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# Upper Mole Flood Alleviation Scheme Environmental Statement

## Volume 1 Main Text

A04 Fourth Draft Final for Planning Submission: 28th January 2011

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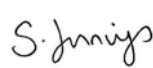
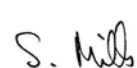

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# Non Technical Summary

## Introduction and Background

This Environmental Statement has been prepared to consider the effects that the Upper Mole Flood Alleviation Scheme might have on the environment. It is a requirement of UK law to carry out such an assessment, where there are likely to be impacts on the environment. The report is important to help the local councils and other interested parties, including the general public, understand where there might be impacts and how we propose to deal with them.

Crawley suffers from flooding from the upper reaches of the River Mole, including the Gatwick Stream, Tilgate Stream, Crawters Brook and Ifield Brook. This affects both residential areas and Gatwick Airport. There were major flood events in 1968 and 2000 and smaller floods in other years. We (the Environment Agency) are proposing to build new flood detention reservoirs to reduce the flood risk in these areas. The scheme started with the raising of Tilgate Dam, which was the subject of a separate environmental assessment and is currently being constructed (completion estimated in early 2011). This scheme was started early as the dam also needed remedial works for safety reasons. We are now progressing the next phase of works, which includes:

- replacement of the existing dam at Clay's Lake with a new higher dam;
- new flood detention reservoir at Worth Farm;
- river restoration and environmental mitigation works in Grattons Park.

A new flood detention reservoir at Ifield was also being progressed, but the planning application for this site has been postponed by the Environment Agency project board pending review of the business case.

Once completed, the schemes (including the dam raising at Tilgate but excluding the potential future works at Ifield) would reduce the risk of flooding at 1038 properties in the Crawley and Horley areas, as well as to Gatwick Airport. The number of properties protected would be higher if climate change increases the risk of flooding in the future, as we expect it to.

It is anticipated that the works would be carried out between 2011 and 2013 with the main period of construction anticipated during 2012. This Environmental Statement considers the proposed works at all three of the locations noted above and accompanies planning applications to the relevant local authorities. For more details or to comment on any of the applications, please contact the local authority for the scheme of interest:

### **Worth Farm**

Stuart Malcolm  
Mid Sussex District Council

### **Clay's Lake**

Stuart Malcolm  
Mid Sussex District Council

### **Grattons Park**

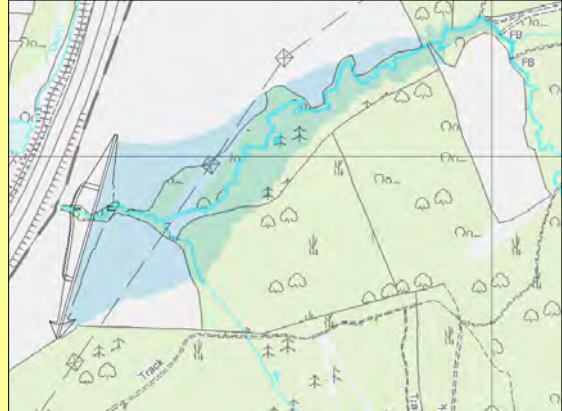
Paul Fairham  
Crawley Borough Council

The following pages detail the scheme proposals for each site, along with the key impacts and proposed mitigation measures.

## **Worth Farm**

### **i Details of the Scheme**

We are planning to build a new flood detention reservoir in agricultural land to the east of Crawley, close to the M23 motorway. There are no existing flood defences at the site. We would build a new embankment dam to a height of 6.5 metres above the surrounding ground, broadly parallel with the M23 motorway. No water would be stored in the reservoir for most of the year and the area could still be used for farming. However, during times of high river flows, water in the brook that would ordinarily run beneath the dam would start to pond up, creating a reservoir. The water would stay within the reservoir for a period of a few days before emptying again as water levels in the river fall. Water would be released at a steady rate so as not to cause flooding downstream.



Once the scheme is complete, the water level is likely to rise up to 3.5 metres above existing bank level on average once every five years (20% annual chance), whilst the annual chance of the reservoir filling to its maximum capacity of 6.5 metres above existing bank level is 1 in 200 (0.5% annual chance). During large floods, the water could flood surrounding agricultural land and areas of trees. Once the flood waters recede, the area would return to normal.

Building the new dam requires a supply of earth and rock, and we are intending to dig some of this from the ground in an area known as a “borrow pit”. We can get this material from the surrounding land within the reservoir footprint and we are proposing to dig into the area of low quality grazing land to the south of the stream to provide this. The remainder of the general fill material will be brought to the site by lorry. Once the works are complete, the borrow area would be restored to create woodland Biodiversity Action Plan (BAP) habitats, improving the diversity of habitats in the area.

We are likely to start some early works on site during 2011, including stockpiling of fill materials, with the main works starting in early 2012 and lasting for about a year.

Having the scheme in place would contribute to provision of flood protection to 1038 properties in the Crawley and Horley areas, as well as at Gatwick Airport. This would minimise the safety and health problems that are associated with flooding such as people being hit by debris in the floodwaters or having to live in damp houses, as well as the real risk to life. It would also reduce the stress people have, wondering if they will be flooded at times of high rainfall.

### **ii The Existing Environment**

The Worth Farm site lies within Mid Sussex District, to the east of Crawley. The land is currently agricultural and lies within the High Weald Area of Outstanding Natural Beauty (AONB). The landscape is of high quality and there are areas of ancient woodland along the stream and in surrounding areas. The site lies hard up against the M23 motorway, which forms the western boundary of the site, with more continuous woodland to the east. The only public views of the site are from the Worth Way footpath to the north as it crosses the M23 and from the M23 itself.

The Gatwick Stream runs through the site. This has populations of coarse fish with the dominant species being bullhead. Other species found include brook lamprey and brown trout. The stream also supports a range of invertebrate species.

We have done surveys of the wildlife in the area and found that there are small populations of slow-worms, grass snakes and common lizards in areas of rough grassland such as the motorway verge. The area supports habitats that are suitable for use by foraging and roosting bats and feeding and

nesting birds. Dormice are present in the ancient woodland. All of these species are protected by either national or European legislation. The woodland areas upstream of the site are designated as a site of nature conservation interest.

There are no known archaeological finds or heritage sites within the footprint of the scheme though it is recognised that the wider landscape is one of historic field boundaries and coppiced woodland. Worth Conservation Area lies close to the west, but is on the other side of the motorway, the works are therefore screened and will have no visual impact on the conservation area. There are no other sites of more than local importance or value close to the scheme.

### **iii Environmental Impacts and Proposed Mitigation Measures**

The largest impacts are expected during the construction phase. The farmer would be unable to use the works area for a period of about a year, although the majority of the northern side of the valley would still be available to use for grazing. The impacts on the farmer would be mitigated through compensation for any loss of revenue. The works are far enough from private residences and public areas not to cause disturbance and screened by the motorway.

Construction of the dam and associated borrow area would result in the loss of areas of grazing pasture, including some rush habitats. It would also result in the loss of the western edge of a belt of trees which is part of an area of replanted ancient woodland along the stream. We would plant an area of new woodland outside the reservoir footprint to replace that lost beneath the dam. This would mitigate for the loss of ancient woodland and impacts on the population of dormice by providing additional habitat. Full details of this would be provided as part of a dormouse European Protected Species licence application to Natural England. All work on site would need to be carried out under the methods detailed in this licence, to ensure that an offence is not committed. Loss of ancient and ghyll woodland will also be mitigated by improved management of retained areas of this type of habitat.

To minimise impacts on other protected species, all tree and vegetation removal would be undertaken outside the bird breeding season and following confirmation that roosting bats are not present. Reptiles would be excluded from the working area before construction begins. We would put up new bat, dormouse and bird boxes and create an area of new woodland habitat within the borrow area, and wet woodland close to the stream.

The works would result in disturbance to the watercourse, with some minor diversions during the construction phase to allow the new structure to be built. Diversions would be carefully managed to minimise impacts on fish populations in the river by moving gravels from the existing river channel into the diversions and ultimately into the new channel. Works to the watercourse and excavation work in general have the potential to produce silt which could get washed into the stream, particularly during heavy rain. A sediment management plan would be produced to ensure that this is well managed and would include measures such as settlement tanks and silt fencing to trap sediment before it reaches the stream.

An archaeologist would be present on site when we are excavating, to check for buried archaeological remains. Whilst we think the risk of this is low, if anything is found, the archaeologist would be able to stop works and advise us of the best way forward.

Lorries and machinery would need to access the site to bring deliveries of general fill for the dam and various other materials, including concrete and sand. This is not anticipated to result in significant disturbance, as vehicles would access the site directly from the M23. However, we would manage all vehicle movements through a traffic management plan, agreeing with the Highways Authority (West Sussex County Council) the numbers and timing of deliveries and routes that heavy goods vehicles have to take. Our access route into the site follows a public right of way for about 60 metres. To ensure the safety of people using the right of way, it would be temporarily diverted while the works are in progress.

The new dam would change the appearance of the area, which is on the edge of the High Weald Area

of Outstanding Natural Beauty. However, the dam is positioned next to the existing M23 motorway, which is on an embankment of a similar height, and as far as possible, we have tried to meet some of the aims of the AONB Management Plan. For example, new planting would be provided to help the embankment blend in with the existing countryside and to soften hard edges. We have chosen finishing materials to be fitting within the rural landscape wherever possible (unless unavoidable for reasons of dam safety).

The creation of a new culvert through the dam is contrary to Environment Agency policy. The artificial channel and structures to control flow would increase the modification of the stream and would hinder some of the natural river processes. Although fish would be able to move through the culvert and we have designed the structure to encourage this, they may be discouraged by its presence. This impact is partially mitigated by the opening up of the existing concrete channel at Grattons Park and re-naturalisation of the stream there. Our assessment of impacts under the Water Framework Directive concludes that the scheme is unlikely to prevent Good Ecological Status being reached as a direct result of the building of the dam. However, the long term and indirect effects are less certain, so we intend to monitor the catchment before and after building the scheme and will put additional measures in place if impacts are found to be occurring.

The farmer would lose an area of grazing land in the location of the restored borrow pit, and when the dam is used to hold back water, the farmer would not be able to access the valley. The farmer would be given flood warnings to enable animals to be moved out of the reservoir area when a flood is due. The water levels would return to normal within a matter of days (depending on the size of the flood) so there would not be any significant long term impact on the availability of the land for grazing.

The reinstatement of the borrow area to woodland habitats as well as the new area of wet woodland close to the stream provide mitigation for the effects of the scheme. They would provide important features for birds and insects, as well as amphibians, small mammals and bats. We would reuse some of the large trees that would be lost as deadwood habitats, improving the diversity of habitats and encouraging the area to develop for wildlife benefit.

In conclusion, there are not believed to be any significant impacts arising from this scheme that cannot be adequately mitigated or managed through the planning and construction management phases.



## **Clay's Lake**

### **i. Details of the Scheme**

We are planning to remove the existing poor condition dam at Clay's Lake, to the south of Crawley, and replace it with a new larger dam on the same site. The water level in the lake would remain the same as it is at the moment for most of the time. The new dam would be 7.7 metres high above the existing water level and 11.8 metres high above the downstream ground level. It would only be used to store water above the normal lake level in times of flood, on a very infrequent basis. When flows of water along Stanford Brook increase, water would start to pond up behind the dam, increasing the size of the reservoir.



The additional water would stay within the reservoir for a period of a few days before returning to normal as water levels in the river fall. The reservoir water would be released at a steady rate so as not to cause flooding downstream.

Once the scheme is complete, the lake is likely to rise just over two metres above its existing level on average once every five years (20% annual chance), whilst the annual chance of the reservoir filling to its maximum capacity of 7.7 metres above normal lake level is 1 in 1000 (0.1% annual chance). During large floods, the water could flood surrounding areas of woodland for a period of a few days in a 1 in 100 chance flood, and about week in a 1 in 1000 chance flood. Once the flood waters recede, the area would return to normal.

Building the new dam requires a supply of earth and rock, and we are intending to dig this out of the ground in an area known as a "borrow pit". We can get a lot of the material we need from the surrounding land, and we are proposing to dig into an area of cleared woodland, some of which has recently been replanted, to provide this. This reduces the number of lorries that need to access the site. The borrow area would be used to create a new pond with surrounding planting. Any trees and saplings removed would be replanted or replaced elsewhere on site.

We are likely to start some early works on site during 2011, with the main construction starting in early 2012 and lasting for about a year.

Having the scheme in place would contribute to the provision of flood protection to 1038 properties in the Crawley and Horley areas, as well as at Gatwick Airport. This would minimise the safety and health problems that are associated with flooding such as people being hit by debris or having to live in damp houses, as well as the real risk to life. It would also reduce the stress people have wondering if they will be flooded. The improvements would also significantly improve the safety of the existing dam which is in poor condition, minimising the risk of future failure.

### **ii. The Existing Environment**

Clay's Lake is in Mid Sussex District. It is an existing lake on the Stanford Brook, a tributary of the Gatwick Stream. The site lies to the south of Crawley and the M23, within the High Weald Forest and an Area of Outstanding Natural Beauty. To the east of the site lies the main London to Brighton railway. Although the lake lies within woodland, areas of land to the north are used as paddocks for a stables business. The land to the south of the lake is in different ownership. The trees on this area of land have been clearfelled and some areas have been replanted with saplings. There are more continuous areas of forest to the west.

The existing dam is 1.3 metres above lake level and 4.3 metres above the downstream land. It is believed to have been constructed between 1949 and 1958. It is made from a sandy, gravely clay, although has been reinforced with rubble following failures which have occurred in recent years.

Access to the lake is via a grassed farm track from Parish Lane to the north.

We have done surveys of the wildlife in the area and found that there are populations of slow worms, grass snakes, common lizards and adders in areas of rough grassland and felled woodland, and great crested newts in a nearby pond. A population of dormice has also been found in the woodland. The area supports habitats that are suitable for foraging and roosting bats and feeding and nesting birds. All of these species are protected at either the national or European level. There is a Site of Special Scientific Interest about 200 metres downstream of the site but on the other side of the railway line. This will not be impacted by the scheme.

The lake supports species such as brown trout, rudd, perch and carp, with associated aquatic plants and invertebrates. Downstream of the dam, the stream contains lamprey larvae, which are UK Biodiversity Action Plan species. The landscape is of high quality, and the ancient woodland around the lake is an important local feature.

There is only one known archaeological site in the footprint of the scheme, the former site of a charcoal burning platform. This is not in the area to be disturbed, but would fall within the new reservoir footprint. There are a few other scattered heritage sites in the area, but these are only of local importance and would be unaffected by the scheme.

### **iii. Environmental Impacts and Proposed Mitigation Measures**

The largest impacts are expected during the construction phase. The area of the works would be unavailable to access by the landowners concerned for a period of about a year; however there is no public or commercial use of the area, so these impacts are limited. The works are far enough from private residences and public areas not to cause any significant disturbance.

Building the new dam would require the loss of areas of woodland around the lake, some of which is ancient woodland. Some newly planted saplings would also be lost within the borrow area. We would plant an area of new woodland outside the reservoir area to replace this, and any saplings lost within the borrow area would either be transplanted (if possible) or replaced. Loss of ancient and ghyll woodland will also be mitigated by improving how we manage existing areas of this type of habitat.

The reptiles, great crested newts and dormice present on site would be excluded from the works area before construction starts. Full details and method statements for this would be provided as part of great crested newt and dormouse European Protected Species licence applications to Natural England. All work on site would need to be carried out under the methods detailed in these licences to ensure that an offence under the legislation protecting great crested newts and dormice is not committed. To minimise impacts on other protected species, all tree and vegetation removal would be undertaken outside the bird breeding season and following confirmation that roosting bats are not present. We would also put up new bat, dormouse and bird boxes.

An archaeologist would be present on site when we are excavating, to check for the presence of buried archaeology. Whilst we think the risk of this is low, if anything is found, the archaeologist would be able to stop works and advise us on the best way forward.

The number of lorries accessing the site would be limited as we can get most of the material we need from the on-site borrow area. However, lorries and machinery would need to access the site to bring deliveries of various materials, including the sand filter for the middle of the dam. This is not anticipated to result in significant disturbance, but we would manage all vehicle movements through a traffic management plan, agreeing the numbers and timing of deliveries and routes that heavy goods vehicles have to take with the Highways Authority (West Sussex County Council).

To build the new dam we need to lower the lake and remove the existing dam. The lake would be drained for the duration of the works and vegetation around the edge of the lake would be cut before the lowering started to discourage birds from nesting there. As it is drained, fish would be removed from the lake by a specialist fish contractor and either stored or sold. The lake would be restocked in accordance with the wishes of the landowner once works are complete. Stream water would be

pumped to the downstream channel through the construction period at broadly the same rate as it enters the lake. The location of the new culvert means that we need a permanent diversion to the watercourse downstream of the dam and this would be designed to be as natural as possible.

Works to the watercourse and excavation work in general have the potential to produce silt which could get washed into the stream, particularly during heavy rain. A sediment management plan would be produced to ensure that this is well managed and would include measures such as straw bales and silt fencing to trap silt before it reaches the stream.

The new dam would change the appearance of the area but this should be considered in the context of its lack of public access and location within a valley that is largely shielded by trees. The dam would also have an effect on the landscape of the Area of Outstanding Natural Beauty. As far as possible, we have tried to meet some of the aims of the AONB Management Plan, for example, new planting would be provided to help the embankment blend in with the existing countryside and to soften hard edges. We have chosen finishing materials to be fitting within the rural landscape wherever possible (unless unavoidable for reasons of dam safety).

The increase in culvert length through the dam is contrary to Environment Agency policy. The structures would increase the modification of the stream and would hinder some of the natural river processes. This impact is partially mitigated by the opening up of the existing concrete channel at Grattons Park and re-naturalisation of the stream there. The existing dam is not passable to fish, which means that while fish are able to move downstream (i.e. out of the lake), they are unable to return upstream, from the brook into the lake. As part of our scheme we are designing the culvert at a suitable gradient to ensure that fish are able to swim in both directions. This is an improvement to the existing situation and mitigates for the impacts on fish resulting from the increase in culvert length. Our assessment of impacts under the Water Framework Directive concludes that the scheme is unlikely to prevent Good Ecological Status being reached as a direct result of the building of the dam. However, the long term and indirect effects are less certain, so we intend to monitor the catchment before and after building the scheme and will put additional measures in place if impacts are found to be occurring.

The new dam would have a considerably larger footprint than the existing dam, and it would extend upstream into the existing lake. This means that the volume of the lake would be less than at present once the scheme is complete. An area immediately upstream of the dam would be dredged to maintain the existing lake depth to allow it to continue to support fish.

When the dam is used to hold back flood water, landowners would not be able to access the woodland in the bottom of the valley. The water levels would return to normal within a matter of days (depending on the size of the flood) so there would not be any significant long term impact. The periodic flooding of the site of the charcoal burning platform is not considered to be important, as the actual feature has been removed and would therefore not be affected.

The reinstatement of the borrow area to a pond including reeds and marginal habitat provides mitigation for the creation of the borrow area and loss of on site habitats. It would provide important features for birds and insects, as well as amphibians and bats. We would reuse some of the large trees that would be lost as deadwood habitats, improving the overall diversity of habitats present within the area.

In conclusion, there are not believed to be any significant impacts arising from this scheme that cannot be adequately mitigated or managed through the planning and construction management phases.

## **Grattons Park**

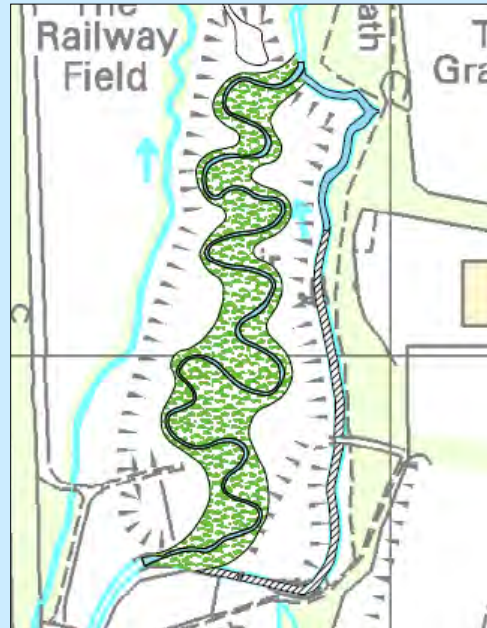
### **i. Details of the Scheme**

We are planning to restore the Gatwick Stream as it runs through Grattons Park, changing its course from the existing concrete, artificially straightened channel to a new, more natural course through the open field. The river would run in a natural course with a series of pools and riffles and varied bank profiles. The existing channel that runs to the east of the park would mostly be backfilled with material excavated from the new channel. The most natural part of the river, at the downstream extent, would be left open as a backwater. Any excess earth would be reused within the park or removed from site.

The works would be undertaken in 2011 or 2012 and would take no more than a year to complete.

### **ii. The Existing Environment**

Grattons Park is an urban park within the Pound Hill area of Crawley, to the northeast of the town centre. It is bounded by the A2011 to the north and the London to Brighton railway line to the west. The park comprises a number of open grassy fields, including sports pitches. The park is important for local recreation and has a variety of footpaths.



The Gatwick Stream currently runs to the east of the main open area, within a concrete channel. A mill leat known as Grattons Park Stream runs to the west of this field. Both these streams run within wooded corridors and there is a larger area of woodland to the north. Gatwick Stream supports a good variety of fish species including brown trout, perch, bullhead and stone loach, and associated aquatic invertebrates.

The park as a whole is a designated Local Nature Reserve (LNR), providing important habitats in the urban environment. We have done surveys of the wildlife in the area, and found that there is a small population of grass snakes. The site also supports habitats that are suitable for foraging and roosting bats and for feeding and nesting birds. All of these species are protected at either the national or European level.

There are a number of archaeological remains present in the wider area; however none are within the site boundary and the majority are only of local importance or value.

### **iii. Environmental Impacts and Proposed Mitigation Measures**

The largest adverse impacts are expected during the construction phase. Local people would be unable to use the works area temporarily, for a period of up to a year, although the remainder of the park would still be available to use. The works are far enough from private residences not to cause significant disturbance.

The realignment of the stream would be through areas of amenity grassland with little ecological value. Grass snakes would be excluded from the working area before construction begins. To minimise impacts on other protected species, all tree and vegetation removal will be undertaken outside the bird breeding season and following confirmation that roosting bats are not present. We would also put up new bat and bird boxes.

The works would temporarily disturb the watercourse with the diversion of the existing stream into a

new channel. The diversion would be carefully managed to minimise impacts on fish populations. Works to the watercourse and excavation work in general have the potential to produce silt which could get washed into the stream, particularly during heavy rain. A sediment management plan will be produced to ensure that this is well managed and would include measures such as settlement tanks and silt fencing to trap silt before it reaches the stream.

The number of lorries accessing the site would be limited, with the most vehicle movements associated with any removal of excess material from site. This is not anticipated to result in significant disturbance, but we will manage all vehicle movements through a traffic management plan, agreeing the numbers and timing of deliveries and routes that heavy goods vehicles have to take with the Highways Authority (West Sussex County Council).

Once the scheme is finished, the adverse environmental effects would cease and all residual effects would be positive. The completed scheme would provide major benefits for local people and wildlife. These include:

- Increased connectivity between the stream and floodplain.
- Restoration back to a natural stream with natural bed and banks and geomorphological features such as riffles and pools.
- Removal of weirs thereby enabling fish to move freely upstream.
- Changes to the channel form in line with latest legislation.
- Increased on-site habitat diversity and connectivity with adjacent habitat.
- Potential to increase the number of protected species and enhance the park's Local Nature Reserve status.
- Improved visual amenity and recreation opportunities.
- Increased opportunities for public access and education.

There are not believed to be any significant impacts arising from this scheme that cannot be adequately mitigated or managed through the planning and construction management phases.

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# List of Abbreviations

<b><u>Abbreviation</u></b>	<b><u>Meaning</u></b>
AOD	Above Ordnance Datum (height above sea level)
AONB	Area of Outstanding Natural Beauty
ASPT	Average Score Per Taxon
BAP	Biodiversity Action Plan
BMWP	Biological Monitoring Working Party
CBC	Crawley Borough Council
CITES	Convention on International Trade in Endangered Species
CFMP	Catchment Flood Management Plan
DWS	Drinking Water Standards
EcIA	Ecological Impact Assessment
ECW	Environmental Clerk of Works
ECoW	Ecological Clerk of Works
EHDR	Envirocheck 'Historical Data Report'
EAL	Environmental Assessment Level
EAP	Environmental Action Plan
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act 1990
EPS	European Protected Species
EQS	Environmental Quality Standards
ES	Environmental Statement
FAS	Flood Alleviation Scheme
FDR	Flood Detention Reservoir
FRM	Flood Risk Management
GAC	Generic Assessment Criteria
HCA	Homes and Communities Agency
HER	Historic Environment Record
HGV	Heavy Goods Vehicle
HSI	Habitat Suitability Index
IEEM	Institute of Ecology and Environmental Management
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LBAP	Local Biodiversity Action Plan
LDF	Local Development Framework
LNR	Local Nature Reserve
NBN	National Biodiversity Network
NMR	National Monuments Record
PAR	Project Appraisal Report
PAWS	Plantation on Ancient Woodland Site
PPG	Pollution Prevention Guideline
PPS	Planning Policy Statement
PRoW	Public Right of Way
RSPB	Royal Society for Protection of Birds
SGV	Soil Guideline Value
UKBAP	UK Biodiversity Action Plan
UTWS	Upper Tunbridge Wells Sandstone
UXO	Unexploded Ordnance
WCA	Wildlife and Countryside Act
WSCC	West Sussex County Council
SAC	Special Area of Conservation
SaFFA	Salmon and Freshwater Fisheries Act
SNCI	Site of Nature Conservation Importance
SSSI	Site of Special Scientific Interest
WFD	Water Framework Directive



# **PART ONE: INTRODUCTION AND METHODOLOGIES**

# 1 Introduction

We (the Environment Agency) are responsible for managing flood risk throughout England and Wales. Given the increasingly noticeable effects of climate change, we are actively preparing for the future and developing national, catchment-based and local strategies to address flooding. As a result of developing these strategies, we have identified various locations across England and Wales that would benefit from active flood risk management. We are implementing schemes to reduce the damage caused by flooding, and help reduce the severity and frequency of flood events.

The Upper Mole sub-catchment has been identified as an area that suffers from notable flood risk, and the Upper Mole Flood Alleviation Scheme (the subject of this report) has been identified as a key measure that can help to reduce this flood risk. We intend to improve the standard of flood risk protection to local communities, particularly in the Crawley area, and to Gatwick Airport. To do this we are proposing works at two sites around Crawley, with further works proposed at a third site to provide mitigation and overall environmental enhancements. The scheme (including works already underway at Tilgate but excluding potential future works at Ifield) would reduce flooding to approximately 1038 properties through the Crawley and Horley areas (without climate change), as well as at Gatwick Airport.

The proposed works are described below with locations shown in Figure 2.1:

- **Worth Farm** – this is a greenfield site to the east of Crawley, close to the M23, on the Gatwick Stream. It is proposed to construct a new flood detention reservoir at this site. The dam would hold no water for most of the year, just filling up during periods of flooding.
- **Clay's Lake** – this is an existing online lake to the south of Crawley, which currently impounds the Stanford Brook, a tributary of the Gatwick Stream. The proposal is to remove and rebuild the existing dam, rebuilding it to a higher level. There would be no change to the normal water level of the lake, but the dam raising would allow extra water to be stored when flows are high, to prevent it flowing out of bank and causing damage downstream. For these short periods of time the level of the lake would rise, but this would return to normal a few days afterwards, as water is gradually released.
- **Grattons Park** – this is an urban park within the town of Crawley and a former flood storage area. The Gatwick Stream runs through the park but has been diverted around the perimeter of the park within a concrete channel. As part of the mitigation and enhancement package associated with the scheme, it is proposed to restore a section of the river through the park, creating a new natural channel through the floodplain to deliver geomorphological, ecological and recreation benefits.

A further flood detention reservoir at Ifield was previously proposed, however the planning application for this site has recently been postponed to allow time for the business case to be revisited.

## 1.1 Purpose of the Report

The Town and County Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 set out statutory procedures for assessing projects that are likely to result in significant impacts on the environment. Schedule 2 lists the types of projects that, depending on their nature, scale, size and potential environmental effects, may require statutory Environmental Impact Assessment (EIA). A 'Screening Opinion' can be sought from the relevant competent authority to confirm if statutory EIA is needed in these cases. Flood defence projects and dams or water storage facilities are listed on Schedule 2 of these Regulations. The requirement for statutory EIA generally depends on the size and nature of the development, and is more likely to be required for major new dams (e.g. where the construction site exceeds 20 hectares) or flood relief works where the area of works exceeds five hectares or more than two kilometres in length.

A 'Screening Opinion' was requested from the relevant Local Planning Authorities (LPAs) (comprising Crawley Borough Council and Mid Sussex District Council) to confirm if a statutory EIA would be required for the proposals. As our proposals lie within areas of environmental sensitivity,

all local authorities confirmed that a statutory EIA would be required for the scheme, and that an Environmental Statement (ES) would be required. The overall purpose of this ES is to document the EIA process that has been undertaken and to present the Environmental Action Plans (EAPs) developed for the projects. This ES has been submitted with the planning applications for the project and will therefore inform the Local Authorities of the environmental effects that may occur as a result of the construction and operation of the scheme.

The ES will be made available to inform statutory and non-statutory bodies and the public about the project and its environmental impacts. As part of this project we are proposing various enhancements to further improve the area. These environmental enhancements form an integral part of this project. The assessment that is presented within this ES therefore considers the proposed construction and operational impacts, mitigation and enhancement measures of the project as one package, rather than separate entities.

Any comments relating to the planning applications or this report should be directed to the planning department at the relevant Local Authority.

## 1.2 Objectives of the Report

The ES will inform the Local Authorities of the environmental aspects of the proposed scheme. It will also act as a decision-making tool, as it presents information about the projects and their environmental effects. This is necessary as it will aid the Local Authorities in deciding the outcome of the planning applications. The ES will also inform other statutory and non-statutory consultees and members of the public about the project.

As we are committed to transparency, the main objective of this ES is to provide clear and concise information about the project and its environmental effects. This will ensure that all interested parties can achieve a thorough understanding of the project. Additional objectives of the report include:

- To present any required mitigation measures;
- To present the EAP that would be used to manage and monitor the environmental effects of the project.

## 1.3 Approach to the Assessment

Once we determined that an EIA was required, we undertook a 'Scoping' exercise. This is important to determine where significant effects are likely to occur with regard to specific environmental topics, such as the landscape or flora and fauna. The Scoping exercise allowed us to focus the EIA, and determine the topics that are considered in detail in this ES. Details of the Scoping exercise are provided in Section 5.1.

In order to gather the required information for this ES and accurately assess the effects of the project, we have undertaken various consultation exercises. This has enabled us to determine how the project is perceived by the public, statutory and non-statutory bodies and to collect relevant baseline information. The latter has been undertaken by consulting various web-based sources of information, site surveys, discussions with Local Authorities, previous reports and through discussions with local organisations and residents or users of the areas. National, regional and local plans and policies have also been consulted in order to set the project within its strategic and policy framework.

We held public open days and various discussions with interested statutory and non-statutory bodies, including staff of Local Authorities, the AONB officer, Natural England, Environment Agency technical specialists, and local land owners and interest groups (Section 4). This early and continued consultation has also allowed interested parties the opportunity to influence the final design of the project by voicing opinions and concerns throughout the design process. Information gathered during the public open days has also contributed to the baseline data where appropriate.

In order to assess the predicted impacts of the project, we have involved specialists in the field of environmental assessment. Specific methodologies have been used to assess the impacts of the project. These are discussed further within Chapter 5 and Appendix B, where appropriate.

The development of the proposed environmental mitigations has been a key aspect of this scheme. In order to develop the most appropriate mitigation measures, a landscape architect was involved in design of the scheme and we have undertaken liaison with the relevant departments of the Local Authorities.

## 1.4 Structure of this Report

This report considers the environmental effects of the Upper Mole scheme as a whole, across the different sites detailed above. The reason for this is to allow it to fully document the “whole scheme” effects of the proposals, ensuring that the sites are not viewed in isolation. Some mitigation and enhancement measures also need to be viewed across the scheme as a whole, particularly in relation to Grattons Park. As such, whilst the sites are the subject of different planning applications, this Environmental Statement has been prepared to support them all.

Schedule 4 of the Town and County Planning (Environmental Impact Assessment) (England and Wales) Regulations 1999 describes the information that must be included in an EIA. We made sure we included all this information and the structure of the report is described in Table 1.1.

**Table 1.1 Structure of the Environmental Statement**

Section		Description
Non-Technical Summary		This provides a summary of the ES. It provides a brief introduction and background to the project and the existing environment, and summarises the key aspects of the project, including the impacts of the project and the integral mitigation measures.
<b>PART 1: INTRODUCTION AND METHODOLOGIES</b>		
1	Introduction	This section provides information of the legislative context of the project and describes the purpose and objectives of the report.
2	Background	This section provides information regarding the background to the project and why the project has become necessary. The section also identifies the location of the project and provides a site description.
3	Consideration of Alternatives	This section discusses the strategic context of the alternatives and presents each alternative that was considered.
4	Consultation	This section provides an overview of the consultation undertaken to date and also discusses the requirement for future consultations.
5	Methodology	This section discusses the issues that have been scoped out of the assessment and the justifications for this, along with generic criteria for assessing the significance of any impacts identified.
<b>PART 2: WORTH FARM</b>		
6	Proposed Works at Worth Farm	A description of the proposed scheme
7	Worth Farm Scheme Options	Specific options considered at this site
8	Worth Farm Environmental Assessment	Presents environmental baseline data and documents the results of the assessment process for each environmental receptor considered. Any additional mitigation measures and the residual impacts of the project are also presented.
<b>PART 3: CLAY'S LAKE</b>		
9	Proposed Works at Clay's Lake	A description of the proposed scheme

Section		Description
10	Clay's Lake Scheme Options	Specific options considered at this site
11	Clay's Lake Environmental Assessment	Presents environmental baseline data and documents the results of the assessment process for each environmental receptor considered. Any additional mitigation measures and the residual impacts of the project are also presented.
<b>PART 4: GRATTONS PARK</b>		
12	Proposed Works at Grattons Park	A description of the proposed scheme
13	Grattons Park Scheme Options	Specific options considered at this site
14	Grattons Park Environmental Assessment	Presents environmental baseline data and documents the results of the assessment process for each environmental receptor considered. Any additional mitigation measures and the residual impacts of the project are also presented.
<b>PART 5: GENERIC MITIGATION, CUMULATIVE EFFECTS AND CONCLUSIONS</b>		
15	Generic Issues and Mitigation	Covers mitigation measures which are common to all sites
16	Cumulative Effects	This section brings together the effects of all the impacts discussed in previous sections and also considers effects on other developments within the vicinity of the project.
17	Environmental Action Plan	This section introduces the project specific EAP and the mitigation measures that need to be carried forward to construction.
18	Conclusions	This section provides a summary of the key effects, mitigation, residual impacts and the use of an EAP.

Various technical reports have been prepared to support this document, and these are provided as supporting reports which can be made available on request. A summary of these reports is listed below:

#### **Ecological Surveys**

- Phase 1 Habitat Survey at Worth, Clay's and Grattons (Environment Agency, 2009);
- Desktop Biodiversity Report at Worth, Clay's and Grattons (SBRC, 2009);
- Bat Surveys at all sites (Jacobs, 2010);
- Badger Surveys at all sites (Jacobs, 2010) (excluded from planning inputs to prevent badger persecution);
- Dormouse Surveys at all sites (Jacobs, 2010);
- Reptile Surveys at all sites (Jacobs, 2010);
- Great Crested Newt Survey at Clay's Lake (Jacobs, 2010);
- Aquatic Ecology Report at all sites (Jacobs, 2010);
- BS:5837 Tree Survey at all sites (Jacobs, 2010).

#### **Cultural Heritage Desk Based Assessment**

- Upper Mole Desk Based Assessment (Jacobs, 2010).

#### **Water and Contamination Studies**

- Water Framework Directive Assessment (Environment Agency, 2010).
- File Note on Contamination Findings (Jacobs 2010).
- Flood Risk Assessment (Jacobs 2011).

#### **Planning**

- Design and Access Statements for all sites (Jacobs, 2011);
- Planning Supporting Statements for all sites (Jacobs, 2011).

## 2 Background

### 2.1 Background to the Project and Need for the Scheme

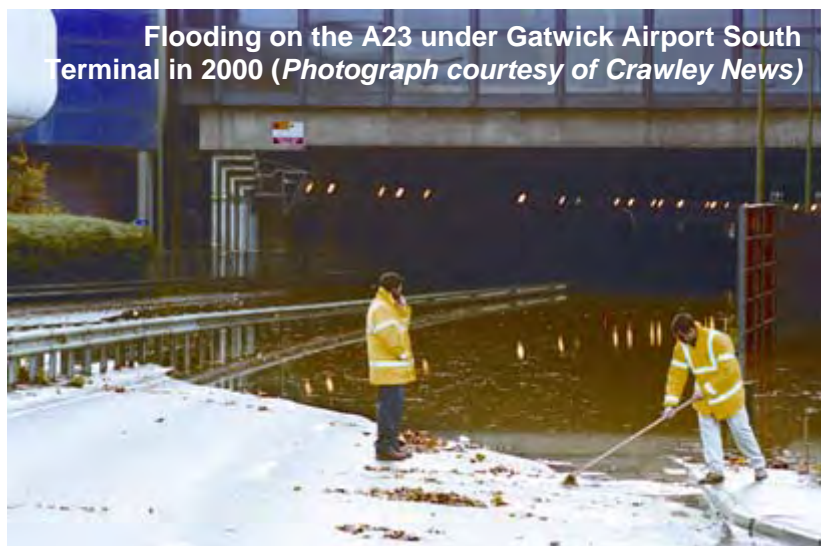
The Mole catchment area is 487 km<sup>2</sup>, and lies within the counties of Surrey and West Sussex. The River Mole is 80 km in length and falls approximately 95 metres from its source to the Thames confluence. It rises to the south of Crawley and flows generally northwards towards its confluence with the Thames at Molesey. Although largely rural, it is home to approximately 296,000 people, mainly within the principal towns of Crawley, Horley, Redhill, Reigate, Dorking, Leatherhead and Esher.

The Mole catchment has experienced extensive flooding on several occasions in recent times, which has led to property and asset damage. The 1968 event is by far the worst flooding event on record within the catchment as a whole and caused extensive property damage. In response to this event, the Lower Mole Flood Alleviation Scheme (FAS) was constructed in the 1980s, from Esher to the Thames confluence.

The principal urban areas in the Upper Mole sub-catchment are Crawley and Horley which have current populations of 100,000 and 20,000 respectively. Downstream of Horley the River Mole passes through mainly agricultural land. The project area includes Gatwick Airport, which is the second largest airport in the UK, employs some 25,000 people and handles 32 million passengers a year.

As the urban areas of Crawley and Horley have developed over time the watercourses have been diverted into a total of 75 culverts with an overall length of 5430 metres. These culverts govern the capacity of the watercourse and thus the risk of flooding. The threshold of flood damage varies between flood risk areas, varying between a 1 in 5 (20%) chance and a 1 in 200 (0.5%) chance in any year. There are currently 1256 properties in Crawley and Horley which would be affected by fluvial flooding in the 1 in 100 (1%) chance event. This increases to 2450 properties with +20% increase in flows due to climate change.

The decision to site Gatwick Airport across three watercourses means that it is vulnerable to flooding from all three watercourses as well as local drainage. Runoff from main airfield paving flows by gravity to a storage pond and is then discharged by pumps directly to the River Mole. As the 1 in 100 chance flood level in the Mole is at the same level as the ground level at the North Terminal, the system is totally dependent on the pumps and on-site storage, with the latter likely to be inadequate at times of prolonged high rainfall due to its modest volume. It is estimated that there is currently a 1 in 20 (5%) chance of Main River flooding closing Gatwick Airport, and with 10% increase in flows due to climate change, this increases to a 1 in 12 (8%) chance.



The probability of flooding of the north terminal area due to backing up from local drainage depends on the storm duration and intensity and it is understood that the on-site drainage capacity was designed for a 1 in 5 (20%) probability event. Gatwick Airport is of national significance and closure due to flooding would have regional and national impacts.



Flooding at Gatwick Airport would cause major disruption for business and private travellers. The airport has many elements of infrastructure such as sub-stations and baggage handling which are vulnerable to flood damage. Flood damage would also cause the write-off of equipment, much of which is bespoke and has a lead time for procurement of several months; the airport is therefore vulnerable to closure for a prolonged period following an extreme flood event.

The most severe flood event in recent history was in 1968, which was estimated to have a 1 in 65 chance of occurring in any year, and resulted in closure to the south terminal and runway for several days. The autumn 2000 flood event was the most severe since then and affected properties mainly in the upper reaches around Crawley, particularly in the recently developed area of Maidenbower, as well as Furnace Green and Three Bridges. 109 properties were flooded and the A23 under Gatwick Airport south terminal was closed for several days due to flooding. There was also flooding on the M25 at Leatherhead and A245 at Cobham for several days. The A23 near Gatwick Airport has also been known to flood and has



been closed in the past, and there is also significant flood risk downstream of Gatwick Airport, within southwest Horley.

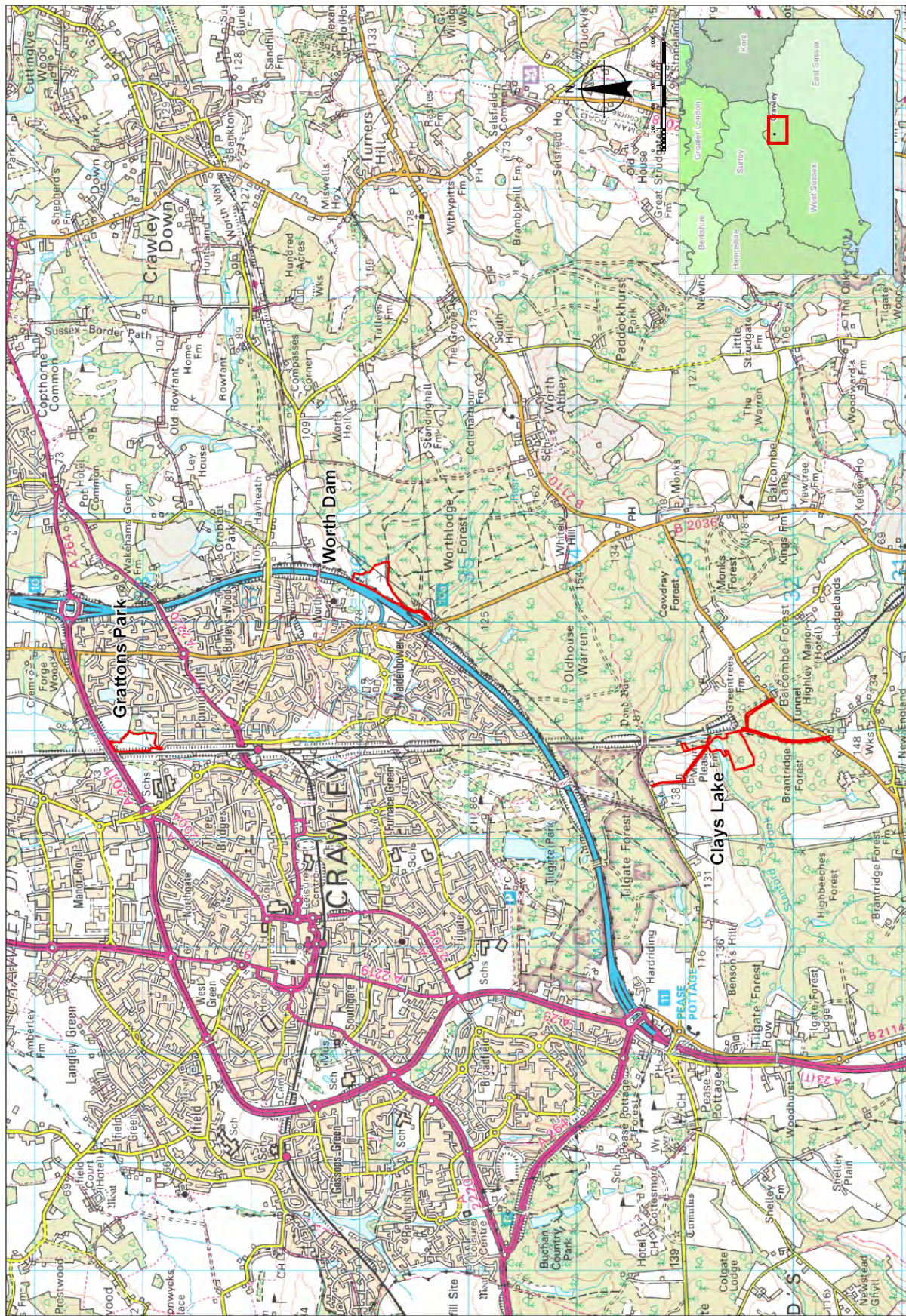
## 2.2 Location and Introduction to the Sites

The proposed scheme is located in and around the town of Crawley, West Sussex. The town is 28 miles south of London and 18 miles north of Brighton. The town has grown in size significantly since the opening of Gatwick Airport for civil flights in 1946 and its designation as a New Town in 1947. The M23 which passes to the eastern side of the town opened in 1975. The town now comprises a number of residential neighbourhoods based around the old market town. The population was about 100,000 people at the time of the 2001 census, and has grown slightly since then. More information on the demography of the town can be found in Section 2.3.

Descriptions of each of the proposed development sites can be found in the following sections.



Figure 2.1: Site Locations and Context





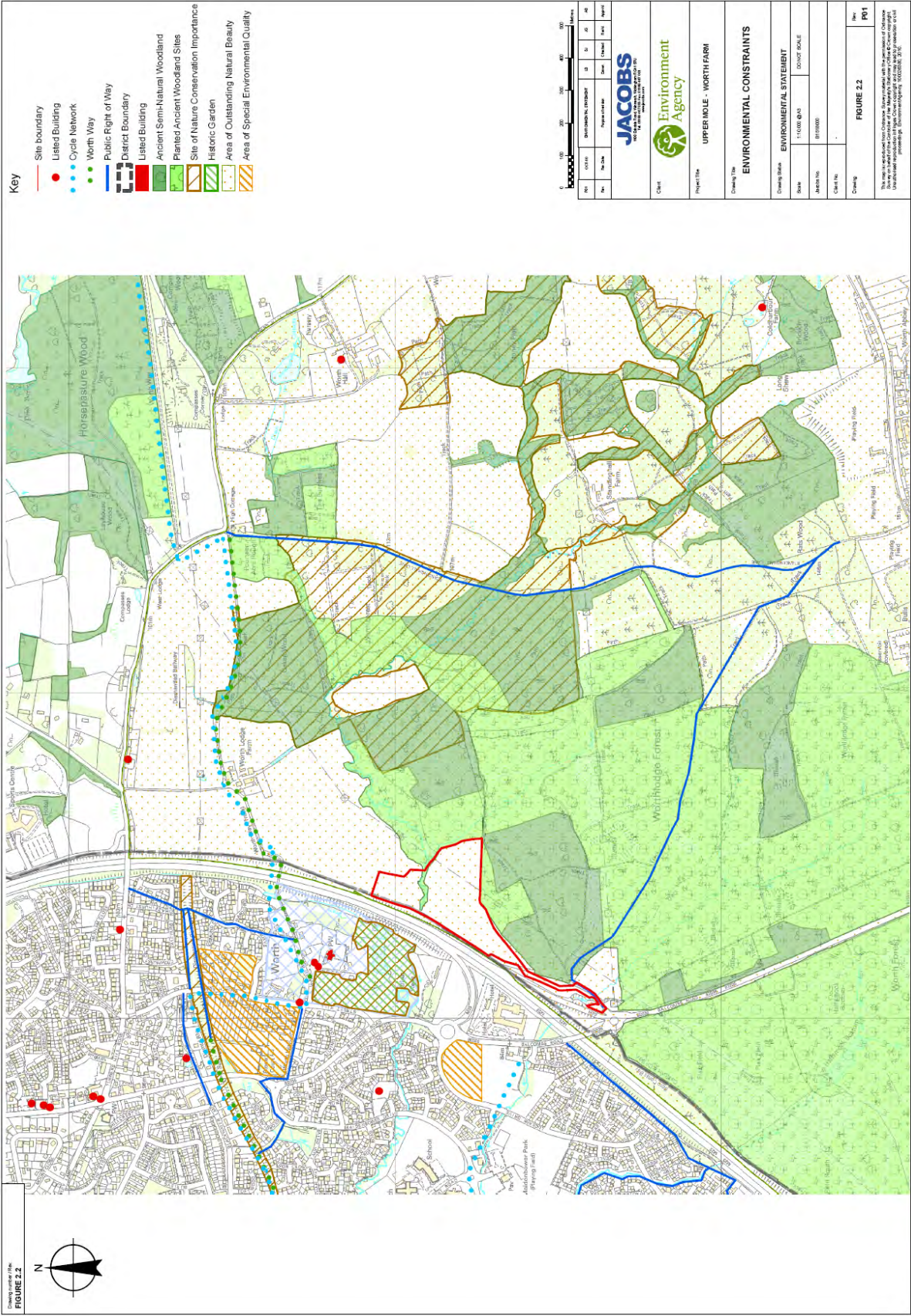
### 2.2.1 Worth Farm

The Worth Farm site lies within Mid Sussex District Council area, to the east of the M23 and the urban edge of Crawley (grid reference TQ303359). The land is currently agricultural and lies within the High Weald Area of Outstanding Natural Beauty (AONB). The Gatwick Stream runs through the site, and there are areas of ancient woodland along the stream and in surrounding areas. Woodland upstream is a designated Site of Nature Conservation Interest (SNCI). The site lies hard up against the M23 motorway, which forms the western boundary of the site, with more continuous woodland to the east.





Figure 2.2 Environmental Constraints at Worth Farm





### 2.2.2 Clay's Lake

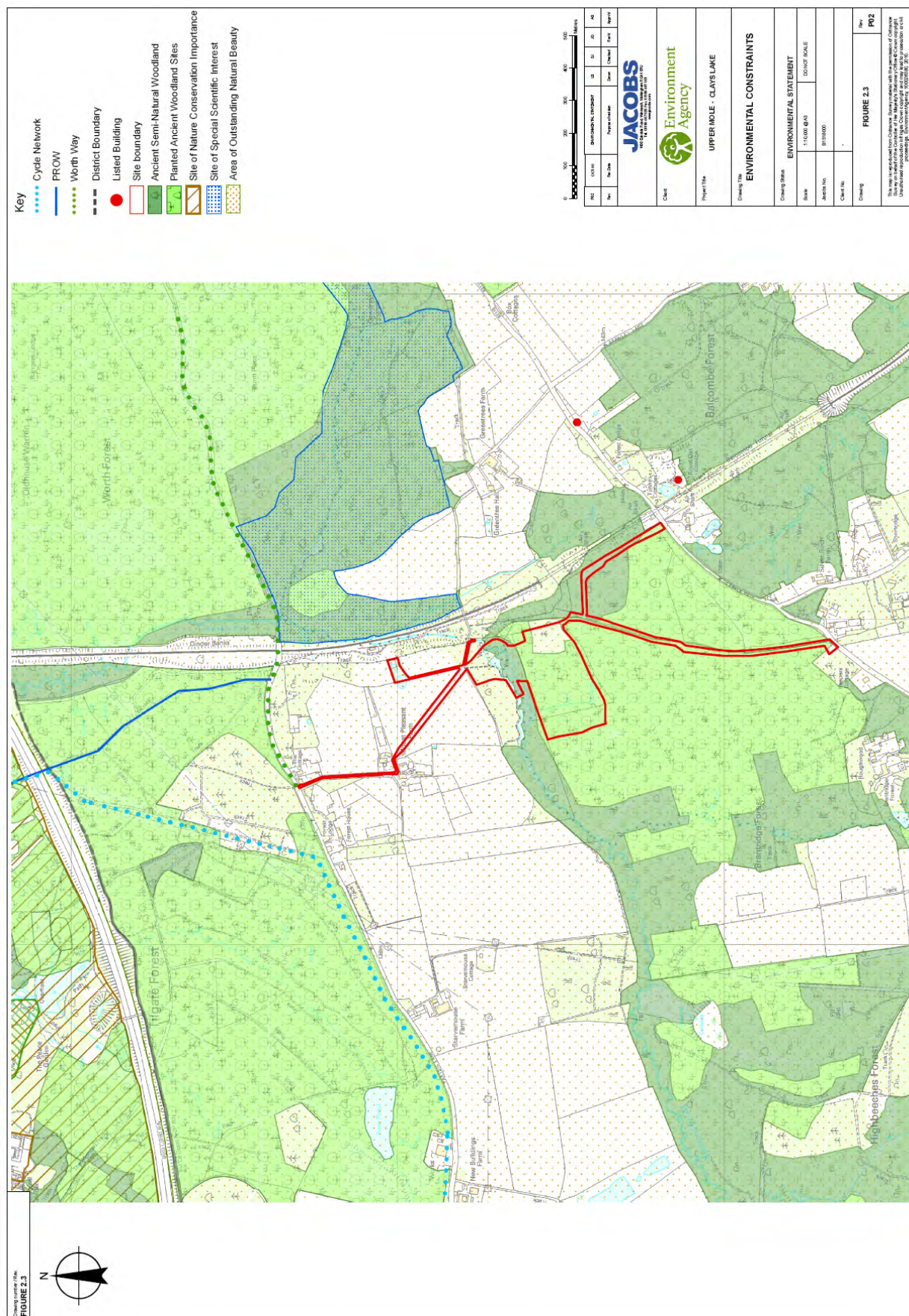
Clay's Lake is an existing lake (grid reference TQ288327) lying on the Stanford Brook, a tributary of the Gatwick Stream. The site lies to the south of Crawley and the M23, within Mid Sussex District Council area, and within the High Weald Forest (parts of which are designated ancient woodland) and AONB. To the east of the site lies the main London to Brighton railway. Worth Forest SSSI lies 200 m downstream of the lake, on the other side of the motorway, and would be unaffected by the works. Although the lake lies within woodland, areas of land to the north are used as paddocks for a stables business. The land to the south of the lake is in different ownership, and has been used for commercial forestry in the past. The trees on this area of land have been clearfelled, although some areas have been replanted with saplings. A more continuous area of forest is located to the west.

The existing dam is 3.8 metres above the invert of the stream and is believed to have been constructed between 1949 and 1958. It is made from local rock, although has been reinforced with building rubble following failures which have occurred in recent years. Currently the reservoir falls outside the remit of the Reservoirs Act as it is not large enough. Access to the lake is via a grassed farm track from Parish Lane to the north.





**Figure 2.3 Environmental Constraints at Clay's Lake**





### 2.2.3 Grattons Park

Grattons Park is an urban park within the Pound Hill area of Crawley, to the northeast of the town centre (grid reference TQ288380). It is bounded by the A2011 to the north and the London to Brighton railway line to the west. The park comprises a number of open grassy fields, including sports pitches, and is a well used thoroughfare by school children and others. The Gatwick Stream currently runs to the east of the main open area, within a concrete channel. A mill leat known as Grattons Park Stream runs to the west of this field. Both these streams run within wooded corridors, and there is a larger area of woodland to the north. The park as a whole is a designated Local Nature Reserve (LNR), providing important habitats in the urban environment. The park is an important local recreational resource.



**Straightened river with concrete structures**



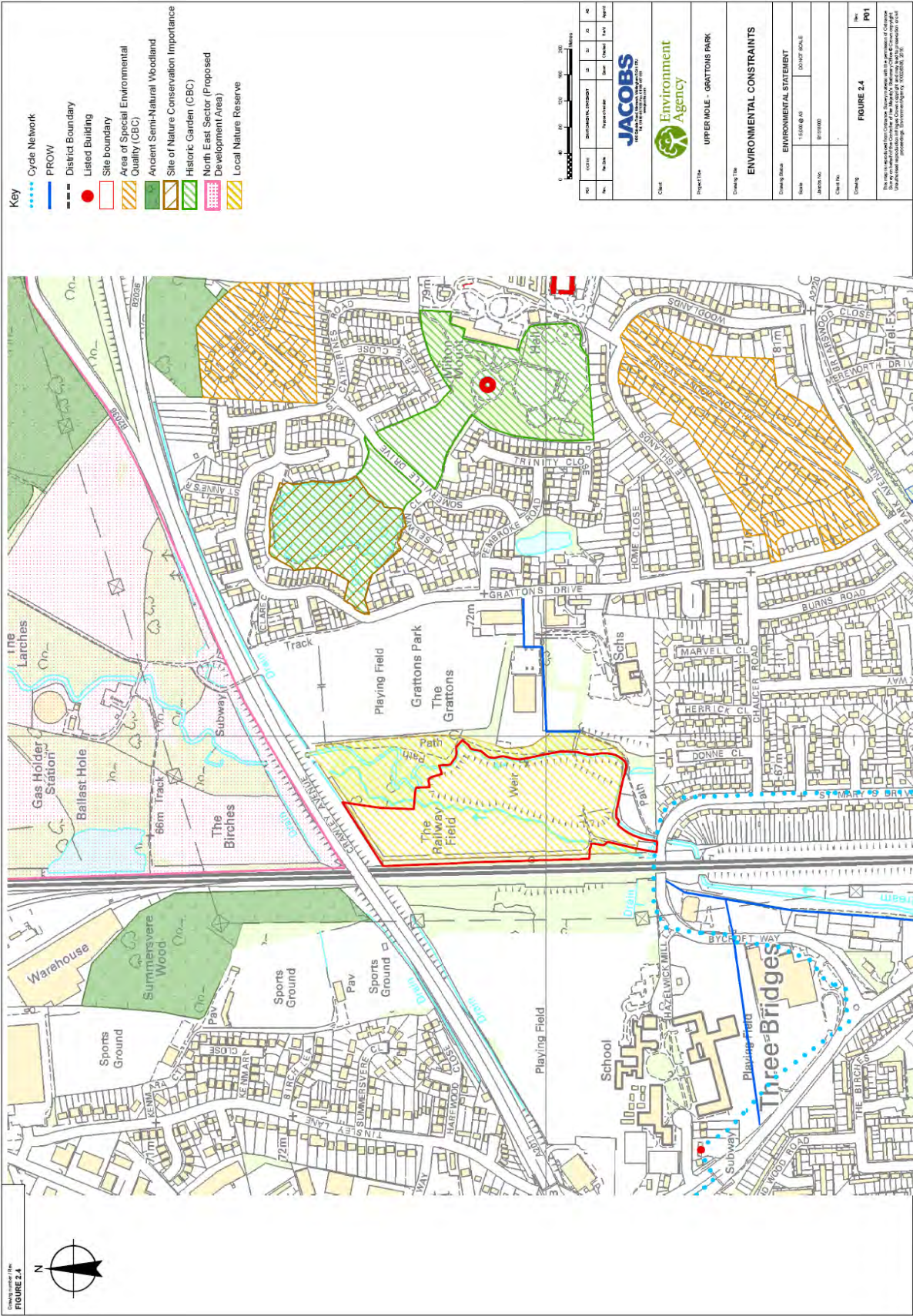
**View across the field at Grattons Park**



**Aerial Photograph of Grattons Park Location**



Figure 2.4 Environmental Constraints at Grattons Park



## 2.3 Crawley's Environmental Setting

### 2.3.1 The Town of Crawley

Crawley has a young population structure, with more very young people, and more people in their 20s and 30s than average. There are fewer older people than average, particularly between 50 and 65, although the elderly population is growing rapidly. There is known to be a mismatch between skills demanded by employers and the skills on offer from unemployed people in the area, which leads to the importation of skills from elsewhere (approximately 40% of all people employed in Crawley commute in)<sup>1</sup>. The economy is dominated by larger firms, particularly those associated with Gatwick Airport, which is a significant support for the local economy.

The Index of Multiple Deprivation (2007) takes into account various aspects of deprivation (income; employment; health and disabilities; education, skills and training; barriers to housing and services; crime; and living environment), to compare small scale geographical areas. Crawley is ranked 207 out of 354 English districts (where one is most deprived) so is less deprived than most<sup>2</sup>. The difference between ranking in employment scale and income scale suggests that there is a high level of employment, but income is relatively low. The reason for this is probably relatively low wages associated with service industries related to the airport and hotels.

People in the Crawley area are subject to flood risk, and as such experience worry and concern about flooding, particularly at times of heavy rainfall. Actual flood events present health risks to residents, including risk of being drowned or hit by debris. In the aftermath of flooding, human consequences include people living in temporary or damp housing, both of which can have adverse impacts on people's mental and physical wellbeing.

The residential properties within Crawley are considered to be of high sensitivity and importance. Gatwick Airport has national significance and is therefore also considered to be of high sensitivity, whereas other commercial businesses in the area are generally considered to be of medium importance (recognising that there will be some that will be more and some that will be less sensitive within this).

### 2.3.2 The Upper Mole Catchment

The study area lies within the upper reaches of the catchment of the River Mole, as shown in Figure 2.5. It rises to the southwest of Crawley, flowing for 80 kilometres to the River Thames near Hampton Court Palace. The Gatwick Stream is a major tributary of the Mole in this area. Annually the Mole catchment receives an average of 761 mm of rainfall. This level of rainfall is greater in the higher parts of the Mole catchment around Crawley, where an average of 800 mm is received per year<sup>3</sup>. The catchment is characterised by urban development and agricultural land use.

The Mole Catchment Abstraction Management Strategy (CAMS) technical document shows the quality in the Upper Mole as being grade B (good) for both biology and chemistry, with a diverse faunal population and pollution sensitive species being present; although the Gatwick Stream is Grade C for biology (fairly good) and D (poor) for chemistry, with reasons for this cited as intermittent pollution events, low flows and urban run off<sup>4</sup>. The Environment Agency does not monitor water quality on the rivers through Crawley as part of their standard programme of monitoring. The closest monitoring point is on the Mole at Gatwick Airport, Pond E, which is some distance downstream and notably, downstream of Crawley Sewage Treatment Works (all our sites lie upstream of this). As such, the data for this site is not considered to be representative of water quality in the more upstream areas.

The Thames River Basin Management Plan notes that the clay characteristics of the Upper Mole catchment exacerbate surface water run-off and some canalised and shaded reaches suffer low dissolved oxygen in times of low flow. Sudden decreases in dissolved oxygen have a detrimental effect on fish and may damage other wildlife.

<sup>1</sup> Crawley Borough Council (2008) LDF Core Strategy

<sup>2</sup> Department for Communities and Local Government website [Accessed 13<sup>th</sup> July 07]  
<http://www.communities.gov.uk/communities/neighbourhoodrenewal/deprivation/deprivation07/>

<sup>3</sup> Environment Agency (2007) The Mole Catchment Abstraction Management Strategy

<sup>4</sup> Environment Agency (2007) The Mole Catchment Abstraction Management Strategy – Technical Document Supporting the Mole CAMS Final Strategy

Some rivers in this catchment are designated heavily modified. Modification of these rivers including in-stream engineering structures has led to loss of habitat diversity and the creation of barriers for fish migration. These issues and the presence of pollutants give rise to poor water quality for a number of rivers, as well as varied biological quality throughout the catchment.

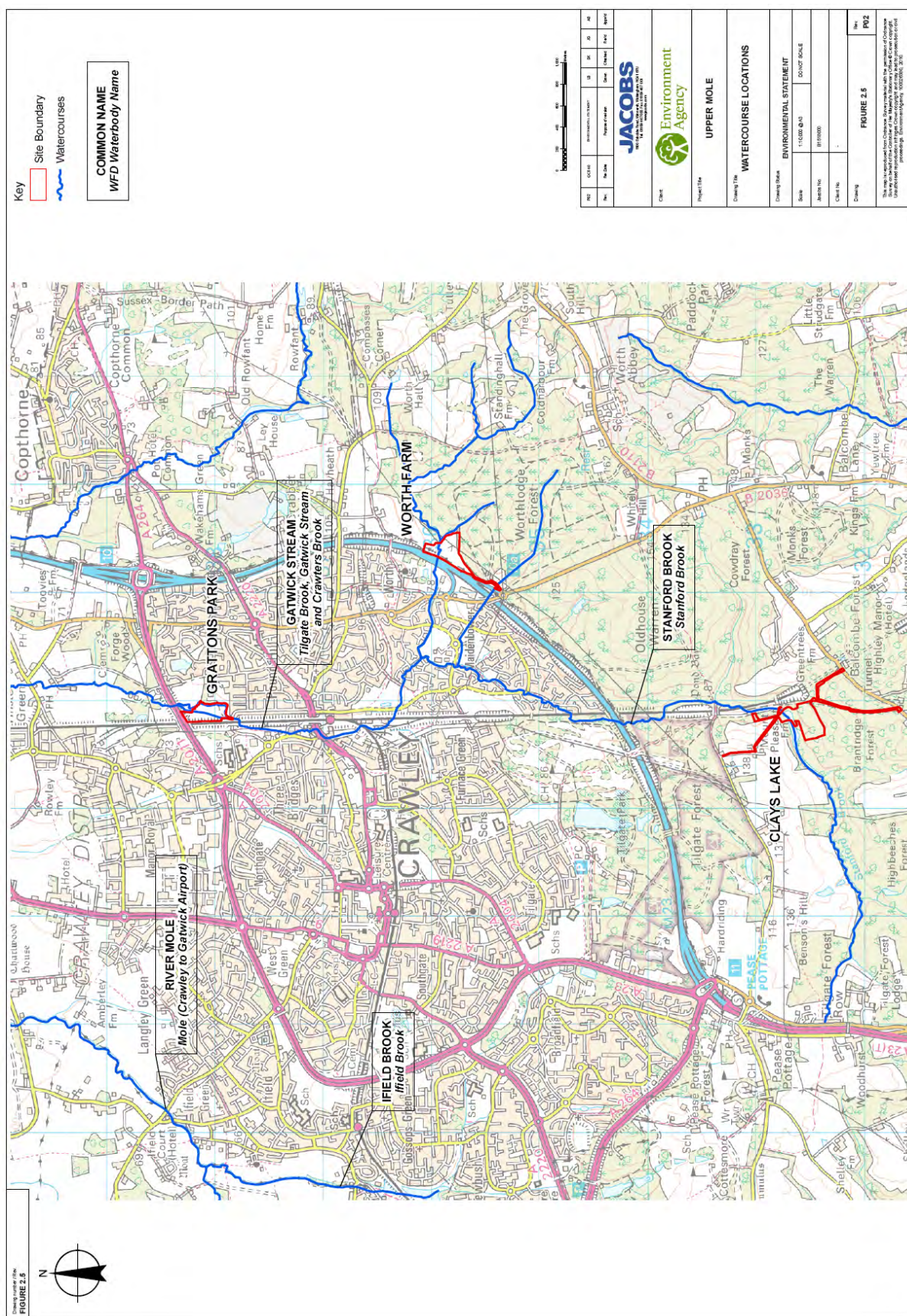
The River Mole and the tributaries covered in this scheme support coarse fish populations of varied but improving quality. Variation in quality along the length of the River Mole in previous years supported a distinct difference in the species and year classes present in the upper and lower reaches of the Mole. Recent and continuing improvement in river quality is blurring this distinction between the upper and lower reaches.

The Gatwick Stream around Horley is dominated by coarse fish, with both high biomass and density. Brown trout, brook lamprey and eel can be found in the river around Horley. Brown trout dominate through Crawley despite obvious risks of diffuse pollution through surface run-off from urban areas. The Stanford Brook which runs through Clay's Lake joins Gatwick Stream at Crawley, which in turn joins the River Mole near Horley. The catchment has a number of structures that, to varying degrees, are barriers to fish passage. The River Mole and its tributaries have the potential to support diverse fish and invertebrate communities where habitat continues to be suitable.

The upper sections of the River Mole and many of its tributaries are inherently flashy in nature, as the river responds to rainfall in the catchment very quickly. This results in an assemblage of invertebrate species tolerant to large fluctuations in flow and spatial and temporal changes in fish populations depending on water levels within the catchment.



**Figure 2.5 Watercourse Locations**



The study area falls within the Mole catchment of the Thames River Basin District and covers two distinct water bodies designated under the Water Framework Directive, namely “Stanford Brook”, and “Tilgate Brook, Gatwick Stream and Crawters Brook at Crawley”.

The headwaters of the Gatwick Stream and Stanford Brook rise on the Cretaceous Hasting Beds of sandstone and clay<sup>5</sup>. Once downstream of the M23, the Gatwick Stream runs through urban development with culverts under the M23 and other roads. The confluence of the streams lies downstream of Maidenbower, to the south east of Crawley, and runs through alluvial deposits of sand, silt and clay until the confluence with Tilgate Brook, downstream of the Billington Drive storage area. The underlying geology for the Gatwick Stream is predominantly Weald clay and sandstone. The river flows through alluvial deposits of sand, silt and clay towards Gatwick Airport and the confluence with the River Mole (Figure 2.5). The River Mole runs from the north west of Crawley across the Weald clay and sandstone, through alluvial deposits and is culverted under Gatwick Airport to its confluence with the Gatwick Stream.

Previous geomorphological studies<sup>6</sup> have shown that the headwater areas of the Gatwick Stream and Stanford Brook display a high level of geomorphological diversity with riffle pool sequences, and connectivity with the floodplain, with sinuous planforms, some natural erosion and incision, and good riparian areas. A desk study of current OS maps (Ordnance Survey Landranger Map 198) suggests that the headwater areas are relatively natural until they are culverted under the M23, at which point the streams enter the main urban area of Crawley.

It is highly probable in common with other parts of the country that the channels (particularly of the smaller streams) were first straightened in the 1600s to create land boundaries between agricultural fields. There are historical records which shown significant lengths of channel were modified in the 1950s and 1960s. It was often typical for channel capacity to be increased downstream of new town development in anticipation that the newly paved areas would increase the speed and volume of runoff. The urbanisation of the Maidenbower area in the late 1980s and early 1990s however, resulted in further straightening of the river channel and an artificially steepened slope, causing incision of the river through the sandstone beds. This has resulted in increased sedimentation downstream especially in more sinuous sections of the river and an overall reduction in channel capacity. The Stanford Brook has increased levels of bank protection, and reduced levels of riparian vegetation cover. As a result of urbanisation the streams appear to have been straightened and consequently have probably been subjected to channel engineering to ensure capacity is retained, reinforcement of both bed and banks, as well as culverting for infrastructure and development. Significant levels of culverting exists in Furnace Green in Crawley, and downstream of Crawley, under Gatwick Airport<sup>7</sup>.

**Table 2.1 Upper Mole FAS Water bodies and their condition**

Scheme	Water body Code	Name of water body	Hydromorphological Designation	Current Status / Potential	Status Objective
Clay's Lake and Worth Farm	GB106039017450	Stanford Brook	Not designated as HMWB or AWB	Moderate Status	Good by 2027
Grattons Park	GB106039017500	Tilgate Brook, Gatwick Stream and Crawters Brook at Crawley	Heavily modified	Moderate Potential	Good by 2027

The River Mole at Gatwick Stream is designated as “no water available” under the Mole Catchment Abstraction Management Strategy (CAMS). This is largely down to integration with the River Thames CAMS, which lies downstream of the Mole. Although the Mole itself was originally assessed to have water available, this was overridden to a status of no water available to avoid

<sup>5</sup> British Geological Survey. Geotitles for Geology. [www.bgs.ac.uk/geotitles/index.htm](http://www.bgs.ac.uk/geotitles/index.htm).

<sup>6</sup> Babbie Brown and Root. Gatwick Stream Alleviation Stream Scoping Report. April 2004. Appendix 7

<sup>7</sup> Jacobs Babbie, 2006, Gatwick Stream (Crawley) FAS Outline Design Gatwick Airport and SW Horley FAS Feasibility; Geomorphology Report



worsening the situation on parts of the Thames that are “overabstracted”. This means that water would be available for abstraction at high flows but not at low flows.

### 2.3.3 Crawley’s Landscape

The assessment of existing landscape elements and features considers the broader ‘High Weald’ and ‘Low Weald’ landscapes initially before the more immediate landscape around the site, in order to give an overview of the surrounding landscape and take its historical background and setting into account.

The main settlement within the wider study area is Crawley, with Copthorne to the east and Horley to the north. The M23 forms Crawley’s southern and eastern boundary. The motorway forms a physical barrier to the urban expansion of the new town. The M23 is crossed by a series of local roads connecting the town with the wider surrounding landscape. To the south and east of the town lies the forested landscape of the High Weald. Within this landscape the settlement pattern is of fragmented or dispersed clusters of properties and farmsteads connected by a rural road network.

The general topography rises from around 75m AOD (Above Ordnance Datum) within Crawley to a ridge line at approximately 150 - 160m AOD in the south. The land flattens out to the west and the north where it becomes a part of a Vale type landscape.

Within Natural England’s national landscape Character study<sup>8</sup> the study area falls within:

- **The High Weald Character Area (122)** – Worth Farm and Clay’s Lake;
- **Grattons Park site** lies within the urban footprint of Crawley and as such does not fall within any character areas.

Worth Farm and Clay’s Lake also fall within the **Worth Forest (Area 8)** of the Mid Sussex District Landscape Character Area study<sup>9</sup> and the High Weald AONB. The key characteristics of this are detailed below<sup>10</sup>:

- The area is a deeply incised, ridged and faulted landform. It includes clays and sandstone with numerous ghyll streams which form the headwaters of rivers;
- It includes a pattern of dispersed historic settlements including farmsteads, hamlets and late medieval villages, developed around historic trade and rural industries
- Ancient routeways now form roads and public rights of way along the tops of ridges.
- There are large areas of woodland including significant areas of ghyll woodland. Over half the woodland within the AONB is classed as ancient woodland.

Small fields bounded by hedgerows often used for grazing, small holdings or non-dominant agriculture are characteristic of the area.

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<sup>8</sup> Natural England National Character Assessment  
<http://www.naturalengland.org.uk/ourwork/landscape/englands/character/areas/default.aspx>

<sup>9</sup> Mid Sussex District Council (November 2005) A Landscape Character Assessment for Mid Sussex

<sup>10</sup> High Weald AONB Joint Advisory Committee (March 2009) The High Weald AONB Management Plan 2004: a 20-year strategy: Adopted March 2004, reviewed 2008 and re-adopted March 2009 2nd Edition

[illegible]



The High Weald AONB Management Plan<sup>11</sup> sets out a 20 year vision for the AONB that incorporates sustainable development within the area. Key aims are ensuring that development within the AONB takes account of and promotes the natural and historic environment. The Plan sets out a number of objectives for the area, the most relevant of which are repeated here:

**G1 Objective: To restore the natural function of river catchments**

Rationale: to protect the built-environment and human life by safe water conveyance within river catchments, whilst increasing the range of ecosystem goods and services (e.g. improving the aquatic ecosystems and water resource provision and mitigating the effects of increasingly frequent and high peak flows) provided by the river catchments of the AONB.

**W1 Objective: To maintain existing extent of woodland and particularly ancient woodland**

Rationale: to maintain irreplaceable habitats for biodiversity, to maintain a key component of the cultural landscape, and to maintain contribution to carbon storage

**W2 Objective: To enhance the ecological functioning of woodland at a landscape scale**

Rationale: to increase the viability of the woodland habitat for wildlife, by identifying and extending the area of appropriately managed woodland to link and enhance isolated habitats and species populations, providing greater connectivity between woodlands and other important wildlife areas, and helping to facilitate species' response to climate change.

**FH4 Objective: To protect the archaeology and historic assets of field and heath**

Rationale: to protect the historic environment of the AONB other than the pattern of fields: i.e. the individual archaeological features

### **2.3.4 General archaeological background and history of the area**

There is limited evidence to suggest prehistoric activity in the area. Mesolithic activity, in the form of a scatter of worked flints was identified at Clay's Lake and a linear arrangement of pits in the Worth Farm study area. Fragments of a polished stone axe, likely to be of Neolithic date, were also recovered from Clay's Lake. There are no records of definite Roman remains in the area.

The Anglo-Saxon church of St Nicholas at Worth indicates that the area was inhabited during the early part of the medieval period. This occupation continued into the Norman period with references to Worth in the Domesday survey of 1086. The survey notes that the landscape has both woodland and pasture, and the fact there was land for six plough teams indicates that there was also arable land. The construction of parish churches by the Normans during the 12th and 13th century was part of a deliberate programme of building with the central aim of asserting the power of the Norman invaders.

The next apparent phase of activity is in the 15th century. Given the location of the area it would be expected that iron production would have been a key industry; however, this does not appear to have been the case. The evidence suggests that iron production was taking place in the area, but the small number of known sites suggests that it was only undertaken on a small-scale. The iron works next to Clay's Lake was one of the most important in the Weald, producing guns for the crown during the 16th century. Warrens appear to play a key part in the landscape during the medieval and later periods and there is evidence for them at Warren Farm in the form of pillow mounds (artificial warrens). Part of the land at Clay's Lake is identified as a warren on a series of early 19th century maps.

The 17th century saw an increase in rural activity, reflecting an emphasis on agricultural production. A number of farms, houses and cottages were built indicating an increased population in the area. This pattern reflects what was happening across parts of southern England during this period. It is likely that much of the landscape was altered in this period to allow intensification of agriculture. The slow down of building construction in the 19th century is of interest and may be in part due to the mechanisation of agriculture, the decline of the Weald iron industry, the new dominance of factories and the agricultural depression of the late 19th century.

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<sup>11</sup> High Weald AONB Joint Advisory Committee (March 2009) The High Weald AONB Management Plan 2004: a 20-year strategy: Adopted March 2004, reviewed 2008 and re-adopted March 2009 2nd Edition

Tracing the development of the landscape through available maps suggests little change during the 19th and into the early 20th century. The fields appear to be roughly rectangular with straight boundaries, which, given the lack of information on enclosure in the area, suggests informal enclosure. It is likely that agriculture remained the main focus for the community. The lack of new development possibly suggests a movement of people away from the country into the urbanised Crawley, which underwent a major programme of expansion in the 19th century. Crawley was one of the eight towns chosen in the post-2nd World War period to provide housing for people outside of London in the countryside. To create the new town, the areas of Ifield and Three Bridges were incorporated into Crawley in 1947.

Crawley had a population of approximately 101,300 people in mid 2008<sup>12</sup>. Crawley is part of the 'New Town' development and its population and industry have grown rapidly over the last few decades and have now absorbed the areas of Three Bridges, Pound Hill and Ifield. Following its long history of being situated on the main road from Brighton to London, Crawley has become the main link from the southern ports to the capital and as such is the main industrial centre in West Sussex. Gatwick airport situated to the north of Crawley is the largest provider of local employment.

### **2.3.2 Regional Geology, Soils and Groundwater**

The records of the British Geological Survey Sheet 302 and Geological Sheets TQ23SE and TQ23NW of the 1:10,000 Series indicate the project sites at Grattons Park and Worth Farm are underlain by Alluvium and River Terrace Deposits over the Upper Tunbridge Wells Sand (UTWS). At Clay's Lake, the drift deposits are absent and the site is underlain by Upper Tunbridge Wells Sand and Grinstead Clay.

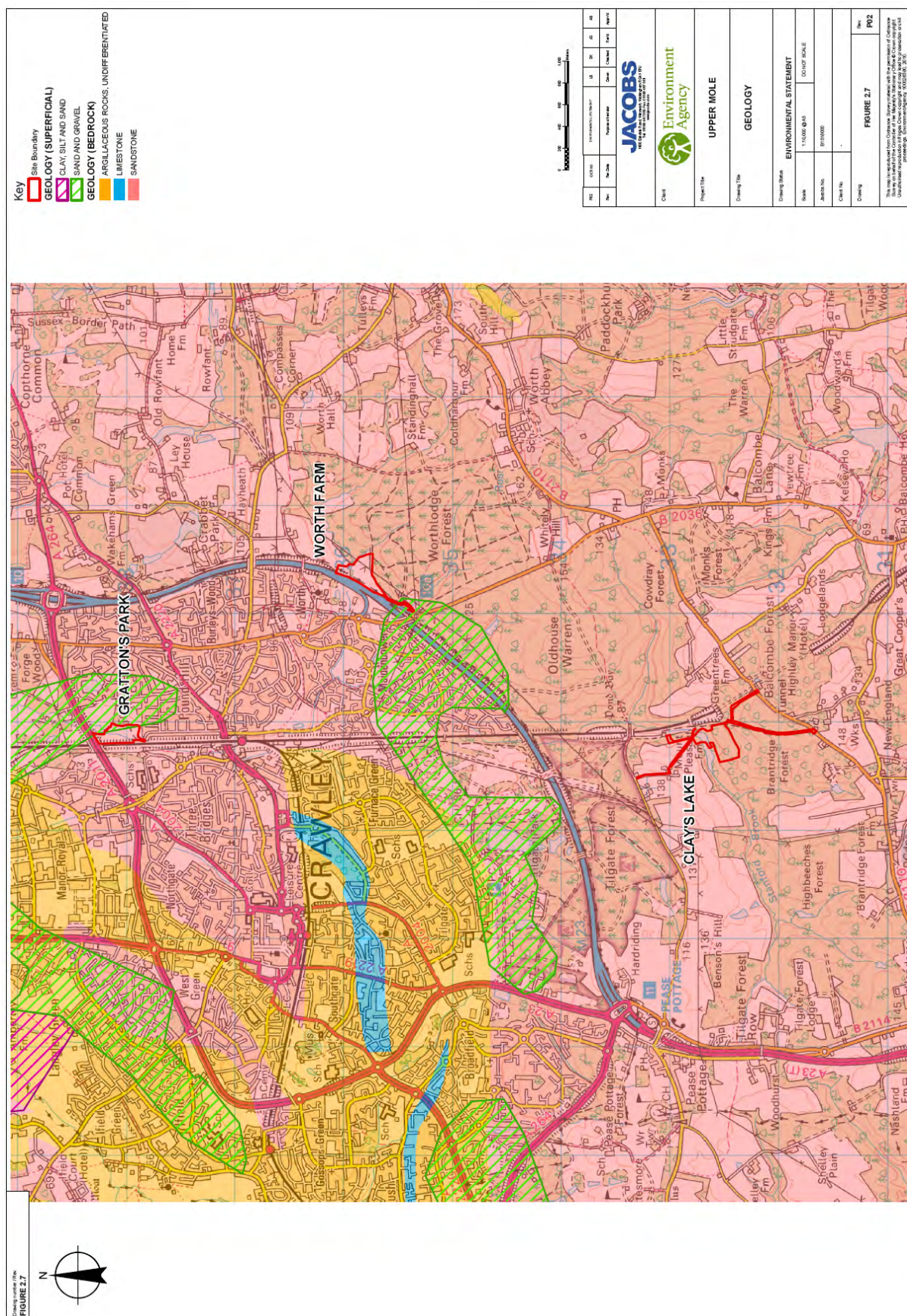
The regional geology is shown in Figure 2.7 and a generalised description of strata in the project area is given in Table 2.2.

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<sup>12</sup> Office for National Statistics, 2010. *Local area migration indicators illustration* [Online] (Data upto 2008) Available at: [http://www.statistics.gov.uk/downloads/theme\\_population/Local-area-migration-indicators.xls](http://www.statistics.gov.uk/downloads/theme_population/Local-area-migration-indicators.xls) [Accessed 21 May 2010]



**Figure 2.7: Solid and Superficial Geology**



**Table 2.2: Generalised description of strata present in project area (from sheet memoir)**

Deposit	Description	Thickness
Alluvium	Typically soft silty clays with a thin basal lag gravel.	Up to 3m
River Terrace	Of local derivation composed predominantly of Wealden siltstone and soft sandstone pebbles. The upper beds are generally oxidised by weathering to a yellowish brown colour and may be loosely described as a loam.  In the Mole basin two terraces can be distinguished, the Second Terrace being about 2m above the first. They are of Devensian age.	Not exceed 3m
Head	Poorly sorted locally derived material, where water acts as the lubricant rather than the primary agent of transport. All gradations occur between the most poorly sorted Head and well sorted river deposits.	Up to 5m
Weald Clay	Predominantly of clay and silty clay but also includes thin beds of sandstone, shelly limestone and clay ironstone. Being more resistant to erosion, these form low escarpments and diversify the otherwise low relief (Galois RW & Worssam (1993)).  Near the ground surface, the Weald Clay is typically pale grey or pale greenish grey, variably mottled with yellowish grey or yellowish brown due to weathering. At about 4m to 6m depth, there is generally a sharp base to the weathered zone. As seen in borehole cores, unweathered clays are mostly greenish grey, but medium to dark grey and olive-grey clays also occur.	Up to 320m
Upper Tunbridge Wells Sand	A complex sequence of thinly interbedded deposits, with fining-up and coarsening-down cycles. Silt is the dominant component. Grey and greenish grey silty mudstones, some showing red mottling, tend to predominate in the lower part of the formation. Beds of pale grey to yellowish grey sandstone mostly occur in the upper part.	60m and 110m (Sheet 302) 44m at Worth Forest Borehole (2891 3500)
Grinstead Clay	Consists largely of grey to greenish grey mudstones, silty mudstones, shale and clay with thin beds of shelly limestone and nodular clay-ironstone, the upper part of the formation is characterised by red clays. A band of fine-grained sandstone, the Cuckfield Stone, occurs throughout much of the outcrop dividing the Grinstead Clay into Upper and Lower members. The base of the Grinstead Clay is marked by a pebble bed.	26.9m in Cuckfield Borehole (2962 2729)

There are two primary soil associations in the Crawley area – the Wickham complex to the west associated with the clay geology; and the Curtisden complex to the east and south, associated with the underlying sandstones. There are also small areas of the Fladbury and Shabington complexes through the town.

The Upper Tunbridge Wells sandstone is part of the Hastings Group of Cretaceous age<sup>13</sup>. Key characteristics are:

- Groundwater flow within the Tunbridge Wells Sands is both intergranular and through joints, and well yields tend to be variable. Groundwater circulation is affected by numerous clay seams and faulting.
- From available pumping test results, 25/75 percentile of transmissivity ranges from 13.8 to 35.4m<sup>2</sup>/ day.
- Main controls on permeability and transmissivity are lithology and degrees of cementation, both of which show great variation. Furthermore faults and faulting add structural complexity. The prediction of aquifer properties is difficult.
- The base of the UTWS also provides spring flows of up to 1000 m<sup>3</sup>/day (12 litre/s).

<sup>13</sup> British Geological Society (2000) The physical properties of minor aquifers in England and Wales"



In terms of local information, springs are noted at:

- Tilgate as the supply to the stream through the Peace Gardens at TQ 2776 339, just to the west of Silt Lake (probably as a result of a permeable layer resting on a mudstone layer within the UTWS).
- Clay's Lake; south of the lake within heath land at western edge of Brantridge Forest, probably associated with local outcropping of the top of the underlying Wadhurst Clay.

#### Aquifer Designations and Definitions

The Environment Agency changed its system of designating aquifers from 1 April 2010<sup>14</sup>. The maps are split into two different type of aquifer designation:

- Superficial (Drift) - permeable unconsolidated (loose) deposits. For example, sands and gravels.
- Bedrock -solid permeable formations e.g. sandstone, chalk and limestone.

Aquifer designations are defined below.

**Principal Aquifers** - layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifers.

**Secondary A Aquifers** - permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers;

**Secondary B Aquifers** - predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

**Secondary Undifferentiated Aquifers** - has been assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

## 2.4 Strategic and Policy Context

### 2.3.1 River Thames Catchment Flood Management Plan

The flood risk policy for the area is defined in the River Thames Catchment Flood Management Plan (CFMP)<sup>15</sup> as:

**Policy 6:** Areas of low to moderate flood risk where we will take action with others to store water or manage run-off in locations that provide overall flood risk reduction or environmental benefits. This policy will tend to be applied where there may be opportunities in some locations to reduce flood risk locally or more widely in a catchment by storing water or managing run-off. The policy has been applied to an area (where the potential to apply the policy exists), but would only be implemented in specific locations within the area, after more detailed appraisal and consultation.

Specific actions promoted as part of the CFMP include:

- Use of the natural protection already provided by the river channel and the open spaces in the floodplain;

<sup>14</sup> <http://www.environment-agency.gov.uk/homeandleisure/117020.aspx>

<sup>15</sup> Environment Agency (December 2009) Thames Catchment Flood Management Plan Summary Report

- Maintenance, and where possible improvement to the flow of water in the rivers as they pass through built up areas;
- Complimented by improvements to other parts of the drainage network;
- Maintain and, if possible improve, the capacity of the floodplain to store water, making use of the open spaces available within the floodplain, and preventing the loss of open spaces;
- Follow up opportunities to store water to reduce flood risk;
- Work with Planning Authorities to maintain the existing open space in the floodplain, manage urban run-off, take advantage of opportunities for flood storage and increase the resistance and resilience of buildings through redevelopment;
- Develop emergency response planning to deal with extreme events, including raising public awareness and working with key partners to identify critical infrastructure at risk.

### 2.3.2 River Mole Strategy Study

A flood risk management strategy was developed in 2005 specifically for the Upper Mole sub-catchment<sup>16</sup>. This identified a number of structural and non-structural options that should be progressed for the region (Section 3), of which two were combined to form the Upper Mole Flood Alleviation Scheme. This comprises five distinct components for reducing flood risk in different areas of the Upper Mole catchment:

- **Ifield** (formerly Rusper Road) – creation of a new flood detention reservoir;
- **Worth Farm** – creation of a new flood detention reservoir;
- **Tilgate Lake** – raising of an existing dam with no change in normal water level;
- **Clay's Lake** – raising of an existing dam with no change in normal water level;
- **Grattons Park** river restoration scheme – a new dam with a section of restored river channel.

These schemes were initially progressed as a fully comprehensive study on the same programme, however the works at Tilgate had to be progressed more urgently; the reservoir needed important construction works for safety reasons (under the Reservoirs Act 1975), and these needed to be carried out as soon as was reasonably possible. It was therefore felt that it could be more quickly progressed as a single scheme, with the remaining sites to follow shortly after. Planning consent for the Tilgate component of the scheme was received in January 2010, and the scheme is being constructed through 2010, with planned completion in early to mid 2011.

Design of the Ifield site was being progressed; however a decision was taken by the Environment Agency project board in January 2011 to postpone submission of the planning application pending review of the business case. This ES therefore covers the potential impacts associated with the other three sites only (Worth Farm, Clay's Lake and Grattons Park). The environmental effects of the Tilgate scheme are documented in the October 2009 Environmental Statement<sup>17</sup>.

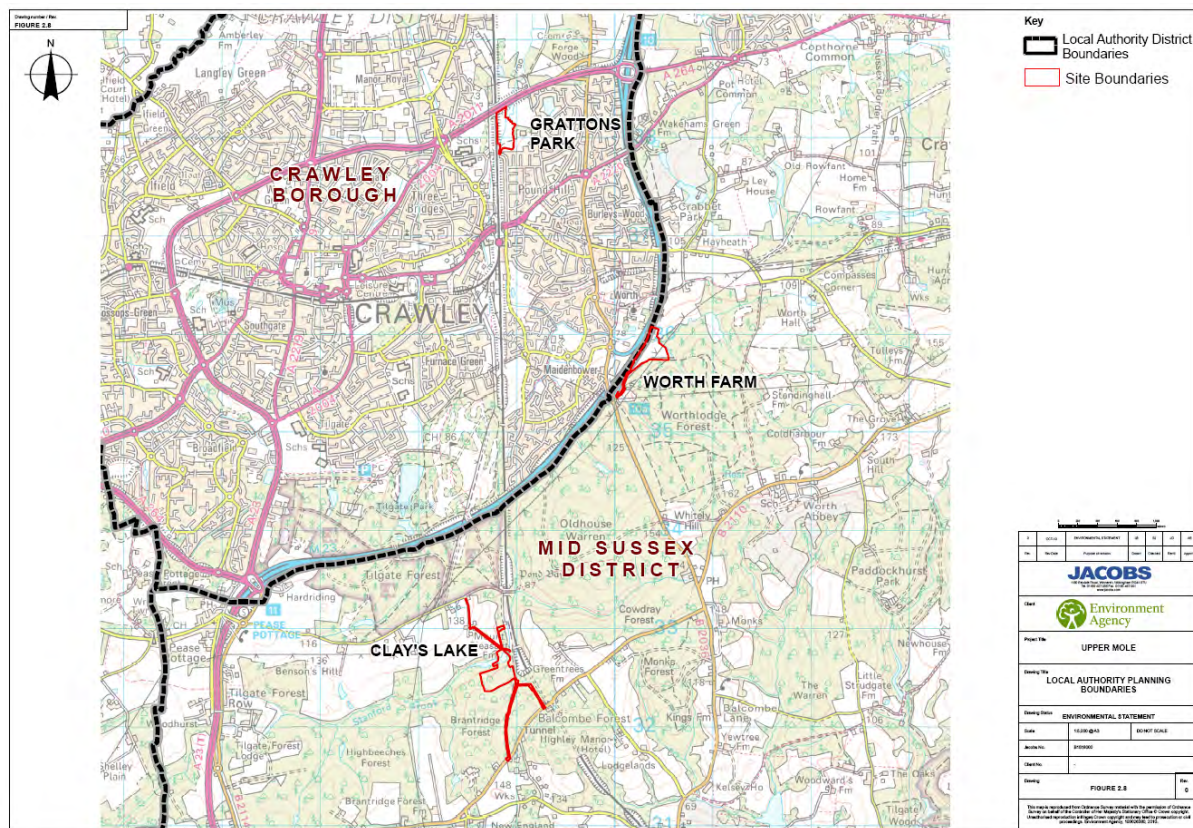
### 2.3.3 Local Planning Context

All three sites lie within the West Sussex County Council area. However, whilst Worth Farm and Clay's Lake fall within the jurisdiction of Mid Sussex District Council, Grattons Park lies within Crawley Borough Council's area (Figure 2.8).

<sup>16</sup> Babbie, Brown and Root (2005) Upper Mole Strategy Study

<sup>17</sup> Environment Agency (2009) Tilgate Dam Raising Environmental Statement

**Figure 2.8 Planning Boundaries**



National planning policy, legislation and guidance is described in Appendix A, while an assessment of the compliance of the scheme against the Development Plan is provided in the Planning Supporting Statement, a supporting report to this document.

## 2.5 Project Objectives

As discussed in Section 2.1, Crawley is subject to flood risk from the Gatwick Stream and River Mole. The project is therefore required to provide the town and its population with adequate protection from the effects of flooding. The specific objective of the scheme is defined below:

To contribute to Government targets to reduce flooding and contribute towards Biodiversity Action Plan (BAP) targets in the Upper Mole.

Figure 2.9 shows areas of existing flood risk in Crawley, and how the Upper Mole Scheme as a whole would improve flood risk to people. Clay's Lake and Worth Farm primarily reduce flood risk to Maidenbower and then also to Billington Drive, Pound Hill, Three Bridges and Tinsley Green downstream. The Ifield scheme mainly reduces risk to the Ifield area, although it should be noted that this element of the work is currently postponed. This does not reduce the effect of, or need for, the other schemes. Cumulatively the schemes reduced flood risk to Gatwick Airport and downstream in Horley.



[illegible]

# 3 Consideration of Alternatives

Considering alternatives is a very important part of making sure you end up with the best final product. We have considered alternatives right from the early stages of project development, from strategic level assessments and feasibility studies which looked at a whole range of alternative methods of managing flood risk, to options workshops to agree the exact location of precise scheme components.

Our aim has been to develop schemes that provide optimal flood risk protection for the best value for money and which deliver environmental benefits.

## 3.1 Previous Studies

Previous studies have been undertaken to investigate opportunities for flood alleviation in the Upper Mole sub-catchment. These studies include:

- The Gatwick Stream Flood Alleviation Scheme: Stage 1 Report;<sup>18</sup>
- The Gatwick Stream Flood Alleviation Scheme: Pre-feasibility study;<sup>19</sup>
- The Gatwick Stream Flood Alleviation Scheme: Feasibility Study Report.<sup>20</sup>

These reports considered a number of flood alleviation options, from which viable options were carried forward into The River Mole Strategy Study<sup>21</sup>. This report identified three flood risk reduction schemes covering Crawley, the Gatwick Airport area and Burstow Stream respectively. The Crawley Option recommended four dams detaining a total of 1.5 Mm<sup>3</sup> of floodwater. A Strategic Environmental Assessment of this flood risk management strategy study was undertaken<sup>22</sup>. Together the above studies considered a number of opportunities for achieving a reduction in flood risk in the Upper Mole catchment. The options considered included flood detention dams, culvert enlargement and the construction of flood walls and/or bunds to temporarily retain flood water. Flood alleviation options considered by the above studies are summarised in Table 3.1.

**Table 3.1 Flood Alleviation Works Considered in Previous Studies**

Candidate Works	Option	Status e.g. rejected or proposed
<b>Pre-feasibility, Oct 2001</b>		
Flood detention reservoirs	3	Proposed, economic with benefit:cost ratio of 3.3
Increase size of culverts	4	Unlikely to be economic; further study of which culverts to amend
Flood embankments	5	Rejected – uneconomic
Dredging	6	Rejected – negligible effect on water levels
<b>Feasibility</b>		
Maidenbower walls	3	Uneconomic
Various flood detention reservoirs	4-6	Proposed, storage in Gatwick Stream, Stanford Brook, Tilgate
Dual Haslett avenue culvert	7	Proposed
Maidenbower Drive culvert	8	Rejected, as unnecessary if flood detention reservoirs have been implemented
Combinations of above; plus Halfsmock stream	9-11	Option 11 gives highest damage avoided, comprising all reservoirs and dual Haslett Avenue culvert
<b>Mole FRM Strategy</b>		
As Option 11 in Gatwick Stream Feasibility Report	ST1.3	

<sup>18</sup> Babbie, Brown and Root, 2001 The Gatwick Stream Flood Alleviation Scheme: Stage 1 Report

<sup>19</sup> Babbie, Brown and Root, 2002 The Gatwick Stream Flood Alleviation Scheme: Pre-feasibility study

<sup>20</sup> Babbie, Brown and Root, 2004 The Gatwick Stream Flood Alleviation Scheme: Feasibility Study Report

<sup>21</sup> Babbie, Brown and Root, 2005 The River Mole Strategy Study

<sup>22</sup> Babbie, Brown and Root, 2005 Strategic Environmental Assessment for the River Mole Strategy Study



Candidate Works	Option	Status e.g. rejected or proposed
Option ST1-3 but with increased storage	ST1.4	Highest benefit:cost ratio; approved by the Environment Agency board, as part of approval of Strategy ST2 to form Upper Mole FAS, of which Tilgate Dam Raising forms the advanced works.
As ST1-4 plus flood walls upstream of Haslett Avenue culvert to railway	ST1.6	Negative incremental benefit
Local bunds along edge of watercourse around Gatwick Airport and Horley	ST2	Approved by the Environment Agency board, as part of approval of FRM Strategy. Refined in subsequent Feasibility Review to comprise Ifield FDR, which now forms part of the Upper Mole FAS

## 3.2 Flood Detention Reservoir Options

### Definition of a Flood Detention Reservoir (FDR)

*Alternatively known as a flood detention basin or pond; flood retention reservoir; dry pond; holding pond; or dry detention basin.*

A flood detention reservoir is designed to hold water during periods of flood flows, but which is empty of water for most of the year. The reservoir functions by allowing large volumes of water to enter, but limits the amount of water allowed to exit down the stream. The water is held back by a dam and control structure.

Whilst normal flows can pass through the dam, when river levels rise, they become so great that they cannot all pass through the structure, hence water starts to build up behind the dam. It is then released gradually as flows decrease.

**Example of an existing flood detention reservoir – Aldington Dam, part of the Ashford FAS**



The pre-feasibility and feasibility studies identified that flood detention reservoirs should form a key part of the flood risk management strategy for the area. We then went on to look at various different sites for these, and assessed the main environmental issues associated with them to assist in the decision-making process.

Key factors important when deciding on the locations for potential dams include:

- The need to locate the dam upstream of the urban areas and infrastructure to be protected, but as far downstream as possible to maximise the amount of run-off collected – a sufficient catchment area is required to make the scheme viable;
- The sizable amount of space required to hold such a large volume of water, which is not readily found in urban areas;
- The need for a site with minimal accessibility and infrastructure to reduce potential safety and security considerations; and
- The need for a particular topography – a valley that is of suitable dimensions to hold the required volume of water.

The sites considered were:

- Option GS1: Gatwick Stream (Worth Dam);
- Option TL: Tilgate Dam;
- Option FS1: Forest Stream;
- Option SB2: Stanford Brook Middle;

- Option SB3: Clay's Lake;
- Option GP: Grattons Park;
- Option UM1: Rusper Road (now known as Ifield);
- Option TM: Titmus Dam.

Of the eight flood detention reservoir options considered, three were excluded, as summarised below.

- **Option FS1: Forest Stream** - rejected mainly owing to the fact that the stream has a small catchment (<1 km<sup>2</sup>) and therefore could only make a modest contribution to flood alleviation, and it would also have various adverse environmental impacts.
- **Option SB2: Stanford Brook Middle** - rejected due to potential adverse effects on a Site of Special Scientific Interest (SSSI), features of archaeological and historic interest and other adverse environmental impacts.
- **Option TM: Titmus Dam** - rejected due to the fact that it only commands a small catchment (<1 km<sup>2</sup>) and could therefore only make a modest contribution to flood alleviation.

This left the remaining five schemes that are being considered, three of the projects being the subject of this Environmental Statement and the others being Tilgate Dam Raising (already under construction) and Ifield (currently postponed pending review of the business case).

### 3.3 Other Options

#### 3.3.1 Increase in conveyance at culverts and local defences

We reviewed the options for culvert enlargement in the River Mole FRM Strategy, and also the culvert at St Marys Drive in Pound Hill. Although in both cases the benefits were localised and insufficient to justify them as incremental schemes on the FDR although some would become economic when replaced as operational life expired.

We have also examined where culverts could be removed, following our de-culverting policy and conclusions in the Pitt Review. The Upper Mole Scheme includes removal of a concrete channel at Grattons Park.

Option ST2 of the Mole Strategy was to provide approximately three kilometres of bunding to raise ground level at strategic points around the confluence of the River Mole and Gatwick Stream. As part of the feasibility study we collected additional data and carried out studies on the mechanisms of flooding at the airport. We concluded that these bunds are both uneconomic and would have significant practical difficulties in terms of not restricting access to property and waterproofing existing services crossing the bund.

#### 3.3.2 Flood relief tunnel to bypass South Terminal and M23 link culverts

Our preliminary assessment indicates that the construction of a tunnel under the South Terminal would currently be uneconomic, but would become marginally economic under climate change, with a 20% increase in river flows. Further study of this and alternative options to reduce residual flood risk at Gatwick Airport below the level achieved by the flood detention reservoirs will be undertaken as a separate study with the airport owners.

## 4 Consultation

In order to keep people informed of our activities, we regularly engage in consultation exercises. This ensures that we remain transparent in our activities, and ensures that the public, statutory and non-statutory bodies are kept informed. Consultation undertaken throughout the design process provides interested parties with the opportunity to raise concerns at an early stage and actively influence the outcome of our projects. It also provides us with the opportunity to clearly explain our projects and activities to wide audiences.

We carried out a stakeholder analysis exercise early in the project, to identify the people that might have an influence over or be affected by our scheme. This helped to inform our programme for consultation. Table 4.1 presents the consultations that have been undertaken and key outcomes (excluding those undertaken in relation to the Ifield site).

**Table 4.1 Consultation History**

Group	Consultation	Date	Key Comments / What was Accomplished?
<b>Local planning authorities (planning department)</b>	<b>Scoping Consultation</b>	June to August 2006	<p>The scoping report was issued to statutory and non-statutory consultees for comment.</p> <ul style="list-style-type: none"> <li>English Heritage required more information on the baseline environment before commenting on the impacts of the scheme although noted there would be a presumption in favour of preservation of archaeological sites.</li> <li>English Nature (now Natural England) commented that there would be potential adverse impacts on ancient woodland and Grattons Park LNR</li> <li>AONB unit noted that both Clay's Lake and Worth Farm schemes are broadly compatible with management objective G1 (to restore the natural function of river catchments) but could impact on upstream areas of ghyll woodland</li> </ul>
	<b>Crawley BC planners</b>	Summer 2010 - present	<p>A meeting was undertaken to determine the responsibility for the planning applications and to discuss their contents. It was agreed that an EIA, planning supporting statement and design and access statement covering the impacts would be appropriate planning input.</p>
	<b>Mid Sussex CC</b>	Summer 2010 - present	<p>A meeting was undertaken to determine the responsibility for the planning applications and to discuss their contents. It was agreed that an EIA, planning supporting statement and design and access statement covering the impacts on both sites would be appropriate planning input. Also requested photographs / visualisations to explain what the schemes would look like.</p> <p>There would be two separate planning applications for Clay's Lake and Worth Farm, although some supporting documentation would be the same.</p>
	<b>West Sussex County Council</b>	Summer 2010–present	<p>Rights of way officer: Requested that we avoid both temporary and permanent footpath diversions. We have tried to minimise closures and diversions where possible, but this is unavoidable in some locations/</p> <p>Requested we seek improvements to existing or opportunities for new rights of way where possible (e.g. a cycle track along access roads). However, constraints posed by landowners and the desire by most private landowners not to encourage access on their land has meant that we have only been able to accommodate limited improvements.</p> <p>Highways team: Ongoing discussions about the access routes into Clay's Lake site.</p>

Group	Consultation	Date	Key Comments / What was Accomplished?
<b>Environmental consultees</b>	<b>Natural England Consultation</b>	Summer – Autumn 2010	<p>We liaised with Natural England to discuss potential impacts on ancient woodland and protected species, and to discuss the requirement for mitigation. We invited Natural England officers to a number of site visits / meetings; however officers were unfortunately unable to attend. We sent them draft drawings for comment.</p> <p>It was suggested that the EIA cover:</p> <ul style="list-style-type: none"> <li>• Landscape character assessments;</li> <li>• Visual impacts;</li> <li>• Designated sites (LNR at Grattons Park);</li> <li>• Impacts on the AONB;</li> <li>• Impacts on ancient woodland (referred to standing advice in relation to ancient woodland);</li> <li>• Impacts on protected species;</li> <li>• Cumulative impacts.</li> </ul> <p>A key issue of concern is the AONB. NE noted that any development taking place within the AONB is expected to be of the highest quality, which should respect, maintain, or enhance, local landscape character or distinctiveness. Full regard should be paid to the High Weald AONB Management Plan for detailed guidance on ways in which landscape character and local distinctiveness can be preserved and how this development can be improved so that it is 'good enough to approve'. Ongoing liaison will be needed with regards to protected species licensing.</p>
	<b>AONB officer</b>	Summer - Autumn 2010	<ul style="list-style-type: none"> <li>• The principle of flood storage fits in with one of the 5 key objectives of the AONB: restoring the natural functions of river catchments (Objective G1).</li> <li>• 15 local authorities in the AONB – all have signed up to the AONB Management Plan. The Management Plan is also a material consideration for planning purposes.</li> <li>• CROW section 85 requires undertakers etc to have a “duty of regard” for the AONB.</li> <li>• AONB is about conserving and enhancing the AONB in its broadest sense, far more than just about scenery.</li> <li>• Archaeology is important as the area was a heavy industrial landscape until 70 years ago</li> <li>• Need to justify location of development within AONB and ancient woodland (irreplaceable asset) and justify the need for the FAS i.e. reasons of overriding public interest – Gatwick etc</li> <li>• It may be that natural regeneration with a management plan would be preferable to new planting.</li> </ul>
<b>Landowners / neighbours / public</b>	<b>Crawley BC Parks team and drainage engineer</b>	Spring 2010 - present	Ongoing discussions / meetings to agree the scope and design of Grattons Park River Restoration in line with future aspirations for the park, and to ensure any concerns and ideas were taken on board.
	<b>Landowner / tenant farmer at Worth Farm</b>	2007 - present	Would rather not have a new public right of way across the land.



Group	Consultation	Date	Key Comments / What was Accomplished?
	<b>Landowners at Clay's Lake</b>	2007 - present	Agreement to replacement dam structure. Agreed that there would be no access across the existing land boundary. Landowner to the south of the lake is keen to see a pond as part of the reinstatement.
	<b>Public Open Days</b>	Autumn 2010	<p>Three public open days were held in late October and early November 2010, one in Maidenbower (one of the main areas protected by the Clay's Lake and Worth Farm schemes), one in Ifield and one by Grattons Park.</p> <p>These were advertised via posters and email, and the following key groups of people were invited directly:</p> <ul style="list-style-type: none"> <li>• Local Council Planners;</li> <li>• Environmental Consultees (Natural England, AONB officer);</li> <li>• Local and County Councillors;</li> <li>• Parish Councils;</li> <li>• Community Groups.</li> </ul> <p>The exhibitions aimed to explain the key aspects of the project to the public, presenting draft drawings and offering opportunities to discuss the proposals and raise any concerns with key members of the project team.</p> <p>Most people who attended were broadly supportive of the scheme, and pleased about the flood risk benefits. Many people were interested in the wider scheme proposals and keen to find out what they comprised. Concerns were raised in relation to temporary disturbance and impacts on private residences.</p>
	<b>Consultation (by CBC and MSDC) on Planning Application &amp; ES</b>	February 2011	This is the current stage of consultation and will influence the determination of the planning application. Various planning documents have been sent to a wide range of consultees and are available to the public.
<b>Other</b>	<b>Highways Agency</b>	Summer 2010	<p>At Worth Farm, requested that:</p> <ul style="list-style-type: none"> <li>• we erect a temporary fence/screen along the M23 to prevent drivers getting distracted by the construction works;</li> <li>• we erect advisory signs leading up to the site entrance, and;</li> <li>• we design the site entrance to ensure that queues do not form onto the motorway slip road, i.e. provide sufficient parking in front of the gate/security hut for vehicles to queue.</li> </ul> <p>All of these requests will be included in the detailed design.</p>
	<b>Network Rail</b>	Summer 2010	Satisfied that the proposed works at Clay's Lake will not have any effect on the safety of the operational railway therefore further involvement is not required unless the designs change.
	<b>Gatwick Airport safeguarding team</b>	Scoping stage and Autumn 2010	During previous stages, the safeguarding team noted that it is important that Gatwick Airport be consulted regarding the creation of any wetlands that may pose bird strike issues. We have currently consulted them with regards to the proposed design and discussions are ongoing. Preliminary comments about planting of ash and oak and concerns about the previously proposed ephemeral pond at Grattons Park have been addressed.

These consultations have had a positive influence on this project, and have ensured that the concerns of all of those interested have been duly addressed.

# 5 Methodology

## 5.1 Screening and Scoping

A scoping report was produced in 2007 which discussed the potential environmental impacts of the Upper Mole FAS at five distinct sites. More specific scoping letters were sent to Crawley Borough Council and Mid Sussex District Councils in July 2010, to clarify the topics that needed to be considered in further detail for each site specifically.

The scoping assessment highlighted that the following topic areas would need further investigation and assessment:

- Human Beings and Human Health;
- Water and Geomorphology;
- Ecology;
- Landscape and Visual;
- Cultural Heritage and Archaeology;
- Traffic and Transport;
- Geology, Hydrogeology and Contamination.

As a result of the preliminary environmental appraisal, it was also possible to identify environmental receptors that would not be significantly affected by the project. Table 5.1 illustrates the receptors that have been scoped out from further detailed assessment and the justification for identifying a non-significant impact.

**Table 5.1: Environmental topics scoped out from detailed assessment**

Topic	Justification
Air and Climate	There may be some short-term localised impacts with regard to air quality as a result of the production of dust during the construction phase of the project. However this will be considered under the "Human beings and human health" chapter and in the Environmental Action Plan. Potential impacts on ecology are considered in the "Terrestrial Ecology" chapter
Land Use	No specific assessment was considered to be warranted. Impacts on recreational land and private property are covered under "Human beings and human health" while impacts on historic parks are covered under "Cultural heritage, archaeology and material assets".
Noise	There may be some short-term localised impacts with regard to noise as a result of the machinery and processes during the construction phase of the project. However this will be considered under the "Human beings and human health" chapter and in the Environmental Action Plan. Potential impacts on ecology are considered in the "Terrestrial Ecology" chapter.

## 5.2 Significance Criteria

The following methodology has been used to assess most impacts of the project. However, it should be noted that, where relevant, specific significance criteria and assessment methods have been used. More detail on the methodologies used for each environmental discipline is provided in Appendix B.

The effects on receptors have been assessed in terms of those predicted during both construction and operation. Consideration has been given to each of the criteria, as described in Table 5.2.

**Table 5.2: Assessment Considerations**

Feature	Description
<b>Geographical Level</b>	Considers whether the effect of the project on the receptor would be at an international, national, regional or local level.
<b>Direct or indirect</b>	Considers whether the project would affect receptors in the immediate locality, or if it would influence features or processes which in turn result in indirect environmental impacts.
<b>Timescale</b>	Considers the duration of the effect on the environmental receptor, which may be temporary, associated with construction activities, or permanent, as a longer-term effect of the operational project.
<b>Reversibility</b>	Considers if the effects of the project are reversible or irreversible.
<b>Beneficial/adverse</b>	Identifies if the project would give rise to beneficial (positive or favourable), adverse (negative or damaging) or neutral (no change to baseline conditions) effects.
<b>Cumulative Effects</b>	Considers the effects from the project in conjunction with other projects / developments in the area. It also pulls together the effects that this project may have as a whole.

The significance of the impact, either beneficial or adverse, is determined through the consideration of the magnitude of the effect versus the importance or sensitivity of the environmental receptor. The importance or sensitivity of the environmental receptor is identified by considering its statutory or non-statutory protection, its vulnerability or rarity, consultee responses, specialist expertise and professional judgement. Table 5.3 illustrates how the magnitude of the effect and the importance or value of the environmental receptor is used to demonstrate the significance of the resulting environmental impact.

**Table 5.3: Significance Matrix**

		Importance/Sensitivity of Receptor		
		Low	Medium	High
<b>Magnitude of Effect</b>	<b>Very Low</b>	Negligible	Negligible	Minor
	<b>Low</b>	Negligible	Minor	Moderate
	<b>Medium</b>	Minor	Moderate	Major
	<b>High</b>	Moderate	Major	Major

The following are definitions for the significance of the impacts as assessed by using the above matrix. These may either be beneficial or adverse.

- **Negligible:** The impact is only very slightly detectable/noticeable, or it is undetectable and of no significance.
- **Minor:** Impact is slightly detectable/noticeable and of some temporary and localised effects, or of a reversible nature.
- **Moderate:** Impact is fairly easily detectable/noticeable and either temporary or permanent, but unlikely to exceed local influence.
- **Major:** Impact is easily detectable/noticeable and likely to be of permanent, long-term significance with irreversible implications exceeding the local area.

The potential environmental impacts of the project are discussed within the individual assessments. These sections also present any additional mitigation measures required for the project's adverse impacts, in particular the unmitigated impacts of moderate and major significance; the residual impact significance is then identified. Mitigation measures are measures that would be provided for adverse impacts in order to decrease the magnitude of the effect of the project on environmental receptors to an acceptable level. An acceptable level is that which is deemed appropriate by relevant legislation, professional judgement and good practice, as well as the view of consultees. Residual impacts are those effects that result subsequent to the application of the proposed mitigation measures to the adverse impacts.