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Hydrotec and Engineering Consultants

Develop Design Deliver

Drainage Strategy and SuDS

7 Enfield Drive, Clayton, Manchester

March 2024

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CLIENT:

AT A Design

Reference: 24/AT A Design /drainage/SuDS/Enfield Dr/ Clayton/Manchester

INSTRUCTION:

Hydrotec and Engineering Consultants was commissioned by AT A Design to carry out a drainage strategy and SuDS design for the proposed residential development on the land at 7 Enfield Drive, Clayton, Manchester, M11 4HP.

SCHEME:

Erection of a two-storey three-bedroom detached dwelling with associated off-road car parking and landscape amenities.

REQUIREMENT:

Surface water drainage strategy and SuDS design for the proposed residential development to assist the planning application requirement.

DOCUMENT REVIEW & APPROVAL

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Executive Summary

A flood risk assessment (FRA) and surface water drainage strategy were conducted to assist the planning application requirement for the proposed development on the land at 7 Enfield Drive, Clayton, Manchester, M11 4HP. The national grid reference number of the development site is SJ 88041 98898 ("the Site"). The proposed development is the erection of a two-storey three-bedroom detached dwelling with associated off-road car parking and landscape amenities.

The present FRA and surface water drainage strategy of the Site were made with the available information including the latest Environment Agency's (EA) flood maps, the latest FEH hydrological data, topographical elevation data (LiDAR), soil map data and sewer maps data of United Utilities.

The present investigation suggests that the Site is in flood zone 1, and therefore, the Site is considered to be out of fluvial and coastal flood risk.

The Site is at a very low surface water flood risk - according to the EA's flood map; Moreover, the hydrological and topographical elevation data suggest that the impact of the overland flow from the surroundings of the Site would be minimal. In addition, the Site is not at risk of groundwater flow. The Site is also not considered to be a foul water flood risk.

The proposed development would have some increase in the impervious surface area, however, this increment of the impermeable land would not deteriorate the surface water drainage substantially to the Site itself or its surrounding areas by the excess surface water runoff. In addition, the proposed eco-friendly layout design and landscape amenities would assist in a better drainage system. Furthermore, the proposed blue-green SuDS features, such as attenuation tank and green garden and plantation, would significantly improve the sustainable drainage systems, local environmental biodiversity and water quality compared with the existing conditions. The infiltration rate of the soils beneath the Site is not good enough for soakaway design. Therefore, in the proposed surface water drainage strategy - the excess surface water runoff would be stored in the underground attenuation tank located on the rear side.

The attenuation storage calculation was performed for the generated surface water runoff within the Site and no external flow was taken into account from the surrounding areas. The

investigation was made at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP including climate change allowance to assist the sustainable drainage systems (SuDS) design. The attenuation requirements for the whole site at 3.3% AEP and 1% AEP are $3m^3$ and $4m^3$; and with climate change allowance $5m^3$ and $8m^3$, respectively.

The size of the underground storage tank would be based on 1% AEP plus a 45% climate change allowance for the proportionate impermeable surface area (i.e. $2.88m^3$, taking into account 2.0 litres/sec greenfield runoff rate) within the Site without deterioration of the Site itself or surrounding areas, a requirement of the LLFA.

The size of the attenuation storage crates would therefore be 2.0m in length, 1.75m in width and 0.75m in depth. The crates, which would have a porosity of 95%, would be surrounded by a 300mm thick gravel layer. Thus, the combined attenuation storage capacity of the crates and gravels is $3.08m^3$, which is more than the requirement for a 1 in the 100-year hydrological event plus climate change allowance. The diameter of the surface water drainage pipes would be 100mm and the gradient of the pipes would be 1 in 100 or more.

There is an existing sewer drainage network passing easterly along Enfield Drive, and therefore it would be suitable to discharge the excess runoff in a controlled manner into this drainage network of United Utilities. However, consent is required from the United Utilities to discharge the outfalls.

The periodic inspection and maintenance of the attenuation tank and drainage features including the water quality of the outfalls would be maintained, and the landowner of the property would be responsible for these services.

The Site is not a risk to surface water drainage and therefore the finished ground floor level of the proposed dwelling would be the same as the ground level. However, it is highly recommended to raise the ground floor level by an additional 150mm freeboard. The access and egress from the Site during any flooding incident would be at Enfield Drive located in the front of the Site.

The generated wastewater flow by the proposed development was estimated to be 0.05 litres/sec. The diameter of the foul water drainage pipes is 100mm and the gradient of the pipes would be 1 in 100 or more. The general observation of sewer drainage networks in the surrounding areas

suggests that the proposed development would not deteriorate the existing sewer drainage network systems. However, a confirmation of consent agreement from United Utilities is required before utilisation of the the proposed dwelling.

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Abbreviations

AEP	Annual Exceedance Probability
CCA	Climate Change Allowance
DWF	Dry Weather Flow
DTM	Digital Terrain Model

EA	Environment Agency
FEH	Flood Estimation Handbook
FRA	Flood Risk Assessment
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	meter Above Ordnance Datum
NGR	National Grid Reference
OS Map	Ordnance Survey Map
SuDS	Sustainable Drainage Systems

1 Introduction

The flood risk and sustainable drainage are important aspects of any new and existing development sites. The flood, which is being enhanced in the recent time due to the global climate change effects, could make vulnerable the properties, communities, and many aspects of human life. Therefore, it is important nowadays to assess the flood risk of any new developments; and the National Planning Policy Framework[1] (NPPF) guidelines have given the authority to the Environment Agency[2] (EA) and local planning authority (LPA) to make sure that any developments should be considered the flood risk assessment from all possible sources for the planning authorisation. These are not only securing the minimum risk at the proposed development site but also reducing the risk to the other existing developments.

Generally, a new development would provide an improvement with better facilities to the users and the communities, but it should also make a satisfaction that the proposed development would not and should not deteriorate to on-site and/or off-site other existing developments in the surrounding areas during its design life. Therefore, it has been a policy of the NPPF, lead local flood authority (LLFA), LPA, water utility companies and other relevant authorities to assess and manage the sustainable surface water drainage systems of all possible sources for a proposed development before granting the planning permission. Thus, the aim of the present assessment is to assist the planners and designers with blue-green sustainable drainage system design for the proposed residential development as well as reduce the flood risk to the other existing developments in the surrounding areas.

1.1 Background of the project site

The proposed development (hereafter "the Site") is the erection of a two-storey three-bedroom detached dwelling with associated off-road car parking and landscape amenities. According to the NPPF guidelines, the proposed development would therefore be classified as a more vulnerable category in terms of flood risk vulnerability classification[3]. The Site is located on the

[1] National Planning Policy Framework - GOV.UK (www.gov.uk)
[2] Flood risk assessments if you're applying for planning permission - GOV.UK (www.gov.uk)
[3] National Planning Policy Framework - Annex 3: Flood risk vulnerability classification - Guidance - GOV.UK (www.gov.uk)

land at 7 Enfield Drive, Clayton, Manchester, M11 4HP. The national grid reference number (NGR) of the Site is SJ 88041 98898. The geographical boundary of the project site lies within Manchester Council's remit who is the lead local flood authority (LLFA), providing advice and guidance for sustainable drainage systems (SuDS) for this development site. The existing condition of the Site comprises an open and bare land surface on the front side and some overgrown grasses and vegetation on the rear side. Enfield Drive is located at the front of the Site and then connected with John Heywood Street. Generally, the adjacent areas have a moderate density of residential developments. The River Medlock is situated approximately 500m away from the Site to the north and the Ashton Canal is situated approximately 600m away to the south. A railway track line is situated on the south side, approximately 450m away. A satellite photograph of the existing condition of the project site is shown in Figure 1.1, and the proposed layout of the development is given in Figure 1.2 in addition to the detailed layout of the proposed development in Appendix I. The total land surface of the proposed development is approximately 265m^2, whereas the surface area footprint of the dwelling is approximately 61m^2.



Figure no.	**1.1**
Title	The location of the Site
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Project no.	3052

Legend

Project boundary: ———

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Figure 1.1: The location and existing condition of the proposed development site.

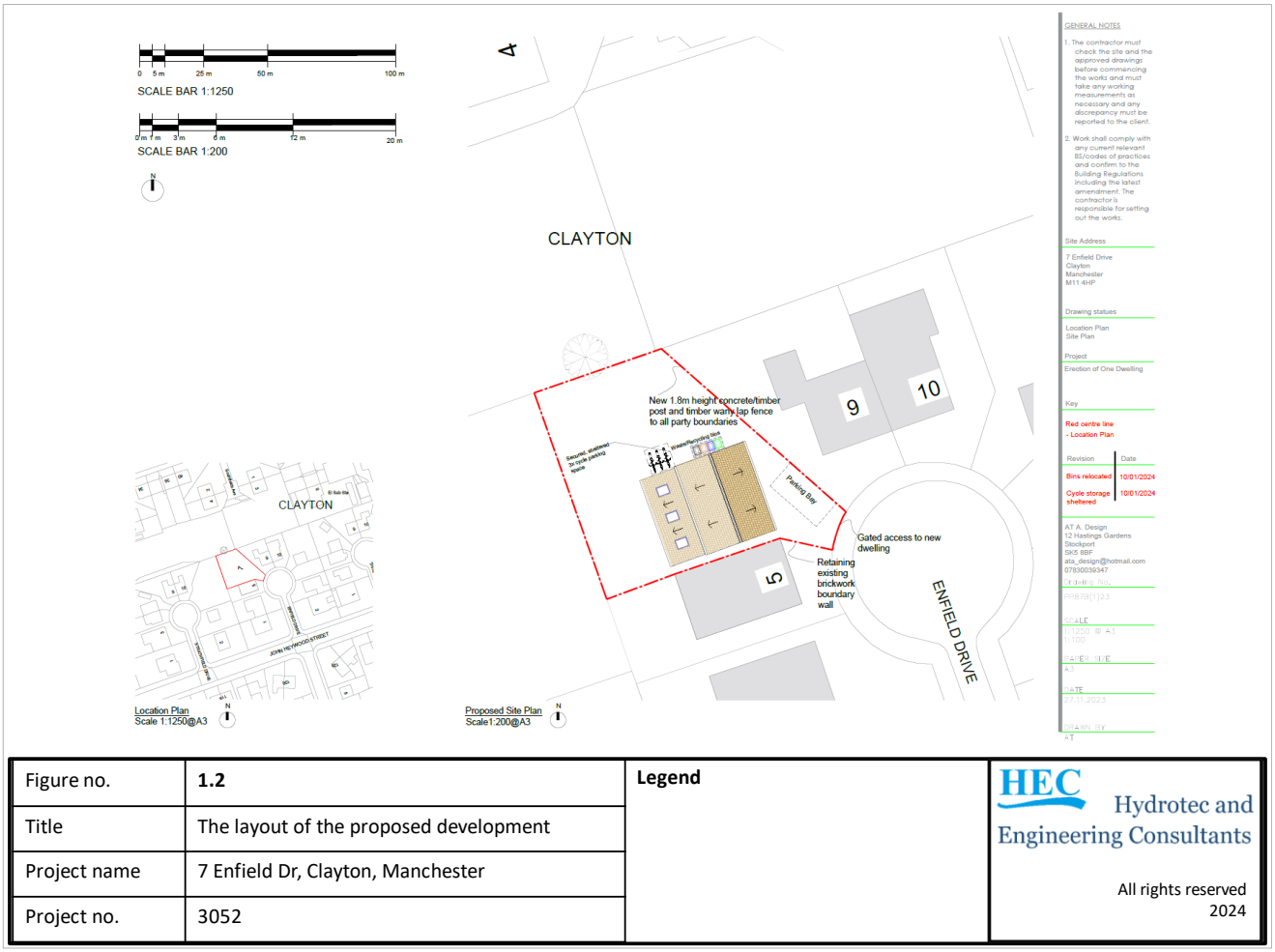


Figure no.	**1.2**	**Legend**	HEC Hydrotec and Engineering Consultants
Title	The layout of the proposed development		
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Figure 1.2: The layout of the proposed Site plan.

2 Potential sources of the flood risk

The proposed development is the erection of a two-storey three-bedroom dwelling with associated off-road car parking and landscape amenities; thus, it is a requirement of LLFA to ensure the provision of appropriate flood risk assessment and sustainable drainage of the surface water within the development, to promote safe and resilient communities, assisting by Environment Agency[4] (EA) and LLFA.

[4] Flood risk assessments if you're applying for planning permission - GOV.UK (www.gov.uk)

2.1 Fluvial and coastal flood risk

The Environment Agency's flood map[5] indicates that the Site is located in flood zone 1, a risk of flooding less than 0.1% AEP (Annual Exceedance Probability), i.e. less than 1 in 1000-year flood event for the fluvial or coastal flows (Figure 2.1). Therefore, the proposed development site is considered to be out of either fluvial or coastal flows. In addition, the EA's flood map[6] suggests that the Site is not at flood risk from the groundwater or reservoir flows (Figure 2.2).

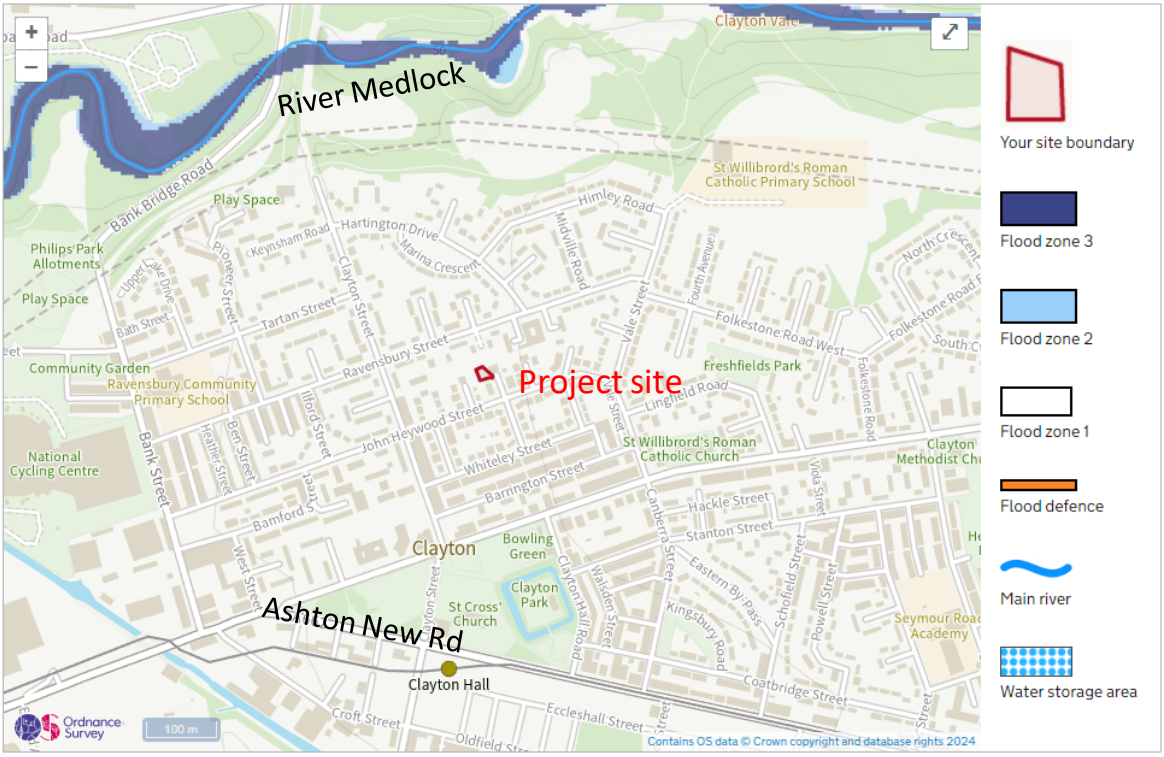


Figure no.	**2.1**
Title	EA's flood map - fluvial
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Figure 2.1: The fluvial and coastal flood risk at the Site - flood zone 1, the land having flood risk less than 0.1% AEP fluvial or coastal flows (reference – EA's flood map[7]).

[5] Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)
[6] Check the long term flood risk for an area in England - GOV.UK (flood-warning-information.service.gov.uk)
[7] Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)

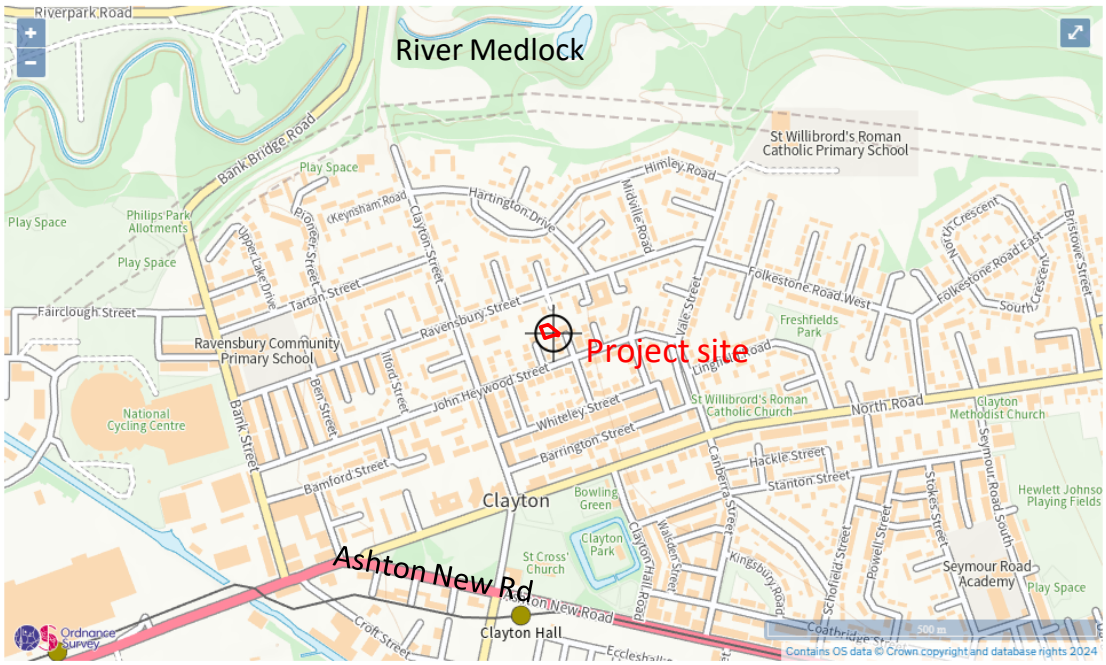


Figure no.	**2.2**
Title	EA's flood map – groundwater
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Figure 2.2: Groundwater flow at the Site – a very low flood risk against the groundwater flow (reference – EA's flood map[8]).

2.2 Surface water drainage

The guidance of the Environment Agency and LLFA based on the national planning policy framework[9] (NPPF) recommends the avoidance of the increase in surface water flooding through requirements for sustainable drainage systems (SuDS) and minimising the area of impermeable surface. Moreover, the NPPF para 167 suggests that "when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment." Therefore, the surface water drainage measures should have a neutral or better effect on the risk

[8] Check the long term flood risk for an area in England - GOV.UK (www.gov.uk)
[9] Op. cit.

of flooding both on and off the site, taking into account rain falling on the site and runoff from adjacent areas.

NPPF, LLFA and EA's guidance takes a presumption against development in a 1 in 30-year hydrological event to the surface water drainage. Development should only be allowed in an area at risk from a 1 in 100-year (with climate change allowance (CCA)) if surface water drainage is manageable without any major risk to the development itself or other surrounding areas. It should be shown that in such cases surface water flows can be contained within the development and any flooding flood volumes do not affect third-party lands, flood the property, or obstruct the key access/egress routes.

Therefore, to achieve the guidance's requirements of the surface water drainage at the Site, the surface water flooding mechanism at the on-site and off-site was assessed with appropriate consideration.

The EA's surface water flood map[10] (Figure 2.3) indicates that the Site would stay at a very low flood risk to surface water drainage (i.e. a very low risk means that each year this area has a chance of flooding less than 0.1% AEP). Therefore, the Site would be considered to be a very low hazard to surface water drainage.

Generally, the surface water overland flow is highly affected by the topographical conditions which define hydrological sub-catchments. For a better understanding of the surface water runoff around the Site, the hydrological sub-catchments were obtained from the Flood Estimation Handbook[11] (FEH22) and the data are presented in Figure 2.4.

[10] Your long term flood risk assessment - GOV.UK (check-long-term-flood-risk.service.gov.uk)
[11] Map - FEH Web Service (ceh.ac.uk)



Figure no.	**2.3**
Title	EA's flood map – surface water drainage
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Figure 2.3: Surface water drainage at the Site – a very low flood risk against the surface water flow (reference – EA's flood map[12]).

The hydrological sub-catchments that could have a possible impact on the Site are presented in Figure 2.4, and the indicative flow paths of the surface water runoff are shown in the blue arrow lines. The Site is located in a hydrological sub-catchment which drains the overland flow westerly and northwesterly into River Medlock. The contributing surface area that could have a possible impact on the Site is very small, i.e. approximately 0.12km^2. Subsequently, the impact of the overland flow from this sub-catchment would be very minor. The northern sub-catchment would convey the overland flow northerly through local drains into River Medlock and would stay away from any surface water runoff contribution to the Site. The sub-catchment located in the south would drain the surface water runoff southerly and would not have any impact of overland flow to the Site. Finally, the sub-catchment located in the far north would drain the

[12] Check the long term flood risk for an area in England - GOV.UK (www.gov.uk)

overland flows northerly into River Medlock and would stay out of the Site. Thus, the effective overland flow contribution to the Site from the adjacent areas would be minimal.

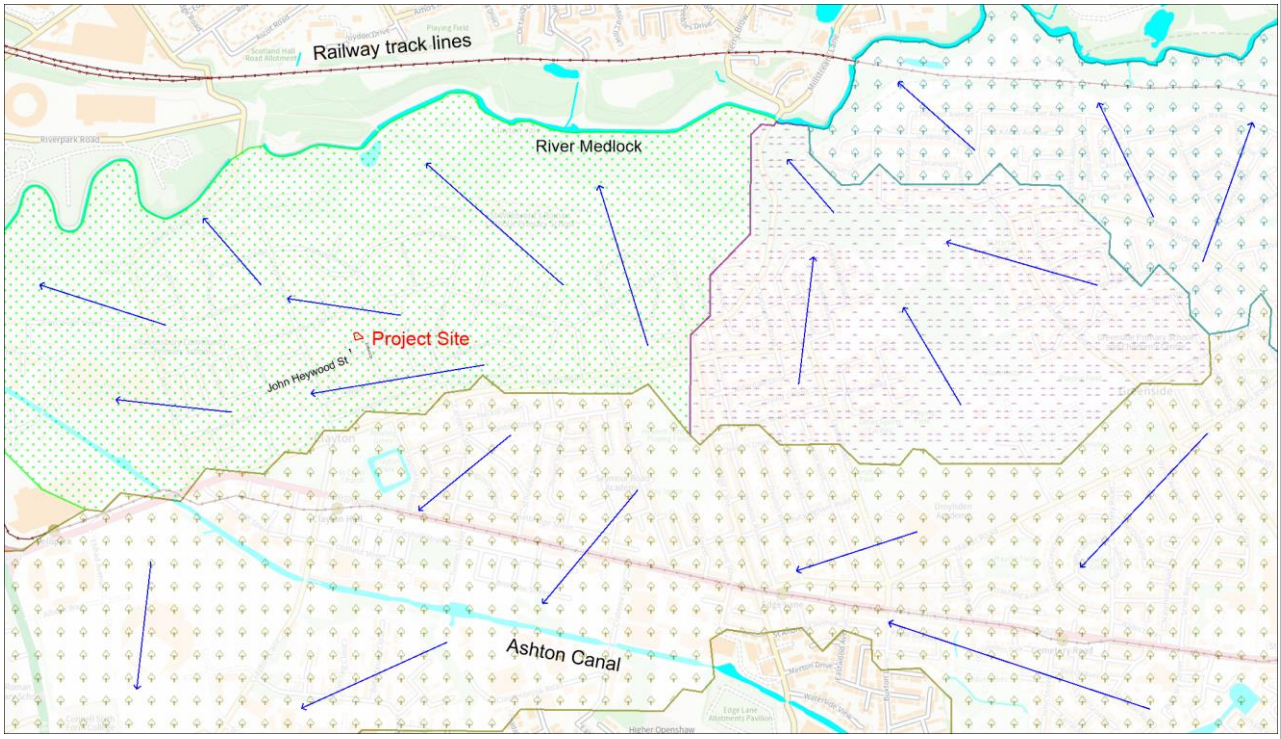


Figure no.	**2.4**
Title	FEH hydrological sub-catchments
Project name	7 Enfield Dr, Clayton, Manchester
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Figure 2.4: The hydrological sub-catchments at the Site (indicative overland flow paths in blue arrow lines); reference of the FEH22[13].

[13] op. cit.

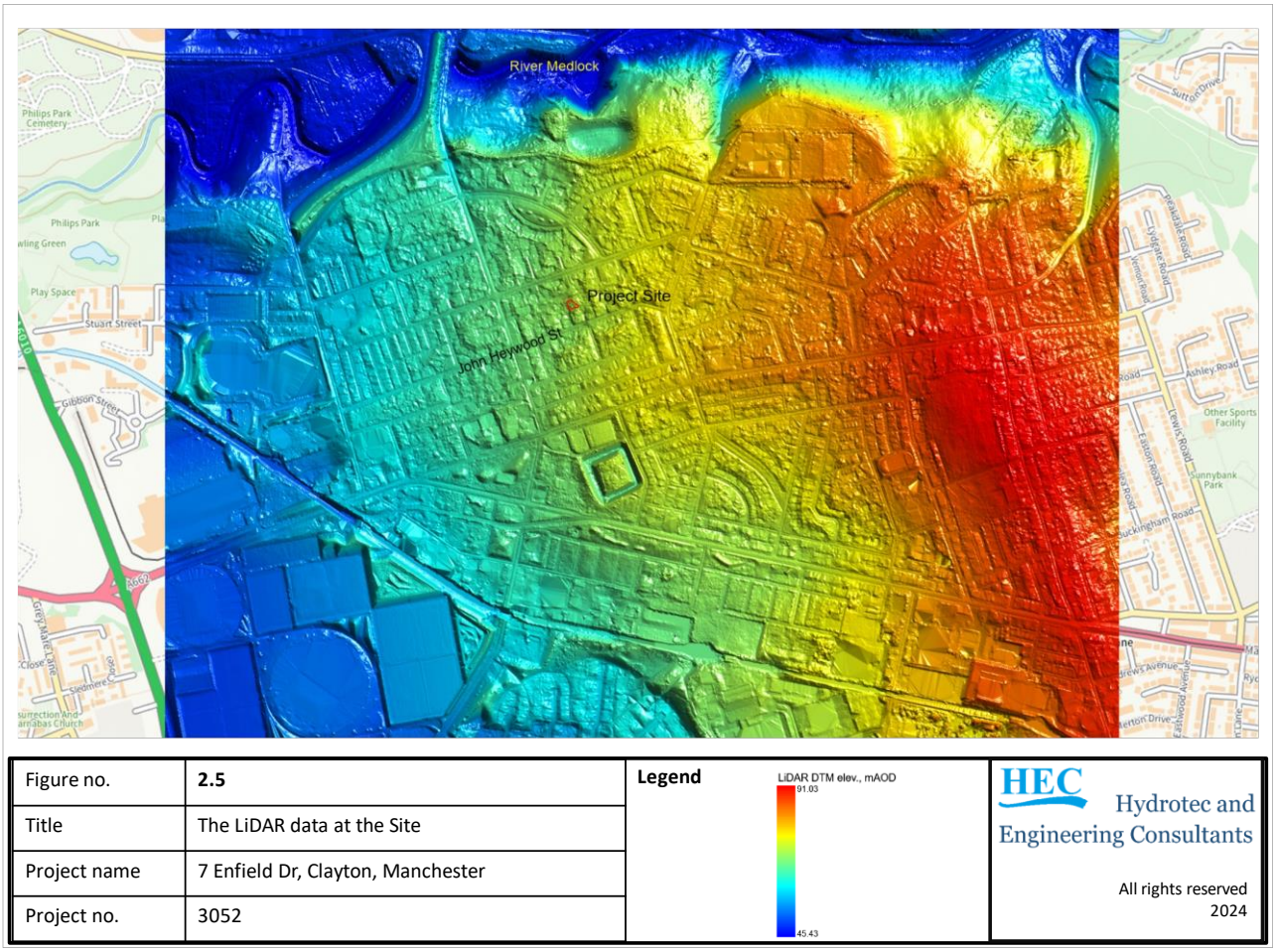


Figure no.	**2.5**
Title	The LiDAR data at the Site
Project name	7 Enfield Dr, Clayton, Manchester
Project no.	3052

Figure 2.5: The LiDAR topographical elevation at the Site.

The intensity and magnitude of the overland flow and path on the ground surface would have a significant effect due to the ground elevation. Therefore, for an understanding of the complexity of the overland flow mechanisms, the topographical elevation at the Site was assessed based on the recent LiDAR[14] (Light Detection and Ranging) DTM (Digital Terrain Model) data (Figure 2.5).

The LiDAR elevation data suggest that the ground level in the adjacent eastern area is relatively higher and bulging in shape, and therefore only a small part of the overland flow from this area would flow westerly and would be contained by local drainage systems. Thus, most of the westerly overland flow would stay away from the Site; subsequently, the impact of the overland land flow from the higher ground surface on the Site would be minimal. In addition to that, most

[14] Defra Data Services Platform

of the far western areas are relatively much lower ground levels and therefore, the overland flow from the adjacent area would flow relatively fast to drain away. Thus, the surrounding area including the Site would not be a surface water flood hazard.

Therefore, the contributing surface water runoff from the off-site to the Site would be relatively low and subsequently, the Site would not be considered any off-site surface water flood risk. Thus, the surface water runoff generated by the proposed development would mainly be by the rainfall on the Site. Subsequently, a drainage strategy for this excess generated surface water runoff would be required to be managed by sustainable drainage systems (SuDS), according to the LLFA guidance.

2.3 Sewer flood risk

The proposed development is the erection of a two-storey three-bedroom detached dwelling on a disused land. Therefore, the proposed development would generate foul water flow by the occupants.

The sewer network data (see also Appendix II) obtained from United Utilities indicate that the existing sewer drainage network systems around the Site are combined, i.e. conveying both surface and foul water by the same pipe. There is an existing 225mm diameter combined sewer pipe in Enfiled Drive conveying the drainage from the adjacent area and then connected to the drainage network in John Heywood Street. Whereas a 300mm diameter pipe along John Heywood Street runs southerly and then upgraded to 375mm in diameter from the junction at Strathfield Drive. In addition, there is a manhole at the front of the proposed Site on Enfield Drive and therefore it would be suitable to discharge the generated outfalls from the proposed development into this manhole. However, there are no details of the cover and invert levels of the manhole in United Utilities data.

For estimation of the generated foul water by the proposed development, the standard guidelines of foul water design were followed. The foul water generation would be highly variable during the days or nights and throughout the year. Considering the standard guidelines from the Sewer

for Adoption[15], the typical peak dry weather flow (DWF) for this type of catchment is considered to be 0.05 litres per sec per dwelling. Thus, the generated foul water flow by the proposed dwelling would be 0.05 litres/sec.

The general observation of the sewer drainage network in the surrounding areas suggests that the proposed development would not make any significant impact on the existing sewer drainage network systems. However, a confirmation of consent agreement from United Utilities is required before the utilisation of the proposed development.

3 Flood attenuation storage requirement

The proposed development is the erection of a two-story three-bedroom detached dwelling with associated off-road car parking and landscape amenities. The proposed development is therefore classified as a more vulnerable category - according to the NPPF flood risk vulnerability classification[16]. Most of the existing land surface on the proposed development site is covered by soft land surface, e.g. overgrown vegetation and some trees and shrubs - see also the recent photograph at the Site in Figure 3.1.

Table 3.1: The surface area of the pre-development and post-development at the Site.

Development	Permeable area, m^2	Impermeable area, m^2
Existing	265	0
Proposed	170	95

The proposed development would modify the existing land surface, however, it would provide a better sustainable drainage system and there would not be any deterioration of the excess surface water hazard due to the proposed development. The permeable and impermeable surface areas of the pre-development and post-development are given in Table 3.1. The total impermeable surface area of the proposed development is approximately $95m^2$, containing the building, off-

[15] Sewerage Sector Guidance-approved documents | Water UK
[16] National Planning Policy Framework - Annex 3: Flood risk vulnerability classification - Guidance - GOV.UK (www.gov.uk)

road car parking space, patios and access road. Thus, the impermeable area due to the proposed development is approximately 36% of the total area.



Figure no.	**3.1**	**Legend**	HEC Hydrotec and Engineering Consultants
Title	Existing ground surface at the Site		
Project name	7 Enfield Dr, Clayton, Manchester		
Project no.	3052		

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Figure 3.1: The photograph of the existing condition at the Site.

Thus, the proposed development would have some impact on the generated surface water runoff due to the impermeable land surface, and therefore, to comply with the NPPF's local plan policy guidance - the development proposal should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. Subsequently, a reduction of the equivalent impermeable surface area footprint (i.e. 36%) of the generated runoff including climate change allowance in the calculations would be managed on-site.

In order to calculate the generated surface water runoff at the Site, the hydrological data were obtained from the Flood Estimation Handbook[17] (FEH22). The cumulative rainfall depths were calculated and the values at 1 in 5-year (20% AEP), 1in 10-year (10% AEP), 1 in 30-year (3.3% AEP) and 1 in 100-year (1% AEP) are provided in Table 3.2 up to 600mins (i.e. 10.0 hrs). The proposed development is for residential use and therefore the design life of the development would be 100 years. Thus, the NPPF's guidance suggests the upper-end allowance for peak rainfall in climate change consideration. The upper-end peak rainfall allowances at the Site in the 2070s epochs are 40% and 45% at 3.3% AEP and 1% AEP, respectively - according to the Environment Agency's climate change allowance guidelines[18]. Subsequently, the climate change allowance (CCA) for the peak rainfall was increased by 25%, 25%, 40% and 45% at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP, respectively.

Table 3.2: The cumulative depth-duration rainfall at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP at the Site.

Duration, mins	Rainfall depths, mm			
	20% AEP	10% AEP	3.3% AEP	1% AEP
15	11.23	13.98	18.33	23.17
30	14.61	18.36	24.21	30.98
45	16.83	21.08	27.98	36.05
60	18.44	23.18	30.75	39.68
90	21.20	26.27	34.29	43.80
120	23.41	28.58	36.84	46.68
180	26.71	32.09	40.91	51.54
240	29.20	34.79	44.09	55.48
300	31.19	37.04	46.74	58.92
360	32.88	38.98	49.07	61.99
420	34.37	40.66	51.18	64.86
480	35.70	42.16	53.12	67.51
540	36.92	43.53	54.91	69.98
600	38.03	44.80	56.58	72.30

[17] Map - FEH Web Service (ceh.ac.uk).
[18] Flood risk assessments: climate change allowances - GOV.UK (www.gov.uk)

One of the main objectives of the surface water attenuation storage is that during the storm event, the generated surface water runoff within the Site would be retained for some time on-site, and therefore the peak flow in the watercourses and/or drainage networks would not be increased substantially to ease the flood risk in the downstream. However, it is an acceptable policy of the LLFA with regard to the greenfield runoff rate to allow some discharge from the development site into the nearby watercourses and/or drainage network systems to reduce the cost and land space for the attenuation storage within the development site.

In the present calculation, the greenfield runoff rates were considered based on the HR Wallingford tools[19], however, the total surface area of the site is less than the minimum area requirement (i.e. 0.10 hectares) for these tools, and therefore the minimum greenfield runoff rate of 2.0 litres/sec was adopted. This value is also recommended by HR Wallingford tools for SuDS design and this would assist in reducing the sedimentation and blockage of the drainage pipes.

The attenuation storage requirements for the proposed development were calculated at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP including climate change allowance[20] and the results are presented in Table 3.3. The attenuation storage requirements for the Site (i.e. surface area of 265m^2) at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP are 1m^3, 2m^3, 3m^3 and 4m^3; and with climate change allowance 2m^3, 3m^3, 5m^3 and 8m^3, respectively.

To assess the feasibility of the attenuation for the generated surface water runoff through underground infiltration, the soil types beneath the Site were assessed based on the Soilscapes map data of Cranfield University[21]. Generally, soil types beneath the Site are slowly permeable, seasonally wet, acid loamy and clayey soils (Figure 3.2), and therefore the infiltration rate on the permeable area would be low and it would not be suitable for soakaway design at the Site. It should, however, be noted that there is no in-situ soil percolation data available at the project site during the publication of the report.

[19] Online tools for sustainable drainage systems (SuDS) (uksuds.com)
[20] Peak rainfall climate change allowances by management catchment - GOV.UK (www.gov.uk)
[21] https://www.landis.org.uk/

Table 3.3: Surface water attenuation storage requirement at 20% AEP, 10% AEP 3.3% AEP and 1% AEP including climate change allowance at the Site.

Return periods	Storm duration, mins	Greenfield runoff rate, l/s	Volume of the surface water runoff, m^3		
			Total runoff	Attenuation req.	Attenuation req. with CCA
20% AEP	15	2.00	3	1	2
	30	2.00	3	0	1
	45	2.00	4	-2	0
	60	2.00	4	-3	-2
	90	2.00	4	-6	-5
	120	2.00	5	-10	-8
	180	2.00	5	-17	-15
	240	2.00	4	-24	-23
	300	2.00	4	-32	-30
	360	2.00	4	-40	-37
	420	2.00	3	-47	-45
	480	2.00	3	-55	-53
	540	2.00	2	-63	-60
	600	2.00	2	-70	-68
10% AEP	15	2.00	3	2	3
	30	2.00	4	1	2
	45	2.00	5	0	1
	60	2.00	5	-2	0
	90	2.00	6	-5	-3
	120	2.00	6	-9	-7
	180	2.00	6	-16	-14
	240	2.00	6	-23	-21
	300	2.00	6	-30	-28
	360	2.00	5	-38	-35
	420	2.00	5	-46	-43
	480	2.00	4	-53	-50
	540	2.00	4	-61	-58
	600	2.00	3	-69	-66
3.3% AEP	15	2.00	5	3	5
	30	2.00	6	2	5
	45	2.00	7	1	4
	60	2.00	7	0	3
	90	2.00	8	-3	1
	120	2.00	8	-6	-2
	180	2.00	8	-13	-9
	240	2.00	8	-21	-16
	300	2.00	8	-28	-23
	360	2.00	8	-35	-30
	420	2.00	8	-43	-37
	480	2.00	7	-50	-45
	540	2.00	7	-58	-52
	600	2.00	6	-66	-60
1% AEP	15	2.00	6	4	7
	30	2.00	8	4	8
	45	2.00	9	4	8
	60	2.00	10	2	7
	90	2.00	10	0	5
	120	2.00	11	-4	2
	180	2.00	11	-10	-4
	240	2.00	11	-17	-11
	300	2.00	11	-25	-18
	360	2.00	11	-32	-24
	420	2.00	11	-39	-31
	480	2.00	11	-47	-38
	540	2.00	11	-54	-46
	600	2.00	11	-61	-53

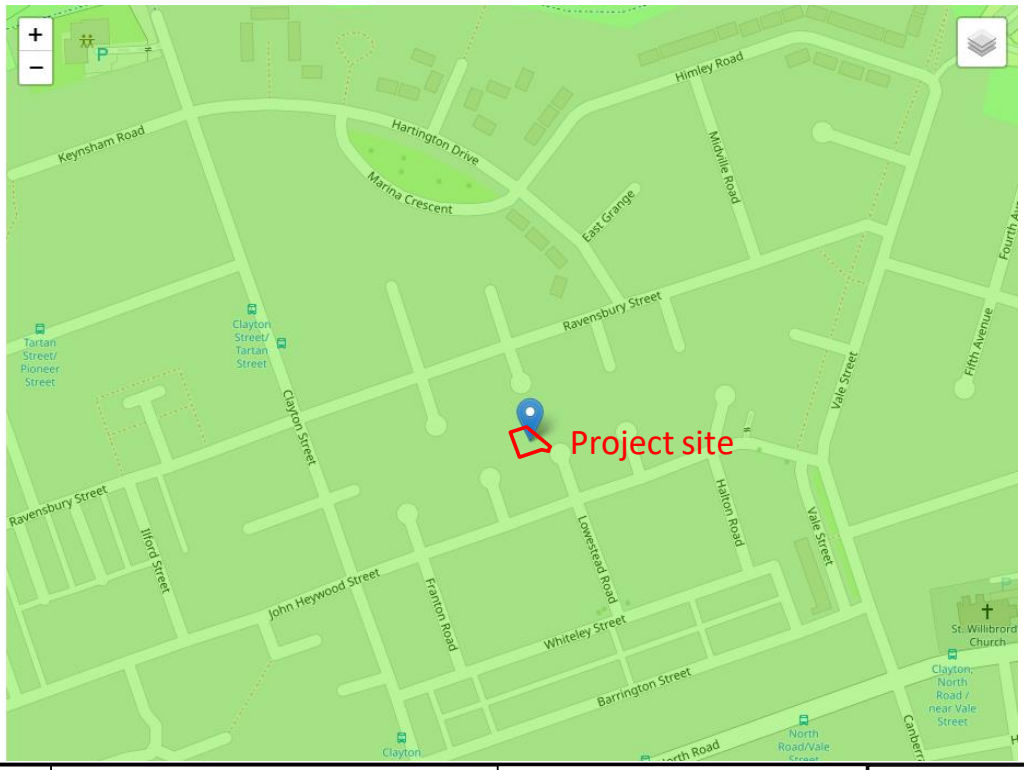


Figure no.	**3.2**	**Legend**	HEC Hydrotec and Engineering Consultants
Title	Soilscapes map data at the Site	Project boundary:	All rights reserved 2024
Project name	7 Enfield Dr, Clayton, Manchester		
Project no.	3052		

Figure 3.2: The soil types beneath the Site – slowly permeable, seasonally wet, acid loamy and clayey soils (reference - Soilscapes map data of Cranfield University[22]).

At present, all the on-site surface water runoff is discharged either in the existing drainage network or nearby overground. However, to comply with the NPPF's local plan policy guidelines and to improve the sustainability of the wider drainage systems, environmental impact and local biodiversity in the surrounding areas – the equivalent impermeable surface area footprint of the proposed development, i.e. 36% of the excess generated surface water runoff, would be attenuated on-site at 1 in 100-year plus a 45% climate change allowance (i.e. 2.88m^3).

The existing sewer drainage network data obtained from the United Utilities indicate that a combined sewer drainage network of 225mm diameter passes along Enfield Dr southerly and then joins to a 375mm diameter pipe in John Heywood Street. Therefore, it would be suitable to

[22] Soilscapes soil types viewer - National Soil Resources Institute. Cranfield University (landis.org.uk)

discharge the excess surface water runoff into them in a controlled manner from an attenuation storage tank.

The proposed development would have an impact on a maximum of 36% impermeable land and therefore the attenuation for the excess runoff would be managed by an underground storage tank (e.g. attenuation crates). The layout of the development site indicates that the location of the proposed attenuation storage tank would be suitable on the northern side (i.e. rear garden). The size of the underground storage tank would be based on the 1% AEP plus a 45% climate change allowance. (i.e. 2.88m^3) while the discharge from the tank would be maintained in a controlled manner by a hydro-valve vortex flow control unit (i.e. 2.0 litres/sec, see also a sample of vortex flow control device in Appendix V).

The proposed development is the erection of a two-storey three-bedroom detached dwelling with associated off-road car parking and private landscape amenities, and the layout of the development was considered well-thought, eco-friendly and sustainable drainage systems including plenty of shrub plantation and open grassland with permeable topsoils, assisting water quality improvement by reducing the suspended solids and silts materials. These proposed features would significantly improve the sustainability of surface water drainage. Moreover, it is highly recommended to adopt rainwater harvesting and water butts for the roof water, a further reduction of surface water drainage.

The water quality of discharged outfalls would be well maintained (e.g. permeable topsoil materials to remove the suspended solids and silts materials) in addition to the periodic inspection and maintenance of the attenuation storage tank and drainage features. The landowner of the proposed dwelling would be responsible for the operation and maintenance of the SuDS system for effective and efficient performance during its design life.

4 SuDS layout design

The proposed development is the erection of a two-storey three-bedroom dwelling with associated off-road car parking space and private landscape amenity facilities. Most of the existing land surface is open grassland and therefore the surface water runoff would slightly be modified by the impermeable land, but this increment of the impermeable land would not

deteriorate the surface water drainage substantially to the Site itself or its surrounding areas by the excess surface water runoff. However, the proposed layout of the Site would rather provide a positive and sustainable drainage system. The proposed drainage network would be combined, (i.e. outfalls of the surface water and foul water drainage would be the same network) and the layout of the drainage network at the Site is shown in Figure 4.1, see also Appendix III for details. The size of the underground attenuation tank was designed for a 1 in 100-year flood event plus a 45% climate change allowance (i.e. 2.88m^3). In the proposed SuDS layout, the surface water runoff from the roof and other impermeable surfaces would be conveyed by surface water pipes, ACO drains and porous trenches into the attenuation tank before discharging into the existing drainage network of United Utilities located in Enfield Drive. There is a manhole located within close proximity of the front of the proposed dwelling, and therefore it would be suitable to connect the proposed drainage network to this manhole.

In the proposed drainage network - the diameter of the drainage pipes is 100mm and pipes are connected with manholes, ACO drains, and gullies. The gradient of the drainage pipes would be 1 in 100 or more. The cover level of the manholes would be the ground level while the invert level would be set to provide the required gradient, taking into account the invert level of the existing manholes. The details of the cross-section of the attenuation storage tank are given in Appendix IV. The size of the attenuation storage crates would be 2.0m in length, 1.75m in width and 0.75m in depth. The porosity of the crates is 95% and therefore they would hold 2.49m^3 of water. In addition, there are 300mm thick gravel layers around the sides; therefore, these porous materials on the sides would hold 0.59m^3 of water, considering the 0.30 porosity of the gravel materials. Subsequently, the total attenuation storage capacity would become 3.08m^3, which is more than the requirement (i.e. 2.88m^3). Furthermore, at the top of the attenuation storage tank, there would be a 250mm thick gravel bed which would be covered by a 100mm thick sand layer, allowing a provision to store surface water runoff at a higher hydrological event. At the bottom of the storage tank (attenuation crates), there would be a 300mm thick gravel bed and this feature would allow the storage capacity of approximately 0.55m^3 of surface water. In addition to that, storage water would infiltrate the underground through the bottom of the tank, whenever it would have an available capacity. Subsequently, this would assist in emptying the attenuation tank during the dry period and allowing available maximum capacity in the next rainfall event. Therefore, the development site would stay out of surface water flood risk with the proposed sustainable drainage systems without deterioration of the Site itself or surrounding areas.

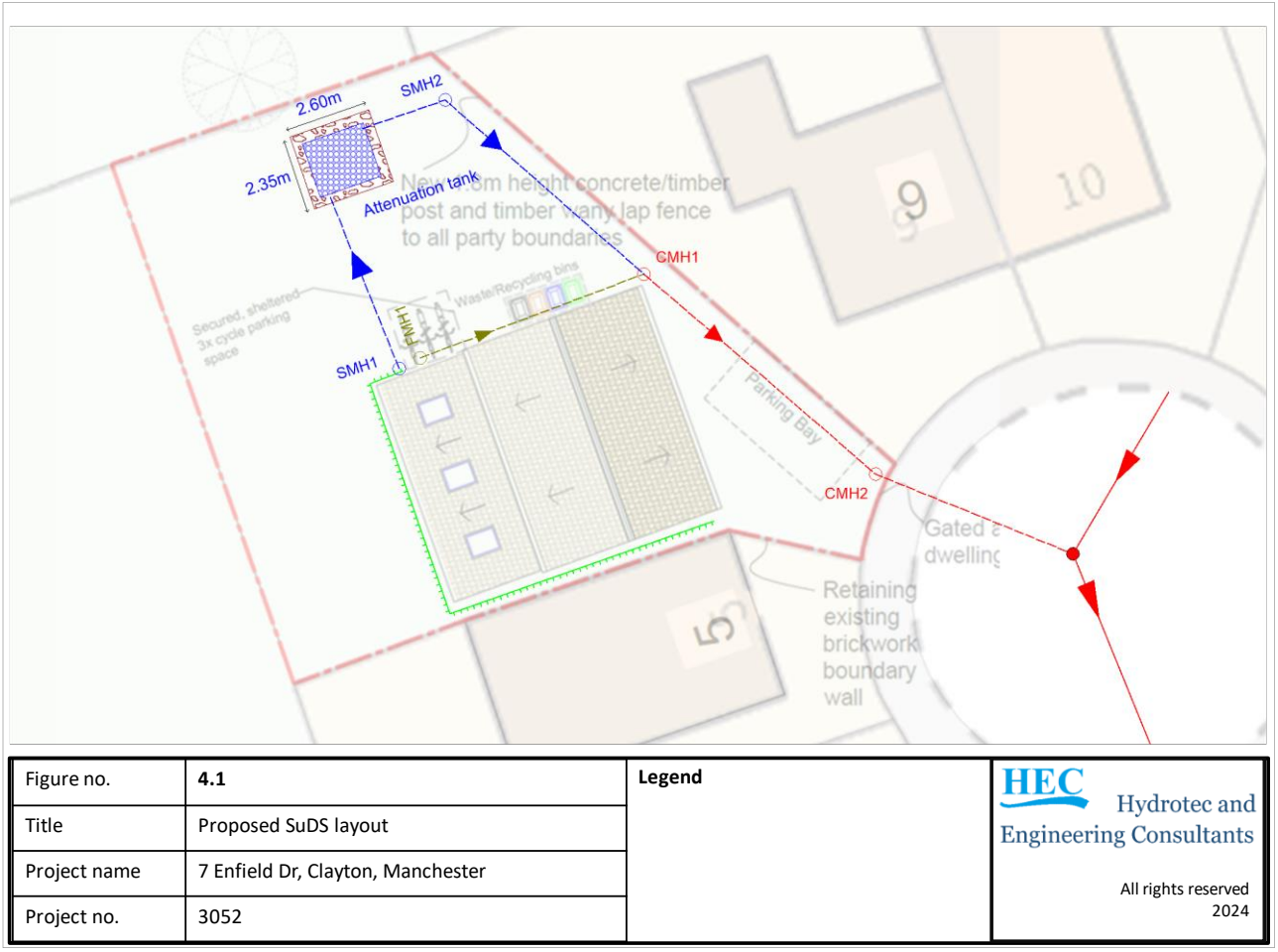


Figure no.	**4.1**	**Legend**	HEC Hydrotec and Engineering Consultants
Title	Proposed SuDS layout		
Project name	7 Enfield Dr, Clayton, Manchester		
Project no.	3052		

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Figure 4.1: The SuDS layout and attenuation storage at the Site.

5 Management and maintenance plan of drainage infrastructures

The landowner of the proposed dwelling would be legally responsible for the management of the proposed blue-green SuDS systems including a periodic inspection and maintenance of the SuDS features and drainage infrastructures within the Site for effective and efficient performance during the design life of the development. The recommended maintenance schedules for the proposed SuDS systems are outlined below.

Table 5.1: Operation and maintenance requirements for filter drains.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Remove litter (including leaf litter) and debris from the filter drain surface, access chambers and pre-treatment devices.	Monthly or as required
	Inspect filter drain surface, inlet/outlet pipework and control system for blockages, clogging, standing water and structural damage.	Monthly
	Inspect pre-treatment systems, inlet and perforated pipework for silt accumulation and establish appropriate silt removal frequencies.	Six monthly
	Remove the sediment from pre-treatment devices.	Six monthly or as required
Occasional maintenance	Remove or control tree roots where they are encroaching on the sides of the filter drain, using the recommended methods.	As required
	At locations with high pollution loads, remove the surface of the geotextile and replace, and replace the overlying filter medium.	Five yearly, or as required
	Clear perforated pipework of blockage.	As required

Table 5.2: Operation and maintenance requirements for attenuation storage tank.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause a risk to performance).	Monthly
	For systems where rainfall infiltrates into the tank from above, check the surface of the filter for blockage by sediment, algae, or	Annually

Maintenance schedule	Required action	Typical frequency
	matter; remove and replace the surface infiltration medium as necessary.	
	Remove the sediment from pre-treatment structures and/or internal forebays.	Annually, or as required
Remedial actions	Repair/rehabilitate inlet, outlet, overflows, and vents.	As required
Monitoring	Inspect/check all inlets, outlets, vents, and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey the inside of the tank for sediment build-up and remove it if necessary.	Every 5 years, or as required

6 Finished floor level and access/egress from the Site

The proposed development, which is the erection of a two-storey three-bedroom detached dwelling with associated off-road car parking, access road and landscape amenities, is classified as a more vulnerable category, according to the NPPF flood risk vulnerability classification[23]. However, the Site would not have a flood risk from fluvial flow. Moreover, the surface water drainage would have a very low risk and would have a minimal impact on the Site, taking into consideration the proposed SuDS features. Therefore, the finished ground floor level of the proposed dwelling would be at the same level as the ground level. However, it is highly recommended to raise the finished ground floor level by an additional 150mm freeboard.

There would not be any issues with the access and egress from the proposed development site during evacuation and emergency vehicles' movement, and Enfield Drive located in front of the Site would be used as an access and egress during any unexpected flooding incident.

[23] National Planning Policy Framework - Annex 3: Flood risk vulnerability classification - Guidance - GOV.UK (www.gov.uk)

7 Conclusions

A flood risk assessment and surface water drainage strategy were conducted to assist the sustainable drainage systems (SuDS) design for the proposed development on the land at 7 Enfield Drive, Clayton, Manchester, M11 4HP. The proposed development is the erection of a two-storey three-bedroom detached dwelling with associated off-road car parking and landscape amenities. The Site lies within Manchester Council's remit who is the LLFA, providing advice and guidance for sustainable drainage systems for this development site.

The present flood risk assessment and drainage strategy for SuDS which are the requirements for the planning application were made with available information including the latest EA's flood maps data, FEH hydrological data, topographical elevation data (LiDAR), soil map data, sewer network data of United Utilities.

The present investigation suggests that the Site is in flood zone 1, and therefore the Site is considered to be out of fluvial and coastal flood risk.

The proposed development site is a very low risk from the surface water flow - according to the EA's flood map[24]. Moreover, the hydrological and topographical elevation data around the Site indicate that the impact of the surface water runoff from the surrounding areas would be minimal. Thus, the attenuation requirement for the Site would only be the generated overland flow at the Site; subsequently, the overland flow from the surrounding areas was not considered. In addition, the Site is not at risk to the groundwater flow.

The attenuation storage requirements were calculated at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP including climate change allowance[25]. The cumulative rainfall depths at these events were estimated from the latest FEH22 rainfall-runoff model data[26]. For the whole site, the attenuation storage requirements at 3.3% AEP and 1% AEP are $3m^3$ and $4m^3$; and with climate change allowance $5m^3$ and $8m^3$, respectively.

[24] Op.cit.
[25] Op.cit.
[26] Op. cit.

The soil types beneath the Site are slowly permeable, seasonally wet, acid loamy and clayey soils with reference to the Soilscapes map data[27]. Therefore, it would not be suitable to attenuate the excess surface water through the soakaway.

In the proposed surface water drainage strategy, the excess generated surface water runoff by the development would be attenuated on-site up to the equivalent footprint of the impermeable surface of the Site (i.e. 36%). The size of the underground storage tank (e.g. attenuation crates) would be based on 1% AEP plus a 45% climate change allowance (i.e. 2.88m^3, taking into account 2.0 litres/sec greenfield runoff rate) in the Site without deterioration of the Site itself or surrounding areas, a requirement of the LLFA.

An existing sewer drainage network is passing easterly along Enfield Drive, and therefore it would be more sustainable to discharge the excess runoff in a controlled manner into this drainage network of United Utilities. However, consent is required from the United Utilities to discharge the outfalls.

The proposed drainage layout for the surface and foul water would be sustainable during the design life of the development, and the diameter of the pipes is 100mm and the gradient of the pipes is 1 in 100 or more. The size of the attenuation crates would be 2.0m in length, 1.75m in width and 0.75m in depth. The crates, which would have a porosity of 95%, would be surrounded by a 300mm thick gravel layer. The combined attenuation storage capacity of the crates and gravels is 3.08m^3, which is more than the requirement for a 1 in the 100-year hydrological event plus climate change allowance.

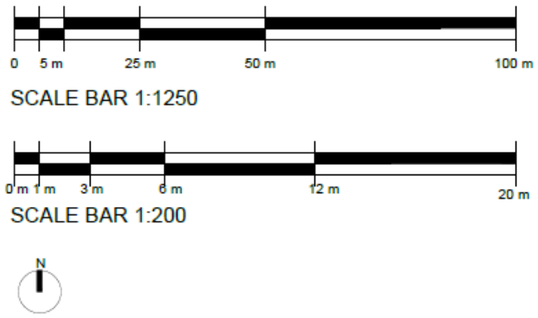
In addition, the proposed eco-friendly layout design and landscape amenities would significantly improve the surface water drainage sustainability, environment and local biodiversity, and water quality compared with the existing conditions. The periodic inspection and maintenance of the attenuation tank and drainage features would be done, and the landowner of the proposed dwelling would be responsible for the maintenance of the proposed SuDS features for effective and efficient operation including the water quality outfalls.

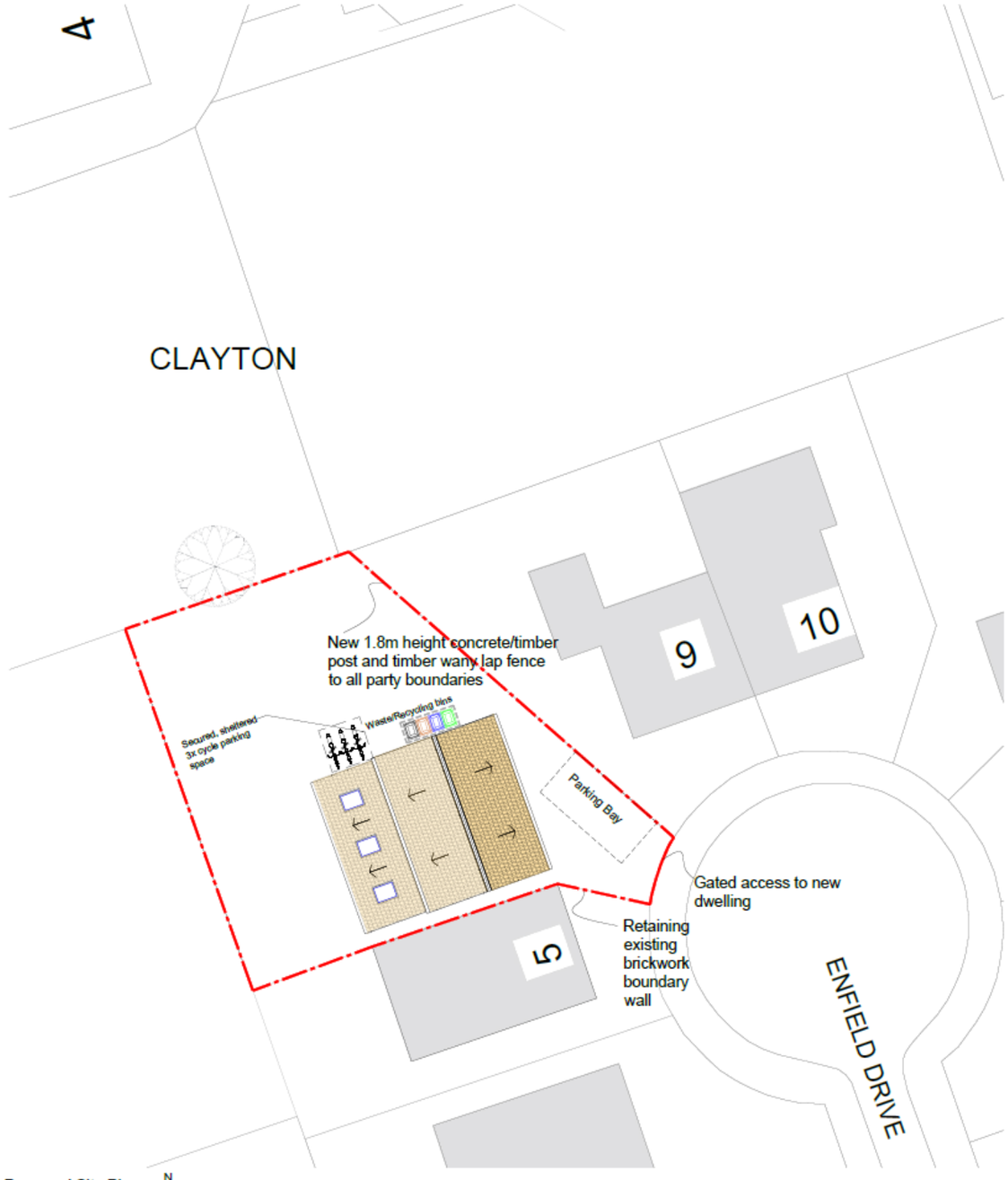
[27] Op.cit.

The Site is not considered to be a flood risk, and therefore the finished ground floor level of the proposed dwelling would be the same as the ground level. However, it is highly recommended to raise the finished ground floor level by an additional 150mm freeboard. The access and egress from the Site during any flooding incident would be on Enfield Drive located in front of the Site.

The generated wastewater flow by the proposed development was estimated to be 0.05 litres/sec. The sewer drainage network data obtained from United Utilities suggest that the existing sewer drainage systems are combined, i.e. conveying the surface and foul water drainage in the same pipe. The general observation of the sewer drainage network in the surrounding areas suggests that the proposed development would not make any significant impact on the existing sewer drainage network systems. However, a confirmation of consent agreement from United Utilities is required before the utilisation of the proposed development.

Appendix I: The layout of the development site.





GENERAL NOTES

1. The contractor must check the site and the approved drawings before commencing the works and must take any working measurements as necessary and any discrepancy must be reported to the client.

2. Work shall comply with any current relevant BS/codes of practices and confirm to the Building Regulations including the latest amendment. The contractor is responsible for setting out the works.

Site Address

7 Enfield Drive
Clayton
Manchester
M11 4HP

Drawing statues

Location Plan
Site Plan

Project

Erection of One Dwelling

Key

Red centre line
- Location Plan

Revision	Date
Bins relocated	10/01/2024
Cycle storage sheltered	10/01/2024

AT A. Design
12 Hastings Gardens
Stockport
SK5 8BF
ata_design@hotmail.com
07830039347

Drawing No.

PP87B(1)23

SCALE

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1:100

PAPER SIZE

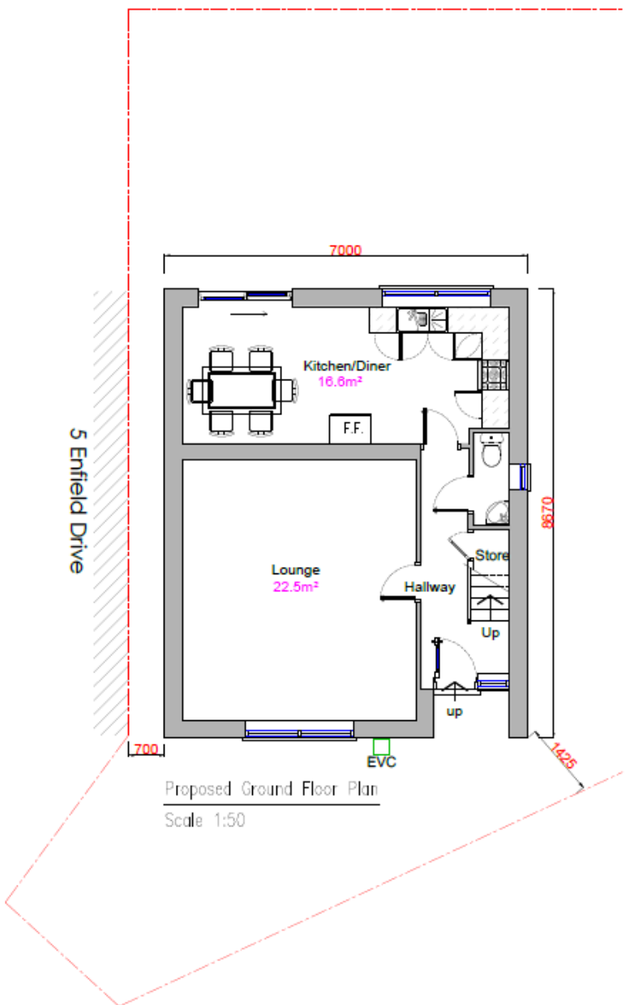
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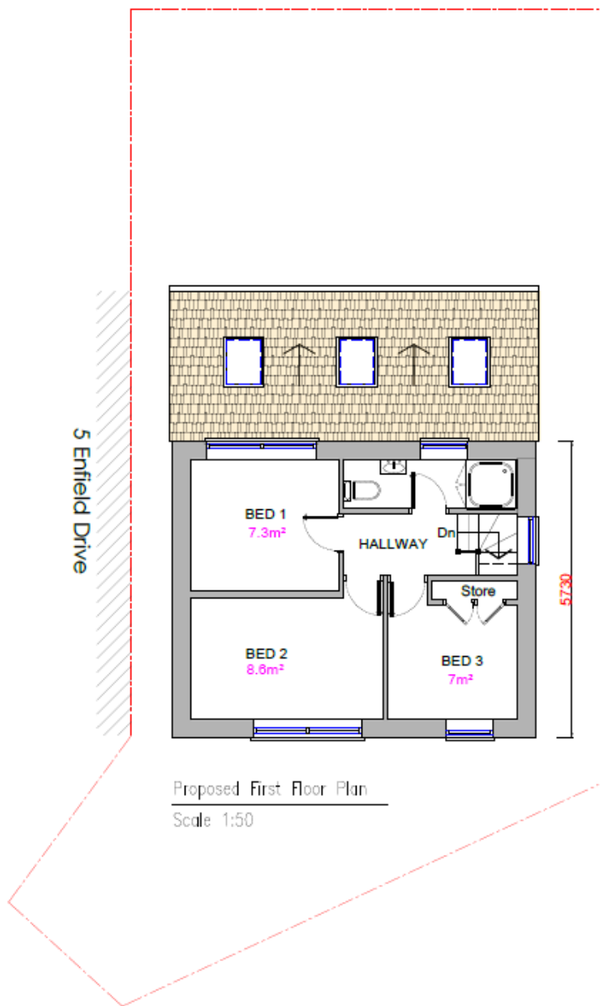
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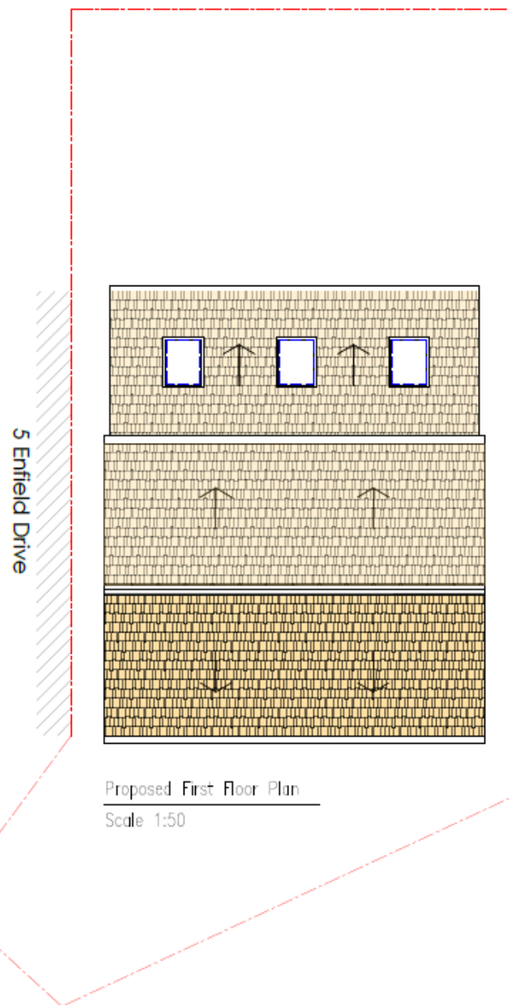
Proposed Ground Floor Plan

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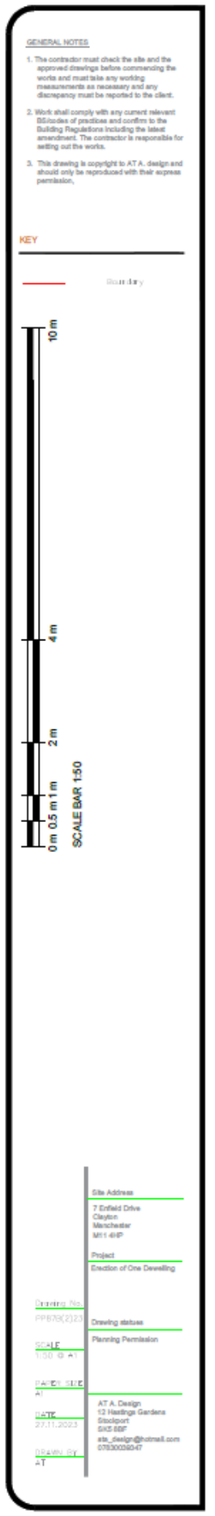
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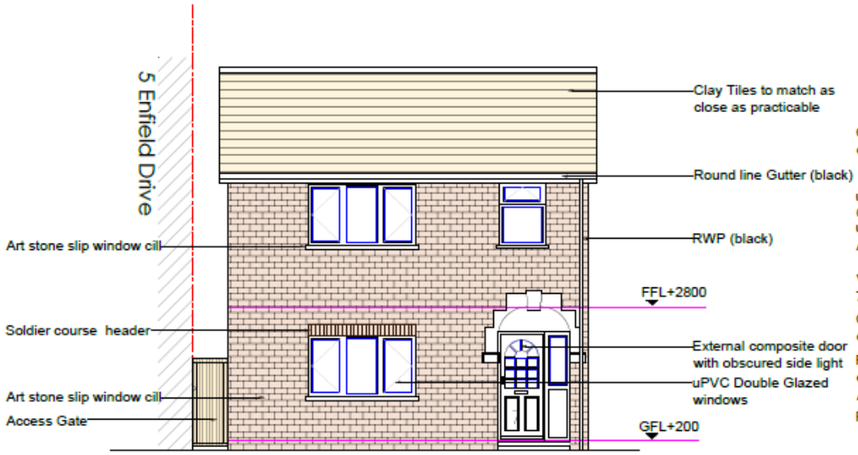
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Proposed First Floor Plan

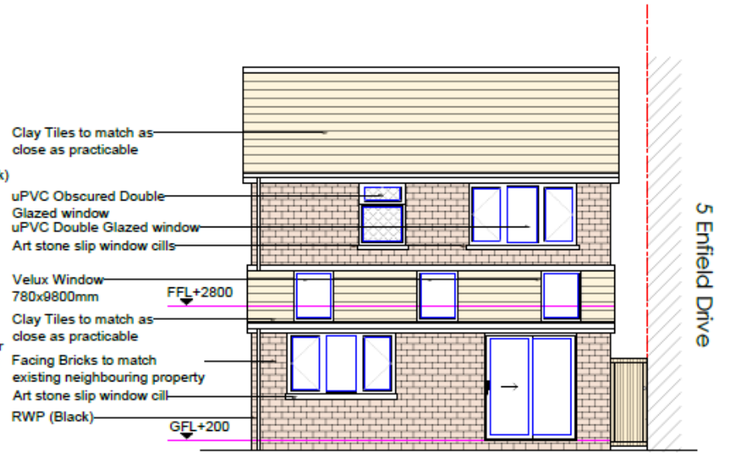
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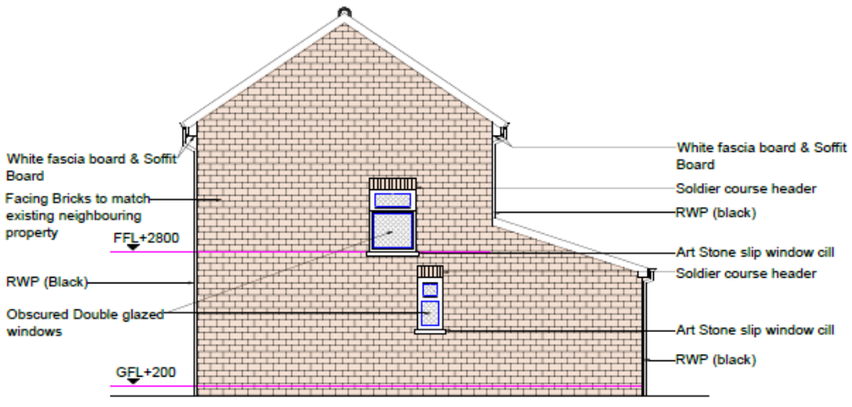
Proposed Front Elevation

Scale 1:50



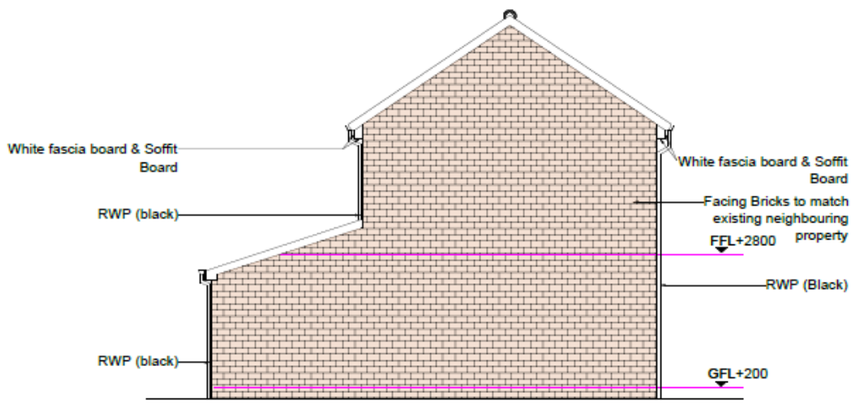
Proposed Rear Elevation

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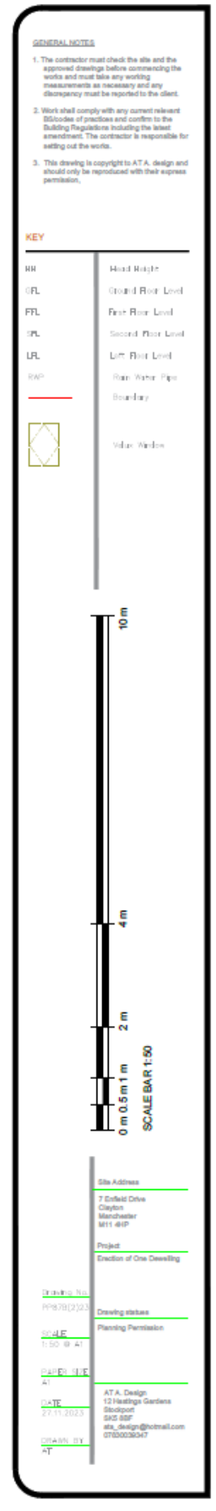
Proposed Side Elevation

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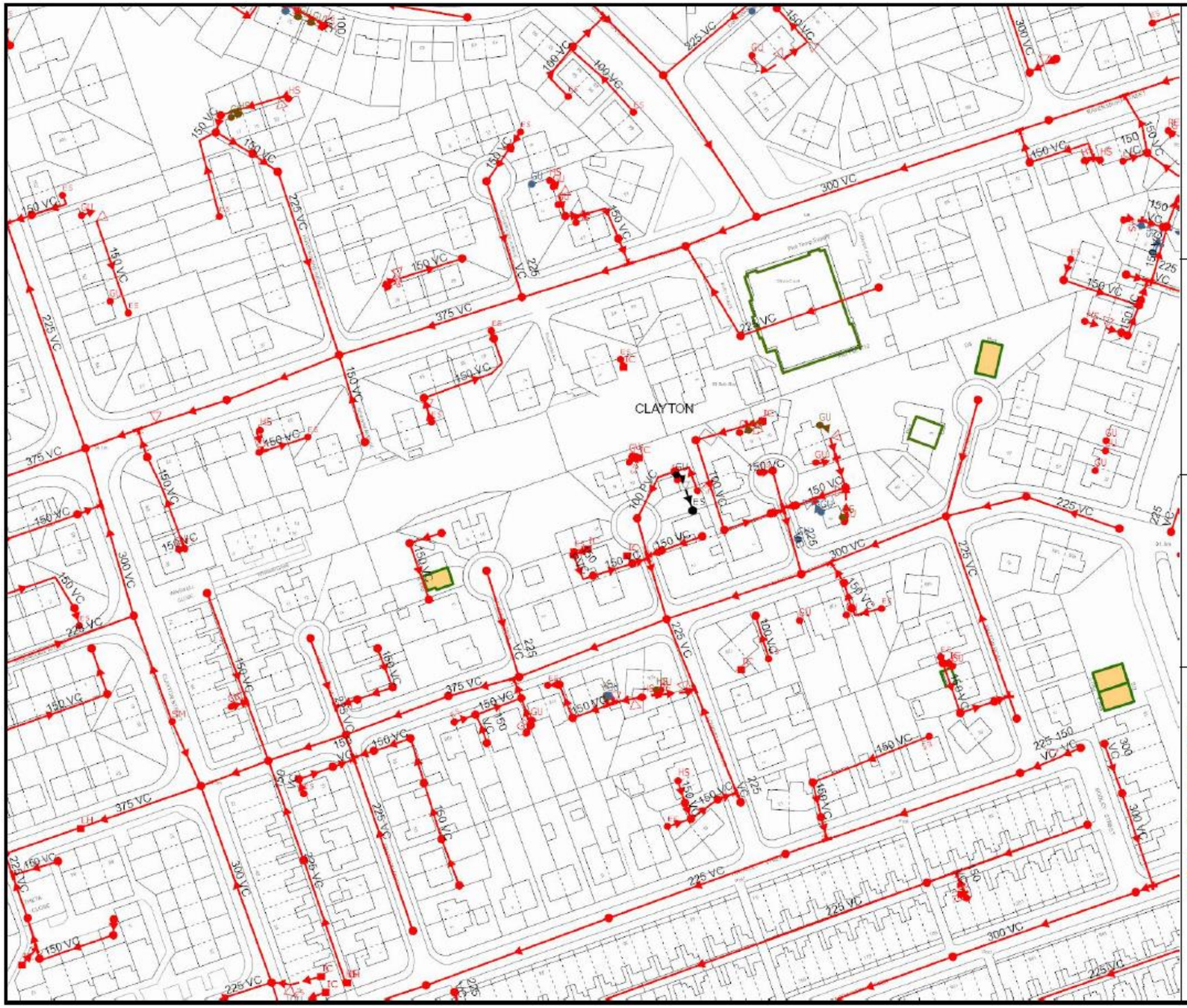


Proposed Side Elevation

Scale 1:50



Appendix II: Sewer drainage network data at the Site, reference to United Utilities.



United Utilities
Water for the North West

SEWER RECORDS

Address or Site Reference

5 ENFIELD DRIVE,
MANCHESTER,
M11 4HP

Scale: 1:1250
Date: 29/02/2024

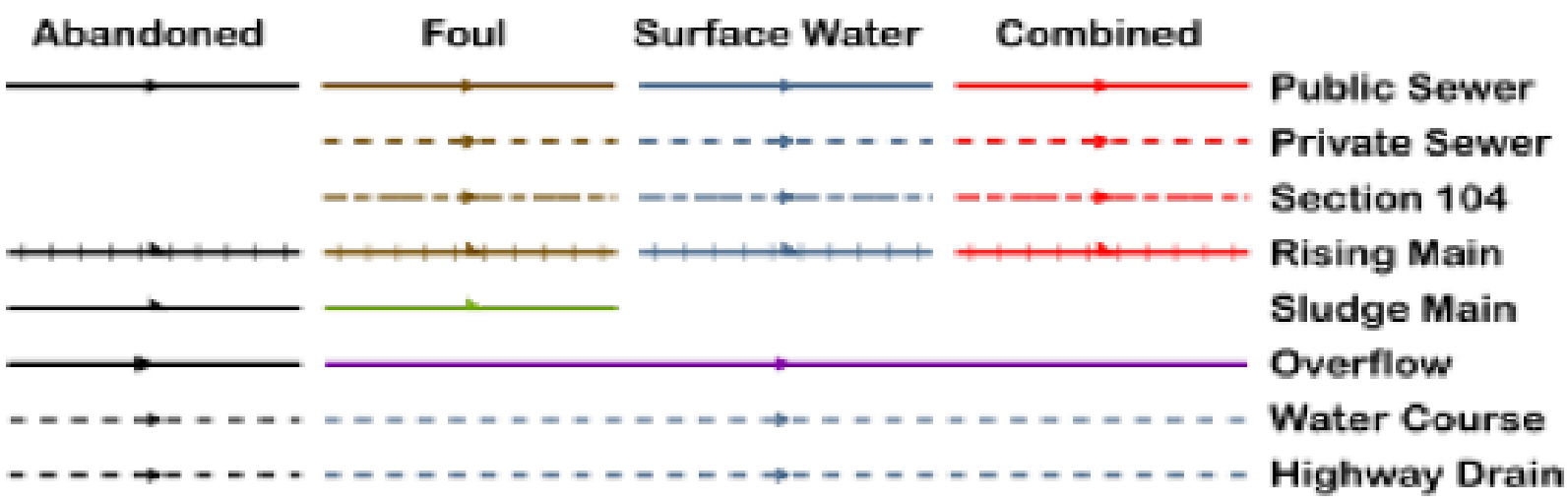
Printed by: Property Searches

The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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United Utilities
Water for the North West

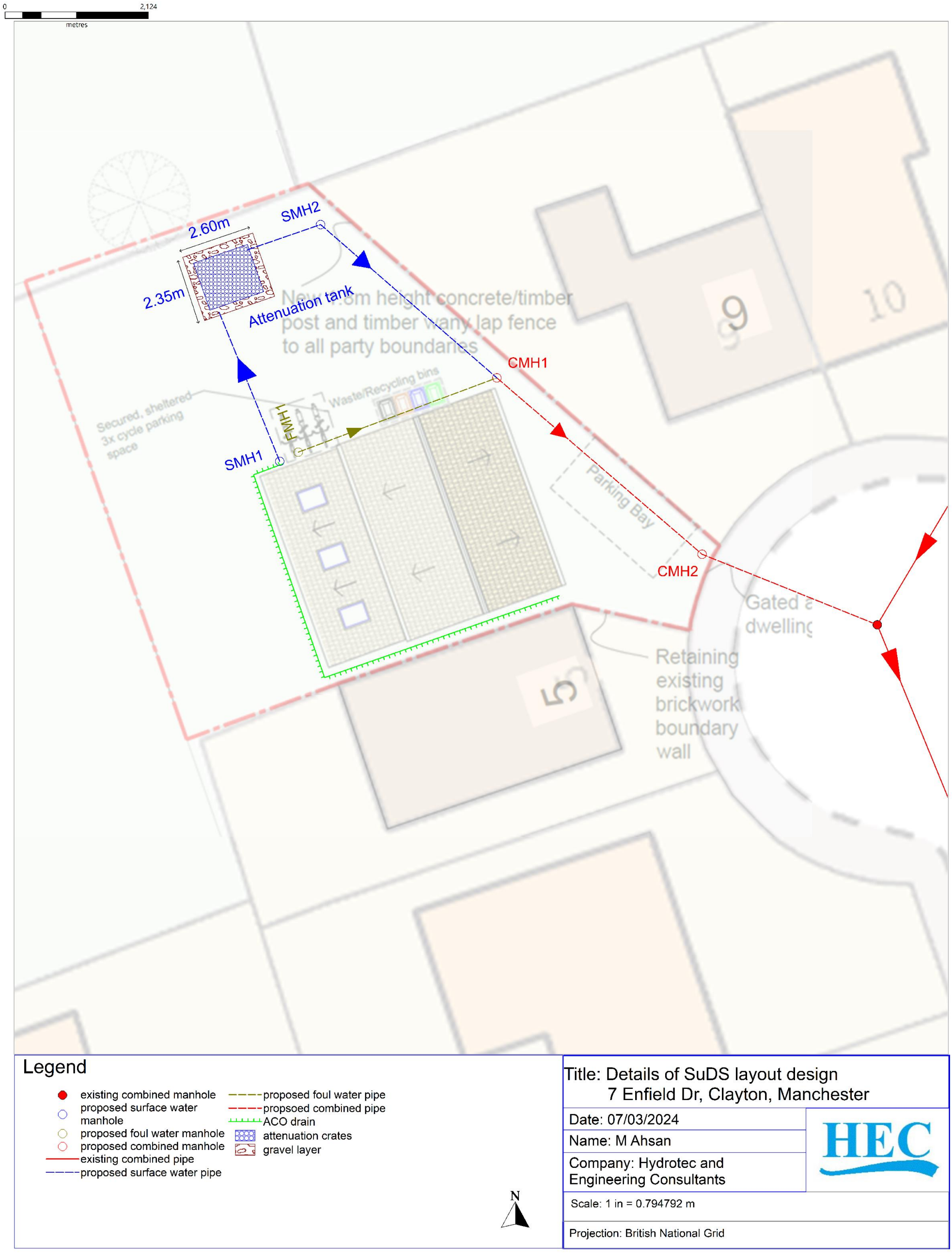
Wastewater Symbology



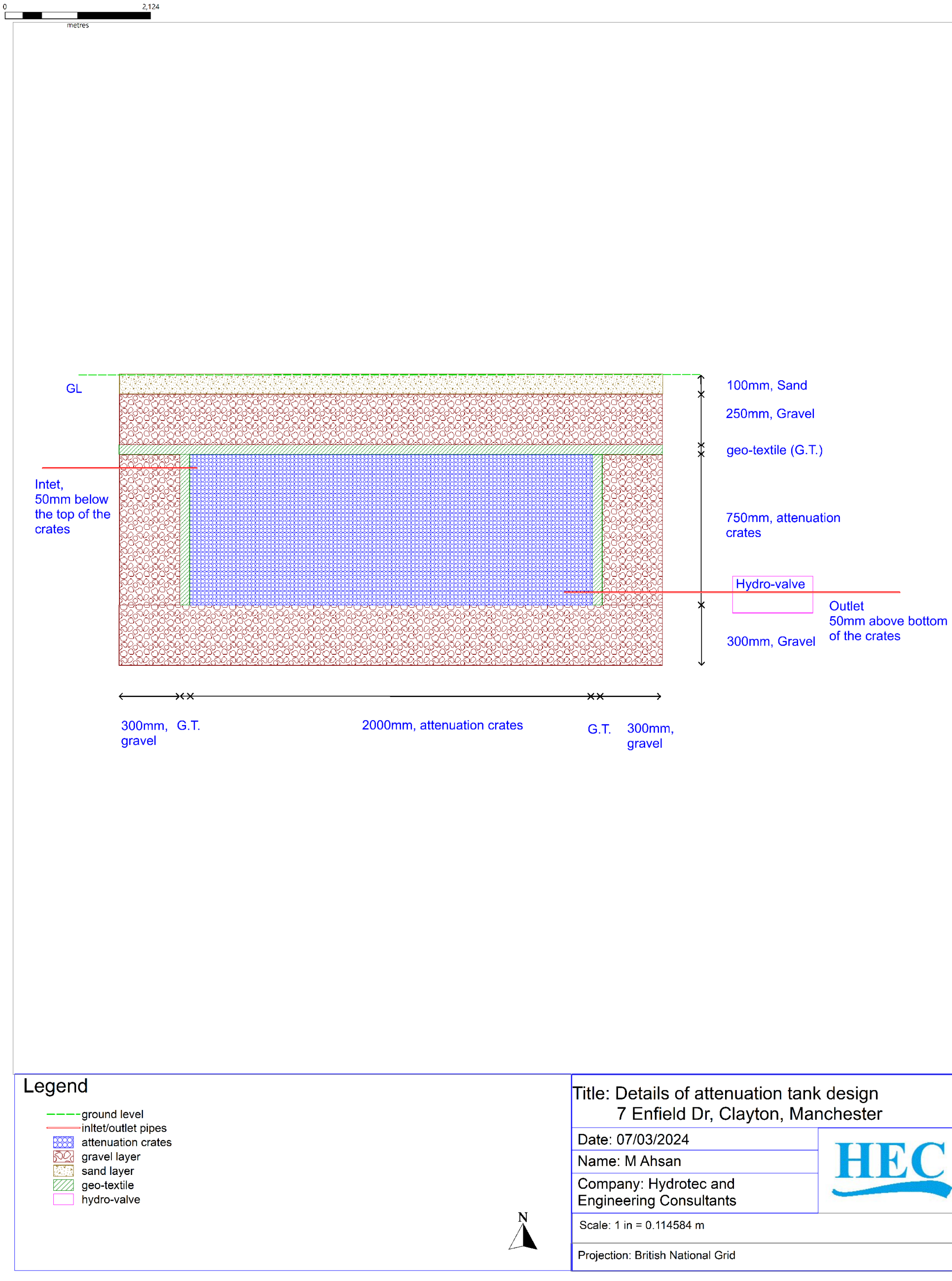
All point assets follow the standard colour convention: red – combined, brown - foul, blue – surface water, purple - overflow

- Manhole
- HS Head of System
- ES Extent of Survey
- RE Rodding Eye
- IN Inlet
- DP Discharge Point
- HY Vortex
- PE Penstock
- WO Washout Chamber
- VA Valve
- AV Air Valve
- NRV Non Return Valve
- SO Soakaway
- GU Gully
- CA Cascade
- FM Flow Meter
- HA Hatch Box
- OI Oil Interceptor
- SM Summit
- DS Drop Shaft
- OP Orifice Plate
- Side Entry Manhole
- Outfall
- Screen Chamber
- IC Inspection Chamber
- Bifurcation Chamber
- LH Lamp Hole
- T Junction / Saddle
- CA Catchpit
- Valve Chamber
- Vent Column
- Vortex Chamber
- Penstock Chamber
- Network Storage Tank
- Sewer Overflow
- WwTW Ww Treatment Works
- Ww Pumping Station
- ST Septic Tank
- CK Control Kiosk
- Change of Characteristic

Appendix III: Details of SuDS layout design at the Site.



Appendix IV: Details of the attenuation tank design at the Site.



Appendix V: A sample of hydro-valve, a vortex flow control device (1-5 litres/sec).

