proposed Development, the current water environment would be subject to future temporal variations. For example, it is anticipated that baseline water quality throughout the study area would be subject to variation, both seasonal and long-term. Whilst it is unknown whether the overall future trend will be for water quality improvements or degradation, legislative drivers, for example the WFD (Ref 6-6; Ref 6-7), will encourage future water quality improvements.

Climate change is anticipated to increase peak rainstorm intensities resulting in increases in fluvial flow peaks and surface water runoff. This would have the potential to increase future baseline flood risk within the study area. However, there is still uncertainty as to the effects of climate change on surface water resources and flood risk.

Sources of Baseline Data

An initial desk based study was carried out to characterise baseline conditions within the study area. The desk study was informed by the following sources of data:

- Envirocheck report including Historic OS maps (Landmark, 2015) (Ref 6-19);
- Flood Estimation Handbook (FEH) CD-ROM (Centre for Ecology and Hydrology, 2009) (Ref 6-20);
- River Basin Management Plan Western Wales River Basin District (EA, 2009) (Ref 6-21);

- Conwy Strategic Flood Consequences Assessment (CCBC, 2012) (Ref 6-23);
- Conwy Strategic Flood Risk Assessment (CCBC, 2011) (Ref 6-24);
- Ordnance Survey (OS) Explorer 1:25,000 Maps;
- NRW Water Framework Directive interactive map (accessed via EA website) (Ref 6-25);
- NRW Flood Mapping (accessed via EA website) (Ref 6-26);
- Welsh Government (WG) Development Advice Maps (6-9); and
- Soilscapes. Cranfield Soil and Agrifood Institute (accessed via website) (Ref 6-27).

Significance Criteria

The adopted assessment methodology, which is drawn from the Water Environment section of the DMRB (Ref 6-15), comprises a number of stages. The first stage involves making a judgement as to the value (or sensitivity) of the surface water receptors identified, which is assigned to one of the categories defined in Table 6-1.

Table 6-1 Criteria for Determining the Value (Sensitivity) of the Hydrological and Surface Water Resources (Ref 6-15)

Sensitivity	**Criteria**	**Typical Examples**	
Very High	Attribute has a very high quality, importance and rarity on a regional or national scale	Surface water:	European Union (EU) designated salmonid/cyprinid fishery.
			Watercourse achieving *WFD* class 'High'. Site protected under EU or United Kingdom (UK) wildlife legislation (Special Area of Conservation, Special Protection Area, Site of Special Scientific Interest, Ramsar site). Supports a public potable water supply to a large community.
		Flood risk:	Designated washland or a large and active floodplain where there is high potential for flooding of a large number (> 100) of residential properties and infrastructure.
High	Attribute has a high quality, importance and	Surface water:	Watercourse achieving *WFD* class 'Good'.
			Major cyprinid fishery.

Sensitivity	Criteria	Typical Examples	
	rarity on a local scale		Species protected under EU or UK wildlife legislation. Supports industrial or agricultural abstraction of > 500 m^3/day or supports a private water supply of potable water to a small community.
		Flood risk:	Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding.
Medium	Attribute has a medium quality, importance and rarity on a local scale	Surface water:	Watercourse achieving *WFD* class ‘Moderate’. Water feature that supports an abstraction for agricultural or industrial use of between 50 and 499 m^3/day, or supports a private water supply of potable water to an individual property.
		Flood risk:	Floodplain or defence protecting 10 or fewer industrial properties from flooding.
Low	Attribute has a low quality, importance and rarity on a local scale	Surface water:	Watercourse that is not a fishery, achieving *WFD* class ‘Poor’. Supports an abstraction for agricultural or industrial use of < 50 m^3/day. Does not support a public or private potable water supply.
		Flood risk:	Floodplain within limited constraints and a low probability of flooding of residential and industrial properties.

The magnitude of change (or impact) on the baseline condition is then assigned considering the scale/extent of change and the nature and duration of the impact. Definitions of magnitude are provided in Table 6-2, which were adapted from the DMRB (Ref 6-15) and the paper Practical Methodology for Determining the Significance of Impacts on the Water Environment (Mustow et al, 2005) (Ref 6-28).

Table 6-2 Criteria for Determining the Magnitude of Impact on the Hydrological and Surface Water Resources (Ref 6-15)

Magnitude of Impact	Criteria	Typical Example	
Major adverse	Results in loss of attribute and/or quality and integrity of the attribute	Surface water:	Loss or extensive change to a fishery. Loss or extensive change to a Nature Conservation Site. Change in the *WFD* class of a river reach or pollution of a potable source of abstraction.
		Flood risk:	Increase in peak flood level (1% annual probability) > 100 mm, or increasing the risk of flooding to >100 residential properties.
Moderate adverse	Results in effect on integrity of attribute, or loss of part of attribute	Surface water:	Partial loss in productivity of a fishery Pollution of a non-potable source of abstraction.
		Flood risk:	Increase in peak flood level (1% annual probability) > 50 mm, or increased flood risk to < 100 residential properties.
Minor adverse	Results in some measurable change in attribute quality or vulnerability	Surface water:	Discharges to a watercourse that result in no significant loss of quality, fishery or biodiversity value.
		Flood risk:	Increase in peak flood level (1% annual probability) < 50 mm or increasing the risk of flooding to < 10 industrial properties.
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use or integrity	The proposed development is unlikely to affect the integrity of the water environment.	
Minor beneficial	Results in some beneficial effect on attribute or a reduced risk of negative effect occurring	Flood risk:	Reduction in peak flood level (1% annual probability) > 10 mm.
Moderate Beneficial	Results in moderate improvement of attribute quality	Flood risk:	Reduction in peak flood level (1% annual probability) > 50 mm.

Magnitude of Impact	Criteria	Typical Example	
Major Beneficial	Results in major improvement of attribute quality	Surface water:	Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring to a watercourse.
		Flood risk:	Reduction in peak flood level (1% annual probability) > 100 mm.

The overall significance of effects on hydrology and surface water receptors is then derived by combining the value (sensitivity) of the resource with the magnitude of the impact (change), as illustrated in Table 6-3.

Where more than one significance outcome is possible, professional judgement is used to determine which is most appropriate, on a case by case basis and ensuring regard to the precautionary principle.

Table 6-3 Criteria for Determining the Significance of Effects on the Hydrological and Surface Water Resources

		MAGNITUDE OF IMPACT			
		Negligible	**Minor**	**Moderate**	**Major**
SENSITIVITY OF ATTRIBUTE	**Very High**	Neutral	Moderate	Large	Very Large
	High	Neutral	Slight/Moderate	Moderate/Large	Large/Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Moderate

Limitations of assessment and assumptions

The water quality of drainage ditches that are located within the proposed Development area is not routinely monitored and no long term dataset is available to define their baseline quality. Whilst a water quality sampling survey was undertaken, the data collected are indicative of a narrow window of time and do not reveal any trends or variations due to flow conditions or seasonality etc. However, using this data in addition to available NRW and Atkins monitoring data (see section 6.4.5), to infer and assess the water quality attributes of the unmonitored watercourses is deemed appropriate.

The flood risk to the development has been defined and assessed using currently available data from NRW and the LLFA, including an NRW hydraulic model that quantifies the flood regime local to the proposed Development site.

6.4 Existing Conditions

6.4.1 Catchment hydrology

The proposed Development is located on a low-lying floodplain in the Conwy Valley. The Conwy Valley has steep sided slopes, rising to over 400m AOD to the west of the Development site.

Both the Afon Conwy and Afon Ddu (from its confluence with the Conwy upstream to Pont Dolgarrog) are classified by NRW as a 'Main River.'

The Afon Conwy, situated approximately 700m north east of the proposed development, flows in a northerly direction and is tidal over the stretch that passes the site. The normal tidal limit of the Afon Conwy is approximately 4km upstream of the site at which point the catchment area is approximately 380km².

The Afon Ddu is a tributary of the Afon Conwy and flows along the northern boundary of the proposed Development site in an easterly direction, to its confluence with the Afon Conwy at NGR 278056, 366770. The Afon Ddu is also tidally influenced and its normal tidal limit is north east of the proposed Development site. Upstream of the B5106 Bridge, the Afon Ddu drains a catchment area of approximately 14km². The catchment receives an average annual rainfall of 2140mm and is steeply sloping, with an average drainage path slope of 221m/km.

There are several drainage ditches located within the proposed Development site and adjacent areas. For the purpose of this assessment, these drainage ditches have been described as Water Receptors (WR) and are identified in Figure 6.1. The drainage ditches are all easterly flowing, with the exception of WR4 and WR6, which both flow north to their confluences with the Afon Ddu and WR2, respectively.

6.4.2 Existing Flood Defence

The existing WTW infrastructure (2.31Ha), including a large building that houses the Granular Activated Carbon (GAC) filtration process, a lagoon, swale, wash water tank and standby generator, are defended by a flood protection bund, comprising earth embankment and plastic sheet piling, to reduce the risk of flooding from both the Afon Ddu and Afon Conwy. This flood protection bund was installed in 1998 with the plastic piles installed in 2011/2012 to raise defence levels to between 6.80m AOD and 6.88m AOD. The standard of protection provided by this defence is for a 1 in 1000 year (with climate) change fluvial event and 1 in 1000 year coastal flood event (with climate change). However, in areas of the existing WTW where there are gaps in the flood protection bund (e.g. from lack of flood gates at the site entrance), flood waters would partially inundate the site with resultant depths of up to 113cm (average of 82cm) in the 1000 year coastal flood event.

6.4.3 Existing Drainage

A topographic survey of the proposed Development site has been undertaken by Alpine Land Surveyors. The survey shows that, on the existing operational WTW site, typical ground levels are approximately 5.0mAOD to 5.5mAOD, while the earth bunds that form the existing flood defences range from approximately 5.56mAOD to 6.67mAOD around the eastern and northern boundaries. However, along the western boundary adjacent to the road the ground levels rise up to over 7mAOD.

In the operational area associated with the proposed Development and in the area required for a temporary construction compound, existing ground levels are relatively flat and typically range from 2.8mAOD to 3.5mAOD.

It is considered that the ditches facilitate drainage across the site, with the exception of WR1 which receives no discharges. Water present in the ditch (WR1) is considered to be a result of high levels of groundwater seepage.

6.4.4 Geology and Soils Description

The local site geology comprises Rhyolite, with Basaltic lava intrusions surrounding the site. Across the majority of the site, the bedrock is overlain by alluvium and soils that are considered freely draining, acid loamy soils over rock (Ref 6-27). Approximately 10% of the total land area within the proposed Development site, along the eastern and northern application boundary, comprises soils that are considered to be loamy and clayey floodplain soils with naturally high groundwater.

6.4.5 Water Quality

NRW routinely monitors the chemical and biological water quality of a number of watercourses within the study area under the requirements of the WFD (Ref 6-6; Ref 6-7).

Afon Ddu

Overall Ecological Potential

The Afon Ddu, located to the north of the proposed Development site, is a heavily modified water body (HMWB) and has a current ecological quality of ‘Moderate Potential’ (Ref 6-25).

Physico-chemical Potential

The Chemical Status of the Afon Ddu does not require assessment under the WFD (Ref 6-25).

Atkins (2015)[1] undertook flow and water quality monitoring along the Afon Ddu from September 2014 to March 2015 to inform a Water Framework Directive Assessment (WFDA) being produced on behalf of NRW.

[1]Sampling was carried out close to the existing WTW, in the lower reaches of the Afon Ddu, before it flows into the Afon Conwy. A variety of parameters were monitored at the sampling site and it was noted that the majority of these parameters met Environmental Quality Standards (EQS). However, there was a general increasing trend in recorded concentrations of nitrates from upstream to downstream along the Afon Ddu.

Additional water quality sampling of the Afon Ddu and other surface water receptors on the proposed Development site was undertaken by Hyder, during a site walkover survey conducted in May 2015. During this survey a number of parameters that are indicators of water quality, including: pH, temperature, conductivity and dissolved oxygen (DO), were recorded at 8

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[1] [1] *Atkins (2015). Dolgarrog WFD RSA Hydrogeological Monitoring and Geomorphology Study: Technical Report. Natural Resources Wales.*

sampling sites, with 2 of these sites located along the Afon Ddu (SW05 and SW06) (Ref 6-17; Ref 6-18).

The locations of the Hyder sampling sites (Site IDs) are illustrated in Figure 6.1 and the measured values of the sampled parameters for the Afon Ddu are summarised in Table 6-4 below.

Table 6-4 In situ water testing results for the Afon Ddu conducted by Hyder

In-Situ Test	Site IDs	
	SW05 (Afon Ddu)	SW06 (Afon Ddu)
Ys/cm (Conductivity)	34	54
Dissolved Oxygen (DO) %	126.4	126.5
Dissolved Oxygen ppm	14.58	14.58
pH	6.79	7.42
Temperature	9.03	9.05

The results of the water quality monitoring undertaken on the Afon Ddu highlight that this watercourse has DO concentrations above the guideline threshold that is set for Salmonid Waters (greater than 75% saturation) and pH levels would achieve compliance with WFD 'High Status' (i.e. between 6 and 9) (Ref 6-31). Therefore, the overall sensitivity of the Afon Ddu is considered to be high.

Afon Conwy

Overall Ecological Potential

The Afon Conwy is designated as estuarine in the proximity of the proposed development and within the study area. NRW has highlighted that the Afon Conwy is a HMWB and therefore has a current ecological quality status of 'Moderate Potential'.

Physico-chemical Potential

The Chemical Status of the Afon Conwy does not require assessment under the WFD (Ref 6-6; Ref 6-7; Ref 6-25). However, this watercourse has been noted to have good general Physico-Chemical Quality, in particular dissolved oxygen is considered 'High' and nitrogen 'Good' in line with EQS set out in the European Union (EU) Dangerous Substances Directive (67/548/EEC) List (Ref 6-30). Iron is attributed as a specific pollutant but the overall quality for the Afon Conwy is considered 'high'. Therefore, the overall sensitivity of the Afon Conwy is considered to be moderate.

Drainage Ditches

Incidental Observations

A site operative at the existing WTW noted a red/orange discolouration of surface waters and sediment within the drainage ditches on site in January 2015.

In-situ Water Quality Observations

Spot sampling of the drainage ditches, which are not routinely monitored for water quality by NRW, was carried out by Hyder during the site walkover survey conducted in May 2015. The locations of the sampling sites are illustrated in Figure 6.1 and the results of the water quality sampling are provided in Table 6-5.

Table 6-5 In situ water testing results for the Drainage Ditches (WR1 to WR6)

In-Situ Test	SW08 (WR1)	SW01 (WR2)	SW02 (WR2)	SW03 (WR4)	SW04 (WR3)	SW07 (WR6)
Ys/cm (Conductivity)	215	100	100	178	79	160
Dissolved Oxygen (D0) %	49.0	36.3	68.1	89.8	67.7	50
pH	6.0	6.6	6.5	7.5	6.9	5.9
Temperature	11.5	12.7	10.4	11.5	10.9	11.0

The data indicates that DO concentrations are above the guideline threshold that is set for Salmonid Waters (75% DO) at sample site SW03 (WR4). However, DO levels in WR1, WR2 and WR6 (see Figure 6.1) are low and would fall into the ‘Poor’ WFD classification. The DO concentrations are above the guideline threshold that is set for Cyprinid Waters (>60% and <75%) at sample sites SW02 (WR2) and SW04 (WR3) (Ref 6-31).

SW01 and SW02 correspond to sampling sites along the same drainage ditch (WR2). However, SW01 was taken in the area in which discoloration was most notable and SW02 was taken close to the confluence of this drainage ditch with WR4.

Recorded pH at the sampling sites indicates that the majority of associated watercourses would achieve compliance with WFD High status (pH >6 and <9).

The electrical conductivity of water is directly related to the concentration of dissolved ions (e.g. nitrate, phosphate, and sodium) in the water. The values recorded are within the indicative range required to support diverse aquatic life, with the exception of site SW04, where a low conductivity was recorded. At sampling site SW08 at WR1 the highest conductivity was recorded, which could be indicative of groundwater seepage as a source water in this ditch.

Whilst it is acknowledged that the recorded indicators of water quality would be subject to temporal variation, the data are considered to represent realistic conditions for the purposes of this assessment as the water quality sampling avoided seasonal extremes (e.g. drought or flood conditions).

Water quality sampling was not carried out at WR5 because the ditch was dry. SW05 and SW06 are the sampling sites located along the Afon Ddu as outlined in Table 6-4.

Level 1 Laboratory Water Quality Testing

In addition to the in-situ water sampling survey, as outlined above, water samples were also obtained at the sampling sites (Figure 6.1) in order to carry out more detailed Level 1 Laboratory analysis, in an attempt to identify the source of the discolouration of the drainage ditches.

The results have identified elevations above the recommended Environmental Quality Standards (EQS) freshwater values for zinc (Zn), manganese (Mn), ferrous iron (Fe), Polycyclic Aromatic Hydrocarbons (PAH) and Total Petroleum Hydrocarbon (TPH). Several other determinands were detected including sulphide, and Acenaphthylene. All surface water samples with EQS exceedances were collected from drainage ditches within the proposed development site, as well as two from the adjacent field.

However, both surface water samples taken from the Afon Ddu did not contain any elevated determinands, with the exception of TPH in one location which only marginally exceeded the EQS.

For a more detailed description of the laboratory water quality testing results, refer to the Hyder Geo-Environmental and Geotechnical Desk Study (Report No: 1279-W-201-HYD-XX-XX-RP-GX-10007). This study considers the following potential sources of the surface water contamination: faulting, acid mine drainage and the presence of a former iron gas pipeline crossing the ditch and proposed Development and concludes that the surface water contamination is unlikely to be a direct result of processes undertaken within the WTW itself.

Pollution Incidents

One pollution incident affecting surface waterbodies located within 1km of the proposed Development has been identified from the Envirocheck report (Landmark, 2014) (Ref 6-19). The location of this pollution incident is highlighted in Figure 6.2.The incident occurred on 30 May 1996 behind the Territorial Army Training Camp at Dolgarrog and the source was heavy fuel oil. NRW designated this as a ‘Minor’ incident.

No pollution incidents have been reported within the proposed Development site (Ref 6-32).

6.4.6 Flood Risk and Land Drainage

Baseline flood risk was assessed with reference to published flood maps from NRW and the Welsh Government (WG), the Conwy Phase 1 and 2 Hydraulic Model (JBA, 2013) (Ref 6-29) provided by NRW and using data supplied by CCBC.

The WG (TAN 15) Development Advice Map (DAM) shows three flood zones, A, B and C. The entirety of the proposed Development site is located in Zone C1 (Plate 6-1). Flood Zone C is based on the EA extreme flood outline and indicates that the proposed Development site is subject to flooding equal to or greater than the 0.1% (1 in 1000 year) flood event. The subdivision C1, indicates areas of the floodplain with significant flood defence infrastructure.

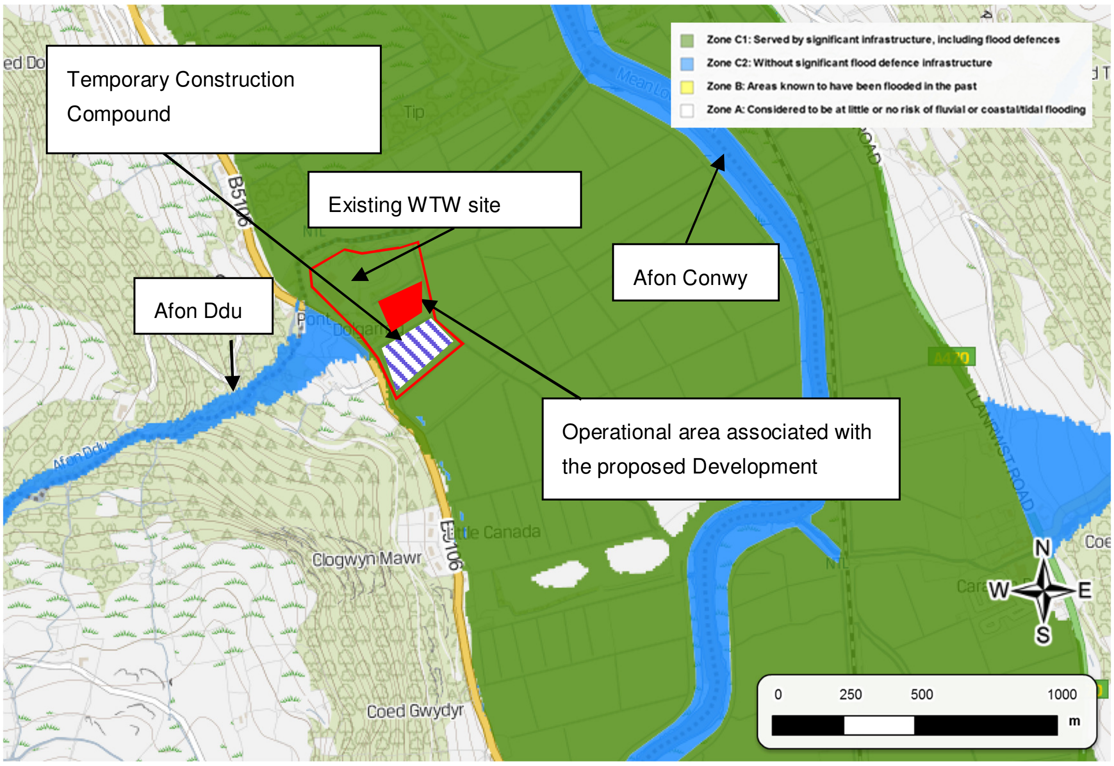

Plate 6-1 Development Advice Map illustrating site in its entirety in Zone C1

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A Stage 2 Flood Consequences Assessment (FCA) has been produced by Hyder (June 2015) and should be read in conjunction with this section of the Environmental Report. The FCA is provided in Appendix 6.1 but a summary of the findings is included within this chapter.

Fluvial Flood Risk

NRW (EA) flood mapping (Ref 6-26) indicates that the site is located in Flood Zone 3 (land assigned as having a 1% or greater chance in any year of flooding from rivers) and is at high risk from both fluvial and tidal flooding from the Afon Conwy and the Afon Ddu (Plate 6-2).

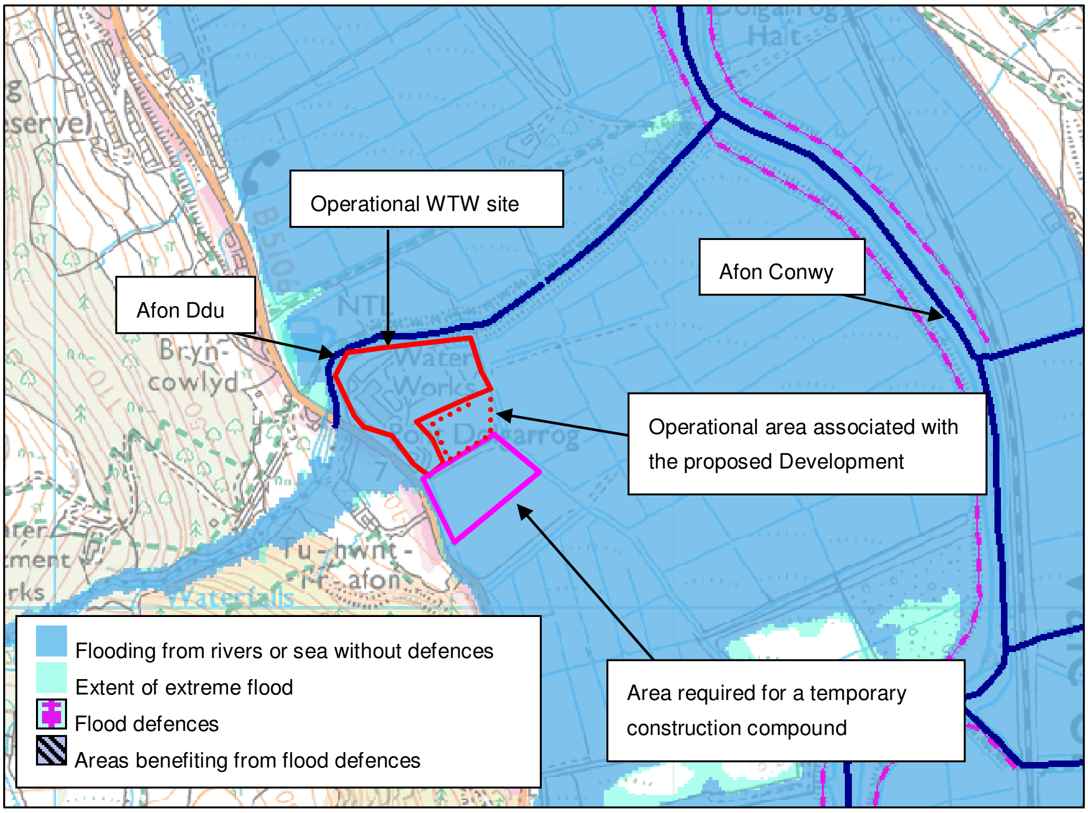

Plate 6-2 EA Flood Map

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As outlined in section 6.4.2, the current WTW is defended against fluvial flooding by an earth embankment (flood protection bund). The standard of protection provided by this defence is for a 1 in 1000 year (with climate change) fluvial event.

Drainage ditches identified during the site walkover, both within the proposed Development site and wider study area, have good flow conveyance capacity, steeply sided channel banks and relatively small catchment areas. It is therefore considered that the sensitivity of these drainage ditches is low.

Ditch WR1 has been confirmed to have no discharges flowing into it and the low level water present in the ditch is considered to be resultant of groundwater seepage. The fluvial flood risk attributed to this ditch is therefore also assessed as low.

Coastal Flood Risk

The site is located approximately 16km upstream of the mouth of the Afon Conwy where it discharges into Conwy Bay. However, with ground levels at the site being in the order of 2.8mAOD to 5.5mAOD, and with the MHWS at 4.05mAOD, the tidal conditions in Conwy Bay are able to propagate upstream through the Dolgarrog area, posing a risk of flooding at the proposed Development site.

A review of the estimated present day 1 in 200 year coastal flood levels (5.3mAOD) at the mouth of the Afon Conwy confirms that the proposed Development site is at significant risk of coastal flooding.

Surface Water Flood Risk

The NRW Updated Flood Map for Surface Water (Ref 6-33), as illustrated in Plate 6-3 below, shows that some 50% of the site falls within the 'very low' category of risk, which is indicative of a chance of surface water flooding each year of less than 0.1% (1 in 1000 year).

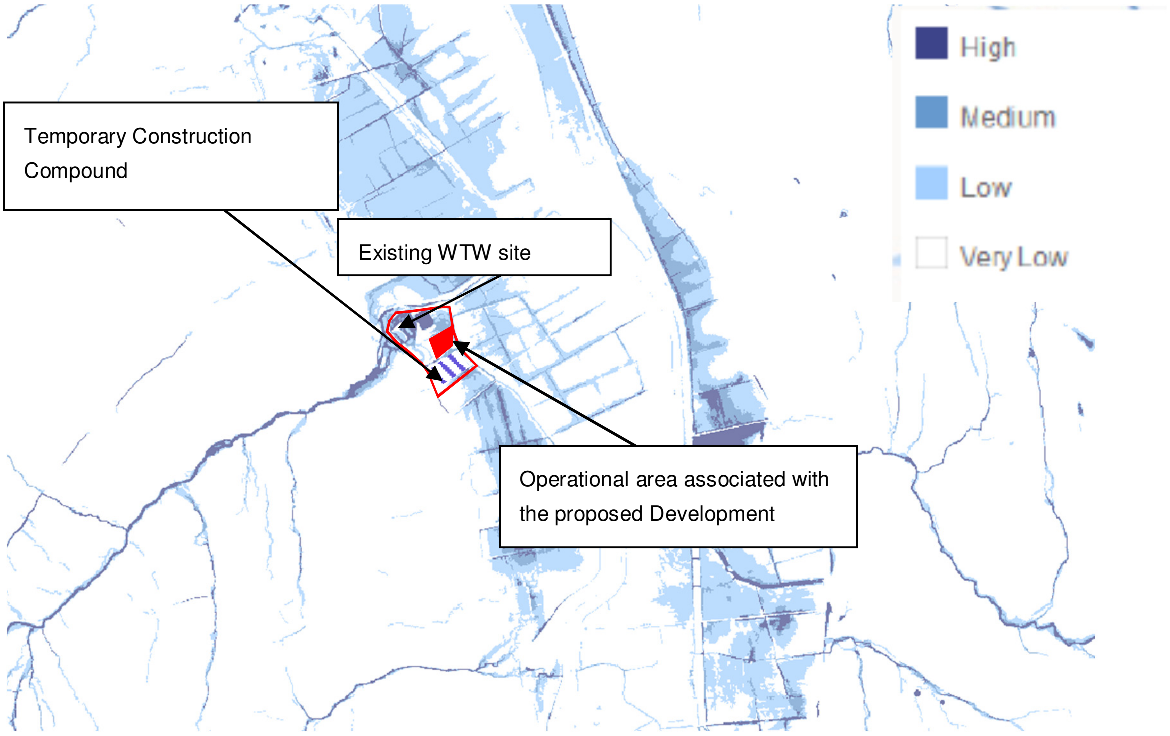

Plate 6-3 Surface Water Flood Risk to the proposed Development site

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There is a high risk of surface water flooding (greater than 1 in 30) in areas around the proposed Development site, including the existing lagoon (as would be expected) and WTW building. The high risk areas are caused by the impounding effects of the existing flood protection bund and lagoon bund. In reality, the existing drainage system, which isn't fully taken into account in the production of the surface water maps, would serve to drain the operational WTW site and prevent the surface water flooding shown in Plate 6-3.

A large proportion of the eastern area of the proposed Development site is considered at low risk of surface water flooding (between 1 in 1000 and 1 in 100). However, a small part of the operational area associated with the proposed Development would also be located on land currently assigned as being at medium risk of surface water flooding (between 1 in 100 and 1 in 30) to the north of WR1 and immediately south east of the existing lagoon.

The proposed Development is located on land classified as Greenfield land. This area slopes down towards the east to the Afon Conwy. Owing to the permeable nature and topography, the operational area associated with the proposed Development and the area required for a temporary construction compound are considered to currently drain naturally via infiltration and overland flow to the nearby land drains.

Groundwater Flood Risk

Groundwater observations recorded as part of the site investigation works confirm that groundwater is present at shallow depths. Exploration Associates (1995) report standing water levels in observation wells at depths ranging from 0.84m to 2.25m. The observed fluctuations in recorded standing water levels could be due to a range of factors including rainfall events and hydraulic continuity with the nearby Afon Ddu.

Groundwater levels recorded by Exploration Associates (1995) merit special note as there may be potential for localised and/or transient artesian conditions given the proposed Development site's low lying situation. In addition, the presence of interbedded fine and coarse strata, and the presence of geological faults could provide a degree of hydraulic continuity with water bearing strata on the valley side.

The proposed Development site is therefore considered to be vulnerable to groundwater flooding, where the alluvium may be in hydraulic continuity with the river or where localised and/or transient artesian conditions may be present. However, there is no historical evidence of groundwater flooding on the proposed Development site. Groundwater flooding, as a result of hydraulic continuity with the Afon Ddu, would only be likely to be a source of flood risk in times of sustained high river levels and would be far outweighed by the risk of direct flooding from the Afon Ddu. The series of drainage ditches located within the surrounding area would also facilitate in the management of onsite drainage and reduce the risk of groundwater flooding to the site.

Artificial Sources of Flood Risk

The site is located within the maximum inundation extent associated with failure of the Llyn Cowlyd Reservoir, as illustrated on the NRW online reservoir flood risk map (Ref 6-22). However, reservoir flooding is extremely unlikely to happen. There has been no loss of life in the UK from reservoir flooding since 1925. All large reservoirs must be inspected and supervised by reservoir panel engineers and essential safety work is also routinely carried out. Therefore, flood risk to the development site from artificial sources is considered to be low.

6.4.7 Water resources (licensed abstractions, consented discharges & private water supplies)

Information on licensed surface water abstractions and discharges was obtained from a Landmark Envirocheck report (Ref 6-19).

One licence for water abstraction (NGR 277800, 365095) from surface water bodies within 1km of the site has been identified (Figure 6.2). This licence (23/66/9/0016) gives consent for a single point abstraction of surface water from a small stream near Cae Coch Farm that flows into the Afon Conwy, for the purpose of general farming and domestic uses.

A total of 5 consented discharges to surface water receptors were identified (Figure 6-2) and these have been summarised in Table 6-6.

Table 6-6 Surface Water Discharges

License Holder	National Grid Reference	Discharge Type	Receptor
Dŵr Cymru – Bryn Cowlyd WTW	277580, 366430	Trade Discharges – Process Effluent – Water Company.	Afon Ddu
Dŵr Cymru	278030, 366850	Sewerage Network – Sewers – Water Company (Storm Sewerage Overflow).	Afon Conwy
Dŵr Cymru	277100, 367200	Sewerage Network – Sewers – Water Company (Storm Sewerage Overflow).	Afon Conwy
Conwy County Borough Council	278130, 365990	Waste site (unspecified).	Afon Conwy
Mr William Stevens	277932, 365146	Domestic (single point) – Treated effluent/sewerage – not Water Company.	Unnamed tributary of Afon Conwy

Other relevant features

Chapter 4: Ecology highlights that the drainage ditches on site and in the wider study area provide suitable habitat to support juvenile fish species in addition to aquatic invertebrates.

6.4.8 Summary of Surface Water Receptors and their Value

Table 6-7 provides a summary of the value / sensitivity assigned to the individual receptors identified through the desk studies, field surveys and consultations undertaken. Values / sensitivities have been assigned using the criteria presented in Table 6-1.

Table 6-7 Summary of surface water receptors and their value (sensitivity)

Receptor	Category	Value (Sensitivity)	Rationale
WR1 (ditch)	Surface Water Quality	**Low**	No suitable habitat features to support juvenile fish and aquatic invertebrates. DO concentrations low, in line with 'Poor' WFD status. No abstractions or discharges.
	Flood Risk	**Low**	Steep channel banks, no discharge to ditch, source of water in ditch from groundwater seepage – negligible associated flood risk. Floodplain within limited constraints and a low probability of flooding of residential and industrial properties, owing to distance from such vulnerable areas. Low surface water flood risk.
WR2 (drainage ditch)	Surface Water Quality	**Low**	No suitable habitat features to support juvenile fish and aquatic invertebrates. Discoloration of watercourse noted during site walkover. Chemical testing on water samples obtained from drainage ditch identified exceedance of EQS for Fe, Zn, Mn and TPH. Variable DO concentrations recorded – low at SW01 in line with 'Poor' WFD status. No abstractions or discharges.
	Flood Risk	**Low**	Steep channel banks, good flow conveyance capacity, relatively small catchment area – negligible associated flood risk. Floodplain within limited constraints and a low probability of flooding of residential and industrial properties, owing to distance from such vulnerable areas. Typically low surface water flood risk, however there are small areas confined along channel designated as high surface water flood risk.
WR3 (drainage ditch)	Surface Water Quality	**Medium**	Suitable habitat features to support juvenile fish and aquatic invertebrates. pH indicative of 'High' status under WFD. No abstractions or discharges. Common place at the local scale.
	Flood Risk	**Low**	Steep channel banks, good flow conveyance capacity, relatively small catchment area – negligible associated flood risk. Floodplain within limited constraints and a low probability of flooding of residential

Receptor	Category	Value (Sensitivity)	Rationale
			and industrial properties, owing to distance from such vulnerable areas. Typically low surface water flood risk, however there are small areas confined along channel designated as high surface water flood risk.
WR4 (drainage ditch)	Surface Water Quality	**Medium**	Suitable habitat features to support juvenile fish and aquatic invertebrates. pH indicative of 'High' status under WFD. No abstractions or discharges. Common place at the local scale.
	Flood Risk	**Low**	Steep channel banks, good flow conveyance capacity, relatively small catchment area – negligible associated flood risk. Floodplain within limited constraints and a low probability of flooding of residential and industrial properties, owing to distance from such vulnerable areas. Low fluvial flood risk and medium surface water flood risk.
WR5 (drainage ditch)	Surface Water Quality	**Low**	Dry ditch No abstractions or discharges.
	Flood Risk	**Low**	Dry ditch with steep channel banks, good flow conveyance capacity, and relatively small catchment area – negligible associated flood risk. Floodplain within limited constraints and a low probability of flooding of residential and industrial properties, owing to distance from such vulnerable areas. Low surface water flood risk.
WR6 (drainage ditch)	Surface Water Quality	**Medium**	Suitable habitat features to support juvenile fish and aquatic invertebrates. DO concentrations low, in line with 'Poor' WFD status. No abstractions or discharges.
	Flood Risk	**Low**	Steep channel banks, good flow conveyance capacity, relatively small catchment area – negligible associated flood risk. Floodplain within limited constraints and a low probability of flooding of residential and industrial properties, owing to distance from such vulnerable areas. Low surface water flood risk.

Receptor	Category	Value (Sensitivity)	Rationale
Afon Ddu	Surface Water Quality	**High**	The current WFD quality of the watercourse is classified as achieving ‘Moderate Potential’. However, DO levels were above threshold for Salmonid Waters and pH levels were indicative of ‘High’ WFD status. Supports one licensed discharge consent. Does not support abstractions.
	Flood Risk	**Medium**	Reach designated as Flood Zone 3. High surface water flood risk along confines of watercourse channel. Few vulnerable receptors in the floodplain. Floodplain or defence protecting 10 or fewer industrial properties from flooding.
Afon Conwy	Surface Water Quality	**Medium**	Current WFD ecological quality (Estuarine) is classified as achieving ‘Moderate Potential’. Licensed abstractions located within hydrological catchment of Afon Conwy. Supports one licensed discharge consent.
	Flood Risk	**Medium**	Tidal Influence. Reach designated as Flood Zone 3. Few vulnerable receptors in the floodplain. Floodplain or defence protecting 10 or fewer industrial properties from flooding (in the vicinity of the site).

6.5 Consultations

Consultation has been undertaken to request baseline hydrology and hydraulic information, identify NRW requirements and the modelling scope of works and discuss the preliminary FCA findings. The information provided is summarised in Table 6-8.

Table 6-8 Relevant Consultation and information provided

Consultee	Date of Consultation	Information Provided
NRW	23 April 2015	Description of NRW Asset type and accompanying data Flood Event Outlines Fluvial Flood Zone Map Tidal Flood Zone Map Conwy Model Update Phase 1 and 2, JBA (2013) Report and Model Files
NRW	29 April 2015	Site meeting at Bryn Cowlyd WTW with NRW Development and Flood Risk Engineer.
NRW	5 May 2015	Conwy modelling data provided to Hyder, including special licences. Confirmation of NRW's requirements in respect of the design and extreme scenarios that the revised model (Hyder) will have to demonstrate to show adequate protection of the Development site and to identify impacts on third party flood risk. NRW request that ideally 100 years of climate change should be used. Blockage assessment of the Afon Ddu is required.
CCBC (LLFA)	26 May 2015 & 14 July 2015	No concerns about impact to the B5106 or adjacent properties due to their level. Satisfied that FCA will address potential impacts from a reduction in floodplain storage as a result of the bund.
NRW	26 June 2015	95% confidence in the CC predictions needs to be assessed. No requirement from NRW for Hyder to run the 0.1% event with CC. As such the summary findings provided to NRW in email (23/06/2015) seem acceptable. The FCA should also refer to surface water drainage arrangements (greenfield runoff rates etc.) and compensation for any infilling of ditches/providing new drainage ditches.
NRW	15 July 2015	Unrestricted discharge permitted to Afon Ddu subject to a formal Flood Defence Consent (FDC) application for the outfall structure.

6.6 Embedded Design Measures

The following section outlines the embedded design measures that would act to safeguard the existing hydrological regime and surface water receptors within the study area.

6.6.1 Temporary Measures during Construction Phase

A Construction Environmental Management Plan (CEMP) would be implemented prior to commencement of the construction works to ensure that good practice is employed and the environment is safeguarded. The contractor would prepare detailed method statements and appropriate controls would be implemented. The plan would cover activities such as excavation and dewatering, storage of fuels, chemicals and oils, vehicle washing, pollution control, and emergency contingency.

The quality of surface watercourses would be protected during the construction period by following good practice pollution control techniques, as documented in the following publications:

- Relevant NRW (formerly Environment Agency) Pollution Prevention Guidance (Ref 6-11);
- C650 – Environmental Good Practice on Site (Ref 6-12); and
- C532 - Control of Water Pollution from Construction Sites (Ref 6-13).

An emergency spillage response plan would be produced. Appropriate equipment (e.g. absorption mats) would be made easily accessible on the proposed Development site and the plan would also provide a full list of protocols and communication channels with NRW in the event of a pollution incident.

The construction site compound areas would be bunded for the storage of fuels, chemicals and refuelling areas, to prevent leakage and would be located as far away as possible from surface water bodies. Any refuelling would only take place within a designated fuel transfer area. Any drainage from this area would incorporate an isolation facility such that the outlet could be sealed in the event of a spillage.

In order to prevent cable trenches acting as preferential drainage pathways, potentially impacting on the existing hydrology and drainage regime of the proposed Development site, clay bunds would be placed at intervals along the trenches prior to backfilling.

Waste water generated from the construction compound would be disposed of via appropriate means, for example pumped out and removed off site by tanker.

The crossing of drainage ditches (WR2 and WR6) within the proposed Development site to facilitate access to the temporary construction compound would be designed and constructed in accordance with best practice guidelines in order to minimise any potential effects on the local hydrological regime. The crossings would comprise a clear span bridge with abutments constructed such that there would be no reduction in flow area/width. In line with CCBC Guidance crossings of this nature would not require consent under the Land Drainage Act, 1991.

Temporary Flood Defences

During the 24 month construction period, a temporary construction compound would be located on the south side of the proposed Development site. This compound would be defended to a level of 5.7mAOD using a 390m earth flood protection bund. The bund would be removed from the floodplain once the construction of the works was complete.

Indicative Drainage Strategy for the Temporary Construction Compound

Access tracks and impermeable areas within the temporary construction compound would be drained using appropriate sustainable drainage techniques. The proposed drainage system would centre on the use of attenuation measures (such as a swale), with off-site discharge flows limited to that of existing runoff rates. Under normal conditions rainfall runoff discharge flows will gravitate to the existing drainage ditches located on the southeast side of the site.

To minimise the impact of the temporary construction compound on flood risk within the nearby drainage ditches, it is essential that surface water drainage arrangements are such that the volumes of run-off and peak flow rates leaving the site during the construction period are no greater than those under existing conditions.

In order to inform this outline drainage strategy existing run-off rates have been calculated (in line with CIRIA C609 guidelines) and the storage volume required to restrict run-off from the new impermeable surfaces to these rates has been estimated

Greenfield rates of runoff from the site have been calculated using the FEH Statistical method, as advised in the latest flood estimation guidelines from the EA (EA, 2015). Runoff rates were calculated for rain storm events, including the 1 in 2 year, 1 in 30 year and the 1 in 100 year storm events in accordance with NRW requirements. The results of these calculations are presented in Table 9-1.

Table 6-1 Greenfield runoff calculation results

Return Period	Greenfield Runoff Rate (l s^{-1} ha^{-1})
1 in 2 year	11.6
1 in 30 year	20.4
1 in 100 year	25.3

Under tide locked conditions (as a result of high water levels within the receiving ditches), reverse flow into the drainage system would be prevented by a non-return valve. In these conditions onsite surface water would back-up and be stored within the swale within the temporary construction compound.

The swale and other SuDS features would also function to settle any suspended sediments in the runoff.

For the temporary construction compound if any infilling of ditches is required then appropriate compensation storage/ditches would be provided to ensure that there was no loss in attenuation capacity of the wider land drainage system.

6.6.2 Permanent Measures during Operational Phase

Flood Defences

Flood protection, comprising an earth bund, would be constructed to provide permanent protection against fluvial and tidal flooding. The operational area associated with the proposed Development would be set, approximately, at existing ground levels (3.5mAOD) and would be contained within a new 360m flood protection bund with a crest level of approximately 6.8mAOD connected into the existing flood protection bund around the operational WTW. In addition, a flood gate (height 6.8mAOD) would be installed at the entrance to the operational WTW site.

Indicative Drainage Strategy for the Development

Given the underlying ground conditions (which inhibit drainage to the soil) and the location of the 'Normal Tidal limit' adjacent to the operational WTW, it is considered that the most practical solution for the management of surface water runoff is to provide an un-restricted discharge directly to the Afon Ddu. This solution has been discussed and agreed in principle with NRW.

If unrestricted discharges to the Afon Ddu are not feasible, this strategy will need to incorporate attenuation and Sustainable Drainage Systems (SUDS) techniques, where possible, to ensure no increase in runoff rates or volumes from the site. An outline drainage strategy has been developed in section 9 of the FCA report (Hyder, 2015).

As part of the detailed design of the development, surface water flood pathways (roads/footpaths) should be identified to ensure that this overland flow is routed away from buildings and into a drainage system that would drain via gravity to an outlet (via flapped outfalls) to the Afon Ddu.

The design and construction of the proposed Development should also ensure that there are no low spots on the site, where unplanned ponding of water could occur and threaten buildings nearby. In addition, the operational area associated with the proposed Development would be constructed on impermeable concrete. This impermeable surface would act as a barrier, preventing potential groundwater flooding from inundating the new infrastructure. This, combined with the proposed surface water drainage strategy, would ensure that the risk of groundwater flooding would be low.

Under tide locked conditions (as a result of high water levels within Afon Ddu), reverse flow into the drainage system would be prevented by a non-return valve. In these conditions surface water would be pumped to an existing stormwater outfall that discharges to the Afon Ddu.

It is understood that the proposed Development would only involve the infilling on one minor (115m long and 1.5m wide) ditch. To compensate for the minor loss in storage in the wider ditch system a new compensation ditch would be constructed between the toe of the proposed flood defence and the western side of the new farm access track.

6.7 Potential Effects on Receptors

The following section assesses the potential effects on the individual receptors identified in Table 6-7, in the absence of mitigation measures. Measures that are embedded in the design of the proposed development to minimise potentially significant effects are summarised in Section 6.6 and these measures have been considered in the assessment of effects.

For the purpose of this assessment, all impacts on water receptors are considered adverse unless otherwise stated.

Construction Phase

Surface Water Quality

The construction phase of the proposed development would involve earthworks including excavations, transportation, stockpiling and backfilling of material. Erosion and subsequent mobilisation of this material by wind or water, and its transportation via surface water runoff to watercourses or drainage ditches has the potential to result in sedimentation.

Sedimentation is most likely to affect the water quality attributes of those watercourses in closest proximity to the construction works. Given that the measures set out within the embedded design measures would greatly reduce the risk of sedimentation occurring and considering that the minimum distance between the works and the closest surface water receptors (i.e. WR2 and WR4, as ditch WR1 is to be removed) is 7m, it is considered that the magnitude of impact would be **Negligible** to all water receptors (not requiring culverting). This would result in an overall **Neutral** significance.

A further potential effect on the surface water quality attributes of surface water receptors is associated with the upgrading of an existing bridge crossing (WR2) and a new bridge crossing (WR6) required to provide access to the temporary construction compound. There is the potential to affect surface water quality through the disturbance of the banks of the drainage ditches which may increase sedimentation, or through increased vehicular traffic in close proximity to the drainage ditches, which increases the likelihood of pollutant spillages. However, given the implementation of a CEMP which would be put in place to ensure good practice is employed during these works and given the effective application of the remaining embedded design measures, the effects of constructing crossings on the surface water quality attributes of these water receptors (WR2 and WR6) are considered to be temporary and **Minor.** This would have an overall **Slight** significance.

There is the potential for accidental spillages of oils, chemicals, cement and fuels from the movement of construction traffic across the proposed Development site, along access tracks and in association with chemical storage facilities. Embedded design measures would greatly reduce the risk of generating polluted runoff from work areas and accidental spillages and it is considered that this magnitude of impact on water receptors would be **Negligible**. This would have an overall **Neutral** significance.

It is proposed that one ditch (WR1) would be infilled, resulting in the total loss of all existing attributes of this water feature. The magnitude of impact would therefore be **Major**. However, taking into consideration the low sensitivity of the ditch, the overall significance would be **Moderate**.

Flood Risk

The proposed development is located in an area at existing risk of both fluvial and tidal flooding from the Afon Conwy and the Afon Ddu. These receptors are therefore attributed medium sensitivity to flood risk as described in Table 6-7.

The construction of the proposed Development and its resultant flood protection, would result in a loss of floodplain storage which has the potential to cause third party or off-site impacts on flood risk. However, hydraulic modelling of the flood resilient bunding as outlined in embedded design measures (section 6.6) and further detailed in the FCA (Appendix 6.1) has demonstrated that the construction of the proposed Development would result in no discernible impact on fluvial and tidal flood risk from the Afon Conwy and the Afon Ddu, with an overall **neutral** significance.

The construction phase would result in the creation of additional impermeable surface areas within the application boundary. Increased rates and volumes of surface water runoff would be generated from these areas of the proposed Development, with the potential for increased surface water flood risk across the site. However, management of surface water runoff using sustainable drainage techniques as described in section 6.6, would reduce this effect to a **Negligible** magnitude. This would result in an overall effect of **Neutral** significance.

A potential effect on flood risk and drainage is associated with the upgrading of the existing crossing to facilitate access across the drainage ditch WR2, in addition to the new crossing of WR6. The crossings would comprise clear span bridges with abutments located outside of the natural channels of the drains, so as not to reduce flow area/width. There would be no requirement during the construction of the crossings to divert, dam or otherwise modify the drainage channels. Therefore the potential for localised flood risk effects is **Negligible**. Given the (Low and Medium) flood risk sensitivity of these drainage ditches, this would result in an overall **Neutral** effect.

Additional **Major** impacts on the flood risk and drainage attributes of WR1 are anticipated during the construction phase, owing to the removal of this ditch. However, this ditch does not perform any significant land drainage/flood risk management function, containing only groundwater seepage. The overall effect is therefore considered to be **Neutral.**

Operational Phase

Surface Water Quality

Once the construction phase is complete the limited maintenance requirements would consist of inspections and routine tasks. The risks of a pollution incident arising from fuels, oils and other chemicals would therefore be reduced compared to the construction phase. The magnitude of impact on the water quality attributes of surface water receptors of low to high sensitivity, during the operational phase, would be reduced to **Negligible**. This would result in a potential impact of **Neutral** significance.

Flood Risk

When compared to the construction phase, the impermeable surface area would be slightly reduced as a result of reinstatement of the construction compound. The potential changes to infiltration rates and surface water drainage described under the construction phase assessment would also be slightly reduced. Surface water runoff would be managed using appropriate SuDS techniques.

There are considered to be no additional potential effects on fluvial flood risk associated with the operational phase of the proposed Development.

Both the construction compound and the crossings over the drainage ditches WR2 and WR6 developed to facilitate access into the construction compound would be temporary and limited to the construction phase. There would be no effects on the hydrological regime of the drainage ditches during the operational phase.

The flood resilient bunding, as outlined in section 6.6 and erected during the construction phase, would reduce the risk of flooding from surface water receptors during the operational phase of the Development.

It is therefore considered that the magnitude of impact on the flood risk attributes of the surface water receptors of low to medium sensitivity, during the operational phase, would be negligible. This would result in a potential impact of **Neutral** significance.

6.8 Summary and Conclusions

The proposed Development is situated in the hydrological catchment of the Afon Ddu which is located immediately to the north and the Afon Conwy located approximately 700m north east. There are drainage ditches located within the proposed Development site, which facilitate surface water drainage.

Baseline information indicates that the water quality attributes of the surface water receptors within the study area are variable, as identified in Table 6-7, and these are assigned from low to high sensitivity values.

NRW flood mapping (Ref 6-26) indicates that the site is located in Flood Zone 3 (land assigned as having a 1% or greater chance in any year of flooding from rivers and 0.5% or greater chance in any year of flooding from the sea) and is at risk from both fluvial and tidal flooding from the Afon Conwy and Afon Ddu.

A hydraulic model was supplied by NRW and has been utilised to quantify flood risk to the proposed Development site from these watercourses during extreme flood events. The Hyder FCA details baseline flood risk and outlines the embedded design measures necessary to ensure that the proposed Development would have an appropriate standard of flood protection and would not increase third party flood risk.

Pollution prevention techniques would be employed to ensure that the risk of spillages, leaks and discharges to surface waters would be reduced as far as possible. Pollution prevention measures would be designed in accordance with good practice guidance and monitored through the implementation of a CEMP.

Drainage ditches WR2 and WR6 would be crossed temporarily during the construction phase to provide onsite access to the construction compound. Best practice guidelines would be implemented in the design and construction of the crossings to minimise the potential for water quality and flood risk impacts on these water receptors.

The proposed Development site would increase the extent of impermeable surface. Localised and minor changes to surface water drainage patterns are predicted. However, these changes would be mitigated by installation of access track cross drainage and by incorporating appropriate SuDS measures.

It is proposed that one ditch (WR1) would be infilled, resulting in the total loss of all existing attributes of this water feature and an impact of **Major** magnitude. However, the ditch is common place and is relevant only at the local scale, with good substitutability. Its value (sensitivity) has therefore been assessed as **Low to Negligible,** resulting in an overall significance of **Moderate** (water quality attributes) **to Neutral** (land drainage function).

Table 6-9 summarises the key effects of the proposed Development during the construction and operational phases.

Table 6-9 Summary of key potential effects during construction and operational phases on surface water receptors

Potential Effects	Phase	Significance
Loss of surface water attributes of WR1 (removal of ditch)	C,O	**Moderate** (water quality attributes)/**Neutral** (land drainage function)
Silt pollution	C,	**Neutral**
Pollution with fuels, oils, cement or concrete	C,	**Neutral**
Increase in flood risk – increased surface water runoff from impermeable areas, loss of floodplain storage and due to soil compaction/disturbance	C, O	**Neutral**

6.9 References

Ref 6-1 The Water Resources Act, 1991 (as amended).

Ref 6-2 The Pollution Prevention and Control Act, 1999.

Ref 6-3 Environmental Permitting (England and Wales) Regulations, 2010 (as amended).

Ref 6-4 The Water Drainage Act, 1991.

Ref 6-5 The Flood and Water Management Act, 2010.

Ref 6-6 Directive 2000/60/EC of the European Parliament (the Water Framework Directive)

Ref 6-7 The Water Environment (Water Framework Directive) (England & Wales) Regulations (2003).

Ref 6-8 Welsh Government, 2014. Planning Policy Wales (PPW), Edition 7. Available at http://wales.gov.uk/docs/desh/publications/140731planning-policy-wales-edition-7-en.pdf.

Ref 6-9 Welsh Government, 2004. Planning Policy Wales Technical Advice Note (TAN) 15: Development and Flood Risk.

Ref 6-10 Conwy County Borough Council (2013) Local Development Plan.

Ref 6-11 Environment Agency (various dates) Pollution Prevention Guidance (PPG). Accessed via www.netregs.gov.uk.

Ref 6-12 CIRIA, 2005. C650 Environmental Good Practice on Site.

Ref 6-13 CIRIA, 2001. C532 Control of Water Pollution from Construction Sites.

Ref 6-14 British Standards Institute, 2009. Code of Practice for Earthworks: BSI 6031

Ref 6-15 Highways Agency, 2009. Design Manual for Roads and Bridges (DMRB) - Volume 11, Section 3, Part 10 Road Drainage and the Water Environment: HD 45/09.

Ref 6-16 Environment Agency Wales, 2006. WAT-RM 30 Regulatory Method for Water Features Surveys.

Ref 6-17 International Standards Organisation, 2005. Guidance on sampling from rivers and streams.

Ref 6-18 Environment Agency, 2009. General Sampling of the Aquatic Environment (ES001).

Ref 6-19 Landmark, 2015. Envirocheck report including Historic OS maps.

Ref 6-20 Centre for Ecology and Hydrology, 2006. Flood Estimation Handbook CD-ROM Version 3.0.

Ref 6-21 Environment Agency, 2009. River Basin Management Plan Western Wales River Basin District.

Ref 6-22 Natural Resources Wales (formerly Environment Agency). Maps of maximum extent of flooding from artificial sources. Accessed via http://www.environment-agency.gov.uk/homeandleisure/37793.aspx

Ref 6-23 Conwy County Borough Council (2012). Conwy Strategic Flood Consequences Assessment.

Ref 6-24 Conwy County Borough Council, 2011. Conwy Strategic Flood Risk Assessment.

Ref 6-25 Natural Resources Wales (formerly Environment Agency).Water Framework Directive (WFD) Maps. Accessed via http://www.environment-agency.gov.uk/homeandleisure/37793.aspx 4

Ref 6-26 Natural Resources Wales (formerly Environment Agency) Flood Maps. Accessed via http://www.environment-agency.gov.uk/homeandleisure/37793.aspx

Ref 6-27 Soilscapes. Cranfield Soil and Agrifood Institute. Accessed via http://www.landis.org.uk/soilscapes/

Ref 6-28 Mustow, S.E, Burgess, P.F. and Walker, N. 2005. ‘Practical Methodology for Determining the Significance of Impacts on the Water Environment’. Journal of the Chartered Institution of Water and Environmental Management, 19 (2).

Ref 6-29 JBA, 2013. Conwy Model Update Phase 1 and 2.

Ref 6-30 European Union (EU) Dangerous Substances Directive (67/548/EEC).

Ref 6-31 UKTAG, 2010. Water Framework Directive: An Approach to the Revoked Directives: - the Freshwater Fish Directive; the Shellfish Directive and the Dangerous substances Directive.

Ref 6-32 Natural Resources Wales (formerly Environment Agency). Pollution Maps. Accessed via http://www.environment-agency.gov.uk/homeandleisure/37793.aspx

Ref 6-33 Natural Resources Wales (formerly Environment Agency).Surface Water Flood Maps. Accessed via http://www.environment-agency.gov.uk/homeandleisure/37793.aspx

Ref 6-34 Environment Agency. 2012. Appendix to Advice Note, Ordinary Watercourse Regulation. Appendix 2 Cross sections of consentable activities.

7 LANDSCAPE AND VISUAL

7.1 Introduction

This Chapter considers the landscape and visual implications of the proposed Development, including the assessment of lighting impacts on the night time landscape. Landscape is defined in the European Landscape Convention as '...an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors' (Council of Europe, 2000) (Ref 7-1). Visual or visual amenity considerations relate specifically to the views of a landscape afforded to people. These separate but related issues form the basis for landscape and visual impact assessment (LVIA).

A full description of the proposed Development is given in Chapter 3. Description of the Proposed Development, and illustrated in Figure 3.1 Proposed Development Site Layout.

This Chapter presents the methodology used to undertake the assessment, the baseline conditions, mitigation measures, and an assessment of impacts which takes into account mitigation measures that are integral to the proposed Development. This is followed by a summary and conclusions.

7.2 Assessment Methodology

The assessment process has been carried out based on 'Guidelines for Landscape and Visual Impact Assessment: Third Edition' (Landscape Institute, LI, and Institute of Environmental Management and Assessment, IEMA, 2013) (Ref 7-2).

The Study Area for this Chapter extends to a 5km radius from the proposed Development (see Figure 7-1 Designations, Zone of Theoretical Visibility and Viewpoints). Beyond this distance the proposed development would not be readily perceptible within the wider landscape.

To refine the assessment, a Zone of Theoretical Visibility (ZTV) has been generated within the Study Area, which represents the theoretical area from which any part of the proposed development may be seen (refer to Figure 7-1 Designations, Zone of Theoretical Visibility and Viewpoints). ZTVs are based on bare ground data, with any ridgelines, plateaux and valleys reflected in the extent of predicted visibility. ZTVs do not take into account local conditions such as subtle variations in landform, built development or vegetation cover, which significantly reduce the extent of actual visibility.

The ZTV was modelled using a Digital Terrain Model (DTM), taking into account the curvature of the earth and assuming a proposed Development height of up to 3m and viewer height of approximately 2 metres above ground level. DTM data was derived from Ordnance Survey (OS) Terrain 50 data (elevation data on a 50 metre grid). ZTV output was overlaid on OS mapping, with an overview reproduced at 1:50,000 scale (see Ref 7-3).

7.2.1 Baseline Evaluation

Baseline conditions are defined by landscape character and respective nature of the receptor, together with visual amenity (as represented by views) and the nature of visual receptors (or potential viewers), in accordance with the criteria set out below.

Table 7-1 Definitions of Landscape Nature of Change

Level of Receptor	**Definition of Nature of Receptor Examples** **(Considers value of receptor and susceptibility to change)**
High	Value: Typically of high importance and rarity, national scale, and limited potential for substitution (e.g. National Parks or Areas of Outstanding Natural Beauty). *Susceptibility to change: Landscape unlikely to tolerate the change proposed.
Medium	Value: Typically of moderate importance and rarity, regional scale, and limited potential for substitution (e.g. Registered Historic Parks and Gardens, Conservation Areas). *Susceptibility to change: Landscape has the potential to tolerate the change proposed.
Low	Value: Typically of low importance and rarity, local scale, such as undesignated or degraded landscapes. *Susceptibility to change: Landscape likely to tolerate the change proposed.
*The judgement concerning susceptibility to change is made by considering the nature/characteristics of the development and receiving landscape, following evaluation of receptor value and prior to the assessment of effects.	

Table 7-2 Definitions of Visual Nature of Change

Level of Visual Receptor	**Definition of Nature of Change Examples** **(Considers value of receptor and susceptibility to change)**
High	Value: Typically nationally recognised/important (e.g. from landscape of national importance). Susceptibility to change: Views from residential properties; where appreciation of affected views may be the principal activity.
Medium	Value: Typically regionally/locally recognised/important (e.g. from landscape of regional/local importance). Susceptibility to change: Views from public rights of way, cycle trails, public open space; where attention may be focused on an affected view.
Low	Value: Typically views not recognised/of importance. Susceptibility to change: Passing views where glimpses or indirect views are available away from the main direction of focus.

Relevant desk-based information was obtained from LANDMAP (Ref 7-4), Conwy County Borough Council (CCBC) (Ref 7-6) and Ordnance Survey (Ref 7-3). Field survey work was undertaken during April 2015 and June 2015. At this time of year, deciduous trees and shrubs are predominantly with leaves such that there is less visibility within the landscape than in winter months (when there is not deciduous leaf cover). Viewpoints have been selected to represent the range of visual receptors. That is those who would have a view of the proposed Development, and views affected, against which visual sensitivity was assessed. Viewpoint photographs were taken in accordance with LI guidance (LI, 2011) (Ref 7-8) using a digital single lens reflex (SLR) camera, with lens selected to provide the digital equivalent of 50mm focal length for a 35mm film format SLR camera. Photographs were then stitched together to generate a panorama spanning a minimum of approximately ninety degrees in the direction of the proposed Development (the full extent of view that would be experienced by the viewer at the selected viewpoint, when facing in that direction).

Table 7-3 presents details of the consultation undertaken during the preparation of this appraisal.

Table 7-3 Summary of Consultation

Consultee	Date of Consultation	Consultation Response	Project Response
David Watson, CCBC Principal Planning Officer	05 June 2015	Following discussion over site position and layout, the viewpoints proposed were considered and it was agreed that the locations were sufficient and should provide an accurate assessment of the sites landscape and visual impact	Assessment to be carried out based on agreed viewpoints.

7.2.2 Assessment

The criteria and threshold matrices used to assess the magnitude of impact and significance of landscape and visual effects are set out below. Impacts are assessed at the construction phase and during the operational phase.

Table 7-4 Assigning Nature of Change

Level of Change	Definition of Nature of Change
High	Total loss of or major alteration to key landscape characteristics such that landscape character will be fundamentally changed.
Medium	Partial loss of or alteration to key landscape characteristics such that landscape character will be partially changed.
Low	Minor loss of or alteration to key landscape characteristics such that landscape character will be similar to the baseline conditions.
Negligible	Very minor loss or alteration to key landscape characteristics such that change in landscape character will be barely distinguishable from the baseline conditions.

Table 7-5 Assigning Nature of Visual Change

Level of Visual Change	Definition of Nature of Visual Change
High	Major change in existing view.
Medium	Partial change in existing view.
Low	Minor change in existing view such that view largely unchanged.
Negligible	Very inconspicuous change in existing view.

A combined assessment of nature of receptor and nature of change is undertaken to determine how significant an effect is, as set out in Table 7-6 below.

Table 7-6 Significance Matrix

Nature of Change	High	Moderate	Moderate / Major	Major
	Medium	Minor / Moderate	Moderate	Moderate / Major
	Low	Minor	Minor / Moderate	Moderate
	Negligible	Negligible	Negligible	Negligible
		Low	Medium	High
		NATURE OF RECEPTOR		
Significance is derived as a product of the nature of receptor and nature of perceived change, as set out above. Where more than one significance outcome is possible, professional judgement is applied to determine that which is most appropriate, on a case-by-case basis.				

Effects may be positive or negative. Applying the precautionary principle, this assessment identifies potential effects as negative although it should be noted that the proposed Development may not be regarded by all as having an adverse effect. Only those effects that are shaded in Table 7-6 above are considered likely to be significant in respect of the decision making process.

Photomontages have been produced for planning consultation purposes to demonstrate the appearance of the proposed Development on completion of construction. A photomontage is a computer rendered image of the proposed Development superimposed onto an existing photograph, representing the likely appearance of the proposed Development. These are based on single frame images with a 45 degree field of view at a 1.5m viewing height.

These photomontages are based on the following;

- Viewpoint 1 (see Figure 7-17 Photomontage 1 Proposed View): Camera Focal Length: 24mm, Distance from Site: 220m;
- Viewpoint 2 (see Figure 7-18 Photomontage 2 Proposed View): Camera Focal Length: 50mm, Distance from Site: 970m; and
- Viewpoint 3 (see Figure 7-19 Photomontage 3 Proposed View): Camera Focal Length: 50mm, Distance from Site: 1070m.

7.3 Existing Conditions

7.3.1 Landscape Policy and Designations

Planning Policy Wales (Edition 7, July 2014) (Ref 7-5) advises that landscape considerations are to be taken into account in determining individual applications and contributing to the implementation of specific projects and that where development does occur it is important to ensure that all reasonable steps are taken to safeguard or enhance the environmental quality of land. The site of the proposed Development, as defined in Chapter 3 is located within the valley floor of the Conwy Valley, and as such falls within the CCBC Local Development Plan. Snowdonia National Park (SNP) is located immediately to the west of the proposed Development site, rising up from the far side of the B5106 to cover the western side slopes of the Conwy Valley. Although the proposed Development site is not situated within the SNP, its proximity to the park boundary and the overlap with the ZTV means it is important to take into consideration the SNP's planning guidance in considering the potential effects of the proposed Development on the setting of this nationally important landscape.

Conwy Local Development Plan 2007 – 2022 (Ref 7-6)

The Conwy LDP (adopted 2013) requires through Strategic Objective 12 that all developments seek to safeguard and enhance the character and appearance of the undeveloped countryside, sites of landscape/conservation importance, and features of archaeological, historic or architectural interest and ensure the conservation of biodiversity and protected species.

Policy NTE/4: The Landscape and protecting Special Landscape Areas specifies that in order to conserve the attributes of the Special Landscape Areas development proposals would have to show particular regard to the character of each locality in order to minimise their impact. Development would only be permitted if it is shown to be capable of being satisfactorily integrated into the landscape. In appropriate cases planning applications should be accompanied by a Landscape and Visual Impact Assessment to assess the visual and landscape impacts of the development.

The integration of development with the landscape should also have regard to landscape elements, such as walls, trees or hedgerows which are important to landscape character and should be retained. Development which is incapable of being sensitively and unobtrusively integrated into the landscape, and which would be detrimental to landscape character, would not be permitted. In certain cases, the proposed development may benefit from being landscaped, in a manner which is in keeping with the locality, to minimise its impact.

The proposals map identifies the site of the proposed Development as being located within the Conwy Valley Special Landscape Area.

LDP 2007 – 2022 (Revised edition 2011) Revised Background Paper 27 – Special Landscape Areas (Ref 7-9), describes this area as a locally important landscape in all aspects layers and of such quality and concentration in the local context as to be worthy of identification as a SLA. The area is also under pressure from sporadic rural development especially from poorly sited static caravan/chalet development due to a past weakness of local policy. The area is a key point of access to Snowdonia National Park and approach along the Conwy Valley. Views need to be preserved and the landscape treated respectfully so as not to degrade existing qualities and views.

The site is located to the southern edge of Pen Isaf (Lower Conwy Valley), as defined by LANDMAP and described within the LDP as 'A topographically diverse landscape, straddling the lower Conwy valley and adjacent uplands on the north eastern flanks of the Carneddau ridge in north Snowdonia, containing extensive and well-preserved relict evidence of land use, communications and defence from the prehistoric period onward'.

The study area also contains a number of biodiversity and historic designations which include the Coed Dolgarrog National Nature Reserve (NNR), located immediately west and north west of the proposed Development site; Morfa Uchaf, Dyffryn Conwy Site of Special Scientific Interest, located immediately to the north, running along the valley floor and covering a variety of saltmarsh and fresh water marsh vegetation communities; and a number of listed monuments and features are also located within the 5km study area, including; Canovium (Caerhun) Roman fort, Maen-y-Bardd settlements and field system and Scheduled Ancient Monuments. The hills rising to the east of the valley are part of the National Trust Wales estate and the Lower Conwy Valley Registered Landscape of Outstanding Historic Interest is located to the north.

Snowdonia National Park Eryri Local Development Plan (Ref 7-7)

The Eryri Local Development Plan (end date 2022) (ELDP) was adopted by Snowdonia National Park Authority on 13 of July, 2011 and reinforces the National Park's purpose in conserving and enhancing the areas natural beauty, wildlife and cultural heritage and providing a clear statement of the statutory responsibilities and role of National Park Authority to promote opportunities for the understanding and enjoyment of the 'Special Qualities' of the area, by the public.

The special qualities which relate specifically to the landscape are defined as being;

- *"The diversity of high quality landscapes and coastal areas within a small geographic area - ranging from coast to rolling uplands to the rugged mountains for which Snowdonia is famed;*

- *Landscapes and townscapes which chart human interaction over centuries, from Neolithic times to the present day; and*

- *Varied biodiversity reflecting Snowdonia's landscapes, geology, land management practices and climate".*

The main policy in the ELDP referring to the landscape specifically is Policy 2: Development and the Landscape. This states that the scale and design of new development should respect the landscape setting and character of the area and that unacceptable impacts would be resisted. This policy also refers to the protection of views into the National Park from surrounding areas. These are considered equally important, particularly when they are extensive and place the area within its geographic context and landscape setting. As such significant development proposals outside but relatively close to its boundaries could have an adverse impact on the setting and landscape quality of the National Park.

The Supplementary Planning Guidance (SPG): Landscapes and Seascapes of Eryri (Ref 7-10) defines landscape and seascape character areas and to appreciate individual characteristic qualities as well as influences which may lead to changes in character. This document defines the boundaries and name individual Landscape Character Areas (LCAs) in SNP, identifies their key characteristics and valued attributes, and identifies forces for change which are likely to influence changes in the landscape for the individual LCA's and the National Park more generally identifies landscape strategies for each.

The landscape character of SNP which lies adjacent to the proposed Development site is characterised in the SPG as Landscape Character Area 1 - Ucheldir y Gogledd. This is described as the first significant upland landscape in the northern part of SNP. A key force for change for this LCA is ‘Pressure for new infrastructure such as water pipelines and wind turbines outside the National Park boundary’. As such the proposed Development should be carefully considered within the requirements of the ELDP policies.

7.3.2 Landscape Character

The Natural Resources Wales (NRW) online landscape assessment and decision making tool, LANDMAP (Ref 7-4) identifies the geological, cultural, habitat, historic and visual and sensory qualities of the landscape within the study area and which fall within the ZTV. These are shown on Figures 7-2 to 7-6. The landscape character of the study area is identified separately for the area covered by the ZVI within the National Park from those areas outside it within the Conwy Valley.

Conwy Valley

From a geological perspective, the proposed Development site is located within the Afon Conwy Valley aspect, classed as an active upland river or stream channel system; which has an overall **high** evaluation.

From a cultural perspective the proposed Development site is located within the Conwy Valley aspect which is evaluated overall as outstanding for its archaeological and landscape riches and for the way in which it has been extensively studied. Within close proximity to the site are two further aspects which are also evaluated as **outstanding**. These are the Conwy River; Dolgarrog –Talybont and Conwy Valley Slopes.

In terms of landscape habitat, the proposed Development site is located within the Vale of Conwy floodplain grasslands aspect, which is evaluated overall as **Medium**; a valuable area of essentially wet pastures, drier further south, occasionally subject to flooding, and with occasional oxbows and abandoned river meanders forming additional wetland habitats and scrubby wet woodland. Several old mine sites also provide important habitats.

In terms of the historic landscape, the proposed Development site is situated within the Dyffryn Conwy aspect, which is evaluated overall as **high**. This is based on its historic field pattern and boundaries and archaeological features which include Aberconwy Abbey and Gwydir Castle.

From a visual and sensory assessment, the proposed Development site is located within the River Conwy Valley Floor aspect, which is evaluated overall as **high**. This is due to the aesthetic qualities of the valley floor surrounded by wooded valley sides providing vistas along the valley, and instilling a strong sense of place unique within the Conwy Valley. To the east is the Afon Conwy aspect which is evaluated as outstanding due to it being a strong natural feature which is aesthetically pleasing in terms of its movement, form and pattern.

In summary, the proposed Development site is located adjacent to the eastern edge of the SNP landscape and within a Special Landscape Area. There are 15 aspect areas, six of which are considered to be of international or national importance, eight to be of regional importance and one of local importance. The area is recognised has having an outstanding cultural value and is recognised for its strong and aesthetically pleasing qualities. Overall, taking into account the immediate and surrounding landscape designations together with scope to accommodate development of the type proposed, the nature of the landscape is considered to be **high**.

Snowdonia National Park

To the west of the proposed Development site, within the Snowdonia National Park are the following aspect areas. The geological layer comprises the Dolgarrog aspect, classed as a Mountain and upland valley / Glaciated mountain terrain / Glacial mountain valley; and evaluated overall as **outstanding**. The cultural layer comprises the Gwydir Forest aspect and is also evaluated overall as **outstanding**. The historic layer comprises the Coed Gwydir, Dolgarrog and Dolgarrog Woods aspects, which are all evaluated overall as **high**. The visual and sensory aspect comprises the Gwydir Forest and the Carneddau uplands aspects, which are also both evaluated as **high**. The former covers the steep wooded valley sides and the east edge of the latter is delineated by the prominent ridgeline on the west side of the Conwy Valley above the proposed Development site. The landscape habitat layer is not directly connected with the Dyffryn Conwy aspect and therefore is not considered further in this assessment.

These seven LANDMAP aspects fall within the SPG Landscape Character Area 1 - Ucheldir y Gogledd. The 'valued attributes' of this LCA are described as having a dramatic and varied topography, combined with complex, internationally renowned geological and geomorphological features. Multiple streams drain from the uninhabited mountains and small bands of woodland and spinneys, including nationally designated native woodlands are spread around large-scale, unenclosed mountains, which contrast with the small historic field patterns on the foothills. Overall this is considered to be a highly tranquil and remote landscape.

7.3.3 Visual Amenity

The ZTV relating to the proposed Development site, which does not take account of land cover or subtle variations in landform is illustrated on Figure 7-1 Designations, Zone of Theoretical Visibility and Viewpoints. The ZTV extends in to the SNP to the west, along the Conwy Valley to the north and south and across the valley to the adjacent foothills to the east. In reality, due to the undulating nature of the ridgelines of the hills on either side of the valley, elevated views to the proposed Development site are limited to the immediate side slopes and high points of the foothills overlooking it. Within the relatively flat valley floor the nature of the mature vegetation within it limits visibility to the proposed Development site to views and glimpses up to 2km from it. Nine viewpoints have been selected to provide a range of views from within the Conwy Valley floor and the valley sides including views looking to and out of the SNP.

Viewpoint 1; View from the B5106, at junction with farm track, looking north

This viewpoint represents one of a series of intermittent views of the proposed Development site for users of the B5106 heading north towards Dolgarrog from Betws-y-Coed, located approximately 300m to the south of the proposed Development site. Taking this into consideration the visual nature is considered to be **Low**. From this position views to the north are framed by the wooded steep side slopes of the Gwydyr Forest to the west within the National Park, with filtered glimpses across the valley floor to the east and set against the steadily rising, settled pasture farmland within the Conwy Valley sides and hills on the opposite side. Views along the valley are restricted by intervening mature field boundary hedgerows and hedgerow trees, typically running west to east across the valley between the B5106 and the Afon Conwy. This vegetation form a considerable visual barrier, which is further increased during the summer months when it is in leaf.

Viewpoint 2; View from the A470T, looking south west

This viewpoint represents one of a series of intermittent oblique views of the proposed Development site from the A470 which runs north to south along the eastern side of the Conwy Valley, located approximately 1km from the proposed Development site at its closest point. Taking this into consideration the visual nature is considered to be **Low**. From this position users have a filtered view across the valley floor in breaks in the adjacent mature road side hedgerow. The intervening mature hedgerows and individual trees running across the valley floor further limit visibility with the existing water treatment facility just visible in breaks between the tree canopies. The steep wooded side slopes of the Gwydyr Forest rising to a sharp, undulating ridgeline of the adjacent foothills which delineates the east edge of the Carneddau Uplands within the SNP forms a large scale backdrop to the view.

Viewpoint 3; View from the Plas Maenan hotel, looking south west

The viewpoint represents part of a panoramic view for users of the Plas Maenan hotel which sits on the lower side slope at approximately 45m Above Ordnance Datum (AOD), on the east side of the Conwy Valley above the A470, approximately 1.2km from the proposed Development site. It is also representative of panoramic views from residential properties scattered along the valley side within the settled pasture farmland of the Conwy Valley sides and hills. Taking this into consideration the visual nature is considered to be **High**. The hotel and its front terrace are positioned to command views out across the Conwy Valley with long views to the north and south along it. From this position the upper canopy of the mature tree line which runs along the A470 is present in the near ground with the valley floor and the Afon Conwy beyond. The steep wooded side slopes of the Gwydyr Forest and the undulating prominent ridgeline of the adjacent foothills of the Carneddau Uplands on the opposite side of the valley within the SNP form a large scale backdrop. The village of Dolgarrog is visible in the north part of the wider view. From this viewpoint the light coloured reflective roof of the existing water treatment building is a clearly visible, low lying element, set within a muted brown coloured block of mature woodland on the opposite side of the valley.

Viewpoint 4; View from the National Trust Viewpoint at Cadair Ifan Goch, looking south west

This viewpoint represents views from the Cadair Ifan Goch National Trust viewpoint, located on the upper side slope at 150m AOD, on the east side of the Conwy Valley, approximately 1.5km from the proposed Development site. This elevated position provides panoramic views along the Conwy Valley, extending north towards the Conwy Estuary within the wider view angle and to the vast scale, dramatic backdrop of the rising moorland slopes of the Carneddau Uplands and the rugged mountain peaks beyond within the SNP to the west. Taking this into consideration the visual nature is considered to be **High**. From this location the Afon Conwy forms a prominent element in the view as it winds its way along the valley floor below, cutting across the field pattern defined by ditches and mature hedgerow boundaries and individual trees. To the north the linear pattern of the settlement at Dolgarrog can be seen as it follows the B5106. The construction work associated with the new Surf Snowdonia development located to the north east edge of the village is clearly noticeable. The light, reflective roof of the existing water treatment building is visible set within the valley floor and in the context of adjacent woodland on the far side of the valley.

Viewpoint 5; View from PRoW, west of the Afon Conwy, looking south west

This viewpoint represents views for users of the Public Right of Way (PRoW), which leads from the old road bridge over the Afon Conwy towards the B5106, located at a distance of approximately 400m from the proposed Development site. Taking this into consideration the visual nature is considered to be **Medium**. Views from this position are filtered to the north and south along the valley floor as a result of the intervening mature field boundary hedgerows and associated trees. Looking west towards the proposed Development site views are dominated by the steep wooded slopes of the Gwydyr Forest within the SNP. The existing water treatment building is glimpsed through the intervening trees canopy in the near distance, with visibility increasing during winter months due to reduced leaf cover.

Viewpoint 6; View from PRoW within the Snowdonia National Park, looking east

This viewpoint is representative of elevated views at 230m AOD, which are experienced by users of the PRoW from within the SNP, near to the Coed Dolgarrog NNR, and located approximately 800m from the proposed Development site. Taking this into consideration the visual nature is considered to be **High**. From this elevated location there are views out across the Conwy Valley, framed by woodland and the steep side slopes of the adjacent foot hills, to the upland ridgelines of the Conwy Valley sides and hills. Views down into the Conwy Valley floor are restricted by the foreground vegetation of the Coed Dolgarrog NNR, although the traffic on the A470 forms a perceptible transient element on the eastern side of the valley.

Viewpoint 7; View from PRoW, above Tu-Hwnt-i'r-Afon within the Snowdonia National Park, looking north east

This viewpoint is representative of filtered and intermittent views from the PRoW as it descends the west valley side within the Gwydyr Forest to the Conwy Valley floor, located approximately 200m from the proposed Development site. This also represents views towards the site from the residential property at Tu-Hwnt-i'r-Afon which is located on the lower slopes of the valley side at 30m AOD, with its front elevation facing the proposed Development site. Taking this into consideration the visual nature is considered to be **High**. From this location the view is focussed on the undulating pasture farmland on the side slopes and foothills within the Conwy Valley sides and hills on the opposite side of the valley. Views to the valley floor are typically restricted by intervening vegetation. The existing entrance to the water treatment site is a barely perceptible element through a gap between the trees along the B5106 in the middle distance. The mature trees beyond the B5106, within the existing WTW helps to screen the existing building. However it is anticipated there would be glimpses to it through the canopy of the leafless vegetation during the winter months.

Viewpoint 8; View from PRoW on the bank of the Afon Conwy, near to Aberconwy Abbey, looking north west

This viewpoint is representative of views from the PRoW which leads along the western bank of the Afon Conwy from Aberconwy Abbey to Llanrwst, located approximately 800m from the proposed Development site. This point is located within the Afon Conwy visual character areas. Taking this into consideration the visual nature is considered to be **Medium**. From this position the Afon Conwy forms a foreground element with a formal line of mature poplar trees on the opposite bank, which limits visibility to the north and west, allowing filtered glimpses in summer through gaps in the canopy across the valley floor beyond. These views would become more apparent during the winter months due to reduced leaf cover. Part of the settlement at Dolgarrog, lying beyond the proposed Development site, is visible in the north west part of the view. To the north, in a different view angle, the former road bridge over the Afon Conwy near to the railway halt at Dolgarrog is perceptible. The existing WTW during the summer months is screened by the intervening vegetation. Increased views may be available in winter months due to reduced leaf cover, however the dense nature of vegetation is likely to limit this.

Viewpoint 9; View from B5160 at south edge of Dolgarrog, looking south

This viewpoint is representative of views from the B5160 near the residential properties at the edge of the village of Dolgarrog, located approximately 500m from the proposed Development site. Taking this into consideration the visual nature is considered to be **High**. From this position views to the south are dominated by the foreground streetscene and the road side vegetation which prevents views out across the valley floor and to the existing WTW.

7.4 Assessment of Impacts

7.4.1 Construction Phase Effects

The main construction activities associated with the proposed Development are projected to take place during a 12 month period, with 6 months commissioning, as described in Chapter 3 of this report. The main construction compound would be located in the southern area of the proposed Development site and is not anticipated to have any significant impact on the surrounding vegetation. The movement of construction traffic is likely to be reduced as far as possible through the utilisation of off-site construction methods. The significant aspects of the proposed Development are likely to be the construction of the new buildings and flood defence bund which would be located within the site and result in the removal of existing mature and semi-mature vegetation within the site. These would be largely screened from most views from the valley floor level by the surrounding vegetation retained to the perimeter of the site, and as a result, the wider landscape character and quality of the Conwy Valley from these areas would remain largely unchanged.

From the SNP construction activities would not be visible and as such the impact on the park would be minimised. From elevated positions from the Conwy Valley to the east of the site there would be clearer views of the change to the landscape, with removal of internal vegetation and construction activities visible.

Overall, considering the nature of construction activities, particularly their relatively transient characteristics, and the nature of change to the landscape would vary from different sections of the valley.

From the Conwy Valley floor and Afon Conwy, the effects from construction are considered to be **Low** due to the high level of existing screening. As such taking into account the **High** nature of receptors the significance of landscape and visual effects during construction is considered to be **Moderate.**

From the SNP the effects of construction are considered to be **Negligible** due to the restricted views of the proposed Development site. As such taking into account the **High** nature of receptors, the significance of landscape and visual effects during construction is considered to be **Negligible.**

From the Conwy Valley sides and the landscape and the visual receptors within it is considered that the construction effects would be **Medium**, and taking into account **High** receptors described in Section 3, the overall significance of landscape and visual effects during construction is considered to be **Moderate**.

7.4.2 Landscape Operation Phase Effects

The proposed Development, once operational, is anticipated to have a similar level of usage to the existing WTW. As such there would be minimal change to the local baseline landscape from additional activity.

From the Conwy Valley floor there would be little change in the nature of landscape from increased operational activity and the nature of change is considered to be **Low**, reducing over time to **Negligible**. Taking into account the **High** nature of landscape receptors, the overall significance of landscape effect is considered to be **Moderate**, reducing over time to **Negligible**.

From the SNP the effects of operation are considered to be **Negligible** due to the restricted views of the proposed Development site. As such the significance of landscape and visual effects during construction is considered to be **Negligible**.

From the Conwy Valley sides to the east of the valley there would initially be a noticeable change in the landscape due to the increased size of the WTW, increased by the vegetation removal during construction. Gradually this would reduce as the new screen planting located around the flood defence bund establishes and increases screening of the proposed Development. The nature of change is therefore considered to be **Medium**, reducing to **Low** after 10-15 years. As a result the significance of landscape effects is considered to be **Moderate**, reducing to **Negligible** after 10-15 years.

7.4.3 Visual Amenity Operation Phase Effects

Viewpoint locations are shown on Figure 7.1 Designations, Zone of Theoretical Visibility and Viewpoints, with photographs provided within Figures 7.7 to 7.15. Three photomontages have been selected as these locations have been identified as where the proposed Development is considered to be most viewed from, and include a range of sensitivities. See Figure 7.17 Photomontage 1 Proposed View, Figure 7.18 Photomontage 2 Proposed View, and Figure 7.19 Photomontage 3 Proposed View.

7.4.4 Viewpoint 1; View from B5106 at its junction with a farm track, looking north

From this viewpoint, to the southern elevation a staggered line of semi-mature trees would reinforce the existing hedgerow vegetation, with understorey habitat planting to reduce the impact of the bund itself. This associated with the hedgerows between the fields to the south of the site are considered to screen the most of the proposed Development. The rooftops and upper sections of the new buildings would be visible within the top tree line, increasing during winter months with reduced leaf cover. As a result, taking into account the **Low** visual nature of the landscape, the nature of change is considered to be **Medium** in winter**,** reducing to **Low** in summer months with additional leaf cover. As a result the significance of effects would be **Minor**.

7.4.5 Viewpoint 2; View from the A470T, looking south west

From this position the existing field boundary hedgerows and mature trees running across the valley floor are considered to screen most views of the proposed Development site. Along the eastern elevation, groups of semi-mature trees would be located to the lower edges of the bund, positioned to maximise screening of the new structures within the proposed Development. In winter months intermittent glimpses of the new buildings may be possible through the vegetation due to reduced leaf cover. Taking this into consideration the nature of change is considered to be **Low** in winter**,** reducing to **Negligible** in summer months with additional leaf cover. As a result, taking into account the **Low** visual nature of the landscape, the significance of effects would be **Minor,** reducing to **Negligible** in summer months.

7.4.6 Viewpoint 3; View from the Plas Maenan hotel, looking south west

From this viewpoint, the roofline and upper sections of the new buildings within the proposed Development site would be visible alongside the existing WTW. The facility would be most visible immediately following construction due to the clearance of vegetation which currently provides screening. The groups of semi-mature trees located to the lower edges of the bund along the eastern elevation would be positioned to maximise screening of the new structures within the proposed Development Over time, as this new planting establishes, visibility of the new buildings would reduce. As a result, taking into account the **High** visual nature of the landscape, the nature of change is considered to be **Medium** immediately following construction, reducing to **Low** after 10 to 25 years. As a result the significance of effects would be **Moderate**.

7.4.7 Viewpoint 4; View from the National Trust Viewpoint at Cadair Ifan Goch, looking south west

At this viewpoint the proposed Development would be clearly visible alongside the existing WTW located within the existing mature woodland. The increase in the size of the site and as a result the increase in the gap within the trees is considered to create a **Medium** nature of change, reducing to **Low** after 15 years due to the establishment of the replacement planting. Taking into account the H**igh** visual nature, the significance of effects is considered to be **Moderate**.

7.4.8 Viewpoint 5; View from PRoW, west of the Afon Conwy, looking south west

From this viewpoint the proposed Development would be largely screened by the existing mature boundary hedgerows retained to the eastern boundary of the site. Vegetation clearance within the proposed Development site necessary to facilitate construction may result in increased views of the existing WTW immediately following construction. Gradually as the mitigation planting of groups of semi-mature trees located to the lower edges of the bund, positioned to maximise screening of the new structures to the eastern boundary establishes, it is considered that visibility of the proposed Development would be significantly reduced to glimpse of the proposed structures through the tree line. These views may be slightly increased during winter months due to reduced leaf cover. As a result it is considered that the nature of change would be **Medium** in winter months reducing to **Low** in summer immediately following construction. After 10 to 15 years following establishment of the proposed boundary planting this nature of change would reduce to **Low** in winter and be **Negligible** in summer. As a result, taking into account the **Medium** visual nature of the landscape, the significance of effects would be **Moderate** in winter, reducing to

Minor in summer months with increased leaf cover immediately following construction. This would decrease to **Minor** in winter months reducing to **Negligible** in winter months after 10 to 15 years.

7.4.9 Viewpoint 6; View from PRoW within the Snowdonia National Park, looking east

It is anticipated the proposed Development would not be visible and therefore users on this footpath would experience **no visual effects**.

7.4.10 Viewpoint 7; View from PRoW, above Tu-Hwnt-i'r-Afon within Snowdonia National Park, looking north east

It is considered that visibility of the proposed Development from this viewpoint would be largely prevented by evergreen planting rising up from the B5160 towards SNP, and the existing WTW boundary vegetation along the edge of the B5160, which would be unaffected by the construction works. Some loss of vegetation along the southern boundary necessary to facilitate construction is likely to be noticeable and change the overall appearance of the views east, however the new bund and raised plateau would be planted with native species woodland mix, interspersed with a number of semi mature trees to ensure that the new structures are screened as far as possible in views from the B5160 and residential properties. Internally new planting would be positioned along the western edge of the proposed Development site to break up the impact of the combined existing and proposed structures and reduce the appearance of the facility as a gap in the woodland block from distance to reduce this effect. As a result, taking into account the **High** visual nature of the landscape, the nature of change is considered to be **Low** immediately following construction, reducing to **Negligible** after 10 to 15 years. As a result the significance of effects would be **Moderate**, reducing to **Negligible** after 10 to 15 years.

7.4.11 Viewpoint 8; View from PRoW on bank of the Afon Conwy near Aberconwy Abbey, looking north west

It is anticipated the proposed Development would not be visible and therefore users on this footpath would experience **no visual effects**.

7.4.12 Viewpoint 9; View from B5160 at south edge of Dolgarrog, looking south

It is anticipated the proposed Development would not be visible from this location and therefore there would be **no visual effects**.

7.5 Mitigation Proposals

The mitigation proposals include retaining and protecting the existing vegetation where practical to do and where this is not possible new replacement planting as well as a flood defence bund with associated planting are proposed. The landscape proposals are illustrated on Figure 7.16, Outline Landscape Proposals. Other mitigation includes careful selection of building colours to blend into the surroundings. Upper sections of building walls would be coloured dark green to reduce visibility from close-by views. Building roofs would be dark grey, to match surrounding traditional slate roofs

7.5.1 Existing Vegetation

It is considered that the majority of the existing mature planting along the south and east boundaries of the proposed Development site would be retained, with only minimal work required to ensure access around the proposed Development to the adjacent farm fields is retained. This would include crown reduction to a small number of trees as a result of a temporary access from the construction compound where it crosses an existing drain located to the centre of the south boundary and as such would result in the loss of some planting at this position.

7.5.2 Mitigation Planting

New native species planting would be undertaken to replace the existing vegetation lost as a result of the construction work within the proposed Development site. This would include planting a staggered line of semi-mature native species trees and understory along the south boundary; planting along the east side of the existing access, planting a native species woodland mix, interspersed with groups of semi-mature and standard size trees on the outer lower face of the flood defence bund to help screen the new built form behind.

7.6 Enhancement Measures

Existing mature hedgerows surrounding the proposed Development site would be reinforced with under-planting to close out existing gaps and replace any species identified as being in poor condition to ensure the continuation of the boundary lines around the site. To the north east of the site, the existing bank which runs east from the lagoon along the edge of the river woodland corridor to the north would be planted with areas of broadleaf species to improve habitat connectivity across the site and with the wider surrounding area.

The grassland which is located along the western edge of the existing WTW would be utilised for reptile translocation prior to works commencing and would be fenced off and protected as such.

7.7 Summary and Conclusions

7.7.1 Landscape character

From the Conwy Valley floor and Afon Conwy the effects of the proposed Development on the landscape character of the surrounding area would be minimised by the restricted visibility towards the site, partly due to the established landscape field pattern and mature field boundary hedgerows. There would be little change in the overall appearance and features of the valley as a result of the proposed Development taking place, with the mitigation planting reducing any visibility of the proposed Development within the existing woodland block, resulting in only a **Low** nature of change. As a result, taking into account the **High** nature of the surrounding landscape, the significance of effects is considered to be **Negligible**.

From SNP the effect of the proposed Development on the landscape Character would be restricted to the lower western slopes of the Conwy Valley surrounding the site with no effect on the character to the uplands. The localised impact of the proposed Development to the immediate area surrounding the site, combined with dense landscape features which would remain unaffected resulting in a **Negligible** nature of change. Taking into account the **High** nature of the surrounding landscape, the significance of effects is considered to be **Negligible**.

From the Conwy Valley sides, to the east of the valley, the proposed Development would result in a noticeable change in the character of the landscape visible, in the form of increased areas of buildings located to the edge of the valley and removed vegetation increasing the gap in planting. However, following establishment of replacement planting increasing the screening of the new facility, this change would be reduced over time. As a result, taking into account the **High** nature of the surrounding landscape, the significance of effects are considered to be **Minor** reducing to **Negligible** after 10 to 15 years following establishment of the boundary planting.

7.7.2 Visual Amenity

From the Conwy Valley floor and the Afon Conwy, the proposed Development is considered to have minimal visual impact on the surrounding landscape character due to the considerable vegetation cover surrounding the propose Development site, and the land pattern of fields with mature boundaries preventing long views towards it. As a result the significance of effects of the proposed Development, taking into account the **High** nature of the local landscape would be **Negligible**.

From within the SNP, the position of the proposed Development site, combined with the surrounding topography results in limited visibility towards the site, with views restricted to the lower edges of the eastern hills, within the Coed Dolgarrog NNR. There are limited points from which views towards the proposed Development site are available and those which exist are constrained be the established vegetation immediately surrounding it and in the wider surrounding area. As a result the significance of effects of the proposed Development, taking into account the **High** nature of the local landscape would be **Negligible**.

From the Conwy Valley sides and hills to the east of the valley there would be a noticeable change in the appearance of the site from these elevated viewpoints, with an increased gap in the woodland area to the base of the Gwydyr Forest and increased number of buildings. Set within the wider landscape, the change in appearance of the WTW would be small in context of the wider views available. Following establishment of the replacement planting, the proposed Development would be further integrated into its surrounding landscape. As a result the significance of effects of the proposed Development on the Conwy Valley sides, taking into account the **High** nature of the local landscape would be **Minor** following completion of the construction works, reducing to **Negligible** after 10 to 15 years following the establishment of the planting.

7.8 References

Ref 7-1 Council of Europe (2000), European Landscape Convention.

Ref 7-2 LI & IEMA (2013) Guidelines for Landscape and Visual Impact Assessment: Third Edition.

Ref 7-3 Ordnance Survey Terrain 50 data.

Ref 7-4 LANDMAP, Countryside Council for Wales interactive maps.

Ref 7-5 Welsh Government, Planning Policy Wales (Edition 7, July 2014).

Ref 7-6 Conwy County Borough Council Local Development Plan 2007 – 2022.

Ref 7-7 Snowdonia National Park Eryri Local Development Plan 2007 – 2022.

Ref 7-8 LI (2011) Photography and Photomontage in Landscape and Visual Impact Assessment.

Ref 7-9 CCBC LDP Revised Background Paper 27 – Special Landscape Areas.

Ref 7-10 Snowdonia National Park SPG: Landscapes and Seascapes of Eryri.

8 TRANSPORT AND ACCESS

8.1 Introduction

8.1.1 This Chapter presents information on the effects of the proposed Development on transport and access receptors.

A full description of the proposed Development is given in Chapter 3: Description of the Proposed Development.

This Chapter describes the methodologies used to assess the potential significant effects of the proposed Development. Details of pre-application consultations are provided. Baseline conditions are discussed, and potential effects described, followed by details of mitigation measures and an assessment of residual effects. A summary of the assessment and conclusion is then provided.

8.2 Methodology

8.2.1 Introduction

The approach outlined below has been followed in preparing this Chapter and includes a summary of the legislation, policy and guidance, the consultation undertaken, a description of the study area, the temporal scope, and significance criteria used, together with the limitations and assumptions of the study.

The assessment process adopted the following approach:

- Consultation with statutory consultees and interested parties;
- Obtaining baseline data including desktop studies, undertaking site visits and requesting information from third parties;
- Identification of potential effects of the proposed Development and assessment of the significance; and
- Identification of mitigation measures.

8.2.2 Policy and Guidance

An outline of the, policy and guidance relevant to the proposed Development at the national, regional and local level is provided below.

National Policy

At a Wales national level, key policies are contained within Planning Policy Wales 7th Edition (PPW) (Welsh Government, 2014) (Ref 8-1) and Technical Advice Note 18: Transport (TAN 18) (Welsh Government, March 2007) (Ref 8-2).

PPW sets out the land use planning policies of the Welsh Government (WG) and advises in paragraph 8.7.1 that, when determining a planning application for development that has transport implications, local authorities should take the following into account:

- The willingness of a developer to provide infrastructure or measures to manage traffic, to overcome transport objections to the proposed development;
- The environmental impact of both transport infrastructure and the traffic generated; and
- The effects on the safety and convenience of other users of the transport network.

Paragraph 8.7.2 of PPW advises that Transport Assessments are an important mechanism for setting out the scale of anticipated impacts a proposed development is likely to have. They assist in helping to anticipate the impacts of development so that they can be understood and catered for. PPW lists the categories of development that the WG expects to be accompanied by a Transport Assessment.

TAN 18 (Ref 8-2) sets out how land use and transport planning should be integrated and how transport impacts should be assessed and mitigated.

Regional Policy

The *North Wales Joint Local Transport Plan* (2015) (Ref 8-3) is a joint plan between the six North Wales Local Authorities of Conwy County Borough Council, Denbighshire County Council, Flintshire County Council, Gwynedd Council, Isle of Anglesey County Council and Wrexham County Borough Council. The vision is '*to remove barriers to economic growth, prosperity and well-being by delivering safe, sustainable, affordable and effective transport networks'*. One of the outcomes of the Plan is to support *'connections to Key Destinations and Markets: Support for Economic Growth through an improvement in the efficiency, reliability, resilience, and connectivity of movement, including freight, within and between North Wales and other regions and countries'.*

Local Policy

The proposed Development is located within the Conwy County Borough Council (CCBC) area. Conwy *Local Development Plan 2007-2022* (LDP) (CCBC, 2007) (Ref 8-4) provides the relevant development planning framework for the County Borough.
The LDP states that new developments are required to address and mitigate against any potential transport impacts and Policy STR/3 states that '*major development*' proposals or development proposals with '*significant transport implications'*, as set out in TAN18, would be required to produce a Transport Assessment and a Travel Plan.

Guidance

Guidance identified as relevant within this assessment is:

- Environmental Impact Assessment: A Guide to Good Practice and Procedures (The Department for Communities and Local Government, 2006) (Ref 8-5) provides advice on the statutory procedures that must be followed for any '*EIA application'*. Although this is not a formal EIA the guidance is still appropriate and reflects good practice guidance on the implementation of the process and suggests additional sources of information;
- Guidelines for the Environmental Assessment of Road Traffic (Institute of Environmental Management and Assessment (IEMA), 1993) (Ref 8-6) (IEMA Guidelines) sets out guidelines for the assessment of the environmental impact of road traffic associated with developments;

- Guidance on Transport Assessment (Department for Transport (DfT), 2007) (Ref 8-7) provides guidance on the assessment of a development's potential transport implications; and
- The Design Manual for Roads and Bridges (DMRB) (Highways Agency, 1993) (Ref 8-8) provides a comprehensive manual relating to the design, assessment and operation of trunk roads (including motorways). It may also be applicable in part to other roads with similar characteristics.

8.2.3 Consultation

Consultation with key stakeholders was undertaken in June 2015, including highways officers for CCBC and North and Mid Wales Trunk Road Agency (NMWTRA). A scoping note setting out the proposed assessment approach was issued to all key stakeholders (see Appendix 8-1). Table 8-1 summarises the consultation and responses received.

Table 8-1 Transport and Access – Summary of Consultations

Consultee	Date of Response	Response	Development Response
CCBC – Highways Officer	Awaiting response	N/A	N/A
CCBC – Bridges and Structures Group	25th March 2015	Pont Dolgarrog (north of the proposed Development on the B5106) is capable of carrying 40 tonnes	HGVs to access the proposed Development along the B5106 from the north
NMWTRA – Highways Officer	Awaiting response	N/A	N/A

8.2.4 Study area

The study area has been determined in accordance with the IEMA Guidelines (Ref 8-6) which suggest a number of rules to delimit the scale and extent of the assessment:

- Include highway links where traffic flows will increase by more than 30% (or the number of Heavy Goods Vehicles (HGVs) will increase by more than 30%); and
- Include any other specifically sensitive areas where traffic flows will increase by 10% or more.

Sensitive areas are defined by the presence of sensitive receptors, using the criteria recommended in paragraph 2.5 of the IEMA Guidelines (Ref 8-6) and summarised in Table 8-2. Sensitive areas are defined by the presence of sensitive receptors, such as congested junctions, hospitals, community centres, conservation areas, schools or colleges.

Table 8-2 Transport and Access – Receptor Sensitivity

Receptor Sensitivity	Receptor Type
Major	Receptors of greatest sensitivity to traffic flow: schools, colleges, playgrounds, accident blackspots, retirement homes, urban/residential roads without footways that are used by pedestrians (IEMA Guidelines Ref 8-6).
Moderate	Traffic flow sensitive receptors including: congested junctions, doctors' surgeries, hospitals, shopping areas with roadside frontage, roads with narrow footways, unsegregated cycleways, community centres, parks, recreation facilities.
Minor	Receptors with some sensitivity to traffic flow: places of worship, public open space, nature conservation areas, listed buildings, tourist attractions and residential areas with adequate footway provision.
Negligible	Receptors with low sensitivity to traffic flows and those sufficiently distant from affected roads and junctions.

The study area has been defined by identifying potential construction routes to the proposed Development where total traffic flows or increases in HGV flows could be greater than 10% (for specifically sensitive areas) or 30% for all other links.

The proposed Development site is located within CCBC and would utilise the existing site access from the B5106 to the Water Treatment Works (WTW). The access would form the only access and egress point for the proposed Development and would be used by both light vehicles and HGV traffic.

The preferred route for HGV traffic to the proposed Development would be via the B5106, B5279, A470 and the A55 as shown as Section 2, Section 4, Section 5, Section 7 and Section 8 on Figure 8-1 Proposed Route to Site. On the preferred route HGVs would travel south from the A55 along the A470, leave the A470 at Tal y Cafn and travel west along the B5279, then turn left at Ty'n-y-groes and travel south along the B5106 to the proposed Development site. The assessment assumes all HGVs would use this route. The route would not require any alterations to the public highway network.

It should be noted that the B5106 to the south of the proposed Development has been identified as not suitable for accommodating HGV traffic due to the 18 tonne weight restriction on the following bridges, Pont Trefriw in Trefriw and Pont Fawr in Llanrwst. The B5106 at Conwy has also been identified as not suitable for accommodating HGV traffic due to the 3.05m width and 3.89m height restrictions at the Conwy Town Wall Arches. Pont Dolgarrog (north of the proposed Development on the B5106) is capable of carrying 40 tonnes (identified through consultations with the CCBC Bridges and Structures Group).

Light vehicle traffic (mainly construction workers) accessing the proposed Development would not be constrained to the HGV route and would also be able to access the proposed Development along the B5106 from Betws-y-Coed/ Llanrwst in the south (Section 1), B5106 from Conwy in the north (Section 3) and the A470 from the south (Section 6).

The HGV access route to the proposed Development has been selected to minimise the effect on the local highway network by following the trunk and principal road network for HGVs for the majority of the route. These routes have been selected so that the effects on sensitive receptors and local communities are minimised as far as possible.

The highway links have been split into sections as shown in Figure 8-1 Proposed Route to Site and detailed as follows:

- Section 1 – B5106 from Betws-y-Coed to the Site Access;
- Section 2 – B5106 from Site Access to B5279;
- Section 3 – B5106/ A547/ A546 from B5279 to A55 (Conwy);
- Section 4 – B5279;
- Section 5 – A470 from A55 to B5279;
- Section 6 – A470 from B5279 to A5 (Betws-y-Coed);
- Section 7 – A55 east of the A470; and
- Section 8 – A55 west of the A470.

8.2.5 Temporal scope

This assessment considers the construction and operational phases of the proposed Development.

8.2.6 Sources of baseline data

The baseline has been established through consultation and traffic data collection as discussed below. Site survey work has been undertaken to identify sensitivity of receptors situated along the proposed access routes.

Traffic Data

Traffic data has been obtained for each of the highway sections considered along the proposed access routes. A detailed assessment of traffic flow data along the B5106 and B5279, together with a high level assessment along the A547, A470 and A55 has been undertaken, and accordingly suitable traffic data has been obtained for each highway section. Traffic flows along the A547 are considered representative of Section 3 for the purpose of the assessment.

As a high level assessment has been undertaken on the A547, A470 and A55 Annual Average Daily Flow (AADF) data has been obtained for each highway section for both total traffic flows and HGV flows (two-way traffic flows). The location of each of the obtained traffic surveys is shown in Figure 8-2 Location and Severity of Accidents and Table 8-3 summarises the sources and the nature of the baseline information obtained.

Table 8-3 Transport and Access – Baseline Traffic Data

Highway Section	Data Source	Data Type
Section 1 – B5106 from Betws-y-Coed to Site Access	Axiom Traffic Limited	7 day ATC – week commencing 1 June 2015
Section 2 – B5106 from Site Access to B5279	Axiom Traffic Limited	7 day ATC – week commencing 1 June 2015
Section 3 – B5106/ A547/ A546 from B5279 to A55 (Conwy)	Department for Transport (Ref 8-9)	Count point data ID: 20671 2013 Annual Average Daily Flow (AADF) – total traffic and HGV flows
Section 4 – B5279	Axiom Traffic Limited	7 day ATC – week commencing 1 June 2015
Section 5 – A470 from A55 to B5279	Department for Transport (Ref 8-9)	Count point data ID 533 2013 AADF – total traffic and HGV flows
Section 6 – A470 from B5279 to A5 (Betws-y-Coed)	Department for Transport (Ref 8-9)	Count point data ID 30539. 2013 AADF – total traffic and HGV flows
Section 7 – A55 east of the A470	Department for Transport (Ref 8-9)	Count point data ID 40529 2013 AADF – total traffic and HGV flows
Section 8 – A55 west of the A470	Department for Transport (Ref 8-9)	Count point data ID 99795 2013 AADF – total traffic and HGV flows

Accident Data

Personal Injury Accident (PIA) data has been obtained from CCBC for the most recent five year period from 1 January 2010 to 31 December 2014. This data has been used to assess the level of injury accidents occurring on the proposed HGV route (namely the B5106, B5279 and A470) to and from the proposed Development and determine whether there are any accident blackspots along the route.

8.2.7 Significance criteria

The assessment of likely significant effects, identification of outline mitigation measures, and assessment of likely residual effects followed the approach outlined below:

- Consideration of best practice/ guidance;
- Professional judgement;
- Consideration of the baseline information obtained, the proposed Development details and issues raised through consultation with interested parties as a result of the pre-application discussions;

- Prediction of potential effects considering baseline information and proposed Development details;
- Identification of effects which, in particular, could be considered to be potentially significant;
- Identification of appropriate mitigation; and
- Prediction of residual effects.

Table 2.1 of the Guidelines for the IEMA Guidelines (Ref 8-6) sets out a list of likely significant effects which should be assessed. The guidelines acknowledge that not all of the effects listed would be applicable to every development.

Noise and Vibration

The effects of noise and vibration have been assessed within Chapter 9: Noise, which includes an assessment of the impacts of road traffic, and are therefore not included within this Chapter.

Visual Effects

The visual effect of traffic is complex and subjective and includes both visual obstruction and visual intrusion. The IEMA Guidelines (Ref 8-6) acknowledge that in the majority of situations, the changes in traffic resulting from a development would have little effect. For the proposed Development there would be negligible visual effects from traffic and as such no detailed assessments have been undertaken within this Chapter.

Severance

Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery. Severance is difficult to measure, and by its subjective nature, is likely to vary between different groups within a single community. In addition to the volume, composition and speed of traffic, severance is also likely to be influenced by the geometric characteristics of a road, the demand for movement across a road, and the variety of land uses and extent of community located on either side of a road. All these factors are considered when determining the likely severance effect.

In general terms, according to the IEMA Guidelines (Ref 8-6), a 30% change in traffic flow is likely to produce a ‘slight’ change in severance, with ‘moderate’ and ‘substantial’ changes occurring at 60% and 90% respectively.

Driver Delay

Delay to drivers generally occurs at junctions where opposing vehicle manoeuvres are undertaken, with vehicles having to give or receive priority depending upon the type of junction arrangement. Driver delay could also occur on narrow rural roads if flows are increased (particularly those whereby it is difficult for vehicles to pass).

It is unlikely that the proposed Development would have a significant effect on junctions around the site, however a capacity assessment of road links has been undertaken if traffic flows exceed threshold levels (as set out within Rule 1 and Rule 2 of the IEMA Guidelines (Ref 8-6)). The routes to be used to access the proposed Development are suitable for accommodating two-way HGV movements and currently accommodate large vehicle movements.

Pedestrian Delay

The delay incurred by pedestrians is generally a direct consequence of their ability to cross roads. Thus the provision of crossing facilities, the geometric characteristics of the road, and the traffic volume, composition and speed are all factors that can affect pedestrian delay and have been considered when assessing this effect. The IEMA Guidelines (Ref 8-6) advise that in assessing levels of, and changes in, pedestrian delay, assessors do not attempt to use quantitative thresholds given the range of local factors and conditions which can influence pedestrian delay. Instead, the Guidelines recommend the use of professional judgement to determine whether pedestrian delay is a significant effect.

Studies have shown that pedestrian delay is perceptible or considered significant beyond a lower delay threshold of 10 seconds for a link with no crossing facilities. A 10 second pedestrian delay in crossing a road broadly equates to a two-way link flow of approximately 1,400 vehicles per hour.

Pedestrian Amenity

The term pedestrian amenity is broadly defined as the relative pleasantness of a journey. It is considered to be affected by traffic flow, speed and composition, as well as footway width, lighting and quality and the separation/protection from traffic. It encompasses the overall relationship between pedestrians and traffic, including fear and intimidation which is the most emotive and difficult effect to quantify and assess. The IEMA Guidelines (Ref 8-6) references a study which suggests that a tentative threshold for judging the significance of changes in pedestrian amenity would be where the traffic flow (or its HGV component) is halved or doubled.

There are no commonly agreed thresholds for estimating levels of danger or fear and intimidation, however the IEMA Guidelines (Ref 8-6) also suggest the adoption of values from Pedestrian Delay, Annoyance and Risk - Imperial College Crompton (1981) (Ref 8-10) when considering any effect on pedestrian fear and intimidation. These thresholds are replicated in Table 8-4 and can be used as a first approximation of the likelihood of pedestrian fear and intimidation, although other factors need to be considered such as proximity to traffic and footpath widths.

Table 8-4 Transport and Access – Pedestrian Fear and Intimidation Thresholds

Degree of hazard	Average traffic flow over 18 hour day (vehicles per hour)	Total 18 hour heavy goods vehicle flow	Average speed over 18 hour day (miles per hour)
Extreme	1,800 +	3,000 +	20 +
Great	1,200–1,800	2,000–3,000	15-20
Moderate	600–1,200	1,000–2,000	10-15

Source: Pedestrian Delay, Annoyance and Risk - Imperial College Crompton (1981) (Ref 8-10)

Accidents and Safety

Consideration has been given to the local circumstances, in particular traffic speed, flow and composition, as well as vehicle conflict and pedestrian activity and the potential increases resulting from the proposed Development. These factors enable a professional judgement to be made regarding the significance of the effect.

Hazardous Loads

The effects on hazardous loads are not included within this Chapter.

Air Pollution including Dust and Dirt

The effects on air quality, dust and dirt are not included within this Chapter.

Significance of Effects

A set of generic significance criteria are proposed in the Environmental Impact Assessment: A Guide to Good Practice and Procedures (The Department for Communities and Local Government, 2006) (Ref 8-5) to describe the significance of effect. These criteria are outlined in Table 8-5.

Table 8-5 Transport and Access – Criteria for Determining Significance of Effects

Significance of Effect	Description
Major	These effects are likely to be important considerations at a regional or district scale.
Moderate	These effects, if adverse, are likely to be important at the local scale. However, the cumulative effect of these may lead to an overall increase in the impact/effect of traffic.
Minor	Generally related to local issues but the effects are relevant in the detailed design of the proposed Development.
Negligible	Effects are generally beneath levels of perception.

Environmental Impact Assessment: A Guide to Good Practice and Procedures (The Department for Communities and Local Government, 2006) (Ref 8-5) states that significance is a function of the value of resources (international, national, regional or local level importance), the magnitude of the impact, the duration involved, the reversibility of the effect and the number and sensitivity of receptors.

The significance of effect on each section of the highway network within the study area has been determined taking into account:

- **Magnitude** of the impact based on the forecast traffic generations associated with the proposed Development, in terms of percentage increases in total traffic and increases in HGV flows;
- **Duration** of increased traffic volumes associated with the proposed Development – for example, whether the impact occurs during a single short period or throughout the construction programme;
- **Reversibility** of the effect of traffic associated with the proposed Development;
- **Highway characteristics** including road classification, existing traffic flows and road geometries of the highway sections; and
- **Sensitive receptors** identified using the criteria recommended in paragraph 2.5 of the IEMA Guidelines (Ref 8-6) and summarised in Table 8-2.

The magnitude of effect and the sensitivity of the receptor would be compared to determine the significance of effect in conjunction with Table 8-6.

Table 8-6 Transport and Access – Determining the Significance of Effect

Magnitude	**Major**	Major	Major	Moderate	Minor
	Moderate	Major	Moderate	Minor	Negligible
	Minor	Moderate	Minor	Negligible	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible
		Major	Moderate	Minor	Negligible
		Sensitivity			

The determination of the overall significance of the effect is a judgement as to whether the magnitude and duration of effects, when combined with the characteristics of the highway network and the sensitivity of receptors, would effect at a regional or district scale or are important at the local scale but cumulatively lead to an overall increase in the effects of traffic (as set out in Table 8-6**Error! Reference source not found.**, a Major or Moderate significance of effect). If this is the case, then the effects are considered to be Significant. If the overall effect is likely to be a local issue or beneath levels of perception, it is considered to be Not Significant.

8.2.8 Cumulative Effects

It is assumed that the construction of Surf Snowdonia would be complete by the time construction of the Bryn Cowlyd WTW commences, so no cumulative effects have been included within the assessment

8.2.9 Limitations of assessment and assumptions

As part of the assessment, it has been assumed that:

- Construction would commence in 2016;
- Construction is expected to take place between January 2016 and December 2017. Construction would take eighteen months, plus a six month commissioning phase;
- Typical construction working hours/days would be 06:00 to 18:00 on Monday to Friday and by exception 06:00 to 18:00 Saturday and Sunday. Construction works outside of the above times would be with prior agreement of CCBC.
- For the purpose of the assessment construction traffic movements on weekends between 06:00-18:00 have been assessed;
- For the purpose of the assessment it is assumed that the same number of workers would be on the site on a weekend, as a weekday;
- All construction traffic (including HGVs) would enter and leave the site via the existing Bryn Cowlyd Water Treatment Works site access onto the B5106;

- It is assumed that HGV movements accessing and departing from the site would use the following route, namely the B5109, B5279, A470 and the A55;
- For the purposes of a robust, worst case assessment it has been assumed that all light vehicle traffic travel via all the routes in the study area, namely the B5106 (north and south), B5279, A470 and the A55;
- All concrete would be imported to site;
- A stabilisation method would be implemented on the construction compound site, which would minimise the need for stone to be imported to site;
- Off-site pre-fabrication would reduce the potential number of construction vehicles; and
- Topsoil would be removed and stockpiled on site and re-used for bund construction.

8.3 Existing Conditions

8.3.1 Existing Highway Network

A description of the existing roads and access arrangements for the proposed Development is detailed below.

Section 1 – B5106 from Betws-y-Coed to Site Access

The B5106 provides a north to south route between Conwy in the north and A5 in the south, whilst also providing access to Llanwrst to the east via the Pont Fawr over the Afon Conwy. The B5106 comprises a single carriageway road of approximately 5.5m in width and is typically subject to the national speed limit. The speed limit reduces to 30mph at the villages of Betws-y-Coed, Llanwrst and Trefriw. The route is predominantly unlit with limited footways located only within the named settlements.

The route passes a number of sensitive receptors including; a school (Ysgol Trefriw), a caravan park and recreational playing fields. There are a number of residential properties fronting the carriageway. Adjacent to the site access is the Conwy Valley Maze. There are some pinch points where on-street parking was observed restricting the width for two-way passing movements, yellow lines are present within Trefiw which restrict parking. Additionally there are weight restrictions on the following bridges. Pont Trefriw in Trefriw, has a width of 4.6m and is subject to a maximum weight restriction of 18 tonnes, whilst Pont Fawr in Llanwrst has a width of 3.6m and is subject to a maximum weight restriction of 18 tonnes. This section of road is considered to be of major receptor sensitivity.

Section 2 – B5106 from Site Access to B5279

The B5106 extends from the site access to the junction with the B5279. It is a single carriageway road which is approximately 6.5m in width within the vicinity of the site access. There are no footways along the B5106 within the immediate vicinity of the site access but footways are present on at least one side of the carriageway within the settlements along the route. The carriageway through the residential areas of Dolgarrog, Tal-y-Bont, Castell, Caerhurn and Ty’n-y-groes are predominantly lit and are subject to 30mph speed restrictions. The B5106 outside the residential areas is typically subject to the national speed limit.

Residential properties front onto the carriageway and the route passes adjacent to or close to a number of receptors including schools (Tal-y-Bont Primary School and Ysgol Dolgarrog), churches, retail stores and a caravan park. There are some pinch points where the narrowing of the carriageway and on-street parking restrict two-way traffic movements. It is considered that this section of road is of a major receptor sensitivity.

Section 3 – B5106/ A547/ A546 from B5279 to A55 (Conwy)

Section 3 comprises the route north along the B5106 from the junction with the B5279 and comprises the B5106, the A547 and the A546. The majority of the section is made up of the B5106. The B5106 is a single predominantly unlit carriageway, extending northwards from the junction with the B5279 to the junction with the A547 within Conwy. The route is subject to the national speed limit outside of the settlements, the speed limit within Ty’n-y-groes is subject to a 30mph speed limit and the speed limit reduces to 40 mph, and then 30 mph within the residential areas of Conwy.

Along the route a number of properties front onto the carriageway with footways limited to residential areas. Ysgol Porth y Felin is also located along the B5106 within Conwy. Within Conwy the route passes through the Conwy Town Wall Arches which narrows to allow only single vehicular passing movements, with a restricted height of 3.9m and width of 3.05m.

The A547 (Conway Road) has an approximate south west to north east alignment and connects the B5106 in the west and the A546 to the east. It has an approximate length of 1km along the route and consists of a single carriageway with street lighting and is subject to the national speed limit. There is a segregated footway located along the entirety of the northern side of the route.

The A546 connects the A547 with the A55 and has an approximate length of around 500m along the route. This route provides access to a number of local facilities including; leisure centre, cinema, retail stores, grocery superstores and Conwy Business Park. As such the route has a footway located on both sides of the carriageway including a shared foot / cycle path and uncontrolled pedestrian and cycle crossings, north of the Junction Way Roundabout. South of the roundabout there is a footway only located on the western side of the carriageway. Overall the receptor sensitivity of the route is considered to be major.

Section 4 – B5279

The B5279 extends from the B5106 within the village of Ty’n-y-groes, to the junction with the A470 in the village of Tal-y-cafn. It comprises an unlit single carriageway with an approximate width of 5.9m (narrows to approximately 4.9m in places), which is subject to the national speed limit. The B5279 has an east to west alignment and contains a bridge crossing over the Afon Conwy. The bridge has a pedestrian footway located on the northern side of the carriageway, there are no other footways located along this route. There are a number of residential properties fronting the carriageway. Tal-y-cafn Railway Station, which provides services to Blaenau Ffestiniog and Llandudno, is accessed east of the Afon Conwy. The B5279 crosses the railway line. As such it is considered that this section of the route is of moderate receptor sensitivity.

Section 5 – A470 from A55 to B5279

The A470 is part of the trunk road network. The section between the junction with the A55 in the north and the junction with B5279 in the south consists of a single carriageway, which is predominately subject to the national speed limit, but reduces to 30mph in the residential area of Llansanffraid Glan Conwy. This section of the A470 has footways on at least one side of the carriageway between the A55 and the village of Pentrefelin. There are no footways south of the village to the B5279 junction. Sensitive receptors along the route comprise; residential properties fronting the carriageway and Ysgol Glan Conwy. As such it is considered that this section of road is of a major receptor sensitivity.

Section 6 – A470 from B5279 to A5 (Betws-y-Coed)

The A470 has an approximate north to south alignment spanning from the junction with the B5279 in the north to the junction with the A5 in the south. The route is predominantly rural in nature, but includes the town of Llanwrst.

This A470 along this route is predominately subject to the national speed limit, which reduces to 20mph within the town of Llanwrst. Between Llanwrst and Betws-y-Coed exists a shared cycle/foot path, set approximately 1m back from the carriageway running parallel to the carriageway. Within Llanwrst properties front onto the carriageway, together with Ysgol Bro Gwydir, a residential care home, hotels and the retail properties along its length. The receptor sensitivity is considered to be of major receptor sensitivity.

Sections 7 – A55 east of the A470 and Section 8 – A55 west of the A470

The North Wales Expressway (A55) is a trunk road between Holyhead and Chester, forming part of the strategic transport corridor across North Wales linking with Ireland and Northern England. The A55 is orientated in an approximate east to west alignment and connects to the M56 and M53 in the east and the Port of Holyhead in the west. The A55 is a dual-carriageway and is predominately subject to the national speed limit. It is considered that this section of the route is of negligible receptor sensitivity.

8.3.2 Accident Data

The obtained accident data for the five year period 2010-2014 has been summarised by each link along the HGV route in Table 8-7. A plot of all observed accidents are shown within Figure 8-2 Location and Severity of Accidents.

Table 8-7 Transport and Access – All Accidents by Severity and Involvement

	Section 2 - B5106 from Site to B5279	Section 4 – B5279 from B5106 to A470	Section 5 - A470 from A55 to B5279	Total
Accidents by Severity				
Fatal	0	0	0	0
Serious	0	0	9	9
Slight	4	2	61	67
Total	**4**	**2**	**70**	**76**
Accidents by vulnerable road user or large vehicle type				
Pedestrian	1	0	4	5
HGV	0	0	2	2
Goods Vehicle (GV)	0	0	6	6

	Section 2 - B5106 from Site to B5279	Section 4 – B5279 from B5106 to A470	Section 5 - A470 from A55 to B5279	Total
Accidents by Severity				
Bus	0	0	2	3
Motor-cycle	0	0	6	6
Cyclist	0	0	4	4
Total	**1**	**0**	**24**	**26**

There have been 76 recorded PIAs across the HGV route. There were no fatal accidents, nine accidents resulted in serious injuries and 67 resulted in slight injuries. Of the 76 PIAs, four involved pedal cyclists, five involved pedestrians, two accidents involved HGVs, six involved Goods Vehicles (GVs), three involved a bus and six involved motorcyclists.

Section 2 – B5106 from Site to B5279

There were a total of four accidents on this section over the five year period, all of which were classified as slight in severity. One of the accidents involved a vulnerable road user and occurred within the village of Tal-y-Bont, when a pedestrian walked out into the road intending to cross, into the path of a vehicle.

Section 4 – B5279 from B5106 to A470

There were a total of two accidents on this section over the five year period, both were slight in severity. None of the recorded accidents involved vulnerable road users, buses, HGVs or GVs.

Section 5 – A470 from A55 to B5279

There were a total of 70 accidents on this section over the five year period, nine serious and 61 slight in severity. Of the nine serious accidents, one involved a pedestrian, one involved a HGV and two involved pedal cyclists. The collision involving the HGV occurred on the southern arm approach of the roundabout at Junction 19, of the A55. It was a rear end shunt where the HGV failed to stop and collided with another vehicle.

There are a number of PIA cluster locations along the section of the HGV route as detailed below. A cluster of five accidents all slight in severity occurred within the village of Pentrefelin within a 50m distance. The collisions did not involve any vulnerable road users, HGVs or GVs. The common causation factors where vehicles failing to slow down resulting in rear end collision.

A cluster of four accidents one serious and three slight in severity occurred to the south of Pentrefelin, within a 70m distance. The serious accident involved a GV, for unknown reasons a vehicle crossed the carriageway causing a head-on collision. Two further collisions involving GV's occurred within the vicinity of the Talgoed Nurseries, both were slight in severity, one occurred where a vehicle veered into the oncoming carriageway colliding into the GV and an additional vehicle, whilst the other PIA occurred whilst a GV stopped behind a vehicle waiting to turn when a vehicle travelling behind collided with the GV.

Within the vicinity of the A55 there exist two clusters of accidents within the recorded period. There were a total of 14 accidents recorded on entry to the southern arm of the roundabout with

Junction 19 of the A55, two of these collisions involved GV's. The common causation of collisions were rear end shunts.

A cluster of nine accidents was recorded along the A55 exit slip road, all of which were slight in severity. Three of the collisions involved vulnerable road users (two pedal cycles and one motorcyclist) being struck by another vehicle. The common causation of collisions were rear end shunts.

An additional collision involving a HGV occurred within the vicinity of the Bodnant Road junction. The accident was slight in severity and was the result of a vehicle crossing the central white line into an on-coming HGV.

Summary

The obtained PIA data for the five year study period has been used as a basis to assess the effects on accidents and safety. The occurrence of two accidents involving HGV's within the study period, does not indicate a safety deficiency with the highway characteristics for accommodating an increase in large vehicles.

8.3.3 Baseline Traffic Data

Traffic data was obtained for each of the highways sections within the study area. Data was obtained from surveys undertaken in 2014 and 2015. Automatic Traffic Counters (ATC) on the B5106 recorded at the site entrance have been used to represent the traffic flows on Section 1 and Section 2.

The construction traffic movements generated by the proposed Development would typically take place on weekdays between 06:00-18:00. Construction works outside these times would seek prior agreement from CCBC. For the purpose of the assessment construction traffic movements on weekends between 06:00-18:00 have been assessed;

Thus the average two-way 12 hour (06:00-18:00) weekday traffic flows and the average two-way 12 hour (06:00-18:00) weekend traffic flows have been obtained from Automatic Traffic Counters (ATC) on the B5106 and B5279. The effect of the proposed Development on a weekend has been assessed separately, as background traffic movements on a weekend typically vary to weekday flows.

The base year two-way total and HGV traffic flows along the assessed highway sections are presented in Table 8-8.

Table 8-8 Transport and Access – Base Year Two-way Traffic Flows

Highway Links	Year	Total Traffic Flows (no. vehicles)			HGVs Flows (no. vehicles)		
		Weekday 12 Hour (06:00-18:00)	Weekend 12 Hour (06:00-18:00)	AADF	Weekday 12 Hour (06:00-18:00)	Weekend 12 Hour (06:00-18:00)	AADF
Section 1- B5106 from Betws-y-Coed to Site Access	2015	1,470	1,510		26	26	
Section 2- B5106 from Site Access to B5279	2015	1,470	1,510		26	26	
Section 3- B5106 / A547 / A546 from B5279 to A55 (Conwy)	2014			14,408			90
Section 4- B5279	2015	1,635	1,411		76	14	
Section 5- A470 from A55 to B5279	2014			7,143			239
Section 6- A470 from B5279 to A5 (Betws-y-Coed)	2014			6,737			178
Section 7- A55 east of the A470	2014			41,390			1,931
Section 8- A55 west of the A470	2014			37,474			2,449

8.3.4 Future conditions

The following section examines the expected changes to the highway network and traffic patterns during the construction phase. For this assessment the expected growth in traffic and planned changes to the highway network have been considered.

8.3.5 General Traffic Growth

The construction is anticipated to commence in 2016. The base year traffic flows have been factored to the Construction Year (2016) by applying a factor derived from the Trip End Model Presentation Program (TEMPRO). TEMPRO presents the output of the National Trip End Model (NTEM), which forms part of the National Transport Model (NTM).

The most recent NTM dataset (6.2) has been used to obtain growth rates. The Growth Factor for 2014 to 2016 for the Conwy region for an average weekday and a Saturday are both 1.0139 and the Growth Factor for 2015 to 2016 for an average weekday and a Saturday are both 1.0112. A Growth Factor for an average weekday has been used as a proxy for AADT flows and is considered appropriate for the assessment.

TEMPRO has a policy based approach where the growth in housing and economic activity reflects the predictions expected through the planning system (strategic growth and committed developments). The growth rates therefore include allowances for background traffic growth through increases in car ownership as well as construction of committed developments. Therefore any committed development traffic has been assumed to be included through the application of the growth rates, and a separate assessment of these flows has not been undertaken.

The resultant 2016 construction year traffic flows are presented in Table 8.9.

Table 8-9 Transport and Access – 2016 Construction Year Predicted Two-way Traffic Flows

Highway Links	Total Traffic Flows (no. vehicles)			HGVs Flows (no. vehicles)		
	Weekday 12 Hour (06:00-18:00)	Weekend 12 Hour (06:00-18:00)	AADF	Weekday 12 Hour (06:00-18:00)	Weekend 12 Hour (06:00-18:00)	AADF
Section 1-B5106 from Betws-y-Coed to Site Access	1,486	1,527		26	26	
Section 2-B5106 from Site Access to B5279	1,486	1,527		26	26	
Section 3-B5106 / A547 / A546 from B5279 to A55 (Conwy)			14,608			91
Section 4-B5279	1,653	1,427		77	14	
Section 5-A470 from A55 to B5279			7,242			242

Highway Links	Total Traffic Flows (no. vehicles)			HGVs Flows (no. vehicles)		
	Weekday 12 Hour (06:00-18:00)	Weekend 12 Hour (06:00-18:00)	AADF	Weekday 12 Hour (06:00-18:00)	Weekend 12 Hour (06:00-18:00)	AADF
Section 6- A470 from B5279 to A5 (Betws-y-Coed)			6,831			180
Section 7- A55 east of the A470			41,965			1958
Section 8- A55 west of the A470			37,995			2483

Other Developments

Construction of the Surf Snowdonia development in Dolgarrog is to be completed in summer 2015, prior to the proposed construction of the Development. There are no other planned or proposed schemes in the vicinity of the proposed Development or immediate surrounding area which are considered likely to result in cumulative effects.

Planned Changes to the Highway Network

There are no known changes proposed to the highway network within the study area.

8.4 Assessment of Effects and Mitigation

8.4.1 Construction Phase

Construction Programme

The construction period is expected to take place between January 2016 and December 2017. Construction would take eighteen months, plus a six month commissioning phase. It is anticipated that Months six to nine of the construction programme would generate the peak vehicle generations.

Anticipated Construction Traffic Vehicle Types

During the construction phase there would be vehicular movements to the site associated with the delivery of construction components and materials, together with the arrival and departure of construction staff. The construction of the proposed Development is anticipated to generate a variety of vehicle types that would travel to and from the proposed Development, which would include cement trucks and articulated trailers.

The delivery of construction components and materials would largely be by HGVs, while staff trips are assumed to be undertaken by car or van. It is not anticipated that Abnormal Indivisible Loads (AILs) would be required to transport materials to or from the proposed Development site.

Anticipated Construction Traffic Trip Generations

This assessment focuses on the peak construction period, as this is when the highest traffic flows would be generated. The vehicle generations that are forecast to occur during the peak day of construction have been assessed.

The total number of vehicle movements generated during the construction phase on the peak day of construction is estimated to be 342 two-way movements (i.e. 171 arrivals and 171 departures). It is estimated that this would consist of 202 two-way HGV movements and 140 two-way light vehicle movements (cars, vans and light goods vehicles).

The traffic generation on the peak day of construction is set out in Table 8-10. The anticipated traffic is made on best estimates, but would be dependent upon a range of factors, such as the shipping of materials and the weather. The number of vehicles assumed in the assessment is indicative and is subject to change depending on the construction contract procured at the time, however it has taken into account the quantity of concrete required during the peak construction phase. At the peak it is anticipated that 70 HGVs transporting concrete to site would be required in one day.

For the purpose of the assessment it has been assumed that staff would travel to the site by van or car. It is anticipated that the total likely to be on site at any one time during construction would not exceed 40. It is assumed that all staff would arrive at the start of the day and depart at the end of the day. This would equate to 80 daily two-way vehicle trips during the peak construction period, assuming no travel off-site during the day. To increase the robustness of the assessment, it has been assumed that all staff would drive in single-occupancy vehicles to the site, although staff would be encouraged to car share. It is also assumed that all vans would also arrive at the start of the day and leave at the end of the day.

Table 8-10 Transport and Access – Estimated Peak Daily Construction Traffic Generations

Transport	Arrivals	Departures	Total two-way
Staff travel (assumed by car)	40	40	80
Vans	30	30	60
Delivery (HGVs)	25	25	50
Concrete HGVs	70	70	140
Articulated HGVs	6	6	12
Total number of vehicles	**171**	**171**	**342**

HGV Traffic Distribution

The peak traffic generation shown in Table 8-10 has been distributed on the network considering that HGVs would only travel to the site via the B5106 (Section 2), B5279 (Section 4) and the A470 (Section 5) to the north towards the A55 (Sections 7 and 8).

Light Traffic Distributions

For the purposes of this assessment it has been assumed that all light vehicle traffic routes via each of the assessment highway sections. This is because it is not known at this stage where staff based at the proposed Development would travel from. Light vehicle traffic could access the proposed Development from any direction, so assuming all light vehicles travel on all routes ensures a robust assessment.

Construction Traffic Generation by Highway Section

In order to assess the highest level of traffic impact, the peak daily HGV and total flows have been assessed against the 2016 construction year flows. The average daily total traffic flows have been calculated for each highway section as presented in Table 8-11.

Table 8-11 Transport and Access – Estimated Distribution of Construction Traffic in Peak Month

Highway Links	Light Distribution	HGV Distribution	Light Vehicles Generations	Total HGV Generations
Site Generation	**100%**	**100%**	140	202
Section 1- B5106 from Betws-y-Coed to Site Access	100%	0%	140	0
Section 2- B5106 from Site Access to B5279	100%	100%	140	202
Section 3- B5106 / A547 / A546 from B5279 to A55 (Conwy)	100%	0%	140	0
Section 4- B5279	100%	100%	140	202
Section 5- A470 from A55 to B5279	100%	100%	140	202
Section 6- A470 from B5279 to A5 (Betws-y-Coed)	100%	0%	140	0
Section 7- A55 east of the A470	100%	100%	140	202
Section 8- A55 west of the A470	100%	100%	140	202

Impacts of Construction Vehicle Traffic

The impacts of construction traffic on traffic flows on each highway section on the 2016 construction year have been assessed. Table 8-12 presents the percentage increase in construction traffic on the highway network.

Table 8-12 Transport and Access – Construction Traffic Impacts

Highway Links	**Receptor sensitivity**	**% increase in total traffic flows**			**% increase in HGV traffic flows**		
		Week day 12 Hour (06:00 - 18:00)	**Weekend 12 Hour (06:00-18:00)**	**AADF**	**Weekday 12 Hour (06:00-18:00)**	**Weekend 12 Hour (06:00-18:00)**	**AADF**
Section 1- B5106 from Betws-y-Coed to Site Access	Major	9%	9%		0%	0%	
Section 2- B5106 from Site Access to B5279	Major	23%	22%		868%	868%	
Section 3- B5106 / A547 / A546 from B5279 to A55 (Conwy)	Major			1%			0%
Section 4- B5279	Moderate	21%	24%		363%	1,527%	
Section 5- A470 from A55 to B5279	Major			5%			83%
Section 6- A470 from B5279 to A5 (Betws-y-Coed)	Major			2%			0%
Section 7- A55 east of the A470	Negligible			1%			10%
Section 8- A55 west of the A470	Negligible			1%			8%

In accordance with the IEMA Guidelines (Ref 8-6) all links with a moderate or above receptor sensitivity are considered to be specifically sensitive areas and as such an increase of 10% or above on total traffic flows or HGVs is considered to be potentially significant and requires detailed assessment of the effects. Receptors with minor or negligible significance are only subject to further assessment if there is a forecast increase in excess of 30% on total traffic flows or HGVs. Table 8-12 demonstrates that the following links would require further more detailed assessment:

- Section 2 – Total traffic and HGVs greater than 10% increase;
- Section 4 – Total traffic and HGVs greater than 10% increase; and
- Section 5 – HGVs in excess of 10% increase.

For all other sections on the network the change in total flow and HGV traffic are below the threshold levels of significance. For all links with negligible or minor receptor sensitivity it is considered that there is a **Negligible** magnitude of effect. For all links with moderate to major sensitivity it is considered that there would be a minor adverse magnitude of effect. The effects are considered to be **Not Significant**.

Section 2 – B5106 from Site Access to B5279

Severance

Section 2 is considered to be of major receptor sensitivity. An increase in total traffic of 23% and 25% increase on a weekday and weekend respectively is forecast. This increase is lower than the magnitude threshold for a slight change in severance (30%) to occur. As such it is considered that there would be a **Negligible** significance of effect on severance in accordance with the IEMA Guidelines (Ref 8-6).

Driver Delay

Delays to drivers are generally caused at junctions and are only likely to be significant when traffic flows on the network are close to capacity. The construction would generate a total traffic flow increase of 23% and 22% over a 12 hour period on this link on a weekday and weekend and as such is unlikely to have an impact on capacity at local junction, particularly during peak weekday hours.

The *Design Manual for Roads and Bridges* (DMRB) (Ref 8-9) sets out the determination of urban road capacity. This suggests that, on the narrowest single carriageway road with the lowest capacity (a busy high street) of 6.1m, the two-way capacity traffic flow is 1,250 vehicles per hour. This figure has been used to assess this section for the purpose of estimating driver delay, as there are no comparative capacity thresholds for rural roads.

The average peak hourly flow observed within the 2015 survey was 170 two-way vehicle movements (17:00-18:00). Applying the TEMPRO Growth Factor to the 2016 construction year flow is 172 two-way vehicle movements or a flow to capacity of 14%. As such even during the peak hour of traffic the link is operating significantly under the maximum capacity of the lowest capacity urban road.

During the peak day of construction, if the total number of construction vehicles over a day using this link is predicted to be 342 vehicles. If half of these vehicles arrived or departed during a one hour period (i.e. 171 vehicles), this would increase the traffic flow to 343 two-way vehicle movements or a flow to capacity of 27%. This is still within lowest urban road capacity and there would be a **Negligible** magnitude of change in driver delay on this link.

Pedestrian Delay

Delay to pedestrians in terms of road traffic is generally a function of being able to cross the road. Studies have shown that pedestrian delay is perceptible or considered significant beyond a lower delay threshold of 10 seconds, for a link with no crossing facilities. A 10 second pedestrian delay in crossing a road broadly equates to a two-way link flow of approximately 1,400 vehicles per hour.

On the basis that 1,400 vehicles per hour equates to a pedestrian crossing delay of 10 seconds, the 2016 peak hour flow of 172 vehicles per hour equates to an approximate crossing delay of 1.2 seconds.

During the peak construction month, if half of the daily vehicles arrived and departed during a one hour period a flow of 343 vehicles per hour equates to an approximate crossing delay of 2.5 seconds. It is therefore considered that the potential effect on pedestrian delay as a result of the proposed Development would be of **Negligible** significance on this link.

Pedestrian Amenity, Fear and Intimidation

The effects on pedestrian amenity, fear and intimidation have been considered in relation to thresholds identified in Table 8-4 as a qualitative analysis of the pedestrian environment to establish the effect on the overall pleasantness of the journey.

The broad threshold for significance in terms of an adverse effect on pedestrian amenity is stated as where flows are broadly doubled.

The 2016 base 18 hour weekday flow on this link is 1,819 total vehicles, which equates to an average traffic flow per hour of 101 vehicles. With the addition of the construction traffic on this link this increases to 2,161 vehicles which equates to an average traffic flow per hour of 120 vehicles.

This falls below the threshold of an average of 600-1,200 vehicles per hour required for a moderate effect on fear and intimidation to occur as a result of traffic flows. There would be an imperceptible change in the level of traffic on this link as a result of the construction of the proposed Development.

The 2016 base weekday HGV flows over an 18 hour period is 29 HGVs, increasing to 231 HGVs with the addition of construction traffic. This is well below the threshold of 1,000 to 2,000 HGVs over an 18 hour period to create a moderate effect. It should be noted that the link does not have a continuous footway nor is it lit along its entire length. However, it is considered that the potential effect on pedestrian amenity, fear and intimidation on this link would be of **Negligible** significance.

Accidents and Safety

The PIA rate along each link have been calculated by cross referencing the recorded number of PIAs on each link from 2010 to 2014 to the vehicle kilometres along each link. The vehicle kilometres over five years have been calculated based on the observed 2015 daily flow along each link. The observed PIA rate along Section 2 is 0.528.

A comparison of the observed PIA to the national PIA rate has been undertaken using the Department for Transport's Reported Road Casualties in Great Britain 2013 (Ref 8-11). Table RAS10002 Reported accidents and accident rates by road class and severity, Great Britain, 2005-09 average, 2005-2013. The national average PIA rate has been obtained by averaging the available reported statistics rates from 2010-2013 for 'other' rural roads (i.e. not an A road). As shown in Table 8-13. Section 2 has a slightly higher accident rate compared to the national average.

Table 8-13 Transport and Access – Observed Injury Accident Rates

Link	Recorded PIAs	Base Year AADF flows	Length of link (km)	Million vehicle kms (mvkm) (over 5 years)	Observed PIA rate (per mvkm)	National statistics average PIA (per mvkm)
Section 2	11	1,901	6.0	20.816	0.528	0.514
Section 4	2	1,976	1.5	5.409	0.370	0.514
Section 5	70	7,143	6.7	87.341	0.801	0.290

The observed PIA rate has then been used to estimate the number of PIAs that could occur as a result of the construction traffic and inform with the analysis of the effect of construction traffic on accidents and safety. The AADF during the construction period assumes 342 construction vehicles (maximum daily construction vehicle generations), which ensures a robust assessment. Table 8-14 shows that based on the forecast AADF during 2016 three accidents are forecast during the eighteen month construction period along Section 2 without the construction traffic (assuming the observed accident rates remain the same in the future year), however with the addition of the construction traffic four PIAs are forecast, an increase of one accident.

Table 8-14 Transport and Access – Section 2 Forecast Accidents

Link	Observed PIA rate (per mvkm)	AADF	Length of link (km)	MvKm (over 18 months)	Predicted Accidents
2016	0.528	1,922	6.0	6.320	3
2016 with construction	0.528	2264	6.0	7.444	4
Difference in predicted accidents over construction period					1

Four PIAs were recorded along this link between 2010 and 2014, none involved HGVs and one involved a pedestrian. As HGVs / buses comprise around 2% of the overall traffic flow on this link, this indicates that there is no specific road safety issue with HGV traffic on this link. There were no locations where a cluster of four or more accidents occurred and no common causalities indicating a deficiency in the highway characteristics or condition.

The link has a slightly higher than average accident rate, but considering the minimal increase in predicted accidents and the observed pattern of accidents it is considered that the proposed Development would have a **Minor Adverse** significance of effect.

Summary

The assessment of this link has demonstrated the following significance of effect, based on Table 8-15, against each of the key criteria:

Table 8-15 Transport and Access – Section 2 Summary of Residual Effects

Criteria	Receptor Sensitivity	Magnitude of Change	Significance of effect
Severance	Major	**Negligible**	**Negligible significance**
Driver Delay	Major	**Negligible**	**Negligible significance**
Pedestrian Delay	Major	**Negligible**	**Negligible significance**
Pedestrian Amenity, Fear and Intimidation	Major	**Negligible**	**Negligible significance**
Accidents and safety	Major	**Minor adverse**	**Minor adverse significance**

Based on the overall analysis of each of the criteria, and due to the short term and temporary construction period, it is considered that the proposed Development would have a **Moderate Adverse** significance of effect on this link. The effects are considered to be **Not Significant**.

Section 4 – B5279

Severance

Section 4 is considered to be of moderate receptor sensitivity. An increase in total traffic of 21% and 24% increase on a weekday and weekend respectively is forecast. This increase is lower than the magnitude threshold for a slight change in severance (30%) to occur. As such it is considered that there would be a **Negligible** significance of effect on severance in accordance with the IEMA Guidelines (Ref 8-6).

Driver Delay

The construction would generate a total traffic flow increase of 21% and 24% over a 12 hour period on this link on a weekday and weekend and as such is unlikely to have an impact on capacity at local junction, particularly during peak weekday hours.

The average peak hourly flow observed within the 2015 survey was 184 two-way vehicle movements (16:45-17:45). Applying the TEMPRO growth factor to this flow to 2016 construction year flow is 186 two-way vehicle movements or a flow to capacity of 15%. As such even during the peak hour of traffic the link is operating significantly under the maximum capacity of the lowest capacity urban road (two-way capacity traffic flow is 1,250 vehicles per hour).

During the peak day of construction, if the total number of construction vehicles over a day using this link is predicted to be 342 vehicles. If half of these vehicles arrived or departed during a one hour period, this would increase the capacity to 357 two-way vehicle movements or a flow to capacity of 29%. This is still well within the assessed capacity for this type of road and there would be a **Negligible** magnitude of change in driver delay on this link.

Pedestrian Delay

There are no pedestrian crossings along this link. On the basis that 1,400 vehicles per hour equates to a pedestrian crossing delay of 10 seconds, the 2016 peak hour flow of 186 vehicles per hour equates to an approximate crossing delay of 1.3 seconds.

During the peak construction month, if half of the daily vehicles arrived and departed during a one hour period a flow of 357 vehicles per hour equates to an approximate crossing delay of 2.6

seconds. It is therefore considered that the potential effect on pedestrian delay as a result of the proposed Development would be of **Negligible** significance on this link.

Pedestrian Amenity, Fear and Intimidation

The 2016 base 18 hour weekday flow on this link is 1,978 total vehicles, which equates to an average traffic flow per hour of 110 vehicles. With the addition of the construction traffic on this link this increases to 2,320 vehicles which equates to an average traffic flow per hour of 129 vehicles.

This falls below the threshold of an average of 600-1,200 vehicles per hour required for a moderate effect on fear and intimidation to occur as a result of traffic flows. There would be an imperceptible change in the level of traffic on this link over an 18 hour period (19 vehicles per hour on average) as a result of the construction of the proposed Development.

The 2016 base weekday HGV flows over an 18 hour period is 79 HGVs, increasing to 281 HGVs with the addition of construction traffic. This is well below the threshold of 1,000 to 2,000 HGVs over an 18 hour period to create a moderate effect. It should be noted that, the link does not have a continuous footway nor is it lit along its entire length. However, it is considered that the potential effect on pedestrian amenity, fear and intimidation on this link would be of **Negligible** significance.

Accidents and Safety

The observed PIA rate along Section 4 is 0.370 (calculated based on the observed 2015 daily flow along each link), which is lower than the national PIA rate (0.514) for ‘other’ rural roads (i.e. not an A road), as shown in Table 8-13.

Table 8-16 shows that based on the forecast 2016 AADF one accident is forecast during the eighteen month construction period along Section four both with and without the construction traffic (assuming the observed accident rates remain the same in the future year). The AADF during the construction period assumes 342 construction vehicles (maximum daily construction vehicle generations), which ensures a robust assessment.

Table 8-16 Transport and Access – Section 4 Forecast Accident

Link	Observed PIA rate (per mvkm)	AADF	Length of link (km)	MvKm (over 18 months)	Predicted Accidents
2016	0.370	1998	1.5	1.642	1
2016 with construction	0.370	2340	1.5	1.923	1
Difference in predicted accidents over construction period					0

Two PIAs were recorded along this link between 2010 and 2014, none involved HGVs and none involved any vulnerable road users. As HGVs / buses comprise around 5% of the overall traffic flow on this link, this indicates that there is no specific road safety issue with HGV traffic on this link. There were no locations where a cluster of four or more accidents occurred and no common causalities indicating a deficiency in the highway characteristics or condition. The link also has a lower than average accident rate and considering the observed pattern of accidents it is considered that the proposed Development would have a **Negligible** significance of effect.

Summary

The assessment of this link has demonstrated the following significance of effect, based on Table 8-17, against each of the key criteria:

Table 8-17 Transport and Access – Section 4 Summary of Residual Effects

Criteria	Receptor Sensitivity	Magnitude of Change	Significance of effect
Severance	Moderate	**Negligible**	**Negligible significance**
Driver Delay	Moderate	**Negligible**	**Negligible significance**
Pedestrian Delay	Moderate	**Negligible**	**Negligible significance**
Pedestrian Amenity, Fear and Intimidation	Moderate	**Negligible**	**Negligible significance**
Accidents and safety	Moderate	**Negligible**	**Negligible significance**

Based on the overall analysis of each of the criteria, and due to the short term and temporary construction period, it is considered that the proposed Development would have a **Minor Adverse** significance of effect on this link. The effects are considered to be **Not Significant**.

Section 5 – A470 from A55 to B5279

Severance

Section 5 is considered to be of major receptor sensitivity. An increase in total traffic of 5% on the AADF traffic flows is forecast. This increase is lower than the magnitude threshold for a slight change in severance (30%) to occur. As such it is considered that there would be a **Negligible** significance of effect on severance in accordance with the IEMA Guidelines (Ref 8-6).

Driver Delay

The construction would generate a total traffic flow increase of 5% in average annual daily flow and as such is unlikely to have an impact on capacity at local junction, particularly during peak weekday hours.

The *Design Manual for Roads and Bridges* (DMRB) (Ref 8-9) sets out the determination of urban road capacity. This suggests that, on a good standard two lane carriageway of 7.3 metres the two-way capacity traffic flow is 2,650 vehicles per hour. This figure has been used to assess this section.

The peak hour flow along the link is unknown. However, along the B5279 the peak hour flows account for 18% of the average daily flow. Thus applying the same proportion to the AADF for traffic flows along Section 5, the two-way peak hour flow has been estimated to be 1,286 in 2015 and 1,303 in the 2016 construction year or a flow to capacity of 49%. As such even during the peak hour of traffic the link is operating under the maximum capacity of the road.

During the peak day of construction, the total number of construction vehicles over a day using this link is predicted to be 342 vehicles. If half of these vehicles arrived or departed during a one hour period, this would increase the capacity to 1,474 two-way vehicle movements or a flow to capacity of 56%. This is within the assessed capacity for this type of road and there would be a **Negligible** magnitude of change in driver delay on this link.

Pedestrian Delay

There are no pedestrian crossings along this link. On the basis that 1,400 vehicles per hour equates to a pedestrian crossing delay of 10 seconds, the 2016 peak hour flow of 1,303 vehicles per hour equates to an approximate crossing delay of 9.3 seconds.

During the peak construction month, if half of the daily vehicles arrived and departed during a one hour period a flow of 1,474 vehicles per hour equates to an approximate crossing delay of 10.5 seconds. It is therefore considered that the potential effect on pedestrian delay as a result of the proposed Development would be of **Minor** significance on this link.

Pedestrian Amenity, Fear and Intimidation

As a high level assessment has been undertaken on the A470 AADF have been obtained. On the B5279 the 18 hours flows (06:00-24:00) accounts for 99% of the 24 hour flows, so for the purpose of the assessment we have used the AADF for the A470 to represent the 18 hour flows for the purpose of this assessment.

The 2016 base 24 hour weekday flow on this link is 7,242 total vehicles, which equates to an average traffic flow per hour of 402 vehicles (across 18 hours). With the addition of the construction traffic on this link this increases to 7,584 vehicles which equates to an average traffic flow per hour of 421 vehicles.

This falls below the threshold of an average of 600-1,200 vehicles per hour required for a moderate effect on fear and intimidation to occur as a result of traffic flows. There would be an imperceptible change in the level of traffic on this link over an 18 hour period (19 vehicles per hour on average) as a result of the construction of the proposed Development.

The 2016 base weekday HGV flows over a 24 hour period is 242 HGVs, increasing to 444 HGVs with the addition of construction traffic. This is well below the threshold of 1,000 to 2,000 HGVs over an 18 hour period to create a moderate effect. It should be noted that the link does not have a continuous footway nor is it lit along its entire length. However, it is considered that the potential effect on pedestrian amenity, fear and intimidation on this link would be of **Negligible** significance.

Accidents and Safety

The observed PIA rate along Section 5 is 0.870 (calculated based on the observed 2014 AADF), which is notably higher than the national PIA rate (0.290) for rural A-roads (i.e. not an A road), as shown in Table 8-18.

Table 8-18 shows that based on the forecast 2016 AADF 21 accidents are forecast during the eighteen month construction period along Section 5 without the construction traffic (assuming the observed accident rates remain the same in the future year), and 22 accidents with the 2016 traffic flows plus construction traffic, an increase of one accident. The AADF during the construction period assumes 342 construction vehicles (maximum daily construction vehicle generations), which ensures a robust assessment.

Table 8-18 Transport and Access – Section 5 Forecast Accident

Link	Observed PIA rate (per mvkm)	AADF	Length of link (km)	MvKm (over 18 months)	Predicted Accidents
2016	0.801	7,242	6.7	26.590	21
2016 with construction	0.801	7584	6.7	27.845	22
Difference in predicted accidents over construction period					1

A total of 70 accidents were recorded along this link between 2010 and 2014, nine serious and 61 slight in severity. There are a number of cluster locations, including within the village of Pentrefelin, south of the village of Pentrefelin and on the southern approach to the roundabout junction with the A55 and on the A55 exit slip road. The common causation factor at the two clusters within/ at the junction with the A55 were rear end shunt collisions. It is considered based on the higher than accident rate along Section 5 and the observed pattern on accidents that the proposed Development would have a **Moderate** significance of effect.

Summary

The assessment of this link has demonstrated the following significance of effect, based on Table 8-19 against each of the key criteria:

Table 8-19 Transport and Access – Section 5 Summary of Residual Effects

Criteria	Receptor Sensitivity	Magnitude of Change	Significance of effect
Severance	Major	**Negligible**	**Negligible significance**
Driver Delay	Major	**Negligible**	**Negligible significance**
Pedestrian Delay	Major	**Negligible**	**Negligible significance**
Pedestrian Amenity, Fear and Intimidation	Major	**Negligible**	**Negligible significance**
Accidents and safety	Major	**Negligible**	**Negligible significance**

Based on the overall analysis of each of the criteria, and due to the short term and temporary construction period, it is considered that the proposed Development would have a **Minor Adverse** significance of effect on this link. The effects are considered to be **Not Significant**.

Operation Phase

A total of eight staff would be based at the site once operational and would travel to site daily by car/van. It is also anticipated that two chemical deliveries per week would be required by HGV, together with periodic HGVs to deliver/ remove skips for removal of dry waste. The site would generate one more HGV per week than current but the number of people based on site would be about the same as current.

Vehicle movements associated with the operation phase are assessed as having a **Negligible** significance of effect. This is considered to be **Not Significant**.

8.4.2 Mitigation Measures

This section sets out the mitigation measures proposed to minimise the potential effects outlined in Section 8.4.1. Although, the effects have all been assessed as **Not Significant**, mitigation measures are proposed as good practice and to reduce the predicted effects.

Construction Phase

A Construction Traffic Management Plan (CTMP) has been prepared and would be implemented during the construction phase. A copy of the CTMP is included in Appendix 8-2. It incorporates:

- Site access and vehicle routeing arrangements, together with a description of the existing transport infrastructure currently serving the site;
- Proposed Development and the anticipated number and nature of vehicle movements to and from the site during construction;
- General construction principles that would be actioned;
- Mitigation measures that could be implemented in order to minimise any adverse effects of vehicular movements associated with the proposed Development on the surrounding highway network; and
- Monitoring that would be undertaken.

Operation Phase

Measures such as car sharing amongst personnel travelling to the site and combined trips would be encouraged where possible in order to reduce the traffic generation.

8.4.3 Residual Effects

This section outlines the predicted residual effects that would prevail as a result of the proposed Development.

Construction Phase

Whilst the CTMP would seek to reduce the vehicular impacts; materials, equipment and construction workers would still need to be travel to and from the proposed Development. The residual significance of effect would however remain unchanged and **Minor Adverse**, this is considered to be **Not Significant**.

Operational Phase

Owing to the relatively few trips generated, the residual significance of effect is considered to remain unchanged at Negligible. This is considered to be Not Significant.

8.5 Summary and Conclusions

A summary of the predicted effects, the mitigation measures and likely residual effects is presented in Table 8-20.

Table 8-20 Transport and Access – Summary of Residual Effects

Potential Effect	Route Section	Significance Prior to Mitigation	Embedded Design and Mitigation Measures	Significance Post Embedded Design and Mitigation Measures
Construction	Section 1	**Not Significant**	CTMP	**Not Significant**
	Section 2	**Minor adverse** **Not Significant**	CTMP	**Not Significant**
	Section 3	**Not Significant**	CTMP	**Not Significant**
	Section 4	**Minor adverse** **Not Significant**	CTMP	**Not Significant**
	Section 5	**Minor adverse** **Not Significant**	CTMP	**Not Significant**
	Section 6	**Not Significant**	CTMP	**Not Significant**
	Section 7	**Not Significant**	CTMP	**Not Significant**
	Section 8	**Not Significant**	CTMP	**Not Significant**
Operation		**Not Significant**	Car sharing	**Not Significant**

8.6 References

Ref 8-1	Welsh Government (2014) Planning Policy Wales, Edition 7.
Ref 8-2	Welsh Government (2007) Technical Advice Note 18: Transport (TAN 18).
Ref 8-3	North Wales Joint Local Transport Plan (2015).
Ref 8-4	Conwy County Borough Council (2007). Conwy Local Development Plan 2007-2022.
Ref 8-5	Department for Communities and Local Government (2006) Environmental Impact Assessment: A Guide to Good Practice and Procedures.
Ref 8-6	Institute of Environmental Management and Assessment (IEMA) (1993) Guidelines for the Environmental Assessment of Road Traffic.
Ref 8-7	Department for Transport (2007) Guidance on Transport Assessment.
Ref 8-8	Highways Agency (1993) The Design Manual for Roads and Bridges (DMRB).
Ref 8-9	Department for Transport www.dft.gov.uk/traffic-counts/cp.php (accessed November 2014).
Ref 8-10	Crompton, D H (1981), Pedestrian Delay, Annoyance and Risk - Imperial College.

Ref 8-11 Department for Transport – Reported road casualties Great Britain: annual report 2013 https://www.gov.uk/government/statistics/reported-road-casualties-great-britain-annual-report-2013.

9 NOISE

9.1 Introduction

This chapter of the ER presents information on the potential effects of the proposed Development on the current noise environment.

Noise surveys have been undertaken to establish ambient and background noise levels. These noise levels have been used to set prospective environmental noise limits for construction works and for post-construction operational noise limits in accordance with planning guidance. Measured ambient noise levels would also be compared with planning guidance, including TAN11 (Ref 9-1), for noise intrusion from industrial development on neighbouring residential development.

9.2 Methodology

The methodology comprises assessing the existing ambient noise environment to establish the baseline conditions. The ambient baseline conditions are then used as a baseline against which to assess the potential construction noise impacts and the operational plant noise impacts.

9.3 Baseline Noise Surveys

The main noise level indices used in this assessment are:

- $L_{Aeq,\,T}$ - the A-Weighted sound pressure level of a steady sound, which contains the same acoustic energy as the noise being assessed over a specific time period, T, and is used in this assessment as the unit of measurement for the average noise level throughout the survey period;
- L_{Amax} - the maximum value that the A-weighted sound pressure level reaches during a measurement period; and
- The L_{A90} is the noise level exceeded for 90% of the measurement period. It is generally used to quantify the background noise level, the underlying level of noise that is present even during the quietest 10% of the measurement period and can be considered to be the ‘average minimum’ noise level.

Baseline noise monitoring surveys were carried out by Hyder Consulting at three locations as agreed with Environmental Health Officer (EHO) at Conwy County Borough Council (CCBC). Continuous monitoring was carried out over a 24-hour period from 9 June 2015 to monitor noise levels over daytime and night time periods. The parameters logged included L_{Aeq}, L_{Amax} and L_{A90} at 10-minute intervals.

9.4 Planning Policy Wales – Technical Advice Note 11

Planning Policy Wales Technical Note 11 (TAN 11- Noise) (Ref 9-1) indicates that, when assessing a proposal for residential development near a source of noise, local planning authorities should determine into which of the four noise exposure categories (NECs) the proposed Development site falls, taking account of both day and night-time noise levels. Local planning authorities should then have regard to the advice in the appropriate NEC, as outlined in Table 9-2 below.

Table 9-2 Noise Exposure Categories

A	Noise need not be considered as a determining factor in granting planning permission, although the noise level at the high end of the category should not be regarded as desirable.
B	Noise should be taken into account when determining planning applications and, where appropriate, conditions imposed to ensure an adequate level of protection.
C	Planning permission should not normally be granted. Where it is considered that permission should be given, for example, because there are no alternative quieter sites available, conditions should be imposed to ensure a commensurate level of protection against noise.
D	Planning permission should normally be refused.

Current and future noise levels have been compared against the criteria in TAN11 (Ref 9-1) to consider the potential noise impacts from the proposed Development. A recommended range of noise levels is given in Table 9-3 for each of the NECs for dwellings exposed to noise from road, rail, air and mixed sources. However, in some cases it may be appropriate for local planning authorities to determine the range of noise levels they wish to attribute to the various NECs. Where there is a clear need for new residential development in an already noisy area some or all NECs might be increased by up to 3dB(A) above the recommended levels. In other cases, a reduction of up to 3dB(A) may be justified.

Table 9-3 Recommended Noise Exposure Categories (TAN 11)

Noise Levels(1) corresponding to the Noise Exposure Categories for New Dwellings $L_{Aeq,T}$dB					
Noise Source		**Noise Exposure Category**			
		A	**B**	**C**	**D**
road traffic	0700-2300	<55	55-63	63-72	>72
	2300-0700(2)	<45	45-57	57-66	>66
rail traffic	0700-2300	<55	55-66	66-74	>74
	2300-0700(2)	<45	45-59	59-66	>66
air traffic(3)	0700-2300	<57	57-66	66-72	>72
	2300-0700(2)	<48	48-57	57-66	>66
mixed sources(4)	0700-2300	<55	55-63	63-72	>72
	2300-0700(2)	<45	45-57	57-66	>66

Notes

(1) ***Noise levels:*** *the noise level(s) ($L_{Aeq,T}$) used when deciding the NEC of a site should be representatives of typical conditions.*

(2) ***Night-time noise levels (2300-0700):*** *sites where individual noise events regularly exceed 82dBL_{Amax} (S time weighting) several times in any hour should be treated as being in NEC C, regardless of the $L_{Aeq,8H}$ (except where the $L_{Aeq,8H}$ already puts the site in NEC D).*

(3) ***Aircraft noise:*** *daytime values accord with the contour values adopted by the Department of Transport which relate to levels measured 1.2m above open ground. For the same amount of noise energy, contour values can be up to 2 dB(A) higher than those of other sources because of ground reflection effects.*

(4) ***Mixed sources:*** *this refers to any combination of road, rail, air and industrial noise sources. The "mixed source" values are based on the lowest numerical values of the single source limits in the table. The "mixed source" NECs should only be used where no individual noise source is dominant.*

To check if any individual noise source is dominant (for the purposes of this assessment) the noise level from the individual sources should be determined and then combined by decibel addition (remembering first to subtract 2 dB(A) from any aircraft noise contour values). If the level of any one source then lies within 2 dB(A) of the calculated combined value, that source should be taken as the dominant one and the site assessed against the appropriate NEC for that source, rather than using the "mixed source" NECs. If the dominant source is industrial noise see paragraph B17 of Annex B.

If the contribution of the individual noise sources to the overall noise level cannot be determined by measurement and/or calculation, then the overall measured level should be used and the site assessed against the NECs for "mixed sources".

TAN 11 (Ref 9-1) states that Local planning authorities must ensure that noise generating development does not cause an unacceptable degree of disturbance. In the case of industrial development, for example, the character of the noise should be taken into account as well as its level. Sudden impulses, irregular noise or noise which contains a distinguishable continuous tone would require special consideration.

TAN 11 (Ref 9-1) also indicates that general guidance on acceptable noise levels within buildings can be found in BS 8233: 1987, which has been updated in 2014 (Ref 9-2).

Formerly a code of practice, the 2014 revision of BS8233: 2014 'Guidance on Sound Insulation and Noise Reduction for Buildings' (Ref 9-2) has recently been issued as a guidance document. The standard is mainly concerned with building design from an acoustic standpoint. It does however contain information relevant to environmental noise more specifically by stating guidance for desirable internal noise levels for dwellings and other buildings. An extract of Table 4 in BS8233 (Ref 9-2) is reproduced in Table 9-4 below.

Table 9-4 Indoor Ambient Noise Levels for Dwellings (Table 4: BS8233-2014)

Activity	Location	07:00 to 23:00	23:00 to 07:00
Resting	Living room	35dB $L_{Aeq,(16hour)}$	-
Dining	Dining room /area	40dB $L_{Aeq,(16hour)}$	-
Sleeping (Daytime resting)	Bedroom	35dB $L_{Aeq,(16hour)}$	30dB $L_{Aeq,(8hour)}$

The information contained within Table 9-4 (Table 4 of BS8233: 2014(Ref 9-2)) is based upon research by the World Health Organisation (WHO) 'Guidelines for Community Noise (Ref 9-3)'.

The WHO Guidelines for Community Noise (Ref 9-3) recommend environmental daytime noise limits to avoid unnecessary annoyance. The maximum external environmental daytime noise is 55dB L_{Aeq} over the 16 hour period (0700 – 2300). For the evening a 45dB $L_{Aeq\ 8\ hour}$ noise level (2300 – 0700) is a recommended maximum outside bedroom windows. This is equivalent to an internal noise level of 30dB L_{Aeq} with a window partially open.

The WHO 'Night noise guidelines for Europe' (Ref 9-4) states that an L_{night}, outside of 40dB should be the target to protect the public, including the most vulnerable groups such as children, the chronically ill and the elderly.

TAN11 (Ref 9-1) requires that industrial noise is considered in terms of BS4142 (Ref 9-5), which has subsequently been updated in 1997 and in 2014.

9.5 Operational Plant Noise (BS4142)

BS 4142:2014 'Methods for rating industrial and commercial sound' (Ref 9-5) is used to determine the impacts of noise from the commercial component of the development upon residential units. The guidance provided within BS 4142 provides a method whereby the likelihood of complaints due to noise from industrial sources can be assessed.

The BS4142 standard (Ref 9-5) advises that the existing background noise levels outside noise sensitive premises are compared with the rating noise levels from any nearby industrial activities. The rating noise level should include corrections for any acoustic character to the noise that makes it more readily discernible to a listener (e.g. whines, crashes, bangs etc.).

The background noise level (L_{A90}) is the noise level that is exceeded for 90% of the monitoring period at the assessment location. For BS 4142 (Ref 9-5) it is usual to measure the background noise level at the nearest noise sensitive receptor to the industrial noise source. The specific noise level is the L_{Aeq} produced by the noise source under investigation, measured as close as possible to the source, over a given reference time interval.

BS4142 (Ref 9-5) also provides corrections that should be applied to the predicted or measured commercial/industrial noise levels where the commercial/industrial noise contains characteristics that make the noise more intrusive. These characteristics include tonality, impulsivity, and intermittency. The corrections can be significant, meaning that noise containing these characteristics may be severely penalised. The corrections are summarised in Table 9-5.

Table 9-5 Corrections for Acoustic Features of Commercial or Industrial Noise

Commercial/industrial noise characteristic	**Perceptibility**		
	Just perceptible	**Clearly perceptible**	**Highly perceptible**
Tonality	+2	+4	+6
Impulsivity	+3	+6	+9
Intermittency	0	+3	+3
Other sound characteristics	0	+3	+3

The greater the difference between rating level and background noise level, the greater the magnitude of impact, as outlined below.

- A difference of around +10dB or more indicates a significant adverse impact, depending on the context;
- A difference of around + 5dB is likely to be an indication of adverse impact, depending on the context; and
- The lower the rating level is relative to the measured background noise level, the less likely it is the specific noise level would have an adverse impact or significant adverse impact.

9.6 Construction Noise

British Standard 5228:2009 +A1: 2014

Construction noise impacts were assessed in accordance with BS 5228 2009 +A1:2014 “Code of practice for noise and vibration control on construction and open sites” – Part1: Noise (Ref 9-6). BS5228: - Part 1 provides recommendations for basic methods of noise and vibration control relating to construction and open sites.

BS5228: - Part 1: Noise (Ref 9-6) provides guidance and recommendations on methods for the calculation of construction noise and the consequential assessment of its impact on those exposed to it.

In addition the Standard makes reference to the legislative background regarding noise control on construction sites, and gives recommendations for basic methods of noise control. The standard provides suitable methods for the calculation of noise from construction activities, including information regarding noise levels from a range of construction equipment.

BS 5228: - Part 1, Annex E (Ref 9-6) gives different methods of guidance on significance of noise effects from construction, and recommends the ABC method to establish construction noise limits.

The ABC method involves rounding the existing ambient noise levels to the nearest 5dB for the appropriate time period (night, evening/weekends or day) and then comparing these levels to the total noise level, including construction noise. If the total noise level exceeds the existing rounded value, then a significant effect is deemed to have occurred. This can be seen more clearly in Table 9-6.

Table 9-6 Threshold of Significant Effect at Dwellings from Construction

Assessment Category and Threshold Value Period	**Threshold Value, in decibels (dB)**		
	Category A	**Category B**	**Category C**
Night-time (23:00 – 07:00)	45	50	55
Evenings and weekends	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

- *Category A is the threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.*
- *Category B is the threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as Category A values.*
- *Category C is the threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than Category A values.*

If the existing ambient noise levels are higher than the threshold values presented in Table 9-6 then a significant effect is deemed to have occurred if the total L_{Aeq} noise level for the period increases by more than 3dB due to construction activity. The ABC method should only apply to residential receptors.

BS 5228 2009 +A1 2014, Part 2: Vibration (Ref 9-7) provides guidance in relation to the effects of construction vibration upon the surroundings. Vibration, even of a very low magnitude, can be perceptible to people. Vibration nuisance is frequently associated with the assumption that, if vibration can be felt then damage is inevitable. However, considerably greater levels of vibration are required to cause damage to buildings and structures. Typically levels of 0.3mm/s may just be perceptible, and levels above 10mm/s may result in cosmetic damage to buildings.

9.7 Traffic Noise

Traffic noise impacts is considered in accordance with the guidance provided in the Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7 HD213/11 'Noise and Vibration' Detailed Assessment methodology (HD213/11) (Ref 9-8).

In the UK, traffic noise is normally assessed using $L_{A10,18hr}$ index, defined as the arithmetic mean of the dB(A) noise levels exceeded for 10% of the time in each of the 18, one-hour periods between 06:00-00:00 on a typical weekday. This takes account of the diurnal variation in traffic noise. Annual average weekday traffic (AAWT) flows, speeds and percentage of heavy vehicles is used to allow for seasonal variations.

HD213/11 provides classification for the magnitude of changes in road traffic noise. A change in road traffic noise of 1dB(A) in the short term (Do-Minimum to Do-Something in the baseline year) is the smallest that is considered perceptible.

In the long term (Do-Minimum in the baseline year to Do-Something in the future assessment year) a 3dB(A) change is considered to be perceptible. The magnitudes of impact in the short and long term are therefore considered to be different. For road traffic noise the classification of magnitude of change is reproduced from HD213/11 in Table 9-7 and Table 9-8 for the short and long term respectively.

Table 9-7 Classification of Magnitude of Noise Impacts in the Short Term

Noise Change $L_{A10, 18 Hour}$	**Magnitude of Impact**
0	No Change
0.1 - 0.9	Negligible
1 - 2.9	Minor
3 - 4.9	Moderate
5 +	Major

Table 9-8 Classification of Magnitude of Noise Impacts in the Long Term

Noise Change $L_{A10, 18 Hour}$	**Magnitude of Impact**
0	No Change
0.1 2.9	Negligible
3 - 4.9	Minor
5 - 9.9	Moderate
10 +	Major

The procedure for predicting the noise level from a road is described in the Department of Transport and Welsh Office Technical Memorandum Calculation of Road Traffic Noise (CRTN) (Ref 9-9) issued by the Department of Transport and Welsh Office, 1988. The prediction method takes into account factors such as the traffic flow, composition and speed, the alignment and distance of the road relative to receiving property, the road surface type, the nature of the intervening ground cover between the road and reflections from building facades in order to calculate the $L_{A10,18\text{-}hr}$ dB noise level.

9.8 Baseline Noise Assessment Results

Baseline noise monitoring surveys were undertaken by Hyder Consulting over a 24 hour period on 9 and 10 June 2015 at the locations indicated on Figure 9-1 Baseline Noise Monitoring Locations.

The baseline noise monitoring surveys locations, which also represent the closest noise receptor locations, are outlined below with distances specified in relation to the proposed Development site boundary:

- NM1 Bryn Cowlyd - 54m;
- NM2 The Stables - 120m; and
- NM3 Conwy Valley Maze (Tu-Hwnt-i'r-Afon) - 110m.

The 24 hour survey data provides for the diurnal differences in ambient noise levels and the noise data has been presented to indicate typical daytime noise levels (0700-2300) and night-time noise levels (2300-0700).

Baseline surveys were carried out using the following instruments as listed in Table 9-8:

Table 9-9 Noise Survey Instrumentation

Location	Instrument	Serial Number
NM1	Rion NL52	00410085
NM2	Rion NL52	00620870
NM3	Rion NL52	00103249

All instruments were calibrated at the start and at the end of the survey period and zero drift was observed. Weather conditions were suitable for noise surveys with calm conditions (no wind) and dry conditions. Site observations are included in Appendix 9.1, which also the full set of baseline noise monitoring survey data. The baseline survey data is summarised in Table 9-10 below.

Table 9-10 Summary of Baseline Noise Survey Data dB(A)

Location	Period	$L_{Aeq.T}$	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
NM1	Daytime (0700-2300	48.8	89.7	32.7	47.1	38.6
	Night-time 2300-0700	44.9	68.7	32.8	42.2	35.7
NM2	Daytime (0700-2300	54.8	96.7	35.9	55.6	39.7
	Night-time 2300-0700	49.2	76.8	35.7	44.6	37.8
NM3	Daytime (0700-2300	50.6	91.8	33.1	47.1	38.3
	Night-time 2300-0700	52.4	85.5	32.6	41.7	35.2

The baseline noise monitoring survey data indicates that the ambient noise levels are generally low with road traffic noise being the most prominent source of noise. The inherent quiet nature of the area is evident when the measured noise levels are compared against the Noise Exposure Categories from TAN 11 (Ref 9-1) as set out in Table 9-2.

The noise survey and assessment locations have been categorised within NEC A, apart from NM3 where night-time noise levels fall within NEC B. The elevated noise levels at NM3 are as a result of an unexplained noise event (noise data in Appendix 9.1) between 03:30 and 04:30 where noise levels were elevated to between 50dB(A) and 68.4dB(A), which elevated the average L_{Aeq} for the night-time period.

9.9 Noise Impact Assessment

The construction and operational noise impacts associated with the proposed Development are considered in this section. The potential construction noise impacts have considered noise from construction plant as well as construction traffic on the adjacent road network.

9.9.1 Construction Noise Assessment

Based on measured ambient noise levels the site would fall under 'Category A' of BS5228-1 and the following thresholds of significance are therefore indicated for construction noise:

- 65dB L_{Aeq} daytime (0700-1900hrs, Sat: 0700-1300hrs);
- 55dB L_{Aeq} evening and weekends (Weekdays 1900-2300hrs, Sat: 1300-2300hrs, Sundays 0700-2300hrs); and
- 45dB L_{Aeq} night-time (2300-0700hrs).

There are no legislated construction noise limits, but generally a limit of 70dB(A) would be deemed an appropriate noise limit in a quieter rural or suburban residential setting where similar baseline noise levels have been recorded.

Given the stage at which the design of the proposed Development is at, there is no detailed construction information available to allow for the assessment of the construction noise impacts. In the absence this information, indicative construction details based upon professional judgement and experience working on similar developments has been considered. Construction works would take place between 06:00hrs and 18:00hrs Monday to Friday and 06:00hrs to 18:00hrs Saturday and Sunday by exception.

The construction noise levels have been predicted with distance from source using the following formula as described in BS5228-1 (Ref 9-6):

$K_h = 20 * \log10 (R/10)$

Where

- K_h = the correction for propagation across hard ground;
- R = the distance to the receptor location; and
- 10 = the distance in metres at which the sound pressure level from the plant has been measured, as recorded in the Tables in BS5228.

The sound pressure levels (L_p) in BS 5228-1 (Ref 9-6) have been presented as a L_{Aeq} at a distance of 10m (Table 9-11). It has been assumed that plant would be operating for long periods of time (“percentage on-time”) so as to present a possible worst case. In clause D1 of BS5228-1 (Ref 9-6) it is indicated that the percentage on-time is the time in the measurement period that the construction plant operates at full power.

Table 9-11 List of Construction Plant and Associated Sound Pressure Level ($L_{Aeq,T}$) in dB at 10m

Plant	**BS5228 Table Reference**	**Sound Pressure L_p at 10m (L_{Aeq} dB)**
Hammer Piling	Table C3 No.1	89
Tracked Excavator	Table C.5 No. 18	80
Dozer	Table C.5 No. 12	77
Dumpers	Table C4 No. 9	77
Vibratory Roller (22t)	Table C5 No. 28	77
Asphalt Paver	Table C5 N0. 33	75
Diesel Generator	Table C4 No. 84	74
Delivery Lorry	Table C.2 No.35	80
Tracked Mobile Crane	Table C4 No.52	75
Telescopic Handler	Table C4 No.54	79
Wheeled Loader	Table C2 No. 26	79
Tower Crane	Table C4 No.49	77
Concrete Saw	Table C4 N0. 71	85
Compressor	Table C5 No.5	75
Excavator	Table C5 No.34	82
Roller Compactor	Table C.5 No.29	76
Water Pump	Table C.2 No.45	65
Concrete Pump & Concrete mixer truck discharging	Table C.4 No. 28	79
Poker Vibrator	Table C.4 No. 33	78
Percussion Drill	Table C4 N0. 69	85
Circular Saw	Table C4 No.72	79
Angle Grinder	Table C4 No.93	80

Potential construction noise impacts would be dependent upon the distance between construction works from receptor locations, therefore noise impacts have been predicted at distances of 10m, 50m, 100m and 200m from the construction works.

The closest residential dwelling is located approximately 150m from the proposed buildings on the Development site (NM3). Works would take place within the proposed Development site away from the site boundary. The distance between receptors and the closest construction works has been considered to present a worst case.

A worst case scenario has also been presented by considering propagation across hard ground and by not considering screening afforded by topographical features, buildings or other structures.

Construction works would commence with mobilisation to site and site preparation followed by physical construction. The noise impacts associated with site clearance are shown in Table 9-12 below.

Table 9-12 Predicted Noise Levels ($L_{Aeq,1hr}$) During Site Clearance

Equipment	Quantity	Plant SPL at 10m L_{Aeq} (dB)	Total SPL @ 10m	Total SPL @20m	Total SPL @ 50m	Total SPL @ 100m	Total SPL @ 200m
Dumpers	2	77	78.5	72.4	64.5	58.5	52.4
Tracked Excavator	1	79	77.5	71.4	63.5	57.5	51.4
Lorry	1	80	78.5	72.4	64.5	58.5	52.4
Roller Compactor	1	76	73.8	67.8	59.8	53.8	47.8
Concrete Saw	1	85	75.0	69.0	61.0	55.0	49.0
Diesel Generator	1	74	74.0	68.0	60.0	54.0	48.0
Total			**84.4**	**78.4**	**70.4**	**64.4**	**58.4**

Given the closest receptor is approximately 110m from the proposed Development site boundary, construction noise levels during site clearance are predicted to be below the weekday threshold of significance of 65dB(A). The threshold of significance is not a noise limit, but is used to indicate significance of impact.

The construction noise levels associated with the excavation of trenches for pipes and services is shown in Table 9-12 below.

Table 9-13 Predicted Noise Levels ($L_{Aeq,1hr}$) for Excavation for Services

Equipment	Quantity	Plant SPL at 10m L_{Aeq} (dB)	Total SPL @ 10m	Total SPL @20m	Total SPL @ 50m	Total SPL @ 100m	Total SPL @ 200m
Excavator	1	82	80	73.8	65.8	59.8	53.8
Telescopic Handler	1	79	77	70.8	62.8	56.8	50.8
Dumpers	1	77	75	68.8	60.8	54.8	48.8
Delivery Lorry	1	80	78	72.4	64.5	58.5	52.4
Roller Compactor	1	76	74	67.8	59.8	53.8	47.8
Generator	1	74	74	68.0	60.0	54.0	48.0
Total			**85**	**78.6**	**70.7**	**64.7**	**58.6**

Given the closest receptor is approximately 110m from the proposed Development site boundary, construction noise levels during excavation for services are predicted to be below the threshold of significance of 65dB(A).

Table 9-14 Predicted Noise Levels ($L_{Aeq,1hr}$) for Building Construction

Equipment	Quantity	Plant SPL at 10m L_{Aeq} (dB)	Total SPL @ 10m	Total SPL @20m	Total SPL @ 50m	Total SPL @ 100m	Total SPL @ 200m
Diesel Generator	1	72	72	66.0	58.0	52.0	46.0
Dumpers	1	77	75	68.8	60.8	54.8	48.8
Telescopic Handler	1	79	77	70.8	62.8	56.8	50.8
Concrete Pump & Concrete mixer truck discharging	1	79	77	71.4	63.5	57.5	51.4
Poker Vibrator	1	78	77	71.0	63.1	57.0	51.0
Tower Crane	1	77	75	68.8	60.8	54.8	48.8
Hammer Piling	1	89	86	80.0	72.0	66.0	60.0
Total			**88**	**82.0**	**74.0**	**68.0**	**62.0**

Given the closest receptor is approximately 110m from the proposed Development site boundary, construction noise levels during construction of the buildings are predicted to be slightly above the threshold of significance of 65dB(A). The predicted noise levels are unmitigated levels and assume that all plant would run simultaneously. The predicted noise levels are however below the suggested daytime noise limit of 70dB(A).

Table 9-15 Predicted Noise Levels ($L_{Aeq,1hr}$) for Building Fit Out

Equipment	Quantity	Plant SPL at 10m L_{Aeq} (dB)	Total SPL @ 10m	Total SPL @20m	Total SPL @ 50m	Total SPL @ 100m	Total SPL @ 200m
Percussion Drill	1	85	81	75.0	67.0	61.0	55.0
Lorry	1	79	77	71.4	63.5	57.5	51.4
Dumpers	1	77	75	68.8	60.8	54.8	48.8
Circular Saw	1	79	75	69.0	61.0	55.0	49.0
Angle Grinder	1	80	76	70.0	62.0	56.0	50.0
Tower Crane	1	77	75	69.4	61.5	55.5	49.4
Total			**84**	**78.4**	**70.5**	**64.5**	**58.4**

Given the closest receptor is approximately 110m from the proposed Development site boundary, construction noise levels during building fit out are predicted to be below the threshold of significance of 65dB(A).

The predicted construction noise levels in Table 9-12 to Table 9-15 above have been compared against daytime thresholds of significance and suggested noise limits for daytime hours. While works would generally be confined to daytime hours, there is the possibility of certain construction works outside of normal daytime hours. Limited construction works may be carried out between 06:00hrs and 07:00hrs Monday to Friday; 13:00hrs to 18:00hrs Saturday and 06:00hrs to 18:00 hrs Sunday.

While there are no legislated construction noise limits, BS5228-1 (Ref 9-6) suggests more stringent noise limits for construction works in the evening, over weekends and at night. The thresholds of significance set out in BS5228-1 (Ref 9-6) and suggested noise limits are set out in Table 9-16.

Table 9-16 Construction Noise Thresholds and Limits for Various Time Periods

Period		Threshold of Significance	Suggested Noise Limit
Monday to Friday	0600-0700	45	55
Weekday	0700-1800	65	70
Saturday	0600-0700	45	55
Saturday	0800-1300	65	70
Saturday	1300-1400	55	65
Saturday	1400-1800	55	65
Sunday	0600-0700	45	55
Sunday	0700-1800	55	65

The details of the construction works to be carried out outside of normal daytime working hours are unknown at this stage. To allow for comparison of potential construction noise levels against the noise criteria for the various daytime periods in 9-16, construction noise levels have been predicted for the all the construction works considered above at each of the considered noise sensitive receptor locations. It is unlikely that all works would need to be carried out outside of normal daytime hours and therefore presents a worst case scenario.

The separation distance between construction works and receptor locations has been taken as the closest distance from each receptor location to any of the proposed buildings to be constructed on the proposed Development site.

The comparison of the predicted noise levels against the threshold of significance criteria and the suggested noise limits is detailed in Table 9-17. Exceedances of the thresholds of significance and the suggested noise limits are indicated by the text in red.

Table 9-17 Assessment of Construction Noise Levels against Criteria for Various Time Periods

Construction Activity	Period		NM1			NM2			NM3		
			Noise Level (Lp)	Exceedance of Threshold of Significance	Exceedance of Suggested Noise Limit	Noise Level (Lp)	Exceedance of Threshold of Significance	Exceedance of Suggested Noise Limit	Noise Level (Lp)	Exceedance of Threshold of Significance	Exceedance of Suggested Noise Limit
Site Preparation	Monday to Friday	0600-0700	56.8	11.8	1.8	60.1	15.1	5.1	60.9	15.9	5.9
	Weekday	0700-1800	56.8	-8.2	-13.2	60.1	-4.9	-9.9	60.9	-4.1	-9.1
	Saturday	0600-0700	56.8	11.8	1.8	60.1	15.1	5.1	60.9	15.9	5.9
	Saturday	0800-1300	56.8	-8.2	-13.2	60.1	-4.9	-9.9	60.9	-4.1	-9.1
	Saturday	1300-1400	56.8	1.8	-8.2	60.1	5.1	-4.9	60.9	5.9	-4.1
	Saturday	1400-1800	56.8	1.8	-8.2	60.1	5.1	-4.9	60.9	5.9	-4.1
	Sunday	0600-0700	56.8	11.8	1.8	60.1	15.1	5.1	60.9	15.9	5.9
	Sunday	0700-1800	56.8	1.8	-8.2	60.1	5.1	-4.9	60.9	5.9	-4.1
Excavation for Pipes and services	Monday to Friday	0600-0700	57.0	12.0	2.0	60.3	15.3	5.3	61.1	16.1	6.1
	Weekday	0700-1800	57.0	-8.0	-13.0	60.3	-4.7	-9.7	61.1	-3.9	-8.9
	Saturday	0600-0700	57.0	12.0	2.0	60.3	15.3	5.3	61.1	16.1	6.1

Construction Activity	Period		NM1			NM2			NM3		
			Noise Level (Lp)	Exceedance of Threshold of Significance	Exceedance of Suggested Noise Limit	Noise Level (Lp)	Exceedance of Threshold of Significance	Exceedance of Suggested Noise Limit	Noise Level (Lp)	Exceedance of Threshold of Significance	Exceedance of Suggested Noise Limit
	Saturday	0800-1300	57.0	-8.0	-13.0	60.3	-4.7	-9.7	61.1	-3.9	-8.9
	Saturday	1300-1400	57.0	2.0	-8.0	60.3	5.3	-4.7	61.1	6.1	-3.9
	Saturday	1400-1800	57.0	2.0	-8.0	60.3	5.3	-4.7	61.1	6.1	-3.9
	Sunday	0600-0700	57.0	12.0	2.0	60.3	15.3	5.3	61.1	16.1	6.1
	Sunday	0700-1800	57.0	2.0	-8.0	60.3	5.3	-4.7	61.1	6.1	-3.9
Building Structures	Monday to Friday	0600-0700	60.4	15.4	5.4	63.6	18.6	8.6	64.5	19.5	9.5
	Weekday	0700-1800	60.4	-4.6	-9.6	63.6	-1.4	-6.4	64.5	-0.5	-5.5
	Saturday	0600-0700	60.4	15.4	5.4	63.6	18.6	8.6	64.5	19.5	9.5
	Saturday	0800-1300	60.4	-4.6	-9.6	63.6	-1.4	-6.4	64.5	-0.5	-5.5
	Saturday	1300-1400	60.4	5.4	-4.6	63.6	8.6	-1.4	64.5	9.5	-0.5
	Saturday	1400-1800	60.4	5.4	-4.6	63.6	8.6	-1.4	64.5	9.5	-0.5
	Sunday	0600-0700	60.4	15.4	5.4	63.6	18.6	8.6	64.5	19.5	9.5
	Sunday	0700-1800	60.4	5.4	-4.6	63.6	8.6	-1.4	64.5	9.5	-0.5

Construction Activity	Period		NM1			NM2			NM3		
			Noise Level (Lp)	Exceedance of Threshold of Significance	Exceedance of Suggested Noise Limit	Noise Level (Lp)	Exceedance of Threshold of Significance	Exceedance of Suggested Noise Limit	Noise Level (Lp)	Exceedance of Threshold of Significance	Exceedance of Suggested Noise Limit
Building Fit-out	Monday to Friday	0600-0700	56.9	11.9	1.9	60.1	15.1	5.1	60.9	15.9	5.9
	Weekday	0700-1800	56.9	-8.1	-13.1	60.1	-4.9	-9.9	60.9	-4.1	-9.1
	Saturday	0600-0700	56.9	11.9	1.9	60.1	15.1	5.1	60.9	15.9	5.9
	Saturday	0800-1300	56.9	-8.1	-13.1	60.1	-4.9	-9.9	60.9	-4.1	-9.1
	Saturday	1300-1400	56.9	1.9	-8.1	60.1	5.1	-4.9	60.9	5.9	-4.1
	Saturday	1400-1800	56.9	1.9	-8.1	60.1	5.1	-4.9	60.9	5.9	-4.1
	Sunday	0600-0700	56.9	11.9	1.9	60.1	15.1	5.1	60.9	15.9	5.9
	Sunday	0700-1800	56.9	1.9	-8.1	60.1	5.1	-4.9	60.9	5.9	-4.1

In Table 9-16 it is indicated that works prior to 08:00 hours and works on Saturday after 13:00 or on Sundays may result in exceedances of the thresholds of significance and/ or the suggested noise limits for those respective periods.

The construction noise levels described in Table 9-16 are unmitigated noise levels and therefore mitigation measures as listed in Section.9.10.1 would need to be implemented to reduce potential construction noise impacts.

9.9.2 Construction Traffic

Traffic data has been provided to indicate traffic noise levels on the B5106 that forms the western boundary of the proposed Development site and the B5279. The traffic data has been presented as an 18hr AAWT and as a 1-hour AAWT (Annual Average Weekday Traffic) for the AM peak period. It is assumed that during the morning peak construction staff would arrive for work and this would coincide with the bulk the construction deliveries to site.

The 18 hour AAWT and 1 hour AAWT traffic data allows for calculation of the noise levels in accordance with CRTN (Ref 9-9).

The 18hour L_{A10} noise level is calculated using the following formula:

Basic Noise Level L_{10} (18 hour) = $29.1 + 10\text{Log}_{10}\ Q$ dB(A)

Where

- Q is the volume vehicles in the 18 hour period.

The 1 hour LA10 Noise level is calculated using the following formula.

Basic Noise Level $L_{10} = 42.2 + 10\ \text{Log}_{10}\ q$

Where

- q is the hourly AAWT vehicle volume.

The correction for speed and percentage HGVs is obtained using the following correction factor.

Correction = $33\ \text{Log}_{10}\ (V + 40 + 500/V) + 10\text{Log}_{10}\ (1 + 5p/V) – 68.8$dB(A)

Where

- V = vehicle speed in km/h; and
- P = percentage HGVs

The $L_{A10\ 18}$ hour noise levels without and with construction traffic is shown in Table 9-18.

Table 9-18 $L_{A10\ 18\ hour}$ Noise Levels Without and With Construction

Link	Scenario	Total Vehicles	Percentage HGVs	Speed	$L_{10\ 18hr}$	Difference dB(A)
B5106 (outside the site entrance)	Without Construction	1819	1.6	53.9	59.8	0.5
B5106 (outside the site entrance)	With Construction	2161	10.7	53.9	60.3	
B5279	Without Construction	1978	4	57.7	60.6	0.2
B5279	With Construction	2320	12.1	57.7	60.8	

The $L_{A10\ 1}$ hour noise levels for the peak AM period, without and with construction traffic are shown in Table 9-19.

Table 9-19 $L_{A10\ 1\ hour}$ Noise Levels Without and With Construction

Link	Scenario	Total Vehicles	Percentage HGVs	Speed	$L_{10\ 1hr}$	Difference dB(A)
B5106 (outside the site entrance)	Without Construction	149	1.4	55.4	62.0	1.6
B5106 (outside the site entrance)	With Construction	229	5.2	55.4	63.6	
B5279	Without Construction	174	4	63.2	63.1	1.2
B5279	With Construction	254	7	63.2	64.3	

Construction traffic noise would be of relatively short duration, occurring while construction is in progress. The increase in road traffic noise as a result of construction traffic is therefore assessed in accordance with the DMRB criteria (Ref 9-8) for noise in the short term (Table 9-7).

The increase in daytime traffic noise levels ($L_{A10,\ 18hr}$) is indicated to be below 1dB(A) which, in terms of the criteria for magnitude of change in DMRB is considered ‘Negligible’.

The increase in noise for the morning peak hour is indicated to be 1.6dB(A) on the B5106 and 1.2dB(A) on the B5279. In terms of the DMRB this increase is considered ‘Minor’.

9.9.3 Operational Plant

The full design details for the operational plant to be installed on site have yet to be finalised. The indicative plant to be installed on site is indicated in Table 9-20.

Table 9-20 Indicative Plant to be Installed on Site

Machine/Equipment	Location	Frequency of Running
Hydro Turbine – Free discharge, Pelton wheel	DAF Building	1 unit running continuously
DAF Recycle Pumps - centrifugal	DAF Building	Continuous
Saturator Compressors - reciprocating contained within an acoustic enclosure	DAF Building	30 minutes every 2 hours
Inter-stage Pumps - vertical turbine	RGF Building	2 continuously, more during high WTW flows
Air Scour Blowers – in acoustic covers	RGF Building	10 minutes every 2 hours
Clean Wash Water Pumps – either vertical turbine or submersible	RGF Building	10 minutes every 2 hours
Sludge Dewatering Centrifuge	Centrifuge Building	Not Known
Emergency Discharge Pumps – canister submersible	Chamber	Emergency only <10 times per year
Standby Diesel Generator Sets	Generator Building	Emergency only – but tested for 1 hr monthly
Sludge Tank Mixer Pumps – flygt dry well	Outdoors	Continuous
Sludge Transfer Pumps – Progressing Cavity Pumps	Outdoors	Not Known

The DCWW Mechanical Specification General Mechanical Requirements June 2011 (Ref 9-10) stipulates that the sound pressure levels emitted by any combination of running plant under normal conditions located within a building shall be the lowest reasonably practicable but shall not exceed the lower exposure action level of 80dB(A) when measured at a distance of 1m from the reference surface of that item. The Specification Manual (Ref 9-10) stipulates a series of design noise limits which are outlined in Table 9-21.

Table 9-21 Design Specification Target Noise Levels

Location	Maximum Noise Level
At any point outside of buildings, including sound pressure levels generated by both Plant and processes	75 dB(A)
1m from an operating item of plant	80 dB(A)
Inside all plant rooms and buildings	80 dB(A)
Inside all mess and rest rooms	65 dB(A)
Inside all control rooms and offices	55 dB(A)

The Specification Manual (Ref 9-10) specifies that maximum noise level for plant shall be as measured at 1m from the item and that sound attenuation systems shall be provided for plant in order to achieve the required external levels.

The design target noise levels have been used to predict the noise levels at nearby receptor locations. The noise levels assigned to the plant to be installed internally to buildings and externally are shown in Table 9-22 together with the combined internal sound pressure level for each building.

Table 9-22 Plant Noise Levels dB(A)

Plant	Number	Sound Pressure dB(A) @ 1m	Combined Plant Sound Pressure dB(A)
Dissolved Air Flotation(DAF) Building			
Hydro Turbine – Free discharge, Pelton wheel	1	80	80.0
DAF Recycle Pump - centrifugal	1	80	80.0
Saturator Compressor - reciprocating contained within an acoustic enclosure	1	80	80.0
Total Sound Pressure dB(A)			**84.8**
Rapid Gravity Filtration (RGF) Building			
Inter-stage Pumps - vertical turbine	2	80	83.0
Air Scour Blowers – in acoustic covers	1	80	80.0
Clean Wash Water Pumps – either vertical turbine or submersible	2	80	83.0
Saturator Compressors - reciprocating contained within an acoustic enclosure	1	80	80.0
Total Sound Pressure dB(A)			**87.8**
Centrifuge Building			
Sludge Dewatering Centrifuge	1	80	80.0
Total Sound Pressure dB(A)			**80.0**
Chamber			
Emergency Discharge Pumps – canister submersible	1	80	80.0
Total Sound Pressure dB(A)			**80.0**
Generator Building			
Standby Diesel Generator Sets	1	80	80.0
Total Sound Pressure dB(A)			**80.0**
External			
Sludge Tank Mixer Pumps – flygt dry well	1	75	75.0
Sludge Transfer Pumps – Progressing Cavity Pumps	1	75	75.0
Total Sound Pressure dB(A)			**78.0**

The final design of the proposed building envelopes has yet to be defined. It has been indicated that buildings would be constructed with concrete walls with a clad portal frame above. Cladding materials have yet to be specified; however Kingspan KS1000 RW composite panels have been used on DCWW structures previously.

Sound transmission through a massive wall depends primarily on the mass of the construction. Details are unknown at this stage. Building Bulletin 93 (BB93) (Ref 9-11) provides information on the sound reduction index (SRI) for common building materials. A 100m concrete would (2,300 g/m^3) have a sound reduction index of 47dB.

It is acknowledged that the SRI for the building envelope would depend on the acoustic performance of all materials used in the construction of the building. However at this stage it is not possible to calculate a composite SRI for the building envelopes.

The sound reduction index of 47dB(A) has been used to calculate the external noise level for the buildings using the following formula:

Lp (external) = Lp (internal) – Rw – 6

The external noise levels for the proposed buildings on site are shown in Table 9-23.

Table 9-23 Plant Noise Levels External to Buildings

Building	Internal L_p dB(A)	External L_p dB(A)
DAF Building	84.8	31.8
RGF Building	87.8	34.8
Centrifuge Building	80.0	27.0

The plant noise levels external to the buildings and the noise levels from external plant have been used to predict noise levels at the closest receptor locations. The plant noise levels have been corrected for distance attenuation to indicate the $L_{Aeq, T}$ levels at each receptor location as shown in Table 9-24.

Table 9-24 Predicted Free-Field $L_{Aeq,T}$ Noise Levels at Receptor Locations

Noise Source	NM1		NM2		NM3	
	Distance (m)	Sound Pressure L_p	Distance (m)	Sound Pressure L_p	Distance (m)	Sound Pressure L_p
DAF Building	281	0	195	0	152	-11.9
RGF Building	262	0	171	0	184	-10.5
Centrifuge Building	240	0	154	0	188	-18.5
External Plant	246	30.2	146	34.7	163	33.8

Table 9-24 indicates that noise breakout from the buildings would result in noise levels that would not be audible at nearby receptor locations. External plant would however have the potential to be audible.

BS412 Assessment

BS4142 (Ref 9-5) requires that the noise rating level (L_{ArTr}) is compared against the background (L_{A90}) noise level. The noise rating level is obtained by allocating a correction for specific acoustic features to the predicted or specific plant noise level.

The corrections for specific acoustic features as set out in Table 9-5 consider acoustic features such as tonality, intermittency, impulsivity and other acoustic features. The proposed internal plant has been shown to be inaudible at receptor locations. External plant may however be audible at considered receptors. The acoustic characteristics of the external plant (sludge tank mixer pumps and sludge transfer pumps) are unknown. However pumps are likely to present tonal characteristics rather than impulse or intermittent characteristics. For the purposes of this assessment, a worst case has been presented and a correction of +6dB has been applied for highly perceptible tones to obtain the noise rating level.

The BS4142 (Ref 9-5) assessment has considered night-time background (L_{A90}) noise levels as the night-time L_{A90} levels are lower than daytime. The night-time period is also considered more sensitive as noise from industrial plant may cause sleep disturbance.

BS4142 indicates that the background noise level is not the lowest measured background sound level, but rather what is typical during particular time periods. The background noise levels as measured at noise monitoring locations NM1, NM2 and NM3 have therefore been analysed to obtain the representative background noise level at each receptor location. The statistical analysis of the background (L_{A90}) noise level for each monitoring location is shown in Table 9-25.

Table 9-25 Statistical Analysis of Background (L_{A90}) Noise Data

	NM1	NM2	NM3
Average	35.7	37.8	35.2
Mode	33.8	36.6	33.3
Min	33.6	36.4	33.3

At NM3 the most frequently recorded and the lowest L_{A90} level is 33.3dB(A). The plant noise rating level has therefore been assessed against a L_{A90} level of 33dB(A) as shown in Table 9-26.

Table 9-26 BS4142 Assessment of Plant Noise

Receptor	Plant Sound Pressure L_p	Noise Rating Level $L_{Ar,Tr}$	Background Noise Level L_{A90}	Difference	Assessment
NM1	30	36	33	3 dB	Adverse Impact
NM2	35	41	33	8 dB	Adverse Impact
NM3	34	40	33	7 dB	Adverse Impact

Table 9-26 indicates that there would be an adverse impact from external plant to be installed on site should that plant run at the external noise limit of 70dB(A) set out in the Welsh Water Mechanical Specification Manual (Ref 9-10). Mitigation would therefore need to be considered as set out below.

BS8233 Assessment

BS8233 (Ref 9-2) sets target noise levels for inside bedrooms of residential dwellings. The predicted noise level at the façade of the residential buildings is shown in Table 9-27. An internal noise target of 30dB(A) is recommended for bedrooms at night. BS8233 (Ref 9-2) indicates that an open window can be expected to reduce noise levels by 15dB. Assuming open windows in summer, the predicted internal noise levels are shown in Table 9-27.

Table 9-27 BS8233 Assessment of Plant Noise

Receptor	Plant L_p at façade dB(A)	Internal Noise Level dB(A)	BS8233 Internal Noise Limit dB(A)
NM1	33.2	18.2	30
NM2	37.7	22.7	30
NM3	36.8	21.8	30

Plant noise levels are shown in Table 9-27 to be well below the night-time design noise limit of 30dB(A) as recommended in BS8233 (Ref 9-2).

9.10 Assessment of Potential Effects and Mitigation

9.10.1 Construction Noise

Unmitigated construction noise levels are indicated to be below a recommended daytime noise limit of 70dB(A) and would not be considered Significant. Methods of construction are as yet unknown, however best practicable means would be used as to ensure noise from each of these processes is minimised.

In accordance with good working practices, the principles of the “best practicable means” (BPM), as defined in the Control of Pollution Act (1974) (Ref 9-12) would be used to reduce noise and vibration emissions throughout the demolition and construction periods. This would incorporate the use of measures to control noise and vibration that do not unreasonably inhibit the work, and the use of working methods that result in minimum effects compatible with normal working practices.

Noise control measures consistent with good working practices would be implemented during the construction phase. Noise and vibration control measures would be implemented within a Construction Environmental Management Plan (CEMP) in consultation with CCBC.

Particular care would be required in the vicinity of residential properties, for example by using quieter, well maintained plant working close to receptors. Liaison with the EHO at CCBC would take place prior to commencement of construction to ensure that appropriate and adequate means of mitigation are applied throughout the construction work. Routine forms of noise and vibration control would be implemented during all phases of construction work. Control measures routinely applied in this way are likely to include the following:

- There is a possibility of construction works between 06:00 and 18:00 hours each day of the week, including Saturday and Sunday. Where possible, construction works would be limited site work where possible to daytime hours, i.e. 06:00-18:00 hours Monday to Friday, 07:00-13:00 hours on Saturdays.
- Noisier activities such as piling, use of concrete saws, angle grinders or similar would be restricted to daytime hours, i.e. 06:00-18:00 hours Monday to Friday.
- Adhere to relevant standards, such as BS 5228 -1 (Ref 9-6) and BS5228-2 (Ref 9-7) to control noise and vibration on site.
- Careful selection of plant and construction methods. Only plant conforming to relevant national, EU or international standards, directives and recommendations on noise and vibration emissions would be used.
- Design and use of site enclosures, housing and temporary stockpiles, where practicable and necessary, to provide acoustic screening at the earliest opportunity. Temporary noise barriers would be used to reduce noise levels where appropriate and practicable. Such measures can be particularly appropriate for stationary or near-stationary plant such as pneumatic breakers, piling rigs and compressors. Barriers would be located as close to the plant as possible and, in order to provide adequate attenuation, would have a mass per unit area of at least 7 kg/m^2.

- All vehicles and mechanical plant used for the purpose of the work shall be fitted with effective exhaust silencers and shall be maintained in good and efficient working order and operated to minimise noise emissions.
- All compressors and generators shall be "sound reduced" models fitted with properly lined and sealed acoustic covers which shall be kept closed whenever the machines are in use, and all pneumatic percussive tools shall be fitted with mufflers or silencers of the type recommended by the manufacturers.
- All machines in intermittent use shall be shut down in the intervening periods between works or throttled down to a minimum. Lorry engines would be switched off when vehicles are stationary. Noise emitting equipment which is required to run continuously shall be housed in a suitable acoustic enclosure.
- Percussive piling would only be used where no other suitable system is available.
- Plant and equipment liable to create noise and/or vibration whilst in operation would, as far as reasonably practicable, be located away from sensitive receptors and away from walls reflecting towards sensitive receptors.
- Where reasonably practicable, fixed items of construction plant would be electrically powered in preference to diesel or petrol driven.
- Machines in intermittent use would be shut down or throttled down to a minimum during periods between works. Static noise emitting equipment operating continuously would be housed within suitable acoustic enclosure, where appropriate.
- All generators and compressors would be 'sound reduced' models fitted with acoustic lining/sealed acoustic covers where appropriate. All ancillary pneumatic percussive tools would be fitted with mufflers or silencers as recommended by the manufacturer.
- Reversing alarms incorporating one of more of the features listed below or any other comparable system would be used where reasonably practicable:
  - Highly directional sounders;
  - Use of broad band signals;
  - Self-adjusting output sounders; and
  - Flashing warning lights.

9.10.2 Construction Traffic

Potential construction traffic noise impacts are indicated to be Negligible for the daytime period and Minor during the peak morning period when contractors arrive on site and the bulk of deliveries are likely to take place.

Considering that the potential increase in noise is Negligible to Minor and that the increase would be for duration of construction works, no further mitigation is proposed to that outlined in Section 9.10.1.

9.10.3 Operational Plant

Given the stage at which the design of proposed Development is, there is limited information on the fixed plant to be installed on site and there is limited detail on the design of the building envelope that would allow for accurate prediction of the noise breakout from the proposed buildings.

BS 4142 (Ref 9-5) requires that the potential influence of uncertainty upon the assessment be reported. The following steps have been taken to minimise uncertainty affecting the measurement values:

Class 1 Instrumentation has been used for all measurements and a field calibration check was carried out both before and after the measurement period using a Reference Sound Calibrator that has been calibrated to UKAS standards.

An outdoor microphone protection system was used to reduce sound attributable to wind at the microphone. Site measurements were also scheduled for a period when wind speeds were not expected to be high and this was confirmed by on site measurements and observations.

There is a high uncertainty with regard to the acoustic data for the plant to be installed on site and the details regarding the attenuation afforded by the building envelope.

External plant is likely to present the highest potential noise impacts at nearby residential receptors. Fixed plant to be installed on site would need to operate at noise levels that ensure the noise rating levels ($L_{Ar,Tr}$) are below the background noise level. Current background noise levels indicate that plant noise would need to be below 33dB(A) at the closest receptors. The appropriate design of fixed plant would be considered at detailed design stage. The acoustic features of each item of plant would need to be considered so that the appropriate corrections set out in BS4142 (Ref 9-5) can be applied in deriving the noise rating level ($L_{Ar,Tr}$).

Noise from plant to be installed within the proposed buildings can be controlled by selection of quieter plant and screening methods within buildings. The building envelope can be designed to reduce noise breakout by selecting materials with a high SRI.

Noise levels within the proposed buildings would be reduced by applying sound absorbing materials on the inside walls and ceilings and for lining air ducts. In addition, acoustic doors and louvres would be used to reduce noise transfer to outside.

Acoustic lourvres of the correct design would also be used for the exhausts and inlets to reduce fan noise. In-lets and outlets would be in rounded or bell-mouth shapes to avoid turbulence. All connection points would be fitted with flexible joints to avoid transfer of noise via pipework and other services.

Vibrations form the machines would be transmitted to the building structure via the physical joints. Therefore, all pipes and ducts would be mechanically isolated from machines, using flexible connectors. Spring-type isolators are effective in reducing the vibration and noise generating from plant to the floor.

9.11 Summary and Conclusions

Potential construction noise impacts would not be considered significant from the proposed works when works are confined to daytime hours and best practicable means is considered to mitigate noise impacts. Construction works outside of normal hours, prior to 08:00 hours in the morning, after 13:00 hours on a Saturday or on a Sunday is likely to result in exceedances of suggested noise limits. Only where essential would construction works be carried out during these times and appropriate mitigation would need to be implemented.

Potential construction traffic noise impacts are also considered to be Negligible, with peak traffic periods likely to result in Minor noise impacts.

There is limited detail available at this stage for detailed consideration of noise impacts associated with operational plant to be installed as part of the proposed Development. Current baseline noise levels measured at three nearby receptor locations include noise from existing site operations. Noise levels are low, with traffic noise identified as the most prominent source of noise. Baseline noise levels indicate that the current noise contribution from the Bryn Cowlyd works does not contribute significantly to the baseline noise environment.

The lack of detail regarding the plant to be installed on site and the acoustic performance of the building fabric creates uncertainty in the findings of the BS4142 assessment (Ref 9-5). Further detailed assessment would need to be carried out to meet operational plant noise limits that would be set as a planning condition by CCBC.

9.12 References

Ref 9-1 Technical Advice Note (Wales) 11 – Noise (TAN 11) (Welsh Assembly Government, 1997).

Ref 9-2 Sound insulation and noise reduction for buildings - code of practice. BS8233: 2014. (British Standards Institute, 2014).

Ref 9-3 Guidelines for Community Noise (World Health Organisation, (1999).

Ref 9-4 Night Noise Guidelines for Europe (WHO, 2009).

Ref 9-5 Methods for rating industrial and commercial sound. BS 4142: 2014. (British Standards Institute, 2014).

Ref 9-6 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. BS 5228:2009 +A1 2014. (British Standards Institute, 2014).

Ref 9-7 Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration. BS 5228:2009 +A1 2014. (British Standards Institute, 2014).

Ref 9-8 Design Manual for Roads and Bridges (DMRB) Volume 11 Section 3 Part 7 HD213/11 ‘Noise and Vibration’ Detailed Assessment methodology (HD213/11) (Highways Agency, 2011).

Ref 9-9 Calculation of Road Traffic Noise (CRTN) (Department of Transport and Welsh Office, 1988).

Ref 9-10 Water Mechanical Specification General Mechanical Requirements. Document ID: MS101 version 2 June 2011. (DCWW, 2011).

Ref 9-11 Building Bulletin 93 (BB93) (Department of Education and Skills, 2015).

Ref 9-12 Control of Pollution Act (1974).

9.13 Glossary

Acoustic barrier	Solid walls or partitions, solid fences, earth mounds, buildings, etc. used to reduce noise, without eliminating it.

Air-borne noise This refers to noise which is fundamentally transmitted by way of the air and can be attenuated by the use of barriers and walls placed physically between the noise and receiver.

Ambient sound The totally encompassing sound in a given situation at a given time, usually composed of sound from all sources near and far.

Assessment Period The period in a day over which assessments are made.

Audible range The limits of frequency which are audible or heard as sound. The normal ear in young adults detects sound having frequencies in the region 20 Hz to 20 kHz, although it is possible for some people to detect frequencies outside these limits.

Background Noise Background noise is the term used to describe the noise measured in the absence of the noise under investigation. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{90} noise level (see below).

Broadband Containing the full range of frequencies.

Decibel [dB] The level of noise is measured objectively using a Sound Level Meter. This instrument has been specifically developed to mimic the operation of the human ear. The human ear responds to minute pressure variations in the air. These pressure variations can be likened to the ripples on the surface of water but of course cannot be seen. The pressure variations in the air cause the eardrum to vibrate and this is heard as sound in the brain. The stronger the pressure variations, the louder the sounds are heard. The range of pressure variations associated with everyday living may span over a range of a million to one. On the top range may be the sound of a jet engine and on the bottom of the range may be the sound of a pin dropping. Instead of expressing pressure in units ranging from a million to one, it is found convenient to condense this range to a scale 0 to 120 and give it the units of decibels.
The following are examples of the decibel readings of every day sounds;

Four engine jet aircraft at 100m	120 dB
Riveting of steel plate at 10m	105 dB
Pneumatic drill at 10m	90 dB
Circular wood saw at 10m	80 dB
Heavy road traffic at 10m	75 dB
Telephone bell at 10m	65 dB
Male speech, average at 10m	50 dB
Whisper at 10m	25 dB
Threshold of hearing, 1000 Hz	0 dB

dB(A): A-weighted decibels The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same dB level are not perceived to be as loud as high frequency sounds. The sound level meter replicates the human response of the ear by using an electronic filter which is called the "A" filter. A sound level measured with this filter switched on is denoted as dB(A). Practically all noise is measured using the A filter. The sound pressure

	level in dB(A) gives a close indication of the subjective loudness of the noise.
Free-Field	A situation in which the radiation from a sound source is completely unaffected by the presence of any reflecting surfaces.
Heavy vehicle (HGV)	Heavy vehicles are assumed to be buses, rigid trucks and semi-trailer trucks with a weight greater than 3 tonnes. Also heavy vehicles can be defined in terms of length as buses, or trucks with a length exceeding 5.25 metres.
Ln noise Descriptors	Because noise varies with time, a single noise value cannot adequately define the noise ambient. For this reason, the acoustic environment is described using a number of noise level descriptors as follows;
L10	The sound pressure level that is exceeded for 10% of the time for which the given sound is measured.
L90	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L90 noise level expressed in units of dB(A).
Leq	The Equivalent sound pressure level - the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring.
LAmax	The maximum RMS A-weighted sound pressure level occurring within a specified time period.
Loudness	A rise of 10 dB in sound level corresponds approximately to a doubling of subjective loudness. That is, a sound of 85 dB is twice as loud as a sound of 75 dB which is twice as loud as a sound of 65 dB and so on. That is, the sound of 85 dB is 400 times the loudness of a sound of 65 dB.
Microphone	An electro acoustic transducer which receives an acoustic signal and delivers a corresponding electric signal.
Noise	Sound which a listener does not wish to hear.
Noise monitor	A sound level meter.
Rating Level (LA,r,Tr)	The noise level of an industrial noise source which includes an adjustment for the character of the noise. Used in BS 4142.
Rw	The weighted sound reduction index is a laboratory measurement of the sound insulating properties of a building material or building element
Sound	A fluctuation of air pressure which is propagated as a wave through air.
Sound Level Meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound Power Level	

(Lw)	The sound energy radiated per unit time by the sound source when measured on the decibel scale.
Sound Pressure Level (Lp)	The fluctuations in air pressure, from the steady atmospheric pressure, created by sound, when measured on the decibel scale.

FIGURES

A3

NOTES:

02	14.07.15	NT	CAULMERT UPDATES	GT	PP	14.07.15
01	02.07.15	NT	PRELIMINARY	GT	PP	02.07.15
Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf
Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name. BRYN COWLYD WTW

Drawing Title. FIGURE 2.1
INDICATIVE SITE LOCATION PLAN

Suitability. WORK IN PROGRESS
Suitability Code. S0

Originator. NT
Designer. PP
Date. 02/07/15

Internal Project Number. UA007911
Scale. 1:25000
Rev. 02

Drawing Number. 1279-W-201-HYD-XX-XX-DR-09004

A1

NOTES:

▬ EXISTING SITE BOUNDARY
🟥 EXISTING FLOOD DEFENCES

KEY PLAN

THIS DRAWING IS INTENDED TO BE USED FOR LOCAL AUTHORITY TOWN AND PLANNING PURPOSES ONLY. REFERENCE SHOULD BE MADE TO THE RESPECTIVE CONSULTANTS DESIGN AND DRAWINGS FOR TECHNICAL CONSTRUCTION DETAILS

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
02	02.07.15	NT	CAULMERT UPDATES	RD	PP	14.07.15
01	02.07.15	NT	PRELIMINARY	RD	PP	02.07.15

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name: BRYN COWLYD WTW

Drawing Title: FIGURE 2.2
EXISTING SITE LAYOUT

Suitability: WORK IN PROGRESS
Suitability Code: S0

Originator: NT
Designer: PP
Date: 02/07/15

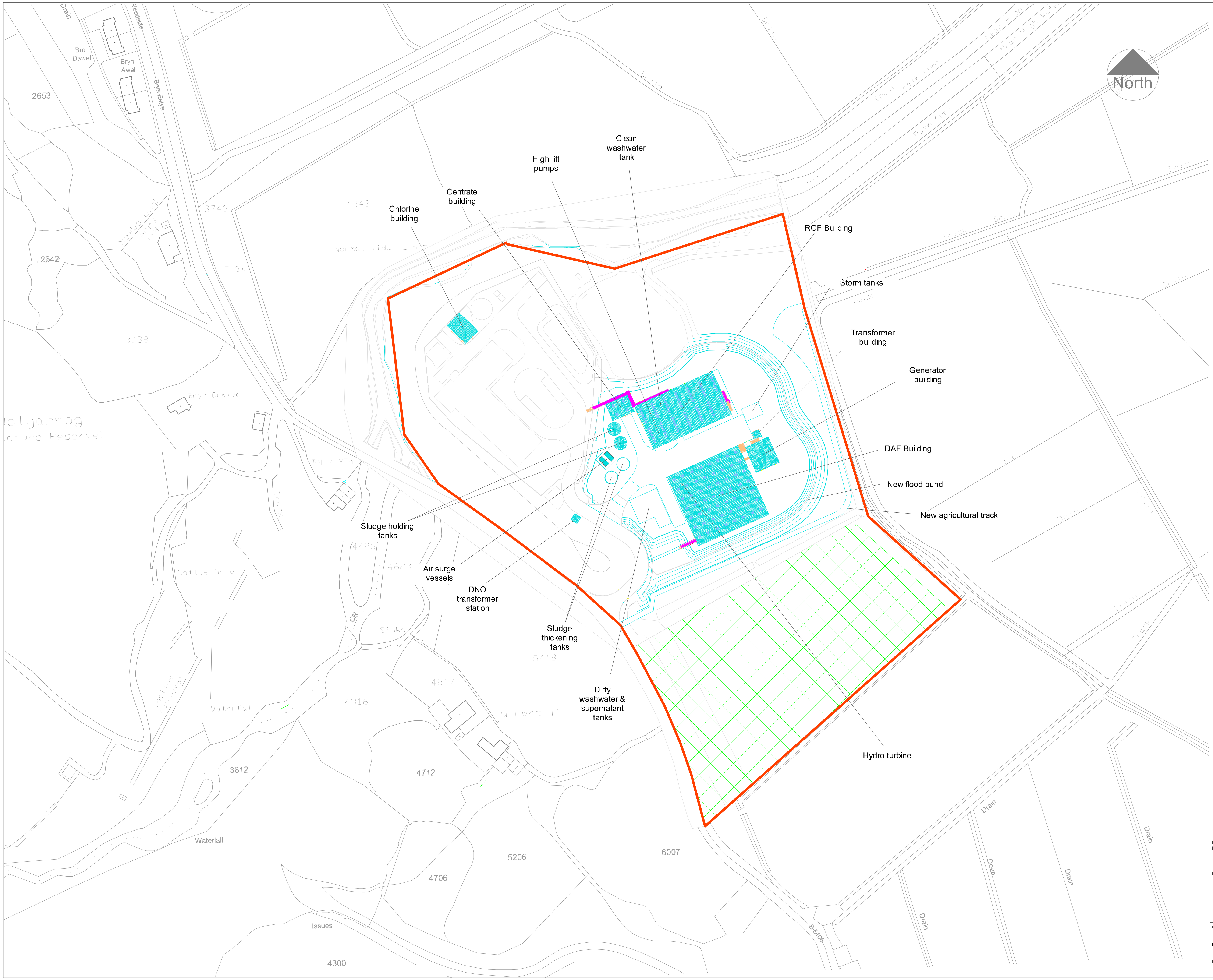
Internal Project Number: UA007911
Scale: 1:1000
Rev.: 02

Drawing Number: 1279-W-201-HYD-XX-XX-DR-09007

A3

NOTES:

1. BUILDING COLOURS ARE FOR INDICATION PURPOSES ONLY AND DO NOT REPRESENT THE FINAL BUILDING COLOURS



🟥	PROPOSED DEVELOPMENT SITE BOUNDARY
▨	PROPOSED TEMPORARY CONSTRUCTION COMPOUND
—	PROPOSED STAIRWELLS
—	PROPOSED WALKWAYS
—	PROPOSED NEW DEVELOPMNENT

KEY PLAN

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
02	14.07.15	NT	CAULMERT UPDATES	RD	PP	14.07.15
01	02.07.15	NT	PRELIMINARY	RD	PP	02.07.15

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Project Name. BRYN COWLYD WTW

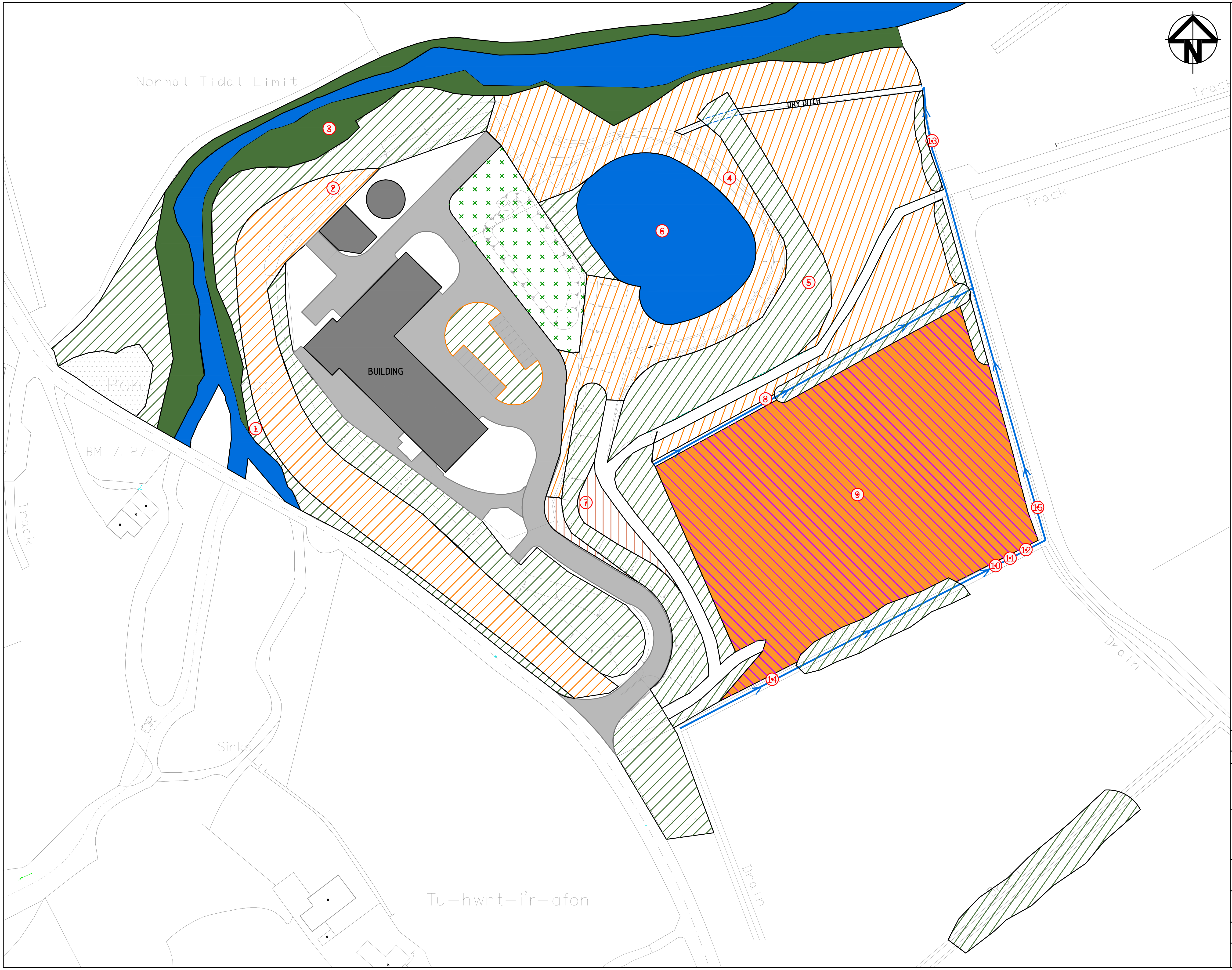
Drawing Title. FIGURE 3.1
PROPOSED DEVELOPEMENT SITE LAYOUT

Suitability. WORK IN PROGRESS
Suitability Code. S0

Originator. NT
Designer. PP
Date. 02/07/15

Internal Project Number. UA007911
Scale. 1:1000
Rev. 02

Drawing Number. 1279_W_201 - HYD - XX - XX - DR - 09023E



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DRAWING DETAIL IS INDICATIVE AND ISSUED FOR DISCUSSION PURPOSES ONLY.

ALL MEASUREMENTS ARE APPROXIMATE.

NOTES:
1. ALL LEVELS ARE IN mAOD
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

🟩	BROAD-LEAVED SEMI-NATURAL WOODLAND
▨	BROAD-LEAVED PLANTATION WOODLAND
X X	SCATTERED SCRUB
SI	SEMI-IMPROVED GRASSLAND
▨	CONIFEROUS PLANTATION WOODLAND
🟧	MARSH/MARSHY GRASSLAND
▧	TALL RUDERAL HERBS
🟦	OPEN STANDING WATER
⬚	BARE GROUND
→	RUNNING WATER
---	DRY DITCH
⑫	TARGET NOTE

P01	03/7/15	RAT	FIRST ISSUE
Rev.	Date.	Drawn.	Description.

DRAFT COPY

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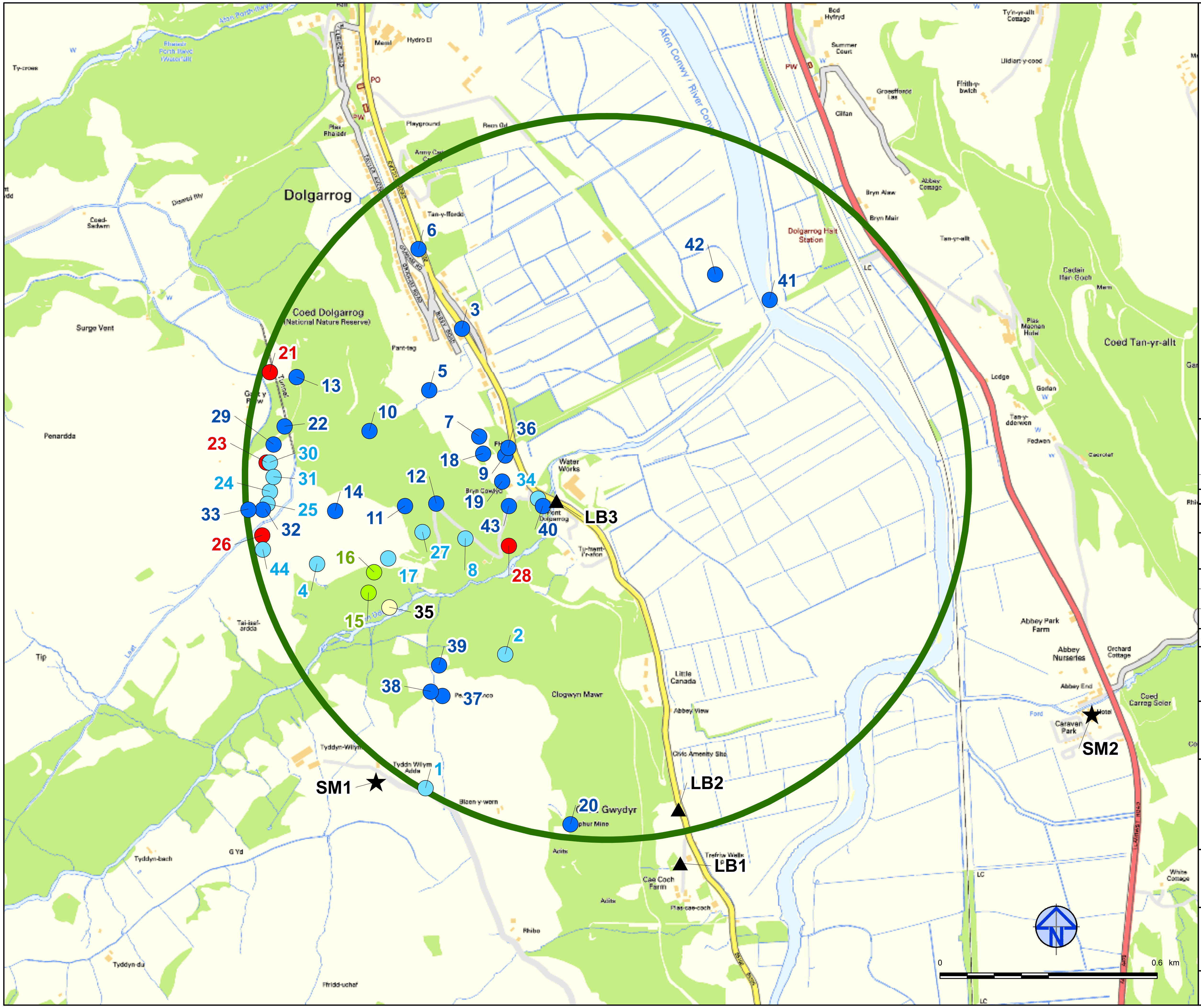
Project Name. BRYN COWLYD WTW

Drawing Title. EXTENDED PHASE 1 HABITAT SURVEY

Scale. NTS
Designer.
Date.

Drawing Number. FIGURE 4.1
Rev. P01

CAF411 - AMP 6 - A1 DRAFT - June 2015



Legend

- ▭ 1km Buffer from Site centre
- ▲ Listed Buildings
- ★ Scheduled Monuments

Undesignated Heritage Assets

- ○ Prehistoric
- ● Medieval
- ● Post-medieval
- ● Modern
- ● Unknown

Issue	Description	Date
02	REVISION 2	03-07-15
01	REVISION 1	30-06-15

Status
PRELIMINARY - CONFIDENTIAL

Scale	1:10,000	Current Issue Signatures
		Drawn D.SAWICKA
Original Size	A3	Checked M.LEAVER
Height Datum	NEWLYN	Approved P. OWEN
Projection	British National Grid	© Copyright reserved

0001-UA007911-BrynCowlyd-UP31-02-CulturalHeritageAssets

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Project
UA007911
Bryn Cowlyd

Title
Figure 5.1
Cultural Heritage Assets

Drawing No.	Project No.	Issue
0001 –	UA007911 –	02

50mm on Original

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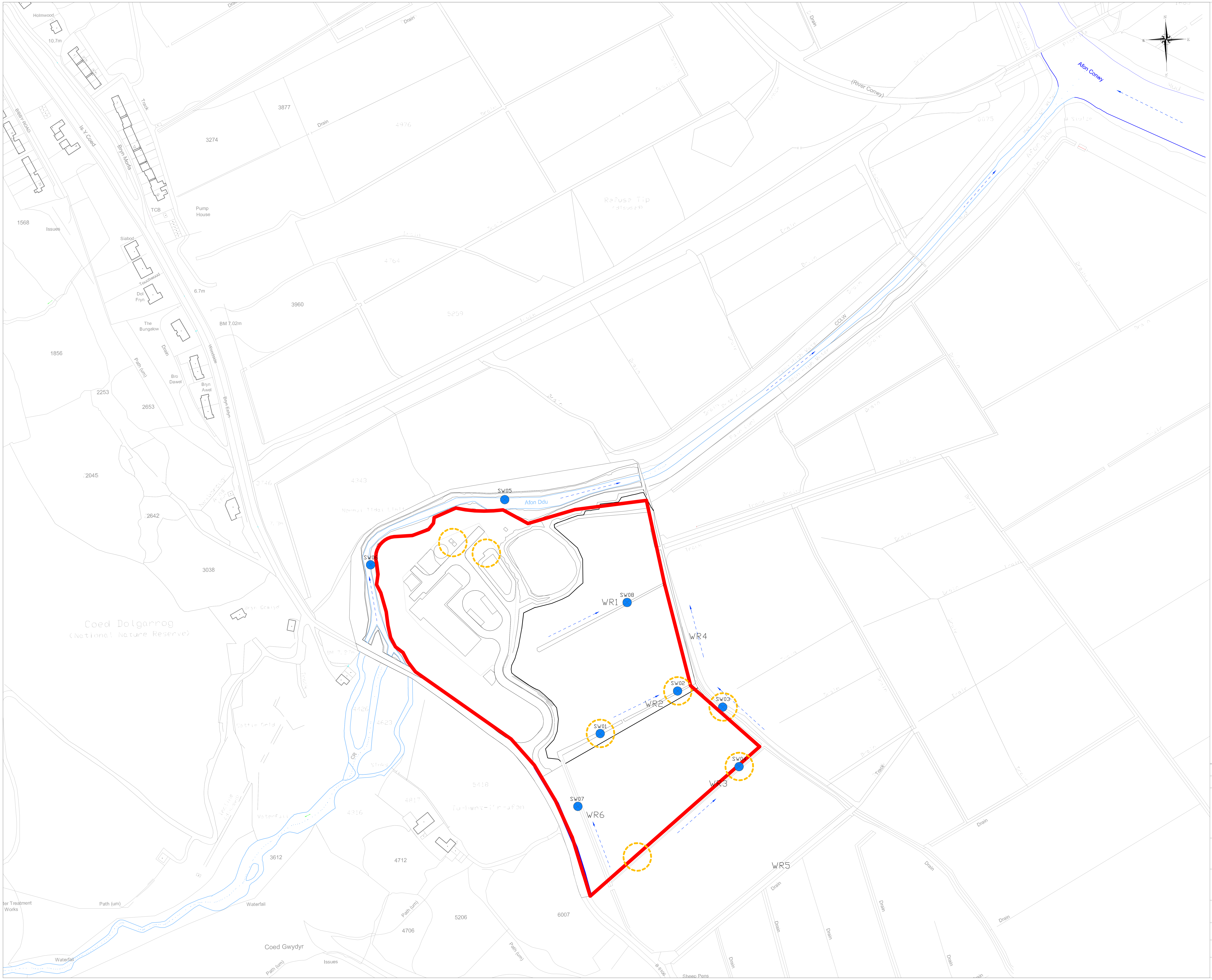

A1

NOTES:

○	OBSERVED CONTAMINATION
●	WATER QUALITY SAMPLING POINTS
WR	WATER RECEPTORS
—	AFON DDU
—	AFON CONWY
- - ►	DIRECTION OF FLOW
▬	PROPOSED SITE DEVELOPMENT BOUNDARY

KEY PLAN

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
01	10.07.15	NT	PRELIMINARY	EC	RD	10.07.15

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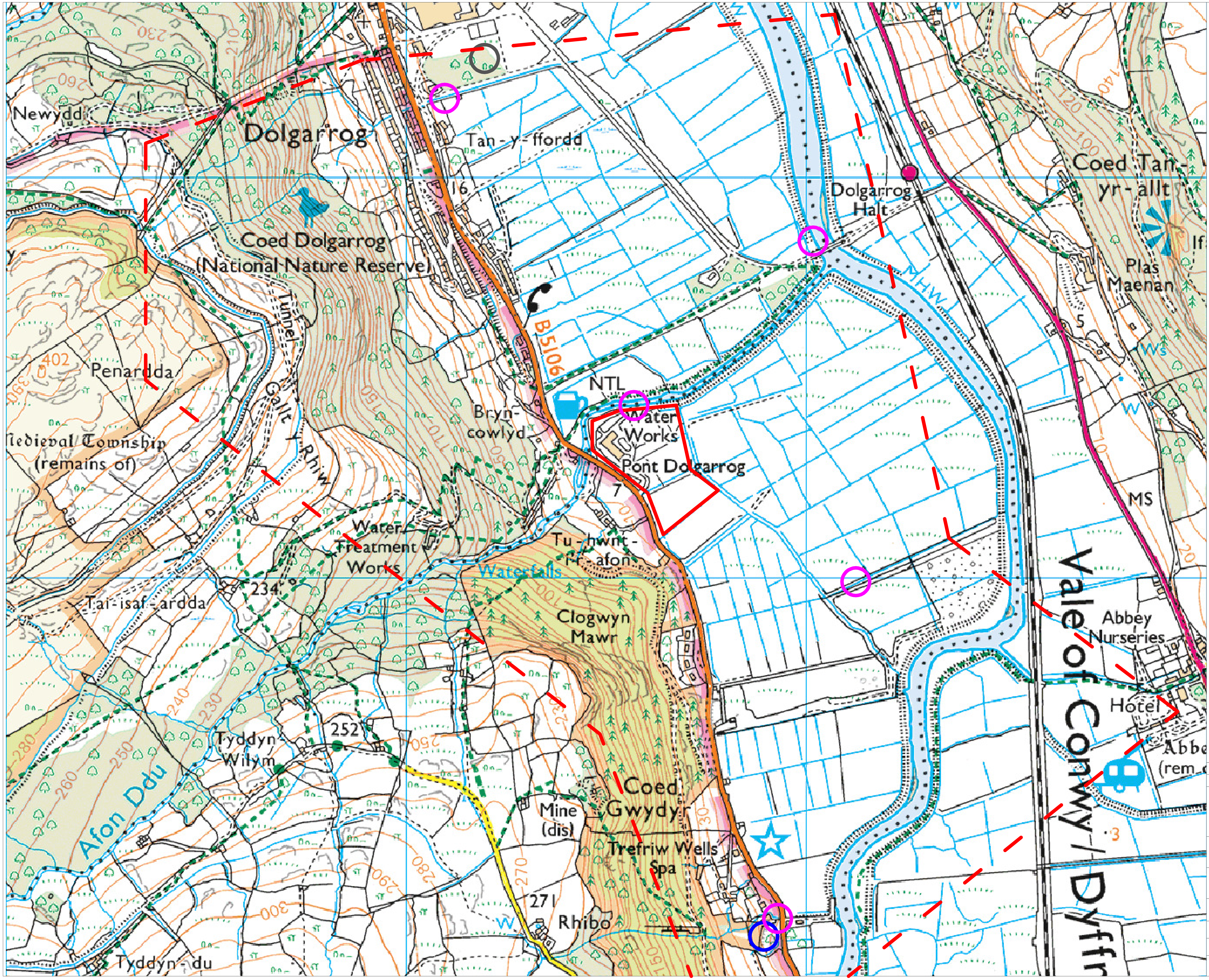
Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name: BRYN COWLYD WTW

Drawing Title:
FIGURE 6.1
CATCHMENT HYDROLOGY AND SURFACE
WATER FEATURE INVESTIGATION

Suitability.: WORK IN PROGRESS
Suitability Code.: S0

Originator.: NT
Designer.: EC
Date.: 10/07/15
Internal Project Number.: UA007911
Scale.: 1:1500
Rev.: 01
Drawing Number.: 1279-W-201-HYD-XX-XX-DR-09033



A1

NOTES:

PROPOSED DEVELOPMENT SITE BOUNDARY

STUDY AREA - 1km EXTENTS FROM SITE BOUNDARY LINE

ABSTRACTION POINTS

SURFACE WATER POLLUTION

DISCHARGE POINTS

KEY PLAN

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
01	13.07.15	NT	PRELIMINARY	EC	RD	13.07.15

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf
Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name. BRYN COWLYD WTW

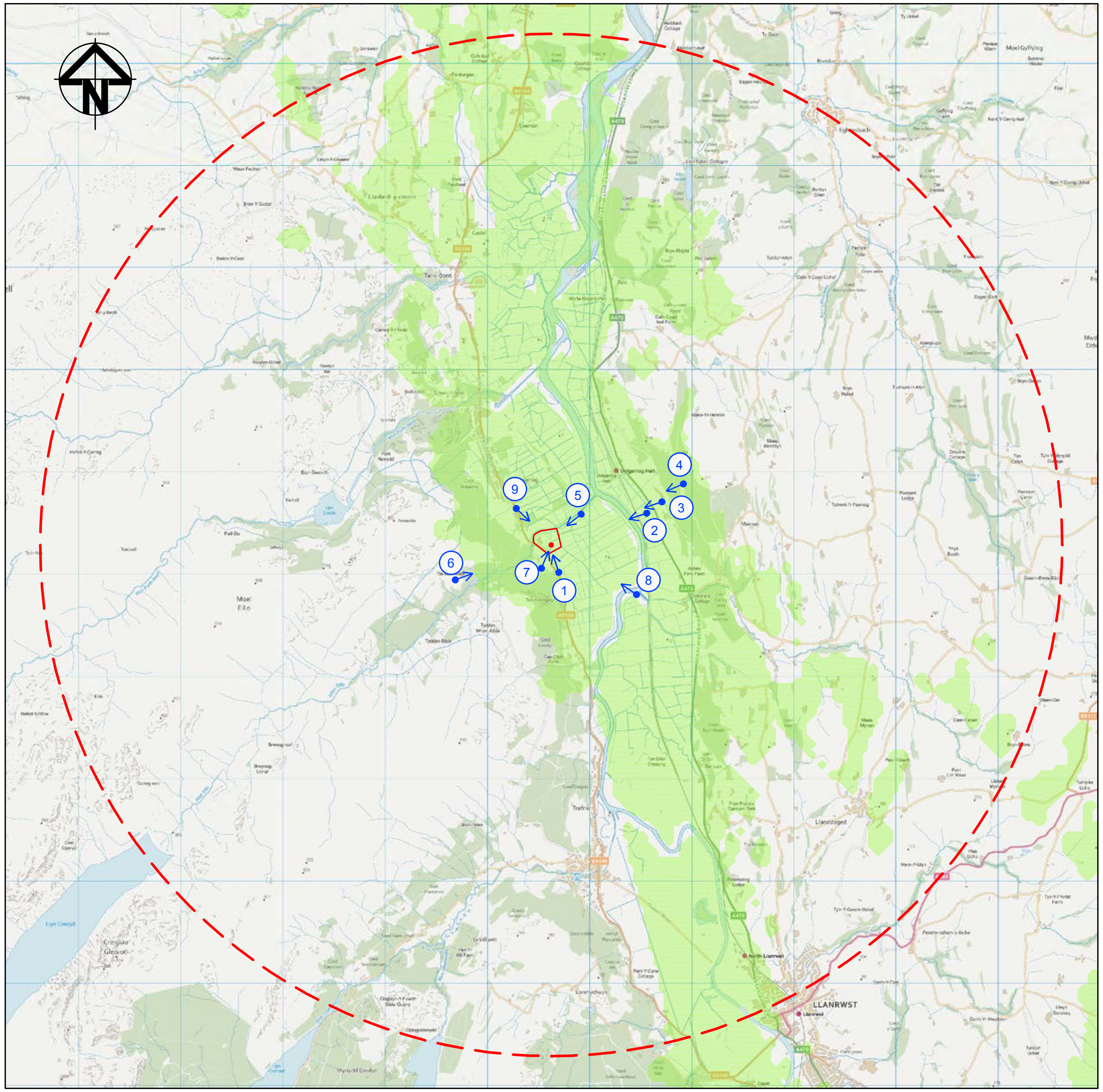
Drawing Title. FIGURE 6.2
STUDY AREA, SURFACE WATER
POLLUTION AND RESOURCE FEATURES

Suitability. WORK IN PROGRESS
Suitability Code. S0

Originator. NT
Designer. EC
Date. 13/07/15

Internal Project Number. UA007911
Scale. 1:10000
Rev. 01

Drawing Number. 1279-W-201-HYD-XX-XX-DR-09034



VIEWPOINT LOCATIONS

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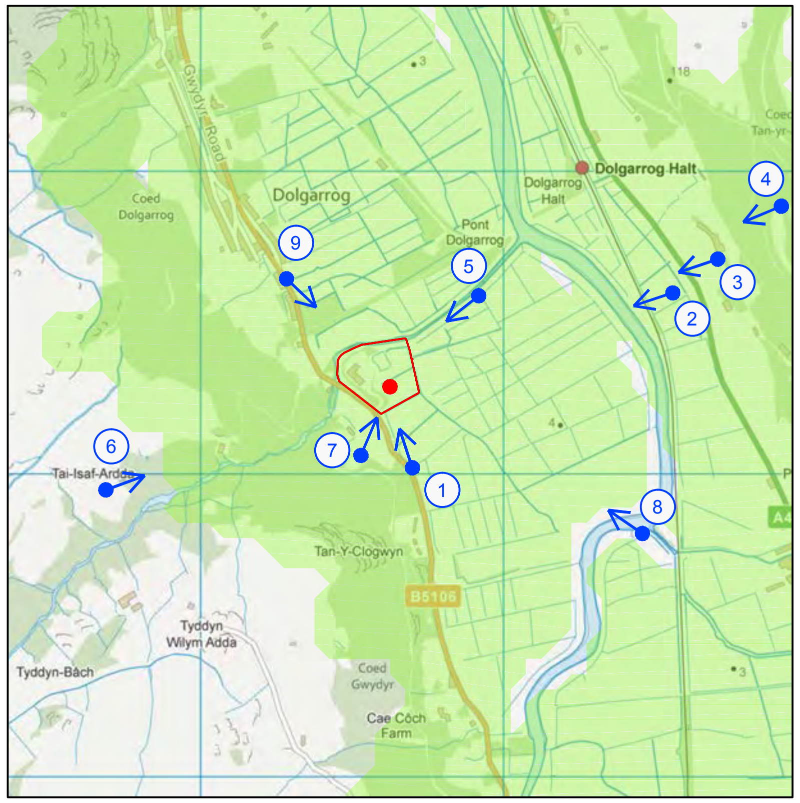
1 : 50 000



INSET - VIEWPOINT LOCATIONS

0 500 1000m
1 : 25 000

KEY:

🟥	SITE AREA
— —	STUDY AREA (5km RADIUS)
🟩	AREA FROM WHICH PART OF, OR ALL OF, PROPOSED DEVELOPMENT MAY BE VISIBLE
①	VIEWPOINT LOCATION

NOTES:

1. THE ZTV WAS CALCULATED USING WINDFARM COMPUTER SOFTWARE BASED ON ORDNANCE SURVEY (O.S) OPENDATA VECTORMAP RASTER TILES OF 1:50,000 SCALE AND "OS TERRAIN 50" DTM GRID DATA BASED ON A 50m GRID.

2. THE ZTV ILLUSTRATES AN AREA OF THEORETICAL VISIBILITY BASED PROPOSED DEVELOPMENT TO A HEIGHT OF 3m.

3. THE ZTV IS BASED ON LANDFORM DATA ONLY, WITH ANY RIDGE LINES, PLATEAUS AND VALLEYS REFLECTED IN THE EXTENT OF PREDICTED VISIBILITY, BUT DOES NOT TAKE ACCOUNT OF LAND COVER.

4. THE ZTV REPRESENTS A "WORSE CASE" SCENARIO WITH REGARD TO THE VISIBILITY OF THE PROPOSED DEVELOPMENT. THE ZTV HOWEVER DOES FORM AN APPROPRIATE STARTING POINT FOR UNDERTAKING THE VISUAL IMPACT ASSESSMENT AND SELECTION OF VIEWPOINTS.

Issue	Description	Date
01	First Issue	26 JUN 15

Status
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	1: 50000 1: 25000	Current Issue Signatures	
		Author P.SUBBIAH	
Original Size	A3	Checker B.POPE	
Height Datum	NEWLYN	Approver R.KITCH	
Grid	O.S	© Copyright reserved	

Filename: 7.1-UA007911-WXD-01-ZTV.DWG

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Project

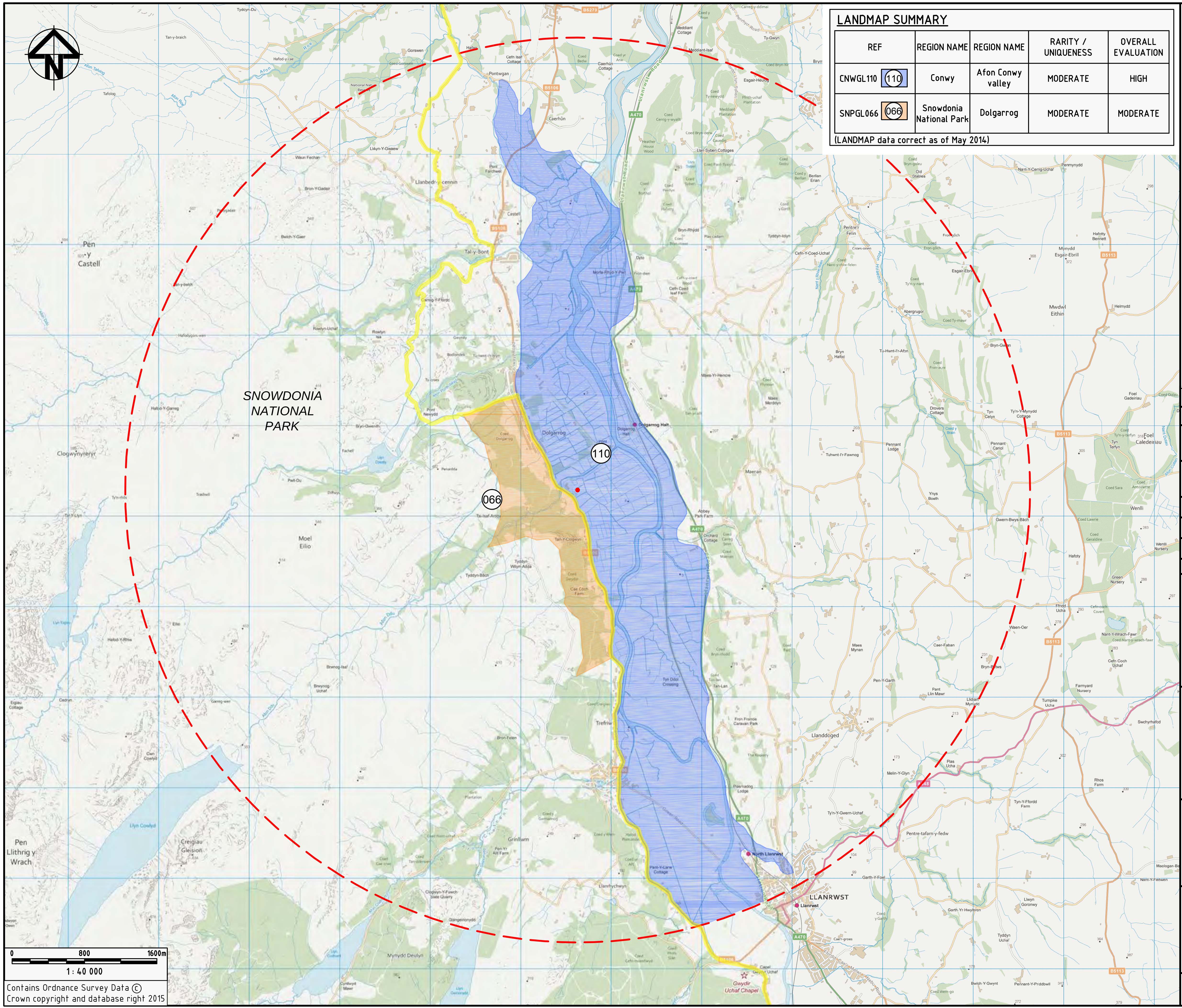
BRYN COWLYD WTW

Title

ZONE of THEORETICAL VISIBILITY

Drawing No.	Project No.	Issue
Fig 7.1 –	UA007911 –	01

50mm on Original



LANDMAP SUMMARY

REF	REGION NAME	REGION NAME	RARITY / UNIQUENESS	OVERALL EVALUATION
CNWGL110 (110)	Conwy	Afon Conwy valley	MODERATE	HIGH
SNPGL066 (066)	Snowdonia National Park	Dolgarrog	MODERATE	MODERATE

(LANDMAP data correct as of May 2014)

KEY:

●	SITE LOCATION
⬚	STUDY AREA (5km RADIUS)
☐	SNOWDONIA NATIONAL PARK BOUNDARY

Issue	Description	Date
01	FIRST ISSUE	26 JUN 15

Status
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	1:40 000	Current Issue Signatures Author P.SHEPHARD
Original Size	A3	Checker B.POPE
Height Datum	NEWLYN	Approver R.KITCH
Grid	O.S	© Copyright reserved

Filename: L001-UA007911-WXD-00_GEOLSCAPE.DWG

Client
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Project
BRYN COWLYD
WTW

Title
LANDMAP
GEOLOGICAL ASPECT

Drawing No.	Project No.	Issue
Fig 7.2 –	UA007911 –	01

50mm on Original

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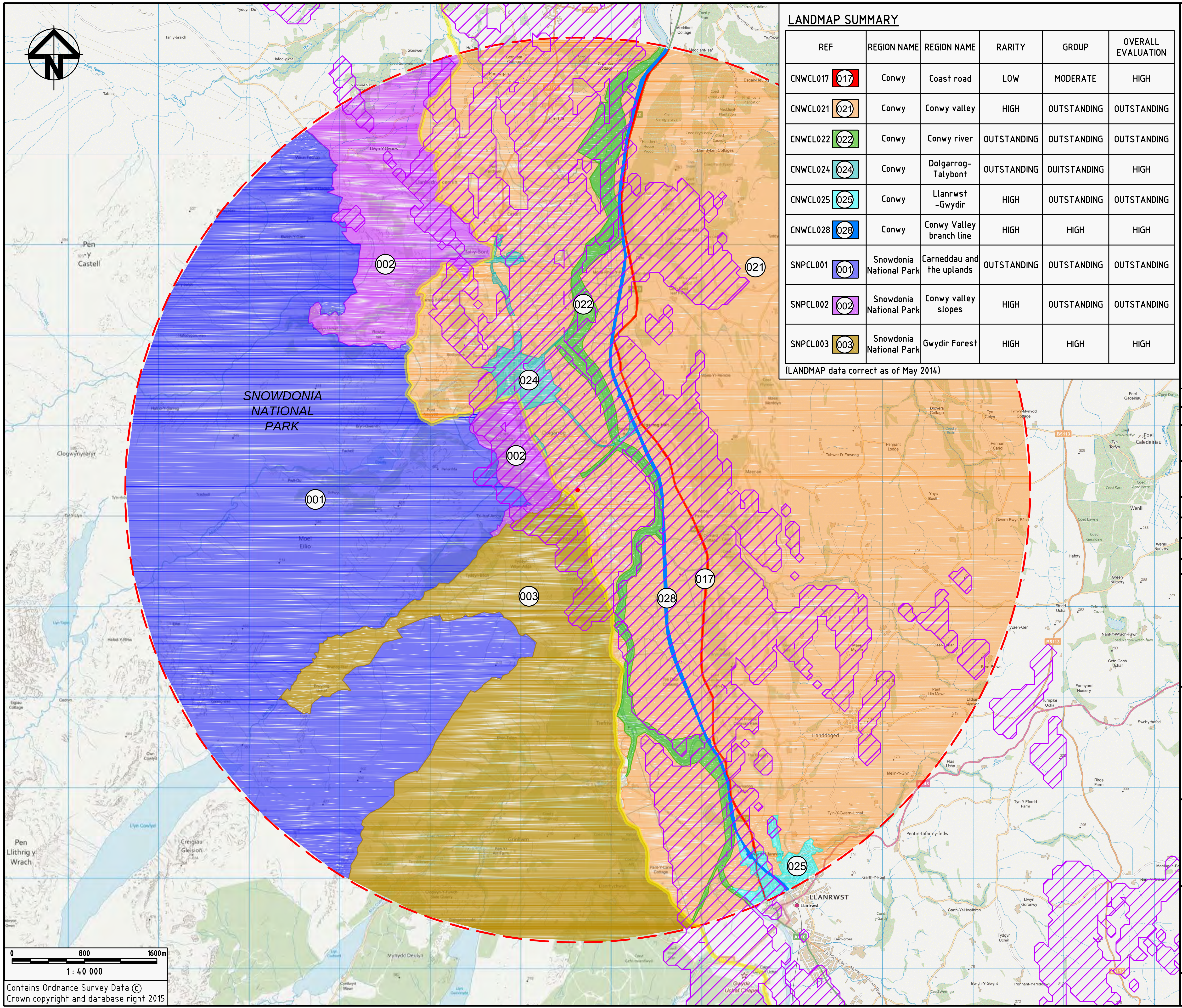

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LANDMAP SUMMARY

REF	REGION NAME	REGION NAME	RARITY	GROUP	OVERALL EVALUATION
CNWCL017 017	Conwy	Coast road	LOW	MODERATE	HIGH
CNWCL021 021	Conwy	Conwy valley	HIGH	OUTSTANDING	OUTSTANDING
CNWCL022 022	Conwy	Conwy river	OUTSTANDING	OUTSTANDING	OUTSTANDING
CNWCL024 024	Conwy	Dolgarrog-Talybont	OUTSTANDING	OUITSTANDING	HIGH
CNWCL025 025	Conwy	Llanrwst -Gwydir	HIGH	OUTSTANDING	OUTSTANDING
CNWCL028 028	Conwy	Conwy Valley branch line	HIGH	HIGH	HIGH
SNPCL001 001	Snowdonia National Park	Carneddau and the uplands	OUTSTANDING	OUTSTANDING	OUTSTANDING
SNPCL002 002	Snowdonia National Park	Conwy valley slopes	HIGH	OUTSTANDING	OUTSTANDING
SNPCL003 003	Snowdonia National Park	Gwydir Forest	HIGH	HIGH	HIGH

(LANDMAP data correct as of May 2014)

KEY:

●	SITE LOCATION
⌜⌟	STUDY AREA (5km RADIUS)
☐	SNOWDONIA NATIONAL PARK BOUNDARY
▨	ZONE OF THEORETICAL VISIBILITY

Issue	Description	Date
01	FIRST ISSUE	26 JUN 15

Status
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	1:40 000	Current Issue Signatures	
		Author P.SHEPHARD	
Original Size	A3	Checker B.POPE	
Height Datum	NEWLYN	Approver R.KITCH	
Grid	O.S	© Copyright reserved	

Filename: L002-UA007911-WXD-00_CULTLSCAPE.DWG

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Project
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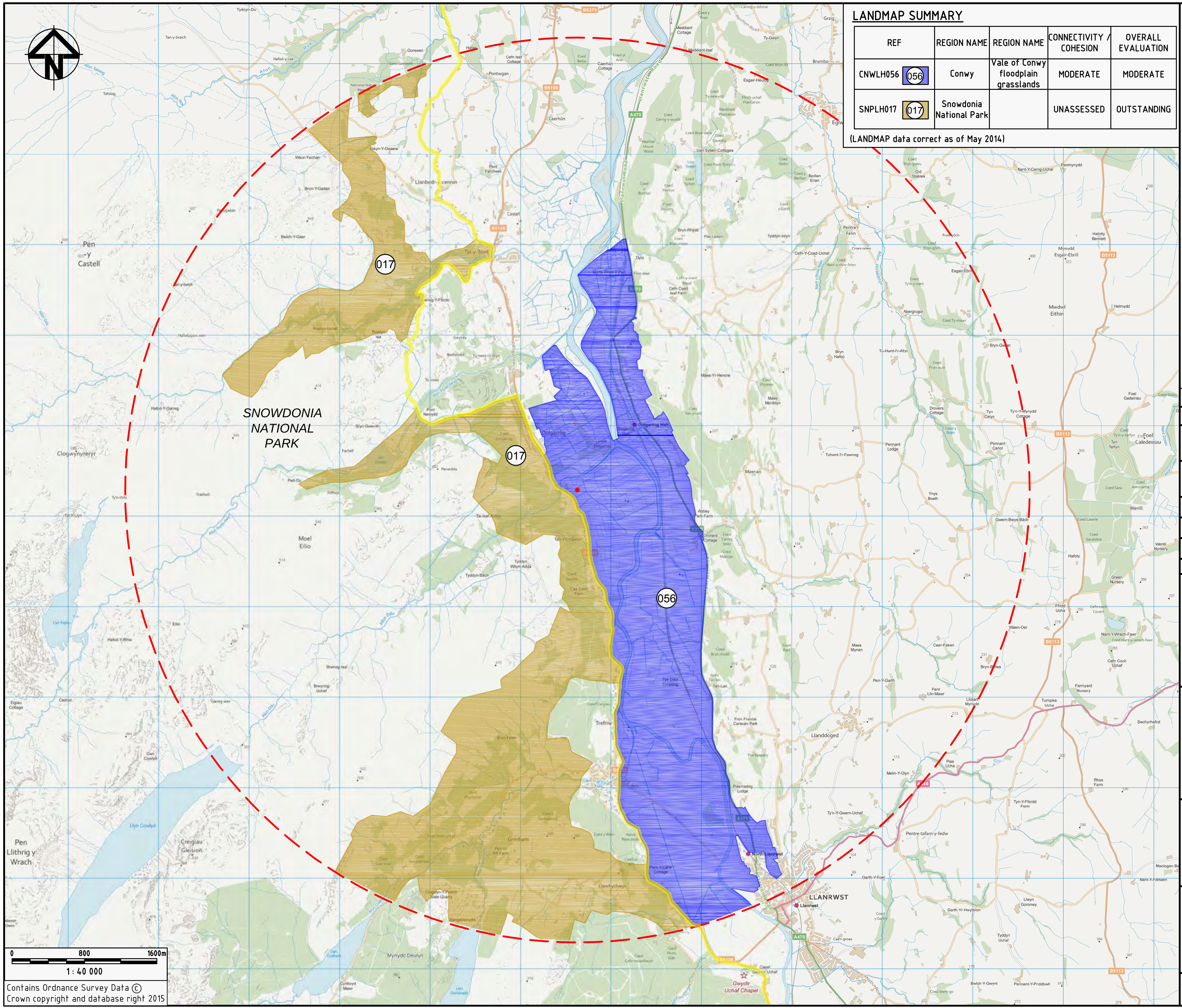
WTW

Title
LANDMAP
CULTURAL LANDSCAPE

Drawing No.	Project No.	Issue
Fig 7.3 –	UA007911 –	01

50mm on Original

Plot Date: 26/Jun/2015 9:58:18 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\L002-UA007911-WXD-00_CULTLSCAPE.DWG V1



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LANDMAP SUMMARY

REF	REGION NAME	REGION NAME	CONNECTIVITY / COHESION	OVERALL EVALUATION
CNWLH056 🟦 056	Conwy	Vale of Conwy floodplain grasslands	MODERATE	MODERATE
SNPLH017 🟫 017	Snowdonia National Park		UNASSESSED	OUTSTANDING

(LANDMAP data correct as of May 2014)

KEY:

●	SITE LOCATION
⬚	STUDY AREA (5km RADIUS)
☐	SNOWDONIA NATIONAL PARK BOUNDARY

Issue	Description	Date
01	FIRST ISSUE	26 JUN 15

Status
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	1:40 000	Current Issue Signatures Author P.SHEPHARD
Original Size	A3	Checker B.POPE
Height Datum	NEWLYN	Approver R.KITCH
Grid	O.S	© Copyright reserved

Filename: L003-UA007911-WXD-00_LSCAPEHAB.DWG

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

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Project

BRYN COWLYD
WTW

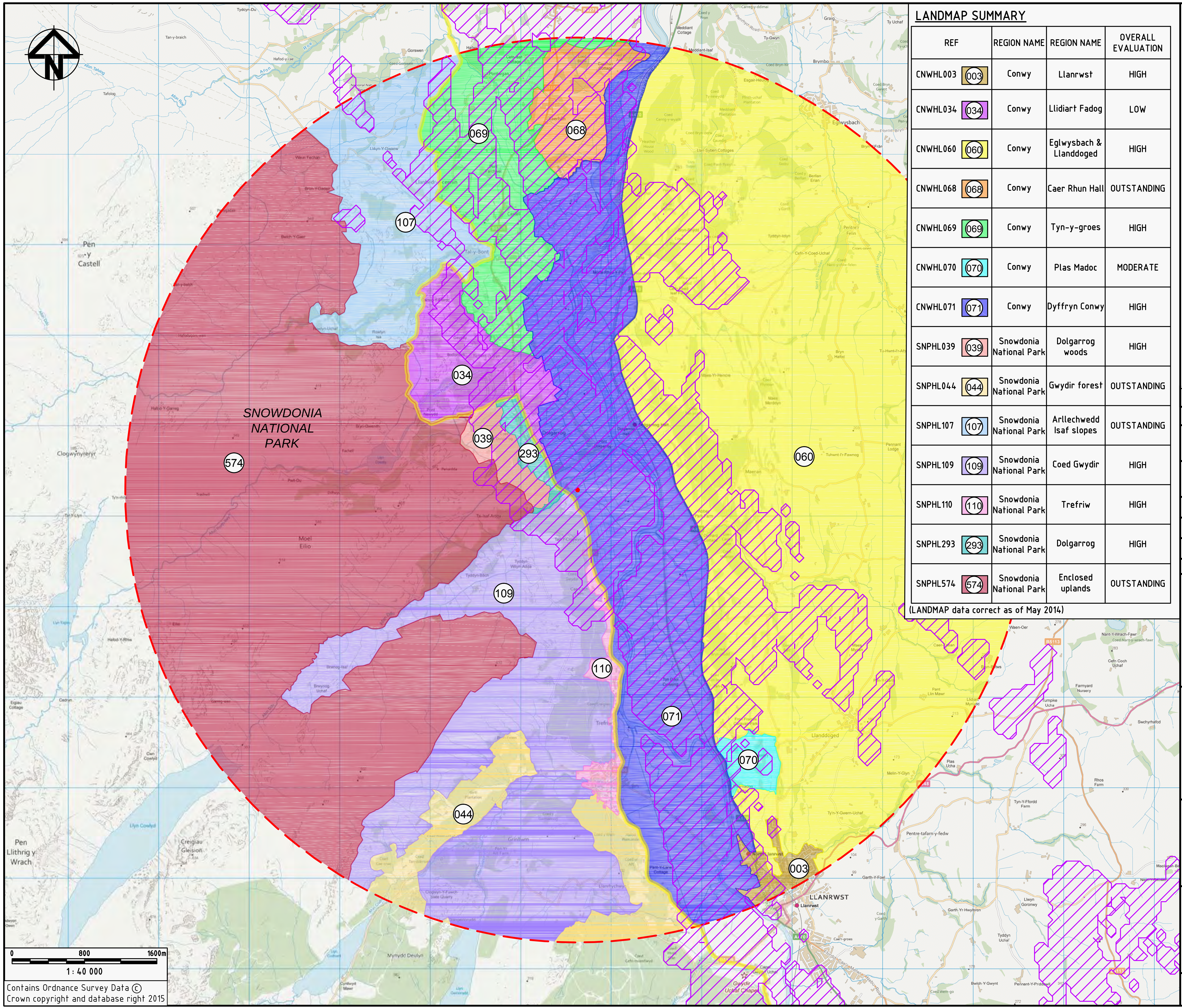
Title

LANDMAP
LANDSCAPE HABITAT

Drawing No.	Project No.	Issue
Fig 7.4 –	UA007911 –	01

50mm on Original

Plot Date: 26/Jun/2015 10:01:02 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\L003-UA007911-WXD-00_LSCAPEHAB.DWG V1



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LANDMAP SUMMARY

REF		REGION NAME	REGION NAME	OVERALL EVALUATION
CNWHL003	003	Conwy	Llanrwst	HIGH
CNWHL034	034	Conwy	Llidiart Fadog	LOW
CNWHL060	060	Conwy	Eglwysbach & Llanddoged	HIGH
CNWHL068	068	Conwy	Caer Rhun Hall	OUTSTANDING
CNWHL069	069	Conwy	Tyn-y-groes	HIGH
CNWHL070	070	Conwy	Plas Madoc	MODERATE
CNWHL071	071	Conwy	Dyffryn Conwy	HIGH
SNPHL039	039	Snowdonia National Park	Dolgarrog woods	HIGH
SNPHL044	044	Snowdonia National Park	Gwydir forest	OUTSTANDING
SNPHL107	107	Snowdonia National Park	Arllechwedd Isaf slopes	OUTSTANDING
SNPHL109	109	Snowdonia National Park	Coed Gwydir	HIGH
SNPHL110	110	Snowdonia National Park	Trefriw	HIGH
SNPHL293	293	Snowdonia National Park	Dolgarrog	HIGH
SNPHL574	574	Snowdonia National Park	Enclosed uplands	OUTSTANDING

(LANDMAP data correct as of May 2014)

KEY:

●	SITE LOCATION
⬚	STUDY AREA (5km RADIUS)
🟨	SNOWDONIA NATIONAL PARK BOUNDARY
▨	ZONE OF THEORETICAL VISIBILITY

Issue	Description	Date
01	FIRST ISSUE	26 JUN 15

Status
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Scales 1:40 000
Current Issue Signatures
Author P.SHEPHARD
Original Size A3
Checker B.POPE
Height Datum NEWLYN
Approver R.KITCH
Grid O.S
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Filename: L004-UA007911-WXD-00_HISTLSCAPE.DWG

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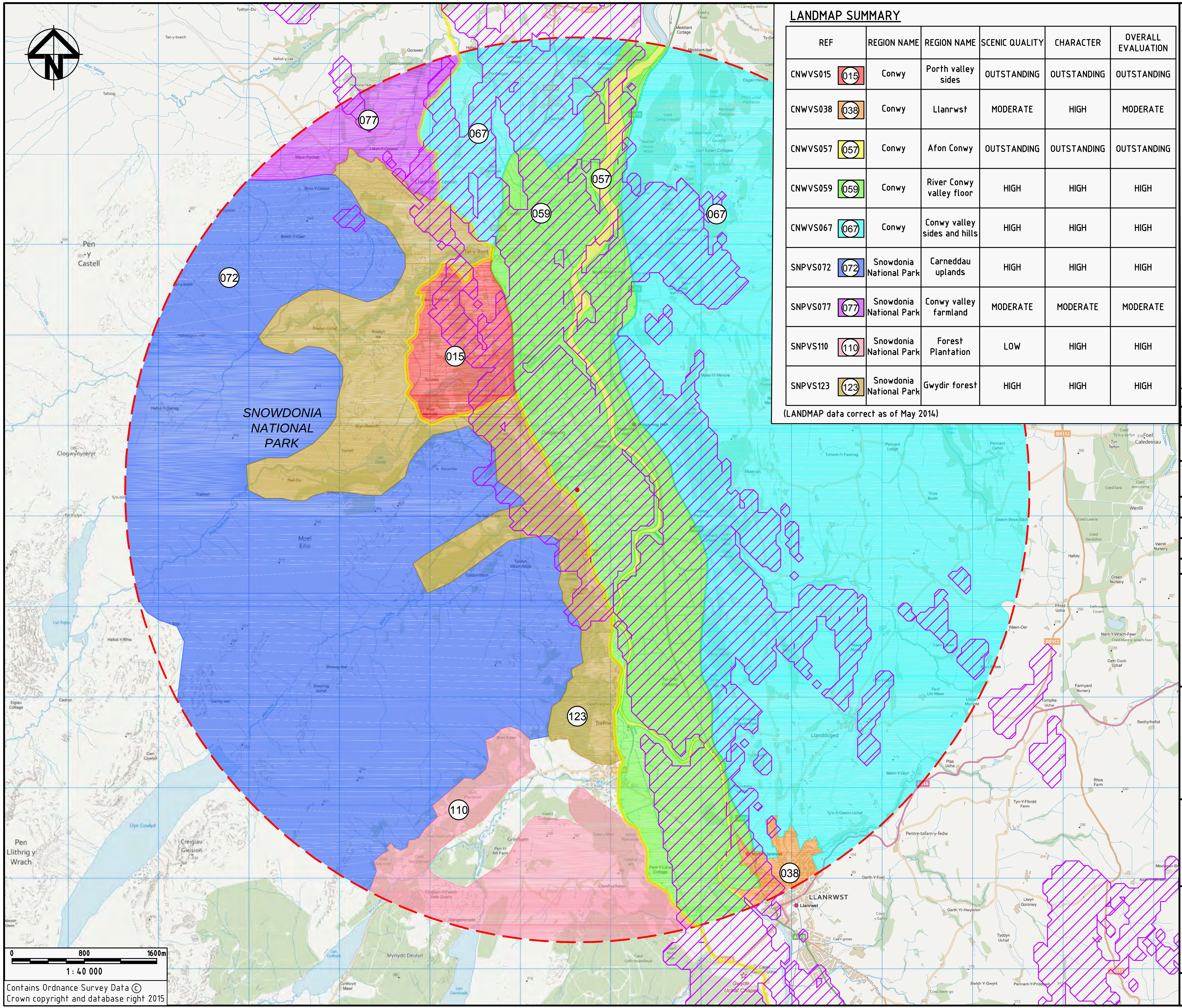
Project
BRYN COWLYD WTW

Title
LANDMAP HISTORIC LANDSCAPE

Drawing No. Fig 7.5 – Project No. UA007911 – Issue 01

50mm on Original

Plot Date: 26/Jun/2015 10:04:13 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\L004-UA007911-WXD-00_HISTLSCAPE.DWG V1



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LANDMAP SUMMARY

REF		REGION NAME	REGION NAME	SCENIC QUALITY	CHARACTER	OVERALL EVALUATION
CNWVS015	015	Conwy	Porth valley sides	OUTSTANDING	OUTSTANDING	OUTSTANDING
CNWVS038	038	Conwy	Llanrwst	MODERATE	HIGH	MODERATE
CNWVS057	057	Conwy	Afon Conwy	OUTSTANDING	OUTSTANDING	OUTSTANDING
CNWVS059	059	Conwy	River Conwy valley floor	HIGH	HIGH	HIGH
CNWVS067	067	Conwy	Conwy valley sides and hills	HIGH	HIGH	HIGH
SNPVS072	072	Snowdonia National Park	Carneddau uplands	HIGH	HIGH	HIGH
SNPVS077	077	Snowdonia National Park	Conwy valley farmland	MODERATE	MODERATE	MODERATE
SNPVS110	110	Snowdonia National Park	Forest Plantation	LOW	HIGH	HIGH
SNPVS123	123	Snowdonia National Park	Gwydir forest	HIGH	HIGH	HIGH

(LANDMAP data correct as of May 2014)

KEY:

● SITE LOCATION

⬚ STUDY AREA (5km RADIUS)

☐ SNOWDONIA NATIONAL PARK BOUNDARY

▨ ZONE OF THEORETICAL VISIBILITY

Issue	Description	Date
01	FIRST ISSUE	26 JUN 15

Status
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Scales	1:40 000	Current Issue Signatures	
		Author P.SHEPHARD	
Original Size	A3	Checker B.POPE	
Height Datum	NEWLYN	Approver R.KITCH	
Grid	0.S	© Copyright reserved	

Filename: L005-UA007911-WXD-00__VISSENS.DWG

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Project
BRYN COWLYD
WTW

Title
LANDMAP
VISUAL & SENSORY

Drawing No.	Project No.	Issue
Fig 7.6 –	UA007911 –	01

50mm on Original

Plot Date: 08/Jul/2015 5:03:15 PM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\L005-UA007911-WXD-00__VISSENS.DWG V1

View from track leading off B5106, 300m from the site, looking north

01	First Issue	26 JUN 15
ssue	Description	Date

Viewpoint Location

Easting	Northing	Ground Level
277701m	366022m	23m A.O.D

Field of View Angle = 24°

Distance to the center of the site = 220m

Picture taken during early April

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status **PRELIMINARY**
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Scales	NTS	Current Issue Signatures	
		Author P.SUBBIAH	
Original Size	A3	Checker B.POPE	
Height Datum	DATUM	Approver R.KITCH	
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Project

BRYN COWLYD
WTW

Title

VIEWPOINT 1

EXISTING VIEW

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Drawing No.	Project No.	Issue
Fig.7.7 –	UA007911 –	01

50mm on Original

Plot Date: 25/Jun/2015 11:49:13 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.7-7.15-UA007911-WXD-01_VIEWPOINTS.DWG V1

View from A470, 1km from the site, looking south west

Issue	Description	Date
01	First Issue	26 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
278595m	366665m	5m A.O.D

Field of View Angle = 50°

Distance to the center of the site = 970m

Picture taken during early April

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status **PRELIMINARY**
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Scales	NTS	Current Issue Signatures
		Author P.SUBBIAH
Original Size	A3	Checker B.POPE
Height Datum	DATUM	Approver R.KITCH
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Filename: 7.7-7.15-UA007911-WXD-01_VIEWPOINTS.DWG

Project
BRYN COWLYD
WTW

Title
VIEWPOINT 2
EXISTING VIEW

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Drawing No.	Project No.	Issue
Fig.7.8 –	UA007911 –	01

50mm on Original

Plot Date: 26/Jun/2015 9:45:54 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.7-7.15-UA007911-WXD-01_VIEWPOINTS.DWG V1

View from Plas Maenan hotel terrace, 1.2 km from the site, looking south west

Issue	Description	Date
01	First Issue	26 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
278710m	366712m	33m A.O.D

Field of View Angle = 50°

Distance to the center of the site = 1070m

Picture taken during early April

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status **PRELIMINARY**
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Scales	NTS	Current Issue Signatures	
		Author P.SUBBIAH	—
Original Size	A3	Checker B.POPE	—
Height Datum	DATUM	Approver R.KITCH	—
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Project
BRYN COWLYD
WTW

Title
VIEWPOINT 3
EXISTING VIEW

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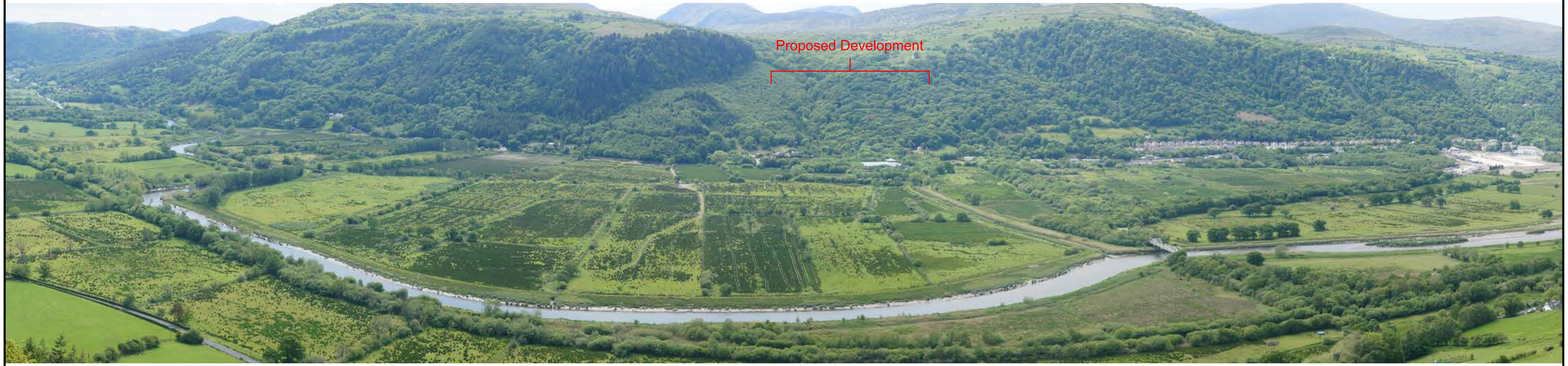
Drawing No.	Project No.	Issue
Fig.7.9 –	UA007911 –	01

50mm on Original

Plot Date: 26/Jun/2015 9:46:38 AM File Location: \\HC-UKR-WN-FS-10\WN__PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.7-7.15-UA007911-WXD-01__VIEWPOINTS.DWG V1



View from Cadair Ifan Goch viewpoint on National Trust Land, 1.5 km from the site, looking south west

Issue	Description	Date
01	First Issue	26 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
278920	366887	135m A.O.D

Field of View Angle = 90°

Distance to the center of the site = 1424m

Picture taken during early June

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status **PRELIMINARY**
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Scales	NTS	Current Issue Signatures	
		Author P.SUBBIAH	—
Original Size	A3	Checker B.POPE	—
Height Datum	DATUM	Approver R.KITCH	—
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Project

BRYN COWLYD
WTW

Title

VIEWPOINT 4

EXISTING VIEW

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Drawing No.	Project No.	Issue
Fig.7.10	– UA007911 –	01

50mm on Original

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View from PRoW leading from Afon Conwy to B5106, 400m from the site, looking south west

Issue	Description	Date
01	First Issue	21 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
277920	366591	4m A.O.D

Field of View Angle = 90°

Distance to the center of the site = 420m

Picture taken during early June

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status: PRELIMINARY
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		Current Issue Signatures	
Scales	NTS	Author P.SUBBIAH	
Original Size	A3	Checker B.POPE	
Height Datum	DATUM	Approver R.KITCH	
Grid	GRID	© Copyright reserved	

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Project
BRYN COWLYD
WTW

Title
VIEWPOINT 5
EXISTING VIEW

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Drawing No.	Project No.	Issue
Fig.7.11–	UA007911–	01

50mm on Original

View from PRoW in Snowdonia National Park, ~~800m~~ from the site, looking east

Issue	Description	Date
01	First Issue	26 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
276688	365949	226m A.O.D

Field of View Angle = 90°

Distance to the center of the site = 999m

Picture taken during early June

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

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Scales NTS
Original Size A3
Height Datum DATUM
Grid GRID
Filename: 7.15-UA007911-WXD-01_VIEWPOINTS.DWG

Current Issue Signatures
Author P.SUBBIAH
Checker B.POPE
Approver R.KITCH

Project
BRYN COWLYD
WTW

Title
VIEWPOINT 6
EXISTING VIEW

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Drawing No.	Project No.	Issue
Fig.7.12–	UA007911–	01

50mm on Original

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View from PRoW, leading from Tu-Hwnt-afon, 200m from the site, looking north east

01	First Issue	26 JUN 15
Issue	Description	Date

Viewpoint Location

Easting	Northing	Ground Level
277531	366063	37m A.O.D

Field of View Angle = 90°

Distance to the center of the site = 246m

Picture taken during early June

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

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Telephone - 0800 0520145
Website - www.dwrcymru.com

Status **PRELIMINARY**
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Scales	NTS	Current Issue Signatures	
		Author P.SUBBIAH	—
Original Size	A3	Checker B.POPE	—
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Project
BRYN COWLYD
WTW

Title
VIEWPOINT 7

EXISTING VIEW

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Drawing No.	Project No.	Issue
Fig.7.13 –	UA007911 –	01

50mm on Original

Plot Date: 26/Jun/2015 9:47:33 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.7-7.15-UA007911-WXD-01_VIEWPOINTS.DWG V1

View from PRoW leading from Aberconwy Abbey to Afon Conwy, 800m from the site, looking north west

Issue	Description	Date
01	First Issue	26 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
278461	365805	5m A.O.D

Field of View Angle = 90°

Distance to the center of the site = 965m

Picture taken during early June

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status **PRELIMINARY**
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Scales	NTS	Current Issue Signatures	
		Author P.SUBBIAH	—
Original Size	A3	Checker B.POPE	—
Height Datum	DATUM	Approver R.KITCH	—
Grid	GRID	© Copyright reserved	

Filename: 7.7-7.15-UA007911-WXD-01_VIEWPOINTS.DWG

Project

BRYN COWLYD
WTW

Title

VIEWPOINT 8

EXISITNG VIEW

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Drawing No.	Project No.	Issue
Fig.7.14	– UA007911 –	01

50mm on Original

Plot Date: 26/Jun/2015 9:48:13 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.7-7.15-UA007911-WXD-01_VIEWPOINTS.DWG V1

View from B5160 on southern edge of Dolgarrog, 500m from the site, looking south

ssue	Description	Date
01	First Issue	26 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
277285	366647	20m A.O.D

Field of View Angle = 90°

Distance to the center of the site = 494m

Picture taken during early June

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status **PRELIMINARY**
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Scales	NTS	Current Issue Signatures	
		Author P.SUBBIAH	
Original Size	A3	Checker B.POPE	
Height Datum	DATUM	Approver R.KITCH	
Grid	GRID	© Copyright reserved	

Filename: 7.7-7.15-UA007911-WXD-01_VIEWPOINTS.DWG

Project
BRYN COWLYD
WTW

Title
VIEWPOINT 9
EXISTING VIEW

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Drawing No.	Project No.	Issue
Fig.7.15-	UA007911-	01

50mm on Original

Plot Date: 25/Jun/2015 11:53:22 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.7-7.15-UA007911-WXD-01_VIEWPOINTS.DWG V1

Schedule A: Native Tree Planting

Abbrev.	Name	Girth/Dia. cm	Height cm	Root Zone	Specification	Mix %	Qty
ACECA	Acer campestre	14-16	400-450	RB	3x; EHS; clear stem 175-200cm; 5 brks	10	6
ALNGL	Alnus glutinosa	14-16	400-450	RB	3x; EHS; clear stem min. 200cm; 5 brks	20	13
BETPE	Betula pendula	14-16	400-450	RB	3x; EHS; clear stem 175-200cm; 5 brks	10	6
POPNI	Populus nigra	14-16	425-600	RB	3x; EHS; clear stem 175-200cm; 5 brks	15	9
PRUAV	Prunus avium	14-16	400-450	RB	3x; EHS; clear stem 175-200cm; 5 brks	5	3
QUERO	Quercus robur	14-16	400-450	RB	3x; EHS; clear stem 175-200cm; 5 brks	10	6
SORAU	Sorbus aucuparia	14-16	400-450	RB	3x; EHS; clear stem 175-200cm; 5 brks	20	13
TILCO	Tilia cordata	14-16	400-450	RB	3x; EHS; clear stem 175-200cm; 5 brks	10	6
					Sub-totals	**100%**	**62**

Schedule B: Feathered Native Tree Planting

Abbrev.	Name	Girth/Dia. cm	Height cm	Root Zone	Specification	Mix %	Qty
ACECA	Acer campestre	12-14	350-425	B	3x; Large Feathered; 7 brks	20	8
ALNGL	Alnus glutinosa	14-16	400-450	RB	3x; Large Feathered; 7 brks	25	12
BETPU	Betula pubescens	12-14	350-425	RB	3x; Large Feathered; 7 brks	25	12
QUEPE	Quercus petraea	10-12	300-350	RB	2x; Feathered; 7 brks	15	7
QUERO	Quercus robur	14-16	400-450	RB	3x; Large Feathered; 7 brks	15	7
					Sub-totals	**100%**	**46**

Schedule C: Understorey planting

Abbrev.	Name	Girth/Dia. cm	Height cm	Root Zone	Specification	Mix %	Area m²	Ctr m	Qty
BETPU	Betula pubescens		40-60	B	1+1; Transplant - seed raised	5		0.75	89
CORAV	Corylus avellana		40-60	B	1+1; Transplant - seed raised; branched; 2 brks	10		0.75	178
CRAMON	Crataegus monogyna		40-60	B	1+1; Transplant - seed raised	10		0.75	178
PRUAV	Prunus avium		40-60	B	1+0; Seedling	10		0.75	178
PRUSP	Prunus spinosa		40-60	B	1+0; Seedling; leader	10		0.75	178
SALCAP	Salix caprea		60-80	B	0/1; Cutting; branched; 2 brks	15		0.75	267
SALCE	Salix cinerea		40-60	B	0/1; Cutting; branched; 3 brks	15		0.75	267
SAMNI	Sambucus nigra		40-60	B	1+0; Seedling; branched; 2 brks	15		0.75	267
SORAU	Sorbus aucuparia		40-60	B	1+0; Seedling	10		0.75	178
					Sub-totals	**100%**	**1000**		**11780**

Schedule D: Native habitat planting

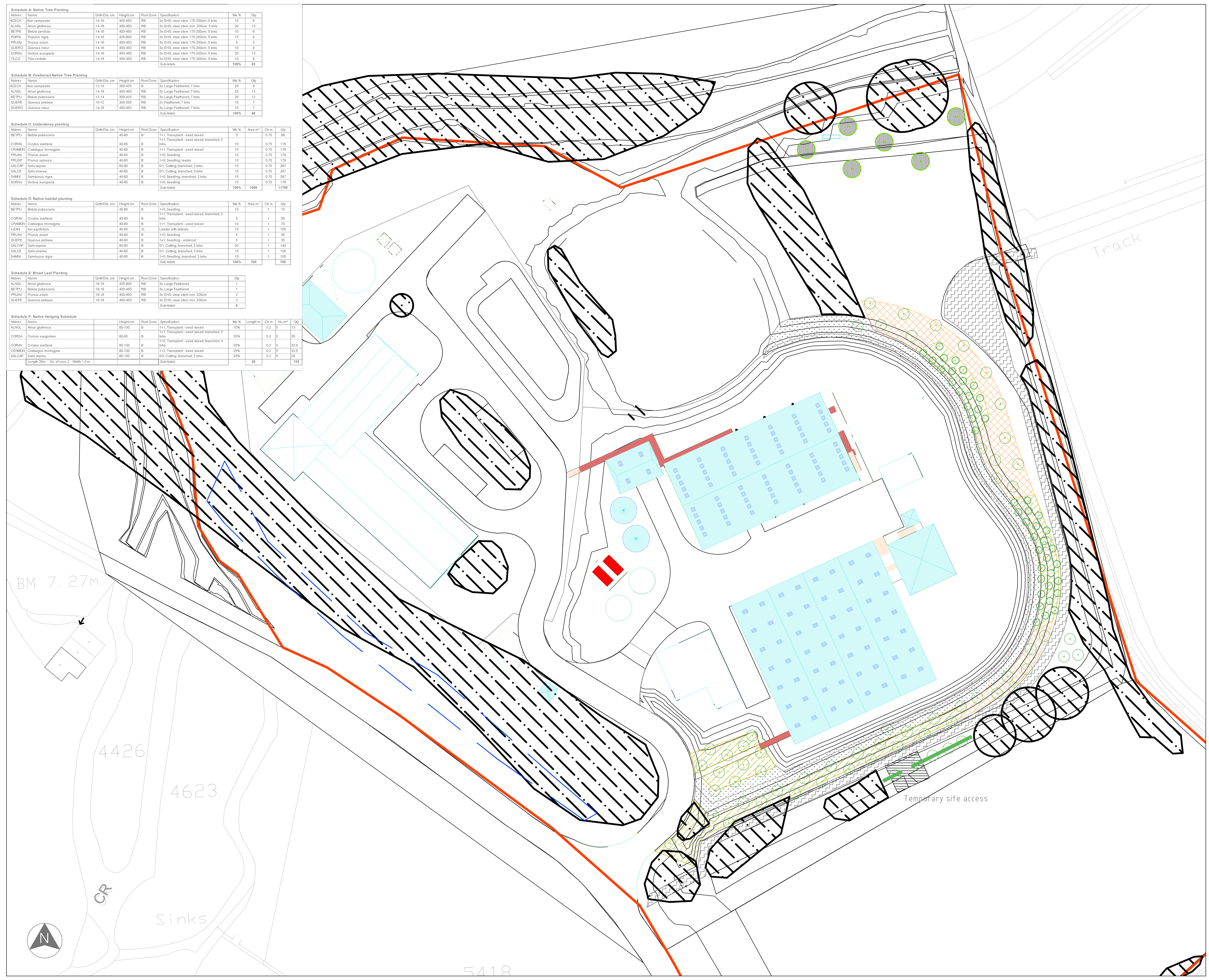
Abbrev.	Name	Girth/Dia. cm	Height cm	Root Zone	Specification	Mix %	Area m²	Ctr m	Qty
BETPU	Betula pubescens		40-60	B	1+0; Seedling	10		1	70
CORAV	Corylus avellana		40-60	B	1+1; Transplant - seed raised; branched; 2 brks	5		1	35
CRAMON	Crataegus monogyna		40-60	B	1+1; Transplant - seed raised	10		1	70
ILEAQ	Ilex aquifolium		40-60	2L	Leader with laterals	15		1	105
PRUAV	Prunus avium		40-60	B	1+0; Seedling	5		1	35
QUEPE	Quercus petraea		40-60	B	1u1; Seedling - undercut	5		1	35
SALCAP	Salix caprea		60-80	B	0/1; Cutting; branched; 2 brks	20		1	140
SALCE	Salix cinerea		40-60	B	0/1; Cutting; branched; 3 brks	15		1	105
SAMNI	Sambucus nigra		40-60	B	1+0; Seedling; branched; 2 brks	15		1	105
					Sub-totals	**100%**	**700**		**700**

Schedule E: Broad Leaf Planting

Abbrev.	Name	Girth/Dia. cm	Height cm	Root Zone	Specification	Qty
ALNGL	Alnus glutinosa	16-18	425-600	RB	3x; Large Feathered	1
BETPU	Betula pubescens	16-18	400-450	RB	3x; Large Feathered	1
PRUAV	Prunus avium	16-18	400-450	RB	3x; EHS; clear stem min. 200cm	2
QUEPE	Quercus petraea	16-18	400-450	RB	3x; EHS; clear stem min. 200cm	2
					Sub-totals	**6**

Schedule F: Native Hedging Schedule

Abbrev.	Name		Height cm	Root Zone	Specification	Mix %	Length m	Ctr m	No./m²	Qty
ALNGL	Alnus glutinosa		80-100	B	1+1; Transplant - seed raised	10%		0.2	5	13
CORSA	Cornus sanguinea		60-80	B	1+1; Transplant - seed raised; branched; 3 brks	20%		0.2	5	26
CORAV	Corylus avellana		80-100	B	1+2; Transplant - seed raised; branched; 4 brks	25%		0.2	5	32.5
CRAMON	Crataegus monogyna		80-100	B	1+2; Transplant - seed raised	25%		0.2	5	32.5
SALCAP	Salix caprea		80-100	B	0/2; Cutting; branched; 2 brks	20%		0.2	5	26
	Length 26m : No. of rows 2 : Width 1.0 m				Sub-totals		**26**			**130**



Notes:
Key

▬	Site Boundary
▭	Re-aligned field access track around edge of site - indicative only
▨	Root protection Area for vegetation to be retained on site and protected during construction period, as per arborocultural report and drawing
○	Proposed light standard staggered native tree planting to bank at min 6M spacing, as per schedule A. 62 Nr total.
◎	Proposed feathered native tree planting, at min 4M spacing as per schedule B. 46 Nr total
▨	Proposed understorey native habitat planting Mix to be located under specimen tree planting, as schedule C. 1,000m²
▦	Proposed native habitat planting mix, as schedule D. 700 m
▬	Proposed native species hedgerow as per schedule F. 25 Ln Metres
▩	Proposed wildflower meadow seeding to top of flood protection bund. 1,120m²
●	Proposed broadleaf planting to improve habitat connectivity across the site and with the surrounding area as recommended within Ecology Chapter as per schedule E. 6 Nr total
▬	Reptile receptor location along western boundary of existing building for reptiles to be translocated as recommended within Ecology Chapter prior to works commencing
▭	Proposed Bat roost box suitable for use by lesser horseshoe bats. To be a minimum size of 2.8m in height and 5m in length - to be erected between planted broadleaves as recommended within Ecology Chapter.

Issue	Description	Date
01	First Issue - Planning	08 JUL 15

Status
PLANNING
NOT TO BE USED FOR CONSTRUCTION

Scales	1:500	Current Issue Signatures	
		Author P. Subbiah	
Original Size	A1	Checker B. Pope	
Datum	DATUM	Approver R. Kitch	
Grid	GRID	© Copyright reserved	

Filename 7.16-UA007911-01 - BRYN COWLYD LANDSCAPE PROPOSALS.DWG

Client
Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Hyder Consulting (UK) Limited

HCL House
St Mellons Business Park
Cardiff
CF3 0EY
United Kingdom

Phone: 44 (0)29 2092 6700
Fax: 44 (0)29 20799275
www.hyderconsulting.com

Project
BRYN COWLYD WTW

Title
Landscape Proposals

Drawing No.	Project No.	Issue
Fig 1.16	UA007911	01

Plot Date: 16/Jul/2015 9:38:22 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.16-UA007911-01 - BRYN COWLYD LANDSCAPE PROPOSALS.DWG V1

View from track leading off B5106, 200m from the site, looking north

As provided by Caulmart Ltd

8 St Georges Court,
Altrincham Business Park,
Dairyhouse Lane,
Altrincham,
Cheshire. WA14 5UA

Issue	Description	Date
02	Updated Photomontage	15 JUL 15
01	First Issue	26 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
277701m	366022m	23m A.O.D

Field of View Angle = 24°

Distance to the center of the site = 220m

Picture taken during early April

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status
PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

Scales	NTS	Current Issue Signatures	
		Author P.SUBBIAH	
Original Size	A3	Checker B.POPE	
Height Datum	DATUM	Approver R.KITCH	
Grid	GRID	Ⓒ Copyright reserved	

Filename 7.17-7.19-UA007911-WXD-02__PHOTOMONTAGES.DWG

Project
BRYN COWLYD
WTW

Title
PHOTOMONTAGE 1
PROPOSED VIEW

HYDER CONSULTING (UK) Limited
5th Floor, The Pithay
All Saints Street,
Bristol, England
BS1 2NL

Tel: +44 (0)117 372 1200
Fax: +44 (0)117 372 1508

Drawing No.		Project No.		Issue
Fig.7.17	–	UA007911	–	02

50mm on Original

Plot Date: 15/Jul/2015 10:00:22 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.17-7.19-UA007911-WXD-02__PHOTOMONTAGES.DWG V1

View from A470, 1km from the site, looking south west

As provided by Caulmert Ltd

8 St Georges Court,
Altrincham Business Park,
Dairyhouse Lane,
Altrincham,
Cheshire. WA14 5UA

Issue	Description	Date
02	Updated Photomontage	15 JUL 15
01	First Issue	26 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
278595m	366665m	5m A.O.D

Field of View Angle = 50°

Distance to the center of the site = 970m

Picture taken during early April

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status **PRELIMINARY**
NOT TO BE USED FOR CONSTRUCTION

Scales	NTS	Current Issue Signatures	
		Author P.SUBBIAH	
Original Size	A3	Checker B.POPE	
Height Datum	DATUM	Approver R.KITCH	
Grid	GRID	© Copyright reserved	

Filename: 7.17-7.19-UA007911-WXD-02_PHOTOMONTAGES.DWG

Project
BRYN COWLYD
WTW

Title
PHOTOMONTAGE 2
PROPOSED VIEW

HYDER CONSULTING (UK) Limited
5th Floor, The Pithay
All Saints Street,
Bristol, England
BS1 2NL

Tel: +44 (0)117 372 1200
Fax: +44 (0)117 372 1508

Drawing No.	Project No.	Issue
Fig.7.18	– UA007911 –	02

50mm on Original

Plot Date: 15/Jul/2015 10:00:39 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.17-7.19-UA007911-WXD-02_PHOTOMONTAGES.DWG V1

View from Plas Maenan hotel terrace, 1.2 km from the site, looking south west

As provided by Caulmart Ltd

8 St Georges Court,
Altrincham Business Park,
Dairyhouse Lane,
Altrincham,
Cheshire. WA14 5UA

Issue	Description	Date
02	Updated Photomontage	15 JUL 15
01	First Issue	26 JUN 15

Viewpoint Location

Easting	Northing	Ground Level
278710m	366712m	33m A.O.D

Field of View Angle = 50°

Distance to the center of the site = 1070m

Picture taken during early April

Client

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Dwr Cymru Welsh Water, Ty Awen, Celtic Springs Business Park, Newport, NP10 8FZ
Telephone - 0800 0520145
Website - www.dwrcymru.com

Status **PRELIMINARY**
NOT TO BE USED FOR CONSTRUCTION

Scales	NTS	Current Issue Signatures	
		Author P.SUBBIAH	
Original Size	A3	Checker B.POPE	
Height Datum	DATUM	Approver R.KITCH	
Grid	GRID	© Copyright reserved	

Filename 7.17-7.19-UA007911-WXD-02__PHOTOMONTAGES.DWG

Project
BRYN COWLYD
WTW

Title
PHOTOMONTAGE 3

PROPOSED VIEW

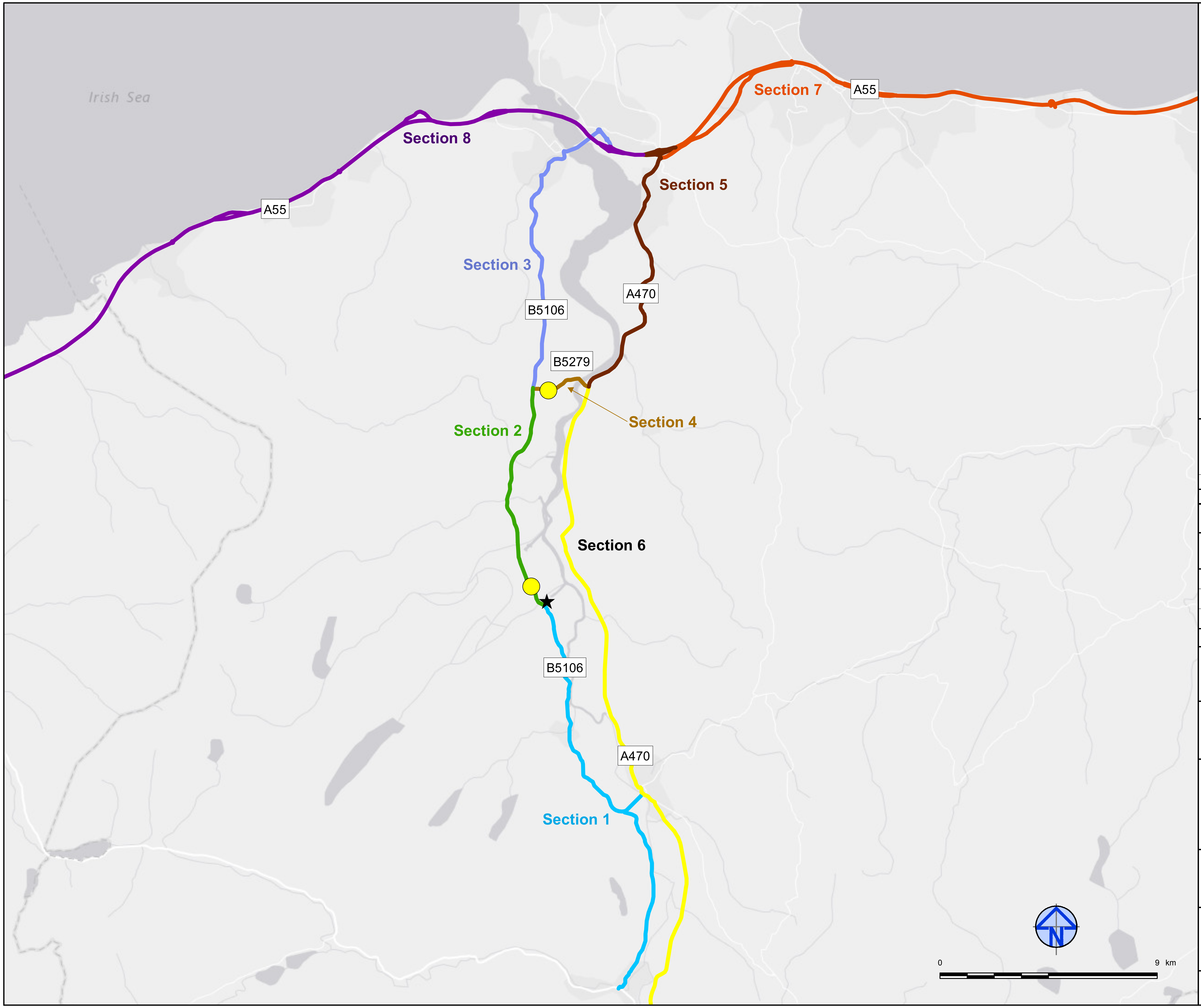
HYDER CONSULTING (UK) Limited
5th Floor, The Pithay
All Saints Street,
Bristol, England
BS1 2NL

Tel: +44 (0)117 372 1200
Fax: +44 (0)117 372 1508

Drawing No.	Project No.	Issue
Fig.7.19 –	UA007911 –	02

50mm on Original

Plot Date: 15/Jul/2015 10:00:54 AM File Location: \\HC-UKR-WN-FS-10\WN_PROJ\PROJECTS\UA007911 - BRYN COWLYD WTW\E-OUR-DRAWINGS\CURRENT\7.17-7.19-UA007911-WXD-02__PHOTOMONTAGES.DWG V1



Legend

★ Site location

● Traffic survey locations

Road Sections:

🟦	Section 1 – B5106 from Betws-y-Coed to Site Access
🟩	Section 2 – B5106 from Site Access to B5279
🟦	Section 3 – B5106/ A547/ A546 from B5279 to A55 (Conwy)
🟫	Section 4 – B5279
🟫	Section 5 – A470 from A55 to B5279
🟨	Section 6 – A470 from B5279 to A5 (Betws-y-Coed)
🟧	Section 7 – A55 east of the A470
🟪	Section 8 – A55 west of the A470

HGV Routes

Section 2 – B5106 from Site Access to B5279
Section 4 – B5279
Section 5 – A470 from A55 to B5279

Issue	Description	Date
02	REVISION 2	09-07-15
01	REVISION 1	07-07-15

Status
PRELIMINARY - CONFIDENTIAL

Scale	1:150,000	Current Issue Signatures
		Drawn D.SAWICKA
Original Size	A3	Checked L.HULME
Height Datum	NEWLYN	Approved G.THOMPSON
Projection	British National Grid	© Copyright reserved

0002-UA007911-BrynCowlyd-UP31-02-Fig8.1-PropRouteToSite

Client
Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

HYDER CONSULTING (UK) Limited

5th Floor, The Pithay
All Saints Street
Bristol, England
BS1 2NL

Tel: +44 (0)870 000 3003
Fax: +44 (0)870 000 3903

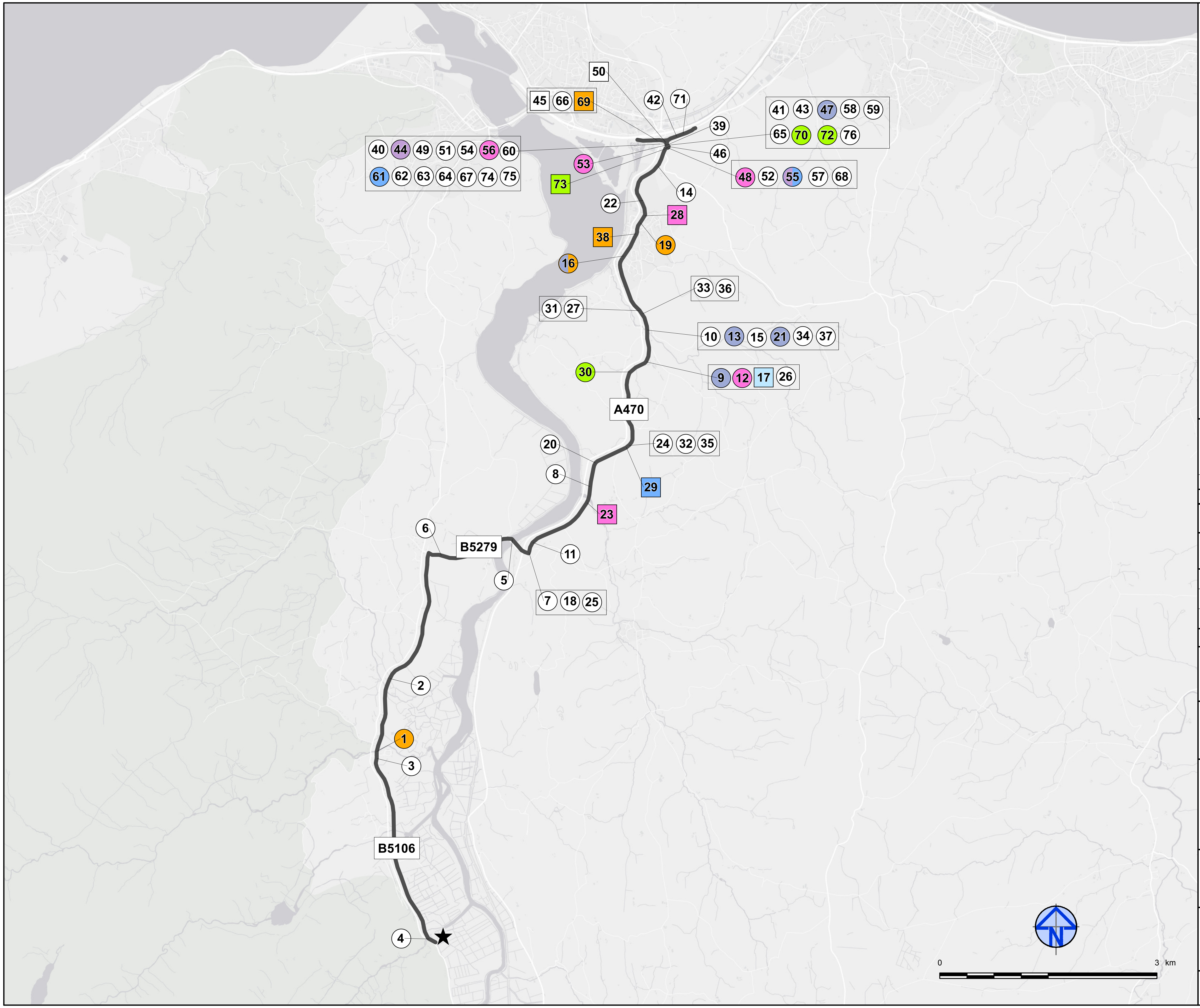
Project
UA007902
Bryn Cowlyd

Title
Figure 8.1
Proposed Route to Site

Drawing No.	Project No.	Issue
0002 –	UA007911 –	02

50mm on Original

Date: 09/07/2015 15:52:41 Path: \\hc-ukr-gd-fs-11\GD_Proj\UA007902 - DCWW AMP6 Schemes\D-Calculations\GIS\0002-UA007911-BrynCowlyd-UP31-02-Fig8.1-PropRouteToSite.mxd



Legend

★ Site location

▬ HGV Route

Accident severity:

○ Slight

☐ Serious

Accident inolving:

▭	Goods Vehicle
▭	Heavy Goods Vehicle
🟩	Cyclist
▭	Motorcycle
🟧	Pedestrian
🟪	Bus

Issue	Description	Date
02	REVISION 2	09-07-15
01	REVISION 1	07-07-15

Status
PRELIMINARY - CONFIDENTIAL

Scale	1:50,000	Current Issue Signatures	
		Drawn D.SAWICKA	
Original Size	A3	Checked L.HULME	
Height Datum	NEWLYN	Approved G.THOMPSON	
Projection	British National Grid	© Copyright reserved	

0003-UA007911-BrynCowlyd-UP31-02-Fig8.2-PIA

Client
Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Hyder
HYDER CONSULTING (UK) Limited
5th Floor, The Pithay
All Saints Street
Bristol, England
BS1 2NL

Tel: +44 (0)870 000 3003
Fax: +44 (0)870 000 3903

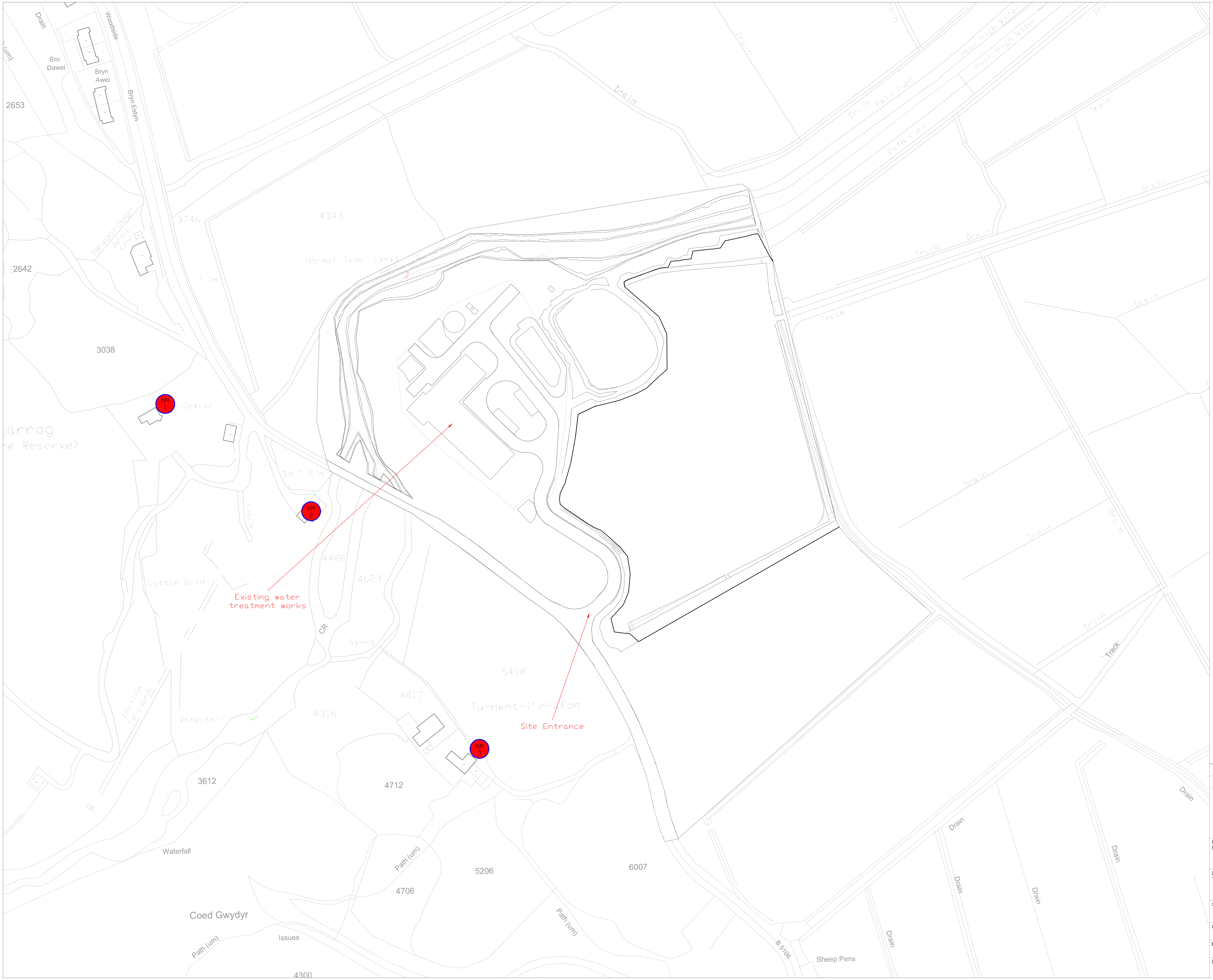
Project
UA007902
Bryn Cowlyd

Title
Figure 8.2
Location and Severity of Accidents

Drawing No.	Project No.	Issue
0003 –	UA007911 –	02

50mm on Original

Date: 09/07/2015 17:07:12 Path: \\hc-ukr-gd-fs-11\GD_Proj\UA007902 - DCWW AMP6 Schemes\D-Calculations\GIS\0003-UA007911-BrynCowlyd-UP31-02-Fig8.2-PIA.mxd



A1

NOTES:

1.

● NOISE MONITORING LOCATIONS

KEY PLAN

THIS DRAWING IS INTENDED TO BE USED FOR LOCAL AUTHORITY TOWN AND PLANNING PURPOSES ONLY. REFERENCE SHOULD BE MADE TO THE RESPECTIVE CONSULTANTS DESIGN AND DRAWINGS FOR TECHNICAL CONSTRUCTION DETAILS

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
01	02.07.15	NT	PRELIMINARY	GT	PP	02.07.15

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name: BRYN COWLYD WTW

Drawing Title: FIGURE 9.1
BASELINE NOISE MONITORING LOCATIONS

Suitability.: WORK IN PROGRESS

Suitability Code.: S0

Originator.: NT

Designer.: PP

Date.: 02/07/15

Internal Project Number.: UA007911

Scale.: 1:1000

Rev.: 01

Drawing Number.: 1279-W-201-HYD-XX-XX-DR-09032

APPENDICES

APPENDIX 2.1 EIA SCREENING OPINION

CONWY
CYNGOR BWRDEISTREF SIROL
COUNTY BOROUGH COUNCIL

Gwasanaethau Rheoleiddio a Thai / Regulatory and Housing Services
Pennaeth Gwasanaeth / Head Of Service – Peter Brown
Rheoli Datblygu / Development Control
Rheolwr Rheoli Datblygu ac Adeiladu / Development and Building Control Manager – Paula Jones
Swyddfeydd Dinesig, BAE COLWYN, LL29 8AR
Civic Offices, COLWYN BAY, LL29 8AR

Mr Howard Jones
Caulmert Limited
8 St Georges Court
Altrincham Business Park
Dairyhouse Lane
Altrincham
Cheshire
WA14 5UA

Gofynnwch am / Please ask for: **Dave Watson**
☎ **01492575246**
📠 **01492 512637**
💻 **dave.watson@conwy.gov.uk**
Ein Cyf / Our Ref: **DC/ENQ/25512**
Eich Cyf / Your Ref:
Dyddiad / Date: **10/07/2015**

Site / Location: Bryn Cowlyd Water Treatment Works
Conway Road
Dolgarrog
Conwy

Proposal: Request for an EIA screening opinion for proposed extensions to existing Bryn Cowlyd Water Treatment Works

Dear Mr Howard Jones

I refer to your letter dated 24 June 2015, requesting a screening opinion as to whether the above proposal is EIA development.

I enclose a screening opinion, which determines that the proposal is not EIA development, and that you will not be required to submit an Environmental Statement.

Any application would be assessed on the basis of the following policy documents:

Conwy LDP:
DP/1 - Sustainable development principle
DP/3 - Design quality and crime reduction
DP/4 - Development criteria
DP/6 - National planning policy and guidance
NTE/1 - The natural environment
NTE/3 – Biodiversity
NTE/4 – The landscape and protecting special landscape areas
NTE/6 - Renewable technologies
CTH/1 – Cultural heritage
CTH/2 – Development affecting heritage assets (Pont Dolgarrog Listed Building; Lower Conwy Valley Historic Landscape)
STR/1 – Sustainable transport, development and accessibility
STR/3 - Mitigating travel impact
MWS/1 – Minerals and Waste
MWS/3 – Safeguarding Hard Rock and Sand and Gravel Resources

Planning Policy Wales 7th Edition, July 2014
Technical Advice Notes: 5 (Nature Conservation and Planning)
11 (Noise)
12 (Design)
18 (Transport)

Notwithstanding the decision that the proposal is not EIA development, any application would need to be supported by the following additional information, where applicable:

i) Design and Access Statement. Explaining the design principles and concepts in relation to environmental sustainability, movement to and from the development, character and community safety. Appraisal of context (physical, social, economic, policy). Policy and approach on access, including assessment of specific issues and features.
http://www.conwy.gov.uk/upload/public/attachments/377/Design and Access statements planning applications.pdf

ii) Visual/landscape assessment. A Landscape and Visual Impact Assessment is required, with photomontages and zones of theoretical visibility, including impact on adjoining Snowdonia National Park and Lower Conwy Valley Historic Landscape, with reference to LANDMAP.

iii) Ecology/Biodiversity assessment. The ecological information should address impacts of the entire development, including any access routes:
- Bats and other protected species, including other mammals, birds, reptiles & amphibians which could be affected.
- Trees, hedges, any other priority habitats which may be affected.

If any of the above, or any other ecological receptors are found to be present and affected, appropriate mitigation or compensation should be incorporated within the application.
You are advised to contact Cofnod (local environmental information centre) as part of a preliminary desk top survey www.cofnod.org.uk. You are also advised to contact NRW and the Council's Countryside Section (contact barbara.owsianka@conwy.gov.uk) to ascertain the need, timing and scope for any surveys.

iv) Assessment of noise and vibration. You are advised to contact the Council's Planning and Environmental Enforcement Section.

v) Assessment upon traffic and transport, including Impacts on public rights of way and their users. This should include a Construction Method Statement that includes:
   a) Haulage routes for contractors' vehicles and other traffic. Swept path analysis of proposed routes if articulated and large rigid trucks are used during the construction phase to identify potential areas requiring works adjacent to the highway;
   b) Anticipated frequency and nature of traffic movements;
   c) Wheel washing facilities;
   d) Access and departure routes for construction traffic routes;
   e) Traffic control plan to ensure that conflicts between inbound and outbound vehicles are not experienced;
   f) The location of contractors' compounds;
   g) Working hours, including delivery times;
   h) Measures to control the emission of dust and dirt during demolition and construction; and
   i) A scheme for recycling/disposing of waste resulting from demolition and construction works.
   j) An indication of the type and number of heavy plant to be used;
   k) Whether any other works (e.g. access, drainage works, hardstandings are proposed);
   i) A method statement for the reinstatement of the land;
   m) The parking of vehicles of site operatives and visitors;
   n) Loading and unloading of plant and materials;
   o) Storage of plant and materials used in constructing the development;

vi) Archaeology and Cultural Heritage. Consult CADW where necessary and Gwynedd Archaeological Planning Service. You are also advised to contact the Council's Senior

Conservation Officer (contact: Huw.Davies@conwy.gov.uk) to assess any impact on Listed Buildings, including Pont Dolgarrog Listed Building.

vii) Impact upon hydrology and hydrogeology. Location is with TAN15 C1 flood zone. Consult NRW to determine suitability of design of development and flood consequences assessment (FCA).

viii) Impact on Safeguarded Sand Resources. Refer to LDP Policies MWS/1 and MWS/3. Consult North Wales Minerals and Waste Planning Service.

ix) Any proposed planning obligations that may be necessary to make the development acceptable in planning terms.

Please contact the above named Officer if you wish to discuss this matter further.

Yours sincerely

Paula Jones
Rheolwr Rheoli Datblygu/Adeiladu / Development and Building Control Manager

TOWN AND COUNTRY PLANNING
(ENVIRONMENTAL IMPACT ASSESSMENT)
(ENGLAND AND WALES) REGULATIONS 1999 -
REGULATION 7.

DETERMINATION AS TO WHETHER OR NOT A DEVELOPMENT PROPOSAL IS SUBJECT TO ENVIRONMENTAL IMPACT ASSESSMENT - SCREENING OPINION.

SECTION A

Enquiry reference:		ENQ/25512
Date of receipt of screening opinion request:		24 June 2015
Address of site:		Bryn Cowlyd Water Treatment Works Conway Road Dolgarrog Conwy
Enquirer	Name:	Mr Howard Jones
	Address:	Caulmert Limited 8 St Georges Court Altrincham Business Park Dairyhouse Lane
Proposed development		Extensions to existing Bryn Cowlyd Water Treatment Works (Screening Opinion)
The applicable thresholds/criteria from column 2 of Schedule 2 of the Regulations for the type of development proposed.		10(b) Urban development projects – the area of the development is approximately 1.5Ha and exceeds the 0.5 Ha threshold. 11(d) Waste water treatment plants – the area of the development is approximately 2900m2 and exceeds the 1000m2 threshold.
Is the proposal in a Sensitive Area as defined in Regulation 2(1)		NO

SECTION B

Consideration has been given by the Local Planning Authority to the Selection Criteria in Schedule 3 of the Regulations, the general guidance contained in the EIA Circular, relevant indicative Criteria in Schedule 3 of the Regulations and, as applicable, the details contained in any request for a screening opinion and in the case of Schedule 2 development.

The Local Planning Authority hereby determines that:

The proposed development is **not** an Environmental Impact Assessment development within the Schedule 2 of the Regulations and you are **not** required to submit copies of an Environmental Statement to the Local Planning Authority with a future planning application for the development.

SECTION C.

The Local Planning Authority's reasons why it has not requested an Environmental Statement in this case are:-

i) The scale of the proposed development is below the criteria indicated in paragraphs A18, A19 and A39 of Welsh Office Circular 11/99 as those above which an Environmental Impact Assessment is more likely to be required;

ii) The proposed development does not constitute major development which is of more than local importance. The development is in a TAN15 C1 flood zone and the Lower Conwy Valley Historic Landscape, and in close proximity to Snowdonia National Park and Pont Dolgarrog Listed Building, but the characteristics and potential impact of the development is unlikely to have significant environmental affect to constitute EIA development. The development and would not have unusually complex and potentially hazardous effects (as defined in paragraphs 41 and 42 of Welsh Office circular 11/99).

.... Date of Determination: 10 July 2015

P Jones
Development and Building Control Manager
On behalf of Conwy County Borough Council

Copy of this determination is placed on the Part 1 Register.

In the case of a notification under Regulation 7(2) that the submission of an environmental statement is required, attention is drawn to the provisions of Regulation 7(4) that requires the applicant to give written notification to the local planning authority within the period of three weeks stating whether he accepts that view or will be requesting a screening direction from the Welsh Government. Failure to so notify the local planning authority will result in the application being deemed to be refused (unless a screening direction has been issued to the effect that the development is not EIA development).

APPENDIX 4.1 EXTENDED PHASE 1 HABITAT REPORT

Hyder

Dŵr Cymru Welsh Water

Bryn Cowlyd Water Treatment Works, Dolgarrog

Appendix 4.1

Extended Phase 1 Habitat Survey

Hyder Consulting (UK) Limited
2212959
HCL House
Fortran Road
St Mellon's Business Park
St Mellons
Cardiff, CF3 0EY
United Kingdom
Tel: +44 (0)29 2092 6700
Fax: +44 (0)29 2079 9275
www.hyderconsulting.com

Dŵr Cymru Welsh Water

Bryn Cowlyd Water Treatment Works, Dolgarrog

Appendix 4.1

Extended Phase 1 Habitat Survey

Author	Emily Greenall
Checker	Rob Davies
Approver	Samantha Walters
Report No	UA007911_UE21_Eco_App_R01
Date	14 July 2015

This report has been prepared for Dŵr Cymru Welsh Water in accordance with the terms and conditions of appointment for an Extended Phase 1 Survey dated March 2015 Hyder Consulting (UK) Limited (2212959) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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2.1 Site Description.. 2

2.2 Details of the Proposed Development 2

3 Methodology 3

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1 Summary

This report presents the findings of an extended Phase 1 Habitat and protected species walkover survey associated with the proposed Development at Bryn Cowlyd Water Treatment Works, undertaken by Hyder Consulting (UK) Ltd on behalf of Welsh Water in April 2015. It also includes the initial results of targeted surveys undertaken to confirm the presence/absence of hazel dormice, reptiles and bats which are still on-going. The detailed methodologies and results of the targeted surveys will be presented in a separate Addendum report in September 2015. This report has been prepared to support a planning application for the installation of new buildings and to increase the retention capacity of the settlement pond. A separate Environmental Report, also prepared by Hyder Consulting, contains further details regarding the proposed Development and an assessment effects arising from the Development.

The purpose of the April 2015 survey was to identify key ecological constraints on the proposed Development site, to inform the design and help advise on appropriate mitigation and enhancement measures. This report summarises existing baseline ecological conditions on the proposed Development site.

A desk study was undertaken in April 2015 in order to identify any existing information relating to the proposed Development site and its surroundings. The Phase 1 habitat survey comprised a site walkover survey to map the Phase 1 habitats present within the proposed Development site boundary, and to assess their potential to support protected species of plants and/or animals. In addition, the surveyor checked for signs of protected species.

The proposed Development is unlikely to result in any significant impact on ecological receptors, providing appropriate best practice measures are adopted during the construction phase, through the implementation of a Construction Environmental Management Plan.

The Development proposals would involve the loss of habitats present on site including planted broad-leaved woodland, semi-improved grassland, and marshy grassland habitat. The habitats present on the proposed Development site are potentially suitable for supporting protected species including nesting birds, badger, reptiles, bats, water vole, otter, juvenile fish and hazel dormouse, all of which were confirmed as present within 2km. No definitive signs of these species were observed during the surveys of the proposed Development site to date. However, surveys for bats, hazel dormouse and reptiles are ongoing at the time of writing (July 2015).

In order to minimise the impact upon nesting birds it is recommended that construction activities take place outside the bird breeding season (1 March to 31 August inclusive). A pre-construction ecological survey should be undertaken to confirm the absence of protected species prior to the commencement of site clearance works, this would include a search for nesting birds, where appropriate.

If surveys reveal that reptiles are present they would be moved from the working area to a suitable receptor location prior to works commencing. These works would be undertaken in accordance with an approved mitigation and method statement. If further surveys confirm the presence of hazel dormice on the proposed Development site, site clearance would proceed under an approved method statement potentially in accordance with a Development licence from Natural Resources Wales. Further surveys for bats are ongoing. If any trees suitable for use by bats require removal to facilitate the Development and further surveys reveal a bat roost mitigation measures would be developed to ensure that the favourable conservation status of the bat population is maintained. Such measures would proceed under an approved method statement potentially in accordance with a Development licence from Natural Resources Wales.

If the proposed Development affect the Afon Ddu, then mitigation measures would need to be implemented to safeguard important fish populations, kingfisher and otter.

2 Introduction and Aims

Hyder Consulting (UK) Limited, working as part of the Dŵr Cymru Welsh Water (DCWW) Capital Deliveries was instructed to undertake an extended Phase 1 Habitat and protected species walkover survey at Bryn Cowlyd Water Treatment Works (WTW) near Dolgarrog in Conwy County Borough Council (CCBC).

This report presents the findings of an extended Phase 1 Habitat and protected species walkover survey. It also includes the initial results of targeted surveys undertaken to confirm the presence/absence of hazel dormice (*Muscardinus avellanarius*), roosting bats and reptiles which are still on-going. The detailed methodologies and results of the targeted surveys will be presented in a separate Addendum report in September 2015. This report has been prepared to support a planning application for the installation of new buildings and to increase the retention capacity of the settlement pond. A separate Environmental Report, also prepared by Hyder Consulting, contains further details regarding the proposed Development and an assessment effects arising from the Development.

The purpose of the April 2015 survey was to identify key ecological constraints on the proposed Development site, to inform the design and help advise on appropriate mitigation and enhancement measures. This report summarises existing baseline ecological conditions on the proposed Development site.

2.1 Site Description

Bryn Cowlyd WTW is situated just south of the village of Dolgarrog in the county of Conwy, North Wales, approximate Grid Reference SH 77514 66325. The proposed Development site is located adjacent to the southern bank of the Afon Ddu approximately 697m upstream from its confluence with the larger Afon Conwy.

The WTW is located on the floodplain of the Afon Ddu. Where the river is adjacent to the proposed Development site it is approximately 10m wide. The river has been assessed as having very good ecological potential and supports populations of salmonid fish (Ref 1).

The land use surrounding the WTW to the east and south east is predominantly floodplain grazing marsh with a network of field drainage ditches that showed evidence of recent dredging management in April 2015. The A470 is the nearest main road to the proposed Development site, this road is parallel with the western boundary of the proposed Development site and bordered by dense woodland to the west.

The water source for the WTW is the Llyn Cowlyd which is located within the Snowdonia National Park approximately 5km west from the WTW. The existing pipeline is routed in close proximity to the Afon Ddu as it leaves the source and runs within Snowdonia National Park and Dolgarrog woodland National Nature Reserve (NNR) for part of its course.

2.2 Details of the Proposed Development

The proposed WTW comprises of a new Dissolved Air Flotation process followed by a single stage of new Rapid Gravity Filters. The pressure will be broken at the head of the works and a turbine installed to utilise the available energy. The water will gravitate through the new treatment units to a high lift pumping station. Water will be then pumped from the water treatment works to the offsite clear water tank.

3 Methodology

3.1 Desk Study

A desk study was undertaken in order to identify any existing ecological information relating to the proposed Development site and its surroundings. The Multi-Agency Geographical Information System (MAGIC) website (Ref 2) was used to search for statutory designated sites of nature conservation value within 5km of the site.

The North Wales Environment Information Service (Ref 3) were consulted in April 2015 to check whether they held any records on statutory or non-statutory designated nature conservation sites and / or records of protected species or species of conservation concern within 2km of the proposed Development site. This included a request for data for habitats and species of Principal Importance for conserving biodiversity in Wales, i.e. those listed under Section 42 of the Natural Environment and Rural Communities Act (Ref 11).

Natural Resources Wales (NRW) were consulted in April 2015 to establish whether they hold any monitoring data on the watercourses within and adjacent to the proposed Development site. Specifically, a request was made for Water Framework Directive (WFD) monitoring data, in order to inform the aquatic ecology baseline. In addition the NRW interactive mapping tool (Ref 5) was used to establish the WFD classification of the Afon Ddu (waterbody ID GB110066054890) that bounds the proposed Development site to the north.

The CCBC Ecologist was contacted in early April 2015 to discuss the proposed approach to ecology surveys. They were contacted again on the 1 June 2015 with a request for information on local nature conservation sites and Tree Preservation Orders (TPO) within 1km and 200m respectively of the proposed Development site.

3.2 Field Survey

3.2.1 Phase 1 Habitat Survey and Protected Species Walkover Survey

An extended Phase 1 habitat and protected species walkover survey was undertaken during April 2015. This comprised a walkover survey to map the Phase 1 habitats present within the proposed Development site and assess their potential to support protected species of plants and/or animals and check for signs of protected species.

The habitat survey involved identifying and mapping the dominant habitat types following the standard survey methodology (Ref 6). Dominant plant species were noted, as were any uncommon species or species indicative of particular habitat types, but there was no attempt to compile exhaustive species lists. Botanical names follow Stace (Ref 7) for higher plants. The outputs of this include a Phase 1 habitat map and a set of Target Notes (TN's) which are illustrated on Figure 4.1 (at the end of this report) and included in Section 6, below.

The protected species walkover survey included a check for mammal signs on site, including badger (*Meles meles*) signs to include setts, paths, latrines and feeding signs; otter (*Lutra lutra*) survey to include a search for holts, couches and spraints, and water vole (*Arvicola amphibius* survey to search suitable habitat areas for latrines, feeding stations and burrows.

In addition, all mature trees were carefully observed from the ground, with binoculars, to determine whether they provide sites potentially suitable for use by roosting bats.

The value of the site for invertebrates, amphibians (including great crested newt (*Triturus cristatus*)); reptiles, breeding and over-wintering birds, European hedgehog (*Erinaceus europaeus*), red squirrel (*Sciurus vulgaris*), polecat (*Mustela putorius)* and hazel dormice was assessed as part of the protected species walkover survey.

In addition, the potential of the watercourses adjacent to the proposed Development site to support fish and aquatic invertebrates including white-clawed crayfish (*Austropotamobius pallipes*) was also assessed.

3.2.2 Targeted Surveys for Protected Species

On completion of the Phase 1 habitat and protected species walkover surveys targeted surveys to confirm the presence/absence of reptiles, roosting bats and hazel dormice have commenced. These surveys are in progress and the full detail of the survey methodologies and results will be presented in an addendum report in September 2015. The results that have been obtained to date (July 2015) have been used to inform this report and the ecological impact assessment contained in Chapter 4 of the Environmental Report that has been produced by Hyder Consulting on behalf of Welsh Water.

4 Results

The results of the desk study and walkover surveys outlined above, together with the initial findings of the targeted surveys for reptiles, bats and hazel dormice have been combined into appropriate species and habitat groups outlined below.

The findings of the Phase 1 habitat survey map are illustrated on Figure 4.1, with supporting Target Notes (TNs) which are referred to within the following sections. Table 2 in Appendix A summarises the conservation status and legal protection afforded to the notable and/or protected species mentioned below. If a species is mention in the text below, but not listed in Table 2 it is considered to be common and/or receives no legal protection.

4.1 Desk Study

4.1.1 Statutory Designated Sites

The site is located adjacent to the Afon Ddu, which is a tributary of the Afon Conwy. 12 km downstream of the proposed Development site the Afon Conwy flows into Y Forŷd Site of Special Scientific Interest (SSSI) which is part of Menai Strait and Conwy Bay Special Area of Conservation (SAC).

There are six statutory designated sites within 2 km of the site: Coed Dolgarrog Woodlands SSSI and NNR to the west; Morfa Uchaf, Dyffryn Conwy SSSI to the north east; Plas Maenan SSSI to the east; and Mwyngloddiau a Chreigiau Gwydyr SSSI to the south west part of which is also designated as a SAC known as the Gwydyr Forest Mines SAC. The reasons for their designations are summarised in Table 1 below.

Table 1 – Qualifying Features for Statutory Designated Sites within 2 km

Protected Site	Qualifying Features	Distance and Direction
Coed Dolgarrog SSSI and NNR	Woodland type	100m to the west
	Woodland birds	
	Invertebrates	

Morfa Uchaf, Dyffryn Conwy SSSI	Reedbed and saltmarsh communities	760m north-east
	Scarce plants	
Mwyngloddiau a Chreigiau Gwydyr SSSI	Bats	924m south
	Calaminarian grasslands	
Plas Maenan SSSI	Lesser horseshoe bats	1.1km east

4.1.2 Non-Statutory Designated Sites

There were no non-statutory designated sites of nature conservation importance within the search area.

4.1.3 Water Framework Directive

The proposed Development site is situated adjacent to the Afon Ddu (Water Body ID GB110066054890) which has been classed as having moderate ecological potential (Ref 1). The proposed Development site is within the Conwy and Clwyd catchment within the Western Wales River Basin District. Land use in the catchment is predominantly agriculture and forestry. Measures for improving water quality are outlined within the Western Wales River Basin Management Plan (RBMP) of which an updated version has recently been circulated for consultation (Ref 4).

4.1.4 Species records within 2km

A number of protected species records were confirmed within 2km of the site (Ref 2). The conservation status and legal protection afforded to these species is summarised in Table 2, Appendix A. The records confirmed the presence of European Protected Species namely otter, hazel dormouse and bats, along with bird species specially protected under Schedule 1 of the Wildlife and Countryside Act (1981, as amended) (Ref 12.). These included marsh harrier (*Circus aeruginosus*), red kite (*Milvus milvus*) and peregrine falcon (*Falco peregrinus*). The data search also confirmed records of species protected under the NERC Act (Ref 11), including salmonids, hazel dormouse, red squirrel, brown hare (*Lepus europaeus*), polecat and European hedgehog.

4.1.5 Plants and Habitats/ Flora

The habitats present within the survey area included marshy grassland, species-poor semi-improved grassland, and plantation broad-leaved woodland. The planted woodland areas provide habitat linkages to woodland in the wider area, linking that along the river corridor to woodland north and west of the proposed Development site, which in turn links to Coed Dolgarrog to the west of the proposed Development site, and Plas Maenan to the east. Both of these sites are known to support bats.

Marshy grassland

Marshy grassland was present in the southern field (TN9). This area was grazed, particularly the eastern side of the field, adjacent to the field drain. The sward largely comprised Soft-rush (*Juncus effusus*), with lesser coverage of Hard Rush (*Juncus inflexus*) and Sedge species (*Carex* spp).

Semi-improved grassland

The species-poor semi-improved grassland areas within the site (TN2 and 4), surrounded the settlement lagoon. This grassland appeared to be infrequently mown, and supported Common Bird's-foot-trefoil (*Lotus corniculatus*), Perennial Rye-grass (*Lolium perenne*), Red Clover (*Trifolium pratense*), Creeping Buttercup (*Ranunculus repens*), Creeping Thistle (*Cirsium arvense*), and White Clover (*Trifolium repens*). Oxeye Daisy (*Leucanthemum vulgare*) was present in a small area to the north of the existing settlement pond, adjacent to the woodland.

Tall ruderal and scrub

Dense stands of tall ruderal herbs (mainly comprising Common Nettle (*Urtica dioica*)) were recorded on the track margins and on the proposed Development site boundary adjacent to woodland areas. A mixture of Bracken (*Rubus fruticosus agg.*), Common Nettle, Ash (*Fraxinus excelsior*) saplings and Indian Balsam (*Impatiens glandulifera*) was also recorded on the track margins and adjacent to the woodland boundary to the north of the existing settlement lagoon.

Broadleaved woodland

Most of the woodlands comprised immature plantation, consisting predominantly of Alder (*Alnus glutinosa*), Ash, Silver Birch (*Betula pendula*), Hazel (*Corylus avellana*) and White Willow (*Salix alba*), with a field layer comprising Bramble and Common Nettle (TN1, 5 and 7). Mature trees were recorded on the east and north east perimeter of the site (TN10, 11, 12 and 13), and adjacent to the river on the northern edge of the site (TN3).

Mature Pedunculate Oak (*Quercus robur*), Ash, Hawthorn (*Crataegus monogyna*) and Sycamore (*Acer pseudoplatanus*) trees were recorded in the woodland identified by TN13.

Watercourses

The Afon Ddu forms the northern boundary to the proposed Development site (TN8, 14 and 15). The drainage ditches within the proposed Development site are linked to the Afon Ddu, they were largely devoid of aquatic vegetation with the exception of patches of Common Water-starwort (*Callitriche stagnalis*).

Waterbodies

No aquatic plants were recorded within the lagoon (TN6), and no records were received for the lagoon.

4.1.6 Notable Plant Species

The data search returned one record of a scarce or rare plant within the search area which was the leafy liverwort Pale Scalewort (*Radula voluta*) approximately 360m from the proposed Development site. This liverwort is more commonly associated with damp shaded rocks near waterfalls and unlikely to be present on the site.

4.1.7 Invasive Plant Species

The consultation response identified Indian Balsam on the Afon Ddu, downstream of the site. As identified previously Indian Balsam was recorded within the proposed Development site within the areas of tall ruderal herbs and on the edge of the tracks throughout the site.

4.1.8 Terrestrial Invertebrates

The desk study confirmed records of small heath (*Coenonympha pamphilus*) and pearl-bordered fritillary (*Boloria euphrosyne*) butterflies together with shaded broad-bar (*Scotopteryx chenopodiata*) moth within 1km of the site. Whilst small heath may use the grassland within the proposed Development site, the habitats were unsuitable for pearl-bordered fritillary and shaded broad-bar. It is considered that small heath may be present but that the other two species would not use the proposed Development site.

The habitat within the proposed Development site provided suitable habitat for a range of aquatic and terrestrial invertebrates, with the lagoon, ditch systems, adjacent watercourse, wood log piles, marshy grassland and mature trees providing suitable refuge and foraging habitat.

4.1.9 Amphibians

The desk study provided no records of great crested newt within 2km of the site and the CCBC Ecologist confirmed that it is unlikely that this species is present within the proposed Development site. In addition, the habitats within the proposed Development site were assessed as sub-optimal for this species, given the lack of suitable breeding locations within the proposed Development site and the wider area.

It is therefore considered likely that great crested newt are absent from the proposed Development site. Whilst other amphibian species may be present the proposed Development site in their terrestrial phase it is unlikely to support significant numbers of amphibians.

4.1.10 Reptiles

The desk study revealed records of common lizard (*Zootoca vivipara*), and grass snake (*Natrix natrix*) within 2km of the proposed Development site. In addition, the local authority ecologist referenced a site 1.2 km away which supports a good population of three reptile species, though these species were not specified.

The habitat on the proposed Development site was considered suitable for reptiles, with suitable habitat present across the site for hibernation, and a mosaic of habitats and structures suitable for foraging. It is likely that the site as a whole supports common lizard, slow-worm (*Anguis fragilis*) and grass snake. Surveys are on-going to establish whether reptiles are present on the proposed Development site, to date (July 2015) their presence has not been confirmed; these surveys follow best practice guidance (Ref 9).

4.1.11 Birds

The marshy grassland, woodland and scrub within the proposed Development site is likely to support nesting birds, in particular passerines (song birds).

Black grouse (*Tetrao tetrix*) have been recorded within 2km of the site, but the proposed Development site does not support suitable habitats for this species.

The desk study confirmed records of kingfisher (*Alcedo atthis*), redwing (*Turdus iliacus*), fieldfare (*Turdus pilaris*) and northern lapwing (*Vanellus vanellus* within 2km of the proposed Development site. The banks of the Afon Ddu had steeply sloping banks that were potentially suitable for nesting kingfisher. It is considered unlikely that redwing and fieldfare would nest on the proposed Development site since it is not in the natural breeding range and the grassland was not suitable for nesting northern lapwing.

There were also records of lesser redpoll (*Acanthis cabaret*), bullfinch (*Pyrrhula pyrrhula*), willow tit (*Poecile Montana*), spotted flycatcher (*Muscicapa striata*), and Cetti's warbler (*Cettia cetti*) within 2km of the proposed Development site. Suitable nesting sites/habitats for these species was not recorded within the proposed Development site.

4.2 Mammals

4.2.1 Bats

The desk study confirmed records of a lesser horseshoe (*Rhinolophus hipposideros*) bat roost 146m and an unknown species bat roost 200m from the proposed Development site. Records were provided for soprano pipistrelle (*Pipistrellus pygmaeus*), brown long-eared bat (*Plecotus auritus*) and several unknown species of bat foraging in the wider area. The desk study confirmed that an artificial 'bat cave' has been created as part of the nearby surf centre project to the north.

The more mature trees within the areas of broad-leaved plantation within the proposed Development site to the east of the settlement lagoon, and within the central and southern areas, contained sites potentially suitable for use by roosting bats, with cavities and/or fissures present. Bat surveys are ongoing in accordance with best practice guideline (Ref 10) to date no bat roosts have been identified on the proposed Development site.

4.2.2 Hazel Dormice

The desk study revealed records of hazel dormice within woodland 200m north of the proposed Development site. This woodland is separated from the proposed Development site by the Afon Ddu which is likely to present a barrier to the movement of hazel dormice, except where the tree canopies intertwine. Within the proposed Development site the more mature woodland on the banks of the Afon Ddu was suitable for use by hazel dormice. The planted woodlands were sub-optimal for use by hazel dormice due to their low species and structural diversity. Given the proximity of the record it has been considered appropriate to undertake surveys for hazel dormice using nest tubes to confirm their presence/absence on the proposed Development site. To date (July 2015) no hazel dormice have been found but surveys are ongoing in accordance with dormouse survey guidance (Ref 8).

4.2.3 Badger

The desk study confirmed records of badger within the search area (1km from the proposed Development site). No definitive signs of badger or their setts were recorded on site.

4.2.4 Otter

The desk study confirmed records of otter within the search area. The banks of the Afon Ddu contained suitable resting places for otter, and the data consultation confirmed presence of salmonids within this section of the river, confirming presence of suitable prey for otter. No otter signs were observed during the survey, nevertheless it is considered that otters would make use of this watercourse. The drainage ditches were considered sub-optimal for use by otters lacking significant places of refuge and sources of prey. Nevertheless otters may use these features whilst travelling through their range.

4.2.5 Water Vole

The desk study confirmed records of water vole within 1km of the proposed Development site and the survey confirmed presence of suitable habitat for water vole within the ditch network on the proposed Development site.

No signs of water vole were recorded on the proposed Development site during the surveys and it is considered that they are absent.

4.2.6 Other Mammals

The data consultation confirmed records of red squirrel, polecat, weasel (*Mustela nivalis*), European hedgehog, stoat (*Mustela erminea*) and brown hare within 2km of the proposed Development site.

The survey concluded that the habitats present on the proposed Development site were suitable for potentially supporting polecat, European hedgehog and brown hare. No habitats likely to be of value to red squirrel and weasel were recorded within the proposed Development site.

No mammal signs were observed during the survey.

4.3 Aquatic Ecology

The WFD monitoring report confirmed the presence of salmonids on the Afon Ddu, which forms the northern boundary to the proposed Development site.

The drainage ditches on the proposed Development site contained potentially suitable habitat for fish, with varied substrate and shading along much of their length and hydrologically connected to other watercourses including the Afon Ddu. However, the low flows within the drainage ditches mean that they are unlikely to support any significant populations of fish or aquatic invertebrates, and hydrological sampling undertaken to inform Hyder’s Environmental Report along these watercourses indicated pollution/ enrichment and low oxygen levels. As such, it is unlikely that the watercourses within the proposed Development site support significant populations of fish.

5 Conclusions

The consultations, extended Phase 1 habitat survey and targeted surveys for reptiles, hazel dormice and bats undertaken to date (July 2015) have confirmed the presence of habitats within the site which are suitable for reptiles, bats, hazel dormice, otters and badgers.

The proposed Development comprises the construction of hard standing and buildings within the grassland and planted broad-leaved woodland. These areas provide potential habitat for protected species including badger, hazel dormouse and bats, although no signs of protected species have been observed on the proposed Development site to date.

Where trees or scrub removal is necessary, this should ideally be undertaken outside of the breeding bird season (that is, not between 1 March and 31 August inclusive). Where works within this season are unavoidable, the proposed Development site should be surveyed prior to vegetation clearance, to confirm the absence of nesting birds. Should nesting birds be present then works would need to cease in a suitable exclusion zone established around the nest (to be confirmed by the site ecologist) until the chicks have fledged.

Further surveys for bats are ongoing if they reveal the presence of a roost within one of the trees that require felling then, mitigation measures would be devised to ensure the favourable conservation status of the bats is maintained. Where possible the roost would be retained in situ and where this is not possible a replacement roost site in the form of an artificial roost site would be provided. This is likely to take the form of a bat box on one of the retained trees. Any works likely to cause disturbance to bats or a loss of a roost site would need to proceed in accordance with a method statement and under licence to NRW. Irrespective of the results of further surveys bat boxes would be installed on the retained trees as a habitat enhancement.

If further surveys confirm the presence of dormice within the footprint of the proposed Development, then a method statement would be prepared to safe guard the population. This is likely to include moving dormice to safe areas outside the Development, the provision of nest boxes and new planting to enhance the value of the proposed Development site for dormice. Dependent on the scale if the impact these measures may need to proceed under a Development licence from NRW.

In the event that targeted surveys confirm the presence of reptiles within the footprint of the proposed Development mitigation measures to safe guard the population and prevent the mortality of reptiles would be implemented. As such, prior to construction works commencing, reptiles would be translocated from the working area, to a suitable receptor location under the direction of the site ecologist. Measures would be implemented to present reptiles from entering the working areas and where appropriate, reptile fencing would be installed. The reptile translocation would commence during the active season which is April to September, prior to winter hibernation. Additionally, all suitable areas of reptile refugia such as log piles on the western edge of the marshy grassland field to the south of the main works, should remain in-situ as far as possible, in order to minimise disturbance.

There is sufficient space within the proposed Development layout to create a suitable receptor site for reptiles. Given the amount of ground disturbance that the proposed Development site has undergone in the past it is considered that it would support, at most, a small population of reptiles. However, if the survey reveals that the proposed Development site supports a medium to large population additional sites would be identified that are suitable to receive the reptiles.

The invasive species Indian Balsam was identified within the proposed Development site. Indian Balsam within the working areas would need to be managed in accordance with current best practice guidelines and legislation.

Works within the Afon Ddu should be avoided, in order to minimise potential impact upon migratory fish. In the unlikely event that in-channel works are necessary then suitable mitigation measures would be discussed and agreed with consultees beforehand, to include a restriction to timing of works to avoid the main salmonid fish migration period, and fish rescue operations to ensure that species are not harmed during the works. Similarly, dependent on the timing of works mitigation measures may also need to be implemented to ensure no disturbance to nesting kingfisher and otter lying-up sites. If works to the drainage ditches are required measures would be implemented to ensure that water quality within the Afon Ddu is protected.

Species specific surveys are ongoing at the proposed Development site for reptiles, bats and hazel dormice and will be reported within an addendum report in September 2015.

An Ecological Mitigation and Enhancement Plan should be agreed with CCBC prior to the commencement of construction. The contents of this Plan should include:

- Provision of broad-leaved planting areas to improve habitat connectivity;

- Provision of suitable bat roost habitat features at suitable locations across the proposed Development site;
- Planting of variety of wildflower species, where possible across the proposed Development site in order to support invertebrate assemblage;
- Where possible, improve marginal habitat along watercourses, and around the margins of the lagoon, to improve water quality; and
- Creation and/or improvement of reptile refugia habitat across the proposed Development site.

The results of targeted surveys for reptiles, bats and hazel dormice which are ongoing at the site at the time of writing, will further inform suitable mitigation and enhancement measures on site.

6 References

Ref 1. Water for life and livelihoods-River Basin Management Plan Western Wales River Basin District - Annex B: Water body status objectives, Environment Agency 2009 (updated 2011).

Ref 2. MAGIC Interactive map, accessed online April 2015: http://www.magic.gov.uk/MagicMap.aspx

Ref 3. North Wales Environmental Information Service, (COFNOD), 2015.

Ref 4. Natural Resources Wales, 2014: Consultation on updating the Western Wales River Basin Management Plan. Accessed online April 2015: http://naturalresourceswales.gov.uk/content/docs/pdfs/consultation-pdfs/2014-ourconsultations/dee-and-western-river-basin-plans/consultation-on-updating-the-western-walesriver-basin-management-plan.pdf?lang=en.

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Ref 6. JNCC, 2010: Handbook for Phase 1 Habitat Survey: A technique for Environmental Audit.

Ref 7. Stace, C. 2010: New Flora of the British Isles Third Edition. Cambridge University Press.

Ref 8. Paul Bright et al, 2006: The Dormouse Conservation Handbook Second Edition. English Nature.

Ref 9. David Sewell et al, 2013: Survey protocols for the British herpetofauna.

Ref 10. Bat Conservation Trust, 2012: Bat Surveys: Good Practice Guidelines Second Edition.

Ref 11. The Natural Environment and Rural Communities Act 2006, HMSO

Ref 12. The Wildlife and Countryside Act 1981. HMSO

Appendix A: Species Conservation Status and Legal Protection

Protected species recorded within 2km of the proposed Development site are listed below

Species Name	Protection
Plants	
Pale Scalewort (*Radula voluta*)	RD1(UK), RD1(Wales), RD2(UK), S42, LI[VC49]
Invertebrates	
Argent and Sable (*Rheumaptera hastate*)	RD2(UK), S42, UKBAP, LBAP
Ashworth's Rustic (*Xestia ashworthii*)	RD2(UK), S42, UKBAP, LBAP
Hedge Rustic (*Tholera cespitis*)	S42, UKBAP, LBAP
Shaded Broad-bar (*Scotopteryx chenopodiata*)	S42, UKBAP, LBAP
Small Heath (*Coenonympha pamphilus*)	RD1(UK), S42, UKBAP, LBAP
Small Pearl-bordered Fritillary (*Boloria selene)*	RD1(UK), S42, UKBAP, LBAP
Fish	
European eel (*Anguilla anguilla*)	S42, UKBAP & LBAP.
Salmonids – Atlantic salmon (*Salmo salar*), Brown sea trout (*Salmo Trutta*)	Salmon and Freshwater Fisheries Act (1975), S42, UKBAP, LBAP. The Afon Conwy and Afon Ddu are migratory routes. Salmon and sea trout spawning areas are located close to the WTW
Reptiles	
Common lizard (*Zootoca vivipara*)	Bern, S42, UKBAP, WCA5, LBAP
Grass snake (*Natrix natrix*)	Bern, S42, UKBAP, WCA5, LBAP
Slow worm (*Anguis fragilis*)	Bern, S42, UKBAP, WCA5, LBAP
Birds	
Barn Owl (*Tyto alba*)	Bern, CITES, RD2(UK), UKBA, WBA, WCA1.1, WCA9, LBAP
Black Grouse (*Tetrao tetrix*)	BDir2.2, S42, UKBAP, UKBR, WBR, LBAP
Cetti's Warbler (*Cettia cetti*)	WCA1.1, LBAP
Common Bullfinch (*Pyrrhula pyrrhula*)	S42, UKBA, UKBAP, UKBR, WBR, LBAP
Cuckoo (*Cuculus canorus*)	S42, UKBA, UKBAP, UKBR, WBR, LBAP
Curlew (*Numenius arquata*)	BDir2.2, Bonn, RD1(UK), S42, UKBA, UKBAP, WBR, LBAP

Fieldfare (*Turdus pillaris*)	BDir2.2, UKBA, UKBR, WBA, WCA1.1, LBAP
Goldeneye (*Bucephala clangula*)	BDir2.2, Bonn, UKBA, WCA1.2, LBAP
Grasshopper Warbler (*Locustella naevia*)	S42, UKBAP, UKBR, WBR, LBAP
Hen Harrier (*Circus cyaneus*)	BDir1, Bonn, CITES, S42, UKBR, WBR, LBAP
Herring Gull (*Larus argentatus*)	BDir2.2, Bonn, S42, UKBA, UKBAP, UKBR, WBR, LBAP
Kestrel (*Falco tinnunculus*)	Bern, Bonn, CITES, S42, UKBA, WBR, LBAP
Kingfisher (*Alcedo atthis*)	BDir1, Bern, UKBA, WBA, WCA1.1, LBAP
Lesser Redpoll (*Carduelis cabaret*)	S42, UKBAP, UKBR, WBR, LBAP
Marsh Harrier (*Circus aeruginosus*)	BDir1, Bonn, CITES, UKBA, WBA, WCA1.1, LBAP
Merlin (*Falco columbarius*)	BDir1, Bern, Bonn, CITES, UKBA, WBA, WCA1.1, LBAP
Northern Lapwing (*Vanellus vanellus*)	BDir2.2, Bonn, S42, UKBA, UKBAP, UKBR, WBR, LBAP
Peregrine Falcon (*Falco peregrinus*)	BDir1, Bern, Bonn, CITES, UKBA, WCA1.1, LBAP
Pied Flycatcher (*Ficedula hypoleuca*)	Bonn, S42, UKBA, WBR, LBAP
Quail (*Coturnix coturnix*)	Dir2.2, Bonn, UKBA, UKBR, WBA, WCA1.1, LBAP
Red Kite (*Milvus milvus*)	BDir1, Bonn, CITES, RD1(UK), UKBA, WBA, WCA1.1, WCA9, LBAP
Redwing (*Turdus iliacus*)	BDir2.2, UKBA, UKBR, WBA, WCA1.1, LBAP
Reed Bunting (*Emberiza schoeniclus*)	Bern, S42, UKBA, UKBAP, UKBR, WBA, LBAP
Ring Ouzel (*Turdus torquatus*)	S42, UKBAP, LBAP, WBR
Skylark (*Alauda arvensis*)	BDir2.2, S42, UKBR, WBA, LBAP
Song Thrush (*Turdus philomelos*)	BDir2.2, Bern, RD2(UK), S42, UKBAP, UKBR, WBA, LBAP
Spotted Flycatcher (*Muscicapa striata*)	Bern, Bonn, S42, UKBAP, UKBR, WBR, LBAP
Willow Tit (*Poecile montana*)	Bern, RD2(UK), S42, UKBAP, UKBR, WBR, LBAP
Mammals	
Bats – Soprano pipistrelle (*Pipistrellus pygmaeus*), Brown long-eared (*Plecotus auritus*), Lesser horseshoe (*Rhinolophus hipposideros*)	Bern, Bonn, EPS, HDir, RD2(UK), S42, UKBAP, WCA5, LBAP
Badger	BA, Bern, LBAP
Brown Hare (*Lepus europaeus*)	Bern, S42, UKBAP, LBAP
European Hedgehog (*Erinaceus europaeus*)	Bern, S42, UKBAP, LBAP
Hazel Dormouse (*Muscardinus avellanarius*)	Bern, EPS, HDir, RD2(UK), S42, UKBAP, WCA5, LBAP
Otter (*Lutra lutra*)	Bern, CITES, EPS, HDir, RD1(UK), RD2(UK), S42,

	UKBAP, WCA5, LBAP
Polecat (*Mustela putorius*)	Bern, HDir, RD2(UK), S42, UKBAP, LBAP
Red Squirrel (*Sciurus vulgaris*)	Bern, S42, UKBAP, WCA5, LBAP
Stoat (*Mustela erminea*)	Bern, NRW, LBAP

Table Notes:

BA - Protection of Badgers Act,

BDir1 - EU Birds Directive Annex 1,

BDir2.1 - EU Birds Directive Annex 2.1,

BDir2.2 - EU Birds Directive Annex 2.2,

Bern - The Bern Convention on the Conservation of European Wildlife and Natural Habitats, Bonn - The Bonn Convention on the Conservation of Migratory Species of Wild Animals, CITES - Convention on International Trade in Endangered Species,

EPS - European Protected Species,

HDir - EU Habitats Directive,

LBAP – Local Biodiversity Action Plan Species

NRW - Natural Resources Wales Priority Species List,

RD1(UK) - Red Data Book listing for the UK based on IUCN guidelines,

RD1(Wales) - Red Data Book listing for Wales based on IUCN guidelines,

RD2(UK) - Red Data Book listing for the UK not based on IUCN guidelines,

S42 - Natural Environment and Rural Communities Act 2006 (Section 42),

UKBA - UK Amber listed birds (not based on IUCN criteria),

UKBAP - UK Biodiversity Action Plan Priority Species,

UKBR - UK Red listed birds (not based on IUCN criteria),

WBA - Welsh Amber listed birds (not based on IUCN criteria),

WBR - Welsh Red listed birds (not based on IUCN criteria),

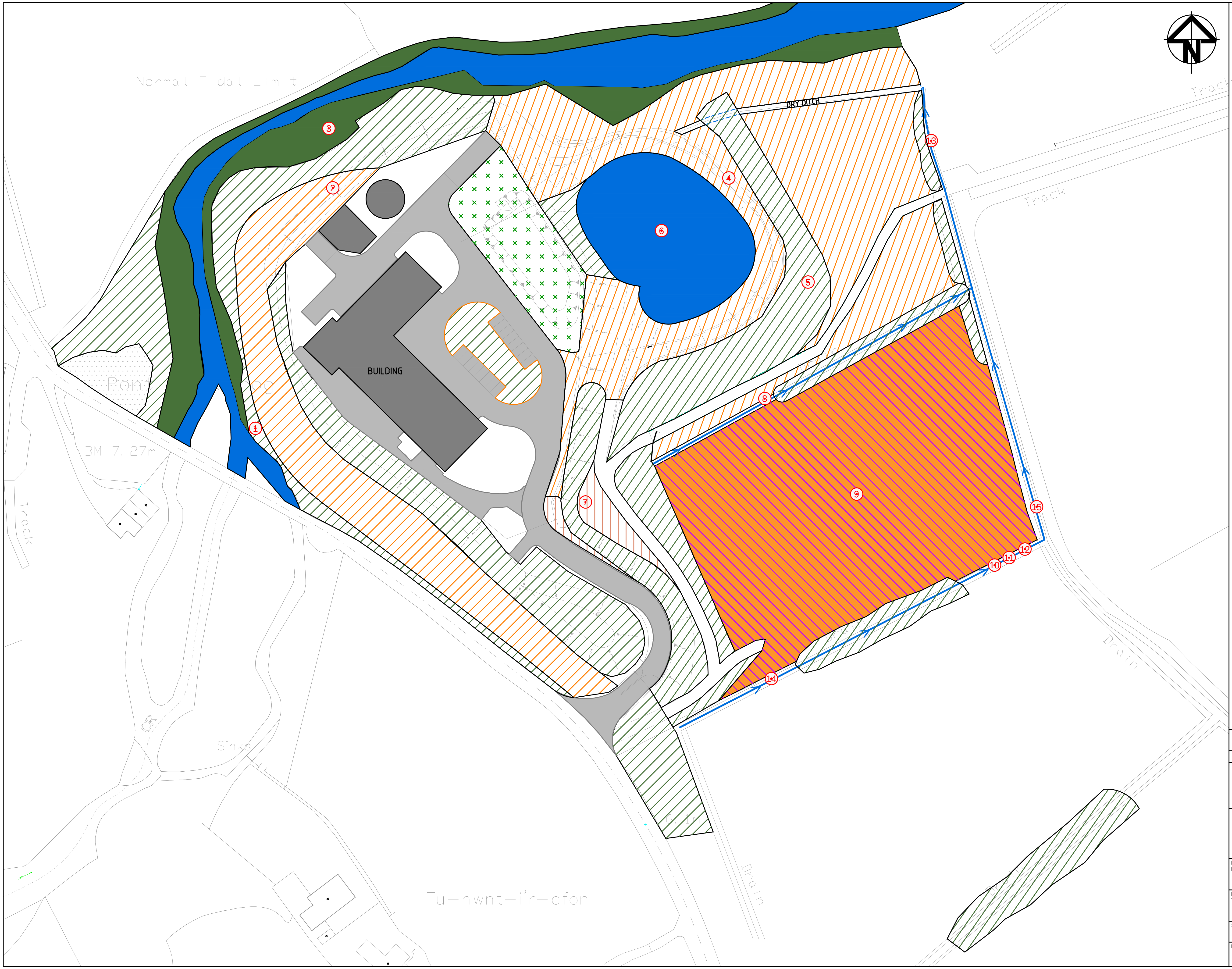
WCA1.1 - Wildlife & Countryside Act 1981 Schedule 1.1,

WCA1.2 - Wildlife & Countryside Act 1981 Schedule 1.2,

WCA5 - Wildlife & Countryside Act 1981 Schedule 5,

Figure 4.1: Extended Phase 1 Habitat Survey

A3



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ALL MEASUREMENTS ARE APPROXIMATE.

NOTES:
1. ALL LEVELS ARE IN mAOD
2. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE STATED.

■	BROAD-LEAVED SEMI-NATURAL WOODLAND
▨	BROAD-LEAVED PLANTATION WOODLAND
x x	SCATTERED SCRUB
SI	SEMI-IMPROVED GRASSLAND
▨	CONIFEROUS PLANTATION WOODLAND
▨	MARSH/MARSHY GRASSLAND
▨	TALL RUDERAL HERBS
■	OPEN STANDING WATER
░	BARE GROUND
→	RUNNING WATER
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⑫	TARGET NOTE

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Project Name. BRYN COWLYD WTW

Drawing Title. EXTENDED PHASE 1 HABITAT SURVEY

Scale. NTS
Designer.
Date.

Drawing Number. FIGURE 4.1
Rev. P01

APPENDIX 6.1 FLOOD CONSEQUENCES ASSESSMENT

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Hyder

SKANSKA

Dŵr Cymru Welsh Water

Bryn Cowlyd Water Treatment Works

Flood Consequences Assessment - Stage 2

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Dŵr Cymru Welsh Water

Bryn Cowlyd Water Treatment Works

Flood Consequences Assessment - Stage 2

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Report No	1279-W-201-HYD-XX-XX-RP-NM-11017
Date	16 July 2015

This report has been prepared for Dwr Cymru / Welsh Water in accordance with the terms and conditions of appointment for Flood Consequences Assessment - Stage 2 dated May 2015. Hyder Consulting (UK) Limited (2212959) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

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1 Summary

Hyder Consulting has been commissioned by Dŵr Cymru Welsh Water (DCWW) to undertake a Stage 2 Flood Consequences Assessment (FCA) to support a planning application for a proposed extension to the existing Bryn Cowlyd Water Treatment Works (WTW) (the 'proposed Development'). Bryn Cowlyd WTW is situated on the eastern side of the B5106 road, approximately 500m to the south east of Dolgarrog, within Conwy County Borough (CCB) in North Wales.

It is understood that the proposed Development comprises the construction of a new pumping station within fields located to the southeast of the existing plant. The works also comprise upgrades to existing water tanks, buildings, pipelines and a below ground pumping station. The development will include the construction of new flood defence bunds to alleviate the risk of flooding. The planning application boundary associated with the proposed Development is approximately 6.1 hectares (ha). Included within this is the area required for a temporary construction compound which would be approximately 1.6ha. The operational area associated with the proposed Development would be 1.6ha.

The FCA has been undertaken with guidance from Natural Resources Wales (NRW) and in accordance with Planning Policy Wales Technical Advice Note 15 – Development and Flood Risk (TAN15).

The Welsh Government (WG) Development Advice Map (DAM) indicates that the proposed Development site is located within Flood Zone C1, therefore an FCA is required to support development on the site. As utilities infrastructure the proposed Development is classified as being "less vulnerable development" in TAN15. It is not feasible to locate the new infrastructure away from the operational WTW site, therefore the proposed Development is considered to be justified at this location.

On the existing operational WTW site, typical ground levels are approximately 5.0mAOD to 5.5mAOD, while the earth bunds that form the defences range from approximately 5.56mAOD to 6.67mAOD around the eastern and northern boundaries. However, along the western boundary adjacent to the road the ground levels rise up to over 7mAOD. The sheet piling increases the defence levels to between 6.80mAOD and 6.88mAOD. Ground levels at the entrance to the operational WTW site are approximately 6.4mAOD to 6.5mAOD.

All sources of potential flood risk to the site have been considered. The proposed Development site is not perceived to be at significant risk of flooding from groundwater or artificial sources.

With the implementation of a suitable surface water drainage strategy, which utilises an un-restricted discharge to the Afon Ddu, there should be no significant risk to the operational area associated with the proposed Development from surface water flooding. Owing to the tidal nature of the receiving watercourse (Afon Ddu) there would be no increase in third party flood risk from surface water. With the implementation of a suitable surface water drainage strategy for the construction compound, there should be no significant risk from surface water flooding. The surface water drainage strategy would ensure that there would be no increase in third party flood risk from surface water.

Fluvial flooding from the adjacent Afon Conwy and Afon Ddu poses a flood risk to the site; however, the primary source of flood risk to the site is from coastal flooding which propagates up the Afon Conwy. As part of the study, an ISIS-TUFLOW hydraulic model provided by NRW has been used to enable a detailed assessment of both the fluvial and coastal flood risk to the proposed Development site.

The Afon Conwy and Afon Ddu in the area of the proposed Development site are tidally controlled/dominated. As consequence, without the formal flood defences in place along the Afon Conwy and Afon Ddu, the floodplain would be flooded to a depth of around 1.2m from a Mean High Water Springs (MHWS) tide.

In a 1 in 100 year fluvial flood event with climate change (2116 horizon) a baseline flood level of 5.82mAOD is predicted in the area of the proposed Development site (with flood depths of up to approximately 2.84m). In a 1 in 1000 year flood (with 2116 MHWS tide) the flood level increases to 6.3mAOD. Owing to the presence of the existing flood protection bund (6.8mAOD), in both these events the operational WTW site is predicted to be flood free. However, the operational area associated with the proposed Development and the area proposed for the temporary construction compound is predicted to be flooded.

In a 1 in 200 year coastal flood event with climate change (2116) a baseline peak flood level of 6.45mAOD has been predicted in the area of the proposed Development site. The flood level increases to 6.63mAOD in a 1 in 1000 year event with climate change (2116). Despite the presence of the existing flood protection bund around the operational WTW site, in a 1 in 200 year coastal flood event, with climate change, and in a 1 in 1000 year event the model predicts that the operational WTW site would be partially inundated. This flooding is not caused by overtopping of the flood protection bund, rather it is due to the lack of flood gates at the site entrance, allowing water into the site through a gap in the flood protection bund. In addition, in these two flood events the operational area associated with the proposed Development and the area proposed for the temporary construction compound are predicted to be flooded.

The new development on the site would be defended with a flood protection bund and a flood gate set at a level of 6.8mAOD. The temporary construction compound would be defended to a level of 5.7mAOD using a 390m flood protection bund.

The study has confirmed that, with the proposed Development in place, the 1 in 100 year fluvial flood (with climate change) level and 1 in 1000 year flood level are not predicted to change significantly. With the proposed 360m flood protection bund and flood gate set to a level of 6.8mAOD, the operational area associated with the proposed Development would be protected from flooding in these two events. Therefore, the FCA has confirmed that the TAN15 fluvial threshold and consequences guidelines have been met.

The study has also confirmed that, with the proposed Development in place, the 1 in 200 year coastal flood (with climate change) level and 1 in 1000 year flood level (with climate change) are not predicted to change significantly. With the proposed flood protection bund and flood gate in place, the operational area associated with the proposed Development would be protected from flooding in these two events. Therefore, the FCA has confirmed that the TAN15 coastal threshold and consequences guidelines have been met.

With the proposed temporary flood protection bund in place, the temporary construction compound is predicted to be protected from flooding in a 1 in 200 year event (2016). The flood predictions also confirmed that predicted 1 in 200 year with climate change coastal flood levels would not change significantly with the temporary construction compound in place. Therefore, the FCA has confirmed that the TAN15 coastal and fluvial threshold guidelines have been met for the temporary construction compound.

In consultations, NRW confirmed that there was a need for a blockage assessment on the Afon Ddu for the B5106 structure. Owing to the cross-sectional area of the two main bridge arches (greater than 3m^2) the risk of a blockage is very low. As a precaution, model blockage sensitivity tests have been undertaken for the 1 in 100 year fluvial event and these have shown that, with a 30% and a 67% blockage within the two main arch openings, the proposed Development is not at risk of flooding.

The study has confirmed that emergency access/egress to/from the proposed Development site can be provided in line with TAN15 guidelines.

2 Introduction

2.1 General

Hyder Consulting has been commissioned by Dŵr Cymru Welsh Water (DCWW) to undertake a Stage 2 Flood Consequences Assessment (FCA) to support a planning application for a proposed extension to the existing Bryn Cowlyd Water Treatment Works (WTW) (the 'proposed Development'). Bryn Cowlyd is situated on the eastern side of the B5106 road, approximately 500m to the south east of Dolgarrog within Conwy County Borough in North Wales.

DCWW has engaged its Capital Delivery Alliance (CDA) Partners, Skanska and Hyder Consulting, to design and construct the proposed Development.

The northern boundary of the site is located on the southern bank of the Afon Ddu, approximately 600m to 800m upstream of its confluence with the Afon Conwy.

The proposed Development comprises the construction of a new pumping station within fields located to the southeast of the existing plant. The works also comprise upgrades to existing water tanks, buildings, pipelines and a below ground pumping station. The development will include the construction of new flood defence bunds to alleviate the risk of flooding.

The FCA has been undertaken with guidance from Natural Resources Wales (NRW) and in accordance with Planning Policy Wales Technical Advice Note 15 – Development and Flood Risk (TAN15).

The Welsh Government (WG) Development Advice Map (DAM) indicates that the site is located within Flood Zone C1. Flood Zone C is based on the Environment Agency (EA) extreme flood outline and indicates that the site is subject to flooding during events equal to or greater than the 0.1% (1 in 1000 year) flood event. The subdivision C1, indicates areas of the floodplain "served by significant infrastructure, including flood defences."

This report documents the approach taken to evaluate sources of flood risk to the proposed Development including fluvial, coastal, groundwater and surface water. The FCA has been informed by the use of hydrodynamic models to simulate the potential propagation of floodwater from both the Afon Conwy and the Afon Ddu onto the site and surrounding area. NRW has provided an ISIS-TUFLOW model of the Afon Conwy for use in this study.

2.2 Scope of Works

The scope of works for this Stage 2 FCA was agreed as follows:

- Acquire and use NRW hydraulic model of the Afon Conwy to identify potential flood risk impacts of the proposed Development, including potential flood bund modification;
- Identify potential mitigation (for example, areas and extent of floodplain compensation storage, if needed) and include in model to demonstrate the proposed Development has no impacts on flood risk to third parties; and
- Produce Welsh Government Technical Advice Note 15 Development and Flood Risk (2004) (TAN15) compliant FCA report.

During the study, NRW requested that an assessment of a blockage of the B5106 road crossing of the Afon Ddu be undertaken to establish any potential flood risk impact on the proposed Development. Therefore, the scope of work was expanded to include:

- Collection of survey data for the Afon Ddu and construction of an ISIS model of the Afon Ddu (from approximately 50m upstream of the B5106, to approximately 190m upstream of the confluence with the Afon Conwy); and
- Assessment of the risk of a blockage of the B5106 road crossing of the Afon Ddu.

2.3 Terminology

Flood risk is a product of both the likelihood and consequence of flooding. Throughout this report, flood events are defined according to their likelihood of occurrence. Floods are described according to an ‘annual chance’, meaning the chance of a particular flood occurring in any one year. This is directly linked to the probability of a flood. For example, a flood with an annual chance of 1 in 100 (a 1 in 100 chance of occurring in any one year on average), has an annual exceedance probability (AEP) of 1%.

2.4 Limitations

This report has been compiled from a number of sources, which Hyder believes to be trustworthy. However, Hyder is unable to guarantee the accuracy of information provided by others. The report is based on information available at the time of writing. Additional information may become available in the future which may have a bearing on the conclusions of this report and for which Hyder cannot be responsible.

3 Background

3.1 Site Location and Description

The proposed Development is located on the eastern side of the B5106, approximately 500m to the south east of Dolgarrog in Conwy County Borough (CCB) in North Wales. The site is located at approximate NGR SH 775 663 as shown on Figure 3-1.

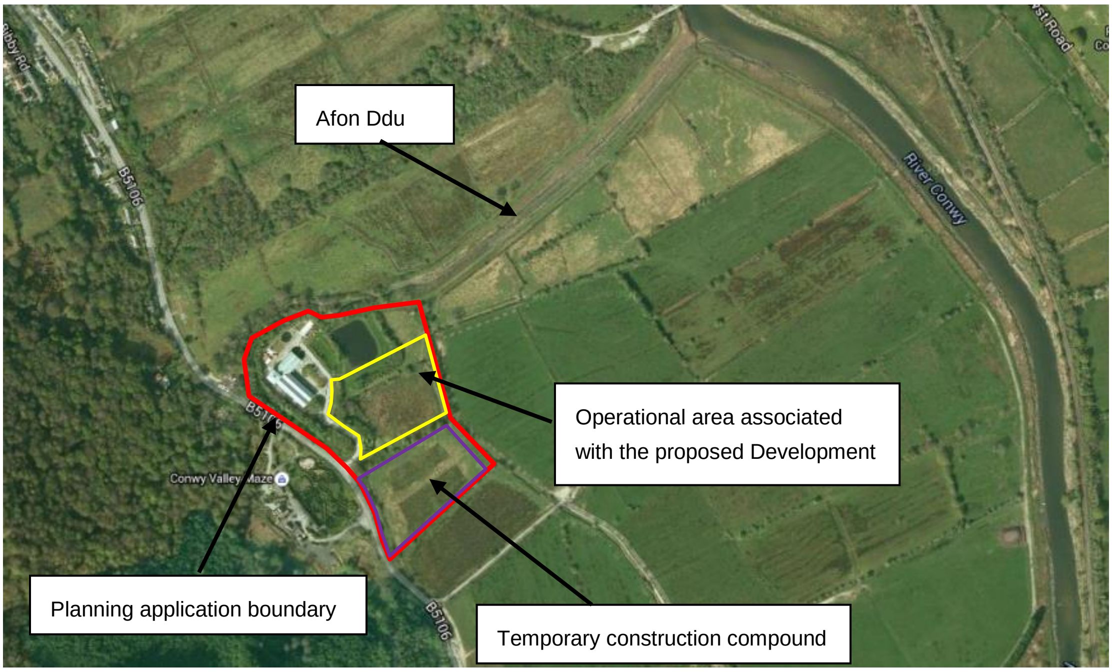

Figure 3-1 Study Area © Google map

The B5106 road forms the western site boundary, providing access between Conwy and Llanrwst to settlements on the western side of the Conwy Valley. To the west of the B5106 is Coed Dolgarrog National Nature Reserve (NNR), situated 120 metres west of the site at its closest boundary, comprising woodland on the steep western side of the valley. Tu Hwnt i'r Afon which contains the Conwy Valley Maze is located to the south west the proposed Development site, on the western side of the B5106. The Afon Ddu forms the northern boundary of the proposed Development site.

The planning application boundary associated with the proposed Development is approximately 6.1 hectares (ha). The application boundary includes:

- Operational WTW – 2.3ha
- Operational area associated with the proposed Development – 1.6ha
- Temporary construction compound – 1.6ha
- Undeveloped land – 0.6ha

The proposed Development site comprises the operational WTW and some undeveloped land. The majority of the operational WTW is hard standing with some soft standing areas to the north and south. Areas of scrub and trees lie along the western site boundary between the B5106 and the proposed Development site, whilst fields extend to the north, east and south of the site.

Apart from the Public Right of Way (PRoW) along the left back of the Afon Ddu, there are no other PRoWs within or adjacent to the proposed Development site.

The existing operational area is 2.3ha. Current WTW infrastructure includes a large building that houses the Granular Activated Carbon (GAC) filtration process, a lagoon, swale, wash water tank and standby generator. There is also a flood protection bund (comprising earth embankment and plastic sheet piling) to reduce the risk of flooding to on site infrastructure from both the Afon Ddu and Afon Conwy. This flood protection bund was installed in 1998 with the plastic piles installed in 2011/2012 to raise the standard of defence. There are areas of soft landscaping around the site and mature trees along boundary fence lines and adjacent to the access road from the B5106.

The operational area associated with the proposed Development is currently used for grazing and is under ownership by DCWW. The field to the south, to be used for the temporary construction compound, is also currently used for grazing and is tenanted by DCWW.

There are a number of existing drainage ditches that border fields to the south and east of the existing WTW.

An agricultural access track runs from the current WTW access point from the B5106 to the south of the lagoon and then on to fields to the east of the WTW.

3.2 Topography

The proposed Development site is at the bottom of the north flowing Conwy river valley which has steep gradients to the west and east rising to 500mAOD to the west and 200mAOD to the east of the Afon Conwy. The general local topography across the site is generally level with a slight down gradient towards the east within the main operations area.

A topographic survey of proposed Development site has been undertaken by Alpine Land Surveyors. The survey shows that, on the existing operational WTW site, typical ground levels are approximately 5.0mAOD to 5.5mAOD, while the earth bunds that form the defences range from approximately 5.56mAOD to 6.67mAOD around the eastern and northern boundaries. However, along the western boundary adjacent to the road the ground levels rise up to over 7mAOD. The sheet piling increases the defence levels to between 6.80mAOD and 6.88mAOD. Ground levels at the entrance to the operational WTW site are approximately 6.4mAOD to 6.5mAOD.

In the operational area associated with the proposed Development and in the area required for a temporary construction compound, existing ground levels are relatively flat and typically range from 2.8mAOD to 3.5mAOD.

3.3 Catchment Description

The Afon Conwy flows in a northerly direction for approximately 43km from its source in the Migneint Moors to its mouth at Conwy Bay. Along its route several tributaries discharge into the Afon Conwy, including the Afon Ddu which enters on the left bank of the Conwy.

The normal tidal limit of the Afon Conwy is approximately 4km upstream of the site at which point the catchment area is approximately 380km². The catchment upstream of the site is predominantly rural with limited urbanised area. Although the catchment is not heavily urbanised, the wet climate, mountainous landscape and a steep valley gradient can result in rapid rises in river levels during and after heavy rainfall.

Upstream of the B5106 Bridge, the Afon Ddu drains a catchment area of approximately 14km². The catchment upstream of the site is predominantly rural with limited area of forestry immediately upstream of the site. The Afon Ddu is also tidal in the area of the proposed Development site.

3.4 Flood History and Defences

In consultation with NRW, three key historical flood events affecting the study area have been identified. The first event corresponds to fluvial flooding attributed to the Afon Conwy in 1980 (the magnitude of this event is unknown). Flood event outline mapping, provided in Appendix B, indicates that the proposed Development site may have been inundated during this event; however, this has not been confirmed.

The second and third events occurred in 2004 and 2005 and both resulted from fluvial flooding from the Afon Conwy. It is understood that the indicative return period of both events was around 1 in 25 to 1 in 30 years (Black & Veatch, 2008). The existing site remained dry during both events. Anecdotal evidence suggests that the flood level adjacent to the site in 2005 was approximately 4.5mAOD which, as shown in Figure 3-2, resulted in the flooding of the operational area associated with the proposed Development and the area required for a temporary construction compound.

Figure 3-2 January 2005 Conwy Valley flooding (Bryn Cowlyd WTW shown in top left)

Further information provided by NRW highlights that the proposed Development site is defended by earth embankments along both banks of the Afon Conwy and Afon Ddu. It is understood that the earth embankment defences (minimum elevation of 4.9mAOD) provide between a 1 in 2 and 1 in 10 year standard of protection against fluvial flooding. Further asset information, as provided by NRW, has been included in Appendix B.

3.5 Need for the Proposed Development

The Bryn Cowlyd WTW was commissioned in 1998 and supplies up to 46 Ml/d to around 98,700 people in the Conwy Valley and along the North Wales coast. Raw water is supplied to Bryn Cowlyd from Llyn Cowlyd, a high level impounding reservoir located in the Carneddau range in the Snowdonia National Park. Following treatment at the works water is currently conveyed under high pressure to an off-site treated water reservoir on the opposite side of the valley.

However, raw water quality is gradually deteriorating with respect to total organic carbon (TOC) and colour. Short term increases of TOC and colour also occur throughout the year as a result of inter-reservoir transfers by the reservoir owner, RWE npower. The existing process is at the limit of treatment capability and occasionally unable to remove the level of TOC being encountered. Therefore, the works is failing to meet the drinking water standards as set by The Drinking Water Inspectorate.

As a result of the WTW failing to meet quality standards, The Drinking Water Inspectorate have issued a formal improvement notice under Regulation 29(4) of the Water Supply (Water Quality) Regulations 2010. This requires DCWW to "*Complete construction, installation, and commissioning of the appropriate coagulation process and improvements to the filtration process by 31st December 2017*".

DCWW has therefore engaged its Alliance Partners, Skanska and Hyder Consulting, to design and construct a treatment process to improve the treated water quality being produced by Bryn Cowlyd WTW.

3.6 Proposed Development

The proposed Development (shown in Appendix A) will comprise buildings, above and below ground tanks, kiosks and water mains. The buildings will contain process tanks, pipework, mechanical equipment such as pumps and electrical control equipment. All the process elements will be contained within the existing DCWW land boundary to the east of the existing plant. However, it is proposed that the contractor will occupy the adjacent field to the south of the site during construction for site accommodation and material and equipment storage.

The operational area associated with the proposed Development would be set, approximately, at existing ground level (3.5mAOD) and would be contained within a new 360m flood protection bund with a crest level of approximately 6.8mAOD (the crest level has been informed by modelling carried out as part of the FCA – see Section 7) connected into the existing bund around the current WTW. This new flood defence bund will have a natural embankment appearance to resemble the existing flood defence bund, with tie in points where the new site links to the existing. The new flood defence bund will be constructed from arisings from the excavation works where possible, to prevent the need for the import of off-site materials. In addition, a flood gate (height 6.8mAOD) would be installed at the entrance of the site.

Construction is expected to take place over a period of 24 months. During this time a temporary construction compound would be located on the south side of the proposed Development site. This compound would be defended to a level of 5.7mAOD (the crest level has been informed by modelling carried out as part of the FCA – see Section 7) using a 390m flood protection bund. The bund would be removed from the floodplain once the construction of the works was complete.

Figure 3-3 presents a schematic drawing of the proposed Development site.

Figure 3-3 Proposed Development

Dissolved Air Flotation (DAF), Rapid Gravity Filters (RGF), Granular Activated Carbon (GAC) filtration

4 TAN15 Development and Flood Risk

4.1 General

TAN15 summarises the guidance to local planning authorities in determining planning applications with regard to flood risk and provides an interpretation of how this guidance applies specifically to a site. It 'provides a framework within which risks arising from both river and coastal flooding and from additional run-off from development in any location can be assessed'. This 'precautionary framework should be used for both forward planning and development control purposes'. Its operation is governed by:

- A Development Advice Map (DAM) containing three zones (A, B and C with subdivisions C1 and C2) which should be used to trigger the appropriate planning tests in relation to Sections 6 and 7 and Appendix 1 (TAN15, para 3.2).
- Definitions of vulnerable development and advice on permissible uses in relation to the location of development and the consequences of flooding (TAN15, para 3.2).

The approach is therefore a staged one:

1 Categorisation of site within TAN15 Flood Zones.

2 Application of TAN15 precautionary framework and determination of whether the proposed Development is 'justified' in that zone (TAN15 Section 6 test).

3 Assessment of flooding consequences (TAN15 Section 7 test and Appendix 1) and production of a Flood Consequences Assessment report.

4.2 Categorisation of the Site within TAN15 Flood Zones

The TAN15 DAM applicable to the site is provided in Figure 4-1. The map shows that the proposed Development site is located in Flood Zone C1 (green).

Flood Zone C is based on the EA extreme flood outline and indicates that the proposed Development site is subject to flooding equal to or greater than the 0.1% (1 in 1000 year) flood event. The subdivision C1, indicates areas of the floodplain with significant flood defence infrastructure.

TAN15 states that Zone C1 is used "*to indicate that development can take place subject to application of the Justification Test, including acceptability of consequences*". Thus, the presence of the site in Zone C1 triggers the next stage in the precautionary framework approach: the 'Justification Test'.

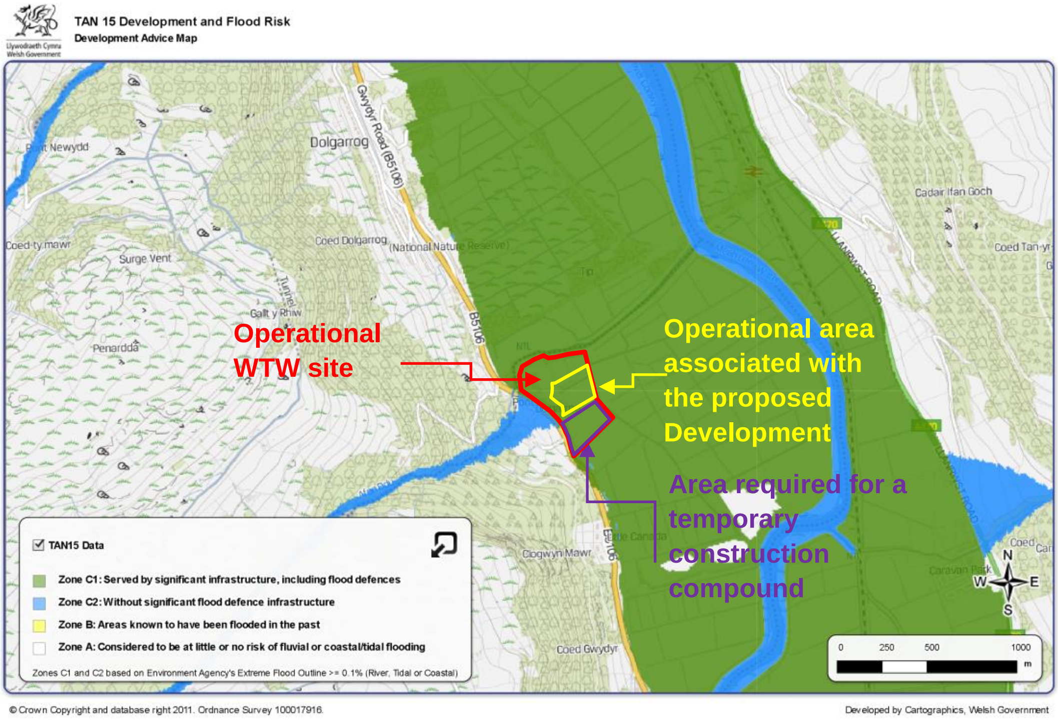

Figure 4-1 DAM extract and site location (green areas = flood zone C1)

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4.3 Application of Justification Test

The TAN15 DAM highlights that the proposed Development site is considered to be located within a flood risk area. As a result there is a requirement to justify the proposed location of development. Paragraph 6.2 of TAN15 states that new development should only be permitted within Zone C1 if determined by the planning authority to be justified in that location.

As utilities infrastructure, the proposed Development is classified as being “less vulnerable development” in TAN15.

The operational area associated with the proposed Development and the area required for a temporary construction compound comprises agricultural fields (Greenfield land). As it is not feasible to locate the new infrastructure away from the operational WTW site, the proposed Development is considered to be justified at this location.

4.4 Assessment of Flooding Consequences

Having established that the proposed Development is justified within the flood risk area, there is a need to assess the consequences of flooding. In order to comply with TAN15 guidance, the FCA must demonstrate that the consequences associated with flooding are acceptable and manageable. An assessment of the flood consequences is provided in the following sections.

5 Potential Sources of Flooding

In line with best practice, this section of the FCA considers flood risk from the range of possible sources listed in Table 5-1.

Table 5-1 Sources of Flooding

Source of Flooding	Description
1. Flooding from rivers (Fluvial)	Floodwater originating from a nearby watercourse when the amount of water exceeds the channel capacity of that watercourse
2. Flooding from the sea (Coastal)	High tides, storm surges and wave action, often acting in combination, flooding low-lying coastal land
3. Flooding from groundwater	Flooding caused when groundwater levels rise above ground level following prolonged rainfall
4. Flooding from land (Surface Water)	Flooding caused by intense rainfall exceeding the available infiltration and/or drainage capacity of the ground
5. Flooding from reservoirs, canals and other artificial sources	Failure of infrastructure that retains or transmits water or controls its flow

5.1 Fluvial

Fluvial flood risk to the proposed Development site arises from the Afon Conwy which flows in a northerly direction, approximately 600m to the north east of the site and the Afon Ddu which runs in an easterly direction to the north of the site.

The indicative EA flood map is shown in Figure 5-1. This map shows that the site lies entirely within Flood Zone 3 (i.e. the fluvial flood risk is greater than 1 in 100).

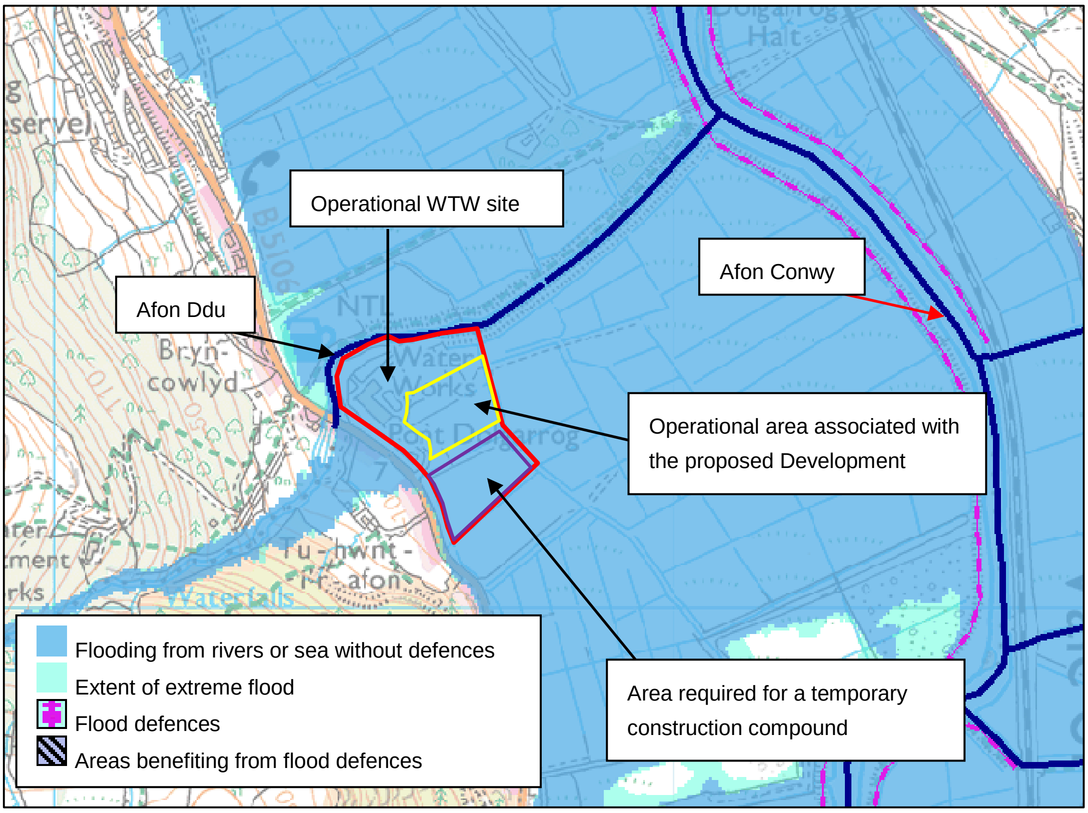

Figure 5-1 EA Flood Map

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It has been confirmed that there is a potential fluvial flood risk to the proposed Development site from both the Afon Conwy and the Afon Ddu. The fluvial flood risk from these two watercourses is therefore assessed in detail in Section 7.

5.2 Coastal

The site is located approximately 16km upstream of the mouth of the Afon Conwy where it discharges into Conwy Bay. However, with ground levels at the site being in the order of 2.8mAOD to 5.5mAOD, and with the MHWS at 4.05mAOD, the tidal conditions in Conwy Bay are able to propagate upstream through the Dolgarogg area, posing a risk of flooding at the proposed Development site.

A review of the estimated present day 1 in 200 year coastal flood levels (5.3mAOD) at the mouth of the Afon Conwy confirms that the proposed Development site is at significant risk of coastal flooding.

It has been confirmed that there is a potential coastal flood risk to the proposed Development site from the propagation of coastal flood conditions in Conwy Bay up the Afon Conwy. Coastal flood risk is therefore assessed in detail in Section 7.

5.3 Groundwater

Groundwater flooding occurs when groundwater rises to the ground surface. This may happen during winter and/or after prolonged or heavy rain storms.

BGS geology maps (http://www.bgs.ac.uk) indicate that the local bedrock geology beneath the proposed Development itself comprises Rhyolite, with Basaltic lava intrusions surrounding the proposed Development site. The NRW Groundwater maps (http://maps.environment-agency.gov.uk) illustrate that the bedrock beneath the site is considered of low permeability with negligible significance for water supply or support of river base flow.

The Soil Map of England and Wales (SSEW, 1983) shows that the proposed Development site is underlain by river alluvium characterised as deep stoneless fine silty and clayey soils variably affected by groundwater; flat land and risk of flooding. Ground investigation studies confirm that the soils underlying the proposed Development site are considered freely draining, acid loamy soils over rock. The topography of the proposed Development site is also relatively uniform and low lying, therefore there is some potential for groundwater to rise to the surface.

Groundwater observations recorded as part of the site investigation works confirm that groundwater is present at shallow depths. Exploration Associates (1995) report standing water levels in observation wells at depths ranging from 0.84m to 2.25m. The observed fluctuations in recorded standing water levels could be due to a range of factors including rainfall events and hydraulic continuity with the nearby Afon Ddu.

Groundwater levels recorded by Exploration Associates (1995) merit special note as there may be potential for localised and/or transient artesian conditions given the proposed Development site’s low lying situation. In addition, the presence of interbedded fine and coarse strata, and the presence of geological faults could provide a degree of hydraulic continuity with water bearing strata of the valley side.

The proposed Development could therefore be vulnerable to groundwater flooding, where the alluvium may be in hydraulic continuity with the river or where localised and/or transient artesian conditions may be present. However, there is no historical evidence of groundwater flooding on the proposed Development site. Groundwater flooding, as a result of hydraulic continuity with the Afon Ddu, would only be likely to be a source of flood risk in times of sustained high river levels and would be far outweighed by the risk of direct flooding from the Afon Ddu. The series of drainage ditches located within the surrounding area would also facilitate in the management of onsite drainage and reduce the risk of groundwater flooding.

In addition, the operational area associated with the proposed Development would be constructed on impermeable concrete. This impermeable surface would act as a barrier, preventing potential groundwater flooding from inundating the new infrastructure. This, combined with the proposed surface water drainage strategy, would ensure that the risk of groundwater flooding would be low.

Overall, it is considered that there is low risk of flooding to the proposed Development site from groundwater. However, groundwater conditions should be taken into account in the design of the operational area associated with the proposed Development.

5.4 Surface Water

NRW’s Updated Flood Map for Surface Water (Figure 5-2) shows approximately 50% of the proposed Development site falls within the ‘very low’ category of risk, which is indicative of a chance of surface water flooding each year of less than 0.1% (1 in 1000 year). The remaining proportion is considered at low, medium or high risk.

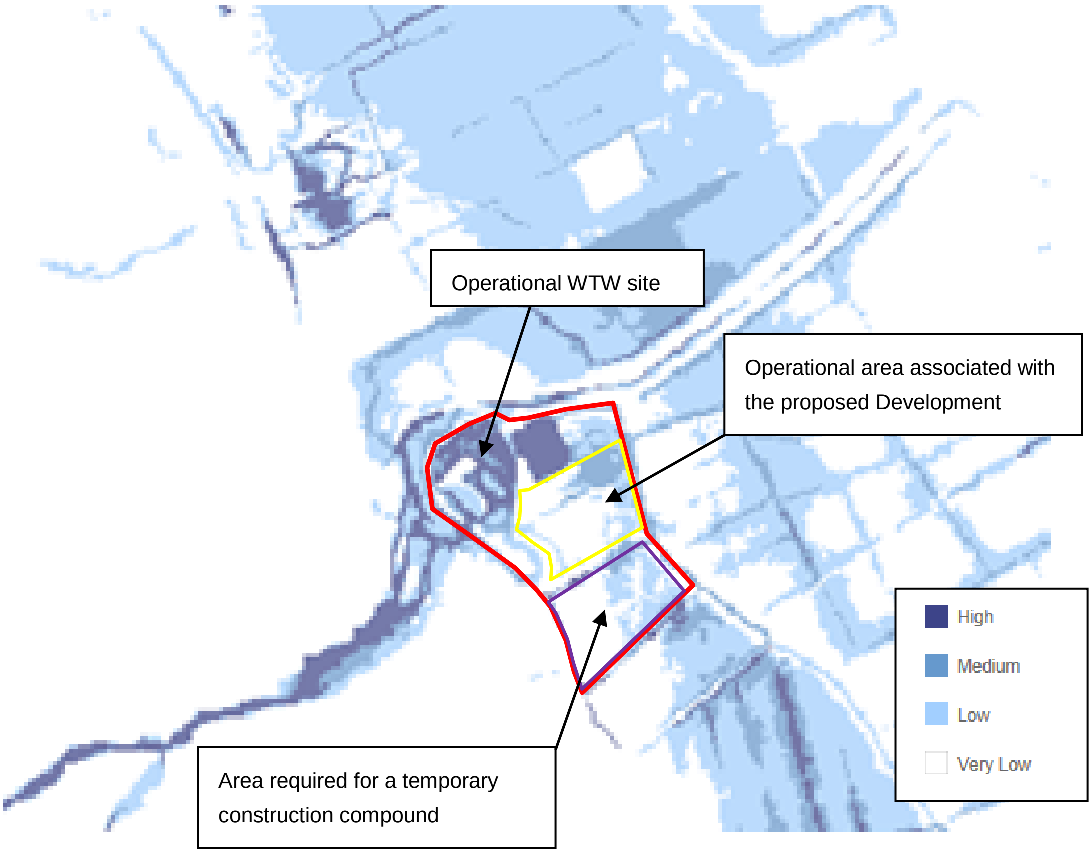

Figure 5-2 Map illustrating Surface Water Flood Risk to the proposed Development site (red line indicates proposed Development)

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There is a high risk of surface water flooding (1 in 30 year) in areas around the operational WTW site, including the existing lagoon and WTW building. The high risk areas are caused by the impounding effects of the existing flood protection bund and lagoon bund. In reality, the existing drainage, which isn't fully taken into account in the production of the surface water maps, would drain the operational WTW site.

A large portion of the operational area associated with the proposed Development and the area required for a temporary construction compound is considered to be at low risk of surface water flooding (between a 1 in 1000 year and a 1 in 100 year). However, a small part of the operational area associated with the proposed Development would also be located on land assigned as being at medium risk of surface water flooding (between 1 in 100 year and 1 in 30 year).

The proposed Development is located on land classified as Greenfield land. This area slopes down towards the east to the Afon Conwy. Owing to the permeable nature and topography, the operational area associated with the proposed Development and the area required for a temporary construction compound are considered to drain naturally via infiltration and overland flow to the nearby land drains.

There will be an increase in coverage of impermeable surfaces with the proposed Development and, therefore, rainfall runoff rates and volumes will increase. However, given the underlying ground conditions (which inhibit drainage to the soil) and the location of the ‘Normal Tidal limit’ adjacent to the operational WTW, it is considered that the most practical solution for the management of surface water runoff is to provide an un-restricted discharge directly to the Afon Ddu. This solution (outlined in detail in Section 9.2) has been discussed and agreed in principle with NRW.

It is not practicable to drain the temporary construction compound to the Afon Ddu. Therefore, construction compound would need to drain to the local land drainage network located within the adjacent fields the east. There will be a temporary increase in coverage of impermeable surfaces with the construction compound and, therefore, rainfall runoff rates and volumes will increase, potentially leading to an increase in flood risk to the local land drainage network from surface water sources. Therefore, in order to mitigate surface water flood risk, an appropriate drainage strategy will be required. This strategy will need to incorporate appropriate attenuation and Sustainable Drainage Systems (SUDS) techniques, where possible, to ensure no increase in runoff rates or volumes from the site. An outline drainage strategy has been developed in Section 9.

With the implementation of a suitable surface water drainage strategy, there should be no significant risk to the proposed Development site from surface water flooding. The surface water drainage strategy would ensure that there would be no increase in surface water run-off from the site to the local land drainage system and that there would be no increase in third party flood risk from this source.

5.5 Artificial Sources

The Llyn Cowlyd reservoir is located upstream of the proposed Development site. The EA has produced mapping that shows the maximum area that might be flooded if this large reservoir was to fail and release the water it holds. An extract of this map for the study area is presented in Figure 5.3, which shows that the proposed Development site is located within the flood extent associated with the failure of a reservoir.

It is understood that the reservoir is managed by RWE npower which acts as ‘undertaker’, under the Reservoirs Act 1975 and subsequent amendments, ensuring reservoir safety through regular monitoring and inspections by qualified civil engineers appointed by Defra.

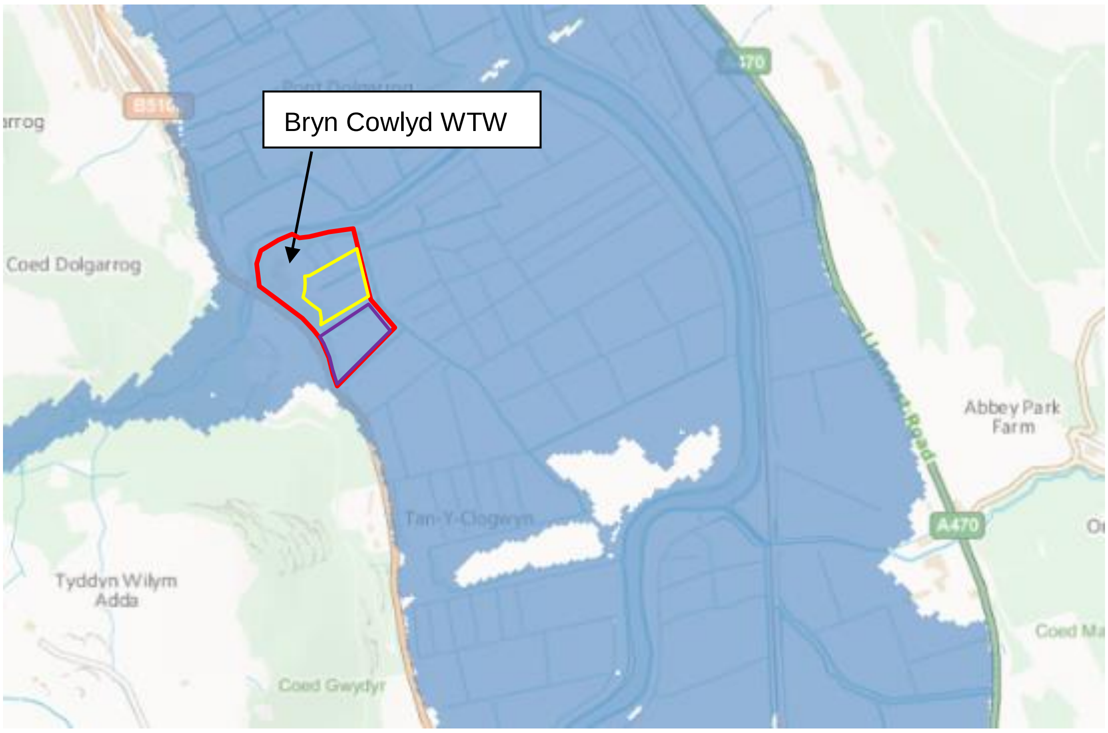

Figure 5-3 Maximum extent of flooding as a result of failure of a reservoir dam

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Whilst the consequences of reservoir breaching can be very high, continuing management of reservoirs under the Reservoirs Act serves to greatly reduce the likelihood of such breaching occurring. As such, in line with the scale and nature of the proposed Development, it is not considered that any changes to the proposed Development are required, over and above those recommended to mitigate against fluvial and coastal flood risk.

Previous consultations with NRW have confirmed that they do not use the reservoir inundation maps as a determinant in planning decisions, because of the extremely low likelihood attached to the flood extents produced.

Apart from the Llyn Cowlyd reservoir there are no other known significant artificial sources of flood risk to the proposed Development site.

6 Assessment Methodology – Fluvial and Coastal

6.1 General

This section outlines the methodology that was adopted in order to quantify the extent of fluvial and coastal flooding in the study area and to confirm the suitability of the proposed flood protection bund to facilitate the proposed Development in line with TAN15 requirements. This methodology is centred on the use of NRW's existing Conwy valley hydraulic (ISIS-TUFLOW) model.

6.2 Consultation and Data Collection

The study has been informed by a number of sources of data provided by the NRW/EA, including:

- Ordnance Survey mapping.
- NRW Conwy valley hydraulic (ISIS-TUFLOW) model.
- LiDAR data.

6.2.1 Site Inspection

Site visits were undertaken in April and May 2015 in order to observe channel characteristics and potential flood mechanisms and to identify key structures.

6.2.2 Survey Data

A topographical survey of the proposed Development site, surrounding area and the Afon Ddu was undertaken by Alpine Land Surveyors. The survey included details of the existing flood protection bund.

Surveyed cross-sections of the Afon Ddu together with details of the B5106 bridge structure have been used to build a bespoke ISIS model of the Afon Ddu in order to inform a blockage risk assessment.

6.2.3 LiDAR Data

1m resolution filtered LiDAR data for the catchment was included with NRW's Conwy valley hydraulic model. A comparison of the LiDAR data against the survey data in the area of the site generally indicates that the LiDAR data is a good match with an elevation accuracy typically in the range of +/-0.02m.

6.2.4 Consultations

Consultations with NRW were undertaken throughout the study to confirm the assessment scope and methodology as well as the suitability of the proposed Development.

6.3 Hydraulic Modelling

The assessment of flood risk has been made using NRW's Conwy valley hydraulic (ISIS-TUFLOW) model. The modelling has been undertaken using ISIS version 6.7.2.117 and TUFLOW build 2013-12-AD-iDP-w64.

The model represents a 15km long section of the Afon Conwy from Betws Y Coed to Tal-y-Cafn. Various updates were made to the model by JBA in 2013 and a review undertaken by Hyder confirmed that the model is suitable for assessing flood risk from the Afon Conwy in the area of the proposed Development site.

6.3.1 Flood Scenarios and Climate Change

The key flood scenarios that have been agreed with NRW for confirming existing flood conditions on the proposed Development site and assessing the potential flood risk impacts associated with the proposed Development are outlined in Table 6-1.

Table 6-2 Design Flood Scenarios

Number	Scenario	Fluvial Boundary	Coastal Boundary
Fluvial			
1	1 in 100 year (2016)	1 in 100 year	MHWS
2	1 in 100 year (2116)	1 in 100 year with 20% increase in peak flow	MHWS 2116
3	1 in 1000 year (2016)	1 in 1000 year	MHWS
4	1 in 1000 year (2116)	1 in 1000 year	MHWS 2116
Coastal			
5	1 in 200 year (2016)	1 in 2 year	1 in 200 year (2016)
6	1 in 200 year (2116)	1 in 2 year with 20% increase in peak flow	1 in 200 year (2116)
8	1 in 1000 year (2116)	1 in 2 year with 20% increase in peak flow	1 in 1000 year (2116)

NRW has confirmed that they are generally advising Local Planning Authorities (LPAs) that a 75 year (equivalent to a 2091 design horizon for this scheme) development lifetime should be adopted for all development types other than highly vulnerable development. However, for the purposes of this FCA, NRW advised that ideally a 100 year (2116) development lifetime should be adopted. The year 2016 has been adopted as the baseline year and climate change allowances for 100 years have been determined from this base date. This is a conservative approach given NRW's general recommendation for a 75 year development lifetime for all development types other than highly vulnerable development.

6.3.2 Manning's Roughness Coefficients

The resistance to flow in a channel or over a floodplain is defined in a hydraulic model by the use of a roughness coefficient, Manning's number, otherwise known as Manning's '*n*'. In the study no changes have been made to the roughness coefficients adopted in NRW's Conwy valley hydraulic (ISIS-TUFLOW) model.

6.3.3 Boundary Conditions

Fluvial flow boundary conditions were provided as part of the Afon Conwy model files for the various return period events modelled in this study. The ISIS-TUFLOW model of the Afon Conwy provided by NRW has not previously been used to model extreme coastal flood events, therefore only MHWS (2013) and MHWS (2113) coastal boundaries were included with the model files supplied.

The latest extreme water levels at the mouth of the Afon Conwy (5.3m AOD 1 in 200 year and 5.51mAOD 1 in 1000 year) for the coastal flooding events considered were obtained from the EA's report on the Coastal Flood Boundary Conditions for UK Mainland and Islands (EA, 2011).

The MHWS tide curves, based on 2016 data, were raised to include the predicted rise in sea levels as a result of climate change for development lifetimes of 75 and 100 years. The predicted rises in sea levels are presented in **Error! Reference source not found.**2. These are based on the climate change projections published in Defra's FCDPAG3 Economic Appraisal Supplementary Note (Defra, 2006).

Table 6-1 Predicted Rise in Sea Level

Period of Time	75 year (2091)	100 year (2116)
2016-2025 (3.5mm/yr)	31.5mm (9 years)	31.5mm (9 years)
2026-2055 (8.0mm/yr)	240mm (30 years)	240mm (30 years)
2056-2085 (11.5mm/yr)	345mm (30 years)	345mm (30 years)
2085-2116 (14.5mm/yr)	87mm (6 years)	449mm (27 years)
Cumulative increments	**703.5mm**	**1065.5mm**

Table 6-3 below presents the resultant design tide heights that have been used as the downstream boundary condition in the ISIS-TUFLOW model of the Afon Conwy.

Table 6-2 Extreme Tide Predictions at Conwy

Design Event	1 in 200 year (2116) flood	1 in 1000 year (2116) flood
Design Life		
Adjusted tide heights	6.37mAOD	6.58mAOD
95% Confidence Bound	+/- 0.2m	+/- 0.3m
Adjusted tide heights with + 95% Confidence Bound	6.57mAOD	6.88mAOD

6.4 Flood Extent Mapping

MapInfo GIS (Geographical Information System) software has been used to define the Afon Conwy flood extents.

7 Fluvial and Coastal Flood Risk Assessment

7.1 General

This section assesses the modelling results for the baseline (existing) and residual (with proposed Development) flood risk during the 1 in 100 year , the 1 in 100 year (with climate change), and the 1 in 1000 year fluvial flood events.

Also considered are the 1 in 200 year (with climate change) and the 1 in 1000 year (with climate change) coastal flood events.

7.2 MHWS Tides

The Afon Conwy and Afon Ddu in the area of the proposed Development site are tidally controlled/dominated. As consequence, without the formal flood defences in place along the Afon Conwy and Afon Ddu (minimal crest height approximately 4.9mAOD) the floodplain would be flooded to a depth of around 1.2m from a MHWS tide (4.05mAOD) and to a depth of 2.2m from a MHWS (2116) tide (5.05mAOD).

7.3 Baseline Fluvial Flood Predictions

7.3.1 1 in 100 year Flood

Figure 7-1 shows the predicted flood extent for the 1 in 100 year fluvial flood event. In this event a peak flood level of 5.18mAOD is predicted in the area of the proposed Development site.

Owing to the presence of the existing flood protection bund (at 6.8mAOD), in a 1 in 100 year fluvial flood event the model predicts that the operational WTW site would remain dry. However, the operational area associated with the proposed Development and the area required for a temporary construction compound are predicted to flood with depths of up to approximately 2.2m.

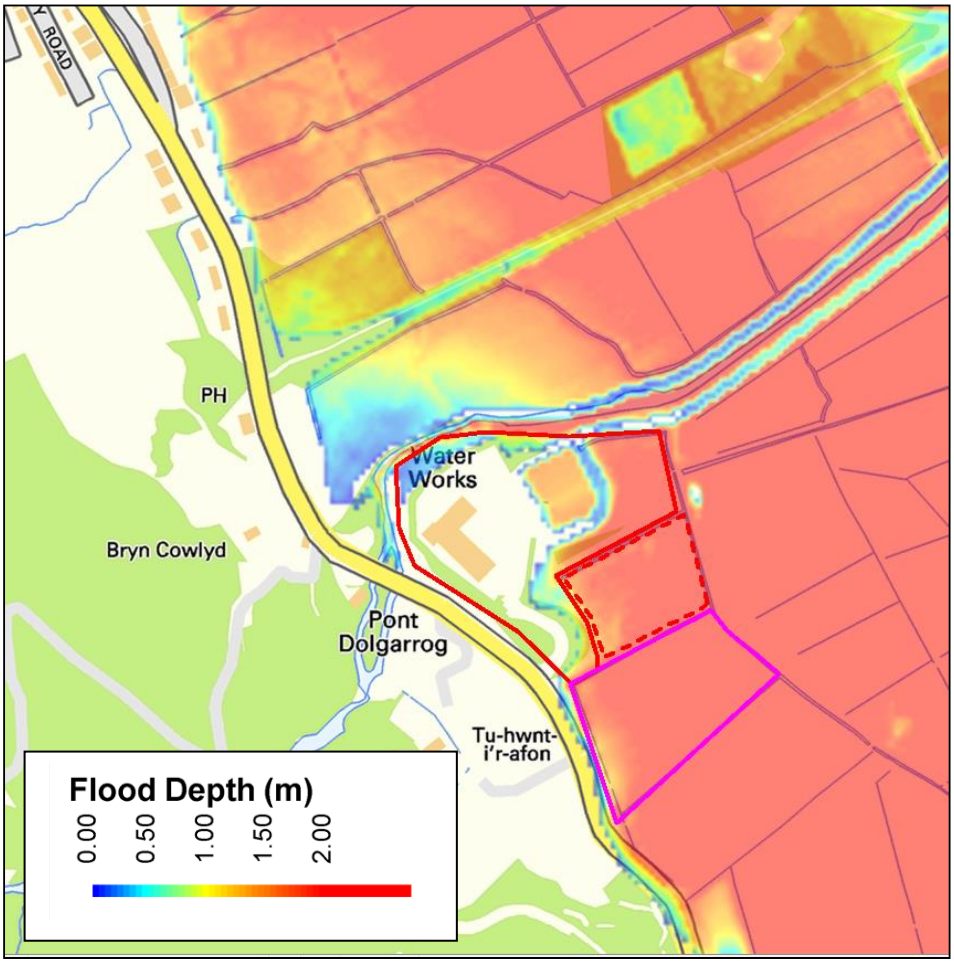

Figure 7-1 1 in 100 year (2016) Fluvial Flood Extent Prediction

7.3.2 1 in 100 year (2116) Flood

Figure 7-2 shows the predicted flood extent for the 1 in 100 year fluvial flood event with climate change. In this event the flood level is predicted to increase to 5.82mAOD in the area of the proposed Development site (with flood depths of up to approximately 2.84m). As shown in Figure 7-2, the operational WTW site is predicted to be flood free.

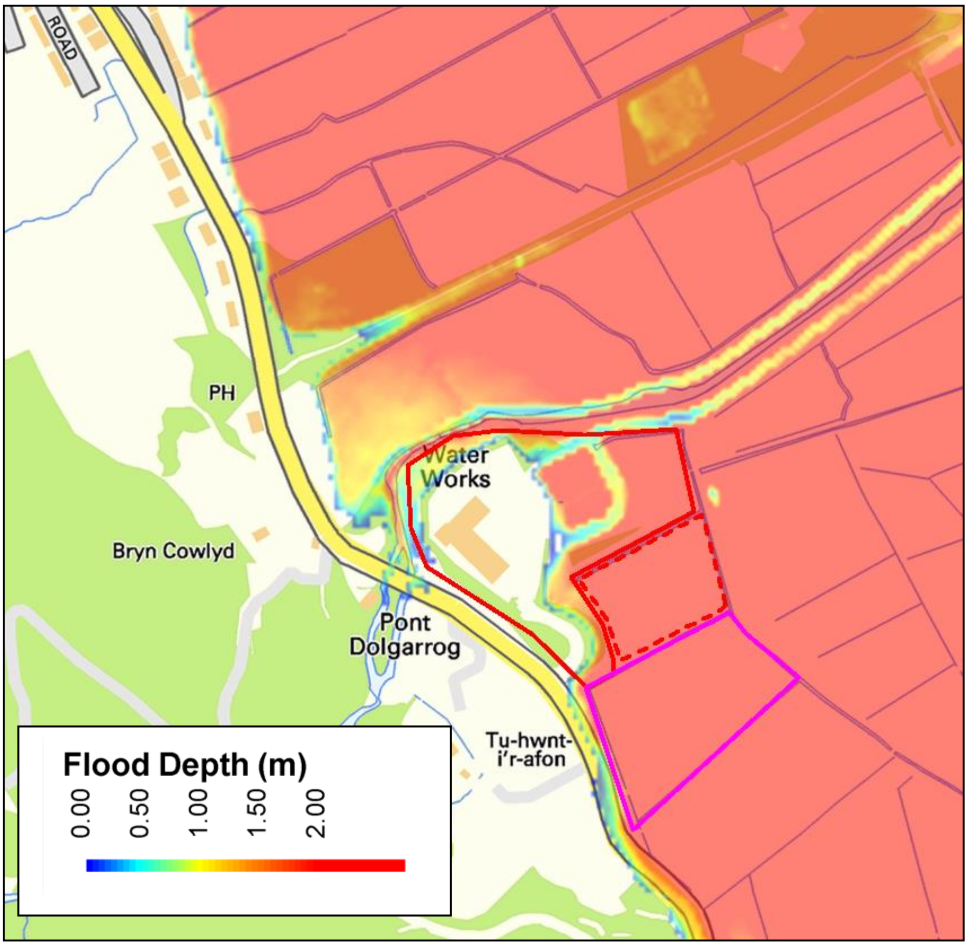

Figure 7-2 1 in 100 year (2116) Fluvial Flood Extent Prediction

7.3.3 1 in 1000 year Flood

Figure 7-3 shows the predicted flood extent for the 1 in 1000 year fluvial flood event. In this event a peak flood level of 6.04mAOD is predicted in the area of the proposed Development site (with flood depths of up to approximately 3.06m). As shown in Figure 7-3, the operational WTW site is predicted to be flood free.

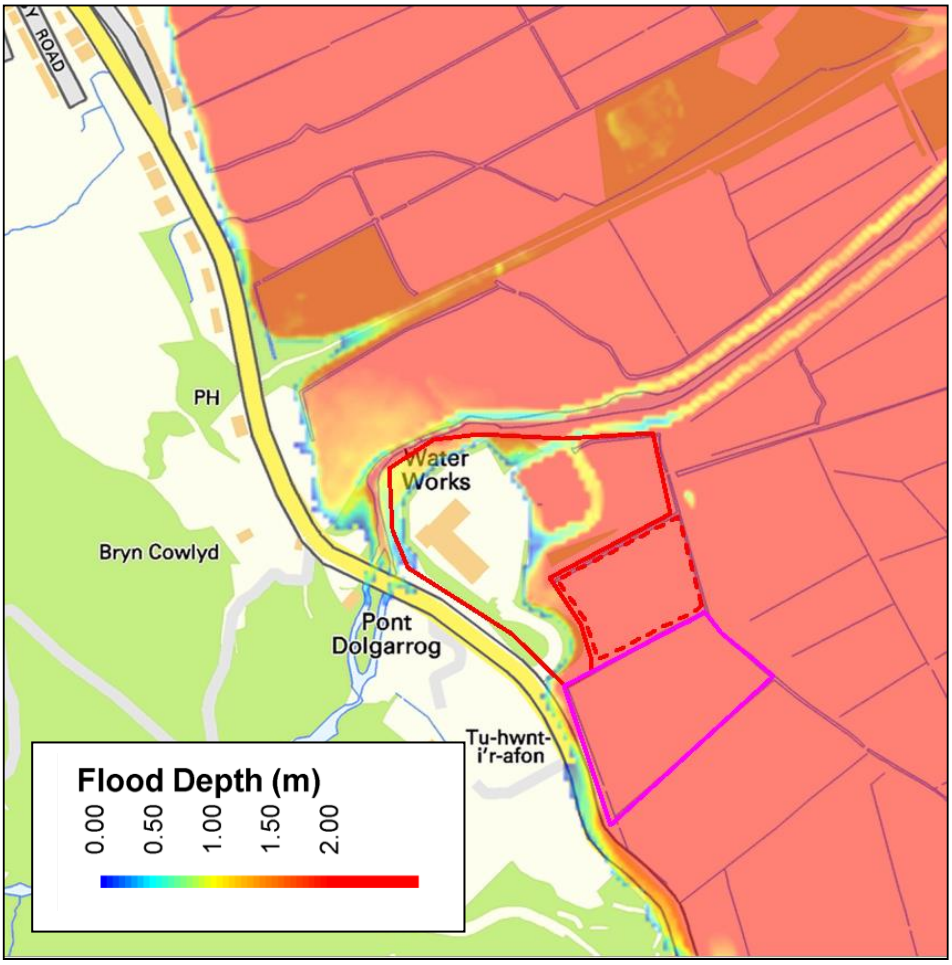

Figure 7-3 1 in 1000 year (2016) Fluvial Flood Extent Prediction

7.3.4 1 in 1000 year with 2116 MHWS Flood

Figure 7-4 shows the predicted flood extent for the 1 in 1000 year fluvial combined with a 2116 MHWS flood event. In this event a peak flood level of 6.30mAOD is predicted in the area of the proposed Development site (with flood depths of up to approximately 3.27m). As shown in Figure 7-4 the operational WTW site is predicted to be flood free.

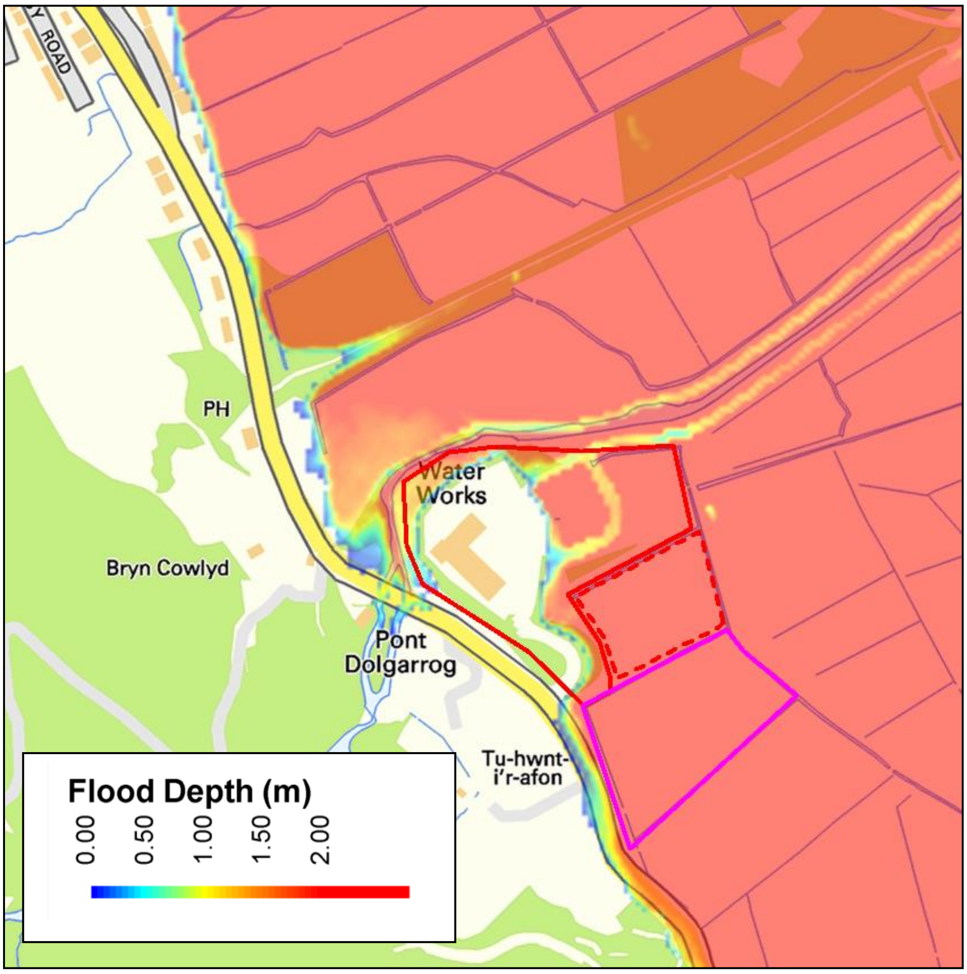

Figure 7-4 1 in 1000 year Fluvial with 2116 MHWS Flood Extent Prediction

7.4 Baseline Coastal Flood Predictions

7.4.1 1 in 200 year (2116) Flood

In a 1 in 200 year coastal flood event, with climate change, a peak flood level of 6.37mAOD has been estimated at the mouth of the Afon Conwy. This coastal flood results in a peak predicted flood level of 6.45mAOD in the area of the proposed Development site (flood extents shown in Figure 7-5). The results therefore confirm that the propagation of the tidal prism upstream along the Afon Conwy results in an 8cm increase in flood levels at the proposed Development site (i.e. due to afflux).

Despite the presence of the existing flood protection bund (at around 6.8mAOD) around the operational WTW site, in a 1 in 200 year coastal flood event, with climate change, the model predicts that the operational WTW site (excluding the area of the swale on the east side of the site) would be partially inundated, with resultant floodwater depths of up to 23cm (average 9cm). This flooding is not caused by overtopping of the flood protection bund, rather it is due to the lack of flood gates at the site entrance, allowing water into the site through a gap in the flood protection bund.

The operational area associated with the proposed Development and the area required for a temporary construction compound are predicted to flood with depths of up to approximately 3.5m.

The 1 in 200 year 95% confidence bound (+/-0.2m), which takes into account climate change uncertainty, is likely to result in a lower bound flood level of 6.25mAOD and upper bound flood level of 6.65mAOD for the 1 in 200 year event in the area of the proposed Development site.

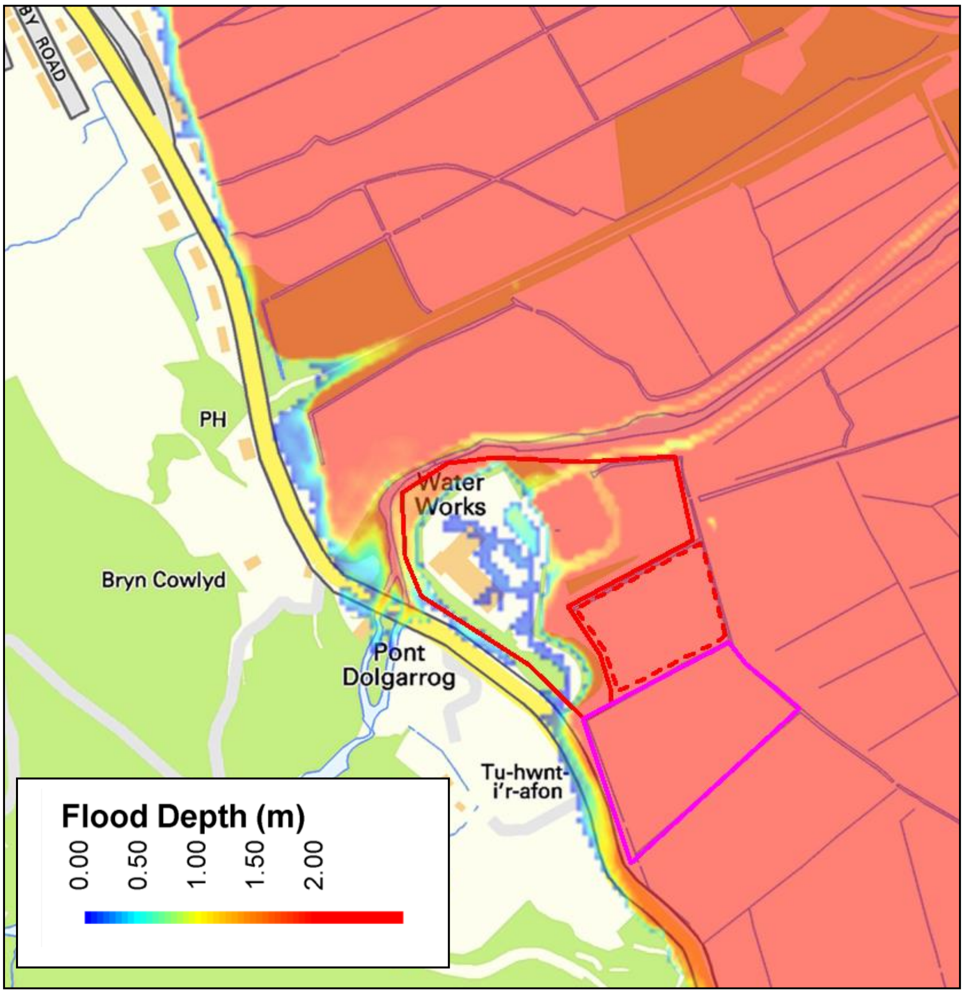

Figure 7-4 1 in 200 year (2116) Coastal Flood Extent Prediction

7.4.2 1 in 1000 year (2116) Flood

In a 1 in 1000 year coastal flood event, with climate change, a peak flood level of 6.58mAOD has been estimated at the mouth of the Afon Conwy. This coastal flood results in a peak predicted flood level of 6.63mAOD in the area of the proposed Development site (flood extents shown in Figure 7-6). The results therefore confirm that the propagation of the tidal prism upstream along the Afon Conwy results in a 5cm increase in flood levels at the proposed Development site (i.e. due to afflux).

Although the existing flood protection bund would not be overtopped in 1 in 1000 year coastal flood event, with climate change, the model predicts that the operational WTW site (excluding the area of the swale on the east side of the site) would be flooded with resultant floodwater depths of up to 113cm (average 82cm) due to floodwater flowing through the entrance to the operational WTW site. The operational area associated with the proposed Development and the area required for a temporary construction compound are predicted to flood with depths of up to approximately 3.8m.

The 95% confidence bound (+/-0.3m), which takes into account climate change uncertainty, is likely to result in a lower bound flood level of 6.33mAOD and upper bound flood level of 6.93mAOD for the 1 in 1000 year event in the area of the proposed Development site. Therefore, in the upper bound scenario the existing flood protection bund would be overtopped in a 1 in 1000 year coastal flood event. The implications of the upper bound scenario are discussed in Section 7.7).

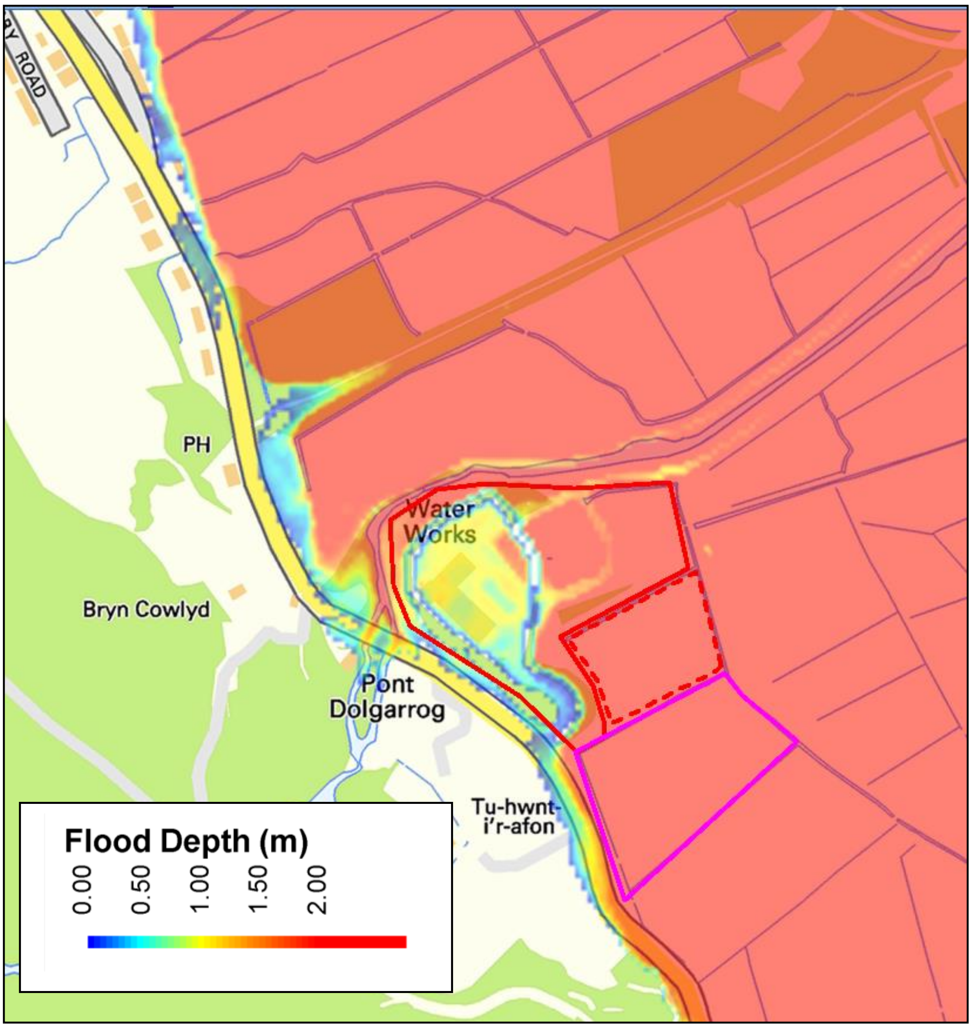

Figure 7-5 1 in 1000 year (2116) Coastal Flood Extent Prediction

7.5 Flood Defences for the proposed Development

The baseline and residual (with proposed Development in place) hydraulic models are exactly the same except for the inclusion of the proposed flood protection which has been added to reflect the flood protection required to achieve TAN15 guidelines.

The operational area associated with the proposed Development would be set, approximately, at existing ground levels (3.5mAOD) and would be contained within a new 360m flood protection bund with a crest level of approximately 6.8mAOD connected into the existing flood protection bund around the operational WTW. In addition, a flood gate (height 6.8mAOD) would be installed at the entrance of the operational WTW site.

During the 24 month construction period, a temporary construction compound would be located on the south side of the proposed Development site. This compound would be defended to a level of 5.7mAOD using a 390m flood protection bund. The bund would be removed from the floodplain once the construction of the works was complete.

7.6 Residual Fluvial Flood Predictions

Model flood predictions show that within a 300m zone around the proposed Development site, the predicted mean baseline 1 in 100 year, 1 in 100 year with climate change and 1 in 1000 year flood levels are not predicted to change significantly (less than 1cm) with the proposed Development in place.

With the proposed 360m flood protection bund and flood gate set to a level of 6.8mAOD, the operational area associated with the proposed Development would be protected from flooding in the 1 in 100 year with climate change (freeboard 0.98m) and 1 in 1000 year (freeboard 0.5m) events. In addition, the proposed Development would not impact on third party fluvial flood risk.

Therefore, the FCA has confirmed that the TAN15 fluvial threshold and consequences guidelines have been met.

7.7 Residual Coastal Flood Predictions

Model flood predictions show that within a 300m zone around the proposed Development site, the predicted mean baseline 1 in 200 year with climate change and 1 in 1000 year with climate change flood levels are not predicted to change significantly (less than 1cm) with the proposed Development in place. This is to be expected given the influence of the coastal boundary in controlling the flood levels in the area of the WTW and the relative size of the coastal floodplain compared to the footprint of the proposed Development site.

With the proposed flood protection bund and flood gate in place, the operational area associated with the proposed Development would be protected from flooding in the 1 in 200 year with climate change (freeboard 0.35m) and 1 in 1000 year (freeboard 0.17m) events. In addition, the proposed Development would not impact on third party coastal flood risk.

Therefore, the FCA has confirmed that the TAN15 coastal threshold and consequences guidelines have been met.

With the inclusion of the 1 in 200 year 95% confidence bound (+/-0.2m), which takes into account climate change uncertainty, the proposed Development would still be protected from flooding in a 1 in 200 year with climate change event (the predicted flood level would be approximately 6.63mAOD in the area of the proposed Development site, with a remaining freeboard of 0.17m).

In the 1 in 1000 year climate change event, the inclusion of the 95% confidence bound (+/-0.3m), which takes into account climate change uncertainty, is likely to result in the overtopping (by up to 0.13m) of the flood protection bund. However, raising the bund further is not considered to be necessary on the grounds that:

- NRW’s general guidance confirms that a 75 year development lifetime should be adopted for less vulnerable development (i.e. the actual design development lifetime is 2091). Therefore, in adopting a 100 year development lifetime (2116), an additional 363mm of potential sea level rise due to climate change has been taken into account in the assessment.

- There is a high degree of uncertainty that sea levels would rise by up to 1066mm over a 100 year period due to climate change.
- There is a high degree of certainty that the 1 in 1000 year sea level would not be under estimated by 300mm (95% confidence bound).
- The likelihood of a 1 in 1000 year coastal flood occurring over the actual development lifetime (100 years) is low (probability less than 10%).
- In addition, if a 1 in 1000 year costal flood occurred and the 300mm 95% confidence bound was realised, the proposed flood protection bund would only be at risk of overtopping from the year 2107 onwards.

7.8 Residual Flood Predictions with temporary construction compound

The predicted 1 in 100 year (2016) fluvial flood level is approximately 5.18mAOD in the area of the proposed Development. Therefore, with the proposed temporary flood protection bund in place (at an elevation of 5.7mAOD), the temporary construction compound would be protected from fluvial flooding in a 1 in 100 year event (2016) (freeboard approximately 0.52m).

The 1 in 200 year (2016) flood level at the mouth of the Afon Conwy is approximately 5.3mAOD. Therefore, with the proposed temporary flood protection bund in place (at an elevation of 5.7mAOD), the temporary construction compound would be protected from flooding in a 1 in 200 year event (2016) (freeboard approximately 0.4m).

Model flood predictions show that within a 300m zone around the proposed Development site, predicted mean baseline 1 in 200 year with climate change coastal flood levels are not expected to change significantly (less than 1cm) with the temporary construction compound in place.

Although the 1 in 200 year (2016) coastal flood (estimated flood level 5.3mAOD in the area of the proposed development) has not been modelled, the model predictions for the 1 in 200 year with climate change coastal flood (predicted peak flood level 6.45mAOD) and the 1 in 100 year (2016) fluvial flood (predicted peak flood level 5.18mAOD) can be used to confirm that the temporary construction compound would not result in a significant change in flood levels within the surrounding area.

Therefore, the FCA has confirmed that the TAN15 coastal and fluvial threshold guidelines have been met for the temporary construction compound.

7.9 Emergency Warning Systems and Flood Management

It is recommended that a flood management plan be produced documenting appropriate flood warning and evacuation procedures. This should set out arrangements for the WTW to be linked to the NRW's advanced flood warning system which sends an automated warning message when the NRW issues a flood alert.

The proposed Development site is located within the Conwy Catchment and North Wales Coast Flood Warning Areas (http://apps.environment-agency.gov.uk/flood). These areas are covered by the EA's general early notification of possible flooding, known as Flood Alert. The EA also issues more specific Flood Warnings in this area. In the implementation of the flood management plan, the site operatives would be able to assess the need to put evacuation procedures into action.

Emergency egress from the WTW entrance to an area outside the 1 in 1000 year flood is available via the B5106.

8 Blockage Assessment

8.1 Overview

NRW has requested that an assessment of a blockage of the B5106 road crossing of the Afon Ddu be undertaken to establish the flood risk impact on the operational area associated with the proposed Development.

The B5106 road crossing comprises a twin stone arched culvert structure, located immediately upstream of the site. The two arches are 5.91m and 6.24m wide and provide internal flow areas of 10.58m² and 9.50m². The risk of a significant build-up of debris at the bridge is therefore relatively low. Typically, the risk of blockages to culverts/bridges with an internal flow area greater than 3m² is considered to be low (Environment Agency Trash and Security Screen Guide, 2009).

In addition to the main twin arches there is also understood to be a third smaller arch on the right side (southeast corner) of the bridge. Owing to the density of the vegetation in this area, the surveyor was unable to gain access to survey the smaller arch. It is speculated that this third arch was constructed over a small leat running to the east of the main channel and under present day conditions flow though the arch would only occur in large flood events. As this third arch has not been represented in the model, the flood level predictions upstream of the bridge and the blockage assessment findings will be conservative.

8.2 Assessment Methodology

Following a review of the NRW Conwy Valley hydraulic model it was confirmed that the Afon Ddu reach, from Pont Dolgarrog downstream to its confluence with the Conwy, was not represented. Therefore, to assess the blockage risk a topographical survey of the Afon Ddu local to the B5106 road crossing was undertaken by Alpine Land Surveyors in June 2015. This survey was used, in conjunction with LiDAR data, to develop a bespoke ISIS model of the Afon Ddu reach.

In the NRW model an inflow boundary was defined for the Afon Ddu. Therefore, a 1 in 100 year inflow boundary along with a 1 in 100 year stage boundary condition was extracted from the NRW model and used to define the upstream and downstream boundary conditions in the Afon Ddu model.

In line with NRW guidance 30% and 67% blockages of the two arches of the bridge along with the baseline conditions have been simulated. The blockages were represented by reducing the cross sectional area of the two main arches.

In the Afon Ddu model a very conservative roughness coefficient of 0.07 has been adopted for the channel. This is characteristic of a steep stream with cobbles and large boulders. At the bridge structure a slightly lower roughness coefficient of 0.04 has been adopted, which reflects the reduction in the size and quantity of boulders observed under the bridge arches.

8.3 Assessment Results

Immediately upstream of the B5106 road crossing of the Afon Ddu a baseline 1 in 100 year flood level of 6.52mAOD is predicted, this increases to 6.84mAOD with a 30% blockage in place and to 7.02mAOD with a 67% blockage in place. With the blockages in place the soffits of the arches are not predicted to surcharge.

A review of the topographic survey indicates that water levels of approximately 6.9mAOD and 7.15mAOD would be required to overtop the road on the northwest and southeast sides of the bridge respectively. The deck of the bridge above the arches is at approximately 8mAOD. Therefore, no overtopping of the eastern side of the road, adjacent to the operational WTW, is predicted to occur in the baseline, 30% blockage or 67% blockage scenarios.

As the road adjacent to the WTW is not predicted to be overtopped in a 67% blockage scenario, it has been concluded that the blockage risk and consequences to the operational area associated with the proposed Development are very low. In addition, the findings of the blockage assessment have shown that the elevation of the proposed flood gate at the entrance to the WTW does not need to be higher than the proposed height of 6.8mAOD.

It is therefore concluded that the blockage risk and consequences to the operational area associated with the proposed Development are very low.

9 Outline Surface Water Drainage Strategy

9.1 Existing Site Drainage

The operational area associated with the proposed Development and the area proposed for the temporary construction compound currently comprises grazed fields and the existing runoff characteristics are predominantly governed by topography, soil type, the nature of overlying surfaces and the presence of any below ground drainage pipes. The soils beneath the site are described as deep stoneless fine silty and clayey soils and, although the site is relatively flat, it is considered that when soils are saturated, during larger storms excess rainfall will form runoff that would drain in accordance with the topography of the site, towards the drainage ditches that are located across the proposed Development and into the Afon Conwy to the east of the WTW.

9.2 Indicative Drainage Strategy for the Proposed Development Operational area

Given the underlying ground conditions (which inhibit drainage to the soil) and the location of the 'Normal Tidal limit' adjacent to the operational WTW, it is considered that the most practical solution for the management of surface water runoff is to provide an un-restricted discharge directly to the Afon Ddu. This solution has been discussed and agreed in principle with NRW.

As part of the detailed design of the development, surface water flood pathways (roads/footpaths) should be identified to ensure that this overland flow is routed away from buildings and into a drainage system that would drain via gravity to an outlet (via flapped outfalls) to the Afon Ddu.

The design and construction of the proposed Development should also ensure that there are no low spots on the site, where unplanned ponding of water could occur and threaten buildings nearby.

Under tide locked conditions (as a result of high water levels within Afon Ddu), reverse flow into the drainage system would be prevented by a non-return valve. In these conditions surface water would be pumped to an existing stormwater outfall that discharges to the Afon Ddu.

It is understood that the proposed Development would only involve the infilling of one minor (115m long and 1.5m wide) ditch. To compensate for the minor loss in storage in the wider ditch system a new compensation ditch would be constructed between the toe of the proposed flood defence and the western side of the new farm access track.

With the implementation of a suitable surface water drainage strategy, which utilises an un-restricted discharge to the Afon Ddu, there should be no significant risk to the operational area associated with the proposed Development from surface water flooding. Owing to the tidal nature of the receiving watercourse (Afon Ddu) there would be no increase in third party flood risk from surface water.

9.3 Indicative Drainage Strategy for the Temporary Construction Compound

Access tracks and impermeable areas within the temporary construction compound would be drained using appropriate sustainable drainage techniques. The proposed drainage system would centre on the use of attenuation measures (such as a swale), with off-site discharge flows limited to that of existing runoff rates.

Under normal conditions rainfall runoff will flow into the drainage system. This would transfer flows under the temporary construction compound flood protection bund before being discharged under gravity to the existing drainage ditches located on the southeast side of the site.

To minimise the impact of the temporary construction compound on flood risk within the nearby drainage ditches, it is essential that surface water drainage arrangements are such that the volumes of run-off and peak flow rates leaving the site during the construction period are no greater than those under existing conditions.

In order to inform this outline drainage strategy existing run-off rates have been calculated (in line with CIRIA C609 guidelines) and the storage volume required to restrict run-off from the new impermeable surfaces to these rates has been estimated

Greenfield rates of runoff from the site have been calculated using the FEH Statistical method, as advised in the latest flood estimation guidelines from the EA (EA, 2015). Runoff rates were calculated for rain storm events, including the 1 in 2 year, 1 in 30 year and the 1 in 100 year storm events in accordance with NRW requirements. The results of these calculations are presented in Table 9-1.

Table 9-3 Greenfield runoff calculation results

Return Period	Greenfield Runoff Rate (l s^{-1} ha^{-1})
1 in 2 year	11.6
1 in 30 year	20.4
1 in 100 year	25.3

Under tide locked conditions (as a result of high water levels within the receiving ditches), reverse flow into the drainage system would be prevented by a non-return valve. In these conditions onsite surface water would back-up and be stored within the swale within the temporary construction compound.

The swale and other SuDS features would also function to settle any suspended sediments in the runoff.

For the temporary construction compound if any infilling of ditches is required then appropriate compensation storage/ditches would be provided to ensure that there was no loss in attenuation capacity of the wider land drainage system.

With the implementation of a suitable surface water drainage strategy, there should be no significant risk to the Temporary Construction Compound from surface water flooding. The surface water drainage strategy would ensure that there would be no increase in third party flood risk from surface water.

10 Conclusions and Recommendations

10.1 Conclusions

1 An FCA for the proposed Development at the Bryn Cowlyd Water Treatment Works, located on the left bank of the tidal Afon Conwy and the right bank of the Afon Ddu, has been undertaken in accordance with the requirements of TAN15 and in line with guidance provided by NRW.

2 The TAN15 DAM indicates that the proposed Development site is located within Flood Zone C1, therefore an FCA is required to support development on the site. As utilities infrastructure, the proposed Development is classified as being 'less vulnerable development' in TAN15. As it is not feasible to locate the new infrastructure away from the operational WTW site, the proposed Development is considered to be justified at this location.

3 The proposed Development will comprise buildings, above and below ground tanks, kiosks and water mains. The buildings will contain process tanks, pipework, mechanical equipment such as pumps and electrical control equipment. All the process elements will be contained within the existing DCWW land boundary to the east of the existing plant. However, it is proposed that the contractor will occupy the adjacent field to the south of the site during construction for site accommodation and material and equipment storage.

4 All sources of potential flood risk to the site have been considered. The proposed Development site is not perceived to be at significant risk of flooding from groundwater or artificial sources.

5 With the implementation of a suitable surface water drainage strategy, which utilises an un-restricted discharge to the Afon Ddu, there should be no significant risk to the operational area associated with the proposed Development from surface water flooding. Owing to the tidal nature of the receiving watercourse (Afon Ddu) there would be no increase in third party flood risk from surface water. With the implementation of a suitable surface water drainage strategy for the construction compound, there should be no significant risk from surface water flooding. The surface water drainage strategy would ensure that there would be no increase in third party flood risk within the surrounding fields from surface water.

6 Fluvial flooding from the adjacent Afon Conwy and Afon Ddu poses a flood risk to the site; however, the primary source of flood risk to the site is from coastal flooding which propagates up the Afon Conwy. As part of the study, an ISIS/TUFLOW hydraulic model provided by NRW has been used to enable a detailed assessment of both the fluvial and coastal flood risk to the site.

7 The Afon Conwy and Afon Ddu in the area of the proposed Development site are tidally controlled/dominated. As consequence, without the formal flood defences in place along the Afon Conwy and Afon Ddu, the floodplain would be flooded to a depth of around 1.2m from a MHWS tide.

8 In a 1 in 100 year fluvial flood event with climate change (2116) a baseline flood level of 5.82mAOD is predicted in the area of the proposed Development site (with flood depths of up to approximately 2.84m). In a 1 in 1000 year fluvial flood (2116) the flood level increases to 6.3mAOD. Owing to the presence of an existing flood protection bund (6.8mAOD), in both these events the operational WTW site is predicted to be flood free. However, the operational area associated with the proposed Development and the area proposed for the temporary construction compound are predicted to be flooded.

9 In a 1 in 200 year coastal flood event with climate change (2116) a baseline peak flood level of 6.45mAOD has been predicted in the area of the proposed Development site. The flood level increases to 6.63mAOD in a 1 in 1000 year coastal flood event with climate change (2116). Despite the presence of the existing flood protection bund around the operational WTW site, in a 1 in 200 year coastal flood event, with climate change, and in a 1 in 1000 year event the model predicts that the operational WTW site would be partially inundated. This flooding is not caused by overtopping of the flood protection bund, rather it is due to the lack of flood gates at the site entrance, allowing water into the site through a gap in the flood protection bund. In addition, in these two flood events the operational area associated with the proposed Development and the area proposed for the temporary construction compound are predicted to be flooded.

10 The new development on the site would be defended with a flood protection bund and a flood gate set at a level of 6.8mAOD. The temporary construction compound would be defended to a level of 5.7mAOD using a 390m flood protection bund.

11 The study has confirmed that, with the proposed Development in place, the 1 in 100 year fluvial flood (with climate change) levels and 1 in 1000 year flood levels are not predicted to change significantly. With the proposed 360m flood protection bund and flood gate set to a level of 6.8mAOD, the operational area associated with the proposed Development would be protected from flooding in these two events. Therefore, the FCA has confirmed that the TAN15 fluvial threshold and consequences guidelines have been met.

12 The study has also confirmed that, with the proposed Development in place, the 1 in 200 year coastal flood (with climate change) levels and 1 in 1000 year flood levels (with climate change) are not predicted to change significantly. With the proposed flood protection bund and flood gate in place, the operational area associated with the proposed Development would be protected from flooding in these two events. Therefore, the FCA has confirmed that the TAN15 coastal threshold and consequences guidelines have been met.

13 With the proposed temporary flood protection bund in place, the temporary construction compound is predicted to be protected from flooding in a 1 in 200 year event (2016). The flood predictions also confirmed that predicted 1 in 200 year with climate change coastal flood levels are not expected to change significantly with the temporary construction compound in place. Therefore the FCA has confirmed that the TAN15 coastal and fluvial threshold guidelines have been met for the temporary construction compound.

14 In consultations, NRW confirmed that there was a need for a blockage assessment on the Afon Ddu for the B5106 structure. Owing to the area of the bridge arches (greater than 3m²) the risk of a blockage is very low. As a precaution, model blockage sensitivity tests have been undertaken for the 1 in 100 year fluvial event and these have shown that, with a 30% and a 67% blockage within the two main arch openings, the proposed Development is not at risk of flooding.

15 The study has confirmed that emergency access/egress to/from the proposed Development site can be provided in line with TAN15 guidelines.

10.2 Recommendations

1 To support the future operation of the WTW, it is recommended that a flood management plan be produced for the site, with appropriate warning and evacuation procedures. This should set out arrangements for the new development and be linked to the NRW's advanced flood warning system which sends an automated warning message when the NRW issues a flood alert.

Appendix A

Drawings

A3

NOTES:

1.

- 🟥 PROPOSED DEVELOPMENT SITE BOUNDARY
- 🟩 PROPOSED CONSTRUCTION COMPOUND
- EXISTING FLOOD DEFENCES

KEY PLAN

01	02.07.15	NT	PRELIMINARY	RD	PP	02.07.15
Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf
Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name. BRYN COWLYD WTW

Drawing Title. PROPOSED DEVELOPEMENT SITE LAYOUT

Suitability. WORK IN PROGRESS

Suitability Code. S0

Originator. NT

Designer. PP

Date. 02/07/15

Internal Project Number. UA007911

Scale. 1:1000

Rev. 01

Drawing Number. 1279_W_201 - HYD - XX - XX - DR - 09023

Appendix B

Correspondence and Product 4 data

From: Huws, Iwan <Iwan.Huws@cyfoethnaturiolcymru.gov.uk>
Sent: 26 June 2015 08:08
To: Russell Green
Subject: RE: Bryn Cowlyd DCWW WTW redevelopment - Preliminary Flood Predictions

Russell
I am generally happy with the approach taken and the content of your e-mail, however I would be grateful if you could clarify a couple of points ?

- The CC predictions I assume include the 95% confidence? I would advise that this is referred to in the final FCA.
- I presume that the 8cm rise due to the propagation of the tidal prism is due to afflux?
- There is no need (from NRW) for you to run the fluvial 0.1% event with cc.
- You state that the floodplain around the site is flooded to a depth of 1.2m with the MHWS (2.2m for MHWS 2115) – is this for a undefended scenario or does it take into account the existing earth defences. (I'm afraid that I have just had a new PC so can not check our asset data).
- I am satisfied that the mean flood levels has been used in this instance due to existing inundation of the valley bottom. As such the summary findings seem acceptable. However we would advise that the final FCA should also refer to surface water drainage arrangements (greenfield run off rates etc.) and compensation for any infilling of ditches/providing new drainage ditches. A section should also be included for floodplain compensation e.g. no land available however the impact of loss of storage has been assessed.

I look forward to your response, however should you wish to discuss, please contact me using the details below (I shall be back in the office on Wednesday 1st).

Regards
Iwan

Iwan Huws
Peiriannydd Datblygiad a Risg Llifogydd / Development and Flood Risk Engineer
Cyfoeth Naturiol Cymru / Natural Resources Wales
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Gwefan / Website:
www.cyfoethnaturiolcymru.gov.uk / www.naturalresourceswales.gov.uk

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From: Russell Green [mailto:Russell.Green@hyderconsulting.com]
Sent: 23 June 2015 17:18
To: Huws, Iwan
Cc: Neil Evans; Aaron McLean
Subject: Bryn Cowlyd DCWW WTW redevelopment - Preliminary Flood Predictions

Iwan,

Further to our conversation last Tuesday, I just wanted to set out the preliminary flood predictions before we finalise the FCA.

Baseline Tidal Flood Predictions

For the 0.5% (2115) scenario, a tidal downstream boundary condition (with a peak flood level of 6.37mAOD) has been applied to NRW's River Conwy ISIS-TUFLOW model. This tidal boundary results in a peak flood level of 6.45mAOD in the area of the WTW (i.e. the propagation of the tidal prism upstream results in an 8cm increase in flood levels at the WTW).

In the 0.1% (2115) scenario, the tidal downstream boundary (with a peak flood level of 6.58mAOD) results in a peak flood level of 6.63mAOD in the area of the WTW (i.e. propagation of the tidal prism results in a 5cm increase in flood levels in the area of the WTW).

In both scenarios the tidal floodplain around the WTW is flooded to a depth of around 3.6m.

Baseline Fluvial Flood Predictions

For the 1% scenario, a peak flood level of 5.18mAOD is predicted in the area of the WTW. The peak flood level rises to 5.82mAOD in the 1% (2115) scenario and to 6.00mAOD in the 0.1% scenario. We are currently waiting for the 0.1% (2115) scenario simulation to complete. However, the peak flood level are significantly lower than the tidal flood scenarios.

In the scenarios simulated the floodplain around the WTW is flooded to a peak depth of between 2.3mAOD and 3.15mAOD. It should be noted that the floodplain is predicted to be flooded to a depth of 1.2m from a MHWS tide and to a depth of 2.2m from a MHWS (2115) tide (i.e. the flood conditions on the floodplain surrounding the WTW is tidally controlled/dominated)

Proposed Scheme

To protect the new WTW infrastructure at Bryn Cowlyd, the proposed scheme comprises a new 360m long flood bund (shown by a blue line in Figure 1) around the perimeter of the new WTW infrastructure. This bund will be set above 6.8mAOD and will tie into the existing bund (shown by a pink line in Figure 1) around the existing WTW. In addition, a flood gate to tie into the existing flood bund, is proposed at the existing entrance to the WTW.

A temporary 390m flood bund, set at 6.37mAOD, will also be constructed to protect a construction compound located immediately south of the WTW.

Residual Tidal Flood Predictions

Analysis undertaken using Mapinfo shows that within a 300m zone around the WTW, the predicted mean 0.5% (2115) and 0.1% (2115) flood levels are not predicted to change significantly (less than 1cm) with the scheme in place. This is to be expected given the influence of the tidal boundary in controlling the flood levels in the area of the WTW and the relative size of the tidal floodplain compared to the area of the proposed scheme.

However, owing to the complexity of the ISIS-TUFLOW model and the extensive flooding predicted (3.6m deep), the model is oscillating slightly at the peak. As shown in Figure 1 below, these oscillations result in localised flood level fluctuations throughout the model domain. This therefore makes it difficult to provide an accurate assessment of the impact of the development proposals in distinct locations and instead the average impact over a wider area (i.e. 300m zone) has been adopted.

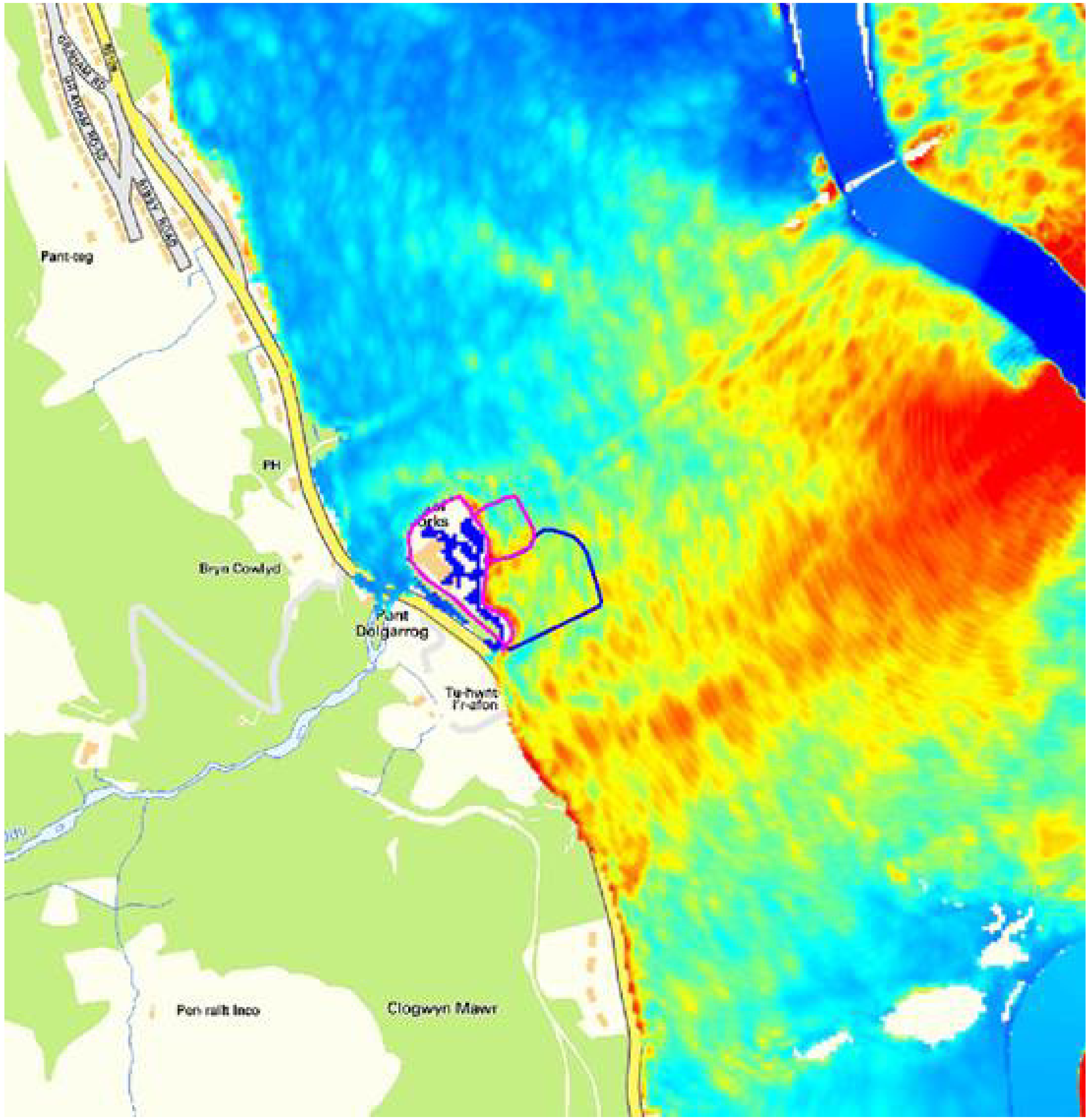

Figure 1: Tidal 0.5% (2115) scenario (Blue contour flood level 6.40mAOD : Cyan contour flood level 6.50mAOD : Yellow contour flood level 6.55mAOD : Orange contour flood level 6.60mAOD : Red contour flood level 6.70mAOD)

Residual Fluvial Flood Predictions

Analysis undertaken using Mapinfo shows that within a 300m zone around the WTW, the predicted <u>mean</u> 1%, 1% (2115) flood levels are not predicted to change significantly (less than 1cm) with the scheme in place. Although we are currently waiting for the 0.1% (2115) scenario simulation to complete, the scheme will not change flood levels significantly.

Temporary Construction Compound

Analysis undertaken using Mapinfo shows that within a 300m zone around the WTW, the predicted <u>mean</u> 0.5% (2115) flood levels are not predicted to change significantly change (less than 1cm) with the temporary construction compound in place.

Afon Ddu blockage

To assess the impact on the WTW of blockage (50% and 80%) of the B5106 road bridge over the Afon Ddu, we are developing a bespoke ISIS model of the watercourse and bridge. At the moment we are awaiting the survey data to be provided. The 1% (2115) flow boundary conditions for the ISIS model of the Afon Ddu will be extracted from the NRW's River Conwy ISIS-TUFLOW model.

In terms of the scheme, it is anticipated that the findings of the blockage assessment will be used to inform the configuration of the flood gate at the entrance to the WTW.

Summary

In summary, the modelling has shown that the tidal flood levels in the area of the proposed scheme are predominantly controlled by the downstream boundary condition. As a consequence, even though the model oscillates slightly at the peak, the modelling shows that the proposed scheme would not have an impact on third party tidal flood risk over the wider area.

Prior to us finalising the FCA, I would be grateful if you could confirm that you are in agreement with our summary findings.

Many Thanks
Russell

Russell Green
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Hyder Consulting PLC
Registered Office: Manning House, 22 Carlisle Place, London, SW1P 1JA
Registered Number: 02212959 England & Wales

Rob Davies

From:	Neil Evans
Sent:	08 July 2015 17:16
To:	Russell Green
Subject:	FW: Bryn Cowlyd DCWW WTW redevelopment - site meeting 29/4

From: Neil Evans
Sent: 05 May 2015 15:24
To: 'Huws, Iwan'
Subject: RE: Bryn Cowlyd DCWW WTW redevelopment - site meeting 29/4

Many thanks Iwan.

Kind regards,

Neil

From: Huws, Iwan [mailto:Iwan.Huws@cyfoethnaturiolcymru.gov.uk]
Sent: 05 May 2015 14:37
To: Neil Evans
Subject: RE: Bryn Cowlyd DCWW WTW redevelopment - site meeting 29/4

Hi Neil
With regards to the two e-mail below, I can confirm that I have forwarded your request for the modelling data to my colleague in Buckley who should be able to provide you with an electronic copy of the model to allow you to manipulate the data. Should you wish to discuss, please contact Glyn Wensley (tel. 0300 065 3905/ glyn.wensley@naturalresourceswales.gov.uk) early next week if you have not received the data.

I would tend to agree with the various scenarios that you have suggested, however I would advise that ideally a 100 years of climate change should be used. If there is to be discussions regarding the climate change allowances, then a model run on the existing events(s) which would compromise the works should be run.

With regards to a blockage on the Afon Ddu bridge, I understand that it is a triple arch bridge and a 30/67% blockage should be considered. For the modelling work it is suggested that one arch is totally blocked along with two arches blocked as a sensitivity test.

You may discuss the ecological issues, Liz Jones would be best to contact (liz.jones@naturalresourceswales.gov.uk tel. 0300 065 3715) whilst Mark Medway may be best placed to discuss water quality issues (mark.medway@naturalresourceswales.gov.uk tel. 0300 065 3732).

Below is a screen shot taken from the Police helicopter video of the Conwy Valley flooding in January 2005.


6
12
30
15
00
-15
-30
-45
-60
-75
-90
-105
2005-01-08
14:11:48

Regards

Iwan Huws
Peiriannydd Datblygiad a Risg Llifogydd / Development and Flood Risk Engineer
Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/Tel: 03000 653783
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Gwefan / Website:
www.cyfoethnaturiolcymru.gov.uk / www.naturalresourceswales.gov.uk

Ein diben yw sicrhau fod adnoddau naturiol Cymru yn cael eu cynnal, eu gwella a'u defnyddio yn gynaliadwy, yn awr ac yn y dyfodol.

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future

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From: Neil Evans [mailto:Neil.Evans@hyderconsulting.com]
Sent: 05 May 2015 09:16
To: Huws, Iwan
Subject: FW: Bryn Cowlyd DCWW WTW redevelopment - site meeting 29/4

Hi Iwan,

Would you know who in NRW we should talk to regarding water quality and ecology on the Bryn Cowlyd site? Our ecologist wants to discuss existing conditions and monitoring data so a name(s) and number would be very useful if you know please?

Many thanks,

Neil

From: Neil Evans
Sent: 30 April 2015 14:06
To: 'Huws, Iwan'
Cc: 'Durrans Ron'; Rob Davies
Subject: RE: Bryn Cowlyd DCWW WTW redevelopment - site meeting 29/4

Hi Iwan,

Thanks for coming to Bryn Cowlyd for the meeting yesterday and providing your advice – it was nice to meet you.

Please find attached the NRW response to my initial data request, for information. As discussed, I would be most grateful if you could forward the complete flood product data available for the site, including the Conwy model and latest hydrology (advising of any associated licensing costs), so we can start to update the baseline and model the development proposals without delay. DCWW is hoping to submit for planning in the near future so early receipt of the model would be much appreciated.

I would also be grateful if you could confirm NRW's requirements in respect of the design and extreme scenarios that we will need to run in order to show adequate protection for the site and to identify any impacts on third party flood risk, in particular with regard to appropriate boundary conditions for each fluvial and tidal scenario. From our initial discussions yesterday, I gathered the following scenarios were likely to be required (but would be grateful for your confirmation or advice otherwise):

- **1% fluvial** (+20% cc) with **MHWS** (+ cc - sea level rise for WTW design lifetime)
- **0.1% fluvial** (no cc) with **MHWS** (+ cc - sea level rise for WTW design lifetime)
- **0.5% tidal** (+ cc - sea level rise for WTW design lifetime) with **QMED** (+20% cc)
- **0.1% tidal** (+ cc - sea level rise for WTW design lifetime) with **QMED** (+20% cc)

There may be additional scenarios depending on DCWW's own requirements for an appropriate standard of protection.

I also understand NRW will want to see the results of a model run simulating a blockage of the Afon Ddu culverts beneath the B5106 – could you please confirm the blockage percentage(s) required?

Please do not hesitate to call me at any time if you wish to discuss this request.

Many thanks,

Neil

Neil Evans
Technical Director – Rivers, Marine & Coastal

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HCL House
St Mellons Business Park
Fortran Road

Cardiff CF3 0EY

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Fax: +44 (0) 2920 925222

www.hyderconsulting.com

From: Huws, Iwan [mailto:Iwan.Huws@cyfoethnaturiolcymru.gov.uk]
Sent: 24 April 2015 08:12
To: Neil Evans
Subject: RE: Bryn Cowlyd DCWW WTW redevelopment - site meeting 29/4

Hi Neil
I can confirm that I can attend at 1pm on the 29th.
Regards

Iwan Huws
Peiriannydd Datblygiad a Risg Llifogydd / Development and Flood Risk Engineer
Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/Tel: 03000 653783
E-bost/E-mail:
Iwan.Huws@cyfoethnaturiolcymru.gov.uk Iwan.Huws@naturalresourceswales.gov.uk

Gwefan / Website:
www.cyfoethnaturiolcymru.gov.uk / www.naturalresourceswales.gov.uk

Ein diben yw sicrhau fod adnoddau naturiol Cymru yn cael eu cynnal, eu gwella a'u defnyddio yn gynaliadwy, yn awr ac yn y dyfodol.

Our purpose is to ensure that the natural resources of Wales are sustainably maintained, enhanced and used, now and in the future

---

Hyder Consulting PLC
Registered Office: Manning House, 22 Carlisle Place, London, SW1P 1JA
Registered Number: 02212959 England & Wales

Rob Davies

From: Russell Green
Sent: 14 July 2015 12:07
To: 'Iwan.Huws@cyfoethnaturiolcymru.gov.uk'
Cc: Gareth Thompson
Subject: Bryn Cowlyd Water Treatment Works

Iwan,

Further to our conversation, I just wanted to confirm that for the proposed Development NRW would allow un-restricted discharge of surface water flows from the site to the Afon Ddu owing to the location of the normal tidal limit adjacent to the WTW.

As discussed, I also understand that in an emergency situation there may be potential to discharge flows arriving at the WTW to the Afon Ddu, but NRW would require an impact assessment to be undertaken to confirm that there would be no impact on third party flood risk.

Thanks
Russell

Russell Green
Principal Engineer – Rivers, Marine & Coastal
Hyder Consulting UK Ltd
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St Mellons Business Park
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Fax: 029 20925222
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Rob Davies

From: Huws, Iwan <Iwan.Huws@cyfoethnaturiolcymru.gov.uk>
Sent: 15 July 2015 09:58
To: Russell Green
Subject: RE: Bryn Cowlyd Water Treatment Works

Russel
I understand that you discussed the proposed discharge from the site with my colleague Emyr Gareth last week. We are of the o[pinion that if the discharge id directly to the Afon Ddu, then un-restricted discharge will be permitted subject to a formal Flood Defence Consent application being made for the outfall structure.

With regards to the emergency discharge, we would have concerns if the discharge was to increase flooding in the receiving watercourse. As such we would suggest that the FCA being produced could refer to a possible MoU regarding the discharge being made when the river Ddu is not in flood and the discharge would increase flooding/overtopping of the Ddu defences.

We also discussed the temporary drainage arrangements for the compound into a ditch within the Internal Drainage District- it is understood that the temporary compound will be there for up to two years as such we would request that the flows are regulated and would advise that for a construction site that ideally the water should be treated to ensure no discolouration in the receiving watercourse due to site activities.

Regards

Iwan Huws
Peiriannydd Datblygiad a Risg Llifogydd / Development and Flood Risk Engineer
Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/Tel: 03000 653783
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Gwefan / Website:
www.cyfoethnaturiolcymru.gov.uk / www.naturalresourceswales.gov.uk

---

From: Russell Green [mailto:Russell.Green@hyderconsulting.com]
Sent: 14 July 2015 12:07
To: Huws, Iwan
Cc: Gareth Thompson
Subject: Bryn Cowlyd Water Treatment Works

Iwan,

Further to our conversation, I just wanted to confirm that for the proposed Development NRW would allow un-restricted discharge of surface water flows from the site to the Afon Ddu owing to the location of the normal tidal limit adjacent to the WTW.

As discussed, I also understand that in an emergency situation there may be potential to discharge flows arriving at the WTW to the Afon Ddu, but NRW would require an impact assessment to be undertaken to confirm that there would be no impact on third party flood risk.

Thanks
Russell

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Natural Resources Wales

North Wales Tidal Water Level Information

This document is provided as part of requests for flood risk data in the vicinity of North Wales Coastline and is used under licence from Natural Resources Wales.

Current Flood Map

The attached flood map shows the current flood zones at this location. This represents the undefended fluvial and tidal flood extents derived from a combination of detailed and generalised modelled data.

The current tidal flood map in this area is derived from a mapping study undertaken by JBA (2011)[1]. This study uses sea levels at discrete node locations around the North Wales coast, taken from the 'Coastal Flood Boundaries for the UK Mainland and Islands' project (2011)[2]. The levels were projected inland over a digital terrain model to produce tidal mapped outlines for both the 0.5% (1 in 200) AEP (annual exceedance probability) and the 0.1% (1 in 1000) AEP.

The flood map can be viewed on the **Environment Agency's** website at http://maps.environment-agency.gov.uk/wiyby

The Coastal Flood Boundary levels were derived using a tidal model calibrated to UK tidal gauge data. The model output is provided for node locations spaced at approximately 2km. 95% confidence bounds for these values were also derived using the confidence intervals for each node location. The extreme sea levels comprise still water level including storm surge, however they do not account for local wave action. The baseline estimations are for the year 2008, so climate change is calculated relative to this year, for example add 18mm for the year 2013.

Extreme sea levels for the node points closest to the site location are included in Table 1 for a range of return periods (events) e.g. T100 is the 1 in 100 year return period tide, which is equivalent to the 1% AEP (Annual Exceedance Probability). The node locations are shown in the enclosed map.

Table 1 - Extreme sea levels for adjacent nodes

Node	Easting	Northing	Extreme Event Sea Level (mAOD)					
			T25	T50	T75	T100	T200	T1000
1102	274988	383578	5.07	5.15	5.20	5.24	5.32	5.53
1104	275125	384182	5.08	5.17	5.21	5.25	5.34	5.54

---

[1] *North Wales Tidal Mapping Study Final Report.* JBA Consulting, November 2011.

[2] *Coastal flood boundary conditions for UK mainland and islands. R&D Report SC060064/TRD: Practical guidance design sea levels.* Environment Agency / Defra, 2011.

To provide the estimate of extreme sea levels for the site (Table 2), levels were interpolated from the adjacent nodes.

Table 2 - Extreme sea levels interpolated between adjacent nodes

Node	Easting	Northing	Extreme Event Sea Level (mAOD)					
			T25	T50	T75	T100	T200	T1000
Site	277500	366400	5.08	5.17	5.21	5.25	5.34	5.54
95% Confidence Bound (+/- m):			*0.10*	*0.10*	*0.10*	*0.20*	*0.20*	*0.30*

The current guidance on climate change from DEFRA (2006)[3] is as follows:

Table 3 - Sea level rise (mm per year)

Assumed vertical land movement	1990-2025	2025-2055	2055-2085	2085-2115
-0.5	3.5	8.0	11.5	14.5

The calculated future extreme sea levels are shown in Table 4. Adopting a precautionary approach as advised by Agency guidance (2011)[4], these levels include the upper level 95% confidence bound.

Table 4 - Extreme sea levels for the site (including 95% Confidence Bound)

Year	Sea level rise(m)	Extreme Event Sea Level (mAOD)					
		T25	T50	T75	T100	T200	T1000
2015	0.025	5.2	5.3	5.3	5.5	5.6	5.9
2065	0.415	5.6	5.7	5.7	5.9	6.0	6.3
2090	0.717	5.9	6.0	6.0	6.2	6.3	6.6
2115	1.080	6.3	6.3	6.4	6.5	6.6	6.9

Additional Information

The local authority may be able to provide information on issues such as localised flooding from sewers, drains and culverts.

Please also find enclosed the Surge Shape required to derive a design tidal-graph. For details on how to perform the necessary calculations please see the associated Technical Report (2011)[2].

Notes

Undefended scenarios are provided as being a possible worst case scenario in the event of defence failure. They are used as the basis of the Flood Map.

---

[3] *Flood and Coastal Defence Appraisal Guidance: FCDPAG3 Economic Appraisal. Supplementary Note to Operating Authorities – Climate Change Impacts.* Defra, October 2006

[4] *Using the national coastal flood boundary data for England and Wales (Operational Instruction 490_11).* Environment Agency, February 2011.

Extreme sea levels provided as part of this project are accurate to one decimal place (Table 4). Two decimal places have been provided to show the gradual change between nodes seen in the model; however, this does not imply greater accuracy

The scope of the model is the mapping of flood risk; it is not intended for detailed design. The model should be considered as the starting point for more detailed modelling, commensurate with the consequences of flooding at the site of interest.

Natural Resources Wales models are available under licence agreement for the purpose of further development. Please contact Natural Resources Wales External Relations for details of terms, conditions and pricing.

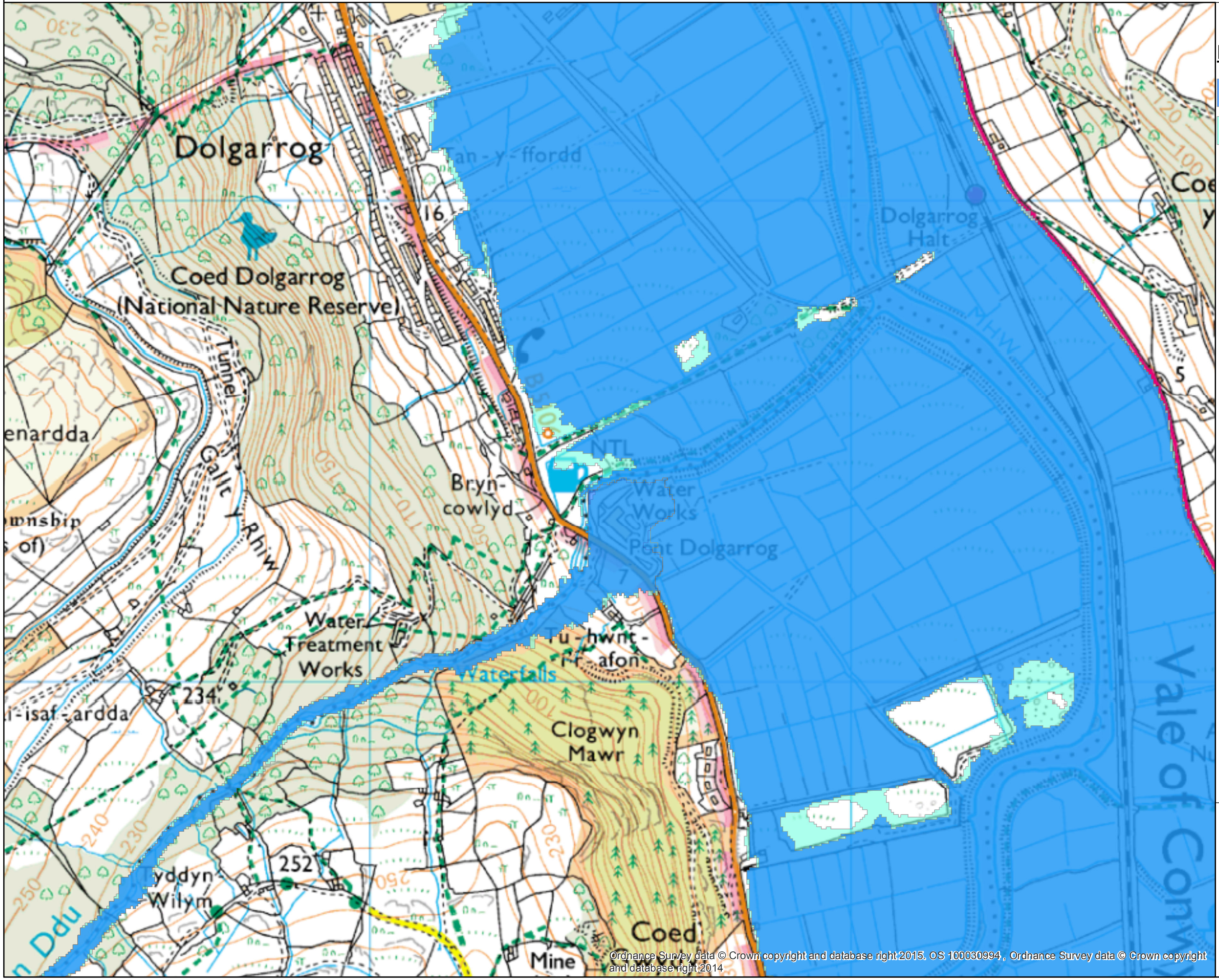
If the data is used in support of a Flood Consequence Assessment, please include the reference number.

Please refer to Natural Resources Wales' standard terms and conditions.

23 April 2015
Food Risk Analysis

Cyfoeth Naturiol Cymru
Natural Resources Wales

Fluvial Flood Zones



Legend

🟦 Fluvial Flood Zone 3 (1% AEP Event)

🟩 Fluvial Flood Zone 2 (0.1% AEP Event)

Flood Zone 3 (fluvial) indicates the area that could be flooded with a 1% (1 in 100) or greater chance of happening each year.

Flood Zone 2 (fluvial) indicates the extent of an extreme flood from a river. These areas are likely to be affected by a major flood, with up to a 0.1% (1 in 1000) chance of occurring each year.

Flood Zones do not provide information on flooding from groundwater or other sources.

0 75 150 300 Meters

N

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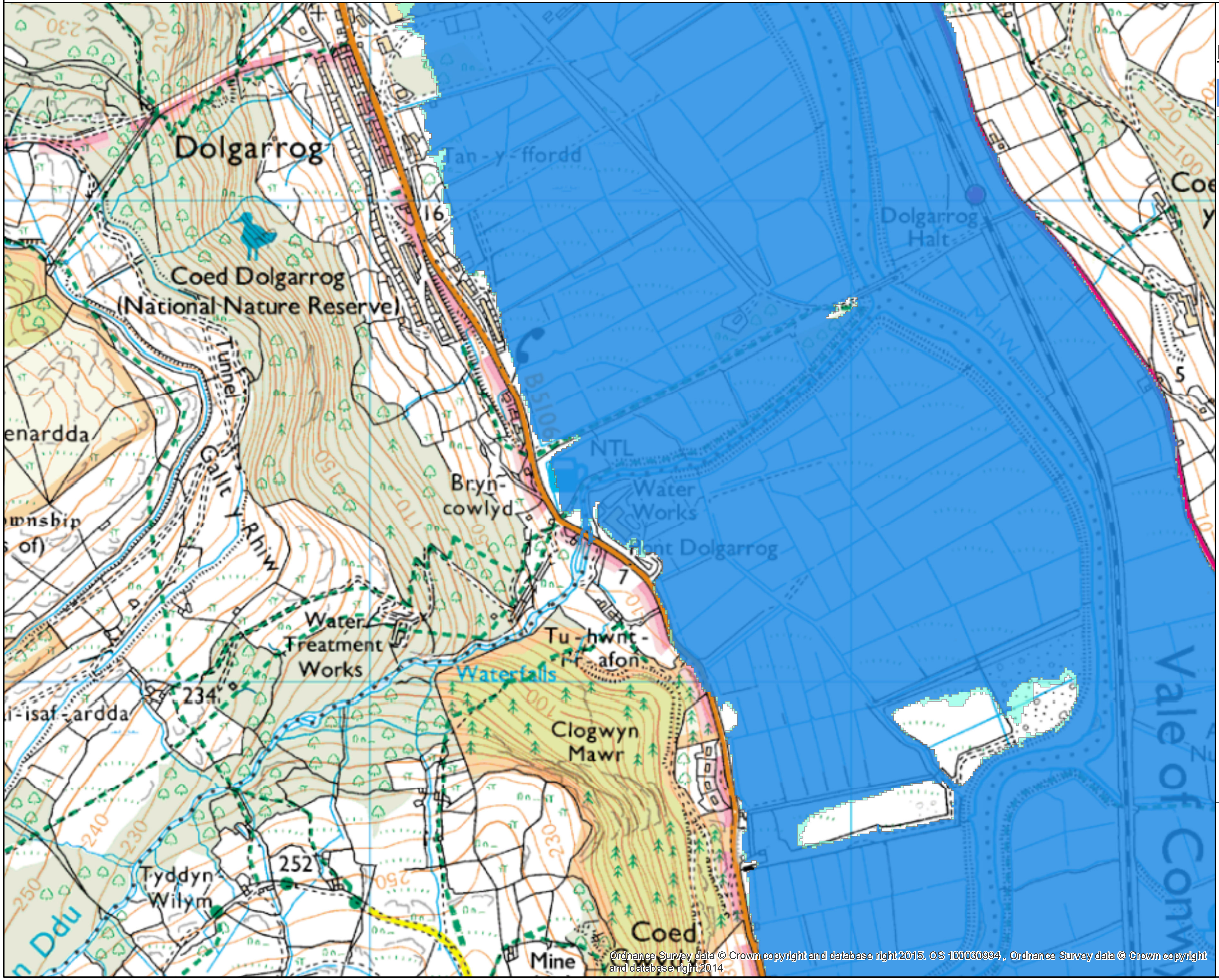
Tidal Flood Zones



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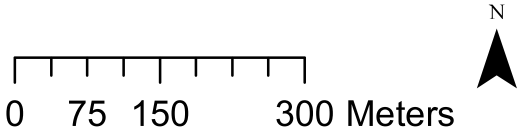
Legend

🟦	Tidal Flood Zone 3 (0.5% AEP Event)
🟩	Tidal Flood Zone 2 (0.1% AEP Event)

Flood Zone 3 (tidal) indicates the areas that could be flooded with a 0.5% (1 in 200) or greater tidal chance of happening each year.

Flood Zone 2 (tidal) indicates the extent of an extreme flood from the sea. These areas are likely to be affected by a major flood with up to a 0.1% (1 in 1000) chance of occurring each year.



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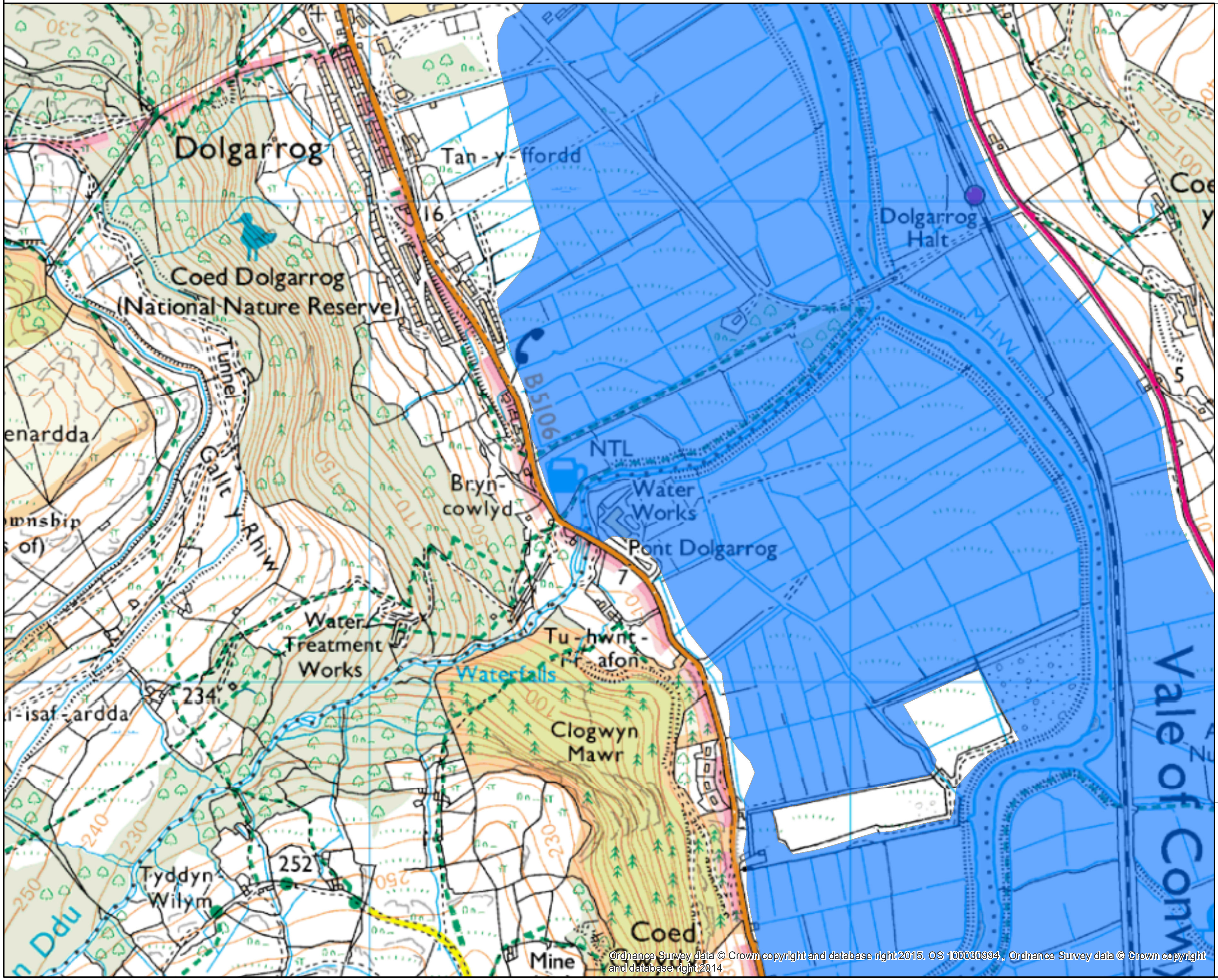
Flood Event Outlines



Legend

🟦 Conwy Valley 1980

Conwy Valley 1980

Flood Event ID: 1006001980001

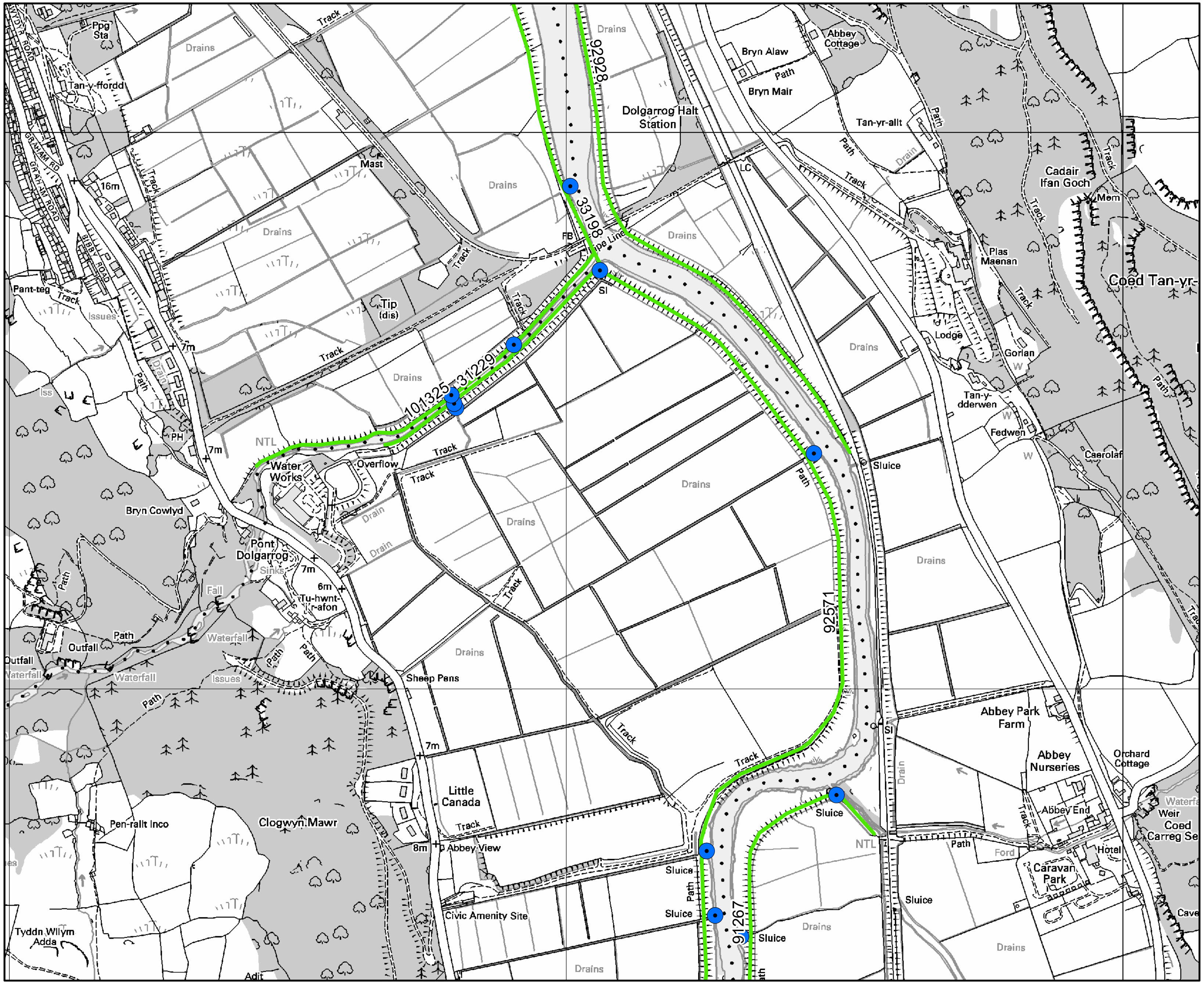
Unsure of start / finish date.
Flooded regularly.

Source of Flooding: Fluvial

Cause of Flooding: Overtopping of defences.

Asset ID	Target Condition	Actual Condition	Length	DCL	UCL
92928	4	4	1.4987km	5.18	5.18
92571	3	3	2.0836km	4.91	6.18
91267	4	4	3.242km	4.9	7.14
33198	3	3	1.7004km	5.09	5.09
101325	3	3	749.1m	4.93	4.97
31229	3	4	509m		

277556, 366455



Legend

● outfall

ASSET_TYPE

🟩 embankment

Meters
0 90 180

1:9,987

N W E S

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Contact Us: Customer Contact Centre, Natural Resources Wales, Tŷ Cambria, 29 Newport Road. Tel: 0300 065 3000. Email: enquiries@naturalresourceswales.gov.uk

Appendix C

Runoff Calculations

Greenfield Runoff Rate Calc for Bryn Colwyd

		2yr		***30yr***		***100yr***	
Area (km2)	***Area (Ha)***	***Flow (m3/s)***	***Flow (l/s)***	***Flow (m3/s)***	***Flow (l/s)***	***Flow (m3/s)***	***Flow (l/s)***
0.57	57	0.66	660	1.16	1160	1.44	1440

	Rate (l/s/ha)
2yr	11.6
30yr	20.4
100yr	25.3

APPENDIX 8.1 TRANSPORT SCOPING NOTE

Laura Norman

From:	Laura Norman
Sent:	15 June 2015 17:39
To:	'richard.eames@conwy.gov.uk'
Cc:	Bryn Cowlyd; Chad Collins
Subject:	RE: Bryn Cowlyd Environmental Report - Traffic and Access Scoping Note
Attachments:	Bryn Cowlyd WTW Scoping Note - 15.6.2015.docx

Tracking:

Recipient	**Delivery**
'richard.eames@conwy.gov.uk'	
Bryn Cowlyd	Delivered: 15/06/2015 17:40
Chad Collins	Delivered: 15/06/2015 17:39

Richard

We are currently preparing the Transport Section of the Environmental Report, Transport Statement and Construction Traffic Management Plan for the proposed Bryn Cowlyd Water Treatment Works, Dolgarrog.

Environmental Report

The attached pre-application consultation note outlines the extent of the transport assessment proposed for the Traffic and Transportation section of the Environmental Report ahead of the planning application.

The purpose of the note is to outline our proposed methodology and to seek your views on our approach. In particular I would be grateful if you can provide advice on the proposed study area/ access route to the Development site and proposed methodology. I will email David Groom separately regarding available PIA data for the study area. I have also shared the attached scoping note with the North and Mid Wales Trunk Road Agency.

Transport Statement

We have also been commissioned to prepare a Transport Statement. We propose that the Transport Statement will consist of the following:

- **Introduction** – This section will include an overview of the development, summary of the assessment methodology and overview of the policy framework.
- **Existing Transport Conditions** – This section will provide an overview of the existing highway, public transport provision, walking and cycling networks, as well as a summary of the PIA data for the study area.
- **Description of the Development** – This section will set out details of the development, site access and on-site transport facilities during both construction and operation.
- **Traffic Generation** – This section will detail traffic generation during the construction and operational phases of the development, including vehicle type, traffic generations and distribution.
- **Traffic Impact Assessment** – This section will provide a high-level assessment of the traffic impact, focusing on the construction phase of the development. The assessment will determine the percentage impact of development generated traffic on the highway sections within the study area. As the development will generate construction movements across the day, we will assess the impact of the two-way traffic generations on the two-way 12 hour traffic flows or AAFT flows on the trunk road network. No junction modelling will be undertaken.

- **Conclusion**

We are not aware of any planned changes to the highway network within the vicinity of the Development or any committed developments that we should include within our assessment.

Construction Traffic Management Plan

We propose that the Construction Traffic Management Plan will consist of the following:

- **Introduction –** A summary of the development and site location.
- **Site access and Routeing –** This section will detail the location of the site access during construction (which will be the existing access to the Bryn Cowlyd Water Treatment Works off the B5106) and routeing of vehicles during construction.
- **Construction Traffic –** This section will provide details on the construction programme, traffic generations, vehicle types and hours of operation.
- **Traffic Management Principles –** This section will provide details on the principles that will be adopted during construction to minimise the impact on the local highway network and local communities.

I would be grateful on your views on the proposed scope of works for the transport chapter of the Environmental Report, the Transport Statement and the Construction Traffic Management Plan. Please feel free to contact me to discuss any of the above.

I look forward to hearing from you.

Many thanks

Laura

Laura Norman MSci MSc CMILT
Principal Transport Planner

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R: +44 (0)29 2092 6700 | F: +44 (0)20 7904 9035

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Bryn Cowlyd Water Treatment Works Environmental Report

Date 18th May 2015
From Hyder Consulting
To Tom Gravett – Conwy County Borough Council;
North and Mid Wales Trunk Road Agency
Subject Bryn Cowlyd pre-application consultation: Traffic and Transportation

1. Overview

This pre-application consultation note outlines the extent of the transport assessment proposed for the Traffic and Transportation section of the Environmental Report ahead of the planning application for the proposed Bryn Cowlyd Water Treatment Works (WTW) (referred to as the Development). The Development site is located along the B5106 approximately 5km northwest of Llanrwst and approximately 13km south of Conwy (as shown in **Figure 1**).

Figure 1: Proposed Development Site Location Plan

Bryn Cowlyd WTW was commissioned in 1998 and serves around 98,700 people in the Conwy valley and along the North Wales coast. However the raw water quality is gradually deteriorating and as a result of the WTW failing to meet quality standards The Drinking Water Inspectorate have issued a formal improvement notice under Regulation 29(4) of the Water Supply (Water Quality) Regulations 2010 requiring Dwr Cymru Welsh Water *to "Complete construction, installation, and commissioning of the appropriate coagulation process and improvements to the filtration process by 31st December 2017".*

Dwr Cymru Welsh Water have engaged it's Alliance Partners, Skanska & Hyder Consulting, to design and construct a treatment process to improve the treated water quality being produced by Bryn Cowlyd WTW. The construction will comprise of buildings, above and below ground tanks, kiosks and water mains. The buildings will contain process tanks, pipework, mechanical equipment such as pumps and electrical control equipment. All the process elements will be contained within the existing Dwr Cymru Welsh Water land boundary. However it is currently proposed that contractor will occupy the adjacent field to the South East of the WTW during construction for site accommodation and material and equipment storage.

The construction period is expected to commence in early 2016 and last approximately eighteen months. During the construction the Development will generate both Heavy Goods Vehicles (HGVs) and light vehicular traffic. It is not known at this stage if the construction will require any Abnormal Invisible Loads.

The traffic and transport assessment will:

- Consider the potential impacts resulting from traffic movements associated with the Development;
- Consider access to the Development for construction traffic; and
- Consider the interaction between traffic movements related to the Development and existing traffic flows on the surrounding highway network during construction and operational phases.

2. Proposed Methodology

This section sets out proposed approach that will be followed to determine the likely effects of the proposed Development.

Policy and Guidance

The methodology has been informed by the policy and guidance identified as relevant to this assessment:

- Planning Policy Wales Edition 7 (Welsh Government, July 2014);
- Technical Advice Note (TAN) 18: Transport (Welsh Government, March 2007);
- Environmental Impact Assessment: A Guide to Good Practice and Procedures (The Department for Communities and Local Government, 2006);
- Guidelines for the Environmental Assessment of Road Traffic (Institute of Environmental Management and Assessment (IEMA), 1993);
- Guidance on Transport Assessment (Department for Transport (DfT), 2007); and
- The Design Manual for Roads and Bridges (DMRB) (Highways Agency, 1993).

Assessment Methodology

The assessment of likely significant effect will follow the approach outlined below:

- Consultation with statutory consultees and interested parties;
- Consideration of best practice / guidance;
- Obtaining the baseline information including desktop studies, undertaking site visits and baseline data;
- Prediction of potential effects considering baseline information and Development details;
- Identification of effects which, in particular, could be considered to be potentially significant in terms of the “the EIA Regulations”;
- Identification of appropriate mitigation measures; and
- Prediction of residual effects.

3. Study Area

Criteria

The study area will be determined in accordance with The Guidelines for the Environmental Assessment of Road Traffic (Institute of Environmental Management and Assessment (IEMA), 1993), which suggests a number of rules to delimit the scale and extent of the assessment:

- Include highway links where traffic flows would increase by more than 30% (or the number of Heavy Goods Vehicles (HGVs) would increase by more than 30%); and
- Include any other specifically sensitive areas where traffic flows would increase by 10% or more.

The study area will be defined by identifying potential delivery routes to the Development where total traffic flows or increases in HGV flows could be greater than 10%. An application of a 10% threshold is considered an accepted methodology

Access Route

The proposed Development site access will utilise the existing WTW site access via the B5106 (see **Figure 1**).

The B5106 links to the A470 in the south at Llanrwst and Betws-y-Coed (via the A5) and links to the A55 at Conwy in the north. However, to the south of the Development on the B5106 there is an 18 tonne weight restriction on the following bridges, Pont Trefriw in Trefriw and Pont Fawr in Llanrwst, whilst in the north Conwy Town Wall Arches have a 3.05m and 3.89m width and height restrictions respectively on the B5106. It should be noted that Pont Dolgarrog (north of the Development along the B5106) is capable of carrying 40 tonnes (identified through consultations with Conwy County Borough Council's Bridges and Structures Group).

Therefore based on the existing restrictions on the highway network within the vicinity of the Development, it is proposed that the HGVs accessing the Development from either the north or the south will do so via the A470. It is proposed that all HGVs will leave the A470 at Tal y Cafn and travel west along the B5279 and then travel south along the B5106 to the Development site. The ES assessment will assume that all HGVs will use this route.

However, light vehicles will not be restricted by the height and weight restrictions discussed above and will have scope to access the site via the B5105 (north and south), the B5279 and the A470. With regard to light vehicles the ES assessment will assume that all light vehicles will use each of these routes, which will result in the traffic assessment being an overestimate of the impact on the highway sections identified, as many of the personnel that will be working on site will stay locally and some deliveries will come from local suppliers.

In summary the highway links that will be considered as part of the assessment are:

- A470 between the A55 and Betws-y-Coed;
- B5279 between the B5106 and the A470;
- B5106 between Betws y Coed and the A55; and
- A55 within the vicinity of Conwy.

We propose to undertake a:

- Detailed assessment of traffic flow data along the B5106 (both north and south of the Development) and the B5279
- High level review of the effect of the proposed Development on the A470 and A55, due to the nature of the highway links being assessed i.e. high existing traffic volumes and composition of HGVs and/or being strategic highway links.

4. Traffic and Transport Assessment

Overview

This section details the assessment that will be undertaken, namely:

- Baseline conditions;
- Identification of the potential effects during construction and operation;
- Identification of appropriate mitigation measures; and
- Prediction of residual effects.

Baseline Conditions

The baseline conditions will be established:

- **Regulatory/Planning Policy Framework** – A review of the current legislation, national, regional and local policies would be undertaken.
- **Existing Highways** – An appraisal of the existing highway sections within the study area would be undertaken, together with a review of receptors.
- **Baseline Traffic Data** – Obtained to determine the existing total traffic and HGV traffic flows on the highway links within the study area. We propose to undertake a detailed assessment of traffic flow data along the B5106 (both north and south of the Development) and the B5279, together with a high level assessment along the A470 and A55.

  Traffic data would be obtained to determine the existing total traffic and HGV traffic flows along the B5106 and B5279 over an average day period and between the working hours of 07:00-19:00 on a weekday and 07:00-13:00 on a Saturday. We will consult with Conwy County Borough Council to determine if data is available otherwise traffic surveys will be commissioned.

  Annual Average Daily Flow data would be obtained for the A470 and A55 from the Department for Transport Count Point Data.
- **Traffic Growth** – It is expected that the construction will commence in 2016. The base year traffic flows will be factored to the construction year by applying a factor derived from the Trip End Model Presentation Program (TEMPRO) for the appropriate area and road type.

Potential Effects

The potential effects in the absence of mitigation measures will be undertaken in the construction and operational phases of the Development.

Construction

- **Indicative Construction Programme** – Details on an indicative construction programme will be presented, with details on the anticipated construction vehicles and traffic trip generations.

- **Significance of Effects** – The significance of effects of construction traffic on each of the highway sections within the study area will be determined by taking into account:

    - **Route sensitivity** – Areas along the highway routes that could be sensitive to changes in traffic/HGV volumes will be identified. Sensitive areas are defined by the presence of sensitive receptors, such as hospitals, community centres, conservation areas, schools or colleges.

    - **Magnitude of Change** – The expected traffic generations would be quantified and where appropriate assessed against anticipated background traffic flows to outline the anticipated percentage increases in total vehicles and HGVs.

A set of generic significance criteria are proposed in the 'Environmental Impact Assessment: A Guide to Good Practice and Procedures' (Department for Communities and Local Government, 2006) to describe the significance of effect, as detailed in **Table 1**.

Table 1: Transport and Access Assessment – Criteria for Determining Significance of Effects

Significance of Effect	Description
Major	These effects are likely to be important considerations at a regional or district scale
Moderate	These effects, if adverse, are likely to be important at the local scale. However, the cumulative effect of these may lead to an overall increase in the impact / effect of traffic
Minor	Generally related to local issues but the effects are relevant in the detailed design of the Development
Negligible	Effects are generally beneath levels of perception

The determination of the overall significance of the effect is a judgement as to whether the magnitude and duration of impacts, when combined with the characteristics of the highway network and the sensitivity of receptors will impact at a regional or district scale or are important at the local scale but cumulatively lead to an overall increase in the effects of traffic. If this is the case, then the effects are considered to be Significant with regard to 'the EIA Regulations'. If the overall effect is likely to be only a local issue or beneath levels of perception, it is considered to be Not Significant with regard to 'the EIA Regulations'.

Operational – A summary of the expected traffic movements during the operational life of the Development will be provided.

Committed Development

We are not aware of any committed developments to be included as part of the assessment.

Mitigation Measures

Mitigation measures will be proposed to minimise the potential effects during the construction and operation phases.

Residual Effects

The potential residual effects on the individual receptors with the provision of the mitigation measures during the construction and operational phases will be presented.

APPENDIX 8.2 CONSTRUCTION TRAFFIC MANAGEMENT PLAN

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Hyder

Dŵr Cymru / Welsh Water

Bryn Cowlyd Water Treatment Works

Construction Traffic Management Plan

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Bryn Cowlyd Water Treatment Works

Construction Traffic Management Plan

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APPENDICES

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1 Introduction

1.1 Overview

Hyder Consulting (UK) Ltd was commissioned by Dŵr Cymru Welsh Water (DCWW) to prepare a Construction Traffic Management Plan (CTMP) for the construction process to improve the treated water quality being produced by the Bryn Cowlyd Water Treatment Works (WTW), near Llanrwst in North Wales.

1.2 Site Location

The proposed Development is located on the eastern side of the B5106, adjacent to Snowdonia National Park, approximately 500m to the south east of Dolgarrog in Conwy County Borough Council (CCBC) in North Wales. The site is located at approximate NGR SH 775 663 as shown in Appendix A.

The B5106 road forms the western site boundary, providing access between Conwy and Llanrwst to settlements on the western side of the Conwy Valley. To the west of the B5106 is Coed Dolgarrog National Nature Reserve (NNR), situated 120 metres west of the site at its closest boundary, comprising woodland on the steep western side of the valley. Tu Hwnt i'r Afon which contains the Conwy Valley Maze is located to the west the proposed Development site, on the western side of the B5106. The Afon Ddu forms the northern boundary of the proposed Development site.

The planning application boundary comprises an area of approximately 6.1ha. Included within this is the area required for a temporary construction compound which will be approximately 1.6ha. The operational area associated with the proposed Development will be 4.5ha. The planning application boundary includes the existing operational area of the WTW.

The proposed Development site is at the bottom of a north flowing river valley which has steep gradients to the west and east rising to 300m AOD to the west and 200m AOD to the east of the Afon Conwy. The general local topography across the site is generally level with a slight down gradient towards the east within the main operations area.

The proposed Development site comprises the operational WTW and some undeveloped land. The majority of the site is hard standing with some soft standing areas to the north and south of the existing WTW.

Areas of scrub and trees lie along the western site boundary between the B5106 and the proposed Development site, with woodland extending into the surrounding area to the west (leading to Coed Dolgarrog NNR), whilst fields extend to the north, east and south of the site. There are no Public Rights of Way (PRoW) within or adjacent to the proposed Development site.

1.3 Need for the Proposed Development

Raw water quality is gradually deteriorating with respect to total organic carbon (TOC) and colour. Short term increases of TOC and colour also occur throughout the year as a result of inter-reservoir transfers by the reservoir owner, National Power. The existing process is at the limit of treatment capability and occasionally unable to remove the level of TOC being encountered. Therefore the works is failing to meet the drinking water standards as set by The Drinking Water Inspectorate.

As a result of the WTW failing to meet quality standards, The Drinking Water Inspectorate have issued a formal improvement notice under Regulation 29(4) of the Water Supply (Water Quality) Regulations 2010. This requires DCWW to "*Complete construction, installation, and commissioning of the appropriate coagulation process and improvements to the filtration process by 31st December 2017*".

1.4 Proposed Development

The proposed Development comprises the construction of new buildings to accommodate the WTW processes, tanks and associated infrastructure summarised below and illustrated in the Proposed Development Site Layout Plan in Appendix A:

- New access roads to new WTW buildings and associated infrastructure;
- Dissolved Air Flotation (DAF) process building (this will include flocculation and DAF lanes and saturator system);
- Rapid Gravity Filters (RGF) process building (this will include a high lift pumping station and well);
- Generator building;
- District Network Operator (DNO) transformer station;
- Transformer building;
- Chemical storage buildings, including Centrate building and Chlorine building;
- Below ground storm tanks and air surge vessels (for suppression system);
- High Pressure water main diversions;
- Services (high and low pressure mains, sample lines, dosing lines, cable runs, building services);
- Flood defence bund; and
- Temporary construction compound.

Only the proposed chlorine building and DNO transformer station are located within the footprint of the existing WTW. All other elements listed above are located outside of the footprint of the existing WTW.

Construction is expected to take place over between January 2016 and December 2017. Construction will take eighteen months, plus a six month commissioning phase. During the construction the proposed Development site will generate both Heavy Goods Vehicles (HGVs) and light vehicular traffic.

1.5 Construction Traffic Management Plan Purpose

The construction phase of the proposed Development will require the movement of materials, equipment and staff both on and off site. This CTMP outlines the management of these movement and interaction with the surrounding road network during the various stages of the construction process.

This CTMP aims to:

- Minimise the generation of traffic to and from the site;
- Ensure that materials delivered by road travel as short a distance as possible;
- Ensure that HGVs travelling to site use the approved access route; and
- Maintain and minimise the impact on the local highway network and local community.

The scope of this report and the proposed HGV route were provided to CCBC on 15 June 2015.

1.6 Construction Traffic Management Plan Management

The Skanska Management Team will be based onsite during the duration of the construction period. A Site Manager will be appointed, who will ensure that all contractors and suppliers are made aware and safely implement this CTMP. The Site Manager will liaise with CCBC and the North and Mid Wales Trunk Road Agency where necessary.

Prior to the appointment of the Site Manager the contact point for the construction of the Bryn Cowlyd WTW is Jill Roberts DCWW's Communication Manager (jill.roberts@dwrcymru.com).

1.7 Report Structure

The remainder of this CTMP sets out the:

- Site access and vehicle routeing arrangements, together with a description of the existing transport infrastructure currently serving the site within Section 2;
- Proposed Development and the anticipated number and nature of vehicle movements to and from the site during construction within Section 3;
- General construction principles that will be actioned within Section 4;
- Mitigation measures that could be implemented in order to minimise any adverse effects of vehicular movements associated with the proposed Development on the surrounding highway network (set out in Section 5); and
- Monitoring that will be undertaken, as detailed in Section 6.

2 Site Access and Routeing

2.1 Introduction

This section provides details of the site access and the access route for construction vehicles, together with a brief summary of the existing condition of the highway network that forms the access route.

2.2 Site Access

All construction traffic (including HGVs) will enter and leave the site via the existing Bryn Cowlyd WTW site access onto the B5106 (as shown in as shown in Photographs 2-1 and 2-2). The access will form the only access and egress point for the site both during the construction and operation periods. The number of people based on site will be about the same as current.

A new internal access road and hardstanding areas are proposed which will link the existing site access road to the RGF and DAF process buildings and other surrounding infrastructure. The proposed development will require a diversion of the agricultural access track that currently runs from the WTW access point from the B5106 to the south of the lagoon and then on to fields to the east of the WTW. The route of the new agricultural access track will be run from the same access point from the B5106 but will run around the southern and eastern sides of the flood defence bund.

Photograph 2-1: Site Access

Photograph 2-2: Site Access

The site access has been designed to accommodate HGV traffic. Swept path analysis demonstrates HGVs turning into and out of the site without conflict and these are shown within Appendix B.

2.3 Vehicle Routeing

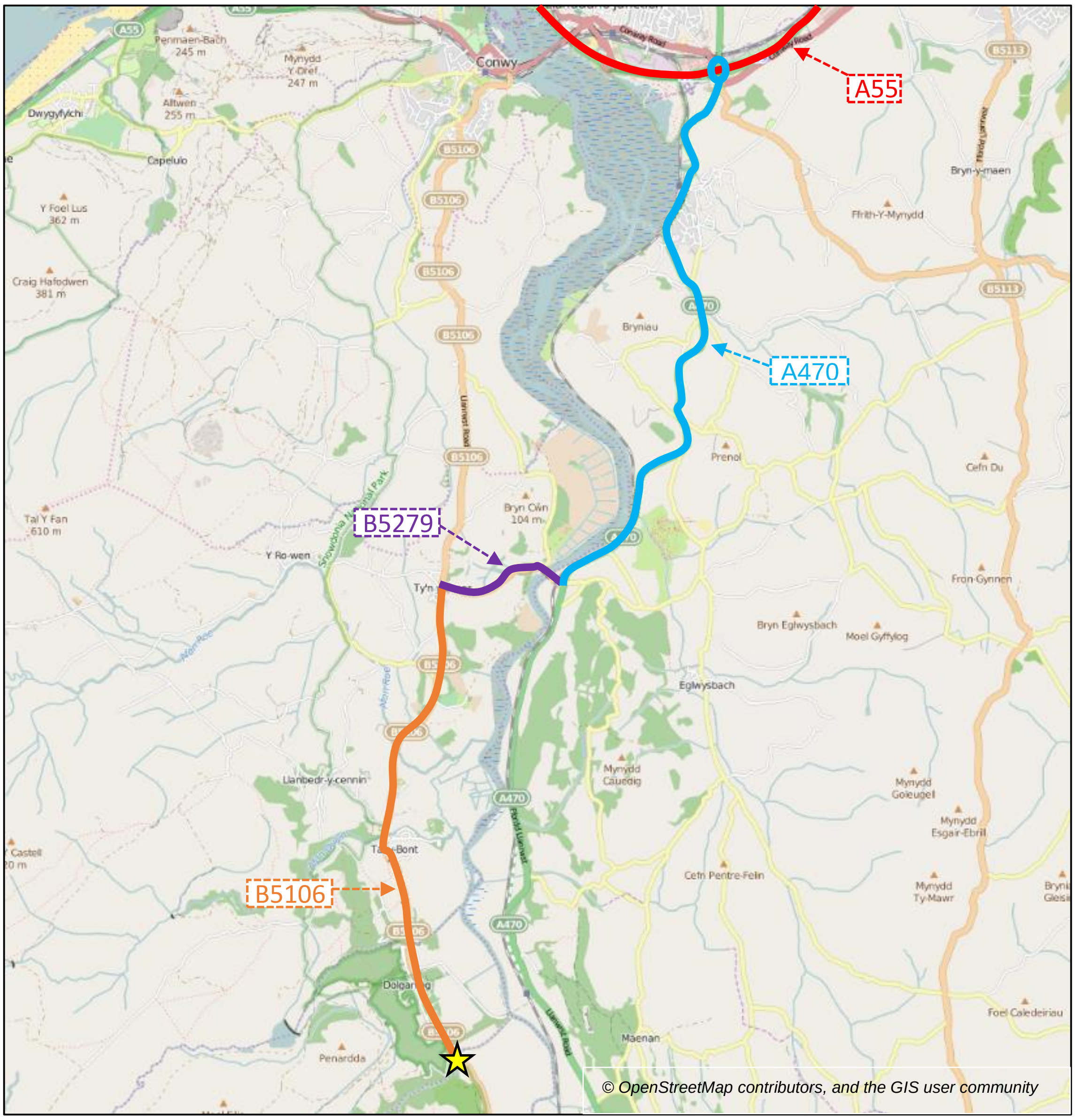
All HGVs accessing the departing from the site will use the following route, namely the B5109, B5279, A470 and A55. The HGV route is presented in Figure 2-1. All HGVs accessing the site will leave the A470 at Tal y Cafn and travel west along the B5279, from which point they will turn left at Ty'n-y-groes and travel south along the B5106 to the proposed Development site. All vehicles departing from the site will use the same route in reverse. HGVs can travel north or south along the A470, however it is assumed that the majority of vehicles will travel from/to the A55 in the north.

It should be noted that Pont Dolgarrog (north of the proposed Development along the B5106) is capable of carrying 40 tonnes (identified through consultations with CCBC's Bridges and

Structures Group) and a swepth path analysis across the bridge is presented in Appendix B, which shows that the bridge can accommodate HGVs but they will utilise the full width of the carriageway. Swepth path analysis at the B5106/ B5279 junction shows HGVs can make the necessary manoeuvre.

It is important to note that to the south of the proposed Development on the B5106 there is an 18 tonne weight restriction on the following bridges, Pont Trefriw in Trefriw and Pont Fawr in Llanrwst. In addition, the B5106 at Conwy has been identified as unsuitable because the Conwy Town Wall Arches have a 3.05m and 3.89m width and height restrictions respectively.

Figure 2-1: HGV Route to the Proposed Development Site



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2.4 Existing Highway Conditions

Overview

A summary of the existing highway sections along the HGV access route serving the proposed Development site are summarised below.

B5106

The B5106 extends from the site access to the junction with the B5279. It is a single carriageway road which is approximately 6.5m in width within the vicinity of the site access. There are no footways along the B5106 within the immediate vicinity of the site access but footways are present on at least one side of the carriageway within the settlements along the route. The carriageway through the residential areas of Dolgarrog, Tal-y-Bont, Castell, Caerhurn and Ty'n-y-groes are predominantly lit and are subject to 30mph speed restrictions. The B5106 outside the residential areas is typically subject to the national speed limit.

Residential properties front onto the carriageway and the route passes adjacent to or close to a number of receptors including schools (Ysgol Tal-y-Bont and Ysgol Dolgarrog), churches, retail stores and a caravan park. There are some pinch points where the narrowing of the carriageway and on-street parking restrict two-way traffic movements.

B5279

The B5279 extends from the B5106 within the village of Ty'n-y-groes, to the junction with the A470 in the village of Tal-y-cafn. It comprises an unlit single carriageway with an approximate width of 5.9m (narrows to approximately 4.9m in places), which is subject to the national speed limit. The B5279 has an east to west alignment and contains a bridge crossing over the Afon Conwy. The bridge has a pedestrian footway located on the northern side of the carriageway, there are no other footways located along this route. There are a number of residential properties fronting the carriageway. Tal-y-cafn Railway Station, which provides services to Blaenau Ffestiniog and Llandudno, is accessed east of the Afon Conwy. The B5279 crosses the railway line.

A470

The A470 is part of the trunk road network. The section between the junction with the A55 in the north and the junction with B5279 in the south consists of a single carriageway, which is predominately subject to the national speed limit, but reduces to 30mph in the residential area of Llansanffraid Glan Conwy. This section of the A470 has footways on at least one side of the carriageway between the A55 and the village of Pentrefelin. There are no footways south of the village to the B5279 junction. Sensitive receptors along the route comprise; residential properties fronting the carriageway and Ysgol Glan Conwy.

A55

The North Wales Expressway (A55) is a trunk road between Holyhead and Chester, forming part of the strategic transport corridor across North Wales linking with Ireland and Northern England. The A55 is orientated in an approximate east to west alignment and connects to the M56 and M53 in the east and the Port of Holyhead in the West. The A55 is a dual-carriageway and is predominately subject to the national speed limit.

3 Construction Traffic

3.1 Introduction

This section sets out the vehicle movements that are anticipated to the generated during the construction phase of the Bryn Cowlyd WTW.

3.2 Construction Programme

The construction period is expected to commence in early 2016 and is anticipated to last until December 2017 (including six months of commissioning). During the construction phase there will be vehicular movements to the site associated with the delivery of construction components and materials, together with the arrival and departure of construction staff. It is anticipated that Months six to nine of the construction programme will generate the peak vehicle generations.

3.3 Hours of Operation

Typical construction working hours/days will be 06:00 to 18:00 hours on Monday to Friday and by exception 06:00 to 18:00 hours Saturday and Sunday. Construction works out side of the above times would be with prior agreement of CCBC.

3.4 Construction Vehicles

The delivery of construction components and materials will largely be by HGVs, while staff trips will largely be by cars or vans. It is not anticipated that Abnormal Indivisible Loads (AILs) will be required to transport materials to or from the proposed Development site.

3.5 Processes to Minimise Traffic Generation

During the proposed Development of the construction programme key attention has been paid to introducing construction methods that will minimise the traffic generated by the proposed Development during its construction phase. For instance, a stabilisation method will be implemented on the construction compound site, which will minimise the quantity of stone required to be imported to site. Additionally the use of off-site pre-fabrication will reduce the potential number of construction vehicles, whilst topsoil will be removed and stockpiled on site and re-used for bund construction and in order to reduce the number of staff trips, staff will be encouraged to car share.

3.6 Construction Traffic Generations

This CTMP focus on the peak period, as this is when the highest traffic flows will be generated. The estimated peak daily construction traffic generations for the proposed Development are set out in Table 3-1. The proposed programme has been made on best estimates, but will be dependent upon a range of factors, such as the shipping of materials and the weather.

The construction phase will result in approximately 171 daily arrivals and 171 daily departures during the peak period of construction, hence 342 two-way vehicles will potentially be generated during this time, which will include 202 two-way HGVs.

Table 3-1: Estimated Peak Daily Construction Traffic Generations

Transport	Arrivals	Departures	Total two-way
Staff travel (assumed by car)	40	40	80
Vans	30	30	60
Delivery (HGVs)	25	25	50
Concrete HGVs	70	70	140
Articulated HGVs	6	6	12
Total number of vehicles	**171**	**171**	**342**
Total number of HGVs	**101**	**101**	**202**

Staff working on the site will travel to the site using vans or cars. It is anticipated that the total likely to be on site at any one time during construction will not exceed 40. It is assumed that all staff will arrive at the start of the day and depart at the end of the day. This would equate to 80 daily two-way vehicle trips during the peak construction period, assuming no travel off-site during the day. It is also assumed that all vans will also arrive at the start of the day and leave at the end of the day. It is anticipated that the deliveries will be on site between 5 and 45 minutes.

3.7 Construction Vehicle Impact

3.7.1 Baseline Traffic Data

Traffic data was obtained for each of the highways sections within the study area. Data was obtained from surveys undertaken in 2014 and 2015. Automatic Traffic Counters (ATC) recorded traffic flows on the B5106 at the site and on the B5279 for seven days during the week commencing 1 June 2015. Annual Average Daily Flow (AADF) data has been obtained from the Department of Transport’s Count Point Data for the A470 and A55 for both total traffic flows and HGV flows (two-way traffic flows).

The base year two-way total and HGV traffic flows along the assessed highway sections are presented in Table 3-2.

Table 3-2 Base Year Two-way Traffic Flows

Highway Links	Year	Total Traffic Flows (no. vehicles)			HGVs Flows (no. vehicles)		
		Weekday 10 Hour (08:00-18:00)	Weekend 10 Hour (08:00-18:00)	AADF	Weekday 10 Hour (08:00-18:00)	Weekend 10 Hour (08:00-18:00)	AADF
B5106 from Site Access to B5279	2015	1,353	1,470		24	25	
B5279	2015	1,463	1,365		70	13	
A470 from A55 to B5279	2014			7,143			239
A55 east of the A470	2014			41,390			1,931
A55 west of the A470	2014			37,474			2,449

3.7.2 2016 Construction Year Traffic Flows

The construction is anticipated to commence in 2016. The base year traffic flows have been factored to the Construction Year (2016) by applying a factor derived from the Trip End Model Presentation Program (TEMPRO). TEMPRO presents the output of the National Trip End Model (NTEM), which forms part of the National Transport Model (NTM).

The most recent NTM dataset (6.2) has been used to obtain growth rates. The Growth Factor for 2014 to 2016 for the Conwy region for an average weekday and a Saturday are both 1.0139 and the Growth Factor for 2015 to 2016 for an average weekday and a Saturday are both 1.0112. A Growth Factor for an average weekday has been used as a proxy for AADT flows and is considered appropriate for the assessment.

TEMPRO has a policy based approach where the growth in housing and economic activity reflects the predictions expected through the planning system (strategic growth and committed developments). The growth rates therefore include allowances for background traffic growth through increases in car ownership as well as construction of committed developments. The application of both growth rates and committed development traffic flows could result in double-counting of traffic flows for the cumulative assessment. Therefore any committed development traffic has been assumed to be included through the application of the growth rates, and a separate assessment of these flows has not been undertaken. The resultant 2016 construction year traffic flows are presented in Table 3-3.

Table 3-3 2016 Construction Year Predicted Two-way Traffic Flows

Highway Links	Total Traffic Flows (no. vehicles)			HGVs Flows (no. vehicles)		
	Weekday 12 Hour (06:00-18:00)	Weekend 12 Hour (06:00-18:00)	AADF	Weekday 12 Hour (06:00-18:00)	Weekend 12 Hour (06:00-18:00)	AADF
B5106 from Site Access to B5279	1,470	1,510		26	26	
B5279	1,635	1,411		76	14	
A470 from A55 to B5279			7,242			242
A55 east of the A470			41,965			1958
A55 west of the A470			37,995			2483

3.7.3 Impacts of Construction Vehicle Traffic

The impacts of construction traffic on traffic flows on each highway section on the 2016 construction year have been assessed, based on a peak daily two-way traffic movements of 342 vehicles (including 202 two-way HGV movements). Table 3-4 presents the percentage increase in construction traffic on the highway network.

Table 3-4 Construction Traffic Impacts

Highway Links	**% increase in total traffic flows**			**% increase in HGV traffic flows**		
	Weekday 12 Hour (06:00-18:00)	**Weekend 12 Hour (06:00-18:00)**	**AADF**	**Weekday 12 Hour (06:00-18:00)**	**Weekend 12 Hour (06:00-18:00)**	**AADF**
B5106 from Site Access to B5279	23%	22%		868%	868%	
B5279	21%	24%		363%	1,527%	
A470 from A55 to B5279			5%			83%
A55 east of the A470			1%			10%
A55 west of the A470			1%			8%

The A55 and A470 forms part of the Welsh trunk road network and are conveniently located approximately 7.5km and 14km from the site respectively, which can accommodate the estimated level of daily construction HGV movements to the site during the construction phase. It is anticipated that the construction of the Surf Snowdonia facility in Dolgarrog will be completed by the time the Bryn Cowlyd WTW commences.

Although the route is considered capable of accommodating HGV flows at the levels generated by the proposed Development, measures to minimise the impact of the traffic generation are set out in Section 4 and mitigation measures are proposed in Section 5 to minimise the effects of the construction traffic, especially as there are a number of sensitive receptors fronting the B5106 and B5279.

4 Traffic Management Principles

4.1 Introduction

This section sets out the traffic management principles that will be adopted during the construction phase to reduce the number of vehicle movements generated by the proposed Development and minimise the impact of the construction traffic on the surrounding highway network and local communities.

4.2 Site Management

The appointed Site Manager will be in charge of Health and Safety on site. A Health and Safety board identifying potential hazards will be updated daily with all visitors required to sign in and adhere to on-site Health and Safety practices. All personnel working on site will be required to wear a high visibility vest or jacket, steel cap boots, and a hard hat as well as any other activity-specific safety wear.

4.3 Site Design

In terms of the site design, the separation of pedestrians and vehicles will be taken into consideration and the Health and Safety Executive (HSE) guidance will be adhered to, which states that *"the majority of construction transport accidents result from the inadequate separation of pedestrians and vehicles. This can usually be avoided by careful planning, particularly at the design stage, and by controlling vehicle operations during construction work."*

The HSE further states that[1];

- *"The law says that you must organise a construction site so that vehicles and pedestrians using site routes can move around safely;*
- *The routes need to be suitable for the persons or vehicles using them, in suitable positions and sufficient in number and size; and*
- *The key message is: construction site vehicle incidents can and should be prevented by the effective management of transport operations throughout the construction process."*

In relation to minimising vehicle movements the HSE guidance states that:

- *"Good planning can help to minimise vehicle movement around a site. For example, landscaping to reduce the quantities of fill or spoil movement.*
- *To limit the number of vehicles on site:*
    - *Provide car and van parking for the workforce and visitors away from the work area;*
    - *Control entry to the work area; and*
    - *Plan storage areas so that delivery vehicles do not have to cross the site."*

---

[1] Health and Safety Executive website - http://www.hse.gov.uk/construction/safetytopics/vehiclestrafficmanagement.htm

The internal site design of the Bryn Cowlyd WTW during construction will be designed in accordance with the HSE guidance. Staff parking will be located away from the turning area and compound where the construction activity will occur, which will allow pedestrians access to the welfare facilities from the car park without crossing the path of construction traffic. The onsite traffic routes and unloading areas will be designated to avoid traffic congestion at the site entrance or vehicles stopping/ queuing on the highway network.

4.4 Site Security

It is intended that temporary security fencingwill surround the proposed Development during the construction phase in order to provide the necessary on-site security. The fencing will comprise typical ‘herras’ type fencing.

Additionally access to the construction site will be controlled and manned by a gatesman at the site entrance during the day and CCTV will be in operation during the night.

4.5 Vehicle Manoeuvring

Access to the construction site will be controlled and manned by a gatesman at the site entrance, who will also manage the passage of vehicles within the site. The gatesman will be responsible for controlling all traffic accessing and exiting, to ensure vehicles enter and exit the site in a safe and efficient manner. They will also be responsible for co-ordinating delivery vehicles. As set out within the HSE guidance the gatesman will be trained and authorised to do so. The site entrance will be maintained, kept clear and clean.

It will be ensured that all vehicles, including HGVs and emergency vehicles, will have adequate space within the site to pull off the carriageway and manoeuvre within the site, thus preventing delay to passing traffic on the B5106. There will be no queuing, parking, loading or unloading on the public highway adjacent to the site and vehicles will be able to drive into the site in a forward direction and turn and exit in a forward direction. In the interests of safety and to minimise disturbance from construction traffic, all construction drivers will be requested to travel at a maximum speed limit of 10 mph when travelling within the site.

When reversing is required (for example within the construction compound), in addition to a competent banksman directing vehicle movements, as set out within the HSE guidance consideration will be given to:

- *“Aids for drivers – mirrors, CCTV cameras or reversing alarms that can help drivers can see movement all round the vehicle;*
- *Lighting – so that drivers and pedestrians on shared routes can see each other easily. Lighting may be needed after sunset or in bad weather; and*
- *Clothing – pedestrians on site should wear high-visibility clothing.”*

4.6 Construction Compound

A construction compound will be constructed within the site and will remain during the construction period. It is proposed that the adjacent field to the south of the WTW will be the site of the temporary construction compound. A temporary 290m long flood bund will be constructed to protect the construction compound area. This will be removed on completion of construction works. Topsoil would be removed and stockpiled on site and will be re-used on site for bund construction and general reinstatement landscaping following the completion of the construction phase.

Storage of Plant and Materials

The compound will be of sufficient size to store materials for the construction until they are required and will also enable vehicles to turn away from vehicles entering the site (such movements will be directed by a gatesman as detailed above).

Loading and Unloading

All delivery vehicles will be able to enter the site and unload within the compound area.

4.7 Construction Plant

The construction plant expected to be used on site during the construction phase is presented in Table 4-1.

Table 4-1 List of Construction Plant

Plant	
Hammer Piling	Tower Crane
Tracked Excavator	Concrete Saw
Dozer	Compressor
Dumpers	Excavator
Vibratory Roller (22t)	Roller Compactor
Asphalt Paver	Water Pump
Diesel Generator	Concrete Pump & Concrete mixer truck discharging
Delivery Lorry	Poker Vibrator
Tracked Mobile Crane	Percussion Drill
Telescopic Handler	Circular Saw
Wheeled Loader	Angle Grinder

4.8 Parking

Vehicle parking for staff and visitors during the construction phase will be accommodated on site and no vehicles associated with the construction will park on the highway network. This will be managed by the gatesman. Construction staff parking will be within the constriction compound. HGVs will be able to park within the Construction Compound. The parking area will be located away from the work area and the turning area for HGVs. It is expected that staff will travel to site in cars and vans, although workers will be encouraged to car share in order to reduce the number of vehicle movements to site.

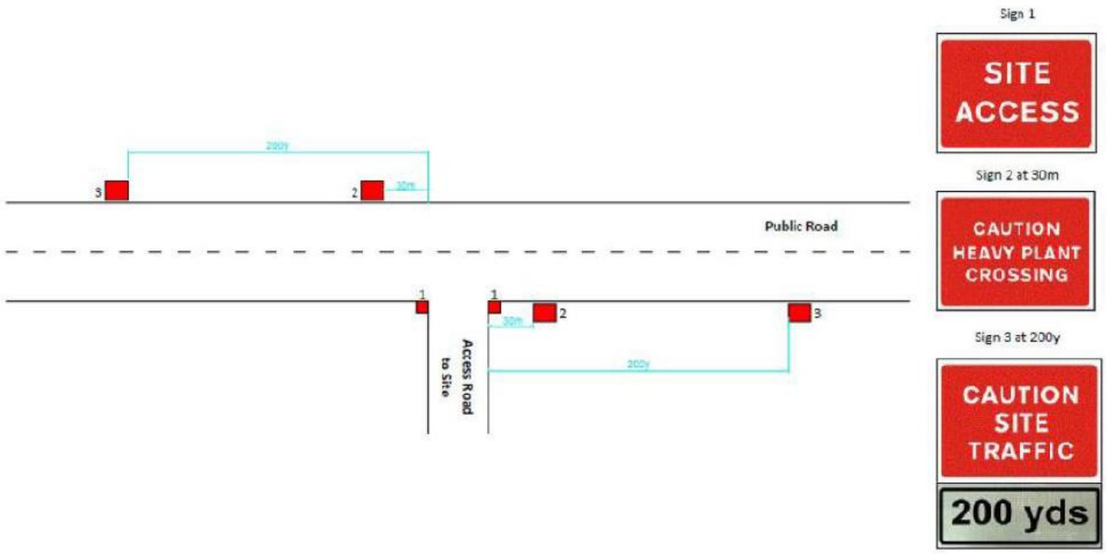
4.9 Traffic Signage

Appropriate signage will be positioned by the contractor along the B5106 to inform drivers of the increased likelihood of vehicles, especially HGVs turning into the proposed Development site. Prior to construction, traffic signage will be put in place for the following (as indicated in Figure 4-1):

- Caution signs warning of works and construction traffic ahead; and
- Signage denoting the construction traffic access to the site.

The exact location the position and content of these signs will be formally agreed with the local highway authority prior to the commencement of construction. The signage will also be bilingual with the Welsh on top.

Figure 4-1: Examples of Potential Traffic Signage Arrangements



4.10 Construction Waste Removal

A Site Waste Management Plan will be prepared for the proposed Development. Construction works are not anticipated to generate excess material. Where possible all excavated material will be reused on site as part of the flood defence bund and landscape screening. Any material surplus to requirements will be disposed of to a licenced facility.

4.11 Engagement with Conwy County Borough Council

The contractor will actively engage with CCBC regarding the construction programme, vehicle movements and any traffic management measures necessary to accommodate the proposed construction traffic generations. The contractor will provide updates to the local highways authority when required.

4.12 Construction Vehicle Routeing Communication

All HGVs accessing the site will have to adhere to the HGV routeing set out within this document. Purchase orders to all suppliers will include detailed information about the required route to access the site, together with other restrictions/ requirements necessary.

In accordance with the HSE guidance:

"The constructors will take steps to make sure that all workers are fit and competent to operate the vehicles, machines and attachments they use on site by, by for example:

- *Checks when recruiting drivers/operators or hiring contractors;*

- *Training drivers and operators; and*

- *Managing the activities of visiting drivers."*

4.13 Community Engagement

The local community, namely local residents, schools and CCBC will be informed of updates in relation to the construction programme and traffic management on a monthly basis. Moreover, each of the schools along the route will also be informed of increased vehicle activity during the construction phase, such as during the large concrete pours and a traffic marshal will be situated within the vicinity of the schools during peak construction activity. It should be noted that no construction vehicle movements will take place before 09:00am, with the exception of programmed works.

4.14 Delivery Scheduling

Where feasible, deliveries will also be scheduled to avoid peak traffic times, i.e. avoiding peak periods on the transport network and outside school pick up/drop off times. During busier periods, where feasible deliveries to the site will be staged with drivers given specific time windows for arrival at site. To manage this, communication will be required. The deliveries to the site will be co-ordinated between the Site Manager and the source company to avoid large numbers of vehicles arriving and departing from the site at the same time, to reduce the impact of construction traffic on the local highway network.

On the infrequent occasions when, during the construction period, peaks of HGV traffic movements associated with the proposed Development are anticipated along the B5106, HGVs will, insofar as reasonably practicable, be held temporarily at one of the two lay-bys on the B5106 near Talybont, or at the Bryn Cowlyd WTW, to ensure that they do not travel past Ysgol Dolgarrog and Ysgol Tal-y-Bont at the start and finish of the school day.

It is expected that HGV deliveries will be distributed throughout the day. As far as possible and feasible, the shifts for construction workers will be scheduled to minimise the number of traffic movements on the local highway network between the peak periods and therefore reduce the impact of traffic related to construction vehicles on the highway network.

5 Environmental Mitigation

5.1 Introduction

This section sets out the mitigation measures that will be considered in order to minimise any adverse effects of vehicular movements associated with the proposed Development on the surrounding highway network.

5.2 Vehicle Management

The environmental impact to the surrounding area will be minimised by routing HGV traffic movements along the agreed route as outlined within Section 2. Fuel consumption will be minimised by encouraging the use of local materials and sub-contractors, where feasible, although it is recognised that there are specialist materials and equipment used in the construction and as such the potential for using local materials may be limited.

5.3 Construction Environmental Management Plan

Pollution prevention and control measures will be managed through the implementation of a Construction Environmental Management Plan (CEMP).

5.4 Vehicle Emissions

All construction vehicles are required to comply with relevant European standards. Suppliers and drivers will be required to:

- Switch off their vehicle’s engine when stationary to prevent exhaust emissions; and
- All vehicles used by contractors must comply with MOT emission standards at all times.

5.5 Noise

Noise generated by construction will be temporary and will be controlled by limiting the hours of noise generating activities to minimise disruption for neighbouring properties. Contractors will be required to conform to the construction noise code of practice BS 5228.

5.6 Air Quality and Dust Management

Given the ground condition of the site, it is not anticipated that any significant dust issues will arise during construction. If conditions on site are very dry then water misting/spraying will be employed to damped ground to avoid any dust nuisance.

The following measures relating to vehicles entering and leaving the site will be adopted on site to reduce the impact of dust on the local highway network:

- Easily cleaned hardstanding areas for vehicles;
- Maintain haul roads and hardstanding by regular brushing and water spraying;
- All vehicles carrying soil and other dusty materials to be fully sheeted; and
- Enforce site speed limit of 10mph.

5.7 Road Cleanliness

The Site Manager will monitor the public highway conditions and will assess if further measures are required to maintain road cleanliness, such as road sweeping. Road sweeping will involve the use of on approved mechanical road sweeper to clean the site of any mud or debris deposited by site vehicles within the vicinity of the site.

By segregating the on-site traffic from the delivery vehicles, the potential for mud can be reduced. Adequate sheeting of vehicles carrying waste materials may also be adopted to reduce the impact from mud. As and when necessary, vehicle wheels will be manually cleaned prior to release onto the public highway.

5.8 Local Environment Protection

The contractor will undertake mitigation measures to protect the local environment during construction, such as:

- All marshalling areas and site offices will be included within the site boundary;
- Provision of adequate storage space within the site will be provided for HGVs, to ensure they are able to pull off the carriageway and that the site entrance does not become blocked at any time; and
- All loads to be properly stowed and secured.

6 Monitoring

6.1 Introduction

This section provides a summary of the CTMP monitoring that will be undertaken.

6.2 Monitoring

The contractor will be responsible for monitoring the operation of the site during construction, the construction routes, delivery timings and access arrangements, as well as to ensure the mitigation measures are implemented effectively. Monitoring will be undertaken continuously, in order to ensure efficient operation and to ensure adverse impacts on the environment are avoided.

Appendix A

Figures

A1

NOTES:

1.

PROPOSED DEVELOPMENT SITE BOUNDARY

KEY PLAN

THIS DRAWING IS INTENDED TO BE USED FOR LOCAL AUTHORITY TOWN AND PLANNING PURPOSES ONLY. REFERENCE SHOULD BE MADE TO THE RESPECTIVE CONSULTANTS DESIGN AND DRAWINGS FOR TECHNICAL CONSTRUCTION DETAILS

Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.
01	02.07.15	NT	PRELIMINARY	RD	PP	02.07.15

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf

Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name. BRYN COWLYD WTW

Drawing Title. SITE LOCATION PLAN

Suitability. WORK IN PROGRESS

Suitability Code. S0

Originator. NT

Designer. PP

Date. 02/07/15

Internal Project Number. UA007911

Scale. 1:10000

Rev. 01

Drawing Number. 1279-W-201-HYD-XX-XX-DR-09004

A3

NOTES:

1. BUILDING COLOURS ARE FOR INDICATION PURPOSES ONLY AND DO NOT REPRESENT THE FINAL BUILDING COLOURS

🟥	PROPOSED DEVELOPMENT SITE BOUNDARY
▨	PROPOSED CONSTRUCTION COMPOUND
—	PROPOSED STAIRWELLS
—	PROPOSED WALKWAYS
🟦	PROPOSED NEW DEVELOPMNENT

KEY PLAN

01	02.07.15	NT	PRELIMINARY	RD	PP	02.07.15
Rev.	Date.	Drawn.	Description.	Chkd.	Appd.	Date.

Capital Delivery Alliance
Cynghrair Cyflawni Cyfalaf
Ty Awen, Spooner Close, Coed Kernew, Newport, NP108FZ

Project Name. BRYN COWLYD WTW

Drawing Title. PROPOSED DEVELOPEMENT
SITE LAYOUT

Suitability. WORK IN PROGRESS
Suitability Code. S0

Originator. NT
Designer. PP
Date. 02/07/15

Internal Project Number. UA007911
Scale. 1:1000
Rev. 01

Drawing Number. 1279_W_201 - HYD - XX - XX - DR - 09023

Appendix B

Swepth Path Analysis

KEY:

VEHICLE WHEEL TRACK

VEHICLE OVERHANG

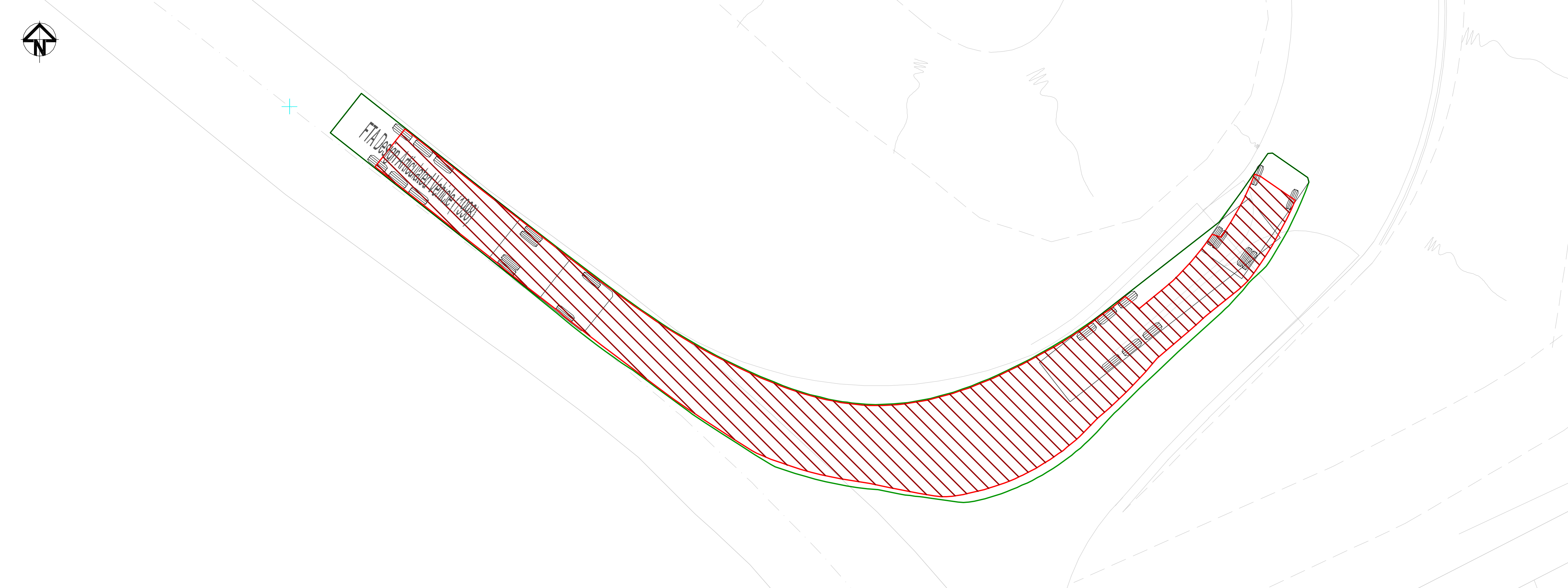
FTA Design Articulated Vehicle (1998)

Overall Length	16.480m
Overall Width	2.550m
Overall Body Height	3.870m
Min Body Ground Clearance	0.515m
Max Track Width	2.470m
Lock to Lock Time	3.00s
Kerb to Kerb Turning Radius	6.550m

VEHICLES AT JUNCTION B5106 / B5279
SCALE - 1:250

FTA Design Articulated Vehicle (1998)	
Overall Length	16.480m
Overall Width	2.550m
Overall Body Height	3.870m
Min Body Ground Clearance	0.515m
Max Track Width	2.470m
Lock to Lock Time	3.00s
Kerb to Kerb Turning Radius	6.550m

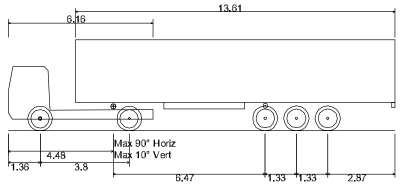
VEHICLE CROSSING OVER BRIDGE
SCALE - 1:500



KEY:

VEHICLE WHEEL TRACK

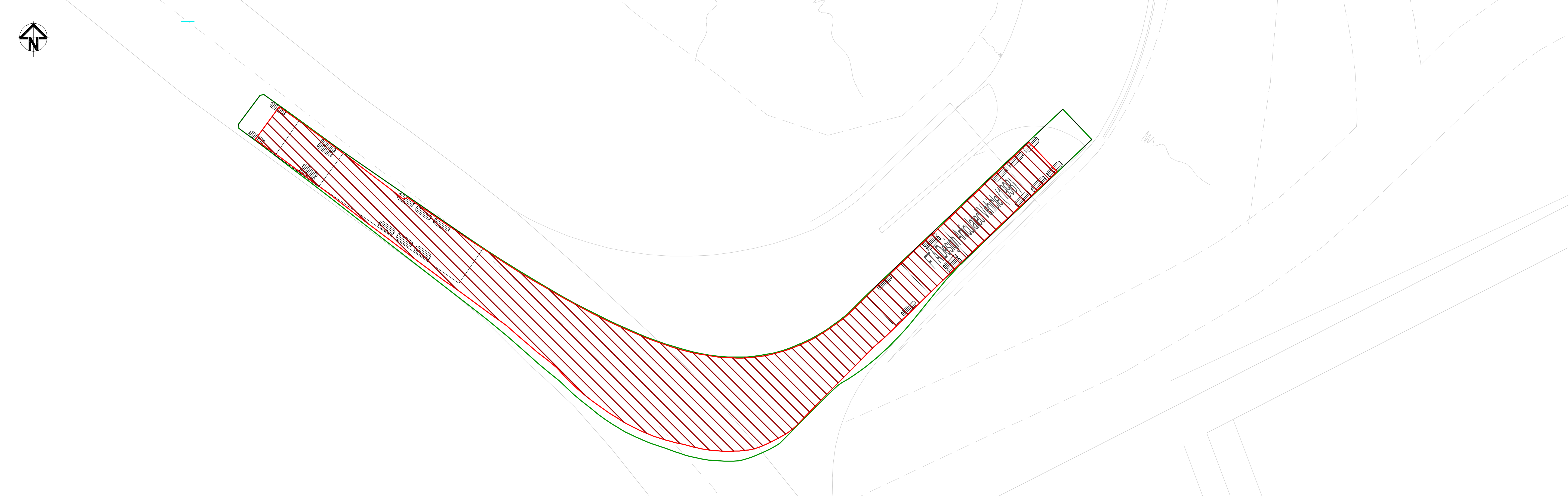
VEHICLE OVERHANG



FTA Design Articulated Vehicle (1998)

Overall Length	16.480m
Overall Width	2.550m
Overall Body Height	3.870m
Min Body Ground Clearance	0.515m
Max Track Width	2.470m
Lock to Lock Time	3.00s
Kerb to Kerb Turning Radius	6.550m

VEHICLE ENTERING
BRYN COWLYD WTW
SCALE - 1:250



VEHICLE EXITING
BRYN COWLYD WTW
SCALE - 1:250

APPENDIX 9.1 BASELINE NOISE SURVEY

Appendix 9-1

Baseline Noise Survey

Site Observations

Notable noise sources

- Aircraft overhead (Occasional low flying aircraft)
- Motorbikes across the valley
- Gorge walkers (school groups)
- One way bridge on B5106 (traffic idling)
- Car park opposite Bryn Cowlyd house
- Quite a few HGV's & Buses
- No plant noise during the day – very quiet hum during the night (almost unnoticeable unless you really listen)

Weather conditions

Blues clear skies, no wind.

NM1

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN01	LN10	LN50	LN90	LN99
1	09/06/2015 11:56	00d 00:10:00.0	54.7	82.5	82.5	36.8	68.8	55.4	44.4	39.5	38.1
2	09/06/2015 12:06	00d 00:10:00.0	45.6	73.4	57.4	37.6	54	48.6	43.6	39.3	38.4
3	09/06/2015 12:16	00d 00:10:00.0	42.4	70.2	50.1	37.2	47.7	45.2	41.1	38.8	37.9
4	09/06/2015 12:26	00d 00:10:00.0	44.4	72.2	58.5	37.6	52.6	46.9	43.1	40	38.5
5	09/06/2015 12:36	00d 00:10:00.0	42.7	70.5	52.4	36.2	48.7	45.3	41.6	38.5	37.2
6	09/06/2015 12:46	00d 00:10:00.0	41.3	69.1	50.4	35.5	48.5	44.5	39.6	37.2	36.2
7	09/06/2015 12:56	00d 00:10:00.0	43.3	71.1	57.1	37.6	51.2	45.9	41.6	39.4	38.5
8	09/06/2015 13:06	00d 00:10:00.0	45.4	73.2	60.8	37.4	54.6	47.8	43.1	40.3	38.4
9	09/06/2015 13:16	00d 00:10:00.0	43.2	71	63.3	36.3	48.6	45.8	41.3	38	37.1
10	09/06/2015 13:26	00d 00:10:00.0	44.7	72.5	59.6	38.1	50.9	47.1	43.9	40.8	39.1
11	09/06/2015 13:36	00d 00:10:00.0	44.5	72.3	56.2	37.7	52.3	47	43.1	39.8	38.4
12	09/06/2015 13:46	00d 00:10:00.0	45.2	73	57.3	36	54.5	48.1	42.3	39	36.9
13	09/06/2015 13:56	00d 00:10:00.0	44.6	72.4	54	37.1	52	47.5	43.1	39.6	38.2
14	09/06/2015 14:06	00d 00:10:00.0	44.2	72	53.2	37.7	51.3	46.8	43.1	40.4	38.7

15	09/06/2015 14:16	00d 00:10:00.0	42.7	70.5	52.8	36.4	47.9	45.4	41.7	38.7	37.3
16	09/06/2015 14:26	00d 00:10:00.0	42.9	70.7	55.7	36.1	49.5	45.5	41.6	38.2	36.9
17	09/06/2015 14:36	00d 00:10:00.0	44.9	72.7	65.7	36.4	52.8	46.8	42.6	39.4	37.3
18	09/06/2015 14:46	00d 00:10:00.0	41.8	69.6	53.1	35.9	47.6	44.5	41	37.7	36.9
19	09/06/2015 14:56	00d 00:10:00.0	43.5	71.3	54	36.6	51	46.3	42.1	39	37.8
20	09/06/2015 15:06	00d 00:10:00.0	44.3	72.1	53.3	38	51.4	47.2	43.2	39.7	38.7
21	09/06/2015 15:16	00d 00:10:00.0	42.4	70.2	49.8	36.1	48.1	45.2	41.5	38.6	37.1
22	09/06/2015 15:26	00d 00:10:00.0	42.3	70.1	53.7	35.8	47.5	45.5	41.2	37.4	36.6
23	09/06/2015 15:36	00d 00:10:00.0	43.9	71.7	55.1	36.7	50.2	46.7	42.7	39.4	37.7
24	09/06/2015 15:46	00d 00:10:00.0	46.4	74.2	64.1	37.4	57.3	48.3	43.2	39.8	38.5
25	09/06/2015 15:56	00d 00:10:00.0	44.7	72.5	58.5	37.2	52	47.2	43.2	39.1	37.9
26	09/06/2015 16:06	00d 00:10:00.0	43.9	71.7	52.6	35.9	50.9	47	42.4	38.3	36.9
27	09/06/2015 16:16	00d 00:10:00.0	45.1	72.9	61	36.5	53	47.9	43.3	39.7	38.2
28	09/06/2015 16:26	00d 00:10:00.0	42.1	69.9	54.5	35.5	49.3	45.3	40.6	37.3	36.5
29	09/06/2015 16:36	00d 00:10:00.0	42.2	70	51	34.9	48.1	45.5	40.7	36.9	35.7
30	09/06/2015 16:46	00d 00:10:00.0	43.2	71	60.4	35.5	52.6	45.4	40.8	37.7	36.3
31	09/06/2015 16:56	00d 00:10:00.0	43.6	71.4	58.9	34.7	53.3	46.6	41	36.9	36

32	09/06/2015 17:06	00d 00:10:00.0	43.4	71.2	56.7	34.7	51.6	47.3	40.3	36.6	35.7
33	09/06/2015 17:16	00d 00:10:00.0	43.1	70.9	55.8	34.5	53.1	45.8	41.1	36.3	35.3
34	09/06/2015 17:26	00d 00:10:00.0	44.1	71.9	57	34.9	54.9	46.8	41.6	37.2	35.6
35	09/06/2015 17:36	00d 00:10:00.0	50	77.8	77.6	34.8	57	48.6	41.9	36.6	35.5
36	09/06/2015 17:46	00d 00:10:00.0	45.9	73.7	64.8	35.8	56.4	47.7	43.2	38.7	36.9
37	09/06/2015 17:56	00d 00:10:00.0	43.2	71	51.5	35.6	49.9	46.4	41.9	37.4	36.5
38	09/06/2015 18:06	00d 00:10:00.0	46.2	74	67.4	34.3	59.6	46.4	40.7	36	35.2
39	09/06/2015 18:16	00d 00:10:00.0	42.9	70.7	52.6	35.7	49.1	46.2	41.6	37.5	36.3
40	09/06/2015 18:26	00d 00:10:00.0	42	69.8	50.6	35	48	45.4	40.5	37.2	36.2
41	09/06/2015 18:36	00d 00:10:00.0	42.2	70	57	34.1	48.7	45.3	40.8	36.7	35
42	09/06/2015 18:46	00d 00:10:00.0	42.2	70	58.4	34.3	50.9	44.9	39.6	35.9	35.1
43	09/06/2015 18:56	00d 00:10:00.0	41.9	69.7	64	34	49.8	44.4	39	36.3	35.3
44	09/06/2015 19:06	00d 00:10:00.0	41.6	69.4	52.3	34.2	47.3	44.7	40.3	36.4	35
45	09/06/2015 19:16	00d 00:10:00.0	41.5	69.3	58.5	34.1	49.1	44.6	39.2	36.4	35.1
46	09/06/2015 19:26	00d 00:10:00.0	48.8	76.6	76.1	33	62.4	48.2	40.9	35.4	34
47	09/06/2015 19:36	00d 00:10:00.0	42	69.8	53.2	32.9	49.6	46.1	39.3	35.7	34.1
48	09/06/2015 19:46	00d 00:10:00.0	40.5	68.3	50.7	32.8	48.4	44	38.2	34.9	33.9

49	09/06/2015 19:56	00d 00:10:00.0	44.6	72.4	72.1	32.8	55.6	45.3	38.7	34.9	33.8
50	09/06/2015 20:06	00d 00:10:00.0	50.3	78.1	73.9	33.1	63.7	51.7	46.5	35.4	34
51	09/06/2015 20:16	00d 00:10:00.0	50.4	78.2	77	34.1	61.1	51	47.4	44.8	39.1
52	09/06/2015 20:26	00d 00:10:00.0	52.9	80.7	77.4	36.1	65.8	53.5	48.6	45.1	40.6
53	09/06/2015 20:36	00d 00:10:00.0	52.9	80.7	77.7	35.4	64.9	53.6	48	45.4	42.2
54	09/06/2015 20:46	00d 00:10:00.0	51.5	79.3	74.1	34	65.6	53.3	46.8	43.6	36.6
55	09/06/2015 20:56	00d 00:10:00.0	53.4	81.2	75	36.6	66	53	48	45.5	42.3
56	09/06/2015 21:06	00d 00:10:00.0	52.8	80.6	76.6	33.2	67.6	52.4	42.2	35.3	34.1
57	09/06/2015 21:16	00d 00:10:00.0	43.3	71.1	69.5	33.2	56.6	44.2	35.8	34.3	33.9
58	09/06/2015 21:26	00d 00:10:00.0	37.8	65.6	54.5	32.9	45.6	41.3	35	34	33.5
59	09/06/2015 21:36	00d 00:10:00.0	41.7	69.5	48.5	33.3	47	44.5	42.4	34.8	33.9
60	09/06/2015 21:46	00d 00:10:00.0	36.6	64.4	48.4	33.1	44.1	39.4	34.7	34	33.7
61	09/06/2015 21:56	00d 00:10:00.0	42.7	70.5	51.8	33.3	49.8	44.3	43	35	34.2
62	09/06/2015 22:06	00d 00:10:00.0	41.9	69.7	54.6	33.2	49.3	44.7	39.9	34.5	34.2
63	09/06/2015 22:16	00d 00:10:00.0	40	67.8	51.8	33.3	47.1	43.2	36.6	34.4	34.1
64	09/06/2015 22:26	00d 00:10:00.0	40	67.8	46.9	32.9	44.4	43.2	35.4	34.1	33.9
65	09/06/2015 22:36	00d 00:10:00.0	39.3	67.1	49.6	32.7	47	43.1	35	33.8	33.6

66	09/06/2015 22:46	00d 00:10:00.0	39.7	67.5	62.7	32.7	44.7	43.3	35.2	33.8	33.5
67	09/06/2015 22:56	00d 00:10:00.0	42.3	70.1	69.2	33.2	49	43.4	39	34.2	33.9
68	09/06/2015 23:06	00d 00:10:00.0	38.8	66.6	53.6	33.1	51	42.5	34.3	33.9	33.7
69	09/06/2015 23:16	00d 00:10:00.0	35.3	63.1	47.7	32.9	44.1	35.7	34.1	33.8	33.6
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71	09/06/2015 23:36	00d 00:10:00.0	35.5	63.3	47	32.8	43.7	36.7	34.3	33.8	33.4
72	09/06/2015 23:46	00d 00:10:00.0	36.7	64.5	52.2	33	50.2	35.1	34.1	33.8	33.6
73	09/06/2015 23:56	00d 00:10:00.0	36.3	64.1	59.2	32.8	46.4	35.5	34	33.6	33.4
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75	10/06/2015 00:16	00d 00:10:00.0	34.8	62.6	39.2	33.1	37.5	35.7	34.5	34	33.8
76	10/06/2015 00:26	00d 00:10:00.0	35.1	62.9	46.4	33	43.5	34.9	34.1	33.7	33.6
77	10/06/2015 00:36	00d 00:10:00.0	34.1	61.9	36.9	32.9	35.2	34.5	34	33.7	33.6
78	10/06/2015 00:46	00d 00:10:00.0	33.9	61.7	36.2	32.8	34.9	34.2	33.9	33.6	33.4
79	10/06/2015 00:56	00d 00:10:00.0	38.7	66.5	45.3	32.9	43.4	42.8	34.2	33.8	33.5
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84	10/06/2015 01:46	00d 00:10:00.0	34.4	62.2	43.2	33.1	37.4	35.2	34.1	33.8	33.7
85	10/06/2015 01:56	00d 00:10:00.0	34.4	62.2	40.4	33.1	37.8	34.7	34.1	33.8	33.7
86	10/06/2015 02:06	00d 00:10:00.0	34.4	62.2	44.1	33.2	36.6	34.7	34.3	34	33.8
87	10/06/2015 02:16	00d 00:10:00.0	34.3	62.1	38.9	33.2	34.9	34.6	34.3	34	33.8
88	10/06/2015 02:26	00d 00:10:00.0	35	62.8	44.5	33.2	41.7	35.7	34.4	34.1	33.9
89	10/06/2015 02:36	00d 00:10:00.0	34.5	62.3	39.1	33.3	37.1	34.9	34.3	34.1	34
90	10/06/2015 02:46	00d 00:10:00.0	34.3	62.1	39.9	33.1	36.4	34.5	34.2	33.9	33.8
91	10/06/2015 02:56	00d 00:10:00.0	34.7	62.5	46	33.2	40.5	35.2	34.1	33.9	33.7
92	10/06/2015 03:06	00d 00:10:00.0	34.2	62	36.7	33.3	34.7	34.5	34.2	34	33.8
93	10/06/2015 03:16	00d 00:10:00.0	34.2	62	41	33.3	34.6	34.3	34.1	34	33.8
94	10/06/2015 03:26	00d 00:10:00.0	35.1	62.9	42.5	33.3	39.1	37	34.3	34	33.8
95	10/06/2015 03:36	00d 00:10:00.0	34.8	62.6	47.5	33.3	40	35.4	34.3	34	33.9
96	10/06/2015 03:46	00d 00:10:00.0	47.2	75	63.4	33.5	58.6	51.2	40.5	34.4	34.1
97	10/06/2015 03:56	00d 00:10:00.0	55.3	83.1	68.5	35	63.1	60.3	51.3	42.4	37.8
98	10/06/2015 04:06	00d 00:10:00.0	54.7	82.5	68.7	35.7	62.9	60.5	49.1	41.5	38.3
99	10/06/2015 04:16	00d 00:10:00.0	48	75.8	56.4	35.6	52.7	51.2	47.3	42	38.8

100	10/06/2015 04:26	00d 00:10:00.0	46.8	74.6	60.7	35.3	52.4	50.3	45.2	40.4	37.3
101	10/06/2015 04:36	00d 00:10:00.0	46.3	74.1	57.7	34.4	52.4	50.2	43.5	38.5	36.7
102	10/06/2015 04:46	00d 00:10:00.0	47.1	74.9	58.8	34.3	53.9	50.8	45.5	39.4	35.9
103	10/06/2015 04:56	00d 00:10:00.0	46.2	74	60.3	34.1	56	49.2	43.1	37.8	35.6
104	10/06/2015 05:06	00d 00:10:00.0	43.4	71.2	58.5	33.8	49.9	47.6	40.3	36	35
105	10/06/2015 05:16	00d 00:10:00.0	49.4	77.2	64.6	34	59.4	54.3	39.8	36.2	34.9
106	10/06/2015 05:26	00d 00:10:00.0	43.1	70.9	54.3	33.9	49.8	46.8	40.7	37.2	35.3
107	10/06/2015 05:36	00d 00:10:00.0	44.4	72.2	53.6	34.2	50.8	48.1	42.4	37.5	35.4
108	10/06/2015 05:46	00d 00:10:00.0	45.4	73.2	57.2	34.8	51.6	49.1	43.2	37.9	36.2
109	10/06/2015 05:56	00d 00:10:00.0	45.1	72.9	61.6	34	53.4	49.7	41.6	36.3	35
110	10/06/2015 06:06	00d 00:10:00.0	45.3	73.1	59.4	35.6	53	49	42.7	38.9	37.1
111	10/06/2015 06:16	00d 00:10:00.0	44.7	72.5	58.9	34.7	53.7	48.6	41.5	37.6	36
112	10/06/2015 06:26	00d 00:10:00.0	46.8	74.6	58.7	34.9	54.6	51.9	42.4	37.9	36.2
113	10/06/2015 06:36	00d 00:10:00.0	46.9	74.7	62.6	34.9	55	50.6	43.9	38	36.7
114	10/06/2015 06:46	00d 00:10:00.0	43.6	71.4	54.3	35.1	51	47.2	41.1	37.9	36.4
115	10/06/2015 06:56	00d 00:10:00.0	43.8	71.6	58	35.2	51.1	47.4	41.7	38.4	36.9
116	10/06/2015 07:06	00d 00:10:00.0	45.1	72.9	57.3	34.9	53.1	48.8	42.6	37.7	36.5

117	10/06/2015 07:16	00d 00:10:00.0	43.6	71.4	60.3	35.2	52.9	46.1	41.1	37.5	36.2
118	10/06/2015 07:26	00d 00:10:00.0	44.1	71.9	59.8	35.2	51.2	47.1	42.4	37.7	36.5
119	10/06/2015 07:36	00d 00:10:00.0	44.2	72	57.8	35.2	51.3	47.5	42.4	38.3	36.7
120	10/06/2015 07:46	00d 00:10:00.0	45	72.8	55	38.1	51	48.1	43.8	40.5	39.3
121	10/06/2015 07:56	00d 00:10:00.0	45.4	73.2	59.9	36.3	51.8	48.6	44.4	40.2	38.7
122	10/06/2015 08:06	00d 00:10:00.0	47.5	75.3	59.7	38.9	52.4	50	46.7	43.4	40.6
123	10/06/2015 08:16	00d 00:10:00.0	45.5	73.3	56.7	37.6	51.7	48.2	44.2	41.7	39.1
124	10/06/2015 08:26	00d 00:10:00.0	45.3	73.1	54.2	37.4	51.4	48.1	44.3	41.1	39
125	10/06/2015 08:36	00d 00:10:00.0	44.7	72.5	52.9	36.1	51.4	47.4	43.4	39.3	38
126	10/06/2015 08:46	00d 00:10:00.0	64.6	92.4	89.7	35.3	80.5	51.6	44.8	38.9	36.8
127	10/06/2015 08:56	00d 00:10:00.0	45.9	73.7	61.3	35.6	51.8	48.9	44.9	40.1	37.3
128	10/06/2015 09:06	00d 00:10:00.0	51.8	79.6	70.1	38.5	64.8	52	47.8	45.4	43.5
129	10/06/2015 09:16	00d 00:10:00.0	46.3	74.1	61.4	37.7	53.5	48.5	45.4	41.8	39.6
130	10/06/2015 09:26	00d 00:10:00.0	44.5	72.3	66.4	37.4	49.5	46.9	43.4	40.4	39
131	10/06/2015 09:36	00d 00:10:00.0	46.1	73.9	56.1	39.3	52.1	48.7	45.2	42.3	40.7
132	10/06/2015 09:46	00d 00:10:00.0	43	70.8	50.5	36.8	48.4	45.4	42.4	39	38
133	10/06/2015 09:56	00d 00:10:00.0	43.3	71.1	56.1	35.9	51.5	46.2	41.7	38.2	37.2

134	10/06/2015 10:06	00d 00:10:00.0	44.6	72.4	61.4	36.8	52.2	47.4	42.5	38.9	37.6
135	10/06/2015 10:16	00d 00:10:00.0	46.3	74.1	69.8	36.3	56.7	48.5	42.9	38.6	37.4
136	10/06/2015 10:26	00d 00:10:00.0	45.9	73.7	58	36.3	53.3	48.4	44.4	40.5	37.5
137	10/06/2015 10:36	00d 00:10:00.0	45.2	73	56.2	39.4	50.5	47.9	44.2	41.5	40.4
138	10/06/2015 10:46	00d 00:10:00.0	47	74.8	62.2	38.3	55	49.1	45.5	42.4	39.8
139	10/06/2015 10:56	00d 00:10:00.0	46.5	74.3	56.5	39.1	51.8	49.2	45.5	42.7	41.2
140	10/06/2015 11:06	00d 00:10:00.0	44.4	72.2	52.4	37.5	49.8	47.3	43.5	40.1	38.6
141	10/06/2015 11:16	00d 00:10:00.0	56.4	84.2	80.1	37.1	71.7	51.4	43.5	40.8	38.3
142	10/06/2015 11:26	00d 00:10:00.0	50.1	77.9	71.1	38.8	63.6	49.3	44.6	41.9	40.3
143	10/06/2015 11:36	00d 00:10:00.0	44.7	72.5	52.3	38.6	49.8	47	44.2	41	39.4
144	10/06/2015 11:46	00d 00:10:00.0	47	74.8	67.7	36.8	58.9	47.5	42.8	39.3	38.3
145	10/06/2015 11:56	00d 00:02:09.9	54	75.1	78.3	37.1	64.7	55.6	47	41.6	37.5

NM2

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
1	09/06/2015 12:23	00d 00:10:00.0	55.1	82.9	78.5	38.6	66.1	57.4	46.2	40.8	39.4
2	09/06/2015 12:33	00d 00:10:00.0	49.9	77.7	64.6	38.1	60.1	54.3	43.3	39.9	38.7
3	09/06/2015 12:43	00d 00:10:00.0	53.1	80.9	73.5	37.8	63.3	57.2	42.8	39.4	38.3
4	09/06/2015 12:53	00d 00:10:00.0	50.8	78.6	68.9	37.4	61.4	55.4	43.3	40.3	38.2
5	09/06/2015 13:03	00d 00:10:00.0	55.4	83.2	71.9	39.3	68.1	59.5	45.8	41.6	40.1
6	09/06/2015 13:13	00d 00:10:00.0	50.8	78.6	66	38.5	62.1	54.7	43.9	40.6	39.2
7	09/06/2015 13:23	00d 00:10:00.0	54.3	82.1	79.2	38.6	64.6	57.5	46.7	41.3	39.6
8	09/06/2015 13:33	00d 00:10:00.0	54.4	82.2	74.5	38.7	68.1	56	43.8	40.7	39.4
9	09/06/2015 13:43	00d 00:10:00.0	56.1	83.9	76.9	37.8	68.7	58.3	47.3	40.4	38.7
10	09/06/2015 13:53	00d 00:10:00.0	54.4	82.2	73.5	38.7	64.5	57.1	45.7	40.9	39.4
11	09/06/2015 14:03	00d 00:10:00.0	54.9	82.7	72.4	39.3	67.1	59.1	46.3	42.5	41
12	09/06/2015 14:13	00d 00:10:00.0	53.7	81.5	72.4	38.6	64.8	57.4	46.3	41.3	39.4
13	09/06/2015 14:23	00d 00:10:00.0	51.8	79.6	68	38.4	61.3	56.7	45.4	40.9	39.1
14	09/06/2015 14:33	00d 00:10:00.0	55.5	83.3	70.2	37.9	66.1	59.4	49	42.2	39.1
15	09/06/2015 14:43	00d 00:10:00.0	51.7	79.5	66.9	38.2	62.7	56.1	44.3	39.7	39

16	09/06/2015 14:53	00d 00:10:00.0	52.6	80.4	69.5	37.8	63.1	56.9	46.1	39.6	38.7
17	09/06/2015 15:03	00d 00:10:00.0	55.5	83.3	71.4	38.8	68.1	58.8	46.4	41.4	40.1
18	09/06/2015 15:13	00d 00:10:00.0	53	80.8	66.1	38.2	62.8	57.8	45.9	41.7	39.1
19	09/06/2015 15:23	00d 00:10:00.0	51.9	79.7	64.1	38.1	61.7	57.1	44	39.5	38.7
20	09/06/2015 15:33	00d 00:10:00.0	53.7	81.5	69.2	38.3	64.1	58.7	45.2	40.4	38.9
21	09/06/2015 15:43	00d 00:10:00.0	57.7	85.5	76.6	38.8	69.8	60.7	48.4	41.2	39.7
22	09/06/2015 15:53	00d 00:10:00.0	53.8	81.6	66.1	38.6	63.3	59	46.5	40.4	39.3
23	09/06/2015 16:03	00d 00:10:00.0	54.4	82.2	72.4	38.3	65.8	58.5	46.1	40.4	39
24	09/06/2015 16:13	00d 00:10:00.0	54.3	82.1	72.8	38.3	67.1	57.3	45.6	41.1	39.1
25	09/06/2015 16:23	00d 00:10:00.0	53.1	80.9	78.9	38.2	63.3	56.5	43.3	39.8	38.8
26	09/06/2015 16:33	00d 00:10:00.0	52.9	80.7	69.9	38.2	63.3	56.8	45.1	40	38.8
27	09/06/2015 16:43	00d 00:10:00.0	50.5	78.3	65.3	37.9	61.6	54.6	42.3	40	39
28	09/06/2015 16:53	00d 00:10:00.0	52.2	80	67.3	37.7	62.8	56.5	44.7	39.7	38.3
29	09/06/2015 17:03	00d 00:10:00.0	52.9	80.7	72.4	37.6	64.2	57.3	42.2	39.1	38.2
30	09/06/2015 17:13	00d 00:10:00.0	54.5	82.3	71.6	38	66.2	58.8	45.3	39.8	38.9
31	09/06/2015 17:23	00d 00:10:00.0	56.9	84.7	77.6	37.7	70.1	58.7	44.6	39.8	38.3
32	09/06/2015 17:33	00d 00:10:00.0	53.6	81.4	68.3	37.4	64.1	58.6	44.2	39	37.9

33	09/06/2015 17:43	00d 00:10:00.0	66.9	94.7	96.7	39.6	72.2	60	49.8	42.2	40.7
34	09/06/2015 17:53	00d 00:10:00.0	53.9	81.7	68.9	38	64.6	58.4	46.3	39.9	38.6
35	09/06/2015 18:03	00d 00:10:00.0	51.3	79.1	65.6	36.9	62.6	56.6	41	38.2	37.5
36	09/06/2015 18:13	00d 00:10:00.0	54.9	82.7	73.8	37.4	67.2	58.2	45.6	39.7	38.2
37	09/06/2015 18:23	00d 00:10:00.0	52.8	80.6	66.8	38.1	63	57.8	44.6	40.2	39
38	09/06/2015 18:33	00d 00:10:00.0	51.7	79.5	67.1	37.2	63.2	55.8	44.2	39.3	37.9
39	09/06/2015 18:43	00d 00:10:00.0	53.1	80.9	70.5	37	65.5	56.3	43.6	39.1	38
40	09/06/2015 18:53	00d 00:10:00.0	48.8	76.6	65	37	61.5	50.9	40.7	38.6	37.7
41	09/06/2015 19:03	00d 00:10:00.0	51	78.8	67.3	37.1	61.8	55.1	44	39.4	38.2
42	09/06/2015 19:13	00d 00:10:00.0	48.6	76.4	65.9	36.7	60	52.2	42.5	38.6	37.5
43	09/06/2015 19:23	00d 00:10:00.0	55.2	83	84.2	36.3	65	55.7	43.2	38	36.9
44	09/06/2015 19:33	00d 00:10:00.0	52.2	80	69.9	36.6	64.5	55.4	42.2	38.7	37.7
45	09/06/2015 19:43	00d 00:10:00.0	51.2	79	67.4	36.4	62.9	55.6	41.6	38	37.2
46	09/06/2015 19:53	00d 00:10:00.0	51.8	79.6	67.4	36.2	63.5	56	42.3	37.6	36.8
47	09/06/2015 20:03	00d 00:10:00.0	53.4	81.2	74.2	36.4	65.6	55.1	39.8	37.5	36.9
48	09/06/2015 20:13	00d 00:10:00.0	52.9	80.7	71.9	36.4	66	55.8	42.9	38.6	37.4
49	09/06/2015 20:23	00d 00:10:00.0	55.7	83.5	76.7	36.7	69.2	55.8	42.7	38.6	37.6

50	09/06/2015 20:33	00d 00:10:00.0	49.5	77.3	65.9	36.6	61.4	52.3	40.6	37.8	37.3
51	09/06/2015 20:43	00d 00:10:00.0	52.5	80.3	73.5	36.4	63.2	53.4	41.4	37.8	36.9
52	09/06/2015 20:53	00d 00:10:00.0	49.8	77.6	67.6	36.7	62.8	50.8	39.9	38	37.4
53	09/06/2015 21:03	00d 00:10:00.0	52	79.8	70.3	36.7	64.9	53.9	40.3	37.8	37.2
54	09/06/2015 21:13	00d 00:10:00.0	49.1	76.9	71	36.6	61.7	48.8	38.8	37.5	37
55	09/06/2015 21:23	00d 00:10:00.0	46.1	73.9	68	36.2	59.4	44.9	37.9	37	36.7
56	09/06/2015 21:33	00d 00:10:00.0	48.3	76.1	62	36.3	60	51.6	39.5	37.2	36.7
57	09/06/2015 21:43	00d 00:10:00.0	46.8	74.6	66.6	36.2	59.7	47.4	38	37	36.7
58	09/06/2015 21:53	00d 00:10:00.0	44	71.8	63.4	36	55.7	44.9	37.7	36.9	36.5
59	09/06/2015 22:03	00d 00:10:00.0	50.1	77.9	70	36.1	63.3	51.3	37.4	36.8	36.5
60	09/06/2015 22:13	00d 00:10:00.0	47.9	75.7	70.3	36	59.8	46.3	37.2	36.7	36.4
61	09/06/2015 22:23	00d 00:10:00.0	46.3	74.1	68	36.1	61.3	40.4	37.2	36.8	36.5
62	09/06/2015 22:33	00d 00:10:00.0	43.3	71.1	65.7	35.9	55.3	37.8	37.1	36.6	36.4
63	09/06/2015 22:43	00d 00:10:00.0	43.4	71.2	65	36	58.1	38.5	37.1	36.7	36.4
64	09/06/2015 22:53	00d 00:10:00.0	46.9	74.7	66.3	36.1	61.1	45	37.4	36.8	36.5
65	09/06/2015 23:03	00d 00:10:00.0	47.9	75.7	68.7	36.2	62.1	43.4	37.4	36.9	36.6
66	09/06/2015 23:13	00d 00:10:00.0	47.1	74.9	70.9	36.2	59.9	38.8	37.1	36.8	36.5

67	09/06/2015 23:23	00d 00:10:00.0	50.8	78.6	74.5	36.1	65.3	42.5	37.4	36.8	36.4
68	09/06/2015 23:33	00d 00:10:00.0	42	69.8	64.4	36.1	51.6	38.6	37.2	36.7	36.5
69	09/06/2015 23:43	00d 00:10:00.0	36.9	64.7	38.7	36	37.6	37.2	36.9	36.6	36.4
70	09/06/2015 23:53	00d 00:10:00.0	49.8	77.6	76.8	35.9	63.5	40.2	36.9	36.5	36.3
71	10/06/2015 00:03	00d 00:10:00.0	37.1	64.9	44.5	35.7	38.5	37.6	37	36.6	36.3
72	10/06/2015 00:13	00d 00:10:00.0	41.3	69.1	62.4	36.1	54.3	38.8	37.1	36.7	36.4
73	10/06/2015 00:23	00d 00:10:00.0	41.5	69.3	62.2	36	52.8	37.7	36.9	36.6	36.4
74	10/06/2015 00:33	00d 00:10:00.0	36.9	64.7	41.3	35.8	38.8	37.3	36.8	36.6	36.3
75	10/06/2015 00:43	00d 00:10:00.0	36.8	64.6	41.2	35.9	38.3	37	36.7	36.4	36.2
76	10/06/2015 00:53	00d 00:10:00.0	37	64.8	41.8	35.9	39.8	37.7	36.8	36.5	36.3
77	10/06/2015 01:03	00d 00:10:00.0	36.8	64.6	37.8	35.9	37.3	37	36.7	36.5	36.3
78	10/06/2015 01:13	00d 00:10:00.0	41.7	69.5	63.6	36	52.5	37.3	36.8	36.5	36.3
79	10/06/2015 01:23	00d 00:10:00.0	36.7	64.5	38.5	35.9	37.3	37	36.7	36.5	36.2
80	10/06/2015 01:33	00d 00:10:00.0	36.7	64.5	41.6	35.8	37.2	36.9	36.7	36.4	36.2
81	10/06/2015 01:43	00d 00:10:00.0	36.9	64.7	39.5	36	38.1	37.2	36.8	36.6	36.3
82	10/06/2015 01:53	00d 00:10:00.0	37.2	65	41.6	36	39.8	37.6	37	36.7	36.4
83	10/06/2015 02:03	00d 00:10:00.0	36.9	64.7	39.9	36.1	37.9	37.2	36.8	36.5	36.3

84	10/06/2015 02:13	00d 00:10:00.0	36.8	64.6	39	35.8	37.4	37	36.8	36.5	36.3
85	10/06/2015 02:23	00d 00:10:00.0	37	64.8	42	36.1	38.8	37.3	36.9	36.6	36.4
86	10/06/2015 02:33	00d 00:10:00.0	36.9	64.7	38.6	36	37.5	37.2	36.9	36.6	36.4
87	10/06/2015 02:43	00d 00:10:00.0	37	64.8	39.4	36.1	38	37.3	36.9	36.7	36.5
88	10/06/2015 02:53	00d 00:10:00.0	36.9	64.7	44	35.9	37.6	37.2	36.8	36.6	36.4
89	10/06/2015 03:03	00d 00:10:00.0	36.9	64.7	40.9	36	38	37.2	36.8	36.6	36.4
90	10/06/2015 03:13	00d 00:10:00.0	36.9	64.7	42.1	36	37.5	37.1	36.8	36.6	36.4
91	10/06/2015 03:23	00d 00:10:00.0	37.2	65	39.9	36.1	38.7	37.9	37.1	36.7	36.5
92	10/06/2015 03:33	00d 00:10:00.0	36.9	64.7	40	36.1	37.6	37.2	36.9	36.6	36.4
93	10/06/2015 03:43	00d 00:10:00.0	41.6	69.4	54.3	36	50.9	45.5	37.3	36.7	36.5
94	10/06/2015 03:53	00d 00:10:00.0	45.2	73	55.5	36.9	52	48.8	43	38.9	37.7
95	10/06/2015 04:03	00d 00:10:00.0	45.9	73.7	54.7	37.5	52.1	49.2	44.4	40.1	38.5
96	10/06/2015 04:13	00d 00:10:00.0	51.1	78.9	66.2	37.9	62.1	54.1	47.3	42.3	39.8
97	10/06/2015 04:23	00d 00:10:00.0	51.4	79.2	68.7	37.4	57.3	55.3	48.9	41.6	38.7
98	10/06/2015 04:33	00d 00:10:00.0	53.1	80.9	67.7	36.8	61	57.1	49.3	39.8	37.7
99	10/06/2015 04:43	00d 00:10:00.0	53.6	81.4	72.9	37.3	61.6	57.4	49.8	41.5	38.5
100	10/06/2015 04:53	00d 00:10:00.0	53.5	81.3	66	37.3	62.4	57.1	50.3	42.8	38.7

101	10/06/2015 05:03	00d 00:10:00.0	48.9	76.7	64.6	36.9	59.4	52.7	43.8	39.1	37.6
102	10/06/2015 05:13	00d 00:10:00.0	54.1	81.9	73.5	36.5	68.2	53.7	44.4	38.1	37.3
103	10/06/2015 05:23	00d 00:10:00.0	60	87.8	76.7	36.8	71.8	64.4	46.2	39.1	37.6
104	10/06/2015 05:33	00d 00:10:00.0	51	78.8	68.2	36.9	60.5	55.1	43	38.6	37.6
105	10/06/2015 05:43	00d 00:10:00.0	52.5	80.3	70.3	37.1	62.6	56.9	44.8	39.5	37.8
106	10/06/2015 05:53	00d 00:10:00.0	51.9	79.7	68.9	36.7	64	56	42.5	38	37.2
107	10/06/2015 06:03	00d 00:10:00.0	53	80.8	70.1	37.1	63.4	57.1	45	39.1	37.8
108	10/06/2015 06:13	00d 00:10:00.0	44.6	72.4	63	37	55.4	46.4	42	38.8	37.8
109	10/06/2015 06:23	00d 00:10:00.0	45.7	73.5	64.7	37.2	57.3	47.4	41.4	38.6	37.7
110	10/06/2015 06:33	00d 00:10:00.0	53.2	81	71	37.2	64.1	57.8	45	39.3	37.9
111	10/06/2015 06:43	00d 00:10:00.0	51.7	79.5	67.1	37.1	62.3	55.9	43.7	39.2	38
112	10/06/2015 06:53	00d 00:10:00.0	50.6	78.4	69.2	37.5	63.8	51.3	41	38.9	38.2
113	10/06/2015 07:03	00d 00:10:00.0	53.1	80.9	74.2	37.8	62.9	57.3	45.3	39.7	38.5
114	10/06/2015 07:13	00d 00:10:00.0	51.6	79.4	68.7	37.4	64.4	53.4	41.4	38.8	38.1
115	10/06/2015 07:23	00d 00:10:00.0	57.1	84.9	82	37.4	69	58.2	43.6	39	38.3
116	10/06/2015 07:33	00d 00:10:00.0	54.5	82.3	77.1	37.5	65.3	58.9	43.6	39	38
117	10/06/2015 07:43	00d 00:10:00.0	52.6	80.4	69.3	37.7	64.9	55.3	43.3	39.6	38.4

118	10/06/2015 07:53	00d 00:10:00.0	55.9	83.7	71.8	37.8	67.1	60.3	45.8	40.9	38.8
119	10/06/2015 08:03	00d 00:10:00.0	55.5	83.3	75.7	39.5	64.5	58.9	50.3	42.2	40.4
120	10/06/2015 08:13	00d 00:10:00.0	54.4	82.2	69.7	37.6	64.6	58.7	47.6	42.7	39
121	10/06/2015 08:23	00d 00:10:00.0	52.2	80	68.1	38.1	62.9	56.5	44.9	40.9	39.2
122	10/06/2015 08:33	00d 00:10:00.0	55.3	83.1	71	37.8	66.9	59.6	47.1	40.1	38.6
123	10/06/2015 08:43	00d 00:10:00.0	54	81.8	75.1	36.7	64.6	57.1	44.6	39.1	37.5
124	10/06/2015 08:53	00d 00:10:00.0	65.3	93.1	89.6	37.2	77	59.9	47.6	39.2	37.9
125	10/06/2015 09:03	00d 00:10:00.0	54.8	82.6	69.5	36.9	66.1	58.5	47.8	39.6	37.9
126	10/06/2015 09:13	00d 00:10:00.0	55.8	83.6	73.8	38.2	67.4	59.6	48.2	41.7	39.9
127	10/06/2015 09:23	00d 00:10:00.0	51.2	79	65.1	38.9	61.8	55.4	44.1	40.5	39.5
128	10/06/2015 09:33	00d 00:10:00.0	51.2	79	64.4	38.3	61.9	55.3	44.3	40.8	39.5
129	10/06/2015 09:43	00d 00:10:00.0	53	80.8	70.1	37.7	64	57.2	44.4	39.5	38.2
130	10/06/2015 09:53	00d 00:10:00.0	52.1	79.9	64.9	37.8	62.2	57.4	43.8	39.3	38.4
131	10/06/2015 10:03	00d 00:10:00.0	56.5	84.3	74.2	37.4	69.1	59.7	46.1	39.8	38.4
132	10/06/2015 10:13	00d 00:10:00.0	54.7	82.5	73.6	37.4	66.9	57.8	46.2	39.3	38.1
133	10/06/2015 10:23	00d 00:10:00.0	56.2	84	77.8	37.6	68.2	59.2	45.9	39.1	38.2
134	10/06/2015 10:33	00d 00:10:00.0	53	80.8	77.9	39.2	63	56.9	44	41.3	40.1

135	10/06/2015 10:43	00d 00:10:00.0	51.5	79.3	67.1	39.3	61.4	55.2	47	43	41
136	10/06/2015 10:53	00d 00:10:00.0	53.7	81.5	75.8	39.6	64.8	57	46.5	42.8	41.3
137	10/06/2015 11:03	00d 00:10:00.0	51.6	79.4	68.2	39.1	61.6	55.4	46.1	41.6	40.2
138	10/06/2015 11:13	00d 00:10:00.0	55.8	83.6	73.6	38.2	68.7	58.5	47	41.4	39.3
139	10/06/2015 11:23	00d 00:10:00.0	54.7	82.5	73.3	39.1	67.3	57.7	45.5	41.6	40.3
140	10/06/2015 11:33	00d 00:10:00.0	51.8	79.6	68.6	39.7	62.8	55.2	45.7	43	40.7
141	10/06/2015 11:43	00d 00:10:00.0	53.4	81.2	70.8	38.7	62.2	57.6	49.2	41.9	39.9
142	10/06/2015 11:53	00d 00:10:00.0	54.6	82.4	72.8	37.4	64.9	58.6	46.8	40	38.5
143	10/06/2015 12:03	00d 00:10:00.0	54	81.8	68.5	37.5	63.9	59.4	45.2	39.1	38
144	10/06/2015 12:13	00d 00:08:25.8	56.5	83.6	73.6	37.6	69.5	59.9	49.3	39.9	38.4

NM3

Address	Start Time	Measurement Time	Leq	LE	Lmax	Lmin	LN1	LN2	LN3	LN4	LN5
1	09/06/2015 11:34	00d 00:10:00.0	52.9	80.7	82	36.1	63.6	51.7	43.4	38.8	37
2	09/06/2015 11:44	00d 00:10:00.0	43.6	71.4	58.3	36.8	49	46	42.7	39.7	38
3	09/06/2015 11:54	00d 00:10:00.0	42.3	70.1	51.6	36.8	47.9	44.4	41.5	39	37.6
4	09/06/2015 12:04	00d 00:10:00.0	50.3	78.1	64.8	37.1	59.8	52.6	48.4	39.9	38
5	09/06/2015 12:14	00d 00:10:00.0	41.7	69.5	52.8	36.3	48.1	44.2	40.6	38.4	37.4
6	09/06/2015 12:24	00d 00:10:00.0	45.7	73.5	60.2	37.8	55.6	47.9	43.1	40.4	39.1
7	09/06/2015 12:34	00d 00:10:00.0	45.5	73.3	60.6	37	57.2	47.3	41.9	39	37.8
8	09/06/2015 12:44	00d 00:10:00.0	42	69.8	52.6	36.3	47.8	44.7	41.1	38.1	37.2
9	09/06/2015 12:54	00d 00:10:00.0	42.4	70.2	51.9	37.2	46.9	44.4	41.8	39.4	38.2
10	09/06/2015 13:04	00d 00:10:00.0	43.6	71.4	58.2	37.6	51	46.1	41.9	39.7	38.5
11	09/06/2015 13:14	00d 00:10:00.0	42.6	70.4	64	36.5	48	44.3	41.1	38.9	37.7
12	09/06/2015 13:24	00d 00:10:00.0	43.2	71	52.6	36.8	49.6	45.5	42.4	39.6	38.1
13	09/06/2015 13:34	00d 00:10:00.0	43.2	71	54.1	37.4	51.2	45	41.9	39.2	38
14	09/06/2015 13:44	00d 00:10:00.0	45.4	73.2	58.3	35.8	55.8	48	42.8	38.7	37.1
15	09/06/2015 13:54	00d 00:10:00.0	43.4	71.2	53.1	36.6	50.9	46.1	42	39.5	37.5

16	09/06/2015 14:04	00d 00:10:00.0	43.6	71.4	54.8	36.8	50.4	46.3	42.2	39.6	38.2
17	09/06/2015 14:14	00d 00:10:00.0	44.6	72.4	61.1	37.6	55.1	45.8	41.9	39.5	38.5
18	09/06/2015 14:24	00d 00:10:00.0	41.9	69.7	50.4	36.1	47.4	44.5	40.8	38.6	37.3
19	09/06/2015 14:34	00d 00:10:00.0	42.6	70.4	53	35.6	49.9	45	41.3	38.2	37
20	09/06/2015 14:44	00d 00:10:00.0	41.2	69	53.5	36.8	46.6	43.3	40.3	38.5	37.5
21	09/06/2015 14:54	00d 00:10:00.0	42.5	70.3	51.6	37	48.8	45	41.4	38.9	37.8
22	09/06/2015 15:04	00d 00:10:00.0	43.1	70.9	52.6	37.2	48.9	45.6	42.1	39.2	38
23	09/06/2015 15:14	00d 00:10:00.0	42.3	70.1	51.5	36.9	47.9	44.9	41.2	39.1	38
24	09/06/2015 15:24	00d 00:10:00.0	42.7	70.5	56.4	36.1	50.7	45.3	40.9	38.3	37.2
25	09/06/2015 15:34	00d 00:10:00.0	42.8	70.6	52.4	36.6	49.7	44.9	41.7	39.7	37.8
26	09/06/2015 15:44	00d 00:10:00.0	45.3	73.1	59.7	37.2	53.3	48.1	42.9	39.4	38.1
27	09/06/2015 15:54	00d 00:10:00.0	45.8	73.6	58.6	37.8	54.3	48.8	43.7	39.9	38.7
28	09/06/2015 16:04	00d 00:10:00.0	46.5	74.3	61.2	36.1	56.5	49.9	42.9	38.8	36.9
29	09/06/2015 16:14	00d 00:10:00.0	61.7	89.5	81.3	37.7	77.5	55.5	44.9	40.5	38.6
30	09/06/2015 16:24	00d 00:10:00.0	46	73.8	63.7	36.5	58.3	47.8	41.2	38.5	37.5
31	09/06/2015 16:34	00d 00:10:00.0	42.9	70.7	58	36.7	51.6	45.3	40.8	38	37.4
32	09/06/2015 16:44	00d 00:10:00.0	42.1	69.9	56.7	35.7	47.7	44.7	40.9	38.4	36.9

33	09/06/2015 16:54	00d 00:10:00.0	42.2	70	55.3	35.7	50.5	44.8	40.3	37.7	36.5
34	09/06/2015 17:04	00d 00:10:00.0	42	69.8	55.6	35.5	49.3	44.7	40.1	37.5	36.5
35	09/06/2015 17:14	00d 00:10:00.0	45.6	73.4	71.6	36	53.4	46.5	41.9	38.7	36.8
36	09/06/2015 17:24	00d 00:10:00.0	45.6	73.4	61.2	36.3	55.3	48.7	42.7	38.9	36.9
37	09/06/2015 17:34	00d 00:10:00.0	46	73.8	65.4	35.5	54.5	49.1	42.5	38.2	36.6
38	09/06/2015 17:44	00d 00:10:00.0	45	72.8	59.8	36.5	53.6	47.3	42.8	39.7	38
39	09/06/2015 17:54	00d 00:10:00.0	45.6	73.4	67.7	36.4	55.4	48.2	42.4	38.7	37.1
40	09/06/2015 18:04	00d 00:10:00.0	41.2	69	49.3	34.8	47.2	44.4	39.5	36.2	35.5
41	09/06/2015 18:14	00d 00:10:00.0	46.8	74.6	66.7	36.1	59	46.8	42	38.8	37
42	09/06/2015 18:24	00d 00:10:00.0	43.7	71.5	56.3	35.1	52.2	46.8	41.4	37.6	36.2
43	09/06/2015 18:34	00d 00:10:00.0	43.2	71	66.2	35.7	51.1	45.6	41.1	37.9	36.6
44	09/06/2015 18:44	00d 00:10:00.0	44.2	72	58.7	35.1	52.9	47.1	42	37.5	36.1
45	09/06/2015 18:54	00d 00:10:00.0	40.1	67.9	53.1	34.6	48.1	42.5	38.3	36.1	35.2
46	09/06/2015 19:04	00d 00:10:00.0	42.8	70.6	54.8	34.7	50.1	45.9	41	37.8	36.3
47	09/06/2015 19:14	00d 00:10:00.0	49.6	77.4	68.4	35	62	52.1	42.3	38.2	36.5
48	09/06/2015 19:24	00d 00:10:00.0	46.4	74.2	66.4	34.2	57.1	48.2	42.5	37.5	34.9
49	09/06/2015 19:34	00d 00:10:00.0	45.2	73	59	34.6	52.5	48.5	43.2	38.7	35.9

50	09/06/2015 19:44	00d 00:10:00.0	45.3	73.1	61.3	34.4	54.5	48.5	42.6	37.7	35.5
51	09/06/2015 19:54	00d 00:10:00.0	49.7	77.5	67.2	34.2	61.4	53.3	41.4	36.9	35.3
52	09/06/2015 20:04	00d 00:10:00.0	41.8	69.6	59.2	33.7	52.5	44.1	39.2	36.1	34.8
53	09/06/2015 20:14	00d 00:10:00.0	43.1	70.9	60.9	35.2	51.7	46.1	40.3	37.3	36.1
54	09/06/2015 20:24	00d 00:10:00.0	50.4	78.2	70.4	34.8	63.6	52.3	42.4	37.9	36
55	09/06/2015 20:34	00d 00:10:00.0	47.2	75	67.2	34.6	58.4	49.4	42.3	37.6	36
56	09/06/2015 20:44	00d 00:10:00.0	50.9	78.7	71.8	34	63.4	53.3	41.1	36.9	35.2
57	09/06/2015 20:54	00d 00:10:00.0	41.2	69	50.6	35	47.8	44.3	39.6	36.6	35.6
58	09/06/2015 21:04	00d 00:10:00.0	45.9	73.7	63.5	34.9	56.9	48.7	41.6	37.7	36
59	09/06/2015 21:14	00d 00:10:00.0	48.9	76.7	65.5	35.1	60.4	51.7	43.4	37.5	35.8
60	09/06/2015 21:24	00d 00:10:00.0	47.3	75.1	65.8	34.7	57.7	51.1	41.2	36.1	35.2
61	09/06/2015 21:34	00d 00:10:00.0	58.4	86.2	82.6	34.1	72.1	56.6	42.4	37	35.4
62	09/06/2015 21:44	00d 00:10:00.0	46.5	74.3	68.9	34.2	58.6	48.7	36.6	35	34.6
63	09/06/2015 21:54	00d 00:10:00.0	47.5	75.3	68.2	34.2	58.9	50.7	39.8	35.4	34.8
64	09/06/2015 22:04	00d 00:10:00.0	44.2	72	66.7	34.4	55.1	46.3	37	35.3	34.8
65	09/06/2015 22:14	00d 00:10:00.0	37.5	65.3	49	33.8	45.3	39.9	35.5	34.6	34.3
66	09/06/2015 22:24	00d 00:10:00.0	36.6	64.4	49.2	33.6	45.6	37	35.3	34.7	34.3

67	09/06/2015 22:34	00d 00:10:00.0	37.2	65	55.8	34	47.2	37	35.2	34.8	34.5
68	09/06/2015 22:44	00d 00:10:00.0	35.7	63.5	45.2	33.1	42.7	36.4	35	34.1	33.6
69	09/06/2015 22:54	00d 00:10:00.0	38.7	66.5	54.4	33.7	48.4	42	35.7	34.5	34.1
70	09/06/2015 23:04	00d 00:10:00.0	37.6	65.4	53.4	33.1	47.2	40.4	34.4	33.9	33.6
71	09/06/2015 23:14	00d 00:10:00.0	37.6	65.4	53.5	33.3	48.9	38.7	34.7	33.9	33.6
72	09/06/2015 23:24	00d 00:10:00.0	40.8	68.6	60.8	34	53	41.4	35.8	34.9	34.6
73	09/06/2015 23:34	00d 00:10:00.0	35.3	63.1	43.4	33.4	41.4	35.9	34.7	34.2	33.8
74	09/06/2015 23:44	00d 00:10:00.0	36.2	64	51.5	32.7	48.7	34.8	33.9	33.4	33.2
75	09/06/2015 23:54	00d 00:10:00.0	36.1	63.9	56.2	32.7	46.3	35.3	34.2	33.7	33.3
76	10/06/2015 00:04	00d 00:10:00.0	34.8	62.6	39.9	33.2	37.4	35.5	34.6	33.9	33.6
77	10/06/2015 00:14	00d 00:10:00.0	36.1	63.9	50.2	33.3	46.2	36	34.6	34.1	33.7
78	10/06/2015 00:24	00d 00:10:00.0	35.8	63.6	49.2	33.5	44.3	35.8	34.8	34.3	34
79	10/06/2015 00:34	00d 00:10:00.0	34.3	62.1	41.3	32.9	36.9	34.8	34.2	33.7	33.4
80	10/06/2015 00:44	00d 00:10:00.0	34.1	61.9	44.7	32.7	36.1	34.5	34	33.5	33.1
81	10/06/2015 00:54	00d 00:10:00.0	34.5	62.3	40.4	32.8	38.5	36	33.9	33.5	33.2
82	10/06/2015 01:04	00d 00:10:00.0	33.7	61.5	35.9	32.7	34.8	34.1	33.7	33.3	33.1
83	10/06/2015 01:14	00d 00:10:00.0	34.5	62.3	45.5	32.6	42.5	34.7	33.7	33.3	33.1

84	10/06/2015 01:24	00d 00:10:00.0	33.7	61.5	39.1	32.6	34.5	34	33.7	33.3	33
85	10/06/2015 01:34	00d 00:10:00.0	33.9	61.7	38.8	32.6	35.1	34.3	33.8	33.4	33.1
86	10/06/2015 01:44	00d 00:10:00.0	34.2	62	38.3	33.1	36.1	34.9	34.1	33.7	33.5
87	10/06/2015 01:54	00d 00:10:00.0	34.4	62.2	42	33.1	38.6	34.7	34.1	33.8	33.5
88	10/06/2015 02:04	00d 00:10:00.0	34.2	62	43.4	32.8	36.1	34.8	34.1	33.5	33.2
89	10/06/2015 02:14	00d 00:10:00.0	34.2	62	40.3	33.1	36.2	34.7	34.1	33.7	33.5
90	10/06/2015 02:24	00d 00:10:00.0	35	62.8	43.6	33.2	40.1	36.1	34.3	33.9	33.6
91	10/06/2015 02:34	00d 00:10:00.0	34.1	61.9	36.6	32.7	35.5	34.7	34.1	33.4	33.1
92	10/06/2015 02:44	00d 00:10:00.0	34.1	61.9	37.9	32.7	35.9	34.8	34	33.5	33.1
93	10/06/2015 02:54	00d 00:10:00.0	34.2	62	40.2	32.9	38.1	34.6	34	33.6	33.3
94	10/06/2015 03:04	00d 00:10:00.0	34	61.8	39.7	32.9	36.7	34.2	33.8	33.5	33.2
95	10/06/2015 03:14	00d 00:10:00.0	33.7	61.5	35.8	32.7	34.3	34	33.7	33.3	33
96	10/06/2015 03:24	00d 00:10:00.0	34.4	62.2	40.3	32.6	38	36	33.8	33.3	33
97	10/06/2015 03:34	00d 00:10:00.0	40.8	68.6	58.7	32.7	53.7	42.1	33.8	33.3	33.1
98	10/06/2015 03:44	00d 00:10:00.0	68.4	96.2	85.5	33	80.3	72.6	52.6	39.1	34.6
99	10/06/2015 03:54	00d 00:10:00.0	54.3	82.1	72.8	37.2	66.7	56.8	48	42.3	39.2
100	10/06/2015 04:04	00d 00:10:00.0	54.9	82.7	76.4	36.9	67.3	57.2	46.3	41.7	39.6

101	10/06/2015 04:14	00d 00:10:00.0	53.2	81	68	37.2	63.1	57.1	48.5	42.3	39.9
102	10/06/2015 04:24	00d 00:10:00.0	50.2	78	62.5	36.1	58.9	55.3	43.5	39.6	37.8
103	10/06/2015 04:34	00d 00:10:00.0	50	77.8	67.8	34	63.5	51	41.8	38.1	36.1
104	10/06/2015 04:44	00d 00:10:00.0	46.8	74.6	75.3	34	51.4	45	41.1	37.7	35.6
105	10/06/2015 04:54	00d 00:10:00.0	43.6	71.4	64	34.7	52.4	45.7	41	37.4	35.7
106	10/06/2015 05:04	00d 00:10:00.0	47.6	75.4	67.1	33.5	61.6	47.5	39.1	35.4	34.3
107	10/06/2015 05:14	00d 00:10:00.0	42.2	70	55.1	32.7	52.6	45.1	37.4	34.4	33.4
108	10/06/2015 05:24	00d 00:10:00.0	44.6	72.4	59.2	33.2	54.4	49.1	38.7	35.6	34.2
109	10/06/2015 05:34	00d 00:10:00.0	41.7	69.5	57.7	33.5	52.3	43.5	38.9	35.8	34.4
110	10/06/2015 05:44	00d 00:10:00.0	44.2	72	56.4	33	52.8	48.2	40.9	36	33.9
111	10/06/2015 05:54	00d 00:10:00.0	43.2	71	66.8	32.7	54.7	44.9	38.3	34.5	33.3
112	10/06/2015 06:04	00d 00:10:00.0	42.7	70.5	60.3	34	51.5	45.2	40.2	37.2	35.3
113	10/06/2015 06:14	00d 00:10:00.0	41.1	68.9	63.3	32.7	47	42.5	38.7	35.9	34
114	10/06/2015 06:24	00d 00:10:00.0	42	69.8	55.6	33.1	49.9	45.5	39.5	35.7	34.1
115	10/06/2015 06:34	00d 00:10:00.0	46.7	74.5	63	33.1	57.4	50.2	41.1	36.3	34.4
116	10/06/2015 06:44	00d 00:10:00.0	44.7	72.5	63.3	33.9	54.8	48.2	39.7	36.3	34.8
117	10/06/2015 06:54	00d 00:10:00.0	45.3	73.1	60.6	34.6	55.2	49.5	40	36.9	35.6

118	10/06/2015 07:04	00d 00:10:00.0	45.7	73.5	66.9	34.1	56.2	48.2	40.1	36.4	35.3
119	10/06/2015 07:14	00d 00:10:00.0	41.7	69.5	56.2	34	50.4	44.9	38.8	36.1	35
120	10/06/2015 07:24	00d 00:10:00.0	42.3	70.1	58.5	33.9	50.5	45.5	39.5	36	34.8
121	10/06/2015 07:34	00d 00:10:00.0	48.6	76.4	66.9	34.8	61.2	50.2	41.6	37	35.6
122	10/06/2015 07:44	00d 00:10:00.0	51	78.8	67.2	34.9	62.8	54	44	39.3	36.8
123	10/06/2015 07:54	00d 00:10:00.0	46.9	74.7	67.9	34.9	59.1	47.6	42.1	37.4	36
124	10/06/2015 08:04	00d 00:10:00.0	48.8	76.6	67.5	35.9	60.3	49.8	44.9	41	37.8
125	10/06/2015 08:14	00d 00:10:00.0	44.4	72.2	57.3	34.3	50.5	47.1	43.4	38	35.5
126	10/06/2015 08:24	00d 00:10:00.0	43.6	71.4	55	36.2	49.3	46.4	42.6	39.8	38.1
127	10/06/2015 08:34	00d 00:10:00.0	43.3	71.1	60.3	33.6	50.3	46.1	41.8	37	35
128	10/06/2015 08:44	00d 00:10:00.0	66.7	94.5	91.8	33.9	80.9	49.9	42.3	37.1	35
129	10/06/2015 08:54	00d 00:10:00.0	43	70.8	55.6	33.8	49.7	46.4	41.3	36.6	34.9
130	10/06/2015 09:04	00d 00:10:00.0	50.4	78.2	71.7	34.9	63.9	50.5	44	40	36.7
131	10/06/2015 09:14	00d 00:10:00.0	44.7	72.5	65.6	36.2	51.8	47	42.7	39.9	37.8
132	10/06/2015 09:24	00d 00:10:00.0	43.2	71	50	37.6	47.2	45.4	42.5	40.2	38.8
133	10/06/2015 09:34	00d 00:10:00.0	44.7	72.5	58.6	36.5	53.4	47.1	42.7	40.4	39
134	10/06/2015 09:44	00d 00:10:00.0	42.9	70.7	53.7	35.5	49.4	45.6	41.8	38.5	36.6

135	10/06/2015 09:54	00d 00:10:00.0	43.9	71.7	60.7	35	53.7	46.3	41.7	38.2	36.4
136	10/06/2015 10:04	00d 00:10:00.0	45.4	73.2	60.5	35.1	55.2	48.3	42.8	38.6	36.7
137	10/06/2015 10:14	00d 00:10:00.0	45.2	73	59.6	34.8	54.9	48.8	41.4	37.4	36
138	10/06/2015 10:24	00d 00:10:00.0	43.6	71.4	56.2	34.3	52.4	46.9	41	37.4	35.5
139	10/06/2015 10:34	00d 00:10:00.0	44.9	72.7	56.2	36.6	51.5	47.2	44	40.9	38
140	10/06/2015 10:44	00d 00:10:00.0	46.6	74.4	64.6	38.1	56.7	48	44.9	42	40
141	10/06/2015 10:54	00d 00:10:00.0	46.8	74.6	55.6	39.4	52.7	48.7	46.1	43.8	41.2
142	10/06/2015 11:04	00d 00:10:00.0	44.1	71.9	52.8	37.5	48.3	46.3	43.8	40.3	38.6
143	10/06/2015 11:14	00d 00:10:00.0	55.9	83.7	76	36	70.8	53.7	43	40.4	38.1
144	10/06/2015 11:24	00d 00:10:00.0	48.7	76.5	67.5	39	61.6	47.4	43.7	41.6	40.4
145	10/06/2015 11:34	00d 00:09:30.0	57.2	84.8	88.2	37.1	64.3	55.7	51	41.6	40.1