Sumner Consultancy Ltd

Civil Engineering &
Transportation Consultant

FLOOD RISK ASSESSMENT

FOR A PROPOSED DEVELOPMENT
AT
BURFORD

FOR

FRANK P MATTHEWS LTD

REPORT VERIFICATION

SITE ADDRESS	Burford
REPORT TITLE	Flood Risk Assessment
JOB NUMBER	522-19
PREPARED BY	JRS

ISSUE NO.	DATE	STATUS	REPORT VERSION	ISSUED BY
1	13-03-20	For Planning	01	JRS

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1. BRIEF

1.1. Sumner Consultancy has been appointed by Frank P Matthews Ltd to carry out a Flood Risk Assessment in connection with a potential development site at Burford.

2. SITE INFORMATION

2.1. The Site is located on the western side of Burford on the southern side of the A456 at Grid Reference X358654 Y268327 with the nearest post code of WR15 8HF. The Site Location Plan is in Appendix 1.

2.2. It is understood that there are no proposals at the present time for the Site other than it could residential or commercial or a mixture of both.

2.3. The A456 runs along the northern side of the Site, and along the southern side of the Site is the River Teme.

2.4. The existing use of the Site is agricultural.

2.5. The area of the Site is approximately 30ha.

2.6. The distance across the Site northwest to southeast is approximately 670m and the distance northeast to southwest is 865m.

2.7. The level along the site road frontage is between 57.75m & 58.00m, and along the boundary with the River Teme it is between 54.00m & 54.50m. A copy of the Site Survey 1:1500 Scale drawing 552-19-04 is in Appendix 2.

2.8. A plan showing the Existing Drainage Information determined from a site inspection is in Appendix 3.

2.9. A watercourse issues midway along the northern part of the Site, 115m from the northern boundary. The watercourse at this location is 1.6m deep with no evidence of a pipe. Photograph 1 in Appendix 4.

2.10. A field drain outfalls into the watercourse just below the issue point. Photograph 2.

2.11. The watercourse flows in a south easterly direction along the eastern side of the field boundary fence for a distance of 144m, when it turns through 90 degrees to flow in a north easterly direction under a footbridge for 110m. Photographs 3 & 4.

2.12. The watercourse turns again through 90 degrees to flow in a south easterly direction, where it immediately drains into a 375mm diameter culvert under a field access crossing. However under crossing the size of the culvert changes to 600mm diameter. Photographs 5 to 8.

2.13. The watercourse continues in a south easterly direction along the western side of the Site boundary hedge to outfall into the River Teme. At the outfall into the River Teme, the watercourse has a vertical drop down to the River of approximately 1.6m. Photographs 9 to 14.

2.14. Adjoining the north western corner of the Site is a ditch/watercourse running along the western side of an access track. Midway down the western side of the Site, the ditch/watercourse turns through 90 degrees. At this point there is a 450mm diameter culvert which continues in a south easterly direction to the River Teme.

2.15. After the ditch/watercourse turns through 90 degrees at the start of the 450mm culvert it flows in a south westerly direction for 195m, where there is a footpath crossing. Photographs 15 to 17.

2.16. The ditch/watercourse then turns through 110 degrees to flow in a south easterly direction for 60m, where it drains into a 450mm diameter culvert which outfalls into the River Teme just downstream of the weir. Photographs 18 to 22.

3. FLOOD INFORMATION

3.1. The GOV.UK Flood Map for Planning in Appendix 5, shows that 71% of the Site Area is in Flood Zones 2 & 3.

3.2. The extent of Flood Zones 2 & 3 are also shown on the Flood Levels drawing 522-19-10 in Appendix 6. Where Flood Zone 2 covers approximately 71% of the Site, and Flood Zone 3 approximately 59%.

3.3. The contours shown on the Site Survey and Flood Levels drawing have been obtained via Promap from a Digital Terrain Model (DTM) of the bare earth/underlying terrain of the earth's surface. They are usually derived from Digital Surface Model's (DSM's) by digitally removing the cultural (man-made) and vegetation features. The LiDAR level information is to a resolution of 1.0m and has a vertical accuracy of +/-15cm.

3.4. It appears from the contours that the level of the limit of Flood Zone 2 is approximately 55.50m AOD, and Flood Zone 3 is approximately 55.25m on the western side of the Site, and approximately 54.75m AOD on the eastern side of the Site.

3.5. The nearest monitoring station to the Site along the River Teme is the Tenbury Station ID: 2005, which is 900m to the east of the north eastern corner of the Site. The highest level ever recorded at the Tenbury Station was 5.97m, reached on Saturday 21st July 2007. The site datum level is 48.00m AOD, which means the flood level was 53.97m.

3.6. Flood Zone 3 is divided into two sub-categories, Flood Zone 3a and Flood Zone 3b. The extent of Flood Zone 3a 'High Probability' is defined as the 1 in 100 year return period fluvial event in this case.

3.7. The Flood Maps do not show the extent of the functional floodplain (Flood Zone 3b). Flood Zone 3b functional floodplain is defined in Table 1 of the National Planning Policy Framework (NPPF) Technical Guidance as the area where water flows or is stored during flood events. The functional floodplain is generally defined by the limit of the 1 in 20 year flood envelope.

3.8. Flood Zone 2 'Medium Probability' floodplain is defined as having between a 1 in 100 year annual probability and 1 in 1000 year annual probability of flooding. The threshold of the Flood Zone 2 floodplain is the 1 in 1000 year extreme event.

3.9. Flood Zone 1 'Low Probability' comprises land as having less than a 1 in 1000 year annual probability of fluvial (i.e. an event more severe than the extreme 1 in 1000 year event).

3.10. The finished floor level of any new building or dwelling should be at least 600mm above Flood Zone 2 level of 55.50m, which would be 56.10m.

4. OTHER SOURCES OF FLOODING

4.1. Ground Water Flooding

4.1.1. According to Cobby et al (2009), groundwater flooding can be defined as flooding caused by the emergence of water originating from subsurface permeable strata. The greatest risks of groundwater flooding are considered to be from either:

- A rise of groundwater in unconfined permeable strata, such as Chalk, after prolonged periods of extreme rainfall;
- A rise of groundwater in unconsolidated, permeable superficial deposits, which are in hydraulic continuity with local river water levels and where the hydraulic gradient of the water table is low.

4.1.2. Groundwater flooding from Chalk aquifers, for example, mainly occurs when the surface of the Chalk is close to, or outcrops at the ground surface. The rise in the water table during prolonged and extreme rainfall can be significant, especially if the Chalk aquifer is unconfined and if the original water level in the aquifer is high. Flooding from such aquifers may occur within a few hours or days of the rainfall or up to a few weeks after.

4.1.3. Deposits comprising a mixture of permeable and impermeable soils can lead to a presence of perched water. Perched water tables are located above less permeable deposits such as clay and are located within water-bearing soils such as sand and gravel. If perched water is unconfined then the potential for recharge and groundwater flooding can be high. If the perched water is confined by less permeable clay deposits, then the clay deposits will have a buffering effect on percolating surface water and thus the recharge potential and rise in the water table is low.

4.1.4. It is common for groundwater flooding from water-bearing superficial deposits to occur within the vicinity of watercourses, as the water table is generally in hydraulic continuity with the water levels in the watercourse. Therefore, if the watercourse floodplain is flat and low-lying, the water table is likely to have a low hydraulic gradient and will rise to the equivalent water level within the watercourse. This, in turn, can cause the water table to breach the ground surface. This is more prominent in winter during which groundwater flooding often precedes fluvial flooding.

4.2. Groundwater Flooding Potential at the Site

4.2.1. The online BGS Geology Viewer the Superficial deposits indicates that an area along the northern side of the Site comprises alluvium – clay, silt, sand & gravel, and to the south, bank farm sand & gravel – sand & gravel.

4.2.2. Reference to local borehole data obtained via the online BGS Geology Viewer shows the nearest borehole is approximately 200m from the north eastern corner of the Site Ref: SO56NE15. The data indicates the following thickness of the strata.

8m of sand & gravel
3m of clays, sand & gravels
39m of grey shales

4.2.3. It is considered that the evidence suggests an overall low risk of groundwater flooding.

4.3. Surface Water Flooding and Sewer Flooding

4.3.1. Surface water and sewer flooding across urban areas is often a result of high intensity storm events which exceed the capacity of the sewers thus causing them to surcharge and flood. Poorly maintained sewer networks and blockages can also exacerbate the potential for sewer flooding.

4.3.2. GOV.UK Flood Risk from Surface Water Extent of Flooding in Appendix 7 indicates that for the watercourse along the central and eastern side of the Site the flooding is contained within the banks of the watercourse.

4.3.3. The plan indicates there is an isolated short and narrow section of flooding towards the south western corner of the Site, which from the contours would appear to be a low spot, there is also a narrow section along the line of the 450mm diameter culvert in the south eastern corner of the Site.

4.3.4. GOV.UK Flood Risk from Reservoirs in Appendix 8 indicates that any flooding from reservoirs is contained within the banks of the River Teme, and finishes just downstream of the weir.

5. SURFACE WATER DRAINAGE

5.1. Information.

5.1.1. Planning policy recommends the maximum practical use of Sustainable Drainage Systems (SUDS) for new development sites. There is a requirement that SUDS be installed where appropriate, in order to limit the amount of surface water runoff entering drainage systems and to return surface water into the ground to follow its natural drainage path.

5.1.2. The National Planning Policy Framework (NPPF) and the Environment Agency require that the effects of climate change to be considered in any assessment of flood risk for developments.

5.1.3. When considering the impacts of climate change on rainfall intensity, NPPF advises that when designing surface water drainage systems for developments, an allowance of 30% for climate change should be included in the calculations.

5.2. Existing Surface Water Drainage

5.2.1. Surface water runoff from the Site will either be to the watercourse midway along the northern and then eastern part of the Site and the ditch/watercourse along the western side of the Site. Runoff will also be direct to the River Teme. A proportion of the surface water landing across the Site will infiltrate into the soils.

5.2.2. Sewer records for the area show that there are no surface water sewers in close proximity to the Site.

5.2.3. In order to prevent an increase in flow rate to the adjoining watercourse, any discharge from the development should to be limited to the Greenfield Runoff, which can be determined when the extent of any proposed development is known. However the area of the site which is outside of Flood Zone 2 is 8.64ha, therefore based on this area, the allowable Q_{BAR} runoff would be 15.46l/s. A copy of the Wallingford Greenfield Runoff Rate Estimation is in Appendix 9.

5.3. Soil Types and SUDS Suitability

5.3.1. The online BGS Geology Viewer the Superficial deposits indicates that an area along the northern side of the Site comprises alluvium – clay, silt, sand & gravel, and to the south, bank farm sand & gravel – sand & gravel.

5.3.2. Reference to local borehole data obtained via the online BGS Geology Viewer shows the nearest borehole is approximately 200m from the north eastern corner of the Site Ref: SO56NE15. The data indicates the following thickness of the strata.

8m of sand & gravel
3m of clays, sand & gravels
39m of grey shales

5.3.3. Shropshire Council's Flood & Water Management Plan in Appendix 10, indicates that the Site is suitable for infiltration or attenuation.

5.3.4. The first requirement for the discharge of surface water is to use soakaways, therefore soakaway tests should be carried out at a number of locations over the Site as defined in BRE Digest 365, to determine whether this could be a viable option.

5.3.5. Any soakaway should be located at a minimum distance 6.0m from the edge of a road. Soakaways should also be 5.0m from any buildings, including garages or property a boundary.

5.3.6. The alternative if soakaways are not suitable is to outfall to watercourse along the central and eastern side of the Site or direct to the River Teme. An outfall to either of these locations will require attenuation in the form of crates or oversized pipes with a controlled discharge at the appropriate rate for the development in the form of a Hydrobrake.

5.4. Soakaways

5.4.1. If the infiltration rate for this site is good, surface water from the roofs of the proposed buildings can outfall to soakaways. There are three types of granular filled soakaways as detailed in BRE Digest 365:

a) A small, usually square granular filled soakaway with a perforated inspection well extending to the base of the soakaway providing an access point to discharge the surface water. Figure 2.

Building Regulations – Drainage and Waste Disposal Approved Document H states that these are generally only suitable to drain impermeable areas of less than 100m^2, and soakaways serving larger areas generally need to be trench type soakaways.

b) A trench soakaway is possibly 1.0 – 2.0m wide with at least two inspection access points, one at each end of a straight trench, with a horizontal perforated or porous distributor pipe linking the ends along the top of the granular fill. Figure 3.

The movement of suspended and floating material into the distributor pipe can be minimised by using wet wells. Figure 4.

c) Precast perforated concrete ring units supported on a concrete foundation and surrounded with granular material.

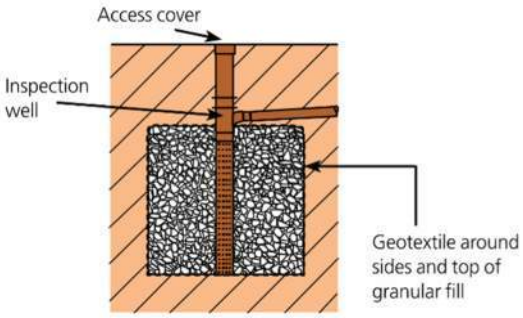


Figure 2

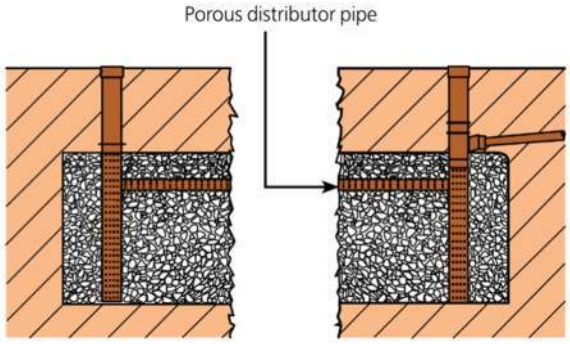


Figure 3

Extracts from BRE Digest 365 Soakaway Design Revision 2016

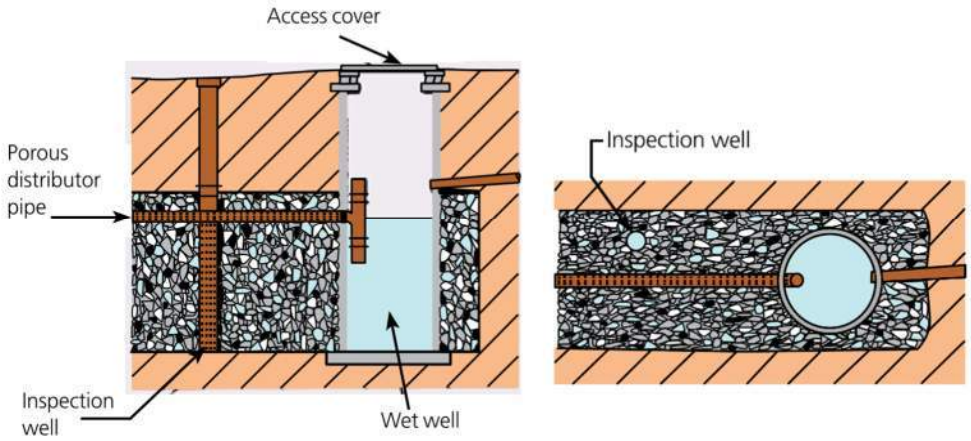


Figure 4

Extracts from BRE Digest 365 Soakaway Design Revision 2016

5.4.2. Soakaways comprising granular fill have void ratio of approximately 30%. To achieve a higher void ratio and hence a higher capacity then plastic cells can be utilised, such as Hydro International's Stormcell Storage System, shown below.

The Stormcell Storage System comes in unit sizes of 2.4 x 1.2 x 0.52m, and also shallow units 120mm deep. The units have a void ratio of approximately 95%, and they can be utilised for infiltration or attenuation. For attenuation a flow control device such as a Hydrobrake would be required to limit the rate of discharge.

5.5. Permeable Paving

5.5.1. Proposed areas of surfacing such as access drives, driveways and car parking areas could be constructed using a permeable surfacing such as permeable block paving, porous tarmac or similar where a permeable sub-base is utilised for infiltration or attenuation.

5.5.2. Surface water from the roofs of the proposed buildings could also be drained onto, or into, these surfaces.

5.5.3. Permeable surfaces can act as an effective way to store surface water and have also been shown to act as a filter and retainer for pollutants, in particular oil.

5.5.4. Interpave's Understanding Permeable Paving – Guidance for Designers, Developers, Planners and Local Authorities Edition 5 states that:

"American and German experience recommends that the design infiltration rate through the surface should be 10% of the initial rate, to take into account the effect of clogging over a 20-year design life without maintenance. Even after allowing for clogging, studies have shown that the long-term infiltration capability of permeable pavements will normally substantially exceed UK hydrological requirements. The typical rainfall rate in the UK is 75mm/hour. The percolation rate through joints of newly laid concrete block permeable paving (CBPP) is 4000mm/hour, so even allowing for the reduction to just 10% discussed above, there is still a large factor of safety".

5.5.5. Unlike impermeable paving, the surface of CBPP can be laid completely flat, as water passes straight into the gaps between the blocks, avoiding ponding. This means that CBPP surfaces are independent of cross-falls, channels and gullies.

5.5.6. The maximum gradient of the pavement surface its self should be about 5% (1 in 20) to prevent water flowing over the surface rather than into the paving joints.

5.6. There are three types of permeable surfacing construction:

a) System A, which is full infiltration
b) System B, which is partial infiltration
c) System C, which is no infiltration

5.7. Permeable Paving Systems

5.7.1. System A Full Infiltration

This is suitable for existing subgrade (ground) with good permeability, System A allows all the water falling onto the pavement to infiltrate down through the constructed layers below and eventually into the subgrade (ground).

Some retention of the water will occur temporarily in the permeable sub-base layer allowing for initial storage before it eventually passes through.

No water is discharged into conventional drainage systems, completely eliminating the need for pipes and gulleys, and making it a particularly economic solution. Figure 1.

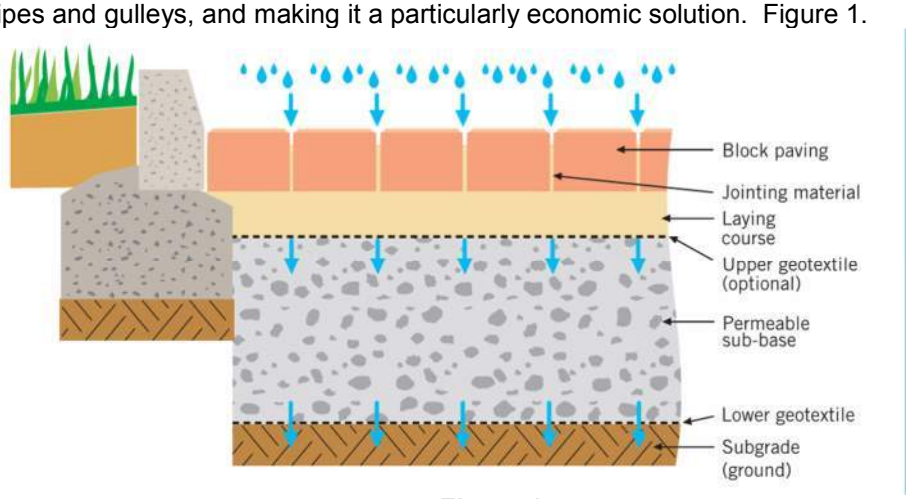


Figure 1
Extract from Interpave Understanding Permeable Paving Edition 5

5.7.2. System B Partial Infiltration

This is used where the existing subgrade (ground) may not be capable of absorbing all the water. A fixed amount of water is allowed to infiltrate which, in practice, often represents a large percentage of the rainfall.

Outlet pipes are connected to the permeable sub-base and allow the excess water to be drained to other drainage devices, such as swales, ponds, watercourses or sewers.

This is one way of achieving the requirement for reducing the volume and rate of runoff and will most likely remove the need for any long term storage. Figure 2.

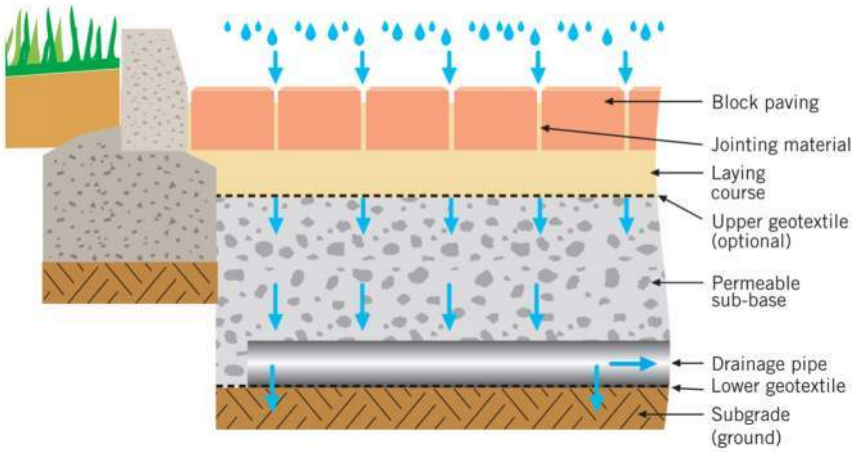


Figure 2
Extract from Interpave Understanding Permeable Paving Edition 5

5.7.3. System C No Infiltration

This is where the existing subgrade (ground) permeability is poor or contains pollutants, or where treated water will be harvested for re-use, irrigation or amenity, System C allows for the complete capture of the water.

It uses an impermeable, flexible membrane placed on top of the subgrade (ground) level and up the sides of the permeable sub-base to effectively form a storage tank.

Outlet pipes are constructed through the impermeable membrane to transmit the water to other drainage devices, such as swales, ponds, watercourses or sewers or for re-use. Importantly, the outlet pipes are designed to restrict flow so that water is temporarily stored within the pavement and discharge slowed.

System C is particularly suitable for contaminated sites, as it prevents pollutants from being washed further down into the subgrade (ground) where they could reach groundwater. Figure 3.

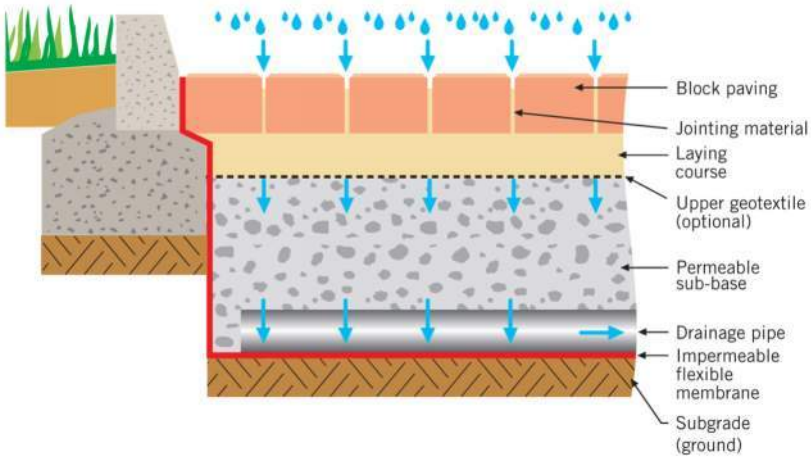


Figure 3
Extract from Interpave Understanding Permeable Paving Edition 5

5.8. If it is found that soakaways are not suitable, then the surface water will need to be attenuated on site before discharging into the adjoining watercourse or River Teme.

5.9. The attenuation on site could be in the form of oversized pipes, Hydro International's Stormcell Storage System or similar.

5.10. A flow control device such as a Hydrobrake would be required to limit the rate of discharge with storage in the form of oversize pipes or underground storage structures.

6. FOUL WATER DRAINAGE

6.1. The nearest foul sewer is 150mm diameter along the A456 in a north easterly direction 265m from the north eastern corner of the Site. The manhole reference number is 0601, it has a cover level of 57.70m and an invert level of 56.49m. An extract from Severn Trent Sewer Records is in Appendix 11.

6.2. The Site levels are such that any foul drainage will need to be pumped to manhole ref: 0601. This will necessitate constructing and adoptable pumping station and for the 150mm diameter sewer at the manhole to be of sufficient size to accommodate the development.

6.3. If an adoptable pumped main is not acceptable, then the alternative would be to individual or single package treatment plants for each area outfalling to the adjoining watercourse or River Teme.

7. CONCLUSION

7.1. 71% of the Site area is located within the Flood Zones 2 & 3, with Flood Zone 3 covering approximately 59%.

7.2. It appears from the contours that the level of the limit of Flood Zone 2 is approximately 55.50m AOD, and Flood Zone 3 is approximately 55.25m on the western side of the Site, and approximately 54.75m AOD on the eastern side of the Site.

7.3. The nearest monitoring station to the Site along the River Teme is the Tenbury Station ID: 2005, which is 900m to the east of the north eastern corner of the Site. The highest level ever recorded at the Tenbury Station was 5.97m, reached on Saturday 21st July 2007. The site datum level is 48.00m AOD, which means the flood level was 53.97m.

7.4. The finished floor level of any new building or dwelling should be at least 600mm above Flood Zone 2 level of 55.50m, which would be 56.10m.

7.5. It is considered that the evidence suggests an overall low risk of groundwater flooding.

7.6. GOV.UK Flood Risk from Surface Water Extent of Flooding indicates that for the watercourse along the central and eastern side of the Site the flooding is contained within the banks of the watercourse. The plan also indicates there is an isolated short and narrow section of flooding towards the south western corner of the Site, which from the contours would appear to be a low spot, and a narrow section along the line of the 450mm diameter culvert in the south eastern corner of the Site. All of these areas are within Flood Zone 2.

7.7. GOV.UK Flood Risk from Reservoirs indicates that any flooding from reservoirs is contained within the banks of the River Teme, and finishes just downstream of the weir.

7.8. Surface water runoff from the Site will either be to the watercourse midway along the northern and then eastern part of the Site and the ditch/watercourse along the western side of the Site. Runoff will also be direct to the River Teme. A proportion of the surface water landing across the Site will infiltrate into the soils.

7.9. Sewer records for the area show that there are no surface water sewers in close proximity to the Site.

7.10. In order to prevent an increase in flow rate to the adjoining watercourse, any discharge from the development should to be limited to the Greenfield Runoff, which can be determined when the extent of any proposed development is known. However the area of the site which is outside of Flood Zone 2 is 8.64ha, therefore based on this area, the allowable Q_{BAR} runoff would be 15.46 l/s.

7.11. The online BGS Geology Viewer the Superficial deposits indicates that an area along the northern side of the Site comprises alluvium – clay, silt, sand & gravel, and to the south, bank farm sand & gravel – sand & gravel.

7.12. Reference to local borehole data obtained via the online BGS Geology Viewer shows the nearest borehole is approximately 200m from the north eastern corner of the Site Ref: SO56NE15. The data indicates the following thickness of the strata.

8m of sand & gravel
3m of clays, sand & gravels
39m of grey shales

7.13. Shropshire Council's Flood & Water Management Plan indicates that the Site is suitable for infiltration or attenuation.

7.14. The first requirement for the discharge of surface water is to use soakaways, therefore soakaway tests should be carried out at a number of locations over the Site as defined in BRE Digest 365, to determine whether this could be a viable option.

7.15. Any soakaway should be located at a minimum distance 6.0m from the edge of a road. Soakaways should also be 5.0m from any buildings, including garages or property a boundary.

7.16. The alternative if soakaways are not suitable is to outfall to watercourse along the central and eastern side of the Site or direct to the River Teme. An outfall to either of these locations will require attenuation in the form of crates or oversized pipes with a controlled discharge at the appropriate rate for the development in the form of a Hydrobrake.

7.17. If the infiltration rate for this site is good, surface water from the roofs of the proposed buildings can outfall to soakaways. There are three types of granular filled soakaways as detailed in BRE Digest 365, which are a small soakaway, trench soakaway or precast concrete ring units.

7.18. Soakaways comprising granular fill have void ratio of approximately 30%. To achieve a higher void ratio and hence a higher capacity then plastic cells can be utilised, such as Hydro International's Stormcell Storage System.

7.19. Proposed areas of surfacing such as access drives, driveways and car parking areas could be constructed using a permeable surfacing such as permeable block paving, porous tarmac or similar where a permeable sub-base is utilised for infiltration or attenuation. Surface water from the roofs of the proposed buildings could also be drained onto, or into, these surfaces.

7.20. There are three types of permeable surfacing construction:

a) System A, which is full infiltration
b) System B, which is partial infiltration
c) System C, which is no infiltration

7.21. If it is found that soakaways are not suitable, then the surface water will need to be attenuated on site before discharging into the adjoining watercourse or River Teme.

7.22. The attenuation on site could be in the form of oversized pipes, Hydro International's Stormcell Storage System or similar.

7.23. A flow control device such as a Hydrobrake would be required to limit the rate of discharge with storage in the form of oversize pipes or underground storage structures.

7.24. The nearest foul sewer is 150mm diameter along the A456 in a north easterly direction 265m from the north eastern corner of the Site. The manhole reference number is 0601, it has a cover level of 57.70m and an invert level of 56.49m.

7.25. The Site levels are such that any foul drainage will need to be pumped to manhole ref: 0601. This will necessitate constructing and adoptable pumping station and for the 150mm diameter sewer at the manhole to be of sufficient size to accommodate the development.

7.26. If an adoptable pumped main is not acceptable, then the alternative would be to individual or single package treatment plants for each area outfalling to the adjoining watercourse or River Teme.

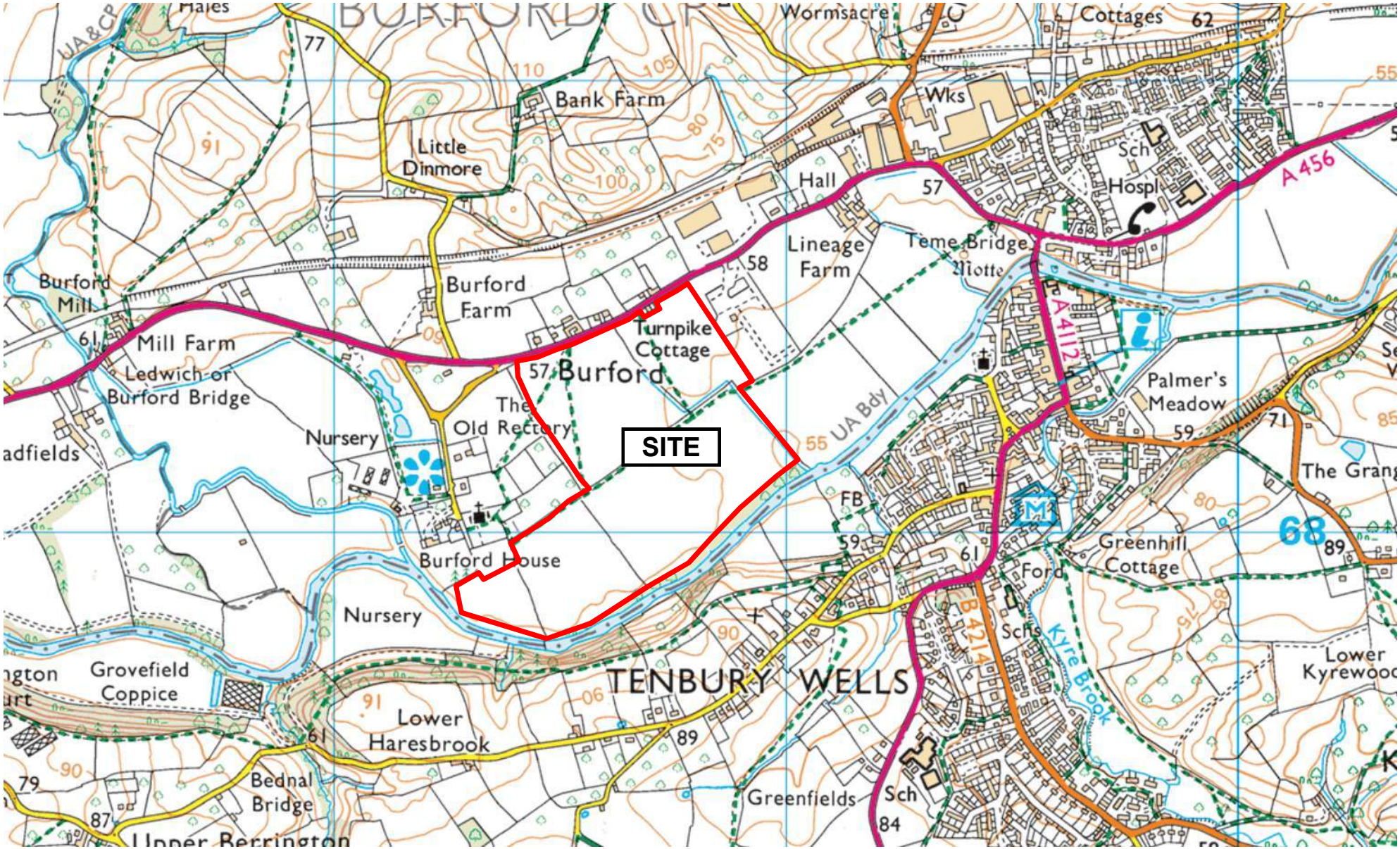
John Sumner IEng MICE
Director
Sumner Consultancy Ltd
March 2020

APPENDIX 1

SITE LOCATION PLAN

SITE LOCATION PLAN

Nearest Post Code WR15 8HF
Grid Reference X358654 Y268327



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Ordnance Survey Paper Mapping Licence Number 100059047

APPENDIX 2

SITE SURVEY 1:1500 SCALE
DRAWING 552-19-04

Notes

1. Do not scale from this drawing.
2. All drawings are to be checked by the contractor and setting out engineer and read in conjunction with one another to ensure they are mutually compatible with each other before any setting out or construction commences.
   In the event of apparent ambiguity or contradiction the engineer and/or architect shall be notified immediately. Sumner Consultancy accepts no liability in the event of not being so notified and where construction work has commenced.
3. The survey has been reproduced via Promap from the Ordnance Survey mapping with the permission of the Controller of Her Majesty's Stationery Office. © Crown Copyright.
   Sumner Consultancy Ltd Ordnance Survey Paper Mapping Licence Number 100059047.
4. The contours have been obtained via Promap from a Digital Terrain Model (DTM) of the bare earth/underlying terrain of the earth's surface. They are usually derived from Digital Surface Model's (DSM's) by digitally removing the cultural (man-made) and vegetation features.
   The LiDAR level information is to a resolution of 1m and has a vertical accuracy of +/-15cm.
   These contours and any level information must only be used as guide.

Revisions

Rev	Date	Description

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Client: FRANK P MATTHEWS LTD

Project: BURFORD

Drawing Title: SITE SURVEY 1:1500 SCALE

Scale: 1:1500	Drawn by: JRS	Date: February 2020

Drawing Number: 522-19-04	Revision:

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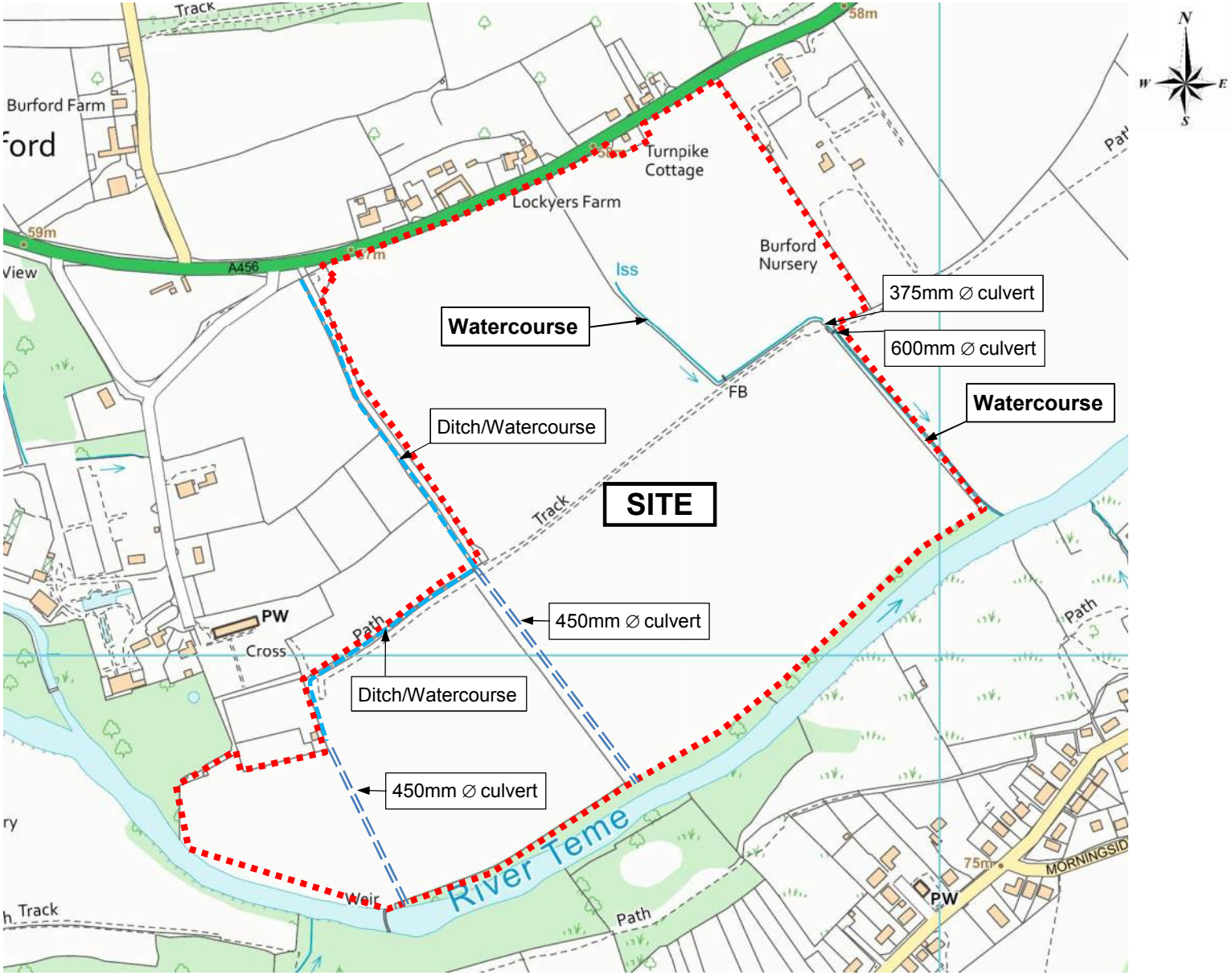
Drawing Size: A1

APPENDIX 3

EXISTING DRAINAGE INFORMATION PLAN

EXISTING DRAINAGE INFORMATION PLAN

Nearest Post Code WR15 8HF
Grid Reference X358654 Y268327



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APPENDIX 4

PHOTOGRAPHS

PHOTOGRAPH 1
Issuing location of watercourse

PHOTOGRAPH 2
Field drain outfalling into watercourse

PHOTOGRAPH 3
Watercourse 104m from the issue point looking in a north westerly direction

PHOTOGRAPH 4
Watercourse 104m from the issue point looking in a south easterly direction
This is where the watercourse turns through 90 degrees an under a footbridge

PHOTOGRAPH 5
Watercourse looking in a south westerly direction towards the footbridge

PHOTOGRAPH 6
375mm diameter culvert under the field access crossing

PHOTOGRAPH 7
600mm diameter downstream culvert under the field access crossing

PHOTOGRAPH 8
Inside the 600mm diameter downstream culvert under the field access crossing

PHOTOGRAPH 9
Watercourse downstream of the field access crossing looking in a south easterly direction

PHOTOGRAPH 10
Watercourse 190m downstream of the field access crossing looking in a north westerly direction

PHOTOGRAPH 11
Watercourse outfall into the River Team with a drop of approximately 1.6m

PHOTOGRAPH 12
Watercourse outfall into the River Team with a drop of approximately 1.6m

PHOTOGRAPH 13
River Teme near the watercourse outfall looking upstream in a south westerly direction

PHOTOGRAPH 14
River Teme near the watercourse outfall looking downstream in a north easterly direction

PHOTOGRAPH 15
Ditch/watercourse adjoining the western boundary looking in a north westerly direction

PHOTOGRAPH 16
Ditch/watercourse flowing in a south westerly direction towards a footpath crossing

PHOTOGRAPH 17
Ditch/watercourse crossing under a footpath crossing

PHOTOGRAPH 18
Ditch/watercourse downstream of the footpath crossing looking in a southerly direction

PHOTOGRAPH 19
450mm diameter upstream culvert

PHOTOGRAPH 20
450mm diameter downstream culvert

PHOTOGRAPH 21
River Teme adjoining the 450mm diameter culvert looking upstream towards the weir

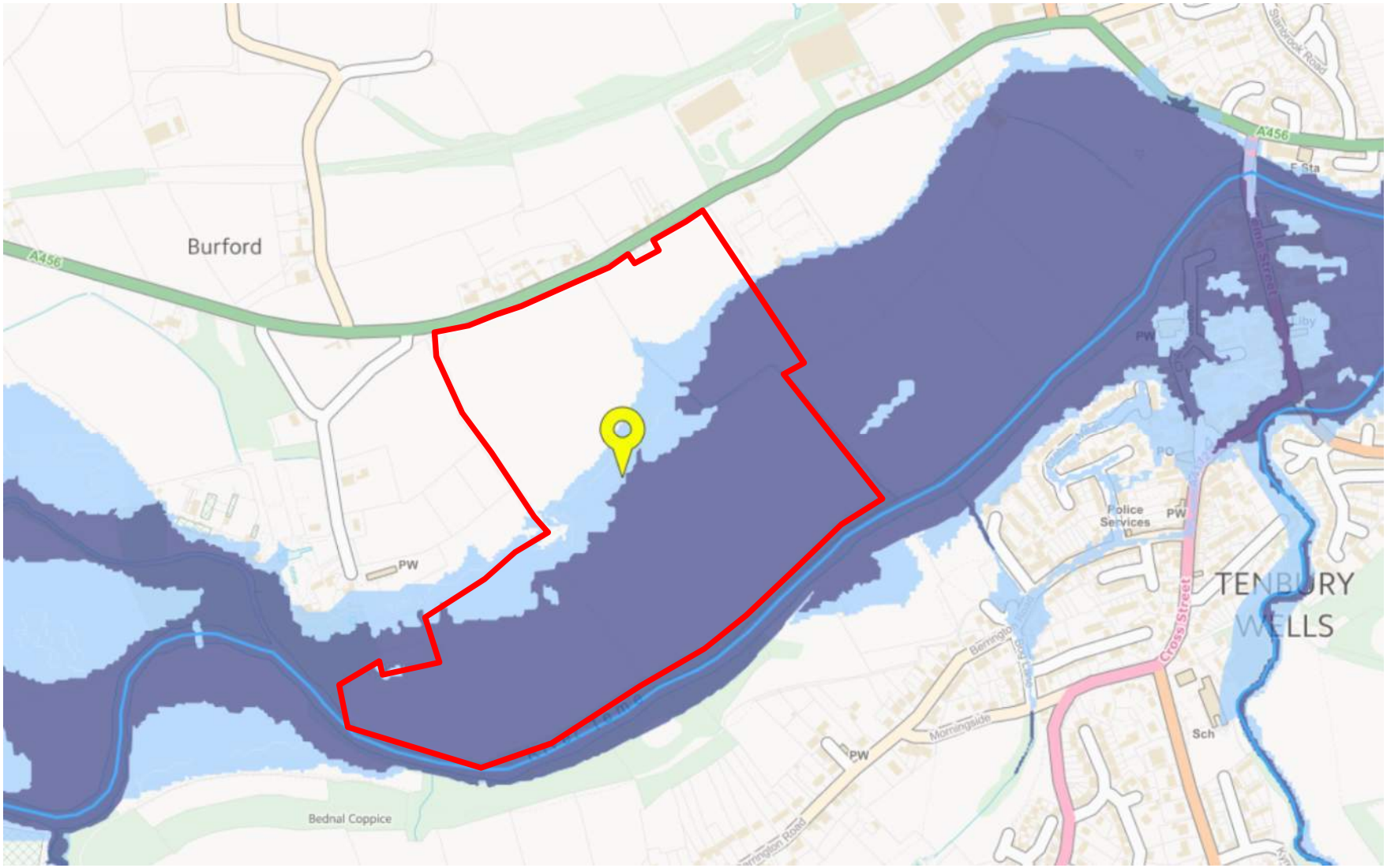
PHOTOGRAPH 22
River Teme adjoining the 450mm diameter culvert looking downstream

APPENDIX 5

GOV.UK FLOOD MAP FOR PLANNING

GOV.UK FLOOD MAP FOR PLANNING

Nearest Post Code WR15 8HF
Grid Reference X358654 Y268327



FLOOD PROBABILITY

- Flood Zone 3
- Area benefiting from flood defences
- Flood Zone 2
- Flood Zone 1
- Flood storage area
- Flood defence
- Main river
- Site location or post code

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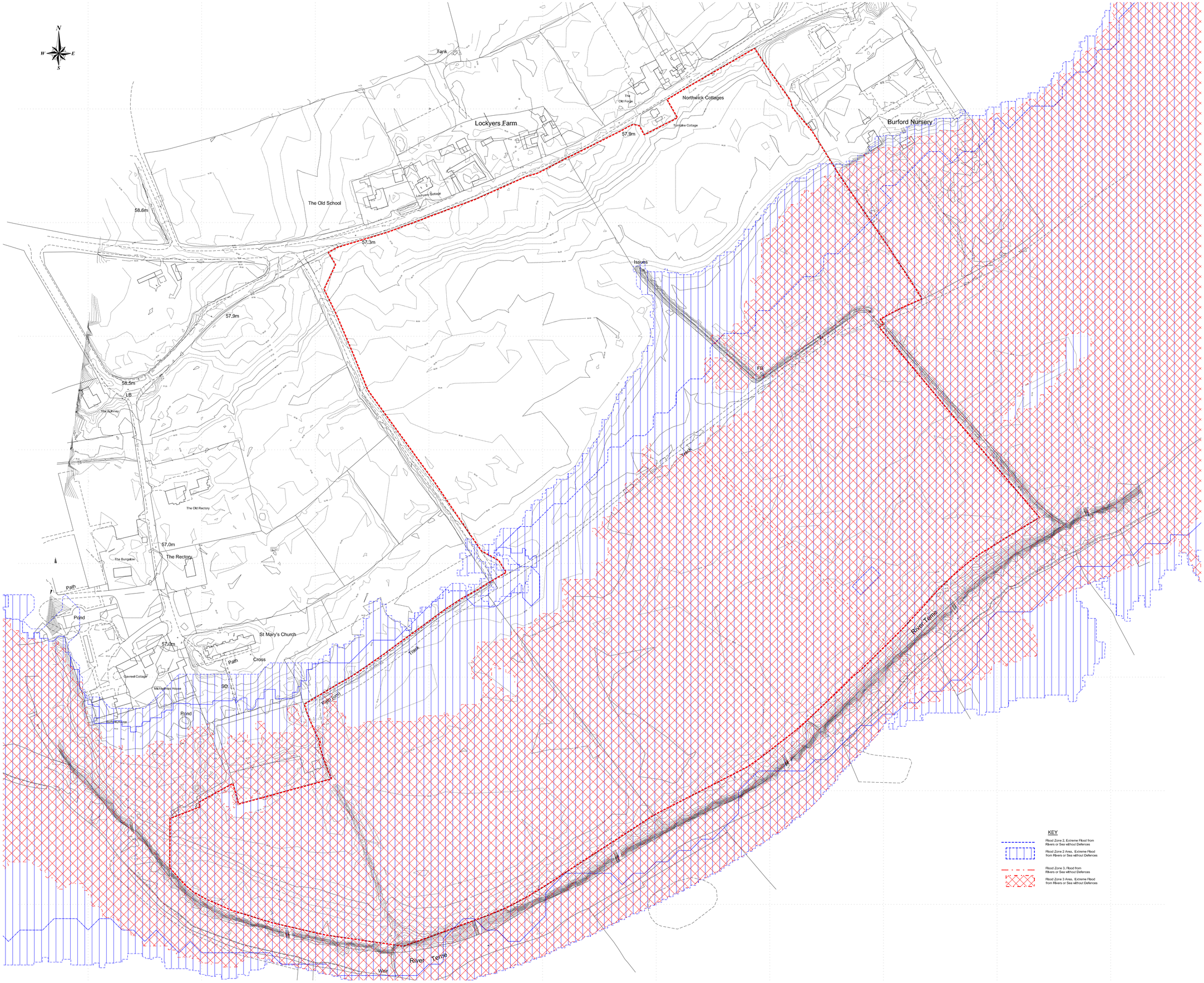
APPENDIX 6

FLOOD LEVELS DRAWING 522-19-10



Notes

1. Do not scale from this drawing.
2. All drawings are to be checked by the contractor and setting out engineer and read in conjunction with one another to ensure they are mutually compatible with each other before any setting out or construction commences.
   In the event of apparent ambiguity or contradiction the engineer and/or architect shall be notified immediately. Sumner Consultancy accepts no liability in the event of not being so notified and where construction work has commenced.
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4. The contours have been obtained via Promap from a Digital Terrain Model (DTM) of the bare earth/underlying terrain of the earth's surface. They are usually derived from Digital Surface Model's (DSM's) by digitally removing the cultural (man-made) and vegetation features.
   The LiDAR level information is to a resolution of 1m and has a vertical accuracy of +/-15cm.
   These contours and any level information must only be used as guide.
5. The flood data has been obtained from Envirocheck which has been produced by The Environment Agency.
   This Data includes; Areas Benefiting from Flood Defences, Flood Water Storage Areas, Extreme Flooding from Rivers or Sea without Defences (Flood Zone 2), Flooding from Rivers or Sea without Defences (Flood Zone 3) and Flood Defences

Revisions

Rev	Date	Description

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Client: FRANK P MATTHEWS LTD

Project: BURFORD

Drawing Title: FLOOD LEVELS

Scale:	1:1500	Drawn by:	JRS	Date:	February 2020

Drawing Number: 522-19-10

Revision:

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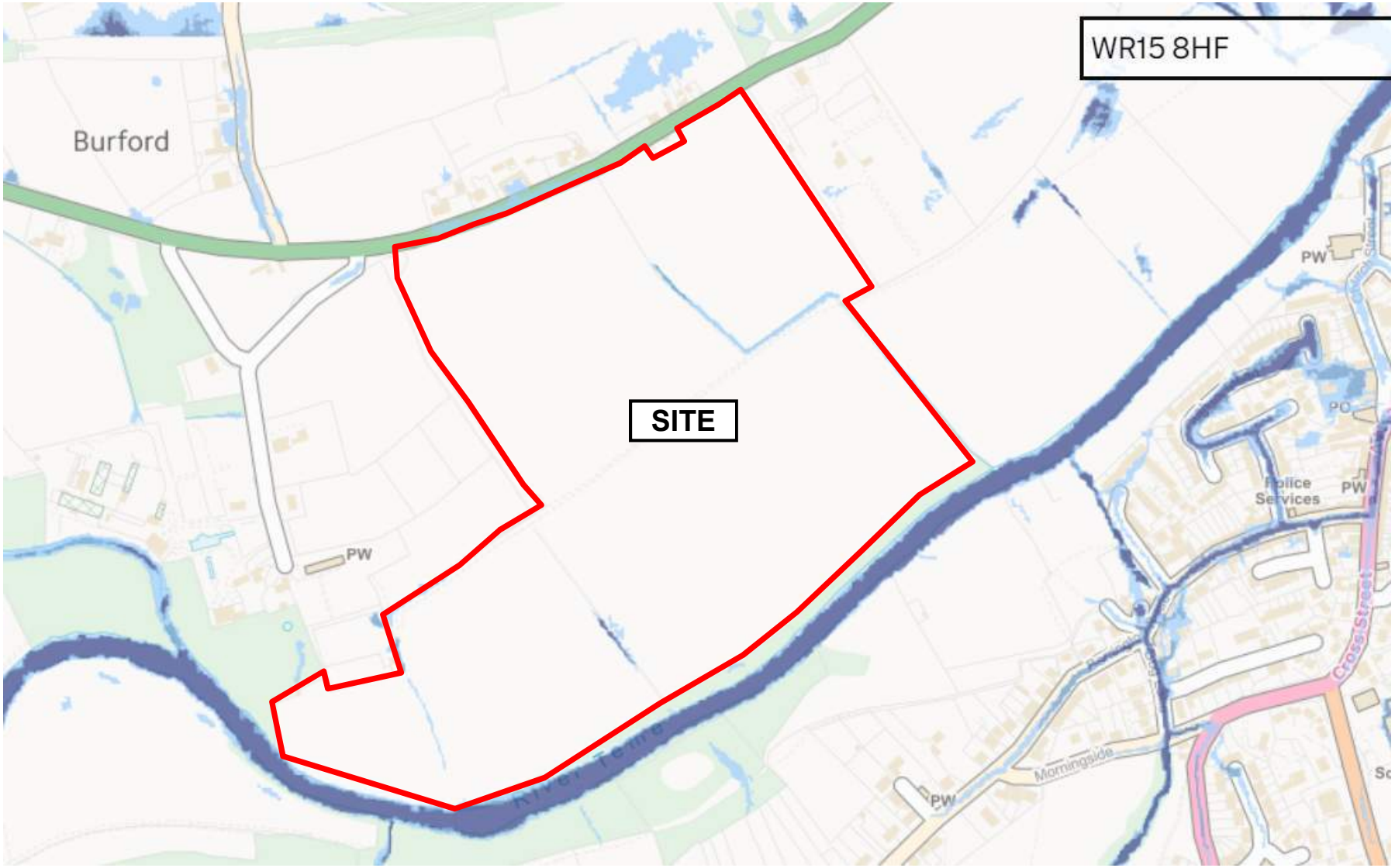
Drawing Size: A1

APPENDIX 7

GOV.UK FLOOD RISK FROM SURFACE WATER EXTENT OF FLOODING

GOV.UK FLOOD RISK FROM SURFACE WATER
EXTENT OF FLOODING

Nearest Post Code WR15 8HF
Grid Reference X358654 Y268327



FLOOD RISK

High | Medium | Low | Very low

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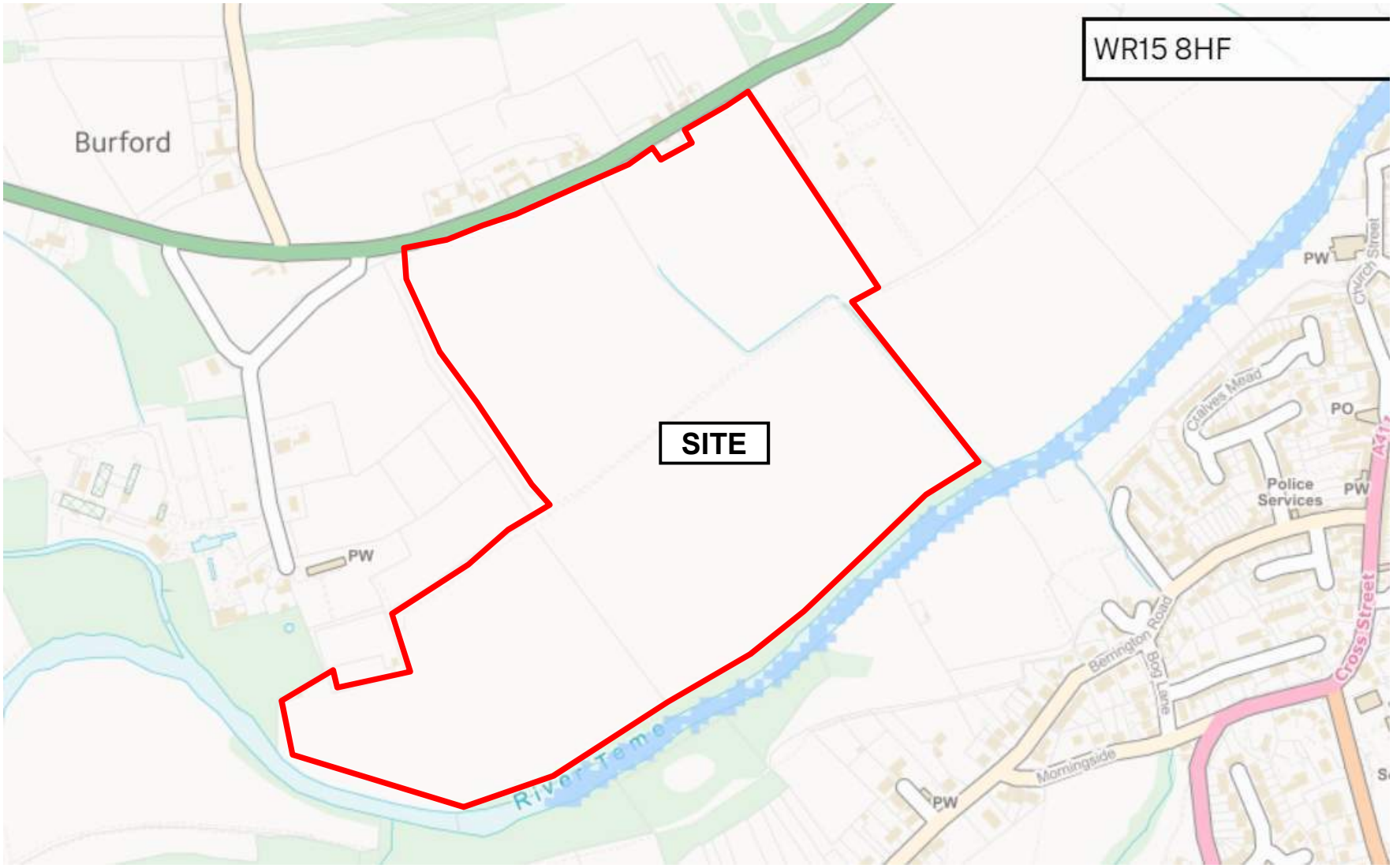
APPENDIX 8

GOV.UK FLOOD RISK FROM RESERVOIRS

GOV.UK FLOOD RISK FROM RESERVOIRS
EXTENT OF FLOODING

Nearest Post Code WR15 8HF
Grid Reference X358654 Y268327



FLOOD RISK

Maximum extent of flooding

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APPENDIX 9

WALLINGFORD GREENFIELD RUNOFF RATE ESTIMATION

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	John Sumner
Site name:	522-19 Burford
Site location:	Burford

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be
the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	52.31088° N
Longitude:	2.60713° W
Reference:	3408507637
Date:	Mar 13 2020 11:39

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 8.64

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	689	689
Hydrological region:	4	4
Growth curve factor 1 year:	0.83	0.83
Growth curve factor 30 years:	2	2
Growth curve factor 100 years:	2.57	2.57
Growth curve factor 200 years:	3.04	3.04

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	15.46	15.46
1 in 1 year (l/s):	12.83	12.83
1 in 30 years (l/s):	30.91	30.91
1 in 100 year (l/s):	39.72	39.72
1 in 200 years (l/s):	46.99	46.99

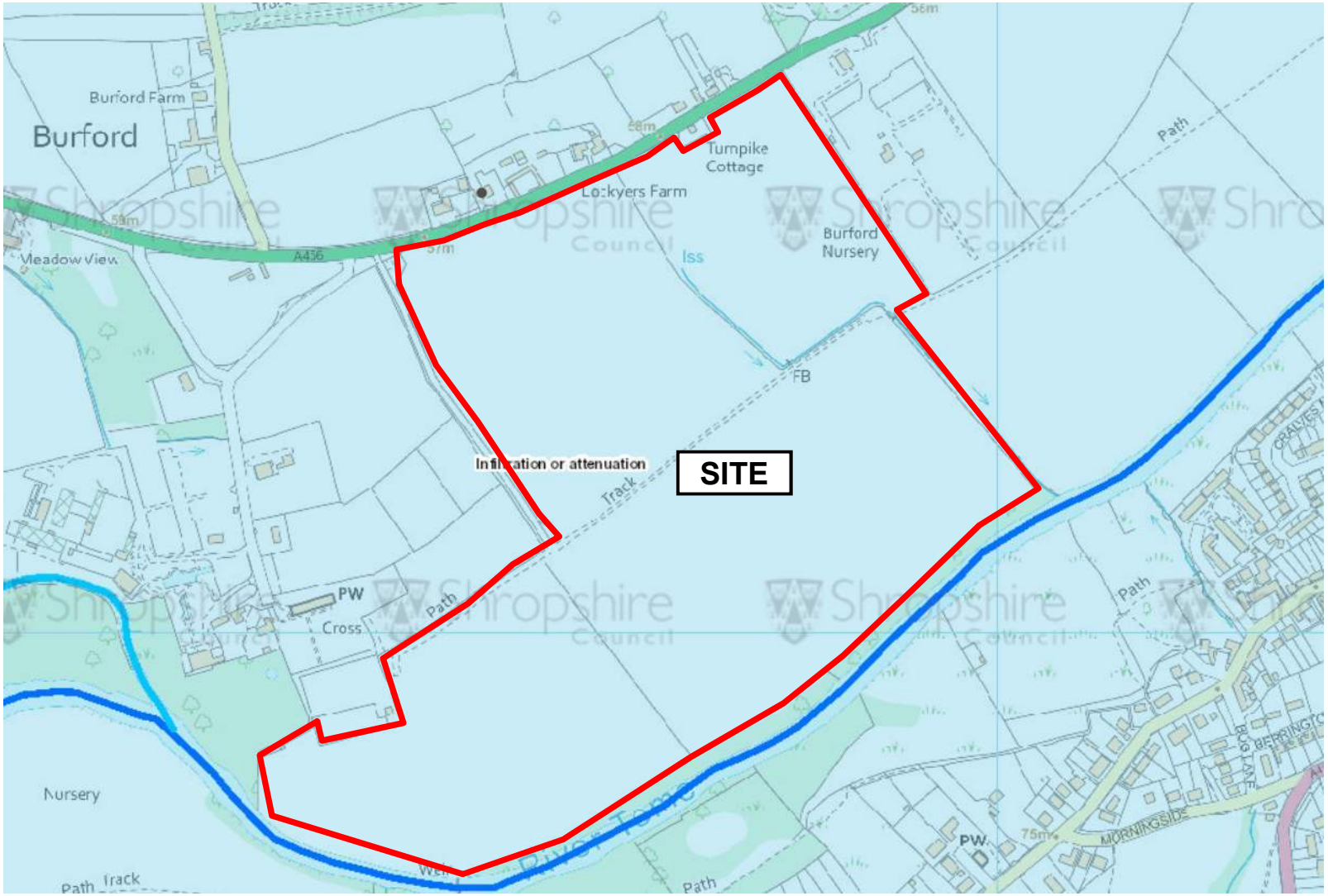
This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

APPENDIX 10

SHROPSHIRE COUNCIL'S FLOOD & WATER MANAGEMENT PLAN

SHROPSHIRE FLOOD & WATER MANAGEMENT PLAN

Nearest Post Code WR15 8HF
Grid Reference X358654 Y268327



Main River

Ordinary Watercourse

Attenuation

Infiltration

Infiltration PLUS treatment

Infiltration or attenuation

Infiltration or attenuation PLUS treatment

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APPENDIX 11

SEVERN TRENT SEWER RECORDS

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
	F		0	0
0601	F	57.7	56.49	1.21
0701	F	57.44	56.07	1.37

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Date: 13/03/20 Map Centre: 358660,268432 Data updated: 28/02/20 Our Ref: 376359 - 1

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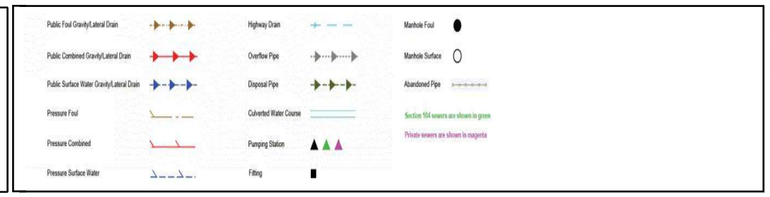

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522-19 Burford

SEVERN TRENT