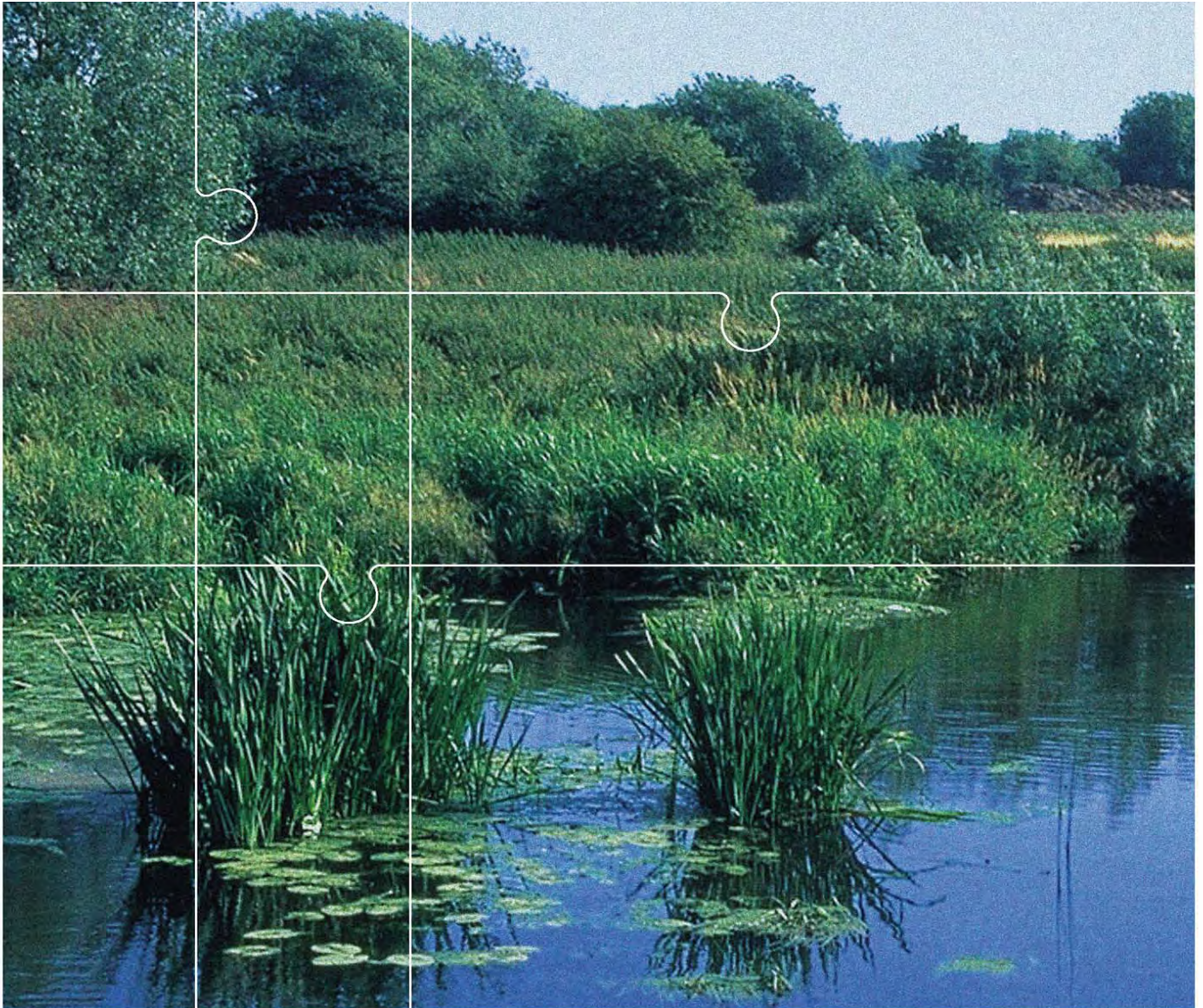


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- Appendix F-1: Capita Symonds Phase 1 Ground Contamination Desk Study Report, Twickenham Railways Station, October 2007 (Ref: version 1.0, October 2007)
- Appendix F-2: RSK Group, Twickenham Railway Station, London Road, Geotechnical Report, August 2010 (Ref: 241458-01(00))
- Appendix F-3: Waterman Energy, Environment & Design Ltd, Generic Quantitative Environmental Risk Assessment, Interpretative Environmental Report on Ground Investigation at Twickenham Railway Station, August 2010 (Ref: EED11251-100/R/1.1.3/GB)
- Appendix F-4: Type 2 Asbestos Survey, Osborne on behalf of Network Rail, 2009



Appendix F-1: Capita Symonds Phase 1 Ground Contamination Desk Study Report,
Twickenham Railways Station, October 2007 (Ref: version 1.0, October 2007)



Phase I Ground Contamination Desk Study Report
Twickenham Railway Station
for Network Rail

Version 1.0
October 2007

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Executive Summary

This report presents the findings of a Phase 1 Ground Contamination Desk Study at Twickenham Railway Station, Twickenham, TW1 3SX.

This report has been prepared to help determine the preliminary requirement for remediation and the level of remediation costs associated with potential future redevelopment of the site.

The desk based preliminary contamination risk attached to the site is assessed to be low to moderate based on the most sensitive end use scenario of a residential building with private gardens. The preliminary contamination risk associated with a less sensitive end use such as commercial buildings is assessed as low. Notwithstanding if the development of the site was restricted to the car parking area in the northern portion of the site the risk would be assessed as low for all end use scenarios.

This preliminary contamination risk is based on potential risk to future users, construction workers, underlying Major Aquifer and the built environment from potential sources of contamination associated with its current and historic use as railway land / station.

Remediation is expected to be required to support future redevelopment of the site, although the level of remediation would be dependent on the sensitivity of the end use.

An intrusive investigation is recommended to be undertaken at the site to confirm the preliminary contamination risk and determine the requirement for remediation to facilitate future development of the site.

The findings of the investigation would support future design and planning applications for redevelopment of the site.

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Figure 2	Site Plan
Figure 3	Conceptual Site Model

Appendices

Appendix 1	Landmark Envirocheck Report
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1. Introduction

- 1.1 This report presents the findings of a Phase 1 Ground Contamination Desk Study at Twickenham Railway Station, London Road, Greater London, TW1 3SX.
- 1.2 The main objective of this report is to obtain and understand the ground conditions and potential contaminant source areas beneath the site with a view to identify contaminated land risks and abnormal costs for remediation and development purposes.
- 1.3 This report is based on desk top information and available historical data and comprises a preliminary risk assessment to identify potential pollution linkages beneath the site.
- 1.4 In accordance with our proposal dated 18th September 2007, we have taken our tasks to comprise the following:
- i. visit the site to assess by visual inspection potential environmental liabilities associated with beneath ground investigation at the site and the surrounding land;
 - ii. to obtain and review readily available historic maps of the site and surrounding land to establish further historical land uses within the vicinity of the site;
 - iii. to review geological and hydrogeological records for the site and surrounding area to assess the potential for pollution migration;
 - iv. to obtain public records held by the Environment Agency and other third parties for the site and surrounding land, including details of licensed landfill, historical landfills, pollution incidents, industrial processes and details of groundwater resources;
 - v. to prepare conceptual site model and undertake a preliminary risk assessment; and
 - vi. to recommend the scope of works for a Phase 2 Geoenvironmental Ground Investigation.
- 1.5 Factual information in this report was obtained from the following sources:
- i. Landmark Information Group, Envirocheck Report;
 - ii. British Geological Survey (BGS) Sheet 270 for South London;
 - iii. the EA Groundwater Vulnerability Map (Sheet 39 West London); and
 - iv. a site visit undertaken by a Capita Symonds Environmental Consultant.
- 1.6 This report is for the use of Network Rail only and should not be relied upon by other parties unless specifically advised by Capita Symonds Ltd in writing.

2. Site Location and Description

Site Location

- 2.1 The site is located at Twickenham Railway Station, Greater London (Postcode TW1 3SX) see Figure 1. The National Grid Reference is 516130, 173700 and the site surface area is approximately 0.99 ha.
- 2.2 The immediate environs of the site consist of a combination of residential and commercial land uses. Bordering the northern perimeter of the site is the River Crane beyond which is residential housing. The railway line runs in a south west to north east direction on the South Western Train Route and a pedestrian iron footbridge which goes over the railway line marks the eastern boundary of the site. Mary's Terrace runs along the southern perimeter of the site beyond which is a mixture of commercial buildings (Regal House Office Block) and residential housing. The west of the site is bounded by London Road.

Site Description

- 2.3 A Capita Symonds Environmental Consultant undertook a site walkover on the 11th of October 2007, with a view to identifying potential areas of contamination concern from the current use of the site. A site layout plan is provided as Figure 2.
- 2.4 The site is a roughly triangular, sloping parcel of land. The boundary of the site is clearly marked by 2 m high fencing to the north and south and a pedestrian footbridge and London Road to the east and west respectively.
- 2.5 The predominant use of the site is as an active railway station in the southern portion of the site and associated car park for Twickenham Railway Station. The car park located in the northern portion of the site has a tarmac surface, is on a gradient and exits onto London Road. There is a small building located in the car park which is used as a booth to sell tickets on rugby match days. There is also a locked outdoor area which contains a large waste bin, shopping trolleys, traffic cones and building debris.
- 2.6 To the south west of the car park bordering London Road is the station building, several bike shelters and an area of soft landscaping.
- 2.7 There are five rail tracks and associated platforms at Twickenham Railway Station, four of which are active. There is a grassed, fenced off area to the south west of platform four which was once rail track. A concrete pedestrian foot bridge crosses the rail tracks at the eastern boundary of the site running across from platform 1 to platform 2 and exits into the car park.

3. Geology, Hydrogeology and Hydrology

Site Geology

- 3.1 A review of the relevant published British Geological Survey (BGS) 1:50,000 solid and drift geological map (Sheet 270 for South London) was undertaken and the published geology of the site is summarised in Table 3.1 below.

Table 3.1 Description of the Published Solid and Drift Geology underlying the Site

Age	Formation	Lithology	Typical Thickness (m)
Devensian	Kempton Park Gravel Formation	Sand and Gravel	Variable
Eocene	London Clay Formation	Clay and Silt	107 - 137 m
Palaeocene	Lambeth Group (Woolwich and Reading Beds)	Sand, Loam and Pebbles	12 - 24 m
Palaeocene	Thanet Sands	Sands	0 – 18 m
Cretaceous	Upper Chalk	Soft white chalk with bands of flint	67 – 91 m

- 3.2 Although published geology does not detail the presence of Made Ground at the site, it is expected that a certain amount will be present due to the sites development as a railway station.

Hydrogeology

Aquifer Classification

- 3.3 As a result of the reported substantial thickness (up to 8m) of drift deposits underlying the site, the EA Groundwater Vulnerability Map (Sheet 39 West London 1:100,000 series) classifies the ground directly underlying the site as a Major Aquifer.
- 3.4 A Major Aquifer is a significant resource capable of producing large quantities of water suitable for potable supply. Minor Aquifers can be formations of variable permeability including unconsolidated deposits. Although not producing large quantities of water for abstraction, they are important for local supplies and in supplying base flow to rivers. Non Aquifers are low permeability strata, which contain no significant exploitable groundwater.
- 3.5 The soil at the site has been given a Soil Leachate Class of High Leaching Potential. Where the soil leachate class has not been established, typically in urban areas, a worst-case classification of high is assumed.

Groundwater Source Protection Zone (SPZ)

- 3.6 The site and surrounding area do not fall within a source protection zone (SPZ) for the protection of Groundwater.

Licensed Abstraction

- 3.7 There are no licensed water abstractions reported as being onsite or within a 500 m radius of the site.
- 3.8 The nearest water abstraction detailed in the Landmark report (see Appendix 1) is recorded as being 1050 m north east of the site. Further details relating to this abstraction are outlined in Chapter 5 of this report.

Hydrology

- 3.9 The nearest watercourse to the site is the River Crane, which is located adjacent to north of the site. The river flows from west to east and the Environment Agency General Quality Assessment (GQA) classification is 'River Quality C' which indicates that it is of fairly good quality.
- 3.10 The River Crane does not have flood defences, and the site lies within an indicative fluvial floodplain. The watercourse is an engineered structure with concrete walls evident adjacent to the site.
- 3.11 The River Thames is located 500 m to the south east of the site. The River Thames has been given an Environment Agency Quality Grade of 'River Quality A' which indicates it is of very good quality.

Radon

- 3.12 The National Radiological Protection Board (NRPB) has reported less than 1% of homes are above the action level associated with naturally occurring radon gas, and as such, no radon protection measures are necessary.

4. Site History

- 4.1 Reference has been made to historic mapping dating from the late 19th Century included in the Envirocheck Report prepared by Landmark Information Group Ltd, attached as Appendix 1. The following Tables provide a chronological commentary describing the historical development of the site and immediate surrounding area, with particular reference to potential sources of contamination.

Table 4. 1 Summary of Mapping Reviewed

Ordnance Survey (OS) Maps Reviewed (published dates)	Map Scale
1874-1881, 1879-1891, 1896, 1898, 1913, 1914-1915, 1934, 1934-1935, 1960-1962, 1959-1961, 1967-1987	1:2,500
1960, 1961-1982, 1981-1990, 1973, 1991, 1994	1:1,250
1871, 1896, 1898, 1920, 1934, 1938, 1949-1960, 1963-1966	1:10,560
1974-1975, 1985, 1985-1995, 1999, 2007	1:10,000

Table 4.2 Summary of the historical development of the site

Map Dates	Description	Comments
1870 – 1891	Open Land Railway Land	The northern portion of the site is open land expected to have been in agricultural use. Railway line (Twickenham Junction) is evident in the southern portion of the site.
1896 – 1960	Railway Land	Railway line has expanded further northwards. By 1914 the footprints of several small buildings located in the northern portion of the site are evident.
1960 – 1999	Twickenham Station Developments	Most of the northern portion of the site has been developed into a car park. By 1973 the car park has expanded further to the west of the site. Two small buildings - a ticket office and storage building are present in the west of the site. Three platforms and their associated railway lines have also been developed at the site. A footbridge linked to the ticket office is present in the south west of the site.
2007	Twickenham Station	The site layout remains largely as described above. Additionally the development of two more footbridges across the railway track are evident at the site.

Table 4.3: Summary of the historical development of the surrounding area (up to 500 m from site boundary)

Map Dates	Approximate Location	Description
1874-1891	All directions	Open land and predominantly residential land use Twickenham Junction Railway Line
1874-1915	50 m west	Brewery
1874-present day	Adjacent to northern boundary 500 m to the south east 150 m south east	River Crane River Thames School
1896-1898	100 m south west	Railway Engine Shed

Map Dates	Approximate Location	Description
1896-1915	200 m south west 300 m south east 225 m north	Nursery Carriage Factory (present until 1898) Nursery
1896-1995	150 m south east	Hospital
1914-1961	150 m east	Goods Shed
1934-1935	75 m west	Corporation Depot
1960-present day	North and South of the site	Residential End Use
1961-1991	150 m east 74 m west	Coal Yard Sorting office

NOTE: All locations are measured from the nearest site boundary.

5. Additional Information

- 5.1 The following research was undertaken to supplement the information gathered from historical mapping, geological assessment and hydrogeological study. The purpose of the research was to review environmental records to identify evidence for contaminative activities on site or in the surrounding area. The principal source of information was the Envirocheck Report provided by the Landmark Information Group, presented as Appendix 1.
- 5.2 Information on existing and recent activities at the site and the immediate surroundings within a 500 m radius, that may have an impact on the environment, are summarised in Table 5.1 below and subsequently expanded in the following sections.

Table 5.1 Summary of Environmental Records

Environmental Aspect	On Site	0-250 m	251-500 m
Water			
Abstractions	NR	NR	NR
Discharge Consents	NR	1	2
Pollution Incidents to Controlled Waters	NR	1	6
Local Authority Pollution Prevention and Control	NR	NR	3
Waste			
Local Authority Recorded Landfill Sites	NR	NR	NR
Licensed Waste Management Facilities	NR	NR	NR
Registered Waste Treatment or Disposal Sites	NR	NR	NR
Industrial Land Use			
Contemporary Trade Directory Entries	NR	13	39
Fuel Station Entries	NR	NR	1

NOTE: NR = None Recorded

Water

- 5.3 There are no recorded abstraction licenses for groundwater or surface water at the site. The nearest water abstraction is recorded as being 1050 m north east of the site and is operated by St Margarets Recreation Grounds. The abstraction is taken from groundwater for private non-industrial amenity: lake and pond throughflow.
- 5.4 There is a discharge consent recorded 5 m north west licensed to Mr S Pannifer (private dwelling) for the discharge of other matter surface water to the River Crane.
- 5.5 There are a further two discharge consents recorded within a 500 m radius of the site. One is located 345 m north east and licensed to Thames Water Utilities Ltd for the discharge of public sewage, storm sewage overflow to a saline estuary. The second is located 488 m south east of the site and licensed to Thames Water Utilities Ltd for the discharge of other matter surface water to a saline estuary.
- 5.6 No pollution incidents to controlled waters have been recorded to have occurred on site.
- 5.7 There is a recorded pollution incident to controlled waters located 52 m west of the site. The incident occurred on the 30th September 1996 and was classed as a minor incident involving unknown oils.

-
- 5.8 There is a further six recorded pollution incidents to controlled waters within a 250 m to 500 m radius of the site. These were all recorded as minor incidents.
- 5.9 There are three Local Authority Pollution Prevention and Controls situated within a 250 m to 500 m radius of the site. The nearest is located approximately 325 m south east of the site and the license holder is Shell Oak Lane for a petrol filling station. The other two are for dry cleaning operators.

Waste

- 5.10 There are no Local Authority Recorded Landfill Sites, Licensed Waste Management Facilities or Registered Waste Treatment or Disposal Sites recorded as being present on the site or within a 500 m radius of the site.

Industrial Land Use

- 5.11 There are no contemporary trade directory entries detailed as being located on the site. There are thirteen contemporary trade directory entries recorded within a 250 m radius of the site, six of which have been recorded as inactive. The remaining seven entries are registered as being dry cleaners, electrical goods sales, manufacture and wholesalers, art restoration and picture cleaning and air conditioning and refrigeration contractors.
- 5.12 There are a further thirty nine directory entries recorded within a 251 m to 500 m radius of the site including printers, optical goods manufacturers, pharmaceutical manufacturers and distributors, electrical goods sales, manufacture and wholesalers, chemical plant and equipment, launderette, fuel dealers and car dealers.
- 5.13 There is one fuel station recorded as being within 500 m of the site. It is located approximately 325 m south east of the site and registered as Shell Petrol Station, Oak Lane.

6. Conceptual Site Model

- 6.1 A conceptual site model (CSM) has been developed for the site. It is based on the desk top information reviewed in the preparation of this report and in particular the historic and current land uses, published geological and hydrogeological mapping.
- 6.2 The CSM has been based on 3 generic end use types described as commercial, residential without gardens and residential with gardens.
- 6.3 The CSM provides a qualitative evaluation of potential pollutant linkages at the site based on plausible contaminant source - pathway - receptor at the site:
- i. Potential Sources of Contamination: these include any actual or potentially contaminating materials and activities, located either on or in the vicinity of the site;
 - ii. Potential Pathways for Contamination Migration: these are the routes or mechanisms by which contaminants may migrate from the source to the receptor; and
 - iii. Potential Receptors of Contamination: these include present or future land users, the environment or built environment.
- 6.4 The CSM is presented schematically as Figure 3 and presents a high sensitivity end use scenario for the site.

Contamination Sources

- 6.5 From the information reviewed in this study, the main potential areas of ground contamination sources are provided below.
- i. Historic and current land use as Railway Land / Station : potential for impacts to shallow ground and underlying groundwater from the following contaminants:
 - Metals;
 - Inorganic chemicals;
 - Asbestos;
 - Chlorinated aliphatic hydrocarbons; and
 - PAHs and PCBs.
 - ii. Made Ground: associated with the development of the station which has the potential for generation of methane and carbon dioxide soil gases.
- 6.6 A number of potential contamination sources have been identified associated with historical uses in the immediate site surroundings including a coal yard and goods shed located to the east of the site.

Environmental Pathways

- 6.7 Potential migration pathways are discussed below.

Airborne Migration Pathways

- 6.8 The particulate inhalation pathway is not considered to be relevant in those areas of the site that will comprise hardstanding, as this will effectively act as a barrier to generation and migration of soil dust to the future end user. The pathway will be potentially active in any areas of soft landscaping such as private gardens or communal areas where hardstanding is not present.

- 6.9 The particulate inhalation pathway may become relevant during the construction phase of the project, principally following hardstanding removal.
- 6.10 The vapour inhalation pathway is considered to be potentially active in any future development scenario, particularly the indoor pathway in areas of built structures. This will become more pertinent in a residential end use scenario due to the extended duration period of an individual from permanent residence.

Aqueous Migration Pathway

- 6.11 The site is recorded as being underlain by the Kempton Park Gravel Formation, which is directly underlain by the London Clay Formation and the Lambeth group.
- 6.12 The Gravel Deposits are typically composed of spatially highly variable horizons of fine sediment, sand and gravel and may include organic materials. The more permeable granular horizons in the Gravel Deposits present a possible pathway for the lateral and vertical migration of any mobile contaminants in shallow groundwater beneath the site.
- 6.13 The significance of the vertical pathway for shallow groundwater migration is considered to be low based on the reported presence and significant thickness of the London Clay and Lambeth Group which is expected to provide an effective aquiclude to vertical groundwater migration to the underlying Chalk Aquifer.

Land Migration Pathway

- 6.14 The land migration pathway is not considered to be relevant in those areas of the site that will comprise hardstanding, as this will effectively act as a barrier to the future end user from dermal and ingestion pathways.
- 6.15 In a residential end use with gardens development scenario the dermal and ingestion pathway will be potentially active in any areas of soft landscaping.
- 6.16 The land migration pathway will be potentially relevant at the construction phase of the project following hardstanding removal at the site.

Receptors

- 6.17 In the context of this site, the following potential site specific on site receptors have been identified:
- i. site users;
 - ii. construction workers;
 - iii. Major Aquifer (Kempton Park Gravels); and
 - iv. built structures.
- 6.18 The following potential site specific off site receptors have been identified:
- i. neighbouring residential users
 - ii. River Crane; and
 - iii. River Thames;
- 6.19 The potential source-pathway-receptor linkages are summarised in Table 6.1 below.

Table 6.1. Summary of Potential Pollutant Linkages

Potential Receptor	Source	Pathway	Potential Pollutant Linkage
Current and future commercial site users (Critical Receptor is a female adult of working age)	Contaminated soil	Dermal Contact / Ingestion / Particulate Inhalation	No

Potential Receptor	Source	Pathway	Potential Pollutant Linkage
	Contaminated soil and groundwater	Vapour Inhalation	Yes
Future residential users (without gardens) (Critical Receptor is a female child of pre school age)	Contaminated soil	Dermal Contact / Ingestion / Particulate Inhalation	No
	Contaminated soil and groundwater	Vapour Inhalation	Yes
Future residential users (with gardens) (Critical Receptor is a female child of pre school age)	Contaminated soil	Dermal Contact / Ingestion / Particulate Inhalation	Yes (private gardens)
	Contaminated soil and groundwater	Vapour Inhalation	Yes
Off site residential users (Critical Receptor is a female child of pre school age)	Contaminated soil and groundwater	Vapour Inhalation	Yes
Construction Workers	Contaminated soil and groundwater	Dermal Contact / Ingestion / Particulate Inhalation/ Vapour Inhalation	Yes
River Crane	Contaminated soil and groundwater	Soil Leaching and lateral migration of groundwater	Yes
River Thames			Yes
Major Aquifer (Kempton Park Gravels)	Contaminated soil and perched groundwater	Soil Leaching migration of groundwater	Yes
Built Structures	Soil gas and contaminated soil	Migration and vapour intrusion	Yes

6.20 There is not considered to be a potential pollution linkage between shallow soil contamination and future commercial users and future residential users without gardens through dermal or ingestion pathways. This is on the basis that the proposed development scenario comprises hardstanding across the site in the form of buildings, parking and associated infrastructure which will effectively form a barrier between potential contaminants in the ground and the end user.

7. Preliminary Risk Assessment

- 7.1 A preliminary risk assessment of the level of risk to the identified receptors is provided below based on the potential pollutant linkages presented in Table 6.1.

Commercial Site Users

- 7.2 There is a **low** preliminary risk to current and future commercial site users based on the hardstanding coverage at the site limiting the dermal and ingestion pathway between potential contaminants and the end user.
- 7.3 There is a potential pathway for vapour inhalation to commercial end users, in areas of built structures at the site. The level of risk is dependant on the presence of volatile vapours in the shallow ground beneath the site, notwithstanding it is expected to be low based on the intermittent usage of the site.

Future Residential Users without gardens

- 7.4 The risk to future users is preliminarily assessed as **low** based on the probable hardstanding coverage across the whole of the site effectively limiting the dermal and ingestion pathway between potential contaminants in the ground and the end user.
- 7.5 In areas of built structures the level of risk will increase from **low to moderate** due to a potential inhalation pathway. The level of risk is dependant on the presence of volatile vapours in the shallow ground beneath the site.

Future Residential Users with gardens

- 7.6 The risk to future users is preliminarily assessed as **low to moderate** based on the historical use of the site as railway land / station.
- 7.7 In particular the potential risk to future site users is assessed to be through:
- generation of soil vapours in the shallow ground beneath the site; and
 - ingestion and dermal contact in any areas of soft landscaping.

Construction Workers

- 7.8 During redevelopment of the site, areas of building and hardstanding will be removed, exposing the underlying soils. Construction workers may therefore come into direct contact with areas of ground contamination and the level of risk is assessed as **moderate**. Notwithstanding this, the risk to construction and maintenance workers can be decreased to **low**, provided appropriate personal protective equipment is used during any groundwork and/or maintenance.
- 7.9 As a minimum it is recommended that safe working practices set out in HSE Document HS (G) 66 'Protection of construction and maintenance workers and the general public during the development of contaminated land' are adopted when addressing areas of moderate to high levels of contamination. Details of identified contaminants should be provided in the health and safety files for the site to inform future site workers of risks such that appropriate mitigation measures can be implemented.

River Crane

- 7.10 The risk to the River Crane is assessed as **low**. If a potential contamination source is identified beneath the site it is assessed to have the potential to migrate laterally to the River Crane. This is due to the granular horizons in the Gravels presenting a possible pathway for the lateral migration of any mobile contaminants.
- 7.11 Notwithstanding it is understood that the River Crane is an engineered structure with concrete walls in the section adjacent to the site which is considered will minimise the migration pathway of any potential mobile contaminants.

River Thames

- 7.12 The risk to the River Thames is assessed as **low**. Site observations indicate that there is a general down gradient towards the river that is located approximately 500 m away. The level of risk will be dependant on the identification of a significant contamination source and hydraulic continuity between underlying groundwater units and the River Thames.

Major Aquifer

- 7.13 The Major Aquifer (underlying Gravel Formation) has been identified as a sensitive receptor. The risk to the groundwater in the Major Aquifer is assessed as **moderate** this is due to the absence of mobile contaminants sources identified at the site. Although there are no records that the Kempton Park Gravel Formation is exploited locally as a resource it is likely to be considered a sensitive receptor when assessing the risks associated with on site concentrations.
- 7.14 The risks to the deeper chalk beds, underlying the site are assessed as being low however, due to the significant thickness of the London Clays at this site, which is considered to provide adequate protection.

Building Materials

- 7.15 There is a **low** risk to building materials and underground services given the historic use of the site and surrounding areas. This indicates the potential presence of oils and solvents which may accelerate corrosion of metals or attack plastics, rubber and other polymeric materials used in pipework and service conduits or as jointing seals and protective coatings to concrete and metals.
- 7.16 As a result of the historical development of the site as a railway station, there is the potential for the presence of Made Ground at the site. Therefore the risk of soil gas accumulation/intrusion to any buildings associated with redevelopment is considered to be **moderate**.

Off Site Residential Users

- 7.17 There is a low risk to off site residential users from the inhalation vapours in shallow groundwater migrating off site.

Risk Assessment Summary

- 7.18 The overall preliminary contamination risk associated with the future use of the site is assessed as **low to moderate** with potential receptor drivers being identified as future users, construction workers, surface and groundwater and the built environment.
- 7.19 Notwithstanding in the northern portion of the site in the area of the car park the preliminary contamination risk associated with the development of this area alone is assessed as **low** as a significant contamination source has not been identified in this part of the site.

8. Conclusions and Recommendations

- 8.1 This Phase 1 Ground Contamination report has not identified significant constraints to future redevelopment of the site from below ground contamination, this is particularly the case in the area of the current car park.
- 8.2 Notwithstanding, potential pollution linkages have been identified at the site and it is located within a sensitive environmental setting due to the underlying Major Aquifer. Limited remediation works may be required to prepare the land to a standard suitable for proposed future development and for the protection of controlled waters. The level and cost of remediation works is dependent on the sensitivity of the future end use.
- 8.3 In the context of the site, it is suggested that remediation costs would be low based on a commercial end use, increasing to low to moderate in a residential with gardens scenario. This is demonstrated in Table 8.1 below, which demonstrates the generic relationship between the sensitivity of the end use and level of contamination risk to the level of remediation costs.

Table 8.1 Relationship between End Use Sensitivity and Contamination Risk, and Abnormal Costs

End Use Sensitivity		Contamination Risk		
		L	M	H
<i>Commercial</i>	L	L	L/M	M
	M	L	M	M/H
<i>Residential with gardens</i>	H	L/M	M/H	H
	Likely Relative Abnormal Costs £			

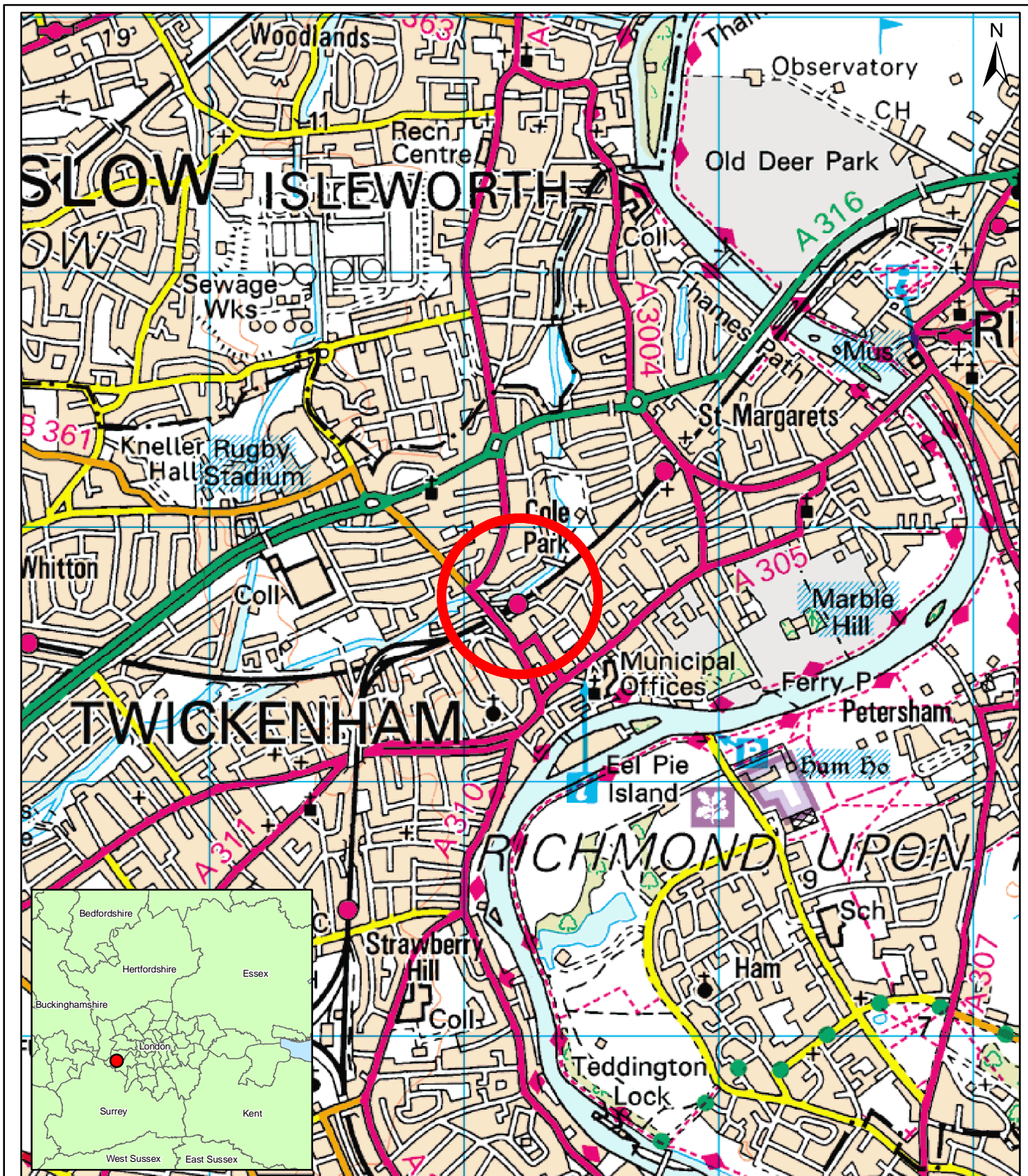
- 8.4 In addition to the remediation costs, there would also be likely additional abnormal costs associated with management of contaminated arisings during the enabling works and construction phases of the development.

Recommendations

- 8.5 In the event of redevelopment of the site, and in accordance with planning policy as outlined in PPS23 (Planning Policy Statement), a limited geoenvironmental ground investigation will be required to be undertaken to confirm the conceptual site model and the preliminary contamination risk.
- 8.6 The objectives of the ground investigation would be to:
- i. confirm shallow ground conditions and groundwater regime beneath the site;
 - ii. determine presence, nature and extent of any contamination in shallow soil and groundwater; and
 - iii. determine soil gas generation potential of any shallow Made Ground beneath the site.
- 8.7 The findings of the ground investigation will identify the requirement for remediation, the level of abnormal costs and support future planning applications associated with the development of the site.

Figures

Figure 1	Site Location Plan
Figure 2	Site Plan
Figure 3	Conceptual Site Model



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Twickenham Station



Figure 1, Site Location

CAPITA SYMONDS

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 Tel: +44 (0) 1342 327161 Fax: +44 (0) 1342 315927

DRAWN BY HH	CHECKED BY AS	PASSED BY AS	DATE 09/10/2007	SCALES @ A4 1:20,000	ISSUING OFFICE E.Grinstead	DRAWING NUMBER CS/026763-01 Figure 1	REV -
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KEY

 Site Boundary

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Twickenham Station



Figure 2, Site Plan

CAPITA SYMONDS

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KEY

RECEPTORS:

ONSITE:

- (A) RESIDENTIAL, FEMALE CHILD (0 – 6 YEARS)
- (B) COMMERCIAL, FEMALE ADULT
- (C) BUILT STRUCTURES
- (D) MAJOR AQUIFER (KEMPTON PARK GRAVELS)

OFFSITE:

- (E) RESIDENTIAL, FEMALE CHILD (0 – 6 YEARS)
- (F) CONTROLLED WATERS – RIVER CRANE
– RIVER THAMES

PATHWAYS:

- (i) INDOOR INHALATION OF VAPOURS FROM SOILS
- (ii) OUTDOOR INHALATION OF VAPOURS FROM SOILS
- (iii) INDOOR INHALATION OF VAPOURS FROM GROUNDWATER
- (iv) OUTDOOR INHALATION OF VAPOURS FROM GROUNDWATER
- (v) INGESTION OF CONTAMINATED SOIL
- (vi) DERMAL CONTACT
- (vii) INHALATION OF WINDBLOWN PARTICULATES
- (viii) LATERAL MIGRATION OF CONTAMINATED WATER
- (ix) LEACHING OF SOILS TO GROUNDWATER

GEOLOGY:

- ☒ MADE GROUND
- ☐ KEMPTON PARK GRAVEL FORMATION
- ☐ LONDON CLAY FORMATION
- ☐ LAMBETH GROUP (WOOLWICH & READING BEDS)
- ☐ THANET SANDS
- ☐ UPPER CHALK

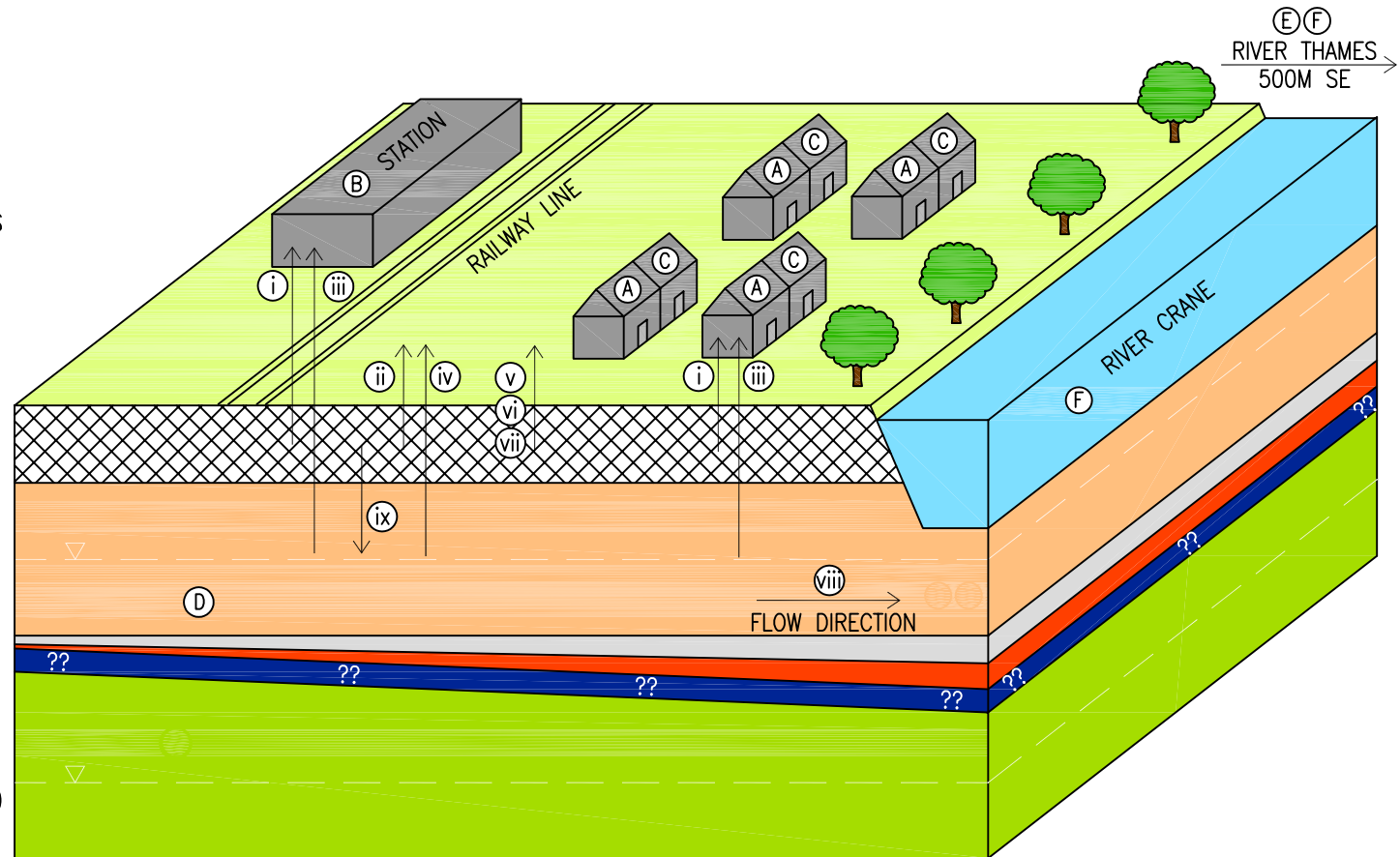


Figure 3: Conceptual Site Model Twickenham Railway Station

Appendices

Appendix 1

Landmark Envirocheck Report