PHASE 1 GEO-ENVIRONMENTAL GROUND INVESTIGATION AT "THE SHARP PROJECT 3", FORMER FUJITSU COMPLEX, WEST GORTON FOR MANCHESTER CITY COUNCIL

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1.0 EXECUTIVE SUMMARY

1.1 Integra Consulting Engineers Ltd has been instructed by Mr Adam Davis of Willmott Dixon on behalf of Manchester City Council to undertake a Phase 1 geo-environmental ground investigation for the land at "The Sharp Project 3", Wenlock Way, West Gorton. The Ordnance Survey national grid reference of the centre of the site is E 386840, N 396990.

1.2 “The Sharp Project 3” is the proposed redevelopment of the former Fujitsu works complex in Gorton to create a Drama Hub. The proposal is for the re-use of the existing computer hall, demolition of existing office space to one the east of the computer hall building and demolition of ancillary workshops to create office accommodation, ancillary film production and new build prop storage / workshops, maintaining the existing Use Class – B1 Business Use. The internal re-arrangement of the computer hall and construction of new prop store, security cabin and reception will provide 13000 sqm and will involve some alterations to the external works and site access. The site is owned and will be managed by Manchester City Council through ‘The Sharp Project’ and individual office and production stages will be tenanted.

1.3 The site is located in an industrial area of West Gorton, Manchester. The location is shown on the site location plans in Appendix 1. The Ordnance Survey national grid reference for the centre of the site is E 386840, N 396990 and it is located at post code M12 5DH. "The Sharp Project 3" site covers an approximately rectangular area of circa 3.3 hectares and is typically flat in nature. The site contains numerous low level buildings, a multi-storey office block and car parking in the eastern section of the site. However, the proposed planning application pertains to a sub section of the site, focused on the existing buildings located on the western section of the site.

1.4 On the basis of the desk study information obtained, it is anticipated that the site will underlain by made ground deposits, which may be significant in localised areas underlain by stiff glacial till which is in turn underlain by bedrock at a depth of approximately 10m below ground level. The made ground deposits are of unknown thicknesses and constituents will be present across the site as a result of historic industrial, excavation and re-profiling works.

1.5 Historically, the site has been occupied by numerous industries including bleach, dye, iron and chemical works up until the early to mid Twentieth Century where it was subsequently utilised as an Electrical Engineering Works (Fujitsu) and office block until the present day.

1.6 Following a review of BRE 211 and HPA / BGS radon reports, the site lies in an area where 1% to 3% of homes are above the action level indicating the site to be in an area where no radon protection measures are required.

1.7 There is a low to moderate potential risk to human health including ground gas and a moderate risk to controlled waters due to potential contamination associated with the previous historical site uses, the unknown nature of the made ground deposits and the numerous potential ground gas sources located on and adjacent to the site. However, the proposed development and controlled waters are considered to be of low sensitivity as detailed within the representative conceptual models. Consequently, a Phase 2 environmental intrusive investigation is deemed necessary including appropriate chemical testing of site materials and waters with groundwater / ground gas monitoring.

1.8 Furthermore, due to geotechnical requirements, site investigation works should be undertaken across the area of the site where development works are to be undertaken i.e. eastern section of the former Fujitsu factory including exploratory holes and associated geotechnical laboratory tests in order to establish the actual ground conditions at the site in order that designs for foundations, roads and underground drainage can be undertaken. Suspected subsurface features such as infilled reservoirs, historic foundations and ground slabs may be present beneath the site and will require investigation.

2.0 INTRODUCTION

2.1 General

This Phase 1 geo-environmental ground investigation and report has been prepared at the request of Mr Adam Davis of Willmott Dixon on behalf of Manchester City Council.

Instructions to proceed were received on 20 February 2013. Desk study work was undertaken between 4 March and 22 March 2013. The walk over survey was carried out on 21 March 2013.

“The Sharp Project 3” is the proposed redevelopment of the former Fujitsu works complex in Gorton to create a Drama Hub. The proposal is for the re-use of the existing computer hall, demolition of existing office space to the east of the computer hall building and demolition of ancillary workshops to create office accommodation, ancillary film production and new build prop storage / workshops maintaining the existing Use Class – B1 Business Use. The internal re-arrangement of the computer hall and construction of new prop store, security cabin and reception will provide 13000 sqm and will involve some alterations to the external works and site access. The site is owned and will be managed by Manchester City Council through ‘The Sharp Project’ and individual office and production stages will be tenanted.

Proposed development plans are contained within Appendix 8.

2.2 Previous Site Investigations

No previous site investigation works were available for review at the time of undertaking this report.

3.0 BRIEF

The brief was to carry out a Phase 1 geo-environmental ground investigation for land at "The Sharp Project 3", Wenlock Way, West Gorton. The extent of the site is shown on the aerial photograph and site plans contained in Appendix 1. The investigation was to include for the following studies:

a) A desk study involving examination of available geological maps, BGS borehole logs, historical Ordnance Survey maps, environmental maps, previous site investigation work (when available) and accessible historical records to assess the probable geological and contaminated land conditions on and below the site.

b) A walk over study of the site to ascertain any evidence of previous and current site uses that may have caused contamination of the ground and surface waters at the site. During the walk over survey, the topography of the site was to be noted along with any land features that could give an indication of probable sub-surface features and formations.

c) Identification of probable contaminants that may be present at the site using current contaminated land guidance and identify potential receptors which could be at risk from potential contaminants.

d) Develop a conceptual model for the site to assess the potential risks of contamination and to undertake a preliminary risk assessment.

e) Determine whether further investigation and assessment is required.

f) Define the scope and extent of further investigations.

A detailed report was to be provided to summarise findings and recommendations.

4.0 LIMITATIONS OF INVESTIGATION WORK AND REPORT

Desk Study References

The desk study has been produced using historical Ordnance Survey maps and environmental maps available at the time the report has been produced. The environmental information used was the current information available at the time of writing but there is no absolute guarantee of accuracy.

Historical Ordnance Survey maps do not provide a comprehensive description of a site's history. They provide details of the site from a date prior to the publication of the map (i.e. a snapshot in time). The period between map editions can be substantial (i.e. several decades). Not all map series are available for every date range in many areas of the UK and therefore there will be gaps in this mapped record for some sites. Potentially contaminative land uses could have been present and removed during such periods and may therefore not form a part of this particular record. In addition, there will be potentially contaminative land uses which are not identified on the map records such as small scale storage / use of hazardous materials, illegal / unlicensed waste disposal activities etc.

Different map series identify different features utilising different symbols which can result in features that remain on site being removed from maps. Some features are also not mapped for security reasons i.e. airfields and other military installations. These areas are mostly shown as blank areas on historical maps.

Exploratory Holes

Where the spacing of exploratory holes for future intrusive investigation work has been presented as part of this report, the spacing has been determined to provide a reasonable indication of the general ground conditions and extent of land / groundwater contamination on the site but the number has ultimately been limited by commercial constraints. The ground conditions at the proposed exploratory holes are no absolute guarantee of the ground conditions between such locations. Due allowance should be made for the possibility of variation in conditions between exploratory hole locations when preparing any assessments of the final foundation and land / groundwater remediation proposals.

Extent of Contamination Studies

This report is strictly limited to the nature of contamination contained within the ground and groundwater at the site. The report does not cover environmental aspects such as air or noise pollution and ground vibrations and the like. In addition, ecological matters relating to wildlife, flora and fauna have not been investigated as part of this report. In particular, the site has not been inspected for the presence or otherwise of Japanese Knotweed. It is recommended that the Client appoints a specialist in this subject to carry out a detailed inspection of the site if its presence is suspected.

Flooding

Flooding in this report is defined as flooding caused by the sea, ditches, rivers, streams, ponds, lakes, reservoirs and the like. It does not extend to flooding caused by surcharged piped drainage systems and investigations into flooding of this nature are excluded from this report.

5.0 THIRD PARTIES

This report has been prepared for the sole use of Willmott Dixon on behalf of Manchester City Council. It must not be copied or passed onto any third party or used for any purpose other than which it was prepared without the permission of the author. This report is copyright.

6.0 SCOPE OF INVESTIGATION WORK

6.1 Walk Over Survey

The site was visited during dry, overcast weather conditions and the objectives of the site walkover were, where applicable:

- to identify and assess visual and olfactory evidence of contamination e.g. staining of concrete / soils, odours, presence of gas protection measures etc;
- to identify locations of potential sources of contamination and assess their conditions i.e. tank location, presence / condition of secondary containment / bunds, location of fill points, process areas;
- to identify surrounding land uses and any potentially contaminating activities;
- to identify / verify the presence of potential receptors (on site and off site) which may be affected by identified sources;
- to obtain information on activities / procedures and standards of housekeeping etc.
- to assess site access and potential investigation locations and constraints.
- to assess any visual subsurface geotechnical features / anomalies e.g. foundations, made ground, subsidence etc

Photographs were taken of the site during the walkover survey and these photographs are contained in Appendix 2.

6.2 Desk Study Documentation

The following documents were obtained and examined during the desk study:

a) An aerial photograph of the site dated 2000. The photograph is contained in Appendix 1.

b) Historical Ordnance Survey maps as follows:

- 1:10560 dated 1848
- 1:500 dated 1891
- 1:10560 dated 1893
- 1:10560 dated 1894
- 1:2500 dated 1908
- 1:10560 dated 1909
- 1:2500 dated 1922
- 1:10560 dated 1923
- 1:10560 dated 1932-1933
- 1:10560 dated 1938
- 1:1250 dated 1948-1950
- 1:2500 dated 1950-1951
- 1:1250 dated 1953-1979
- 1:10000 dated 1956
- 1:2500 dated 1964-1967
- 1:10000 dated 1968
- 1:25000 dated 1975
- 1:1250 dated 1975-1990
- 1:1250 dated 1975-1976
- 1:1250 dated 1977-1991
- 1:10000 dated 1981
- 1:1250 dated 1985-1992
- 1:10000 dated 1987
- 1:1250 dated 1992 (x2)
- 1:10000 dated 1993
- 1:1250 dated 1993-1995
- 1:1250 dated 1993-1996
- 1:1250 dated 1994-1996
- 1:1250 dated 1995-1997
- 1:10000 dated 2006
- 1:10000 dated 2012

These maps are contained in Appendix 3.

c) Environmental maps obtained through Envirocheck as follows:

- Environment Agency and hydrological map dated 2013
- Groundwater vulnerability map dated 1999
- Sensitive land uses map dated 1991 - 2013
- Summary maps showing locations of recorded waste sites, industrial land use sites and hazardous substances sites in adjacent areas.

These maps are contained in Appendix 4.

d) An environmental report obtained from Landmark, the environmental database company, which provides a list of recorded past and present activities at or adjacent to the site which could have an impact on the levels of contamination in the soils and groundwater at the site.
This report is contained in Appendix 5.

e) The British Geological Survey (BGS) 1:10,000 Solid Edition geological map (references SJ89NE). A part extract of the map covering the area under consideration is contained in Appendix 6. 2 No. BGS boreholes, constructed local to the site, were obtained (references: SJ89NE127 and SJ89NE274) - these borehole logs are contained in Appendix 6. The extracts have been copied under licence from the British Geological Society.

f) Coal Authority Mining report reference 51000193817003. This report is contained in Appendix 6

g) The Indicative Atlas of Radon for England and Wales published by the British Geological Survey and the Health Protection Agency was examined to assess the probable presence or otherwise of radon gas in the ground. Extracts of the relevant maps are contained in Appendix 7.

7.0 FINDINGS

7.1 Description of the Site

The site is located in an industrial area of West Gorton, Manchester. The location is shown on the site location plans in Appendix 1. The national Ordnance Survey grid reference for the centre of the site is E 386840, N 396990 and it is located at post code M12 5DH.

"The Sharp Project 3" site covers an approximately rectangular area of circa 3.3 hectares and is typically flat in nature. The site contains numerous low level buildings, a multi-storey office block and car parking in the eastern section of the site. However, the proposed planning application pertains to a subsection of the site, focused on the existing buildings located on the western section of the site.

The existing site plans are contained in Appendix 9.

An aerial photograph of the site prior to works commencing is contained in Appendix 1.

7.2 Walk Over Survey

During the walk over survey, the following features were noted relating to geology and contaminated land matters:

Geology

The site consisted of numerous varying storey buildings which were either being utilised as office space or derelict awaiting redevelopment. Further to these buildings the site contained predominately hardstanding areas with nominal areas of soft landscaping around the peripheries of the external areas occupied by trees and vegetation (which are to remain).

At the time of the site walkover, demolition works were being undertaken with the internal features of the former Fujitsu factory being soft stripped and the demolition and crushing of buildings along the northern boundary being undertaken.

Numerous services were noted along the access roads, with the surface water drainage being subject to surface water management whilst the demolition was being undertaken to negate the blockage of the services.

Contaminated Land

No significant contaminative sources were recorded on site.

Photographs taken during the walkover survey are contained in Appendix 2.

7.3 Geology

The BGS 1:10,000 geological map of the site indicates that the site is overlain by superficial deposits of glacial till (formerly boulder clay) underlain by solid geology consisting of the Halesowen Formation which comprises mudstone, siltstone and sandstone. Extracts of the geological map are contained within Appendix 6.

7.3.1 BGS Borehole Logs

2No. BGS borehole logs were obtained in close proximity of the site, namely:

SJ89NE 127

This borehole was located approximately 25m south of the site and was constructed at an unknown date but is envisaged to be around the turn of the Twentieth Century.

The borehole typically recorded the following strata:

- 'Earth' to a depth of 1.83m underlain by
- Grey Clay to a depth of 10.97m underlain by
- Grey / Red / Black Shale to a depth of 34.75m underlain by
- Interbedded layers of limestone and fireclay to a depth of 46.03m underlain by
- Suspected sandstone to a depth of at least 61.27m where the borehole was terminated.

SJ89NE 274

This borehole was located approximately 50m west of the site and was constructed in 1966 at an elevation of 167.17feet (50.9m) AOD.

The borehole typically recorded the following strata:

- Made Ground to a depth of 0.8m underlain by
- Very stiff, sandy, boulder clay (glacial till) to a depth of 8.22m underlain by
- Interbedded layers of Red / Grey / Pink mudstone and limestone to a depth of 22.85m where the borehole was terminated.

The BGS borehole logs referred to above are contained in Appendix 6.

7.4 Site History

The site development history has been researched with reference to historical maps and street plans. These are included in Appendix 3 to this report and the principal observations, divided into site and off site history are summarised below.

Site History

Dates	Site Features
1848 - 1891	The site is shown as rural land with localised industrial buildings located across the south eastern site section which is noted as 'Cotton of Gorton' and 'Bleach and Dye Works' located on the eastern site extremity. A surface water course known as Corn Brook is noted flowing from east to west across the north eastern extremity of the site.
<1891 – 1940s	The eastern and central site section has developed with the central section occupied by 'Union Iron Works' with an associated reservoir and chimney and Dallon Chemical Works located across the eastern site section with associated chimneys and tanks on the eastern extremity of the site. By 1908 the Dallon Chemical Works is no longer shown. The south western extremity of the site is occupied by residential housing. By 1922, the Union Iron works had expanded across the western site section and Corn Brook is noted to be culverted onsite and immediately abutting the site. By the 1930s the onsite reservoir is no longer recorded, presumed infilled.
1948 – 1980s	The site is still occupied by Union Iron Works but the site has undertaken mass redevelopment with the numerous smaller buildings being replaced with larger buildings across the site, in particular the central and eastern section. Numerous electrical substations and above ground storage tanks (of unknown use) are recorded across the western section of the site. By the 1960s the site is noted as being a 'Works' and further residential properties are located abutting the western site boundary. The building in the north western extremity of the site is noted as being a canteen. By the 1970s the site is noted as being both a 'Works' and an 'Electrical Engineering Works'.
1985 - 2013	By 1987, the site has been redeveloped with all buildings, with the exception of the former canteen, redeveloped into the present day layout.

Off Site History

The areas to the north and east of the site have been historically utilised for significant potentially contaminative industrial activities since pre-1848, although the majority of these activities ceased in the early part of the Twentieth Century. The areas to the south and west of site consisted of rural land and developed into typically residential or commercial land uses. The principal contaminative land uses are detailed within the table below:

Dates	**Features**	**Distance and Direction**
1848 - 1908	Ardwick Chemical Works	10m North
1848 - 1932	Multiple Chemical Works	180m East and North East
1851 - 1908	Brick Works and Brick Fields	130m North
1851 - 1948	Engineering Works (By 1948 known as gas stove and meter works)	40m South East
1908 - 1922	Raven Slate Works (with multiple chimneys)	10m North
1948 - 2006	Multiple Engineering Works	80m North East
1948 - 1953	Excelsior Chemical Works and Refuse Heap	110m East

Numerous other industries were noted within 250m of the site including further multiple engineering works, made ground, chimneys and electrical sub-stations.

7.5 Waters and Flooding

Environmental data relevant to the site and its immediately surrounding area has been obtained from sources available in the public domain. In addition, an environmental report was obtained from Landmark, the commercial suppliers of environmental data. The Landmark report and associated maps that have been inspected are presented in Appendices 4 and 5 and the principal observations in relation to waters and flooding can be summarised as follows:

Flooding

- The site is located within an area designated as Flood Zone 2 and 3, an area that is classified as at risk from flooding from river or sea flood events.

Surface Water

- The nearest surface water feature is Corn Brook which historically flowed through the north eastern extremity of the site and abutting the northern site boundary until the early part of the twentieth century when the brook was partially culverted. Further culverting and modification works were subsequently undertaken during the twentieth century. A small section of Corn Brook is noted to issue at surface abutting the north eastern section of the site.
- The nearest surface water abstraction point is in excess of 1km from the site.

Hydrogeology

- The site is underlain by bedrock which is classified as a Secondary A (minor) aquifer overlain by unproductive superficial deposits (glacial till).
- The site is not located within 1 km of a Source Protection Zone.
- The nearest groundwater abstraction point is in excess of 1km from the site.

Pollution Incidents to Controlled Waters

- No pollution issues are recorded within 250m of the site.

7.6 Hazardous Installations, Landfill and Waste

The following information relating to hazardous installations, landfill and waste obtained from the Landmark report, published information and the walkover survey can be summarised as follows:

- There are 6 No. active or revoked Local Authority Pollution Prevention and Controls (LAPPC) located within 250m of the site which are associated with iron, steel and non-ferrous metal foundry processes (revoked 43m north west), hot and cold blast cupolas (revoked 43m north west), Di-isocynate processes (authorised 61m north west), waste oil burners (revoked 80m west) and respraying of road vehicles (permitted / revoked 156m and 164m north).
- No recorded registered contemporary landfills, BGS recorded mineral sites or registered waste treatment or disposal sites are located within 250m of the site.

- A number of significant contemporary trade directories are located within 250m of site. These include:
    - Numerous active and inactive vehicle engineering works including sprayers and scrap metal centres

7.7 Mining

7.7.1 Coal / Fireclay Mining

The Coal Authority Mining Report (reference: 51000193817003) states that the site is in the likely zone of influence from workings in four seams of coal at 290m to 1080m depth below ground level which were last worked in 1957. The report confirms that any ground movement from these coal workings should now have ceased. No mine shaft entries or outcropping coal seams are recorded within close proximity of the site. No other issues were raised relating to present or future working (other than the usual reserved rights for extraction of remaining coal) or undocumented historical shallow mine workings.

7.7.2 Brine Extraction

The site lies outside a recognised salt / brine extraction area.

7.8 Radon

The Indicative Atlas of Radon in England and Wales produced by the Health Protection Agency and British Geological Survey indicates that the site lies in an area where 1% to 3% of homes are above the action level.

BRE211 ‘Guidance on Protective Measures for New Buildings’ indicates the site to be in an area where no radon protection measures are required.

Map 17 of the Indicative Atlas of Radon in England and Wales and Map 17 of BRE 211 ‘Guidance on Protective Measures for New Buildings’ contains information on the region in which the site is located and are presented in Appendix 7.

8.0 CONCLUSIONS

8.1 General

As a result of undertaking a walkover survey of the site and reviewing the documented historical activities, it is concluded that the site is at moderate to high risk of land contamination including ground gas and moderate risk of potential geotechnical discontinuities resulting from previous site uses that could affect the proposed development.

Proposed Development

As stated in section 2.1 of this report, “The Sharp Project 3” is the proposed redevelopment of the former Fujitsu works complex in Gorton to create a Drama Hub. The proposal is for the re-use of the existing computer hall, demolition of existing office space to the east of the computer hall building and demolition of ancillary workshops to create office accommodation, ancillary film production and new build prop storage / workshops maintaining the existing Use Class – B1 Business Use. The internal re-arrangement of the computer hall and construction of new prop store, security cabin and reception will provide 13000 sqm and will involve some alterations to the external works and site access. The site is owned and will be managed by Manchester City Council through ‘The Sharp Project’ and individual office and production stages will be tenanted.

Proposed development plans are contained within Appendix 8.

8.2 Geology

On the basis of the desk study information obtained, it is anticipated that the site is underlain by made ground deposits, which may be significant in localised areas due to the presence of historical infilled reservoirs and the previous site usage underlain by stiff glacial till which is in turn underlain by bedrock at a depth of approximately 10m below ground level.

The made ground deposits are of unknown thicknesses and constituents and will be present across the site as a result of historic industrial, excavation and re-profiling works. Furthermore, if development is to span the historic reservoir it is recommended that intrusive works are undertaken to identify the extent, depth and constituents (both solid and liquid) of this subsurface feature.

It is envisaged due to the significant historical site usage that subsurface features, including former foundations and floor slabs, may be present. It is recommended that intrusive investigation works are undertaken to investigate whether any significant obstructions are present which may result in notable issues during construction.

Based on our assessment of the Coal Authority report and the relevant BGS geological map, we would categorise the risk posed by previous mining activities with respect to the proposed development as low.

In order to confirm the presence and composition of the suspected made ground deposits and to determine the ground conditions with a greater degree of certainty and allow design of the proposed building foundations, drainage, services and external areas to be undertaken, it is recommended that intrusive investigation is undertaken at the site – as detailed in Section 8.10.

8.3 Contaminated Land Legislative Framework

The assessment of contaminated soils is carried out within the current legal framework, which is based upon the Environmental Protection Act Part 2A and current national planning guidelines. Under this framework, the potential contamination of a proposed development site is a material planning consideration. In addition, land that is deemed harmful to human health or has the potential to pollute waters can be designated as contaminated land and appropriate remediation can be enforced by the Local Authority.

Following the “Way Forward” report undertaken by Department for Environment, Food and Rural Affairs (DEFRA) a new approach to land contamination was issued by DEFRA and the Environment Agency (EA). Two documents have been produced which supersede the previous Contaminated Land Reports (CLR) 7 – 10. The two

reports are ‘Human health toxicological assessment of contaminants in soil’ (formerly CLR 9) and ‘Updated technical background to the CLEA model’ (formerly CLR 10) and other supporting documentation including revised toxicological reports.

Broadly, the approach consists of preparation of conceptual models to illustrate how potential contamination (source) can reach (through a pathway) humans or receptors (targets).

As a result of these conceptual models, each of which are site specific, a risk analysis can be carried out to determine the frequency of testing to establish levels of source contamination, possible mobility of those contaminants and the potential hazards those mobilised contaminants could cause to human receptors.

In addition to direct human receptors, water courses, aquifers and agricultural resources must be considered as these are potential indirect pathways to humans.

The government is part way through the publication of a number of updated toxicological reports and associated updated Soil Guideline Values which give guidance on acceptable soil contamination for a limited number of contaminants and further authoritative guidance on the toxicity of other contaminants for risk assessment purposes.

As of March 2009, updated toxicological reports and revised Soil Guideline Values have been published for the following determinands:

- Arsenic
- Nickel
- Selenium
- Benzene
- Toluene
- Ethylbenzene
- Mercury (elemental, methyl and inorganic)
- Xylene (O, M and P)
- Cadmium
- Phenol
- Dioxins, furans etc.

Where no updated toxicological reports or Soil Guideline Values are available, the existing toxicological reports and associated Soil Guideline Values will naturally be used to classify the risk and toxicity posed by the selected determinands. The previous SGV for lead was utilised in the generic assessment criteria as lead is a special case as the former SGV was not based on the CLEA model but equations utilising blood lead concentrations. There is currently no guidance on how to risk assess lead but it is understood that a new methodology is being formulated which will allow the use of CLEA. Consequently, the former SGV for lead has been retained by Integra until this has been clarified.

In addition, where updated Soil Guideline Values and/or toxicological reports are not available, guidance is available from the Environment Agency on acceptable methods of assessing human health risks utilising recognised methodology developed in the UK and abroad. The means available to assess human health risks and to be utilised on this site are as follows:

Assessment	**Means**
Production of conceptual models	Human health toxicological assessment of contaminants in soil and Contaminated Land Report 11
Scope of contamination testing	Human health toxicological assessment of contaminants in soil (2009) and DEFRA Industry Profiles
Contamination sampling rates	Contaminated Land Report 4
Laboratory testing	MCERTS Accreditation
Acceptable contamination levels for Arsenic, Nickel, Mercury, Selenium, Ethylbenzene, Toluene, Benzene, Cadmium, Phenol and Xylenes	Updated Published Soil Guideline Value Reports (March 2009 onwards)
Acceptable contamination levels for Chromium and Lead.	Current Published Soil Guideline Value Reports (2002 – 2004)
Acceptable levels for other contaminants except cyanide and except where the conceptual model includes dermal absorption	LQM CIEH (2nd Edition 2009) / CL:AIRE (GAC January 2010)
Acceptable contamination levels for cyanide and where the conceptual model includes dermal absorption	Updated technical background to the CLEA model
Assessment of Total Petroleum Hydrocarbons within the above framework as adopted by the Environment Agency	Total Petroleum Hydrocarbon Criteria Working Group and updated technical background to the CLEA model
Acceptable contamination levels for selected aqueous determinands	River Basin Management Plan, Environmental Quality Standards (EQS) and UK Drinking Water Standards (UK DWS)

8.4 Sources of Contamination and Probable Contaminants

Evidence obtained from the historical Ordnance Survey maps and the secondary information indicates that the site has historically been occupied by numerous industries including bleach, dye, iron and chemical works up until the early to mid Twentieth Century subsequently utilised as an Electrical Engineering Works (Fujitsu) and office buildings until the present day.

Summary

The principal potential contaminative sources which could affect the site include:

- On site contamination arising from the historic bleach, dye and iron works site usage.
- Associated made ground deposits across the site from unknown sources including former on and off site chimneys and the onsite infilled reservoir
- Associated hydrocarbon storage and potential spillage / leakage across the site
- Contamination from historic chemical and bleach works located abutting the northern and eastern site boundary

Despite further potential contaminative sources being identified off site, the above contaminative sources have been identified as the principal contaminative sources, on the basis of their proximity and significance which are likely to have resulted in the most significant potential detrimental effect to the site.

As a result of the age of deposition of contamination associated with the former bleach, dye and iron works it is suspected that if contamination of volatile substances were present within the ground that these are likely to have volatilised or, if a pathway exists migrated off site.

The walkover survey indicated that there was no extensive use or storage of hydrocarbons for fuel or heating as the entire site was served by existing gas mains. No present day contaminative sources were identified on site.

In consideration of the above and the guidance contained in the appropriate DEFRA industry profile and good engineering practice, it is therefore proposed to test for the following contaminants on the site:

Sulphate, boron, arsenic, barium, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium, zinc, nitrate, sulphide, cyanide, pH and sulphur, phenols, benzene, toluene ethylbenzene, xylenes, Total Petroleum Hydrocarbon screen followed by Speciated Aliphatic and Aromatic Total Petroleum Hydrocarbon Fractions (TPHCWG) where applicable, Speciated Polyaromatic Hydrocarbons, and Volatile and Semi Volatile Organic Compounds.

Asbestos testing would also be undertaken within any made ground encountered on site.

8.5 Pathways for Contamination

Waters

The desk study indicated that the site is directly underlain by a Secondary A (minor) aquifer located in the bedrock below the site. Furthermore, it is envisaged that made ground deposits of unknown thicknesses and constituents will be present across the site due to historic excavation, infilling, waste disposal and re-profiling works underlain by low permeable glacial till deposits to a depth of approximately 10m.

Consequently, it is envisaged at this stage that any identified contamination will be negated from migrating vertically into the underlying aquifer due to the presence of the low permeability glacial till deposits. However, at this stage it is unknown whether shallow groundwater / perched water is present located upon / within the glacial till which may create a lateral pathway into the adjacent surface water feature (where unculverted) – Corn Brook.

It is unknown whether existing drainage is present beneath the site which may discharge into the culverted surface water course (Corn Brook) located abutting the northern site boundary. This potential drainage may be acting as a conduit / pathway for contaminated liquid to discharge into the watercourse with nominal diffusion and attenuation.

Presently, there is limited site specific information with regard to the underlying ground conditions. Consequently, detailed appraisal of potential site pathways should be undertaken following completion of the proposed intrusive site investigation works.

It should be noted that the infiltration pathway from precipitation and / or surface water is likely to be negated for the majority of the current site and the proposed site area due to the impermeable hard landscaped nature. Consequently, it is envisaged that non-mobile contamination located within the unsaturated zone beneath the site will have a nominal influence on the controlled waters receptors.

Site Occupants

The pathways along which contamination could potentially reach the targets on site during use and after completion of development works are detailed in 'Updated Technical Background to the CLEA Model' (Environment Agency 2009) and can be summarised as follows:

a) *Ingestion of soil directly and indoor dust* *[1]*[2]
b) Inhalation of soil dust (indoor and outdoor)
c) *Dermal contact with soil (indoor and outdoor)* *[2]
d) Inhalation of soil vapours (indoor and outdoor)
e) *Oral background*[2]
f) Inhalation background

*[1] *Treated as one pathway*

*[2] *Pathway negligible for current / proposed on site occupants and only considered representative for site workers and in proposed minor areas of soft landscaping*

The exposure pathways (dermal, oral background and indirect / direct ingestion) for the identified contaminative sources are effectively eliminated through the hard landscaped nature of the site, negating any direct or indirect contact between any contamination and the current / proposed site occupants. However, the dermal, oral and ingestion exposure pathways are still present for ground workers, service pipes (permeation) and within the proposed minor areas of soft landscaping. Accordingly,

these exposure pathways have been included within the site conceptual model but are not considered to be significant. The aforementioned pathways can be negated, hence removed from the site conceptual model if appropriate Personal Protective Equipment (PPE) is utilised by ground workers and appropriate service pipes are utilised. These exposure pathways are not deemed to be significant for the areas of proposed public open space.

8.6 Targets of Contamination

Targets for these pathways include the following:

a) Construction workers
b) The general public
c) Groundwater contained within Secondary A aquifer overlain by unproductive low permeability deposits
d) Surface water features (Corn Brook)
e) Subsurface plastic e.g. potable plastic water pipe
f) Building fabric e.g. concrete foundations etc

8.7 Conceptual Model for Human Health Risk Assessment

The desk study has identified numerous potential contaminative sources and proposed human health receptors. However, the exposure pathways (dermal and indirect / direct ingestion) for the identified contaminative sources are effectively eliminated through the hard landscaped nature of the proposed site, negating any direct or indirect contact between any contamination and the current / proposed site occupants.

It should however be noted that the dermal and indirect / direct ingestion pathways for contamination are still present for the anticipated ground workers, service pipes (permeation) and within the small areas of soft landscaping throughout site. Accordingly, the aforementioned pathways have been included within the site conceptual model. These pathways can however be negated and removed from the site conceptual model if appropriate Personal Protective Equipment (PPE) is worn by site workers and pertinent service pipes are utilised. Furthermore, these

exposure pathways are not determined to be significant for the areas of proposed public open space.

It is considered that a low to moderate risk to human health is present from the inhalation exposure pathway(soil vapour) posed by the potential on site VOC's from historic site bleach, dye and iron works usage and migratory contamination from the historic chemical works and bleach works. It should be noted that the source of VOC's from the historic on and off site sources are likely to be lower risk due to the volatility and age of the potential contamination deposition.

A site conceptual model in the form of a linkage table for the purposes of a preliminary risk assessment for the human health gas risk of site occupants has been produced as a result of the probable contaminants, pathways and targets identified in sections 8.4, 8.5 and 8.6 above:

CONTAMINANT	PATHWAY	RECEPTOR
Arsenic Barium Chromium total / $^{5+}$ Vanadium Beryllium Cadmium Copper Lead Nickel Zinc Boron Selenium Mercury Cyanide	Ingestion of contaminated soil and dust (indoor and outdoor)	Construction worker
	Dermal contact with contaminated soil (outdoor and indoor)	Construction worker
	Inhalation of contaminated dust (indoor and outdoor)	Construction worker
Sulphate Cyanide	Direct contact with building fabric	Fabric of buildings on and off site
pH	Direct contact with building fabric	Fabric of buildings on and off site

Volatile Organic Compounds Semi Volatile Organic Compounds Total Petroleum Hydrocarbons Polycyclic Aromatic Hydrocarbons Phenols Benzene Toluene Ethylbenzene Xylenes	Inhalation of contaminated dust (indoor and outdoor)	Human occupants & construction workers
	Dermal contact with contaminated soil (outdoor and indoor)	Construction workers
	Inhalation of soil vapours (indoors and outdoors)	Construction workers
	Permeation	Subterranean plastic service pipes
Asbestos	Inhalation of contaminated dust (indoor and outdoor)	Construction workers

8.7.1 Conceptual Model for Ground Gas Risk Assessment

The site and adjacent off site areas contain potential ground gas sources in the form of:

- Made ground deposits (unknown constituents and quantity)
- Infilled reservoir located on site (unknown constituents and quantity)
- Residual hydrocarbon vapours from historic site usage
- Numerous infilled ground / localised refuse tip (110m east) and made ground within 250m of the site
- Organic sediments associated with surface water course

It should be noted that there are no recorded historic landfills, registered contemporary landfills or registered waste treatment or disposal sites within 250m of the site.

Source	Pollutant	Pathways	Receptors	Risk
Potential made ground deposits and infilled reservoir (unknown constituents and quantity)	Methane / Carbon dioxide / Hydrogen Sulphide	Ingress and accumulation Migration, ingress and accumulation Inhalation of vapours	Human occupant Building and Structures Site Workers	Moderate
Residual hydrocarbon vapours from hydrocarbon contamination from historic site usage	Methane / VOC's			Low / Moderate
Off site infilled ground and refuse tip (110m east)	Methane / Carbon dioxide / Hydrogen Sulphide			Low
Organic sediments associated with surface water course	Carbon dioxide			Very Low

Utilising the guidance stipulated in CIRIA 665 (2007) and CIRIA 552 (2001), the probability and consequence of the identified potential ground gas sources at the development is considered to result in a **low to moderate** level of risk.

If any previously unrecorded potential ground gas sources are recorded during the site investigation works, for instance organic soils (peat), then further appropriate ground gas monitoring will naturally be undertaken.

8.8 Conceptual Model for Waters Risk Assessment

The site is underlain by Secondary A (minor) aquifer, potentially overlain by made ground deposits of an unknown nature which are in turn underlain by low permeability superficial deposits (glacial till) to a depth of approximately 10m.

Furthermore Corn Brook surface water course and culverted watercourse is located abutting the northern site boundary.

The potential contaminative sources identified on site are namely the historic site usages such as a former dye, bleach, chemical and iron works and made ground deposits of an unknown nature.

As discussed in section 8.5, it is considered that any identified contamination will be able to migrate laterally into the surface water course located 150m on the northern site boundary via unknown perched water. The vertical migration pathway into the

underlying aquifer is not regarded as significant due to the considerable anticipated low permeability glacial till deposits which will mitigate the migration of any potential contaminants.

However, it should be noted that the infiltration pathway from precipitation and / or surface water is likely to be negated for the majority of the current site and the proposed site due to the impermeable hard landscaped nature of the site(s). Consequently, it is envisaged that, for non-mobile contamination located within the unsaturated zone beneath the areas of hardstanding, significant migration is unlikely to have occurred.

Proposed Site Investigation Works

To establish whether or not contaminative determinands are present on site (forming a risk to controlled waters), it is proposed that solid contamination testing of the made ground along with chemical testing of the underlying perched water (if present) is undertaken. Furthermore, depending on the findings of the aforementioned solid and perched water chemical testing, it may be prudent to undertaken chemical testing of the underlying aquifer and adjacent Corn Brook to appraise the influence of the any identified contamination.

As part of the site investigation works, an assessment of the underlying low permeability superficial deposits will be undertaken together with hydraulic gradients of any ground water present to establish the hydrogeological regime beneath the site e.g. establish whether hydraulic continuity between any perched water and Corn Brook is present or whether existing drainage is providing a potential contaminative pathway.

A conceptual model in the form of a linkage table for the purposes of a preliminary risk assessment for pollution of waters has been produced as a result of the probable contaminants, pathways and targets identified in sections 8.4, 8.5 and 8.6 above as follows.

CONTAMINANT	PATHWAY	RECEPTOR
Arsenic Barium Chromium Vanadium Beryllium Cadmium Copper Lead Nickel Zinc Boron Selenium Mercury Cyanide Volatile Organic Compounds Total Petroleum Hydrocarbons Polycyclic Aromatic Hydrocarbons Phenols Benzene Toluene Ethylbenzene Xylenes	Migration through ground vertically into groundwater – *low risk*	Groundwater within Secondary A aquifer Discharges from groundwater, e.g. springs and rivers
	Migration through ground laterally into shallow perched water	Corn Brook Unknown Perched Water Aquatic organisms
Sulphate pH	Migration through ground vertically into groundwater	Groundwater within Secondary A aquifer Discharges from groundwater, e.g. springs and rivers

8.9 Preliminary Risk Assessment Summary

Human Health

There is a **low to moderate** potential risk to human health including ground gas due to potential contamination associated with the previous historical site uses, the unknown nature of the made ground deposits and the numerous potential ground gas sources located on and adjacent to the site.

Waters / Groundwater

There is a **moderate** potential risk to controlled waters due to historical site uses and the unknown nature of the made ground material across the site. If significant contamination concentrations are recorded then the risk to potential controlled waters will be increased due to the sensitive receptors and anticipated pathways.

8.10 Scope of Phase 2 Intrusive Geo-Environmental Ground Investigation

As a result of the preliminary risk assessment, a Phase 2 intrusive environmental ground investigation should be carried out to determine the ground conditions beneath the site and to determine the concentrations of probable contaminants in the ground and groundwater. This investigation should include the installation of exploratory holes across the site. Samples of soil and groundwater should be collected and an MCERTS accredited laboratory should undertake chemical composition tests to determine contamination levels.

On this basis site investigation works will be required across targeted areas of site, in particular the area in which the existing ground is broken to construct the new development. These works will comprise of:

- Exploratory holes consisting of 150mm diameter shell and auger boreholes and potentially window samples / trial pits where suitable in line with recommendations of 9.2.
- Insitu geotechnical testing e.g. Standard Penetration Tests (CPT's / SPT's) in solid / granular material
- Ex-situ geotechnical testing e.g. undisturbed samples for triaxial testing (cohesive material), moisture content, moisture condition values (m_{cv}'s)
- Chemical testing (water soluble sulphates and pH)

- Environmental chemical testing of solid and water samples – see sections 8.7 and 8.8
- Gas and ground depth monitoring of boreholes

9.0 RECOMMENDATIONS

9.1 There is a **low to moderate** potential risk to human health including ground gas and a **moderate** risk to controlled waters due to potential contamination associated with the previous historical site uses, the unknown nature of the made ground deposits and the numerous potential ground gas sources located on and adjacent to the site – as detailed within the representative conceptual models. Consequently, a Phase 2 environmental intrusive investigation is deemed necessary including appropriate chemical testing of site materials and waters with groundwater / ground gas monitoring.

9.2 On the basis of the desk study information obtained, it is anticipated that the site is underlain by made ground deposits, which may be significant in localised areas due to the presence of historical infilled reservoirs, underlain by stiff glacial till which is in turn underlain by bedrock at a depth of approximately 10m below ground level. The made ground deposits are of unknown thicknesses and constituents and will be present across the site as a result of historic industrial, excavation and re-profiling works. Due to geotechnical requirements, site investigation works should be undertaken across the area of the site where development works are to be undertaken i.e. eastern section of the former Fujitsu factory including sufficient exploratory holes and associated geotechnical laboratory tests to establish the actual ground conditions at the site in order that designs for foundations / roads and underground drainage can be undertaken. Suspected subsurface features such as infilled reservoirs, historic foundations and ground slabs may be present beneath the site and will require investigation utilising trial pits in close proximity to the proposed development, where appropatie.

9.3 Based on our assessment of the Coal Authority report and the relevant BGS geological map, we would categorise the risk posed by previous mining activities with respect to the proposed development as low.

9.4 On this basis site investigation works will be required across targeted areas of site, in particular the area in which the existing ground is broken to construct the new development. These works will comprise of:

- Exploratory holes consisting of 150mm diameter shell and auger boreholes and potentially window samples / trial pits where suitable in line with recommendations of 9.2.
- Insitu geotechnical testing e.g. Standard Penetration Tests (CPT's / SPT's) in solid / granular material
- Ex-situ geotechnical testing e.g. undisturbed samples for triaxial testing (cohesive material), moisture content, moisture condition values (m_{cv}'s)
- Chemical testing (water soluble sulphates and pH)
- Environmental chemical testing – see section 8.7 and 8.8
- Gas and groundwater depth monitoring of boreholes

9.5 From the results of the Phase 2 work, a Phase 3 numerical risk assessment report may be required and the conceptual models refined accordingly.

9.6 In the event that elevated concentrations of contaminants are detected on site, numerical risk assessments should be undertaken using approved conceptual models.

9.7 The scope of physical site remediation works to remove soils and groundwater that are contaminated to an unacceptable level should be determined and appropriate recommendations summarised in the Phase 3 report.

9.8 From the results of the geotechnical intrusive works, the type of foundation construction and associated capacities can be calculated and the type of highway and drainage constructions can be established.

9.9 It should be noted that, if any visual or olfactory evidence of contamination is encountered during remediation or construction work, then the Local Authority Environmental Health Officer and Environment Agency should be contacted immediately in order to agree any necessary remediation measures.

APPENDIX 1

SITE LOCATION PLANS AND AERIAL PHOTOGRAPH


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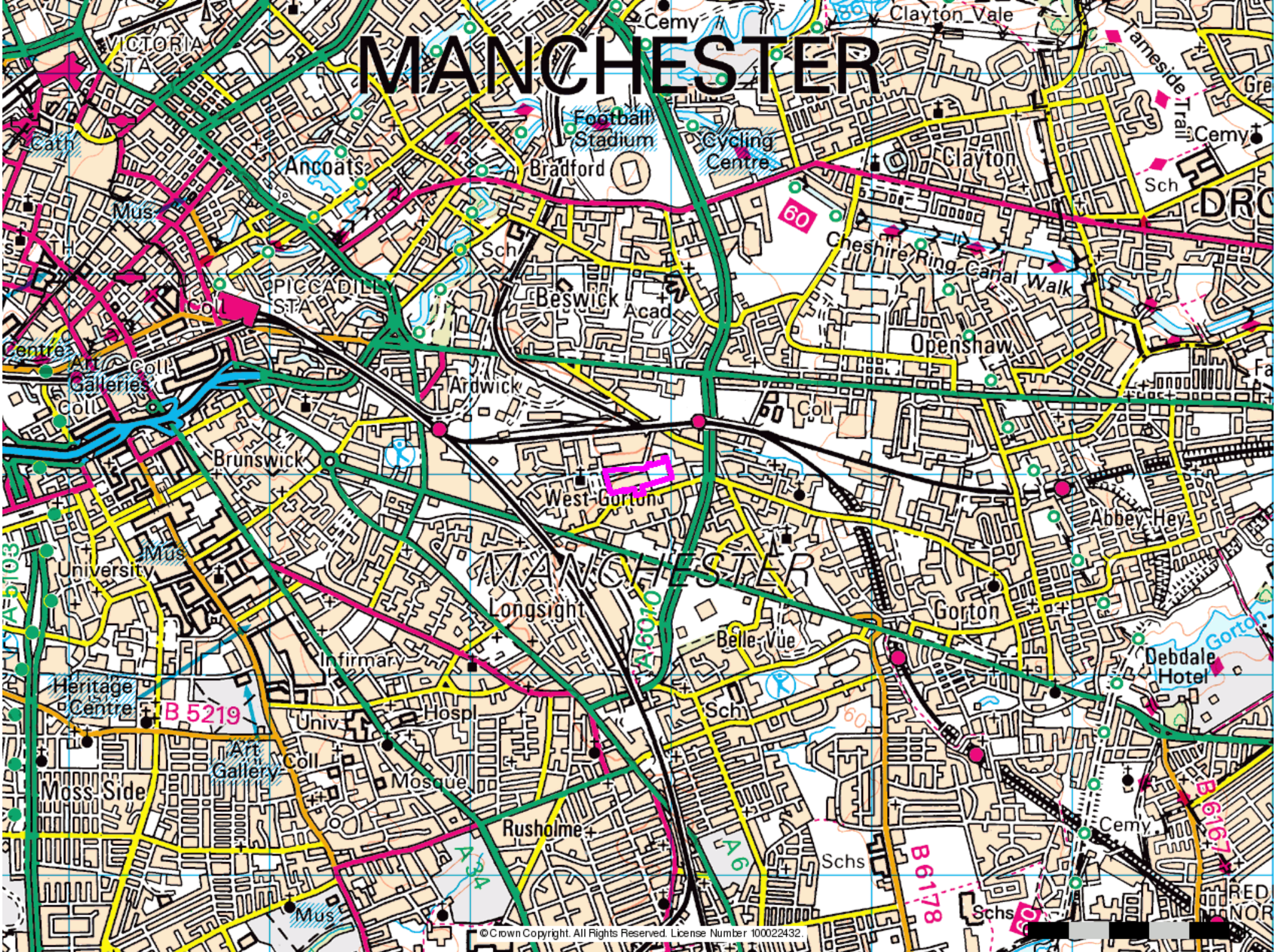

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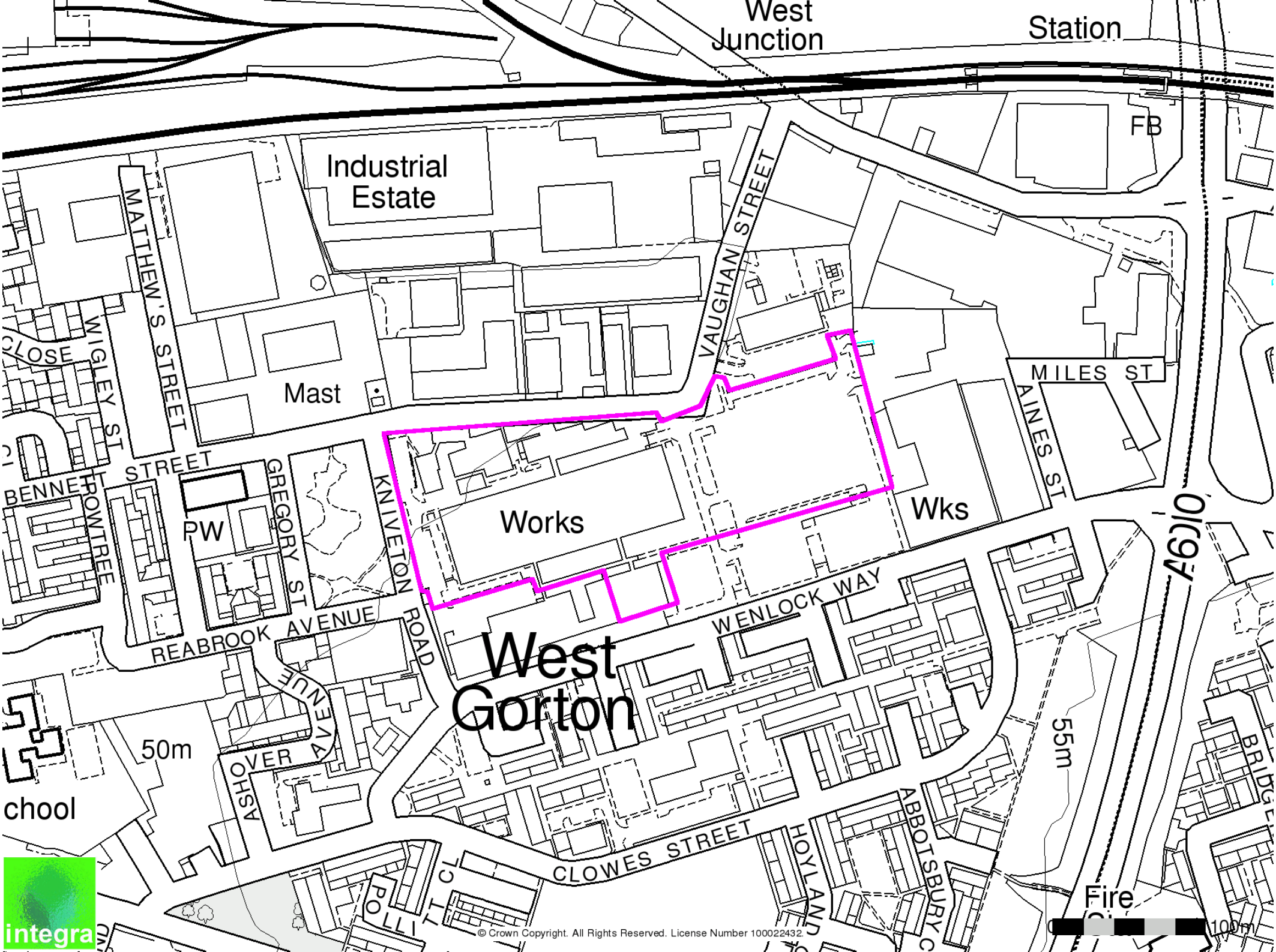
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AINES ST
BENNETT STREET
TROWTREE
PW
GREGORY ST
KNIVETON ROAD
Works
Wks
WENLOCK WAY
REABROOK AVENUE
West
Gorton
ASHOVER AVENUE
50m
55m
chool
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APPENDIX 2

WALK OVER SURVEY PHOTOGRAPHS



Plate 1: shows the eastern section of the former Fujitsu factory which is due to be demolished to ground slab level with the subsequent construction of the proposed development utilising the existing ground slab.



Plate 2: shows the area where the former on site reservoir would have existed. No evidence of ground instability was present across the buildings or external areas.



Plate 3: shows the demolition works of the buildings along the northern section of the site.



Plate 4: shows the typical internal site usage within the former Fujitsu buildings.



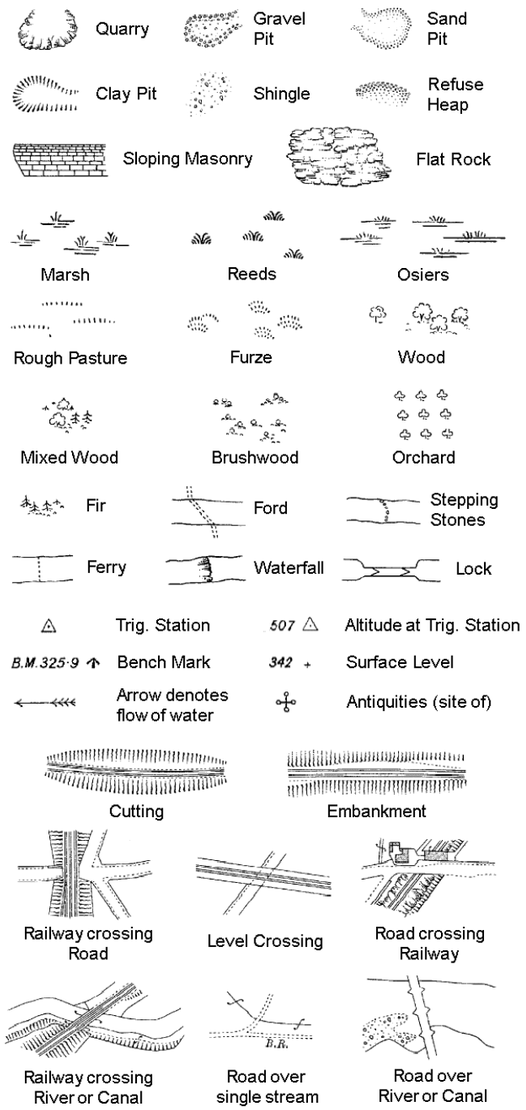
Plate 5 : shows the typical internal site usage within the office section of the former Fujitsu buildings.

APPENDIX 3

HISTORICAL ORDNANCE SURVEY MAPS

Historical Mapping Legends

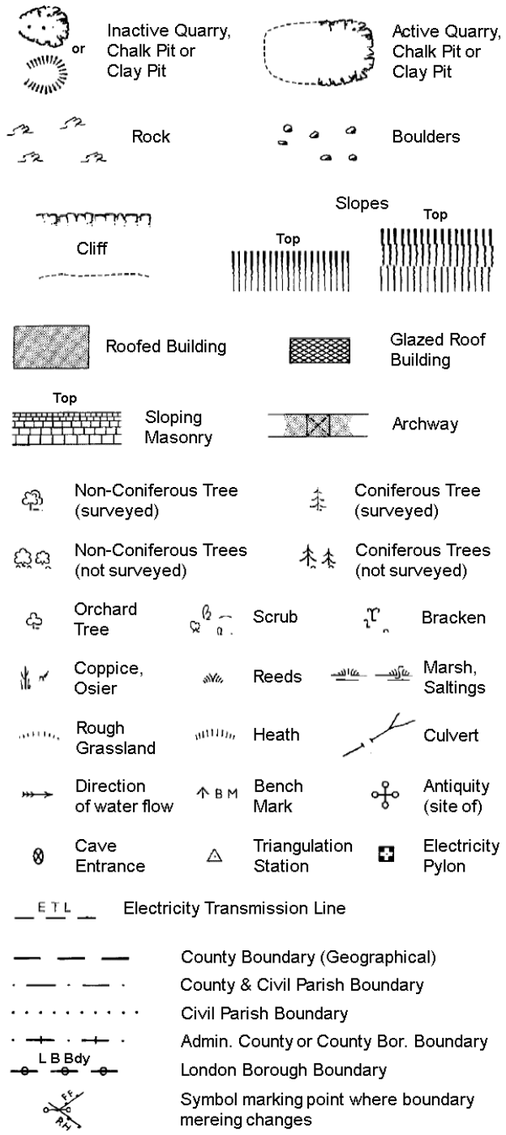
Ordnance Survey County Series and Ordnance Survey Plan 1:2,500



County Boundary (Geographical)
County & Civil Parish Boundary
Administrative County & Civil Parish Boundary
Co. Boro. Bdy.
County Borough Boundary (England)
Co. Burgh Bdy.
County Burgh Boundary (Scotland)

B P B S	Boundary Post or Stone	P.C.B	Police Call Box
B.R.	Bridle Road	P	Pump
E.P	Electricity Pylon	S.P	Signal Post
F.B.	Foot Bridge	St.	Sluice
F.P.	Foot Path	Sp.	Spring
G.P	Guide Post or Board	T.C.B	Telephone Call Box
M.S	Mile Stone	Tr.	Trough
M.P M.R	Mooring Post or Ring	W	Well

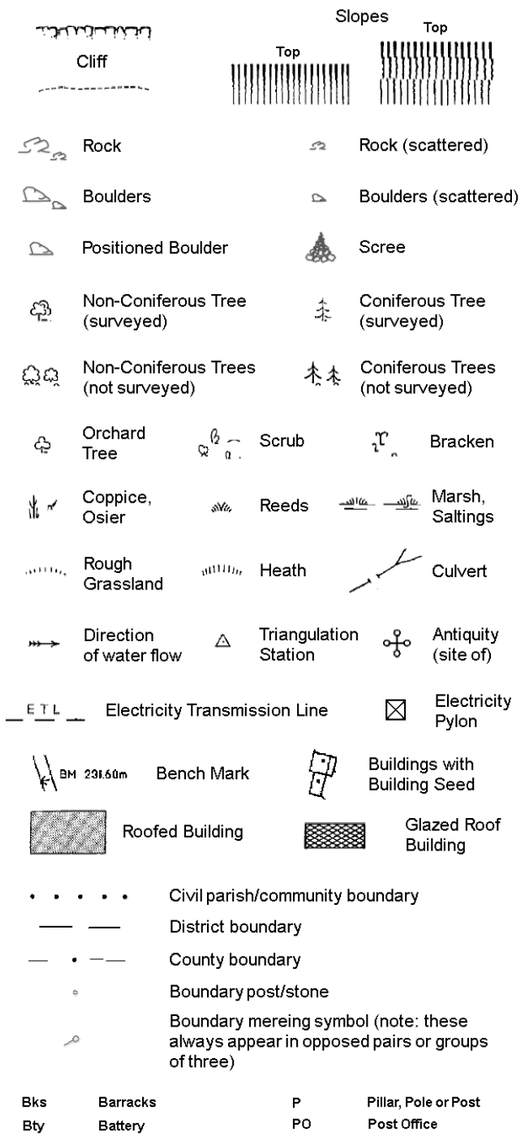
Ordnance Survey Plan, Additional SIMs and Supply of Unpublished Survey Information 1:2,500 and 1:1,250



County Boundary (Geographical)
County & Civil Parish Boundary
Civil Parish Boundary
Admin. County or County Bor. Boundary
L B Bdy
London Borough Boundary
Symbol marking point where boundary mereing changes

BH	Beer House	P	Pillar, Pole or Post
BP, BS	Boundary Post or Stone	PO	Post Office
Cn, C	Capstan, Crane	PC	Public Convenience
Chy	Chimney	PH	Public House
D Fn	Drinking Fountain	Pp	Pump
El P	Electricity Pillar or Post	SB, S Br	Signal Box or Bridge
FAP	Fire Alarm Pillar	SP, SL	Signal Post or Light
FB	Foot Bridge	Spr	Spring
GP	Guide Post	Tk	Tank or Track
H	Hydrant or Hydraulic	TCB	Telephone Call Box
LC	Level Crossing	TCP	Telephone Call Post
MH	Manhole	Tr	Trough
MP	Mile Post or Mooring Post	Wr Pt, Wr T	Water Point, Water Tap
MS	Mile Stone	W	Well
NTL	Normal Tidal Limit	Wd Pp	Wind Pump

Large-Scale National Grid Data 1:2,500 and 1:1,250



Civil parish/community boundary
District boundary
County boundary
Boundary post/stone
Boundary mereing symbol (note: these always appear in opposed pairs or groups of three)

Bks	Barracks	P	Pillar, Pole or Post
Bty	Battery	PO	Post Office
Cemy	Cemetery	PC	Public Convenience
Chy	Chimney	Pp	Pump
Cis	Cistern	Ppg Sta	Pumping Station
Dismtd Rly	Dismantled Railway	PW	Place of Worship
El Gen Sta	Electricity Generating Station	Sewage Ppg Sta	Sewage Pumping Station
El P	Electricity Pole, Pillar	SB, S Br	Signal Box or Bridge
El Sub Sta	Electricity Sub Station	SP, SL	Signal Post or Light
FB	Filter Bed	Spr	Spring
Fn / D Fn	Fountain / Drinking Ftn.	Tk	Tank or Track
Gas Gov	Gas Valve Compound	Tr	Trough
GVC	Gas Governer	Wd Pp	Wind Pump
GP	Guide Post	Wr Pt, Wr T	Water Point, Water Tap
MH	Manhole	Wks	Works (building or area)
MP, MS	Mile Post or Mile Stone	W	Well

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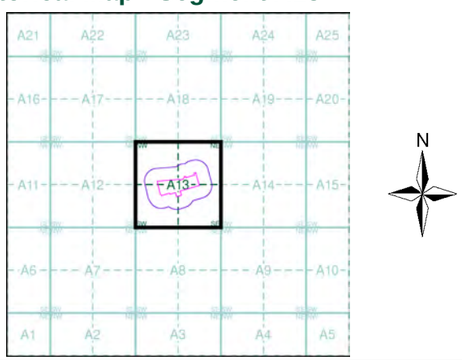
Historical Mapping & Photography included:

Mapping Type	Scale	Date	Pg
Lancashire And Furness	1:2,500	1893	2
Lancashire And Furness	1:2,500	1908	3
Lancashire And Furness	1:2,500	1922	4
Ordnance Survey Plan	1:1,250	1948 - 1950	5
Ordnance Survey Plan	1:2,500	1950 - 1951	6
Ordnance Survey Plan	1:1,250	1953 - 1979	7
Ordnance Survey Plan	1:2,500	1964 - 1967	8
Ordnance Survey Plan	1:1,250	1975 - 1990	9
Supply of Unpublished Survey Information	1:1,250	1975 - 1976	10
Additional SIMs	1:1,250	1977 - 1991	11
Additional SIMs	1:1,250	1985 - 1992	12
Large-Scale National Grid Data	1:1,250	1992	13
Additional SIMs	1:1,250	1992	14
Large-Scale National Grid Data	1:1,250	1993 - 1995	15
Large-Scale National Grid Data	1:1,250	1993 - 1996	16
Large-Scale National Grid Data	1:1,250	1994 - 1996	17
Large-Scale National Grid Data	1:1,250	1995 - 1997	18
Large-Scale National Grid Data	1:1,250	1997	19

Historical Map - Segment A13



Order Details

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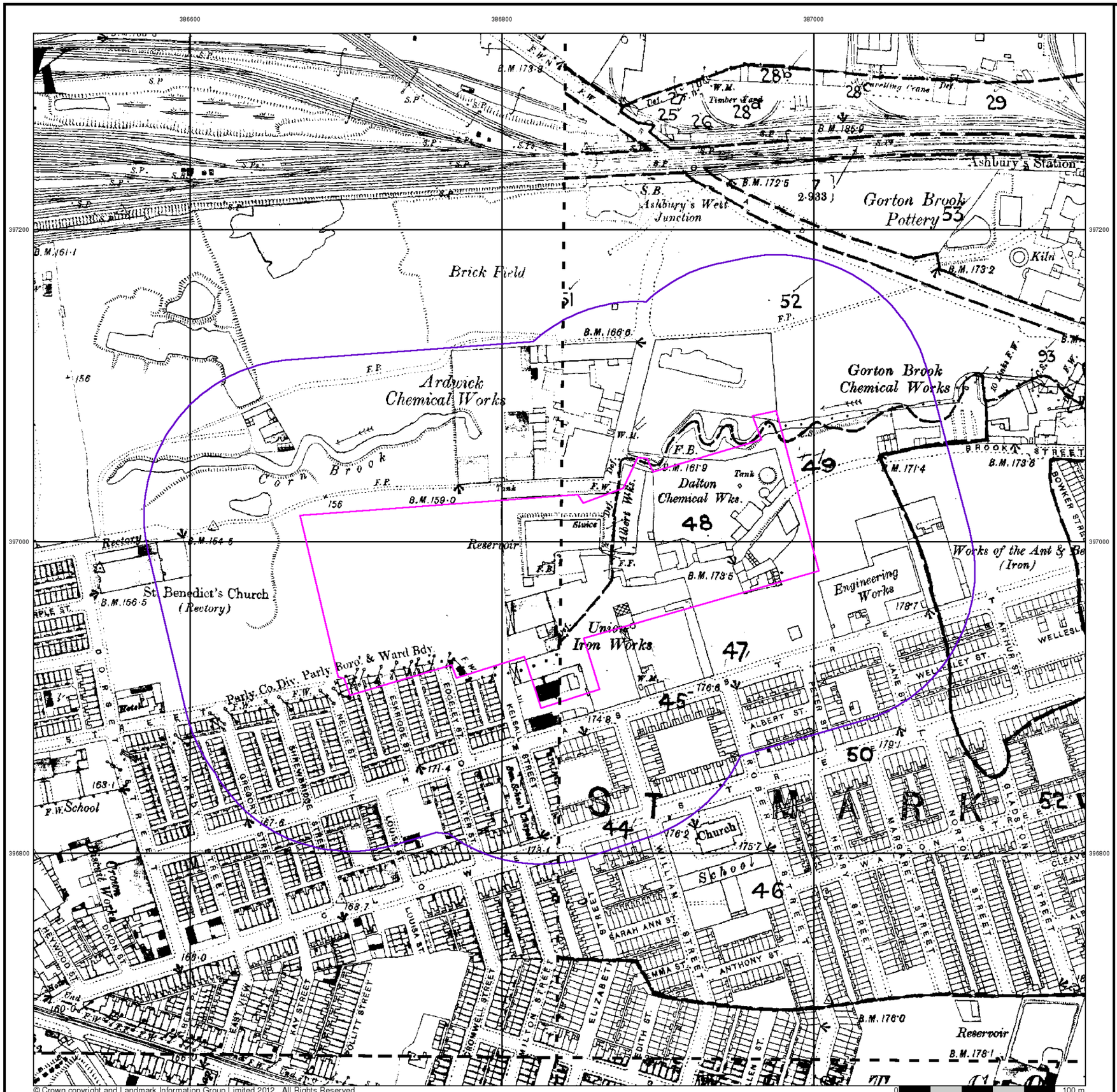
Customer Ref:	2692
National Grid Reference:	386840, 396990
Slice:	A
Site Area (Ha):	3.27
Search Buffer (m):	100

Site Details

Site at, Gorton, Manchester

Landmark Information Group

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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Lancashire And Furness

Published 1893

Source map scale - 1:2,500

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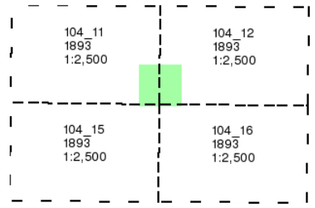
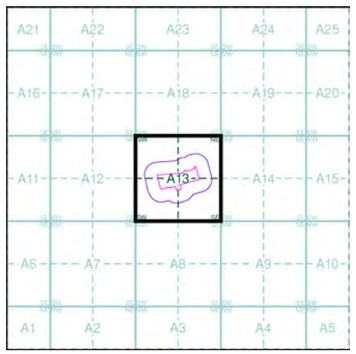
Map Name(s) and Date(s)



Historical Map - Segment A13



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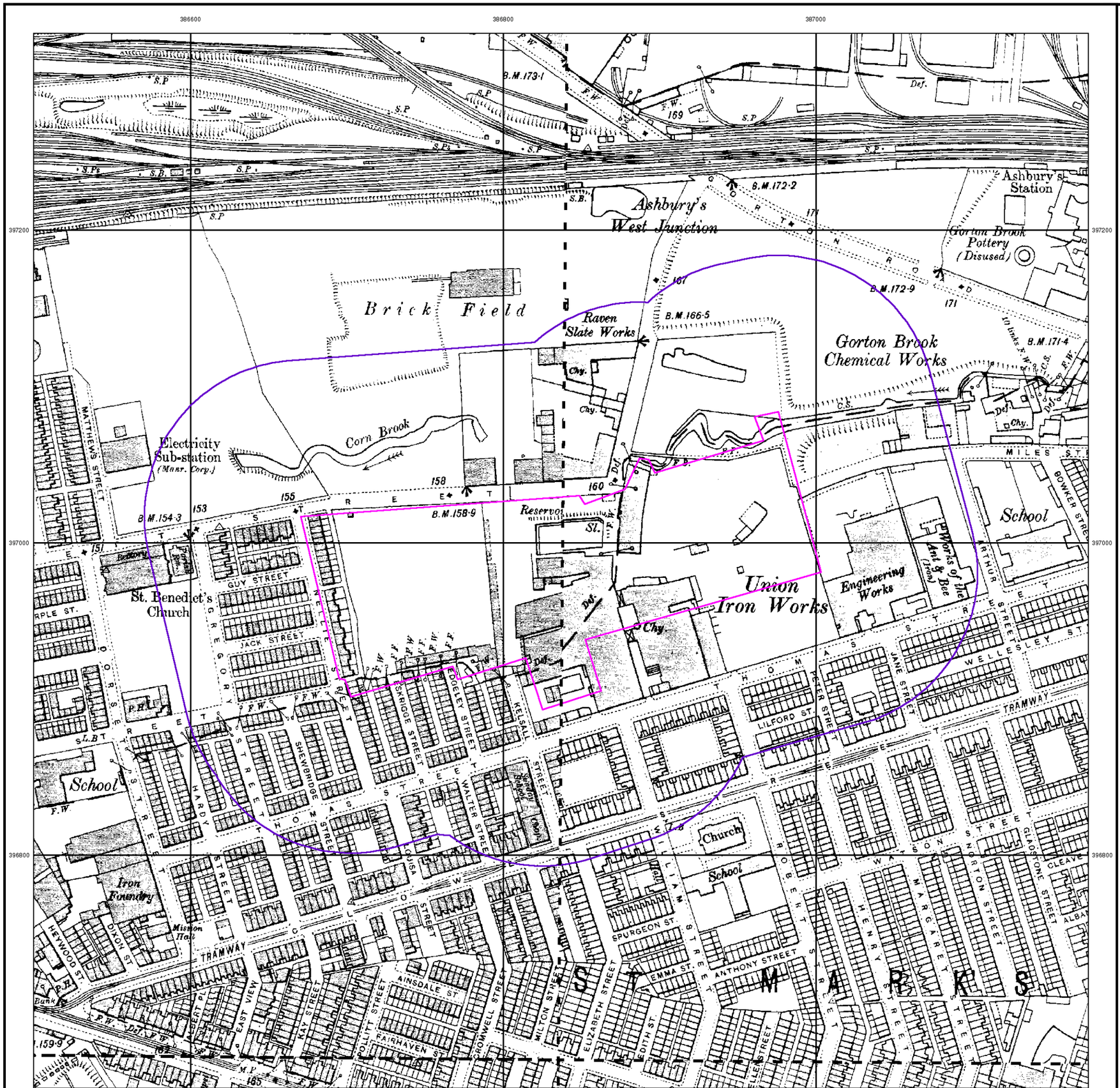

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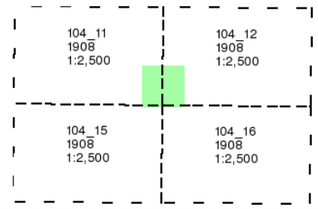
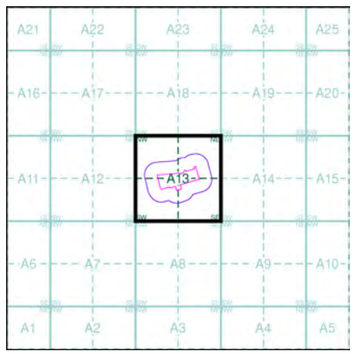


Historical Map - Segment A13



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Customer Ref:	2692
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Slice:	A
Site Area (Ha):	3.27
Search Buffer (m):	100

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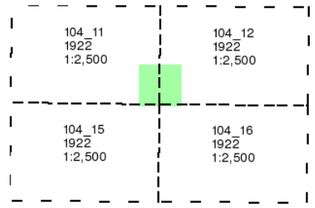
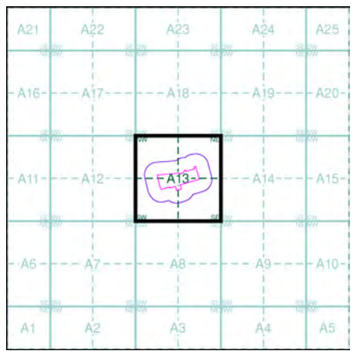
Map Name(s) and Date(s)



Historical Map - Segment A13



Order Details

Order Number:	44476818_1_1
Customer Ref:	2692
National Grid Reference:	386840, 396990
Slice:	A
Site Area (Ha):	3.27
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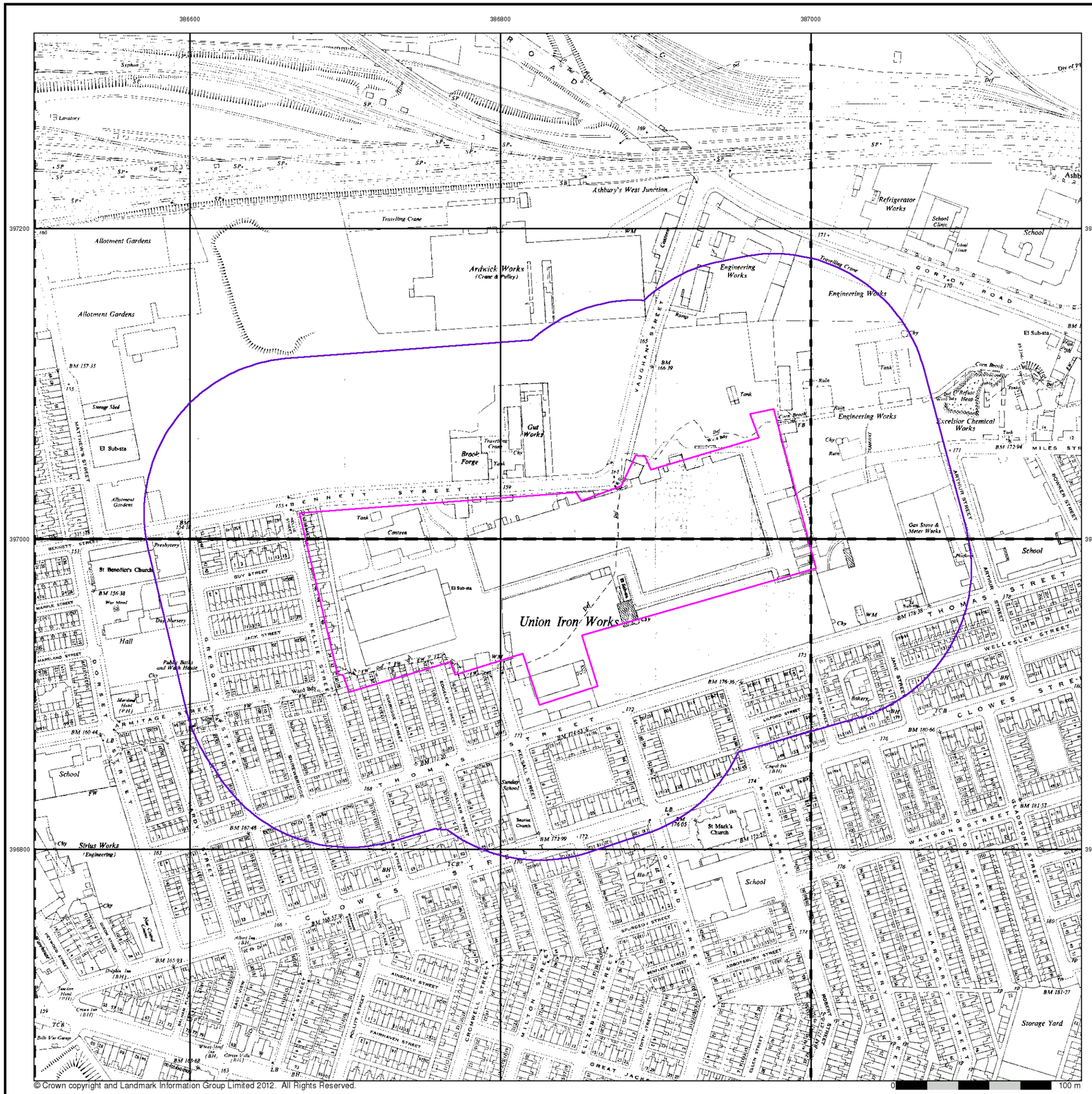

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Ordnance Survey Plan

Published 1948 - 1950

Source map scale - 1:1,250

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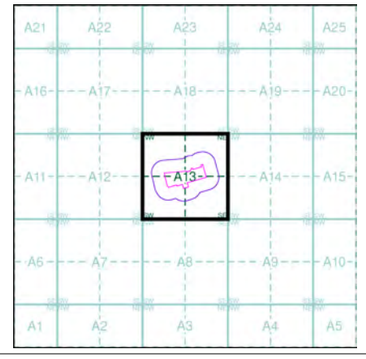
Map Name(s) and Date(s)

SJ8697SW 1948 1:1,250	SJ8697SE 1948 1:1,250	SJ8797SW 1948 1:1,250
SJ8696NW 1948 1:1,250	SJ8696NE 1949 1:1,250	SJ8796NW 1950 1:1,250

Historical Map - Segment A13



Order Details

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Customer Ref:	2692
National Grid Reference:	386840, 396990
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Ordnance Survey Plan

Published 1950 - 1951

Source map scale - 1:2,500

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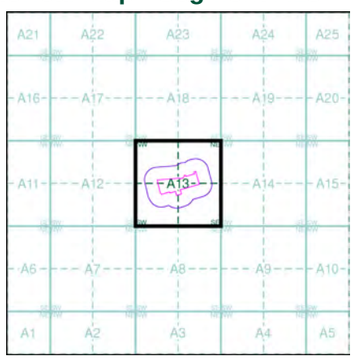
Map Name(s) and Date(s)

SJ8697 1950 1:2,500	SJ8797 1951 1:2,500
SJ8696 1951 1:2,500	SJ8796 1951 1:2,500

Historical Map - Segment A13



Order Details

Order Number:	44476818_1_1
Customer Ref:	2692
National Grid Reference:	386840, 396990
Slice:	A
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Ordnance Survey Plan

Published 1953 - 1979

Source map scale - 1:1,250

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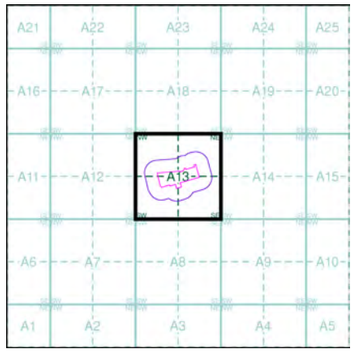
Map Name(s) and Date(s)

SJ8697SW 1971 1:1,250	SJ8697SE 1953 1:1,250	SJ8797SW 1957 1:1,250
SJ8696NW 1961 1:1,250	SJ8696NE 1957 1:1,250	SJ8796NW 1979 1:1,250

Historical Map - Segment A13



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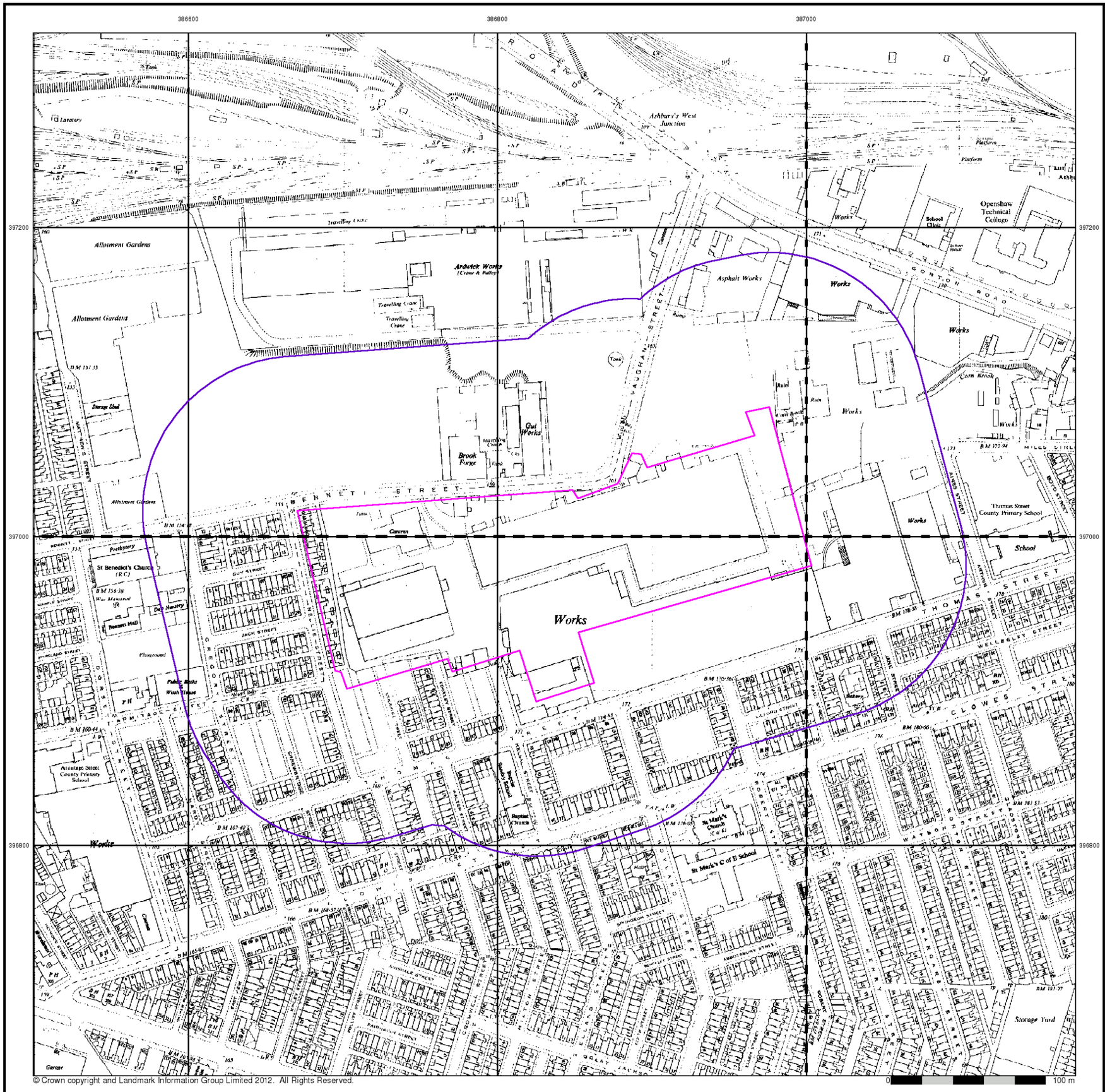

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Ordnance Survey Plan

Published 1964 - 1967

Source map scale - 1:2,500

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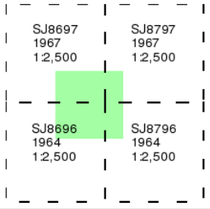
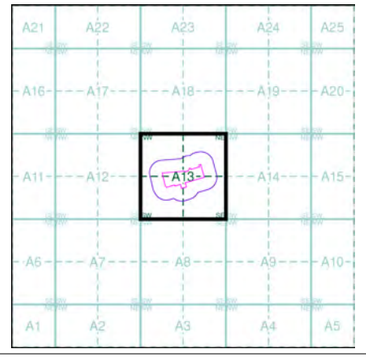
Map Name(s) and Date(s)



Historical Map - Segment A13



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National Grid Reference:	386840, 396990
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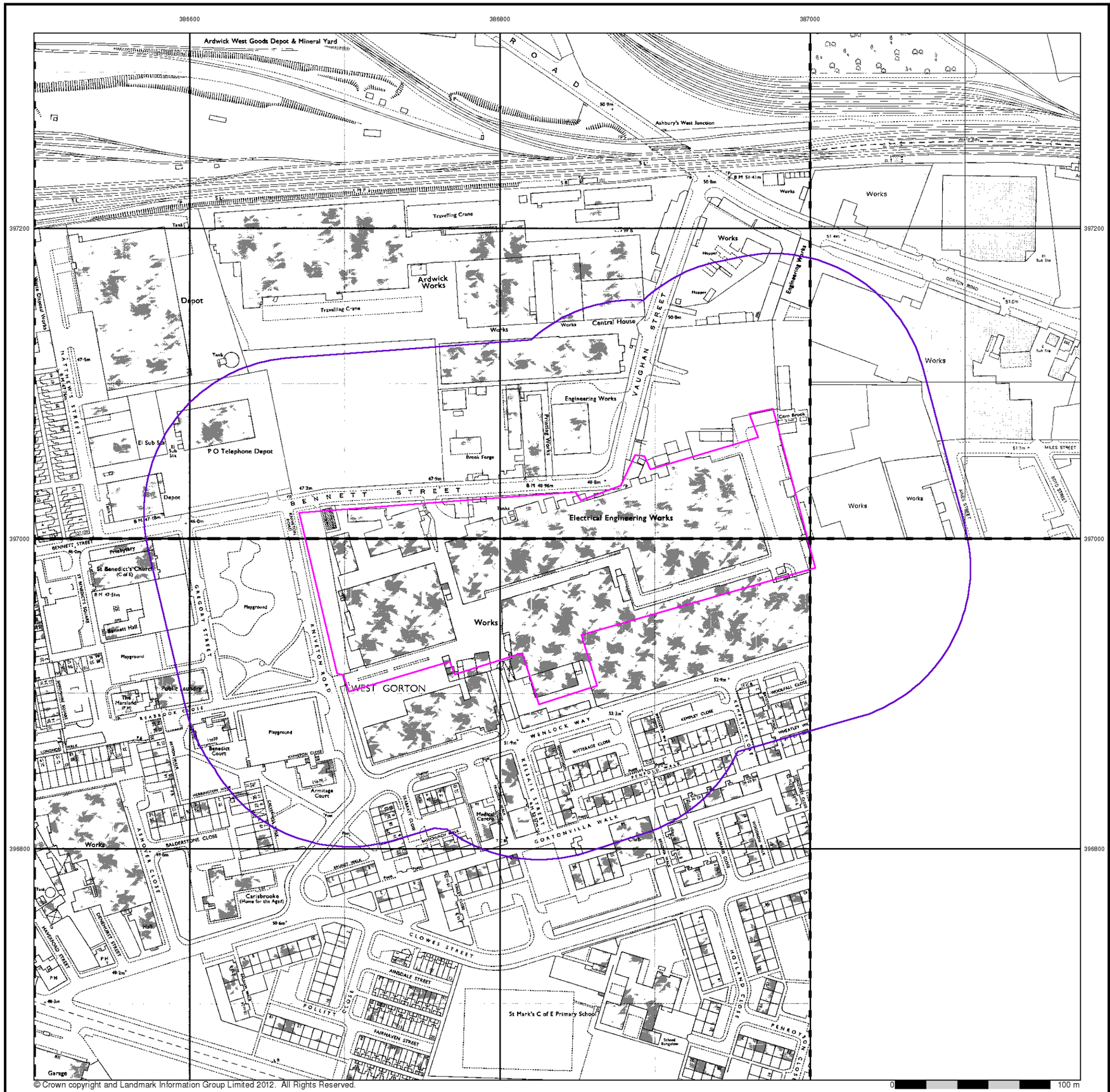

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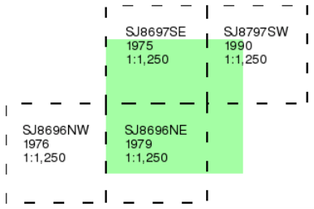
Ordnance Survey Plan

Published 1975 - 1990

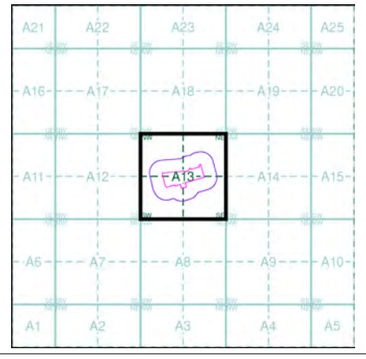
Source map scale - 1:1,250

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



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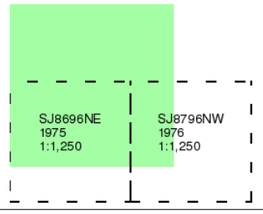
Supply of Unpublished Survey Information

Published 1975 - 1976

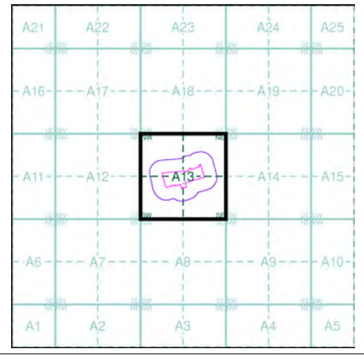
Source map scale - 1:1,250

SUSI maps (Supply of Unpublished Survey Information) were produced between 1972 and 1977, mainly for internal use at Ordnance Survey. These were more of a `work-in-progress' plan as they showed updates of individual areas on a map. These maps were unpublished, and they do not represent a single moment in time. They were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



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Additional SIMs

Published 1977 - 1991

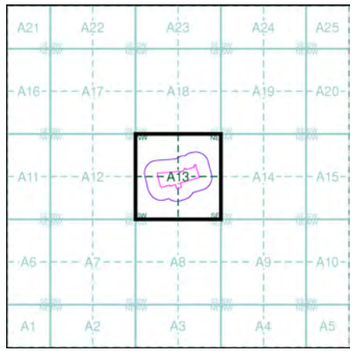
Source map scale - 1:1,250

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)

SJ8697SW 1988 1:1,250	SJ8697SE 1983 1:1,250	SJ8797SW 1980 1:1,250
SJ8696NW 1991 1:1,250	SJ8696NE 1983 1:1,250	SJ8796NW 1977 1:1,250

Historical Map - Segment A13



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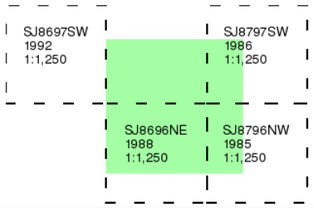
Additional SIMs

Published 1985 - 1992

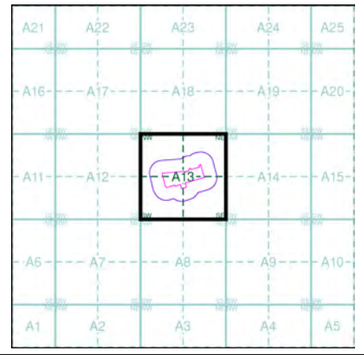
Source map scale - 1:1,250

The SIM cards (Ordnance Survey's `Survey of Information on Microfilm') are further, minor editions of mapping which were produced and published in between the main editions as an area was updated. They date from 1947 to 1994, and contain detailed information on buildings, roads and land-use. These maps were produced at both 1:2,500 and 1:1,250 scales.

Map Name(s) and Date(s)



Historical Map - Segment A13



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