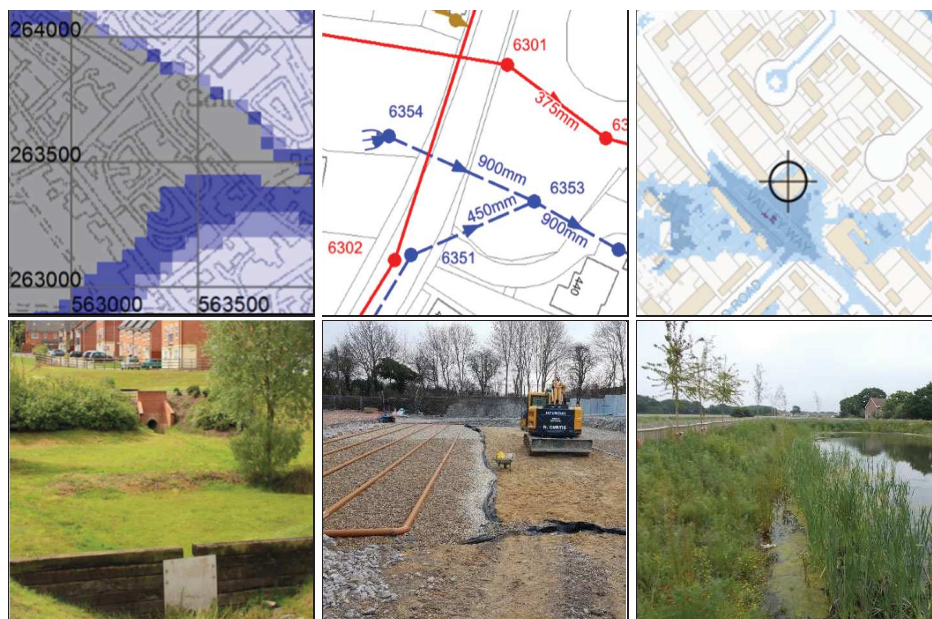




Flood Risk Assessment and Drainage Strategy

**178A West Street
Havant, Hants**

Reference: 1828

Issue: **Date:**

1 12/12/2019

2 15/4/2020 *Updated for Winter GWL results.*

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1. Introduction

- 1.1 Instructions were received from Havant Housing Association to undertake a Flood Risk Assessment (FRA) and set out a Drainage Strategy (DS) for a planning application for the development of 20nr 1-bed 1 person specialist apartments on 'the Coal Yard', 178A West Street, Havant, Hants PO9 1LR.
- 1.2 This assessment has been undertaken by A P Traves BSc CEng MIStructE MCIHT.
- 1.3 The client's attention is drawn to the conditions and limitations contained in Appendix D.

2. Development Description & Location

- 2.1 The site comprises approximately 0.29 Ha of land to at 178A West Street, Havant, Hants (grid ref 470950 106550). The site extents are indicated on the annotated aerial photograph in Appendix A. The existing topography is shown on drawing 17853-PD101 contained in Appendix A of this report.
- 2.2 The site comprises an irregular shaped parcel of land at 178A west Street, Havant. The front of the site is impermeably paved and there is a small commercial building on the north side of the pavement. The rear of the site is currently undeveloped.
- 2.3 It is proposed to redevelop the front part of the site for 20 No 1-bed 1 person specialist apartments operated by Havant Housing Association. The proposed layout is shown on PDP Architects drawing 28065-PD111 contained in Appendix A of this report.

3. Local Development Documents & Strategic Flood Risk Assessment

- 3.1 The Strategic Flood Risk Assessment (SFRA) for Partnership for Urban South Hampshire (PUSH) has been reviewed and this indicates the following:
- 3.2 Local flood interactive mapping is held on the PUSH SFRA web portal. This has been out of service for around 1 year for update, and the date at which it is due to go back on line has been continually deferred by PUSH. There is currently no access to the mappings so other sources have been used where available.
- 3.3 Hampshire CC Groundwater Management Plan (GWMP) does not identify groundwater issues within Havant.
- 3.4 Flood mapping data has been reviewed from the Environment Agency (EA) website. (refer to Appendix B). This indicates the following:
- 3.5 The EA mapping indicates the front of the site lies in FZ1, the extreme rear of the site lies in FZ3 and FZ2 extends from the rear towards the front of the site and lies partly under the proposed building location. More detailed information regarding flood levels was also obtained from the EA and the particulars of this are discussed in Section 8.
- 3.6 The EA mapping indicates the proposed housing is at low (<1% AEP) risk of surface water flooding. The retained open space area to the rear is at medium to high risk of surface water flooding but no building is proposed in this area. The watercourse forming the western boundary of the site has an inherent surface water flood risk as this contains water throughout the year. It is not proposed to undertake development within the channel.
- 3.7 The EA mapping indicates the site is not in an area of reservoir flood risk.
- 3.8 MAGIC mapping indicates the site lies in a Source Protection Zone 1 (SPZ1) for subsurface activity.

- 3.9 MAGIC mapping indicates the site is not within a drinking water safeguard or protection zone.
- 3.10 The Havant Borough Core Strategy-March 2011 sets out environmental policy with respect to flood risk and climate change in CS15 Flood and Erosion Risk. This is supported by Havant Borough Local Plan 2036 (Draft) policies E12 Managing Flood Risk in New Development and E13 Drainage Infrastructure in New Development.
- 3.11 CS15 requires that unacceptable levels of flood risk are avoided and that surface water is proactively managed through promotion of sustainable drainage techniques.
- 3.12 E12 requires that any new development will be safe over its lifetime, including the access, without increasing flood risk elsewhere.
- 3.13 E13 requires that any new development will have no net increase in surface water run-off compared with the pre-development rate and the drainage system does not increase flood risk elsewhere.
- 3.14 Chapter 9 of this report identifies that the proposed building will be at low risk of flooding CS15, E12 and E13 can therefore be met by:
- Implementing a surface water drainage strategy that manages flood risk from the new development.
 - Provision of a satisfactory sustainable surface water drainage system.
- 3.15 In essence the local policies replicate the requirements of current national policies and practice, and in meeting national policy local policy will also be met.

4. Catchment Flood Management & Shoreline Management Plans

- 4.1 The site is at an elevation of some 7 m AOD and is remote from the influence of tidal flooding. Shoreline Management Plans are not applicable at this location.
- 4.2 The South East Hampshire Catchment Flood Management Plan summary – December 2009 (CFMP) indicates the site falls within sub-area 5 Havant and Denmead. The CFMP states that policy 4 is the preferred policy approach:
- “Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change.”*
- 4.3 Overall the CFMP does not present any issues that would prohibit the development of this site with respect to flood issues provided the surface water drainage is based on SuDS principles.

5. Catchment Data

- 5.1 BGS mapping indicates the site geology generically comprises Head deposits and Alluvium over London Clay and Lambeth Group. The site lies on the east bank of Hermitage Stream and is bounded on the northern side by a large historic earthwork railway embankment.
- 5.2 A Geotechnical site investigation was undertaken by Messrs Soils Ltd and the key findings of their report 17902-MIR-927 November 2019 are discussed in the following paragraphs. The soil logs are reproduced in Appendix B.
- 5.3 4No. dynamic sampler boreholes (WS01-WS04) were made to a depth of 4.00m below ground level (bgl). Holes WS01-WS03 were fitted with monitoring wells.
- 5.4 4No. dynamic probe holes (DP01-DP04) were made to a depth of 6.00mbgl.

- 5.5 Made ground and alluvium was encountered within the upper 4m in WS01-WS04. London Clay was inferred to have been encountered in the dynamic probing at some 5.4mbgl. The Lambeth Group was not encountered.
- 5.6 The soils profile is summarised on Table 2.2 of the geotechnical report.
- 5.7 The made ground typically forms the upper 2m of soils and comprises 0.5-0.75m slightly sandy Clay over sandy silty Gravel. Paragraph 2.3.1 of the geotechnical report states *“the stratum is largely out of context with the surrounding area and likely to comprise fill emplaced to level the site following redirection of the stream...during construction of the railway.”* This statement is borne out by examination of old Ordnance Survey maps which suggest the present railway bridge over the stream was built off line of an original stream line through the site and the stream line then diverted along the northern side of the new embankment and through the new bridge and the redundant channel line infilled.
- 5.8 Paragraph 2.3.2 of the geotechnical report identifies the Alluvium to comprise a slightly fine sandy Clay.
- 5.9 Paragraph 2.3.3 of the geotechnical report indicates no sample of London Clay was recovered but the dynamic probe results infer this is located around 6mbgl.
- 5.10 Paragraph 2.5 of the geotechnical report indicates no groundwater was encountered in WS01-WS04 which were made to some 4mbgl. The report does however note that lining of the river channel (ie walls) may affect the results. A programme of GWL monitoring was subsequently undertaken (refer to paragraph 5.11).
- 5.11 In addition to holes WS01-WS03, two additional holes WS101 and WS102 were subsequently made on the land at the rear. The Groundwater Level (GWL) in these was monitored over winter 2019-2020 and is reported on in Soils Ltd report 18075/FLR rev 1.01 of March 2020, relevant information from which is contained in Appendix B. Table 1 of the report indicates that over the front part of the site where the building and car parking are proposed GWL had little variation but peaked slightly in late February early March 2020 at some 1-1.5mbgl. In WS101 and WS102 in the lower rear part of the site to be retained as soft scape GWLs also peaked at this time at close to surface level. Once the difference in AOD surface levels between the front and rear parts of the site is taken into account the results indicate a relatively static and consistent GWL across the site.

6. Sewage Authority Data

- 6.1 There are three public foul water sewers beneath the site; one 300mm DN, one 525mm DN and one 600mm DN. A copy of the local sewer plan is contained in Appendix B. The existing building on site discharges to the 300mm DN sewer.
- 6.2 The proposed development will continue to discharge foul water (FW) to the existing public FW sewer. A sewer capacity check has been undertaken by Southern Water which confirms there is adequate capacity in the local sewerage network to accommodate the foul flow from the development. A copy of this check is contained in Appendix B.
- 6.3 The standing wastewater Infrastructure Charge (IC), which came into force from 1st April 2018, will be paid.

7. Site Particulars

- 7.1 A walkover site reconnaissance was undertaken in July 2019. The site is some 0.29 Ha in area and is located on the north side of West Street. The site comprises an irregular shaped parcel of land at 178A West Street, Havant. The front of the site is impermeably paved and there is a small commercial building on the north side of the pavement. The rear of the site is currently undeveloped.

- 7.2 The rear of the site falls east to west, towards Hermitage Stream from around 7.2m AOD to around 6.2m AOD.
- 7.3 The yard at the front of the site also falls east to west from around 7.2m AOD to around 6.6m AOD.
- 7.4 The proposed dwellings are to be located on the land in excess of 8.3-8.5m to the north and east sides of the site. The lower lying land (7.0-7.5m AOD) to the south west corner of the site falls to the south west and is to be retained as open space within the FZ2/3 flood plain.
- 7.5 The front of the site is impermeably paved and there is a small single storey building to the north side of the pavement.
- 7.6 The western edge of the rear of the site is bounded by the channel wall to Hermitage Stream and the front of the site is separated from Hermitage Stream by a paved car sales lot. The adjacent Hermitage Stream channel is of engineering construction with concrete and masonry channel walls and a flat concrete invert.
- 7.7 The land to the north of the site comprises the embankment to the south coast mainline railway and the bridge over Hermitage Stream adjacent the northwest corner of the site.
- 7.8 North of the railway and the site and east and south of the site land use comprises residential dwellings. The immediately west of the site comprises an open car sales yard and the land use to the western side of Hermitage Stream adjacent to the site comprises commercial accommodation.

8. Source-Pathway-Receptor Assessments

- 8.1 The site is at an elevation of some 7m AOD and is not susceptible to tidal flooding.
- 8.2 The EA mapping indicates the front of the site where the access and majority of the building are proposed to be located in FZ1 (low risk) with a significant part of the rear land and small part of the proposed building location in FZ2 (medium risk) and a small part of the rear land in FZ3 (high risk).
- 8.3 More detailed information was obtained from the EA for flood levels and compared to the site specific topographic survey. The flood level data is contained in Appendix B and a copy of the topographical survey is contained in Appendix A. These are discussed in the following paragraphs:
- 8.4 The flow from the two separate bridge spans over hermitage Stream coalesce adjacent the rear of the site and are indicated to have the following flood levels:
- | | |
|-----------|-----------|
| 1%AEP | 6.34m AOD |
| 1%AEP +CC | 6.58m AOD |
| 0.1%AEP | 6.77m AOD |
- Adjacent the existing building on site the flood levels are indicated to be:
- | | |
|-----------|-----------|
| 1%AEP | 6.26m AOD |
| 1%AEP +CC | 6.48m AOD |
| 0.1%AEP | 6.67m AOD |
- Adjacent the site entrance on the northern side of West Street bridge the flood levels are indicated to be:
- | | |
|-----------|-----------|
| 1%AEP | 6.24m AOD |
| 1%AEP +CC | 6.48m AOD |
| 0.1%AEP | 6.63m AOD |
- For simplicity the following conservative values have been used for assessment and mitigation calculation.
- | | |
|---|----------|
| FZ3 ₂₀₁₉ rear land and proposed building | 6.4m AOD |
|---|----------|

FZ3 +CC rear land and proposed building	6.6m AOD
FZ3 +CC access and proposed car park	6.5m AOD

- 8.5 With reference to Figure 1 of the flood storage compensation assessment (refer to letter of 15th October 2019 contained in Appendix C) this shows the current ground contours and proposed minor alterations to existing ground levels. The level of area B will be increased to bring this above FZ3 +CC level of 6.6m AOD and to compensate for this volume areas C and D will be reduced to 6.25m AOD. This will produce a net storage gain at each stage and a cumulative increase in net storage in excess of 45m³ at FZ3 +CC flood level of 6.6m AOD.
- This will have a beneficial effect to slightly reduce local flood levels.
 - The proposed building will be above FZ3 +CC flood level
 - The front car park and access to the building will be above FZ3+CC
- 8.6 The minor alterations to ground levels set out in paragraph 8.5 will also slightly redistribute the location of the medium and low surface water flood risk areas on the site such that the proposed building and access will be located wholly within the low risk area (0.1-1%AEP). The watercourse (Hermitage Stream) to the west of the site inherently contains water and the channel is defined to be >1% AEP.
- 8.7 The EA mapping indicates the site is not in an area of reservoir flood risk.
- 8.8 The Hampshire CC Groundwater Management Plan (GWMP) does not identify groundwater issues within Havant.
- 8.9 The SFRA does not indicate any sewer flooding at the site.
- 8.10 The critical flood source for the rear of the site is fluvial out of bank flow from the Hermitage stream to the West. The critical flood source for the proposed building and car park to the front of the site is pluvial run-off from within the site. The site surface water drainage system will accord with the principles of CIRIA C753.
- 8.11 The flood receptors of the development would be:
- Residential dwellings
 - Users of the residential dwellings
- 8.12 The proposed development and existing site classifications to Table 2 (Paragraph 066 Reference ID: 7-066-20140306) are as follows:
- | | |
|-------------------------|-----------------|
| • Existing agricultural | Less vulnerable |
| • Proposed residential | More vulnerable |

9. Flood Probability

- 9.1 The EA flood zones shown on the outputs and included in Appendix B represents current best estimates of zone 2 and zone 3 flooding. It does not take account of potential climate change impacts. The flood zone definitions to Table 1 (NPPG Reference ID: 7-065-20140306) are as follows:

Zone 1	Low probability of flooding (<0.1% AEP)
Zone 2	Medium probability of tidal flooding (0.1-0.5% AEP)
	Medium probability of fluvial flooding (0.1-1% AEP)
Zone 3a	High probability of tidal flooding (>0.5% AEP)
	High probability of fluvial flooding (>1% AEP)
Zone 3b	Functional floodplain (>5% AEP probability of flooding)

The flood map does not differentiate between zones 3a and 3b.
Zone 3b is only considered appropriate for water-compatible development.
Zone 3a is additionally considered appropriate for less vulnerable uses.

- 9.2 The proposed dwellings are to be located well above FZ3 +CC and will therefore be at low risk of flooding.
- 9.3 The proposed rear open space in FZ2/3 will remain as soft landscaping (water compatible) at medium/high risk.

10. Climate Change

- 10.1 The new climate change allowances for flood risk assessment GOV.UK 17 December 2019 update have been used. Climate change values for the site are:
- Peak river flow: Table 1, South East, third epoch, higher central +45%
 - Peak rainfall intensity: Table 2, third epoch, upper end +40%
- 10.2 Surface water drainage strategy is discussed in Chapter 11. The volumes and flows for this strategy have been derived in accordance with CIRIA C753 and include for climate change effects.

11. Detailed Development Proposals & Surface Water Strategy

- 11.1 Surface water drainage must accord with a receptor hierarchy in which Tier 1 (infiltration) must be considered first.
- 11.2 The site soils investigation by Soils Ltd (refer to Section 5) identified around 2m of fill on the site with the fill below 0.5m being of a more gravelly nature. However, given a design flood level of 6.6m AOD and the immediate proximity of Hermitage Stream it is extremely likely that this more gravelly fill would therefore be below GWL as the flood levels in the watercourse rise. Furthermore the infiltration of run-off into made ground is a geohazard as this has potential to induce movement. The results of the Winter GWL monitoring are discussed in Section 5. Considering the GWL monitoring results in conjunction with the soil profile logs from WS03 and WS04 it is apparent that at the level where the soil is of a more gravelly nature it lies below GWL. Therefore attenuated discharge to the watercourse (Tier 2) will be required and the porous pavements would therefore be a class C sealed system.
- 11.3 A UKsuds IOH124 greenfield runoff calculation for the site has been made (Refer to Appendix C). This indicated the following rates:

Q _{bar}	1.46 l/sec
Q ₁	1.24 l/sec
Q ₃₀	3.36 l/sec
Q ₁₀₀	4.66 l/sec

The site is however brownfield and the existing building roof and pavement comprise some 180m² at an existing unattenuated run-off rate of 50 mm/hr. The existing brownfield run-off rate from this is 2.50 l/sec.

There are two approaches to setting post development discharge rates. Either a variable rate discharge and provision of separate long-term storage which itself is limited to a discharge rate of 2 l/sec/Ha; or set a flat discharge of Q_{BAR} or 2 l/sec/Ha and provide adequate storage to facilitate this. In both cases there is a pragmatic lower threshold to mitigate the potential blockage risk associated with small orifices for low flow rates. This is accepted to be 5 l/sec where discharging to open water bodies to allow for vegetation or 2 l/sec where discharging into sewers or piped systems which inherently have no vegetation.

- 11.4 The proposed site characteristics comprise:

Roof & car park	870 m ²
Soft landscape	2,005 m ²

The proposed positively drained site surfaces (roof and driveway) amount to some 870m² (30%). An assessment calculation for the storage required for 870m² drained area attenuated to 2 l/sec for a 1%AEP +40% Climate Change storm is contained in Appendix C. This indicates a storage volume of approximately 50m³ would be required. There are a number of means by which this volume could be provided and 400m² of class C sealed permeable pavement with a 0.36m CGA foundation of 35% void has been used for illustration purposes. Examination of the proposed site layout indicates there would be sufficient space to accommodate the required footprint of 400m². It is concluded that the proposed layout could support the appropriate attenuation storage for 2 l/sec to Hermitage Stream. There would be a net reduction of some 20% (0.50 l/sec)

- 11.5 The UKSUDS surface water storage assessment has been used to confirm the sizings. A copy of this calculation is contained in Appendix C.
- 11.6 The surface water drainage system will be designed to accommodate a 1 in 100 year +50% combined climate change and urban creep rainfall event. With respect to the Non-statutory Technical Standards for Sustainable Drainage Systems (NTS SuDS) the design accords with requirements S3 and S5-9. Design and construction details will accord with Building Regulations, so according with S10-11 and S13-14. The surface water design does not include pumping so S12 is not applicable. The detailed design can be secured by standard planning condition as usual. As set out in paragraph 11.2 if the permeability testing, GWL monitoring and geohazard risks permit it then a Tier 1 infiltration pavement would be provided, however this is considered extremely unlikely in which case a Tier 2 attenuation discharge to watercourse strategy will be provided.
- 11.7 Water butts should be installed to intercept roof water run-off. These will reduce the annual volume of surface water discharge but will not make a material contribution to regulation of critical run-off as these tend to be full during Winter months as there is minimal demand for irrigation in these months.
- 11.8 In summary source control will be provided by:
 - Attenuation storage as outlined in paragraph 11.4
 - Provision of water butts as outlined in paragraph 11.7
- 11.9 The surface water strategy better the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.
- 11.10 The use comprises generally low and very low pollution hazard levels (C753 Table 26.2) and does not require groundwater risk screening.
- 11.11 Simple index approach calculations are contained in Appendix C. These demonstrate that the proposed SuDS infrastructure can provide the mitigation necessary. It is proposed to provide a porous pavement to treat attenuated run-off prior to discharge into the watercourse.
- 11.12 The existing site falls east to west. The site morphology is not going to be altered so there will be no impact on local flood flow pathways and exceedance flows will continue to discharge west from the site to watercourse, as currently occurs.
- 11.13 A schedule of O&M maintenance requirements for the SuDS infrastructure is also contained in Appendix C. The site SuDS assets will be maintained by the Housing Association.

12. Sequential & Exceptions Tests

- 12.1 The proposed development comprises 20nr 1-bed 1 person specialist apartments dwellings. Havant Housing Association have a number of specific needs and constraints upon providing this specialist housing and have set these out in the Sequential Test in

Section 8 of the Design and Access Statement. This demonstrates that there are no other reasonably available sites appropriate to the proposed development in areas with a lower risk of flooding. The proposal therefore meets the Sequential Test.

- 12.2 Application of the Exceptions Test is required.
- 12.3 Paragraph 160(a) of the NPPF requires the development to provide wider sustainability benefits to the community. Havant Housing Association (HHA) provides supported accommodation to tenants with specialist supported living needs across the Borough of Havant for 30 years. HHA's aim is to provide discreet, high quality accommodation within the Havant community. Within this programme, it is necessary for such schemes to be located close to the amenities central Havant has to offer. For tenants to be truly integrated into the community whilst retaining their independence, they require access to shops, transport hubs and leisure/ entertainment amenities, that in the Havant area, only the town centre can fully offer. This provision of specialist supported accommodation is of wider sustainability benefit to the community.
- 12.4 Paragraph 160(b) of the NPPF requires that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible reducing flood risk overall. Paragraph 8.5 demonstrates that the minor adjustment to ground levels will make the development safe, will not increase flood risk elsewhere, and, will have a beneficial effect to slightly reduce local flood levels:
- This will have a beneficial effect to slightly reduce local flood levels.
 - The proposed building will be above FZ3 +CC flood level
 - The front car park and access to the building will be above FZ3+CC
- Paragraph 160(b) of the NPPF is therefore also met.

13. Flood Risk Management Measures

- 13.1 The source pathway receptor assessment is contained in Chapter 8.
- 13.2 Paragraph 8.10 identifies that that fluvial flooding is the governing source at the rear of the site. Paragraph 8.4 demonstrates the 1%AEP flood level at the proposed building location will lie between 6.48 and 6.58m AOD. It is proposed to adopt a FFL of at least 7.1m AOD to provide a freeboard in excess of 0.52m.
- 13.3 Paragraph 8.10 also identifies that on site surface run-off is the governing flood source to the car park and access. The management of the storage and conveyance of these volumes and flows is provided for by the surface water strategy set out in Chapter 11. The strategy accords with CIRIA C753 SuDS Manual.
- 13.4 The surface water strategy betters the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.

14. Off Site Impacts

- 14.1 The surface water strategy betters the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site .

15. Residual Risks

- 15.1 The proposed surface water strategy for the development provides for flood events up to 1:100 year 2019_{AD} + CC rainfall/fluvial flood events. The residual flood risk is therefore for events in excess of 1:100 year 2019_{AD} + CC rainfall/fluvial flow.
- 15.2 The proposed FFL is located well above 1:100 year 2019_{AD} + CC fluvial flood level from the watercourse. The residual flood risk is therefore fluvial events in excess of 1:100 year 2019_{AD} + CC.