

Engineers in Partnership

Flood Risk Assessment & Drainage Strategy

Report

*Residential Development at
Boverton*

for

David Wilson Homes

July 2014

Project no. 14009

Revision A

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& Drainage Strategy*

Document Control

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Signatories in this approval box have checked this document in line with the requirements of QuadConsult QMS Procedures				

Revision History

Revision	Date	Purpose/Status	Approved
A	07-08-2014	Final Issue	SPM

Distribution

	Function Title	Company	Name
0			
1			
2			
3			

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References

TAN 15 Development & Flood Risk
CIRIA C697 The SuDS Manual
CIRIA C635 Designing for Exceedance
CfSH
CFSH Tech Guide

Abbreviations

1.0 INTRODUCTION

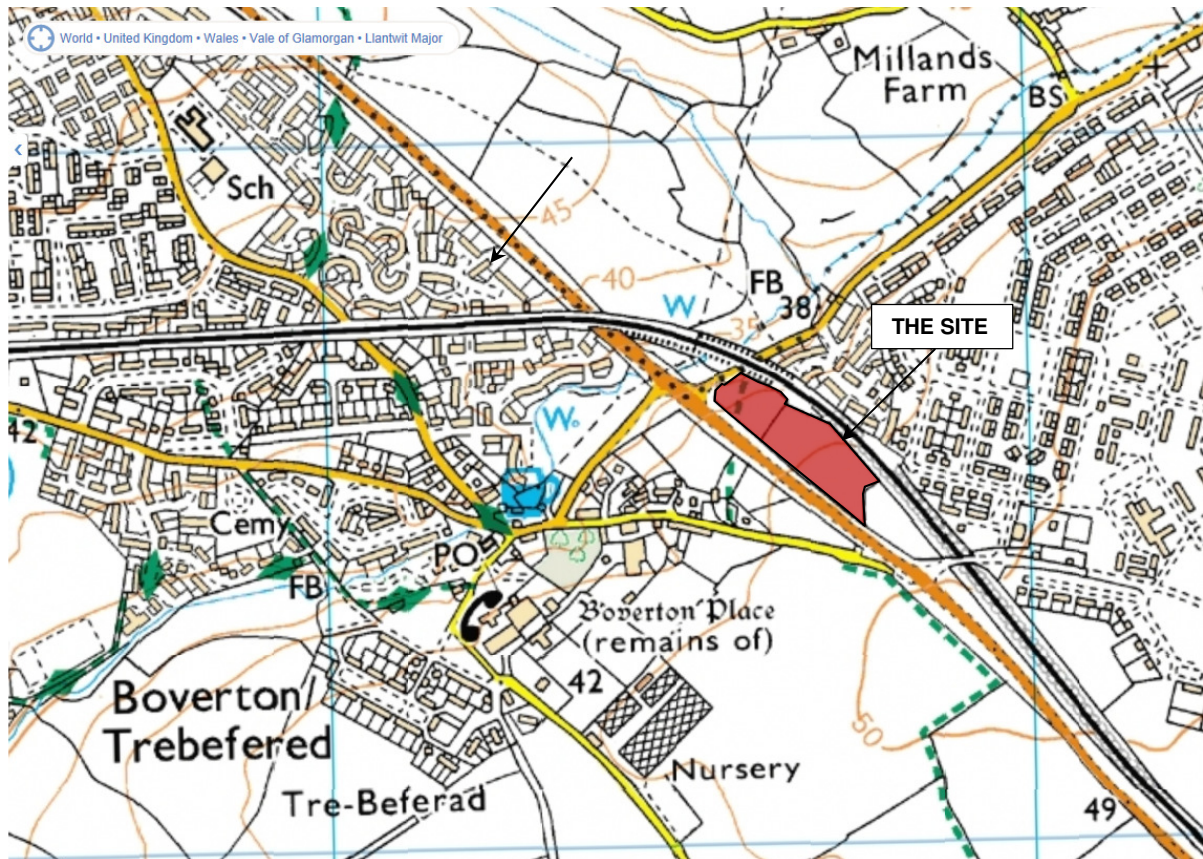
- 1.1 QuadConsult Ltd has been commissioned by David Wilson Homes to undertake a Flood Consequences Assessment (FCA) and foul and surface water drainage disposal strategy in support of a planning application for a 64 unit residential development off the B4265 in Boverton on the outskirts of Llantwit Major.

2.0 SCOPE

- 2.1 This Flood Consequences Assessment has been prepared in accordance with *Planning Policy Wales Technical Advice Note 15 Development & Flood Risk*, good practice and CIRIA C697 Sustainable Urban Drainage and the Code for Sustainable Homes.
- 2.1.1 Demonstrate that there is a low risk of flooding from all sources including fluvial, tidal/ coastal, groundwater, sewers and infrastructure failure.
 - 2.1.2 Assess the acceptability for Flooding Consequences.
 - 2.1.3 Consider Flood Mitigation Measures where appropriate.
 - 2.1.4 Propose a Foul and Surface water drainage strategy.
 - 2.1.5 Conclude with a summary of Flood Risk mitigation measures if required.

3.0 SITE LOCATION

- 3.1 The proposed development is a Greenfield site which abuts the B4265 (Llantwit Major bypass) and is situated between the village of Boverton and M.O.D St. Athan. It is situated 1.2 miles east of Llantwit Major.
- 3.2 There is a live rail line approximately 15 metres to the north of the site.



SITE LOCATION

4.0 SITE DESCRIPTION & TOPOGRAPHY

- 4.1 The site is greenfield and comprises 2 No. land parcels separated by a wire fence reinforced with dense planting.
- 4.2 It slopes from south east to north-west at a reasonably uniform grade of 1 in 20; the southern edge is predominantly an embankment falling down to the B4265 and is defined at its top edge by a wooden rail fence which is again reinforced with dense planting.
- 4.3 The site is defined along all boundaries by fences and dense planting and made accessible by a concrete track off Eglwys Brewis Road; a 300mm diameter surface water drain at the foot of the embankment to the south is also recorded on the topographic survey.
- 4.4 There are also other dense pockets of vegetation across the site primarily around the dilapidated barn/stable.
- 4.5 A review of the topographical survey and Ordnance Survey do not indicate the presence of any watercourse within the site, the nearest identifiable watercourse being the Boverton Brook situated on the other side of Eglwys Brewis Road approximately 50m to the north west of the site.
- 4.6 Integral Geotechnique have undertaken a site investigation and provided an interpretative report.
- 4.7 The site typically falls from 48m A.O.D in the south east to 35m in the northwest of the site.

5.0 EXISTING GEOLOGY & HYDROGEOLOGY

- 5.1 The site geology typically comprises 300mm topsoil over 0.5m (localised) silty clays over weathered limestone comprising clayey GRAVELS and COBBLES with frequent boulders of angular and tabular limestone. An extract of the hydrogeology section of the Integrals Geotechnique report is shown below:

Boverton Brook is located some 15m to the north of the site. The Brook flows in a south-western direction. Llanmaes Brook flows into Boverton Brook some 150m to the northeast of the site. Boverton Brook becomes Hoddnant when passing through the village of Boverton, to the south-west of the site.

The Environment Agency groundwater vulnerability map and aquifer database classifies the bedrock beneath the site as a Secondary 'A' Aquifer. Secondary 'A' Aquifers are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers

There are no superficial soils beneath the site; hence no classification for superficial soils is applied. Given the anticipated ground conditions, no perched water body is anticipated.

The Envirocheck report indicates that there are no recorded discharge consents within 500m of the site, and only two within 1km. The nearest discharge consent is recorded some 773m to the north-east of the site and operated by Kelda Water Services (Estates) Limited. The discharge is located at Royal Air Force (West Camp) St Atha, St Athan Nr Barry, where trade effluent is discharged into Boverton Brook.

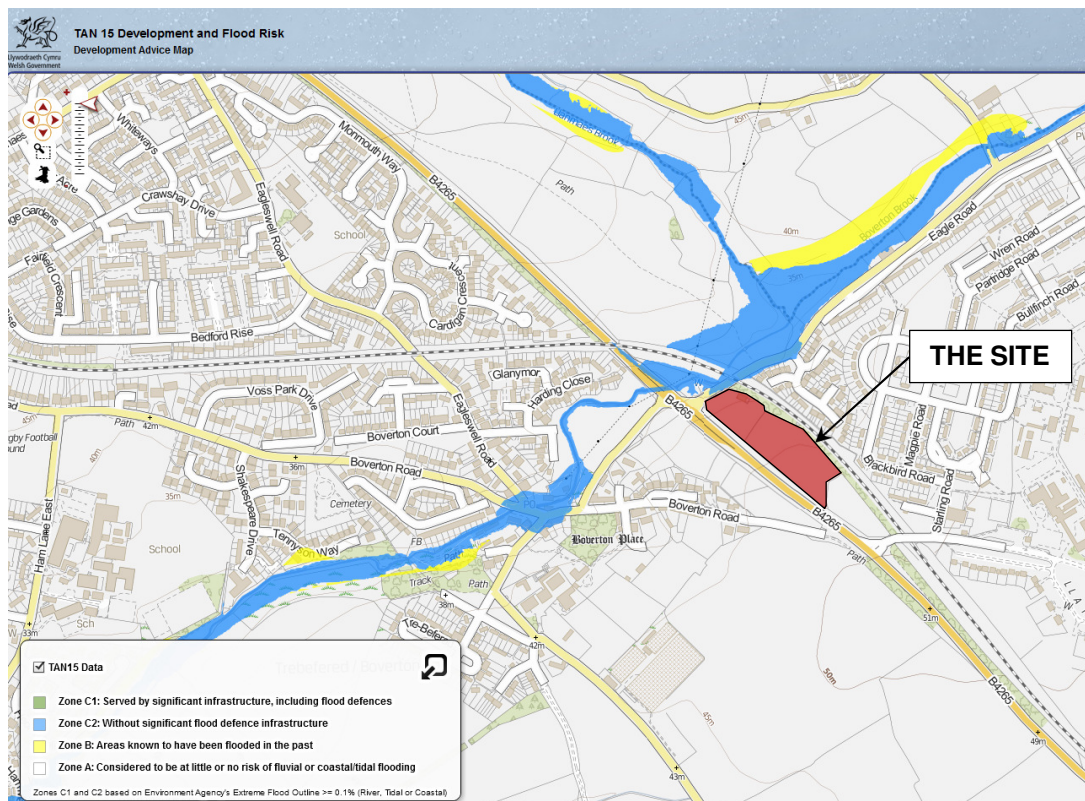
The Envirocheck Report states that there are no groundwater abstractions within 500m of the site. It is important to note, however, that an artesian well and pumping station is recorded on ordnance survey and historical maps to be located some 30m to the north of the site. The abstraction rate from the well is probably of such a volume that it does not require registration

The soils have been classified as having a high leachate potential. Soils of high leaching potential are coarse textured or moderately shallow soils which readily transmit non-absorbed pollutants and liquid discharges but which have some ability to attenuate absorbed pollutants because of their large clay or organic matter contents

Extract from Integral Geotechnique Report

6.0 TAN15 EXISTING FLOOD RISK

6.1 QuadConsult Ltd has reviewed the Development Advice Maps, an extract of which is shown below.



6.2 Figure 2 of TAN 15 defines highly vulnerable development as “...all residential premises (including hotels and caravan parks) public buildings (e.g. schools, libraries, leisure centres), especially vulnerable industrial development (e.g. power stations, chemical plants, incinerators) and waste disposal sites.

6.3 **The site and surrounding area lies wholly within Zone A** and is therefore considered to be at **little or no risk** of fluvial or coastal/tidal flooding.

6.4 A review of the NRW flood maps confirm that the nearest potential source of fluvial flooding to be from the Boverton Brook to the north west of the site. Inspection of the site topography in this area suggests an extreme flood event level approximating to 35m A.O.D. Based upon the preliminary site layout the lowest anticipated slab level will be in the order of 41.45m, some 6m above the extreme event level.

6.5 *Fig 1 of TAN 15 therefore concludes that the requirements of the sequential test are deemed to have been met in that there are no competing sites with a lower flood risk. The development consequently accords with the requirements of TAN 15 and Planning Policy Wales (6th Edition February 2014)*

7.0 ASSESSING FLOODING CONSEQUENCES

- 7.1 The site is deemed to be at little or no risk of fluvial or tidal/ coastal flooding as discussed in the preceding section 6.0 but TAN 15 and SUR 2 require the site to be assessed against all sources of flooding.
- 7.2 Other sources of flooding would include:
- 7.3 **Streams & Rivers**
- 7.4 As previously stated there are no other streams or watercourses in the locality other than that described in the preceding section.
- 7.5 Consequently the site can be considered at negligible risk of flooding from streams and rivers.
- 7.6 **Groundwater**
- 7.7 The Integral Geotechnique report states that no groundwater issues were recorded during the site investigation. The elevated nature of the site in comparison with the surrounding area confirms that the risk of groundwater breaking the surface and potentially threatening properties to be minimal.
- 7.8 **Sewers & Highway Drains**
- 7.9 The new drainage infrastructure will be designed in accordance with Sewers for Adoption 7th Edition and the Code for Sustainable Homes. Consequently, the proposed drainage network design will ensure that no surface water escapes for the 30 year storm event and that it also meets with the requirements of the Code for Sustainable Homes Category 4 (Sur1) for storms up to and including the 100 year +CC events.
- 7.10 The storm events should be modelled using sensitivity analysis with a view to determining where the network would flood and to what extent. The site has a reasonable fall across it so velocities and routes of escaped surface flows will be considered at detailed design stage.
- 7.11 The proposed surface water drainage design philosophy is described in more detail in Section 10.0, but basically comprises a traditional piped gravity system outfalling to an infiltration basin and/or soakaways. Some permeable paving and domestic soakaways have also been proposed to dispose of surface water at source with a view to reducing the overall size of the infiltration basin. Surface water at the site entrance is also proposed to connect into the existing 300Ø surface water drain that runs at the foot of the embankment adjacent the B4255. Any potential flood routing arising from exceedance would occur along the proposed highway away from the properties.
- 7.12 The proposed layout of the site considers flow paths, should surcharge and subsequent flooding of the sewers occur and avoids areas where overland flows could become contained and subsequently enter properties.
- 7.13 The site is elevated above other existing surface and foul water drainage infrastructure and can be considered to be at negligible risk of flood from these sources.
- 7.14 **Surface Water**
- 7.15 The porous nature of the underlying soils suggests that flooding from overland surface water flows to be highly improbable and can therefore be discounted at this stage.

7.16 **Infrastructure Failure**

- 7.17 The most probable mode of flooding on the site, apart from sewer surcharge, would be as a result of collapse or blockage of the surface water sewer network. If this occurred, surface water would escape through either the manhole covers or gullies.
- 7.18 The foul and surface water drainage infrastructure will be designed in such a way so as to direct any escaped flows away from properties, in particular entrances to dwellings. Dwellings should ideally be sited away from hollows and configured in a manner where water cannot become trapped (i.e. low points confined on three sides)

8.0 ACCEPTABILITY FOR FLOODING CONSEQUENCES

- 8.1 Section A1.14 and A1.15 of TAN 15 define the acceptability criteria adopted when considering a site for development. For residential developments where a fluvial mechanism is thought the most likely the frequency threshold is 1% (the 1 in 100 probability in any one year).
- 8.2 This report has already addressed this likelihood and concluded that the site is at little or no risk of fluvial or tidal/ coastal flooding.
- 8.3 The previous sections of this report conclude that the most likely mechanism for flooding would be via infrastructure failure.
- 8.4 The development layout of the site should be assessed against the proposed drainage network. Surcharging or flooding of any manhole or gully should be assessed in terms of flood routing and ensure that no property is at risk as a result of surface water escape. Particular attention should be paid to any low lying properties.
- 8.5 The site could then be considered safe from all perspectives of flooding and the proposed usage as residential deemed suitable.

9.0 FLOOD MITIGATION MEASURES

- 9.1 The likelihood of flooding affecting the properties is deemed negligible from all sources although the following actions could be implemented as a precautionary measure.
- 9.1.1 Thresholds to properties can be designed in a manner to direct water away towards landscaped or grassed areas thereby affording dry access and egress.
- 9.1.2 Boundary treatments throughout the site should leave sufficient clearance to allow potential surface flows to bypass properties without impediment.

10.0 SURFACE WATER DRAINAGE STRATEGY

- 10.1 The site geology is such that at present rainfall simply drains to ground through the topsoil and relatively permeable substrate.
- 10.2 Part H of the Building Regulations and current best practice requires a sequential approach for the disposal of surface water. In the first instance, investigations are undertaken to determine if runoff can be treated and disposed of at source via infiltration, following which watercourses and positive drainage systems can be considered adopting the principles and techniques described in **CIRIA C697 'The SuDS Manual'**.
- 10.3 As the site is to be assessed against the Code for Sustainable Homes (CfSH), there is also a requirement that the peak rate of runoff should not increase over the development lifetime (allowing for climate change) above that for the predevelopment site for the 1 year and 100 year return periods.
- 10.4 QuadConsult Ltd has reviewed the site investigation report undertaken by Integral Geotechnique (Ref: 11344/GNS/14/SI) and note that infiltration rates between 1.52×10^{-5} and 5.19×10^{-5} m/s have been determined across the site; test results of this order suggest that infiltration techniques are appropriate for surface water disposal. Further testing will be required at the proposed location and depth of infiltration structures at detailed design stage, to ensure that a robust solution is proposed to satisfy the requirements of the adopting authority and Code.
- 10.5 The layout of the development is such that there is available space on the west of the site to locate an infiltration basin and/or soakaways. The general topography and proposed development levels lead to this natural point of outfall. A drainage concept plan is included in Appendix A. Soakaways to the rear of properties are also proposed to deal with surface water disposal at source rather than concentrating all flows at the infiltration basin.
- 10.6 Preliminary calculations have been prepared to demonstrate that surface water can be routed, stored and disposed of via infiltration for a range of storm return periods including the 100yr + CC and included in Appendix B, also summarised below. The half drain-down times have been checked and comply with BRE 365 and C697 requirements. As space is limited in the open area some disposal at source has also been proposed in the form of porous surfacing and soakaways as highlighted on the drainage concept plan. **All of these techniques accord with the requirements of CIRIA C697 'The SuDS Manual'**.

Return Period (years)	Max Volume Stored (m ³)	Half Drain Time (mins)
2	92	87
30	206	201
100+ CC	411	379

- 10.7 The broad shallow nature of the infiltration basin also suggests that it could double as an amenity or landscape area, encouraging biodiversity and providing an asset to the local residents.

- 10.8 A small section of the access highway is proposed to connect to the 300Ø surface water land drain at the site access subject to approval from the highway authority. This is because it is not practical to drain back into the site.

11.0 FOUL WATER DRAINAGE STRATEGY

- 11.1 The proposed development of 64 units will generate a predicted peak flow of approximately 3 l/s. A review of the DCWW sewer records for the area indicates the presence of a public 225mm diameter foul water sewer to the west of the site in Eglwys Brewis Road.
- 11.2 We propose to connect into this sewer as shown on the drainage concept plan although this is subject to DCWW approval. QuadConsult Ltd would not envisage the flow rate of 3l/s presenting a problem although the ability of the receiving treatment plant to cater for the flows would need to be checked with DCWW.
- 11.3 It is a legal requirement for the developer to have a Section 104 Agreement in place prior to communication with an existing public sewer (see below)

Companies wholly or mainly in Wales

“On 1st October 2012 the Welsh Government implemented Section 42 of the Flood and Water Management Act 2010 in the operating area of Dŵr Cymru Welsh Water. This requires any developer who wishes to make a connection to the public sewer system, that creates any sewers or lateral drains first to enter into a Section 104 agreement with the Water and Sewerage Company that will ensure the any sewers or lateral drains created by the connection will be adopted by the Sewerage Undertaker”

12.0 SUMMARY & CONCLUSIONS

12.1 SUMMARY OF FLOOD RISK

12.2 The site satisfies the requirements of TAN 15 Figure 1 in that it is located within Zone A as described on the Natural Resources Wales Development Advice Maps and consequently satisfies the aims of the precautionary framework by directing development away from those areas which are at high risk of flooding.

12.3 The primary potential source of flooding is either through surcharge or failure of the proposed surface water infrastructure although using established engineering techniques and appropriate design the likelihood and effects of this are deemed manageable.

12.4 With appropriate design, the development will remain flood free for the 1:100+CC year event.

12.5 Flood risk via other mechanisms such as coastal, groundwater or surface and foul sewer infrastructure flows have been considered and deemed to be negligible and manageable.

12.6 The proposed development would have no significant detrimental effects to third parties in the event of flood.

12.7 Summary of SW & FW Disposal

12.8 The percolation test results contained within the site investigation suggest that disposal of surface water via infiltration techniques to be appropriate.

12.9 The layout of the site is such that construction of an infiltration basin to the west of the development coupled with localised soakaways and porous surfacing is deemed most appropriate. This fully accords with the principles described in CFSH and CIRIA C697 The SUDS Manual for surface water disposal and treatment.

12.10 The infiltration basin could also provide a useful open/landscape area for either recreational purposes or to encourage biodiversity in the area.

12.11 Predicted peak foul water flows from the development at 3 l/s should not present a significant impact onto the local foul network although approval to communicate with the sewer must be secured and agreed with DCWW. The ability of the receiving treatment plant to cater for the additional loads will also need to be checked with DCWW.

12.12 MITIGATION MEASURES

12.13 Thresholds to properties can be designed in a manner to direct water away towards landscaped or grassed areas thereby affording dry access and egress.

12.14 CONCLUSION

12.15 The proposed development complies with the criteria when assessing flood consequences as laid out in Section 7 and Appendix 1 of TAN 15.

12.16 Surface water can be disposed of primarily within the curtilage of the site using appropriate techniques described within CIRIA C697 'The SuDS Manual' using infiltration techniques. A connection with the existing 300Ø land drain at the site entrance will also be required to deal with surface water run off at its junction with the B4265.

12.17 The FCA demonstrates that with appropriate design the proposed properties will remain flood-free for the 100+CC event and that safe routes of access and egress can be provided.

12.18 It could then be concluded that in terms of flood risk the proposed development is acceptable.

APPENDIX A
DRAINAGE CONCEPT PLAN

APPENDIX B
ATTENUATION CALCULATIONS

