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LEA Investments

Langford Lane, Kidlington

ENGINEERING APPRAISAL

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CONTENTS

APPENDICES

A Drawings
159/017/01 - Site Location Plan
159/017/02 – Proposed Development Layout
159/017/04 – Road Layout Langford Lane
159/017/05 – Junction Layout into Site
159/017/06 – Long Section of Access Road
159/017/07 – Vehicle swept paths in service yards
159/017/08 – Site investigation. Trial pit and soakage test layout
159/017/09 – Indicative foul drainage layout
159/017/10 – Storm Water Attenuation Pond and Infiltration Trenches
Topographic Survey by MSurv

B Drawings from Statutory Authorities
- British Telecom
- High Voltage electricity
- Low Voltage electricity
- Gas
- Water
- Foul and Storm sewers
- Highway Boundary Map

C Geotechnical Information
- Extract from BGS map
- Laboratory Test Results
- Impermeable areas and infiltration rate calculations

D Environmental Maps
- Site Sensitivity Maps
- Flood Map
- Groundwater and aquifers
- Selection of Historical Maps

1.0 INTRODUCTION

1.1 Haydn Evans Consulting were appointed by LEA Investments to carry out an engineering appraisal of the Old Rugby ground, Langford Road, Kidlington. The extent of the commission was as follows:

- Review current and historical uses of the site and surrounding area to ascertain the potential for contamination
- Carry out an intrusive ground investigation to determine subsoil types and provide guidance on likely types of foundation and bearing capacities
- Undertake soakage tests to determine if soakaways are viable
- Provide preliminary design of access into the site, its effect on existing services; obtain highway authority input
- Propose a foul drainage strategy and agree with Thames Water
- Propose a surface water drainage strategy

2.0 LOCATION, THE SITE AND SURROUNDING AREA

2.1 The site is to the north west of Kidlington village, itself some 6 miles to the north of Oxford City Centre. The national grid reference is 447600 214700 with access into the site off the south side of Langford Lane. A location plan is shown on drawing 159/017/01.

2.2 Site

The site is roughly rectangular approximately 250m x 210m with a total area of 5.2 hectares. It appears to be virtually level although there is a slight slope from west to east of 2.5m adjacent Langford Lane and 0.75m along the rear southern boundary. It is below the level of Langford Lane by 1.1m at the western side and about 0.9m at the eastern side. The surrounding area generally slopes towards the south east.

It ceased being used as the rugby club some ..... years ago and since then has been left unused. There are mature trees along the eastern and northern (Langford Lane) boundaries whilst the western boundary comprises brambles and hedges. The southern boundary is open and unmarked.

2.3 Surrounding Area

On the opposite side of Langford Lane is Oxford Airport and Oxford Spires Business Park. To the west is Evenlode Crescent serving the Ambulance Station, depot and detention centre whilst to the east is Oxford Motor Park. The immediate area to the south is undeveloped.

2.4 Proposed Development

The current proposal comprises eight units. The two nearest the road are likely to be offices whilst the remainder are earmarked for general commercial use. Some of the units may be divided into two. The proposed development layout is shown on drawing number 159/017/02.

The units are served by a central access road with car parking in front of the units. Access to the rear service yards is via roadways between each unit.

3.0 SITE HISTORY

3.1 The site history has been determined by examining 1:2500 and 1:10000/10560 maps and plans of the site and surrounding areas. A selection of these maps has been included in the appendix D.

3.2 In 1876/84 the site was agricultural land adjacent Langford Lane. A quarry is shown 150m to the east. 300m to the east is a ditch draining southward and some 40m beyond the Oxford Canal. Apart from Campsfield Farm 300m to the north all the surround area is farm fields.

3.3 By 1899/1900 the quarry is noted as old quarry presumably disused. Another quarry (some 500m from the site) is now shown beyond Campsfield Farm. By 1923 this is also shown as disused. Otherwise the situation both in 1923 and 1936 remains unchanged.

3.4 The 1947 map shows considerable development to the north of Langford Lane presumably being the infrastructure for the wartime airfield. There are also buildings to the southwest off one arm of the road which subsequently became Evenlode Crescent. The site itself remained agricultural land. A sewage works is shown 400m to the southeast.

3.5 By 1955 the area to the north of Langford Lane is noted as Oxford Aerodrome. The layout of the buildings is largely unchanged with only some to the north having been demolished.

3.6 In 1974 the site is shown as a rugby football field with a pavilion and limited car parking in the northeast corner. Evenlode Crescent to the west has been developed with semi-detached houses, depot, detention centre and electricity sub-station. A piggery is shown 150m to the southeast. To the north on the far side of Langford Lane is an electricity sub-station 30m from the site. The majority of the small buildings have been replaced with new buildings including Langford Hall and the Water-board depot. A number of tanks are noted next to some of the original buildings although none are closer than 120m to the site boundary. Development to the east has begun although is at least 220m from the site.

3.7 By 1992 the commercial development to the east had reached the site boundary and the roundabout on Langford Lane at the northeast corner of the site constructed. To the northeast of this junction Oxford Spires Business Park was being developed. Some of the houses around Evenlode Crescent to the west have been demolished and by 1993 the detention centre had been extended southwards.

3.8 The pavilion in the corner of the sports field is no longer shown on the 2006 map. Further development has taken place on the airport site and the Ambulance Station constructed near the junction of Evenlode Crescent with Langford Lane. There is a new access off the roundabout into the development to the east. Near the piggery two ponds are shown 150m to the southeast.

3.9 By 2013 the airport buildings on the other side of Langford Lane opposite the site had been constructed. Otherwise the situation was largely unchanged.

From a review of the historic maps no previous land uses of the site or surrounding area suggest a potential for contamination to have affected the site.

4.0 ENVIRONMENT SETTING

4.1 Hydrogeology

The site is situated over a secondary aquifer. The soils have a high leaching potential although this reduces to intermediate leaching potential in the northwest corner. Secondary aquifers seldom produce large quantities of water for abstraction but they are important for local supplies and providing base flows to rivers.

To the southwest just beyond the detention centre is an area of unproductive strata whilst to the northeast 250m from the site is an area of principal aquifer.

There is one licensed water abstraction in the area to the northeast on the extremity of the principal aquifer.

- Inchcape Estates Ltd from groundwater 447890E 214850N.

There are no source protection zones in the surrounding area.

4.2 Hydrology

There is a ditch flowing southwards some 200m to the east of the site. A further 100m beyond this ditch is the Oxford Canal which runs in a north-south direction.

700m to the south of the site is Rowel Brook which flows from west to east.

The site is not located in an area designated by the Environment Agency as at risk from flooding from rivers.

4.3 Landfill Search

There is one historical landfill site within 1km of the site.

- Willow Way Begbroke : Industrial Commercial & Household waste
  447598E 214050N, 525m to the south.

There are no licensed waste management facilities, registered landfill sites or registered waste sites within 1km of the site.

4.4 Pollution Control

Records have been checked for the occurrence of any of the following within 250m of the site:-

- Discharge consents : none
- Pollution prevention and controls : none
- Pollution incidents to controlled waters :
  - Minor incident in 1995 at 447950E 214700N, 230m from the site
  - Significant incident at 447900E 214900N, 250m from the site, date not known

In both cases the receiving water was not given.

- There are no records of major accident hazard sites, explosive sites, notifications of installations handling hazardous substances or planning hazardous substance consents or enforcements within 250m of the site.
- There is one fuel station within 1km of the site
  Woodstock Road East, Begbroke 447111E 213861N, obsolete

Various environmental maps and plans are included in the appendices. From a review of the Environmental setting there is no reason to suspect the site has or is at risk at being affected by contamination from the surrounding area.

5.0 EXISTING SERVICES

5.1 BT

BT Openreach has provided a plan showing there is both overhead and underground equipment in the vicinity of the site although they have no assets on the site itself.

There is an underground duct along the south side of Langford Lane which appears to be under the footpath.

An overhead cable follows the track adjacent the east boundary and serves the bungalow to the southwest of the site.

There are underground ducts and junction boxes in Evenlode Crescent.

An extract of the BT Openreach plan is shown in Appendix B.

The proposed access into the site will cross the existing BT ducts if they are under the footpath on the south side of Langford Lane or in the verge behind. Therefore an allowance should be made for lowering the ducts until such time the precise position and depth can be determined by localised excavation.

5.2 Electricity

Scottish & Southern Energy have provided records of high voltage and low voltage mains in the area.

There is a substation on the north side of Langford Lane with an 11kV main crossing the road and running underneath the footpath on the south side for two thirds the width of the site.

A further 11kV cable is on the east side of Evenlode Crescent which then turns eastwards following the hedgerow approximately 150m beyond the southern boundary.

There is a now redundant overhead LV service shown on the site inside the tree line alongside Langford Lane which presumably served the rugby club. An underground LV service is shown behind Langford Lane footpath but just outside the site boundary; if shown correctly this would be at the base of the slope in the tree line. There is a further underground LV service alongside Evenlode Crescent.

Extracts from both the Scottish & Southern Energy high voltage and low voltage plans are shown in Appendix B.

The proposed access into the site will cross both the high voltage and low voltage cables. The nominal depths of these cables when laid below a footpath are 0.6m and 0.45m respectively. When under a road they should both be laid an additional 0.15m deeper. Therefore it is anticipated these cables will need to be lowered in the vicinity of the new road crossing.

The capacity of the existing electricity infrastructure to service the site has not been investigated.

5.3 Gas

Southern Gas Networks have provided a plan showing their assets in the vicinity of the site.

There is a 250mm diameter medium pressure gas main which appears to be under or immediately behind the footpath on the south side of Langford Lane. Two slit trenches were excavated either side of the proposed site access; the main was approximately 1m behind the footpath and the cover varied from 1.0m to 1.2m below footpath level.

There is a further medium pressure gas main along the eastern side of Evenlode Crescent.

An extract from the Southern Gas Networks plan is shown in Appendix B.

The location of the gas main means that it will be under the carriageway when Langford Lane is widened to create the right turn lane. The minimum required cover underneath a road is 0.75m. It should therefore be feasible to retain the gas main in its current position provided the widened road is only marginally lower than the existing channel lane.

The capacity of the existing gas infrastructure to supply the site has not been investigated.

5.4 Water

Thames Water have provided a plan showing their water services in the area.

There is a 225mm strategic main on the south side of Langford lane with two spurs into the site which presumably served the old rugby club pavilion. The main was found in the two slit trenches either side of the proposed site access at a depth 1.0m to 1.2m below the footpath and 0.3m on the site side of the gas main i.e. at 1.2 to 1.3m beyond the back of footpath. Two hydrants are shown on this main across the frontage of the site.

There is a 450mm diameter trunk main on the north side of Langford Lane and a distribution main along the far side of Evenlode Crescent.

An extract of the Thames Water, water map is shown in Appendix B.

The strategic main will be under the carriageway when Langford Lane is widened to create the right turn lane. The minimum depth of cover for a UPVC pipe underneath a road is 750mm. It should therefore be feasible to retain the water main in its current position provided the widened road is only marginally lower than the existing channel line.

The capacity of the existing water infrastructure to supply the site has not been investigated.

5.5 Foul Drainage

Thames Water have provided a plan which shows the nearest adopted foul drainage is in the access road which serves Oxford Motor Park commercial development to the east of the site. The head of the sewer is near the south end, it then runs north along the road, crosses the Ford franchise car park before discharging to the head of the sewer in Langford Lane approx 150m to the east of the site.

No adopted foul drainage is shown in Evenlode Crescent.

An extract of the Thames Water, sewer map is shown in figure B.

The invert levels of the sewer in Langford Lane are not known but it is very unlikely to be sufficient deep to permit a gravity discharge from the site. Therefore the proposed development will need to drain by gravity to a pumping station with a pumping main discharging to the adopted sewer in Langford Lane.

Economically it would be preferable to lay the main within the soft verge in front of the Ford franchise. This area is not part of the highway and therefore an agreement would need to be negotiated with the owner.

The ground conditions on site will make excavation down to 1.7 – 2.2m hard going. Beyond that depth specialist equipment will be required to excavate any trenches, pumping stations etc. Consequently the pipework needs to be kept as shallow as feasible which would suggest locating the pumping station near the centre of the site; this will need to be reviewed in conjunction with the phasing of the development.

5.6 Surface Water

The Thames Water plan shows a surface water sewer on the north side of Langford Lane. The manhole covers are in the verge but neither the diameter nor the depth of the sewer is known. Refer to the extract of the Thames Water sewer map in Appendix B.

The drainage strategy in the Flood Risk Assessment prepared in October 2012 by the Baynham Meikle Partnership suggested that infiltration drainage should be considered. Therefore a number of soakage tests were undertaken in August 2013 to establish permitted infiltration rates. The results of these tests and possible drainage strategies have been discussed in section 9.

6.0 SITE ACCESS

6.1 Access into the site is off Langford Lane. It is currently a single carriageway road with a 30mph (50kph) speed limit. To the west is a roundabout serving Oxford Airport and Oxford Motor park. To the east is a right turn lane serving Evenlode Crescent marked out with diagonal hatching but no bollards.

6.2 It is proposed there will be a central access road along the length of the site serving commercial premises on each side. At the location of the junction with Langford Lane the site is approximately one metre below the level of the carriageway. The access road must not have a gradient steeper than 1 in 50 for the first 15m from Langford Lane; thereafter it can slope down into the site at a maximum gradient of 1 in 20.

6.3 Langford Lane is relatively busy particularly at peak periods. Vehicles from the west stopping on the carriageway and trying to turn right into the site would inevitably cause tailbacks at peak times. It is therefore very unlikely highways would agree to the development without provision for vehicles turning right into the site.

6.4 Consideration could be given to making the junction a no right turn into the site. Vehicles would then pass the site, go around the roundabout to the north-east and come back along Langford Lane to turn left into the site. Preventing the right turn manoeuvre is always difficult to manage; a central barrier cannot be installed along Langford Lane as vehicles will still need to turn right (east) out of the site. However it could be discussed with highways to obtain their opinion; it maybe an acceptable temporary option until a certain number of units have been occupied.

6.5 Alternatively a new right turn lane for vehicles from the west could be constructed. This would involve moving the kerb line of Langford Lane some 4m southwards to create sufficient width of carriageway, creating a hatched area with a central bollard at the east end. This would prevent vehicles from the east turning left into the site being overtaken and hence allowing those exiting the site to turn right at the same time.

6.6 The new access road must comply with statutory visibility requirements for vehicles turning onto Langford Lane. There are two requirements; the set back ('x') distance governed in part by the number of vehicles likely to be using the junction and visibility along the road ('y') distance which is governed by the speed of traffic along the main road.

6.7 The Department of Transport document TD42/95 covers the 'Geometric Design of Major/Minor Priority Junctions'. This gives a 'y' distance for a 50kph road of 70m. The desirable 'x' distance in clause 7.6c is 9m. However clause 7.8 for lightly trafficked simple junctions states this may be reduced to 4.5m. Drawing 159/017/04 shows the junction layout with a right turn lane and the implications on land take for both the 4.5 x 70m and 9.0 x 70m visibility splays.

6.8 The Designing for Deliveries document produced by the Freight Transport Association provides design recommendations for the use of heavy goods vehicles. The advice is principally concerned with the layout of facilities off the public highway. However for a straight section of access road it is recommended to have 1.3m between opposing vehicles and clearances of 0.5m between the vehicles and the carriageway edges. On the basis a standard heavy goods vehicle is 2.55m wide the total carriageway width would be 7.4m. The standard width of a two way access road is typically 7.3m which has generally been adequate for the heavy goods vehicles in current use. It is therefore recommended the central access road within the site is 7.3m wide with 1.5m wide footpaths each side.

6.9 Vehicle Manoeuvres within the service yards have been 'Autotracked'. The swept paths are shown on drawing 159/017/07. The area is quite restricted for 16.5m long articulated vehicles. More detailed consideration will be necessary to improve the layout and to make it easier for articulated vehicles to enter and exit the loading bays.

6.10 Permeable paving is not considered to be suitable for service yards or other areas where heavy goods vehicles regularly turn due to the scrubbing action of the manoeuvre. These areas either need to be concrete, heavy duty macadam or heavy duty block paving laid to falls with positive drainage. Both concrete and heavy duty macadam need to be laid a number of weeks before they are actually used.

7.0 GROUND INVESTIGATION

7.1 The ground investigation was carried out on 9th July 2013 and comprised the excavation of 9 trial pits using a JCB excavator. The pits were spread across the site with the primary purpose of establishing parameters for foundation design and road construction. A view was also taken as to whether a return visit would be made to test percolation rates for the design of soakaways.

7.2 Weather

The day was hot and sunny. The preceding fortnight has also been dry and sunny although previously there had been an above average amount of rainfall.

7.3 Trial Pits

The locations of the trial pits are shown on drawing number 159/017/08.

TP1

0-250	Topsoil
250-1000	Fractured ROCK with interstitial stiff mid-brown sandy clay
1000-1500	Fractured ROCK
1500-2200	Stiff light grey with streaks of orange SAND
	Water trickling at 2100
2200-2300	ROCK
2300	Bottom of pit. Unable to progress any further with excavator.
	Depth to water; 1900 after 5 hours.

TP2

0–200	Topsoil
200-300	Stiff mid brown sandy CLAY
300-1700	Fractured ROCK broken into cobbles up to 200mm across when excavated with interstitial stiff mid brown sandy clay.
	Becoming wet at 1600
1700-1800	ROCK. Water trickling in at 1750
1800	Bottom of pit. Unable to progress any further with excavator.
	Depth to water; 1600 after 4 hours

TP3

0-250	Topsoil
250-550	Stiff dark brown sandy silty CLAY with rootlets
550-1600	Fractured ROCK with interstitial stiff mid brown sandy clay
1600-1700	ROCK
1700	Bottom of pit. Unable to progress any further with excavator.
	No water.

TP4

0-200	Topsoil
200-300	Stiff mid brown sandy CLAY
300-1600	Fractured ROCK broken into cobbles up to 200mm across when excavated with interstitial stiff mid brown sandy clay
1600-1850	ROCK
1850	Bottom of pit. Unable to progress any further with excavator
	No water

TP5

0-200	Topsoil
200-450	Stiff dark brown silty CLAY
450-1400	Fractured ROCK with interstitial stiff mid brown sandy clay
1400-2000	Very stiff grey brown CLAY
2000-2100	ROCK
2100	Bottom of pit. Unable to progress any further with excavator
	No water

TP6

0-300	Topsoil
300-550	Fractured ROCK with interstitial stiff mid brown clay
550-850	Stiff mid brown CLAY
850-1600	Fractured ROCK with interstitial stiff mid brown clay
1600-2000	Stuff grey/mid brown CLAY
2000-2100	ROCK
2100	Bottom of pit. Unable to progress any further with excavator
	50mm water in pit after 1 hour

TP7

0-300	Topsoil
300-500	Stiff dark brown silty CLAY
500-1250	Fractured ROCK with interstitial stiff mid brown clay
1250-1500	Stiff light brown clay
1500-1900	Rock in layers 30-40mm thick when broken out
1900-2000	ROCK
2000	Bottom of pit. Unable to progress any further with excavator
	No water

TP8

0-400	Topsoil
400-1500	Fractured ROCK with interstitial stiff mid brown clay
1500-1800	ROCK
1800	Bottom of pit. Unable to progress any further with excavator
	No water

TP9	
0-250	Topsoil
250-800	Stiff orangey mid brown silty CLAY
800-1900	Fractured ROCK with interstitial stiff mid brown clay Pocket of mid brown stiff clay with streaks of orange sand at 1500
1900-2000	ROCK
2000	Bottom of pit. Unable to progress any further with excavator No water

7.4 Ground Conditions

Across the site is a layer of topsoil 200-400mm deep. In some areas is a thin layer of mid or dark brown silty clay; in places the two layers can be difficult to distinguish.

Across the majority of the site fractured rock was then encountered. Although this could be excavated with the JCB it was tough digging with the rock being raised in angular pieces up to 200mm across. Any voids between these angular cobbles have been filled with stiff clay with these pockets of clay being up to 200mm across. In some of the pits a layer of stiff clay up to 600mm thick was found at depth.

Between 1500 and 2200 a non-fractured rock was encountered. This could not be excavated with the JCB and hence none of the trial pits penetrated into this layer more than 300mm.

Two layers of clay were found in trial pit 6 near the west boundary and soakage test 4 found firm/stiff clay to a depth of 2650mm before any rock was encountered. This shows there are variations in soil strata across the site particularly in the western section.

7.5 Laboratory Analysis

Four samples were analysed for shrinkage potential and found to have a plasticity index ranging from 16-39%. This represents a soil of low to medium volume change potential.

There were no visual signs of any contamination on site and hence a selection of three near surface soil samples and one ground water sample were tested for the CLEA suite of contaminants. None of the contaminants tested were above soil guideline values for commercial developments. However there were slightly elevated levels of Arsenic and Chromium if the upper layer was to be exported for a residential (with plant uptake) land use.

There are some small spoil heaps around the old pavilion car park. These together with the car park surfacing materials may contain some contamination and therefore any allowance should be made to remove these to an approved landfill facility.

Soil samples were tested for sulphates and classified as having a DS-1 design sulphate class. With a pH ranging from 7.3 to 7.7, natural soil with mobile ground water the Aggressive Chemical Environment for Concrete (ACEC) is AC-1.

Laboratory analysis results are included in Appendix C of this report.

7.6 Foundation Proposals

The proposed development is to comprise commercial and possible storage units. Foundation loads will therefore be relatively heavy.

The rock encountered across the site is calcareous limestone of the Cornbrash formation. This strata varies in thickness from 0-5m and is underlain by Forest Marble clay 5-15m thick. The thickness of the limestone rock is not known and may vary considerable across the site.

The fractured limestone rock is interspersed with layers of stiff clay. The bearing capacity should therefore be based on the strength of the stiff clay. A nett allowable bearing pressure of 150kN/m^2 may conservatively be used.

When bearing on the un-fractured rock at a depth of 1700-2200mm the bearing capacity should be based on the strength of the underlying clay unless the thickness of the limestone rock is proven by rotary boring through the strata and into the Forest Marble clay. The nett allowable bearing pressure should therefore be restricted to 150kN/m^2 when bearing on the un-fractured rock.

It is anticipated foundations will be mass concrete pads to support framed construction with strip footings for loadbearing walls. Where strip footings are founded on the clay in the zone of influence of trees, foundation depths will need to be in accordance with the NHBC recommendations.

Ground bearing floors can be utilised bearing on the stiff mid brown clay. In the zone of influence of any trees suspended ground floors will need to be considered. This will only occur around the perimeter of the site. If the floor will be heavily loaded, for example by high bay racking, settlement of the underlying layers may occur and it would therefore be necessary to investigate the thickness of the limestone rock and properties of the underlying clay.

Services trenches should be kept as high as feasible and consideration should be given to building up the levels across the site to reduce the depth of excavation into the fractured rock

Drainage trenches will inevitable be relatively deep. Ideally the drainage layout should avoid the need to penetrate into the un-fractured rock; any excavations in this material will have to be carried out using an impact breaker.

8.0 SOAKAGE TESTS

8.1 Soakage tests were carried out on 14 August 2013. Initially it was proposed to carry out four tests. S1 and S2 were to be shallow on top of/just into the fractured rock to establish whether permeable paving would be viable. S3 and S4 were to be as deep as feasible, that is down to the un-fractured rock to justify deeper soakaways to take roof water.

8.2 The first pit excavated (S4) did not encounter the rock but remained in stiff clay to a depth of 2650. S1 and S5 (the replacement for S4) both drained extremely slowly and were abandoned. A new pit S6 was subsequently excavated and tested. S2 was abandoned after 20 minutes when all the water suddenly drained down a rabbit hole; it was replaced by S2/1.

8.3 Ground conditions at the various soakage test locations shown on drawing number 159/017/08 were as follows:-

S1	0-200	Topsoil
	250-530	Fractured ROCK with very little clay
S2	0-400	Topsoil
	400-525	Fractured ROCK with clay
S2/1	0-300	Topsoil
	300-400	Mid brown clay
	400-550	Fractured ROCK
S3	0-250	Topsoil
	250-1100	Fractured ROCK with very little clay
S4	0-400	Topsoil
	400-2300	Firm/stiff mid brown mottled with orange slightly sandy CLAY
	2300-2650	Very stiff grey CLAY
	2650	Fractured ROCK. 50mm water in base of pit after 3 hours
S5	0-300	Topsoil
	300-1250	Very stiff mid brown slightly sandy CLAY
	1250-1990	Fractured ROCK with interstitial mid brown clay. Top surface of rock varied from 1100 to 1400 along the length of the pit

S6	0-200	Topsoil
	250-400	Stiff mid brown CLAY
	400-1050	Fractured ROCK with interstitial clay

The soakage tests were carried out in accordance with BRE Digest 365, although typically each pit was only filled twice due to restrictions with the available water supply and lack of time. Graphs showing the test results are given in Appendix C

The calculated infiltration rates are as follows:-

	First Test (mm/hr)	**Second Test (mm/hr)**
S1	43	34
S2/1	425	335
S3	674	445
S5	20	--
S6	231	178

Both near surface and deep soakage tests on the western part of the site had slow infiltration rates which are inadequate for designing soakaways. Those on the eastern part and central section had much higher infiltration rates; soakaways are viable in these areas.

9.0 DRAINAGE STRATEGY

9.1 Based on the proposed development layout an indicative foul drainage layout has been shown on drawing 159/017/09. Given that any excavations below a depth of 1.5m to 2.0m will be into (unfractured) rock the layout needs to minimize the depth of the drainage.

This would be achieved by locating the pumping station towards the middle of the site. Even so the fall on the pipe from the head of the run to the pumping station will be in the order of 1.8m to 2.1m depending on the final route. Allowing for 0.6m cover at the head of the run foul drainage trenches will be approaching 3m deep near the centre of the site.

The location of the pumping station is likely to be affected by the phasing of the site and to what extent the layout of the units has been finalised. For future layout flexibility it is best located in the car parking area although if adopted parking over it will not be permitted and a number of spaces will be lost.

The rising main will be about 320m long and laid at a nominal cover of 1.2m. It would discharge into a new manhole in front of the car showroom on Oxford Motor Park some 100m to the east of the roundabout. A final section of gravity sewer will be necessary to connect into the adopted sewer.

For the purposes of this appraisal we have assumed the following occupancies:
Units 1 and 2 – 200 people each
Units 3, 4, 7 and 8 – 40 people each
Units 5A, 5B, 6A and 6B – 25 people each

Based on these figures the flow rate into the pumping station will be about 7.5 – 8.0 litres per second. Thames Water should adopt the pumping station and rising main provided they are constructed in accordance with Sewers for Adoption 7th Edition. They normally require 24 hour emergency storage. However if the site is purely for commercial use they are likely to accept that the majority of the inflow occurs during a 10 hour period which would equate to an inflow of 275-300m^3 for a full day. This storage volume needs to be provided below the invert of the incoming pipe. It would therefore need to be about 8m x 8m x 4.5m below incoming invert making the overall depth about 6m. This would need to be a reinforced concrete box with separate valve chamber.

Alternatively a smaller wet well could be used with a separate emergency storage chamber which would need to be flushed out after it had been used.

9.2 Surface Water

There are no ditches in the general vicinity. Therefore the following possibilities have been considered for surface water disposal.

1 Discharge into the adopted storm system at a rate calculated for a Greenfield site, which ranges from 2.1, 5.7 to 8.0 litres per second for the 1 in 2, 1 in 30 and 1 in 100 year return periods, see clause 4.4.2 of the Baynham Meikle Partnership report. An attenuation volume of 1750m³ to 4200m³ will be required depending on the discharge rate figure agreed with Thames Water. This can either be provided by a pond or underground storage tanks. The level of the drainage in Langford Lane may be too high in which case the storm water would need to be pumped into the adopted sewer; for storm water this is generally a last resort.

2 Drain the surface water from the roads and pavements into the ground using permeable paving. Permeable paving is not recommended for service yards due to the scrubbing action of heavy goods vehicles turning tight corners. This would also apply to the access road/entrances into the various units. Permeable paving can realistically only be considered for car parking areas, and straight sections of access road.

3 Drain surface water via gullies and pipes to a series of local soakaways. For the eastern units 1, 3, 5 and 7 these soakaways can be located to front and rear of the buildings at a depth where the base penetrates into the rock. Soakaways for the western units 2, 4, 6 and 8 would have to be located to the front of the unit, between the building and access road. Test S6 in this area had a good infiltration rate but significantly below that of the tests further east. Hence any proposed soakaways in this area would have to be the subject of further testing to verify soakage rates are adequate.

4 Drain the entire site to a single pond or attenuation tank with various soakaways and pipes infiltrating the water into the ground. The infiltration pipework would need to be in the eastern part of the site probably under the car parking. The pond or attenuation tank needs to be relatively nearby.

Normally soakaways need to contain the storm of 1 in 10 year return period underground whilst the storm of 1 in 100 year + 30% must be contained on the site. The amount of storage within the pond will need to be agreed with the Environment Agency. However for the purposes of this study we have allowed for the 1 in 30 year return period storm to be retained in the pond and then considered the amount of surface flooding that would occur for the 1 in 100 year plus 30% storm.

The volume of storage required is a function of the permeability rate and length of infiltration pipework. Taking a permeability rate of 250mm per hour with a factor of safety of 1.5 the storage volume required to drain the entire site is as follows:

Length of Infiltration Pipework	**Storage Volume 30 year Return Period**	**Storage Volume 100 Year + 30% Return Period**
200m	1990m³	2735m³
300m	1785m³	2490m³
400m	1625m³	2285m³

If the roof, car parks and service yards of Units 3, 5, and 7 on the east side of the site drain directly to their own soakaways the storage volume required would be reduced as follows:

Length of Infiltration Pipework	**Storage Volume 30 year Return Period**	**Storage Volume 100 Year + 30% Return Period**
200m	1060m³	1500m³
300m	930m³	1330m³

A pond could be up to 1.8m deep. Assuming a required storage volume of 1800m³ the required surface area would be 1000m². Part of this could be accommodated in the zone between units 7 and 8 car parking. Alternatively the pond could be located at the front of the site and designated as open space. No allowance has been taken for infiltration through the base of the pond so it can if required be landscaped to become a feature.

Service yards are areas where oil spills are considered to be quite likely. Therefore these areas should be routed through an oil interceptor prior to discharge either to the pond a soakaway or to the adopted sewer.

10.0 SUMMARY

10.1 Inspection of historic maps and review of the Environmental Setting suggest there is no reason to believe that the site has been contaminated in the past or is at risk of being affected in the future.

The right turn lane and junction into the site can be constructed over the existing gas and water mains. Electricity cables may need to be lowered.

The alterations to Langford Lane to create the right turn lane and the layout of the junction into the site will need to be submitted to the highway authority.

Foundations can be constructed on either the stiff clay or fractured rock. It is anticipated mass concrete pads will be utilised to support framed construction with strip footings for loadbearing walls. Foundations in clay will need to take account of the zone of influence of trees. Generally ground bearing floors can be utilised. If heavily loaded it will be necessary to investigate the thickness of the underlying rock.

The foul sewerage system will need to drain to a pumping station. The holding tank will need to be of sufficient size to contain the 24 hour flow and therefore is likely to be a reinforced concrete box. A 320mm long rising main will discharge to a new manhole about 100m to the east of Oxford Motor Park roundabout.

The local adopted storm sewers are too high to accept gravity discharge and there are no ditches in the area. Infiltration rates into the ground were very good on the eastern half of the site but inadequate on the western half. It is therefore proposed to dispose of surface water to a single pond in the eastern half of the site with a network of infiltration pipes under the adjacent car parking areas.

APPENDIX A

Drawings

159/017/01 - Site Location Plan
159/017/02 – Proposed Development Layout
159/017/04 – Road Layout Langford Lane
159/017/05 – Junction Layout into Site
159/017/06 – Long Section of Access Road
159/017/07 – Site Investigation Trial Pit Layout
159/017/08 – Indicative Foul Drainage Layout
159/017/09 – Storm Water Attenuation Pond & Infiltration Trenches
Topographic Survey by MSurv

APPENDIX B

Drawings from Statutory Authorities

- British Telecom
- High Voltage electricity
- Low Voltage electricity
- Gas
- Water
- Foul and Storm sewers
- Highway Boundary Map

APPENDIX C

Geotechnical Information

- Extract from BGS map
- Laboratory Test Results
- Impermeable areas and infiltration rate calculations

APPENDIX D

Environmental Maps

- Site Sensitivity Maps
- Flood Map
- Groundwater and aquifers
- Selection of Historical Maps