



GEO-ENVIRONMENTAL CONSULTING

BEK Geo-Environmental Consulting

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Our Ref: BEK/25202/251218/DH

18th December 2025

D Houlker

Land adjacent to Miles Hill
Moor Lane
Billington
BB7 9SE

Proposed Detailed Drainage Strategy – Class Q Conversion of an Agricultural Building to One Dwelling

BEK Enviro (BEK) has been instructed by Daniel Houlker to provide a Detailed Drainage Strategy for the proposed class Q conversion of an agricultural building to one dwelling.

Existing Site

The site at present comprises of an agricultural barn building with access direct from Moor Lane at the south east of the site.

- Roof Area Barn = 340m²

Development Proposals

Development proposals comprise of conversation of the barn into a residential dwelling using the same footprint. The surrounding access and hardstanding will remain unchanged following development.

- Proposed Roof Area = 0.034 Hectares (340m²)

Existing Drainage

Due to the rural location of the site, there are no public surface water sewers within the vicinity of the proposed development site.

The barn at present is formally drained via rainwater downpipes, however at the time of writing a CCTV Survey was not available to determine where the surface water discharged.

Hierarchy of Surface Water Disposal

In accordance with the NPPF and the Non-Statutory Technical Standards for SUDS: Practice Guidance the discharge of surface water shall comply with the drainage hierarchy detailed within the National Planning Policy Framework, Planning Practice Guidance and within Building Regulations Part H and specifies the following methods in order of preference:

- Infiltration via soakaway or other suitable infiltration device
- Discharge to watercourse
- Discharge to public sewer

Infiltration

Excavations on-site revealed that the underlying ground comprises of clay, following a period of rain, water pooled at the base of the excavation rather than draining away.

Excavation On-Site Depicting Clay



Standing Water After Rainfall



Based on the above, soakaways are not considered to be suitable for inclusion within the proposed drainage strategy.

Watercourse

The client has undertaken consultation with the surround land owners which determined that a culverted watercourse is located within the field to the north east of the site, which is also within the client's ownership.

Location of the Culverted Watercourse



Due to the fact that infiltration methods are not considered to be viable, it is recommended that surface water from the site is directed into the culverted watercourse located north east of the site.

Existing Runoff Rates

Existing runoff rates have been calculated using the Modified Rational Method based on the roof area of the existing barn i.e. 0.035Ha

- Existing Discharge Rate = 4.8l/s

Proposed Discharge Rates

Proposed discharge rates have been restricted to as close as possible to 70% of the existing runoff rate during the extreme 1 in 100 year + 50% climate change event + 10% urban creep factor.

Based on a minimum aperture of 50mm within the flow control device, so not to increase the risk of blockage and siltation the proposed flow is identified on the page overleaf.

- Proposed Discharge Rate = 3.4l/s

Proposed Drainage Strategy

Surface water flows from the proposed building roof area are collected via a network of rainwater down pipes, before discharging into the culverted watercourse located within the field to the north east of the site.

Flows have been restricted to no more than 3.4l/s by means of an orifice flow control chamber, for all events up to and including the 100 year + 50% climate change event with the inclusion of 10% urban creep factor.

Flows in excess of this will be attenuated within an offline attenuation tank located within the field east which is also within the client's ownership.

Proposed Discharge Rates

Return Period	Proposed Discharge Rate (l/s)
1 Year	1.5
30 Year + 40% Climate Change + 10% Urban Creep	2.2
100 Year + 50% Climate Change + 10% Urban Creep	3.4

Flow Control Chamber

- S2
- Orifice Flow Control
- Chamber 1050mm Dia
- Aperture = 50mm Dia

Attenuation

- Offline Geo-Cellular Tank
- Area = 40m²
- Depth of Crate = 0.300m
- Porosity = 0.95

Exceedance Routes (Normal Conditions)

The proposed surface water drainage network has sufficient capacity to retain flows below ground level during all return periods up to the 1 in 100 year + 50% climate change event + 10% urban creep, with no surface flooding.

Exceedance Routes (Total System Failure)

In the unlikely event of total system failure surface water is expected to flow north into the agricultural field.

As such, the risk associated with flooding to the proposed development and surrounding buildings is considered to be low.



Foul Flows

Foul flows from the proposed development site will discharge into a Package Treatment Plant with clean effluent discharging into the culverted watercourse via a single connection.

Package Treatment Plant

- *Klargester Bio Disc BA or Similar*
- *Suitable for min 6 Persons*

Maintenance and Management

Following development, the drainage network serving the site will remain private, upon request from the LPA the developer is to provide evidence of the funding mechanism for the management and maintenance of the drainage system.

Typical maintenance requirements for attenuation tanks are provided below and overleaf:

Exceedance Route Total System Failure

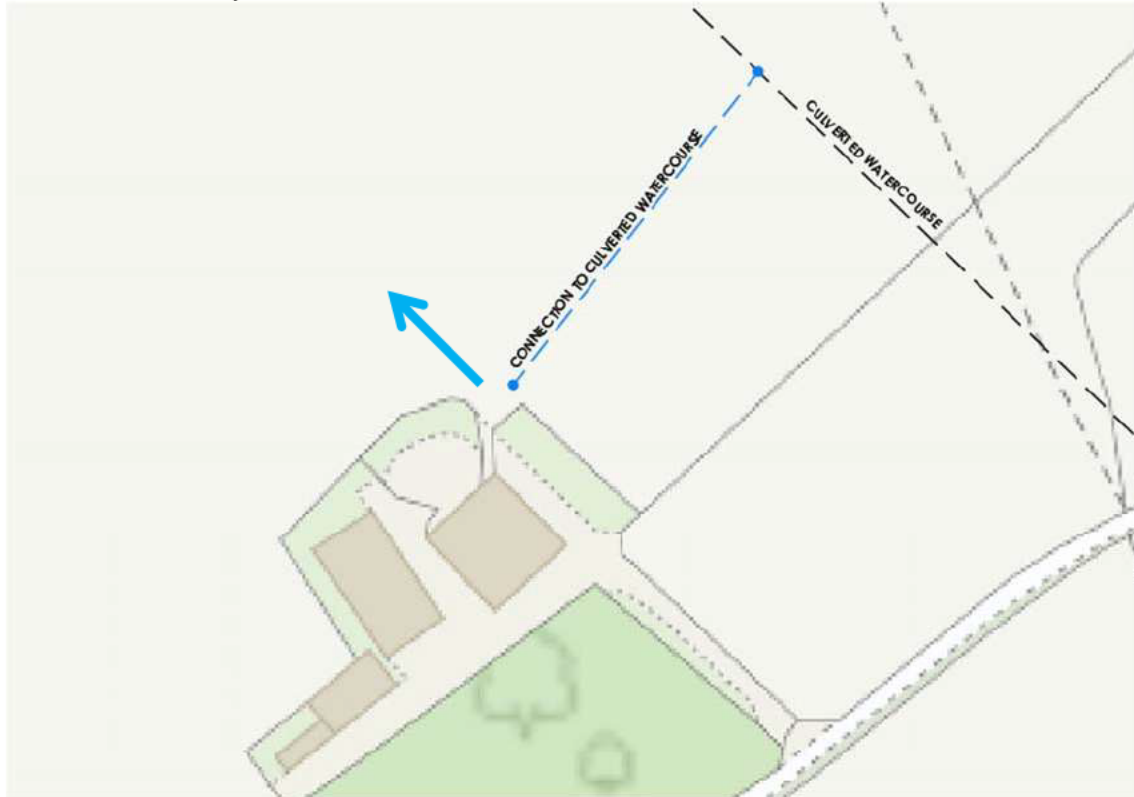


TABLE 21.3 Operation and maintenance requirements for attenuation storage tanks

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 risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, 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 inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

I trust the above is satisfactory. Should you require anything further please do not hesitate to contact the undersigned.

Yours sincerely



DAVID EMMOTT
BSc (Hons) MSc MEnvSc CEnv

- Annex A – Proposed Drainage Layout
- Annex B – Typical Drainage Details
- Annex C – Modelled Surface Water Network

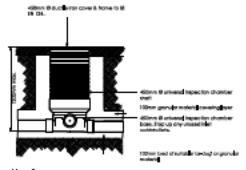


ANNEX A

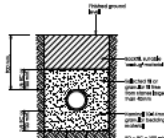
Proposed Drainage Layout

ANNEX B

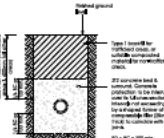
Typical Drainage Details



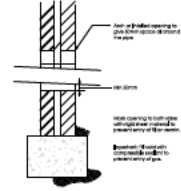
Typical Polypropylene Inspection Chamber
Max. 1.2m Deep
Scale 1:20
(See also call sheet: 02040000000000000000)



Typical French Detail
Scale 1:10



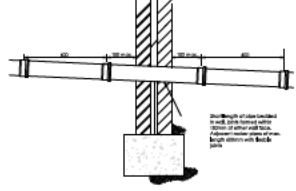
Shallow Trench Detail
Scale 1:10



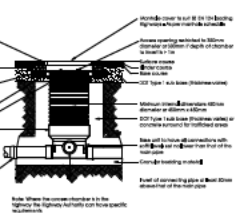
Pipes Through Walls (b)
Scale 1:10



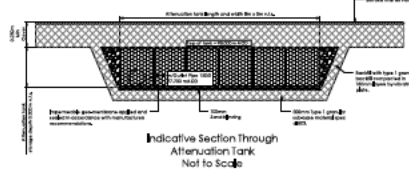
Joints for Concrete Encased Pipes
Scale 1:10



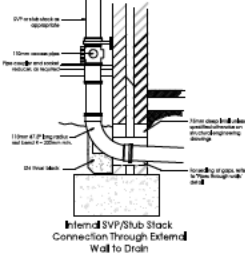
Pipes Through Walls (a)
Scale 1:10



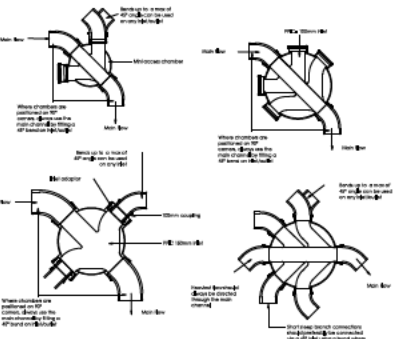
Typical Inspection Chamber
Max. 3m Deep Non Entry
Scale 1:20



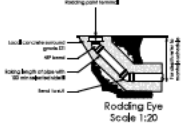
Indicative Section Through Attenuation Tank
Not to Scale



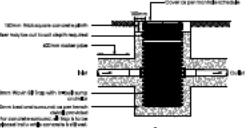
Internal SVP/Sub Stack Connection Through External Wall to Drain
Scale 1:10



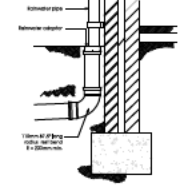
Mini Access Chamber & PFC Installation Details
Scale 1:10



Roding Eye
Scale 1:20



Typical Catch Pit
Scale 1:20



External RWP to Drain
Scale 1:10

- CONSTRUCTION**
1. COVERINGS TO BE ACCURATELY FITTED TO THE CHAMBER TO PREVENT WATER INGRESS.
 2. THE COVERING MUST BE SECURED TO THE CHAMBER WALLS BY MEANS OF ANCHORS OR BOLTS TO PREVENT WATER INGRESS.
 3. THE CHAMBER MUST BE PROTECTED FROM COLLISION WITH VEHICLES OR OTHER EQUIPMENT.
 4. ALL CHAMBERS MUST BE PROTECTED FROM COLLISION WITH VEHICLES OR OTHER EQUIPMENT.
 5. THE COVERING MUST BE PROTECTED FROM COLLISION WITH VEHICLES OR OTHER EQUIPMENT.
 6. THE COVERING MUST BE PROTECTED FROM COLLISION WITH VEHICLES OR OTHER EQUIPMENT.
 7. THE COVERING MUST BE PROTECTED FROM COLLISION WITH VEHICLES OR OTHER EQUIPMENT.
 8. THE COVERING MUST BE PROTECTED FROM COLLISION WITH VEHICLES OR OTHER EQUIPMENT.

Minimum Recommended Trench Widths for Structured Wall Pipes in Poor Ground Conditions.

Pipe Diameter (mm)	Minimum Trench Width (mm)	Minimum Trench Depth (mm)
100	100	100
150	150	150
200	200	200
250	250	250
300	300	300
350	350	350
400	400	400
450	450	450
500	500	500
550	550	550
600	600	600
650	650	650
700	700	700
750	750	750
800	800	800
850	850	850
900	900	900
950	950	950
1000	1000	1000

Extract from Table A2 WB 4-09-02
Processed and modified by BEX Ltd.

Notes:
1. The minimum recommended trench widths are based on the assumption that the ground is of poor quality.
2. The trench width should be increased if the ground is of better quality.
3. The trench depth should be increased if the ground is of better quality.
4. The trench width and depth should be increased if the ground is of better quality.

- GENERAL NOTES**
1. ALL WORK TO BE IN ACCORDANCE WITH THE RELEVANT STANDARDS AND SPECIFICATIONS.
 2. THE WORKMAN SHOULD BE ADEQUATELY TRAINED AND QUALIFIED.
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 9. THE WORKMAN SHOULD BE ADEQUATELY TRAINED AND QUALIFIED.
 10. THE WORKMAN SHOULD BE ADEQUATELY TRAINED AND QUALIFIED.

NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER
2	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER
3	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER
4	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER
5	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER
6	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER
7	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER
8	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER
9	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER
10	ISSUED FOR TENDER	10/10/2023	DAK/HOLLER

ANNEX C

Modelled Calculation Report

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	150.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	0.400
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Depth (m)
RE1	0.034	4.00	99.250	100	0.550
S1			99.250	450	0.739
TANK		4.00	98.250	450	0.550
S2			98.250	1050	0.560
S3			98.250	450	0.580

Links (Input)

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	RE1	S1	19.000	0.600	98.700	98.511	0.189	100.5	150	4.32	47.6
1.001	S1	S2	9.000	0.600	98.511	97.690	0.821	11.0	150	4.37	47.4
2.000	TANK	S2	1.000	0.600	97.700	97.690	0.010	100.0	150	4.02	48.8
1.002	S2	S3	2.000	0.600	97.690	97.670	0.020	100.0	150	4.40	47.3

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	19.000	100.5	150	Circular	99.250	98.700	0.400	99.250	98.511	0.589
1.001	9.000	11.0	150	Circular	99.250	98.511	0.589	98.250	97.690	0.410
2.000	1.000	100.0	150	Circular	98.250	97.700	0.400	98.250	97.690	0.410
1.002	2.000	100.0	150	Circular	98.250	97.690	0.410	98.250	97.670	0.430

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	RE1	100	Manhole	Adoptable	S1	450	Manhole	Adoptable
1.001	S1	450	Manhole	Adoptable	S2	1050	Manhole	Adoptable
2.000	TANK	450	Manhole	Adoptable	S2	1050	Manhole	Adoptable
1.002	S2	1050	Manhole	Adoptable	S3	450	Manhole	Adoptable

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
Rainfall Events	Singular	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	19.000	Additional Storage (m ³ /ha)	20.0
Ratio-R	0.300	Starting Level (m)	
Summer CV	0.750	Check Discharge Rate(s)	x
Winter CV	0.840	Check Discharge Volume	x

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	40	10	0
100	50	10	0

Node S2 Online Orifice Control

Flap Valve	x	Design Depth (m)	0.600	Discharge Coefficient	0.600
Replaces Downstream Link	x	Design Flow (l/s)			
Invert Level (m)	97.690	Diameter (m)	0.050		

Node TANK Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	97.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	68

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	40.0	40.0	0.300	40.0	46.7	0.301	0.0	46.7

Results for 1 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute summer	RE1	10	98.756	0.056	4.4	0.0697	0.0000	OK
15 minute winter	S1	10	98.540	0.029	4.4	0.0046	0.0000	OK
120 minute winter	TANK	80	97.743	0.043	0.9	1.6251	0.0000	OK
15 minute summer	S2	9	97.800	0.110	4.4	0.0955	0.0000	OK
15 minute summer	S3	10	97.699	0.029	1.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute summer	RE1	1.000	S1	4.4	1.074	0.248	0.0795	
15 minute winter	S1	1.001	S2	4.4	1.076	0.081	0.0714	
120 minute winter	TANK	2.000	S2	-0.9	-0.358	-0.053	0.0048	
15 minute summer	S2	1.002	S3	1.5	0.575	0.083	0.0051	1.6

Results for 30 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	RE1	10	98.829	0.129	16.5	0.1759	0.0000	OK
15 minute winter	S1	10	98.568	0.057	16.5	0.0090	0.0000	OK
120 minute winter	TANK	86	97.908	0.208	3.8	7.9310	0.0000	SURCHARGED
120 minute winter	S2	86	97.908	0.218	5.7	0.1886	0.0000	SURCHARGED
120 minute winter	S3	86	97.706	0.036	2.2	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	RE1	1.000	S1	16.5	1.443	0.931	0.2108	
15 minute winter	S1	1.001	S2	16.5	1.411	0.305	0.1038	
120 minute winter	TANK	2.000	S2	-3.8	-0.404	-0.216	0.0176	
120 minute winter	S2	1.002	S3	2.2	0.639	0.124	0.0069	16.2

Results for 100 year +50% CC +10% A Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
15 minute winter	RE1	10	99.001	0.301	22.8	0.4121	0.0000	FLOOD RISK
15 minute winter	S1	10	98.576	0.065	21.4	0.0104	0.0000	OK
120 minute winter	TANK	84	98.165	0.465	5.7	11.4929	0.0000	FLOOD RISK
120 minute winter	S2	84	98.165	0.475	8.0	0.4111	0.0000	FLOOD RISK
120 minute winter	S3	84	97.714	0.044	3.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m ³)	Discharge Vol (m ³)
15 minute winter	RE1	1.000	S1	21.4	1.473	1.208	0.2374	
15 minute winter	S1	1.001	S2	21.3	1.492	0.394	0.1124	
120 minute winter	TANK	2.000	S2	-5.7	-0.473	-0.318	0.0176	
120 minute winter	S2	1.002	S3	3.4	0.716	0.191	0.0095	22.9