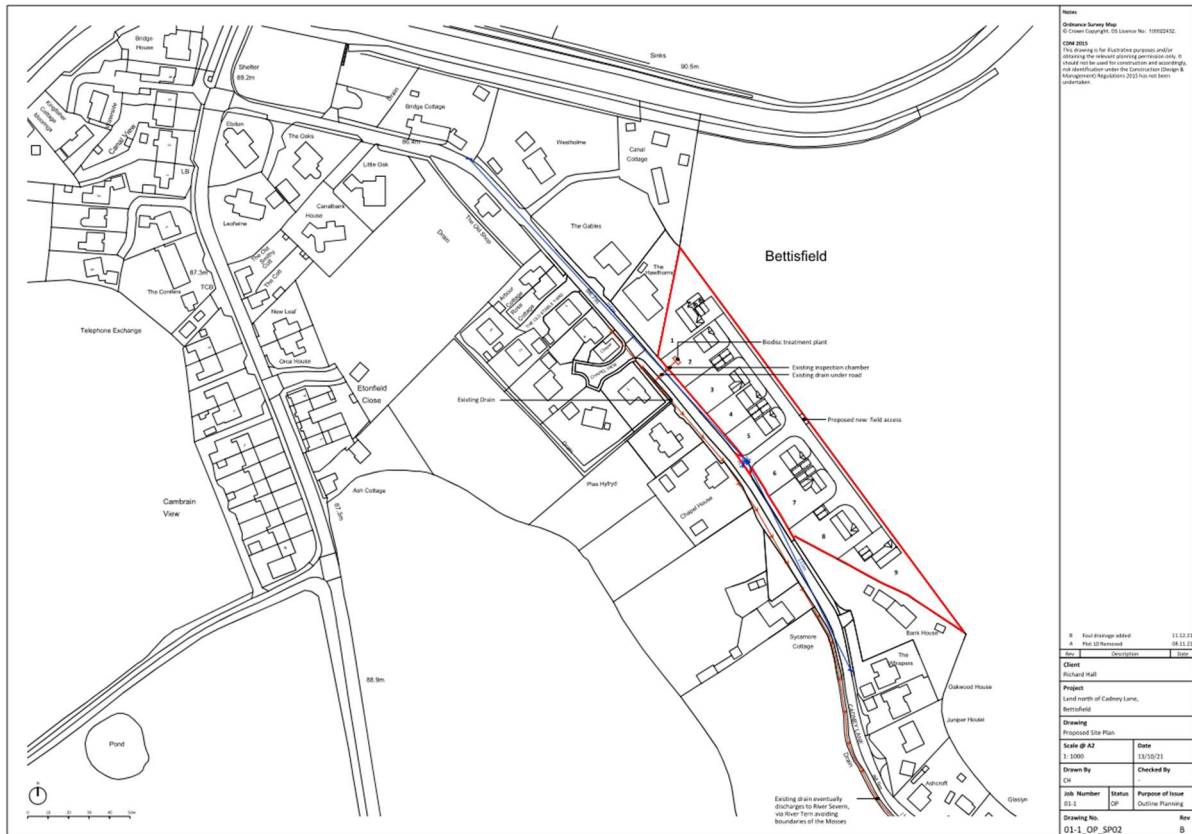




Foul Drainage Strategy for land East of Cadney Lane, Bettisfield, Wrexham SY13 2LW Rev. 2

Contract Ref: FD066

Roger Parry & Partners on behalf of Mr Hall

Contents

QUALITY ASSURANCE RECORD.....	3
Contributors for Townsend Water Engineering:	3
Document Status and Revision History:.....	3
Limitation of liability and use.....	3
1. INTRODUCTION	4
1.1 Purpose of this report.....	4
1.2 Sources of information and consultation	4
1.3 Structure of this report.....	4
2. SPATIAL PLANNING CONSIDERATIONS	5
2.1 Location Plan.....	5
2.2 Natural Resources for Wales Flood Zone	6
2.3 Soil Characteristics	7
2.4 Soil conditions	8
3. FOUL DRAINAGE STRATEGY	11
3.1 General.....	11
3.2 Design of foul drainage	11
3.3 Determining the dimensions of the drainage field.....	12
3.4 Assessment of the Treatment System Against Guidance	14
3.5 Operation and maintenance requirements for the drainage field.....	15
3.6 Operation and maintenance requirements for the package treatment works and pump.....	15
4. SUMMARY AND CONCLUSIONS	17
5. REFERENCES	18
Appendix A: Percolation Tests.....	19
Figure 1: Location of development (Source: Bing map)	5
Figure 2: Aerial photograph of the site (Source: Bing Aerial Map)	6
Figure 3: Flood map for planning (Copyright NRW)	7
Figure 4 – Site location in relation to SPZ's (blue area the SPZ)	7
Figure 5: Soil Maps	8
Figure 6: Test Hole Location	9
Figure 7: Conservation map (Source: Magic Map)	10
Figure 8: Typical layout of a drainage field	13
Figure 9: Proposed foul drainage layout.....	13
Table 1: Grid reference details for the site (planning application & https://www.streetmap.co.uk/)	6

QUALITY ASSURANCE RECORD

This report documents work undertaken by Townsend Water Engineering for Mr Hall. The Purpose of this work is to provide a Foul Drainage Strategy (FDS) in support of the planning application for a 9 dwellings at Land East of Cadney Lane, Bettisfield, Wrexham SY13 2LW.

Contributors for Townsend Water Engineering:

Name	Role
Charles Townsend	Project Manager

Document Status and Revision History:

Version	Date	Author	Reviewer	Authoriser	Status / Comment
1	28/09/22	Charles Townsend	Charles Townsend	Charles Townsend	First Issue
2	29/09/22	Charles Townsend	Charles Townsend	Charles Townsend	Second Issue

Limitation of liability and use

The work described in this report was undertaken for the party or parties stated; for the purpose or purposes stated; to the time and budget constraints stated. No liability is accepted for use by other parties or for other purposes, or unreasonably beyond the terms and parameters of its commission and its delivery to normal professional standards.

1. INTRODUCTION

1.1 Purpose of this report

Townsend Water Engineering Ltd. have been commissioned by Roger Parry and Partners on behalf of Mr. Hall to undertake a foul drainage strategy. The Foul Water Drainage Strategy is designed to manage foul water for a proposed nine dwellings at Land East of Cadney Lane, Bettisfield, Wrexham SY13 2LW. Wrexham council have been corresponding with the client and do not want the foul water to be discharged into the watercourse to the west. Therefore this report is investigating if it is possible to discharge foul water to ground.

The proposed foul water treatment and disposal strategy is based on the following references: The Building Regulations Part H 2015, BS6297 Code of practice for the design and installation of drainage fields for use in wastewater treatment; Sewers for Adoption (7th Edition),

1.2 Sources of information and consultation

This report has been informed by:

- Proposed site plan from Roger Parry and Partners;
- The National Planning Policy Framework.

1.3 Structure of this report

The report has been structured in order to deal with key drainage related issues of the NPPF Practice Guide. The principal sections are as follows:

- Section 2 refers to spatial planning considerations by reference to the proposed land use and flood zoning;
- Section 3 presents a foul drainage strategy for the dwelling;
- Section 4 provides a summary of the findings.

Additional Appendices are provided that deal with the following:

- Appendix A presents Percolation Test Results.

2. SPATIAL PLANNING CONSIDERATIONS

2.1 Location Plan

The proposed development site is shown in Figure 1 (OS map) and Figure 2 (aerial), with location and grid reference details found in Table 1. The site of the proposed development is located at Land East of Cadney Lane, Bettisfield, Wrexham SY13 2LW. The approximate area of the site within redline boundary is 0.7ha. The proposed site lies within the upper catchment of the River Roden, itself a tributary of the River Severn. The main access to the site is from the west off Cadney Lane.

The site's elevation is approximately 90m AOD according to OS mapping. The aerial photo illustrates that the land of the development site is currently greenfield.

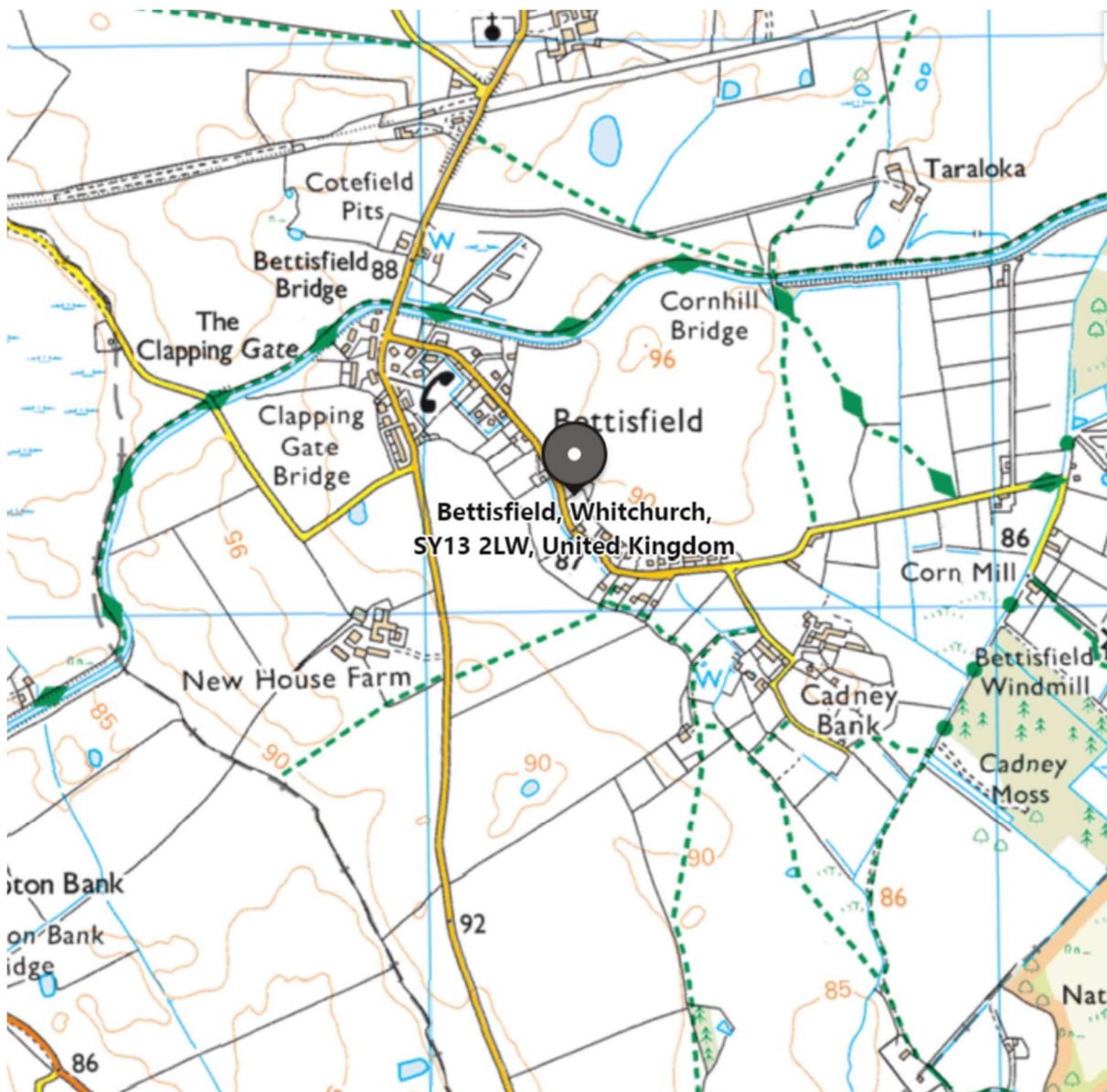


Figure 1: Location of development (Source: Bing map)

Table 1: Grid reference details for the site (planning application & <https://www.streetmap.co.uk/>)

Reference	Value
OS X (Eastings)	346217
OS Y (Northings)	335354
Nearest Post Code	SY13 2LW
Nat Grid	SJ462353/ SJ4621735354

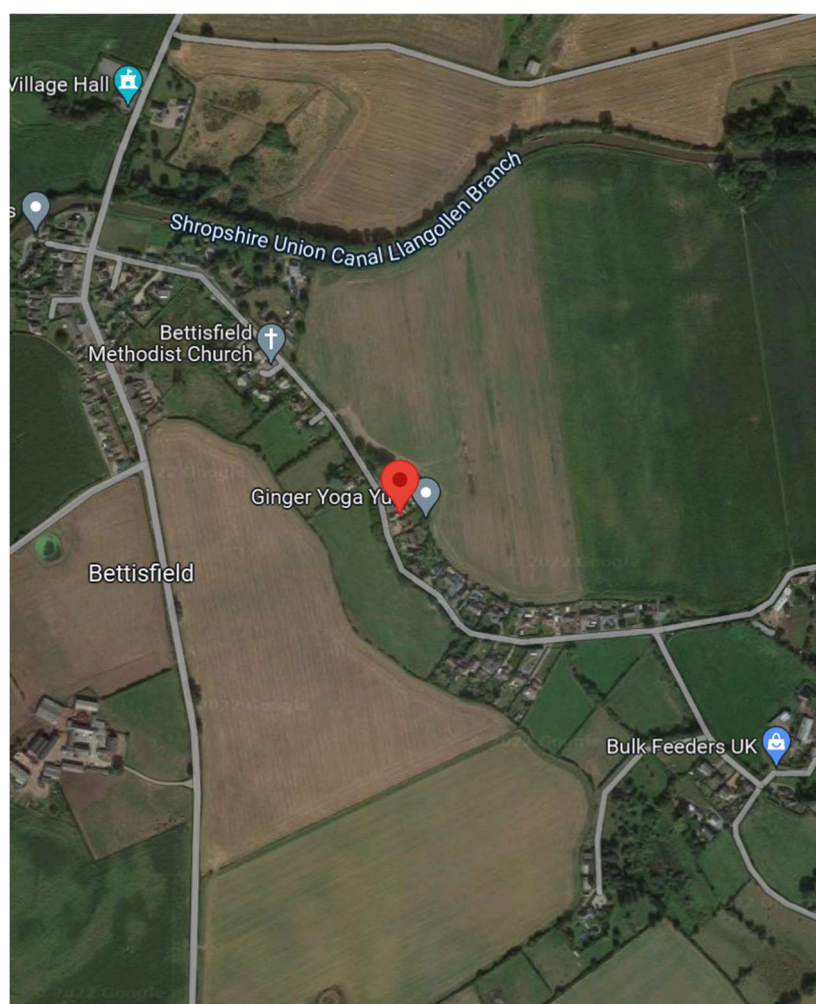


Figure 2: Aerial photograph of the site (Source: Bing Aerial Map)

2.2 Natural Resources for Wales Flood Zone

The Natural Resources for Wales Flood Zone map for planning (Figure 3) indicates the site is in 'Flood Zone A', defined as areas having less than 0.1% annual exceedance probability of river flooding. This suggests the site is at low risk of fluvial flooding. There is some medium flooding in the north west of the site.

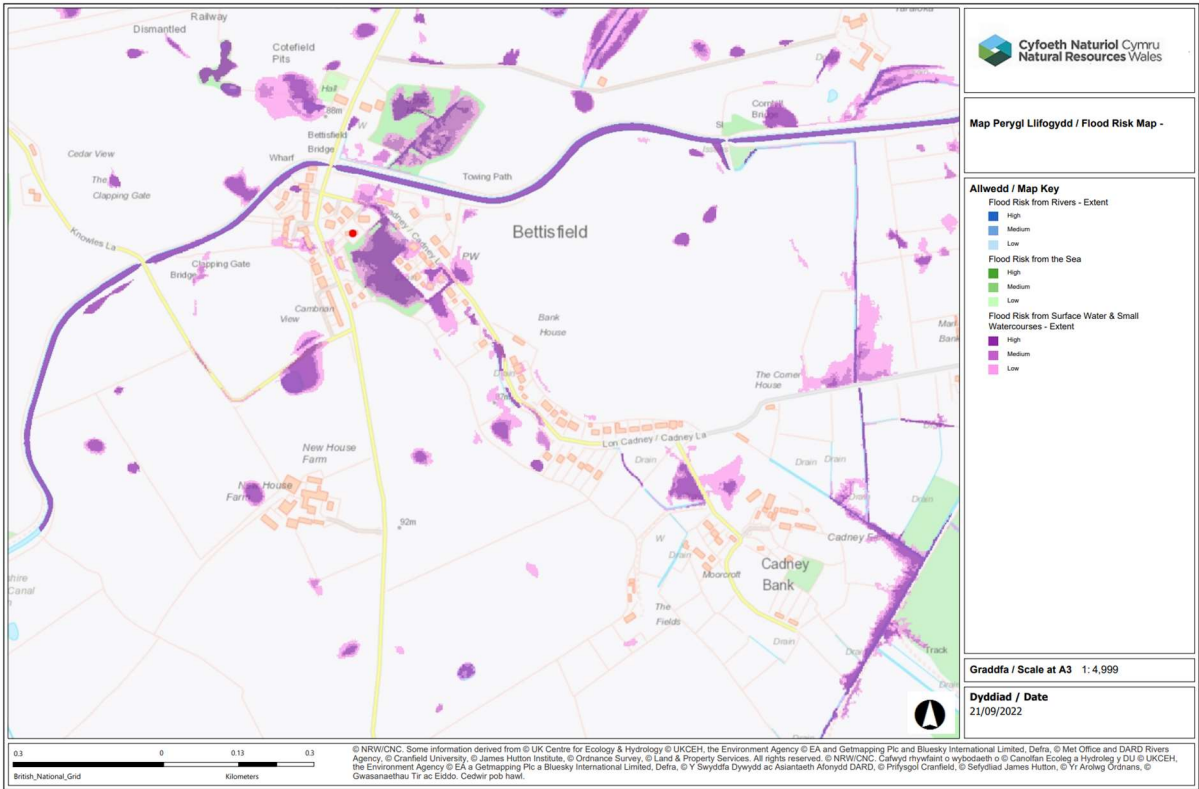


Figure 3: Flood map for planning (Copyright NRW)

2.3 Soil Characteristics

Source Protection Zones (SPZ) in relation to the development are considered in 4. The site was found to be approximately 7.6 km distance from the nearest SPZ. Any SuDS features or foul drainage strategy presented in this report are considered not to interfere with the SPZ.

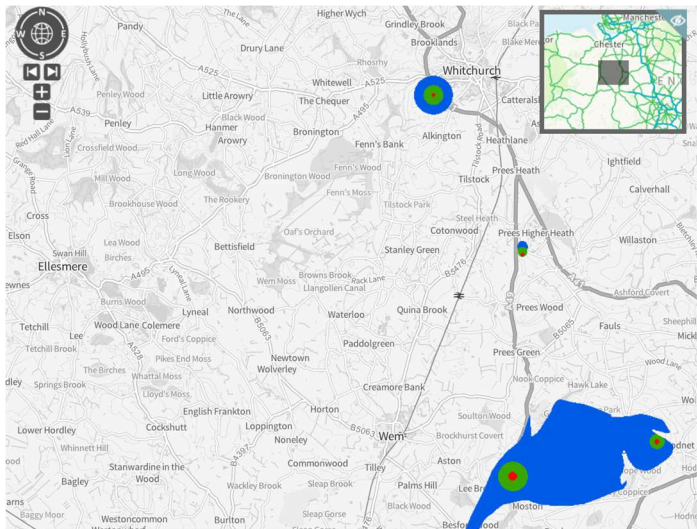


Figure 4 – Site location in relation to SPZ's (blue area the SPZ)

2.4 Soil conditions

Soil-scape map developed by Cranfield university shows that the underlying soil for this site is freely draining slightly acid loamy soils. The soil-scape map is shown in Figure 5. According to the soil-scape map, the underlying soil is suitable for infiltration drainage. A Soil investigation was carried out at the site by the client Mr. Hall in September 2022 to assess the percolation rate. Percolation tests were carried out at 3 locations. Test location 1 was ignored as this is in an area of high percolation (the Vp value was over 88mm/s. The drainage field will not be built there. Test location 2 had a Vp value of approximately 13mm/s and test location 3 had a Vp value of 16s/mm. For the drainage value a percolation value of 16s/mm has been used. The results are in Appendix A.

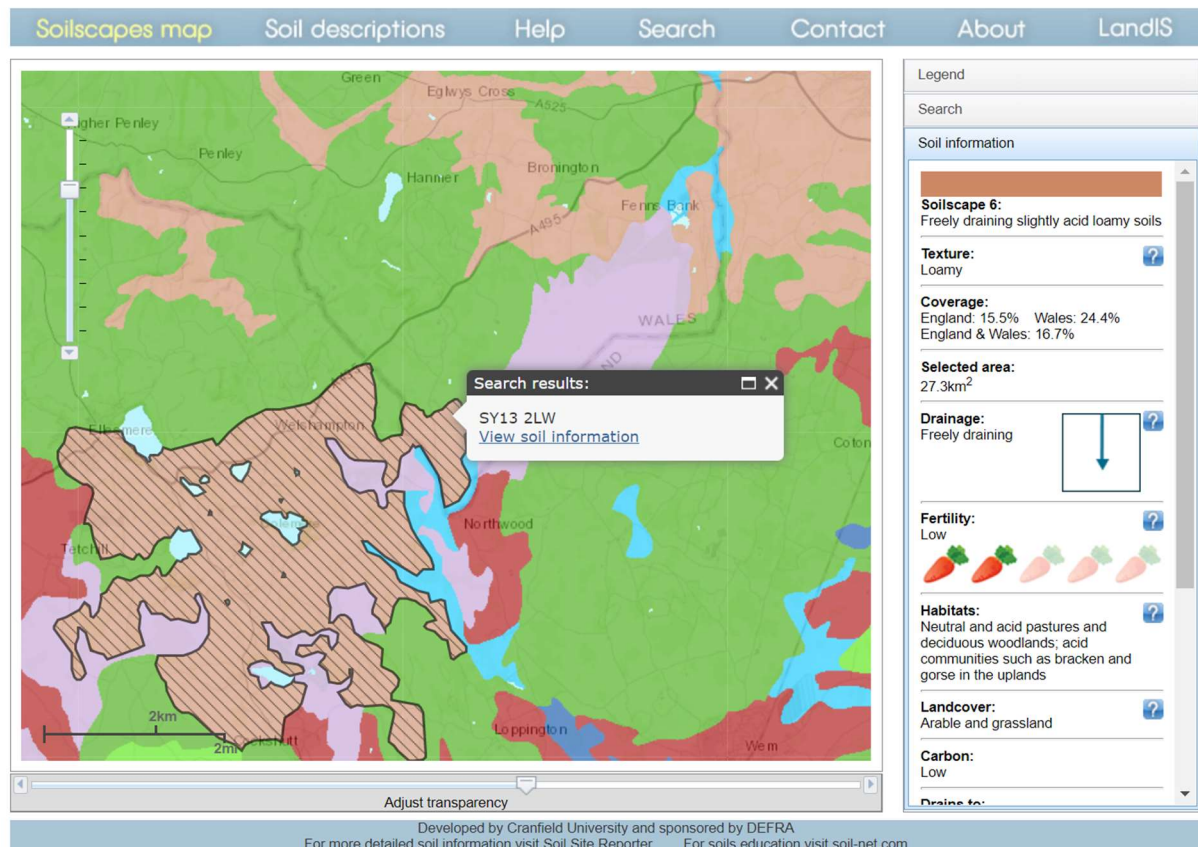


Figure 5: Soil Maps

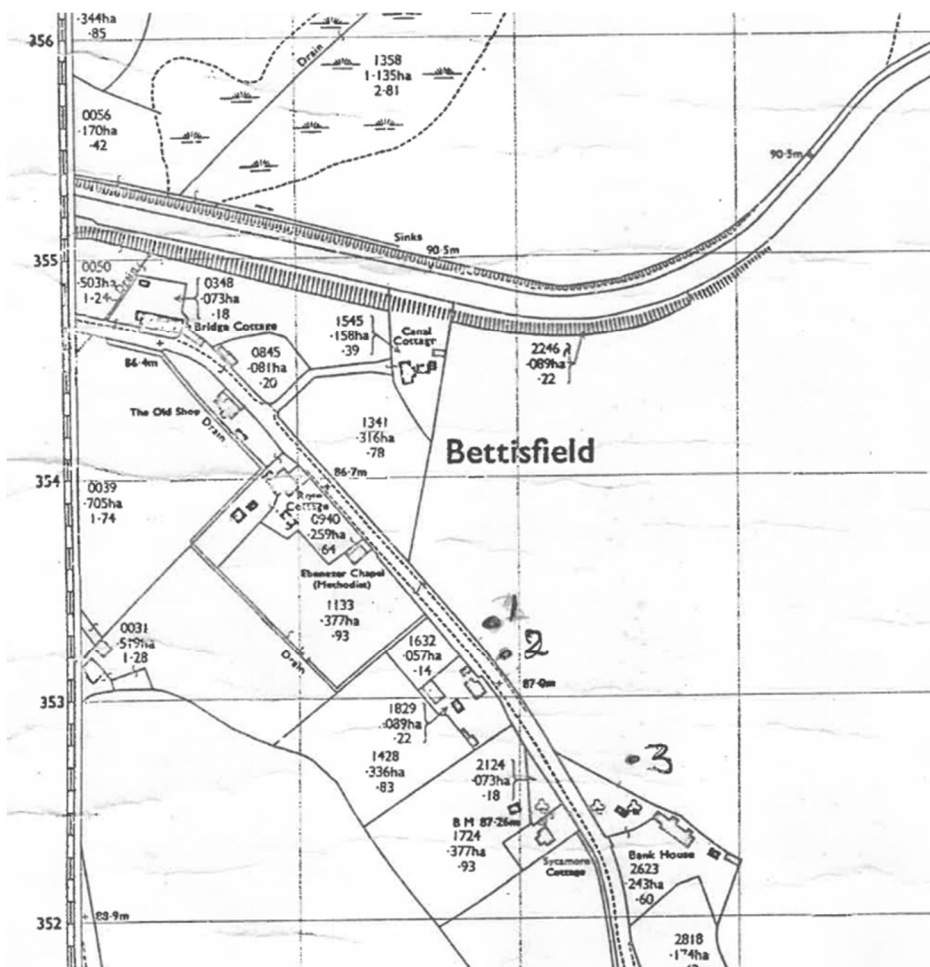


Figure 6: Test Hole Location

2.5 Conservation areas near the site.

According to the Magic Map the site is upstream of a SAC called Fenn's Whixhall, Bettisfield, Wem & Cadney Mosses. The site is over 600m upstream of the SAC, please see in Figure 7

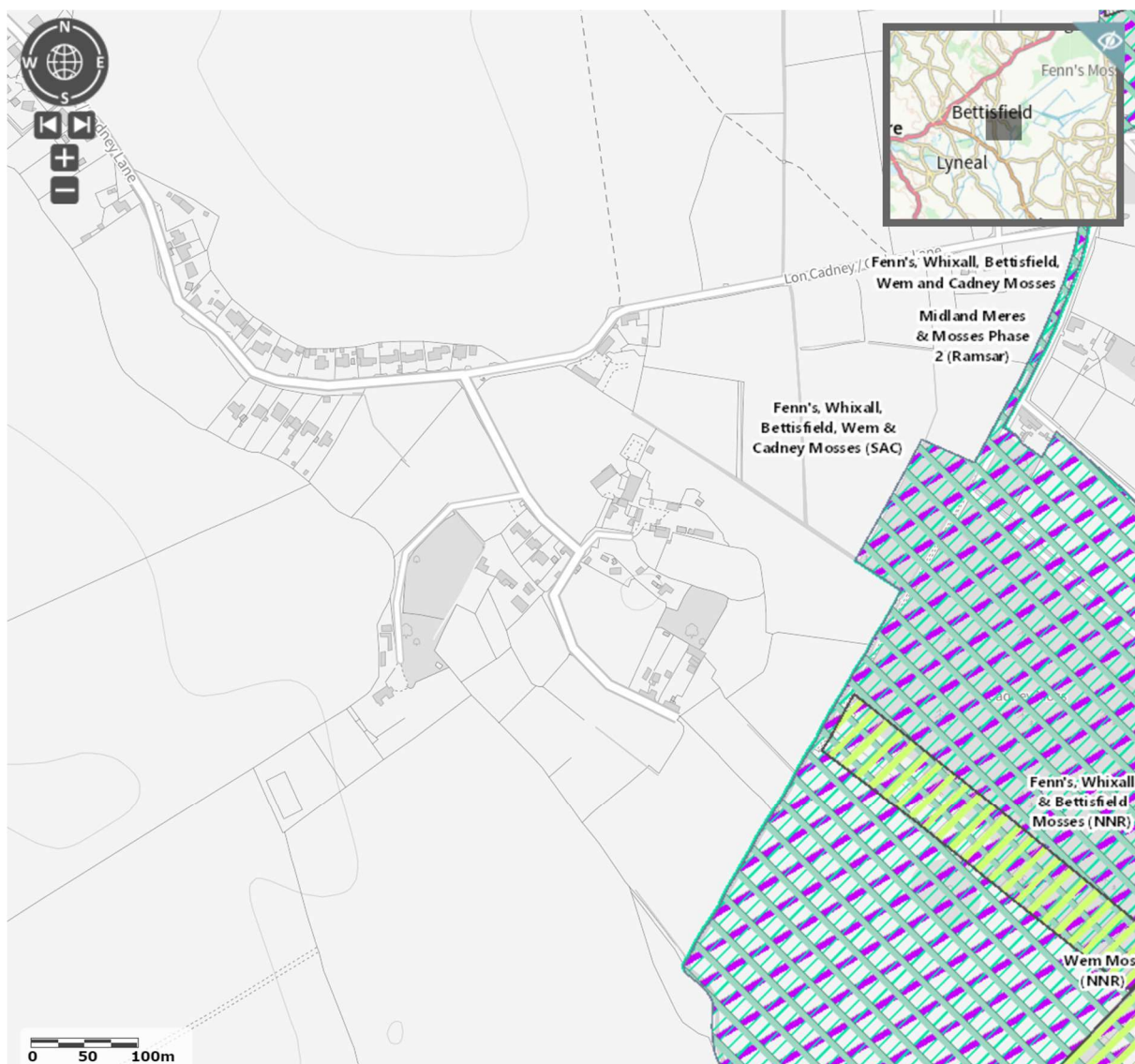


Figure 7: Conservation map (Source: Magic Map)

3. FOUL DRAINAGE STRATEGY

3.1 General

Correspondence has been had with NRW and they require further information regarding the Foul Drainage. Within their correspondence they do not wish to see foul water discharge into the watercourse at the western boundary of the site. This is because they believe that the watercourse may be seasonally dry and therefore will not be able to dilute the treated foul water from the site. Therefore they have asked that other methods of discharge are investigated. This report will investigate this.

Bettisfield does not have Severn Trent foul mains. This has been confirmed by Severn Trent within the planning process please see appendix B.

As indicated in chapter two the ground is permeable and percolation tests have been undertaken and suggest the ground is suitable for a drainage field.

If a drainage field is required, the following criteria must be adhered to:

- The drainage field should be more than 50 m from the designated site boundary or sensitive interest feature (includes Habitats of Principal Importance and other designated ecological important features identified through Core Strategy SD4/LD2/SS6).
- The drainage field should be more than 40 m from any surface water feature e.g. ditch, drain or watercourse.
- The drainage field should be in an area with a slope no greater than 15%.
- The drainage field should be in an area where the high-water table groundwater depth is at least 2 m below the surface at all times.
- The drainage field will not be subject to significant flooding, e.g. it is not in flood zone 2 or 3 and;
- There are no other known factors which would expedite the transport of phosphorus for the transport of phosphorous, e.g. fissured geology, insufficient soil below the drainage pipes, known sewer flooding, conditions in the soil/geology that would cause remobilisation of phosphorus, presents of mineshafts, etc and;
- To ensure that there is no significant in combination effect, the discharge to ground should be at least 200m from any other discharge to ground.

As this is a greenfield development there are no existing foul water drainage arrangements. The ground is sufficiently permeable for a drainage field to be effective. It is proposed that foul water flows from each dwelling are collected and piped to a package sewage treatment plant followed by a drainage field. The houses are approximately 90mAOD from OS survey data. The drainage field is approximately 92mAOD and therefore a pump is likely to be required.

3.2 Design of foul drainage

The foul water system from the proposed dwellings will include a sewage treatment plant treatment followed by a drainage field. The design of the foul water strategy is based on the following assumptions:

- Once collected, the foul water flows are to be treated by means of a package sewage treatment plant. It can then be discharged to drainage field to the south- west of the site;
- The sewage treatment plant should be sited at least 7m from any habitable parts of buildings;
- The drainage field should be at least 15m from any buildings and suitable distance apart from the other fields;

- The property owners would be responsible for the management and maintenance of the foul drainage system serving their properties.

According to the 'British Waters – Flows and Loads Code of Practice – 4: Sizing Criteria, Treatment Capacity for Sewage Treatment Systems', when calculating the anticipated discharge volume, a treatment system for a single house with up to and including 3 bedrooms shall be designed for a minimum population (P) of 5 people. For each additional bedroom 1 person should be added therefore a 4-bedroom house requires a 6 P system. For groups of houses, the total P values should be added together and where P is 26-50, a correction factor of 0.8 should be applied (Flows and Loads Code of Practice – 4).

In our case, we preliminary have 4x four -bedroom houses and five 3-bedroom houses, and that provides a total number of people = 39P (6 x4 + 5x3). Then using the correction factor of 0.8, the total amount of people is 32 people (rounded up as you cannot have a part of a person).

Allowing 150 litres per person, it produces a maximum daily discharge volume of 4.8 m³. This is the P value and volume should be used for sizing a single treatment system.

As the volume is more than 2 m² a bespoke permit will be required from the Environment Agency.

The Package Treatment Plant specification and detailed should be provided by the manufacturer or installation contractors responsible for installing the Package Treatment Plant. Treated effluent from the Package Treatment Plant should be discharged to the drainage field. It is believed a pump and maintenance regim may be required so it has been included within this report.

3.3 Determining the dimensions of the drainage field

A drainage field should be constructed to be large enough to be stable and to provide sufficient treatment. The size of a drainage percolation field located after a package treatment plant can be determined by the formula given in BS6297. This formula is

$$\text{Area} = \text{Population} \times V_p \times 0.20$$

Thus for this development

$$At_1 = P \times V_p \times 0.20$$

where:

At_1 = minimum area of the washed gravel around the distribution pipework at the top of the field (m²)

P = number of persons served (32 in our case)

V_p = percolation value for the surrounding ground (taken as 16 from the soil test)

With the values above $At = 32 \times 16 \times 0.20 = 102\text{m}^2$.

Assuming a 900 mm wide linear trench, a total length of $102 / 0.9 = 113\text{m}$ is required. This may be configured as seven parallel perforated drainage pipes of length 16.1 m long. Each pipe should be 2 m apart, resulting in a drainage field of approximately 16.1 m by 19m (7x 0.9 m wide trenches, 6 x minimum 2 m gaps). If required, the inspection and distribution chamber can be placed in the centre of the drainage field as this will reduce the length of the pipe trenches.

The location of the Package Treatment Plant and drainage field is shown in Figure 8 in accordance with general requirements, it may be seen that

- the Package Treatment Plant is greater than 7 m from the nearest building
- the drainage field is greater than 50 m from the nearest surface water feature

- the drainage field is set on land with a slope of less than 15% according to topographical survey and constructed below ground with a pipe gradient of 1 in 200.

A typical section of the drainage field is shown in Figure 7. The proposed foul drainage layout is shown in Figure 8.

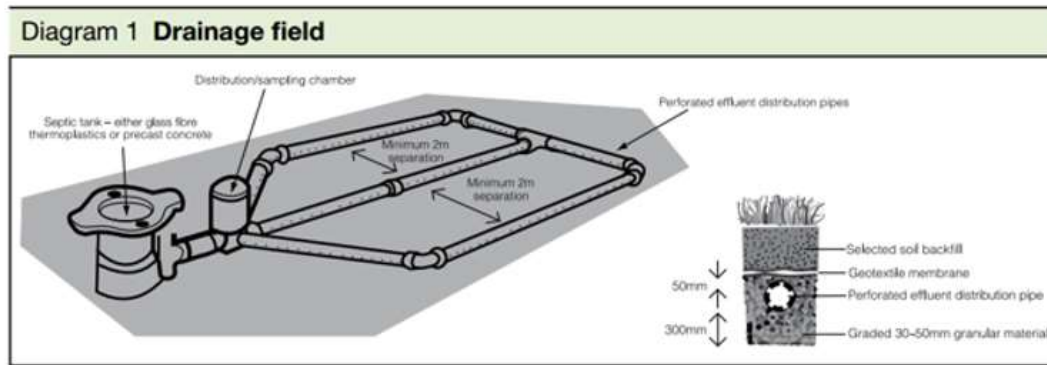


Figure 8: Typical layout of a drainage field

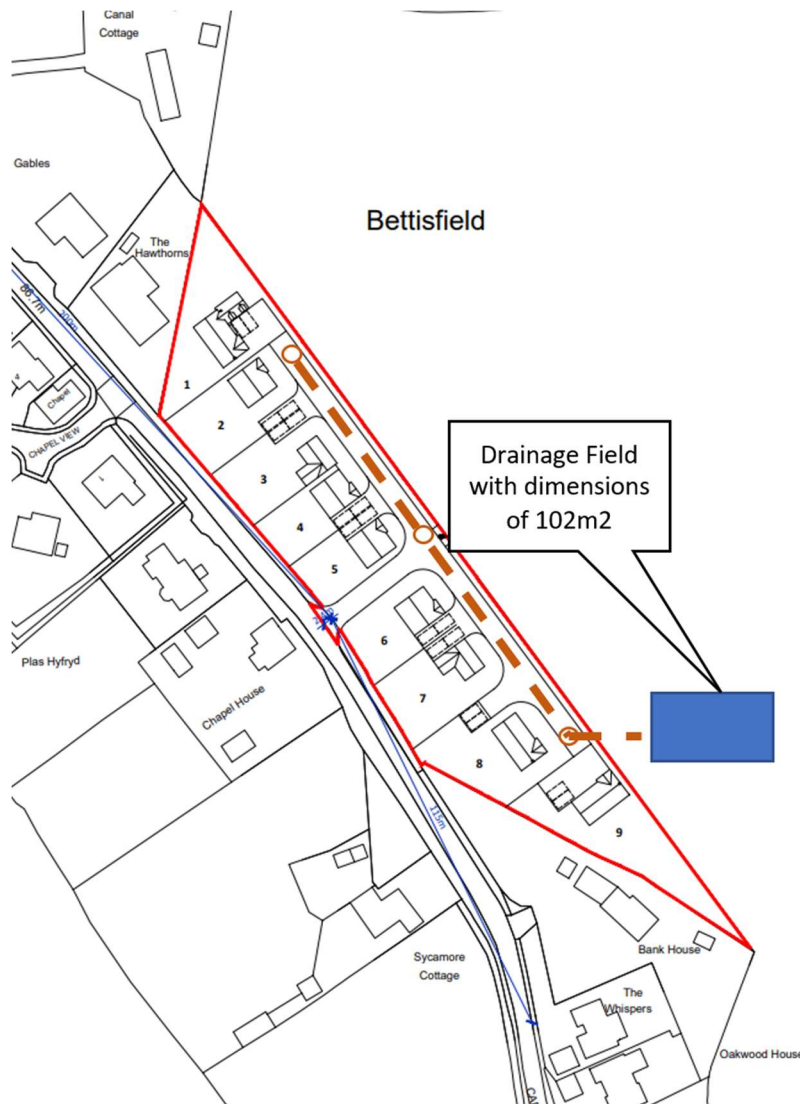


Figure 9: Proposed foul drainage layout

3.4 Assessment of the Treatment System Against Guidance

The proposed on site treatment arrangement complies with the requirements of the Building Regulations Part H, the General Binding Rules plus BS6297.

The strategy complies with all the bullet points as below:

1. The drainage field should be more than 50 m from the designated site boundary or sensitive interest feature
The drainage field is over 50m away from any designated site boundary or sensitive interest feature.
2. The drainage field should be more than 40 m from any surface water feature e.g. ditch, drain or watercourse.
There are no ditches within 40m of the drainage field
3. The drainage field should be in an area with a slope no greater than 15%.
The slope is less than 15%
4. The drainage field should be in an area where the high-water table groundwater depth is at least 2 m below the surface at all times.
According to the groundwater tests the groundwater was below 2.7m
5. The drainage field will not be subject to significant flooding, e.g. it is not in flood zone C and;
The site is outside of Flood Zone C.
6. There are no other known factors which would expedite the transport of phosphorus for the transport of phosphorous, e.g. fissured geology, insufficient soil below the drainage pipes, known sewer flooding, conditions in the soil/geology that would cause remobilisation of phosphorus, presents of mineshafts, etc and;
There are no known other factors which might expedite the transport of phosphorus.
7. To ensure that there is no significant in combination effect, the discharge to ground should be at least 200m from any other discharge to ground.
According to the NRW database there are no licenced drainage fields or mounds within the area.

3.5 Operation and maintenance requirements for the drainage field

The general requirements for the maintenance of drainage fields are as follows:

- The system should be inspected annually using the monitoring tubes;
- Compaction or disturbance of the area over and around the drainage field should be avoided.
- Chambers should be kept clear of obstruction checked for correct distribution.
- Electrical and mechanical devices should be serviced in accordance with the manufacturer's instructions.
- Routine pumping-out of the dosing chamber should be undertaken at least once every three to five years or as required by the manufacturer's specifications.
- It is recommended that the dosing chamber be equipped with a high-water alarm to alert the homeowner to a possible pump failure or choked distribution pipework.
- Never plant trees or shrubs with extensive root systems on or near the field as they may clog drainage pipes.
- Avoid traffic and construction on the field or on its slope; this could compact the soil, thus reducing the absorptive capacity of the mound.
- Grease, oil, solvents and toxic chemicals should never be poured or flushed down the drain. These materials may damage the system.
- Take steps to reduce household water use, and always avoid putting any solids, such as food, plastics and paper, in the wastewater system.
- Keep a diagram showing the location of the dosing tank, and absorption field in relation to the house.

3.6 Operation and maintenance requirements for the package treatment works and pump.

To ensure the reliable long-term operation of the drainage network there will need to be maintenance arrangements put into place. The key points are considered below (black text) – together with the mechanism by which these are addressed (blue text).

1. How maintenance and eventual replacement of the package treatment plant will be funded.
[Sinking fund as part of the site maintenance charge paid to the Management Company.](#)
2. Please clarify which party will retrieve inorganic debris from the package treatment plant when this is discharged down the drains. The inorganic debris will need to be removed in a timely manner to ensure the continued operation of the plant.

[The appointed and certified foul drainage maintenance contractor, who will be administered by the Management Company.](#)

3. Please clarify who will be responsible for communicating with new residents (e.g. new tenants) to advise them to dispose of inorganic debris using bins.

[The Management Company plus a hand over pack provided to each new purchaser or occupier. Noting that this is not an unusual arrangement and occurs in many properties across the UK. Appropriate signage will also be located within a property.](#)

4. Which party will maintain the package treatment plant and which drains will be owned by respective property owners or a third party. If a private management company is proposed, then the land on which the package treatment plant is built and the plant itself will need to be owned by all of the property owners. This policy is consistent with our SuDS guidance and will ensure continuity if the management company went into administration.

The Management Company will appoint a suitably qualified and certified foul drainage maintenance contractor. This is unlikely to include Welsh Water as they have not in the past undertaken this function.

The ownership of the land can be resolved by the site owner and developer.

5. In the event of electrical power failure, the Residual Current Device may isolate the package treatment plant. In this scenario pollution will occur. The RCD would need to be installed in a dry place, please confirm where. Please advise which party will be responsible for switching the package treatment plant on after an electrical power failure.

The suitably qualified and certified foul drainage maintenance contractor, appointed by the Management Company, will be responsible. To ensure action by the appointed contractor the pump station will require a telemetry system that provides alarm notifications. Typically, these alarms will include High plus Extreme High Water level, pump failure, power failure. The Management Company will be responsible for ensuring that the telemetry system is connected to the appointed contractor.

6. If a water company operated a remote pumping station, then they would install telemetry so that their maintenance team could respond to pump failure within 3 hours to mitigate the risk of pollution. Because there will be multiple users, the residents will not be immediately accountable and so will rely on any management company to resolve a problem. A method will need to be developed to ensure that failure of the package treatment plant will be communicated to those who maintain it.

The suitably qualified and certified foul drainage maintenance contractor, appointed by the Management Company, will be responsible. To ensure action by the appointed contractor the pump station will require a telemetry system that provides alarm notifications. Typically, these alarms will include High plus Extreme High Water level, pump failure, power failure. The Management Company will be responsible for ensuring that the telemetry system is connected to the appointed contractor.

Other comments on volume of storage and the required response time are as below.

The applicant will need to provide details of local contractor who will be able to attend site to start tanker works within 24 hours, on any day of the year. If the local contractor does not offer this service at weekends or on bank holidays, then the minimum duration will need to be increased from 24 hours.

These parameters are used to establish the amount of storage that needs to be provided. As can be seen, based on the above figures an absolute minimum of 4.8m³ will be required.

The water will need to be stored below ground in the sewerage system. On water industry applications the water is normally stored below the incoming pipe invert, i.e. in a pump shaft. This ensures that the upstream facilities will continue to drain without backing up (as solids will build up in the pipework). If pipe blockages occur, then there will be a nuisance and also the risk of foul pollution

The telemetry and alarm system will allow the contractor to be notified directly of problems at the station so that they can attend and rectify these.

4. SUMMARY AND CONCLUSIONS

A summary of the main conclusions for the FDS is presented below:

- Development proposals are for the erection of nine dwelling units, at Land East of Cadney Lane, Bettisfield, Wrexham, SY13 2LW.
- The proposed development is for outline planning.
- The proposed development is in River Roden catchment which is part of the River Severn catchment.
- Bettisfield has no public sewer in the vicinity of it. From the information on the planning application there appears to be no aspiration to build a foul sewer into this area.
- Soils at the site are shown on regional mapping to have "*freely draining*." A Soil investigation was carried out at the site by the client in September 2022. The test results demonstrate that the percolation rate at the site is between 88s/mm and 13s/mm. As parts of the site are permeable, a drainage field can be used.
- It is recommended that further tests are undertaken at detailed design to ensure that where the drainage field is placed has satisfactory percolation.
- The foul water flows from the site will be managed by a package treatment systems, located in the east of the site;
- The foul water flows are to be treated by means of a sewage treatment plant. The flows can then be discharged to the drainage field within the owner's land to the east of the site.
- Note that the owners of the properties will be responsible for employing a suitable contractor to undertake the management and maintenance of the foul drainage system plus the removal of sludge as required.

5. REFERENCES

Author	Date	Title/Description
British Water	2013	Flows and Loads Code of Practice – 4_Sizing Criteria, Treatment Capacity for Sewage Treatment Systems.
BS 6297: 2007 +A1 : 2008	2008	Code of practice for the design and installation of drainage fields for use in wastewater treatment
Centre for Ecology and Hydrology.		The Flood Estimation Handbook Web Service https://fehweb.ceh.ac.uk/
CIRIA	2015	The SUDS Manual – CIRIA Report C753.
DCLG	Mar 2012	Technical Guidance to the National Planning Policy Framework.
Institute for Hydrology	June 1994	IH124: Institute of Hydrology Report No. 124 Flood Estimation for Small Catchments
Environment Agency/ UK Government	2018	Interactive Flood Maps. https://flood-warning-information.service.gov.uk/long-term-flood-risk/
Ministry of Housing, Communities and Local Government.	2019	National Planning Policy Framework
UK HM Government	2015	Building Regulations Part H
WHS	2016b	Revitalised Flood Hydrograph Model ReFH2: Technical Guidance.

Appendix A: Percolation Tests

Percolation Test Recording Sheet

1. These tests should be carried out within and be representative of, the proposed infiltration area which should be at least 5m from the intended building and any boundary and 40m from any watercourse.
2. Excavate 3 percolation holes, not less than 5m apart , 300mm square to a depth of 300mm which is 1m below ground level. Where deep holes are necessary, the hole should conform to this shape at the bottom but may be enlarged above the 300mm level to enable safe excavation to be carried out.
3. Extreme weather conditions should be avoided when testing.
4. In evaluating your test results please note that where the V_p value does not fall between 12 secs/mm and 100secs/mm then infiltration trench or bed systems may not be possible.

Trial Hole	Depth below ground level	Depth of Water (minimum 300mm)	Time taken between 75% & 25% full(seconds) (T)	Percolation Value $V_p = T/150$ (V_p)
1	(Test 1)	300mm	13290	88.6
2	(Test 2)	300mm	1980	13.2
3	(Test 3)	300mm	2490	16.6

Location: Land East of Cadney Lane, Bettisfield

Date test carried out: In September

Name of person carrying out the test: Richard Hall (client)

HOLE 1 DURING



HOLE 4 AFTER



HOLE 2 DURING

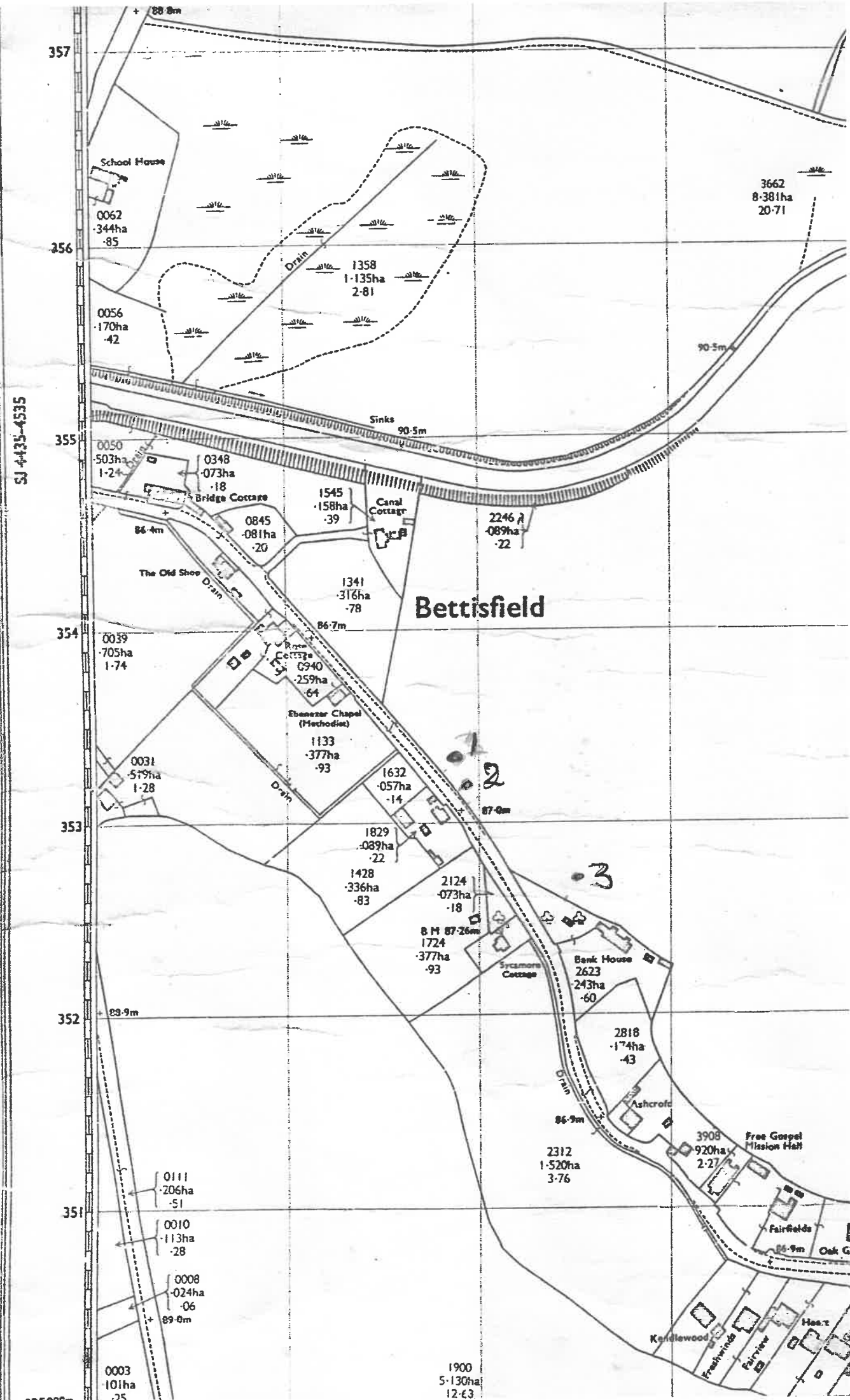


HOLE 2 AFTER



HOLE 3 DURING





Bettisfield