



Phase I Geo-Environmental Desk Study

Proposed Fenland Centre
Carrington Drove
Crowland
Peterborough
PE6 0BZ

Prepared for:

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EPS Project Reference: UK15.1838

Date Issued: 20th April 2015

Report Status: Final



CARRINGTON DROVE, CROWLAND

NON TECHNICAL SUMMARY

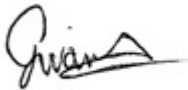
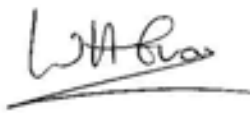
This report presents the findings of a Phase I Geo-Environmental Desk Study which was carried out to identify potential contamination from previous or current uses of the site and surrounding area and to provide an initial assessment of geological and geotechnical aspects of the site and how the proposed development or surrounding environment might be affected.

- The site, located just south of the town of Crowland, is currently divided into two distinct land uses consisting of a set of disused poultry sheds to the south and an agricultural field to the north. It is not reported to be within an environmentally sensitive location, with tidal flat deposits and mudstone bedrock beneath the site which are not valuable or important resources for groundwater.
- Historical mapping indicates that the land has remained largely undeveloped throughout the recent past with the only construction observed to be the current poultry sheds / storage building, built during the 1970's.
- Contamination sources were found during the site walk over at the poultry farm but have not been considered as risks to the proposed redevelopment on account that the hardstanding beneath the proposed building and associated parking will limit any potential interactions between shallow soils and future users. The agricultural field to the north east was also not considered to pose any risk, having remaining largely undeveloped throughout history.
- Asbestos containing materials were however identified within the roof and surrounding a collapsed shed located at the far north eastern boundary, the removal of which should be carried out by an appropriately qualified professional.
- A copy of this report should be forwarded to Holland District Council to support planning applications and for inclusion into their land quality records.

By their very nature, the above bullet points represent a simplified summary of our work and should not be relied upon to form the basis for key decisions for the proposed development. A full picture is provided in the following report, or alternatively give us a call and we'll talk you through it.



Project Reference:	UK15.1838	
Title:	Phase I Geo–Environmental Desk Study – Carrington Drove	
Client:	Ruthkay Ltd c/o TAC architects	
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Status:	Final	

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The report has been written, reviewed and authorised by the persons listed above. It has also undergone EPS' in house quality management inspection. Should you require any further assistance regarding the information provided within the report, please do not hesitate to contact us.

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1 INTRODUCTION

In April 2015, Environmental Protection Strategies Ltd (EPS) was commissioned by Ruthkay Ltd c/o TAC Architects to complete a Phase I Geo-Environmental Desk Study at Carrington Drove, Crowland, Peterborough, PE6 0BZ ('the site'); see Figure 1.

The work was commissioned in order to satisfy planning requirements, (Condition #20-Contamination) for 'Alterations, extensions and replacement buildings to create new Fenland Tourism Centre and relocation of Crowland Caravans and Camping', under Holland District Council reference H02-0026-15.

This report presents the findings, conclusions, and recommendations of the Phase I Desk Study undertaken for the site as instructed.

1.1 Background

A desk study comprises the first stage of any geo-environmental assessment, the purpose of which is to determine what potentially contaminative activities may have occurred at the property or the surrounding area which may pose an environmental or geological risk to site users, the surrounding environment or proposed development, either at present or in the future.

The method used in this investigation to assess the environmental risk posed is based on the concept of 'contaminant linkage', which considers the following three factors:

Source	The location from which an environmentally hazardous / contaminative substance is, (or was,) derived.
Receptor	An environmentally sensitive object or condition e.g. person, property, controlled water, or ecological system, which may be present now or in future.
Pathway	A route or mechanism via which a source could come into contact with a receptor to cause significant harm.

If all three factors are identified, there is the potential for a 'contaminant linkage' to be active, which could result in significant harm being caused to the environment or human health.

1.2 Objectives

The purpose of this desk study is to evaluate the potential contaminant linkages that may be active at the site in its current condition, or could become active in future, and to determine if any action is required to investigate them further or to break them.

This is achieved by carrying out the following activities:

- a) Examining the site history - late 1800s to present day, through collection of historical maps of the area, site records, records held by relevant local authorities, the Environment Agency and review of other information databases.



- b) Characterising the sites environmental and geological sensitivity through examination of existing geological, hydrogeological, topographical, and historical maps and aerial photographs of the area.
- c) Identifying Potential Areas of Concern (PAOCs) through a combination of historical map and data review and site inspection together with interview of key site personnel.
- d) Consideration of any future plans for the site and the effects any proposed changes may have on contaminant linkages over time.
- e) Development of a site conceptual model and contaminant linkage assessment.

1.3 Project Limitations and Constraints

The purpose of this report is to present the findings of a Phase I Geo-Environmental Desk Study conducted at the location(s) specified. When examining the data collected from the investigations made during the assessment, EPS makes the following statements:

This report does not include specific investigation for the presence of either Potential Asbestos Containing Material (PACM) or Japanese Knotweed at the subject site however, if obvious evidence of either is observed during EPS site walkover, details will be provided in this report. Specialist contractors should be commissioned to make detailed assessments and recommendations if these materials are suspected.

2 GEO-ENVIRONMENTAL SETTING

The following section provides a summary of the information collected in relation to the site location and history.

2.1 Site Location and Description

Detail	Description
Location	The site is located east of Carrington Drove, south of the village of Crowland.
Grid Reference	524322, 308757
Topographic Elevation	The site lies at an approximate topographic elevation of 1m above ordnance datum (AOD).
Topographic Gradient	Topography across the site is generally flat.
Description of Site	The site was found to comprise two defined areas currently occupied by a disused poultry farm with associated infrastructure to the south west and an undeveloped agricultural field to the north east. The poultry farm comprised four rectangular wood and corrugated steel poultry sheds, with associated steel silos presumed to be related to former provision of livestock feed. On inspection, the sheds were found to be unoccupied, and surfaced in concrete hardstanding of good condition. The eastern most shed was noted to be in a dilapidated state, with much of its metal framed structure collapsed. The areas surrounding the sheds were put to concrete / asphalt hardstanding and grass surface. Other infrastructure noted across the plot was a disused engine stored towards the north, a set of three above ground LPG (propane) tanks towards the south (presumed to be disused / decommissioned), and an unbunded, single skinned, above ground fuel storage tank sited upon breeze block stilts also located towards the south. This tank was noted to exhibit black staining towards its base, with further staining and hydrocarbon odour noted down one side of the breeze block stilts, and on the concrete at its base. The second area of the site, located to the north east, comprised an agricultural field, currently surfaced with ploughed soil. A derelict wooden panelled / breeze block shed, currently in a state of collapse, was observed towards the north eastern boundary of the field. The roofing was noted to be of asbestos cement roof tile construction, whilst further asbestos sheeting and pipework, (some asbestos items broken and fragmented) was observed piled adjacent to the collapsed shed. Various other items were noted to be present in this area including wooden crates, plastic containers, concrete and a damaged trailer. Vegetation in this area was observed to be overgrown with untended plants and grasses whilst a number of mature trees were also present.

	Access is gained to the site as a whole via a five panelled gated entrance to the north west, which leads onto Carrington Drove, which in turn leads off from the A16 roadway.
Surrounding Land Use	The immediate surrounding area comprises a small residential bungalow to the north west, whilst drainage channels bound the south and western edges of the site. The broader surrounding area comprises agricultural land use with the village of Crowland located further to the north.

A plan showing the site location is provided as Figure 1, the current site layout is detailed on Figure 2 and an aerial photograph is included as Figure 3. Selected site photographs are included as Appendix A, an indicative proposed development plan as Appendix B and relevant extracts of a Landmark Envirocheck report are included as Appendix C.

2.2 Environmental Setting

Detail	Description	
Geology	Geological maps of the area indicate the site to lie directly upon Tidal Flat Deposits which are underlain by mudstone of the Oxford Clay Formation. Information on the sites geological context is included as Appendix D.	
Geological Hazards	Hazard	On Site Risk
	Mining	No Hazard
	Collapsible Ground	No Hazard
	Compressible Ground	Moderate
	Ground Dissolution	No Hazard
	Running Sand	Moderate
	Landslide	Very Low
	Shrinking / Swelling Clay	Moderate
	Radon	No Hazard
Radon	The BGS and Health Protection Agency (HPA) report entitled ' <i>Indicative Atlas of Radon in England and Wales</i> ' (November 2007) shows the site to lie within a 1km grid section where the percentage of homes above the radon action level is between 0% and 1%. The joint Building Research Establishment Ltd (BRE) report entitled: ' <i>Radon: Guidance on Protective Measures for New Buildings - 2007</i> ' reports that the site does not lie within an area where basic radon protection methods will need to be employed.	
Hydrogeology	Groundwater vulnerability maps for the area report the underlying superficial and bedrock geology to be unproductive strata. The site does not lie within a groundwater Source Protection Zone with no groundwater abstractions identified in proximity to the site. Groundwater vulnerability maps are included as Appendix E.	

Detail	Description		
Hydrology	The nearest surface water features are the two drainage ditches that bound the site to the south and west. Two surface water abstractions are reported within 300m, both relating to abstractions from a drain for agricultural use.		
Landfill & Waste	The EA public database does not list the presence of any historic or current landfill sites in proximity to the site.		
Industrial Land Use	The Envirocheck report lists four active / inactive industrial land uses in the area the most pertinent of which are summarised below.		
	Land Use	Distance (Direction)	Status
	Car Dealers	0m	Active (Was not observed during site walkover)
	Garage Services	450m north west	Inactive
Pollution Incidents	Petrol Filling Station	450m north west	Obsolete
	A single pollution incident to surface water has been highlighted within a 500m search radius pertaining to a Category 3-minor incident 370m north east, of unknown pollutant.		
Sensitive Land Use	The site is not reported to lie within an area of sensitive land use.		

2.3 Site History

A summary of historical map data from 1887 to 2015 is provided below and copies of relevant historic maps and any others examined during the investigation are included in this report as Appendix F.

- The earliest maps from 1887 show the site to be undeveloped and part of a larger agricultural field. The surrounding area is also presumed to be put to agricultural use with a network of drainage channels already established separating field the boundaries. Carrington Drove is located to the west.
- No change is observed until 1975 when three poultry sheds are constructed towards the south west. During this period, two small rectangular structures, presumed to be storage sheds upon concrete hardstanding, are constructed at the north eastern boundary of the field. A sewage works is also present further to the north east.
- By 2006 a fourth poultry shed has been added to the site and one of the structures at the north easterly boundary has been removed. During this period, a residential bungalow is constructed directly west of the poultry sheds. No further change is observed to the site to present day with the only additional change to the surrounding area noted to be the construction of the A16 roadway, located to the north west.

3 ENVIRONMENTAL CONCEPTUAL MODEL

The following section provides a review of the contaminant linkages that may be active at the site through examination of the potential sources that may be present as a result of historic and / or current site activities and where potential interaction between these sources and the identified human / environmental receptors may occur.

3.1 Source Characterisation

The following potential contaminant sources have been identified at the site and in the surrounding area:

Potential Source	Source Description	Principal Contaminants of Concern
Current & Historic Site Use	In-fill material of unknown origin (Made Ground) used to level areas beneath poultry farm structures	PAH, Metals, ACM
	Above ground fuel / LPG storage tanks	TPH (incl. PAH) BTEX
	Building materials	ACM

Notes: PAH Polycyclic Aromatic Hydrocarbons
TPH Total Petroleum Hydrocarbons
BTEX Benzene, Toluene, Ethyl-benzene, Xylenes
ACM Asbestos Containing Material

3.2 Potential Receptors

A framework for the assessment of risks arising from the presence of contamination in soils has been produced by the Environment Agency and the Department for the Environment, Food and Rural Affairs (DEFRA) and is presented with the report: '*Using Science to Create A Better Place: Updated Technical Background to the CLEA Model – Science Report SC050021/SR3*'. This guidance document defines a series of standard land-uses, which form a basis for the development of an Environmental Conceptual Model.

Proposals for the site include the creation of a new Fenland Tourism Centre and the relocation of Crowland Caravans and Camping. This proposed future land use, as defined within Science Report SC050021/SR3, has been considered as:

- Commercial

In view of the environmental setting, current and potential future land use of the site and surrounding sites, the potential receptors for any contaminant impact are discussed below:

Receptor	Site Specific Description
Human	Future site users, site workers involved in the site redevelopment, and those working and living in the surrounding area have the potential to be at risk from exposure to potential contaminants of concern (CoCs).
Groundwater	The site is reported to be underlain by Tidal Flat Deposits overlying mudstone of the Oxford Clay Formation which are both defined by the EA as unproductive strata. Given the lack of groundwater resource potential in the local area, groundwater is not currently considered to be an environmentally sensitive receptor.
Surface Water	Surface waters have been identified in the surrounding area, the nearest of which are two drainage channels that bound the edges of the site. Given the proximity of these features, surface waters should be considered as a sensitive receptor to any site derived contaminants.
Flora and Fauna	Proposed developments for the site are likely to include small areas of planting. Therefore flora and fauna should still be considered as a sensitive receptor.
Buildings & Infrastructure	Below ground structures are likely to be present at the site that may be affected by the potential presence of contaminants in the sub-surface. These include concrete used in building foundations, buried potable water supply pipes and other service lines and pipes.
Adjacent Land	The surrounding land is identified as broadly agricultural and a residency is also located directly adjacent to the site. Adjacent land therefore should be considered as a potential receptor.

3.3 Potential Pathways

Where contaminants may be present in soil, there are a number of potential pathways that enable human receptors to come into contact with or be exposed to them. The most direct pathways, considered under current UK legislation, can be summarised as follows:

- Direct ingestion of contaminated soil
- Ingestion of household dust
- Ingestion of contaminated vegetables
- Ingestion of soil attached to vegetables
- Dermal contact with contaminated soil
- Dermal contact with household dust
- Inhalation of fugitive soil dust
- Inhalation of fugitive household dust
- Inhalation of vapours outdoors
- Inhalation of vapours indoors

Clearly, not all of these potential pathways apply for every standard land-use; the simplest example for exclusions being a commercial / industrial site which is covered by concrete hardstanding. The concrete precludes the direct exposure of humans working at the site to any contaminated soils.

However in addition to direct exposure pathways, a number of physical transport mechanisms / pathways may also exist at a site that allow remote or less accessible contaminants in soil or groundwater to reach human or environmental receptors both at a site and beyond the site boundary. These include the following:

- Downward and lateral movement of contaminants in soil either by gravity or through being 'leached' by percolating rainwater.
- Lateral migration of contaminants dissolved in groundwater.
- Direct seepage or leaching of contaminants from soil into subsurface drains or supply pipework.
- Volatilisation of contaminants from groundwater or unsaturated soils into buildings or outdoor air.

Through examination of the standard land use and environmental setting at each site, the presence of pathways and transport mechanisms described above must be considered when assessing whether a contaminant linkage may plausibly be active, and therefore be included in the conceptual site model.

3.4 Summary of Contaminant Linkages

No plausible contaminant linkages have been identified at the site. Any residual risks can be dealt with through a precautionary and sustainable approach to site redevelopment.

The following comments are made with respect to contaminant linkages which have been considered through development of the conceptual model, but have not been concluded as 'plausible' – i.e. through which a significant possibility of significant harm could occur to an identified receptor:

- The fill materials identified as being potentially present beneath the poultry sheds are anticipated to be negligible in depth on account of the age / size of the sheds and the undeveloped nature of the surrounding nature. It is also known through observations of the current proposed development plan that the poultry farm area of the site is to be entirely covered in either proposed building footprint or hardstanding surround, effectively capping any potential contaminants in shallow soils and inhibiting exposure to future site users. The field to the north east has remained largely as undeveloped agricultural land throughout history, and so no risks to future site users have been identified in this area. Recommendations associated with the identified asbestos in a small dilapidated storage shed to the north east are discussed in section 5 below.
- Given the likely shallow and localised nature of any impacts to surface soils, no site derived contaminants of concern have been identified at the site which could pose a significant risk to the foundations / utility pipes of any on-site buildings / infrastructure.



- A set of three above ground LPG calor gas tanks were identified located to the south of the poultry sheds. These tanks were noted to be in good condition, located on a concrete pad and presumed to be disused at the time of inspection. Additionally, LPG is stored under high pressure and any discharge of liquefied gas would be expected to vaporise upon release, therefore not posing any risk to the site sub-surface
- A single skinned above ground fuel tank was identified at the site. Its historical contents remain unknown however, hydrocarbon staining and odour was noted around the tanks base and across the breeze block stilt / concrete surface at ground level. The concrete at the base of the tank was noted to be in good condition with little to no weathering, and so vertical migration of any fuel spillages through the hardstanding and into underlying soils is anticipated to be minimal. Additionally, the site is not reported to be within an environmentally sensitive location, with local geology not identified for groundwater resource potential. Finally, any potential minor fuel spillages that may have infiltrated into underlying soils, are anticipated to be capped beneath proposed building footprint / hardstanding surface and so no risk of exposure to future site users has been recognised.

4 GEOTECHNICAL GROUND MODEL

Geological records indicate the ground conditions to comprise Tidal Flat Deposits underlain by clays / mudstones of the Oxford Clay Formation. A conceptual geotechnical ground model is provided in the table below which assesses design elements, anticipated strata and ground conditions:

Element	Anticipated Strata	Parameter(s)	Anticipated Conditions
Foundations	Made Ground	Allowable Bearing Pressure	Not appropriate as a bearing strata
		Settlement	High sensitivity
		Volume Change	Depends upon the soil composition
	Tidal Flat Deposits	Allowable Bearing Pressure	50kN/m ² to 100kN/m ²
		Settlement	Moderate to high sensitivity
		Volume Change	Moderate to high volume change potential
	Oxford Clay Formation	Allowable Bearing Pressure	50kN/m ² to 150kN/m ²
		Settlement	Moderate sensitivity / Long term consolidation under loading
		Volume Change	Moderate to high volume change potential
Drainage	Made Ground	Permeability	Not suitable for infiltration drainage
	Tidal Flat Deposits	Permeability	Potentially suitable for infiltration drainage depending upon site specific materials
	Oxford Clay Formation	Permeability	Unlikely to be suitable for infiltration drainage
Concrete Grade	Made Ground	Grade	Low to moderate risk of high sulphate levels
	Tidal Flat Deposits	Grade	Low to moderate risk of high sulphate levels
	Oxford Clay Formation	Grade	Moderate to high risk of high sulphate levels

5 CONCLUSIONS & RECOMMENDATIONS

This Phase I Desk Study has not identified any plausible contaminant linkages to be active as a result of the historic / current use of the site.

Consideration has been given to potential sources of site-derived contamination including an anticipated small thickness of made ground fill beneath the current poultry sheds and an above ground fuel storage tank located to the south west. These sources were subsequently discounted as posing any risk to the future development on account of the environmental insensitivity of the local area, and the nature of the proposed development which incorporates areas of building footprint and hardstanding across the entire poultry farm area. This will have the effect of breaking any possible contaminant linkages between future site users and shallow soils.

An agricultural field located towards the north east of the poultry sheds is the proposed location for touring caravan pitches / further tourist accommodation and amenities. This area is known to have remained undeveloped throughout recent history and has remained largely agricultural field until present day. There is however, a small wooden storage shed, currently in a dilapidated state, located towards the far north eastern boundary. No evidence to suggest the presence of historical / current contaminative items was identified within the sheds that could be considered to pose a risk to the future development. There was however, asbestos cement roofing identified as part of the shed structure and upon further inspection, other suspected asbestos items were found scattered in the near vicinity which included asbestos sheeting and pipework.

It is advised that as part of the coming development, the asbestos in this area be identified and completely removed from site and disposed of appropriately by adequately qualified professionals in order to minimise the risks to human health during its removal.

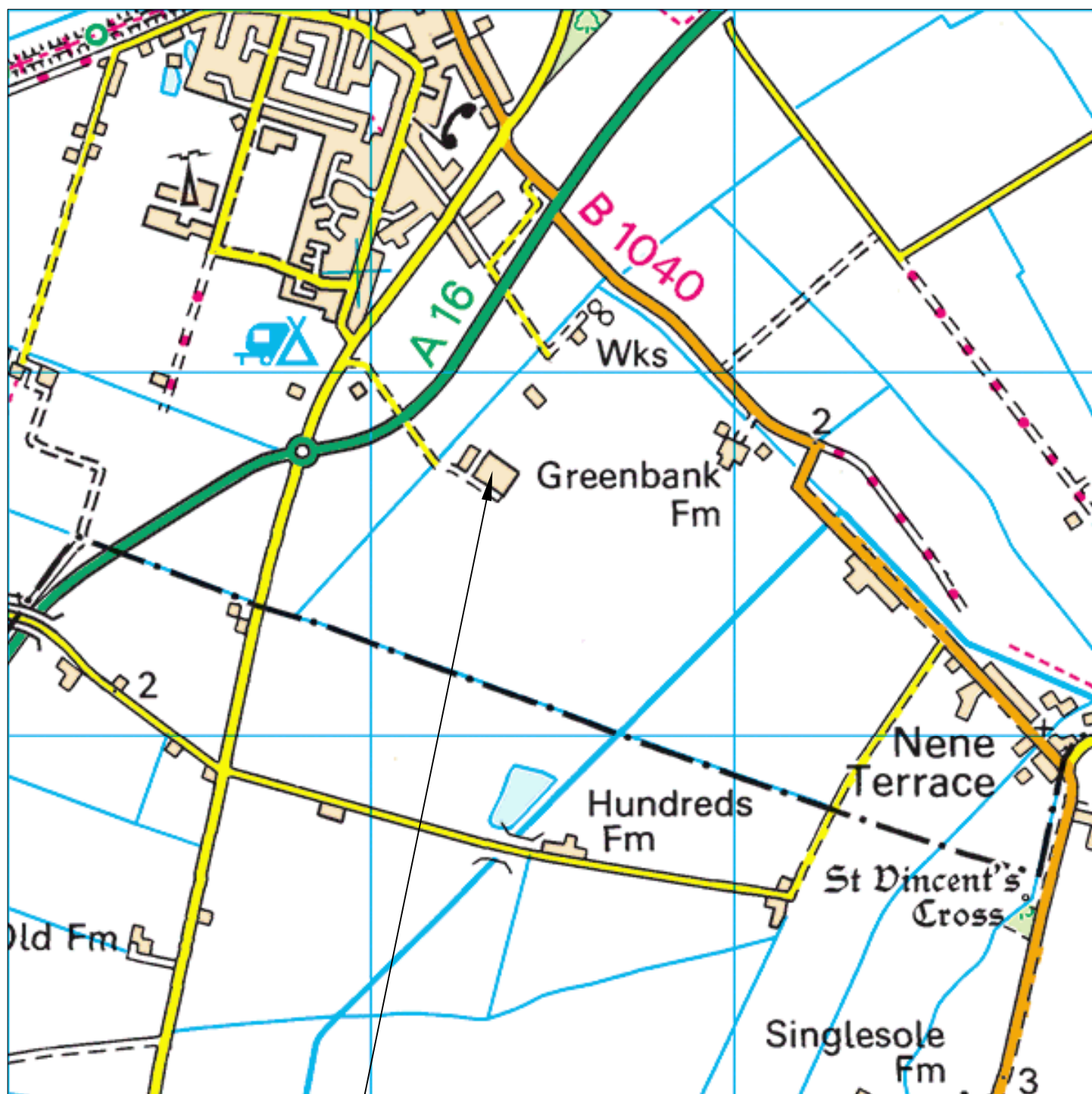
In addition to the above it is recommended that all construction workers operating at the site should be advised of the potential for contact with made ground in the subsurface. Appropriate health and safety precautions should also be adopted during any excavation works to avoid exposure to soils. Reference should be made to the following HSE document: *Protection of Workers and the General Public during Development of Contaminated Land*.

In accordance with the Model Procedures for Management of Land Contamination (Contaminated Land Report 11) risks have not been identified by this work that will require further assessment. A summary of the approach outlined in CLR11, marking the work already completed under the risk assessment phase, is presented as a flow diagram in Figure 4 of this report.

A copy of this report should be provided to the Environmental Health department of Holland District Council so that the information may be used to support planning proposals for the site.



FIGURES



Approximate Site Location

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Title: Site Location Plan

Project: Proposed Fenland Centre,
Carrington Drove, Crowland

Client: Ruthkay Ltd

Fig No: 1

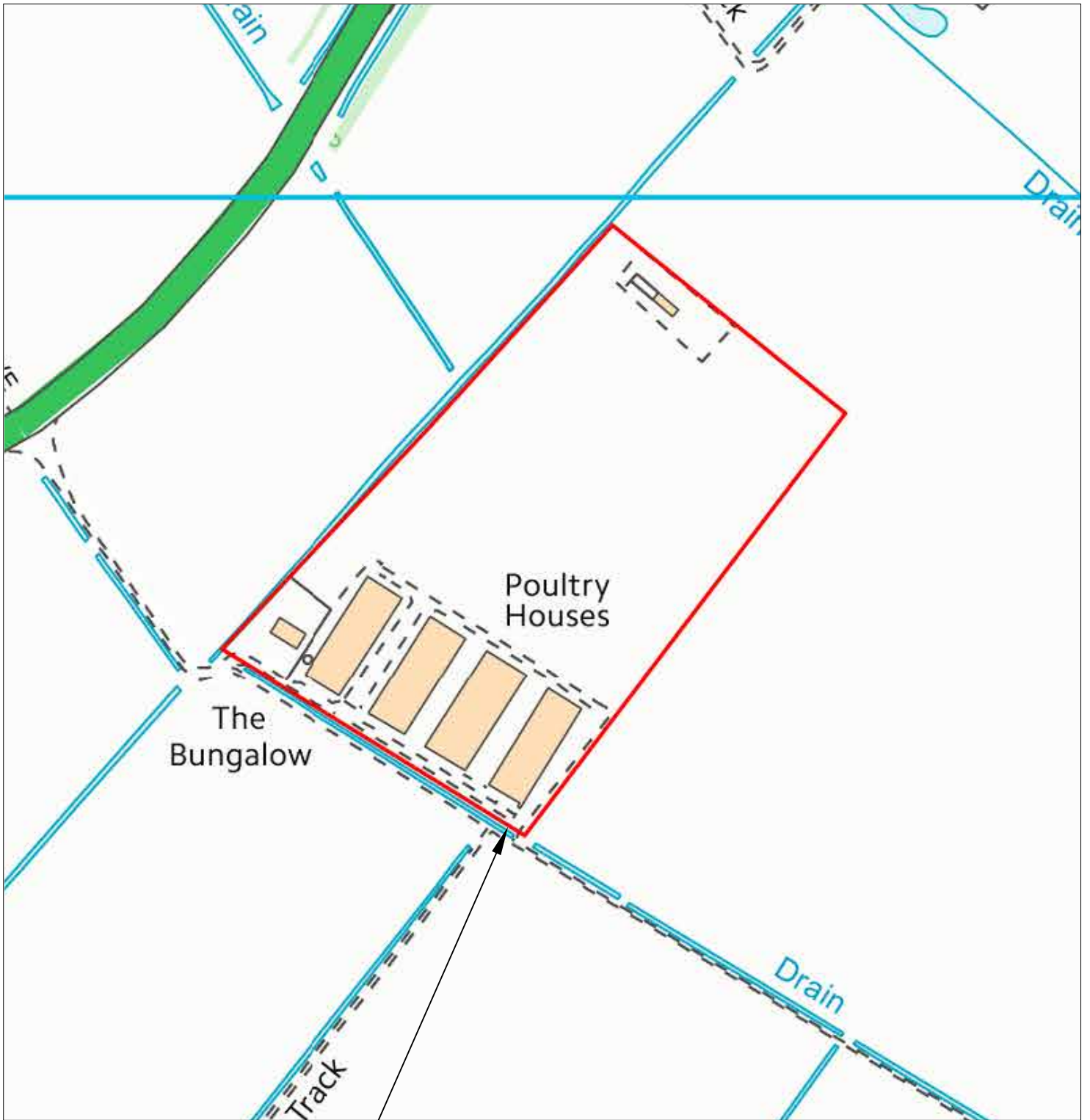
Scale: NTS

Drawn By: KH **Approved By:** GL

Job No: UK15.1838

Dwg No: Ruthkay/CarringtonDrove/0415/01

Date: April 2015



Approximate Site Boundary

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Title: Current Site Layout Plan

Project: Proposed Fenland Centre,
Carrington Drove, Crowland

Client: Ruthkay Ltd

Fig No: 2

Scale: NTS

Drawn By: KH | Approved By: GL

Job No: UK15.1838

Dwg No: Ruthkay/CarringtonDrove/0415/02

Date: April 2015



Approximate Site Location

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Title: Aerial Photograph

Project: Proposed Fenland Centre,
Carrington Drove, Crowland

Client: Ruthkay Ltd

Fig No: 3

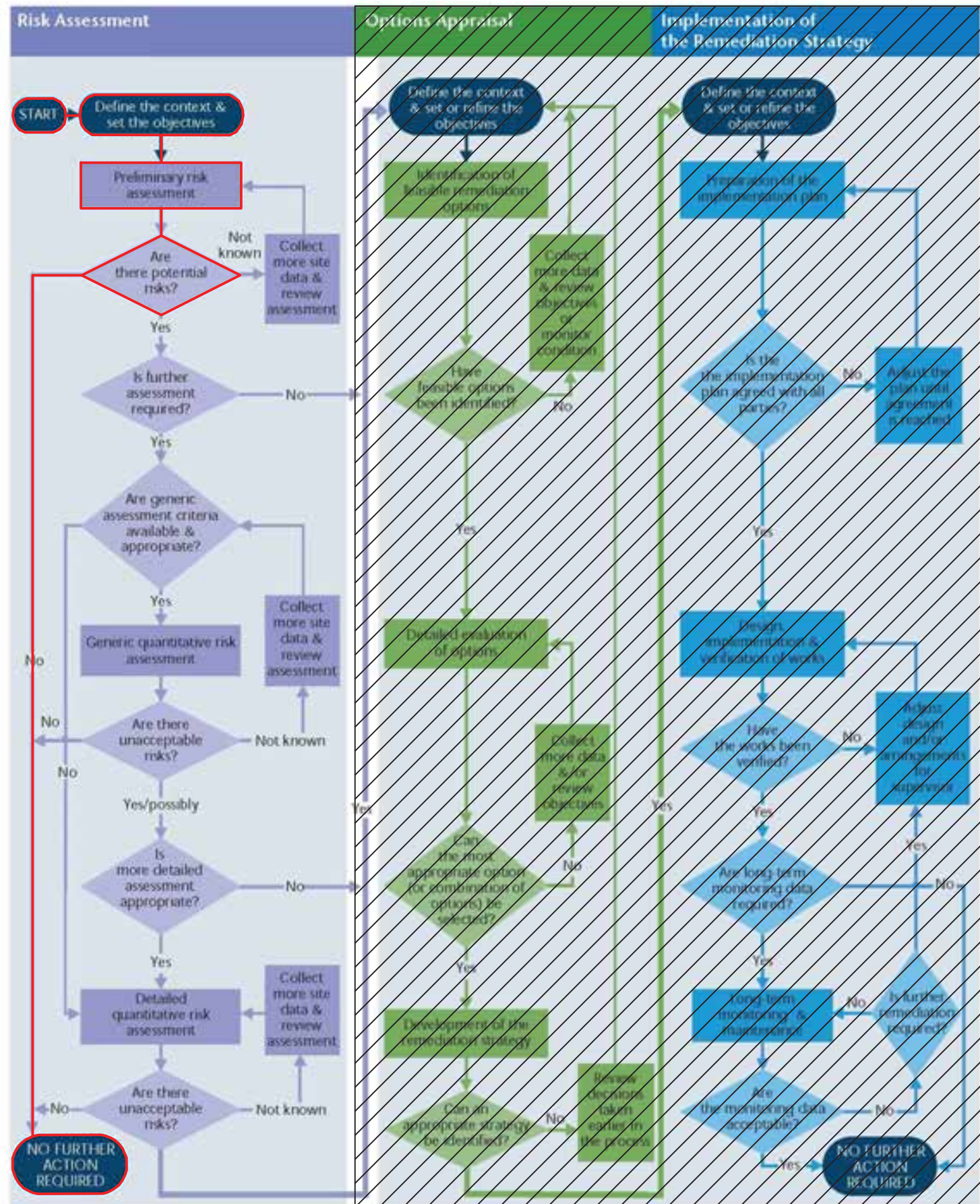
Scale: NTS

Drawn By: KH **Approved By:** GL

Job No: UK15.1838

Dwg No: Ruthkay/CarringtonDrove/0415/03

Date: April 2015



Assessment Pathway for Site



Title: Site Context - CLR11

Project: Proposed Fenland Centre,
Carrington Drive, Crowland

Client: Ruthkay Ltd

Fig No: 5

Scale: n/a

Drawn By: KH **Approved By:** GL

Job No: UK15.1838

Dwg No: Ruthkay/CarringtonDrive/0415/04

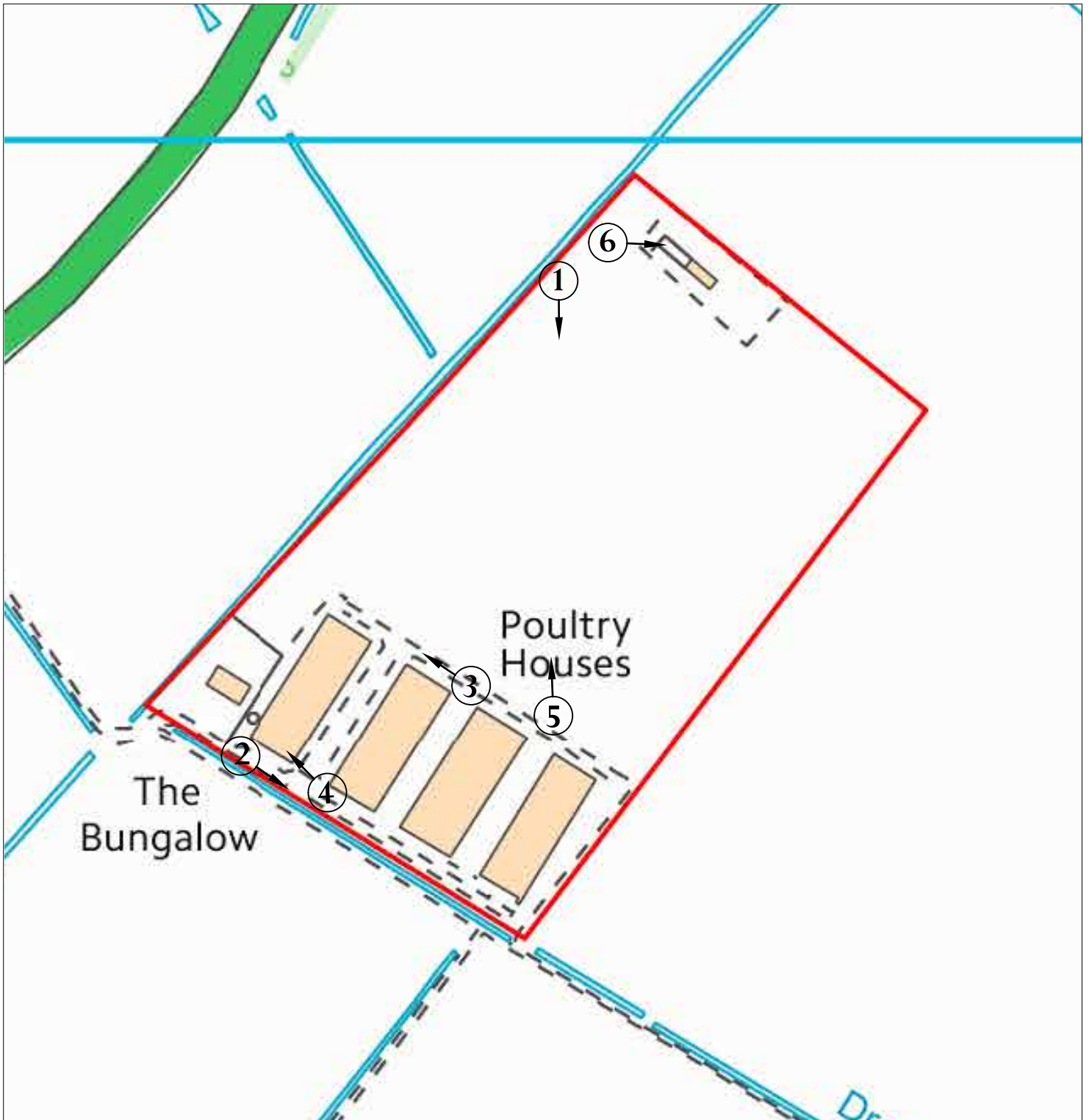
Revision Date: April 2015



APPENDICES

APPENDIX A

Selected Site Photographs



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Title: Photo Location Plan

Project: Proposed Fenland Centre,
Carrington Drove, Crowland

Client: Ruthkay Ltd

Appendix: A

Scale: Not to Scale

Drawn By: GW **Approved By:** GL

Job No: UK15.1838

Dwg No: Ruthkay/CarringtonDrove/0415/A

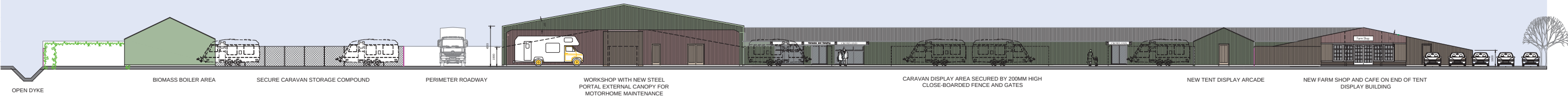
Date: April 2015

Photo 1: Photograph looking south across the entire site (agricultural field/disused poultry sheds)	Photo 2: View south east along the southern boundary. Note above ground LPG tanks
	
Photo 3: A collapsed feed silo	Photo 4: Above ground fuel storage tank identified towards the south west of the poultry sheds
	
Photo 5: Looking north across the ploughed agricultural field towards the small shed	Photo 6: Dilapidated shed at the north eastern boundary. Asbestos cement roofing and other suspected asbestos items are located in the area
	

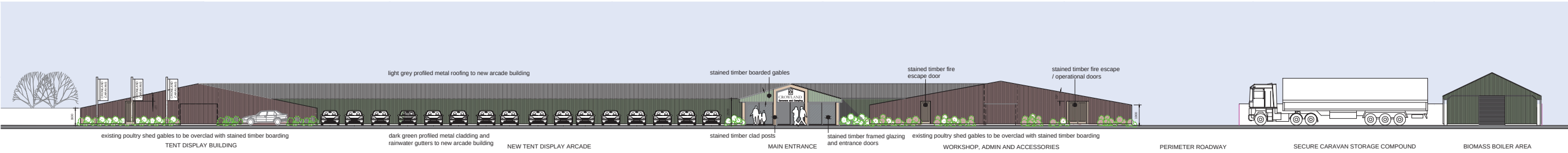


APPENDIX B

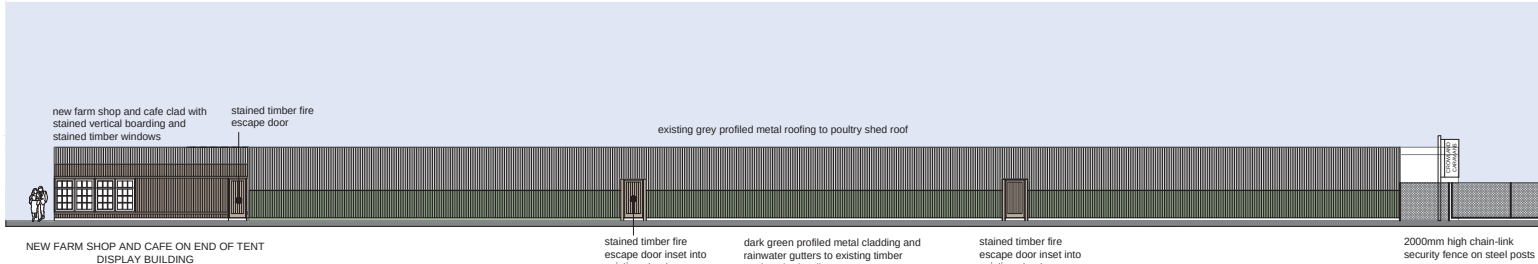
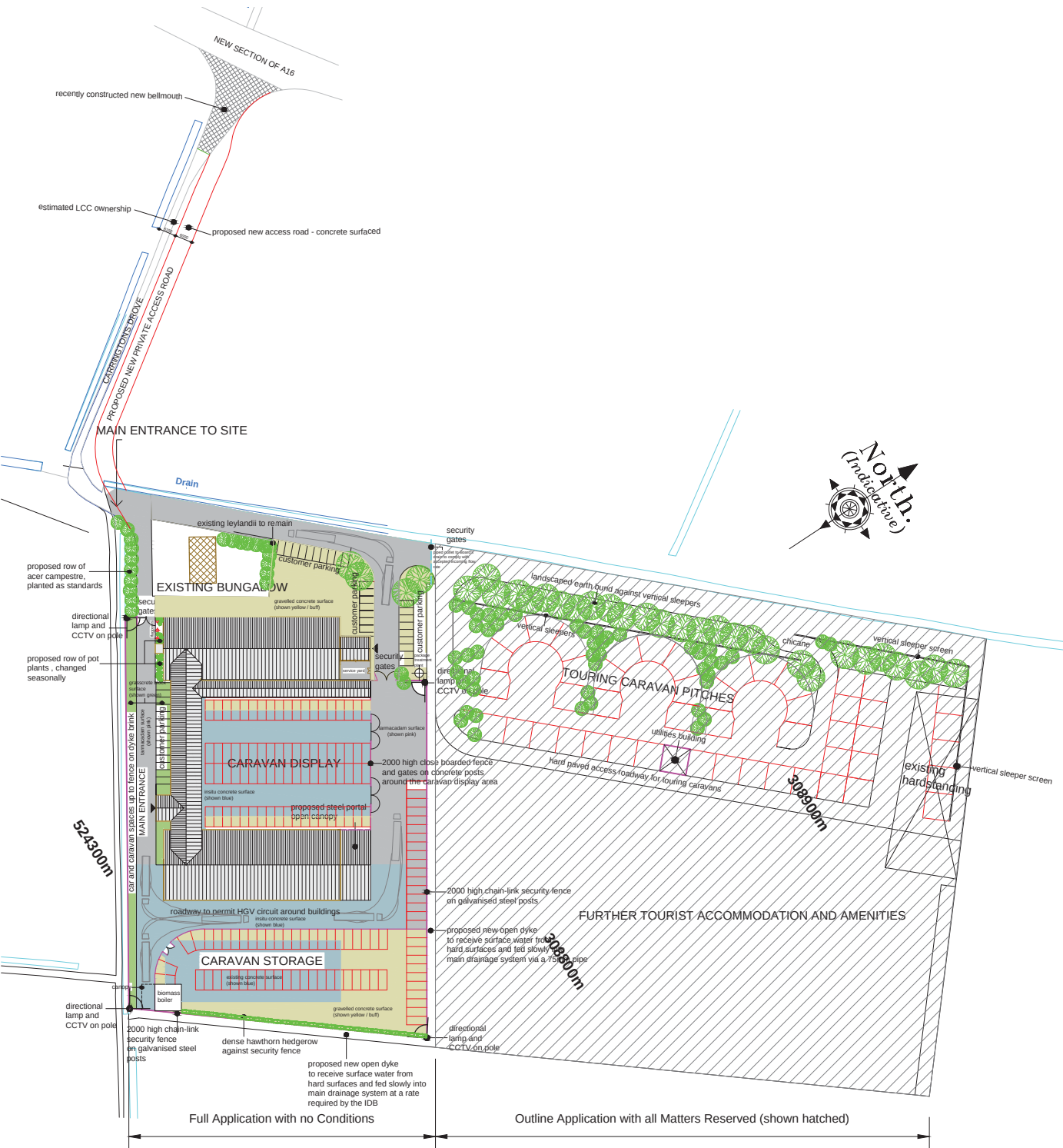
Indicative Proposed Development Plan



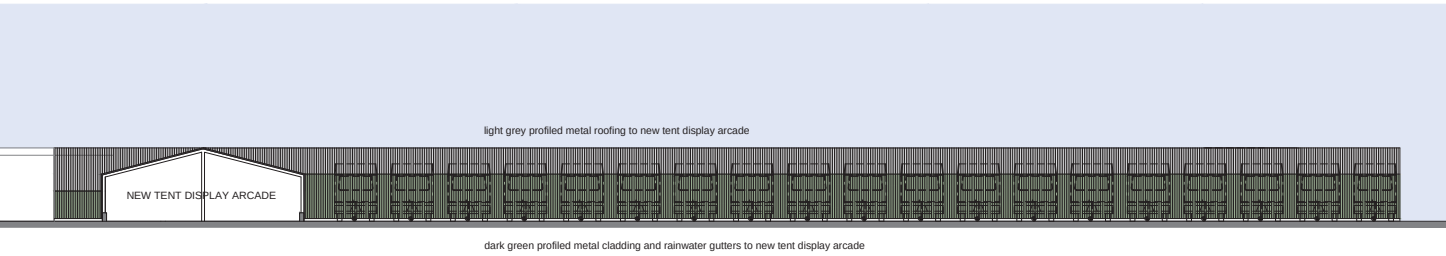
ELEVATION OF CROWLAND CARAVAN BUILDINGS FROM SOUTH WEST



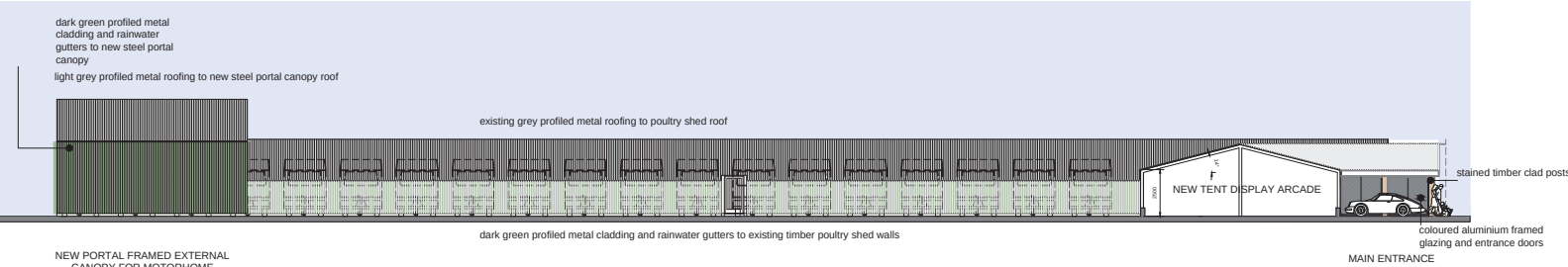
ELEVATION OF CROWLAND CARAVAN BUILDINGS FROM NORTH EAST



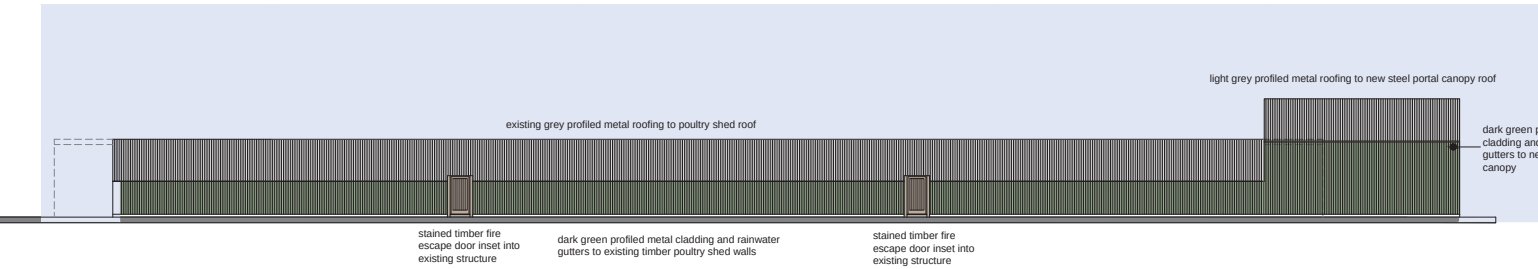
TENT DISPLAY BUILDING - N W ELEVATION



TENT DISPLAY BUILDING - S E ELEVATION



WORKSHOP BUILDING - N W ELEVATION



WORKSHOP BUILDING - S E ELEVATION

Revision	Date	Drawn	Description
Client	Ruthkay Ltd		
Project	Proposed Fenland Centre at Carrington Drive, Crowland		
Drawing	Planning Application Drawing 1 of 2		
Scale	1:1000, 1:500, 1:200 @ A1	Drawn TAC Chkd AWM	Date 07/08/2014
Drawing No.	08/228/PA/10		
Trevor A Clay RIBA Ltd, 14 Old Fendike Road, Weston Hills, Spalding, Lincs. PE126DD 01406 380027 07778 597975 trevor@tacarchitects.co.uk www.tacarchitects.co.uk			



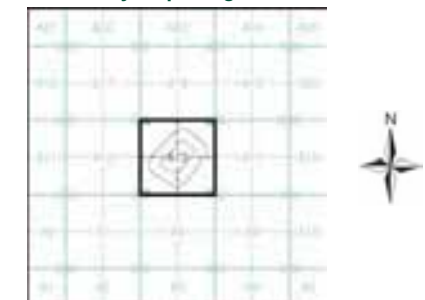
APPENDIX C

Surrounding Land Use



- General**
- Specified Site
 - Specified Burial(s)
 - Drinking Reference Point
 - Map ID
 - Severed or Type of Location
- Agency and Hydrological**
- Contaminated Land Register Entry or Notice (Location)
 - Contaminated Land Register Entry or Notice (Location)
 - Discharge Consent
 - Enhancement or Protection Notice
 - Integrated Pollution Control
 - Integrated Pollution Prevention Control
 - Local Authority Integrated Pollution Prevention and Control
 - Local Authority Pollution Prevention and Control Enforcement
 - Pollution Incident to Controlled Polluter
 - Provision Relating to Authorised Processes
 - Provision Relating to Controlled Polluter
 - Registered Pollutive Substance
 - River Network or Water Feature
 - River Quality Sampling Point
 - Substantive Pollution Incident Register
 - Water Abstraction
 - Water Industry Act Release
- Waste**
- DOS Recorded Landfill Site (Location)
 - DOS Recorded Landfill Site
 - Ex History Landfill (Buried Refill)
 - Integrated Pollution Control Registered Waste Site
 - Unlicensed Waste Management Facility (Location)
 - Unlicensed Waste Management Facility (Location)
 - Local Authority Recorded Landfill Site (Location)
 - Local Authority Recorded Landfill Site
 - Registered Landfill Site
 - Registered Landfill Site (Location)
 - Registered Landfill Site (Now Buried in Soil)
 - Registered Landfill Site (Now Buried in Soil)
 - Registered Waste Transfer Site (Location)
 - Registered Waste Transfer Site
 - Registered Waste Treatment or Disposal Site (Location)
 - Registered Waste Treatment or Disposal Site
- Geological**
- DOS Recorded Mineral Site
- Industrial Land Use**
- Contemporary Trade (Industry) Entry
 - Fuel Station Entry
- Hazardous Substances**
- Controlled Site
 - Explosive Site
 - Hazard Site
 - Planning Hazardous Substance Consent
 - Planning Hazardous Substance Enforcement

Site Sensitivity Map - Segment A13



Order Details

Order Number: 66141052_1_1
 Customer Ref: UK15.1838
 National Grid Reference: 524370, 308830
 Slice: A
 Site Area (Ha): 4.86

Site Details

Proposed Fenland Centre, Carrington Drive, Crowland,
 Peterborough, Cambs, PE6 0BZ



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General

- Specified Site
- Specified Buffer(s)
- Drinking Water Point
- Map ID
- Severed or Type of Location

Agency and Hydrological

- Contaminated Land Register Entry or Notice (Location)
- Contaminated Land Register Entry or Notice (Boundary)
- Discharge Consent
- Enforcement or Protection Notice
- Integrated Pollution Control
- Integrated Pollution Prevention Control
- Local Authority Integrated Pollution Prevention and Control
- Local Authority Pollution Prevention and Control
- Local Authority Pollution Prevention and Control Enforcement
- Pollution Incident to Controlled Polluter
- Provision Relating to Authorised Processes
- Provision Relating to Controlled Polluter
- Registered Polluting Substance
- River Network or Water Feature
- River Quality Sampling Point
- Substances Pollution Incident Register
- Water Abstraction
- Water Industry Act Release

Geological

- DOG Recorded Mineral Site

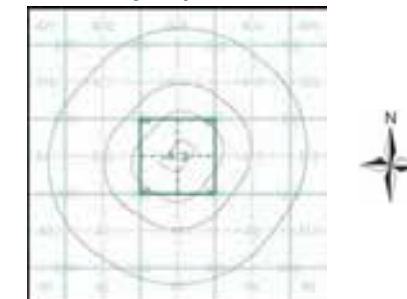
Industrial Land Use

- Contemporary Trade (Industry) Entry
- Fuel Station Entry
- DOG Recorded Landfill Site (Location)
- DOG Recorded Landfill Site
- Ex History Landfill (Buried Part)
- Ex History Landfill (Project)
- Integrated Pollution Control Registered Waste Site
- Landfill Waste Management Facility (Location)
- Landfill Waste Management Facility (Boundary)
- Local Authority Recorded Landfill Site (Location)
- Local Authority Recorded Landfill Site
- Registered Landfill Site
- Registered Landfill Site (Location)
- Registered Landfill Site (Part Buried in Soil)
- Registered Landfill Site (Part Buried in Soil)
- Registered Waste Transfer Site (Location)
- Registered Waste Transfer Site
- Registered Waste Treatment or Disposal Site (Location)
- Registered Waste Treatment or Disposal Site

Hazardous Substances

- COSEH Site
- Explosive Site
- HMHS Site
- Planning Hazardous Substance Consent
- Planning Hazardous Substance Enforcement

Site Sensitivity Map - Slice A



Order Details

Order Number: 66141052_1_1
Customer Ref: UK15.1838
National Grid Reference: 524370, 308830
Slice: A
Site Area (Ha): 4.86
Search Buffer (m): 1000

Site Details

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APPENDIX D

Geological Context

Geology 1:50,000 Maps Legends

Superficial Geology

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	ALV	Alluvium	Clay, Silt, Sand and Gravel	Flandrian - Flandrian
	TFD	Tidal Flat Deposits	Sand and Silt	Holocene - Holocene
	ABSG	Abbey Sand and Gravel	Sand and Gravel	Devensian - Devensian
	MRCG	March Gravels Member	Sand and Gravel	Ipswichian - Ipswichian
	TFD1	Tidal Flat Deposits, 1	Clay and Silt	Quaternary - Quaternary
	PEAT	Peat	Peat [Unlithified Deposits Coding Scheme]	Quaternary - Quaternary
	RTD1	River Terrace Deposits, 1	Sand and Gravel	Quaternary - Quaternary
	TFD1	Tidal Flat Deposits, 1	Sand and Silt	Quaternary - Quaternary

Bedrock and Faults

Map Colour	Lex Code	Rock Name	Rock Type	Min and Max Age
	OXC	Oxford Clay Formation	Mudstone	Oxfordian - Callovian



Geology 1:50,000 Maps

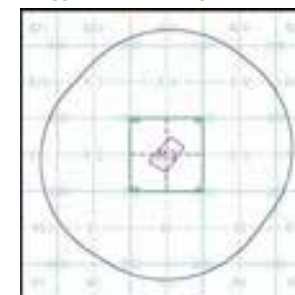
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published paper maps.

The various geological layers - artificial and landslip deposits, superficial geology and solid (bedrock) geology are displayed in separate maps, but superimposed on the final 'Combined Surface Geology' map. All map legends feature on this page. Not all layers have complete nationwide coverage, so availability of data for relevant map sheets is indicated below.

Geology 1:50,000 Maps Coverage

Map ID:	1
Map Sheet No:	158
Map Name:	Peterborough
Map Date:	1984
Bedrock Geology:	Available
Superficial Geology:	Available
Artificial Geology:	Available
Faults:	Not Supplied
Landslip:	Not Available
Rock Segments:	Not Supplied

Geology 1:50,000 Maps - Slice A



Order Details:

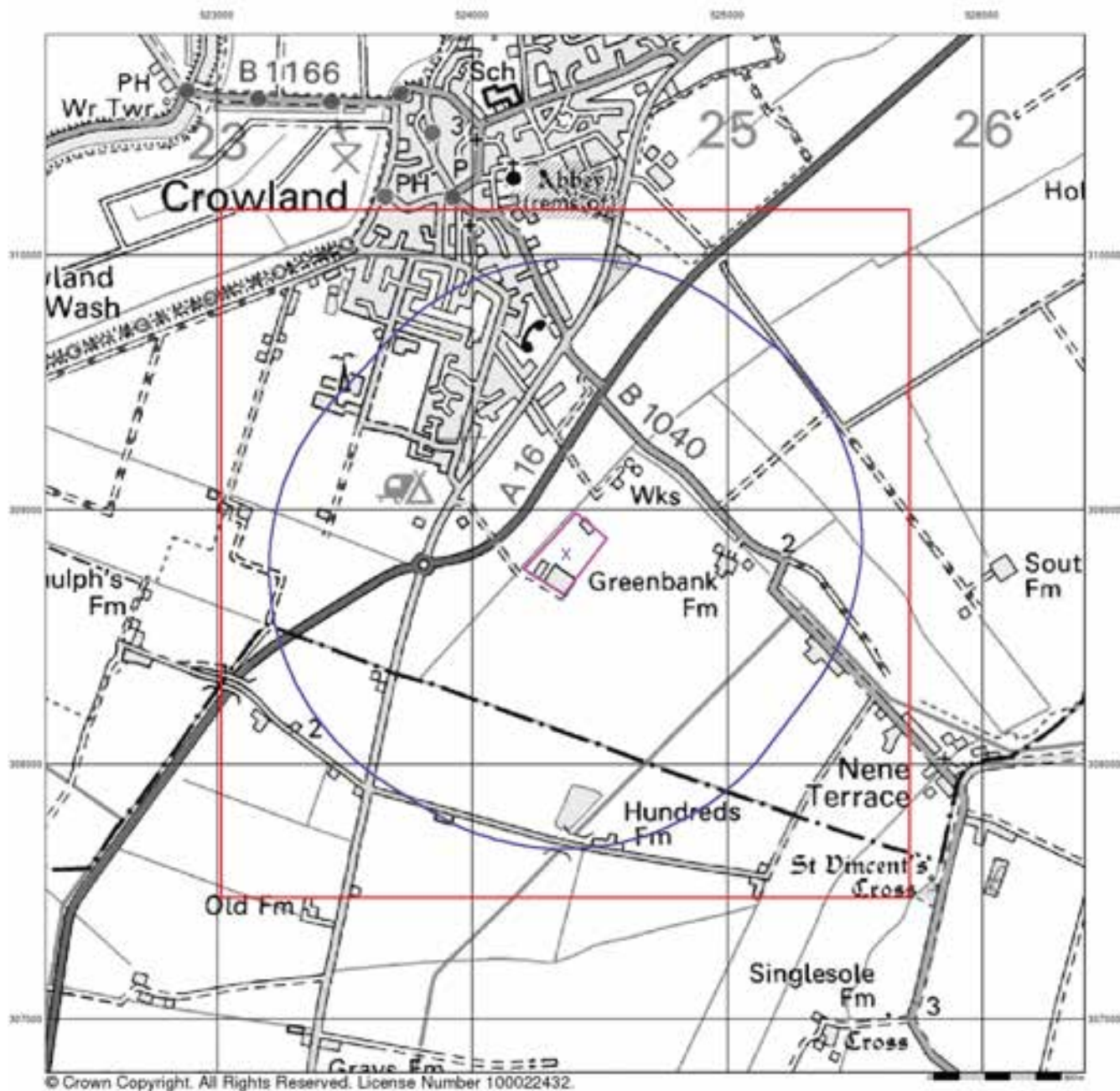
Order Number:	66141052_1_1
Customer Reference:	UK15.1838
National Grid Reference:	524370, 308830
Slice:	A
Site Area (Ha):	4.86
Search Buffer (m):	1000

Site Details:

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Artificial Ground and Landslip

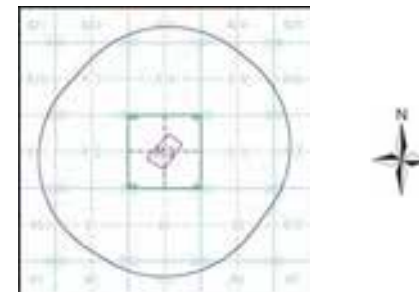
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions and unstable ground.

Artificial ground includes:

- Made ground - man-made deposits such as embankments and spoil heaps on the natural ground surface.
- Worked ground - areas where the ground has been cut away such as quarries and road cuttings.
- Infilled ground - areas where the ground has been cut away then wholly or partially backfilled.
- Landscaped ground - areas where the surface has been reshaped.
- Disturbed ground - areas of ill-defined shallow or near surface mineral workings where it is impracticable to map made and worked ground separately.

Mass movement (landslip) deposits on BGS geological maps are primarily superficial deposits that have moved down slope under gravity to form landslips. These affect bedrock, other superficial deposits and artificial ground. The dataset also includes foundered strata, where the ground has collapsed due to subsidence.

Artificial Ground and Landslip Map - Slice A



Order Details:

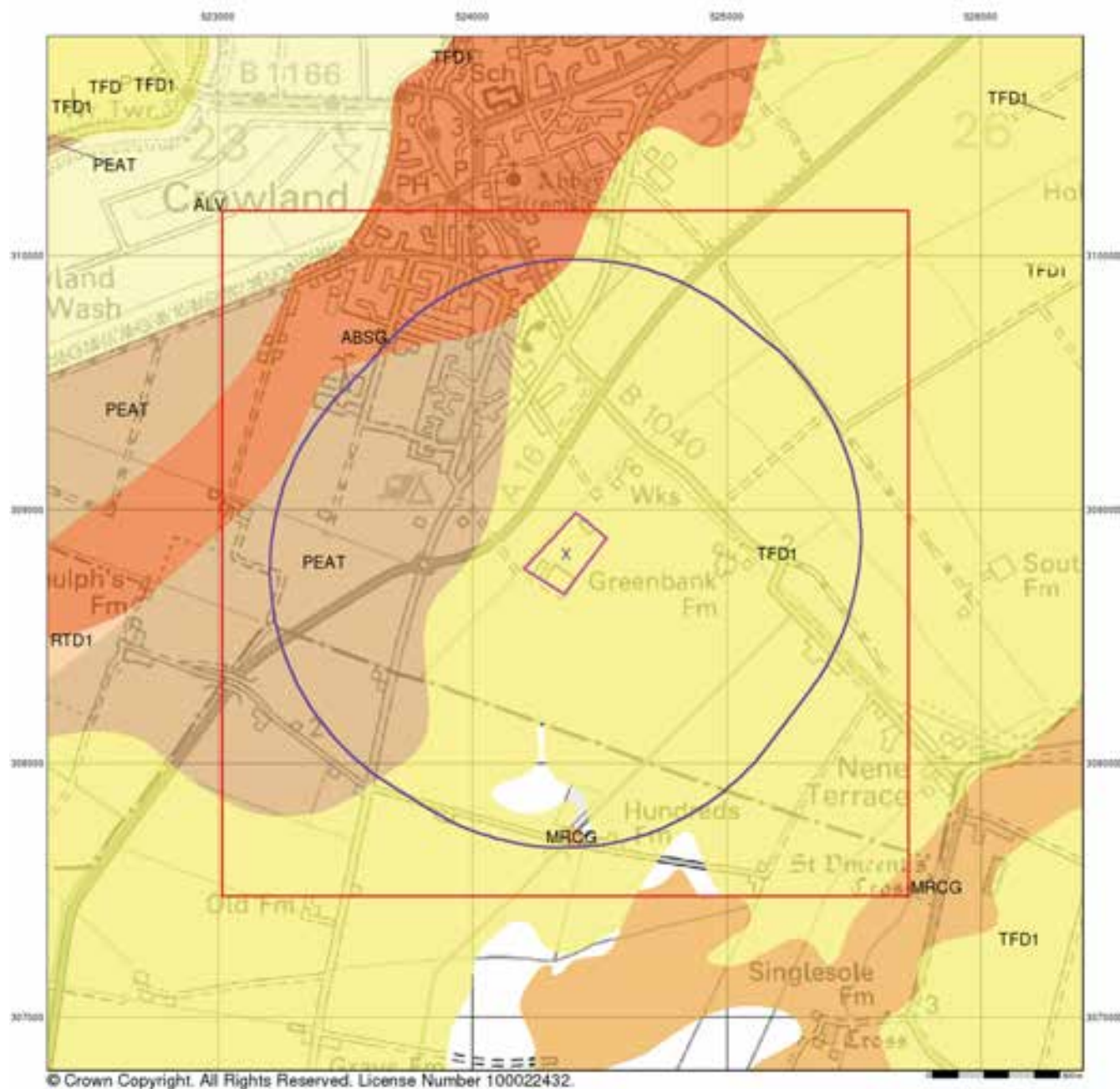
Order Number: 66141052_1_1
 Customer Reference: UK15.1838
 National Grid Reference: 524370, 308830
 Slice: A
 Site Area (Ha): 4.86
 Search Buffer (m): 1000

Site Details:

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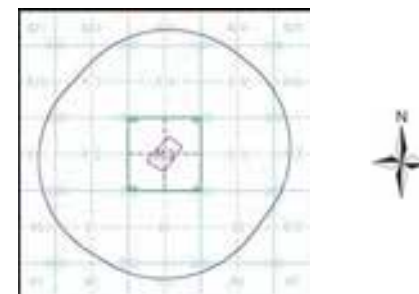
Superficial Geology

Superficial Deposits are the youngest geological deposits formed during the most recent period of geological time, the Quaternary, which extends back about 1.8 million years from the present.

They rest on older deposits or rocks referred to as Bedrock. This dataset contains Superficial deposits that are of natural origin and 'in place'. Other superficial strata may be held in the Mass Movement dataset where they have been moved, or in the Artificial Ground dataset where they are of man-made origin.

Most of these Superficial deposits are unconsolidated sediments such as gravel, sand, silt and clay, and onshore they form relatively thin, often discontinuous patches or larger spreads.

Superficial Geology Map - Slice A



Order Details:

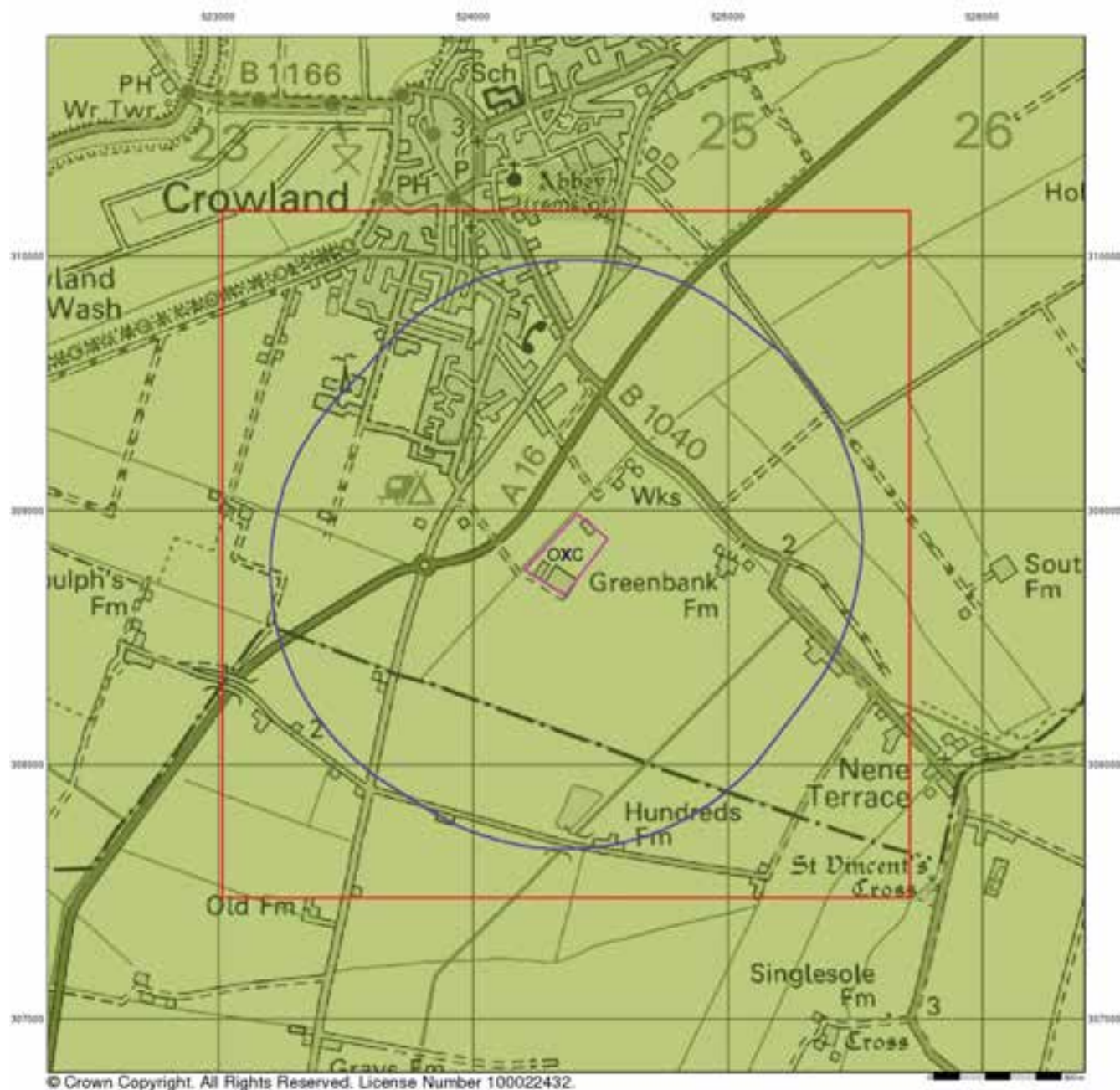
Order Number: 66141052_1_1
 Customer Reference: UK15.1838
 National Grid Reference: 524370, 308830
 Slice: A
 Site Area (Ha): 4.86
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Bedrock and Faults

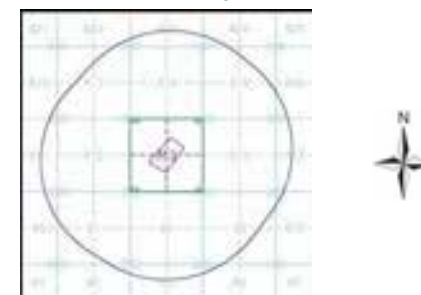
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

The bedrock has formed over vast lengths of geological time ranging from ancient and highly altered rocks of the Proterozoic, some 2500 million years ago, or older, up to the relatively young Pliocene, 1.8 million years ago.

The bedrock geology includes many lithologies, often classified into three types based on origin: igneous, metamorphic and sedimentary.

The BGS Faults and Rock Segments dataset includes geological faults (e.g. normal, thrust), and thin beds mapped as lines (e.g. coal seam, gypsum bed). Some of these are linked to other particular 1:50,000 Geology datasets, for example, coal seams are part of the bedrock sequence, most faults and mineral veins primarily affect the bedrock but cut across the strata and post date its deposition.

Bedrock and Faults Map - Slice A



Order Details:

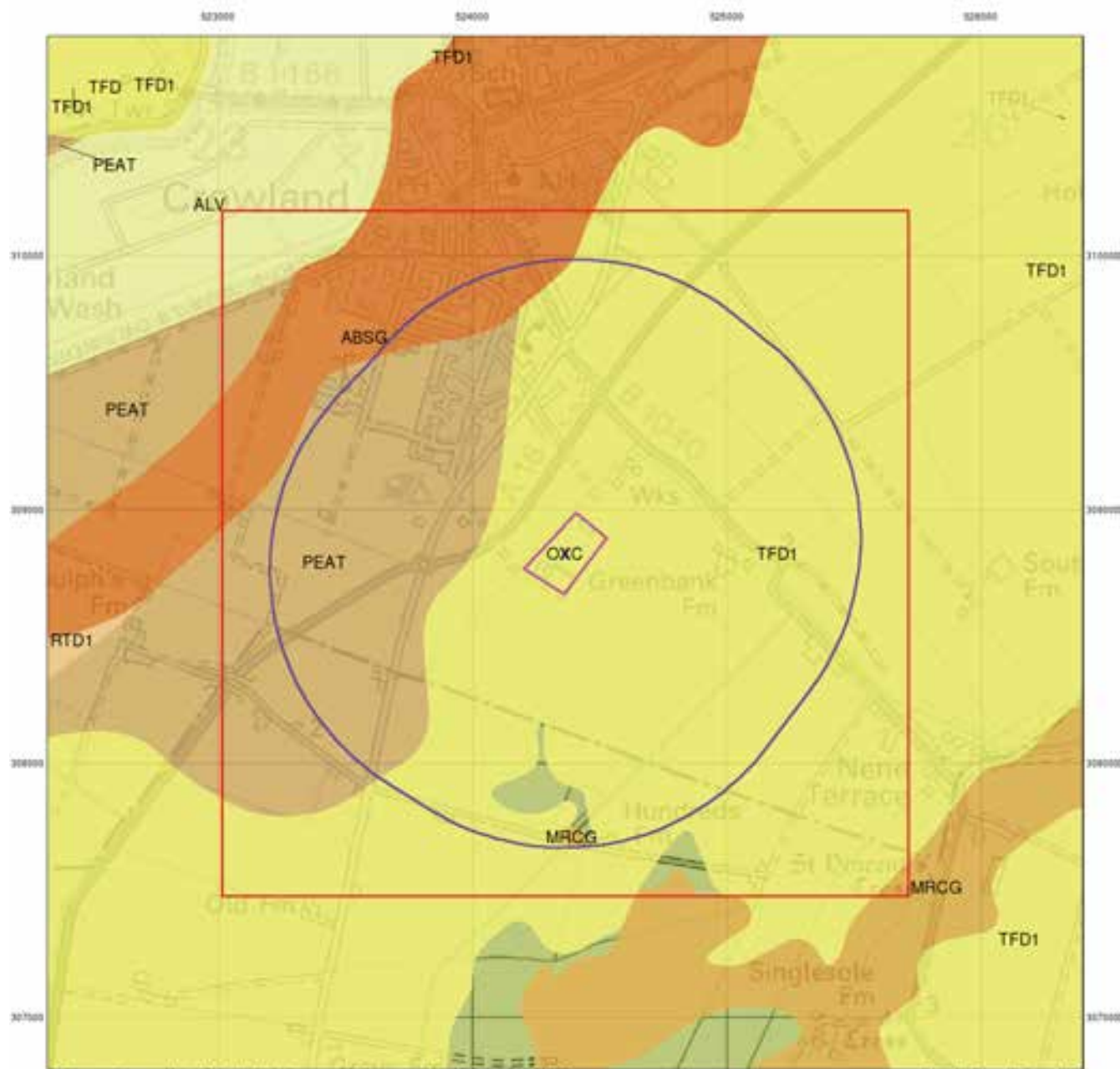
Order Number: 66141052_1_1
 Customer Reference: UK15.1838
 National Grid Reference: 524370, 308830
 Slice: A
 Site Area (Ha): 4.86
 Search Buffer (m): 1000

Site Details:

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Combined Surface Geology

The Combined Surface Geology map combines all the previous maps into one combined geological overview of your site.

Please consult the legends to the previous maps to interpret the Combined "Surface Geology" map.

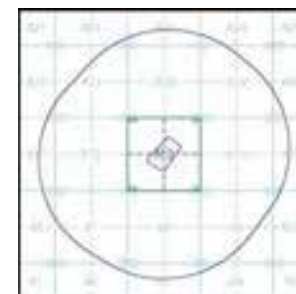
Additional Information

More information on 1:50,000 Geological mapping and explanations of rock classifications can be found on the BGS website. Using the LEX Codes in this report, further descriptions of rock types can be obtained by interrogating the 'BGS Lexicon of Named Rock Units'. This database can be accessed by following the 'Information and Data' link on the BGS website.

Contact

British Geological Survey
Kingsley Dunham Centre
Keyworth
Nottingham
NG12 5GG
Telephone: 0115 936 3143
Fax: 0115 936 3276
email: enquiries@bgs.ac.uk
website: www.bgs.ac.uk

Combined Geology Map - Slice A



Order Details:

Order Number: 66141052_1_1
Customer Reference: UK15.1838
National Grid Reference: 524370, 308830
Slice: A
Site Area (Ha): 4.86
Search Buffer (m): 1000

Site Details:

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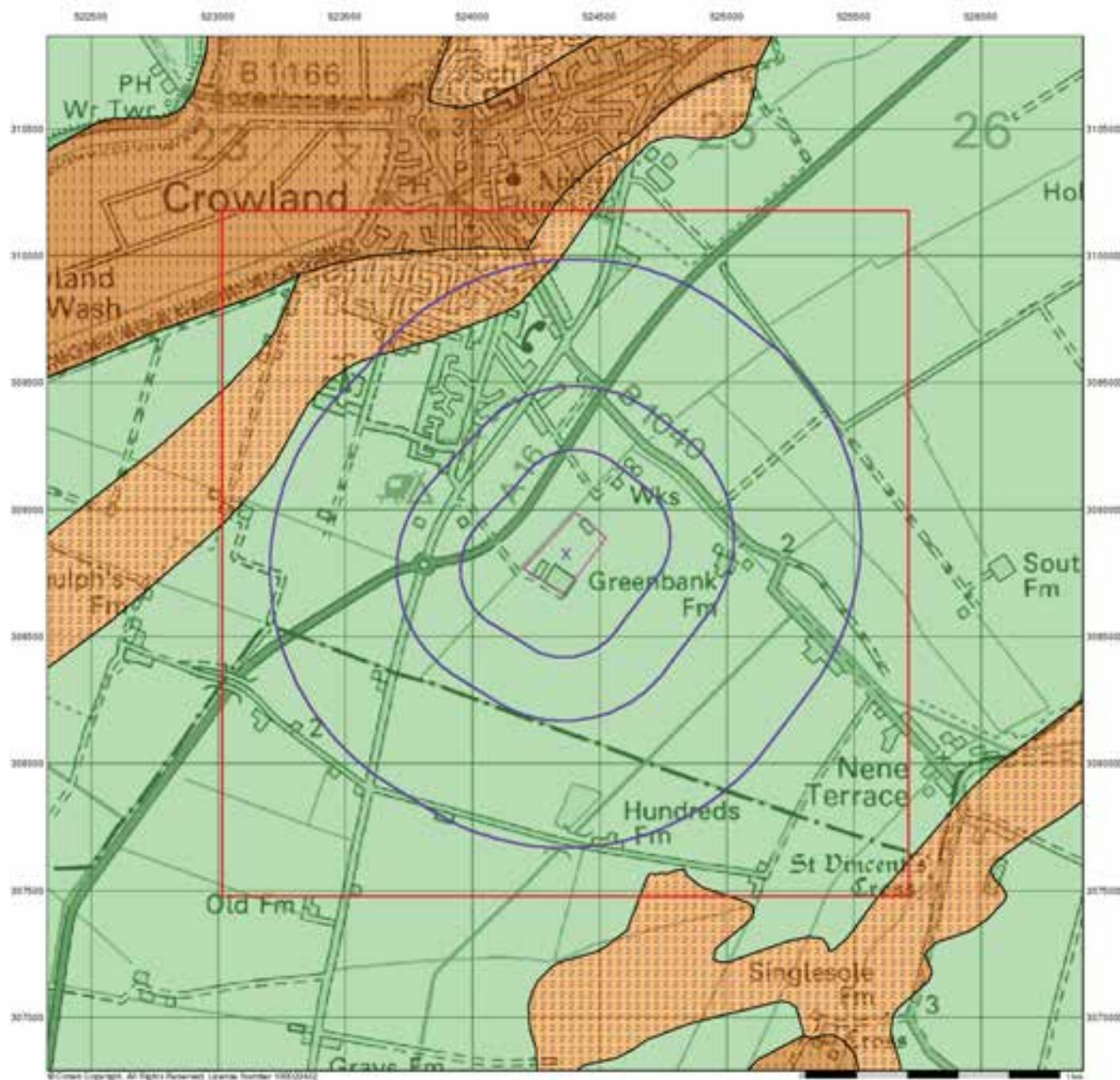


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APPENDIX E

Groundwater Vulnerability Maps



Groundwater Vulnerability

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

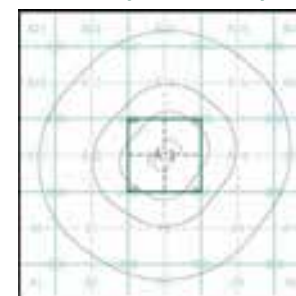
Agency and Hydrological

Geological Classes

Major Aquifer (Highly Permeable)		High (H) 1, 2, 3, U
		Intermediate (I) 1, 2
		Low
Minor Aquifer (Variably Permeable)		High (H) 1, 2, 3, U
		Intermediate (I) 1, 2
		Low
Non Aquifer (Negligibly Permeable)		
Water or Sea		
Drift Deposit		

Soil Classes

Site Sensitivity Context Map - Slice A



Order Details

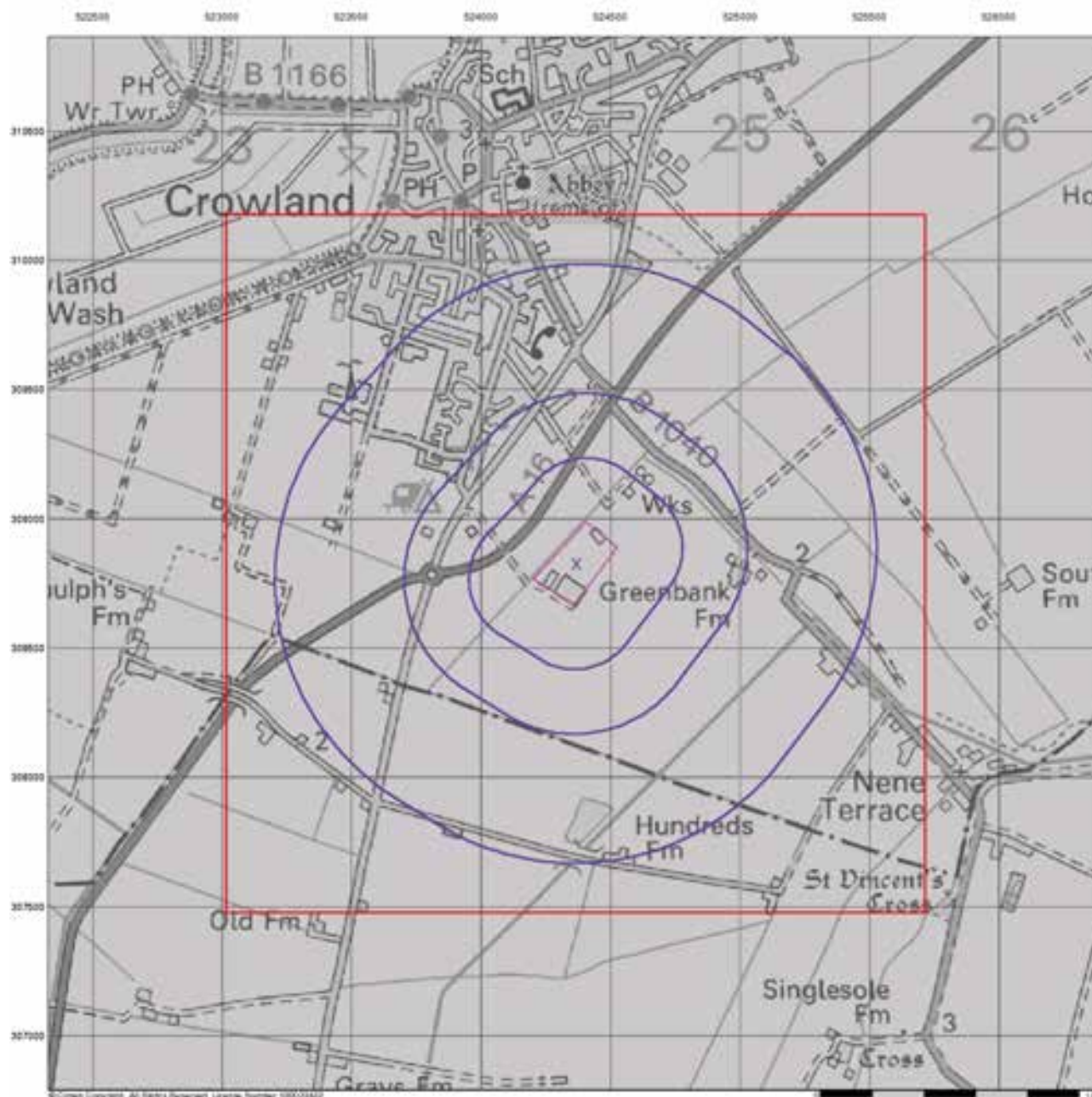
Order Number: 66141052_1_1
 Customer Ref: UK15.1838
 National Grid Reference: 524370, 308830
 Slice: A
 Site Area (Ha): 4.86
 Search Buffer (m): 1000

Site Details

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Bedrock Aquifer Designation

General

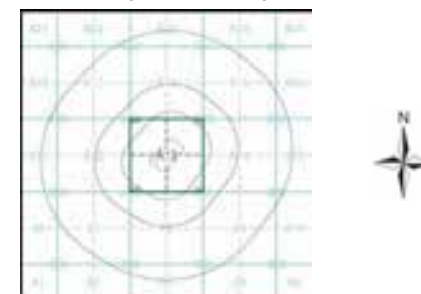
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Site
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A



Order Details

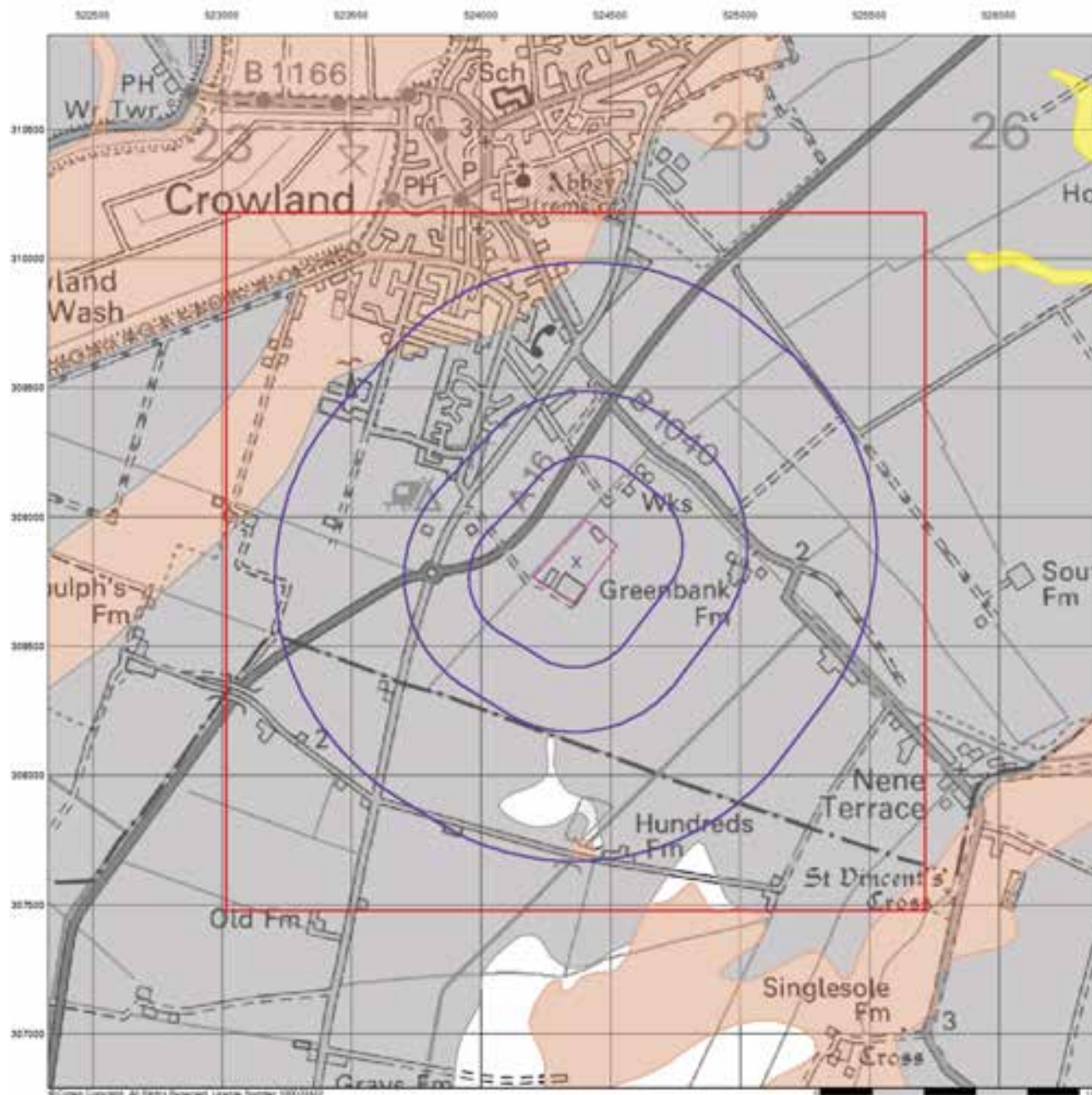
Order Number: 66141052_1_1
 Customer Ref: UK15.1838
 National Grid Reference: 524370, 308830
 Slice: A
 Site Area (Ha): 4.86
 Search Buffer (m): 1000

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Superficial Aquifer Designation

General

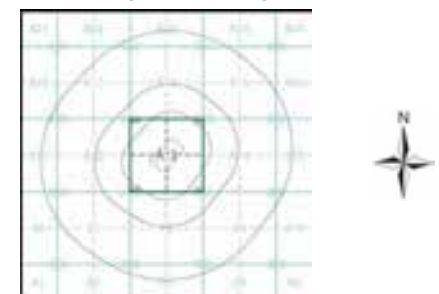
- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Site
- Map ID

Agency and Hydrological

Geological Classes

- Principal Aquifer
- Secondary A Aquifer
- Secondary B Aquifer
- Secondary Undifferentiated
- Unproductive Strata
- Unknown

Site Sensitivity Context Map - Slice A



Order Details

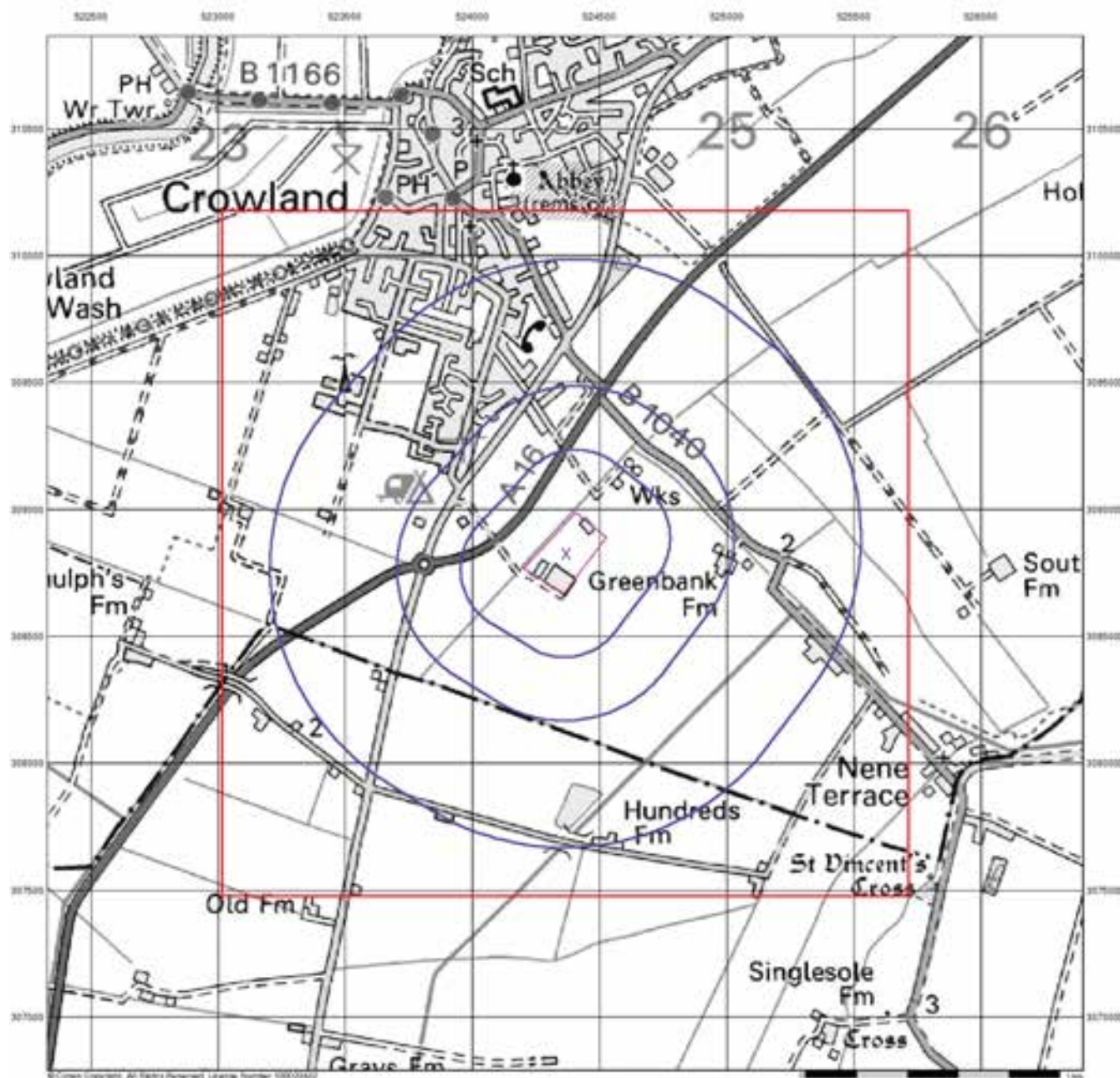
Order Number: 66141052_1_1
 Customer Ref: UK15.1838
 National Grid Reference: 524370, 308830
 Slice: A
 Site Area (Ha): 4.86
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Site Details

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Source Protection Zones

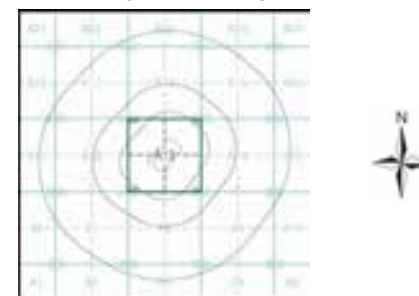
General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Slice
- Map ID

Agency and Hydrological

- Inner zone (Zone 1)
- Inner zone - subsurface activity only (Zone 1c)
- Outer zone (Zone 2)
- Outer zone - subsurface activity only (Zone 2c)
- Total catchment (Zone 3)
- Total catchment - subsurface activity only (Zone 3c)
- Special interest (Zone 4)
- Source Protection Zone Borehole

Site Sensitivity Context Map - Slice A



Order Details

Order Number: 66141052_1_1
 Customer Ref: UK15.1838
 National Grid Reference: 524370, 308830
 Slice: A
 Site Area (Ha): 4.86
 Search Buffer (m): 1000

Site Details

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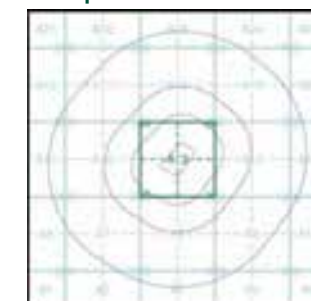
General

- Specified Site
- Specified Buffer(s)
- Showing Reference Flood

Agency and Hydrological (Flood)

- Extreme Flooding from Rivers or Seas without Defences (Zone 2)
- Flooding from Rivers or Seas without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Flood Map - Slice A



Order Details

Order Number: 66141052_1_1
Customer Ref: UK15.1838
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Slice: A
Site Area (Ha): 4.86
Search Buffer (m): 1000

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APPENDIX F

A Selection of Historic Maps



Lincolnshire

Published 1887

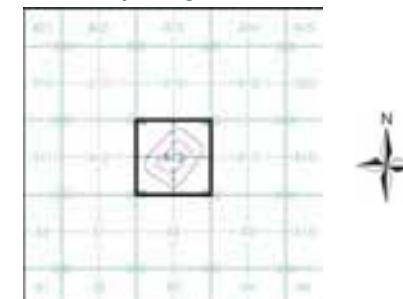
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number: 66141052_1_1
Customer Ref: UK15.1838
National Grid Reference: 524370, 308830
Slice: A
Site Area (Ha): 4.86
Search Buffer (m): 100

Site Details

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Ordnance Survey Plan

Published 1975

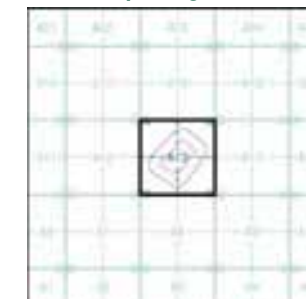
Source map scale - 1:2,500

The historical maps shown were reproduced from maps predominantly held at the scale adopted for England, Wales and Scotland in the 1840's. In 1854 the 1:2,500 scale was adopted for mapping urban areas and by 1896 it covered the whole of what were considered to be the cultivated parts of Great Britain. The published date given below is often some years later than the surveyed date. Before 1938, all OS maps were based on the Cassini Projection, with independent surveys of a single county or group of counties, giving rise to significant inaccuracies in outlying areas.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number: 66141052_1_1
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Slice: A
Site Area (Ha): 4.86
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Large-Scale National Grid Data

Published 1995

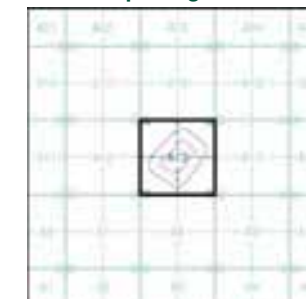
Source map scale - 1:2,500

'Large Scale National Grid Data' superseded SIM cards (Ordnance Survey's 'Survey of Information on Microfilm') in 1992, and continued to be produced until 1999. These maps were the fore-runners of digital mapping and so provide detailed information on houses and roads, but tend to show less topographic features such as vegetation. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number: 66141052_1_1
Customer Ref: UK15.1838
National Grid Reference: 524370, 308830
Slice: A
Site Area (Ha): 4.86
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VectorMap Local

Published 2015

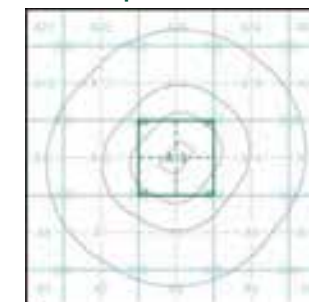
Source map scale - 1:10,000

VectorMap Local (Raster) is Ordnance Survey's highest detailed 'backdrop' mapping product. These maps are produced from OS's VectorMap Local, a simple vector dataset at a nominal scale of 1:10,000, covering the whole of Great Britain, that has been designed for creating graphical mapping. OS VectorMap Local is derived from large-scale information surveyed at 1:1250 scale (covering major towns and cities), 1:2500 scale (smaller towns, villages and developed rural areas), and 1:10 000 scale (mountain, moorland and river estuary areas).

Map Name(s) and Date(s)

TF21SW 2015 Variable	TF21SE 2015 Variable
TF20NW 2015 Variable	TF20NE 2015 Variable

Historical Map - Slice A



Order Details

Order Number: 66141052_1_1
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