# Technical Note: Flood Risk and Surface Water Runoff Assessment for Land adjacent to Main Road, Birdham, Chichester, PO20 7HU

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**Project:** 2242 – Main Road, Birdham

***Background and Scope***

Herrington Consulting Ltd. has been commissioned by *The Trustees of D R Pick Grandchildren's Settlement* to prepare a technical assessment appraising the risk of flooding and opportunities for surface water management at the land adjacent to Main Road, Birdham, Chichester, PO20 7HU.

The masterplan for the development has not currently been established and therefore, this letter provides details on the potential risk of flooding from various sources as well as solutions for draining the site sustainably, in accordance with National Planning Policy.

The aim of this report is to provide detailed constraints and information relating to the potential risk of flooding and drainage solutions and confirm whether the proposals are viable, and provide support for the allocation of the development within the Local Plan.

***Site Location and Existing Use***

The site is located at OS coordinates 482300, 099631 off Main Road in Birdham. In total, the wider site covers an area of approximately 13.3ha, with a proposed development area of 3.6ha, and currently comprises greenfield land.

***Proposed Development***

The development will be for up to 125 residential units, located on the parcel of land south of the access road connecting the A286 with Whitestone Farm Cottages.

***Flood Risk Assessment***

Reference to the Environment Agency's (EA) 'Flood Maps for Planning' identifies that the development site is situated within a Flood Zone 1. Nevertheless, the NPPF requires that for sites larger than 1ha, a flood risk assessment is prepared to appraise the risk from all sources. The potential sources of flooding have therefore been assessed and the level of risk has been summarised below:

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| Source of Flooding | Risk of Flooding |
|---|---|
| Flooding from Rivers | Low |
| Flooding from the Sea | Low |
| Flooding from Ordinary or Man-made Watercourses | Appraised further below |
| Flooding from Groundwater | Appraised further below |
| Flooding from Sewers | Appraised further below |
| Flooding from Reservoirs, Canals and other Artificial Sources | Low |
| Flooding from Land (overland flow and surface water runoff) | Appraised further below |

*Table 1 - Summary of flood sources and risk.*

***Flooding from Ordinary or Man-made Watercourses*** – Natural watercourses that have not been enmained and man-made drainage systems such as irrigation drains, sewers or ditches could potentially cause flooding.

Further to this, historic maps for the site identify that prior to ~1970 there were several ponds near to Whitestone Farm Cottages. These ponds appear to have drained to a watercourse located to the southeast of the site, via a drainage ditch or small watercourse which crossed part of the site. These ponds and drainage ditches have since been infilled and replaced by a pumping station and underground pipe. This mapping also shows a number of drainage ditches within the fields surrounding the site. This information has been provided by the landowner who has also confirmed that the pump discharges water into a watercourse to the south of the site. A copy of the historic map is appended to this report for reference. Figure 1, below, shows the location of the pond and pipe in relation to the development site.

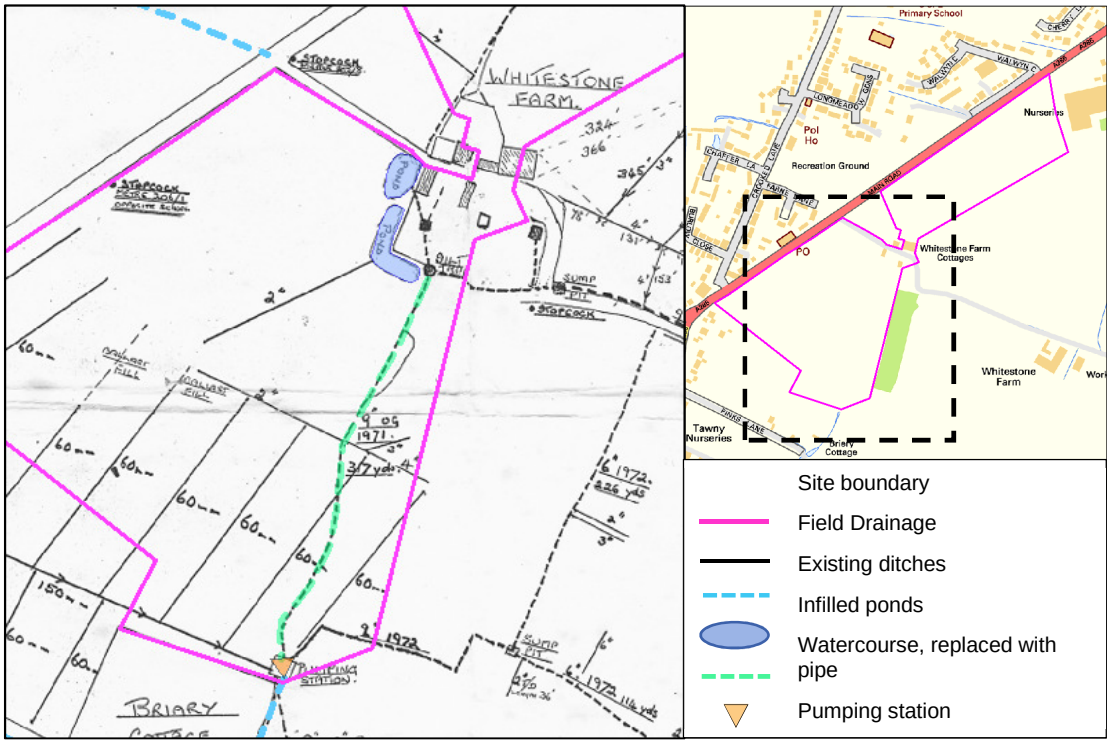


*Figure 1 – Existing drainage at Main Road Birdham, showing historic ponds and watercourse / ditch.*

Flooding has been previously observed, and confirmed by the landowner, in the area around Whitestone Farm cottages and the existing antiques shop and was attributed to a failure of the pumping station. Evidence of waterlogging above where the historic ponds were located has also been seen. As a result, there is a high probability that water either collects or emerges in this part of the site.

It is recommended that site investigations are undertaken to determine the source of flooding in this area. Nonetheless, to minimise the risk of flooding to the development, the proposed dwellings should be located away from areas of lower lying land where floodwater could accumulate. Furthermore the removal of the pumping station and daylighting the watercourse may further reduce the risk to the development. The impacts of removing the culvert and crating new ponds in this area should be assessed in detail.

***Flooding from Groundwater*** – Groundwater flooding is most likely to occur in low-lying areas that are underlain by permeable rock (aquifers). The underlying geology in this area is London Clay Formation (clay, silt and sand) overlain by River Terrace Deposits (sand, silt and clay).

Inspection of groundwater flood risk mapping data compiled by the British Geological Survey shows that the development site lies within an area shown to be at low risk from groundwater flooding. Nevertheless, historic maps indicate that in the past, there have been ponds on site, which could be an indicator of elevated groundwater levels. This is partially supported by the Chichester District Council (CDC) Strategic Flood Risk Assessment (SFRA), which shows that there have been historic records of flooding on site.

One location where groundwater emergence could occur is within the lower lying land around the infilled ponds seen on Figure 1 (above). In this case the residential dwellings should not be located in the lower lying areas around the infilled ponds which could instead be dedicated to flood storage or sustainable drainage systems.

In addition, daylighting the culverted watercourse and creating new ponds in the lower parts of the site could increase the chance of any groundwater emerging at the site being collected by the drainage system and directed away from the development. Consequently, with these measures incorporated into the design of the development, the risk of flooding from this source would be low in the future.

Notwithstanding this, to further quantify the risk of flooding from groundwater and to determine the suitability of SuDS across the lower parts of the site, it is recommended that ground investigations are undertaken in order to confirm the underlying geology and groundwater levels at the site.

***Flooding from Sewers*** – Inspection of asset location mapping provided by Southern Water reveals that there are no sewers crossing the development site, but nearby sewers are designated foul only. In addition, there is a privately-owned network of surface water drainage pipes which runs across the site. The aim of this surface water drainage network is to pump surface water from the site into a drainage ditch further to the south of the development site. Details of this network are currently unknown and as such, it will be necessary to establish the exact location and type of pipes as part of detailed site investigations. Notwithstanding this, if water was to exit either the private or public sewer network (i.e. as a result of a blockage or extreme rainfall event) water would flow towards the lower-lying areas to the south and flow away from site. Consequently, the risk of flooding from this source is considered to be *low*.

***Flooding from Land (overland flow and surface water runoff)*** – The EA's 'Risk of Flooding from Surface Water' map shows that the majority of the development site is at 'very low' risk of surface water flooding. This is supported by historic evidence of the site as shown in photographs 7 and 9 included within the Landscape Report prepared for the site (by others).

Interrogation of aerial height data reveals that floodwater originates from on-site and therefore it will be possible to reduce the risk of flooding by incorporating a sustainable drainage system (SuDS) into the scheme design. An outline strategy for incorporating SuDS into the scheme is outlined in the following section. On this basis, the risk of flooding from surface water is considered to be low.

### *Surface Water Management Strategy*

#### *Background and Policy*

The general requirement for all new development with respect to surface water runoff is to ensure that the runoff is managed sustainably and that the drainage solution for the development does not increase the risk of flooding at the site, or to the surrounding area.

For undeveloped greenfield sites, the impact of the proposed development will require mitigation to ensure that the runoff from the site replicates the natural drainage characteristics of the pre-developed site. In this instance, the proposed development is for the construction of approximately 125 residential units on land totalling greater than 1ha. As a result, the proposals are classified as 'major' development and therefore, the non-Statutory Technical Standards for Sustainable Drainage Systems (NTSS) will apply.

In addition to National Planning Policy requirements, the proposals must meet the requirements of Chichester District Council's Local Planning Policy 42 and supplementary planning policy relating to drainage and SuDS.

Policy 42 requires all developments to manage surface water runoff sustainably and ensure that there is no increase in the amount of surface water runoff discharged offsite post development. As part of the policy requirements, an assessment of rainfall events which exceed the design standards should also be undertaken with the scheme designed to manage excess runoff in a way which does not result in undue risk to the site or surrounding area. Where possible, SuDS should be incorporated within open green spaces or integrated into the development (i.e. green corridors).

***Existing Drainage***

Based on the information provided, the existing drainage in this area comprises an extensive network of land drains and ditches (refer to enclosed plans). A large proportion of this network drains towards Whitestone Farm cottages. Any rainfall landing on the fields across the site is likely to drain into the relatively shallow field drainage system.

A large pipe connects the drainage system at Whitestone Farm with a pumping station and watercourse to the south of the development site. This watercourse is assumed to have onward connectivity to the sea via a network of ditches within Somerley and the Earnley Rife.

The greenfield runoff rates for the site have been calculated for the development site in Table 2 below.

| Return Period | Greenfield Runoff Rates (l/s/ha) | Greenfield Runoff estimated for the entire development site ~ 13.2 ha (l/s) |
|---|---|---|
| 1 in 1 year | 1.4 | 18.0 |
| Qbar (~1 in 2 year) | 1.6 | 21.2 |
| 1 in 30 years | 3.7 | 48.7 |
| 1 in 100 years | 5.1 | 67.6 |

*Table 2 – Greenfield Runoff rates per hectare and for the entire development site based on FEH data point data.*

***Opportunities for Managing Surface Water Runoff***

Part H of the Building Regulations summarises a hierarchy of options for discharging surface water runoff from developments. The preferred option is to infiltrate water into the ground, as this deals with the water at source and serves to replenish groundwater. If this option is not viable, the next option of preference is for the runoff to be discharged into a watercourse. Only if neither of these options are possible, the water should be conducted into the public sewer system.

The following opportunities for managing the surface water runoff discharged from the development site are listed in order of preference:

*Infiltration* – The relatively impermeable London Clay bedrock and anticipated high groundwater in this area are likely to prohibit the use of infiltration SuDS at this site. Notwithstanding this, site investigations should be undertaken to confirm whether any runoff from the proposed development can be drained to the ground

via infiltration SuDS. At this stage in the development design process it is assumed that infiltration rates at the site will be low, and groundwater levels elevated such that infiltration SuDS will not be viable. Consequently, an alternative method for draining the site will be required.

*Connection to a Watercourse* – There are several ditches and small watercourses located in the area surrounding the development site. In this case, a connection to the watercourse adjacent to Briary Cottage, south of the site, is likely to present the most suitable solution for draining surface water runoff from the proposed development. A desktop study has been undertaken using aerial imagery and topographic LIDAR, and concludes that the watercourse adjacent to Briary Cottage appears to continue south through a caravan park, before turning east and linking up with a larger network of ditches, that are assumed to drain to a watercourse located adjacent to Somerley lane, as seen in Figure 1 (below).

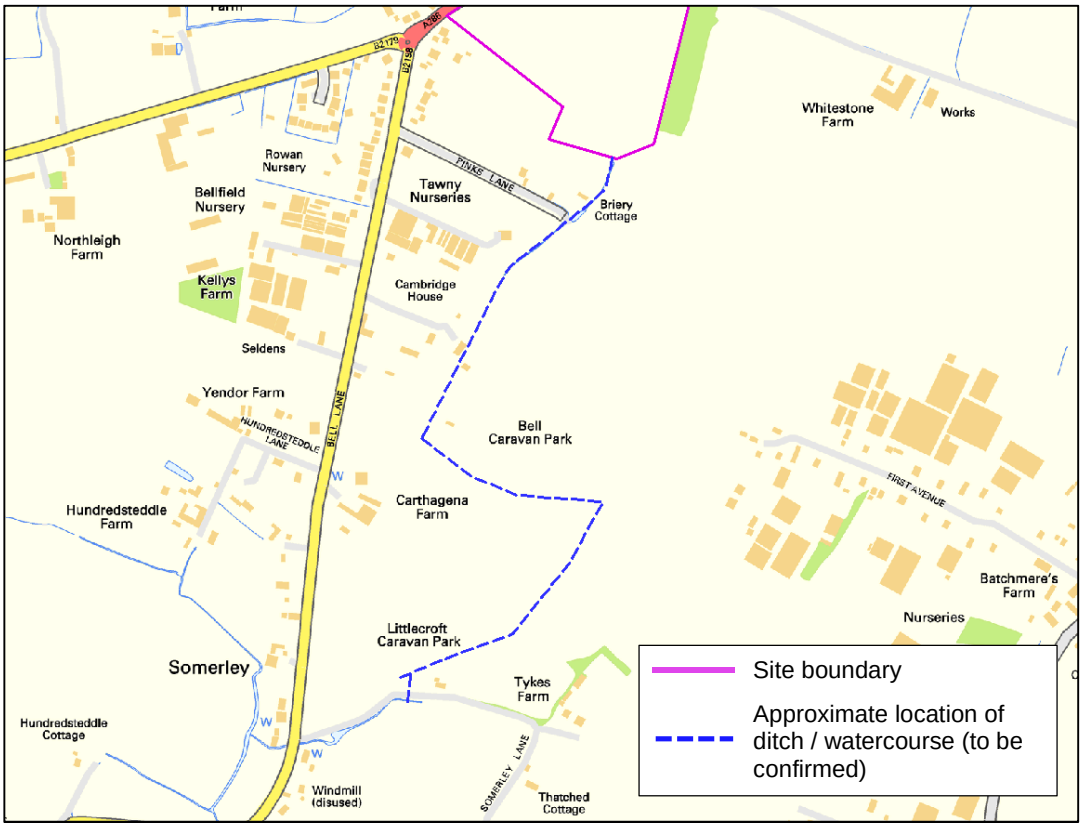


*Figure 2 – Assumed connectivity between the watercourse at Briary Cottage and wider drainage network.*

Prior to the submission of a planning application for the development, the onward connectivity of the ditch network and watercourses to the south of the site will need to be confirmed and if onward connectivity is not available, agreements for new connection across 3rd party land, may be required.

*Connection to the Public Sewer System* – Asset location mapping provided by Southern Water suggests that the sewers in this area are designated for foul effluent only. Whilst a surface water connection to the foul sewer system can sometimes be accepted in this case there is a more preferential solution for managing surface water runoff from the development is available, a surface water connection to the public sewer system is unlikely to be acceptable to the sewerage undertaker (Southern Water).

### *Constraints and Further Considerations*

There are several potential constraints that should be considered as part of the drainage strategy. The key constraints that are relevant to this development are listed below:

- The field between the northern and southern parcels of land is outside of the landlord's land ownership. As a result, it may be difficult to drain the northern parcel of land to the watercourse located south of the site.

- The proposed development and drainage system should take into consideration the existing onsite drainage network and make sure any changes to the existing drainage network do not increase the risk of flooding at Whitestone Farm cottages or within the surrounding area.

- As the site is relatively flat, a traditional gravity piped drainage system may not be achievable without undertaking land raising across parts of the site. To minimise land alterations SuDS such as swales, filter strips, and permeable paving could be proposed.

- Where possible, water should be integrated into the open environment, this can include SuDS such as swales and ponds located within green corridors through the site.

- The landscape and ecological reports for the development both recommend the use of green roofs and/or walls. The use of green roofs or walls is unlikely to provide a significant reduction in the amount of stormwater storage that is required to manage runoff from the development. Nevertheless, these features can provide benefits in the form of improvements to the quality of water discharged offsite and would help the development to meet the requirements of local planning policy.

- If ground conditions permit, the existing pump and pipe should be replaced with an open ditch and drainage system which operates under gravity, in line with S12 of the NTSS. Care should be taken to ensure that opening the culvert does not increase the risk of flooding at Whitestone Farm cottages.

### *SuDS Options*

A range of typical SuDS that can be used to manage surface water runoff and improve the environmental impact of a development is listed in Table 3 (below) along with the relative benefits of each feature and the appropriateness for the subject site.

| SuDS | Environ-mental benefits | Water quality improvement | Suitability for low permeability soils (k<10-6) | Ground-water recharge | Suitable for small/ confined sites? | Site-specific restrictions | Appropriate for subject site? |
|---|---|---|---|---|---|---|---|
| Wetlands | ✓ | ✓ | ✓ | x | x | None | Yes |
| Retention ponds | ✓ | ✓ | ✓ | x | x | None | Yes |
| Detention basins | ✓ | ✓ | ✓ | x | x | None | Yes |
| Infiltration basins | ✓ | ✓ | x | ✓ | x | Likley high groundwater and poor infiltration | To be confirmed |
| Soakaways | x | ✓ | x | ✓ | ✓ | Likley high groundwater and poor infiltration | To be confirmed |
| Underground storage | x | x | ✓ | x | ✓ | The site is relatively flat and as such deep underground storage systems may be difficult to implement | Yes |
| Swales | ✓ | ✓ | ✓ | ✓ | x | None | Yes |
| Filter strips | ✓ | ✓ | ✓ | ✓ | x | None | Yes |
| Rainwater harvesting | x | ✓ | ✓ | ✓ | ✓ | None | Yes |
| Permeable paving | x | ✓ | ✓ | ✓ | ✓ | Yes (infiltration may be restricted). | Yes |
| Water butts | ✓ | x | ✓ | x | ✓ | None | Yes |
| Green roofs | ✓ | ✓ | ✓ | x | ✓ | Dependant on proposed roof construction | Unknown |

*Table 3 – Suitability of SuDS.*

From the table above, it is evident that a wide range of SuDS are potentially viable for use at this site and an outline surface water drainage strategy has therefore been proposed based on the use of a combination of SuDS.

***Outline Surface Water Drainage Strategy***

Using FEH point data, calculations have been undertaken to determine the volume of storage required for stormwater at the site. To ensure long term storage for stormwater is provided, it is assumed that the rate of surface water runoff will be discharged offsite post development will need to be restricted to the greenfield runoff rate for the 1 in 1 year return period rainfall event (i.e. ~18l/s). A summary of these calculations is provided in Table 4 below.

| Parameter | Value |
|---|---|
| Area draining to SuDS | ~ 3.66 ha |
| Type of SuDS (Assumed) | Pond / Wetland area |
| Percentage of impermeable surfacing within area draining to SuDS | ~ 55% |
| Suitable CV value based on assumed impermeable percentage | 0.84 (winter)<br>0.75 (summer) |
| Peak rate that runoff is permitted to discharge offsite (i.e. greenfield runoff rate under the 1:1 year return period rainfall event). | 18l/s |
| Maximum fluctuation in water levels within pond/wetland area during the design rainfall event (1:100+CC) | 500 mm |
| Total volume of storage required | ~ 2500m$^3$ |

*Table 4 – Summary of drainage calculations showing the required storage for stormwater.*

Figure 3 shows where the storage for surface water runoff could potentially be situated on-site. This plan also shows several green corridors and the area where development would be best suited based on the flood risk and drainage constraints.

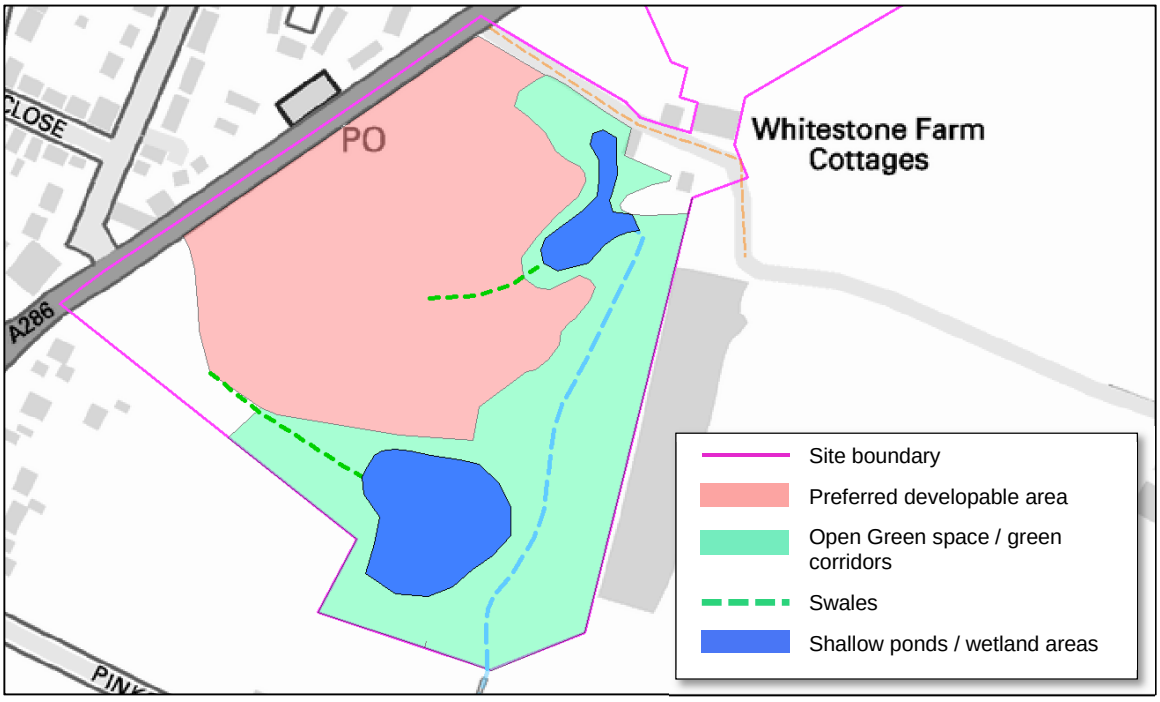


*Figure 3 – Indicative plan showing areas for utilising SuDS.*

The above plan assumes the use of large ponds or wetland areas. However, as a wide range of SuDS are potentially suitable for this site alternative options could be used. Some of these options are discussed in further detail below, and should be considered for inclusion within the scheme layout as it is developed;

- Swales could be located throughout the development, adjacent to roads or within green corridors through the centre of the site. Rills and small channels may also be suitable in the denser parts of the site where space for large swales may not be available.

- Runoff from small areas of roof or hardstanding such as garages, sheds, and paths could be drained into bioretention features such as rain gardens, these features could overflow into swales or the underground piped drainage network.

- Some hardstanding surfaces such as driveways, patios or roads could be made permeable. These permeable areas can intercept rainfall and hold this water within a porous sub-base that underlies the surface of the hardstanding. It is recognised that the use of permeable surfacing may restrict which roads within the development can be adopted and therefore may not be suitable for use across all hardstanding surfaces at the site.

- Green roofs and/or walls could be used for buildings which can support their inclusion. The use of green roofs and/or walls would help to intercept small volumes of water from frequent low intensity rainfall events (i.e. the 5mm rainfall event) and could also provide benefits to the quality of water discharged offsite.

#### *Surface Water Management Summary*

There are a wide range of SuDS which are suitable for the site and could be used to integrate water into the development. The benefits these SuDS provide can go beyond just providing stormwater management and these additional benefits should be considered within the drainage design for the development. Notwithstanding this, it is evident that a sufficient volume of water can be accommodated onsite to allow the rate runoff discharged offsite to be restricted in a way which matches the greenfield site conditions.

### *Foul Water Drainage Strategy*

In addition to managing surface water runoff from the development site, there will also be a requirement to ensure foul effluent can be drained from the proposed dwellings in a safe and sustainable way.

In general, there are two methods for draining effluent from proposed developments. The preferred solution is a connection to the public sewer network, which is controlled by the sewerage undertaker. Nonetheless, if there are no sewers near to the development site, then the use of package treatment systems or cesspits is permitted.

The Environment Agency (EA) control the use of package treatment systems by requiring all developments to connect to the public sewer system if the site boundary is within 30m (plus an additional 30 meters for every proposed unit), from an existing sewer. In this case the proposed development of ~125 units is located near to the existing foul sewers which serve the village of Birdham. As a result, the use of package treatment systems is unlikely to be considered appropriate.

#### *Existing Sewers and Connections*

As the existing site is undeveloped, there are assumed to be no existing connections to the public sewer network. If this is the case, then a new foul drainage connection to the public sewer system will be required.

Asset location sewer mapping has been obtained from Southern Water. This mapping shows several sewers within the village of Birdham to the north and west of the site. An extract from this mapping is shown in Figure 4.

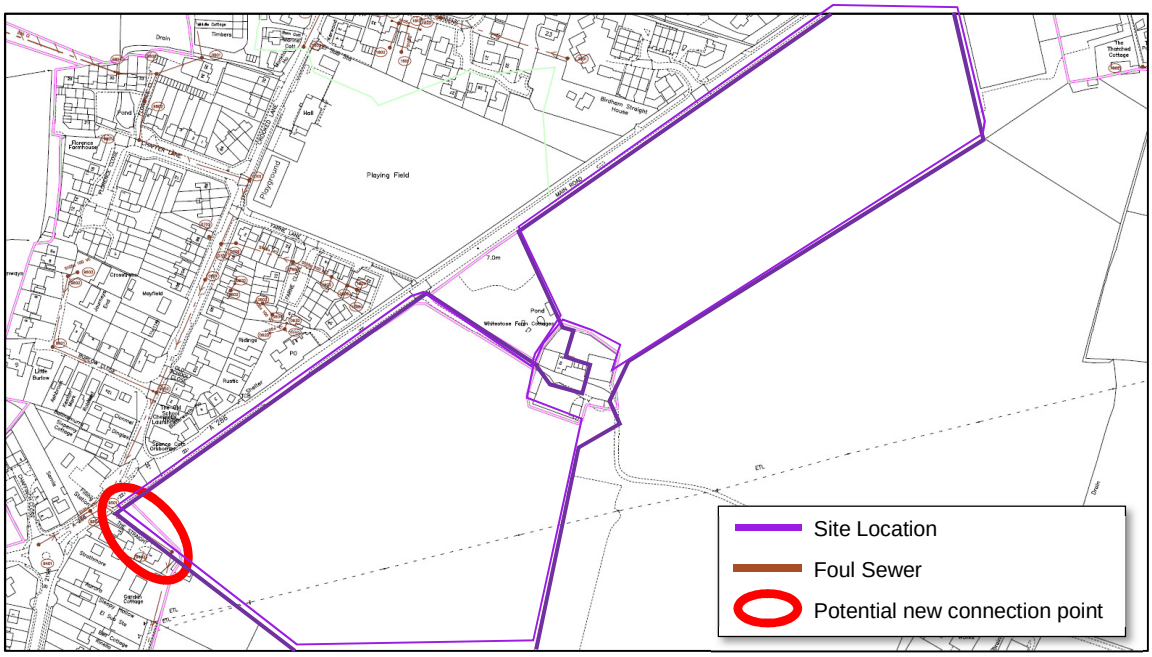


Figure *4 – Extract from asset location mapping provided by Southern Water.*

From Figure 4, it can be seen that there are several existing foul sewers near to the development site. In this instance, the preferred point for a new connection is likely to be at, or near to, manholes 9501 or 9402 which are situated to the south west of the proposed development (as highlighted in Figure 4).

### *Additional Effluent and Existing Sewer Capacity*

If a new foul drainage connection constructed, additional foul effluent will be discharged to the public sewer system. The peak rate effluent will be discharged into these sewers from the proposed development of ~125 residential units has been calculated to be approximately 5.8l/s, using the 4000l/day methodology detailed in Sewers for Adoption Volume 7.

It is recognised that the existing sewerage infrastructure in this area (e.g. pipes, pumping stations, and treatment works) may not have sufficient capacity to accommodate the increase in effluent discharged as a result of the development. It is therefore recommended that a foul water capacity check is carried out to determine the capacity of the existing sewerage infrastructure.

If insufficient sewerage capacity is currently available to serve the proposed development, it will be necessary to upgrade the existing sewers in this area prior to the development being occupied.

### *Water Industry Act*

The Water Industry Act 1991 provides developers with a mechanism for connecting to the public sewerage infrastructure. The type of connection depends on the type and location of the sewers in relation to the site and third-party land.

As part of the Section 98 process it is necessary to determine whether the existing sewer network requires any upgrades to accommodate effluent from the development site. If upgrades to the sewerage system are required these will be requisitioned under the same Section 106 or 98 application.

It is acknowledged that the cost of a new connection and any additional upgrade works can be charged to the developer and that the sewerage undertaker must undertake any works as part of this process within a reasonable timeframe. The LPA should account for the undertakers anticipated timescales when granting planning consent. To reduce the chance of delays, whilst waiting for sewer upgrades. The sewerage undertaker will be consulted as part of the Local Plan process so that they can anticipate and include any necessary upgrades within their forward plan.

***Pumping Stations***

Although the sewers at manholes 9501 and 9402 are relatively deep (~3m below ground), it may still be necessary to lift effluent from the lowest parts of the site into the public sewer system via pumps. If a pumping station is required, it is likely this will need to be constructed in accordance with the guidance provided in Sewers for Adoption 7. If this is the case, a 15m easement for noise and odour pollution will be required around the pumping station and offline emergency storage will also need to be provided. The potential need to include a foul water pumping station should be considered further throughout the masterplanning phase.

***Conclusions and Recommendations***

It has been identified that the majority of the site is not exposed to any significant risk of flooding form any sources. It is only during an extreme pluvial event that localised surface water flooding could occur and the existing pumping station on site could potentially fail.

It has been demonstrated that the risk is limited to surface water runoff from the site which accumulates within natural topographic depressions on site. Nevertheless, by incorporating SuDS into the design of the scheme, it will be possible to manage and reduce the risk of surface water runoff and thus, ensure that the risk is not increased onsite or offsite.

To minimise the likelihood of the pumping station failing, it is recommended that the existing culvert is replaced with an open watercourse where possible. In addition, the sequential approach should be adopted and only SuDS should be located within the lower-lying areas to the south. All residential development should be located on the higher ground towards Main Road as shown in Figure 3.

In conclusion, the scheme for ~ 125 units will be viable and meet the planning requirements providing that the recommendations outlined below are followed:

- It is recommended that site investigations are undertaken to determine in the area where the ponds have been infilled historically. The results should be used to determine whether flooding observed at the site is a result of surface water runoff or groundwater emergence.

- The impacts of replacing the pump and pipe which currently drain the fields across the site with open water features i.e. ponds and a watercourse will need to be assessed in detail to determine if doing so will decrease the risk of flooding at the site and or within the surrounding area.

- The drainage strategy for the development will need to be developed for the site. The strategy should be designed to meet the requirements of the National Technical Standards for SuDS and Local Planning Policy.

- It is recommended that site investigations are undertaken at the site, including infiltration testing, contamination testing, and groundwater testing to confirm whether infiltration SuDS are viable.

- Sufficient space should be allocated within the development, for SuDS which promote biodiversity, such as ponds, swales, detention basins etc.

- It is recommended that the sewerage undertaker (Southern Water) is consulted with regards to the capacity of the existing foul sewer system in this area.