



**FLOOD RISK ASSESSMENT REPORT FOR
PROPOSED SINGLE STOREY REAR
EXTENSION AT No 13 GLENWOOD AVENUE,
RAINHAM, ESSEX, RM13 9AD**

Report prepared

by

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1.0 Site Details

The scheme proposal is for the construction of a single storey rear extension at No 13 Glenwood Avenue. The proposed building is to be of insulated cavity wall construction and have a flat roof. Flood assessment has been undertaken as per guidance by LPAR issued by the local planning authority.

Site address: **13 Glenwood Avenue**
Rainham
Essex
RM13 9AD

Local Planning Authority: **London Borough of Havering**

Aerial view of the site and its surroundings



Front elevation of dwelling



Rear elevation of dwelling



2.0 Flood Risk

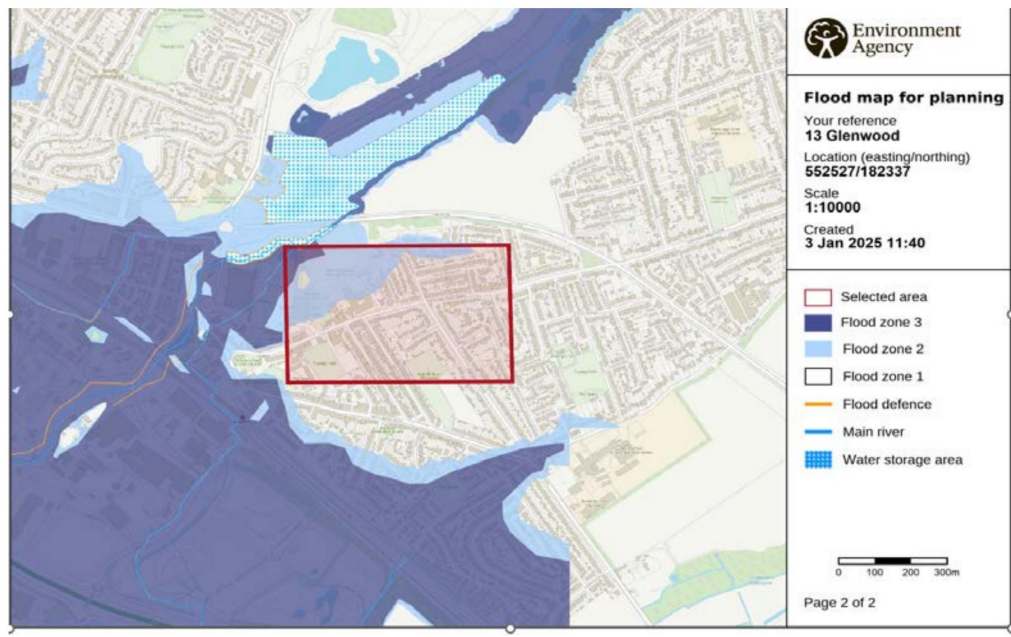
The Annex C of Planning Policy Statement 25 (PPS25) sets out the forms of flooding that are possible causes and risk of flooding on development site:

- Flooding from Rivers
- Flooding from the Sea
- Flooding from Land
- Flooding from Groundwater
- Flooding from Sewers
- Flooding from Reservoirs, Canals and Other Artificial Sources

2.1 Flood Zone - Flood Risk for X:552527, Y:182337

The flood risk map developed by The Environment Agency shows the relative risk of flooding for different return periods. The information that the flood map provides an indication of the likelihood of flooding in the catchment of the proposed development. The Environment Agency's Flood Risk Assessment map uses ground levels, predicted flood levels, information on flood defences, and local knowledge. The likelihood is described in one of three categories, low, moderate or significant, as used by the insurance industry.

Environment Agency Flood Map for Catchment



A floodplain is the area that would naturally be affected by flooding if a river rises above its banks, or high tides and stormy seas cause flooding in coastal areas.

There are two different kinds of area shown on the Flood Map. They can be described as follows:

- **Dark blue** ■ shows the area that could be affected by flooding, either from rivers or the sea, if there were no flood defenses. This area could be flooded:
- from the sea by a flood that has a 0.5 per cent (1 in 200) or greater chance of happening each year;
- or from a river by a flood that has a 1 per cent (1 in 100) or greater chance of happening each year.

(For planning and development purposes, this is the same as Flood Zone 3, in England only.)

- **Light blue** □ shows the additional extent of an extreme flood from rivers or the sea. These outlying areas are likely to be affected by a major flood, with up to a 0.1 per cent (1 in 1000) chance of occurring each year.

(For planning and development purposes, this is the same as Flood Zone 2, in England only.)

These two colours show the extent of the natural floodplain if there were no flood defences or certain other manmade structures and channel improvements.

- **Clear** □ shows the area where flooding from rivers and the sea is very unlikely. There is less than a 0.1 per cent (1 in 1000) chance of flooding occurring each year. The majority of England and Wales falls within this area.

(For planning and development purposes, this is the same as Flood Zone 1, in England only.)

The development lies within flood zone 1 of the Environment Agency's flood map. Land located within this zone is at no or very low risk of flooding with a probability or likelihood of flooding is 1 in 1000. In accordance with table D1 of PPS25 sites within Flood Zone 1 all uses of land are suitable for use. As the proposed development does not exceed 1 hectare in size a formal FRA is not required. Although this is not required there is a need to assess the vulnerability of the site to flooding from other sources to meet the SUR2 requirements of the Code of Sustainable Homes. Assessment for this site has been based on the Environment Agency's, the proposed layout of the development and the layout of the drainage network and the topography of the site.

Table D.1: Flood Zones

(Note: These Flood Zones refer to the probability of river and sea flooding, ignoring the presence of defences)

Zone 1 Low Probability

Definition

This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (<0.1%).

Appropriate uses

All uses of land are appropriate in this zone.

FRA requirements

For development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water run-off, should be incorporated in a FRA. This need only be brief unless the factors above or other local considerations require particular attention. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Zone 2 Medium Probability

Definition

This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1%) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1%) in any year.

Appropriate uses

The water-compatible, less vulnerable and more vulnerable uses of land and essential infrastructure in Table D.2 are appropriate in this zone.

Subject to the Sequential Test being applied, the highly vulnerable uses in Table D.2 are only appropriate in this zone if the Exception Test (see para. D.9.) is passed.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to reduce the overall level of flood risk in the area through the layout and form of the development, and the appropriate application of sustainable drainage techniques.

Zone 3a High Probability**Definition**

This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.

Appropriate uses

The water-compatible and less vulnerable uses of land in Table D.2 are appropriate in this zone.

The highly vulnerable uses in Table D.2 should not be permitted in this zone.

The more vulnerable and essential infrastructure uses in Table D.2 should only be permitted in this zone if the Exception Test (see para. D.9) is passed. Essential infrastructure permitted in this zone should be designed and constructed to remain operational and safe for users in times of flood.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques;*
- ii. relocate existing development to land in zones with a lower probability of flooding;*
- and*
- iii. create space for flooding to occur by restoring functional floodplain and flood flow pathways and by identifying, allocating and safeguarding open space for flood storage.*

Zone 3b The Functional Floodplain**Definition**

This zone comprises land where water has to flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

Appropriate uses

Only the water-compatible uses and the essential infrastructure listed in Table D.2 that has to be there should be permitted in this zone. It should be designed and constructed to:

- remain operational and safe for users in times of flood;*
- result in no net loss of floodplain storage;*
- not impede water flows; and*
- not increase flood risk elsewhere.*

Essential infrastructure in this zone should pass the Exception Test.

FRA requirements

All development proposals in this zone should be accompanied by a FRA. See Annex E for minimum requirements.

Policy aims

In this zone, developers and local authorities should seek opportunities to:

- i. reduce the overall level of flood risk in the area through the layout and form of the development and the appropriate application of sustainable drainage techniques; and*
- ii. relocate existing development to land with a lower probability of flooding.*

2.2 Flood Vulnerability

The risk vulnerability of various developments is highlighted by Table D2 in the PPS25. The table outlines the impact of flooding on a particular site uses identified by the flood risk vulnerability classification varies within each vulnerability class. It is therefore essential that mitigation measures need to ensure that the development is safe within a particular vulnerability classification.

Table D.2: Flood Risk Vulnerability Classification

Essential Infrastructure	• Essential transport infrastructure (including mass evacuation routes) which has to cross the area at risk, and strategic utility infrastructure, including electricity generating power stations and grid and primary substations
Highly Vulnerable	• Police stations, Ambulance stations and Fire stations and Command Centres and telecommunications installations required to be operational during flooding. • Emergency dispersal points. • Basement dwellings. • Caravans, mobile homes and park homes intended for permanent residential use. • Installations requiring hazardous substances consent.¹⁹
More Vulnerable	• Hospitals. • Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels. • Buildings used for: dwelling houses; student halls of residence; drinking establishments; nightclubs; and hotels. • Non-residential uses for health services, nurseries and educational establishments. • Landfill and sites used for waste management facilities for hazardous waste.²⁰ • Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan
Less Vulnerable	• Buildings used for: shops; financial, professional and other services; restaurants and cafes; hot food takeaways; offices; general industry; storage and distribution; non-residential institutions not included in 'more vulnerable'; and assembly and leisure. • Land and buildings used for agriculture and forestry. • Waste treatment (except landfill and hazardous waste facilities). • Minerals working and processing (except for sand and gravel working). • Water treatment plants. • Sewage treatment plants (if adequate pollution control measures are in place).

Water-compatible Development	• Flood control infrastructure. • Water transmission infrastructure and pumping stations. • Sewage transmission infrastructure and pumping stations. • Sand and gravel workings. • Docks, marinas and wharves. • Navigation facilities. • MOD defence installations. • Ship building, repairing and dismantling, dockside fish processing and refrigeration and compatible activities requiring a waterside location. • Water-based recreation (excluding sleeping accommodation). • Lifeguard and coastguard stations. • Amenity open space, nature conservation and biodiversity, outdoor sports and recreation and essential facilities such as changing rooms. • Essential ancillary sleeping or residential accommodation for staff required by uses in this category, subject to a specific warning and evacuation plan.
-------------------------------------	--

The proposed usage of the site is for a dwelling house and based on the vulnerability classification in table D2 above, this use would be considered to be building used for residential use to be 'Less Vulnerable'. Based on the Environment Agencies Flood map the development site is located within Zone 1 but in close proximity of Zone 2. In accordance with table 3²² below the site is suitable for any development.

Table D.3²²: Flood Risk Vulnerability and Flood Zone 'Compatibility'

Flood Risk Vulnerability classification (see Table D2)		Essential Infrastructure	Water compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone (see Table D.1)	Zone 1	✓	✓	✓	✓	✓
	Zone 2	✓	✓	Exception Test required	✓	✓
	Zone 3a	Exception Test required	✓	✗	Exception Test required	✓
	Zone 3b 'Functional Floodplain'	Exception Test required	✓	✗	✗	✗

Key:

✓ Development is appropriate

✗ Development should not be permitted

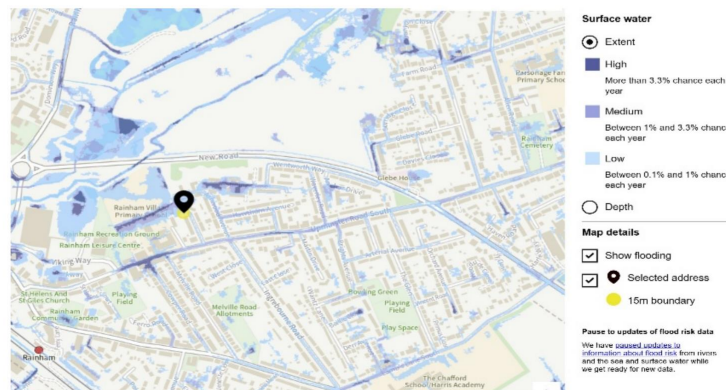
3.0 Flood Risk Assessment

The effects of the various forms of flooding are set out in Annex C of the Planning Policy Statement 25 and these are considered to assess the flood risk to the development site and the implications elsewhere due to the development.

3.1 Flooding from River

The nearest rivers to the development site is Ingrebourne River which is approximately 250m to the North of the site. It is clear from the f surface flooding map for the catchment the site is at low risk of flooding.

Surface Flooding Map for Rainham



3.2 Flooding from Land

The natural topography of the development site and the surrounding area is that there is a fall from the West to the East therefore, any surface runoff on the land would drain toward the West away from the dwelling. Consultation with Thames Water and the local authority Building Control confirm that there is no history of flooding or any specific drainage problems on the sewer network in the vicinity of the development site.

3.3 Flooding from Groundwater

Site trial excavation no ground water was encountered. Consultation with Thames Water and the local authority Building Control confirm that there is no recorded history of ground water flooding in the vicinity of the development site. It can therefore, be concluded that there is no risk of flooding from the groundwater on this site.

3.4 Flooding from Sewers

The existing sewers network that serves the development site has been designed in accordance with the requirements of Building Regulations and has adequate capacity therefore, unlikely to surcharge and cause flooding. Consultation with Thames Water and the local authority Building Control confirm that there is no history of flooding or any specific drainage problems on the sewer network in the vicinity of the development site. It can therefore, be concluded that there is no risk of flooding due to surcharge of sewers.

3.5 Flooding from Reservoirs, Canals or Other Artificial Sources

There is no risk to the development site from reservoirs or canals as there are no such facilities of this kind in the vicinity of the development site. Consultation with Thames Water confirm that there are no known reservoirs in the area. It can therefore, be concluded that there is no risk of flooding.

4.0 Management of Surface Water Runoff

The history of development site is that it is within a fully developed residential area and the site has been paved for parking and hard standing areas thus 40% of development site was impermeable. The surface runoff from the existing site is managed by a networks of existing drains constructed for the catchment.

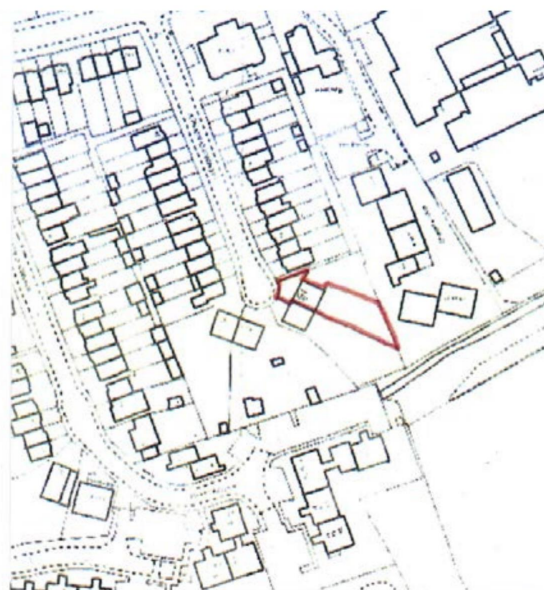
The surface water runoff from the planned rear extension will be discharging by the following options:

- Provide soakaway
- Underground harvesting tank.
- Water butts at ground level

Harvested surface water could be used a grey water for garden.

5.0 Proposed Detail of Scheme Proposals

Site Location Plan



Existing Dwelling Layout Plan and Elevations



Proposed Layout Plan and Elevations for Rear Extension



Proposed impermeable roof area of Out Building $A_p = 30 \text{ m}^2$

Runoff from existing dwelling is discharged to the existing sewer.

Runoff from the proposed out building is to be to a soakaway set 5m from the foundations of the planned rear extension.

5.1 Surface Runoff Calculations based on 'Wallingford Procedure'

Design check for rainfall intensity for 1 in 100 year

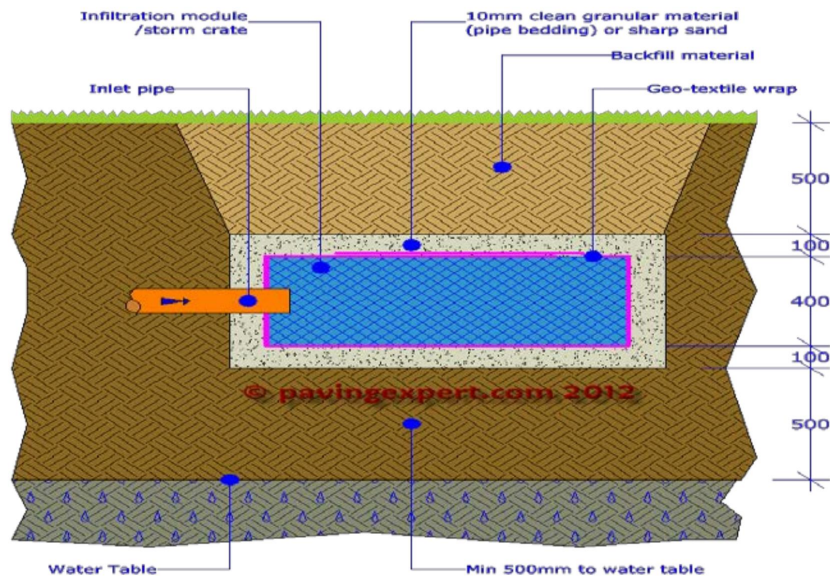
Rainfall intensity $I = 50 \text{ mm/hr}$

Peak Discharge $Q_p = 2.76 \times A_p \times i$ (liters/sec)

- Discharge for proposed site $Q_p = 2.76 \times 30 \times 50 = 4.140 \text{ l/s}$

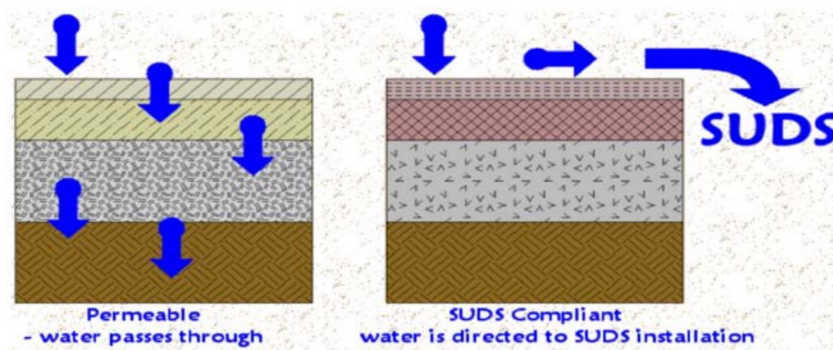
5.2 Options for Disposal of Surplus Surface Water Run off

- **Attenuation Storage Soakaway**

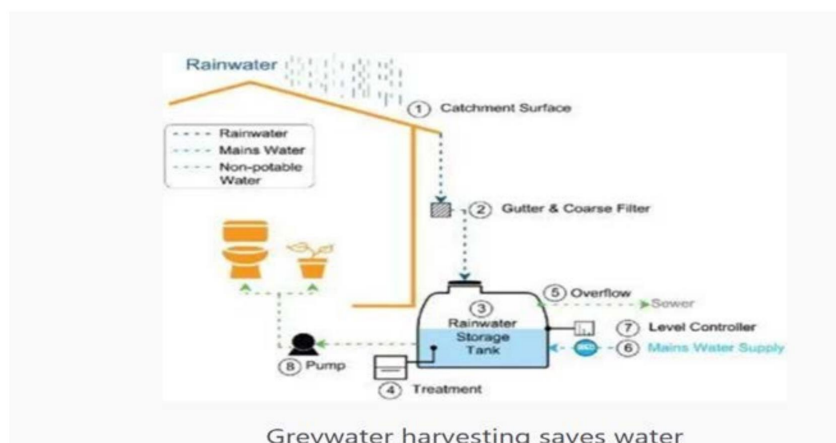


- **Soakaway Paving for Paved Areas**

Provision of the soakaway will be subject to further site investigations to establish the permeability of the ground on this site.



- **Greywater Harvesting**



5.3 Conclusions

This report considers the potential of flood risk that arises from the proposed development on this site is negligible. The assessment criterion used has been outlined by the Planning Policy Statement 25.

The development site is located within Flood Zone 2 and in this zone land is assessed as having a less than 1 in 1000 annual probability of river or sea flooding in any year (1% - 0.1%). In this zone developments for assembly use is designated as 'Medium Probability' of flooding.

Based on the established historical development use of this site it has been confirmed both by Thames Water and the Local Authority that there is no history of flooding on this site.

It has also been established that there are no recorded historical flooding of this site from over land, groundwater, sewers surcharge or any other artificial sources.

It is conclusive that the risk of flooding from development proposals will not affect the development site or the local catchment in the vicinity of the site.

Provision of the soakaway will be subject to further site investigations to establish the permeability of the ground on this site. Minimum acceptable permeability of 1×10^{-6} metres/second would have to be achieved.

If attenuation storage soakaway is provided adequate design measures must be put in place for future maintenance and limiting silt accessing the tank.

6.0 Soakaway design

Design calculations attached in appendix

Appendix

Your Logo / Company Details Here	Project:	13 Glenwood Avenue, Rainham, Essex RM13 9AD		By:															
	Calculation:	Soakaway Design		Approved:															
	Infiltration Test Results Analysis																		
	Sheet Number:	Cover Sheet	Date:		22-Dec-24														
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0	Original	01/05/2020																	

Your Logo / Company Details Here	Project:	13 Glenwood Avenue, Rainham, Essex RM13 9AD		By:	
	Calculation:	Soakaway Design			
	Infiltration Test Results Analysis				
	Sheet Number:	1	Date:	22 Dec 2024	Approved:

Infiltration Test (BRE 365)

Trial Pit Details

Total Pit Depth	1	m
Total Pit Length	1	m
Total Pit Width	0.65	m

Test Results		
	Time (Mins)	Water Level (From Base)
1	0	1.00
2	30	0.85
3	134	0.35
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		

The graph illustrates the water level in the trial pit over time. The y-axis represents the water level from the base, ranging from 0 to 1.2. The x-axis represents time in minutes, ranging from 0 to 160. A solid blue line shows the water level decreasing from 1.00 at 0 minutes to approximately 0.35 at 134 minutes. Two horizontal dashed red lines are drawn at 0.75 (labeled 75%) and 0.25 (labeled 25%) to provide reference points.

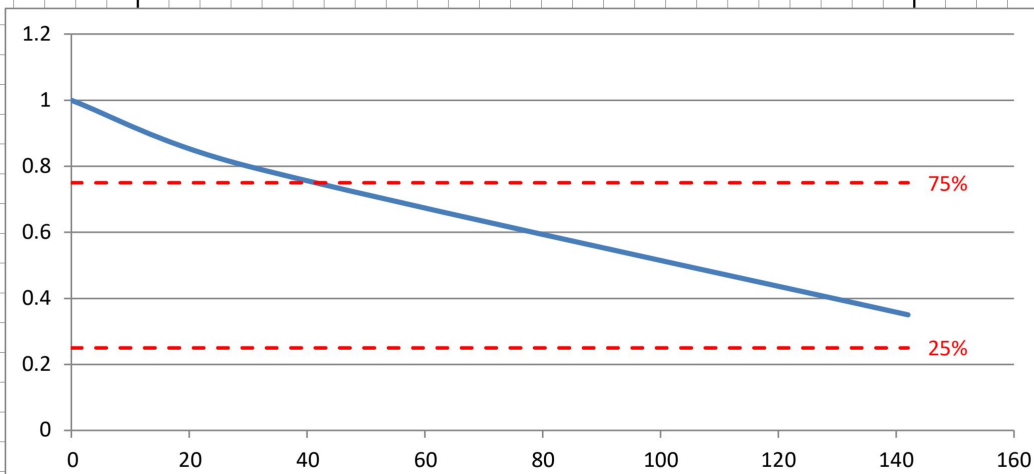
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	Calculation:	Soakaway Design		
	Infiltration Test Results Analysis			Approved:
	Sheet Number:	2	Date:	22 Dec 2024
Results Time to reach 75% depth: 50.8 mins Time to reach 25% depth: 95.7 mins Soil Infiltration Rate: 5.24348E-05 m/s 0.18876535 m/hr				

Your Logo / Company Details Here	Project:	13 Glenwood Avenue, Rainham, Essex RM13 9AD	By:
	Calculation:	Soakaway Design	
	Infiltration Test Results Analysis		
	Sheet Number:	3	Date: 23-Dec-24
Approved:			

Infiltration Test (BRE 365)**Trial Pit Details**

Total Pit Depth	1	m
Total Pit Length	1	m
Total Pit Width	0.65	m

Test Results		
	Time (Mins)	Water Level (From Base)
1	0	1.00
2	30	0.80
3	142	0.35
4		
5		
6		
7		
8		
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Your Logo / Company Details Here	Project:	13 Glenwood Avenue, Rainham, Essex RM13 9AD		By:
	Calculation:	Soakaway Design		Approved:
	Infiltration Test Results Analysis			
	Sheet Number:	4	Date:	23 Dec 2024
Results Time to reach 75% depth: 42.4 mins Time to reach 25% depth: 101.4 mins Soil Infiltration Rate: 3.99272E-05 m/s 0.143738007 m/hr				

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	Calculation:	Soakaway Design																	
	Sheet Number:	Cover Sheet	Date:	02-Jan-25															
Approved:																			
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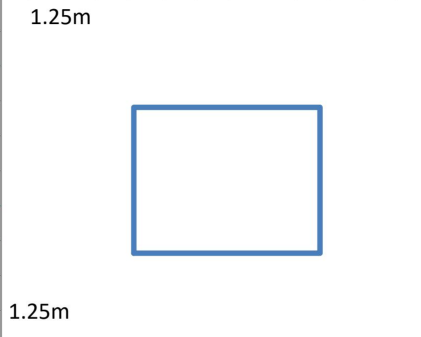
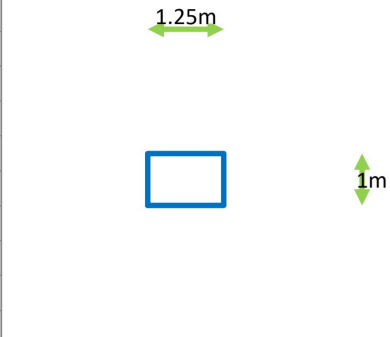
Your Logo / Co	Project:	13 Glenwood Avenue, Rainham, Essex RM13 9AD		By:
	Calculation:	Soakaway Design		
	Wallingford Procedure Rainfall			Approved:
Sheet Number:	2	Date:	02-Jan-25	

Catchment Details				
Catchment Area		23	m ²	
Location		England & Wales		
City/Town		London		
M5-60	20.47	Override-		
r Ratio	0.44	Override-		
Runoff Coefficient		95	%	

Design Storm Details				
Return Period		100	years	
Climate Change Allowance		1.4		

Ground Information				
Infiltration Rate		0.1437	m/hr	
Factor of Safety		1		

Soakaway Design				
Soakaway Shape		Rectangular Trench/Pit		
Number of Soakaways		1		
Length		1.25	m	
Width		1.25	m	
Effective Depth		1.00	m	
Backfill Porosity		95	%	
Additional Outflow (If Any)		0	l/s	
Base Infiltration Factor		0		

Soakaway Plan		Soakaway Cross Section	
			

3.99E-05 m/s

Your Logo / Company Details Here	Project:	13 Glenwood Avenue, Rainham, Essex RM13 9AD		By:
	Calculation:	Soakaway Design		Approved:
	Sheet Number:	3	Date:	02-Jan-25

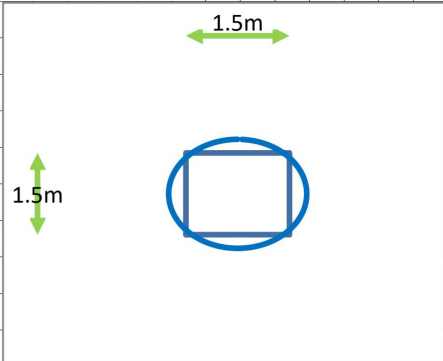
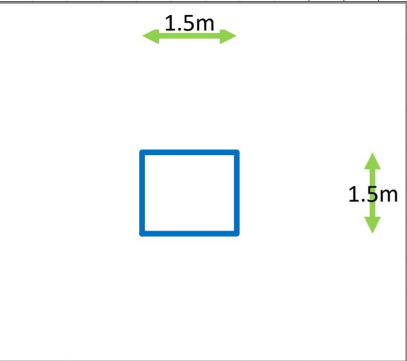
Catchment Details			
Catchment Area	23	m ²	6 hrs
Runoff Coefficient	85	%	
Design Storm Intensity	50	mm/hr	
Design Storm Duration	360	mins	

Ground Information

Infiltration Rate	0.1437	m/hr
Factor of Safety	1.5	

Soakaway Design

Soakaway Shape	Manhole Within Pit	
Number of Soakaways	1	
Length	1.5	
Width	1.5	m
Effective Depth	1.5	m
Backfill Porosity	30	%
Additional Outflow (If Any)	0	l/s
Base Infiltration Factor	0	
Manhole Diameter	2000	mm

Soakaway Plan	Soakaway Cross Section
	

Storage Volume Required	3.28 m ³	Acceptable
Storage Area Provided	4.08 m ³	
Time for Emptying 50%	3.8 hours	Acceptable

Your Logo / Company Details Here	Project:	13 Glenwood Avenue, Rainham, Essex RM13 9AD				By:
	Calculation:	Soakaway Design				
	BRE 365 Method					Approved:
	Sheet Number:	4	Date:	02-Jan-25		

Catchment Details					
Catchment Area			23	m ²	
Location			England & Wales		
City/Town			london		
M5-60	20.47	Override-	20		
r Ratio	0.44	Override-			
Runoff Coefficient			100	%	

Design Storm Details			
Return Period		100	years
Climate Change Allowance		1.4	

Ground Information		
Infiltration Rate	0.14374	m/hr

Soakaway Design		
Length	1.50	m
Width	1.50	m
Effective Depth	1.50	m
Backfill Porosity	30	%

Results

Storm Duration	Z1	Z2	Rainfall	Inflow	Outflow	Storage Required	%
5	0.39	1.88	20.34	0.47	0.05	0.41	40.9
10	0.54	1.92	28.79	0.66	0.11	0.55	54.8
15	0.65	1.93	35.01	0.81	0.16	0.64	63.6
30	0.82	1.96	44.89	1.03	0.32	0.71	70.0
60	1.00	2.00	56.00	1.29	0.65	0.64	63.3
120	1.19	2.02	67.60	1.55	1.29	0.26	25.8
240	1.39	2.02	78.75	1.81	2.59	0.00	0.0
360	1.53	2.01	86.01	1.98	3.88	0.00	0.0
600	1.70	1.99	94.91	2.18	6.47	0.00	0.0
1440	2.07	1.97	114.11	2.62	15.52	0.00	0.0

Maximum Storage Volume Required:	0.71 m ³ (30 min Storm)	
Storage Volume Provided:	1.01 m ³	Acceptable
Time of Emptying:	0.78 Hours	Acceptable

Your Logo / Company Details Here	Project:	13 Glenwood Avenue, Rainham, Essex RM13 9AD				By:
	Calculation:	Deep Bore Soakaway Design				Approved:
	BRE 365 Method					
	Sheet Number:	5	Date:	02-Jan-25		

Catchment Details					
Catchment Area			23	m ²	
Location			England & Wales		
City/Town			london		
M5-60	20.47	Override-	20		
r Ratio	0.44	Override-	0.4		
Runoff Coefficient			100	%	

Design Storm Details			
Return Period		100	years
Climate Change Allowance		1.4	

Ground Information	
Infiltration Rate	0.1437 l/s

Soakaway Design		
Diameter	1.05	m
Effective Depth	1.50	m
Backfill Porosity	100	%

Results

Storm Duration	Z1	Z2	Rainfall	Inflow	Outflow	Storage Required	%
5	0.37	1.87	19.60	0.45	0.04	0.41	31.4
10	0.52	1.91	28.04	0.64	0.09	0.56	43.0
15	0.63	1.93	34.25	0.79	0.13	0.66	50.7
30	0.80	1.96	44.10	1.01	0.26	0.76	58.2
60	1.00	2.00	56.00	1.29	0.52	0.77	59.3
120	1.21	2.02	68.41	1.57	1.03	0.54	41.5
240	1.45	2.01	81.59	1.88	2.07	0.00	0.0
360	1.60	2.00	89.86	2.07	3.10	0.00	0.0
600	1.79	1.99	99.75	2.29	5.17	0.00	0.0
1440	2.24	1.96	122.66	2.82	12.4	0.00	0.0

Maximum Storage Volume Required:	0.77 m ³ (60 min Storm)	
Storage Volume Provided:	1.30 m ³	Acceptable
Time of Emptying:	1.49 Hours	Acceptable