



Hydrotec and Engineering Consultants

Develop Design Deliver

Drainage strategy and SuDS

**Land opposite 11-15 New St, Littleborough
Rochdale**

October 2023

CLIENT:

AT A Design

Reference: 23/AT A Design /drainage/SuDS/Littleborough/New St

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 opposite 11-15 New St, Littleborough, OL15 8LX.

SCHEME:

Erection of a two-storey four-bedroom dwelling with associated car parking and landscape amenities.

REQUIREMENT:

Surface water drainage strategy and SuDS design for the proposed residential development to fulfil 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 opposite 11-15 New St, Littleborough, OL15 8LX. The national grid reference number of the development site is SD 92630 15950 (“the Site”). The proposed development is the erection of a two-storey four-bedroom detached dwelling with associated 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 (survey and LiDAR), soil map data, 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 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. 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 impermeable surface area, however, this increment of the impermeable land would not deteriorate the 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 SuDS features, such as porous trench and attenuation tank would improve the sustainable drainage systems, local environmental biodiversity and water quality compared with the existing conditions. Therefore, in the proposed surface water drainage strategy - the surface water runoff would be attenuated on-site only for the equivalent footprint of the excess impermeable land.

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 2m³ and 3m³; and with climate change allowance 3m³ and 4m³, respectively.

The proposed layout of the Site would provide well sustainable drainage distribution of the overland flow and therefore the excess runoff within the Site would be stored in an underground storage tank located on the rear side, e.g. western side. The attenuation storage requirement was taken to 53% of the total runoff by the Site., taking into consideration the equivalent footprint of the excess impermeable land and overall drainage improvement of the existing development.

There would be one attenuation tank and the size of the underground storage tank would be based on 3.3% AEP plus climate change allowance (i.e. 1.60m³, taking into account 2.0 litres/sec greenfield runoff rate), a requirement of the LLFA. Attenuation at 1% AEP plus climate change allowance would be a combination of attenuation tank and overland flooding within the Site without deterioration of the Site itself or surrounding areas.

The size of the attenuation storage crates would therefore be 1.5m in length, 1.25m 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 1.80m³, which is more than the requirement for a 1 in the 30-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.

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 house would be the same as the existing ground floor 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 New St located in front of the Site.

The generated wastewater flow by the proposed development was estimated to be 0.05 litres/sec. However, a confirmation of consent agreement from the United Utilities is required before utilisation of the proposed development.

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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 Framework¹ (NPPF) guidelines have given the authority to the Environment Agency² (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 sustainable drainage system design for the proposed development as well as 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 four-bedroom detached dwelling with associated car parking and landscape amenities. According to the NPPF guidelines, the proposed development would be classified as a more vulnerable category in terms of flood risk vulnerability classification³. The Site is located on the land opposite 11-15 New St, Littleborough, OL15 8LX. The national grid reference number (NGR) of the Site is SD 92630 15950. The geographical boundary of the project site lies within Rochdale Borough Council’s

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)

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 a brownfield site, mainly covered by gravel. A large part of the southern area of the Site is covered with vegetation including a pond. New St is located in front of the Site on the east side and the surroundings are well-developed residential built-up areas. New Rd (A58) passes northeasterly and approximately 40m away on the west side of the Site. River Roch is situated on the south side and approximately 400m away from the Site. 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. The total area of the project site is approximately 225m² and therefore it would be classified as a minor development⁴ according to the Environment Agency's Standing Advice.



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

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

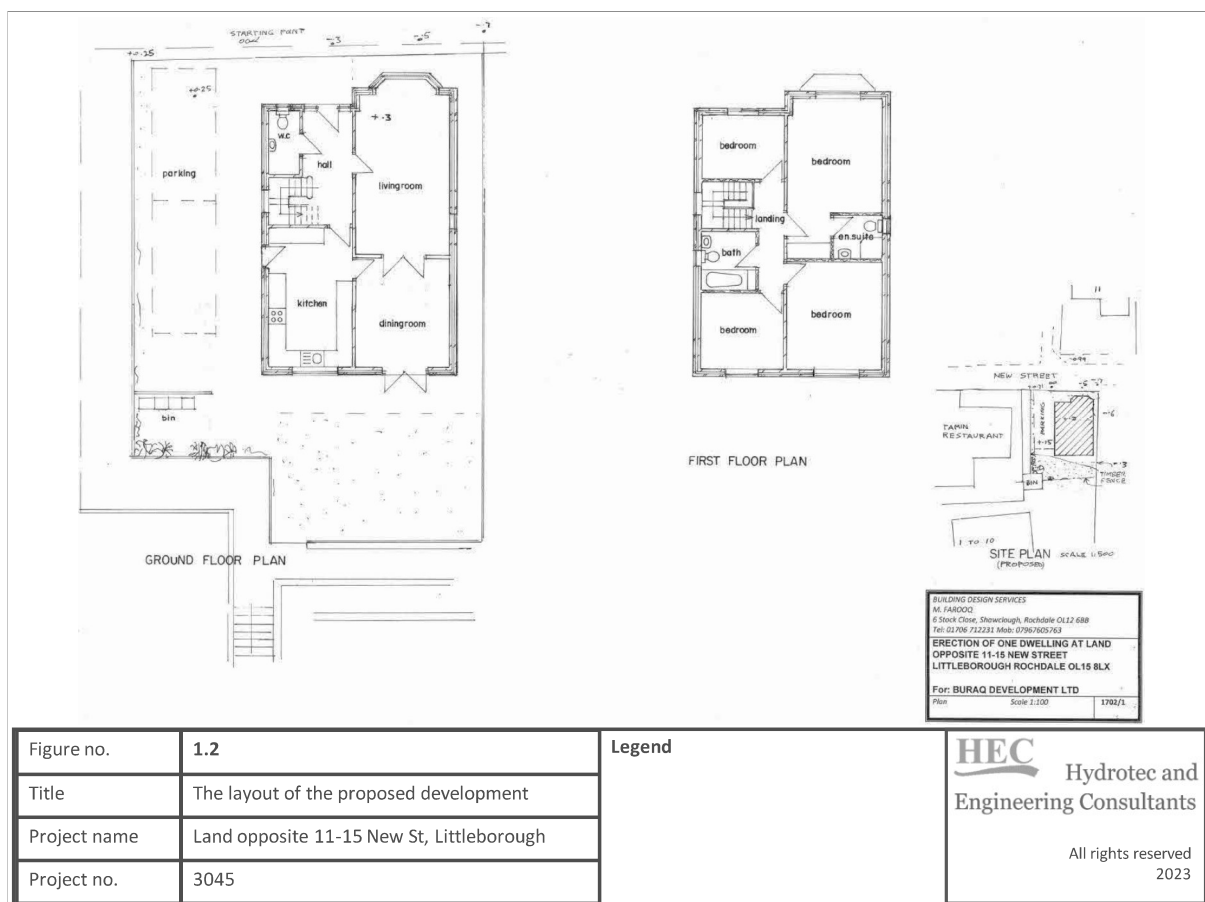


Figure 1.2: The layout of the proposed development.

2 Potential sources of the flood risk

The proposed development is the erection of a two-storey four-bedroom detached dwelling with associated 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 Agency⁵ (EA) and LLFA.

⁵ 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 map⁶ 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 map⁷ suggests that the Site is not at flood risk from the groundwater or reservoir flows (Figure 2.2).

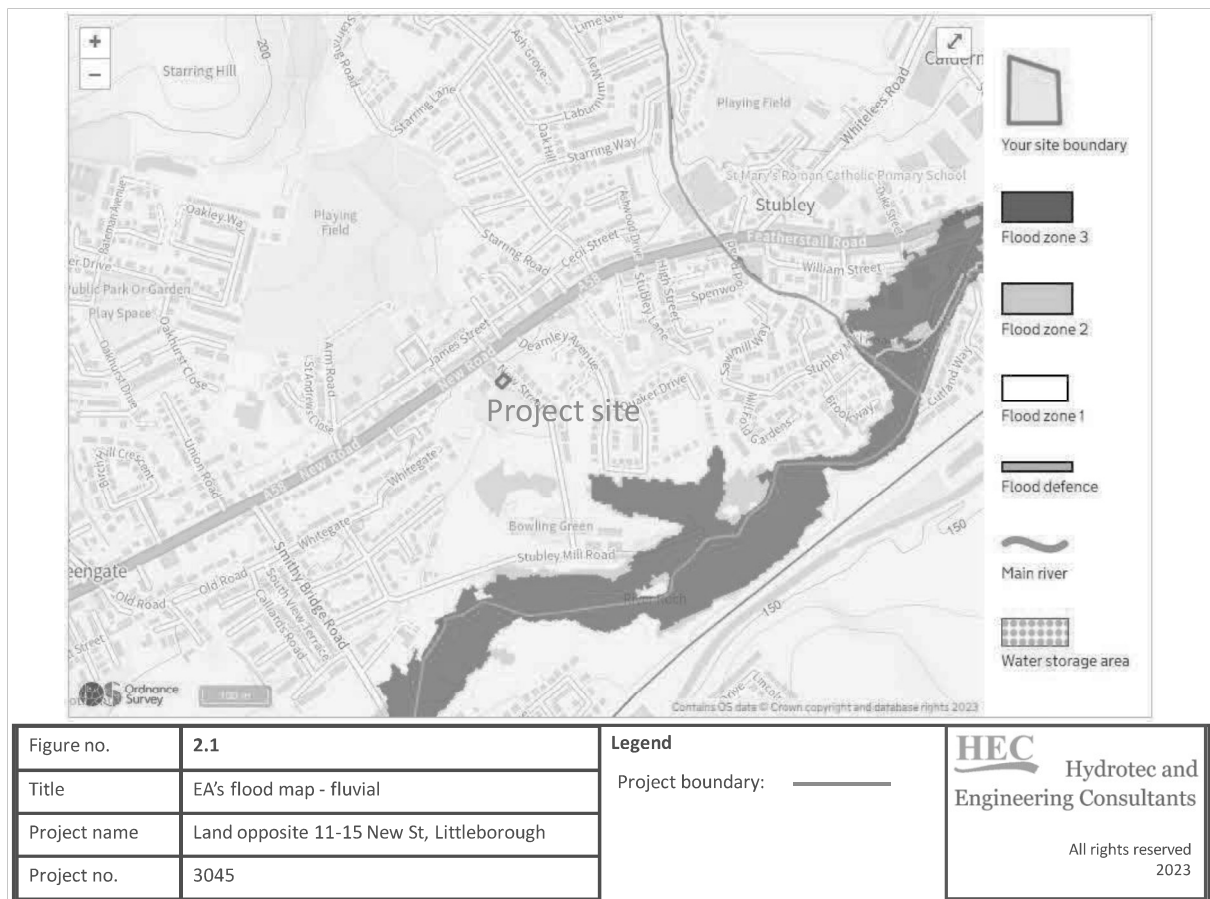


Figure 2.1: The fluvial and coastal flood risk at the Site - flood zone 1, the land having flood risk less than 0.1% AEP fluvial or coastal flows (reference – EA's flood map⁸).

⁶ Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)

⁷ Check the long term flood risk for an area in England - GOV.UK (flood-warning-information.service.gov.uk)

⁸ Flood map for planning - GOV.UK (flood-map-for-planning.service.gov.uk)

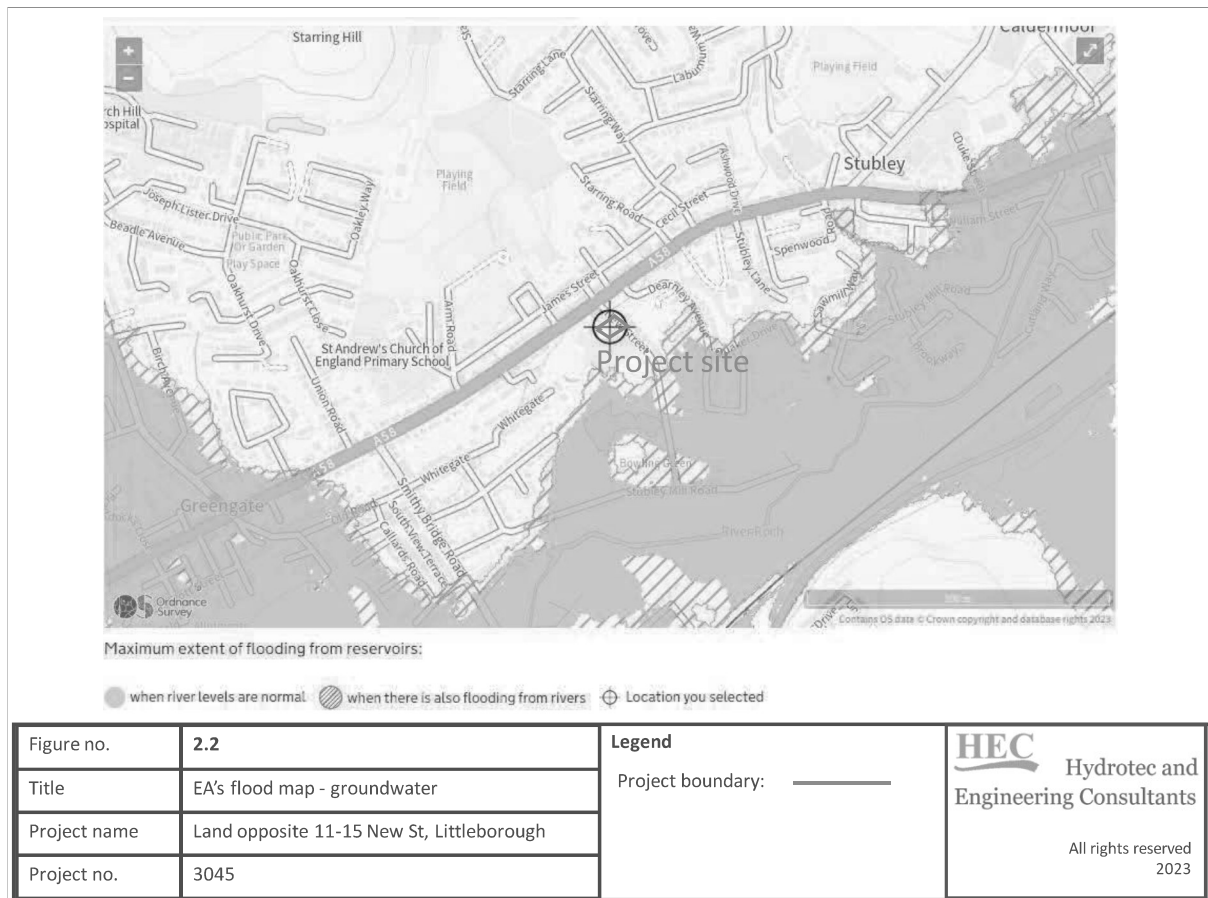


Figure 2.2: Groundwater flow at the Site – a very low flood risk against the groundwater flow (reference – EA’s flood map⁹).

2.2 Surface water drainage

The guidance of the Environment Agency and LLFA based on the national planning policy framework¹⁰ (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

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

¹⁰ Op. cit.

effect on the risk 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 map¹¹ (Figure 2.3) indicates that most of 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 no 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 Handbook¹² (FEH22) and the data are presented in Figure 2.4.

¹¹ [Your long term flood risk assessment - GOV.UK \(check-long-term-flood-risk.service.gov.uk\)](https://check-long-term-flood-risk.service.gov.uk)

¹² [Map - FEH Web Service \(ceh.ac.uk\)](https://ceh.ac.uk)

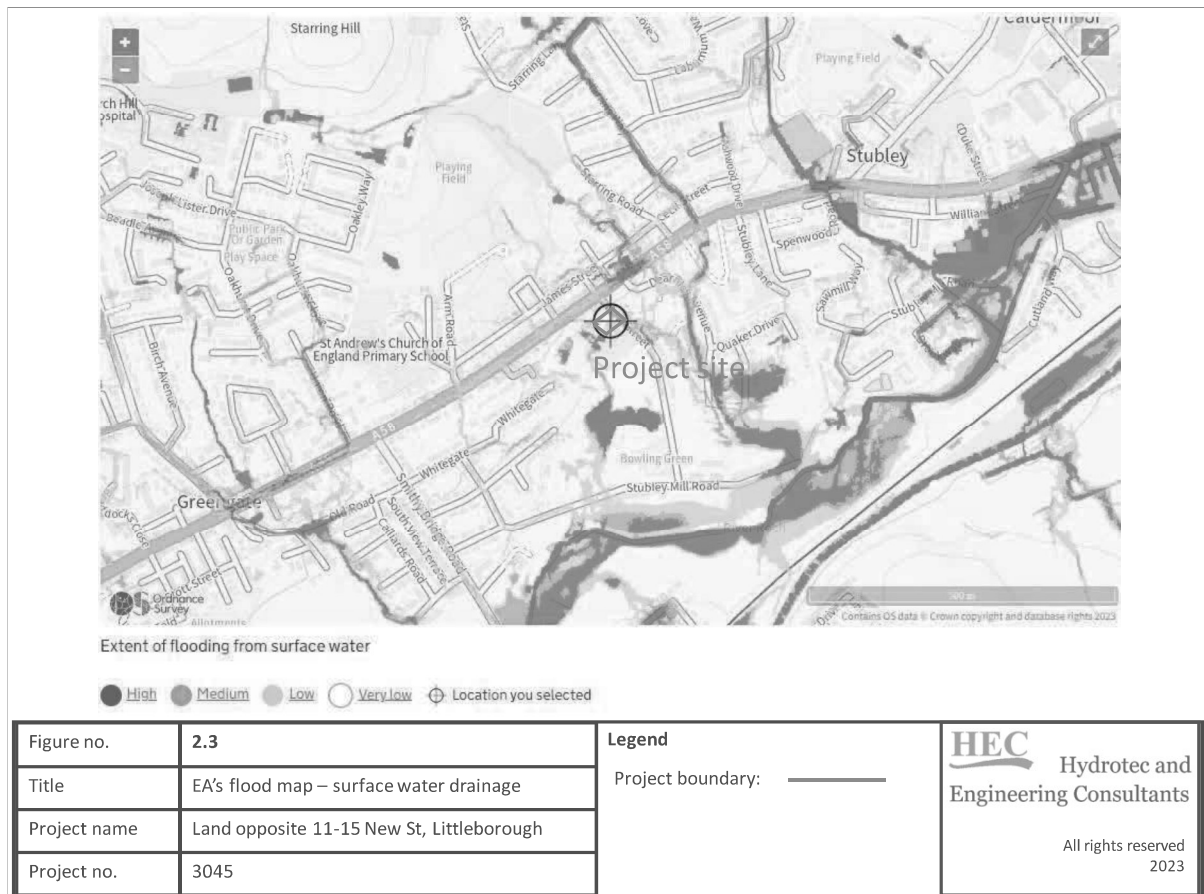


Figure 2.3: Surface water drainage at the Site – a very low flood risk against the surface water flow (reference – EA’s flood map¹³).

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 southwesterly into the River Roch. The contributing surface area that could have a possible impact on the Site is relatively small, i.e. approximately 0.10km². Subsequently, the upstream of the sub-catchment would convey relatively less overland flow towards the Site. The sub-catchment located on the northeastern side of the Site would convey the overland flow into Featherstall Brook and therefore this sub-catchment would not have any overland flow contribution to the Site. Finally, the western sub-catchment would drain the overland flow southerly into the Ash Brook, far away from the Site. Therefore, the surface water runoff from

¹³ Check the long term flood risk for an area in England - GOV.UK (www.gov.uk)

this sub-catchment would stay out of the Site. Thus, the effective overland flow contribution to the Site from the adjacent areas would be minimal.

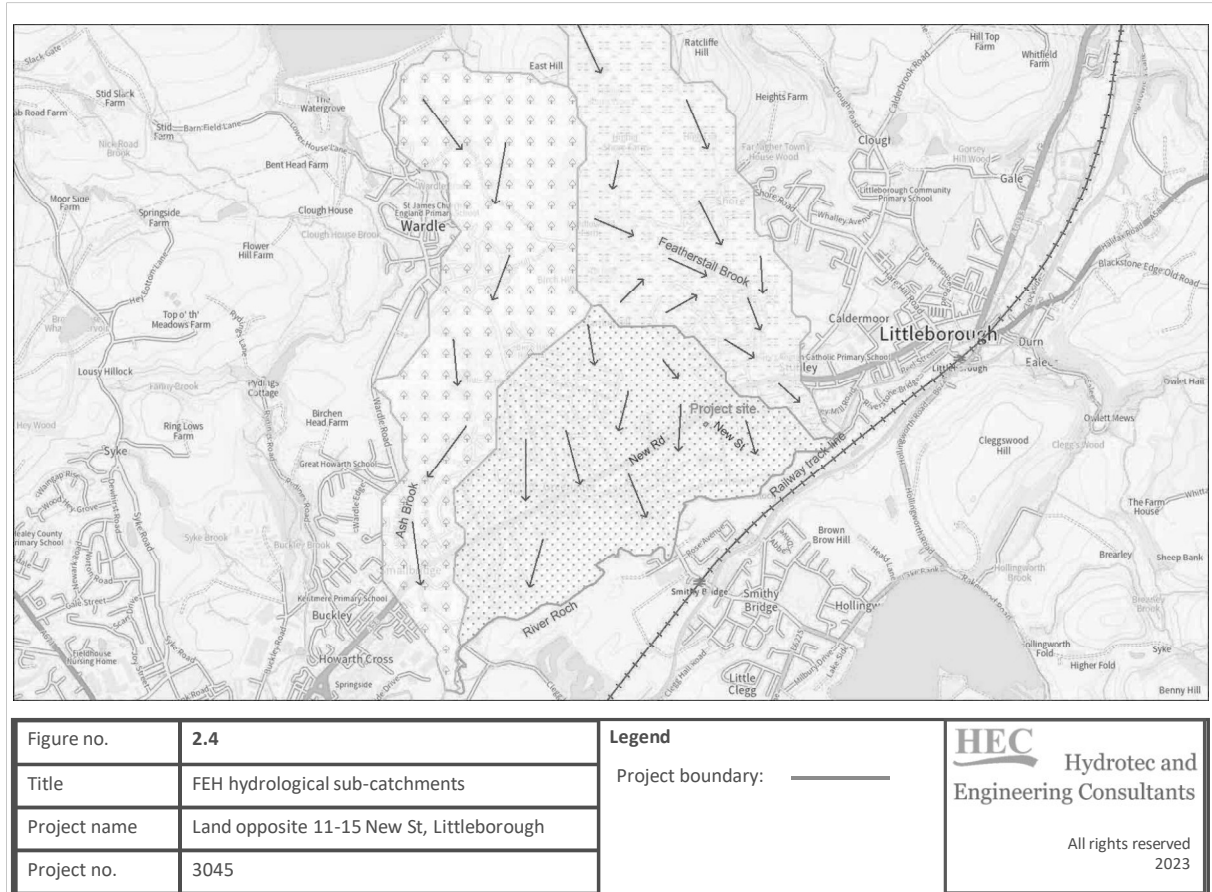


Figure 2.4: The hydrological sub-catchments at the Site (indicative overland flow paths in blue arrow lines); reference of the FEH22¹⁴.

¹⁴ op. cit.

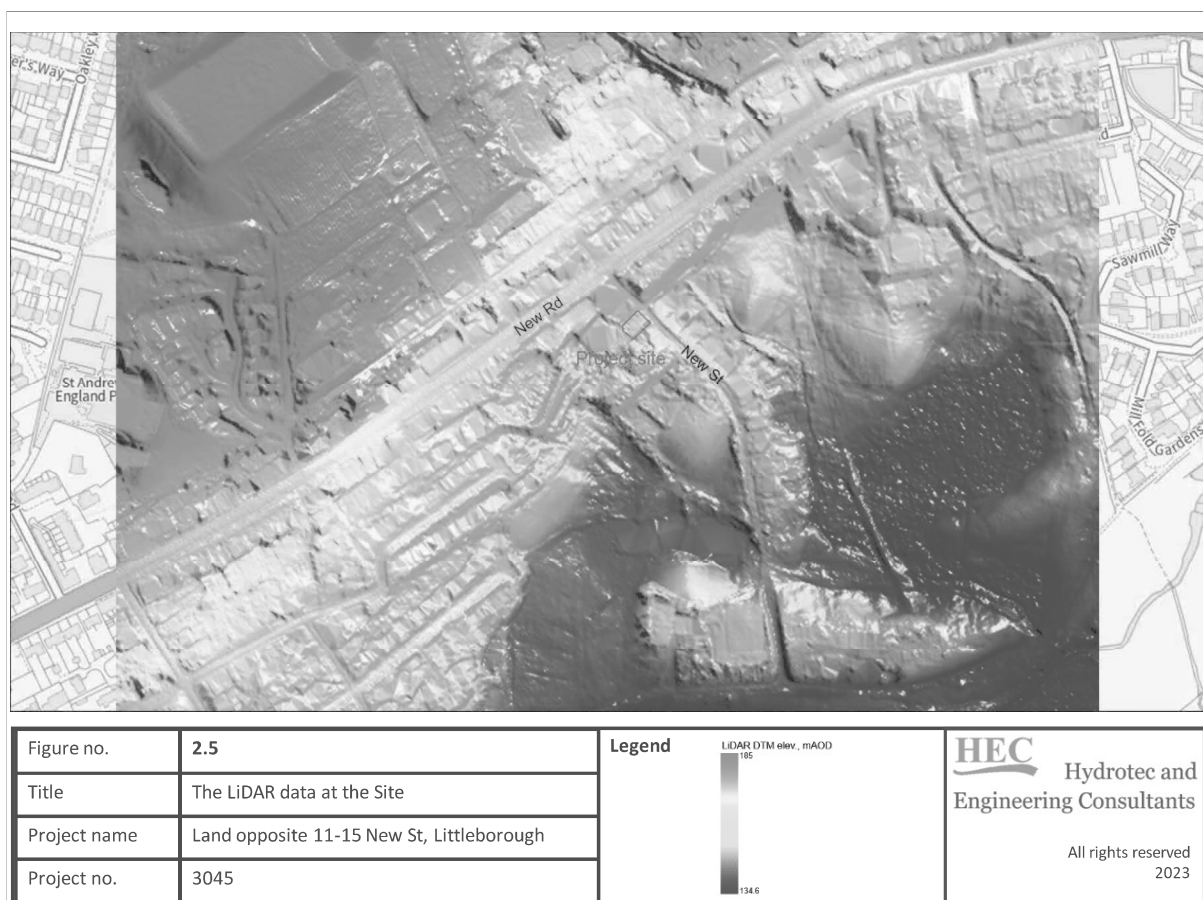


Figure 2.5: The LiDAR topographical elevation at the Site.

The intensity and magnitude of the overland flow paths 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 LiDAR¹⁵ (Light Detection and Ranging) DTM (Digital Terrain Model) data (Figure 2.5) and topographical survey data (Appendix I).

The topographical survey data in Appendix I suggest that the ground levels on the Site would have an inclination towards the east. The ground level on the western boundary is around 0.36m higher than that of the easter side. Therefore, the overland flow on the Site would flow relatively quickly towards the east. Subsequently, most of the time the proposed development site would stay dry, i.e. a very low surface water flood risk.

¹⁵ Defra Data Services Platform

The LiDAR elevation data suggest that the ground level in the far northwestern area is relatively higher and inclines towards the south. Therefore, most of the overland flow from this area would flow in the southeasterly. However, there would not be a direct impact of this overflow to the Site. Furthermore, the southern part of the Site is relatively depressed and subsequently any overland flow from the northern area would be contained. Thus, the surrounding area of the Site would remain low surface water flood risk including New St.

Therefore, the contributing surface water runoff from the off-site to the Site would be relatively small 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 four-bedroom dwelling house and therefore, the proposed development would generate foul water flow.

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 water and foul water flows through the same pipe. A drainage pipe of 375mm diameter passes along New St and southerly, and there is a manhole located in front of the Site. There are no details of the cover and invert levels of the manhole. Therefore, it would be suitable to discharge the generated foul water flows by the proposed dwelling into the existing drainage network.

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 Adoption¹⁶, the typical peak dry weather flow (DWF) for this type of catchment is considered

¹⁶ [Sewerage Sector Guidance-approved documents | Water UK](#)

to be 0.05 litres per sec per dwelling. The general observation of sewer drainage networks in the surrounding areas suggests that the proposed development would not make any significant impact on the existing sewer drainage network systems. However, consent of agreement is required from the United Utilities before utilising the proposed development.

3 Flood attenuation storage requirement

The proposed development is the erection of a two-storey four-bedroom detached dwelling with associated car parking and landscape amenities. The proposed development is therefore classified as a more vulnerable category - according to the NPPF flood risk vulnerability classification¹⁷. The proposed development would modify the existing land surface and the total impermeable surface area of the proposed development is approximately 120m², containing the building, car parking space and access road. Most of the existing land surface on the proposed development is a brownfield, covered by gravels - see also photographs of the front and rear sides in Figure 3.1 and 3.2, respectively. The permeable and impermeable surface areas of the pre-development and post-development are given in Table 3.1. The increased impermeable area due to the proposed development is approximately 120m² or 53% of the total area.

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	226	0
Proposed	106	120

¹⁷ [National Planning Policy Framework - Annex 3: Flood risk vulnerability classification - Guidance - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/61271/nppf-annex3.pdf)



Figure no.	3.1	Legend	HEC Hydrotec and Engineering Consultants All rights reserved 2023
Title	Existing ground surface, looking front side		
Project name	Land opposite 11-15 New St, Littleborough		
Project no.	3045		

Figure 3.1: The photograph of the existing condition at the Site, looking front side.

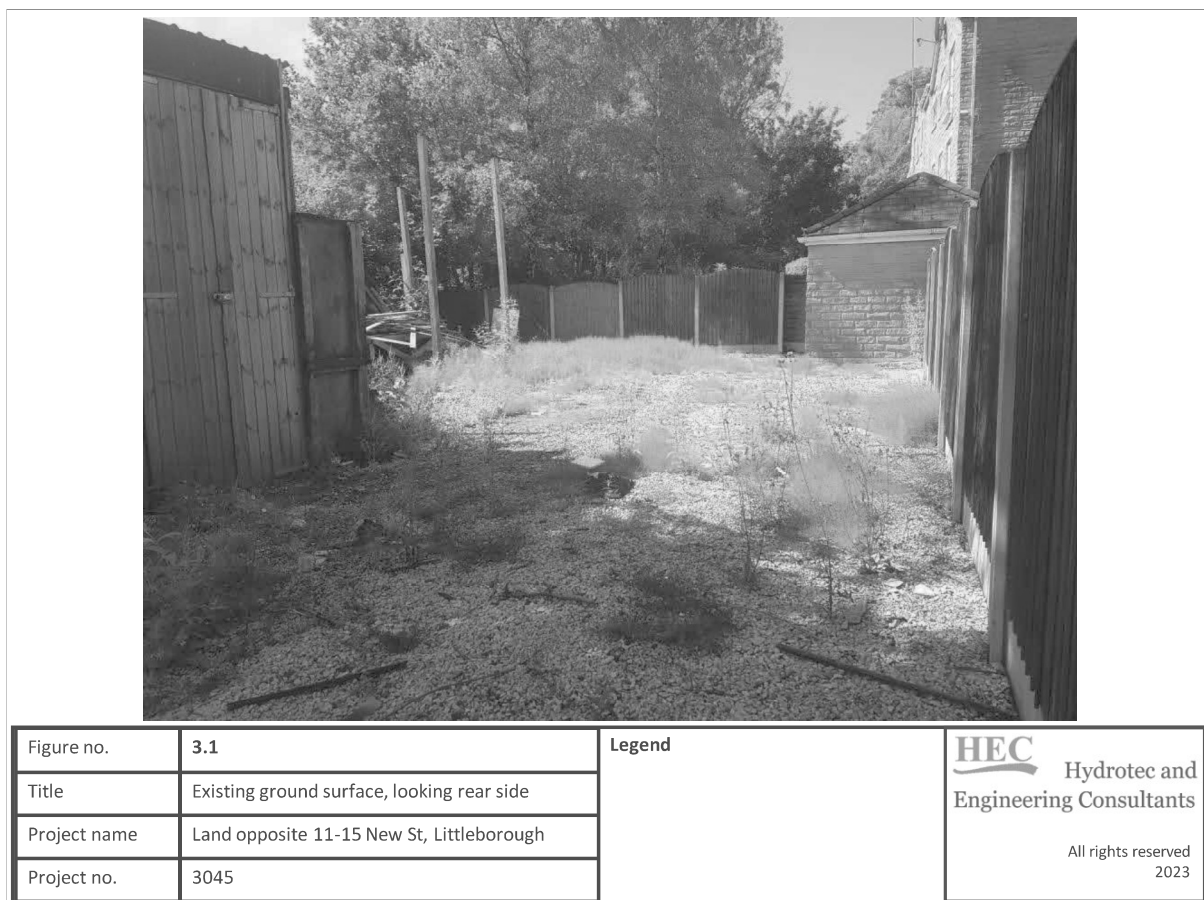


Figure 3.2: The photograph of the existing condition at the Site, looking rear side.

The proposed development would have some impact on the generated surface water runoff due to the increased 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 footprint 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 Handbook¹⁸ (FEH22). The cumulative rainfall depths were calculated and the values at 1 in 5-year (20% AEP), 1 in 10-year (10% AEP), 1 in 30-year (3.3% AEP) and 1 in 100-year (1% AEP) are provided in Table 3.1 up to 600mins (i.e. 10.0 hrs). The

¹⁸ Map - FEH Web Service (ceh.ac.uk).

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 central allowance for peak rainfall in climate change consideration. The central peak rainfall allowances at the Site at the 2070s epoch are 30% and 30% at 3.3% AEP and 1% AEP, respectively - according to the Environment Agency's climate change allowance guidelines¹⁹. Subsequently, the climate change allowance (CCA) for the peak rainfall was increased by 20%, 20%, 30% and 30% 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	10.11	12.65	16.65	20.94
30	13.88	17.55	23.30	29.66
45	16.49	20.75	27.76	35.66
60	18.45	23.35	31.16	40.19
90	21.80	27.06	35.42	45.06
120	24.52	29.88	38.50	48.43
180	28.66	34.44	43.58	54.31
240	31.90	38.01	47.62	59.09
300	34.61	40.95	51.03	63.20
360	36.96	43.49	54.01	66.88
420	39.02	45.75	56.69	70.30
480	40.86	47.78	59.13	73.46
540	42.53	49.63	61.38	76.43
600	44.06	51.34	63.47	79.23

¹⁹ Flood risk assessments: climate change allowances - GOV.UK (www.gov.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	2	0	1
	30	2.00	2	-1	-1
	45	2.00	3	-3	-2
	60	2.00	3	-5	-4
	90	2.00	3	-8	-7
	120	2.00	2	-12	-11
	180	2.00	2	-20	-19
	240	2.00	1	-28	-27
	300	2.00	0	-36	-35
	360	2.00	-1	-44	-43
	420	2.00	-2	-53	-51
	480	2.00	-3	-61	-59
	540	2.00	-5	-69	-68
	600	2.00	-6	-78	-76
10% AEP	15	2.00	2	1	1
	30	2.00	3	0	0
	45	2.00	3	-2	-1
	60	2.00	4	-4	-2
	90	2.00	4	-7	-6
	120	2.00	4	-11	-9
	180	2.00	3	-19	-17
	240	2.00	2	-27	-25
	300	2.00	1	-35	-33
	360	2.00	0	-43	-41
	420	2.00	-1	-51	-49
	480	2.00	-2	-60	-57
	540	2.00	-3	-68	-66
	600	2.00	-4	-76	-74
3.3% AEP	15	2.00	3	2	3
	30	2.00	4	1	2
	45	2.00	5	0	2
	60	2.00	5	-2	0
	90	2.00	6	-5	-3
	120	2.00	6	-9	-6
	180	2.00	5	-17	-14
	240	2.00	4	-24	-21
	300	2.00	4	-32	-29
	360	2.00	3	-41	-37
	420	2.00	2	-49	-45
	480	2.00	1	-57	-53
	540	2.00	0	-65	-61
	600	2.00	-2	-74	-69
1% AEP	15	2.00	4	3	4
	30	2.00	6	2	4
	45	2.00	7	1	4
	60	2.00	7	0	3
	90	2.00	8	-3	0
	120	2.00	8	-7	-3
	180	2.00	8	-14	-10
	240	2.00	7	-22	-18
	300	2.00	6	-30	-25
	360	2.00	6	-38	-33
	420	2.00	5	-46	-41
	480	2.00	4	-54	-49
	540	2.00	3	-62	-57
	600	2.00	2	-70	-65

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, 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 allowance²⁰, and the results are presented in Table 3.3. The attenuation storage requirements for the Site (i.e. surface area 226m²) at 20% AEP, 10% AEP, 3.3% AEP and 1% AEP are 0m³, 1m³, 2m³ and 3m³; and with climate change allowance 1m³, 1m³, 3m³ and 4m³, 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 Soilsmap data of Cranfield University²¹. Generally, soil types beneath the Site are slowly permeable seasonally wet and acid loamy and clayey soils (Figure 3.3), and therefore the infiltration rate on the permeable area would be low and it would not be suitable for soakaway design, taking into the conservative approach. 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.

²⁰ Peak rainfall climate change allowances by management catchment - GOV.UK (www.gov.uk)

²¹ Op.cit.

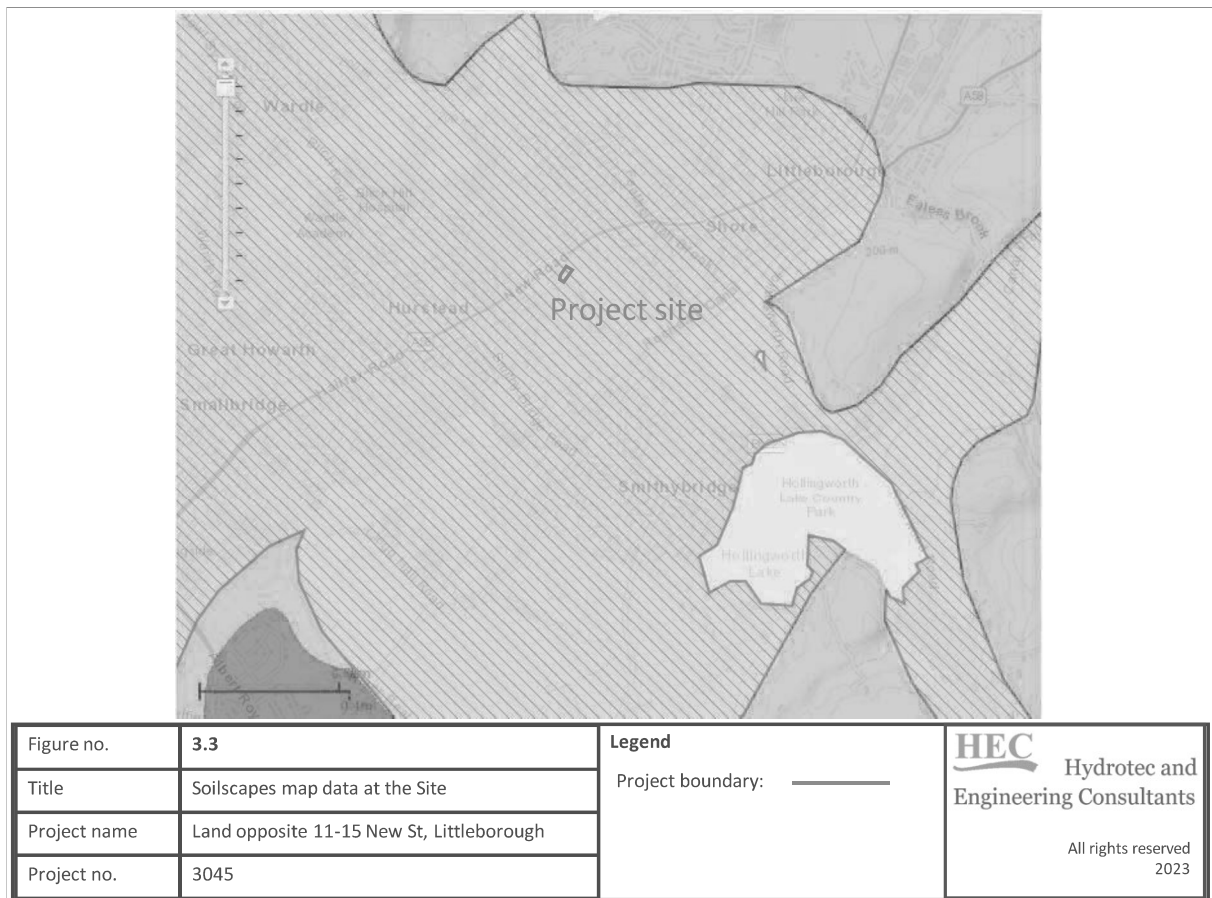


Figure 3.3: The soil types beneath the Site - slowly permeable seasonally wet and acid loamy and clayey soils (reference - Soilsmap map data of Cranfield University²²).

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 guidance and to improve the sustainability of the wider drainage systems, environmental impact and local biodiversity in the surrounding areas – the proportionate footprint of the excess impermeable surface by the proposed development would be attenuated on-site

The proposed development would have an impact on a maximum of 53% permeable land and therefore the attenuation for the excess runoff would be managed by an underground storage tank (e.g. attenuation crates). The topographical survey data and layout of the development site indicate that the location of the proposed attenuation storage tank would be suitable on the

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

western side of the proposed new dwelling (i.e. rear side of the proposed house). The size of the underground storage tank would be based on the 3.3% AEP plus climate change allowance. (i.e. 1.60m^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). Attenuation storage at 1% AEP plus climate change allowance would be a combination of attenuation tank and overland flooding within the Site without deterioration itself or surrounding areas.

The proposed development is the erection of a two-storey four-bedroom dwelling house with associated car parking and landscape amenities, and the layout of the development was considered well-thought eco-friendly and sustainable drainage systems including plenty of shrub plantation with permeable porous trenches, assisting water quality improvement by reducing the suspended solids and silts materials. These proposed features would significantly improve the sustainability of surface water. 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 by porous trenches (e.g. sand and gravel materials) in addition to the periodic inspection and maintenance of the attenuation storage tank and drainage features. The landowner of the development site 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 detached dwelling house with associated car parking space and private landscape amenities. The existing land surface is a brownfield and therefore the surface water runoff would be modified, however, the proposed layout of the Site would provide a positive and sustainable drainage system. The proposed drainage network would be separate, i.e. separate surface water and foul drainage networks and the layout of the drainage networks at the Site is shown in Figure 4.1, see also Appendix III for details. The size of the attenuation tank was designed for a 1 in 30-year flood event plus a 30% climate change allowance for the respective impermeable footprint of development (i.e. 1.6 m^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 surface water drainage network.

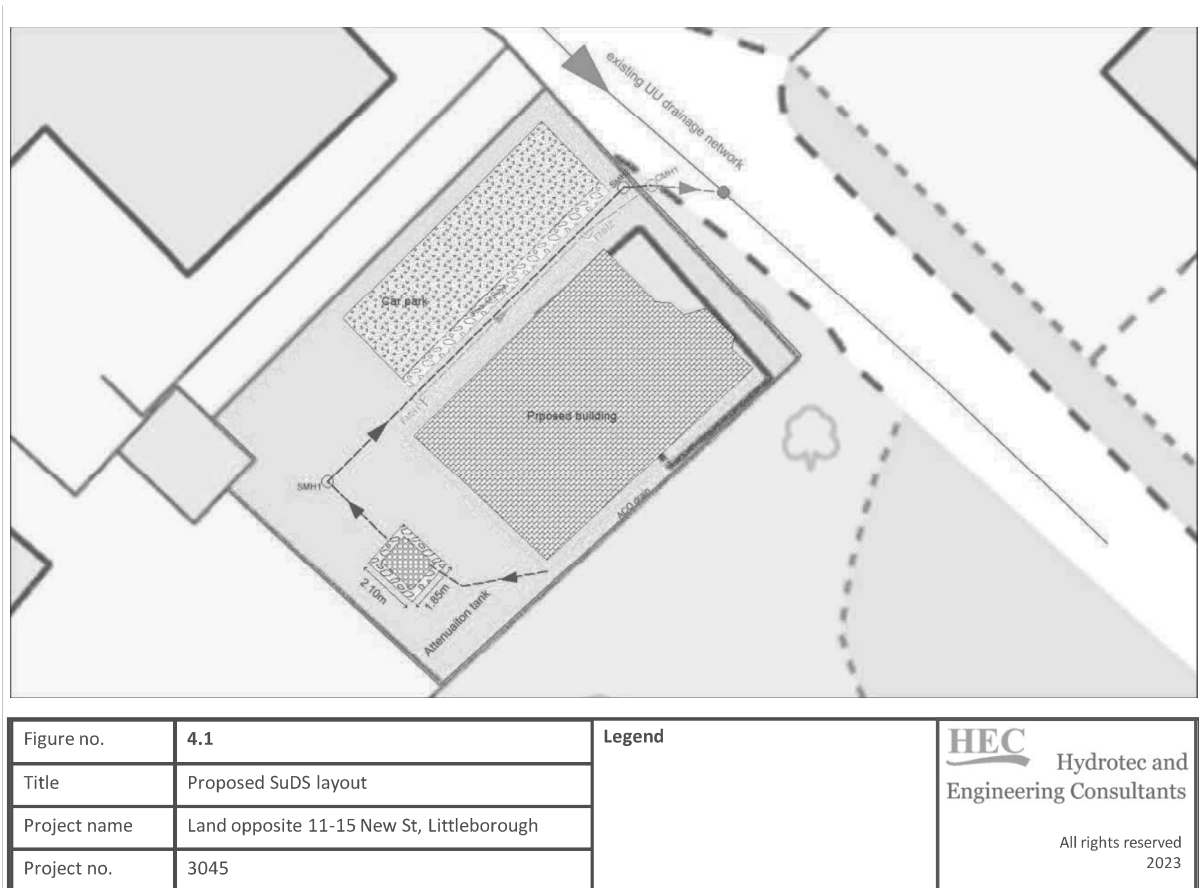


Figure 4.1: The SuDS layout and attenuation tank at the Site.

In the proposed drainage networks - the diameter of the drainage pipes is 100mm and pipes are connected with manholes, ACO drains, and gullies. In addition, the runoff from the car park would be treated by porous trenches. 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, tanking into account the the invert level of the existing drainage manholes. The details of the cross-section of the attenuation tank are given in Appendix VI. The size of the attenuation storage crates would be 1.5m in length, 1.25m in width and 0.75m in depth. The porosity of the crates is 95% and therefore they would hold 1.34m³ of water. In addition, there are 300mm thick gravel layers around the sides; therefore, these porous materials on the sides would hold 0.45m³ of water, considering the 0.30 porosity of the gravel materials. Subsequently, the total attenuation storage capacity would become 1.80m³, which is more than

the requirement (i.e. 1.60m³). 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 0.35m³ 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, and 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.

5 Management and maintenance plan of drainage infrastructures

The landowner of the property would be legally responsible for the management of the proposed SuDS systems including a periodic inspection and maintenance of the SuDS systems 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	Six monthly

Maintenance schedule	Required action	Typical frequency
Occasional maintenance	pipework for silt accumulation and establish appropriate silt removal frequencies.	
	Remove the sediment from pre-treatment devices.	Six monthly or as required
	Remove or control tree roots where they are encroaching on the sides of the filter drain, using the recommended methods.	As required
Occasional maintenance	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 matter; remove and replace the	Annually

Maintenance schedule	Required action	Typical frequency
	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

Table 5.3: Operation and maintenance requirements for pervious pavements.

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over the whole surface).	Once a year, after autumn leaves fall or reduced frequency as required based on site-specific observation of clogging or manufacturer's recommendation - pay particular attention to areas where water runs onto the pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required

Maintenance schedule	Required action	Typical frequency
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying.	As required – once per year on less frequently used pavement
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required
	Remedial work to any depressions, rutting, and cracked or broken blocks considered detrimental to the structural performance or a hazard to users and replace lost jointing material.	As required
	Rehabilitation of surface and upper substructure by remedial sweeping.	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging).
Monitoring	Initial inspection	Monthly for three months after installation.
	Inspect for evidence of poor operation and/or weed growth – if required, take remedial action.	Three monthly, 48 hours after large storms in the first six months.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually
	Monitor inspection chambers	Annually

6 Finished floor level and access/egress from the Site

The proposed development, which is the erection of a two-storey four-bedroom detached dwelling house with associated car parking space, is classified as a more vulnerable category, according to the NPPF flood risk vulnerability classification²³. However, the Site would not have a flood risk from fluvial flow. Moreover, the surface water drainage would have a very low flood 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 houses would be at the same level as the existing ground floor level. However, it is highly recommended to raise the 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 New St located in front of the Site would be used as an access and egress during any unexpected flooding incident.

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 opposite 11-15 New St, Littleborough, OL15 8LX. The proposed development is the erection of a two-storey four-bedroom detached dwelling house with associated car parking and landscape amenities. The Site lies within Rochdale Borough 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 (survey and LiDAR), soil map data, sewer network data of United Utilities.

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

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 low risk from the surface water flow - according to the EA's flood map. 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 and subsequently, the overland flow from the surrounding areas was not taken into consideration. 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 allowance²⁴. The cumulative rainfall depths at these events were estimated from the latest FEH22 rainfall-runoff model data²⁵. For the whole site, the attenuation storage requirements at 3.3% AEP and 1% AEP are 2m³ and 3m³; and with climate change allowance 3m³ and 4m³, respectively.

There is no in-situ soil percolation data available during the publication of this report, but the soil types beneath the Site are slowly permeable seasonally wet and acid loamy and clayey soils with reference to the Soilsmap map data²⁶. Thus, it would not be suitable to attenuate the excess surface water through the soakaway.

There are existing combined drainage networks passing southerly along New St, and therefore it would be 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.

In the proposed drainage strategy, the proportionate footprint of the increased impermeable land by the development would be attenuated. The size of the underground storage tank (e.g. attenuation crates) would be based on 3.3% AEP plus climate change allowance (i.e. 1.6m³, taking into account 2.0 litres/sec greenfield runoff rate), a requirement of the LLFA. Attenuation

²⁴ Op.cit.

²⁵ Op. cit.

²⁶ Op.cit.

at 1% AEP plus climate change allowance would be a combination of attenuation tanks and overland flooding within the Site without deterioration of the Site itself or surrounding areas.

The proposed layout for the separate surface water and foul water drainage system 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 1.5m in length, 1.25m 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 1.80m³, which is more than the requirement for a 1 in the 30-year hydrological event plus climate change allowance.

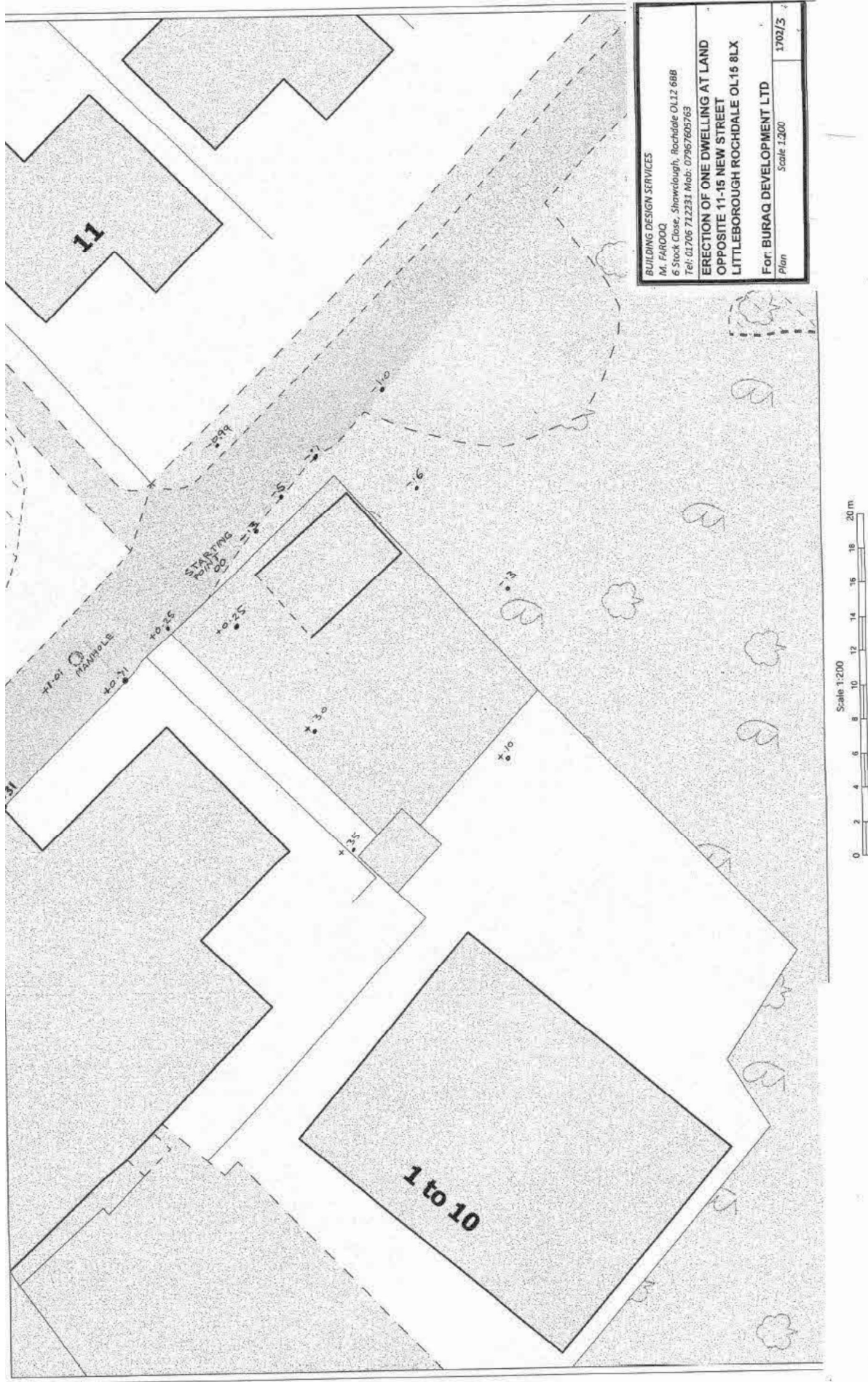
In addition, the proposed eco-friendly layout design and landscape amenities would improve significantly surface water drainage sustainability, environmental impact, local biodiversity, and water quality compared with the existing conditions. The periodic inspection and maintenance of the underground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

The Site is not considered to be a flood risk, and therefore the finished ground floor level of the proposed development would be the same as the existing ground floor 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 on New St 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 water and foul water drainage through the same pipe. The general observation of sewer drainage networks 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 the United Utilities is required before utilisation of the proposed development.

Appendix I: Topographical survey data on the Site.



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

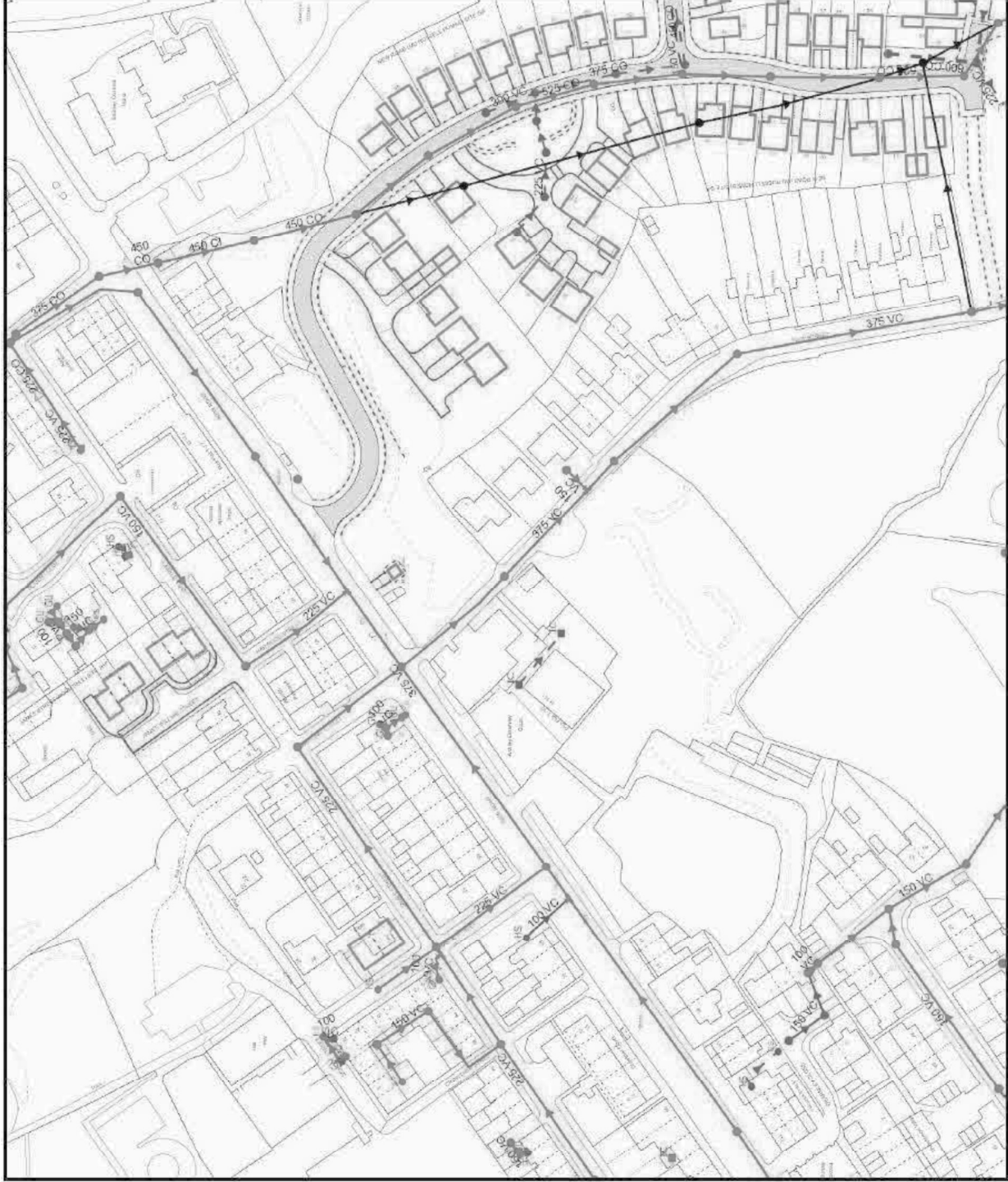


Wastewater Symbolology

Abandoned	Foul	Surface Water	Combined	
				Public Sewer
				Private Sewer
				Section 104
				Rising Main
				Sludge Main
				Overflow
				Water Course
				Highway Drain

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

Manhole	Side Entry Manhole
Head of System	Outfall
Extent of Survey	Screen Chamber
Rodding Eye	Inspection Chamber
Inlet	Bifurcation Chamber
Discharge Point	Lamp Hole
Vortex	T Junction / Saddle
Penstock	Catchpit
Washout Chamber	Valve Chamber
Valve	Vent Column
Air Valve	Vortex Chamber
Non Return Valve	Penstock Chamber
Soakaway	Network Storage Tank
Gully	Sewer Overflow
Cascade	Ww Treatment Works
Flow Meter	Ww Pumping Station
Hatch Box	Septic Tank
Oil Interceptor	Control Kiosk
Summit	Change of Characteristic
Drop Shaft	
Orifice Plate	



SEWER RECORDS

Address or Site Reference

11 NEW STREET,
LITTLEBOROUGH,
OL15 8HW

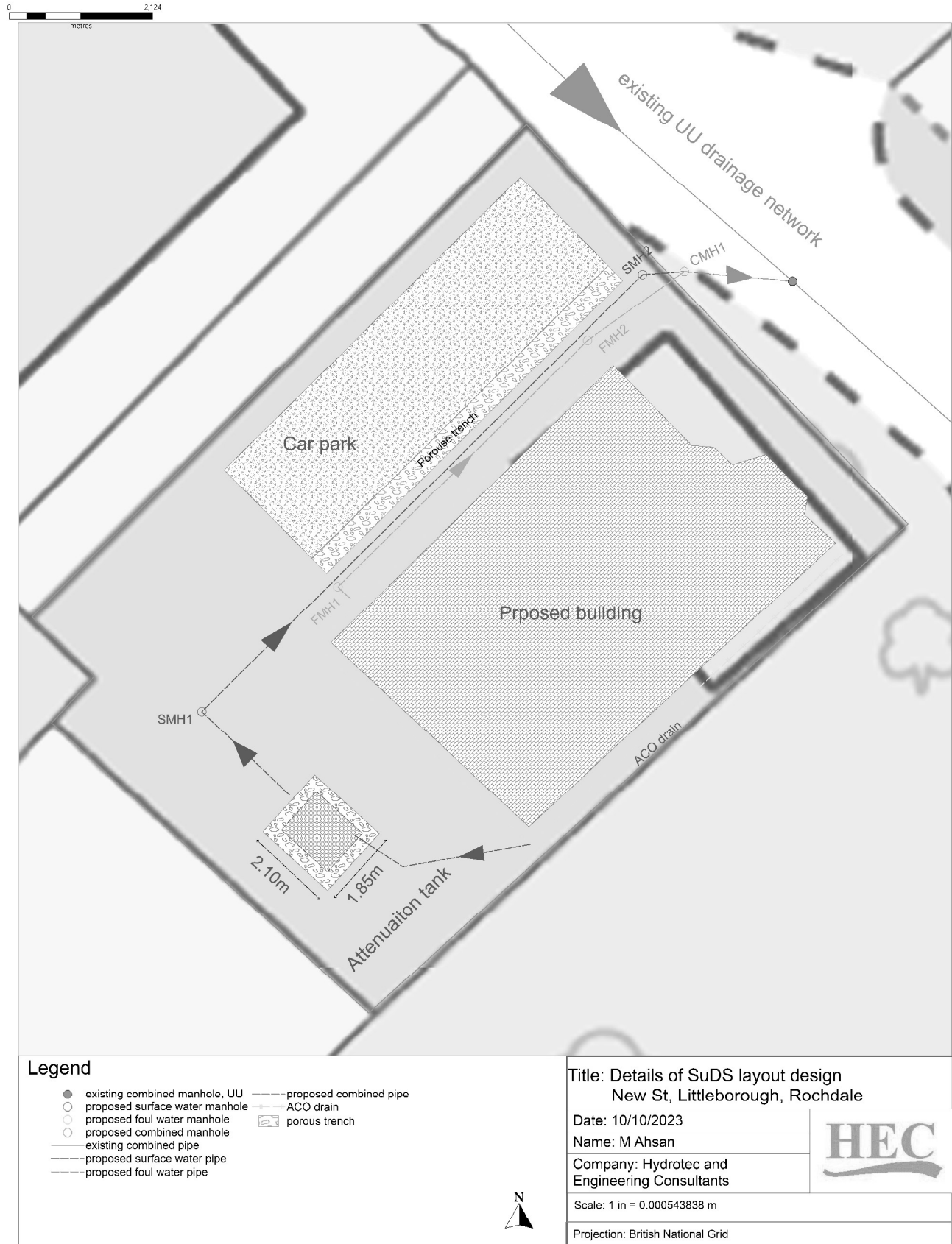
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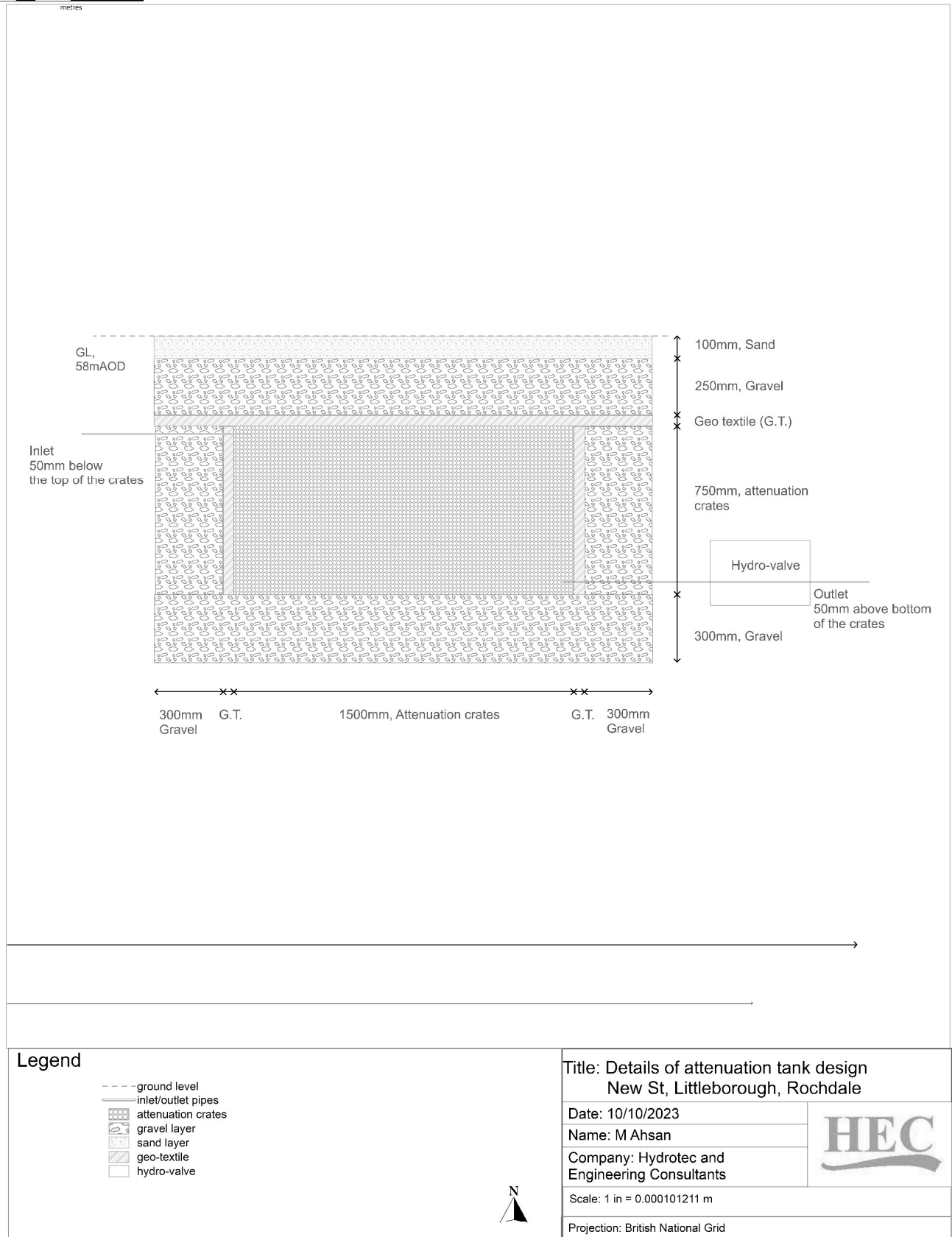
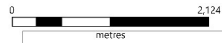
The position of the underground apparatus shown on this plan is approximate only and is given in accordance with the best information currently available. United Utilities Water will not accept liability for any loss or damage caused by the actual position being different from those shown.

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



Appendix IV: Details of the cross-section of the attenuation tank.



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

