

Proposed Site Improvement, HGV Gatehouse, Marshalls Mono Ltd, Newport

784-A069428-4

Flood Consequences Assessment

For SAB Submission

Marshalls Mono Ltd

November 2022

**Document prepared on behalf of Tetra Tech Limited. Registered in England
number: 01959704**



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Acronyms/Abbreviations

Acronyms/Abbreviations	Definition
AEP	Annual Exceedance Probability
FCA	Flood Consequences Assessment
HGV	Heavy Goods Vehicle
SAB	SuDS Approving Body
TAN	Technical Advice Note
NRW	Natural Resource Wales
NCC	Newport City Council
LFRMS	Local Flood Risk Management Strategy
CCE	Couch Consulting Engineers
BGS	British Geological Survey
SuDS	Sustainable Drainage Systems
FFL	Finished Floor Levels
FEMP	Flood Evacuation Management Plan
FFL	Finished Floor Levels
CC	Climate Change
CEMP	Construction Environmental Management Plan

Note of Flood Frequencies

AEP (%)	50	20	10	5	3.33	2	1.33	1	0.5	0.1
AEP	0.5	0.2	0.1	0.05	0.033	0.02	0.0133	0.01	0.005	0.001
Return Period (Years)	2	5	10	20	30	50	75	100	200	1000

1.0 Introduction

1.1 Purpose of this Report

- 1.1.1 Tetra Tech Ltd have been appointed by Marshalls Mono Ltd (the 'Client') to prepare a Flood Consequence Assessment (FCA) for the proposed construction of a new entrance for Heavy Good Vehicles (HGV), cars and pedestrians and associated infrastructure at Eastern Dry Dock, Corporation Road, Newport NP19 4RE.
- 1.1.2 This report has been prepared in support of a SuDS Approving Body (SAB) application for the proposed development as outlined in Section 1.2.
- 1.1.3 The proposed layout is included in Appendix A.

1.2 Proposed Development

- 1.2.1 The proposed development is for the construction of an entrance road and HGV gatehouse to form a new access point and stacking location for HGV's visiting Marshalls Newport facility.
- 1.2.2 Works associated with the project will include:
 - Demolition of existing buildings and walls (in the way of the proposed roadway)
 - Groundworks and civils
 - Construction of a small office.

1.3 Scope of the Report

- 1.3.1 The Flood Consequences Assessment will consider all potential sources of flood risk including 'Main Rivers', 'Ordinary Watercourses', surface water and overland flow routes, groundwater, sewers, and reservoirs. It will identify the level of risk and, where necessary, propose mitigation to manage flood risk.
- 1.3.2 The assessment will be undertaken in accordance with the Technical Advice Note (TAN) 15: development, flooding and coastal erosion, Natural Resource Wales (NRW) guidance and local guidance including the Newport City Council (NCC) Local Flood Risk Management Strategy (LFRMS).

- 1.3.3 A drainage strategy including surface water calculations for the proposed development has been designed by Couch Consulting Engineers (CCE). This FCA will discuss the proposed drainage strategy as provided by CCE.

1.4 Previous Submissions

- 1.4.1 An application to the SAB was made previously in April 2023 for a previous proposed layout with consultation comments received from both Welsh Water and NCC. The layout and proposals have since been amended from this earlier application however the consultation response is included in Appendix B for reference and the relevant feedback has been considered within this iteration of the report.

1.5 Limitations of this Report

- 1.5.1 This report has been prepared by Tetra Tech Ltd on behalf of Marshalls Mono Ltd in connection with the scope of the report as described in Section 1.3 above and taking into account the particular instructions and requirements set out in Tetra Tech's fee proposal and the Client's acceptance. It is not intended for and should not be relied on by any third party and no responsibility is undertaken to any third party.
- 1.5.2 Tetra Tech Ltd accepts no duty or responsibility (including in negligence) to any party other than Marshalls Mono Ltd and disclaims all liability of any nature whatsoever to any such party in respect of this report.
- 1.5.3 This report cannot be reproduced without Tetra Tech's written consent.

2.0 Site Description

2.1 Existing Site

2.1.1 The proposed site layout is included as Appendix A.

2.1.2 The site is located at Marshalls Mono Ltd, Eastern Dry Dock, Corporation Rd, Newport NP19 4RE (ST 32803 85595) as show in Figure 2-1 below.

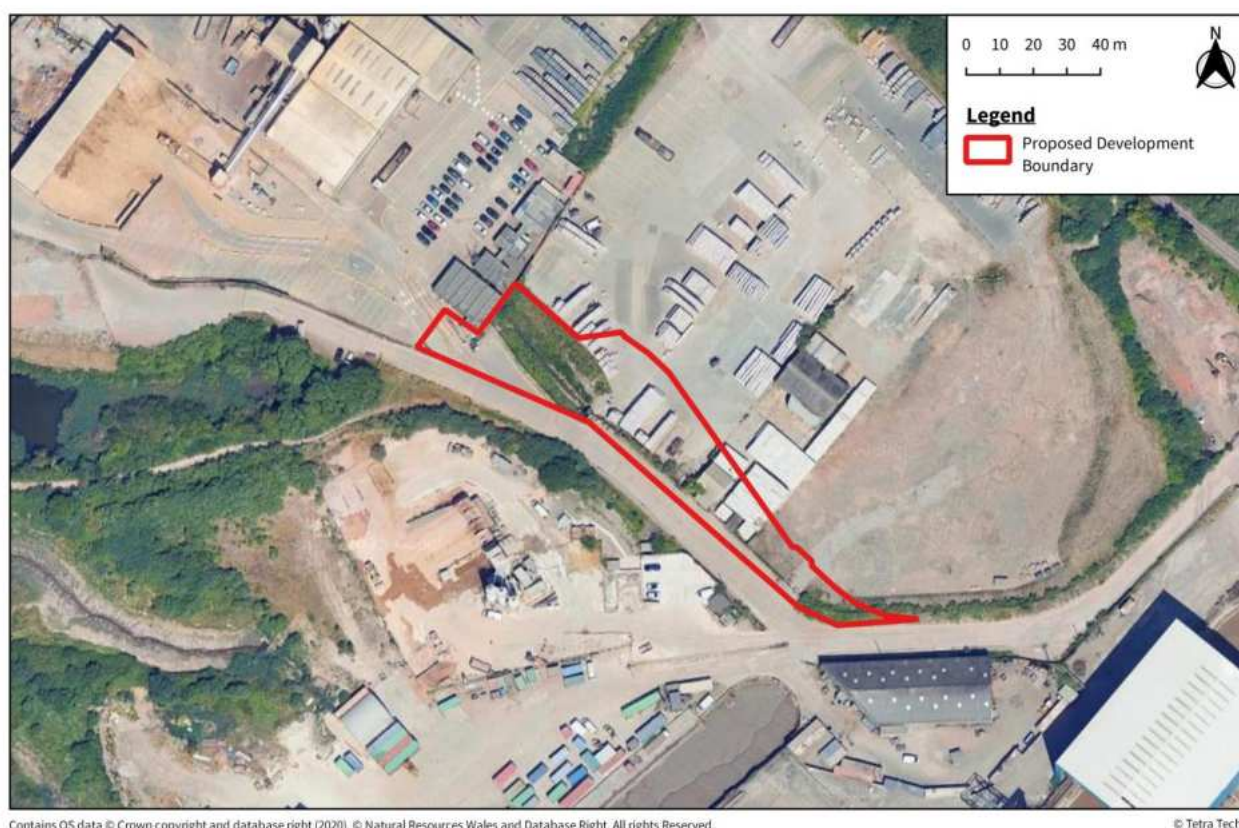


Figure 2-1: Proposed Development Boundary

2.1.3 The HGV Gatehouse site is part of the wider industrial site currently used for industrial processes such as the manufacture of block paving and other concrete products. The wider site is bounded by a railway and Corporation Road to the north and east, by a concrete plant and the River Usk to the south, and by industrial units to the west.

2.1.4 The existing site is brownfield and the proposed development area within the red line boundary shown in Figure 2-1 is 0.31 Ha.

2.2 Site Topography

- 2.2.1 A topographic survey is included in Appendix C.
- 2.2.2 The topographical survey of the wider site indicates that levels generally fall from the eastern and western boundaries towards the central part of the site.
- 2.2.3 The levels within the proposed development area generally fall from south to north with a level of 8.12m AOD on the southern perimeter falling to 7.64m AOD in the north. There is an existing ditch located within the site. This is illustrated in Figure 2-2 below.

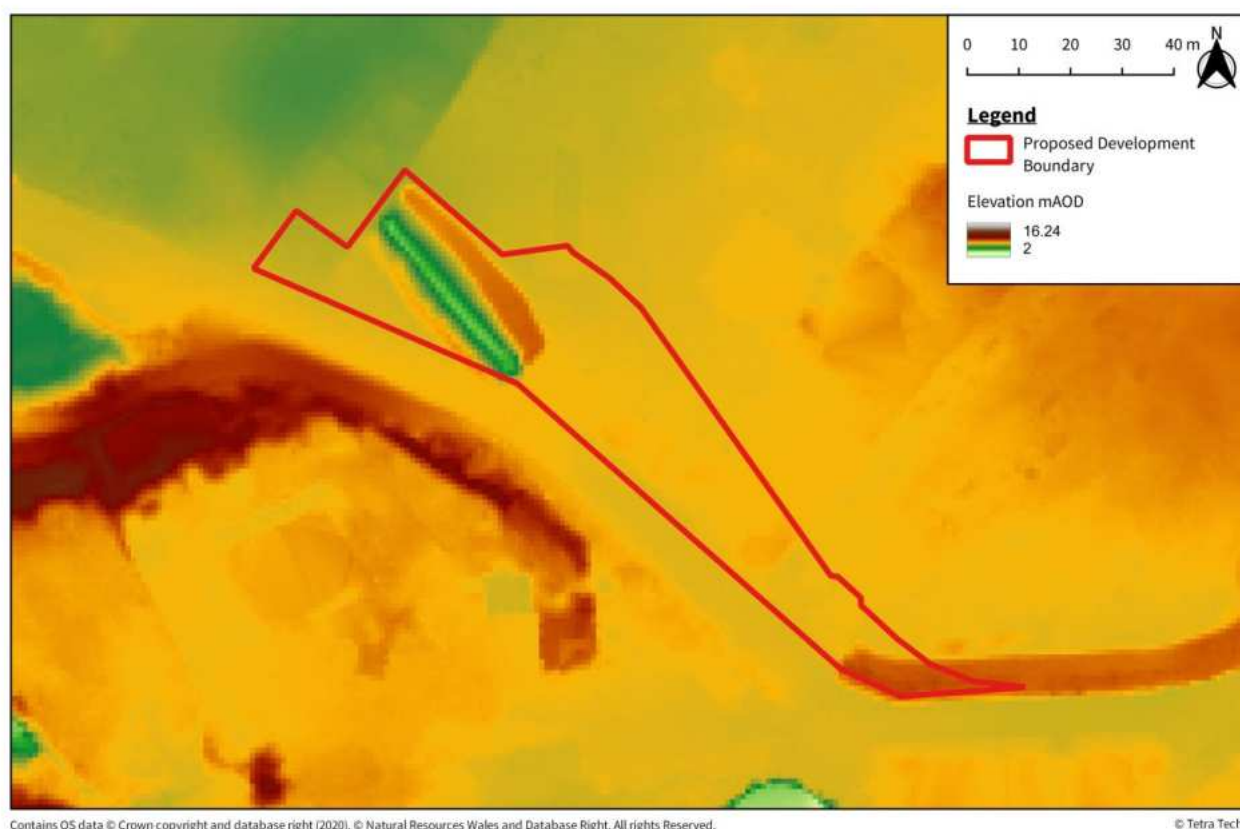


Figure 2-2: LiDAR Elevations

2.3 Existing Drainage

Main Rivers

- 2.3.1 The nearest Main River to the site is the tidal River Usk approximately 160m south of the site and forms the southern boundary of the Usk estuary Site of Special Scientific Interest.

Ordinary Watercourses

- 2.3.2 Within the wider industrial site, there are two ditches flowing south through the central and western areas.
- 2.3.3 The most southern drainage ditch falls within the HGV Gatehouse proposed development boundary. The water level within this ditch was 4.72 mAOD at time of the topographic survey included in Appendix C.
- 2.3.4 The ditches are partly culverted and outfall to the River Usk with non-return valves. The watercourses are part of the wider system of land drainage (known as Reens) which drain the low-lying land to the east of the Usk.

2.4 Existing Sewers

- 2.4.1 The existing Marshalls site is served by a private drainage system where surface water drains to the existing ditches onsite.
- 2.4.2 Within the northwest section of the wider site the ditches drain to an existing detention basin located on the southwest perimeter of the wider site via a 750mm diameter pipe that also receives flows from other units within the business park. This pond is believed to drain to the River Usk with no formal flow control other than that provided by the outfall diameter and the non-return valve.
- 2.4.3 Within the proposed development site, surface water drains into the existing drainage ditch located towards the north as identified in Figure 2-2. The exact discharge point is unknown, but it is assumed that the ditch discharges to the River Usk via the 225mm diameter culvert located at the downstream end of the ditch.
- 2.4.4 There is a 225mm diameter foul sewer located to the north of the proposed HGV Gatehouse site, situated within the wider Marshalls site.

2.5 Ground Conditions

Geology

- 2.5.1 A review of British Geological Survey (BGS) online geological mapping indicates that the superficial geology of the site is clay and silt predominately from tidal flat deposits.

- 2.5.2 The bedrock geology is indicated to be mudstone with some sandstones present.
- 2.5.3 The nearest Borehole to the site (and located within the Marshall complex) is ST38NW397 as shown in Figure 2-3 below and available from BGS online. This record indicates the presence of sand underlain by clay and mudstone.



Figure 2-3: Borehole Record Location

Hydrogeology

- 2.5.4 A review of Defra's online 'Magic' mapping indicates that the bedrock aquifers are classified as Secondary B which are aquifers that have mainly lower permeability layers that may store and yield limited amounts of groundwater through characteristics like thin cracks (called fissures) and openings or eroded layers.
- 2.5.5 Information for the superficial aquifers was not available for Wales on the Defra portal.

Source Protection Zones

- 2.5.6 The site is located within a shallow aquifer which supplies a variety of local industries including production of drinks and poultry processing operations. There are a number of abstraction boreholes within the site and near the site, which supply the nearby factories.
- 2.5.7 As a result of the presence of nearby abstraction boreholes, there are a number of groundwater source protection zones within the wider site.

3.0 Flood Risk

3.1 Flood Risk

3.1.1 A floodplain is the area that would naturally be affected by flooding if a river rises above its banks or is inundated by the sea (costal or tidal flooding). In Wales, flood zones are defined by TAN 15 for planning purposes.

3.1.2 The Welsh Government are currently in the process of updating the TAN 15 guidance which has currently been published for consultation purposes. Whilst the updated TAN 15 is yet to be adopted the revised document classifies Flood Zones as follows:

- Flood Zone 1 – less than 1 in 1,000 (0.1%) chance of flooding in a given year;
- Flood Zone 2 – less than 1 in 100 (1%) but greater than 1 in 1,000 (0.1%) chance of fluvial flooding in a given year, including climate change or a less than 1 in 200 (0.5%) but greater than 1 in 1,000 chance of tidal flooding, including climate change;
- Flood Zone 3 – A greater than 1 in 100 (1%) chance of fluvial flooding in a given year, including climate change or a greater than 1 in 200 chance of tidal flooding in a given year, including climate change; and
- TAN15 Defended Zones – Areas where flood risk management infrastructure provides a minimum standard of protection against flooding from rivers of 1 in 100 plus climate change and freeboard or areas where flood risk management infrastructure provides a maximum Standard of Protection against flooding from the sea of 1 in 200 plus climate change and freeboard.

3.2 Rivers and Sea Flood Risk

3.2.1 A review of the NRW Flood Risk from Rivers indicates that the site is located within Flood Zone 1 and therefore the risk of fluvial flooding is considered low.

3.2.2 However, the site is located entirely within Flood Zone 3 for Sea Flood Risk as shown in Figure 3-1. This is due to the tidal nature of the River Usk at this location.

3.2.3 Therefore, the risk of tidal flooding at the site is considered high.



Figure 3-1: Sea Flood Risk

NRW Flood Data Review

- 3.2.4 Flood level data provided by NRW is included as Appendix D.
- 3.2.5 The data provided by NRW includes climate change based on average sea level rises, which increase depending on the length of period considered. Table 3-1 below indicates the modelled flood levels for a range of return periods and climate change allowances in a defended scenario.

Table 3-1: NRW Modelled Flood Levels

Return Period	Model Result	2015	2070	2090	2115	2097 (Interpolated)
1 in 200-year	Mean	7.73	8.17	9.25	9.55	9.33
	Max	8.51	8.96	9.25	9.56	9.34
1 in 1000-year	Mean	8.72	9.17	9.51	9.88	9.61
	Max	8.84	9.29	9.51	9.88	9.61

- 3.2.6 As set out in the Welsh Government's guidance 'Flood Consequences Assessments: Climate Change Allowances' (September 2021), commercial/industrial developments should use a 75-year lifetime of development.
- 3.2.7 This would bring the return period for the development to 2097 and flood data for 2090 and 2115 is shown in Table 3-1. This information has been interpolated to obtain anticipated values for 2097.
- 3.2.8 It can be seen that part of the site is currently at risk of flooding during a 1 in 200-year return period event. Maximum depths of flooding could reach up to 1.92m within the southern part of the entire Marshalls site where the HGV Gatehouse application site is located.
- 3.2.9 The higher depths of 2m are outside of the application boundary for the HGV Gatehouse. Depths would increase significantly as a result of climate change as shown in Table 3-1.
- 3.2.10 Given that the site is at risk of coastal flooding, the levels indicated above would only last for a few hours and would vary with the tidal cycle. In Newport, which is located in the Severn Estuary, the tide rises and falls rapidly; although it needs to be noted that a tidal surge would alter the normal tide pattern in addition to raising the tide levels.
- 3.2.11 There is a level monitoring station in the River Usk in the inlet of the Alexandra Docks to the southwest of the site. The difference between the low and high tide levels is normally around 12m.
- 3.2.12 The data provided by NRW also included undefended flood levels, which are shown in Table 3-2 below. As there are a number of existing defences alongside the River Usk, any required mitigation measures are to be based on the defended levels.

Table 3-2: Undefended Levels in the Usk (m AOD)

Return Period	1 in 200-year	1 in 1000-year
Mean	8.52	8.83
Max	8.53	8.83

Flood Defences

- 3.2.13 NRW mapping indicates the location of some flood defences to the north of the site as shown in Figure 3-2 below. The TAN 15 defended zone is also located to the east of the site, but the site does not fall within its extents.

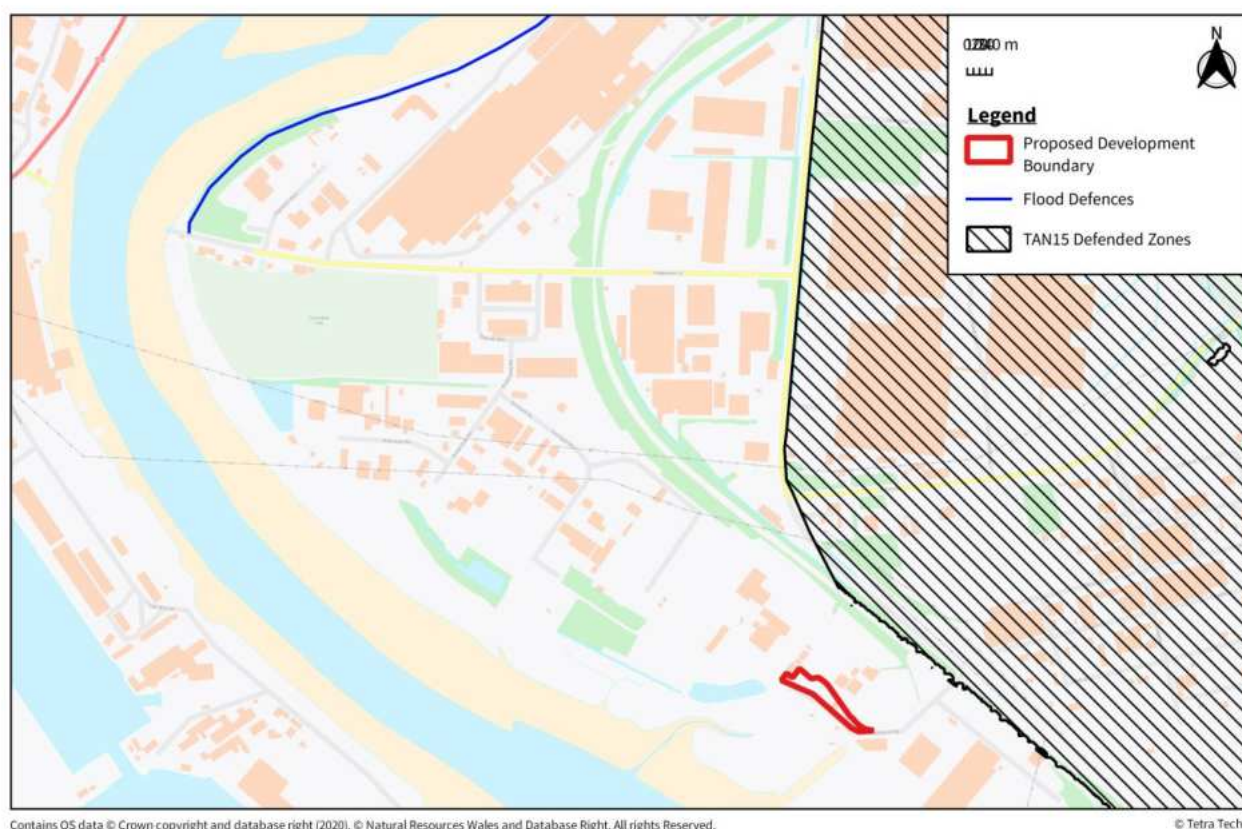


Figure 3-2: Flood Defences and Defended Zones

NRW Approved Flood Defence Scheme

- 3.2.14 A flood defence scheme to reduce the tidal risk of flooding from the River Usk to properties in Stephenson Street, Newport, has now been approved by Newport City Council. The scheme proposes new defences along the Usk. The proposals will provide a 1 in 200-year standard of protection up to 2069, when the standard of protection will start to decrease as a result of the continued sea level rise.
- 3.2.15 The relevant new flood defences in the area are:

- New flood walls along the Marshalls site boundary with East Bank Road. These will make the existing access redundant.
- New flood gate in Corporation Road in the underpass of the Railway Bridge.

3.2.16 The consequence of installing new flood walls and gates at these locations is that the predicted flood levels within the Marshalls site will increase over 100mm during the 1 in 100-year return period event with no climate change.

3.2.17 Appendix E includes the relevant extracts from the information submitted in support of NRW's planning application.

Climate Change

3.2.18 Guidance on climate change allowances published by the Welsh Government in September 2021 state the mean sea level rise allowances required for Newport as shown in Table 3-3 below. The anticipated 75-year lifecycle (2097) of the development is very close to the year 2100 so the 2100 values are accepted as the climate change levels. The data shown in Table 3-1 above includes climate change estimations.

Table 3-3: Expected Sea Level Rise 2100

Allowance Percentile	70th	95th
Sea Level Rise (m)	0.85	1.11

Historic Flooding

3.2.19 A review of available NRW mapping indicates that the site is within an area previously affected by flooding in December 1981 as shown in Figure 3-3.



Figure 3-3: Historic Flood Extents

3.3 Surface Water and Overland Flows

- 3.3.1 Surface water flooding can occur during high intensity rainfall events as sheet runoff from fields or hard paved areas. It is particularly prevalent in areas with significant hard standing or poorly permeable soils (i.e. clay). This is because the grounds capacity for infiltration is reduced. In addition, the inability to enter local drainage systems also contributes to risk from this source.
- 3.3.2 As shown in Figure 3-4, the site does not sit within Flood Zone 2 or 3 however there are some localised areas of Flood Zone 2 adjacent to the site.
- 3.3.3 Therefore, the risk of flooding from surface water and ordinary watercourse is considered low.



Figure 3-4: Surface Water Flood Risk

3.4 Groundwater Flooding

- 3.4.1 Groundwater flooding occurs when water levels in the ground rise above the land surface. This type of flooding is most likely to occur in areas above an aquifer. The occurrence of groundwater flooding is usually local and does not generally pose a significant risk to life due to the slow rate at which the water level rise.
- 3.4.2 The Newport LFRMS indicates that groundwater flooding is not a significant issue within the area. Therefore, it is considered that the risk of flooding from groundwater is low within the site.

3.5 Sewer Flooding

- 3.5.1 Sewer flooding occurs when intense rainfall overloads the sewer system capacity and/or when sewers cannot discharge properly to watercourses due to high water levels. Sewer flooding can also be caused when problems such as blockages, collapses or equipment failure occur in the sewerage system.

- 3.5.2 There are no offsite sewers through the site; and there is an existing drainage ditch system serving the site. Therefore, it is considered that the risk of flooding from sewers is low.

3.6 Reservoir Flooding

- 3.6.1 Flooding from reservoirs occurs when a reservoir dam is overtopped or breaches due to structural failure. The consequence of such an event would be severe but the probability of a catastrophic dam failure is considered to be extremely low due to the management and maintenance required under the Reservoirs Act 1975.
- 3.6.2 A review of the NRW 'Flood Risk from Reservoirs' map identified that the site is not at risk of flooding as a result of reservoir failure.
- 3.6.3 The risk of reservoir flooding is considered very low due to the low likelihood of an event.

3.7 Canal Flooding

- 3.7.1 Flooding from a canal occurs when the canal is overtopped or breaches due to failure.
- 3.7.2 There are no canals in proximity to the site and therefore the risk is considered negligible.

3.8 Summary of Flood Risk

- 3.8.1 The flood risk can at the site is summarised in Table 3-4.

Table 3-4: Flood Risk Summary

Source	Risk
Fluvial	Low
Tidal	High
Surface Water	Low
Groundwater	Low
Sewer	Low
Reservoir	Low
Canals	Negligible

4.0 Development Proposals

4.1 Proposed Development

- 4.1.1 The proposed development is for the construction of an entrance road and HGV gatehouse to form a new access point and stacking location for HGV's visiting Marshalls Newport facility.
- 4.1.2 Works associated with the project will include:
- Demolition of existing buildings and walls (in the way of the proposed roadway)
 - Groundworks and civils
 - Construction of a small office.
- 4.1.3 The proposed site layout is included in Appendix A.

4.2 Planning Policy and Guidance

- 4.2.1 The LLFA for the site is NCC and the following national and local policies should be adhered to.

Planning Policy Wales

- 4.2.2 Planning Policy Wales (Edition 11) sets out the land use policies of the Welsh Government and is supported by Technical Advice Note (TAN) 15 (Development and Flood Risk). In all zones, development should reduce and must not increase the risk of flooding on site or elsewhere.
- 4.2.3 In accordance with Schedule 3 of the Flood and Water Management Act 2010, as of the 7th of January 2019, all new development where the construction area is of 100m² or more will require Sustainable Drainage Systems (SuDS) to manage on-site surface water.
- 4.2.4 Approval from the SAB will be required before construction work can commence. Ultimately, all surface water drainage systems must be designed and built in accordance with the National Standards for Sustainable Drainage Systems.

Justification Tests

- 4.2.5 According to TAN 15 Development Vulnerability Categories industrial uses are classified as 'Less Vulnerable Development'.
- 4.2.6 The proposals are for the modernisation and improvement of the existing industrial site; and therefore, the proposed facilities need to be located within the Marshalls site.
- 4.2.7 Therefore, as the site is considered 'Less Vulnerable Development' and is previously developed the proposals are considered justifiable.

Local Policy Documents

- 4.2.8 The Newport Council Local Development Plan 2011-26 adopted January 2015 includes policy SP3 on flood risk, which indicates similar requirements to those indicated by TAN 15.

4.3 Development and Flood Risk

Flood Risk to the Development

- 4.3.1 As previously demonstrated the site is at low risk of flooding from all sources with the exception of Tidal flooding. The review of levels included in Section 3.1 above has concluded that flood waters within the HGV Gatehouse site could reach depths of 1.92m.

Flood Risk Arising from the Development

- 4.3.2 It is not anticipated that the proposals will result in an increase in flood risk from the development.

Proposed Mitigation and Resilience Measures

- 4.3.3 The Finished Floor Levels (FFLs) of the proposed gatehouse is to be elevated approximately 1.2m above the surrounding ground level to approximately 9.34m AOD to suit HGV cabin height as shown in Appendix F.

- 4.3.4 Whilst it is proposed to raise the FFL of the new Gatehouse Building, the undercroft of the building will be floodable.
- 4.3.5 There is an existing Flood Evacuation Management Plan (FEMP) in place for the site and this will be updated to reflect the new development and will be actioned in the event of a Flood Warning being issued by NRW.
- 4.3.6 As the site is at risk associated to high tides and surge events, the maximum expected river level will be predicted days (astronomical high tide), or at least hours (surge event), before any flooding takes place; providing NRW with sufficient time to issue a flood warning and for any staff to evacuate.
- 4.3.7 All staff will evacuate to their homes, or warned not to come to site, in the event of a flood warning being issued. As there is a new flood gate to be installed in the Corporation Road underpass, the updated FEMP will include contact details of the relevant staff at NRW managing the closure of the flood gate to ensure that there are no people trapped within the Marshalls site as a result of the closure of the flood gate.
- 4.3.8 In addition, a surface water drainage system is proposed which will provide a betterment on existing conditions.
- 4.3.9 It is not anticipated any works would have an impact on flood risk elsewhere. The entire area of land to the south and southeast of the site is at risk of flooding, and whilst the risk of flooding is associated with high water levels in the River Usk, these are dictated by high tides or tidal surges.

5.0 Surface Water Management Requirements

5.1 Drainage Hierarchy

5.1.1 In order to ensure that surface water runoff from a developed site does not increase the risk of flooding, in accordance with national and local policy, the management of runoff should be considered via a sequential approach, in line with Building Regulations (Part H) (2010). The following options for the disposal of runoff have been considered at a high level, in order of preference:

- Water Reuse (i.e., through rainwater harvesting);
- Discharge to an adequate soakaway or some other adequate infiltration system (i.e. to ground);
- Discharge to a watercourse; and
- Discharge to a sewer (surface water before combined).

Water Reuse

5.1.2 Rainwater Harvesting is not considered appropriate at the site for the following reasons:

- The proposed modular building for the gatehouse is not suitable for rainwater harvesting.
- The area of the proposed HGV gatehouse roof available for rainwater harvesting is approximately 70m².
- The expected amount of rainwater to be harvested is limited due to the small size of the catchment area.

Discharge to Ground

5.1.3 Infiltration is not anticipated to be feasible due to the presence of clay and sandstone, potential tidal influence on groundwater levels, proximity to groundwater protection zones and lack of available space for infiltration features due to operational nature of the already developed site.

Discharge to Watercourse

- 5.1.4 As infiltration is considered unsuitable, discharge to watercourse is the next stage in the hierarchy.
- 5.1.5 The existing drainage system utilises the existing ditch network and eventually discharges to the River Usk. There is no existing surface water drainage network at the proposed site and the surface water flows from this location are anticipated to drain into the ditch.
- 5.1.6 It is proposed to continue to utilise the drainage provided by the ditch however, a surface water sewer network is proposed which would discharge into the ditch at a restricted rate.

Discharge to Sewer

- 5.1.7 As it is proposed to discharge to watercourse, this has not been considered further at this stage.

5.2 Impermeable Areas

- 5.2.1 The existing site is considered brownfield and predominantly impermeable.
- 5.2.2 The proposed red line boundary site area is 0.31 Ha and the existing impermeable area is 0.25 Ha.
- 5.2.3 However, the impermeable areas forming the development is 0.21 Ha.
- 5.2.4 As the site is already developed and it is an industrial site a 10% allowance for urban creep has not been included.

5.3 Surface Water Discharge Rates

- 5.3.1 The existing site comprises mostly impermeable areas that would run-off directly at an unrestricted rate. As the works include a new surface water drainage system that will discharge at restricted rates for the areas under development this will provide a betterment to the existing arrangements.
- 5.3.2 As the site is brownfield the modified rational method has been used to calculate the proposed discharge rates based on the existing impermeable area of 0.25 with

a 70% betterment incorporated as requested by Newport SAB required. These calculations are included in Appendix G.

5.3.3 The allowable calculated discharge using this method is 10.43 l/s.

5.3.4 The drainage strategy provided by CCE proposes to limit the discharge to 10 l/s.

Pre-Development Run-Off Volumes

5.3.1 In the absence of an existing surface water drainage system, a simple micro-drainage model was developed to estimate the pre-development run-off volume for the 1:100, 6-hour design rainfall with a 40% climate change uplift.

5.3.2 The model shows that this volume is 201.91m³ as shown in the extract from Micro-drainage in below.

Critical Summary of Results by Maximum Level (Rank 1)									
Pipe Number	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Discharge Vol (m ³)
1.000	1	360 minute 100 year Summer I+40%	7.850	6.575	0.000	0.000	1.07		192.284
2.000	2	360 minute 100 year Summer I+40%	7.850	6.527	0.002	0.000	1.12		201.908

Figure 5-1: Micro-Drainage Pre-development Volume Extract for 100y + 40% CC, 6hr event

5.4 Required Attenuation

5.4.1 Attenuation of surface water runoff is required to maintain the restricted discharge rate and manage water runoff appropriately within the site. No flooding must occur during a rainfall up to and including the 1 in 30-year return period and any flooding during the 1 in 100-year return period plus 40% Climate Change (CC) is limited to external surfaces and retained within the site boundaries.

5.4.2 Due to the layout of the site is not possible to retain flooded water from the 1 in 100-year return period within the site boundary and in a safe area (i.e. landscape/ car parking). As a result, attenuation will be provided for the 1 in 100-year event + 40% CC.

5.4.3 The estimated attenuation requirements obtained using FEH method are shown in Table 5-1.

Table 5-1: Estimated Attenuation Requirements

Impermeable Area (Ha)	Proposed Discharge Rate (l/s)	1 in 100 year + 40% CC (m ³)
0.21	10	87

5.4.4 The attenuation calculations are included as Appendix H.

6.0 Sustainable Drainage Systems

6.1 Review of SuDS Options

- 6.1.1 In order to comply with the national guidelines and policies set by the EA and the Non-Statutory Technical Standards for Sustainable Drainage, the design of the surface water drainage system should seek to maximise the use of SuDS techniques.
- 6.1.2 This section reviews the suitability of the different SuDS elements available for the application site.

6.2 The SuDS Management Train

- 6.2.1 The main purpose of SuDS is to manage the surface water runoff generated by a development within the development site, attenuating additional flows generated by the introduction of impermeable areas whilst providing water quality treatment to the runoff and amenity and landscape benefits to the community. SuDS features can be categorised as follows:
- Source Control - Manage Runoff at its Source:
 - Water butts, green/brown roofs, permeable pavements, rainwater harvesting systems, bio-retention systems.
 - Site Control - Manage Runoff Generated by a Wider Area:
 - Swales, ponds, infiltration devices, filter strip, French drains.
 - Regional Control - Manage Runoff Generated by Several Sites:
 - Basins, ponds and wetlands.
- 6.2.2 Figure 6-1 highlights the SUDS principles and how they may be applied to a development via the SuDS Management Train.

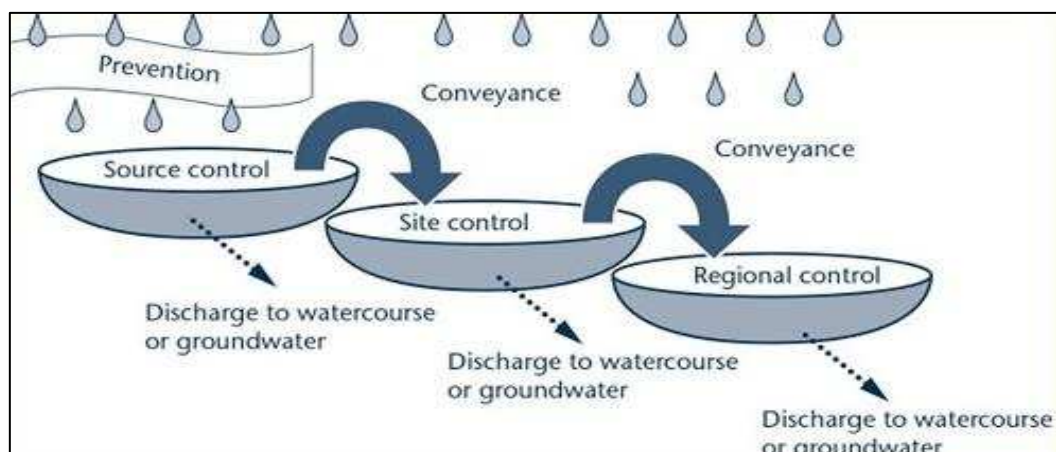


Figure 6-1: SuDS Management Train

6.2.3 Table 6-1 summarises the suitability of different SuDS elements to the proposed development.

Table 6-1: Suitability of SuDS to the Development

Type of SuDS	Description	Applicability to the Site
Source Control		
Rainwater Harvesting	Recycling of water from roofs and impermeable areas.	This is not appropriate for the development as discussed in Section 5.1
Green Roofs	Vegetated roofs that reduce runoff and remove pollutants.	Green roofs not suitable for lightweighted structure
Permeable Surfaces	Access roads and site compound formed by compacted crushed aggregate.	This is not appropriate within the site as anticipated high traffic flows and maintenance requirements.
Rain Gardens & Bio-retention Systems	Shallow depressions with free draining soil and planted with vegetation that withstands occasional flooding.	Insufficient space within area being developed.
Site and Regional Control		
Filter drains	Linear drains or trenches filled with granular material that allow infiltration to the surrounding ground.	These are considered suitable for the site.
Swales	Vegetated channels to convey, store and treat runoff.	Insufficient space within area being developed.

Detention Basins & Ponds	Shallow areas of open space that temporarily hold water and collect silt.	Enhancements to existing ditch is proposed (converting the existing ditch to a pond)
Infiltration Basins	Shallow depression that stores runoff before it infiltrates into the subsoil.	These are not considered further as infiltration is considered not feasible
Infiltration Devices	Generally granular trenches or soakaways that store water and allow infiltration to the surrounding ground.	These are not considered further as infiltration is considered not feasible.

6.2.4 Based on Table 6-1, filter drains and basins/ponds are considered the most appropriate SuDS features for the site.

6.3 Water Quality

- 6.3.1 The SuDS design should seek to provide an appropriate management train of SuDS components to effectively mitigate the pollution risks associated with the site users. The requirements for discharge to surface waters state that the 'Simple index approach' should be used.
- 6.3.2 Step 1 of the simple index approach is to identify the pollution hazard indices for the proposed land use. Within this development, the key drivers in respect of pollutant risks to the receiving watercourse are pollution from the adjacent roads and associated traffic.
- 6.3.3 In accordance with Table 26.2 of The SuDS Manual CIRIA C753, the pollution hazard level of the entire site is 'Medium' for the proposed land use as shown in Table 6-2.

Table 6-2: Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbon
Commercial yard and delivery areas.	Medium	0.7	0.6	0.7

- 6.3.4 Step 2 of the simple index approach is to select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index. Provided that the mitigation indices of the treatment techniques are greater than or equal to the hazard indices for the proposed development then there should be no reduction in the overall water quality within the receiving system.
- 6.3.5 Table 26.3 of The SuDS Manual states the various mitigation indices for discharges to surface waters for a variety of SuDS features. It is proposed to provide treatment to the surface water through the provision of filter drains and additionally, it is proposed to make ecological improvements to the existing ditch by re-purposing into a pond feature.
- 6.3.6 The mitigation indices for these features are shown below in Table 6-3.

Table 6-3: SuDS Mitigation Indices

SuDS Component	Total Suspended Solids	Metals	Hydrocarbon
Filter Drains	0.4	0.4	0.5
Pond	0.7	0.7	0.5
Total Mitigation Index	0.75	0.75	0.75

- 6.3.7 Where two SuDS components are in series the Total SuDS mitigation index is as follows:

$$\text{Total SuDS mitigation index} = \text{mitigation index}_1 + 0.5 (\text{mitigation index}_2)$$

- 6.3.8 Therefore, surface water which passes through the filter drain and then pond will undergo the required level of treatment. However, not all surface water flows will be collected by the filter drain.

- 6.3.9 As the mitigation indices for the proposed pond as shown in Table 6-3 do not exceed the pollution hazard indices for hydrocarbon shown in Table 6-2, it is anticipated that the run-off from the development which passes through the pond only will not receive sufficient treatment.
- 6.3.10 Therefore, an interceptor has been proposed within the drainage scheme.
- 6.3.11 A suitable interceptor for the site is a gravity separator. Gravity separators are available as prefabricated proprietary systems but can also be built in situ. They should comply with BS EN 858-1:2002.
- 6.3.12 A Class 1 interceptor should be provided as this is suitable for discharge to surface water.
- 6.3.13 It should be noted that the existing site is currently developed, and surface water run-off is collected within the ditch and the introduction of the proposed SuDS will provide a betterment on the existing site arrangements in terms of improved water quality.

7.0 Surface Water Drainage Strategy

7.1 Proposed Drainage and SuDS Principles

- 7.1.1 The developable impermeable area for the site is 0.21 Ha. As the existing site is brownfield, the proposed discharge rate for the site is the modified rational method with 70% betterment which has been calculated as 10 l/s.
- 7.1.2 The attenuation requirements at the 1 in 100 year + 40% CC event for an impermeable area of 0.21 Ha at a discharge rate of 10 l/s is 87 m³.
- 7.1.3 In order to comply with the national guidelines and policies set by the SAB and the Non-Statutory Technical Standards for Sustainable Drainage, the design of the surface water drainage system should seek to maximise the use of SuDS techniques.
- 7.1.4 As discussed in 6.2, the most appropriate SuDS for the development are filter drains and ponds. These SuDS provide a significant water quality improvement on the existing site arrangements, but an interceptor is also required to provide the level of treatment required.

7.2 Proposed Surface Water Drainage Strategy

- 7.2.1 A drainage strategy for the development has been produced by CCE and is included as Appendix I.
- 7.2.2 It is proposed to provide attenuation through an attenuation tank and filter drains. Additionally, it is also proposed to adapt the existing ditch into a pond feature which will provide additional attenuation in addition to the attenuation provided within the surface water drainage network.
- 7.2.3 The networks will discharge into the proposed pond feature at a rate of 10.00 l/s via a hydro-brake flow control restriction.
- 7.2.4 From there it discharges via the existing culvert to the River Usk which is tidal at this location.
- 7.2.5 The attenuation potential of the ditch has not been considered in the overall design of the surface water network.

- 7.2.6 Discharge will be treated using an interceptor before outfall into the proposed pond. The proposed pond will also provide further water quality enhancements. Filter drains are also proposed but these do not provide the required mitigation and therefore interceptors are proposed prior to outfall into the ditch.
- 7.2.7 An additional filter drain is proposed on the western corner of the ditch will provide improved treatment to surface water run-off flowing from the north but not considered within the current strategy as it is outside the development boundary.
- 7.2.8 The associated hydraulic calculations completed by CCE are included in Appendix J. These demonstrate no flooding at the 1 in 100 plus 40% climate change event.
- 7.2.9 Typical Construction Details are included as Appendix L.
- 7.2.10 The attenuation tank configuration is suitable for Polypipe Polystorm crates. The Hydro-Brake flow control unit is by Hydro International and is specified on the drainage plan. The final supplier will be confirmed at the detailed design/construction stage and therefore it is anticipated that detailed product details will be provided at the detailed design stage.

Post Development Discharge Volumes

- 7.2.11 Extracts of the hydraulic modelling calculations show that for the 1 in 100 year with 40% climate change uplift the discharge volume is 157.8m³ for the 6-hour design event as shown in Figure 7-1 below.
- 7.2.12 This is less than the pre-development volume shown in **Error! Reference source not found.** and therefore it can be demonstrated that betterment has been provided.

Results for 100 year +40% CC 360 minute winter, 1800 minute analysis at 6 minute timestep.														
US Node ID	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status	Link ID	DS Node ID	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
1	240	6.708	0.158	6.9	0.1791	0.0000	OK	1.000	2	6.9	0.495	0.098	4.7309	
2	240	6.708	0.508	9.8	0.5741	0.0000	SURCHARGED	1.001	3	8.4	0.623	0.124	0.9347	
cpit 1	240	6.710	0.160	5.3	4.5642	0.0000	SURCHARGED	2.000	3	5.3	1.235	0.165	0.1357	
3	240	6.707	0.557	26.9	15.8728	0.0000	SURCHARGED	1.002	4-control	-16.2	0.384	-0.111	0.6136	
4-control	240	6.706	0.706	9.1	1.2486	0.0000	SURCHARGED	Hydro-Brake®	hwall	8.3				
hwall	184	6.050	0.100	11.6	0.0000	0.0000	OK	1.004	outfall	11.6	0.736	0.386	0.4005	157.8
cpit 2	184	6.765	0.015	3.3	0.0168	0.0000	OK	3.000	hwall	3.3	0.710	0.060	0.0043	
outfall	184	5.952	0.088	11.6	0.0000	0.0000	OK							

Figure 7-1: Extract of Discharge Volume for 100 year + 40% CC, 6-hour event

7.3 Finished Floor Levels

- 7.3.1 A development should be set at minimum FFLs of a required freeboard above the relevant flood levels as required by the appropriate guidance.
- 7.3.2 The FFLs of the proposed gatehouse is to be elevated approximately 1.2m above the surrounding ground level to approximately 9.34m AOD to suit HGV cabin height as shown in Appendix F.

7.4 Exceedance Flow Routes

- 7.4.1 In setting the final external levels for the development it is important to ensure that if flows in exceedance of the 1 in 100 years plus 40% CC storm event occur or a failure of the site surface water drainage system occurs, suitable overland flood routes are provided within the development to ensure no localised flooding of the buildings occurs within the development.
- 7.4.2 Due to the proposed elevations of the HGV Gatehouse, it is not anticipated that surface water overland flows would enter the proposed building.
- 7.4.3 The exceedance plan produced by CCE is included in Appendix K.

7.5 Residual Flood Risk

- 7.5.1 The residual flood risks to the development are:
- Tidal Flooding
 - Storm events that exceed the capacity of the drainage system, as events beyond the 1 in 100-year storm event plus 40% allowance for Climate Change will not be explicitly catered for.
 - Flooding due to failure of the drainage system during the life of the development. Regular, ongoing maintenance will therefore be required to ensure that the capacity of the system is maintained to the required design standards.

7.6 Construction and Maintenance

- 7.6.1 All proposed drainage features, including surface water, SuDS and foul will remain private.

- 7.6.2 Details of how surface water runoff and potential pollution can be managed for any potential development will be detailed and managed by the appointed Contractor for any works in a Construction Environmental Management Plan (CEMP) or similar.
- 7.6.3 A summary of the general maintenance requirements for the proposed SuDS elements are shown in Table 7-1, Table 7-2 and Table 7-3 below.

Table 7-1: Proprietary Treatment Maintenance Requirements

Maintenance Schedule	Required Action	Frequency
Routine Maintenance	Remove litter and debris and inspect for sediment, oil and grease accumulation	Six-monthly
	Change the filter media	As recommended by the manufacturer
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six monthly
	Inspect filter media and establish appropriate replacement frequencies	Six monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first half year of operation, then every six months.

Table 7-2: Pond Maintenance Requirements

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove litter and debris	Monthly (or as required)
	Inspect marginal and bankside vegetation and remove nuisance items (for first three years)	Monthly (at start, then as required)
	Inspect inlets, outlets banksides, structures, pipework etc. for evidence of blockage and / or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May to October)
	Inspect silt accumulation in the forebay and main body of the pond and establish removal frequencies. Undertake contamination testing once some build-up has occurred, to inform management and disposal options.	Half-yearly

Flood Consequences Assessment

	Remove 25% of bank vegetation from water's edge to a minimum of 1 m above water level	Annually
	Remove sediment from any forebay	Every 1 – 5 years or as required
Occasional maintenance	Remove sediment from the main body of the pond when pool volume is reduced by 20%	With effective pre-treatment with will only be required rarely, e.g., every 25-50 years
Remedial actions	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Repair / rehabilitate inlets, outlets and overflows	As required

Table 7-3: Filter Drain Maintenance Requirements

Maintenance Schedule	Required Action	Frequency
Regular Maintenance	Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional Maintenance Monitoring	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

- 7.6.4 As part of any future reserved matters applications, a full and specific inspection and maintenance schedule should be provided identifying who will be responsible for each SuDS element and the proposed inspection and maintenance schedules.
- 7.6.5 It is anticipated that future maintenance of the drainage system will be undertaken by Marshalls as part of the overall site maintenance programme.

8.0 Foul Drainage

8.1 Existing Drainage

- 8.1.1 There is an existing foul drain in the access road that forms the western boundary of the HGV Gatehouse and wider site. There is another foul drain alongside the northern boundary of the HGV site.

8.2 Proposed Foul Drainage

- 8.2.1 A foul drainage system is required for the proposed gatehouse and modular despatch building, which will discharge into a foul cesspit tank.
- 8.2.2 The position of the new cesspool for the building allows for a tanker to remove waste without obstructing the roadway.
- 8.2.3 The Proposed foul layout is included with the drainage strategy in Appendix I

9.0 Conclusions and Recommendations

9.1 Conclusions

9.1.1 The follow conclusions have been made in the reporting:

- The proposals are for the construction of a new entrance for HGVs, cars and pedestrians. This includes a revised road layout, modular dispatch office, traffic barriers and associated works.
- The current site is approximately 0.31 Ha and currently comprises brownfield land.
- The nearest main river to the site is the River Usk which is tidal at this location.
- The nearest ordinary watercourse to the site is the existing ditch within the proposed development boundary.
- The site falls within Flood Zone 3 for Tidal Flooding.
- The risk of flooding from all other sources is considered low.
- The proposed development components are classified as 'Less Vulnerable Development' according to TAN 15.
- The proposals are considered to pass the justification test as the existing site is already developed, and the proposals will support existing employment.
- Marshalls Mono Ltd accepts the potential consequences of flooding to the proposed building and equipment and resilience measures are also proposed.
- It is proposed to provide a surface water drainage system that discharges with a 70% betterment on the existing brownfield rate while providing attenuation for the 1 in 100-year plus 40% climate change event.
- It is proposed to discharge surface water into the existing ditch as infiltration is not considered feasible and to mimic existing arrangements.
- The proposed discharge rate is 10 l/s based on the 0.21 ha development area.
- SuDS will be provided in the form of filter drains and a pond and attenuation provided within an offline tank within the system.

- A by-pass separator will be required to ensure that the attenuated surface water receives appropriate treatment prior to discharge into the ditch. However, the re-purposing of the ditch into a pond means that it is anticipated that the surface water will receive additional treatment in the pond.

9.2 Recommendations

9.2.1 The following recommendations are made:

- Flood resilience measures are to be provided to a level of 9.56m AOD in order to aid a speedy recovery to normal site operations in the event of a flood.
- The existing Flood Evacuation Management Plan is to be updated to include contact details for NRW to make sure that the closure of the proposed flood gate takes place only once everyone at Marshalls' site has been able to evacuate the site.
- In order to ensure the protection of the River Usk SAC and SSSI, a CEMP should be provided that includes general site management, pollution prevention and details of responsible persons and emergency contact details.
- Products details are to be included, at the detailed design stage including the product specifications and appropriate manufacturers maintenance instructions.
- A detailed survey of the existing surface and foul water drainage system, culverts and ditches within the site is required to inform the design.
- The existing flood evacuation management plan is to be updated to reflect the changes of operations within the site.
- The gatehouse is to be provided with flood resilience measures such as raised power outlets and air bricks and use of flood resistant construction materials.
- On completion, a regular inspection and maintenance regime is to be provided and implemented.
- All SUDS should be designed in accordance with The SUDS Manual (Ciria C753) and Defra's Non-technical standards for sustainable drainage systems.

9.3 Previous SAB Consultation

- 9.3.1 The proposals address and are compliant with the feedback received from the SAB on the 8th of June 2023. Each of the points raised by the SAB during this consultation have been considered in the proposals as follows:
- 9.3.2 Further information on why rainwater harvesting is not suitable.**
- 9.3.3 *Section 5.1 sets out why rainwater harvesting is not considered suitable for the site.*
- 9.3.4 Calculations to be provided in FEH.**
- 9.3.5 *Calculations have been undertaken using the FEH method.*
- 9.3.6 A 70% betterment on the existing rates being incorporated.**
- 9.3.7 *A 70% betterment on existing brownfield rates for the development area is proposed.*
- 9.3.8 Pre and post runoff volumes to show if a betterment has been achieved.**
- 9.3.9 *The pre and post development run-off volumes have been discussed in Section 7.3*
- 9.3.10 Exceedance plan.**
- 9.3.11 *An exceedance plan is included in Appendix K.*
- 9.3.12 Amenity comments from statutory consultee to be addressed if necessary.**
- 9.3.13 *Amenity comments were not received.*
- 9.3.14 Biodiversity comments from statutory consultee to be addressed if necessary.**
- 9.3.15 *Biodiversity comments were not received.*
- 9.3.16 A full and comprehensive CEMP to be provided.**
- 9.3.17 *This is included alongside the submission.*
- 9.3.18 Products details including the product specifications and appropriate manufacturers maintenance instructions.**
- 9.3.19 *Typical construction details have been included alongside the submission. Potential product suppliers for the proposed drainage elements have been*

discussed in Section 7.2 however; it is anticipated that full product details and relevant manufacturers maintenance instructions will be confirmed at the detailed design stage.

9.3.20 Confirmation as to who is responsible for the maintenance of the SUDS features.

9.3.21 Marshalls Mono Ltd are responsible for the maintenance of the SuDS features.