CPLC Water and Environment
Water and Environmental Engineering Consultancy

WANBOROUGH FLOOD AND DRAINAGE MANAGEMENT REPORT

Wanborough, Swindon, Wiltshire

Revised Report: February 2011

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1. Introduction

1.1 Background

This document has been prepared by CPLC Water and Environment Ltd, for Wanborough Parish Council (WPC) and the residents of Wanborough in relation to drainage and the history of flooding experienced throughout the village.

This Flood and drainage management report is conducted in support of an overall plan to improve the existing drainage throughout the parish and reduce the risk of any further flooding to properties in and around the village. This report aims to highlight the flood prone areas identify the reasons for flooding and provide potential solution options. The resolutions to the flooding will involve a combined contribution from local farmers and other private landowners, the Environment Agency (EA), Swindon Borough Council (SBC), Thames Water and Highways Agency. Furthermore, the ongoing future management and maintenance of the drainage systems will involve all parties and a schedule of maintenance works should also be considered.

1.2 Requirements for a Flood Management Report

The requirements for SWMPs are provided in "Planning Policy Statement Note 25: Development and Flood Risk" (PPS25)

These Guidance Notes are:

SWMPs And how they integrate into the planning system

5.33 Opportunities for local authorities and the other key stakeholders to develop surface water management plans (SWMPs) are also being explored by Government as part of the Water Strategy *Future Water* (Defra 2008).SWMPs have an important role in developing a coordinated strategic approach to managing surface water drainage and reducing flood risk.

They should reflect the future proposals of all key stakeholders and provide a clear delivery plan. They may also provide a way to integrate the requirements of forthcoming River Basin Management Plans (RBMP) into development planning. SWMPs should focus on managing flood risk and optimising the provision of SUDS.

5.34 Paragraph 6 of PPS25 encourages LPAs to prepare a SWMP to help reduce the impacts of flooding through new development. SWMPs will build on Strategic Flood Risk Assessments(SFRAs), Catchment Flood Management Plans, Shoreline Management Plans and River Basin Management Plans, and will aim to provide cost-beneficial solutions for the areas at greatest risk of surface water flooding.

Planners at the strategic and development control levels can then develop strategies to ensure effective surface water management in the future. SWMPs should inform the preparation by LPAs of their Core Strategy documents. In this way Core Strategies should include appropriate policies on flooding and surface water drainage. Core Strategy development plan documents may be found unsound at public examination if flooding and drainage issues have not been properly addressed. SWMPs do not form part of the statutory spatial planning system, but have important links with it. Figure 5.6 sets out the relationship between these plans and documents.

SWMPs and SFRAs also have close links to water cycle strategies. In areas of high housing growth, water cycle studies and water cycle strategies will play important roles in developing a programme for enabling the required improvements to water services infrastructure to be provided. Figure 5.7 sets out the links between these plans and documents.

Core Strategies currently being implemented by local authorities include surface water management plans and flood management plans.

SURFACE WATER MANAGEMENT PLANS: PURPOSE AND OUTCOMES

5.37 Defra's Water Strategy identifies the key purposes of a SWMP as:

- ensuring that allocations within an area are properly supported by adequate surface water management;

- providing a common framework for stakeholders to agree responsibilities for tackling existing drainage problems and preventing future problems; where development pressures are high it can be part of a Water Cycle Strategy; and

• demonstrating how capital investment, infrastructure and maintenance can deliver the required surface water management.

5.38 It is envisaged that SWMPs should:

• be developed in a partnership of all relevant stakeholders for surface water management in which all data is shared and responsibilities are clarified;

• map and quantify current and future surface water flood risks which will apply to existing as well as new development;

• influence planning policy so that new development is directed away from areas of high surface water flood risk (sequential approach, PPS25 paragraphs 14 and 15), or to ensure that flood risk can be managed effectively (making development safe without increasing flood risk and where possible reducing it overall (paragraph 5, PPS25));

• Master plan the provision of drainage for new development e.g. through planning of strategic SUDS or similar;

• contain a prioritised delivery plan that comprises a coordinated series of investments in infrastructure (or operations and maintenance) that can be proven to be the most cost beneficial means of reducing flood risk for new and existing development; and

• be reviewed periodically to update delivery plans in the light of new or improved information.

(Source Halcrow, 2008 Work in Progress)

5.39 Local authorities will need to work with the Environment Agency and other stakeholders (such as sewerage undertakers, their own drainage and emergency planning staff, highways authorities and neighbouring authorities), in the preparation of these plans.

5.40 Whilst provision of new surface water infrastructure is seen as being delivered principally by developers, the plans will avoid decisions being taken on a site-by-site basis and will provide a stronger strategic framework for developers and designers to work within.

5.41 Defra's research project *Urban Flood Risk and Integrated Drainage* is considering the potential contribution that integrated urban drainage management can make to sustainable surface water drainage. A scoping report has been produced and pilot studies are currently underway.

5.42 The findings of the Integrated Urban Drainage projects has informed the development of Defra's *Water Strategy* and the next stage of the project will be to produce a practice guide specifically aimed at providing detailed guidance on SWMPs – this is due for publication in Autumn 2008.

SITE-SPECIFIC SURFACE WATER MANAGEMENT

5.43 Surface water management issues should be covered in a site-specific FRA (see chapter 3 PPS25 and the FRA pro-forma, appendix C) to accompany a planning application. Surface water management is a material planning consideration and a key component of design, and will need to be considered at the earliest possible stage in the planning and design process, in consultation with the LPA, sewerage undertakers, Environment Agency and other relevant bodies.

5.44 The first point of reference for a site drainage or surface water management strategy for a new development site should be policies in LDDs and Supplementary Planning Documents (SPDs), and any site-specific guidance within the SFRA or SWMP. The key requirements for new development are outlined below.

SITE DRAINAGE WITHIN A DEVELOPMENT

5.45 The FRA accompanying the planning application should show how surface water management is functioning on the site at present and how it is to be undertaken in the new development. Drainage of rainwater from the roofs of buildings and paved areas around buildings should comply with the 2002 amendment to Approved Document H – *Drainage and waste disposal*, of the Building Regulations (BR part H).Development should comply with the Building Regulations Part C, *Resistance to moisture and weather*, with regard to maintaining the integrity of existing land drainage arrangements on development sites.

5.46 All sewers that will subsequently be adopted by the sewerage undertaker must be designed and built in accordance with the requirements of Sewers for Adoption, Edition 6 (WRc 2006). This document provides guidance on suitable return periods for use in the design of sewerage systems for various development types. In general terms, sewers should be designed to ensure that no flooding occurs above ground level for events with a return-period of 30 years.

1.3 Consultation

In preparing this flood management report, consultation has been undertaken with the Environment Agency, Swindon Borough Council regarding its requirements, proposals and the extent of available information on flood risk throughout the parish. Its views were also sought on the likely mechanisms of flooding, the surface runoff implications and any control measures it considers might be required in accordance with the requirements of PPS25.

Information was also received from Thames Water about the existing foul and surface water drainage system and the Highways Agency via WSP Civils and Mouchel Parkman regarding the drainage of the A419 Commonhead Junction.

The Parish Council and the residents of Wanborough provided a great deal of background information on historic and recent flooding events. This formed the initial basis of the report and provided a platform for the investigation into the catchment hydraulics and existing drainage problem areas.

1.4 Roles and Responsibilities

THE HIGHWAYS AUTHORITIES

Local highways authorities have responsibility for managing road drainage from roads on the local road network, in so far as ensuring that drains which are their responsibility are maintained. The Highways Agency is responsible for managing road drainage from the trunk road network in England, including the slip roads to and from trunk roads.

SEWERAGE UNDERTAKERS

Sewage undertakers are generally responsible for surface water drainage from development via adopted sewers and in some instances SuDS. They should ensure that Urban drainage Plans reflect the appropriate Regional Spatial Strategies (RSS's) and local development documents (LDDs) in line with their obligations in the current legislation and their Asset Management Plans (AMPs).

THE INSURANCE INDUSTRY

Developments at risk of flooding may increasingly face difficulties with the cost or availability of insurance. This, in turn, could cause problems for property buyers in obtaining mortgages. In extreme cases, properties might remain unsold, leading to blight. The Association of British Insurers and the Council of Mortgage Lenders will comment on individual proposals on which the EA object and where there appears to be a high risk. Those proposing development, especially speculative investment, are advised to consult ABI guidance at an early stage in order to understand the insurance industries concerns. The insurance industry may wish to seek to reduce the risk exposure by making appropriate representations about proposals for the location of new development during the preparation of development plans.

THE COMMUNITY

Community involvement is an essential element in delivering sustainable development and creating sustainable and safe communities. The Planning and Compulsory Purchase Act 2004 regional planning bodies and local planning authorities to prepare a statement of Community Involvement, in which they set out their policy on involving their community in preparing RSSs and LDDs and on consulting on planning applications. This should include community engagement on flood risk issues across the wide range of stakeholders including those mentioned above and community groups.

OPERATING AUTHORITIES

An operating authority is anybody, including the EA, LPAs and Internal Drainage Boards (IDBs) which has power to make or maintain works for the drainage of land.

The Environment Agency

The EA was established by the Environment Act 1995 and is a non-Departmental Public Body of Defra. It is the principal flood defence operating authority in England. Under the Water Resources Act 1991, the EA has permissive powers for the management of flood risk arising from designated Main Rivers and the sea. The EA is also responsible for flood forecasting and flood warning dissemination, and for exercising a general supervision over matters relating to flood defence.

The EA is required to arrange for all its flood defence functions (except financial ones) to be carried out by Regional Flood Defence Committees (RFDCs) under s106 of the Water Resources Act 1991. In order to carry out these functions, the EA through RFDCs has various statutory powers including the following:

- To maintain or improve any watercourse which are designated as main rivers;
- To maintain or improve any sea or tidal defence;
- To install and operate flood warning equipment;
- To control actions by riparian owners and occupiers which might interfere with the free flow of watercourses; and
- To supervise internal drainage boards

The RDFCs are required to take an interest in all flood matters in their area and in particular to take decisions about the annual programmes of improvement and maintenance work to be carried out by the Environment Agency.

Local Authorities

Local Authorities have certain permissive powers to undertake Flood defence works under the Land Drainage Act 1991 on watercourses which have not been designated as Main River and which are not within Internal Drainage Board areas. There are also over 80 maritime district councils which have powers to protect land against coastal erosion under the Coastal Protection Act 1949. Local authorities can control the culverting of watercourses under s263 of the Public Health Act 1936

Internal Drainage Boards

Internal Drainage Boards (IDBs) are independent bodies, created under various statutes to manage land drainage in areas of special drainage need. These areas include not only agricultural land but also large urban areas. There are over 100 boards in England, concentrated in lowland areas of East Anglia, Somerset, Yorkshire and Lincolnshire. Each board operates within a defined area in which they have permissive powers under the Land Drainage Act 1991 to undertake flood defence works, other than on watercourses that have been designated as 'Main'.

2. Wanborough Baseline Environmental Conditions

2.1 Location and Topography

Wanborough is located east of Swindon, just off Junction 15 of the M4 motorway Figure 2.1.

The village is divided into two parts by a steep hill, the parts being known, not surprisingly, as Upper Wanborough and Lower Wanborough,

Upper Wanborough is about 200 metres above sea level (although the parish extends much further south and rises to 280 metres); the further north end of Lower Wanborough is around 100 metres. The lowest part of the parish, in the north and north-west, was marked on old maps as Wanborough Marsh; with good reason as much of this area is floodplain for River Cole, Dorcan Brook and the Liden Brook; while the highest, largely uninhabited, area in the south was marked as Wanborough Plain.

2.1.1 Catchment Characteristics

The physical characteristics of the village do not suggest that it may be prone to flooding. Much of the developed area is situated on sloping ground between the higher ground in the south south-east and the lower ground up to and beyond the Marsh in the north north-west area. Suggesting the natural runoff effect should allow surface water to fall through the town and out beyond the Marsh and into the river basin area of the River Cole.

Drainage within the urbanised area should facilitate this movement of water, but over time parts of the system may have become lost or neglected and no longer work sufficiently.

Also, recent weather patterns have seen an increase in rainfall events and many older drainage systems are unable to cope with increased flows particularly as urban areas increase in size

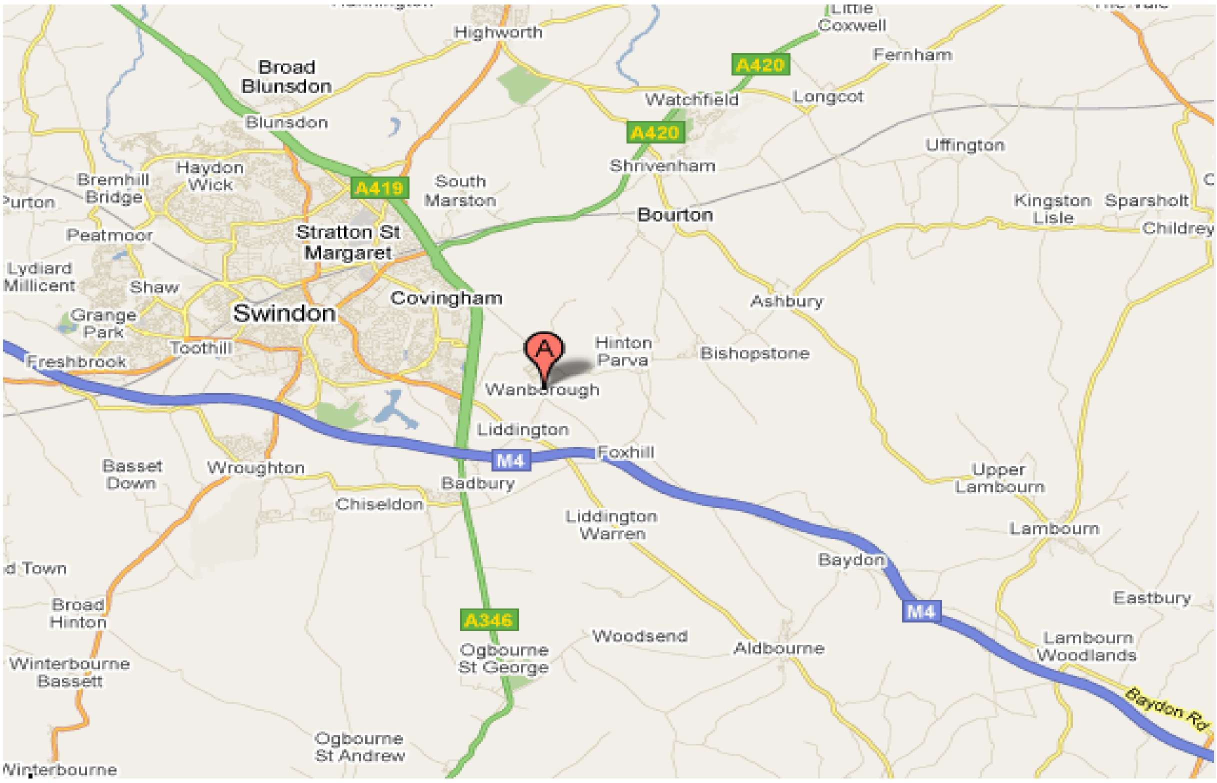

Figure 2.1: Wanborough Location Map

2.2 Hydrology and Flooding

2.2.1 Flooding General

In general, floods that cause significant impacts on large numbers of people are relatively infrequent. The timing of flood events is difficult to predict, as they occur as a result of specific combinations of environmental and meteorological factors. However, the probability that a particular magnitude of flood will occur sometime in the future can be estimated.

It is important that the meaning and implications of flood probability, together with the inherent uncertainties involved with assessing it, are understood by all those involved in the consideration of flood risk.

Until recently it was common practice for flood studies to use the average period between events, expressed as a return period, to describe the probability of a flood event of given magnitude; For example, a flood with a long-term average recurrence interval of 100 years was called a 100 year return period flood. However, it is now generally considered that this concept may be misleading as, after a flood that is deemed to have had a return period of 100 years or more occurs; many may consider it most unlikely that such an event will occur again in their lifetime. The 1990s and early 2000s were a shock to many people in flood affected areas, when a succession of “long return period” (i.e. relatively infrequent) flood events occurred within a few years, or even months, of each other.

It is important to understand that even relatively low probability floods, considered over a long period of time, have a significant likelihood of occurring.

The *Flood Estimation Handbook* (Institute of Hydrology, 1999) gives an equation to estimate the likelihood of a flood of given probability occurring during a specified period. For example, a 1 per cent annual probability flood has a 22 per cent chance of occurring at least once in a 25 year period (the duration of a typical residential mortgage), and a 53 per cent chance of occurring at least once in a 75 year period (a typical human lifetime).

2.2.2 Flooding – processes and consequences

Flooding brought on by heavy rain in a catchment is a natural occurrence and it is unreasonable to expect that, with the resources available to the public sector, it can be entirely prevented. This is one of the reasons why the approach to flooding is risk-based and not one that attempts to deliver absolute protection for people, their property and public infrastructure. It is also why flood risk management is not just about the design, building and maintenance of defence structures. It can include preventative actions such as reducing the source of flood risk through changes in land management or use and avoiding inappropriate development in flood risk areas. It also includes responding to the prediction of flooding by warning those at risk and seeking to build resilience into properties.

Flooding can occur from a number of sources: from rivers and the sea, directly from rainfall on the ground surface, from rising groundwater, and from overwhelmed sewers and drainage systems.

Flooding can also occur when defences are overtopped or breached, where flood water cannot pass rapidly enough down a channel to where a pump is sited, when pumps fail, and often when channels, culverts and bridges are blocked by debris.

Flooding can develop gradually or rapidly according to how fast water runs off the land surface into watercourses and how steeply the ground rises in the catchment. In a large, relatively flat catchment, flood levels will rise slowly and natural floodplains may remain flooded for several days, acting as the natural regulator of the flow. In small steep catchments and heavily-urbanised catchments, intense rainfall locally can result in the rapid onset of flooding with little warning. Such 'flash' flooding, which may only last a few hours, can cause considerable damage and possible threat to life.

Factors which affect the scale and severity of the consequences of flooding include the:

- Origin and mechanism of flooding.
- Duration of flooding.
- Rate of onset of flooding.
- Rate of rise of flood water.
- Depth and velocity of flood waters.
- Presence or absence of debris in the flood water.
- Degree to which people and or assets are exposed to the flood water.
- Extent and vulnerability of the people and properties affected.

For floodplain wetlands, flooding has to be considered as part of a natural and essential process that maintains their wetland status. The plant and animal communities of these wetlands have evolved partly in response to that flooding and now depend upon regular cycles of inundation and drying.

In most cases, floodplain plant and animal communities have evolved with regular winter flooding and gradual drying during the spring and summer. The winter flooding is essential to provide water to the system and it also provides an element of dynamism and change. The flooding moves seeds and other plant propagules around the system, and through erosion or sediment deposition creates areas of bare mud and shingle for plant and animal colonisation. In some cases the flood flows can be strong enough to uproot and remove shrubs and trees, setting back the process of vegetation succession that would otherwise lead to an open floodplain becoming floodplain woodland.

Flooding can have adverse effects on nature conservation interests and these arise under specific circumstances, including:

- The season of the flooding – summer floods can wash away nests and for some birds this will be the end to their only breeding attempt that year.
- The duration of flooding – extended flooding in warm weather can lead to de-oxygenation of the water and the risk of fish kills on site or when the flood water is pumped back into a river.
- The nutrient content of the water – nutrients deposited by flooding can raise soil nutrient levels leading to changes in the vegetation, frequently an increased dominance of robust grasses over rarer flowering plants.
- The sediment content of the water – erosion of channel banks and adjacent land introduces sediment within the system, which is then redistributed. This can both create new habitat and damage existing habitat.
- The presence of invasive species – flooding can spread plants and animals from one part of the drainage area to another, e.g. fish fry, seeds and other plant propagules.

2.2.3 Watercourses

MAIN RIVER

There are 3 main rivers within the Wanborough parish; Liden Brook, who's source is located high in the Wanborough Plain to the south, is the closest to any residential areas (Moorleaze and The Marsh); this flows south to north and bounds the eastern fringe of the A419 up to the Liden Lagoon then continues to flow north until it confluences with the River Cole. The Dorcan Brook which just fringes the north-west corner of the Wanborough parish area has its source located close to Coate Water Country Park and continues on from where the River Ray ends; this again flows in a northerly direction from the Dorcan area of Swindon until it also confluences with the River Cole, Appendix A.

LAND DRAINS AND DITCHES

Due to the topography surrounding the village and the abundance of springs these play a major role within the drainage system. Not only do they collect surface water from the land, but are also utilised by highway drainage and Thames Water surface water sewers

The main carriers flow north-westerly and working from west to east include 1] Inlands farm/Calder Vale (water from Upper Wanborough/Pack Hill area); it is considered however, that some of this water would have naturally flowed towards Moorleaze into the Liden Brook. 2] Another main carrier from Underdown Farm merges with King's Lane ditch and drains land between Kite Hill and Upper Wanborough area and flows beneath The Marsh road via a culvert passed The Marsh Cottage and continues north-eastwards through Lake Cottage and Moat Cottage into the Liden Brook. 3] This main carrier drains Kite Hill and possibly some of Upper Wanborough also. It should continue to flow through Green Lane, across The Marsh road and through Wanborough Marsh via Wrights Bridge and Wansdyke into the Liden Brook. However, some of this water now takes a longer route westwards via roadside ditches and again discharges through The Marsh. 4] Stacey's Lane seems to follow a natural drainage path, but evidence of a carrier ditch has disappeared through development. However, a ditch re-emerges at Rotten Row adjacent to College Green which continues to flow towards Burycroft, where it then discharges into a culvert adjacent to no's 10 and 11 Burycroft it then re-emerges downstream of The Beaks as open watercourse and continues to flow north-west to the Liden Brook. 5] Springlines, now intercepted by a residential estate can be split into 2 ditch systems. The main one flows from the B4507, down the west boundary of Springlines residential area to Beanlands where it is then lost in the Thames Water surface water sewers. However, the main ditch would have continued across Beanlands, Avenell Road through Kimbers Field and Yonder Way and joined with the existing ditch on the east boundary of Hooper's Field. The ditch would then have continued across Burycroft between no.4 and the Public House, northwards to the Liden Brook. 6] The remaining ditch from Springlines would have flowed through Chapel Lane via The Warrens, continued alongside the playing fields to Rotten Row where the only remaining evidence of the drain is visible close to the bus shelter. From here it will have joined with a ditch that flowed along Wanborough Road. 7] Callas Hill/ High Street would have been a drain that joined with Wanborough Road and; 8] there is also the existing land drains that flow through Horpit.

Many of these ditches are in poor condition and require improvements however, this operation requires careful planning to minimise the risk of flooding to downstream areas, plans highlighting drainage and ditches throughout the Wanborough area can be viewed in Appendix B.

2.2.4 Local Hydraulics and Flood Risk

The Flood Estimation Handbook shows that Wanborough is situated within the Liden Brook catchment area (Figure 2.2). This is a fairly large and steep catchment of approximately 14.09 square kilometres, taking in the high ground to the south of Liddington and Wanborough. A number of surrounding villages drain into the Liden Brook including parts of Coate and Dorcan areas of Swindon, which drain via the Liden Lagoon. Badbury and Liddington drain into the headwaters of the Liden Brook and are close to its source. The village of Wanborough and the Horpit area drain into the downstream reaches of the brook before the brook's confluence with the River Cole.

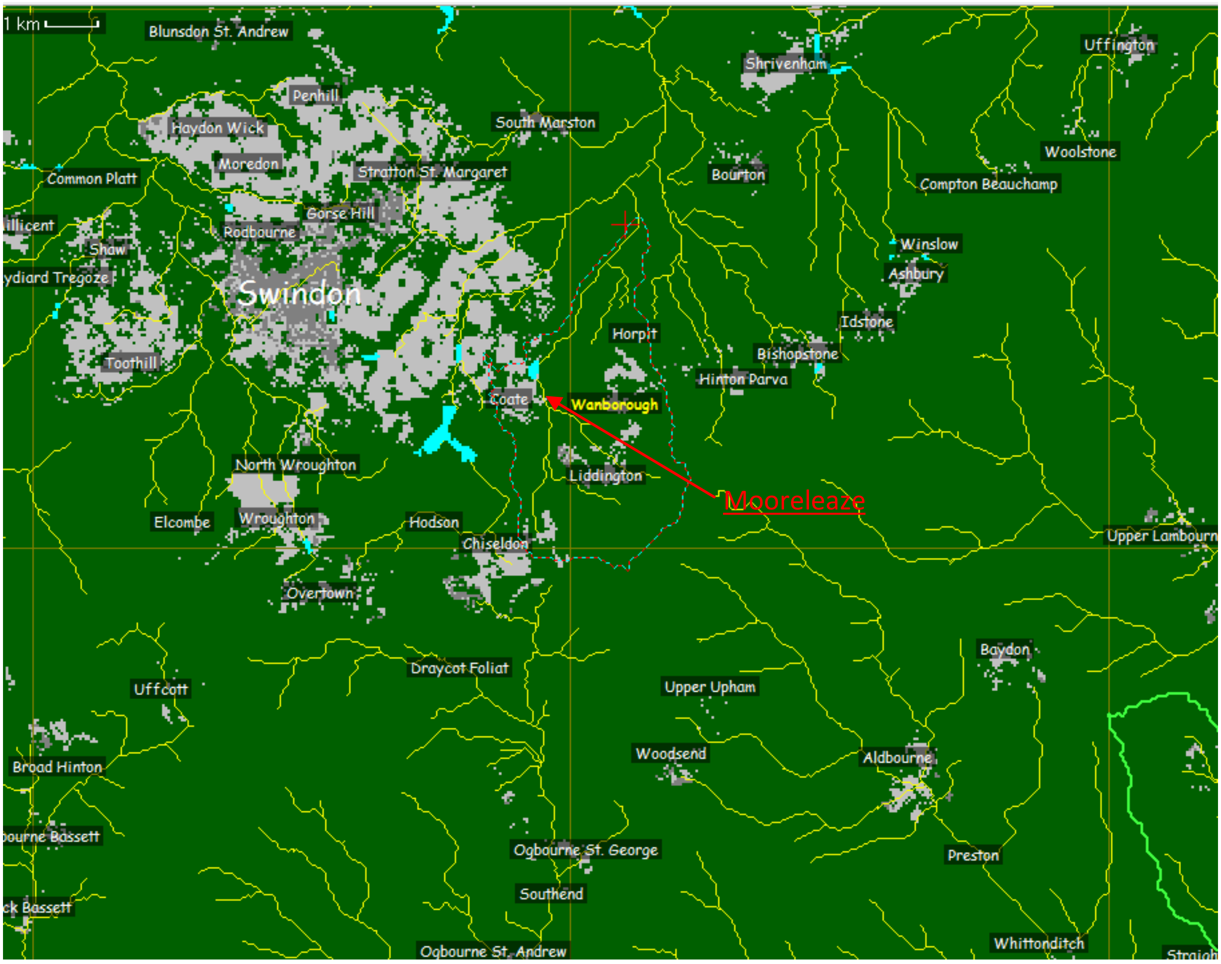

Figure 2.2: Liden Brook FEH Catchment Area

A further study of the Flood Estimation Handbook reveals that the village of Wanborough can be divided into several sub-catchments, all within the Liden Brook catchment. This would allow for a detailed hydrological study of the area if required at a later date. However, a summary of these areas is as follows:

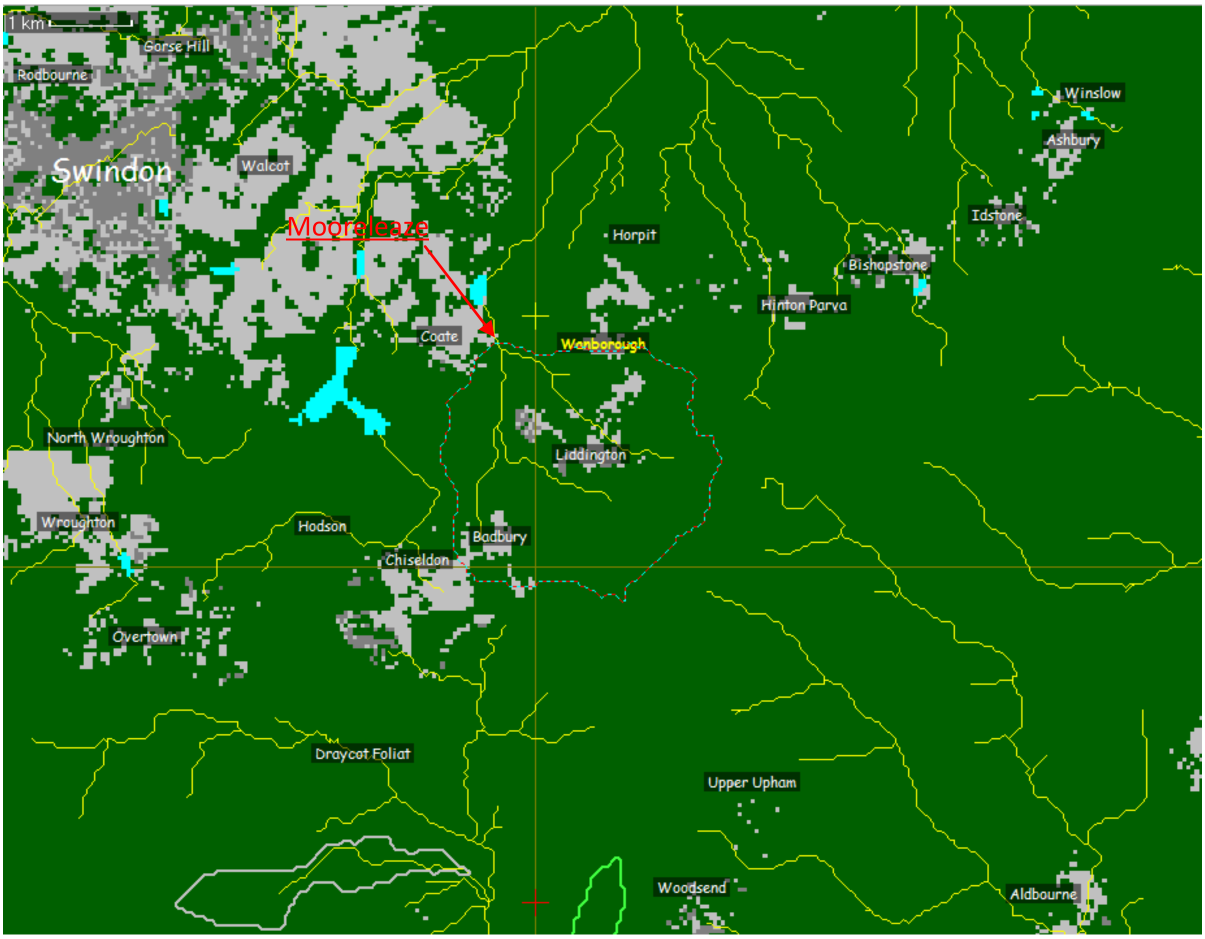

Figure 2.3: Catchment Area-1; for the purpose of this report, we will call this the Mooreleaze catchment, which includes the villages of Lidington and Badbury; and the high ground of the escarpment to the south of the motorway. This is a fairly steep catchment and is approximately 7.5 square kiolmeters. It is assumed a considerable volume of water would flow through this section of the river during extreme rainfall events. Following the flooding events in 2007 and 2008 the EA commissioned a modelling study for the Liden Brook/Liden Lagoon. This study modelled several scenarios for reducing water levels upstream of the lagoon. It concluded that regrading the river bed downstream of the lagoon reduced levels upstream significantly, but this would also reduce levels in the lagoon. Therefore this option was considered non-viable. A copy of the study report is located in Appendix C.

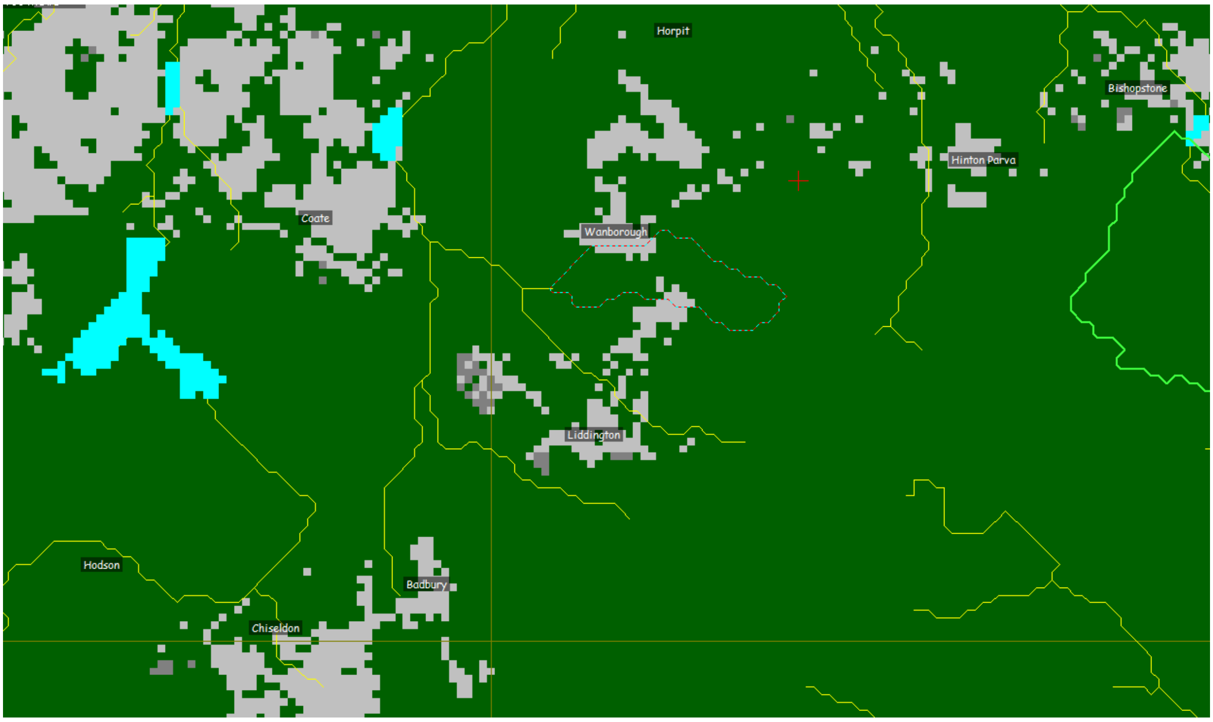

Figure 2.4: Catchment Area-2; The southern part of Upper Wanborough and North Liddington. This area drains into the Liden Brook via land to the south of Pack Hill. Approximate catchment area is 0.51 square kilometers.

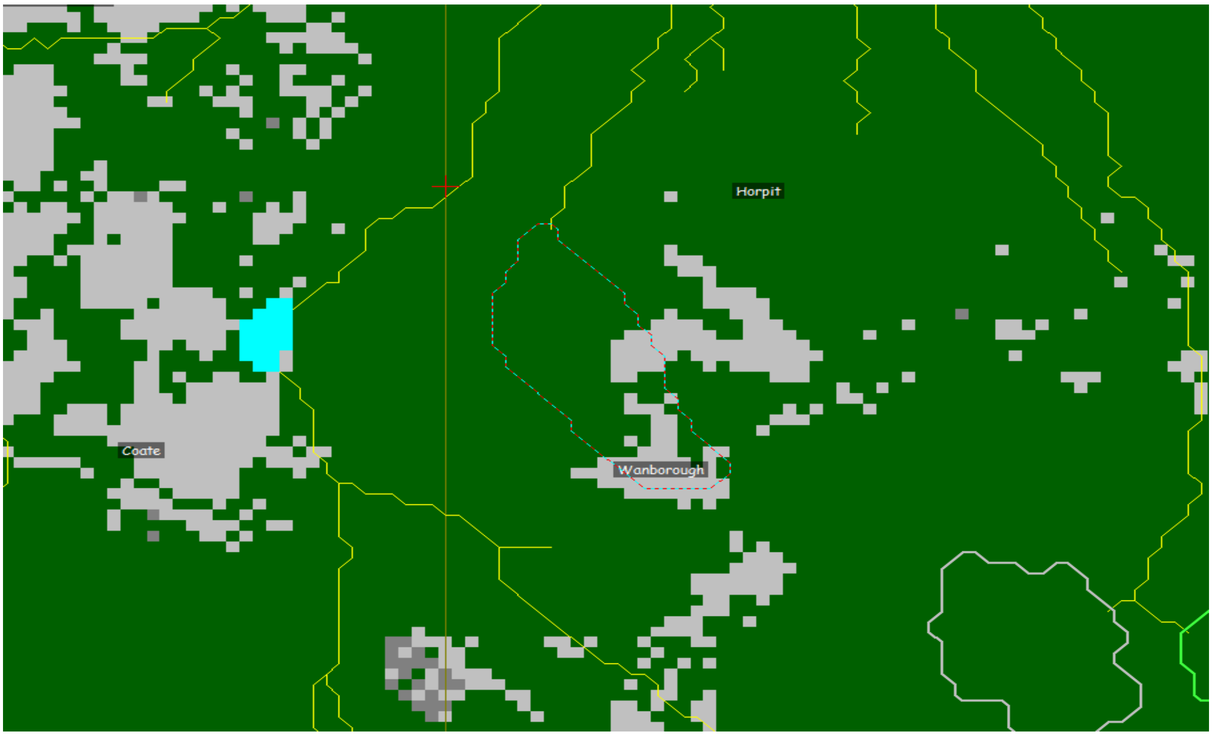

Figure 2.5: Catchment Area-3; Upper Wanborough, Kite Hill. This area drains into the Liden Brook via The Marsh and Calder Vale. Approximate catchment area is 0.77 square kilometers.

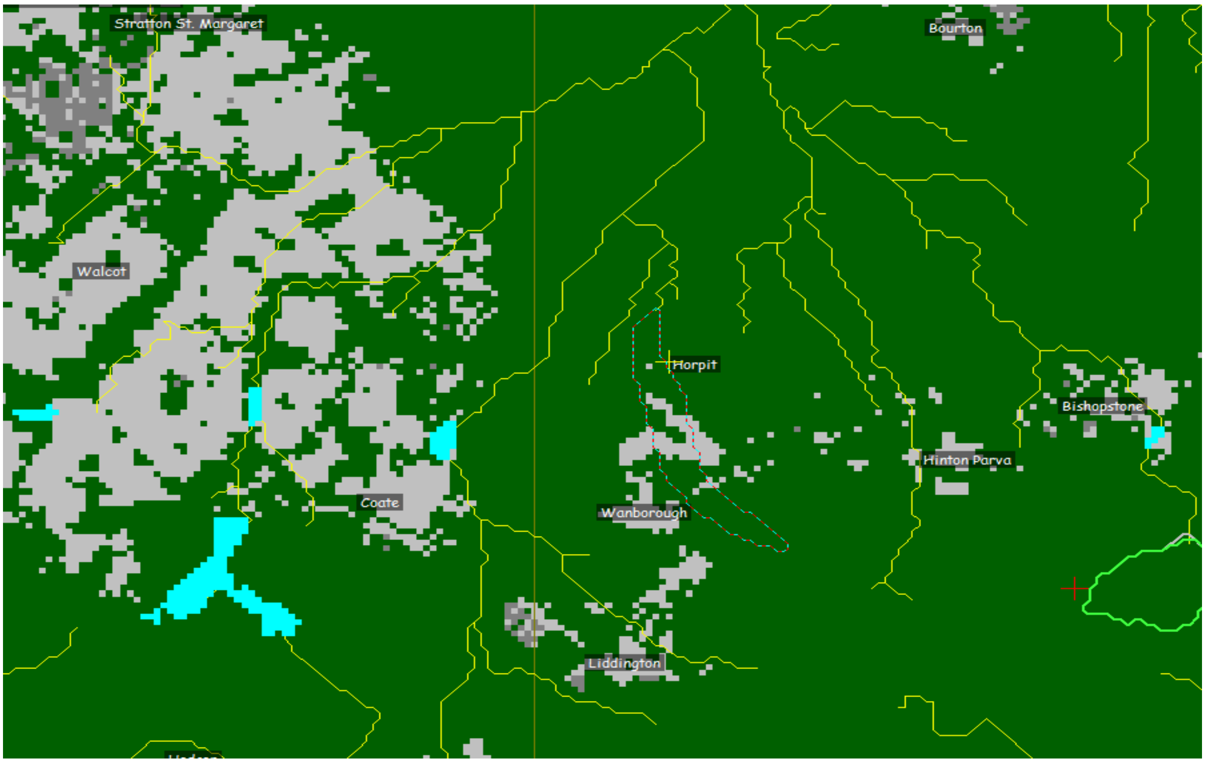

Figure 2.5: Catchment Area-4; Stacey's Lane, Springlines and the central residential area. This area drains into the Liden Brook via Rotten Row, Burycroft and The Marsh. Approximate catchment area is 0.59 square kilometers.

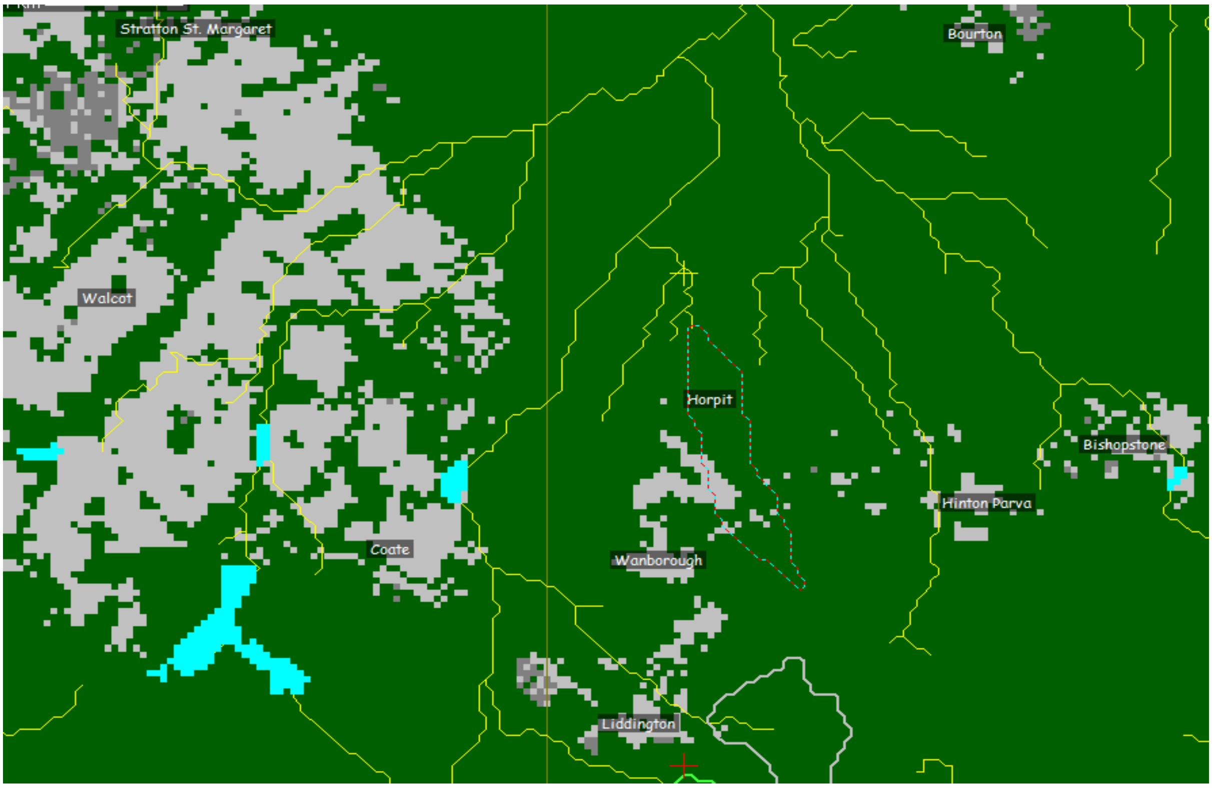

Figure 2.5: Catchment Area-5; Callas Hill, High Street, Horpit. This area drains into the downstream section of Liden Brook via ditches and land drains through Horpit. Approximate catchment area is 0.71 square kilometers.

The FEH catchment descriptors form the foundation of any hydrological study and the parameters will vary slightly for each catchment area within Wanborough. The overall average annual rainfall for Wanborough is approximately 720mm per annum.

Fluvial Flooding

Exceedence of the flow capacity of the channel of a river, stream or other natural watercourse, typically associated with heavy rainfall events. Excess water spills onto the flood plain Coastal and tidal flooding High tides, storm surges and wave action, often in combination Estuarial flooding and watercourses affected by tide locking Often involving high tidal levels and high fluvial flows in combination

The nearest main river is the Liden Brook which flows northwards along the west boundary of Great Moorleaze Farm. Heavy rainfall events of 2007 and 2008 induced high water levels on this section of the river, which caused flooding the Moor Leaze area.

The high water levels in the river combined with poor land drainage as well as poor highway drainage on Pack Hill and the A419 caused some considerable flooding. This has since prompted action from the Environment Agency and local authority Swindon Borough Council who made some improvements to this area, which is covered in more detail in section 3, Area 10 and 11 of this report.

The Environment Agency (EA) published flood map Figure 2.1 shows that the main village area of Wanborough is situated outside the Liden Brook floodplain (Flood Zone 2 and 3) and is therefore not affected by fluvial flooding from the Liden Brook.

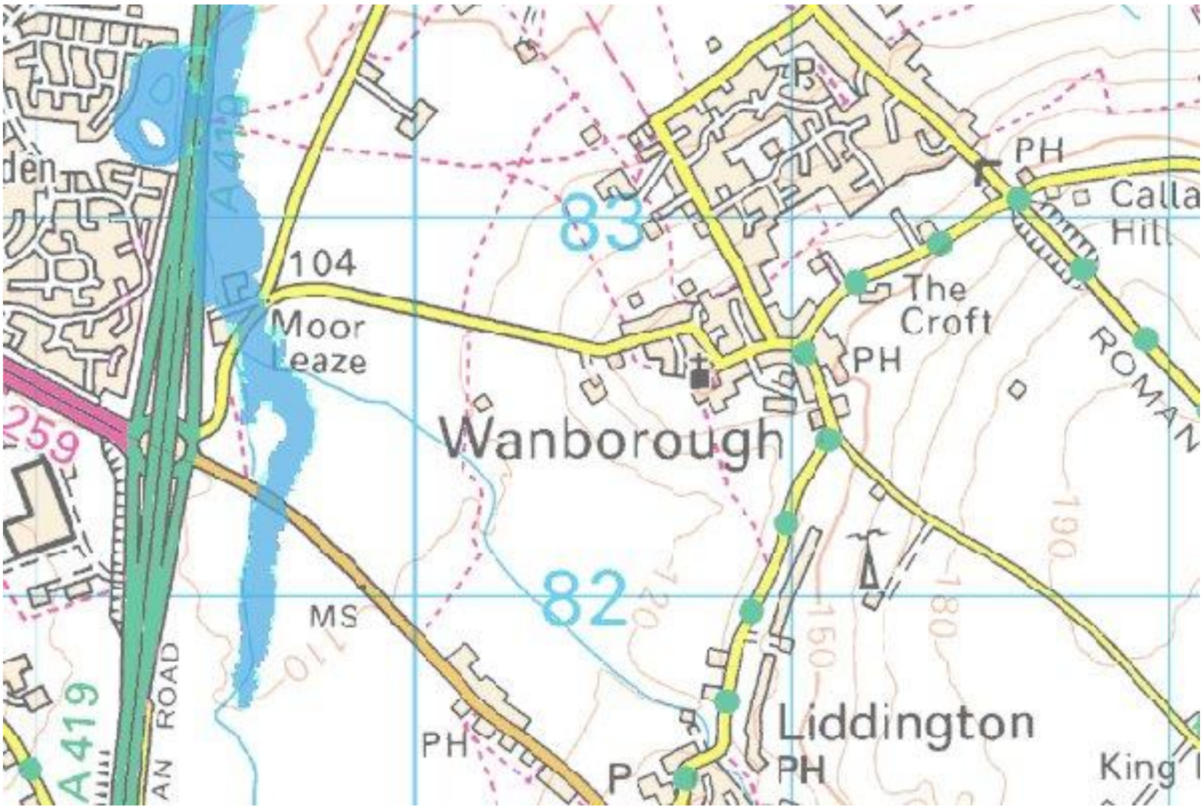

Figure 2.6: Environment Agency Published Flood Zone Map

FLOODING FROM LAND

Overland flow is water flowing over the ground surface that has not entered a natural drainage channel or artificial drainage system (other commonly used terms for this phenomenon are pluvial flooding or surface water runoff flooding). There are records of resulting flood damage in the East and West Midlands of England, the Isle of Wight and Somerset between the 1970s and 1990s (Boardman, 1995). Typically, overland flow can cause localised flooding in natural valley bottoms as normally dry areas become covered in flowing water and in natural low spots where the water may pond. This flooding mechanism can occur almost anywhere, but is likely to be of particular concern in any topographical low spot, or where the pathway for runoff is restricted by terrain or man-made obstructions.

During late June and early July 2003, heavy rainfall resulted in the rapid saturation of hillsides on the periphery of an urban area. Water began to run over the ground surface and was concentrated by walls and highway channels. In places the water overtopped the kerb lines and ran down through paths and gardens, flooding garages and causing problems with entry into buildings. These flows lasted for three days and a second incident occurred only weeks later.

Figure 2.7: Example of overland flow into property

Overland flow is caused when the intensity of rainfall exceeds the infiltration capacity of the surface onto which it falls (infiltration-excess overland flow) or when, during prolonged periods of wet weather, the soil is so saturated such that it cannot accept any more water (saturation-excess overland flow). Developments that include significant impermeable surfaces, such as roads, car parks and roofs, may increase the occurrence of overland flow. Overland flow will tend to occur for a similar period of time as the rainfall event that causes it. However, the flood water may remain for some time after accumulating at the surface in low areas with no significant outlet. This type of flow may occur as sheet flow or, on erodible surfaces, may form rills and gulley's during storm events. Overland flow can also result in so-called "muddy floods" where soil and stones are washed onto roads and into properties.

Overland flow may also occur where water that is flowing through the soil or rock below ground level returns to the surface, where the soil is saturated further down the slope (return flow). This type of overland flow is a form of shallow groundwater flooding and typically occurs at the base of slopes, where the surface gradient changes. This will be for a longer duration than the excess overland flow types as it is fed by water stored in, and running through, the soil from upslope, and may be supplemented by regional groundwater flooding.

Flooding from overland flow caused by inadequate drainage, i.e. unmaintained ditches and watercourses etc is causing some problems in and around Wanborough. Due to the general topography of the area with the higher ground to the south and lower ground to the north; water from the surrounding hills flows northwards and is picked up by a series of ditches combined with positive drainage systems

However, recent and proposed improvement works by SBC will provide some improvements, particularly along Burycroft and up to the Marsh; here, SBC have cleared and dug ditches as well as installed new culverts across gateways. SBC are also proposing to introduce a large swale in the field adjacent to Burycroft (owned by Woodlands Trust) and continue ditch improvement works in this area. The ongoing drainage investigation in conjunction with Wanborough Parish Council and CPLC will highlight the many improvements required throughout the parish with a view to implementing further improvement works to this area to alleviate the flooding.

Flooding from Sewers (Under-Capacity of the Existing Drainage Network)

- inadequate flow capacity in public sewers
- random blockages in pipes and intercepting traps
- recurring blockages (due to characteristics of sewerage systems)

- inability of drainage flows from basements to enter public sewers
- pumping station failures
- burst rising mains
- high watercourse or tide levels causing inflows to sewers
- siltation (due to flat sewer gradients or sewer features)
- build-up of fats and greases
- sewer collapses.

Flooding from foul or combined foul and surface water sewer systems may be particularly unpleasant as flood waters are contaminated with sewage, with the resultant health risks. Flood water can sometimes enter directly into properties via the foul drainage system (through toilets etc). Fluvial flooding can also be contaminated with sewage as a result of combined sewer overflows or where there is a connection between the surface and foul drainage systems.

Many artificial drainage systems, such as pipes, land drains, sewers, and drainage channels (e.g. ditches and culverts), exist to manage runoff and effluent from developments. During heavy rainfall, flooding from artificial drainage systems may occur if the rainfall event exceeds the capacity of the drainage system or if the system becomes blocked by debris or sediment. This will also occur if the system surcharges due to a high water level in the receiving watercourse.

Flooding can also occur if water overflows from the drainage system, or if water is unable to enter a drainage system that is blocked or has inadequate capacity. Problems sometimes occur where the existing land drainage systems have become disrupted by development or construction work, and have not been tied into the development drainage strategy. During heavy rainfall these drains may discharge water as artificial springs, resulting in flooding.

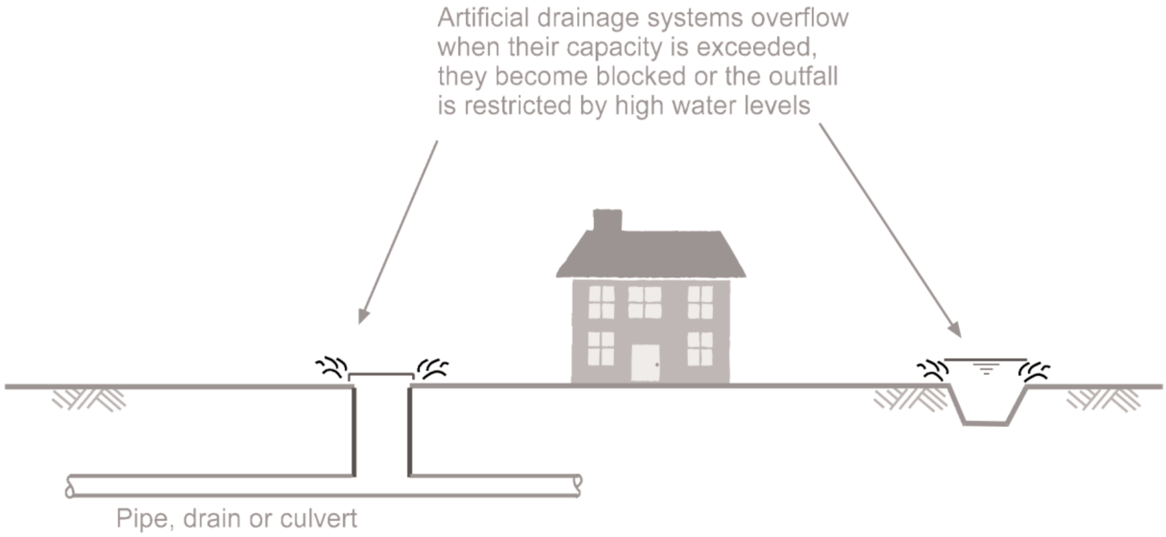

Figure 2.8: Overflow from drainage systems

Flooding from artificial drainage systems can occur more frequently than from other sources as many of these systems were designed to a lower standard than that required for new development. For example, drainage ditches created to improve agricultural productivity are unlikely to have been designed to contain flows greater than the 10 per cent annual probability of exceedence flow (ADAS, 1984).

Flooding from artificial drainage systems may occur during events that are below the design capacity of the system if the system capacity is temporarily reduced due to blockage by debris. This can be a particular problem with underground drains or sewers, since the location of the blockage may not be easy to identify or to clear. Flooding may also result if a pumping station fails. Infiltration of groundwater into sewer systems may also reduce their capacity to receive and transmit runoff.

There are reports of flooding from parts of the surface water drainage network provided by Thames Water and the highway drainage network that service the area. During heavy rainfall events these systems are reported to surcharge causing water to back-up and flow from the manholes and gullies. It is considered that these networks have not been adequately designed to control peak flows during heavy rainfall events.

FLOODING FROM GROUNDWATER

A key issue regarding groundwater flooding is that it may occur in areas outside flood plains associated with watercourses, and there may be no obvious visual clues that the site would be at risk of flooding if groundwater levels rose. This type of flooding can be very localised. This is because the geology of the underlying aquifers is a key controlling factor, and the existence of permeable fissures or joints, or variations in aquifer properties can result in groundwater emerging at the surface at very specific and localised points. These locations are often the locations of old springs or ephemeral streams. If these flow during only the very wettest periods, their presence may have become almost forgotten by the local population and development may have occurred nearby, without regard for the possible flood risk.

In some parts of the country, particularly urban areas, groundwater levels may be rising as a result of reductions in groundwater abstractions during the latter part of the 20th century (Simpson *et al*, 1989; Wilkinson and Brassington, 1991). The risk of groundwater flooding may be increased where rising groundwater levels affect shallow water tables.

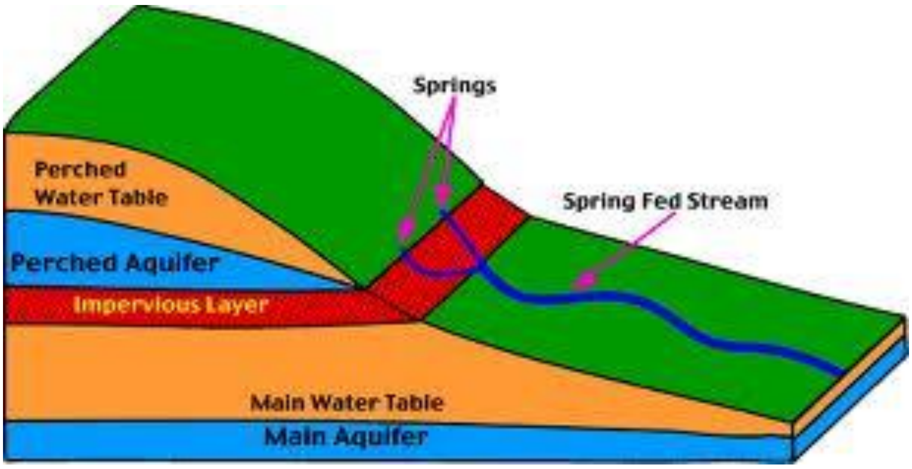

Figure 2.9: How some springs may appear in Wanborough?

It is considered that many parts of Wanborough, particularly the central residential area are situated near locations of old springs or ephemeral streams. These only become visible during heavy periods of rainfall, so it is acceptable that they may not have been noticed by the developers of the residential estate.

Flooding from Reservoirs, Canals and Other Artificial Water Sources

There are no reservoirs, canals or artificial watercourses within the vicinity of this site.

Flooding from infrastructure failure

Structural, hydraulic or geotechnical failure of infrastructure that retains, transmits or controls the flow of water

2.2.5 Existing Flood Alleviation Measures

As the village is located some way from the river there are no flood defences in place.

2.2.6 Flooding History

In the summer of 2007 extreme rainfall volumes were recorded and again in 2008 and the village of Wanborough experienced heavy flooding in many parts of the town. Fluvial flooding was concentrated along the Liden Brook where high water levels caused the river to burst its banks causing extensive flood damage to properties around Moorleaze and flooding to land downstream of the Marsh.

In addition to the fluvial flooding, regular localised surface water flooding occurred throughout the village; again, caused by a combination of poorly maintained ditches, undersized/damaged culverts and surcharging sewers. This had a detrimental effect on properties as well as local roads and highways; in particular, the Wanborough/Swindon Road was heavily flooded causing many problems for traffic.

It would not be a fair statement to suggest that Wanborough village has always been susceptible to surface water flooding, particularly as it situated on a slope between high ground in the south and the river basin to the north and water from the escarpment to the south tries to make its way to the floodplain and rivers to the north, through the village. The heavy rainfall events merely highlighted the weaknesses within the existing drainage system that serves the village.

2.3 Geology and Hydrogeology

A full soils report produced by the NSRI Cranfield University is located in Appendix E; this covers all aspects of the soil conditions around Wanborough.

2.4 Drainage (General)

2.4.1 Drainage Systems

Undeveloped sites generally rely on natural drainage to convey or absorb rainfall, the water either soaking into the ground or flowing across the surface into watercourses, providing a natural flow of environmental and ecological benefit. Sites currently or previously used for agricultural purposes may additionally have systems of underground drainage pipes as well as open ditches and watercourses

2.4.2 The Effect of Development

The effect of development is generally to reduce the permeability of at least part of a site or area. This markedly changes the areas response to rainfall. Without specific measures, the volume of water that runs off and the peak runoff flow rate is likely to increase. Inadequate surface water drainage systems in new development can threaten the development itself and increase the risk of flooding to others.

To satisfactorily manage flood risk in new development, appropriate surface water drainage arrangements are required to manage surface water and the impact of the natural water cycle on people and property. The effective disposal of surface water from development is a material planning consideration in determining proposals for the new development and use of land. It will always be much more effective to manage surface water flooding at and from new development early in the land acquisition and design process rather than to resolve the problem after development. Site layout should be influenced by the topography; the location of buildings where surface water may flow naturally or as a result of development under extreme circumstances should be avoided if possible.

Surface water arising from a developed area should, as far as practicable, be managed in a sustainable manner to mimic the surface water flows arising from the area prior to the proposed development, while reducing the flood risk to the area itself and elsewhere, taking climate change into account. This should be demonstrated as part of a flood risk assessment.

It is very evident throughout Wanborough that many natural drainage systems have been destroyed by housing developments.

2.4.3 Drainage in Wanborough

The parish of Wanborough is situated within what can be described as a natural drainage basin; as it is bound by a natural escarpment, with high ground in the south and the floodplains of the Liden Brook and River Cole to the north-north-west.

Wanborough should be well situated in terms of flood prevention and drainage; as the village is situated on sloping ground. The surface water generated from the higher ground should ideally run through the town and end up in the Liden Brook. However, the drainage throughout Wanborough relies on a combination of positive and natural land drainage systems to convey surface water through the village. Some of which are very outdated and/or poorly maintained.

Thames Water provides the positive drainage system which comprises a foul drainage and a surface water system for most of the newly built residential areas; some plans can be viewed in Appendix F. However, some parts of the village have just a foul sewer and indeed the rural parts of the village rely solely upon natural systems such as soakaways, ditches, and septic tanks.

The Highways Agency is responsible for the maintenance of the drainage system for the A419, which forms the west boundary of the village, and in particular the Commonhead Junction, detail located in Appendix G.

Swindon Borough Council Highways Authority also has a network of highway drainage throughout the village. Both SBC and Thames Water utilize ditches as part of their network.

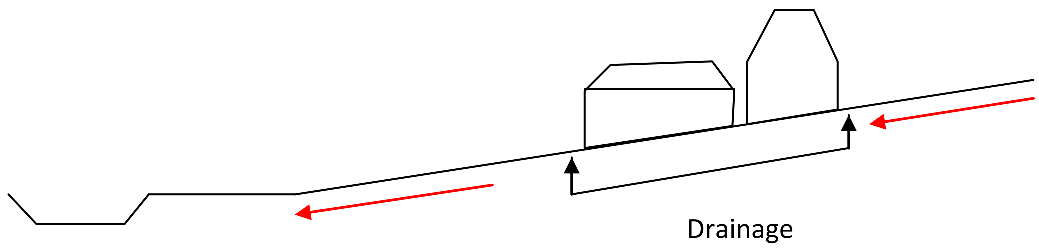

Figure 2.10: Schematic View Wanborough Catchment

3. Drainage and Flood Management Assessment

Area 1- B4507 Top of Springlines

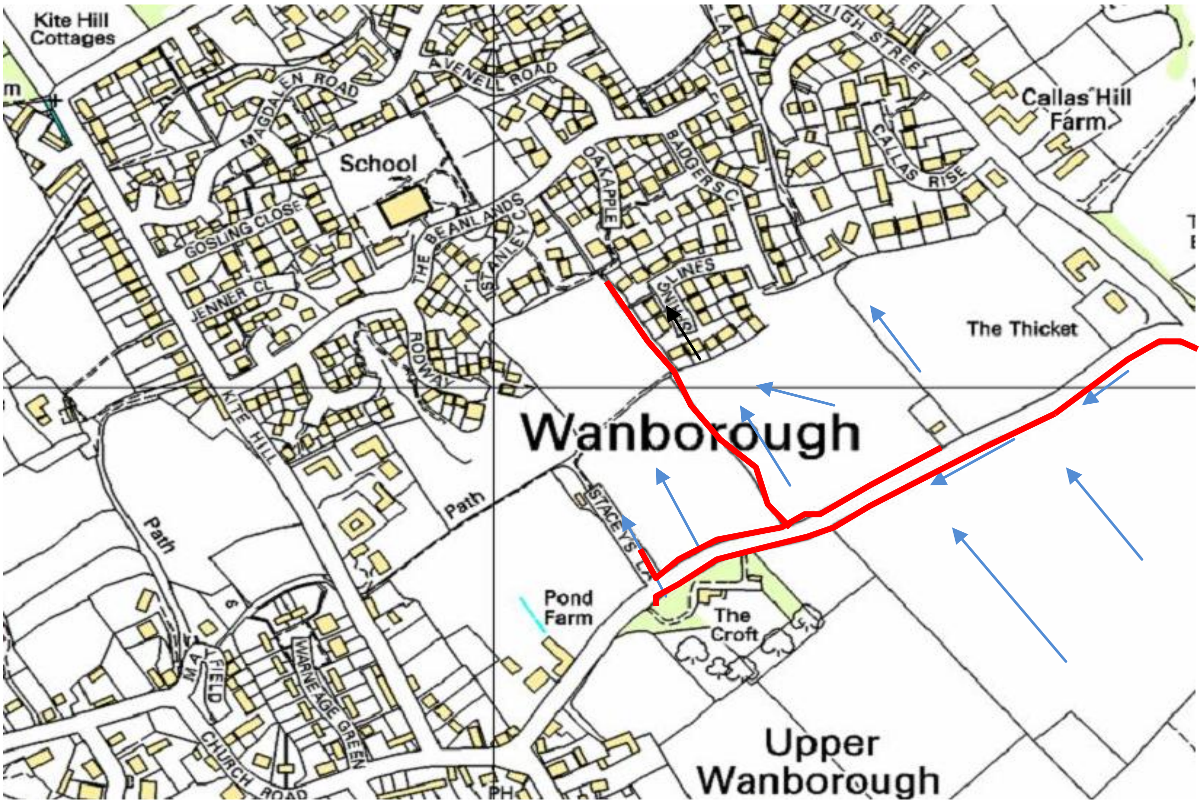

Figure 3.1: Location Plan - Land above Springlines and B4507

Drainage

A combination of gully pots and grips try to pick up water from the road (B4507) and deposit into ditches either side of the road. The ditch on the south-east side of the road collects water generated in the fields on higher ground again to the south east. The ditch runs in a south-westerly direction and it is unclear at this stage, but is considered the ditch is culverted beneath the road to the ditch on the other side of the road which then connects to ditches flowing north-westerly towards the residential area, where they feed into the Thames Water surface water sewer systems.

Flood History

Excessive overland flows during extreme events of 2007 and 2008. Much of the surface water which flows through Wanborough is generated on the higher ground above Springlines and again the higher ground south south-east of the B4507. Heavy rainfall caused a number of springs to emerge and create overland flows across the fields; flowing north-west towards lower Wanborough. Ditches alongside the B4507 were overrun as surface water continued to flow down Stacey's Lane and into the fields above Springlines. As well as the water from the higher ground, springs emerged in the fields immediately above Springlines which increased the volume of water. Much of this water was retained behind a raised earth embankment behind Springlines, which was possibly constructed by the developer in an attempt to protect the residential properties below (See Photos 3.12&3.13). The remainder of the flood water generated from this area continued to flow towards Stanley Close, Beanlands and further north north-east through Chapel Orchard, The Warrens and Chapel Lane.

Reasons for Flooding

- Excessive rainfall
- Springs/ possibly perched water table
- connecting ditches and culverts in poor condition; unable to contain flows
- original ditches are practically non-existent
-

Suggested Mitigation Methods

Much of the storm water which causes the flooding downstream, through central and lower Wanborough is generated here; so the main recommendation is to control the water in this area

- clear ditches and investigate culvert connections on B4507
- reinstate ditches in fields above Springlines
- clear and check culvert capacity
- Introduce infiltration basin/s in field above (south) Springlines

- Introduction of ring soakaways would allow storage of water generated on highway; as opposed to free flow via ditches (barely visible now) towards the residential estate.
- reinstate ditch west of Springlines with possibility of flow control structures if required
- Pipe ditch section alongside Springlines with oversize pipe and hydro-brake
- construct headwall at culvert beneath footpath between Springlines and Oak apple

Responsibilities

- Land owner
- Developer
- Swindon Borough Council (Highways)

Photos


Photo 3.1: View facing east B4507


Photo 3.2: View facing west B4507

Photo 3.3: Ditch is overgrown and not deep enough; could be resized to pick up overland flows from springs on the higher ground to the south east. Photo 3.4 (supplied by WPC): Following heavy rainfall in 2007, it is clear the ditches here did not have the capacity to contain the overland flows a lot of which was generated by springs on the higher ground. This creates a two-fold problem as the water on the road cannot discharge into the ditch and overflowing water from the ditch pours onto the road. Current location of outfalls from this ditch is not known as yet (Nick Smith, SBC); however, it is considered the ditch is connected to ditches on adjacent side of road via culverts; this requires further investigation.

Although very difficult to distinguish there are ditches on the north side of the B4507, again running east to west; these should also collect water from the road and as mentioned above possibly connect with the ditch on the other side of the road. This ditch is intercepted by 3 ditches and possibly 4 ditches at one time, flowing northwards towards central/lower Wanborough. The ditches are highlighted on Figure 3.1 and again in more detail in Appendix B.

Photo 3.5 and 3.6 above (supplied by WPC): Shows the ditch either side of the driveway to The Croft is empty and water on the road. This would suggest that the ditch does not connect with the ditch further along this road and the lack of grips or gullies does not allow water to reach the ditch; also a restriction with the connecting culvert beneath driveway.

This area also requires further investigation to determine outfall location.

Photo 3.7 and 3.8 supplied by WPC): Shows points on the road (B4507) where water seems to collect (ponding) during heavy rainfall events. This is ideal for pinpointing areas to locate grips or indeed gullies; but as discussed briefly earlier the connecting ditches etc need to be cleared to allow water to discharge away; also along this section of road consideration could be given to the use of soakaways with overflows to connecting ditches, which will assist in controlling heavy flows.

Photo 3.9 (supplied by WPC): shows a section of ditch on the north side of the road in poor condition; the ditch is unable to store and/or convey storm water.

Photo 3.10: During the heavy rainfall events Stacey's Lane acted as a natural flow path and it is considered that there should be a small ditch either side of the lane

Clearance and maintenance of the ditches is recommended. However, consideration is required for the effects downstream to ensure the risk to properties is not increased. Connecting culverts and ditches will require attention which may include flow control structures to reduce the impact when discharging into the Thames Water surface water sewers; this is covered in a little more detail further on in this chapter. However, a level 2 assessment maybe required to ascertain peak flows and channel and culverts capacities.

Photo 3.11: View of fields above Springlines facing north

The fields above Springlines not only act as a receptor for water generated in the hills above B4507, but also generate flows from springs. Generally, the flow paths are located on the east side, the middle and the western edge of the field when looking at the photo above. The tree line at the foot of the hill forms the boundary between the field and the residential housing area. In front of the tree line is a raised embankment; possibly constructed by the developer in an attempt to protect the houses.

Photo 3.12 (supplied by WPC): view showing spring/surface water flow on western side of field directly behind Springlines, generated during heavy rainfall event of 2007; this water tends to attenuate behind the embankment, as shown in Photo 3.13 below. Further protection for Springlines can be implemented here with the introduction of an infiltration or detention basin. These can be designed with an overflow pipe linking with the ditch or drainage system at either end of the field. Infiltration basins can be constructed along other parts of this field boundary particularly where flow paths are generated. These recommendations are highlighted on the plans in Appendix B.

Photo 3.13 (Supplied by WPC): Water being held behind raised embankment area 2007.

As mentioned earlier there is a ditch or drainage system at both ends of this field and both seem to have been left to deteriorate. At the eastern side a ditch was nonexistent and access was not possible to investigate the connection to the system through to Chapel Orchard which then connects to Chapel Lane. The original ditch line would have continued northwards through Chapel Lane between the garage and the recreation park until linking with the ditch/ drainage system in Rotten Row. Recent developments over the years have seen the ditch diminish into private drainage systems combining open and piped systems. This area requires further investigation to establish the capacity of the connecting systems.

The ditch on the west side of the field is considered the main system for this area and collects water from the highway and the land above it. The ditch is in poor condition and requires reinstating. However, as discussed earlier further investigation is required to determine the effects downstream.

Photo 3.14: view facing south at tree line where original ditch should be; Photo 3.15: view facing west at ditch line.

Photo 3.16: view facing south (upstream) at tree line where original ditch should be; Photo 3.17: view facing north (downstream) at ditch line; residents have attempted to dig ditch on right hand side of footpath to protect their property

Photo 3.18: view facing north (upstream) at tree line where original ditch should be;

 

Photo 3.19 and 3.20: show flood water flowing down footpath from the field behind Springlines; the reason for this is the ditch has over the years been neglected and disappeared; possibly since the development of the residential area. Water now finds the footpath as the quickest route downhill.

 

Photo 3.21 and 3.22: water continues to flow down footpath and over the top of culverted section of intercepting footpath into the gardens of Oak Apple Close, which have a well kept section of ditch which extends to the Beanlands headwall where it then connects and attempts to discharge into the Thames Water storm/surface water sewer. This is also a known problem area and is covered in the next downstream section.

Photo 3.23: shows the culverted section of the intercepting footpath located between Springlines and Oakapple. This is a critical area in a number of ways:

- Water does not flow in line with the culvert as the ditch has disappeared and water flows down the footpath before joining the ditch on the other side of the fence. The ditch should be reinstated in line with this culvert.
- The culvert inlet should have a headwall to protect it and downstream from any flood surges
- Consideration should be given to the use of a trash screen to prevent blockages from vegetation etc
- Although a headwall will offer some protection; the upstream attenuation recommendations such as soakaways at the B4507; flow control within ditch and infiltration basin will provide a stable long term benefit and reduce the risk of flooding downstream.

Area 2 - Central/Lower Wanborough Residential Estate

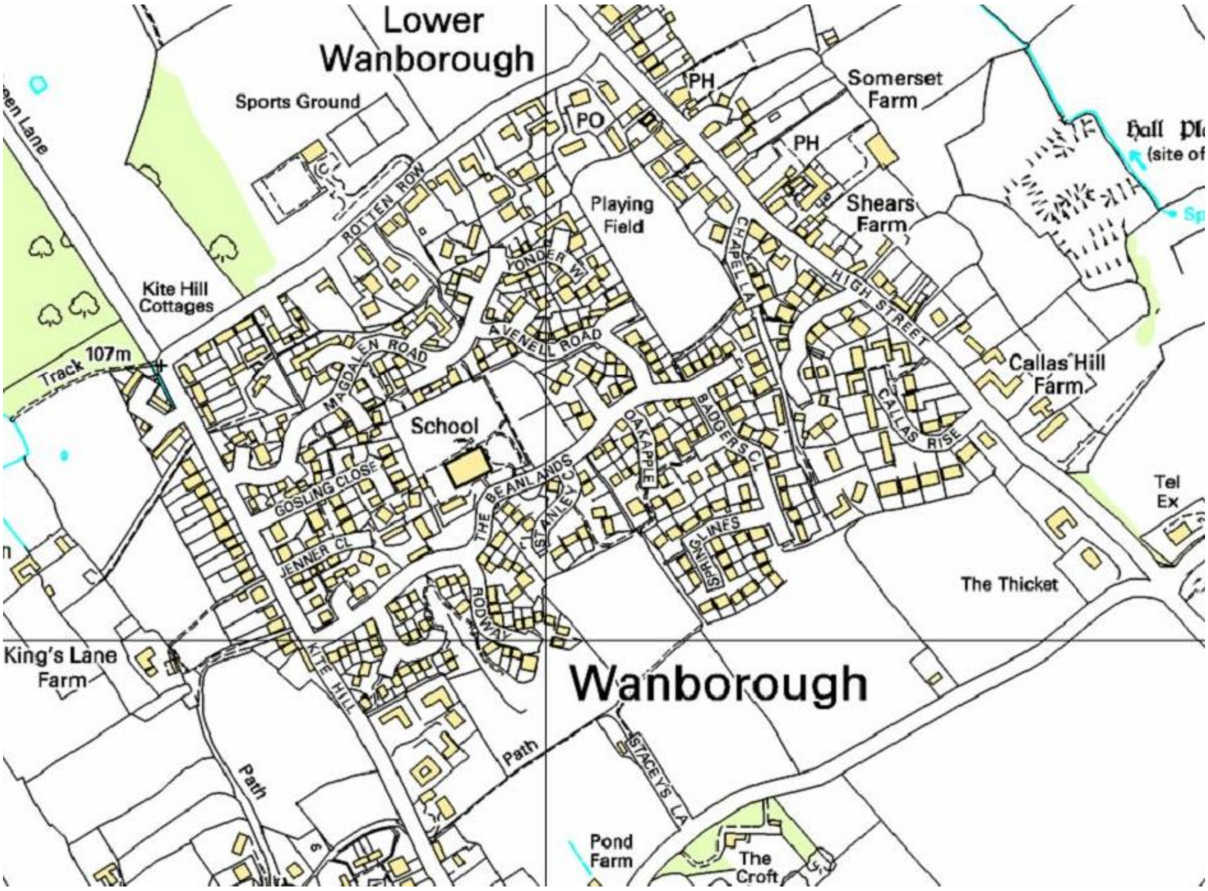

Figure 3.2: Location Plan - Central Wanborough Residential Estate

Drainage

The drainage throughout the main residential estate (shown above) comprises foul and surface water sewers provided by Thames Water. A copy of the sewer plans for each area is located in Appendix F.

Flood History

A number of areas throughout this estate have experienced flooding, particularly during the 2007 and 2008 events.

Reasons for Flooding

The flooding that occurs throughout this residential estate is due to surcharging sewers that cannot control or contain excessive surface water flows that are generated from the high ground south of

Springlines; and subsequent overland flows caused by out-of-bank flows and surcharging manholes throughout the system.

Springlines

No properties are reported as flooding yet, but under constant threat particularly during heavy rainfall events. This is due because of their proximity behind the earth embankment and the distinct absence of the ditch.

Beanlands

No properties are reported as flooding, but excessive water on road, which is generated from the Springlines ditch trying to discharge into Thames Water sewer via a 225mm culvert and headwall located adjacent to No. 2 Beanlands. This inlet connection tries to discharge against a 450mm surface water sewer at 90 degrees and against the flow; thus creating a dam effect during heavy storms causing water to back-up.

Oak Apple Close

No properties are reported as flooding, but are located directly adjacent to the flow path of the Springlines ditch. Residents maintain this section of ditch situated between Springlines and Beanlands. Excessive uncontrolled flows could cause a threat to adjacent properties.

Stanley Close

No properties are reported as flooding, but possibly a threat of flooding to properties caused by overland flows generated in fields south of area

The Warrens

No reported flooding to property, but overland flow was experienced during heavy rainfall events, particularly summer 2007 and summer 2008. These flows were again generated from springs in the fields on the higher ground south of the area, and flow towards the east corner of the fields. As discussed briefly in section 3 Area 1; it is feasible to consider that prior to recent development this water was naturally controlled with a ditch system, which conveyed water down Chapel Lane and beyond Rotten Row, Burycroft eventually discharging into the Liden Brook.

Chapel Lane

As with The Warrens there is no reported flooding to property, but overland flows are experienced during heavy rainfall events. Chapel Lane is located downstream of The Warrens and would be part of the same drainage system originating in the fields above The Warrens. However, recent developments have introduced a combination of drainage methods to replace the original system which include open ditch, piped sections, concrete channel and highway drain at the bottom end of the lane. From here it is unclear at this stage whether the highway drain continues northwards alongside the playing fields (as the original ditch would have done) to join the system at Rotten Row; or meets highway drainage in the High Street.

Kimbers Field

A history of flooding problems for no's 3 and 4 in this close relate to a surcharging highway drain and overland flows, particularly during heavy rainfall events of 2007 and 2008. Unfortunately these properties are situated on lower ground and therefore susceptible to overland flows and surcharging sewers. A site investigation was carried out by a representative of CPLC, SBC and Thames Water and a number of conclusions were drawn from this investigation.

- The highway drains are working as they should be; but they are connected to the Thames Water sewer which tends to back-up during extreme rainfall events thereby restricting the discharge from highway drainage.
- In turn, the TW sewer from Kimbers Field is discharged into the main surface water sewer that runs down Avenell Road; inspection of the adjoining chamber revealed 1] the upstream sewer section comprised a wide flat concrete bottom; an ageing design renowned for slow flows and; 2] the downstream soffit level was higher than the upstream soffit level. These are normally constructed level to level along with the gradient of the pipe (see diagram 3.1).

- The surface water sewer from Avenell Road discharges into the main 450mm storm sewer in Magdalen Road, which has a large catchment area originating at Grange Close, picking up surface water from properties down Kite Hill, Jenner Close, Magdalen Road Palmers Close, The Witheys and Wild Acre before Avenell Road. Inspection of the adjoining chamber revealed that the Avenell sewer meets the 450mm sewer at 90° right angle; suggesting that if the 450mm sewer is running at full bore then this would prevent the Avenell sewer from discharging and again the 'knock-on' affects upstream preventing Kimbers Field from discharging into Avenell Road.

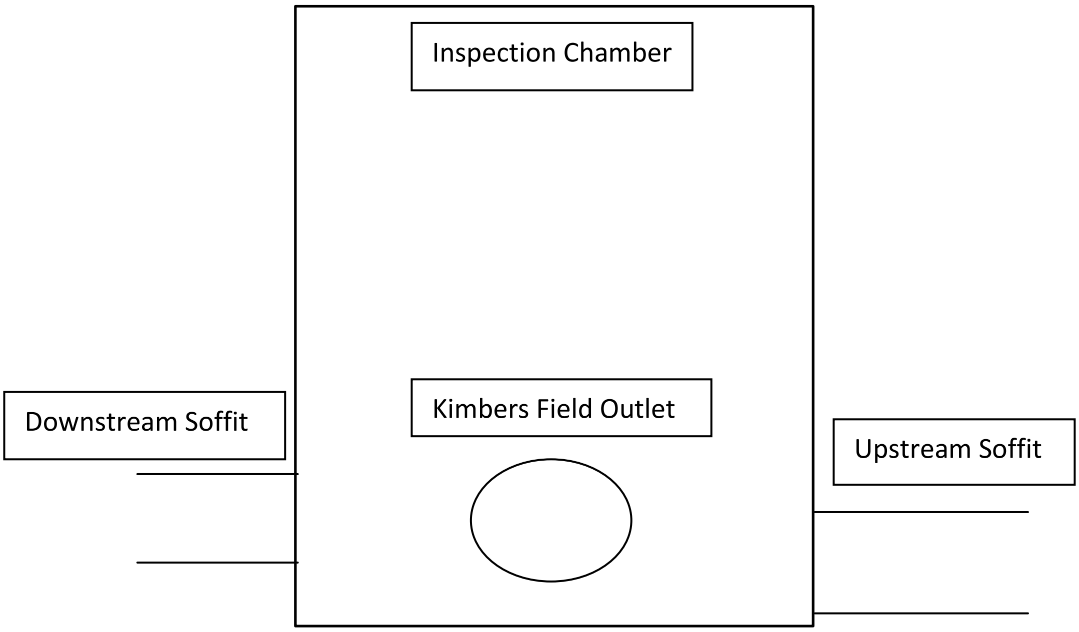

Figure 3.3: block and line diagram of adjoining 'manhole inspection chamber' from Kimbers Field into Avenell Road

- This area is situated on lower ground levels, thereby restricting the 'head' and/or gradient required to discharge the highway drains into the surface water sewer situated on higher ground.
- In order to gain as much head as possible the outlet is practically lower than the soffit levels thereby restricting outflow even more during normal heavy rainfall periods.

Overland flows were also experienced during the 2007 and 2008 flood events; these were generated further upstream at Beanlands where excessive flows caused the culvert inlet to the Thames Water sewer system to surcharge. This caused storm water to follow its natural flow path down the hill in a north westerly direction across open space next to the school and down into Avenell Road eventually ending at the lowest point which was Kimbers Field.

The natural flow path or original ditch route was along the tree line on the eastern edge of the open space then continuing north-westerly across Kimbers Field until linking up with the ditch alongside Hooper's Field.

More recently a surcharging highway drain gully located outside no's 4 and 5 had grey water and foam pouring out of it. Investigation revealed an improper 'dirty water' connection into the surface water sewer instead of the foul sewer; see Photo 3.29.

<u>The Hedges</u>

Has a history of properties flooding, particularly no's 3, 4, 5, and 6, which are situated on ground levels lower than the road level. Heavy rainfall events in the summer of 2007 and 2008 caused Thames Water surface water sewers to surcharge particularly at junctions where smaller sewers tried to discharge into main sewers; these generated overland flows which flowed down the road and into properties stationed at a lower ground level.

As with Kimbers Field, it is feasible to consider the same problem is occurring here:

- This area is situated on lower ground levels, thereby restricting the 'head' and/or gradient required to discharge the highway drains into the surface water sewer situated on higher ground.
- In order to gain as much head as possible the outlet is practically lower than the soffit levels thereby restricting outflow even more during normal heavy rainfall periods.

A representative from CPLC has held discussions with Thames Water who have now requested a plan highlighting all problem areas within the residential estate with a view for further investigations to justify required improvement works.

<u>Magdalen Road</u>

No reported flooding incidents; however, the central section of Magdalen road shares a surface water system with the Hedges and College Green

College Green

No reported flooding to property, but an ongoing problem does persist here at the junction before it discharges into a culvert beneath Rotten Row; prior to discharging into open watercourse that flows northwards towards the Marsh.

Yonder Way

Two properties here No. 1 and No. 19 are listed as susceptible to flooding; again the same theory for surcharging as Kimbers Field would apply here as the surface water sewer from this area tries to discharge into the 450mm storm sewer in Magdalen Road at right-angle 90° during high flows.

Suggested Mitigation Methods

1. As discussed briefly in section 3.1 the best and foremost method of mitigation is to control flows as close to the source as possible; which would include attenuation as far upstream as possible, starting with the B4507. Then, working down to ditches with flow control weirs; infiltration basin behind Springlines etc. This would be particularly beneficial to all areas mentioned in this section of the report, except College Green and The Hedges which are not in the direct flow path of the land above Springlines drainage route.

2. The drainage system through The Warrens and Chapel Lane requires further investigation in order to ascertain what the system comprises. It is unclear at this stage the extent of the flooding or overland flow experienced here and therefore difficult to determine whether attenuation in the form of an infiltration/detention basin would be beneficial in the field behind The Warrens.

3. An improvement to the Thames Water surface water sewers is also an option, particularly at the right angled junctions namely Kimbers Field, Avenell Road, Magdalen Road and Yonder Way. However, it should be noted that the upstream attenuation recommendations would create a lot less pressure on the existing system.

4. The existing system works well under normal conditions, but was not designed very well and consideration was not given to extreme flows and the pressures generated from the higher ground. The recommended improvements would include installation of new chambers and

sewers to 'take-out' the right-angled junctions. The locations of these junctions are highlighted on the drainage and flood management plans in Appendix B.

5. The Thames Water surface water sewers system will need to be modelled In order to calculate its functionality and full operating capacity.

6. The Hedges and Kimbers Field are situated on lower ground levels thereby restricting the 'head' and/or gradient required to discharge the highway drains into the surface water sewer situated on higher ground:

   - A simpler solution here is to discharge water from the highway drain into the soakaways that serve the houses. This would require the existing soakaways to be improved to ensure they have the capacity (SBC).
   - Another option is to install a ringed soakaway section at each location (SBC). Average cost for the installation of a ring soakaway is circa 5k.
   - In conjunction with the ring soakaways ACO drains should be considered to collect overland flows and discharge into soakaways
   - as an extra precaution would be to introduce a speed ramp designed in keeping with surround buildings

Responsibilities

Swindon Borough Council (Highways and Land Drainage)

Thames Water

Photos


Photo 3.24 Headwall inlet to Thames Water sewers; Photo 3.25: shows 225mm culvert, possibly undersized. Another problem with this inlet is that it joins the main 450mm sewer at 90° right angle, so during heavy flows the 450mm sewer will act as a dam causing water to back-up and surcharge at the headwall inlet.


Photo 3.26 and Photo 3.27: show the headwall surcharging during the 2007 summer event.

Photo 3.28: Kimbers Field; view looking upstream towards Avenell Road. No's 3, 4 and 5 are potentially susceptible to surcharging sewers and overland flows generated upstream. In the foreground is the highway gully adjacent to No.3, prone to surcharging. A short-term cost-effective solution option would be to install a ring soakaway in the road between the gullies (SBC). Photo 3.29: shows the property with an improper connection into the surface water sewer, which is considered to cause the surcharging foamy water from the gully adjacent to No. 4.

Photo 3.30: The Hedges looking upstream towards Magdalen Road shows the properties below the road surface level therefore potentially susceptible to surcharging sewers and overland flows generated upstream, as with Kimbers Field. Potential options to reduce the risk of flooding are to introduce ACO drains to pick up overland flows and discharge into soakaways. Photo 3.31: looking downstream at lower section of The Hedges; highway gullies here experience same problem as Kimbers Field and potential solution is to soakaways into road.

Photo 3.32: Looking upstream at the upper section of Chapel Lane; drainage requires further investigation as old ditch system lost. This section has only a shallow concrete channel to convey surface water. Photo 3.33: Looking upstream at the middle section of Chapel Lane; possibly original ditch system in hedge line and no evidence of drainage in this section, so water flows over track surface causing erosion and washing away materials.

Photo 3.34: Looking upstream at the lower section of Chapel Lane; here the highway drain system is evident; an investigation can determine the extent of the drainage and whether it extends the full length of Chapel Lane. However, at this stage it is considered that this system starts here and discharges into the High Street system. If this is the case then the gullies shown in the photo would struggle to pick-up the surcharging water flowing down the hill, due to their size and location.

Area 2 - High Street / Callas Hill

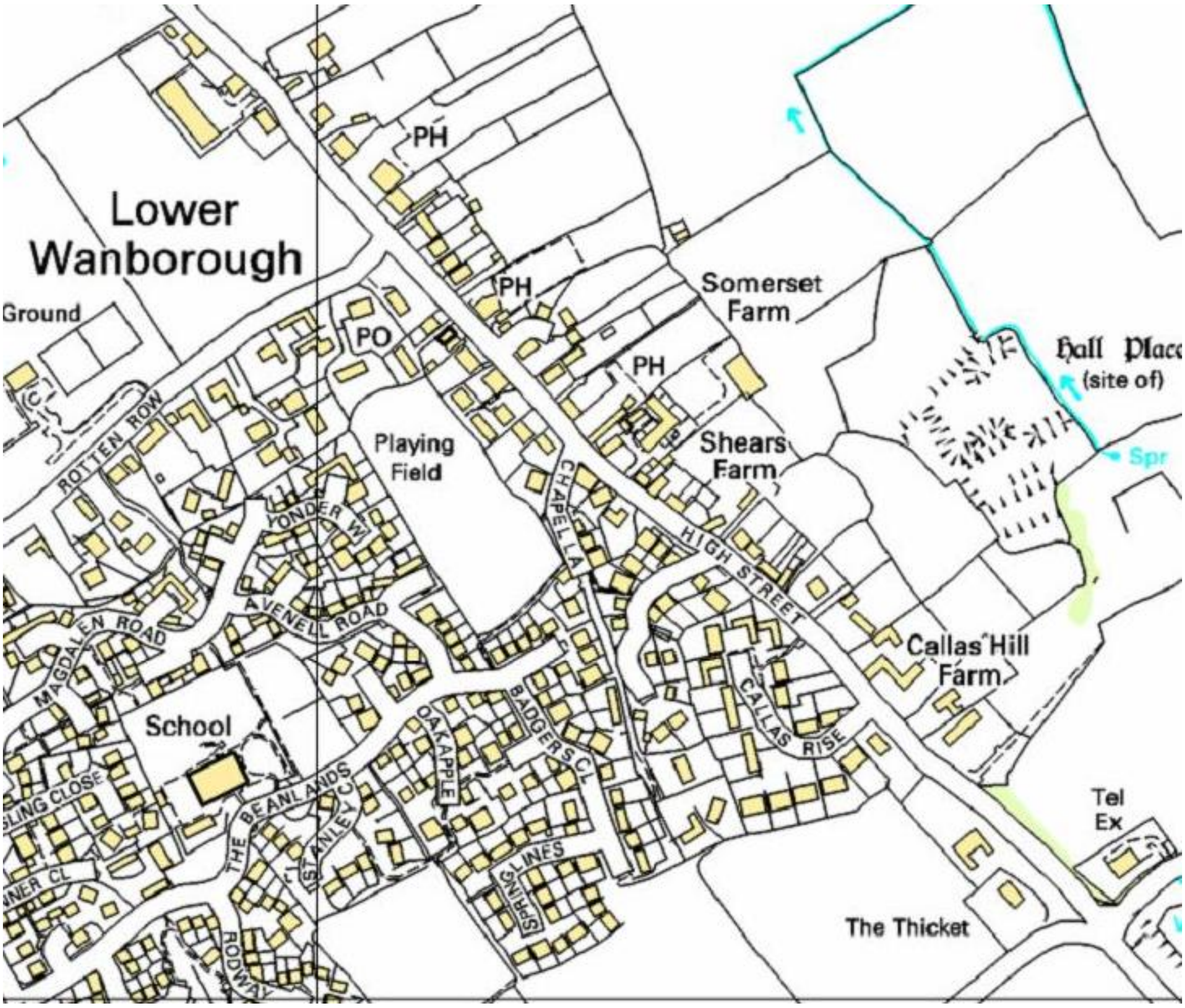

Figure 3.4: Location Plan; High Street

Drainage

There is very little or no positive surface water drainage system provided by Thames Water in High Street and Callas Hill. Many of the properties on the north-east side of the High Street rely on private drainage systems. There is a highway drainage system from Callas Hill through to Wanborough Road and this comprises open-ditch with piped sections. Again it is considered appropriate to flush, CCTV and map the highway drain system in this area as well as the remainder of the village.

Flood History

There are no reported flooding incidents in the High Street. However, during heavy rainfall events, excess water is seen running down the road.

Reasons for Flooding

Excess rainfall, generation of fast flowing water from hill

Blocked and poorly maintained system, particularly in the Callas Hill section which is lined both sides by steep densely vegetated banks

Lack of collection points

Suggested Mitigation Methods

Increase number of gullies and collection points

Introduce soakaway to control flows

Introduce retaining wall structure around gullies to reduce debris getting into system

Responsibilities

Swindon Borough Council Highway Authority

Photos

Photo 3.35: view looking south-east close to top of High Street/ Callas Hill. Looks as though this area has been used for parking by a heavy vehicle; shows the vulnerability of the embankment due to wetness. This maybe a good location to introduce a soakaway, or extend existing drainage system with protected gully (photo 3.40). Kerbs or retaining structure could also be considered here.

Photos 3.36 and 3.37: looking upstream towards top of High Street/Callas Hill. Heavy rainfall events would wash debris and vegetation from wooded area either side of road which then gets carried down the road and into gullies and culvert inlets causing blockages in the system.

Photo 3.38: Collection point/ kerbside gully again susceptible to blockage with debris and vegetation from surrounding embankment.

Photo 3.39: the same gully as above filling up with leaves; also evident here is road re-surfacing works are also gradually impeding the capacity of the gully as it sinks lower beneath the surface.

Photo 3.40: Shows an example of new roadside gully collection point with protective retaining wall structure. These have been introduced on a number of B-class roads throughout the county.

Photo 3.41: Photo 3.42: Further down the hill (High Street- west side) highway drainage combining piped and open ditch sections. Shows very little collection points/ grips etc also Photo 3.42 highlights susceptibility to blockage restriction to inlets.

Photo 3.43: High Street east-side; the shallow ditch does not show much sign of being in use as a highway drain. It could be the time of year suggesting a winterbourne ditch, or water from the road not being able to reach the ditch due to amendments by landowner, or possibly replaced by a newer system in the High Street (doubtful). Photo 3.44: shows intake at end of ditch which probably connects to piped highway drain in the High Street; all this section may require reinstating. However, it is recommended to have the whole system flushed CCTV'd and mapped.

Area 3 - Upper Wanborough

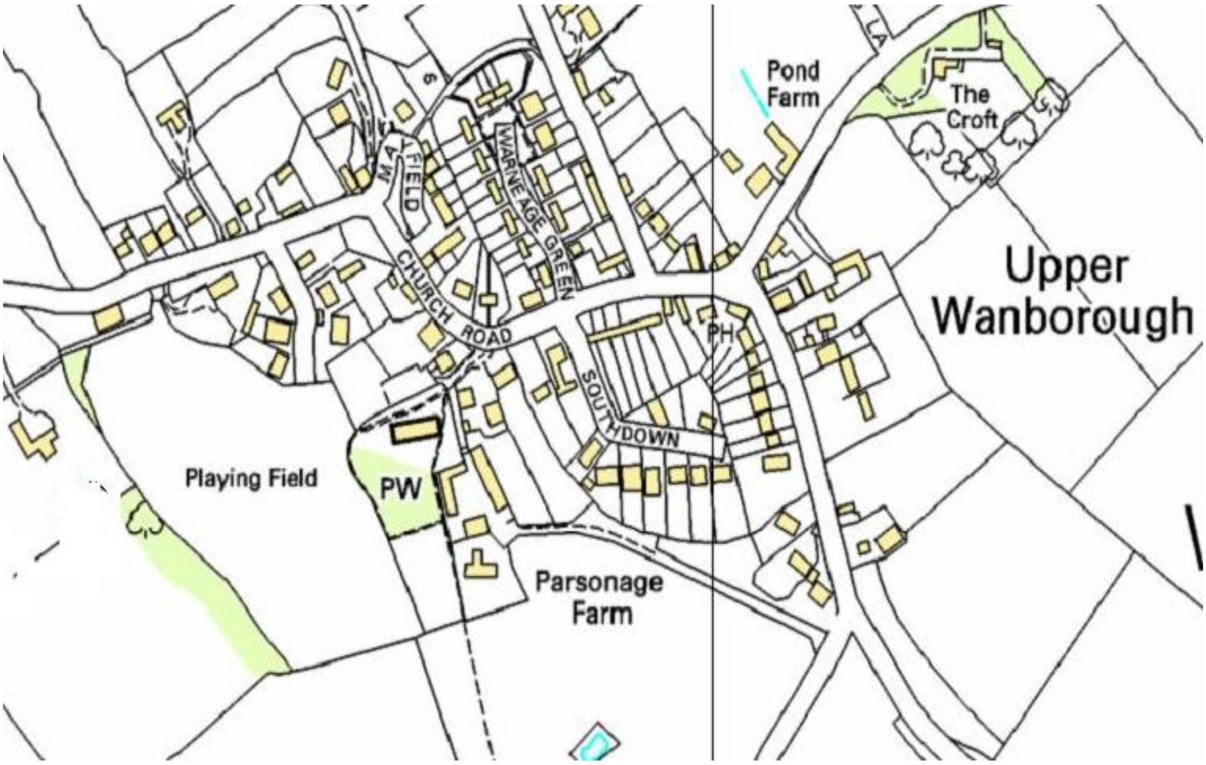

Figure 3.5: Location Plan; Upper Wanborough

Drainage

There is very little or no positive surface water drainage system provided by Thames Water in the Upper Wanborough area. Many of the older original properties rely on private drainage systems such as soakaways. Church Road, Southdown, Mayfield and Warne age Green have highway drainage systems, which will be controlled by Highways Authority (SBC).

Flood History

There is no reported flood history from Upper Wanborough

Reasons for Flooding

Suggested Mitigation Methods

Responsibilities

Photos

Area 5 – Kite Hill

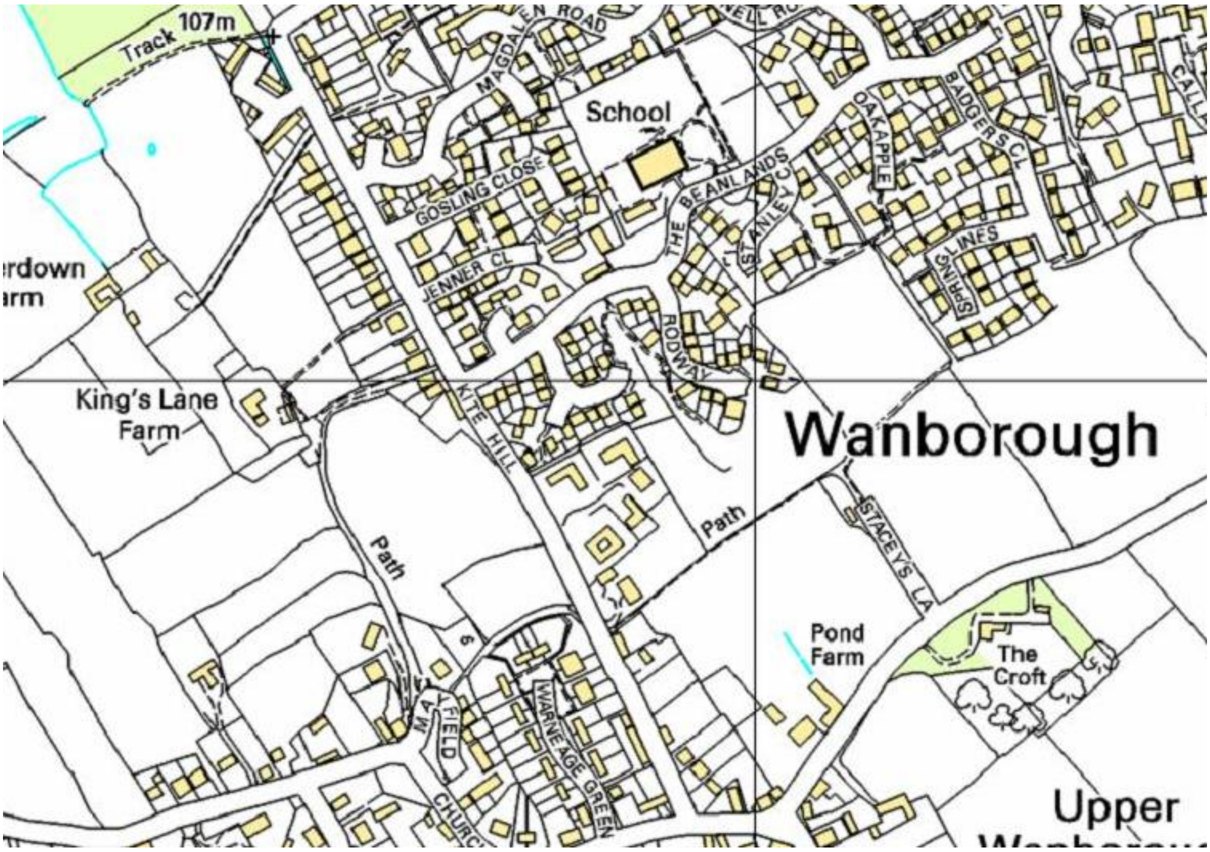

Figure 3.6: Location Plan; Kite Hill

Drainage

The drainage system in Kite Hill comprises open ditches with piped sections, which combine land drainage and highway drainage. The combination of ditches and piped sections run down both east and west side of Kite Hill.

As with High Street / Callas Hill Kite Hill is fairly steep and from the higher ground in Upper Wanborough down to Rotten Row there is a 25 metre fall. Containment of heavy flows within these combined systems can create problems such as surcharging sewers and overtopping open ditch sections.

The drainage on the west side discharges into the open ditch in Green Lane, via a series of very restricting culverted headwalls and then continues to flow north-west towards the Marsh.

The drainage on the east side of Kite Hill discharges from open ditch into a culvert designed to convey water beneath the road where Kite Hill meets Rotten Row. From here it discharges into an open ditch again which flows easterly down Rotten Row to the watercourse adjacent to College

Green. It is considered the water may continue eastwards down Rotten Row or follow the watercourse north towards Burycroft. There is an alternative flow route from the culvert beneath Kite Hill and that is to continue down the east side of Green Lane and eventually confluence with the drain on the west side of Green Lane. There is also a pond in the field to the east side of Green Lane which offers an opportunity for attenuation with permissions and careful planning.

Flood History

Properties at the lower end of Kite Hill have a high risk of flooding due to their location to the open ditch sections and are situated at the bottom of the hill

The residential property Wynnstay has a flood history, particularly during the extreme events of 2000, 2007 and 2008, probably caused by overland flows/ surcharging highway drains

Excess water running down the road potential risk to some properties

Ditch sections overflowing potential flooding to properties

Surcharging drains

Reasons for Flooding

Gullies filled with debris i.e. vegetation (leaves etc) and soil from embankments either side of road at upper section of Kite Hill.

Gradient of hill

Heavy water flow exceeding capacity of connecting culverts

Overland flows caused by surcharging sewers

Overland flows caused by overtopping ditch sections with high-sided walls over culverted assess points

Overland flows caused by emerging springs

Suggested Mitigation Methods

Control of flows upstream...

Increase number of collection points, particularly at the top of the road

Regular clearing and maintenance of gullies

Restrictions in ditch (west) – clear ditch, remove headwalls; replace with larger diameter pipe sections

Need to allow a controlled flow of water to reach the open ground adjacent to Green Lane and Hooper's Field.

Responsibilities

Swindon Borough Council Highway Authority

Riparian residents

Photos

Photo 3.45 and Photo 3.46: views facing north and south near the top of Kite Hill; steep vegetated earth banks allow vegetation and soil debris to be washed onto road during rainfall

Photo 3.47 and 3.48: show the gullies in Kite Hill being filled with leaves etc causing the drains to surcharge and generate overland flows down the road.

Photo 3.49 and 3.50: the lower section of Kite Hill comprises open ditch on both sides of the road; the photos above show a couple of culverted access points within the west ditch. Photo 3.49 restricts flows as it requires ditch clearing. Photo 3.50, shows either a poorly designed culvert or a culvert designed to hold back (attenuate) flows with very small pipes and a headwall; a possible solution for Springlines and other parts of the village drainage system but here can only cause risk of flooding to adjacent properties.

Photo 3.51: At the foot of the open ditch on the west side of Kite Hill is the structure shown above. This is considered to be purpose built to hold up flows. However, the purpose for this is unclear as there is no property at risk downstream of this, from here the water is discharged into Green Lane, which is considered to be a better location for attenuation. Holding back flow at this location and indeed the locations shown in Photo 3.50 and 3.52 increases the risk of flooding to adjacent properties.

Photo 3.52: All the properties pictured above are listed as high risk of flooding; this picture highlights 2 possible reasons for flooding. 1] The properties are lower than the road. 2] The stream crossings will restrict heavy flows as the culverts are far too small and the concrete pathways above them effectively form dam like structures which would be feasible in rural areas to hold back flows; similar to 'stank'-type weirs.

Photo 3.53: View at the foot of Kite Hill where it joins with Rotten Row Kerbside gully connects with

culverted section beneath footpath before discharging into ditch against tree line

Photo 3.54: View looking east down Rotten Row; Highway ditch needs clearing

Photo 3.55: View looking north down Green Lane; ditch on both sides can be reinstated. Ideal place for flow attenuation /retaining structures instead of existing location at west ditch in Kite Hill

Area 6 – Rotten Row

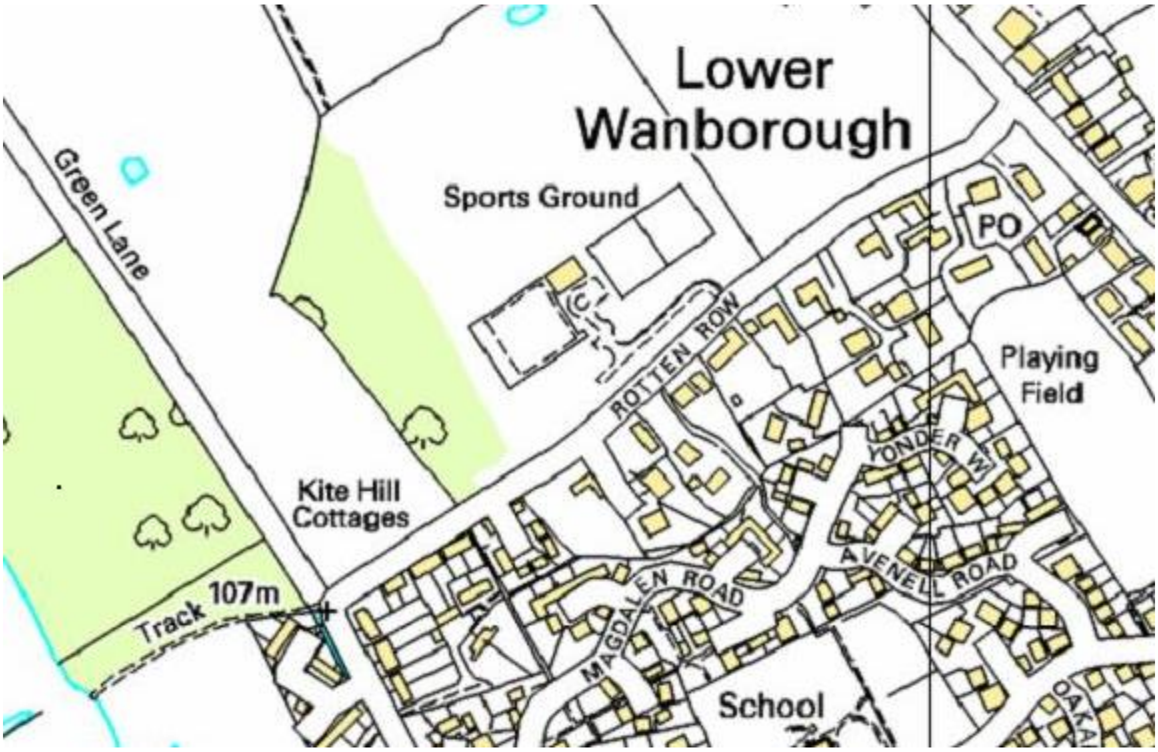

Figure 3.7: Location Plan; Rotten Row

Drainage

A combination of ditches and highway drainage form the north and south side of the street. It is considered that both sides connect to highway drainage in High Street.

Drainage along the north side of the street comprises kerbside gullies which discharge into the ditch running down the north side of the road. The water leaves this ditch via 2 other watercourses either side of Hooper's Field, which flow northwards towards the Marsh and Burycroft, and the lower section of the road (east) drains into High Street.

The south side of the road is drained mostly with a below-surface system (piped) and a small section of open ditch. It is considered that some parts of this system may feed across and discharge into the north side ditch. And again the lower section of the road discharges into the High Street system.

It is again recommended to clean, CCTV and map the highway drainage.

Rotten Row runs south-west to north-east and intercepts the drainage flow path from upstream at almost a 90® right-angle. This puts a lot of pressure on the receiving culverts as they try to convey the water beneath the road and discharge into the watercourses north of Rotten Row.

Flood History

Orchard Close, The Willows and College Green have all experienced some flooding, particularly during the extreme events of 2000, 2007 and 2008

Reasons for flooding

Rotten Row like Burycroft runs west to east and therefore intercept drainage from high ground in the north. During heavy rainfall events the existing system struggles to cope with the volume of water due to poor maintenance and outdated design.

Overland flows caused by surcharging sewers

Limited capacity of culverts/inlets

Suggested Mitigation Methods

Reinstate/clear the ditches

Flush and check highway drainage

Regular gully maintenance

Replace and/or repair deficient and sunken gully pots (kerbside)

Responsibility

Swindon Borough Council highways Authority

Photos

Photo 3.56: Ditch on south side of Rotten Row aligning with Pond House/Wessex House properties; outlet beneath access road is missing. Ditch should connect to highway drain discharging east towards High Street, suggesting there should be a piped or culverted section from this point to the garage; or ditch on the side of road.

Photo 3.57: Remnants of old ditch system bordering Glenville/ Pond House area; possibly lost during development. Kerb- gully pot suggests it now forms part of the highway drainage, linking south side of road to the High Street, past the garage.

Photo 3.58: culvert beneath access road into Hooper's Field requires flushing

Photo 3.59: Ditch on eastern boundary of Hooper's Field flows northwards and discharges into Burycroft. Ditch forms part of the highway drain system collecting water from Rotten Row and some from the connecting drains in Kite Hill. Ditch requires improvements but it should be noted that this section of ditch can provide some storage during extreme rainfall events due to its depth and location.

Flow control structures such as 'stanks' type weirs can be installed to hold back flows to reduce risk of overflowing ditches and subsequent flooding in Burycroft. Care needs to be taken so as to prevent backing-up of drains in Rotten Row.

Photo 3.60: Kerb gully-pots are broken or blocked in Rotten Row and require clearing or replacing

Photo 3.61: ditch flows eastwards towards Hooper's Field forms part of highway drainage and requires attention along with gully pots

Photo 3.62: culvert and headwall discharging into woodland currently owned by Woodlands Trust; ditch on the downstream side requires digging/improvements – (another potential area for

attenuation). However, ditch also forms part of highway drainage and more notably Thames Water SW sewer that collects water from properties in and around Magdalene Road area also discharges here.

Photo 3.63: Another view showing headwall and intercepting ditch (west to east) which forms part of highway drain system, but also collects water from Kite Hill (east side).

Area 7 - Burycroft

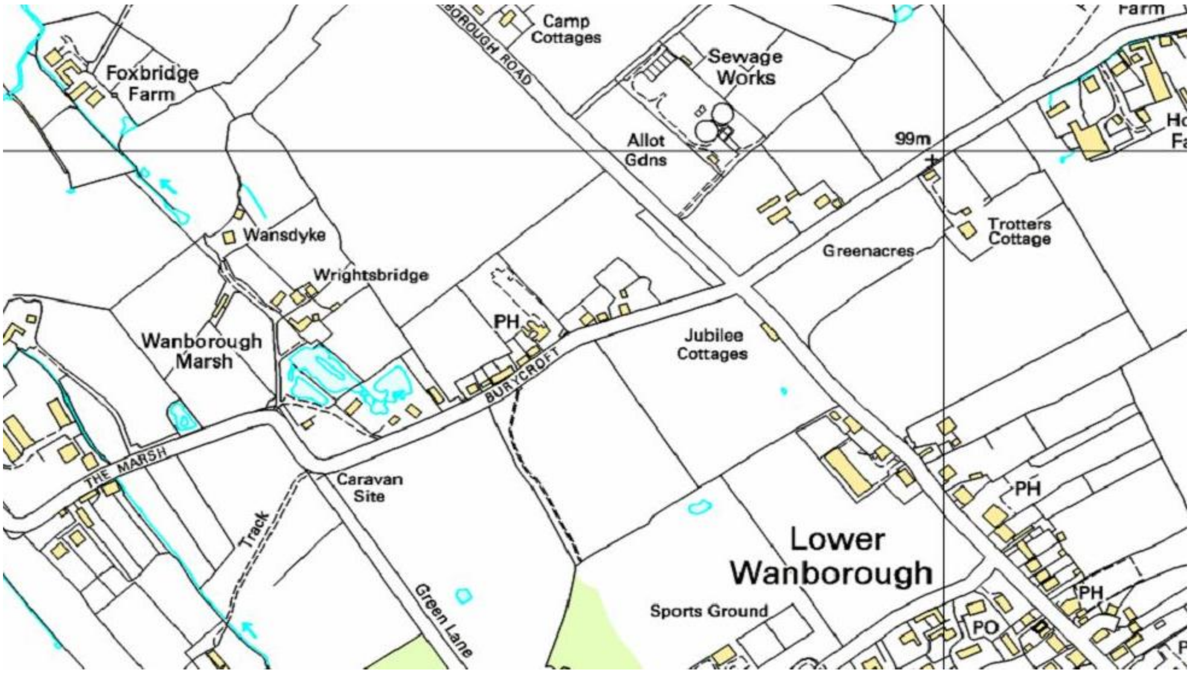

Figure 3.8: Location Plan; Burycroft

Drainage

There is no positive surface water drainage system in Burycroft; Thames Water only provides a foul sewer that serves the existing properties.

Surface water, particularly highway drainage utilizes the existing ditch along the south side of the road. This ditch also intercepts water from the ditches flowing northwards from Rotten Row. From here the water is discharged into a culvert beneath Burycroft, which in turn discharges back into an open ditch just east and downstream of Beaks and then on past Wrightsbridge.

Flood History

A number of properties in Burycroft have all experienced flooding, particularly during the extreme events of 2000, 2007 and 2008.

Reasons for Flooding

Sheer volume of water...Burycroft runs virtually east to west and therefore intercepts land drains flowing south to north from Rotten Row. There are at least 3 drains that reach Burycroft from Hooper's Field and Rotten Row and this excludes the High Street/Wanborough Road highway drain and the ditches that run through Green Lane. During heavy rainfall events the ditch is unable to contain the volume of water.

There is only one outlet culvert which restricts the discharge from the ditch

The downstream ditch requires reinstating

Suggested Mitigation Methods

In terms of mitigation Burycroft can be considered quite fortunate as there are a number of possible options:

Swindon Borough Council have already implemented some improvement works here including ditch and culvert improvements; they also have proposals to introduce further attenuation measures such as a large swale/detention basin, an outline plan can be viewed in Appendix H.

Increase size of receiving ditch to allow for more storage

Control/attenuation of flows upstream on the land between Rotten Row and Burycroft; and again attenuation further upstream close to source upstream of Springlines will also reduce the volume of water reaching this far.

Introduce another outlet from Burycroft ditch, via connection into Thames Water storm sewer close to junction with Wanborough Road.

Ditch either side of road heading west from Wanborough Road requires regarding and clearing

High drainage repairs at junction around to Jubilee Cottages

Responsibilities

Highways Authority, SBC

Thames Water

Riparian Land Owners

Photos

Photo 3.64: View facing west along Burycroft ditch; ditch can be widened here to allow for more storage. Photo 3.65: Another view facing west; surface water on road can be removed by introducing grips

Photo 3.66 and Photo 3.67: Ditch from Rotten Row joining with Burycroft

Area 8 – The Marsh

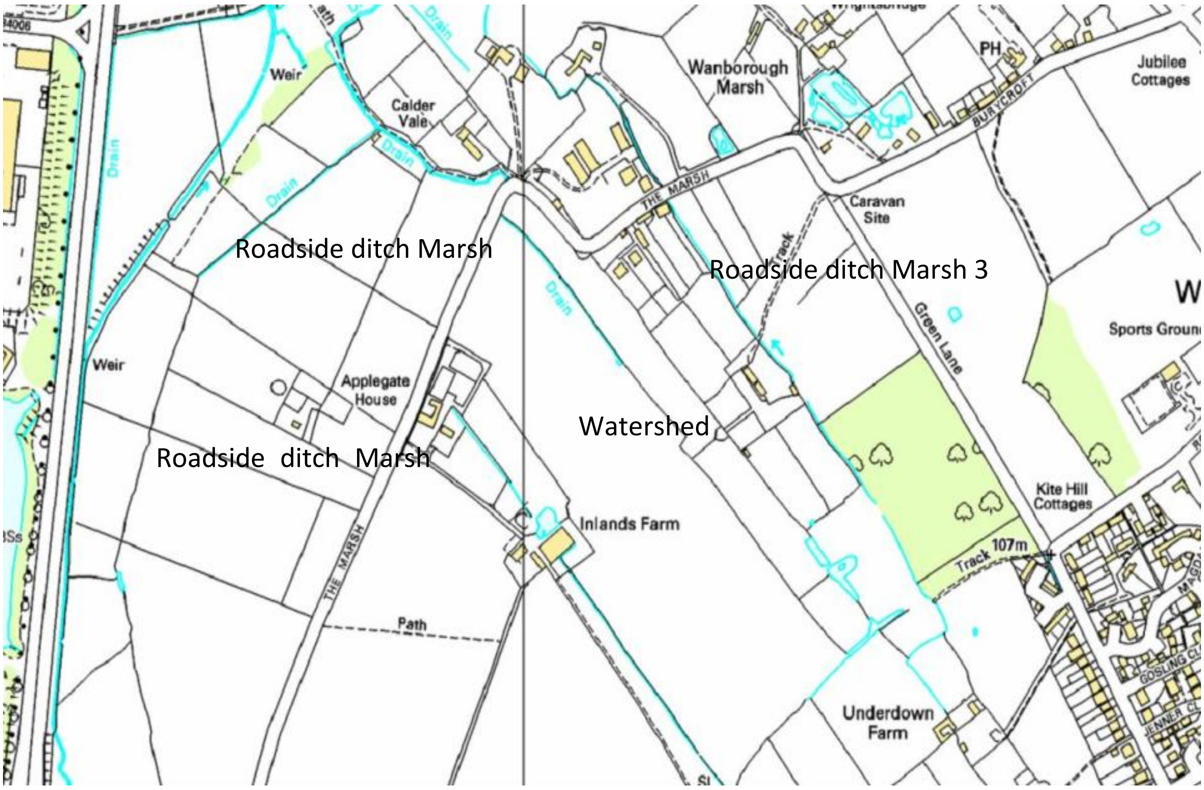

Figure 3.9: Location Plan; the Marsh

Drainage

- The first and foremost part of the drainage is the land drains through Cedar Vale and The Marsh / Lake Cottage and Moat Cottage (discussions with SBC). The reason for this being that a majority of the surface water generated through central Wanborough is discharged/conveyed through these areas
- Roadside ditches – a roadside ditch runs adjacent to the west side of the road from Moorleaze to Cedar Vale. It is worth noting that there is a watershed along this section of ditch (highlighted on plan); this means that the southern section of this ditch should flow southwards and discharge into the piped drainage around Great Moorleaze Farm (highways Authority drain?). The northern section flows northwards to Cedar Vale... where it joins the land drain which flows through Cedar Vale in a northerly direction until it joins with the Dorcan Brook.
- There is a small section of roadside ditch which should flow from the residential properties (Marsh Lea) towards Cedar Vale where it also joins the land drain via a culvert beneath the road; this ideally needs reinstating with gateway culvert.

- Another section of ditch runs from residential properties on opposite side of road this flows north easterly and discharges into the land drain that flows northwards through Wanborough Marsh.

Flood History

Highway flooding

Flooding to residential and agricultural properties during 2007/2008 storms; properties affected include: Moat Cottage, Lake Cottage, Foxbridge Farm, Mooreleaze Farm, Wansdyke and Wrightsbridge.

Reasons for flooding

High water levels in the River Cole and subsequently Dorcan Brook and Liden Brook caused water to back-up in the land drain initiating high water levels causing the land drain to overtop its banks. This will have been the main cause for flooding, particularly for the properties Moat Cottage and Lake Cottage. The back-up effect will have had an impact on the remaining properties in The Marsh area as connecting ditches and other drainage systems were overtopped or surcharged.

Excess water during 2007/2008 storms will have overpowered the design life of many drainage systems and this was experienced in many parts of the town

Poorly maintained ditches: the ditch along the marsh road between Moorleaze and Cedar Vale requires some attention (Photos 3.68-3.71).

The ditch adjacent to Marshlea is in reasonable condition; however the water seems to have nowhere to go, as there is no culvert beneath the driveway linking it to the ditch downstream, which does require some attention.

Remaining ditches through the Marsh require improvements.

Blocked or Broken culverts: Investigation required into all culverts including the lay-by upstream of Moorleaze and ditch/drainage downstream to this (Link to possible highway drain around Great Moorleaze Farm). Field access culverts require flushing.

The culvert beneath Marshlea access drive (Photo 3.28) should ideally be reinstated allowing water to drain away. The option of doing nothing here is not critical however, but may cause some light highway flooding. The culvert beneath the field access should be reinstated unless gateway no longer used then ditch to be reopened.

Suggested Mitigation Methods/Recommendations

Clear ditches and culverts; working from the downstream sections first.

Grips to collect water from road

Attenuation: to prevent flooding to properties downstream, attenuation is recommended upstream.

Proposed development on the Marsh will need to consider the flooding and drainage problems in this area and whether a drainage system proposed for the development can offer any surface water mgt benefits to the surrounding area – consider volumes from green lane /kite Hill

Culverts through Inlands Farm and Applegate House require inspection. Although no reported problems

Culverts along land drains through Cedar Vale and The Marsh require inspection possible Swindon Borough Council (SBC) intervention

Diverting flow routes, i.e. Wanborough marsh ponds (Ducksbridge)?

Responsibilities

Swindon Borough Council

Landowners

Photos

Photo 3.68: View facing south towards Moorleaze; stagnant water in ditch close to watershed: water here should flow north through the culvert access in photo 3.23 and continue along poorly maintained section of ditch photo 3.24 Then discharging into piped section to Cedar Vale

Photo-3.69: Well built field access culvert at point of watershed on Marsh Road; Photo-3.70: ditch downstream of culvert continues to Applegate House.

Photo-3.71: ditch continues to this section adjacent to Applegate House; from here it discharges into 600mm diameter piped ditch section; Photo-3.72 shows the outlet from land drain through Applegate House and Inlands Farm; this is conveyed through culvert beneath Marsh Road then also discharged into 600mm piped section.

Photo-3.73: Outlet into Cedar Vale land drain

Photo-3.74: Roadside ditch outside Marshlea residential property; not a highway drain but drains land on which the residential properties are located. Access drive should have culvert beneath it to allow this water to drain towards Cedar Vale.

Photo-3.75: Disused access to field; should have small culvert and ditch either side should be reinstated

Photo-3.76: View facing north at land drain adjacent The Marsh. This land drain requires improvements; SBC have commenced some works (Appendix H) continuing negotiations with land owners

Photo-3.77: View southwards at land drain culvert outlet beneath The Marsh road. The culvert requires attention; increasing the capacity of the culvert by resizing may be an option to reduce risk of flooding

Photo-3.78: View where The Marsh meets Burycroft via Green Lane

Area 9 – Pack Hill

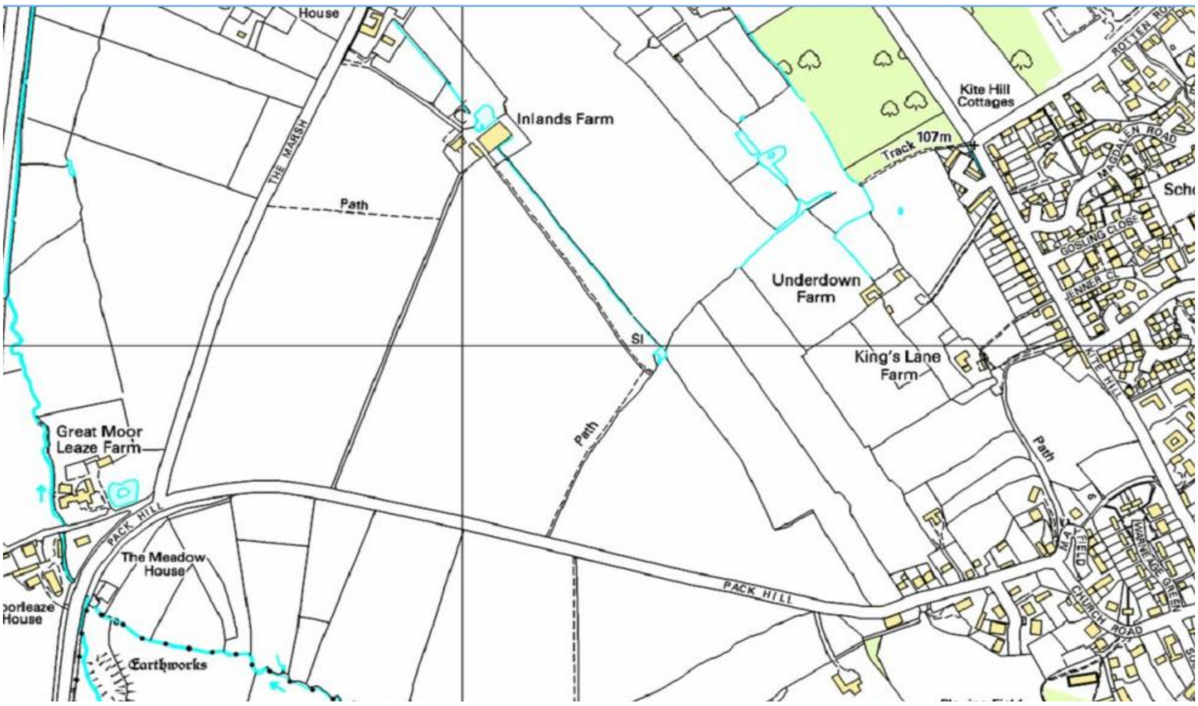

Figure 3.10: Location Plan; Pack Hill

Drainage

A combination of Roadside ditches and gullies

Flood History

Excess water on road 2007

Reasons for Flooding

Prolonged periods of heavy rainfall; gradient of hill

Surrounding ground levels higher than the road level can sometimes cause flooding problems within highway drainage systems as soil and vegetation can get washed down and block gullies and culvert

Not enough collection points including grips and gullies

Sunken blocked and broken kerbside gullies

Poorly maintained ditches

Suggested Mitigation Methods

Clear ditches and culverts

Introduce more gullies and grips

Gullies with masonry retaining wall structures could be used where steep sided earth banks line the road.

Replace damaged/ sunken kerb gullies

Responsibilities

Highways Authority, SBC

Photos

Photo 3.79: sunken kerb gullies caused by resurfacing of road; this allows surface water to bypass the gully and continue to flow down road. As this water gathers momentum down the hill it is unlikely to get picked up by the next gully and so on until it reaches the lowest point and then ponds and floods the road and/or adjacent properties.

Photo 3.80: high sided banks either side of the road allows debris and vegetation to get washed down and block gullies.

Photo-3.81: View west down Pack Hill; undersized and lack of gullies along the upper section of road; allowing road to be used as a conduit.

Photo-3.82 Roadside ditch down Pack Hill (north), now diverted northwards (see Appendix B). Fly-tipping is always a problem, regular maintenance will ensure the ditches remain clear and free-flowing.

Area 10 – Moorleaze

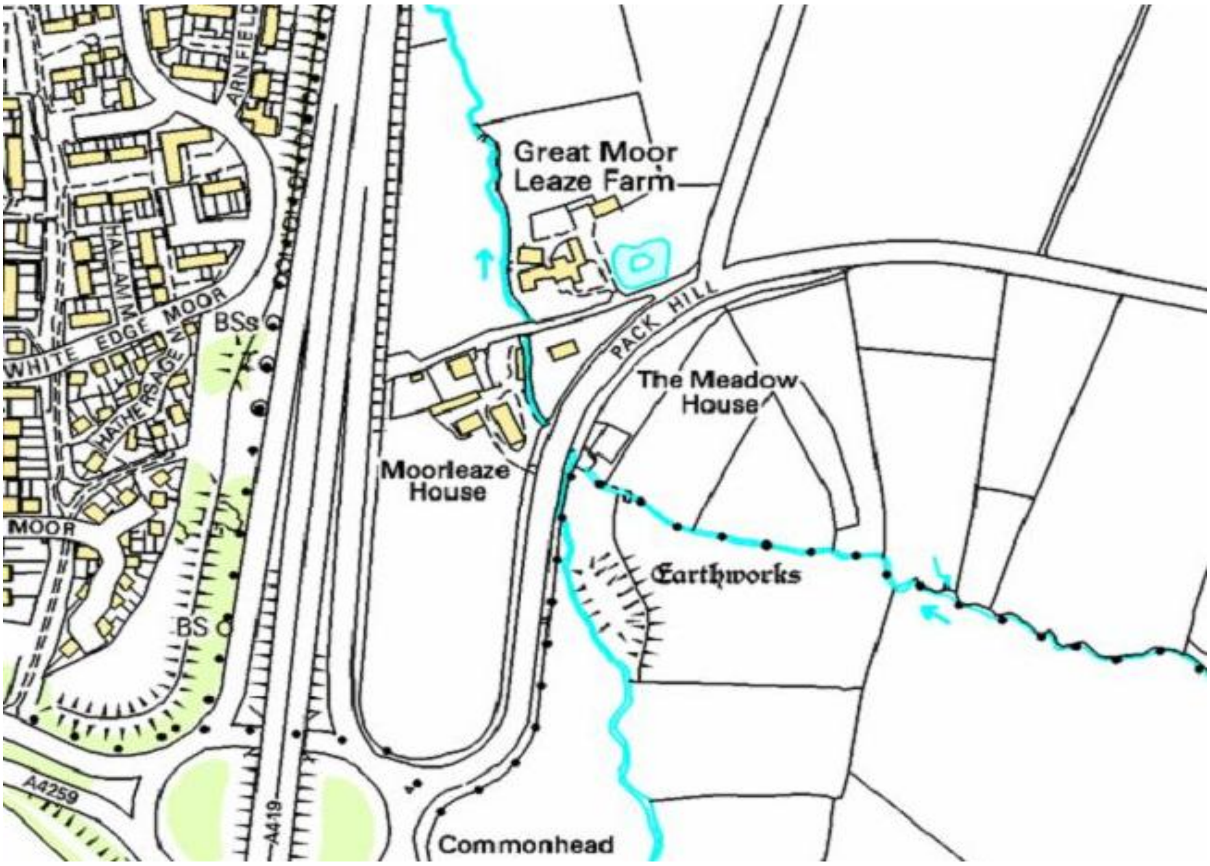

Figure 3.11: Location Plan for Moorleaze area

Drainage

Access road to Moorleaze – part of Old Swindon Road evidence of highway drainage system; prior to this it would have been a ditch system linked with the remainder of Pack Hill and the west side of The Marsh.

Roadside ditch – This ditch collects surface water from the road at the foot of Pack Hill and is fed via grips; this section of ditch offers a large holding area within land adjacent to Meadow House

Flood History

There are four residential properties in Moorleaze; all of which experienced severe flooding in 2007 and 2008, except for Meadow House, which is raised on higher ground.

"The worst flooding occurred on the 20th July 2007 and the water came from Pack hill, across the pond area from Hussy's fields and the Marsh. Flood water also went through the main gateway, along the drive and under the fir trees on the main gate side of Great Moorleaze Farm. This combined with flooding from the A419 drainage system and high water levels in the Liden Brook.

The water from the A419, and surrounding area was flowing into the Liden brook, this got caught behind the new barriers which SBC put in and created a weir type dam which over flowed and sent the water up the lane as the area around Moorleaze House and Dave Manners farm yard were flooded out. The 2 lots of water collided outside our driveway and then flooded throughout house as it tried to get back to the natural water cause and the quickest way was through the house! The flood water from the Marsh and some of Pack Hill went across the barns and field areas. The water was waist high on this occasion.

On the 3rd June 2008 the flood occurred in a similar manner but due to us having done the open ended pipe, put in significant drainage across the field and barns area, put in the large wooden gates and sand bagged it as well as SBC having changed the culvert, changed the bridge structure and dug out the ditch at the bottom of pack hill the flooding was only knee high", Jo Baines.

Reasons for flooding

Main River

Fluvial flooding during extreme rainfall events, particularly 2007/2008, which some considered to be classed in the region of 1 in 200-year return periods, was caused by high water levels, and experienced in all UK Rivers.

Prior to the 2007/2008 events; a lack of maintenance to the Liden Brook may have contributed to the flooding around Moorleaze

Highways

Mooreleaze access road highway drainage system – poor (dated) some gullies blocked; investigation proposed – SBC

Grips, culverts and Ditch (highway flooding- Mooreleaze/Pack Hill)

Land Drainage

Possible culvert missing/dysfunctional beneath Marsh Road; to connect to drainage system around Moorleaze Farm (above) – SBC/landowner

Diversion of ditch upstream – it is assumed that the ditch alongside Pack Hill continued to the Marsh Road, as well as diverting northwards upstream. However, this section of ditch appears to have been back-filled. During an extreme rainfall event it is possible the ditch may have overtopped by heavy flows from Pack Hill, as it tried to follow its natural course. This coupled with a dysfunctional culvert at Marsh Road junction would account for surface flooding in the field.

The field drainage system may also be dysfunctional due to lack of ditches and suitable outlets.

Suggested Mitigation measures/Recommendations

Diversion of ditch northwards is beneficial to Moorleaze and to Pack Hill highway, as it diverts water away from the area. However, improvements are required to ensure it has capacity to contain flows generated from Pack Hill during heavy storms.

The ditch flows through Inlands Farm via a large attenuation pond and then continues through Applegate House and discharges via a culvert on The Marsh road. To date CPLC has not managed to gain access to Applegate House in order to investigate the ditch. Access is required to both properties to investigate the system to ensure system meets requirements to minimise risk of flooding to these properties.

Use of flow control structures such as weirs may be an option, if required, to contain/control flows in ditch and field area upstream (south) of Inland's Farm.

Downstream of Applegate House the water is discharged into a large-diameter piped section of ditch; this flows northwards along the west side of The Marsh road about 50 metres to the entrance of Cedar Vale, where it discharges into open ditch drainage channel, which continues on to the Dorcan Brook. The drainage channel may require digging and the piped section of ditch needs flushing through.

Investigate drainage beneath junction; possibility to divert to other side of road where the larger ditch/holding area (see Plan-1)

Investigate /reinstate drainage for access road

Reduce flows from The Marsh road by diverting west into Liden Brook through field north of Great Moorleaze Farm

Clear ditch along The Marsh

Possible existing culvert across the marsh road (Photo 3); S.B.C. to investigate; this will require ditch to be reinstated at least around the culvert inlet; this will improve the field drainage

Environment Agency improvement works on Liden Brook

Grips – have been introduced on the section of road (a3333) adjacent to Moorleaze; however, one or two more may be required to pick-up surface water ponding over the road.

Responsibilities

Swindon Borough Council – Highways and Land Drainage may have some input here; particularly as it gets water off road. The Land Drainage Act should ensure landowners maintain their watercourses. However, initially in this case liaison between landowner and SBC would be beneficial to provide a solution to minimize flooding to highway and properties in Moorleaze area.

Photos

Photo 3.83 Flooding at Moorleaze House, Old Swindon Road in July 200

Photo 3.84: Flooding at Great Moorleaze Farm in July 2007

Photo 3.85. Flooding in field adjacent to Great Moorleaze Farm. Good attenuation area. However, original ditches around field may have been backfilled some years ago. It is also assumed that a culvert existed in the corner of field to disperse water into drainage system across road and into Liden Brook.

Photo 3.86: Is this line of original culvert beneath road? SBC to investigate with vactor and cctv. Drainage on opposite side of road around Great Moorleaze Farm boundary will need to be investigated and reinstated.

Photo 3.87: Flooding at foot of Pack Hill, July 2007; SBC have cleared ditch and installed new larger culvert.

Photo 3.88: Flooding on Pack Hill road; SBC have since dug out grips. However, this area may require further improvements, i.e. more grips.

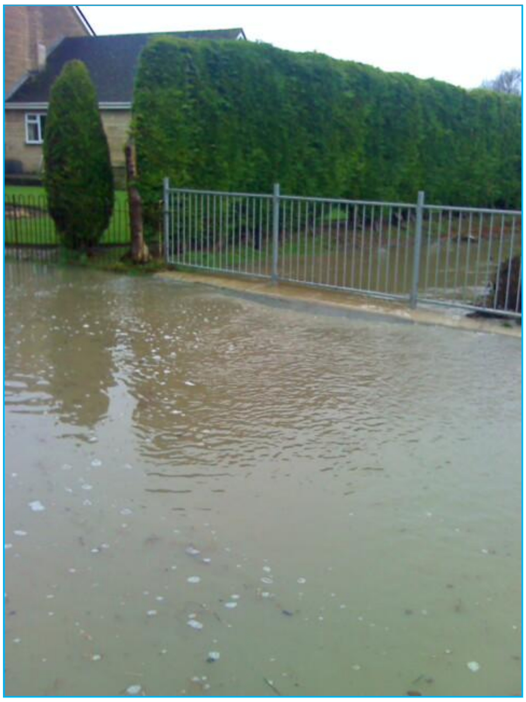

Photo 3.89 and Photo 3.90; Flooding of the Liden Brook, July 2007.

Photo 3.91. Pack Hill/Moorleaze Ditch (South)

Photo 3.92. highway drain runs alongside south boundary fence of Great Moorleaze Farm; requires flushing, cctv and mapping

Photo 3.93. gully amd pipe susceptible to blockage from falling vegetation and debris from overland flows

Photo 3.94 / 3.95 no evidence of culvert beneath this lay-by probably buried over time due to poor maintenance. However, this does disconnect flows from upstream which would be beneficial to the Moorleaze area and possible a good location to divert flows west straight to the Liden Brook

Area 11 – A419 Commonhead Junction

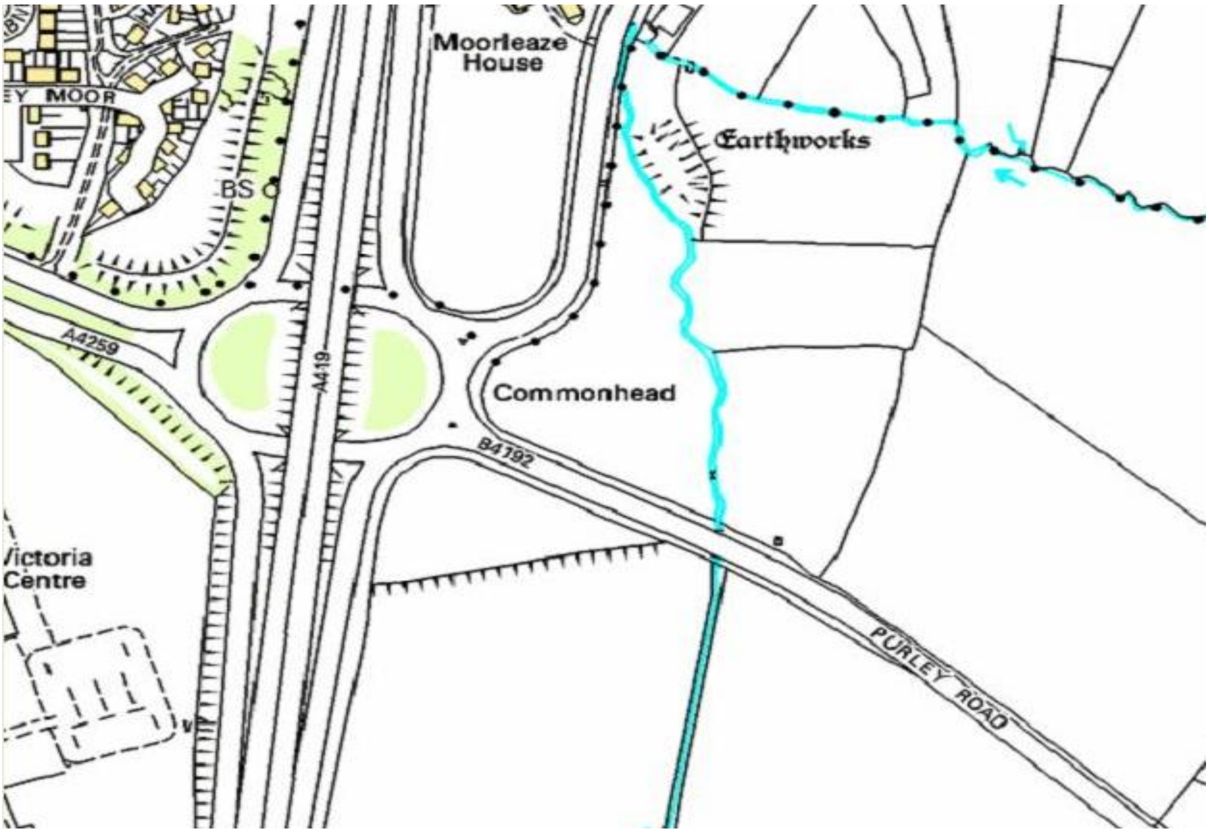

Figure 3.12: Commonhead Junction

This junction was constructed to meet demands of expanding town of Swindon and subsequently the increase in traffic volumes. It replaced part of the old ring road A419, and created a greater hard standing area to be drained. Located on the east side of this junction is Mooreleaze and a little further east is Wanborough.

Drainage

The junction has its own drainage system; a plan showing the drainage catchment areas for the Commonhead Junction is located in Appendix C. Outfalls A, B, D, E and F discharge into the ditch on the North East side of the junction around Moorleaze Farm and then northward into the Liden Brook.

Outfalls C and G discharge into the ditch on the South West side and eventually end up in the large pond near Liden Estate.

The flow control structures are 375 dia. piped culverts with overflow weirs.

Flood History

2007 flooding from ditch / outfalls from junction drainage

Reasons for flooding

- Just sheer volume of surface water in 2000 and 2007 events caused high river levels in the River Cole and then the Liden Brook, which subsequently reduced the drainage capacity by restricting the flow from the north and south outfalls from the Commonhead junction.

- Ditches poorly maintained: dense vegetation may have impeded flow through the flow control structures (Photo 3.3), particularly the outlet structure at the roundabout (Photo 3.4).

- Undersized culverts; connecting ditches

- the outlet structure which connects to the ditch south of Moorleaze Farm (Photos 3.4-3.7)

- due to the intensity of the rainfall it is also possible that much of the surface water will have run down the road and not got picked up by the kerb-gullies; this could explain why there seemed to be very little water in the ditches at the time of the flooding.

Suggested Mitigation measures/improvements

Remedial Measures

- Whole system to be flushed and cctv'd if required

- Clear ditches – regular maintenance of this ditch is recommended to minimize vegetation and possibility of blockages; bed of stream should be clear of vegetation to maintain smooth gradient
- Increase capacity of connecting culverts at the south west outlet

Possible Solutions

- Increase capacity of connecting culverts at the south west outlet
- Source Control: Attenuation is probably the best option; the existing flow control structures are not adequate enough to control the flows during heavy rainfall events
  - Storage capacity possible for extreme events in Mooreleaze ditch; investigate possibility of attenuation basin
  - Oversize pipes – Pipe the section of ditch using oversize pipes for attenuation
  - Ring Soakaways and/or geocells; particularly useful on roundabout and area of land on south east side of roundabout, to attenuate flows from outfalls A, B, D and E.
  - Larger recessed gullies will collect more water off the road and allow for storage and control within the ditches

Responsibilities

- Ditch would normally be landowners' responsibility. However, in this case I believe it should now be the responsibility of the Highways Agency as they seemed to have adopted it to drain the junction slip roads.
- Drainage structures such as pipes and culverts are the responsibility of the Highways Agency

Photos

Photo 3.96: View northwards junction sliproad with drainage ditch on the right

Photo 3.97 View southwards junction sliproad with drainage ditch on the left

Photo 3.98 Flow control structure – headwall and culvert within ditch

Photo 3.99 Outlet structure – headwall and culvert within ditch

Photo 3.100 south facing – ditch piped beneath footway to open ditch

Photo 3.101 south facing – ditch piped beneath footway to open ditch

Photo 3.102 Open ditch south of Moorleaze Farm

Photo 3.103 Open ditch south of Moorleaze Farm

4. RECOMMENDATIONS AND CONCLUSIONS

- Highway drainage to be cleaned cctv'd measured and mapped; highlighting areas of poor or no drainage
- Swindon Borough Council to carry out repairs to highway drainage as highlighted on plans in Appendix B
- Ditches and culverts throughout Wanborough need to be cleared/ reinstated, as highlighted on plans in Appendix B; this will involve discussions with landowners
- Existing development impeding land drainage systems
- new development impeding drainage systems
- Level 2 study will include peak flow rates for each watercourse, culvert and map whole system throughout the village this will help determine ditch and culvert sizes also provide technical data for any required attenuation and/or improvement works; however, this level of detail may not be required at this stage until obvious improvements have been applied such as ditch works and culvert repairs etc.

APPENDICES

Appendix A

Main Rivers Map

APPENDIX B

AREA DRAINAGE MAPS

Appendix C

Liden Brook Modelling Study

APPENDIX D

CRANFIELD UNIVERSITY SOIL REPORT

APPENDIX E

THAMES WATER ASSET MAPS

Appendix F

A419 Commonhead Junction Drainage Detail

APPENDIX G

SWINDON BOROUGH COUNCIL COMPLETED AND PROPOSED WORKS PLAN

APPENDIX H

WANBOROUGH DRAINAGE AND FLOOD MANAGEMENT WORKS SHEET

Notes

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