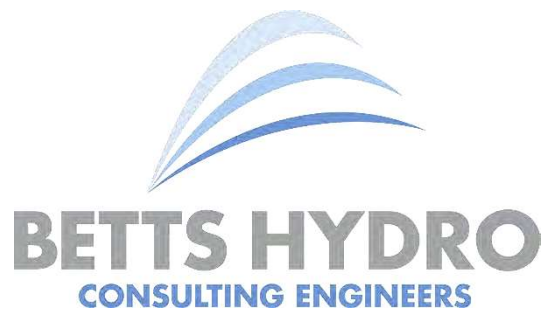




**LAND EAST OF TAN Y BONT
MAIN ROAD, RHOSROBIN
WREXHAM**

**FLOOD CONSEQUENCE ASSESSMENT
AND DRAINAGE MANAGEMENT STRATEGY**



For

Castle Green Homes Limited
Unit 20
St Asaph Business Park
St Asaph
Denbighshire
LL17 0LJ



AUGUST 2021

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**LAND EAST OF TAN Y BONT
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AND DRAINAGE MANAGEMENT STRATEGY**

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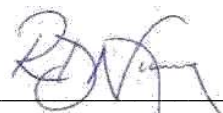
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EXECUTIVE SUMMARY

This Flood Consequence Assessment and Drainage Management Strategy was commissioned by Castle Green Homes Limited referred to hereafter as 'the client'. This assessment has been prepared to support a planning application for the construction of residential development on land east of Main Road in Rhosrobin, Wrexham.

Flood Risk

The total site covers 15.76ha and in accordance with TAN15, the proposals are highly vulnerable in nature. Consultation with the National Resources Wales, Wrexham County Borough Council and Welsh Water have been carried out and have not identified any historical flooding to the site. This assessment has reviewed all sources of flood risk both to the development, including fluvial, tidal, pluvial, groundwater, sewers, and flooding from artificial sources.

National Resources Wales' data sets show the site to be at very low risk from fluvial and tidal flood risk sources. The nearest Main River (River Alyn) is located 400m to the north. The flood risk to the site from the River Alyn is 'very low' due to its proximity from the site and the surrounding topography. Onsite land drainage features have been identified from a site walkover, although these features are understood to aid in the local drainage only and due to their small scale/nature the flood risk associated is understood to be low.

The primary source of flood risk to the site is considered to be from surface water flooding. The potential flood risks to the site from surface water will be managed and reduced, post-development, through appropriate levels design and incorporation of a sustainable drainage management system. Due to the relatively low flood risks identified as part of this assessment, the principle focus of this assessment is on the sustainable management of surface water run-off to ensure that no increased flood risk results from the proposals.

Drainage Strategy

In order for the development proposals to be justified in line with the guidance set out in SuDS Standards for Wales, new development must not increase flood risk elsewhere and where possible offer improvement on the pre-development situation. The sustainable drainage hierarchy has been considered in accordance with the Welsh SuDS Standards, which look to deal with surface water run-off as close to source as is practical.

The published online datasets have been reviewed to consider how favourable the underlying strata is to support a potential infiltration-based drainage solution. The online datasets and FEH catchment characteristics are further supported by BRE 365 Soakaway Testing undertaken by Tier Consult Ltd (Ref: T/14/1400-DS1/SGJ). The report identified there was a range of infiltration characteristics across the site.

It is therefore proposed that any impermeable areas that can drain to soakaway (or an alternative method of infiltration) should do so via appropriately designed infiltration-based solution, as this would significantly improve the sustainability of the surface water systems. There are potential locations for where larger scale infiltration methods might be suitable.

Detailed design will need to be undertaken to confirm the specific SuDS to be utilised following a more detailed analysis of levels, ground conditions and attenuation requirements, in conjunction with the SAB at Wrexham County Borough Council. The SAB have statutory

responsibility for approving and where appropriate adopting the proposed drainage systems on new developments. This report is to support the proposed planning application and the full SAB approval will need to be sought separately by the developer.

To conclude, the development area has been considered in accordance with TAN15 and suitable mitigation measures have been proposed to ensure that the development is safe for its lifetime. This Flood Consequence Assessment and Drainage Management Strategy is commensurate with the development proposals and in summary, the development can be considered appropriate in accordance with TAN15, providing the mitigation measures proposed are conformed to.

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Abbreviations & Acronyms

BGS	British Geological Survey
CC	Climate Change
DAM	Development Advice Map
FCA	Flood Consequence Assessment
FEH	Flood Estimation Handbook
Ha	Hectare
HD	Hafren Dyfrdwy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	metres Above Ordnance Datum
NGR	National Grid Reference
NRW	National Resources Wales
NSRI	National Soil Resource Institute
OS	Ordnance Survey
PFRA	Preliminary Flood Risk Assessment
PPW	Planning Policy Wales
QSE	Quick Storage Estimate
SFCA	Strategic Flood Consequence Assessment
SAB	SuDS Approving Body
SuDS	Sustainable Drainage Systems
TAN15	Technical Advice Note 15
UKCIP	United Kingdom Climate Impacts Programme
WCBC	Wrexham County Borough Council

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1.0 INTRODUCTION

1.1 Planning Policy Context

- 1.1.1 All forms of flooding and their impact on the natural and built environment are material planning considerations. Planning Policy Wales (PPW) sets out the Government's objectives for the planning system, and how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change. Government policy with respect to development in flood risk areas is contained within the PPW, Technical Advice Note 15, (TAN15) 'Development and Flood Risk' issued in July 2004.

Technical Advice Note 15

- 1.1.2 TAN15 provides technical guidance to supplement the policy's set out in PPW with regards to 'development and flood risk', a framework is provided to enable new development to be considered appropriately with regards to arising risks of fluvial and tidal flooding along with risks associated with additional run-off from development in all locations (see **Appendix A**).

Sustainable Drainage Approval Board (SAB) Requirements

- 1.1.3 From January 2019, all new developments of at least 2 properties or over 100m² in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government standards for sustainable drainage. Schedule 3 of the Flood and Water Management Act 2010 (FWMA) establishes Wrexham County Borough Council as a SuDS Approving Body (SAB).
- 1.1.4 The SAB have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments. The SAB application is undertaken separately to the planning permissions and developers are required to obtain both planning approval and SAB approval prior to commencement of any proposed construction works. This Flood Consequence Assessment and Drainage Management Strategy is to support the proposed planning application and SAB approval will need to be sought separately by the developer once more details are available for the drainage proposals.

1.2 Site Context

- 1.2.1 This Flood Consequence Assessment (FCA) has been prepared to support a full planning application for the construction of residential dwellings on undeveloped land located off Tan y Bont, Main Road, Rhosrobin, Wrexham. Outline planning approval for residential development has already been granted for the site by WCBC (Ref: P/2016/0189). The proposals will therefore be complete with access, car parking, external works and lighting, landscaping, boundary walls/fencing, external services, and drainage.
- 1.2.2 The proposals are Highly Vulnerable in nature and an FCA is required to justify that the proposed development proposals are appropriate. This FCA will provide justification that:

-  The consequences of flooding to that development and elsewhere have been fully considered and implemented against for the lifetime of the development.
-  No increase in flooding will occur to the development area or surrounding area due to the proposals including flooding from surface water and sewers.

1.3 Consultation

- 1.3.1 The preparation of this report has been undertaken in consultation with Natural Resources Wales (NRW), Wrexham County Borough Council (WCBC) and Welsh Water (WW). The responses can be seen in **Appendix B, C and D**. The Local Planning Authority (LPA), WCBC (also acts as the Lead Local Flood Authority), will make the final decision about any planning permission. The LPA should consult with NRW who will provide advice and guidance on flood issues at a strategic level and in relation to planning applications

2.0 EXISTING SITE BACKGROUND

2.1 Location

- 2.1.1 The development is accessed off Tan y Bont, (Main Road) and Plas Acton Road Rhosrobin, Wrexham. The Ordnance Survey National Grid Reference (OS NGR) for the site is E: 333085, N: 352580 and the nearest postcode is LL11 4RP. A Location Plan is included in **Appendix E**. The total site covers 15.76ha and is edged in red in **Figure 1**. To the north of site is Plas Acton Road and residential dwellings, to the east of site is the A483 with further residential dwellings located beyond. To the south of site is Main Road with residential and commercial development located further south and to the east of site lies a railway line and undeveloped land, as illustrated in **Figure 1**.



Figure 1: Existing Site Features Plan (Google Maps, 2021)

2.2 Existing and Historical Land Use

- 2.2.1 The development site is currently undeveloped agricultural land and comprises of low-density vegetation, with some taller shrubs along the field boundaries. As illustrated in **Figure 1**, there are existing onsite land drainage features present within the centre of site, although the full function of these is not currently known. Historically the site was utilised for agricultural purposes.
- 2.2.2 The mapping has also identified that Wat's Dyke (a linear earthworks feature) is located crossing the site from the south towards the northern corner. An offset from this asset has also been indicated on the planning layout. No other historical uses have been identified during the preparation of this report.

2.3 Site Walkover

2.3.1 A site walkover was undertaken by Betts Hydro in January 2021 after a prolonged heavy rainfall event. The site walkover identified that there are existing onsite land drainage features present within the centre of site where naturally low-lying areas are located. Also, within the natural low-lying areas across the site there was evidence of ponding/standing water and saturated ground adjacent to some field boundaries, field boundaries, as shown within **Figure 2**. The A483 is raised relative to the site and run-off naturally conveys across the site towards the south/south-eastern boundary meaning flows are restricted from leaving the site extents due to the elevated bypass.



Figure 2: Site Features and Observations Plan (Betts Hydro, 2021)

2.4 Topography

2.4.1 TAN15 requires all sources of flood risk to be considered, taking into consideration the existing terrain and ground levels. A detailed site topographical survey has been undertaken and reviewed as part of this FCA's (it is included in **Appendix G** for reference). The levels onsite are shown to range from 97.5AOD along the south-western boundary, down to 81.9mAOD within the northern corner of site.

2.5 Justification for Development

- 2.5.1 Planning Policy Wales (5th Ed. – November 2012) states that the Welsh Government is committed to promoting 'sustainable development' by providing for homes, infrastructure, investment and jobs in a way which is consistent with sustainable development principles PPW Sec. 2.2).
- 2.5.2 The FCA will be considerate to the nature and scale of the proposals and will review flood risk to and from the development along with considering any appropriate mitigation measures based on the identified risks.
- 2.5.3 The development proposals are of a Highly Vulnerable nature but will be located solely within Flood Zone A. Mitigation measures are proposed to safeguard the development against any potential residual flood risks identified and it is considered that the proposals can be justified in accordance with TAN15 Guidance.

3.0 DEVELOPMENT PROPOSALS

3.1 Nature of the development

- 3.1.1 This assessment has been prepared to support a planning application for the construction of 189no. residential dwellings on undeveloped land off Main Road in Rhosrobin, Wrexham. As indicated in the planning layout (see snippet in **Figure 3**), the proposals will be complete with access, car parking, external works, landscaping, walls/fencing, external services, and drainage (full plan in **Appendix H**).



Figure 3: Proposed Planning Layout (Castle Green Homes, 2021)

- 3.1.2 The total site area covers 15.76ha, although based on the planning layout the development area will cover a smaller area of 6.51ha (represented by the green dotted line in **Figure 3**). The development area is 100% permeable at present, however given the proposals, the impermeable areas of the site will increase because of development. For this assessment, the post-development impermeable areas are assumed to increase to 66% of the development area, equating to 4.30ha.

3.2 Development Constraints

- 3.2.1 Onsite land drainage features have been identified from a site walkover the mapping, this feature is understood to aid in the local drainage only, and it is likely that there will be development constraints associated. The site layout (**Appendix H**) shows that the proposals will interact with some of the existing land drainage features identified onsite during the walkover and it is therefore proposed that further investigation is undertaken at an early stage to identify their full purpose.

- 3.2.2 Welsh Water (WW) sewer records have identified a public foul water sewer located onsite (see sewer records in **Appendix C**). There is also a requirement to provide maintenance offsets from the centreline of public sewers, where they are located onsite. Where appropriate offsets cannot be achieved then diversion may be required, subject to consent. Early discussion with WW is advised for any proposed works to the public sewer network. Based on the layout an appropriate offset has been allowed for.
- 3.2.3 Review of the mapping has also identified that Wat's Dyke (a linear earthworks feature) is located crossing the site from the south towards the northern corner. An offset from this asset has been included within the planning layout.
- 3.2.4 All new developments of at least 2 properties or over 100m² in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government standards for sustainable drainage. The SAB (WCBC) have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments. The SAB application is undertaken separately to the planning permissions and this assessment is to support the proposed planning application.

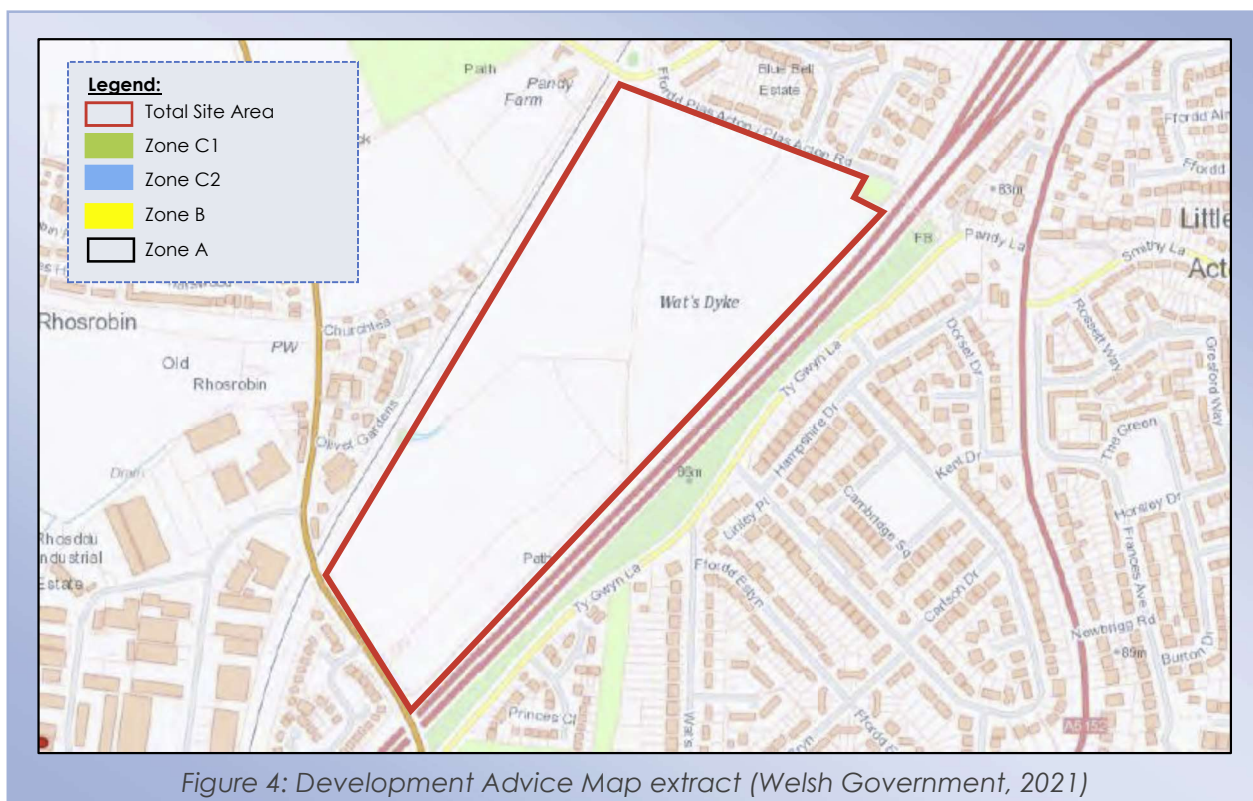
4.0 TECHNICAL ADVICE NOTE 15 (TAN15)

4.1 Flood Zone Classification

4.1.1 The Welsh Government Development Advice Map (DAM) is to be utilised when considering and determining flood risk associated with planning developments within Wales, these maps are based on extreme flood events outlined by the Natural Resources Wales (NRW) and British Geological Survey (BGS) data (TAN15).

4.1.2 The site is located with Flood Zone A, as illustrated in **Figure 4** and the DAM (**Appendix B**) identifies what these three keys 'Flood Zones' are considered to represent in terms of flood risk. The flood zone classifications are noted as:

- **Flood Zone A:** Areas considered to be at little or no risk of fluvial/tidal flooding.
- **Flood Zone B:** Areas known to have historically flooded based on sedimentary evidence deposits.
- **Flood Zone C:** Areas considered to be located on floodplain based on EA extreme flood outline data (equal to or greater than 0.1% fluvial/tidal flooding). This zone is subdivided into:
 - **Zone C1** - Areas considered to be developed and served by significant infrastructure (flood defences).
 - **Zone C2** - Areas considered to be located within natural floodplain without significant flood defences.



4.2 Category of Development

4.2.1 TAN15 states that types of development may not be considered 'acceptable' based on their vulnerability to the consequences of flooding, identified on the DAM. The vulnerability of different land-uses is described in detail in TAN15 however there are

three key categories as summarised in **Table 1**. The development proposals are 'highly vulnerable' in nature, based on the planning proposals and TAN15 guidance.

DEVELOPMENT CATEGORY	DESCRIPTION	TYPES
EMERGENCY SERVICES	Facilities which always need to remain operational and accessible.	❖ Hospitals & Ambulance Stations, ❖ Fire & Police Stations, ❖ Coastguard Stations.
HIGHLY VULNERABLE	Development where the ability of occupants to decide on whether they wish to accept the risk and manage the consequences associated with flooding is limited.	❖ Residential Developments, Hotels, Caravan Parks, Public Buildings. ❖ Power Stations, Chemical Plants, Waste Disposal.
LESS VULNERABLE	Development where the ability of occupants to decide on whether they wish to accept the risks associated with flooding is greater than 'highly vulnerable category'.	❖ General Industrial, ❖ Commercial Developments, ❖ Utilities Infrastructure, ❖ Transport.

Table 1: Development category of vulnerability (Source: TAN15: Section5)

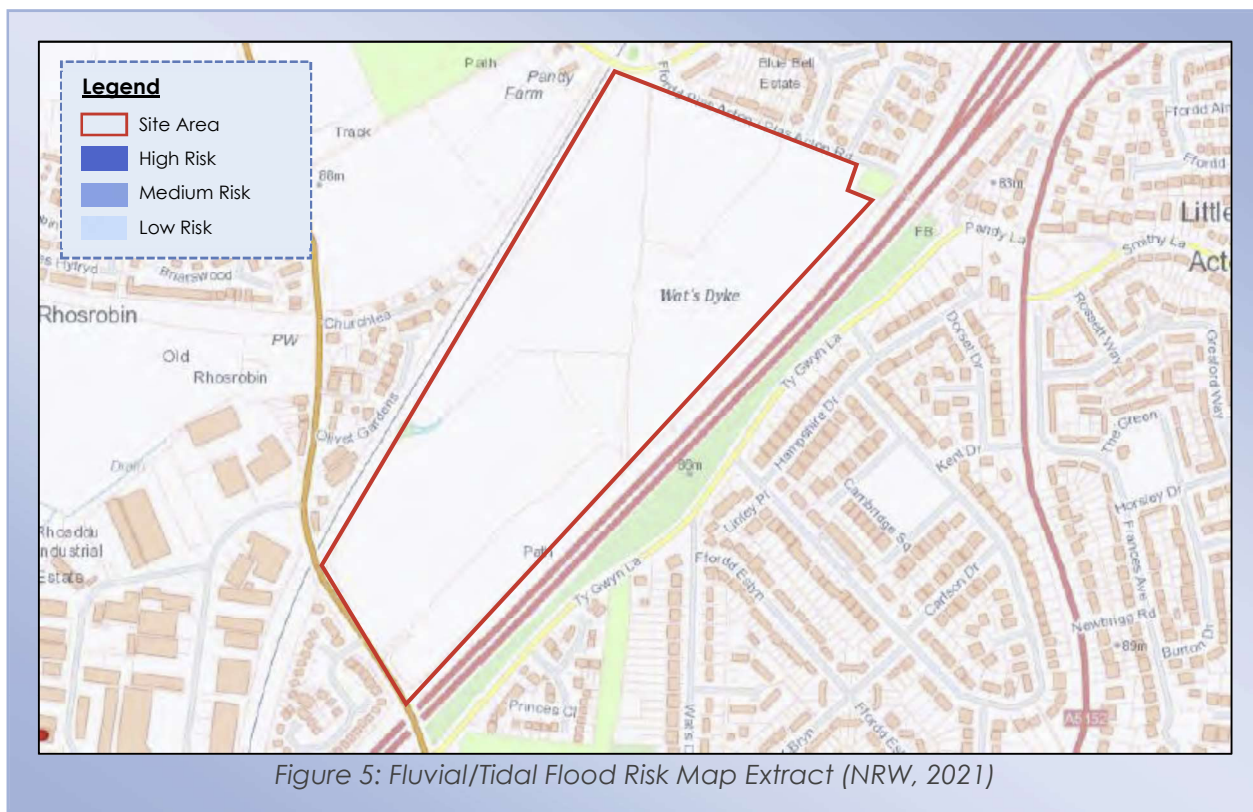
4.3 Acceptability Criteria

- 4.3.1 Various criteria are identified within TAN15 (Section 7), these are used to determine whether this development is 'acceptable' based on the nature and scale of proposals. Appropriate management should be considered with any proposed consequences of potential flooding.
- 4.3.2 The nature of use will be highly vulnerable in accordance with TAN15, however this development is located wholly within Flood Zone A, therefore the proposals are not at risk from fluvial/tidal flooding. In accordance with TAN15 highly vulnerable development is considered acceptable within Flood Zone A, providing surface water is appropriately managed. Sections 5.0 and 6.0 of this report assess the potential consequences of flood risk and considered appropriate management for surface water in accordance with the above.

5.0 SOURCES OF FLOOD RISK

5.1 Fluvial & Tidal Flood Risk

- 5.1.1 In accordance with TAN15 new development should “be guided to locations at little or no risk from all sources of flooding” and the consequences of flooding to and from the proposals should be considered to ensure no increased flood risk will result from the proposals. Information relating to the flood risk at the site has been obtained from the Welsh Government’s DAM and the Natural Resources Wales online Flood Mapping (see **Appendix B** for full details).
- 5.1.2 The DAM shows the development area is located within Flood Zone A, however, this section of the report will refer to the potential flood risk in terms of the more detailed NRW data sets that show risk to the site from fluvial and tidal sources. Based on the fluvial flood risk mapping (**Figure 5**), the site is predicted to be at very low risk from fluvial and tidal flooding.



- 5.1.3 The nearest Main River (River Alyn) is located 400m to the north of site. This Main River has been considered as part of the national flood mapping datasets and the potential flood risks represented in the long-term government flood maps. The risk to the site from the River Alyn is ‘very low’ due to its proximity from the site and the surrounding topography (see full mapping in **Appendix B**).
- 5.1.4 Onsite land drainage features have been identified from a site walkover, these features are understood to aid in the local drainage only, and it is likely that there will be development constraints associated. Due to their scale and nature the proposed flood risk from these sources is understood to be low. The site layout (**Appendix H**) shows that the proposals will interact with some of these existing features and it is therefore

proposed that further investigation into these features is undertaken at an early stage to identify their full purpose (incoming connections, any offsite connectivity).

- 5.1.5 Consultations with the key authorities including National Resources Wales, the Lead Local Flood Authority and the Local Planning Authorities have not identified any historical flooding at the site or the need to undertake a more detailed assessment of flood risk for this asset.

5.2 Surface Water

- 5.2.1 Surface water flooding occurs when rainwater is unable to drain away through the normal drainage systems or soak into the ground but lies on or flows over the ground instead. An increase in impermeable areas can reduce the ability for percolation therefore increasing surface water run-off. If this run-off is not controlled effectively, it can increase localised flooding in neighbouring areas of the catchment.



- 5.2.2 TAN15 states that 'the aim should be for new development not to create additional run-off when compared with the undeveloped situation' and that any new

development should look to reduce the overall run-off where possible to provide betterment on the existing situation (Section 8.3).

- 5.2.3 The site is shown to mostly be at very low risk from surface water based on the NRW online mapping (**Figure 6**). There are some areas onsite at higher risk from surface water flooding, these areas correspond with the naturally low-lying areas onsite located within the centre and northern corner of site.
- 5.2.4 When the proposed planning layout is overlaid with the surface water flood extent plan, it can be stated that the proposed development areas will remain within those parts of the site at very low to low risk from surface water flooding. The areas shown to be at highest flood risk are located within undeveloped areas or areas designated for surface water attenuation.
- 5.2.5 Residual risk from surface water flooding will be managed and reduced, post-development through appropriate levels design and incorporation of a sustainable drainage management system. Natural flow routes will be maintained where practical, and a formal sustainable surface water drainage regime will be implemented to manage existing and proposed surface water run-off.
- 5.2.6 In order to further mitigate for any residual risks, it is advised that (following any re-grade of the site) finished floor levels are elevated above the external levels to provide safe overland flood routes for excess surface water run-off.

5.3 Pluvial Flood Risk

- 5.3.1 Intense rainfall that is unable to soak into the ground or enter drainage systems can run-off land and result in flooding. Local topography and the land-use can have a strong influence on the direction and depth of flow. The surrounding areas are a mix of developed and undeveloped greenfield land, the risk of pluvial run-off onto the site from these areas is considered to be minimal due to the natural ground levels which fall away from site and the manmade surface water infrastructure in place to cater for the developed areas.
- 5.3.2 The volume and rate of overland flow from land can be exacerbated if development increases the percentage of impermeable area. Any pluvial flows generated by the site will need to be catered for within the proposals through appropriate spatial management and inclusion of surface water management infrastructure. Any overland flows generated by the site must be carefully controlled, with safe avenues directing flow away from the proposed or existing adjacent buildings being advised.

5.4 Artificial Sources of Flood Risk

- 5.4.1 TAN15 suggests that for development to be 'justified' then all sources of flood risk must be considered both to the development area and arising from the proposals.

Reservoirs

- 5.4.2 Reservoirs are bodies of water holding over 25,000cu.m of water and based on the National Resources Wales reservoir flood mapping, the proposed development area

would not be influenced by any flooding associated with the nearest reservoir breach/overtopping event.

Canals

- 5.4.3 There are no canals within the immediate vicinity of the site and therefore the risk to the proposals from canal associated flooding is low.
- 5.4.4 Irrespective, it is advised that external levels fall away from the proposed property (where feasible) to minimise the flood risk from a variety of sources. By keeping the finished floor levels elevated relative to the externals, this should help create an overland flood flow route in the event of a breach or any other source of flooding that could lead to overland flows including reservoir or canal flooding.

5.5 Groundwater Flood Risk

- 5.5.1 Groundwater flooding is caused by unusually high groundwater levels, it occurs as excess water emerges at the ground surface (or within manmade underground structures). Groundwater flooding tends to be more persistent typically lasting for weeks or months and it can result in significant damage to property.
- 5.5.2 In general terms groundwater flooding can occur from three main sources:
- ☞ If groundwater levels are naturally close to the surface, then this can present a flood risk during times of intense rainfall.
 - ☞ Seepage and percolation occur where embankments above ground level hold water. In these cases, water travels through the embankment material and emerges on the opposite side of the embankment.
 - ☞ Groundwater recovery/rebound occurs where the water table has been artificially depressed by abstraction. When the abstraction stops, the water table makes a recovery to its original level. There is the potential for groundwater flooding in low lying areas where groundwater levels have been depressed below their pre-pumping conditions, where these were at or close to ground level.
- 5.5.2 No groundwater flood risk has been identified during consultation with the various interested parties or in review of the SFCA. Any mitigation proposed to safeguard the development against more primary flood risk sources would also be suitable to mitigate for other potential residual sources such as groundwater flooding.

5.6 Sewer Flood Risk

- 5.6.1 In urban areas, rainwater is frequently drained into surface water sewers or sewers containing both surface and wastewater known as 'combined sewers'. Foul water flooding often occurs in areas prone to overland flow and can result when the sewer is overwhelmed by heavy rainfall and will continue until the water drains away. It can also occur when the sewers become blocked or is of inadequate capacity, this could lead to there being a high risk of internal property flooding with contaminated water.
- 5.6.2 Welsh Water (WW) sewer records have identified a public foul water sewer located onsite (see sewer records in **Appendix C**). There will also be a requirement to provide maintenance offsets from the centreline of public sewers, where they are located onsite. Based on the site layout an appropriate offset has been allowed for.

- 5.6.3 Consultation with WW did not identify any existing sewer flood risk issues directly to the site or within the neighbouring areas associated with the public sewer network (refer to **Appendix C**). During the walkover however the highway was observed to be flooded, at the entrance to Plas Acton Road (see **Appendix F**). It is currently not known if this was linked to WW or LPA assets.

5.7 Historical and Anecdotal Flooding Information

- 5.7.1 Review of WCBC Preliminary Flood Consequence Assessment did not identify any historical flooding to the site area, this was supported by the findings in the Strategic Flood Risk Assessment (some general mapping extracts have been included in **Appendix I**).
- 5.7.2 Discussions with WCBC confirmed they have no records of historical flooding directly at the site. Furthermore, consultations with NRW and WW have also failed to highlight any recorded historical flooding relevant to this FCA.
- 5.7.3 As discussed in Section 2.3, during the walkover however the highway was observed to be flooded, at the entrance to Plas Acton Road (see **Appendix F**). It is currently not known if this was linked to WW or LPA assets. There was also evidence of ponding/standing water and saturated ground adjacent to some field boundaries, field boundaries, as shown within **Figure 2**. The A483 is raised relative to the site and run-off naturally conveys across the site towards the south/south-eastern boundary meaning flows are restricted from leaving the site extents due to the elevated bypass.

5.8 Mitigation Measures and Residual Risks

- 5.8.1 The development area is shown to be located within Flood Zone A on the DAM and is at low risk of flooding from the key sources reviewed. Mitigation measures have however been considered below to safeguard the proposals against residual flood risks associated with climate change over the lifetime. These measures either reduce the vulnerability of the development or improve the resilience of the proposals in the potential extreme scenarios.

Mitigation Measures

- 5.8.2 For 'highly vulnerable' development located within Flood Zone A, it is typical to set the Finished Floor Levels (FFL) of residential dwellings to a minimum of 150mm above the existing ground levels. Furthermore, by ensuring the FFLs are raised sufficiently above the proposed external levels (following any re-grade) should provide additional mitigation against the risk of overland flows associated with flooding from a variety of sources, including groundwater and surface water.
- 5.8.3 Any overland flows generated by the development must be carefully controlled and safe avenues directing overland flows away from any proposed properties is advised. Any natural conveyance routes should be maintained through the site, where practical. Where this is not practical then provision will need to be made to intercept and convey flows safely through the proposals to outfall as they would naturally.

- 5.8.4 Onsite land drainage features have been identified from a site walkover the mapping, this feature is understood to aid in the local drainage only, and it is likely that there will be development constraints associated. The current planning layout (**Appendix H**) shows that the proposals will impact upon the existing land drainage ditches in part, it is therefore proposed that further investigation into is undertaken of these features to confirm their nature and connectivity at an early stage in case allowances have to be made within the layout to keep these features.
- 5.8.5 Welsh Water (WW) sewer records have identified a public foul water sewer located onsite (see sewer records in **Appendix C**). There will be a requirement to provide maintenance offsets from the centreline of public sewers, where they are located onsite; where offsets cannot be achieved then diversion may be required. Early discussion with WW is advised for any proposed works to the public sewer network, this includes any proposed diversion work where this is required to accommodate the proposals. Based on the site layout an appropriate offset has been allowed for.
- 5.8.6 Review of the mapping has also identified that Wat's Dyke (now a linear earthwork) is located crossing the site from the south towards the northern corner of site. An offset from this asset has been included within the site layout.
- 5.8.7 All new developments of at least 2 properties or over 100m² in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government standards for sustainable drainage. The SAB have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments.
- 5.8.8 To minimise the flood risk to the neighbouring properties and conform to the guidance set out in TAN15, it is proposed that surface water run-off be managed effectively and sustainably in accordance with best practice and standard guidance. It is recommended that the peak rates of surface water run-off generated by the proposals be restricted to the equivalent of the pre-development greenfield situation.
- 5.8.9 The proposed onsite surface water drainage system will need to be sized to contain the 1 in 30yr return period event below ground with exceedance from storm events up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change being contained onsite.
- 5.8.10 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either the Water Company or the Local Authority then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.

Residual Risks

- 5.8.11 If an extreme rainfall event exceeds the design criteria for the drainage system it is likely that there will be some overland flows that are unable to enter the system, it is important that these potential overland flows are catered for within the proposed planning layout in the event that the capacity of the drainage system is exceeded.

6.0 SURFACE WATER MANAGEMENT

6.0.1 In order for the development proposals to be justified in line with the guidance set out in TAN15, development must not increase flood risk elsewhere within the catchment and where possible offer improvement on the pre-development situation. Surface water management is therefore a key focus. The Welsh Government: 'Statutory standards for sustainable drainage systems' (2018) are aimed at ensuring that the most effective drainage scheme is delivered for protecting and enhancing both the natural and built environment. Standard S1 comprises of five levels, which are discussed in detail in this assessment subsequently. The five levels are:

- Priority Level 1: Surface water runoff is collected for use.
- Priority Level 2: Surface water runoff is infiltrated to ground.
- Priority Level 3: Surface water runoff is discharged to a surface water body.
- Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system.
- Priority Level 5: Surface water runoff is discharged to a combined sewer.

6.1 Priority Level 1: Surface water runoff is collected for use.

6.1.1 Surface water re-use is applicable for residential properties. An external water butt is recommended to be installed on each dwelling to promote external water re-use. Internal rainwater harvesting systems are not proposed. In line with section G1.4 of the 'Statutory standards for sustainable drainage systems', internal rainwater harvesting is not proposed for this site as:

- There is no foreseeable demand for non-potable water on the site throughout its design life.
- There is no foreseeable need to harvest water at the site and Welsh Water have not identified potential stresses on mains water supplies in this area.
- The use of rainwater harvesting is not a cost-effective part of the solution for managing surface water runoff on the site, taking account of the potential water supply benefits of such a system.

6.2 Priority Level 2: Surface water runoff is infiltrated to ground.

6.2.1 Any proposed impermeable areas that can drain to soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems and be justified in line with TAN15. The published online datasets have initially been reviewed to consider how favourable the underlying strata is to support a potential infiltration-based solution at the site.

6.2.2 The British Geology Survey (BGS) mapping data indicates that ground conditions comprise of Salop Formation (Mudstone, Sandstone and Conglomerate) with superficial deposits of Sand and Gravel. Furthermore, the Cranfield Soil and Agrifood Institute Soilscape soil type viewer identifies the soils to be freely draining slightly acid loamy soils. Furthermore, based on the FEH catchment data, the soil factor for the area has been identified to be 0.1, which suggests the soils are very permeable (based on a scale of 0.1 to 0.5, with 0.5 being impermeable). These conditions would suggest

support to a full infiltration-based surface water management regime at the site due to the underlying strata.

- 6.2.3 The online datasets and FEH catchment characteristics are further supported by BRE 365 Soakaway Testing undertaken by Tier Consult Ltd (Ref: T/14/1400-DS1/SGJ). The report identified there was a range of permeable and not permeable areas onsite. The permeable soils that were encountered had infiltration rates ranging from a low value of 5.18×10^{-6} m/s to the highest value of 3.52×10^{-6} m/s. Following review of the site plan and topography, a possible location for an infiltration basin, based on the Soakaway results has been shown in **Figure 7**.



- 6.2.4 It is further recommended that permeable roads and permeable driveways are implemented where feasible, as illustrated in within **Figure 7**. Areas onsite that are unable to discharge directly to ground due to ground conditions will be lined and have a connection into the onsite infiltration basin proposed adjacent to the northern boundary of site where positive infiltration results were identified.

- 6.2.5 The specific drainage infrastructure to be implemented will be confirmed during the detailed design stage following discussion with all relevant parties and confirmation of the ground conditions at the specific drainage locations.
- 6.2.6 In terms of discharge rates, in accordance with the Statutory Technical Standards for Sustainable Drainage Systems in Wales (2018), the proposed discharge rates should not exceed the existing percolation rates on the site, to be confirmed following onsite testing. The surface water drainage system proposed will need to be sized to contain up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change.

Sustainable Drainage Systems

- 6.2.7 From January 2019, all new developments of at least 2 properties or over 100m² in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government standards for sustainable drainage. Schedule 3 of the Flood and Water Management Act 2010 (FWMA) establishes Wrexham County Borough Council as a SuDS Approving Body (SAB).
- 6.2.8 The SAB have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments. The SAB application is undertaken separately to the planning permissions and developers are required to obtain both planning approval and SAB approval prior to commencement of any proposed construction works.
- 6.2.9 Sustainable Drainage Systems (SuDS) can address the four key sustainability objectives embedded in this policy including providing space for water (water quantity), improving water quality and biodiversity, along with providing valuable amenity/recreational space in new development sites. Using SuDS onsite will reduce the volume of surface water entering the downstream watercourse and sewer network which is the preferred approach.



- 6.2.10 Promoting SuDS to deal with surface water at source will limit the requirement for hard engineering-based attenuation and conveyance (see examples in **Figure 8**). Given the scale of development being proposed and evidence of a positive infiltration

characteristics onsite there is opportunity to incorporate SuDS methods such as attenuation pond/basin(s) to assist with the proposed surface water drainage regime (if designed appropriately), as shown within the proposed planning layout.

- 6.2.11 It is also proposed that permeable paving and bio-filtration (tree pits) are implemented in non-adopted areas where at all feasible to allow the first 5mm of rainfall to be dealt with at source as identified in the SuDS Manual. By including measures such as these the surface water run-off is being dealt with at source and this will assist locally with surface water management (subject to optimum ground conditions).
- 6.2.12 Detailed design will need to be undertaken to confirm the specific SuDS to be utilised following a more detailed analysis of levels, ground conditions and attenuation requirements, in conjunction with the SAB at Wrexham County Borough Council. The SAB (WCBC) have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments. This report is to support the proposed planning application and the full SAB approval will need to be sought separately by the developer in due course.

Maintenance

- 6.2.13 The maintenance of communal drainage features such as an infiltration basin will be the responsibility of SAB and the maintenance of private drainage features such as water butts and individual property soakaways will be the responsibility of individual property owners. Maintenance of shared permeable surfaces (permeable paved access roads and parking areas) can be arranged through appointment of a site management company. A full SuDS maintenance and management plan will be prepared following the detailed design stage to consider appropriate management of all the proposed drainage systems.

6.3 Priority Level 3: Surface water runoff is discharged to a surface water body.

- 6.3.1 If infiltration is unable to offer a full surface water management solution for the site then the alternative discharge method would be to discharge into the nearest watercourse. As discussed previously, the nearest Main River (River Alyn) is located 400m to the north of site though 3rd party land and the onsite land drainage features are understood to aid in the local drainage only (no formal offsite connections have been identified as part of this assessment). There are therefore no smaller watercourses located in proximity to site suitable for handling surface water discharge from the proposed development site.

6.4 Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system.

- 6.4.1 As a connection to the watercourse is not likely to be feasible, should infiltration not provide a full management solution then the alternative method would be a connection to the neighbouring public sewer network. WW sewer records identify limited public surface water sewer assets within the neighbouring area and WW would not accept a surface water connection from the development to the onsite public foul water sewer network. Further discussion with WW would be needed to ascertain their

preferred connection point should a surface water connection be required. There are therefore no proposals to connect into the sewer network or highway drain at this stage as infiltration testing was positive.

6.5 Priority Level 5: Surface water runoff is discharged to a combined sewer.

- 6.5.1 As discussed above, should infiltration and a connection to the watercourse not be feasible then the alternative method would be a connection to the neighbouring public sewer network. Further discussion with WW would be needed to ascertain their preferred connection point should a surface water connection be required. There are therefore no proposals to connect into the sewer network or highway drain at this stage as infiltration testing was positive.

6.6 Climate Change

- 6.6.1 There are significant indications that the UK climate is changing; the nature of this change will vary based on regional and catchment differences, consensus is that effects will become more pronounced over the coming decades. With reference to TAN15 the most likely effects to be experienced within Wales are:
-  Increases in sea levels.
 -  Greater inflow into estuaries and the sea
 -  Significant changes in rainfall patterns seasonally
 -  Increased evapotranspiration
- 6.6.2 Making 'provisions' for these anticipated future changes to flood risk is an important action, ensuring future 'sustainable development' within Wales as identified within TAN15; Section 2.1. Current expert opinion indicates the likelihood of more frequent short duration and high intensity rainfall events and the addition of more frequent periods of long duration rainfall meaning future flooding events will have a greater impact on the environment and society.
- 6.6.3 Any increase in the level of flood risk to the potential development from Climate Change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system, along with the potential impact of sea level rise and its associated impact on flood water levels. Climate Change should be accounted for within the design and it is recommended that an increase in peak rainfall intensity of 40% is allowed for as identified within TAN15 and SuDS Standards for Wales.

7.0 FOUL WATER MANAGEMENT

- 7.1 Consultation with WW has been carried out to obtain the sewer records, which have identified there is a public foul water sewer (150mm dia. & 600mm dia.) located entering site from the south-western boundary and crosses the site to the northern corner (refer to sewer records within **Appendix C**). As the site is undeveloped at present, there are no onsite foul water flows currently generated thus no existing foul water connections present.
- 7.2 The proposals will be to have a new formal connection to the public foul sewer (150mm dia.) located on-site. Detailed drainage design will be required to confirm this strategy and identify whether a site wide gravity connection is feasible, although given the existing fall across the site this is anticipated to be feasible.
- 7.3 Consents and relevant agreements will be required from WW prior to commencement of works and early discussion is undertaken early to establish whether there are any additional constraints which need to be considered. A connection is proposed to be made on the site to avoid offsite construction activities and third-party access consent.
- 7.4 Based on the proposals for the construction of 189no. residential dwellings, the approximate peak foul water flows generated have been calculated to be 8.75l/s. This rate is calculated based on 4000 litres per dwelling per 24 hours; the guidance contained within Sewers for Adoption (SfA).

8.0 SUMMARY AND CONCLUSIONS

- 8.1 This Flood Consequence Assessment and Drainage Management Strategy was commissioned by Castle Green Homes Limited referred to hereafter as 'the client'. This assessment has been prepared to support a planning application for the construction of residential development on land east of Main Road in Rhosrobin, Wrexham.

Flood Risk

- 8.2 The total site covers 15.76ha and in accordance with TAN15, the proposals are highly vulnerable in nature. Consultation with the National Resources Wales, Wrexham County Borough Council and Welsh Water have been carried out and have not identified any historical flooding to the site. A site walkover was undertaken by Betts Hydro in January 2021 after a prolonged heavy rainfall event. The site walkover identified ponding/standing water and saturated ground adjacent to some field boundaries. This assessment has reviewed all sources of flood risk both to the development, including fluvial, tidal, pluvial, groundwater, sewers, and flooding from artificial sources.
- 8.3 National Resources Wales' data sets show the site to be at very low risk from fluvial and tidal flood risk sources. The nearest Main River (River Alyn) is located 400m to the north. The flood risk to the site from the River Alyn is 'very low' due to its proximity from the site and the surrounding topography. Onsite land drainage features have been identified from a site walkover, although these features are understood to aid in the local drainage only and due to their small scale/nature the flood risk associated is understood to be low.
- 8.4 The primary source of flood risk to the site is considered to be from surface water flooding. The potential flood risks to the site from surface water will be managed and reduced, post-development, through appropriate levels design and incorporation of a sustainable drainage management system. Due to the relatively low flood risks identified as part of this assessment, the principle focus of this assessment is on the sustainable management of surface water run-off to ensure that no increased flood risk results from the proposals.

Drainage Strategy

- 8.5 In order for the development proposals to be justified in line with the guidance set out in SuDS Standards for Wales, new development must not increase flood risk elsewhere and where possible offer improvement on the pre-development situation. The sustainable drainage hierarchy has been considered in accordance with the SuDS Standards for Wales, which look to deal with surface water run-off as close to source as is practical.
- 8.6 The published online datasets have been reviewed to consider how favourable the underlying strata is to support a potential infiltration-based solution at the site. The online datasets and FEH catchment characteristics are further supported by BRE 365 Soakaway Testing undertaken by Tier Consult Ltd (Ref: T/14/1400-DS1/SGJ). The report identified there was a range of infiltration characteristics across the site.
- 8.7 It is therefore proposed that any impermeable areas that can drain to soakaway (or an alternative method of infiltration) should do so via appropriately designed infiltration-based solution, as this would significantly improve the sustainability of the

surface water systems. There are potential locations for where larger scale infiltration methods might be suitable.

- 8.8 It is further recommended that permeable roads and permeable driveways are implemented where feasible to allow the first 5mm of rainfall to be dealt with at source as identified in the SuDS Manual. The specific drainage infrastructure to be implemented will be confirmed during the detailed design stage following discussion with all relevant parties and confirmation of the ground conditions.
- 8.9 The surface water drainage system proposed will need to be sized to contain up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change. In terms of discharge rates, in accordance with the SuDS Manual (CIRIA 753) and the SuDS Standards for Wales (2018). The proposed discharge rates should not exceed the existing percolation rates onsite.
- 8.10 Detailed design will need to be undertaken to confirm the specific SuDS to be utilised following a more detailed analysis of levels, ground conditions and attenuation requirements, in conjunction with the SAB at Wrexham County Borough Council. The SAB have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments. This report is to support the proposed planning application and the full SAB approval will need to be sought separately by the developer.
- 8.11 To conclude, the development area has been considered in accordance with TAN15 and suitable mitigation measures have been proposed to ensure that the development is safe for its lifetime. This Flood Consequence Assessment and Drainage Management Strategy is commensurate with the development proposals and in summary, the development can be considered appropriate in accordance with TAN15, providing the mitigation measures proposed are conformed to.

9.0 RECOMMENDATIONS

- 9.1 For 'highly vulnerable' development located within Flood Zone A, it is typical to set the Finished Floor Levels (FFL) of residential dwellings to a minimum of 150mm above the existing ground levels. Furthermore, by ensuring the FFLs are raised sufficiently above the proposed external levels (following any re-grade) should provide additional mitigation against the risk of overland flows associated with flooding from a variety of sources, including groundwater and surface water.
- 9.2 Any overland flows generated by the development must be carefully controlled and safe avenues directing overland flows away from any proposed properties is advised. Any natural conveyance routes should be maintained through the site, where practical. Where this is not practical then provision will need to be made to intercept and convey flows safely through the proposals to outfall as they would naturally.
- 9.3 Onsite land drainage features have been identified from a site walkover the mapping, this feature is understood to aid in the local drainage only, and it is likely that there will be development constraints associated. The current planning layout (**Appendix H**) shows that the proposals will impact upon the existing land drainage ditches in part, it is therefore proposed that further investigation into is undertaken of these features to confirm their nature and connectivity at an early stage in case allowances have to be made within the layout to keep these features.
- 9.4 Welsh Water (WW) sewer records have identified a public foul water sewer located onsite (see sewer records in **Appendix C**). There will be a requirement to provide maintenance offsets from the centreline of public sewers, where they are located onsite; where offsets cannot be achieved then diversion may be required. Early discussion with WW is advised for any proposed works to the public sewer network, this includes any proposed diversion work where this is required to accommodate the proposals. Based on the site layout an appropriate offset has been allowed for.
- 9.5 Review of the mapping has also identified that Wat's Dyke (now a linear earthwork) is located crossing the site from the south towards the northern corner of site. An offset from this asset has been included within the site layout.
- 9.6 All new developments of at least 2 properties or over 100m² in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government standards for sustainable drainage. The SAB have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments.
- 9.7 To minimise the flood risk to the neighbouring properties and conform to the guidance set out in TAN15, it is proposed that surface water run-off be managed effectively and sustainably in accordance with best practice and standard guidance. It is recommended that the peak rates of surface water run-off generated by the proposals be restricted to the equivalent of the pre-development greenfield situation.
- 9.8 The proposed onsite surface water drainage system will need to be sized to contain the 1 in 30yr return period event below ground with exceedance from storm events up

to and including the 1 in 100yr return period storm event with a 40% allowance for climate change being contained onsite.

- 9.9 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either the Water Company or the Local Authority then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.

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