



Land North of the Railway Line (West), Rhooose

Flood Consequences Assessment & Drainage Strategy Report

May 2014

Waterman Transport & Development Limited

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Flood Consequences Assessment & Drainage Strategy Report

Client Name: Taylor Wimpey Limited

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Quality Assurance – Approval Status

This document has been prepared and checked in accordance with
Waterman Group's IMS (BS EN ISO 9001: 2008 and BS EN ISO 14001: 2004)

Issue	Date	Prepared by	Checked by	Approved by
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B	May 2014	Graeme Tulip	Andrew Wilkinson	Andrew Wilkinson

Comments

Our Markets



Property & Buildings



Transport & Infrastructure



Energy & Utilities



Environment

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Much of the information presented in this report is based on information provided by others. That information has neither been checked nor verified by Waterman Transport & Development Ltd.

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1. Introduction

It is the intention of Taylor Wimpey Limited to develop a site in Porthkerry Road, Rhose, Vale of Glamorgan, for residential and educational use. The proposed development is located to the south of Porthkerry Road as shown on the site boundary plan included as Appendix A herewith. The applicant is seeking outline permission to develop:

- Circa 350 Houses
- A 258 Pupil Primary School (210 primary pupils and 48 part time nursery spaces)

The development site forms approximately 50% of a housing allocation within the Vale of Glamorgan's (VoG) Unitary Development Plan (UDP) 1996 – 2011. Outline Planning permission has also already been granted to Bellway and Persimmon homes for 350 houses, on the neighbouring site to the east which forms the other half of the site's allocation.

Waterman Transport and Development Ltd. has been commissioned to investigate the existing drainage provisions that serve the existing site and to establish a drainage strategy for the proposed development. The strategy will be developed having general regard to the planning recommendations in Planning Policy Wales, TAN 15 and the guidance contained within the Construction Industry Research and Information Association (CIRIA) document C697, entitled 'The SUDS manual' (2007).

2. The Site

2.1 General Description

The proposed development site is located (approximately) at National Grid Reference 306725E, 166122N. A Site Location Plan is included as Appendix A.

The existing Site has a total area of approximately 12.7ha. The Site is bounded to the west by residential development, to the north by residential development with Porthkerry Road beyond, to the east by open fields and to the south by the railway with residential land beyond for 50% of the southern boundary and fields beyond for the rest of the land south of the railway. The proposed Masterplan for the development is included in Appendix B herewith.

Topographical survey data of the Site indicates that the existing ground levels within the Site vary from approximately 58.8mAOD to 60.8mAOD on the northern boundary to around 41.3mAOD to 42.5mAOD on the southern boundary. The Site falls in a general south/south-easterly direction. The slope tends to be uniform.

There are no discernable watercourses on the site or in the general vicinity of the site but the surface profile of the site indicates that surface water flow is channelled along local depressions during high rainfall and surface run-off events.

The level of the rail track on the embankment forming the southern boundary of the site is slightly elevated in comparison with the ground levels along this boundary of the site. The rail embankment height along the southern boundary increases from nil (i.e. at grade) at the western end, to approximately 3m above ground level at the eastern end of the southern boundary.

2.2 Proposed Development

The proposed development comprises the construction of circa 350 residential units and a primary school plus ancillary development including, car parking, hard enclosed play areas and supporting social facilities (green amenity space), together with associated works.

General vehicular access to the proposed development site is via a short length of Estate Road, which is accessed off the Porthkerry Road near the northeast corner of the site. A single property on Porthkerry Road will be demolished to allow the access to be constructed.

3. The Hydrological Regime

3.1 Hydrology

The Site lies on high ground a short distance from the coast. The vast majority of the Site drains in a general southerly/south-easterly direction. The relatively steep nature of the site results in overland flow (or sub-surface flow). There are no watercourses in the immediate vicinity but the land generally falls to the south and to the coast where surface water and sub-surface flow discharges to the Estuary.

The Welsh Assembly's Technical Advice Note 15 Development Advice Map and the Environment Agency's Flood Map, indicates that the Site is not at risk of fluvial or tidal flooding.

3.2 Hydrological Calculations

The proposed development site (approximately 12.73ha) is currently unoccupied. The mixture of permeable and impermeable areas in the proposed development works will generate a greater rate and volume of surface water runoff than the original 'Greenfield' runoff rate prior to any development in this area, however in order to achieve betterment (and to satisfy Code for Sustainable Homes) it is recommended that the rate of discharge of surface water runoff from the proposed development be restricted to the Qbar Greenfield rate of run-off.

The Qbar Greenfield runoff rate for the Site area has been calculated to be 68.9 litres/sec. This rate of runoff has been calculated for the Site using industry best practice, which recommends using the Institute of Hydrology Report 124 (1994) method for small catchments. The hydrological calculations are included in Appendix C herewith.

4. Drainage from Existing Site

The proposed development site does not benefit from formalised foul or surface water drainage. As mentioned previously surface water discharges overland or in near surface soils and eventually discharges to the Estuary. The local hydrology and hydrogeology are influenced to a large extent by the presence of rock which is close to the surface. The principal components of the surface water regime on the site are indicated on Drawing No. CIV15342/SA/92/004/A01, a copy of which is included in Appendix E herewith.

4.1 Surface Water Drainage

Site investigations have shown that the existing site is served by a land drainage system that drains beneath the railway embankment and then through both the developed and undeveloped land to the south of the railway, to finally discharge into the Estuary at various points along the shoreline.

Site investigations have shown that there is no evidence of any existing formalised piped system or discernable watercourses within the site. Runoff however naturally gravitates to the southern boundary of the site and continues to permeate to the south beneath the railway embankment. The surface water flows would eventually discharge to the Estuary, either through the sub-strata or through the land drainage system that exists to the south of the railway. It is clearly evident that ground water generally permeates under the railway embankment unless run-off is high when areas of shallow flooding occur near the upstream face of the railway embankment.

Permeability/Soakaway testing along the southern boundary of the site (and just north of the railway embankment) has shown a good infiltration rate (e.g. 3×10^{-4}) in the near surface sedimentary soil layer (approx. 0.5m thick) above the weathered limestone rock (approx. 2.0m thick). The weathered limestone is underlain by more competent limestone.

The investigations have indicated that the competent rockhead depth is approximately 3.0m across the site. An intrusive GI and a supplementary suite of borehole soakage tests at various depth bands up to 10m in five boreholes across the site, has confirmed that the competent limestone is uniformly strong in composition and relatively impermeable with very little fracturing. The Measured rates of permeability which were consistently identified as being very low (e.g. 1×10^{-7} or 1×10^{-8}) and in this respect it was clear that the competent rock has limited infiltration potential at the locations tested. These borehole tests confirmed that the existing surface water regime comprises surface water flow and sub-surface flow (in the near surface soils).

In other words, the existing greenfield site would appear to drain predominantly by a combination of overland surface water runoff (towards the southern boundary) and lateral infiltration in a southerly direction through the upper free-draining sedimentary soil layer. There would however also be some lesser vertical infiltration into the underlying rock.

Due to the absence of any clear and obvious piped system at the southern boundary it is reasoned that this natural land drainage within the near surface soils facilitates flow beneath/through the railway embankment and onwards to the south where the flow is intercepted in part by a formal land drainage system. The latter land drainage system is understood to have been constructed by a previous developer to act as a cut off to prevent surface water flowing over the field to the south of the railway. Several outfalls connecting to the land drainage system are visible on the southern side of the railway embankment. The function of this surface water drain is however not fully known however it is likely to intercept some of the sub-surface flow.

The existing access (also a public right of way) onto Porthkerry Road includes a surface water outfall discharging surface water runoff onto the existing track. This flow gravitates through the site in a southerly direction along the public right of way, until it exits the site whilst still flowing along the track. Overland

flow then continues down the track and finally beneath the railway embankment at the southern boundary of the adjacent site.

We are aware that the properties on Murlande Way, to the north of the proposed development site, drain their surface water runoff to soakaways. The resulting sub-surface flow would permeate through the substrata as described above.

4.2 Foul Water Drainage

There is an existing DCWW foul rising main that runs within and along the southern boundary of the site. This apparatus has an easement associated with it, which would have to be maintained as part of any future development proposals.

There are off-site foul drainage networks in all the surrounding residential estates and also in Porthkerry Road.

DCWW were commissioned in 2005 to undertake a hydraulic study of the DCWW foul sewage apparatus in order to discuss options for a larger 600-unit development. Since that time however two major developments have been granted outline consent. In this case, DCWW confirmed that additional modelling would need to be carried out on account of a change in circumstances.

The previously agreed and preferred solution for the combined site (600-units) was to construct a new foul pumping station on site. The new pumping station would be constructed on the line of the existing rising main in the south eastern corner of the site (i.e. the currently proposed site). Off-site improvements to the existing public sewerage system were also identified as being required.

As part of the planning obligations for the adjacent development, the design of its drainage system has been developed to provide a foul water connection to serve the currently proposed scheme. Details of the invert level of the planned connection are currently unknown.

5. Drainage from Proposed Site

5.1 Surface Water

Planning Policy Wales and its associated Technical Advice Note (TAN) 15 requires that consideration be given to any potential for flooding from surface water emanating from the proposed development sites. The redevelopment of existing permeable 'Greenfield' land to form hard (impermeable) surfaces such as highways, buildings and associated hardstandings will cause an increase in surface water runoff rates and volumes unless appropriate mitigation measures are designed.

The Environment Agency (EA) and TAN 15 require all new developments to consider, and where possible incorporate, the use of sustainable drainage techniques (SuDS) to effectively dispose of surface water emanating from the Site, and provide betterment where practicable. It should be noted that the proposed development site is located above a minor aquifer. The Site is not located within a groundwater source protection zone.

The integration of SuDS techniques into the development proposals will provide betterment to both the proposed development site and downstream properties in terms of flood protection and water quality. One of the key aims of utilising SuDS is to replicate the runoff from the existing regime, to ensure that the hydrological status quo is retained. This has particular relevance to 'Greenfield' (i.e. undeveloped) sites, which forms the majority of the Site area.

In the case of the proposed development site, a Site Investigation (SI) has been carried out to determine whether certain SuDS techniques (such as soakaways) are viable options to manage surface water runoff. The SI comprised infiltration tests to identify the permeability of the underlying soils and thus the suitability of soakaways. The SuDS hierarchy, which is included as Table 1, has been used to provide a basis for the choice of SuDS techniques used to manage surface water runoff from the proposed development site.

There are several options for draining surface water from the proposed development site. One such option would be to construct a new surface water sewer, which would finally discharge to the sea. This was the preferred option by the design team on the adjacent Persimmon/Bellway application site.

Outline Consent has been granted for the Persimmon/Bellway scheme which not only promoted the construction of a new outfall sewer under the Railway but also undertook to provide a surface water sewer connection to serve the currently proposed development site (to be developed by Taylor Wimpey).

The conditions attached to the permission on the adjacent land do not, in the considered view of the applicants and their advisors, offer comfort that the land within this application could be drained via land to the east.

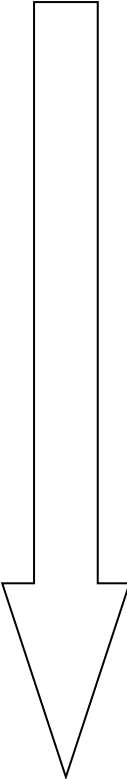
The applicants therefore must be in a position to be able to access, drain and develop the application site independently of the land to the east. Not to do so would result in unacceptable uncertainty over the timing or delivery of any form of development on their land.

An alternative option would be to restrict the post development rate of runoff of surface water to existing greenfield rate and to continue to discharge to the existing (and natural) land drainage system. This option would retain the hydrological status quo by providing attenuation on site. The attenuation facilities could be in the form of a lined pond and/or swale or alternatively sub-surface attenuation facilities could be designed to fit under the future highways or landscaped/public areas. A flow control device would then restrict the outfall from the attenuation facility into the open ditch that runs along the southern site boundary. The proposals in respect of the future strategy for disposal of surface water are indicated on Drawing No. CIV15342/SA/92/0001/A04, a copy of which is included in Appendix F.

Historical discussions held with the Vale of Glamorgan Land Drainage Officers suggested that there may be concerns expressed by local residents and the Local Authority over the ownership and potential use of the existing land drainage system to the south of the Railway. This is understandable because the integrity of the system could not be verified in the recent sewer investigations. For this reason the

proposed drainage strategy for the proposed development works does not include the use of the downstream land drainage system.

Table 1: The SuDS Hierarchy

Sustainability Value	SuDS Technique	Flood Reduction	Pollution Reduction	Landscape & Wildlife Benefit
Most sustainable	Basins and Ponds			
	- Constructed wetlands			
	- Balancing ponds	✓	✓	✓
	- Detention basins			
	- Retention ponds			
	Filter Strips and Swales	✓	✓	✓
	Infiltration Devices			
	- Soakaways	✓	✓	✓
	- Infiltration trenches and basins			
	Permeable Surfaces and Filter Drains			
	- Gravelled areas	✓	✓	
	- Solid paving blocks			
	- Porous paving			
Least Sustainable	Tanked Systems			
	- Over-sized pipes/tanks	✓		
	- Storm cells			

Source: *The SUDS Manual, CIRIA C697, 2007*

In order to replicate the existing hydrology and hydrogeology in respect of the future drainage design it is proposed to collect all surface water runoff generated by the future site impermeable areas in a piped network with in-built storage and hydrobrake flow-control points to attenuate flows down to the greenfield Qbar rate. This greenfield flow would then be released in a controlled manner back into the ground via an infiltration trench/distribution system (or other groundwater recharge system) constructed along the full length of the southern site boundary. This distribution system will consist of a perforated pipe within a granular trench to receive and distribute the attenuated flow and would effectively act as a groundwater recharge system, replicating the existing hydrology. The attenuation provided and the infiltration trench itself is sized to accept the 100yr critical storm flows (including an allowance for climate change) without flooding properties, hence providing betterment at the southern boundary, which is known to attract standing water during storm conditions.

The inherent 'betterment' within this proposal is therefore the attenuation of ALL future site storm return periods and storm durations to the existing Qbar 'greenfield' rate. This will bring significant betterment (reduction) to flows entering the downstream catchment, as illustrated by the existing and proposed hydrographs shown on Drawing No. CIV15342/SA/92/0001/A04, included in Appendix F herewith.

Discussions have taken place with Dwr Cymru Welsh Water who has provisionally agreed in principle to adopt the proposed surface water system, notwithstanding the provision of detail, and subject to the following:

- Sub-surface attenuation being used in lieu of ponds
- Domestic runoff being greater than highway runoff
- Soakaways being adopted by Vale of Glamorgan

In the interests of maintaining the quality of the surface water discharge, surface water runoff from areas of hardstandings such as car parking and highways will pass through interceptors or trapped gullies prior to discharging to the watercourse.

The proposed access road will include a culvert designed to convey the surface water runoff that currently discharges onto the existing track. The development proposals include the management of this overland flow as it gravitates through the site in a southerly direction along the public right of way. It is envisaged that a shallow open channel will be formed on one side of the public right of way and used to convey the aforementioned floodwater.

The proposed on-site infrastructure to the south of properties on Murlande Way will be designed to ensure that there is no detrimental impact on the performance of the existing soakaways that currently serve these properties.

5.2 Foul Drainage

Recent discussions have taken place with DCWW regarding the provision of the foul water drainage facilities to serve the proposed development. Discussions covered issues relating to constraints in the DCWW network and points of adequacy to discharge foul flows from the proposed development.

Dwr Cymru Welsh Water's (DCWW) response to our foul sewage capacity enquiry for the proposed 350 units and a copy of the adopted sewerage plan is included in Appendix C. It states that an updated Hydraulic Modelling Assessment (HMA) would need to be carried out in order to confirm the required solution. This additional modelling exercise is now on-going, and a primary school is now also being included in the Assessment.

Given the topography of the site, the proposed foul drainage system will comprise a network of on-site gravity sewers, which drain the proposed development to the southern corner of the site. The location of the existing local foul drainage infrastructure means that a new on-site foul pumping station would need to be constructed to pump flows to the public sewerage system. The point of connection to the public sewer will be determined by the on-going HMA.

Given that Taylor Wimpey are required to fund upgrades to the Rhoose PS (as part of their nearby scheme), which lies to the west of this site, it has been suggested to DCWW that the potential to discharge a pumped flow from the aforementioned on-site foul PS into Rhoose PS should be explored.

The adjacent Bellway/Persimmon site is due to provide a connection for foul drainage from the site, however preliminary advice from the adjacent developers suggests that there would still be a requirement to pump some of the site's foul flows into the proposed drainage system on the adjacent site. A combined drainage system with the adjacent site is likely to generate economies of construction but there are obvious issues around timing of delivery of the adjacent site compared with this development site.

6. Summary

The site is not affected by fluvial or tidal flooding. The risks associated with pluvial, groundwater and sewer flooding are also considered to be low.

Surface water runoff from the existing site is drained through the sub-soil. Excess runoff collects at the bottom of the site before soaking away into the sub-soil.

The proposed surface water drainage strategy utilises SUDS principles to replicate the existing site hydrology, however there is the future possibility of discharging some of the surface water runoff into the adjacent site's future drainage system (subject to details).

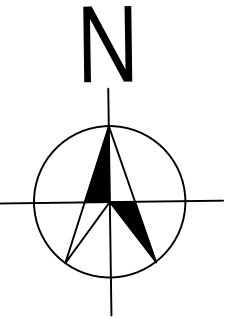
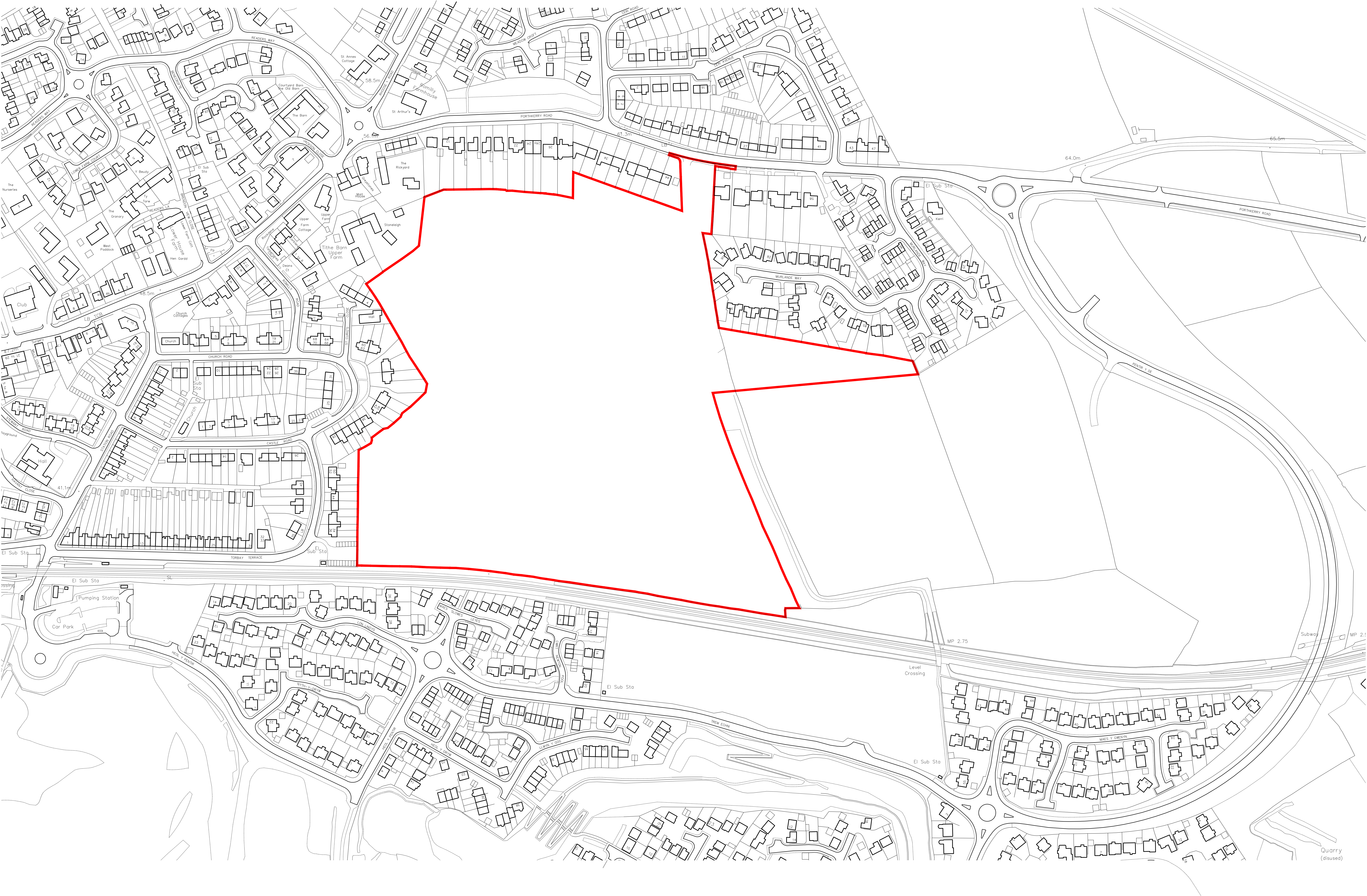
Foul flows will gravitate to a new on-site pumping station at the southern site boundary, pumping thereafter to the existing public sewer network (at a location that is to be confirmed by DCWW). Again, there is the future possibility of discharging some of the development's foul water into the adjacent site's future drainage system (subject to details).

APPENDICES

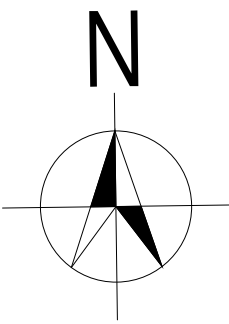
A. Location Plan

REVISIONS:

1



B. Proposed Masterplan



Taylor Wimpey

REVISIONS:

KEY

- Site Boundary
- Site Access
- Future Link to Land East
- Cycle/Footway Access
- Primary Street
- Secondary Street
- Feature Square
- Mews/Shared Surface
- Private Driveways
- Cycle/Footway Routes
- Pedestrian Links
- Existing Public Right of Way
- Development Blocks
- Illustrative Residential Buildings
- Focal Buildings
- Existing Buildings
- School Site
- Pumping Station
- Pumping Station 15m no build zone
- Existing Foul Pipe
- Existing Gas Main
- Green Space
- Existing Trees
- Existing Hedgerows
- Proposed Hedgerows
- Proposed Trees
- Local Area of Play (LAP) min 100m
- Local Equipped Area of Play (LEAP) min 400m
- Existing water courses/ditches

MASTERPLAN

SCALE: 1:1000 @ A1

DATE: APRIL 2014

DRAWING TITLE: MASTERPLAN

DRAWN: JJR

DRAWING NO: 0508-1003

THE OLD BREWERY, LODWAY, PILL, BRISTOL BS20 0DH
t:01275 813380 f:01275 813381 e:admin@focusdp.com



C. Hydrological Calculations

Greenfield runoff estimation for sites

Site name: Rhoose
Site location: Rhoose

Site coordinates
Latitude: 51.38919° N
Longitude: 3.34107° W

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Reference: gcjs7gp5ermid / 12.6
Date: 28 Mar 2014

Site characteristics

Total site area	12.6	ha
Significant public open space	0	ha
Area positively drained	12.6	ha

Methodology

Greenfield runoff method	IH124
Qbar estimation method	Calculate from SPR and SAAR
SPR estimation method	Calculate from SOIL type
SOIL type	5
HOST class	N/A
SPR	0.53

Hydrological characteristics

	Default	Edited	
SAAR	901	901	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	0.86	0.86	
Hydrological region	9	9	
Growth curve factor: 1 year	0.88	0.88	
Growth curve factor: 10 year	1.42	1.42	
Growth curve factor: 30 year	1.78	1.78	
Growth curve factor: 100 year	2.18	2.18	

Greenfield runoff rates

	Default	Edited	
Qbar	2.84	106.08	l/s
1 in 1 year	11.09	93.35	l/s
1 in 30 years	22.43	188.81	l/s
1 in 100 years	27.47	231.24	l/s

Please note that a minimum flow of 5 l/s applies to any site

Site name: Rhoose
Site location: Rhoose

Site coordinates
Latitude: 51.38919° N
Longitude: 3.34107° W

This is an estimation of the greenfield runoff rate limits that are needed to meet normal best practice criteria in line with Environment Agency guidance "Preliminary rainfall runoff management for developments", W5-074/A/TR1/1 rev. E (2012) and the CIRIA SUDS Manual (2007). It is not to be used for detailed design of drainage systems. It is recommended that every drainage scheme uses hydraulic modelling software to finalise volume requirements and design details before drawings are produced.

Reference: gcjs7gp5ermd / 12.6
Date: 28 Mar 2014

Site characteristics

Total site area	12.6	ha
Significant public open space	0	ha
Area positively drained	12.6	ha

Methodology

Greenfield runoff method	FEH	
Qmed estimation method	Calculate from BFI and SAAR	
BFI and SPR estimation method	Calculate from dominant HOST	
HOST class	N/A	
BFI / BFIHOST	0.00	
Qmed	N/A	l/s
Qbar / Qmed Conversion Factor	N/A	

Hydrological characteristics

	Default	Edited	
SAAR	901	901	mm
M5-60 Rainfall Depth	20	20	mm
'r' Ratio M5-60/M5-2 day	0.3	0.3	
FEH/FSR conversion factor	0.86	0.86	
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Growth curve factor: 30 year	1.78	1.78	
Growth curve factor: 100 year	2.18	2.18	

Greenfield runoff rates

	Default	Edited	
Qbar	---	---	l/s
1 in 1 year	---	---	l/s
1 in 30 years	---	---	l/s
1 in 100 years	---	---	l/s

Please note that a minimum flow of 5 l/s applies to any site

D. DCWW Corespondence

Waterman
38 Cathedral Road
Cardiff
CF11 9LL

Date: 08/10/2012
Enquiries Tel.: 08009172652
Our Ref.: 2012/DCWW/82868
Your Ref.: C 13532 120913 GT L
Grid Ref.: ST0671666369

FAO: Graeme Tulip

Dear Sir

Re: Residential development for approximately 350 homes, Porthkerry Road, Rhoose, Cardiff, CF62 3LY

Further to the above consultation we would provide the following comments:-

SEWERAGE

In relation to capacity to accept sewage flows from the proposed development, we would confirm the following.

The public sewerage system in the area of the proposed development is generally of a separate type.

It is unlikely that sufficient capacity exists within the public sewerage system to accommodate the additional flows from the proposed development of approximately 350 dwellings. Therefore, in order to progress matters it will be necessary to carry out a hydraulic modelling assessment of the public sewerage network in order to establish whether a point of adequacy exists within the network to accommodate the development, and / or any improvements works required. For you to obtain a quotation for the hydraulic modelling assessment (HMA), we will require a fee of £250 + VAT. This fee is non refundable, payment must be made by cheque, made payable to Dwr Cymru Welsh Water, and sent to the above address.

We can confirm that the last HMA for this site known as Rhoose Point was undertaken in 2005 and was based on a model previously verified in 2003. The outcome of the 2005 HMA provided 4 no. options to the developer for connection as follows: Option 1 A gravity off line attenuation at Porthkerry Pumping Station; Option 2 A pumped off line attenuation at Porthkerry Pumping Station; Option 3 Online Storage upstream of Porthkerry Pumping Station and Option 4 Intercept Rhoose Pumping Station Rising main.

In 2007 the model was updated as part of a separate scheme within the catchment. However, since the model was verified a large development has been built near the proposed Rhoose development. Therefore, the model will need to be updated and re-verified before it can be used for a new HMA.

In relation to the surface water flows from the proposed development, these will have to be disposed of separately by other means, such as using soakaways or discharging directly to a watercourse. Permissions to connect to a watercourse may need to be sought from the Land Drainage Authority and / or Environment Agency.

Please note that no highway or land drainage run-off will be permitted to discharge directly or indirectly into the public sewerage system.

As indicated on the attached public sewer record the development site is crossed by a 300mm public foul sewer. Please note that no development (including the raising or lowering of ground levels) will be permitted within the safety zone of the sewer which is measured 3 metres either side of the centreline (6 metres in total).

If any onsite or offsite sewers are to be offered for adoption, an application should be made to this office. The design of which should be in accordance with the publication "Sewers for Adoption" - 7th Edition.

The Welsh Government have introduced new legislation that will make it mandatory for all developers who wish to communicate with the public sewerage system to obtain an adoption agreement for their sewerage with Dwr Cymru Welsh Water (DCWW). A Mandatory Build Standard for the construction of sewerage apparatus and an agreement under Section 104 of the Water Industry Act (WIA) 1991 will need to be completed in advance of any authorisation to communicate with the public sewerage system under Section 106B WIA 1991 being granted by DCWW.

The new standard came into force on the 1 October 2012 and we would welcome your support in informing applicants who wish to communicate with the public sewerage system to engage with us at the earliest opportunity. Information on the Mandatory Build Standards is available for viewing on the Developer Services Section of our website - www.dwrcymru.com

Further information on the Mandatory Build Standards can be found on the Welsh Government website - www.wales.gov.uk

SEWAGE TREATMENT

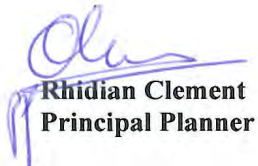
No problems are envisaged with the Waste Water Treatment Works for the treatment of domestic discharges from this site.

WATER SUPPLY

A water supply can be made available to service this proposed development. However, this would require the installation of off-site mains from our 200mm diameter watermain in the junction of Pentir Y De and Porthkerry Road location. A budgetary cost for providing a watermain to the periphery of your development would be circa £57k. Under Sections 40 - 41 of the Water Industry Act 1991 the above cost is requisitionable and, subject to us receiving your detailed site layout plan and your programme for construction, we would be able to provide a more accurate assessment of the developer's contribution. These details should be sent to the above address.

We hope the above is satisfactory. However, should you require further assistance please contact us on the above telephone number, quoting our reference.

Yours faithfully,



Rhidian Clement
Principal Planner






















































































































Enc: Sewer Plan
Water Plan
Receipt

Demands upon the water and sewerage systems change continually; consequently the information given above should be regarded as reliable for a maximum period of 12 months from the date of this letter.



Porthkerry Road

LEGEND(Representative of most common features)

- | Abstract symbols | Food chamber | Solution water chamber | Combustion chamber | Water chamber | Special purpose chamber | Treatment mode | Private sewer | Private sewer subject to bank | Private sewer (no agreement) | Private Sewer Transfers | Lateral Drains | Inspection Chamber |
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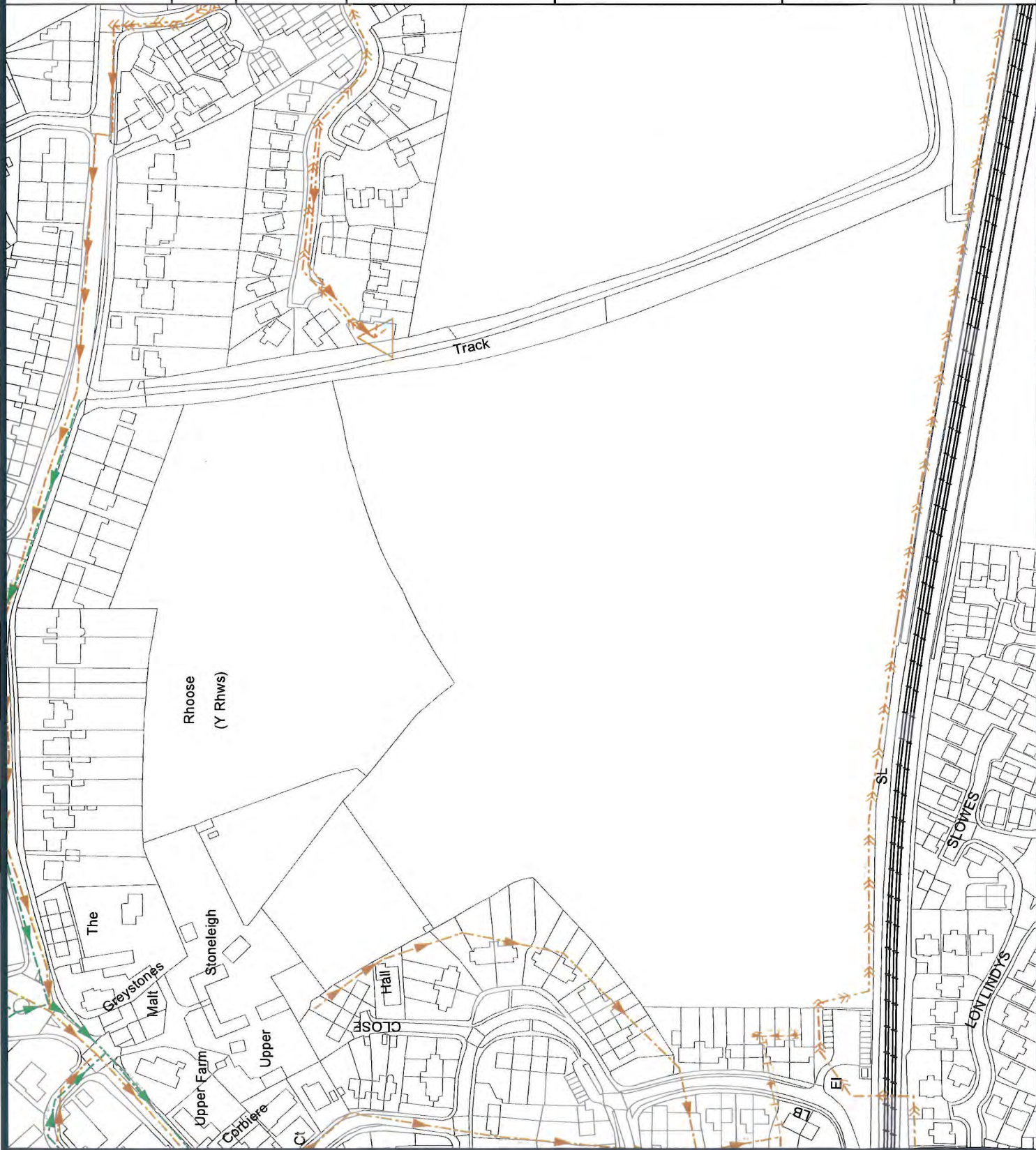
Notes:

Dor Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available at the time of writing. It is not intended to constitute a warranty of the accuracy of the works made in the vicinity of the Company's apparatus and any crisis of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

**EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.**

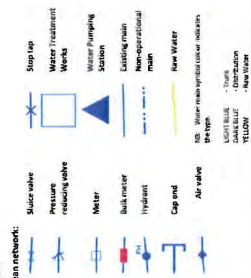
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Map Ref: 306543 166492
Map scale: 1:2,500
Printed by: Mel
Printed on: 26/9/12





LEGEND



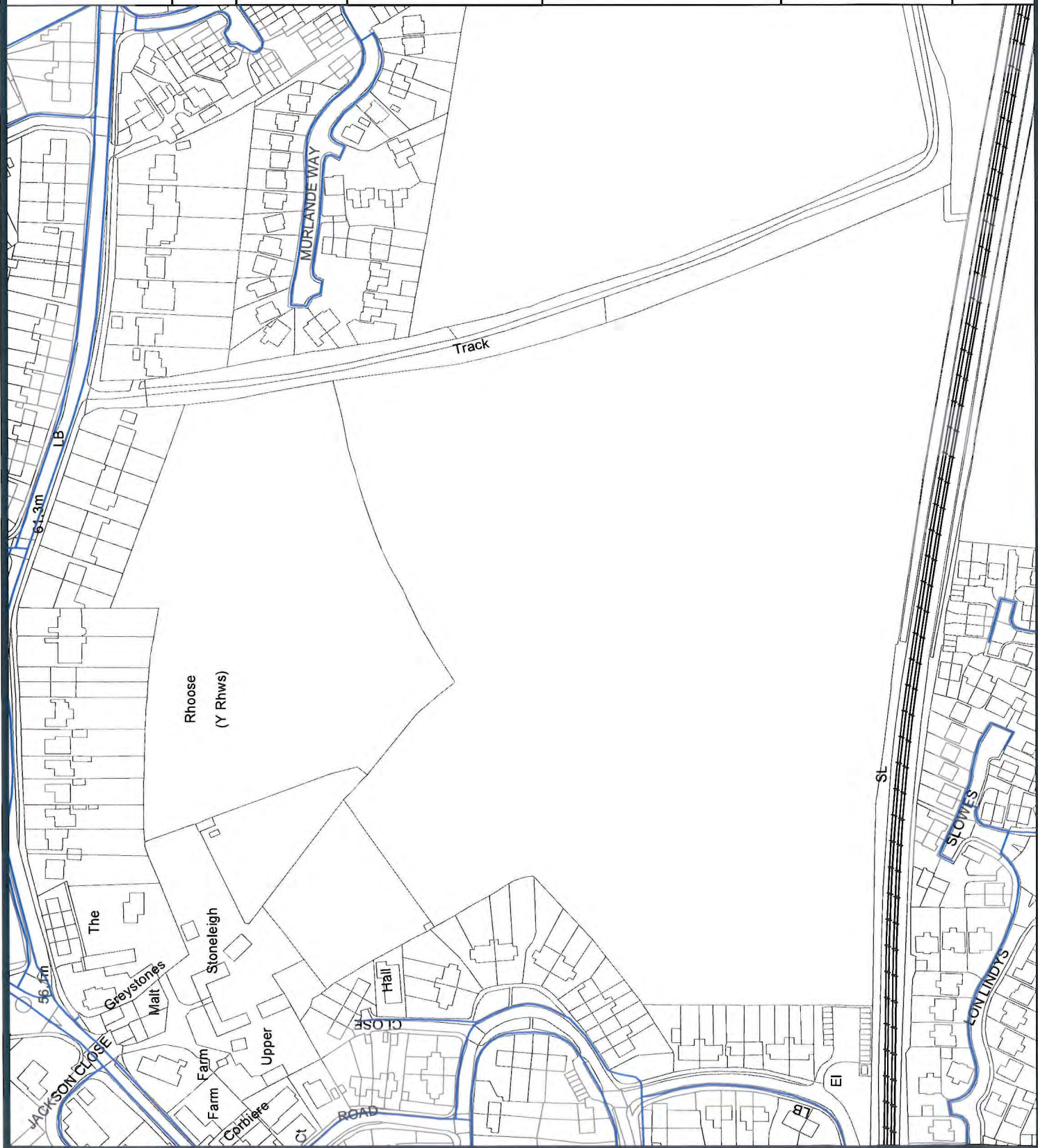
Notes:

Dŵr Cymru Cymru gives the information as to the position of its underground apparatus by way of general guidance only on the basis of the best information available to it at the time of the survey. It is not responsible for any damage to property or persons caused by the use of the information for any purpose other than that for which it was intended. It is the responsibility of the user to ensure that the information is used in accordance with the relevant legislation and to ensure that the information is not used for any purpose other than that for which it was intended. It is the responsibility of the user to ensure that the information is used in accordance with the relevant legislation and to ensure that the information is not used for any purpose other than that for which it was intended.

**EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.**

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Map Ref: 306543 166492
Map scale: 1:2,500
Printed by: Mel
Printed on: 26/9/12





DŴR CYMRU
WELSH WATER

OFFICIAL RECEIPT

VAT No GB 7711231 59

Pentwyn Road, Nelson, Treharris CF46 6LY
Tel: (01443) 452300 Fax: (01443) 452323

Date: 18-Sep-12

Receipt No: 124377

HCL Ref: 388016

WATERMAN
38 CATHEDRAL ROAD
CARDIFF

CF11 9LL

Cheque No
11293

ServiceDescription	Quantity	Net Charge	VAT Charged	Value
Spec Develop Enqry Level 1 Combine	1	£150.00	£30.00	£180.00
TOTALS		£150.00	£30.00	£180.00

Total (exc VAT) £150.00

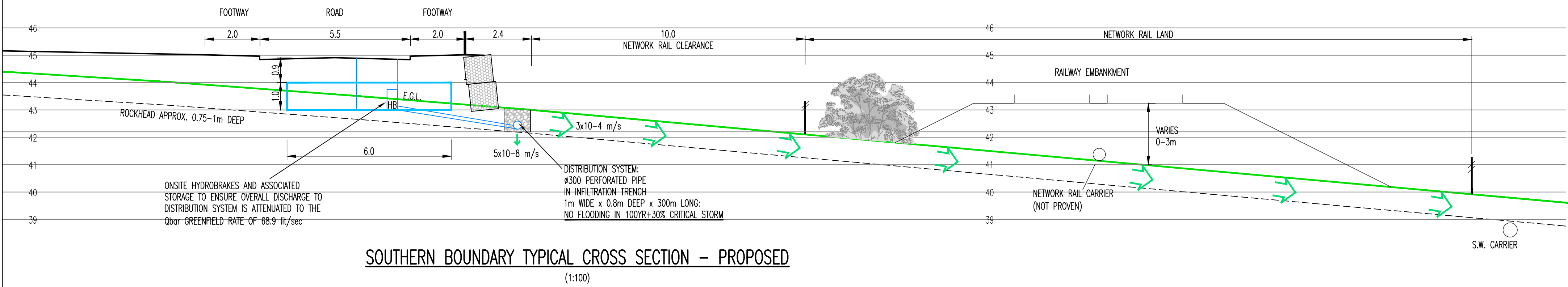
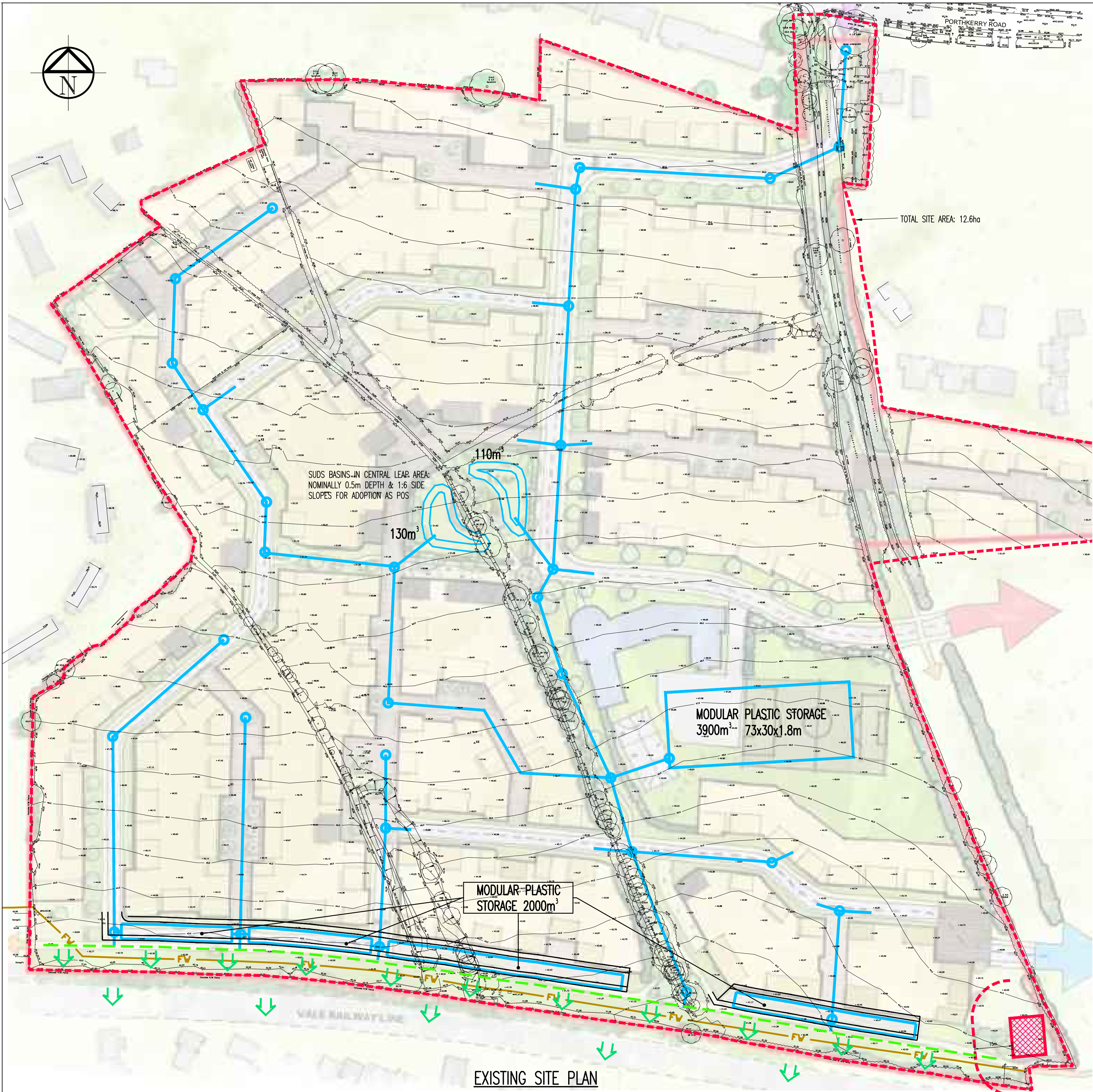
Total VAT £30.00

Total Value Received £180.00

FOR THE COMPANY

E. Existing Hydrology

F. Proposed Drainage



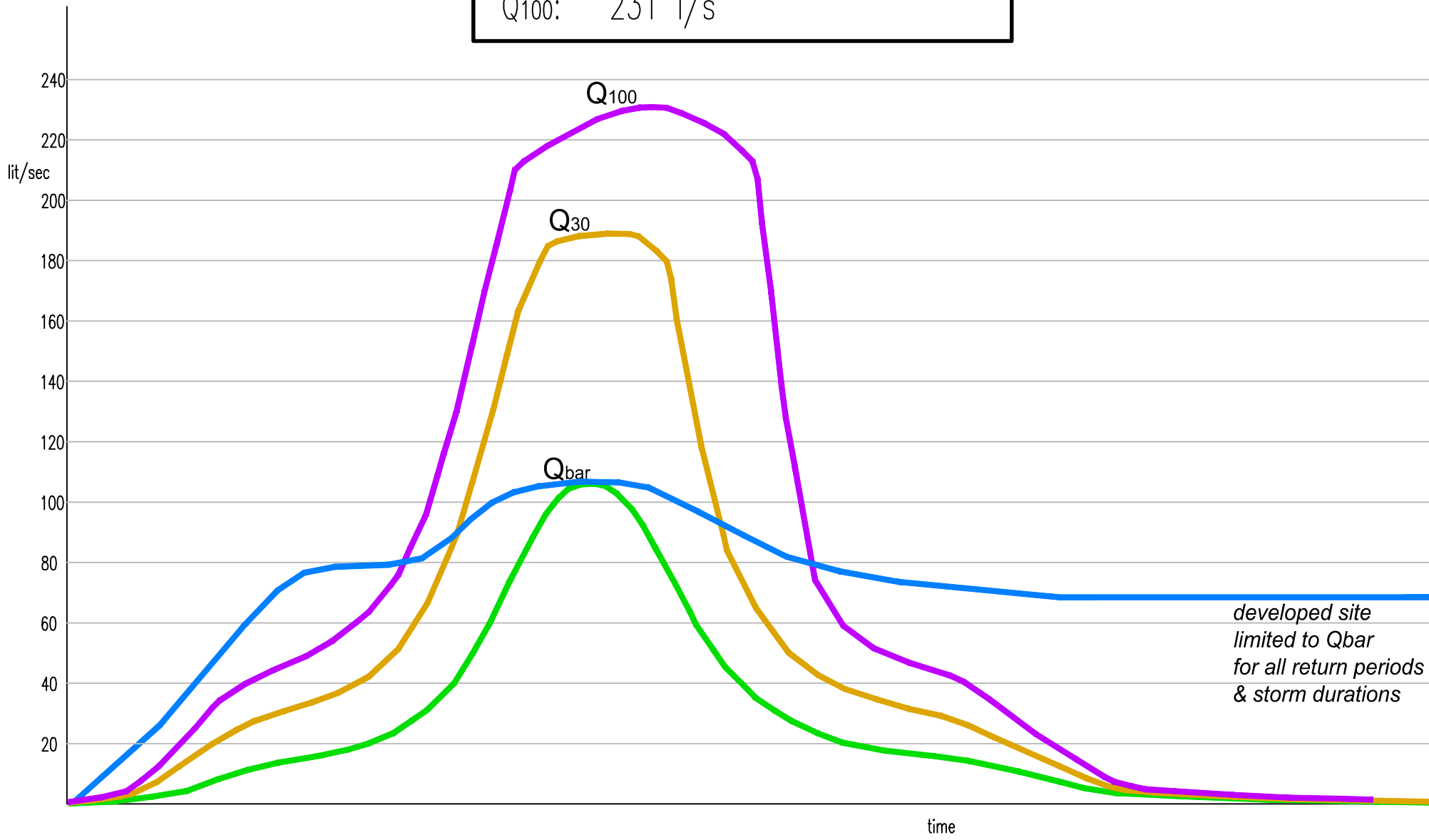
Greenfield Runoff: IH124 Methodology, Site Area 12.6ha, Soil Type 5

$Q_{bar}: 106 \text{ l/s} = 8.41 \text{ l/s/ha}$

$Q_{30}: 189 \text{ l/s}$

$Q_{100}: 231 \text{ l/s}$

$\rightarrow \times 12.6\text{ha} \times 65\% \text{ impermeable} = 68.9 \text{ lit/sec}$



TYPICAL HYDROGRAPH

This drawing should not be scaled. Dimensions to be verified on site.
Any discrepancies should be referred to the Engineer prior to work being put in hand.
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Pickfords Wharf, Clink Street, London SE1 1DG t 020 7928 7888 f 020 7902 0992

- KEY:
- ↓
- DRAINAGE MECHANISMS IN THE DEVELOPED SITE ARE DESIGNED TO MIMIC THE EXISTING MECHANISMS, WHILST ALSO PROVIDING SIGNIFICANT DOWNSTREAM AND ONSITE FLOOD RISK MITIGATION.
- FUTURE SITE DRAINAGE MECHANISMS:
- i) Laterally in southerly direction through free-draining top layer out of southern boundary infiltration trench.
 - ii) Vertically from infiltration trench in to weathered limestone as status quo (low but measurable permeability)
 - iii) Overland flow reduced at southern boundary: infiltration trench sized to accommodate 100yr+30% critical storm without flooding.

A02	27.03.14	DRAINAGE UPDATED, SOUTHERN BOUNDARY TYPICAL CROSS SECTION AND QBAR GRAPH & TABLE ADDED.	SJ
A01	21.03.14	FIRST ISSUE	SJ
Rev	Date	Description	By

Amendments

Project: PORKHERRY ROAD, RHOOSE

Title: DRAINAGE LAYOUT

Client: TAYLOR WIMPEY

38 Cathedral Road Cardiff CF11 9LL
t 029 2038 4400 f 03333 444 501
mail@watermangroup.com www.watermangroup.com

Drawing Status				
PRELIMINARY				
Designed by	GT	Checked by	GT	Project No
Drawn by	SJ	Date	MARCH 2014	15342 -
Scales @ A1		1:1000	Computer File No	
work to figured dimensions only			C:\15342-SA-92-001.dwg	
Publisher	Zone	Category	Number	Revision
CIV	SA	92	0001	A02

