

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
20	BGS Recorded Mineral Sites Site Name: Chalk Hole Shaw Location: Istead Rise, Gravesend, Kent Source: British Geological Survey, National Geoscience Information Service Reference: 131067 Type: Opencast Status: Ceased Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Cretaceous Geology: White Chalk Subgroup Commodity: Chalk Positional Accuracy: Located by supplier to within 10m	A14SW (E)	592	1	564237 170075
21	BGS Recorded Mineral Sites Site Name: Dover Castle Chalk Pit Location: Istead Rise, Gravesend, Kent Source: British Geological Survey, National Geoscience Information Service Reference: 131102 Type: Opencast Status: Ceased Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Cretaceous Geology: White Chalk Subgroup Commodity: Chalk Positional Accuracy: Located by supplier to within 10m	A8NE (S)	625	1	563805 169594
22	BGS Recorded Mineral Sites Site Name: Istead Rise Chalkwell Location: Southfleet, Gravesend, Kent Source: British Geological Survey, National Geoscience Information Service Reference: 220328 Type: Underground Status: Ceased Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Cretaceous Geology: White Chalk Subgroup Commodity: Chalk Positional Accuracy: Located by supplier to within 10m	A17SE (NW)	734	1	563280 170900
23	BGS Recorded Mineral Sites Site Name: Northfleet Green Chalk Pit Location: Southfleet, Gravesend, Kent Source: British Geological Survey, National Geoscience Information Service Reference: 131065 Type: Opencast Status: Ceased Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Cretaceous Geology: White Chalk Subgroup Commodity: Chalk Positional Accuracy: Located by supplier to within 10m	A17SE (NW)	848	1	562977 170804
24	BGS Recorded Mineral Sites Site Name: Stanhill Farm Denehole Location: Southfleet, Gravesend, Kent Source: British Geological Survey, National Geoscience Information Service Reference: 220783 Type: Underground Status: Ceased Operator: Unknown Operator Operator Location: Not Supplied Periodic Type: Cretaceous Geology: White Chalk Subgroup Commodity: Chalk Positional Accuracy: Located by supplier to within 10m	A12NW (W)	978	1	562640 170300
	BGS Measured Urban Soil Chemistry No data available				
	BGS Urban Soil Chemistry Averages No data available				
	Coal Mining Affected Areas In an area that might not be affected by coal mining				
	Mining Instability Mining Evidence: Conclusive Rock Mining Source: Ove Arup & Partners Boundary Quality: As Supplied	A13NE (NE)	0	-	563642 170230

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
	Man-Made Mining Cavities Easting: 563400 Northing: 170400 Distance: 265 Quadrant Reference: A13 Quadrant Reference: NW Bearing Ref: NW Cavity Type: 2x Chalkwells (Connected) Commodity: Chalk Solid Geology Detail: Chalk Group Superficial Geology No Details Detail:	A13NW (NW)	265	8	563400 170400
	Man-Made Mining Cavities Easting: 563300 Northing: 170900 Distance: 725 Quadrant Reference: A18 Quadrant Reference: SW Bearing Ref: NW Cavity Type: Chalkwell Commodity: Chalk Solid Geology Detail: Chalk Group Superficial Geology No Details Detail:	A18SW (NW)	725	8	563300 170900
	Non Coal Mining Areas of Great Britain Risk: Rare Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	563642 170230
	Non Coal Mining Areas of Great Britain Risk: Likely Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	126	1	563507 170310
	Non Coal Mining Areas of Great Britain Risk: Highly Likely Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	176	1	563464 170336
	Non Coal Mining Areas of Great Britain Risk: Rare Source: British Geological Survey, National Geoscience Information Service	A13SE (S)	201	1	563642 170000
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	563642 170230
	Potential for Collapsible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SE (S)	201	1	563642 170000
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	563642 170230
	Potential for Compressible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	171	1	563742 170401
	Potential for Compressible Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SE (S)	201	1	563642 170000
	Potential for Compressible Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	237	1	563809 170433
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	563642 170230
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Moderate Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	61	1	563569 170285
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	155	1	563563 170393
	Potential for Ground Dissolution Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NW (N)	170	1	563590 170415

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	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13SE (S)	201	1	563642 170000
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NE (E)	217	1	563875 170243
	Potential for Ground Dissolution Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (E)	246	1	563903 170240
	Potential for Landslide Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	563642 170230
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	155	1	563563 170393
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	171	1	563742 170401
	Potential for Landslide Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SE (S)	201	1	563642 170000
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (E)	217	1	563875 170243
	Potential for Landslide Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	237	1	563809 170433
	Potential for Landslide Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NE (E)	246	1	563903 170240
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	563642 170230
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Low Source: British Geological Survey, National Geoscience Information Service	A13NW (NW)	155	1	563563 170393
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	171	1	563742 170401
	Potential for Running Sand Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SE (S)	201	1	563642 170000
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (E)	217	1	563875 170243
	Potential for Running Sand Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	237	1	563809 170433
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	563642 170230
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: No Hazard Source: British Geological Survey, National Geoscience Information Service	A13SE (S)	201	1	563642 170000
	Potential for Shrinking or Swelling Clay Ground Stability Hazards Hazard Potential: Very Low Source: British Geological Survey, National Geoscience Information Service	A13NE (E)	217	1	563875 170243
	Radon Potential - Radon Affected Areas Affected Area: The property is in a Lower probability radon area (less than 1% of homes are estimated to be at or above the Action Level). Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	563642 170230

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	Radon Potential - Radon Protection Measures Protection Measure: No radon protective measures are necessary in the construction of new dwellings or extensions Source: British Geological Survey, National Geoscience Information Service	A13NE (NE)	0	1	563642 170230

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25	Contemporary Trade Directory Entries Name: 1st Advanced Tanks & Pipework Ltd Location: 20, Worcester Close, Istead Rise, Gravesend, Kent, DA13 9LB Classification: Tank Cleaning & Repairing Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SE (E)	22	-	563680 170225
26	Contemporary Trade Directory Entries Name: B & R Crane Care Ltd Location: 4, Bramley Close, Istead Rise, Gravesend, Kent, DA13 9LA Classification: Lifting Equipment Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SW (SW)	42	-	563592 170208
27	Contemporary Trade Directory Entries Name: K R Cleaning Services Location: 53, Worcester Close, Istead Rise, Gravesend, Kent, DA13 9LB Classification: Carpet, Curtain & Upholstery Cleaners Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SE (SE)	109	-	563706 170103
28	Contemporary Trade Directory Entries Name: G S S Hardware Location: 50, Istead Rise, Gravesend, Kent, DA13 9JF Classification: Hardware Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SE (S)	118	-	563647 170083
28	Contemporary Trade Directory Entries Name: Northfleet Services Dry Cleaners Ltd Location: 52, Istead Rise, Gravesend, Kent, DA13 9JF Classification: Dry Cleaners Status: Active Positional Accuracy: Automatically positioned to the address	A13SE (S)	119	-	563642 170082
29	Contemporary Trade Directory Entries Name: Red Kite Flutes Location: 28, Brookside Road, Istead Rise, Gravesend, DA13 9JJ Classification: Musical Instrument - Manufacturers Status: Active Positional Accuracy: Automatically positioned to the address	A13SE (E)	216	-	563874 170225
30	Contemporary Trade Directory Entries Name: Dent King Location: Flowerhill Way, Istead Rise, Gravesend, Kent, DA13 9DS Classification: Car Body Repairs Status: Inactive Positional Accuracy: Manually positioned to the road within the address or location	A13SW (SW)	235	-	563412 170132
31	Contemporary Trade Directory Entries Name: Quality1 Location: 24, Lesley Close, Istead Rise, Gravesend, Kent, DA13 9JS Classification: Car Painters & Sprayers Status: Active Positional Accuracy: Automatically positioned to the address	A13SE (S)	262	-	563717 169946
32	Contemporary Trade Directory Entries Name: Fast Press Location: 22, Haven Close, Istead Rise, Gravesend, Kent, DA13 9JR Classification: Ironing & Home Laundry Services Status: Inactive Positional Accuracy: Automatically positioned to the address	A13SE (SE)	282	-	563796 169955
32	Contemporary Trade Directory Entries Name: T R S Mechanical Handling Ltd Location: 21, Haven Close, Istead Rise, Gravesend, Kent, DA13 9JR Classification: Fork Lift Trucks Status: Active Positional Accuracy: Automatically positioned to the address	A13SE (SE)	300	-	563802 169938
32	Contemporary Trade Directory Entries Name: Capable Cleaners Location: Istead Rise, Gravesend, Kent, DA13 9JR Classification: Cleaning Services - Domestic Status: Inactive Positional Accuracy: Manually positioned within the geographical locality	A13SE (SE)	337	-	563849 169923
33	Contemporary Trade Directory Entries Name: Greentech Engineering Ltd Location: 17, Lewis Road, Istead Rise, Gravesend, Kent, DA13 9JQ Classification: Mechanical Engineers Status: Inactive Positional Accuracy: Automatically positioned to the address	A8NE (S)	316	-	563689 169887

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33	Contemporary Trade Directory Entries Name: Peninsular Logistics Ltd Location: 25, Lewis Road, Istead Rise, Gravesend, DA13 9JQ Classification: Road Haulage Services Status: Active Positional Accuracy: Automatically positioned to the address	A8NE (S)	360	-	563711 169846
34	Contemporary Trade Directory Entries Name: Motorzone Location: Memorial Hall, Lewis Road, Istead Rise, Gravesend, DA13 9JQ Classification: Car Dealers - Used Status: Inactive Positional Accuracy: Automatically positioned to the address	A8NE (S)	423	-	563746 169788
35	Contemporary Trade Directory Entries Name: Ea Auto Repairs Location: 65, Fairview Road, Istead Rise, GRAVESEND, Kent, DA13 9DU Classification: Garage Services Status: Inactive Positional Accuracy: Automatically positioned to the address	A12SE (W)	452	-	563167 170197
36	Contemporary Trade Directory Entries Name: Pest Check Location: 26, Bracondale Avenue, Istead Rise, Gravesend, DA13 9ED Classification: Pest & Vermin Control Status: Active Positional Accuracy: Automatically positioned to the address	A8NE (SE)	478	-	563966 169835
37	Contemporary Trade Directory Entries Name: Gem West Cranes Ltd Location: 41, Upper Avenue, Istead Rise, Gravesend, Kent, DA13 9DA Classification: Crane Manufacturers Status: Inactive Positional Accuracy: Automatically positioned to the address	A8NW (SW)	479	-	563385 169801
38	Contemporary Trade Directory Entries Name: Expansion Airconditioning Services Ltd Location: 185, Downs Road, Istead Rise, Gravesend, Kent, DA13 9HF Classification: Air Conditioning Equipment & Systems Status: Inactive Positional Accuracy: Automatically positioned to the address	A8NW (S)	582	-	563503 169637
39	Contemporary Trade Directory Entries Name: Highways Recovery Services Ltd Location: 16, Long Walk, Istead Rise, Gravesend, DA13 9HH Classification: Car Breakdown & Recovery Services Status: Inactive Positional Accuracy: Automatically positioned to the address	A7NE (SW)	636	-	563094 169885
40	Contemporary Trade Directory Entries Name: R S Motors Location: 27, Arcadia Road, Istead Rise, GRAVESEND, Kent, DA13 9EH Classification: Garage Services Status: Inactive Positional Accuracy: Automatically positioned to the address	A8SW (S)	694	-	563635 169507
41	Contemporary Trade Directory Entries Name: Bp Express Shopping Location: Turnpike Service Station, Wrotham Rd, Gravesend, Kent, DA13 9RE Classification: Petrol Filling Stations Status: Inactive Positional Accuracy: Manually positioned to the road within the address or location	A19NW (NE)	936	-	564124 171064
42	Points of Interest - Commercial Services Name: Quality1 Location: 24 Lesley Close, Istead Rise, Gravesend, DA13 9JS Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A13SE (S)	262	9	563717 169946
43	Points of Interest - Commercial Services Name: The Dent Co Location: 111 The Drove Way, Istead Rise, Gravesend, DA13 9JY Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A12NE (W)	346	9	563283 170342
44	Points of Interest - Commercial Services Name: Peninsular Logistics Ltd Location: 25 Lewis Road, Istead Rise, Gravesend, DA13 9JQ Category: Transport, Storage and Delivery Class Code: Distribution and Haulage Positional Accuracy: Positioned to address or location	A8NE (S)	360	9	563711 169846

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45	Points of Interest - Commercial Services Name: Clearway Bulk Service Ltd Location: 63 Flowerhill Way, Istead Rise, Gravesend, DA13 9DS Category: Transport, Storage and Delivery Class Code: Distribution and Haulage Positional Accuracy: Positioned to address or location	A12SE (W)	385	9	563246 170143
45	Points of Interest - Commercial Services Name: Clearway Bulk Service Ltd Location: 63 Flowerhill Way, Istead Rise, Gravesend, DA13 9DS Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A12SE (W)	386	9	563245 170143
46	Points of Interest - Commercial Services Name: E A Auto Repairs Location: 65 Fairview Road, Istead Rise, Gravesend, DA13 9DU Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A12SE (W)	452	9	563167 170197
47	Points of Interest - Commercial Services Name: Pest Check Location: 26 Bracondale Avenue, Istead Rise, Gravesend, DA13 9ED Category: Contract Services Class Code: Pest and Vermin Control Positional Accuracy: Positioned to address or location	A8NE (SE)	478	9	563966 169835
48	Points of Interest - Commercial Services Name: Thames Trimming Location: 16 Downs Road, Istead Rise, Gravesend, DA13 9HE Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A12SE (SW)	549	9	563195 169892
48	Points of Interest - Commercial Services Name: Thames Trimming Location: 16 Downs Road, Istead Rise, Gravesend, DA13 9HE Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A12SE (SW)	549	9	563195 169892
49	Points of Interest - Commercial Services Name: R S Motors Location: 27 Arcadia Road, Istead Rise, Gravesend, DA13 9EH Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A8SW (S)	694	9	563635 169507
49	Points of Interest - Commercial Services Name: R S Motors Location: 27 Arcadia Road, Istead Rise, Gravesend, DA13 9EH Category: Repair and Servicing Class Code: Vehicle Repair, Testing and Servicing Positional Accuracy: Positioned to address or location	A8SW (S)	694	9	563635 169507
50	Points of Interest - Manufacturing and Production Name: London Masonry Services Location: 315 Wrotham Road, Istead Rise, Gravesend, DA13 9JH Category: Extractive Industries Class Code: Stone Quarrying and Preparation Positional Accuracy: Positioned to address or location	A14SW (E)	320	9	563978 170216
51	Points of Interest - Manufacturing and Production Name: Piggery Location: DA13 Category: Farming Class Code: Livestock Farming Positional Accuracy: Positioned to address or location	A7NE (SW)	668	9	563181 169724
52	Points of Interest - Manufacturing and Production Name: Tank Location: DA13 Category: Industrial Features Class Code: Tanks (Generic) Positional Accuracy: Positioned to an adjacent address or location	A8SW (S)	782	9	563400 169460
53	Points of Interest - Recreational and Environmental Name: Playground Location: Not Supplied Category: Recreational Class Code: Playgrounds Positional Accuracy: Positioned to an adjacent address or location	A13NE (N)	84	9	563656 170339

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53	Points of Interest - Recreational and Environmental Name: Playground Location: Nr Worcester Close, DA13 Category: Recreational Class Code: Playgrounds Positional Accuracy: Positioned to address or location	A13NE (N)	90	9	563656 170345
54	Gas Pipelines Name: SHORNE TO FARNINGHAM Nat Grid: Owned By National Grid Diameter (mm): 750 Building Proximity: Not Supplied Distance (m): Status: Active Pipe Length (m): 15540.1 Pipe Number: Not Supplied	A18SE (N)	334	10	563673 170588
55	Gas Pipelines Name: GRAVESEND THAMES SOUTH TO TATSFIELD Nat Grid: Owned By National Grid Diameter (mm): 750 Building Proximity: Not Supplied Distance (m): Status: Active Pipe Length (m): 41265.75 Pipe Number: Not Supplied	A18SE (N)	418	10	563671 170673

Map ID	Details	Quadrant Reference (Compass Direction)	Estimated Distance From Site	Contact	NGR
56	Ancient Woodland Name: Walnut Wood Reference: 1498487 Area(m ²): 47669.14 Type: Ancient and Semi-Natural Woodland	A8SW (S)	830	11	563395 169411
57	Areas of Adopted Green Belt Authority: Gravesham Borough Council Plan Name: Gravesham Local Plan - Core Strategy Status: Adopted Plan Date: 30th September 2014	A13NE (NE)	0	12	563642 170230
58	Nitrate Vulnerable Zones Name: North Kent Description: Groundwater Source: Environment Agency, Head Office	A13NE (NE)	0	4	563642 170230

Agency & Hydrological	Version	Update Cycle
Contaminated Land Register Entries and Notices Environment Agency - Head Office Sevenoaks District Council - Environmental Health Department Thurrock Borough Council - Environmental Health Department Dartford Borough Council - Environmental Health Department Gravesham Borough Council - Public Health Services	June 2020 October 2017 October 2017 September 2017 September 2017	Annually Annual Rolling Update Annually Annual Rolling Update Annual Rolling Update
Discharge Consents Environment Agency - Anglian Region Environment Agency - Southern Region	April 2022 April 2022	Quarterly Quarterly
Enforcement and Prohibition Notices Environment Agency - Anglian Region Environment Agency - Southern Region	March 2013 March 2013	
Integrated Pollution Controls Environment Agency - Anglian Region Environment Agency - Southern Region	January 2009 January 2009	
Integrated Pollution Prevention And Control Environment Agency - Anglian Region Environment Agency - South East Region - Kent & South London Area Environment Agency - Southern Region	April 2022 April 2022 April 2022	Quarterly Quarterly Quarterly
Local Authority Integrated Pollution Prevention And Control Thurrock Borough Council - Environmental Health Department Gravesham Borough Council - Environmental Health Department London Port Health Authority - Environmental Services Dartford Borough Council - Environmental Health Department Sevenoaks District Council - Environmental Health Department	February 2015 October 2014 October 2014 September 2014 September 2014	Variable Variable Variable Variable Variable
Local Authority Pollution Prevention and Controls Thurrock Borough Council - Environmental Health Department Gravesham Borough Council - Environmental Health Department London Port Health Authority - Environmental Services Dartford Borough Council - Environmental Health Department Sevenoaks District Council - Environmental Health Department	February 2015 October 2014 October 2014 September 2014 September 2014	Not Applicable Annual Rolling Update Annual Rolling Update Annual Rolling Update Annual Rolling Update
Local Authority Pollution Prevention and Control Enforcements Thurrock Borough Council - Environmental Health Department Gravesham Borough Council - Environmental Health Department London Port Health Authority - Environmental Services Dartford Borough Council - Environmental Health Department Sevenoaks District Council - Environmental Health Department	February 2015 October 2014 October 2014 September 2014 September 2014	Variable Variable Variable Variable Variable
Nearest Surface Water Feature Ordnance Survey	June 2022	
Pollution Incidents to Controlled Waters Environment Agency - Southern Region Environment Agency - Anglian Region	December 1999 September 1999	
Prosecutions Relating to Authorised Processes Environment Agency - Anglian Region Environment Agency - Southern Region	July 2015 July 2015	
Prosecutions Relating to Controlled Waters Environment Agency - Anglian Region Environment Agency - Southern Region	March 2013 March 2013	
Registered Radioactive Substances Environment Agency - Anglian Region Environment Agency - Southern Region	June 2016 June 2016	As notified As notified
River Quality Environment Agency - Head Office	November 2001	Not Applicable

Agency & Hydrological	Version	Update Cycle
River Quality Biology Sampling Points Environment Agency - Head Office	April 2012	
River Quality Chemistry Sampling Points Environment Agency - Head Office	April 2012	
Substantiated Pollution Incident Register Environment Agency - Anglian Region - Eastern Area Environment Agency - South East Region - Kent & South London Area Environment Agency - Southern Region - Kent Area Environment Agency - Southern Region - Kent and East Sussex	April 2022 April 2022 April 2022 April 2022	Quarterly Quarterly Quarterly Quarterly
Water Abstractions Environment Agency - Anglian Region Environment Agency - Southern Region	July 2022 July 2022	Quarterly Quarterly
Water Industry Act Referrals Environment Agency - Anglian Region Environment Agency - Southern Region	October 2017 October 2017	
Groundwater Vulnerability Map Environment Agency - Head Office	June 2018	As notified
Groundwater Vulnerability - Soluble Rock Risk Environment Agency - Head Office	June 2018	As notified
Bedrock Aquifer Designations Environment Agency - Head Office	January 2018	Annually
Superficial Aquifer Designations Environment Agency - Head Office	January 2018	Annually
Source Protection Zones Environment Agency - Head Office	July 2022	Bi-Annually
Extreme Flooding from Rivers or Sea without Defences Environment Agency - Head Office	May 2022	Quarterly
Flooding from Rivers or Sea without Defences Environment Agency - Head Office	May 2022	Quarterly
Areas Benefiting from Flood Defences Environment Agency - Head Office	May 2022	Quarterly
Flood Water Storage Areas Environment Agency - Head Office	May 2022	Quarterly
Flood Defences Environment Agency - Head Office	May 2022	Quarterly
OS Water Network Lines Ordnance Survey	July 2022	Quarterly
Surface Water 1 in 30 year Flood Extent Environment Agency - Head Office	May 2018	Annually
Surface Water 1 in 100 year Flood Extent Environment Agency - Head Office	May 2018	Annually
Surface Water 1 in 1000 year Flood Extent Environment Agency - Head Office	May 2018	Annually
Surface Water Suitability Environment Agency - Head Office	February 2016	Annually
BGS Groundwater Flooding Susceptibility British Geological Survey - National Geoscience Information Service	May 2013	As notified

Waste	Version	Update Cycle
BGS Recorded Landfill Sites British Geological Survey - National Geoscience Information Service	November 2002	As notified
Historical Landfill Sites Environment Agency - Head Office	April 2022	Quarterly
Integrated Pollution Control Registered Waste Sites Environment Agency - Anglian Region Environment Agency - Southern Region	January 2009 January 2009	Not Applicable Not Applicable
Licensed Waste Management Facilities (Landfill Boundaries) Environment Agency - Anglian Region - Eastern Area Environment Agency - South East Region - Kent & South London Area Environment Agency - Southern Region - Kent Area Environment Agency - Southern Region - Kent and East Sussex	April 2022 April 2022 April 2022 April 2022	Quarterly Quarterly Quarterly Quarterly
Licensed Waste Management Facilities (Locations) Environment Agency - Anglian Region - Eastern Area Environment Agency - South East Region - Kent & South London Area Environment Agency - Southern Region - Kent Area Environment Agency - Southern Region - Kent and East Sussex	April 2022 April 2022 April 2022 April 2022	Quarterly Quarterly Quarterly Quarterly
Local Authority Landfill Coverage Dartford Borough Council - Environmental Health Department Gravesham Borough Council Kent County Council - Waste Management Group Sevenoaks District Council Thurrock Borough Council - Environmental Health Department	February 2003 February 2003 February 2003 February 2003 February 2003	Not Applicable Not Applicable Not Applicable Not Applicable Not Applicable
Local Authority Recorded Landfill Sites Dartford Borough Council - Environmental Health Department Gravesham Borough Council Kent County Council - Waste Management Group Sevenoaks District Council Thurrock Borough Council - Environmental Health Department	October 2018 October 2018 October 2018 October 2018 October 2018	
Potentially Infilled Land (Non-Water) Landmark Information Group Limited	December 1999	Not Applicable
Potentially Infilled Land (Water) Landmark Information Group Limited	December 1999	
Registered Landfill Sites Environment Agency - Anglian Region - Eastern Area Environment Agency - Southern Region - Kent Area Environment Agency - Southern Region - Kent and East Sussex	March 2006 March 2006 March 2006	Not Applicable Not Applicable Not Applicable
Registered Waste Transfer Sites Environment Agency - Anglian Region - Eastern Area Environment Agency - Southern Region - Kent Area Environment Agency - Southern Region - Kent and East Sussex	April 2018 April 2018 April 2018	
Registered Waste Treatment or Disposal Sites Environment Agency - Anglian Region - Eastern Area Environment Agency - Southern Region - Kent Area Environment Agency - Southern Region - Kent and East Sussex	June 2015 June 2015 June 2015	

Hazardous Substances	Version	Update Cycle
Control of Major Accident Hazards Sites (COMAH) Health and Safety Executive	January 2022	Bi-Annually
Explosive Sites Health and Safety Executive	March 2017	Annually
Notification of Installations Handling Hazardous Substances (NIHHS) Health and Safety Executive	August 2001	
Planning Hazardous Substance Enforcements Thurrock Borough Council - Development Control Sevenoaks District Council London Port Health Authority - Environmental Services Dartford Borough Council Kent County Council Gravesham Borough Council	December 2015 February 2016 January 2008 January 2016 January 2016 October 2015	Variable Variable Annual Rolling Update Variable Variable Variable
Planning Hazardous Substance Consents Thurrock Borough Council - Development Control Sevenoaks District Council London Port Health Authority - Environmental Services Dartford Borough Council Kent County Council Gravesham Borough Council	December 2015 February 2016 January 2008 January 2016 January 2016 October 2015	Variable Variable Annual Rolling Update Variable Variable Variable

Geological	Version	Update Cycle
BGS 1:625,000 Solid Geology British Geological Survey - National Geoscience Information Service	January 2009	As notified
BGS Estimated Soil Chemistry British Geological Survey - National Geoscience Information Service	December 2015	As notified
BGS Recorded Mineral Sites British Geological Survey - National Geoscience Information Service	May 2022	Bi-Annually
CBSCB Compensation District Cheshire Brine Subsidence Compensation Board (CBSCB) Cheshire Brine Subsidence Compensation Board (CBSCB)	August 2011 November 2020	As notified
Coal Mining Affected Areas The Coal Authority - Property Searches	March 2014	Annual Rolling Update
Mining Instability Ove Arup & Partners	June 1998	Not Applicable
Non Coal Mining Areas of Great Britain British Geological Survey - National Geoscience Information Service	May 2015	Not Applicable
Potential for Collapsible Ground Stability Hazards British Geological Survey - National Geoscience Information Service	April 2020	As notified
Potential for Compressible Ground Stability Hazards British Geological Survey - National Geoscience Information Service	January 2019	As notified
Potential for Ground Dissolution Stability Hazards British Geological Survey - National Geoscience Information Service	January 2019	As notified
Potential for Landslide Ground Stability Hazards British Geological Survey - National Geoscience Information Service	January 2019	As notified
Potential for Running Sand Ground Stability Hazards British Geological Survey - National Geoscience Information Service	January 2019	As notified
Potential for Shrinking or Swelling Clay Ground Stability Hazards British Geological Survey - National Geoscience Information Service	January 2019	As notified
Radon Potential - Radon Affected Areas British Geological Survey - National Geoscience Information Service	July 2011	Annually
Radon Potential - Radon Protection Measures British Geological Survey - National Geoscience Information Service	July 2011	Annually

Industrial Land Use	Version	Update Cycle
Contemporary Trade Directory Entries Thomson Directories	July 2022	Quarterly
Fuel Station Entries Catalist Ltd - Experian	June 2022	Quarterly
Gas Pipelines National Grid	October 2021	Bi-Annually
Points of Interest - Commercial Services PointX	June 2022	Quarterly
Points of Interest - Education and Health PointX	June 2022	Quarterly
Points of Interest - Manufacturing and Production PointX	June 2022	Quarterly
Points of Interest - Public Infrastructure PointX	June 2022	Quarterly
Points of Interest - Recreational and Environmental PointX	June 2022	Quarterly
Underground Electrical Cables National Grid	May 2021	Bi-Annually

Sensitive Land Use	Version	Update Cycle
Ancient Woodland Natural England	February 2021	Bi-Annually
Areas of Adopted Green Belt Dartford Borough Council Gravesham Borough Council Sevenoaks District Council Thurrock Borough Council - Development Control	October 2020 October 2020 October 2020 October 2020	Quarterly Quarterly Quarterly Quarterly
Areas of Unadopted Green Belt Dartford Borough Council Gravesham Borough Council Sevenoaks District Council Thurrock Borough Council - Development Control	October 2020 October 2020 October 2020 October 2020	Quarterly Quarterly Quarterly Quarterly
Areas of Outstanding Natural Beauty Natural England	January 2021	Bi-Annually
Environmentally Sensitive Areas Natural England	January 2017	
Forest Parks Forestry Commission	April 1997	Not Applicable
Local Nature Reserves Natural England	February 2021	Bi-Annually
Marine Nature Reserves Natural England	July 2019	Bi-Annually
National Nature Reserves Natural England	January 2021	Bi-Annually
National Parks Natural England	February 2018	Bi-Annually
Nitrate Sensitive Areas Natural England	April 2016	Not Applicable
Nitrate Vulnerable Zones Department for Environment, Food and Rural Affairs (DEFRA - formerly FRCA) Environment Agency - Head Office	April 2016 June 2017	Bi-Annually
Ramsar Sites Natural England	August 2020	Bi-Annually
Sites of Special Scientific Interest Natural England	February 2021	Bi-Annually
Special Areas of Conservation Natural England	July 2020	Bi-Annually
Special Protection Areas Natural England	February 2021	Bi-Annually

A selection of organisations who provide data within this report

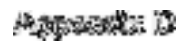
Data Supplier	Data Supplier Logo
Ordnance Survey	
Environment Agency	
Scottish Environment Protection Agency	
The Coal Authority	
British Geological Survey	
Centre for Ecology and Hydrology	
Natural Resources Wales	
Scottish Natural Heritage	
Natural England	
Public Health England	
Ove Arup	
Stantec UK Ltd	

Contact	Name and Address	Contact Details
1	British Geological Survey - Enquiry Service British Geological Survey, Environmental Science Centre, Keyworth, Nottingham, Nottinghamshire, NG12 5GG	Telephone: 0115 936 3143 Fax: 0115 936 3276 Email: enquiries@bgs.ac.uk Website: www.bgs.ac.uk
2	Environment Agency - National Customer Contact Centre (NCCC) PO Box 544, Templeborough, Rotherham, S60 1BY	Telephone: 03708 506 506 Email: enquiries@environment-agency.gov.uk
3	Gravesham Borough Council - Environmental Health Department Civic Centre, 132 Windmill Street, Gravesend, Kent, DA12 1AU	Telephone: 01474 337241 Fax: 01474 337546 Email: glyn.thomson@gravesham.gov.uk Website: www.gravesham.gov.uk
4	Environment Agency - Head Office Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol, Avon, BS32 4UD	Telephone: 01454 624400 Fax: 01454 624409
5	Ordnance Survey Adanac Drive, Southampton, Hampshire, SO16 0AS	Telephone: 03456 05 05 05 Email: customerservices@ordnancesurvey.co.uk Website: www.ordnancesurvey.gov.uk
6	Gravesham Borough Council Cygnet House, 132 Windmill Street, Gravesend, Kent, DA12 1AU	Telephone: 01474 564422 Fax: 01474 337546 Website: www.gravesham.gov.uk
7	Kent County Council - Waste Management Group Block H, The Forstal, Beddow Way, Aylesford, Kent, ME20 7BT	Telephone: 01622 605976 Website: www.kent.gov.uk
8	Stantec UK Ltd Caversham Bridge House, Waterman Place, Reading, RG1 8DN	Telephone: 0118 950 0761 Email: pba.reading@stantec.com Website: www.stantec.com
9	PointX 7 Abbey Court, Eagle Way, Sowton, Exeter, Devon, EX2 7HY	Website: www.pointx.co.uk
10	Landmark Information Group Limited Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9966 Fax: 0844 844 9951 Email: helpdesk@landmark.co.uk Website: www.landmark.co.uk
11	Natural England County Hall, Spetchley Road, Worcester, WR5 2NP	Telephone: 0300 060 3900 Email: enquiries@naturalengland.org.uk Website: www.naturalengland.org.uk
12	Gravesham Borough Council Cygnet House, 132 Windmill Street, Gravesend, Kent, DA12 1BQ	Telephone: 01474 564422 Fax: 01474 337546 Website: www.gravesham.gov.uk
13	Dartford Borough Council Civic Centre, Home Gardens, Dartford, Kent, DA1 1DR	Telephone: 01322 343434 Fax: 01322 343047 Website: www.dartford.gov.uk
14	Sevenoaks District Council Council Offices, Argyle Road, Sevenoaks, Kent, TN13 1HG	Telephone: 01732 227000 Fax: 01732 742339 Website: www.sevenoaks.gov.uk
-	Public Health England - Radon Survey, Centre for Radiation, Chemical and Environmental Hazards Chilton, Didcot, Oxfordshire, OX11 0RQ	Telephone: 01235 822622 Fax: 01235 833891 Email: radon@phe.gov.uk Website: www.ukradon.org
-	Landmark Information Group Limited Imperium, Imperial Way, Reading, Berkshire, RG2 0TD	Telephone: 0844 844 9952 Fax: 0844 844 9951 Email: customerservices@landmarkinfo.co.uk Website: www.landmarkinfo.co.uk

Contact	Name and Address	Contact Details
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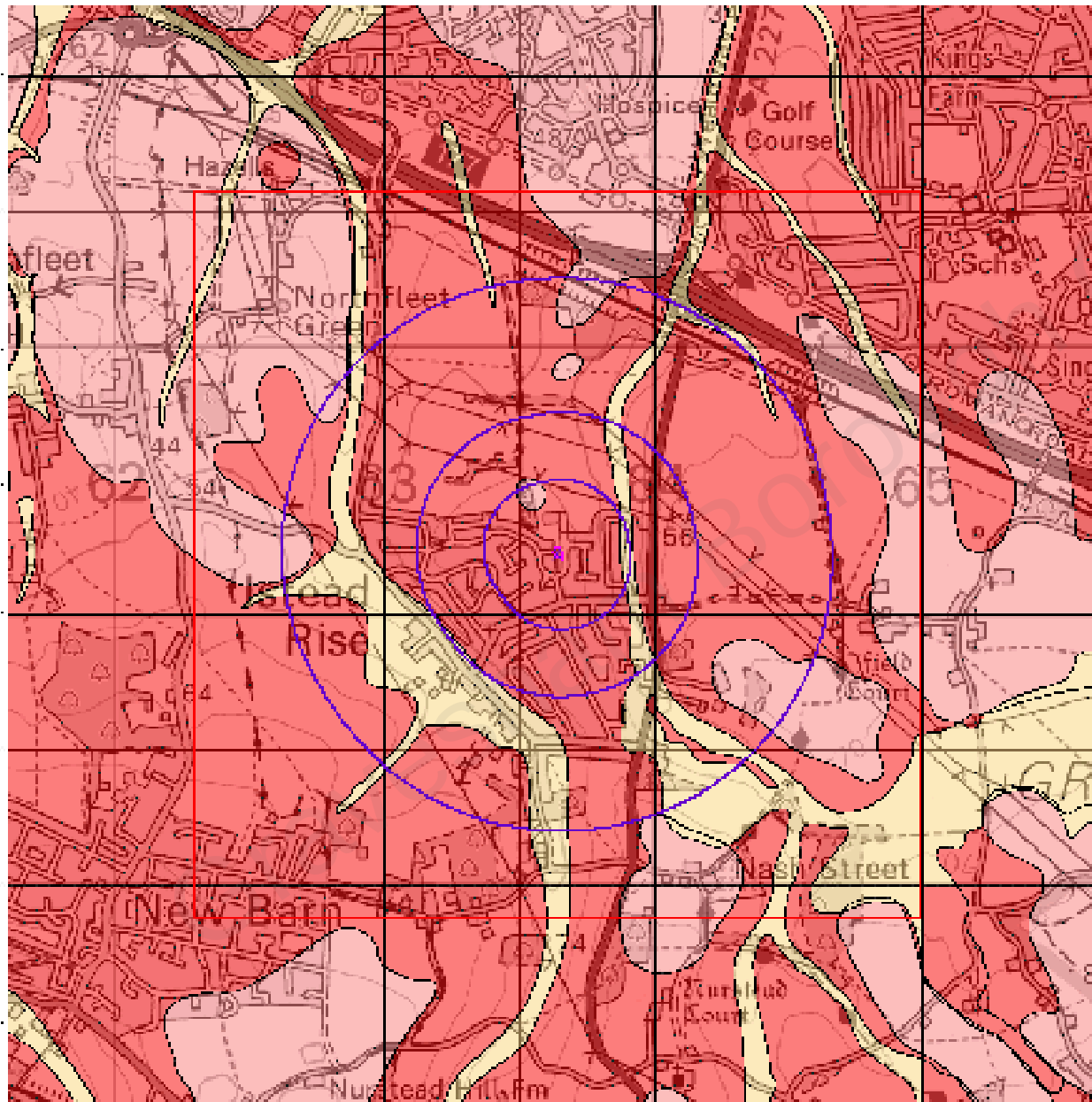
Please note that the Environment Agency / Natural Resources Wales / SEPA have a charging policy in place for enquiries.

Gravesham Borough Council



Site Sensitivity Maps

Gravesham Borough Council



Groundwater Vulnerability

General

GV = Groundwater Vulnerability
L = Low
M = Medium
H = High
X = Unassessed

Agency and Hydrological

Bedrock Aquifers

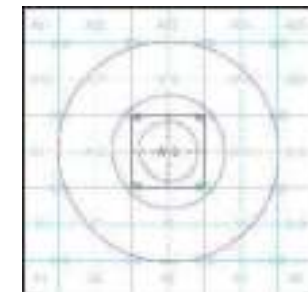
- High Vulnerability Fractured Granites
- High Vulnerability Shallowly dipping
- Medium Vulnerability Shallowly dipping
- Medium Vulnerability Deeply dipping
- Low Vulnerability Shallowly dipping
- Low Vulnerability Deeply dipping
- Unassessed aquifer

Superficial Aquifers

- High Vulnerability Fractured Granites
- High Vulnerability Shallowly dipping
- Medium Vulnerability Shallowly dipping
- Medium Vulnerability Deeply dipping
- Low Vulnerability Shallowly dipping
- Low Vulnerability Deeply dipping
- Unassessed aquifer

Unassessed aquifer
Unassessed

Site Sensitivity Context Map - Slice A



Order Details

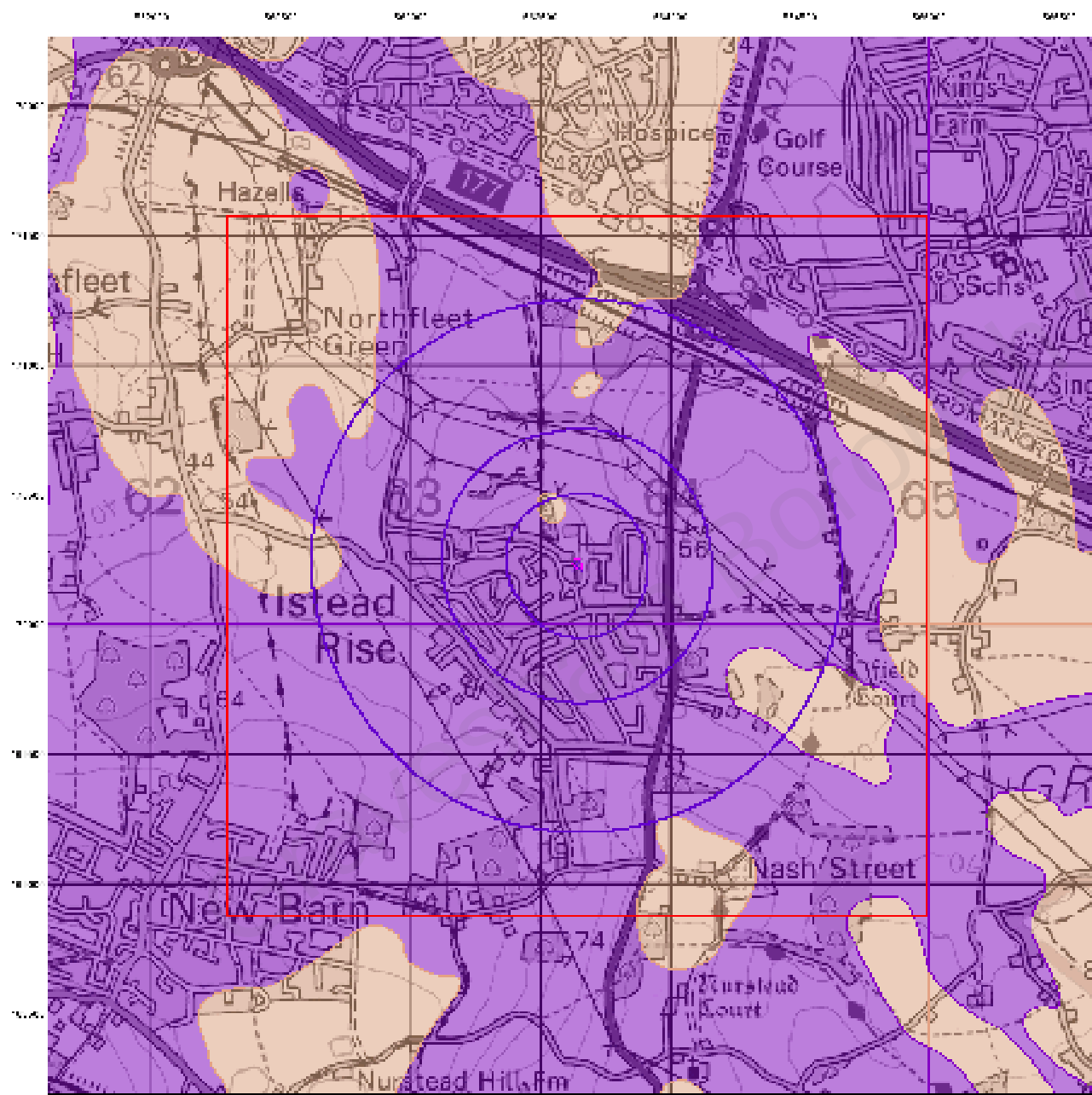
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Customer Ref: 20374
National Grid Reference: 563640, 170230
Slice: A
Site Area (Ha): 0.14
Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



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



Bedrock Aquifer Designation

GHINI.it

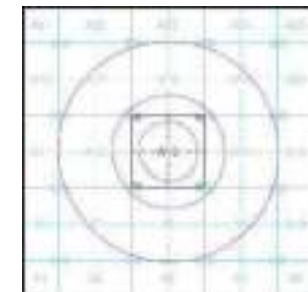
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Agency and Hydrological

Stacked Checkmate

-  Financial Capital
-  Social Networks Capital
-  Accumulating Structure
-  Developing Capital Resources
-  Financial Resources
-  Capital
-  Accumulating Capital and Financial Capital

Site Sensitivity Context Map - Slice A



Order Details

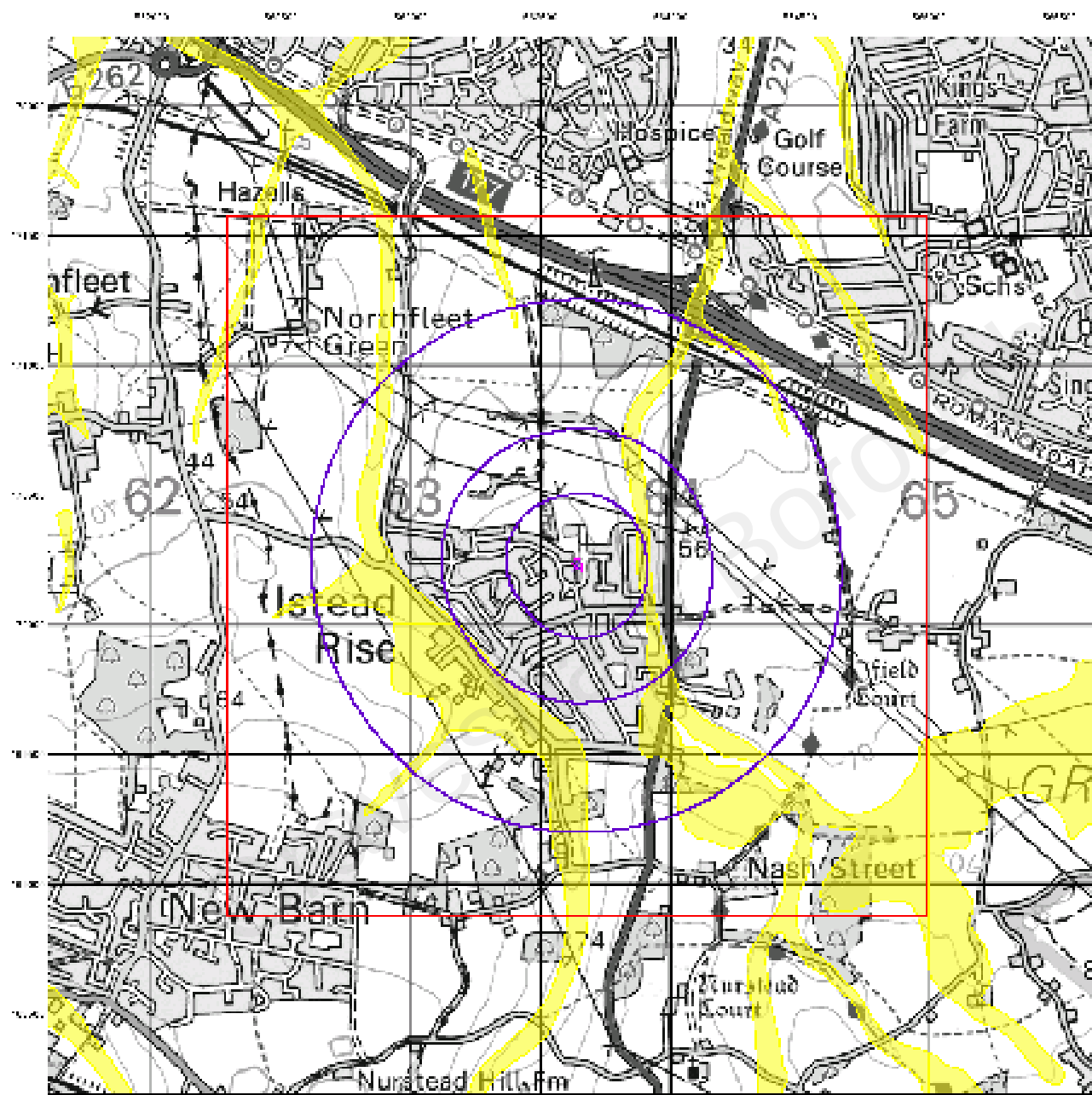
| | |
|--------------------------|----------------|
| Order Number: | 299386280_1_1 |
| Customer Ref: | 20374 |
| National Grid Reference: | 563640, 170230 |
| Slice: | A |
| Site Area (Ha): | 0.14 |
| Search Buffer (m): | 1000 |

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



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



Superficial Aquifer Designation

Ground

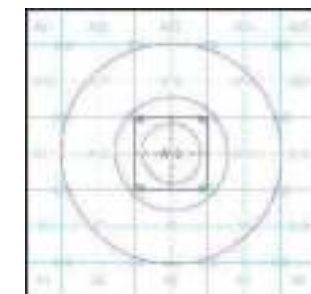
Groundwater Level
 Groundwater Level
 Groundwater Level

Agency and Hydrological

Geological Classes

- Alluvial Aquifer
- Sandstone Aquifer
- Sandstone Aquifer
- Sandstone Aquifer
- Unconsolidated Aquifer
- Unconsolidated Aquifer
- Unconsolidated Aquifer

Site Sensitivity Context Map - Slice A



Order Details

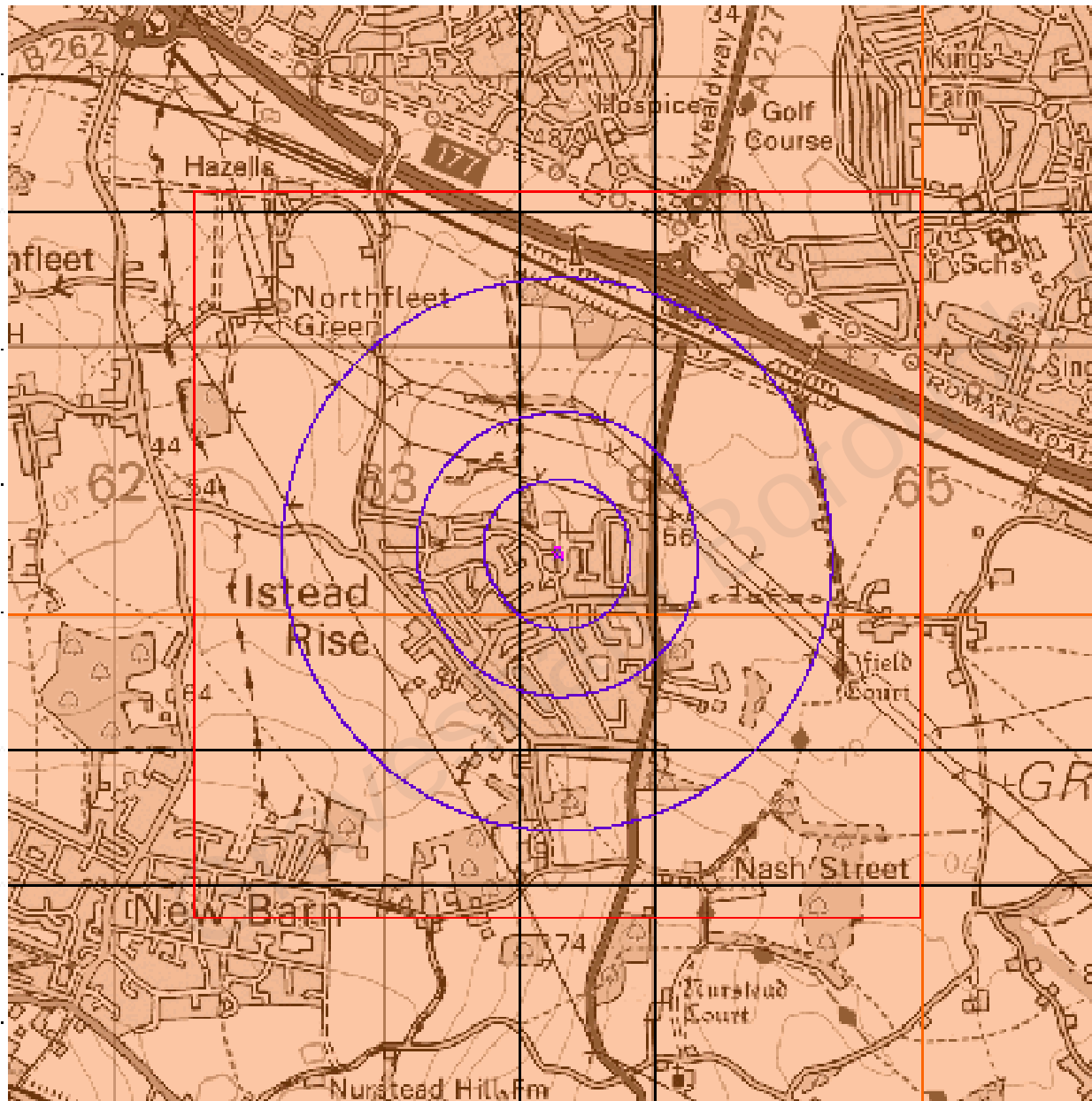
Order Number: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



Tel: 0844 844 9952
 Fax: 0844 844 9951
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BGS Flood GFS Data

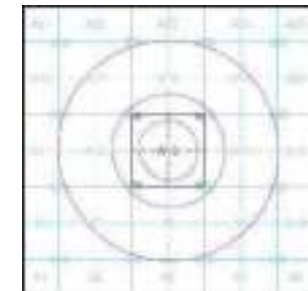
General

- Flooded
- Flooded
- ✕ Flooded
- ✕ Flood

Agency and Hydrological (Flood)

- Flooded
- Flooded
- Flooded
- Flooded

Site Sensitivity Context Map - Slice A



Order Details

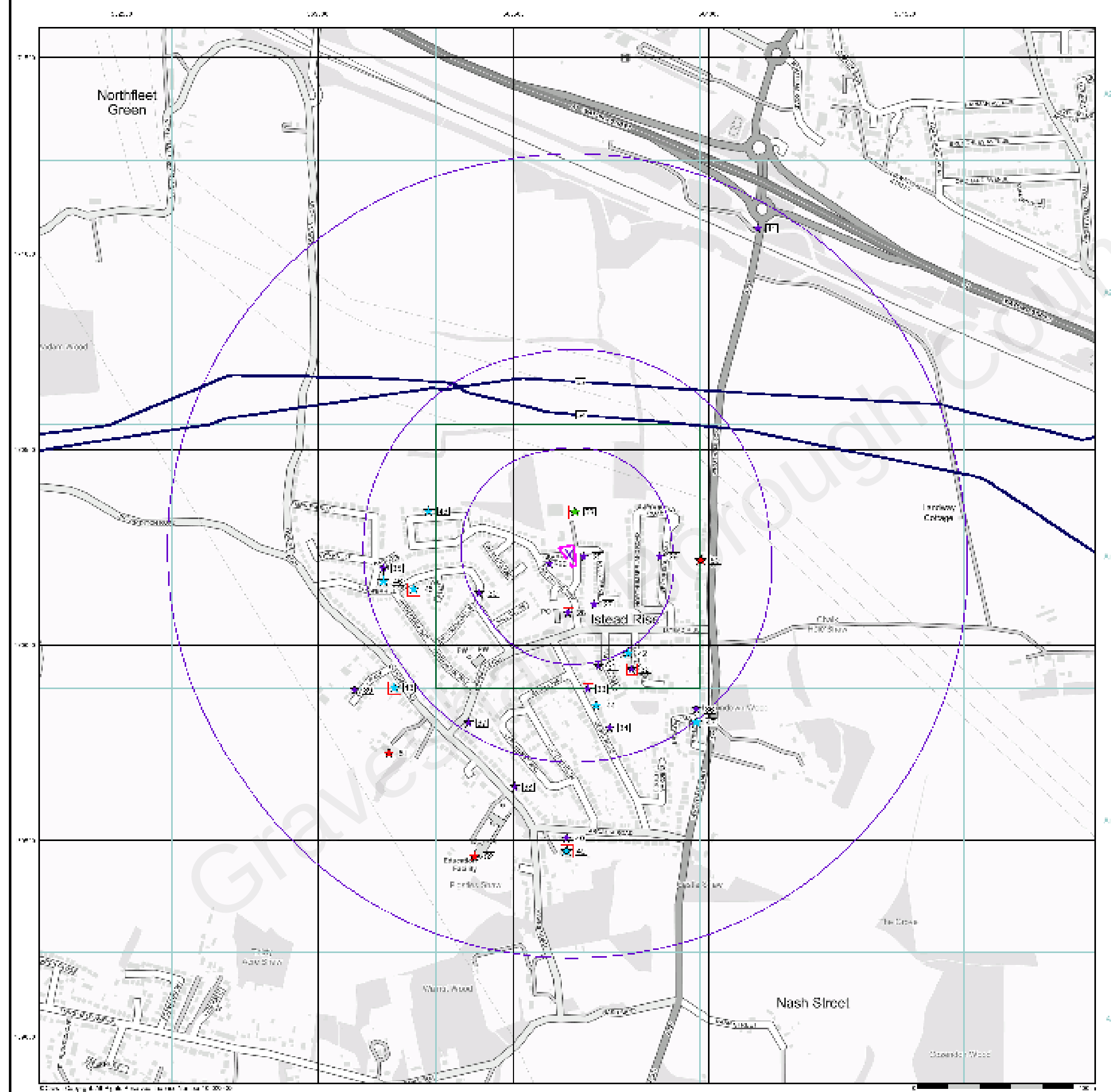
Order Number: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



Tel: 0844 844 9952
 Fax: 0844 844 9951
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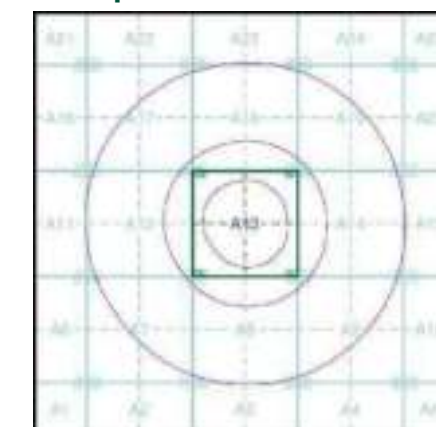
General

- Study Point
- Search Buffer
- ✕ Flood Defence Point

Agency and Hydrological (Flood)

- Flooded Flooding from River or Bay within Defence (Zone 1)
- Flooded from River or Bay without Defence (Zone 2)
- ▨ Area Benefiting from Flood Defence
- Floodable along Roads
- Flood Defence

Flood Map - Slice A



Order Details

Order Number: 299386280_1_1
Customer Ref: 20374
National Grid Reference: 563640, 170230
Slice: A
Site Area (Ha): 0.14
Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB

General

- Study Location
- Search Buffer
- X Borehole Location
- Map ID
- | Location of Local Roads

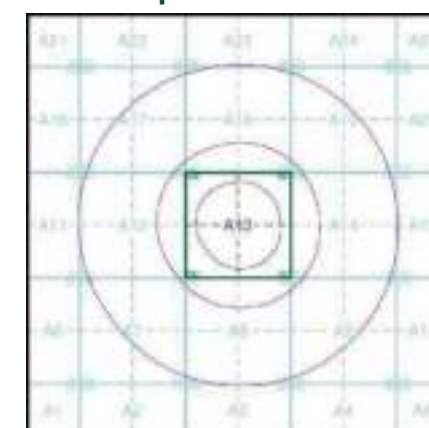
Agency and Hydrological (Boreholes)

- Borehole Location
- Borehole Location
- Borehole Location
- Confined
- Other

For Borehole information please refer to the Borehole .csv file which accompanied this slice.

A copy of the BGS Borehole Ordering Form is available to download from the Support section of www.envirocheck.co.uk.

Borehole Map - Slice A



Order Details

Order Number: 299386280_1_1
Customer Ref: 20374
National Grid Reference: 563640, 170230
Slice: A
Site Area (Ha): 0.14
Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

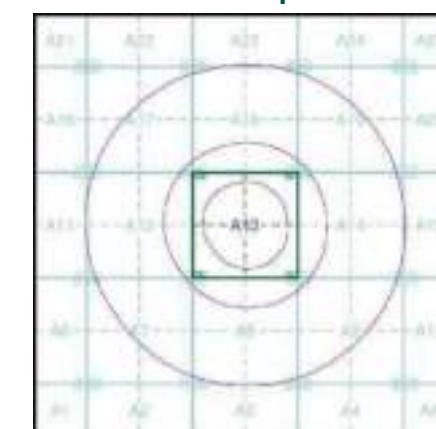
OS Water Network Data

- | | |
|----------------|---------------------------|
| — Canal | — Drain |
| — Reservoir | — Other |
| — Forewater | — Lake |
| — Marsh | — Transfer |
| — Tidal River | — Lock Or Flight Off take |
| — Inland River | — Sea |

Contours (height in meters)

- Standard Contour: — 100 —
- Master Contour: — 100 —
- Spot Height: 100.3
- MFL — Mean Low Water
- MHW — Mean High Water

OS Water Network Map - Slice A



Order Details

Order Number: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB

General

- Study Area
- Search Buffer
- X Existing Drainage Point

Risk of Flooding from Surface Water

- High - 50 Year Return Period
- Medium - 100 Year Return Period
- Low - 100 Year Return Period

Suitability

- Study Area Suitability Map Scale
- All soils in search buffer
- Goodly L.L. L.
- Goodly L.L. L.
- Goodly L.L. L.
- Goodly L.L. L.
- Goodly L.L. L.

E/NRW Suitability Map - Slice A



Order Details

Order Number: 299386280_1_1
Customer Ref: 20374
National Grid Reference: 563640, 170230
Slice: A
Site Area (Ha): 0.14
Search Buffer (m): 1000

Site Details

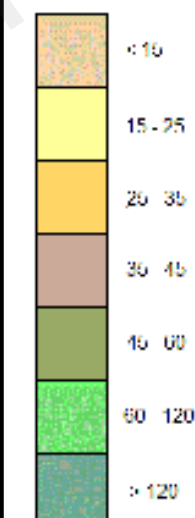
Worcester Close, Istead Rise, GRAVESEND, DA13 9LB

General

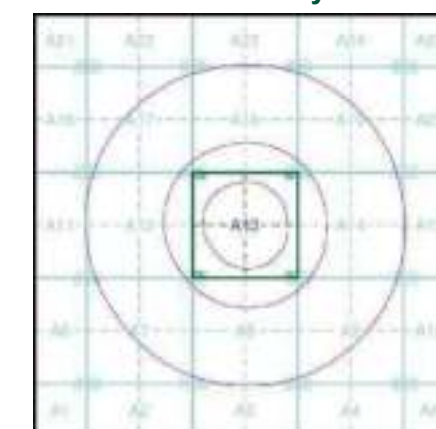
AS Specified Soil AS Soil Buffer Boundary AS Working Reference Point

Estimated Soil Chemistry Arsenic

Arsenic Concentrations mg/kg



Estimated Soil Chemistry Arsenic - Slice A



Order Details

Order Details: 299386280_1_1
Customer Ref: 20374
National Grid Reference: 563640, 170230
Slice: A
Site Area (Ha): 0.14
Search Buffer (m): 1000

Site Details

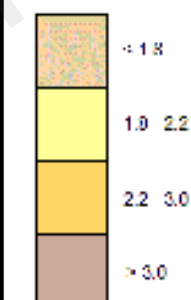
Worcester Close, Istead Rise, GRAVESEND, DA13 9LB

General

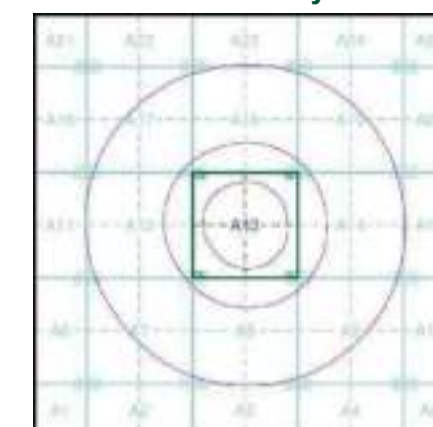
△ Specimen 011 ○ Specimen 012 X Specimen 013

Estimated Soil Chemistry Cadmium

Cadmium Concentrations mg/kg



Estimated Soil Chemistry Cadmium - Slice A



Order Details

Order Details: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

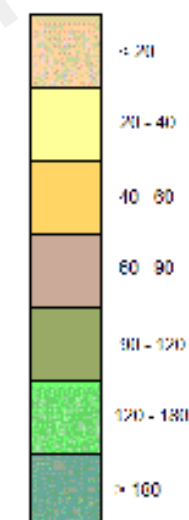
Worcester Close, Istead Rise, GRAVESEND, DA13 9LB

General

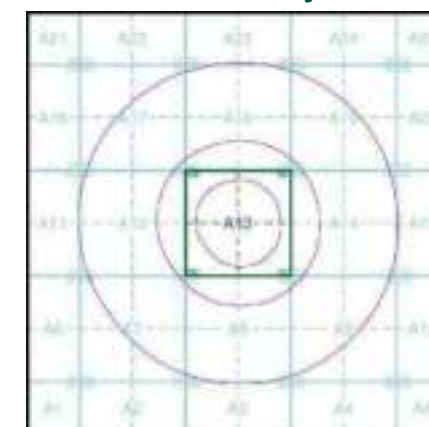
X Specified site
 X Specified site buffer
 X Final site boundary

Estimated Soil Chemistry Chromium

Chromium Concentrations mg/kg



Estimated Soil Chemistry Chromium - Slice A



Order Details

Order Details: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

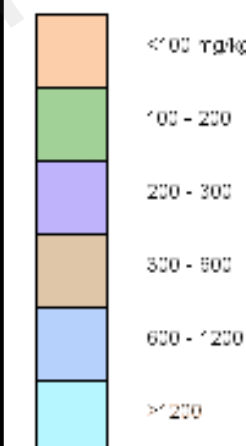
Worcester Close, Istead Rise, GRAVESEND, DA13 9LB

General

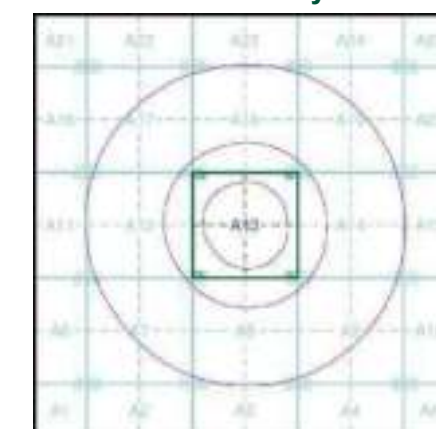
Specified Site Specified Parameter Existing Features

Estimated Soil Chemistry Lead

Lead Concentrations mg/kg



Estimated Soil Chemistry Lead - Slice A



Order Details

Order Details: 299386280_1_1
Customer Ref: 20374
National Grid Reference: 563640, 170230
Slice: A
Site Area (Ha): 0.14
Search Buffer (m): 1000

Site Details

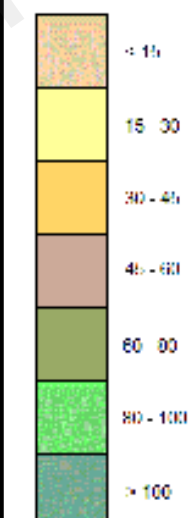
Worcester Close, Istead Rise, GRAVESEND, DA13 9LB

General

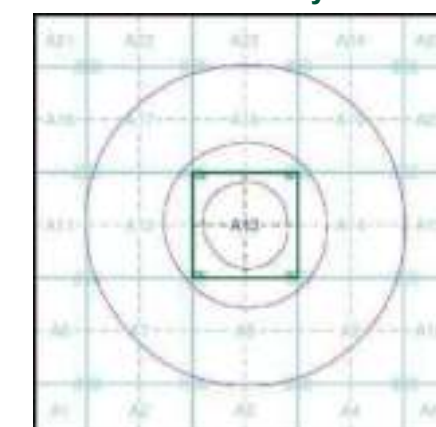
○ Boundary Line
 ○ General Contour
 X Change to contour ...

Estimated Soil Chemistry Nickel

Nickel Concentrations mg/kg



Estimated Soil Chemistry Nickel - Slice A



Order Details

Order Details: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB

Geology 1:50,000 Maps Legends

Artificial Ground and Landslip

| Map Colour | Lex Code | Rock Name | Rock Type | Min and Max Age |
|---|----------|---------------------------|--------------------|-------------------------|
|  | WGR | Worked Ground (Undivided) | Void | Not Supplied - Holocene |
|  | MGR | Made Ground (Undivided) | Artificial Deposit | Not Supplied - Holocene |
|  | WMGR | Infilled Ground | Artificial Deposit | Not Supplied - Holocene |

Superficial Geology

| Map Colour | Lex Code | Rock Name | Rock Type | Min and Max Age |
|---|----------|-----------|-----------------------------|---------------------------|
|  | HEAD | Head | Clay, Silt, Sand and Gravel | Not Supplied - Quaternary |

Bedrock and Faults

| Map Colour | Lex Code | Rock Name | Rock Type | Min and Max Age |
|---|----------|--|-----------|--------------------------|
|  | TAB | Thanet Formation | Sand | Not Supplied - Thanetian |
|  | LSNCK | Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation (Undifferentiated) | Chalk | Not Supplied - Turonian |



Geology 1:50,000 Maps

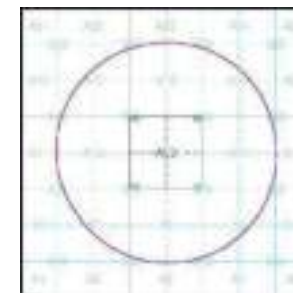
This report contains geological map extracts taken from the BGS Digital Geological map of Great Britain at 1:50,000 scale and is designed for users carrying out preliminary site assessments who require geological maps for the area around the site. This mapping may be more up to date than previously published 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: | 271 |
| Map Name: | Dartford |
| Map Date: | 1998 |
| Bedrock Geology: | Available |
| Superficial Geology: | Available |
| Artificial Geology: | Available |
| Faults: | Not Supplied |
| Landslip: | Available |
| Rock Segments: | Not Supplied |

Geology 1:50,000 Maps - Slice A



Order Details:

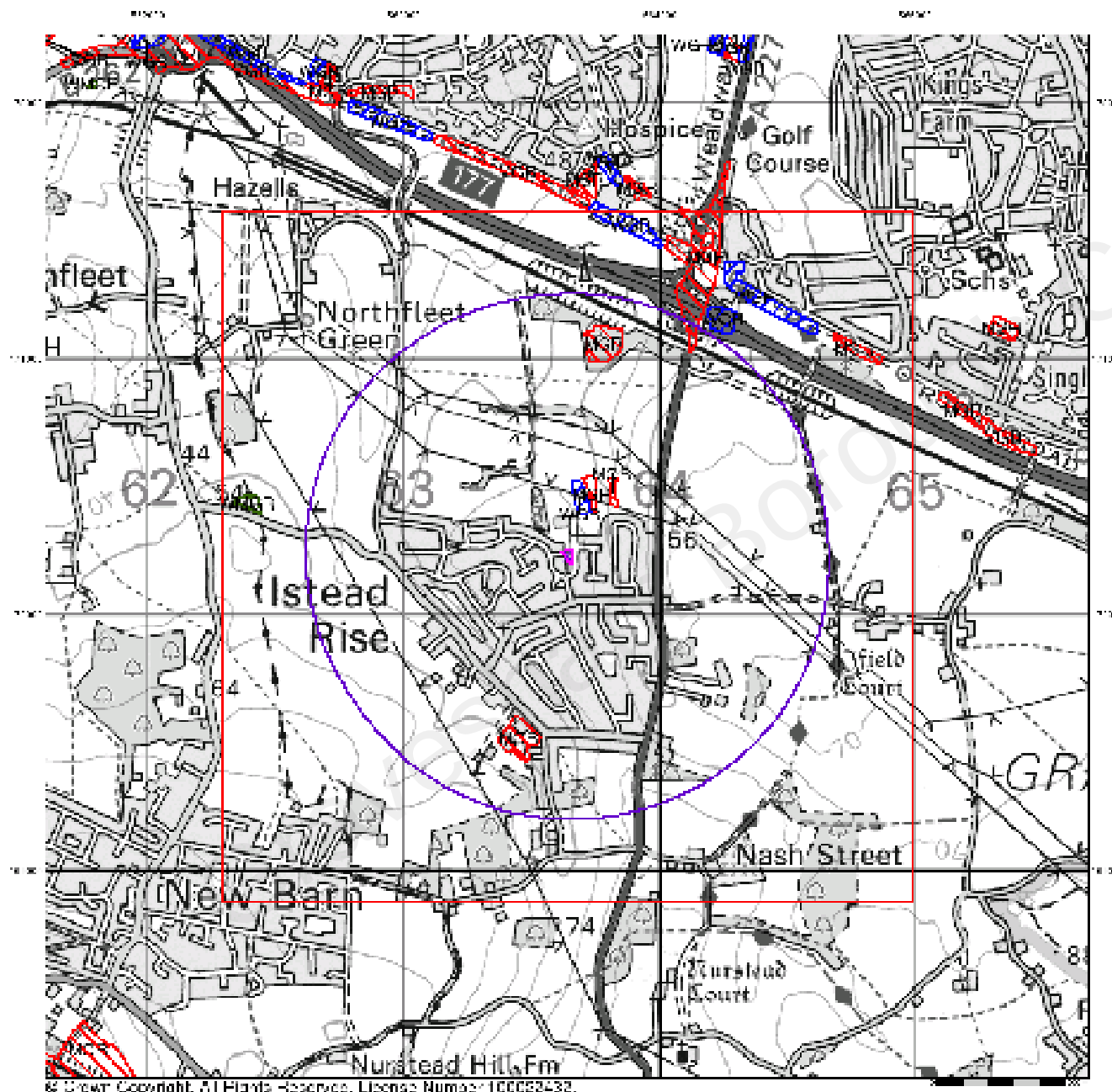
| | |
|--------------------------|----------------|
| Order Number: | 299386280_1_1 |
| Customer Reference: | 20374 |
| National Grid Reference: | 563640, 170230 |
| Slice: | A |
| Site Area (Ha): | 0.14 |
| Search Buffer (m): | 1000 |

Site Details:

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



Tel: 0844 844 9952
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Artificial Ground and Landslip

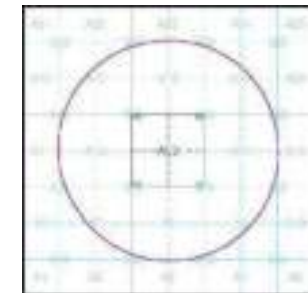
Artificial ground is a term used by BGS for those areas where the ground surface has been significantly modified by human activity. Information about previously developed ground is especially important, as it is often associated with potentially contaminated material, unpredictable engineering conditions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

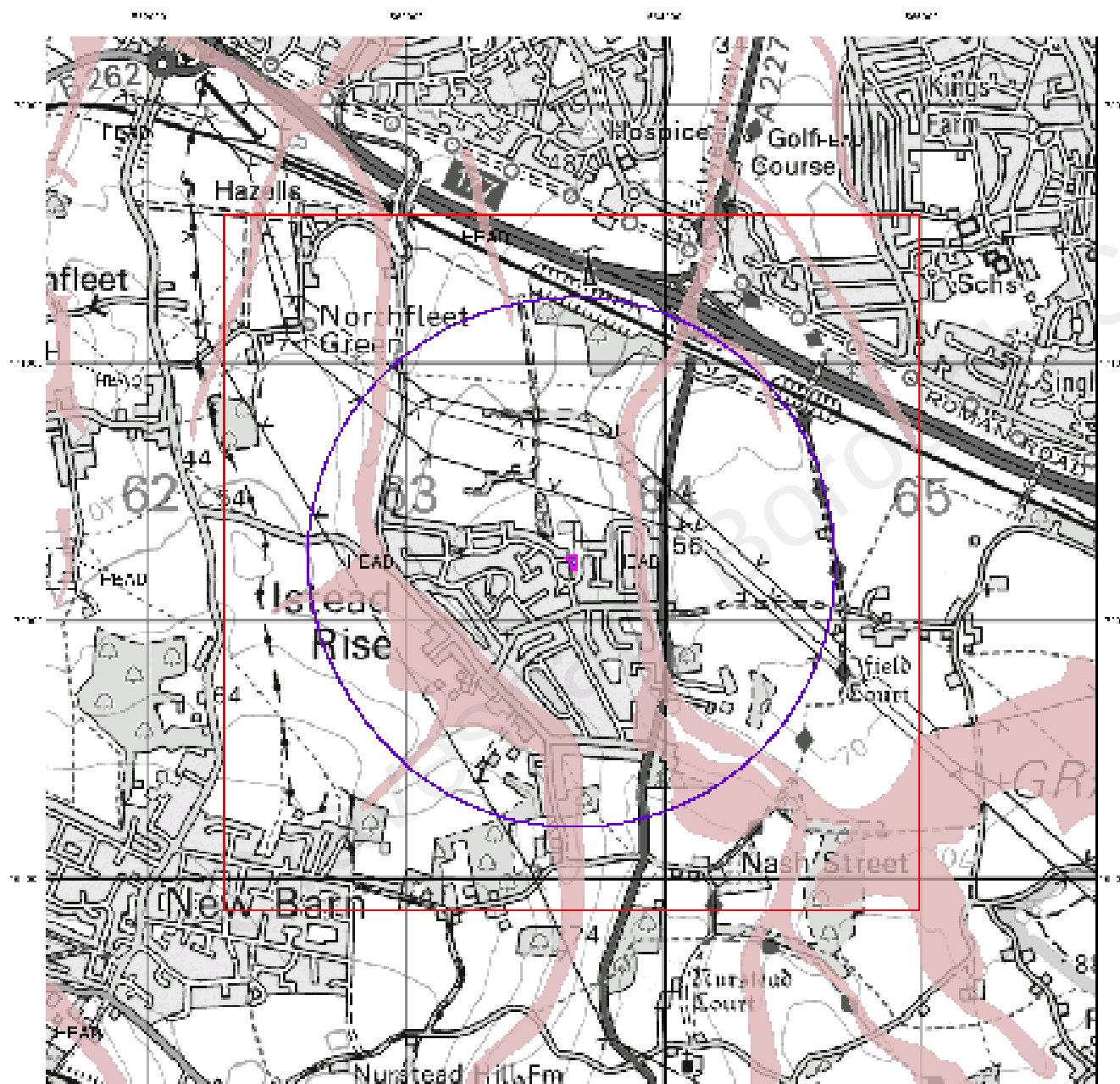
Order Number: 299386280_1_1
 Customer Reference: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details:

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



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 Web: www.envirocheck.co.uk



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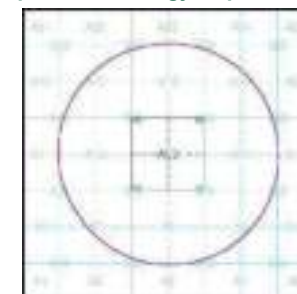
Superficial Geology

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:

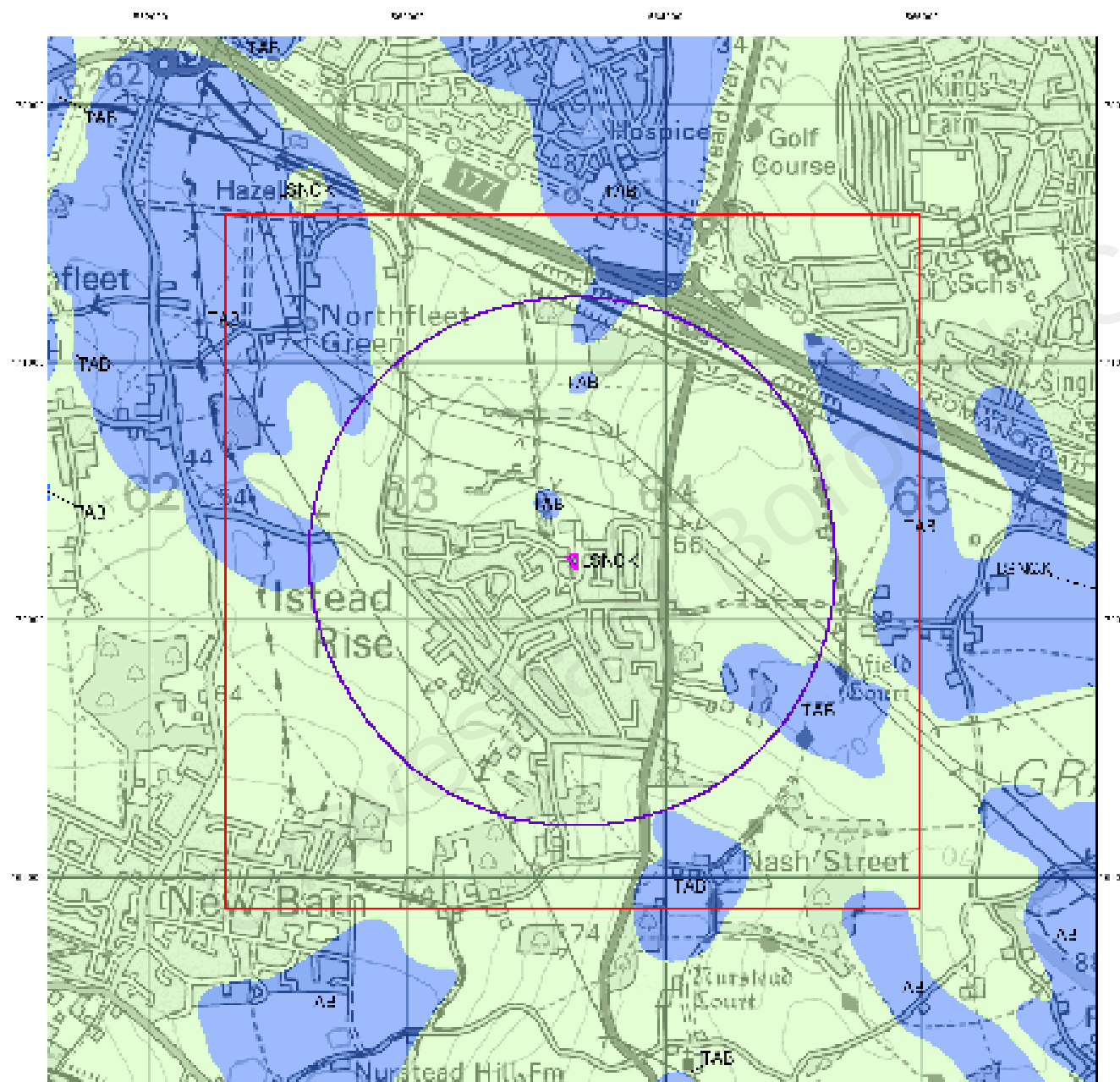
Order Number: 299386280_1_1
 Customer Reference: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details:

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



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 Web: www.envirocheck.co.uk



Bedrock and Faults

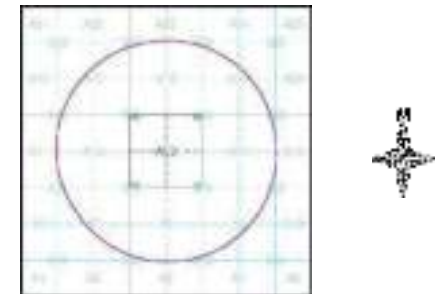
Bedrock geology is a term used for the main mass of rocks forming the Earth and are present everywhere, whether exposed at the surface in outcrops or concealed beneath superficial deposits or water.

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:

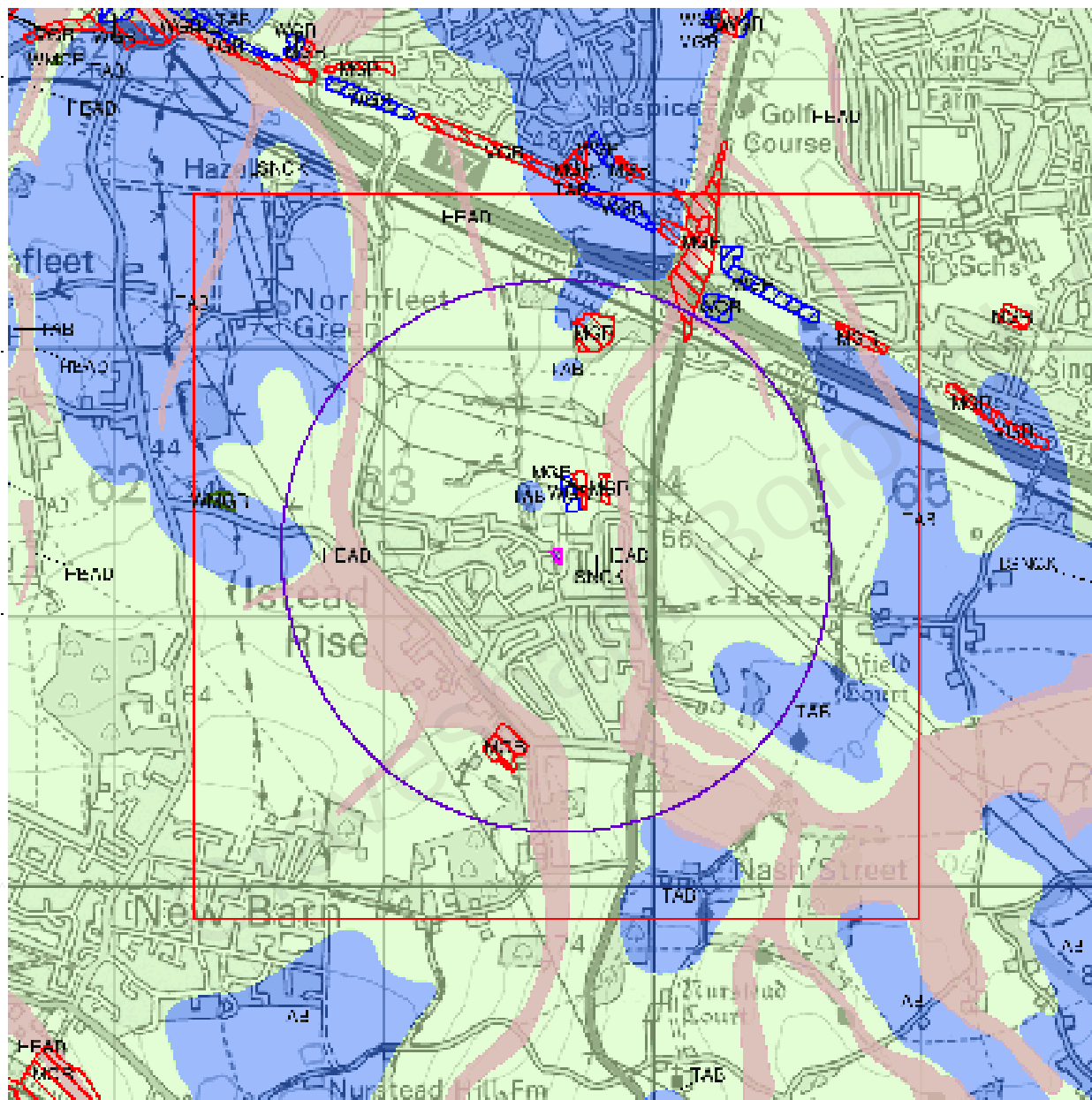
| | |
|--------------------------|----------------|
| Order Number: | 299386280_1_1 |
| Customer Reference: | 20374 |
| National Grid Reference: | 563640, 170230 |
| Slice: | A |
| Site Area (Ha): | 0.14 |
| Search Buffer (m): | 1000 |

Site Details:

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



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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.

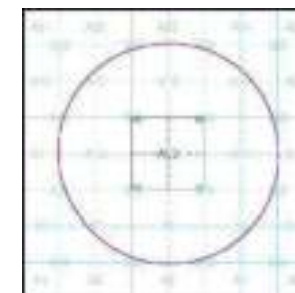
Additional Information

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: 299386280_1_1
Customer Reference: 20374
National Grid Reference: 563640, 170230
Slice: A
Site Area (Ha): 0.14
Search Buffer (m): 1000

Site Details:

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



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Envirocheck[®] Report:

Mining and Ground Stability Datasheet

Order Details:

Order Number:

299386280_1_1

Customer Reference:

20374

National Grid Reference:

563640, 170230

Slice:

A

Site Area (Ha):

0.14

Search Buffer (m):

1000

Site Details:

Worcester Close

Istead Rise

GRAVESEND

DA13 9LB

Client Details:

Mr N Lambert

Soils Ltd

Newton House

Cross Road

Tadworth

Surrey

KT20 5SR

| Report Section and Details | Page Number |
|---|-------------|
| Summary | - |
| <p>The Summary section provides an overview of the data contained within the report, detailing the number of data set features or the existence of a data set in relation to the buffer selected.</p> <p>For ease of reference, the report is broken down into 4 sections of data; Mining and Natural Cavities Data, Historical Land Use Information (1:2,500), Historical Land Use Information (1:10,000) and Ground Stability Data (1:50,000).</p> | |
| Mining and Natural Cavities Data | 1 |
| <p>The Mining and Natural Cavities Data section features data sets related to the existence of mining areas and their potential hazards; and details of naturally formed cavities.</p> <p>Data sets within this section are not plotted, with the exception of BGS Recorded Mineral Sites and Potential Mining Areas which feature on the Historical Land Use Information (1:10,000) map.</p> | |
| Historical Land Use Information (1:2,500) | - |
| <p>The Historical Land Use Information (1:2,500) section contains data captured from analysis carried out by Landmark of 1:1,250 and 1:2,500 scale historical Ordnance Survey mapping, identifying areas where, historically, the land uses were potentially contaminative.</p> <p>For the purpose of this Envirocheck module, only historical data relating to mining and ground stability has been included and plotted on the corresponding Historical Land Use Information (1:2,500) map. This section also includes the Subterranean Features data set, which details various man-made and man-used underground spaces obtained from the Subterranea Britannica society.</p> | |
| Historical Land Use Information (1:10,000) | 3 |
| <p>The Historical Land Use (1:10,000) section covers data captured from the systematic analysis carried out by Landmark of 1:10, 560 and 1:10,000 scale historical Ordnance Survey mapping dating back to the mid-19th century, identifying potentially contaminative past industrial land uses.</p> <p>For the purpose of this Envirocheck module, only data relating to mining and ground stability has been included and plotted on the accompanying Historical Land Use Information (1:10,000) map.</p> | |
| Ground Stability Data (1:50,000) | 4 |
| <p>The Ground Stability (1:50,000) section includes the BGS Geosure data suite, reporting features to 250m and plotted onto 3 separate maps. Also reported is brine subsidence, brine mining and salt mining data sets, of which Brine Pumping and Salt Mining Related Features are plotted, and subsidence insurance claims and insurance investigations data, which is not plotted.</p> | |
| Historical Map List | 6 |
| <p>The Historical Map List section details the historical mapping that has been analysed for your site, in relation to the Historical Land Use Information sections.</p> | |
| Data Currency | 7 |
| Data Suppliers | 8 |
| Useful Contacts | 9 |

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The brine subsidence data relating to the Droitwich area as provided in this report is derived from JPB studies and physical monitoring undertaken annually over more than 35 years. For more detailed interpretation contact enquiries@jpb.co.uk. JPB retain the copyright and intellectual rights to this data and accept no liability for any loss or damage, including in direct or consequential loss, arising from the use of this data.

The Mining Instability data was obtained on licence from Ove Arup & Partners Limited (for further information, contact mining.review@arup.com). No reproduction or further use of such Data is to be made without the prior written consent of Ove Arup & Partners Limited. The supplied Mining Instability data is derived from publicly available records and other third party sources and neither Ove Arup & Partners nor Landmark warrant the accuracy or completeness of such information or data.

Report Version v53.0

| Data Type | Page Number | On Site | 0 to 250m | 251 to 500m | 501 to 1000m |
|--|-------------|---------|-----------|-------------|--------------|
| Mining and Natural Cavities Data | | | | | |
| BGS Recorded Mineral Sites | pg 1 | | 1 | 1 | 6 |
| Coal Mining Affected Areas | | | n/a | n/a | n/a |
| Man Made Mining Cavities | pg 2 | | | 1 | 1 |
| Mining Instability | pg 2 | Yes | n/a | n/a | n/a |
| Natural Cavities | | | | | |
| Non Coal Mining Areas of Great Britain | pg 2 | Yes | Yes | n/a | n/a |
| Potential Mining Areas | | | | | |
| Historical Land Use Information (1:2,500) | | | | | |
| Extractive Industries or Potential Excavations from 1855-1909 (100m) | | | | n/a | n/a |
| Extractive Industries or Potential Excavations from 1893-1915 (100m) | | | | n/a | n/a |
| Extractive Industries or Potential Excavations from 1906-1937 (100m) | | | | n/a | n/a |
| Extractive Industries or Potential Excavations from 1924-1949 (100m) | | | | n/a | n/a |
| Extractive Industries or Potential Excavations from 1950-1980 (100m) | | | | n/a | n/a |
| Subterranean Features (100m) | | | | n/a | n/a |
| Historical Land Use Information (1:10,000) | | | | | |
| Air Shafts | | | | | |
| Disturbed Ground | | | | | |
| General Quarrying | pg 3 | | | | 1 |
| Heap, unknown constituents | | | | | |
| Mineral Railway | | | | | |
| Mining & quarrying general | | | | | |
| Mining of coal & lignite | | | | | |
| Quarrying of sand & clay, operation of sand & gravel pits | pg 3 | | | 1 | 3 |
| Former Marshes | | | | | |
| Potentially Infilled Land (Non-Water) | pg 3 | | | 1 | 4 |
| Potentially Infilled Land (Water) | | | | | |
| Ground Stability Data (1:50,000) | | | | | |
| CBSCB Compensation District | | | n/a | n/a | n/a |
| Brine Pumping Related Features | | | | | |
| Brine Subsidence Solution Area | | | | | |
| Potential for Collapsible Ground Stability Hazards | pg 4 | Yes | Yes | n/a | n/a |
| Potential for Compressible Ground Stability Hazards | pg 4 | Yes | Yes | n/a | n/a |
| Potential for Ground Dissolution Stability Hazards | pg 4 | Yes | Yes | n/a | n/a |
| Potential for Landslide Ground Stability Hazards | pg 4 | Yes | Yes | n/a | n/a |
| Potential for Running Sand Ground Stability Hazards | pg 5 | Yes | Yes | n/a | n/a |
| Potential for Shrinking or Swelling Clay Ground Stability Hazards | pg 5 | Yes | Yes | n/a | n/a |
| Salt Mining Related Features | | | | | |

Report Version v53.0

Gravesham Borough Council

| Map ID | Details | Quadrant Reference (Compass Direction) | Estimated Distance From Site | Contact | NGR |
|--------|---|--|------------------------------|---------|---------------|
| 1 | BGS Recorded Mineral Sites
Site Name: Istead Rise Chalkwell
Location: Istead Rise, Gravesend, Kent
Source: British Geological Survey, National Geoscience Information Service
Reference: 220345
Type: Underground
Status: Ceased
Operator: Unknown Operator
Operator Location: Not Supplied
Periodic Type: Cretaceous
Geology: White Chalk Subgroup
Commodity: Chalk
Positional Accuracy: Located by supplier to within 10m | A13NW (NW) | 225 | 1 | 563422 170362 |
| 2 | BGS Recorded Mineral Sites
Site Name: Frog'S Island Chalk Pit
Location: Istead Rise, Gravesend, Kent
Source: British Geological Survey, National Geoscience Information Service
Reference: 131068
Type: Opencast
Status: Ceased
Operator: Unknown Operator
Operator Location: Not Supplied
Periodic Type: Cretaceous
Geology: White Chalk Subgroup
Commodity: Chalk
Positional Accuracy: Located by supplier to within 10m | A13NW (N) | 269 | 1 | 563537 170504 |
| 3 | BGS Recorded Mineral Sites
Site Name: Huntontdown Chalk Pit
Location: Istead Rise, Gravesend, Kent
Source: British Geological Survey, National Geoscience Information Service
Reference: 131103
Type: Opencast
Status: Ceased
Operator: Unknown Operator
Operator Location: Not Supplied
Periodic Type: Cretaceous
Geology: White Chalk Subgroup
Commodity: Chalk
Positional Accuracy: Located by supplier to within 10m | A9NW (SE) | 577 | 1 | 564039 169767 |
| 4 | BGS Recorded Mineral Sites
Site Name: Chalk Hole Shaw
Location: Istead Rise, Gravesend, Kent
Source: British Geological Survey, National Geoscience Information Service
Reference: 131067
Type: Opencast
Status: Ceased
Operator: Unknown Operator
Operator Location: Not Supplied
Periodic Type: Cretaceous
Geology: White Chalk Subgroup
Commodity: Chalk
Positional Accuracy: Located by supplier to within 10m | A14SW (E) | 592 | 1 | 564237 170075 |
| 5 | BGS Recorded Mineral Sites
Site Name: Dover Castle Chalk Pit
Location: Istead Rise, Gravesend, Kent
Source: British Geological Survey, National Geoscience Information Service
Reference: 131102
Type: Opencast
Status: Ceased
Operator: Unknown Operator
Operator Location: Not Supplied
Periodic Type: Cretaceous
Geology: White Chalk Subgroup
Commodity: Chalk
Positional Accuracy: Located by supplier to within 10m | A8NE (S) | 625 | 1 | 563805 169594 |
| 6 | BGS Recorded Mineral Sites
Site Name: Istead Rise Chalkwell
Location: Southfleet, Gravesend, Kent
Source: British Geological Survey, National Geoscience Information Service
Reference: 220328
Type: Underground
Status: Ceased
Operator: Unknown Operator
Operator Location: Not Supplied
Periodic Type: Cretaceous
Geology: White Chalk Subgroup
Commodity: Chalk
Positional Accuracy: Located by supplier to within 10m | A17SE (NW) | 734 | 1 | 563280 170900 |

| Map ID | Details | Quadrant Reference (Compass Direction) | Estimated Distance From Site | Contact | NGR |
|--------|--|--|------------------------------|---------|---------------|
| 7 | BGS Recorded Mineral Sites
Site Name: Northfleet Green Chalk Pit
Location: Southfleet, Gravesend, Kent
Source: British Geological Survey, National Geoscience Information Service
Reference: 131065
Type: Opencast
Status: Ceased
Operator: Unknown Operator
Operator Location: Not Supplied
Periodic Type: Cretaceous
Geology: White Chalk Subgroup
Commodity: Chalk
Positional Accuracy: Located by supplier to within 10m | A17SE (NW) | 848 | 1 | 562977 170804 |
| 8 | BGS Recorded Mineral Sites
Site Name: Stanhill Farm Denehole
Location: Southfleet, Gravesend, Kent
Source: British Geological Survey, National Geoscience Information Service
Reference: 220783
Type: Underground
Status: Ceased
Operator: Unknown Operator
Operator Location: Not Supplied
Periodic Type: Cretaceous
Geology: White Chalk Subgroup
Commodity: Chalk
Positional Accuracy: Located by supplier to within 10m | A12NW (W) | 978 | 1 | 562640 170300 |
| | Coal Mining Affected Areas
In an area which may not be affected by coal mining | | | | |
| | Man Made Mining Cavities
Cavity Type: 2x Chalkwells (Connected)
Commodity: Chalk
Solid Geology Detail: Chalk Group
Superficial Geology No Details
Detail: | A13NW (NW) | 265 | 2 | 563400 170400 |
| | Man Made Mining Cavities
Cavity Type: Chalkwell
Commodity: Chalk
Solid Geology Detail: Chalk Group
Superficial Geology No Details
Detail: | A18SW (NW) | 725 | 2 | 563300 170900 |
| | Mining Instability
Mining Evidence: Conclusive Rock Mining
Source: Ove Arup & Partners
Boundary Quality: As Supplied | A13NE (NE) | 0 | 3 | 563642 170230 |
| | Non Coal Mining Areas of Great Britain
Risk: Rare
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 0 | 1 | 563642 170230 |
| | Non Coal Mining Areas of Great Britain
Risk: Likely
Source: British Geological Survey, National Geoscience Information Service | A13NW (NW) | 126 | 1 | 563507 170310 |
| | Non Coal Mining Areas of Great Britain
Risk: Highly Likely
Source: British Geological Survey, National Geoscience Information Service | A13NW (NW) | 176 | 1 | 563464 170336 |
| | Non Coal Mining Areas of Great Britain
Risk: Rare
Source: British Geological Survey, National Geoscience Information Service | A13SE (S) | 201 | 1 | 563642 170000 |

Historical Land Use Information (1:10,000)

| Map ID | Details | Quadrant Reference (Compass Direction) | Estimated Distance From Site | Contact | NGR |
|--------|--|--|------------------------------|---------|---------------|
| 9 | General Quarrying
Use: Not Supplied
Date of Mapping: 1869 | A14SW (E) | 594 | - | 564239 170073 |
| 10 | Quarrying of sand & clay, operation of sand & gravel pits
Use: Not Supplied
Date of Mapping: 1898 | A13NW (N) | 262 | - | 563538 170497 |
| 11 | Quarrying of sand & clay, operation of sand & gravel pits
Use: Not Supplied
Date of Mapping: 1897 | A9NW (SE) | 551 | - | 564025 169789 |
| 12 | Quarrying of sand & clay, operation of sand & gravel pits
Use: Not Supplied
Date of Mapping: 1869 | A8NE (S) | 625 | - | 563804 169593 |
| 13 | Quarrying of sand & clay, operation of sand & gravel pits
Use: Not Supplied
Date of Mapping: 1898 | A17SE (NW) | 849 | - | 562974 170803 |
| 14 | Potentially Infilled Land (Non-Water)
Use: Unknown Filled Ground (Pit, quarry etc)
Date of Mapping: 1991 | A13NW (N) | 263 | - | 563535 170497 |
| 15 | Potentially Infilled Land (Non-Water)
Use: Unknown Filled Ground (Pit, quarry etc)
Date of Mapping: 1981 | A9NW (SE) | 551 | - | 564025 169789 |
| 16 | Potentially Infilled Land (Non-Water)
Use: Unknown Filled Ground (Pit, quarry etc)
Date of Mapping: 1991 | A14SW (E) | 596 | - | 564240 170070 |
| 17 | Potentially Infilled Land (Non-Water)
Use: Unknown Filled Ground (Pit, quarry etc)
Date of Mapping: 1981 | A8NE (S) | 625 | - | 563804 169593 |
| 18 | Potentially Infilled Land (Non-Water)
Use: Unknown Filled Ground (Pit, quarry etc)
Date of Mapping: 1991 | A17SE (NW) | 846 | - | 562979 170805 |

| Map ID | Details | Quadrant Reference (Compass Direction) | Estimated Distance From Site | Contact | NGR |
|--------|---|--|------------------------------|---------|---------------|
| | CBSCB Compensation District
The site does not fall within the brine compensation area. | | | | |
| | Brine Subsidence Solution Area
The site does not fall within the brine subsidence solution area. | | | | |
| 19 | Potential for Collapsible Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 0 | 1 | 563642 170230 |
| 20 | Potential for Collapsible Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13SE (S) | 201 | 1 | 563642 170000 |
| 21 | Potential for Compressible Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 171 | 1 | 563742 170401 |
| 22 | Potential for Compressible Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 237 | 1 | 563809 170433 |
| | Potential for Compressible Ground Stability Hazards
Hazard Potential: No Hazard
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 0 | 1 | 563642 170230 |
| | Potential for Compressible Ground Stability Hazards
Hazard Potential: No Hazard
Source: British Geological Survey, National Geoscience Information Service | A13SE (S) | 201 | 1 | 563642 170000 |
| 23 | Potential for Ground Dissolution Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 0 | 1 | 563642 170230 |
| 24 | Potential for Ground Dissolution Stability Hazards
Hazard Potential: Moderate
Source: British Geological Survey, National Geoscience Information Service | A13NW (NW) | 61 | 1 | 563569 170285 |
| 25 | Potential for Ground Dissolution Stability Hazards
Hazard Potential: Low
Source: British Geological Survey, National Geoscience Information Service | A13NW (NW) | 155 | 1 | 563563 170393 |
| 26 | Potential for Ground Dissolution Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13SE (S) | 201 | 1 | 563642 170000 |
| 27 | Potential for Ground Dissolution Stability Hazards
Hazard Potential: Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (E) | 217 | 1 | 563875 170243 |
| 28 | Potential for Ground Dissolution Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (E) | 246 | 1 | 563903 170240 |
| | Potential for Ground Dissolution Stability Hazards
Hazard Potential: No Hazard
Source: British Geological Survey, National Geoscience Information Service | A13NW (N) | 170 | 1 | 563590 170415 |
| 29 | Potential for Landslide Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NW (NW) | 155 | 1 | 563563 170393 |
| 30 | Potential for Landslide Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 171 | 1 | 563742 170401 |
| 31 | Potential for Landslide Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (E) | 217 | 1 | 563875 170243 |
| 32 | Potential for Landslide Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 237 | 1 | 563809 170433 |
| 33 | Potential for Landslide Ground Stability Hazards
Hazard Potential: Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (E) | 246 | 1 | 563903 170240 |
| | Potential for Landslide Ground Stability Hazards
Hazard Potential: No Hazard
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 0 | 1 | 563642 170230 |

| Map ID | Details | Quadrant Reference (Compass Direction) | Estimated Distance From Site | Contact | NGR |
|--------|---|--|------------------------------|---------|---------------|
| | Potential for Landslide Ground Stability Hazards
Hazard Potential: No Hazard
Source: British Geological Survey, National Geoscience Information Service | A13SE (S) | 201 | 1 | 563642 170000 |
| 34 | Potential for Running Sand Ground Stability Hazards
Hazard Potential: Low
Source: British Geological Survey, National Geoscience Information Service | A13NW (NW) | 155 | 1 | 563563 170393 |
| 35 | Potential for Running Sand Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 171 | 1 | 563742 170401 |
| 36 | Potential for Running Sand Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (E) | 217 | 1 | 563875 170243 |
| 37 | Potential for Running Sand Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 237 | 1 | 563809 170433 |
| | Potential for Running Sand Ground Stability Hazards
Hazard Potential: No Hazard
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 0 | 1 | 563642 170230 |
| | Potential for Running Sand Ground Stability Hazards
Hazard Potential: No Hazard
Source: British Geological Survey, National Geoscience Information Service | A13SE (S) | 201 | 1 | 563642 170000 |
| 38 | Potential for Shrinking or Swelling Clay Ground Stability Hazards
Hazard Potential: Very Low
Source: British Geological Survey, National Geoscience Information Service | A13NE (E) | 217 | 1 | 563875 170243 |
| | Potential for Shrinking or Swelling Clay Ground Stability Hazards
Hazard Potential: No Hazard
Source: British Geological Survey, National Geoscience Information Service | A13NE (NE) | 0 | 1 | 563642 170230 |
| | Potential for Shrinking or Swelling Clay Ground Stability Hazards
Hazard Potential: No Hazard
Source: British Geological Survey, National Geoscience Information Service | A13SE (S) | 201 | 1 | 563642 170000 |

The following mapping has been analysed for Historical Land Use Information (1:2,500):

| 1:2,500 | Mapsheet | Published Date |
|----------------------|----------|----------------|
| Kent | 010_14 | 1874 |
| Kent | 010_14 | 1896 |
| Kent | 010_14 | 1908 |
| Kent | 010_14 | 1938 |
| Ordnance Survey Plan | TQ6369 | 1961 |
| Ordnance Survey Plan | TQ6370 | 1961 |

The following mapping has been analysed for Historical Land Use Information (1:10,000):

| 1:10,560 | Mapsheet | Published Date |
|----------------------|----------|----------------|
| Kent | 010_00 | 1869 |
| Kent | 018_00 | 1869 |
| Essex | 088_00 | 1872 |
| Essex | 089_00 | 1872 |
| Kent | 018_NE | 1897 |
| Kent | 018_NW | 1897 |
| Kent | 010_SE | 1898 |
| Kent | 010_SW | 1898 |
| Kent | 010_SE | 1909 |
| Kent | 010_SW | 1909 |
| Kent | 018_NE | 1909 |
| Kent | 018_NW | 1909 |
| Kent | 010_SW | 1938 |
| Kent | 018_NW | 1938 |
| Kent | 018_NE | 1939 |
| Kent | 010_SE | 1946 |
| Ordnance Survey Plan | TQ66NW | 1961 |
| Ordnance Survey Plan | TQ67SW | 1962 |
| 1:10,000 | Mapsheet | Published Date |
| Ordnance Survey Plan | TQ66NW | 1981 |
| Ordnance Survey Plan | TQ67SW | 1991 |

| Mining and Cavities Data | Version | Update Cycle |
|--|------------------------------|-----------------------|
| BGS Recorded Mineral Sites
British Geological Survey - National Geoscience Information Service | May 2022 | Bi-Annually |
| Coal Mining Affected Areas
The Coal Authority - Property Searches | March 2014 | Annual Rolling Update |
| Man Made Mining Cavities
Stantec UK Ltd | December 2021 | Bi-Annually |
| Mining Instability
Ove Arup & Partners | June 1998 | Not Applicable |
| Natural Cavities
Stantec UK Ltd | December 2021 | Bi-Annually |
| Non Coal Mining Areas of Great Britain
British Geological Survey - National Geoscience Information Service | May 2015 | Not Applicable |
| Historical Land Use Information (1:2,500) | Version | Update Cycle |
| Subterranean Features
Landmark Information Group Limited | June 2022 | Bi-Annually |
| Ground Stability Data (1:50,000) | Version | Update Cycle |
| CBSCB Compensation District
Cheshire Brine Subsidence Compensation Board (CBSCB)
Cheshire Brine Subsidence Compensation Board (CBSCB) | August 2011
November 2020 | As notified |
| Potential for Collapsible Ground Stability Hazards
British Geological Survey - National Geoscience Information Service | April 2020 | As notified |
| Potential for Compressible Ground Stability Hazards
British Geological Survey - National Geoscience Information Service | January 2019 | As notified |
| Potential for Ground Dissolution Stability Hazards
British Geological Survey - National Geoscience Information Service | January 2019 | As notified |
| Potential for Landslide Ground Stability Hazards
British Geological Survey - National Geoscience Information Service | January 2019 | As notified |
| Potential for Running Sand Ground Stability Hazards
British Geological Survey - National Geoscience Information Service | January 2019 | As notified |
| Potential for Shrinking or Swelling Clay Ground Stability Hazards
British Geological Survey - National Geoscience Information Service | January 2019 | As notified |
| Brine Subsidence Solution Area
Johnson Poole & Bloomer | December 2020 | Annual Rolling Update |

A selection of organisations who provide data within this report

| Data Supplier | Data Supplier Logo |
|---------------------------|--|
| Ordnance Survey |  |
| British Geological Survey |  |
| The Coal Authority |  |
| Ove Arup |  |
| Stantec UK Ltd |  |
| Wardell Armstrong |  |
| Johnson Poole & Bloomer |  |

| Contact | Name and Address | Contact Details |
|---------|---|--|
| 1 | British Geological Survey - Enquiry Service
British Geological Survey, Environmental Science Centre, Keyworth,
Nottingham, Nottinghamshire, NG12 5GG | Telephone: 0115 936 3143
Fax: 0115 936 3276
Email: enquiries@bgs.ac.uk
Website: www.bgs.ac.uk |
| 2 | Stantec UK Ltd
Caversham Bridge House, Waterman Place, Reading, RG1 8DN | Telephone: 0118 950 0761
Email: pba.reading@stantec.com
Website: www.stantec.com |
| 3 | Ove Arup & Partners
Central Square, Forth Street, Newcastle upon Tyne, Tyne and Wear, NE1
3PL | Telephone: 0191 261 6080
Fax: 0191 261 7879 |
| - | Landmark Information Group Limited
Imperium, Imperial Way, Reading, Berkshire, RG2 0TD | Telephone: 0844 844 9952
Fax: 0844 844 9951
Email: customerservices@landmarkinfo.co.uk
Website: www.landmarkinfo.co.uk |

Historical Land Use Information (1:2,500)

General

Specialist data: Specialist data: X showing the location of the site on the map.

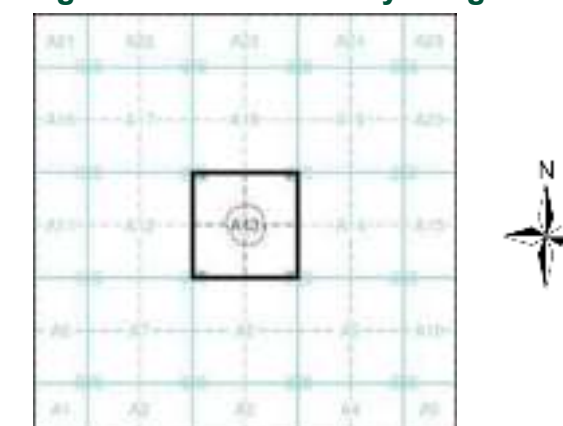
Potentially Contaminative Industrial Uses (Extractive Industries Activity)

| | Point | Line | Polygon |
|--|-------|------|---------|
| Extractive Industries Activity - by year 1850 - 1870 | ▲ | — | ■ |
| Extractive Industries Activity - by year 1870 - 1910 | ▲ | — | ■ |
| Extractive Industries Activity - by year 1910 - 1930 | ▲ | — | ■ |
| Extractive Industries Activity - by year 1930 - 1950 | ▲ | — | ■ |
| Extractive Industries Activity - by year 1950 - 1970 | ▲ | — | ■ |

Subterranean Features

| | Point | Line | Polygon |
|-----------------------|-------|------|---------|
| Subterranean features | ▼ | --- | ■ |

Mining and Ground Stability - Segment A13

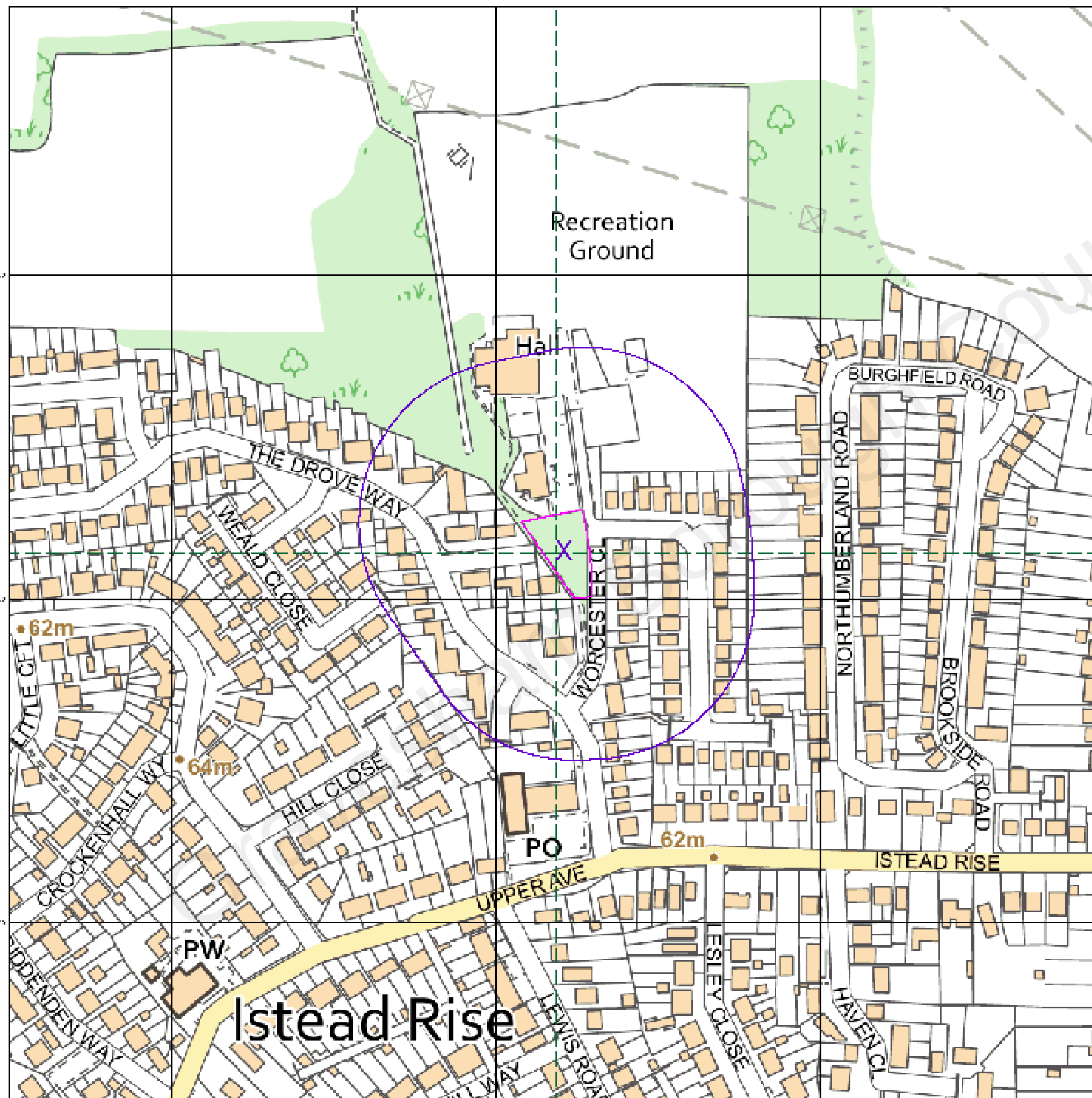


Order Details

Order Number: 299386280_1_1
Customer Ref: 20374
National Grid Reference: 563640, 170230
Slice: A
Site Area (Ha): 0.14
Plot Buffer (m): 100

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



Historical Land Use Information (1:10,000)

General

Search Buffer Zone
 Search Buffer (m)
 Search Buffer (m)
 Search Buffer (m)

Potentially Contaminative Industrial Uses (Past Land Uses - Mining)

| | Point | Line | Polygon |
|---------------------------|-------|------|---------|
| Asbestos | | | |
| Bituminous Road | | | |
| Chemical Manufacturing | | | |
| Engineering Works | | | |
| Food Processing | | | |
| Food Processing (Dairy) | | | |
| Food Processing (Meat) | | | |
| Food Processing (Poultry) | | | |
| Food Processing (Seafood) | | | |

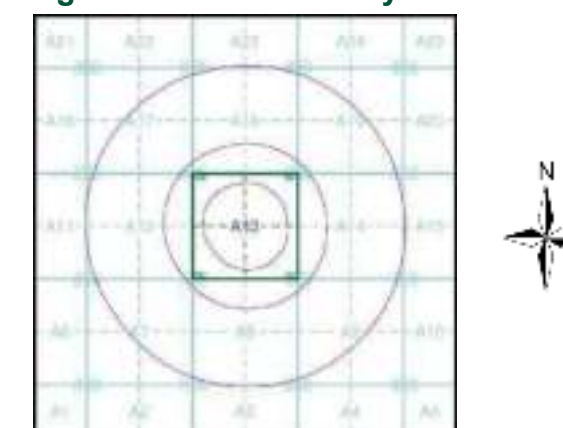
Historical Land Use

| | Point | Line | Polygon |
|--------------------------------------|-------|------|---------|
| Brickworks - Infill and (Brickworks) | | | |
| Brickworks - Infill and (Brickworks) | | | |
| Brickworks - Infill and (Brickworks) | | | |

Mining Data

Mining Data (Line)
 Mining Data (Point)

Mining and Ground Stability - Slice A



Order Details

Order Number: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

Worcester Close, Isleard Rise, GRAVESEND, DA13 9LB



Ground Stability Data (1:50,000)

General

1:1000
 1:5000
 1:25000

Potential for Compressible Ground Stability Hazards

High
 Medium
 Low
 Very Low

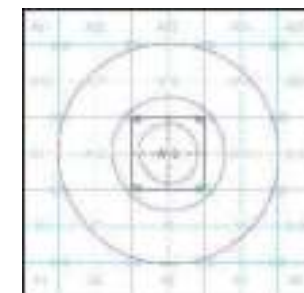
Potential for Collapsible Ground Stability Hazards

High
 Medium
 Low
 Very Low

Brine Pumping and Salt Mining

Brine Pumping
 Salt Mining
 Brine Pumping
 Salt Mining

Mining and Ground Stability - Slice A



Order Details

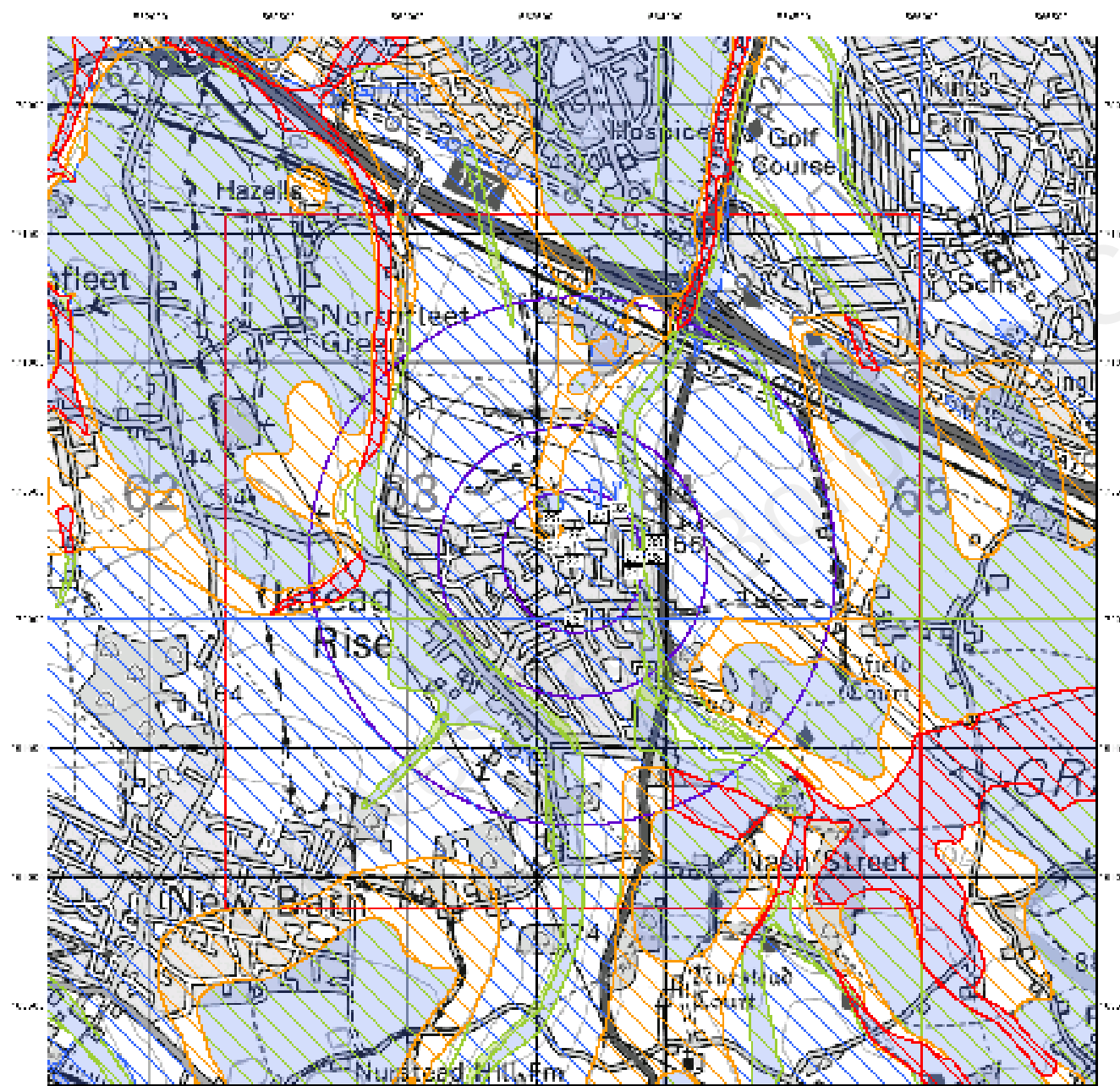
Order Number: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



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



Ground Stability Data (1:50,000)

General

Proposed Development Existing Development Unaffected Area

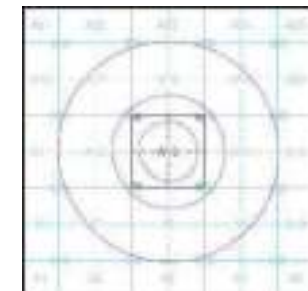
Potential for Landslide Ground Stability Hazards

High Low
 Moderate Very Low

Potential for Ground Dissolution Stability Hazards

High Low
 Moderate Very Low

Mining and Ground Stability - Slice A



Order Details

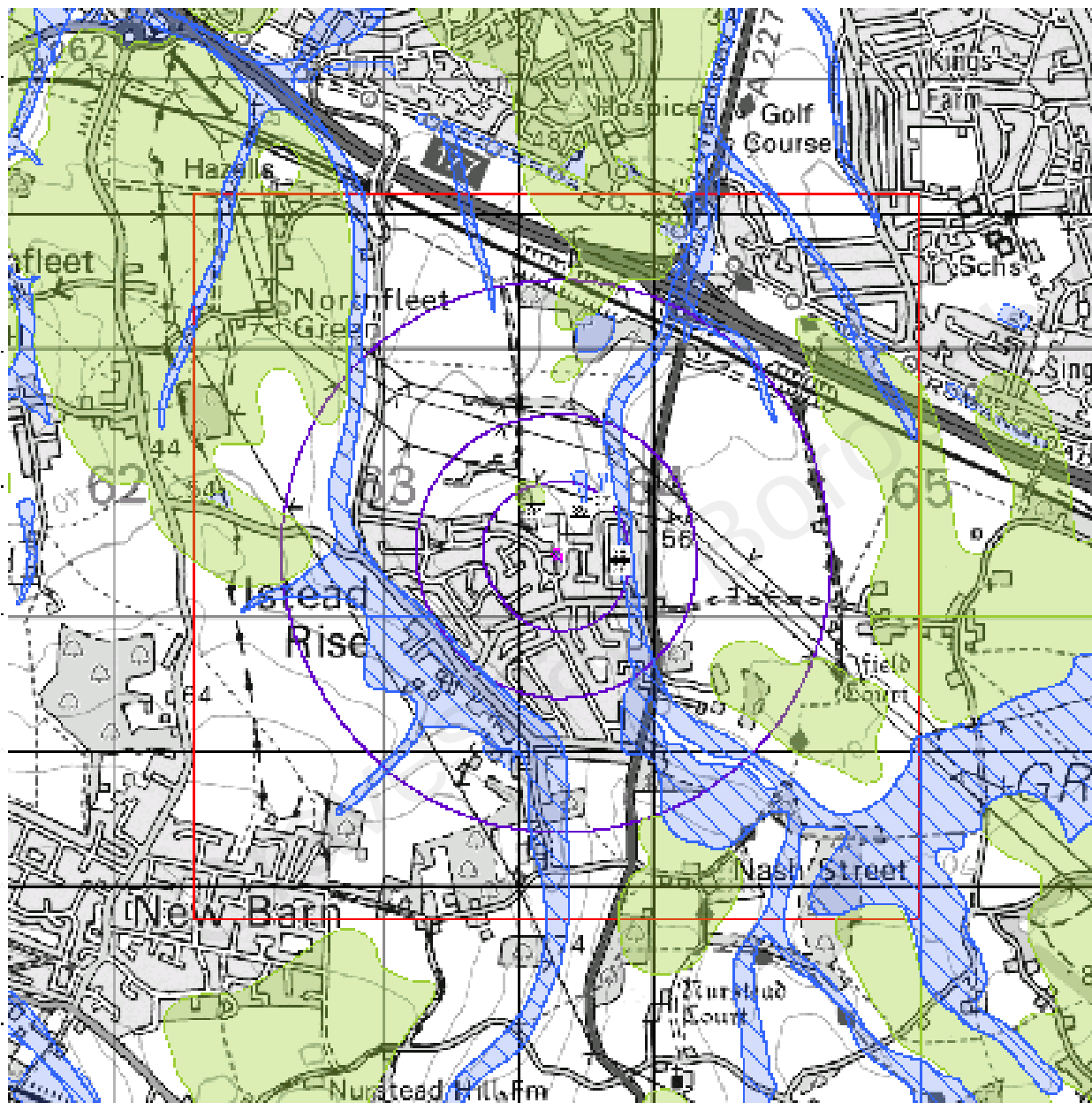
Order Number: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



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



Ground Stability Data (1:50,000)

General

1:10000
 1:25000
 1:50000

Potential for Running Sand Ground Stability Hazards

1:10000
 1:25000
 1:50000

Potential for Shrinking or Swelling Clay Ground Stability Hazards

1:10000
 1:25000
 1:50000

Mining and Ground Stability - Slice A



Order Details

Order Number: 299386280_1_1
 Customer Ref: 20374
 National Grid Reference: 563640, 170230
 Slice: A
 Site Area (Ha): 0.14
 Search Buffer (m): 1000

Site Details

Worcester Close, Istead Rise, GRAVESEND, DA13 9LB



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

Appendix B

Site Photographs



Photo 1:

Site area with numerous large mature trees. View looking north.



Photo 2:

Hardstanding footpath onsite. View looking south.



Photo 3: Manhole seen near the centre of the site. View looking south.



Photo 4: Road of Worcester Close, with site area on the right. View looking south.



Risk Assessment Criteria

The classification presented in Table F.1 to Table F.4 below are modified from, 'contaminated land risk assessment: A guide to good practice, 2001, CIRIA C552'.

Table F.1. Classification of Consequence

| Classification | Definition |
|-----------------------|--|
| Severe | Short-term (acute) risk to human health likely to result in "significant harm" as defined by the Environmental Protection Act 1990, Part IIA. Short term risk of pollution (note: Water Recourses Act contains no scope for considering significance of pollution) of sensitive water resource. Catastrophic damage to buildings/property. A short-term risk to a particular ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000.) |
| Medium | Chronic damage to Human Health ("significant harm" as defined in DETR, 2000). Pollution of sensitive water recourse (note: Water Recourses Act contains no scope for considering significance of pollution). A significant change in a particular ecosystem (note: the definitions of ecological systems within the Draft Circular on Contaminated Land, DETR, 2000.) |
| Mild | Pollution of non-sensitive water recourses. Significant damage to crops, buildings, structures and services ("significant harm" as defined in the Draft Circular on Contaminated Land, DETR, 2000.) |
| Minor | Harm, although not necessarily significant harm, which may result in a financial loss, or expenditure to resolve. Non-permanent health effects to human health (easily prevented by means such as personal protective clothing etc.) |

Table F.2. Classification of Probability

| Classification | Definition |
|-----------------------|--|
| High likelihood | There is a pollution linkage and an event that either appears very likely in the short term and almost inevitable over the long term or there is evidence at the receptors of harm or pollution. |
| Likely | There is a pollution linkage and all the elements are present and in the right place, which means that it is probable that an event will occur. Circumstances are such that an event is not inevitable but possible in the short term and likely over the long term. |
| Low likelihood | There is a pollution linkage and circumstances are possible under which an event could occur. However, it is by no means certain that even over a longer period such event would take place and is less likely in the short term. |
| Unlikely | There is a pollution linkage, but circumstances are such that it is improbable that an event would occur even in the long term. |

Table F.3. Comparison of Consequence Against Probability

| Probability | Consequence | | | |
|--------------------|--------------------|-------------------|-------------------|-------------------|
| | Severe | Medium | Mild | Minor |
| High likelihood | Very high risk | High risk | Moderate risk | Moderate/low risk |
| Likely | High risk | Moderate risk | Moderate/low risk | Low risk |
| Low likelihood | Moderate risk | Moderate/low risk | Low risk | Very low risk |
| Unlikely | Moderate risk | Low risk | Very low risk | Very low risk |

Table F.4. Risk Classifications

| | |
|-----------|---|
| Very High | There is a high probability that severe harm could arise to a designated receptor from an identified hazard at the site without remediation action OR there is evidence that severe harm to a designated receptor is already occurring. Realisation of that risk is likely to present a substantial liability to be site owner/or occupier. Investigation is required as a matter of urgency and remediation works likely to follow in the short-term. |
| High | Harm is likely to arise to a designated receptor from an identified hazard at the site without remediation action. Realisation of the risk is likely to present a substantial liability to the site owner/or occupier. Investigation is required as a matter of urgency to clarify the risk. Remediation works may be necessary in the short-term and are likely over the longer term. |
| Moderate | It is possible that harm could arise to a designated receptor from an identified hazard. However, it is either relatively unlikely that any such harm would be severe, and if any harm were to occur it is more likely, that the harm would be relatively mild. Further investigative work is normally required to clarify the risk and to determine the potential liability to site owner/occupier. Some remediation works may be required in the longer term. |
| Low | It is possible that harm could arise to a designated receptor from identified hazard, but it is likely at worst, that this harm if realised would normally be mild. It is unlikely that the site owner/or occupier would face substantial liabilities from such a risk. Further investigative work (which is likely to be limited) to clarify the risk may be required. Any subsequent remediation works are likely to be relatively limited. |
| Very low | There is a low possibility that harm could arise to a receptor. In the event of such harm being realised it is not likely to be severe. |
| None | No potential risk if no pollution linkage has been established. |



Detailed UXO Risk Assessment

Gravesham Borough Council



1ST LINE DEFENCE



Detailed Unexploded Ordnance (UXO) Risk Assessment

| | |
|-------------------------|-------------------------------------|
| Project Name | Worcester Close, Gravesend |
| Client | Soils Limited |
| Site Address | Worcester Close, Gravesend DA13 9LB |
| Report Reference | DA16287-00 |
| Date | 26/09/2022 |
| Originator | RS |



Executive Summary

Site Location and Description

The site is located in Istead Rise, within the borough of Gravesham, Kent.

According to recent aerial imagery, a car park, structure, and small area of vegetated ground is situated north of the site, with Worcester Close affixed to the east and a footpath and undeveloped ground to the south. Residential properties and Bramley Close border west of the site.

According to recent aerial imagery, the site is occupied by undeveloped and vegetated land.

The site is approximately centred on the OS grid reference: **TQ 63643 70235**.

Proposed Works

Information provided by the client suggests that the development comprises the construction of a two-storey residential block of eight apartments, with works including four window sampling boreholes and drill piling, as well as three Dynamic Cone Penetrometer tests.

Geology and Bomb Penetration Depth

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation – chalk of the Cretaceous period.

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the limitations of site-specific geotechnical information provided for the purpose of this report. An assessment can be made once further information becomes available or by an UXO Specialist on-site.

It should be noted that the maximum depth that a bomb could reach may vary across a site and will be largely dependent on the specific underlying geological strata and its density.

UXO Risk Assessment

1st Line Defence has assessed that there is a **Low Risk** from items of German air delivered UXO and a **Negligible Risk** from Allied UXO across the site. This assessment is based on the following factors:

The Risk from German Air Delivered UXO

- During WWII, the site was situated within the Urban District of Northfleet, which sustained an overall high density of bombing, according to official Home Office bombing statistics, with an average 103.2 items recorded per 1,000 acres. This was mainly due to areas such as Northfleet and Gravesend being subject to 'tip-and-run' raids, whereby surplus ordnance was jettisoned by German bombers on their way home, as they came directly under the Luftwaffe's flight path to London.
- No positive evidence could be found to suggest that the site sustained any direct incidents of bombing within the available bomb mapping and written records. However, multiple incidents of bombing are recorded within the wider area with the closest record approximately 220m south-west of the site.
- No major signs of damage such as cratering, scattered earth or indentations in the ground were evident within post-WWII aerial imagery dated 1946. It should be noted however, that given the site's undeveloped composition, smaller indicators of damage may not be visible in these images.
- The ground cover across the site is not anticipated to have been greatly conducive to the detection of evidence of UXO. Given the agricultural, vegetated nature of the site, any indication of UXBs, such as bomb entry holes which could have been as small as 20cm, are at an increased likelihood of becoming obscured by vegetation and crop.
- It is not known how often the site would have been accessed during the war, however, as the site was occupied and surrounded by agricultural farmland, it may have been subject to intermittent levels of access and observation. Although this would likely have been seasonal, and relied on the vigilance of individuals working the land.
- In summary, no HE bombs were recorded on or within close proximity to the site. Additionally, no conclusive evidence of damage can be found within the site boundary on aerial photography. Given the site's undeveloped ground cover during wartime, the possibility of an on-site UXO incident cannot be entirely discounted. However, given the relatively small site area and the aforementioned discussed factors, the risk is not considered significant enough to warrant proactive risk mitigation measures. As a result, the site has been assessed to be of **Low Risk** for German aerial-delivered UXO contamination.

UXO Risk Assessment**The Risk from Allied UXO**

- There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA.
- The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding air delivered ordnance.

Recommended Risk Mitigation Measures

The following risk mitigation measures are recommended to support the proposed works at Worcester Close, Gravesend:

All Works

- UXO Risk Management Plan
- Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.

Note – the above risk mitigation measures are not considered necessary for any works taking place at the location of and at the depths of any post-war development present.

Glossary

| Abbreviation | Definition |
|--------------|---|
| AA | Anti-Aircraft |
| AFS | Auxiliary Fire Service |
| AP | Anti-Personnel |
| ARP | Air Raid Precautions |
| DA | Delay-action |
| EOC | Explosive Ordnance Clearance |
| EOD | Explosive Ordnance Disposal |
| FP | Fire Pot |
| GM | G Mine (Parachute mine) |
| HAA | Heavy Anti-Aircraft |
| HE | High Explosive |
| IB | Incendiary Bomb |
| JSEODOC | Joint Services Explosive Ordnance Disposal Operation Centre |
| LAA | Light Anti-Aircraft |
| LCC | London County Council |
| LRRB | Long Range Rocket Bomb (V-2) |
| LSA | Land Service Ammunition |
| NFF | National Filling Factory |
| OB | Oil Bomb |
| PAC | Pilotless Aircraft (V-1) |
| PB | Phosphorous Bomb |
| PM | Parachute Mine |
| POW | Prisoner Of War |
| RAF | Royal Air Force |
| RCAF | Royal Canadian Air Force |
| RFC | Royal Flying Corps |
| RNAS | Royal Naval Air Service |
| ROF | Royal Ordnance Factory |
| SA | Small Arms |
| SAA | Small Arms Ammunition |
| SD2 | Anti-personnel "Butterfly Bomb" |
| SIP | Self-Igniting Phosphorous |
| U/C | Unclassified bomb |
| UP | Unrotated Projectile (rocket) |
| USAAF | United States Army Air Force |
| UX | Unexploded |
| UXAA | Unexploded Anti-Aircraft |
| UXB | Unexploded Bomb |
| UXO | Unexploded Ordnance |
| V-1 | Flying Bomb (Doodlebug) |
| V-2 | Long Range Rocket |
| WAAF | Women's Auxiliary Air Force |
| X | Exploded |

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1st Line Defence Limited

Detailed Unexploded Ordnance (UXO) Risk Assessment

Site: Worcester Close, Gravesend
Client: Soils Limited

1. Introduction

1.1. Background

1st Line Defence has been commissioned by Soils Limited to conduct a Detailed Unexploded Ordnance (UXO) Risk Assessment for the works proposed at Worcester Close.

Buried UXO can present a significant risk to construction works and development projects. The discovery of a suspect device during works can cause considerable disruption to operations as well as cause unwanted delays and expense.

UXO in the UK can originate from three principal sources:

1. Munitions resulting from wartime activities including German bombing in WWI and WWII, long range shelling, and defensive activities.
2. Munitions deposited as a result of military training and exercises.
3. Munitions lost, burnt, buried or otherwise discarded either deliberately, accidentally, or ineffectively.

This report will assess the potential factors that may contribute to the risk of UXO contamination. If an elevated risk is identified at the site, this report will recommend appropriate mitigation measures, in order to reduce the risk to as low as is reasonably practicable. Detailed analysis and evidence will be provided to ensure an understanding of the basis for the assessed risk level and any recommendations.

This report complies with the guidelines outlined in *CIRIA C681*, 'Unexploded Ordnance (UXO) A Guide for the Construction Industry.'

2. Method Statement

2.1. Report Objectives

The aim of this report is to conduct a comprehensive assessment of the potential risk from UXO at Worcester Close. The report will also recommend appropriate site and work-specific risk mitigation measures to reduce the risk from explosive ordnance during the envisaged works to a level that is as low as reasonably practicable.

2.2. Risk Assessment Process

1st Line Defence has undertaken a five-step process for assessing the risk of UXO contamination:

1. The likelihood that the site was contaminated with UXO.
2. The likelihood that UXO remains on the site.
3. The likelihood that UXO may be encountered during the proposed works.
4. The likelihood that UXO may be initiated.
5. The consequences of initiating or encountering UXO.

In order to address the above, 1st Line Defence has taken into consideration the following factors:

- Evidence of WWI and WWII German air delivered bombing as well as the legacy of Allied occupation.
- The nature and conditions of the site during WWII.
- The extent of post-war development and UXO clearance operations on site.
- The scope and nature of the proposed works and the maximum assessed bomb penetration depth.
- The nature of ordnance that may have contaminated the proposed site area.

2.3. Sources of Information

Every reasonable effort has been made to ensure that relevant evidence has been consulted and presented in order to produce a thorough and comprehensible report for the client. To achieve this the following, which includes military records and archive material held in the public domain, have been accessed:

- The National Archives and Kent History and Library Centre.
- Historical mapping datasets.
- Historic England National Monuments Record.
- Relevant information supplied by Soils Limited.
- Available material from 33 Engineer Regiment (EOD) Archive (part of 29 Explosive Ordnance and Disposal and Search Group).
- 1st Line Defence's extensive historical archives, library and UXO geo-datasets.
- Open sources such as published books and internet resources.

3. Background to Bombing Records

3.1. General Considerations of Historical Research

This desktop assessment is based largely upon analysis of historical evidence. Every reasonable effort has been made to locate and present significant and pertinent information. 1st Line Defence cannot be held accountable for any changes to the assessed risk level or risk mitigation measures, based on documentation or other data that may come to light at a later date, or which was not available to 1st Line Defence during the production of this report.

It is often problematic and sometimes impossible to verify the completeness and accuracy of WWII-era records. As a consequence, conclusions as to the exact location and nature of a UXO risk can rarely be quantified and are, to a degree, subjective. To counter this, a range of sources have been consulted, presented and analysed. The same methodology is applied to each report during the risk assessment process. 1st Line Defence cannot be held responsible for any inaccuracies or the incompleteness in available historical information.

3.2. German Bombing Records

During WWII, bombing records were generally gathered locally by the police, Air Raid Precaution (ARP) wardens and military personnel. These records typically contained information such as the date, the location, the amount of damage caused and the types of bombs that had fallen during an air raid. This information was made either through direct observation or post-raid surveys. The Ministry of Home Security Bomb Census Organisation would then receive this information, which was plotted onto maps, charts, and tracing sheets by regional technical officers. The collective record set (regional bomb census mapping and locally gathered incidents records) would then be processed and summarised into reports by the Ministry of Home Security Research and Experiments Branch. The latter were tasked with providing the government 'a complete picture of air raid patterns, types of weapons used and damage caused- in particular to strategic services and installations such as railways, shipyards, factories and public utilities.'¹

The quality, detail and nature of record keeping could vary considerably between provincial towns, boroughs and cities. No two areas identically collated or recorded data. While some local authorities maintained records with a methodical approach, sources in certain areas can be considerably more vague, dispersed, and narrower in scope. In addition, the immediate priority was mostly focused on assisting casualties and minimising damage at the time. As a result, some records can be incomplete and contradictory. Furthermore, many records were even damaged or destroyed in subsequent air raids. Records of raids that took place on sparsely or uninhabited areas were often based upon third party or hearsay information and are therefore not always reliable. Whereas records of attacks on military or strategic targets were often maintained separately and have not always survived.

3.3. Allied Records

During WWII, considerable areas of land were requisitioned by the War Office for the purpose of defence, training, munitions production and the construction of airfields. Records relating to military features vary and some may remain censored. Within urban environments datasets will be consulted detailing the location of munition production as well as wartime air and land defences. In rural locations it may be possible to obtain plans of military establishments, such as airfields, as well as training logs, record books, plans and personal memoirs. As with bombing records, every reasonable effort will be made to access records of, and ascertain any evidence of, military land use. However, there are occasions where such evidence is not available, as records may not be accessible, have been lost/destroyed, or simply were not kept in the first place.

¹ <http://www.nationalarchives.gov.uk/help-with-your-research/research-guides/bomb-census-survey-records-1940-1945/>.

4. UK Regulatory Environment and Guidelines

4.1. General

There is no formal obligation requiring a UXO risk assessment to be undertaken for construction projects in the UK, nor is there any specific legislation stipulating the management or mitigation of UXO risk. However, it is implicit in the legislation outlined below that those responsible for intrusive works (archaeology, site investigation, drilling, piling, excavation etc.) should undertake a comprehensive and robust assessment of the potential risks to employees and that mitigation measures are implemented to address any identified hazards.

4.2. CDM Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) define the responsibilities of parties involved in the construction of temporary or permanent structures.

The CDM 2015 establishes a duty of care extending from clients, principle co-ordinators, designers, and contractors to those working on, or affected by, a project. Those responsible for construction projects may therefore be accountable for the personal or proprietary loss of third parties, if correct health and safety procedure has not been applied.

Although the CDM does not specifically reference UXO, the risk presented by such items is both within the scope and purpose of the legislation. It is therefore implied that there is an obligation for parties to:

- Provide an appropriate assessment of potential UXO risks at the site (or ensure such an assessment is completed by others).
- Put in place appropriate risk mitigation measures if necessary.
- Supply all parties with information relevant to the risks presented by the project.
- Ensure the preparation of a suitably robust emergency response plan.

4.3. The 1974 Health and Safety at Work etc. Act

All employers have a responsibility under the Health and Safety at Work etc. Act 1974 and the Management of Health and Safety at Work Regulations 1999, to ensure the health and safety of their employees and third parties, so far as is reasonably practicable and conduct suitable and sufficient risk assessments.

4.4. CIRIA C681

In 2009, the Construction Industry Research and Information Association (CIRIA) produced a guide to the risk posed by UXO to the UK construction industry (CIRIA C681). CIRIA is a neutral, independent and not-for-profit body, linking organisations with common interests and facilitating a range of collaborative activities that help improve the industry.

The publication provides the UK construction industry with a defined process for the management of risks associated with UXO from WWI and WWII air bombardment. It is also broadly applicable to the risks from other forms of UXO that might be encountered. It focuses on construction professionals' needs, particularly if there is a suspected item of UXO on site, and covers issues such as what to expect from a UXO specialist. The guidance also helps clients to fulfil their legal duty under CDM 2015 to provide designers and contractors with project specific health and safety information needed to identify hazards and risks associated with the design and construction work. This report conforms to this CIRIA guidance and to the various recommendations for good practice referenced therein. It is recommended that this document is acquired and studied where possible to allow a better understanding of the background to both the risk assessment process and the UXO issue in the UK in general.

4.5. Additional Legislation

In the event of a casualty resulting from the failure of an employer/client to address the risks relating to UXO, the organisation may be criminally liable under the Corporate Manslaughter and Corporate Homicide Act 2007.

5. The Role of Commercial UXO Contractors and The Authorities

5.1. Commercial UXO Specialists

The role of a UXO Specialist (often referred to as UXO Consultant or UXO Contractor) such as 1st Line Defence, is defined in CIRIA C681 as the provision of expert knowledge and guidance to the client on the most appropriate and cost-effective approach to UXO risk management at a site.

The principal role of UXO Specialists is to provide the client with an appropriate assessment of the risk posed by UXO for a specific project, and identify and carry out suitable methodology for the mitigation of any identified risks to reduce them to an acceptable level.

The requirement for a UXO Specialist should ideally be identified in the initial stages of a project, and it is recommended that this occur prior to the start of any detailed design. This will enable the client to budget for expenditure that may be required to address the risks from UXO, and may enable the project team to identify appropriate techniques to eliminate or reduce potential risks through considered design, without the need for UXO specific mitigation measures. The UXO Specialist should have suitable qualifications, levels of competency and insurances.

Please note 1st Line Defence has the capability to provide a complete range of required UXO risk mitigation services, in order to reduce a risk to as low as reasonably practicable. This can involve the provision of both ground investigation, and where appropriate, UXO clearance services.

5.2. The Authorities

The police have a responsibility to co-ordinate the emergency services in the event of an ordnance-related incident at a construction site. Upon inspection they may impose a safety cordon, order an evacuation, and call the military authorities Joint Services Explosive Ordnance Disposal Operation Centre (JSEODOC) to arrange for investigation and/or disposal. Within the Metropolitan Police Operational Area, SO15 EOD will be tasked to any discovery of suspected UXO. The request for Explosive Officer (Expo) support is well understood and practiced by all Metropolitan Boroughs. The requirement for any additional assets will then be coordinated by the Expo if required.

In the absence of a UXO specialist, police officers will usually employ such precautionary safety measures, thereby causing works to cease, and possibly requiring the evacuation of neighbouring businesses and properties.

The priority given to the police request will depend on the EOD teams' judgement of the nature of the UXO risk, the location, people and assets at risk, as well as the availability of resources. The speed of response varies; authorities may respond immediately or in some cases it may take several days for the item of ordnance to be dealt with. Depending on the on-site risk assessment the item of ordnance may be removed from the site and/or destroyed by a controlled explosion.

Following the removal of an item of UXO, the military authorities will only undertake further investigations or clearances in high-risk situations. If there are regular UXO finds on a site the JSEODOC may not treat each occurrence as an emergency and will recommend the construction company puts in place alternative procedures, such as the appointment of a commercial contractor to manage the situation.

6. The Site

6.1. Site Location

The site is located in Istead Rise, within the borough of Gravesham, Kent.

According to recent aerial imagery, a car park, structure, and small area of vegetated ground is situated north of the site, with Worcester Close affixed to the east and a footpath and undeveloped ground to the south. Residential properties and Bramley Close border west of the site.

The site is approximately centred on the OS grid reference: **TQ 63643 70235**.

Site location maps are presented in **Annex A**.

6.2. Site Description

According to recent aerial imagery, the site is occupied by undeveloped and vegetated land.

A recent aerial photograph and site plan are presented in **Annex B** and **Annex C** respectively.

7. Scope of the Proposed Works

7.1. General

Information provided by the client suggests that the development comprises the construction of a two-storey residential block of eight apartments, with works including four window sampling boreholes and drill piling, as well as three Dynamic Cone Penetrometer tests.

8. Ground Conditions

8.1. General Geology

The British Geological Survey (BGS) map shows the bedrock geology of the site to be underlain by the Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation – chalk of the Cretaceous period.

8.2. Site Specific Geology

Borehole data has been provided by Soils Limited. See below for a brief example description of the geology encountered.

| Example Window Sampling Borehole | |
|---|---|
| Depth (m) | Description |
| 0.4 | Stiff greyish brown, slightly sandy, slightly gravelly clay. |
| 0.8 | Stiff greyish brown, slightly sandy, slightly gravelly clay. |
| 1.2 | Stiff dark brown multi-coloured slightly sandy, slightly gravelly clay. |
| 1.7 | Stiff greyish brown, slightly sandy clay. |
| 2.3 | Structureless chalk |

9. Site History

9.1. Introduction

The purpose of this section is to identify the composition of the site pre and post-WWII. It is important to establish the historical use of the site, as this may indicate the site's relation to potential sources of UXO as well as help with determining factors such as the land use, groundcover, likely frequency of access and signs of bomb damage.

9.2. Ordnance Survey Historical Maps

Relevant historical maps were obtained for this report and are presented in **Annex D**. See below for a summary of the site history shown on acquired mapping.

| Pre-WWII | | |
|----------|---------|--|
| Date | Scale | Description |
| 1938 | 1:2,500 | This map indicates that the site and surrounding area was occupied by an orchard, likely part of <i>Istead Nurseries</i> . |

| Post-WWII | | |
|-----------|---------|---|
| Date | Scale | Description |
| 1961-62 | 1:2,500 | This map does not indicate any changes to or within the surrounding area of the site. Some structural changes can be observed within the wider vicinity, approximately 350m south-west of the site. |

10. Introduction to German Air Delivered Ordnance

10.1. General

During WWI and WWII, the UK was subjected to bombing which often resulted in extensive damage to city centres, docks, rail infrastructure and industrial areas. The poor accuracy of WWII targeting technology and the nature of bombing techniques often resulted in neighbouring areas to targets sustaining collateral damage.

In addition to raids which concentrated on specific targets, indiscriminate bombing of large areas also took place. This occurred most prominently in the London 'Blitz', though affected many other towns and cities. As discussed in the following sections, a proportion of the bombs dropped on the UK did not detonate as designed. Although extensive efforts were made to locate and deal with these UXBs at the time, many still remain buried and can present a potential risk to construction projects.

The main focus of research for this section of the report will concern German air delivered ordnance dropped during WWII, although WWI bombing will also be considered.

10.2. Generic Types of WWII German Air Delivered Ordnance

To provide an informed assessment of the hazards posed by any items of unexploded ordnance that may remain in situ on site, the table below provides information on the types of German air delivered ordnance most commonly used by the Luftwaffe during WWII. Images and brief summaries of the characteristics of these items of ordnance are listed in **Appendices i-iii**.

| Generic Types of WWII German Air Delivered Ordnance | | |
|---|--|--|
| Type | Frequency | Likelihood of detection |
| High Explosive (HE) bombs | In terms of weight of ordnance dropped, HE bombs were the most frequently deployed by the Luftwaffe during WWII. | Although efforts were made to identify the presence of unexploded ordnance following an air raid, often the damage and destruction caused by detonated bombs made observation of UXB entry holes impossible. The entry hole of an unexploded bomb can be as little as 20cm in diameter and was easily overlooked in certain ground conditions (see Annex E). Furthermore, ARP documents describe the danger of assuming that damage, actually caused by a large UXB, was due to an exploded smaller bomb. UXBs therefore present the greatest risk to present-day intrusive works. |
| 1kg Incendiary bombs (IB) | In terms of the number of weapons dropped, small IBs were the most numerous. Millions of these were dropped throughout WWII. | IBs had very limited penetration capability and in urban areas would often have been located in post-raid surveys. If they failed to initiate and fell in water, on soft vegetated ground, or bombed rubble, they could easily go unnoticed. |
| Large Incendiary bombs (IB) | These were not as common as the 1kg IBs, although they were more frequently deployed than PMs and AP bomblets. | If large IBs did penetrate the ground, complete combustion did not always occur and in such cases they could remain a risk to intrusive works. |
| Aerial or Parachute mines (PM) | These were deployed less frequently than HE and IBs due to size, cost and the difficulty of deployment. | If functioning correctly, PMs would generally have had a slow rate of descent and were very unlikely to have penetrated the ground. Where the parachute failed, mines would have simply shattered on impact if the main charge failed to explode. There have been extreme cases when these items have been found unexploded. However, in these scenarios, the ground was either extremely soft or the munition fell into water. |
| Anti-personnel (AP) bomblets | These were not commonly used and are generally considered to pose a low risk to most works in the UK. | SD2 bomblets were packed into containers holding between 6 and 108 submunitions. They had little ground penetration ability and should have been located by the post-raid survey unless they fell into water, dense vegetation or bomb rubble. |

10.3. Failure Rate of German Air Delivered Ordnance

It has been estimated that 10% of WWII German air delivered HE bombs failed to explode as designed. Reasons for why such weapons might have failed to function as designed include:

- Malfunction of the fuze or gain mechanism (manufacturing fault, sabotage by forced labour or faulty installation).
- Many were fitted with a clockwork mechanism that could become immobilised on impact.
- Failure of the bomber aircraft to arm the bombs due to human error or an equipment defect.
- Jettisoning the bomb before it was armed or from a very low altitude. This most likely occurred if the bomber aircraft was under attack or crashing.

From 1940 to 1945, bomb disposal teams reportedly dealt with a total of 50,000 explosive items of 50kg, over 7,000 anti-aircraft projectiles and 300,000 beach mines. Unexploded ordnance is still regularly encountered across the UK, see press articles in **Annex F**.

10.4. UXB Ground Penetration

An important consideration when assessing the risk from a UXB is the likely maximum depth of burial. There are several factors which determine the depth that an unexploded bomb will penetrate:

- Mass and shape of bomb.
- Height of release.
- Velocity and angle of bomb.
- Nature of the ground cover.
- Underlying geology.

Geology is perhaps the most important variable. If the ground is soft, there is a greater potential of deeper penetration. For example, peat and alluvium are easier to penetrate than gravel and sand, whereas layers of hard strata will significantly retard and may stop the trajectory of a UXB.

10.4.1. The J-Curve Effect Principle

J-curve is the term used to describe the characteristic curve commonly followed by an air delivered bomb dropped from height after it penetrates the ground. Typically, as the bomb is slowed by its passage through underlying soils, its trajectory curves towards the surface. Many UXBs are found with their nose cone pointing upwards as a result of this effect. More importantly, however, is the resulting horizontal offset from the point of entry. This is typically a distance of about one third of the bomb's penetration depth, but can be higher in certain conditions (see **Annex E**).

10.4.2. WWII UXB Ground Penetration Studies

During WWII the Ministry of Home Security undertook a major study on actual bomb penetration depths, carrying out statistical analysis on the measured depths of 1,328 bombs as reported by bomb disposal (BD) teams. Conclusions were drawn predicting the likely average and maximum depths of penetration of different sized bombs in different geological strata.

For example, the largest common German bomb (500kg) had a likely concluded penetration depth of 6m in sand or gravel but 11m in clay. The maximum observed depth for a 500kg bomb was 11.4m and for a 1,000kg bomb 12.8m. Theoretical calculations suggested that significantly greater penetration depths were probable.

10.4.3. Site Specific Bomb Penetration Considerations

When considering an assessment of the bomb penetration at the site of proposed works the following parameters should be used:

- WWII geology – Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formation.
- Impact angle and velocity – 10-15° from vertical and 270 metres per second.
- Bomb mass and configuration – The 500kg SC HE bomb, without retarder units or armour piercing nose (this was the largest of the common bombs used against Britain).

It has not been possible to determine maximum bomb penetration capabilities at this stage due to the limitations of site-specific geotechnical information provided for the purpose of this report. An assessment can be made once further information becomes available or by an UXO Specialist on-site.

10.5. V-Weapons

Hitler's 'V-weapon' campaign began from mid-1944. It used newly developed unmanned cruise missiles and rockets. The V-1, known as the *flying bomb* or *pilotless aircraft*, and the V-2, a long range rocket, were launched from bases in Germany and occupied Europe. A total of 9,251 V-1s and 1,115 V-2s were recorded in the United Kingdom.

Although these weapons caused considerable damage, their relatively low numbers allowed accurate records of strikes to be maintained. These records have mostly survived. There is a negligible risk from unexploded V-weapons on land today. Even if the 1,000kg warhead failed to explode, the weapons are so large that they would have been observed and dealt with at the time. Therefore, any V-weapons referenced in this report are referenced not as a viable risk factor, but primarily in order to help account for evidence of damage and clearance reported.

11. The Likelihood of Contamination from German Air Delivered UXBs

11.1. World War I

During WWI Britain was targeted and bombed by Zeppelin Airships as well as Gotha and Giant fixed-wing aircraft. The objective of these raids was to unnerve the British public, to destroy strategic targets and to ultimately attempt to coerce Britain's capitulation from the war. A WWI map of air raids and naval bombardments across the UK was consulted, see **Annex G**. This source does not record any WWI bombing incidents to have affected the site area.

WWI bombs were generally smaller and dropped from a lower altitude than those used in WWII. This resulted in limited UXB penetration depths. Aerial bombing was often such a novelty at the time that it attracted public interest and even spectators to watch the raids in progress. For these reasons there is a limited risk that UXBs passed undiscovered in the urban environment. When combined with the relative infrequency of attacks and an overall low bombing density, the risk from WWI UXBs is considered low and will not be further addressed in this report.

11.2. World War II Bombing of Urban District of Northfleet

The Luftwaffe's main objective for the attacks on Britain was to inhibit the country's economic and military capability. To achieve this they targeted airfields, depots, docks, warehouses, wharves, railway lines, factories, and power stations. As the war progressed the Luftwaffe bombing campaign expanded to include the indiscriminate bombing of civilian areas in an attempt to subvert public morale.

During WWII the site was located within the Urban District of Northfleet, which sustained an overall high density of bombing, as represented by bomb density data figures. This was mainly due to the position of Kent within the south-east of England which came directly under the Luftwaffe's flight path to London and other parts of England. These areas were subject to 'tip-and-run' raids, whereby surplus ordnance was jettisoned by German bombers on their way home, as well as air raids on targets identified by the Luftwaffe, primarily along the coast and Thames Estuary, Gravesend included. Luftwaffe Reconnaissance Photography of Gravesend (see **Annex H**) highlights a power station in Gravesend as a potential target, situated approximately 4.2km north of the site.

Records of bombing incidents in the civilian areas of the Urban District of Northfleet were typically collected by Air Raid Precautions wardens and collated by Civil Defence personnel. Some other organisations, such as port and railway authorities, maintained separate records. Records would be in the form of typed or hand written incident notes, maps and statistics. Bombing data was carefully analysed, not only due to the requirement to identify those parts of the country most needing assistance, but also in an attempt to find patterns in the Germans' bombing strategy in order to predict where future raids might take place.

Records of bombing incidents are presented in the following sections.

11.3. WWII Home Office Bombing Statistics

The following table summarises the quantity of German air delivered bombs (excluding 1kg incendiaries and anti-personnel bombs) dropped on the Urban District of Northfleet between 1940 and 1945.

| Record of German Ordnance Dropped on the Urban District of Northfleet | | |
|---|----------------------------------|--------------|
| Area Acreage | | 3,770 |
| Weapons | High Explosive bombs (all types) | 364 |
| | Parachute mines | 3 |
| | Oil bombs | 7 |
| | Phosphorus bombs | 0 |
| | Fire pots | 9 |
| | Pilotless aircraft (V-1) | 5 |
| | Long range rockets (V-2) | 1 |
| Total | | 389 |
| Number of Items per 1,000 acres | | 103.2 |

Source: Home Office Statistics

This table does not include UXO found during or after WWII.

Detailed records of the quantity and locations of the 1kg incendiary and anti-personnel bombs were not routinely maintained by the authorities as they were frequently too numerous to record. Although the risk relating to IBs is lesser than that relating to larger HE bombs, they were similarly designed to inflict damage and injury. Anti-personnel bombs were used in much smaller quantities and are rarely found today but are potentially more dangerous. Although Home Office statistics did not record these types of ordnance, both should not be overlooked when assessing the general risk to personnel and equipment.

11.4. Kent Daily Bomb Census Maps (1940-1944)

To understand the density of bombing in the region of the site area, bomb maps covering the entirety of Kent were obtained from the Kent History and Library Centre. These maps recorded daily bombing incidents at the beginning of the war, however from 1942 onwards tended to be consolidated. Incidents plotted on these maps include H.E strikes, incendiary bombing, crashed German and British planes, shells, and aerial mines.

The bombing incidents on these map editions were plotted on small scale maps, and bomb strikes for the whole county of Kent were recorded on single map sheets. The plotted bomb locations therefore cannot be considered accurate, and it has not been possible to determine the exact locations of individual strikes beyond identifying the general area within which the bomb fell. Maps that show bomb strikes within the site locality have been presented in **Annex I** and discussed below.

| Kent ARP Daily Bomb Census Mapping – Annex I | |
|--|--|
| Date | Comments |
| 1 st August 1940 | One HE bomb strike is recorded to the north-east of the site area. |
| 24 th November 1940 | One HE bomb strike is recorded to the north-east of the site area. Incendiary bombing is recorded further to the east. |
| 20 th April 1941 | HE bomb strikes are recorded to the north-west and north-east of the site area. |
| 5 th June 1941 | Five HE bombs are recorded to the south and east of the site area. |

11.5. V-1 and Shells Daily Bomb Census Maps

Bomb plot maps showing the location of all the V-1 and shell incidents in the County of Kent was compiled in 1944. Due to the large scale of the maps, only the incidents wherein the radius of the incident overlapped with the general area of the site have been listed below. The sections covering the area of the site were checked and are presented in **Annex J**.

| Kent V-1 and Shells Bomb Census Maps – Annex J | |
|--|---|
| Date Range | Comments |
| 21 st January 1944 | Two HE bomb strike are recorded to the north-west of the site area. Incendiary bombing is also recorded to the north. |
| 4 th February 1944 | Multiple HE bombs are recorded south of the site. |
| 5 th July 1944 | A V-1 strike is recorded to have fallen north-west of the site area. |
| 28 th July 1944 | A V-1 strike is recorded approximately further north of the site. |
| 29 th July 1944 | A V-1 strike is recorded to have fallen further north of the site. |

11.6. Kent War Diaries: Northfleet

A Kent War Diary for the district of Northfleet was obtained from the Kent History and Library Centre. The War Diaries comprise a set of written records that detail the date, time, location, type of bomb, and damage caused for bombing incidents across Kent. Wartime Cassini grid references are often used within this record set in order to give an approximate location of incidents.

No references to the site could be found within this record set.

11.7. Kent War Diaries: Medway Group

Three War Diaries for the Medway Group were consulted for this report from the Kent History and Library Centre. The War Diaries comprise a set of written records that detailed the location and time of bombing incidents on multiple districts within northern Kent. These encompass the dates of June 1940 – October 1940, November 1940 – April 1941 and April 1941 – March 1945. Records are often updated as incidents develop, often with further details regarding the exact location of strikes and any damage caused. Incidents are sometimes accompanied by a map reference, which is not always sufficient to pinpoint the exact incident location due to the broad area they cover.

Excerpts of relevant bombing incidents are presented in **Annex K** and transcribed below. The approximate locations of the bombing incidents with Cassini map references are presented in **Annex L**.

| Kent War Diaries: Medway Group | | | |
|--------------------------------|--|--------------|--|
| Date | Location | Type of Bomb | Comments |
| 24 th November 1940 | Northfleet
M.R. 080896 | H.E | <i>The map reference of this strike is recorded approximately 670m north of the site.</i> |
| 20 th March 1941 | Northfleet
M.R. 078887 | A.A. Shell | One A.A. Shell exploded. One house slightly damaged.
<i>Recorded approximately 220m south-west of the site.</i> |
| 5 th June 1941 | Northfleet
Downs Road
M.R. 075885 | 1 H.E | Time: 01.53
<i>Recorded approximately 550m south-west of the site.</i> |
| 5 th June 1941 | Northfleet
Istead Rise
M.R. 077886 | 1 H.E. | Time: 01.53
Water main damaged.
<i>Recorded approximately 350m south-west of the site.</i> |
| 5 th June 1941 | Northfleet
Istead Rise | 8 HE | Time: 02.39
Eight further HE's in open ground.
Electricity mains damaged. Istead Rise.
<i>Exact location unknown.</i> |
| 5 th June 1941 | Northfleet
M.R.s 074885
– 076887 | 14 H.E | REF: 01.53 x 02.39
<i>This record is an update on the three incidents recorded above on the same date. The map references provided record these incidents as approximately 330 – 620m south-west of the site.</i> |

11.8. Northfleet Air Raid Damage Files

Written ARP Incident Records were obtained from The National Archives. This record was compiled by local Air Raid Precaution (ARP) personnel and volunteers during the war and records the location, date and time of bombing raids, as well as the types of bomb used and the damage caused.

This record set was checked, and no references to the site were found within it.

11.9. WWII-Era Aerial Photography

WWII-era aerial photography for the site area was obtained from the National Monuments Record Office (Historic England). This photography provides a record of the potential composition of the site during the war, as well as its condition immediately following the war (see **Annex M**).

| WWII-Era Aerial Photography | |
|-------------------------------|---|
| Date | Description |
| 11 th October 1946 | This image shows that the site was occupied by vegetated agricultural land. No structures can be observed on or near the site. No distinct signs of bomb damage, such as cratering or scattered earth, is indicated, either on site or in the wider vicinity. |

11.10. Abandoned Bombs

A post air-raid survey of buildings, facilities, and installations would have included a search for evidence of bomb entry holes. If evidence of an entry hole was encountered, Bomb Disposal Officer Teams would normally have been requested to attempt to locate, render safe, and dispose of the bomb. Occasionally, evidence of UXBs was discovered but due to a relatively benign position, access problems, or a shortage of resources the UXB could not be exposed and rendered safe. Such an incident may have been recorded and noted as an 'abandoned bomb'.

Given the inaccuracy of WWII records, and the fact that these bombs were 'abandoned', their locations cannot be considered definitive or the lists exhaustive. The MoD states that 'action to make the devices safe would be taken only if it was thought they were unstable'. It should be noted that other than the 'officially' abandoned bombs, there will inevitably be UXBs that were never recorded.

1st Line Defence holds no records of officially registered abandoned bombs at or near the site of the proposed works.

11.11. Bomb Disposal Tasks

The information service from the Explosive Ordnance Disposal (EOD) Archive Information Office at 33 Engineer Regiment (now part of 29 EOD & Search Group) no longer processes commercial requests for information. It has therefore not been possible to include any updated official information regarding bomb disposal/clearance tasks with regards to this site. A database of known disposal/clearance tasks has been referred to which does not make reference to such instances occurring within the site of proposed works. If any relevant information is received at a later date, Soils Limited will be advised.

11.12. Evaluation of German Air Delivered UXO Records

| Factors | Conclusion |
|--|--|
| Density of Bombing
<i>It is important to consider the bombing density when assessing the possibility that UXBs remain in an area. High bombing density could allow for error in record keeping due to extreme damage caused to the area.</i> | <p>During WWII the site was situated within the Urban District of Northfleet, which sustained an overall high density of bombing, according to official Home Office bombing statistics, with an average 103.2 items recorded per 1,000 acres. This was mainly due to Kent coming directly under the Luftwaffe's flight path to London and other parts of England. As such, areas such as Northfleet and Gravesend were subject to 'tip-and-run' raids, whereby surplus ordnance was jettisoned by German bombers on their way home, as well as air raids on targets identified by the Luftwaffe, primarily along the coast and Thames Estuary, Gravesend included.</p> <p>No positive evidence could be found to suggest any bombing occurred directly on site. Kent Daily bomb maps indicate multiple incidents within the surrounding area, however it should be noted that the exact locations of bomb strikes cannot be identified using Kent Daily bomb mapping due to their small scale; these were used to gauge localised bombing density rather than precise strikes.</p> <p>The Kent: Medway Group War Diaries, which uses wartime Cassini grid referencing to provide an approximate indication of bomb strike locations, records the closest incident as an A.A. shell which exploded approximately 220m south-west of the site. The closest HE bombing was noted as occurring on the 5th June 1941, situated approximately 330 – 620m to the south-west. See Annex L for approximate locations of the Cassini referenced bombing.</p> |
| Damage
<i>If buildings or structures on a site sustained bomb or fire damage, any resulting rubble and debris could have obscured the entry holes of unexploded bombs dropped during the same or later raids. Similarly, a high explosive bomb strike in an area of open agricultural land will have caused soil disturbance, increasing the risk that a UXB entry hole would be overlooked.</i> | <p>As the site and surrounding area primarily comprised open agricultural farmland and orchards during the war, signs of bomb damage are difficult to interpret from comparing pre and post-war OS mapping. It can be noted however that no changes were discernible on site or in the immediate surrounding vicinity. Post-WWII aerial photography, dated 1946, does not appear to show any distinct signs of damage, such as bomb cratering or scattered earth, on site or within the wider vicinity; though typical signs of bomb damage could have been obscured by growing vegetation over time.</p> |
| Ground Cover
<i>The nature of the ground cover present during WWII would have a substantial influence on any visual indication that may indicate UXO being present.</i> | <p>Given that the site was occupied by open agricultural farmland, vegetation and orchards, the ground cover is not considered to have been conducive to the detection of evidence of UXO. Indications of bombing, such as bomb entry holes which could have been as small as 20cm in diameter, could easily be overlooked in these conditions, or covered by growing vegetation.</p> |
| Access Frequency
<i>UXO in locations where access was irregular would have a greater chance of passing unnoticed than at those that were regularly occupied. The importance of a site to the war effort is also an important consideration as such sites are likely to have been both frequently visited and subject to post-raid checks for evidence of UXO.</i> | <p>The site as a whole may have received some level of intermittent access, given that the land on site appears to have been agricultural in nature, though this would likely have been seasonal, and relied on the vigilance of individuals working the land. Given the lack of any developed structures on or within the immediate surrounding area of the site, it is considered unlikely that the site would have been subject to post-raid checks for UXO.</p> |

| | |
|----------------------------|---|
| Bomb Failure Rate | There is no evidence to suggest that the bomb failure rate in the locality of the site would have been dissimilar to the 10% normally used. |
| Abandoned Bombs | 1 st Line Defence holds no records of abandoned bombs at or within the site vicinity. |
| Bombing Decoy sites | 1 st Line Defence could find no evidence of bombing decoy sites within the site vicinity. |
| Bomb Disposal Tasks | 1 st Line Defence could find no evidence of bomb disposal tasks within the site boundary and immediate area. |

12. Introduction to Allied Ordnance

12.1. General

Many areas across the UK may be at risk from Allied UXO because of both wartime and peacetime military use. Typical military activities and uses that may have led to a legacy of military UXO at a site include former minefields, home guard positions, anti-aircraft emplacements, training and firing ranges, military camps, as well as weapons manufacture and storage areas.

Although land formerly used by the military was usually subject to clearance before returned to civilian use, items of UXO are sometimes discovered and can present a potential risk to construction projects.

It should be highlighted that there is no evidence that the site formerly had any military occupation or usage that could have led to contamination with such items of Allied ordnance. Despite this, urban areas, such as the location of the site, can be at risk from buried unexploded anti-aircraft projectiles fired during WWII – as addressed below.

12.2. Defending the UK From Aerial Attack

During WWII the War Office employed a number of defence tactics against the Luftwaffe from bombing major towns, cities, manufacturing areas, ports and airfields. These can be divided into passive and active defences (examples are provided in the table below).

| Active Defences | Passive Defences |
|---|---|
| <ul style="list-style-type: none"> • Anti-aircraft gun emplacements to engage enemy aircraft. • Fighter aircraft to act as interceptors. • Rockets and missiles were used later during WWII. | <ul style="list-style-type: none"> • Blackouts and camouflaging to hinder the identification of Luftwaffe targets. • Decoy sites were located away from targets and used dummy buildings and lighting to replicate urban, military, or industrial areas. • Barrage balloons forced enemy aircraft to greater altitudes. • Searchlights were often used to track and divert adversary bomber crews during night raids. |

Active defences such as anti-aircraft artillery present a greater risk of UXO contamination than passive defences. Unexploded ordnance resulting from dogfights and fighter interceptors is rarely encountered and difficult to accurately qualify.

12.2.1. Anti-Aircraft Artillery (AAA)

During WWII three main types of gun sites existed: heavy anti-aircraft (HAA), light anti-aircraft (LAA) and 'Z' batteries (ZAA). If the projectiles and rockets fired from these guns failed to explode or strike an aircraft they would descend back to land. The table below provides further information on the operation and ordnance associated with these type of weapons.

| Anti-Aircraft Artillery | | | | |
|--------------------------------------|---|---------|--------------|------------------|
| Item | Description | | | |
| HAA | These large calibre guns such as the 3.7" QF (Quick Firing) were used to engage high flying enemy bombers. They often fired large HE projectiles, which were usually initiated by integral fuzes, triggered by impact, area, time delay or a combination of aforementioned mechanisms. | | | |
| LAA | These mobile guns were intended to engage fast, low flying aircraft. They were typically rotated between locations on the perimeters of towns and strategically important industrial works. As they could be moved to new positions with relative ease when required, records of their locations are limited. The most numerous of these were the 40mm Bofors gun which could fire up to 120 x 40mm HE projectiles per minute to over 1,800m. | | | |
| Variations in HAA and LAA Ammunition | Gun type | Calibre | Shell Weight | Shell Dimensions |
| | 3.0 Inch | 76mm | 7.3kg | 76mm x 356mm |
| | 3.7 Inch | 94mm | 12.7kg | 94mm x 438mm |
| | 4.5 Inch | 114mm | 24.7kg | 114mm x 578mm |
| | 40mm | 40mm | 0.9kg | 40mm x 311mm |
| Z-AA | The three inch unrotated rocket/projectile known as the UP-3 had initially been developed for the Royal Navy. The UP-3 was also used in ground-based single and 128-round launchers known as "Z" batteries. The rocket, containing a high explosive warhead was often propelled by cordite. | | | |

The conditions in which anti-aircraft projectiles may have fallen unnoticed within a site area are analogous to those regarding air delivered ordnance. Unexploded anti-aircraft projectiles could essentially have fallen indiscriminately anywhere within range of the guns. The chance of such items being observed, reported and removed during the war depends on factors such as land use, ground cover, damage and frequency of access – the same factors that govern whether evidence of a UXB is likely to have been noted. More information about these factors with regards to this particular site can be found in the German Air Delivered Ordnance section of this report.

Illustrations of Anti-Aircraft artillery, projectiles and rockets are presented at **Appendix iv**.

13. The Likelihood of Contamination from Allied Ordnance

13.1. Introduction

There are several factors that may serve to either affirm, increase, or decrease the level of risk within a site with a history of military usage. Such factors are typically dependent upon the proximity of the proposed area of works to training activities, munition productions and storage, as well as its function across the years.

This section will examine the history of the proposed site and assess to what degree, if any, the site could have become contaminated as a result of the military use of the surrounding area.

13.2. Evaluation of Contamination Risk from Allied UXO

1st Line Defence has considered the following potential sources of Allied ordnance contamination:

| Sources of Allied UXO Contamination | Conclusion |
|---|--|
| Military Camps
<i>Military camps present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training.</i> | <p>1st Line Defence could find no evidence of a military camp within the site.</p> <p>Northumberland Bottom Camp and an anti-aircraft battery were located approximately 900m north of the site. It was built in 1938 with four 3.7 inch guns mounted on octagonal emplacements, with two additional guns added in 1940. Two magazines and a radar installation for gun direction were also present at the site of this camp/HAA battery. It was decommissioned for active service in 1945 but held in reserve until 1956, later being cleared for the construction of the Channel Tunnel in 2000. Given the distance of this camp from the site, it is not thought likely to have had any impact on the site boundary, or to increase the risk of contamination from Allied ordnance within the site area.</p> |
| Anti-Aircraft Defences
<i>Anti-Aircraft defences were employed across the country. Proximity to anti-aircraft defences increases the chance of encountering AA projectiles.</i> | <p>1st Line Defence could find no evidence of Anti-Aircraft defences such as a HAA or LAA gun emplacement occupying or bordering the site. The closest HAA was located approximately 800m north of the site. Despite this distance the maximum effective range of an AA projectile can be up to 15km.</p> <p>The conditions in which HAA or LAA projectiles may have fallen unnoticed within a site footprint are generally analogous to those regarding German air delivered ordnance.</p> |
| Home Guard Activity
<i>The Home Guard regularly undertook training and ordnance practice in open areas, as well as burying ordnance as part of anti-invasion defences.</i> | <p>Evidence of Home Guard activity is often difficult to locate, owing to the ad-hoc nature of Home Guard activity within each local area. Such training was often conducted on a small scale at the discretion of individual commanders and as such was seldom recorded officially. As such, no positive evidence could be found to confirm the presence of HG units within proximity to the site.</p> |
| Defensive Positions
<i>Defensive positions suggest the presence of military activity, which is often indicative of ordnance storage, usage or disposal.</i> | <p>There is no evidence of any pillbox, emplacement or other defensive features formerly located on or bordering the site footprint.</p> |

| | |
|--|---|
| <p>Training or firing ranges</p> <p><i>Areas of ordnance training saw historical ordnance usage in large numbers, often with inadequate disposal of expended and live items. The presence of these ranges significantly impact on the risk of encountering items of ordnance in their vicinity.</i></p> | <p>No evidence of training or firing ranges could be found within the site or surrounding area.</p> |
| <p>Defensive Minefields</p> <p><i>Minefields were placed in strategic areas to defend the country in the event of a German invasion. Minefields were not always cleared with an appropriate level of vigilance.</i></p> | <p>There is no evidence of defensive minefields affecting the site.</p> |
| <p>Ordnance Manufacture</p> <p><i>Ordnance manufacture indicates an increased chance that items of ordnance were stored, or disposed of, within a location.</i></p> | <p>No information of ordnance being stored, produced, or disposed of within the proposed site could be found.</p> |
| <p>Military Related Airfields</p> <p><i>Military airfields present an elevated risk from ordnance simply due to the large military presence and likelihood of associated live ordnance training or bombing practice.</i></p> | <p>The site was not situated within the perimeters or vicinity of a military airfield.</p> |

14. The Likelihood of UXO Contamination Summary

The following table assesses the likelihood that the site was contaminated by items of German air delivered and Allied ordnance. Factors such as the risk of UXO initiation, remaining, and encountering will be discussed later in the report.

| UXO Contamination Summary | |
|---|--|
| Quality of the Historical Record | <p>The research has evaluated pre- and post-WWII Ordnance Survey maps, Luftwaffe reconnaissance imagery, Kent Daily and V-1/Shells Bomb Census Maps, Medway Group War Diaries, Kent UXB Schedule, Northfleet War Diaries, Kent Air Raid Damage Files and RAF WWII-era aerial photography.</p> <p>The record set is of generally mixed quality. Multiple data sets exist which provide information on the site's district during wartime. However, some data sets such as Kent Daily Bomb maps only provide approximate information rather than precise bomb strike locations and cannot be corroborated with other sources.</p> |
| German Air Delivered Ordnance | <ul style="list-style-type: none"> During WWII, the site was situated within the Urban District of Northfleet, which sustained an overall high density of bombing, according to official Home Office bombing statistics, with an average 103.2 items recorded per 1,000 acres. This was mainly due to areas such as Northfleet and Gravesend being subject to 'tip-and-run' raids, whereby surplus ordnance was jettisoned by German bombers on their way home, as they came directly under the Luftwaffe's flight path to London. No positive evidence could be found to suggest that the site sustained any direct incidents of bombing within the available bomb mapping and written records. However, multiple incidents of bombing are recorded within the wider area with the closest record approximately 220m south-west of the site. No major signs of damage such as cratering, scattered earth or indentations in the ground were evident within post-WWII aerial imagery dated 1946. It should be noted however, that given the site's undeveloped composition, smaller indicators of damage may not be visible in these images. The ground cover across the site is not anticipated to have been greatly conducive to the detection of evidence of UXO. Given the agricultural, vegetated nature of the site, any indication of UXBs, such as bomb entry holes which could have been as small as 20cm, are at an increased likelihood of becoming obscured by vegetation and crop. It is not known how often the site would have been accessed during the war, however, as the site was occupied and surrounded by agricultural farmland, it may have been subject to intermittent levels of access and observation. Although this would likely have been seasonal, and relied on the vigilance of individuals working the land. In summary, no HE bombs were recorded on or within close proximity to the site. Additionally, no conclusive evidence of damage can be found within the site boundary on aerial photography. Given the site's undeveloped ground cover during wartime, the possibility of an on-site UXO incident cannot be entirely discounted. However, given the relatively small site area and the aforementioned discussed factors, the risk is not considered significant enough to warrant proactive risk mitigation measures. As a result, the site has been assessed to be of Low Risk for German aerial-delivered UXO contamination. |
| Allied Ordnance | <ul style="list-style-type: none"> There is no evidence that the site formerly had any military occupation or usage that could have led to contamination with items of Allied ordnance, such as LSA and SAA. The conditions in which HAA or LAA projectiles may have fallen unnoticed within the site boundary are however analogous to those regarding air delivered ordnance. |

15. The Likelihood that UXO Remains

15.1. Introduction

It is important to consider the extent to which any explosive ordnance clearance (EOC) activities or extensive ground works have occurred on site. This may indicate previous ordnance contamination or reduce the risk that ordnance remains undiscovered.

15.2. UXO Clearance

1st Line Defence has found no evidence in the public domain or within internal records that any official ordnance clearance operations have taken place on site. Note however that we have not received confirmation of this fact from the 33 EOD Regiment Archive (now part of 29 EOD & Search Group). It should also be noted that in addition to 29 EOD & Search Group archival information, 1st Line Defence also do not currently have access to data that may be relevant including 5131(BD)SQN Archive, SD Training Technical Advisory Section (TAS) and MACA Records (bomb disposal callouts).

If such information is available at a later date, it is recommended that it be reviewed as it will assist with understanding both levels and types of contamination likely to be present, and may indicate risk reduction in certain areas.

15.3. Post-War Redevelopment

According to recent aerial photography, no developments have taken place on site post-WWII.

The risk of UXO remaining is considered to be mitigated at the location of and down to the depth of any post-war redevelopment on site. For example, the risk from deep buried UXO will only have been mitigated within the volumes of any post-war pile foundations or deep excavations for basement levels. The risk will however remain within virgin geology below and amongst these post-war works, down to the maximum bomb penetration depth.

16. The Likelihood of UXO Encounter

16.1. Introduction

For UXO to pose a risk at a site, there should be a means by which any potential UXO might be encountered on that site.

The likelihood of encountering UXO on the site of proposed works would depend on various factors, such as the type of UXO that might be present and the intrusive works planned on site. In most cases, UXO is more likely to be present below surface (buried) than on surface.

In general, the greater the extent and depth of intrusive works, the greater the risk of encountering. The most likely scenarios under which items of UXO could be encountered during construction works is during piling, drilling operations or bulk excavations for basement levels. The overall risk will depend on the extent of the works, such as the numbers of boreholes/piles (if required) and the volume of the excavations.

Generally speaking, the risk of encountering any type of UXO will be minimal for any works planned within the footprint and down to the depth of post-war foundations and excavations.

16.2. Encountering Air Delivered Ordnance

Since an air delivered bomb may come to rest at any depth between just below ground level and its maximum penetration depth, there is a chance that such an item (if present) could be encountered during shallow excavations (for services or site investigations) into the original WWII ground level as well as at depth.

17. The Likelihood of UXO Initiation

17.1. Introduction

UXO does not spontaneously explode. Older UXO devices will require an external event/energy to create the conditions for detonation to occur. The likelihood that a device will function can depend on a number of factors including the type of weaponry, its age and the amount of energy it is struck with.

17.2. Initiating Air Delivered Ordnance

Unexploded bombs do not spontaneously explode. All high explosive filling requires significant energy to create the conditions for detonation to occur.

In recent decades, there have been a number of incidents in Europe where Allied UXBs have detonated, and incidents where fatalities have resulted. There have been several hypotheses as to the reason why the issue is more prevalent in mainland Europe – reasons could include the significantly greater number of bombs dropped by the Allied forces on occupied Europe, the preferred use by the Allies of mechanical rather than electrical fuzes, and perhaps just good fortune. The risk from UXO in the UK is also being treated very seriously in many sectors of the construction industry, and proactive risk mitigation efforts will also have affected the lack of detonations in the UK.

There are certain construction activities which make initiation more likely, and several potential initiation mechanisms must be considered:

| UXB Initiation | |
|-------------------------------|--|
| Direct Impact | Unless the fuze or fuze pocket is struck, there needs to be a significant impact e.g. from piling or large and violent mechanical excavation, onto the main body of the weapon to initiate a buried iron bomb. Such violent action can cause the bomb to detonate. |
| Re- starting the Clock | A small proportion of German WWII bombs employed clockwork fuzes. It is probable that significant corrosion would have taken place within the fuze mechanism over the last 70+ years that would prevent clockwork mechanisms from functioning. Nevertheless, it was reported that the clockwork fuze in a UXB dealt with by 33 EOD Regiment in Surrey in 2002 did re-start. |
| Friction Impact | The most likely scenario resulting in the detonation of a UXB is friction impact initiating the shock-sensitive fuze explosive. The combined effects of seasonal changes in temperature and general degradation over time can cause explosive compounds to crystallise and extrude out from the main body of the bomb. It may only require a limited amount of energy to initiate the extruded explosive which could detonate the main charge. |

18. Consequences of Initiation/Encounter

18.1. Introduction

The repercussions of the inadvertent detonation of UXO during intrusive ground works, or if an item or ordnance is interfered with or disturbed, are potentially profound, both in terms of human and financial cost. A serious risk to life and limb, damage to plant and total site shutdown during follow-up investigations are potential outcomes. However, if appropriate risk mitigation measures are put in place, the chances of initiating an item of UXO during ground works is comparatively low.

The consequences of encountering UXO can be particularly notable in the case of high-profile sites (such as airports and train stations) where it is necessary to evacuate the public from the surrounding area. A site may be closed for anything from a few hours to a week with potentially significant cost in lost time. It should be noted that even the discovery of suspected or possible item of UXO during intrusive works (if handled solely through the authorities), may also involve significant loss of production.

18.2. Consequences of Detonation

When considering the potential consequences of a detonation, it is necessary to identify the significant receptors that may be affected. The receptors that may potentially be at risk from a UXO detonation on a construction site will vary depending on the site specific conditions but can be summarised as follows:

- People – site workers, local residents and general public.
- Plant and equipment – construction plant on site.
- Services – subsurface gas, electricity, telecommunications.
- Structures – not only visible damage to above ground buildings, but potentially damage to foundations and the weakening of support structures.
- Environment – introduction of potentially contaminating materials.

19. 1st Line Defence Risk Assessment

19.1. Risk Assessment Stages

Taking into account the quality of the historical evidence, the assessment of the overall risk from unexploded ordnance is based on the following five considerations:

1. That the site was contaminated with unexploded ordnance.
2. That unexploded ordnance remains on site.
3. That such items will be encountered during the proposed works.
4. That ordnance may be initiated by the works operations.
5. The consequences of encountering or initiating ordnance.

19.2. Assessed Risk Level

1st Line Defence has assessed that there is an overall **Low Risk** from German and anti-aircraft unexploded ordnance at the site of proposed works. There is also an assessed **Negligible Risk** from Allied unexploded ordnance.

| Ordnance Type | Risk Level | | | |
|---|------------|-----|--------|------|
| | Negligible | Low | Medium | High |
| German Unexploded HE Bombs | | ✓ | | |
| German 1kg Incendiary Bombs | | ✓ | | |
| Anti-Aircraft Artillery Projectiles | | ✓ | | |
| Allied Land Service and Small Arms Ammunition | ✓ | | | |

Please note – although the risk from unexploded ordnance on this site has been assessed as ‘Low’, this does not mean there is ‘no’ risk of encountering UXO. This report has been undertaken with due diligence, and all reasonable care has been taken to access and analyse relevant historical information. By necessity, when dealing historical evidence, and when making assessments of UXO risk, various assumptions have to be made which we have discussed and justified throughout this report. Our reports take a common-sense and practical approach to the assessment of risk, and we strive to be reasonable and pragmatic in our conclusions.

It should however be stressed that if any suspect items are encountered during the proposed works, 1st Line Defence should be contacted for advice/assistance, and to re-assess the risk where necessary. The mitigation measures outlined in the next section are recommended as a minimum precaution to alert ground personnel to the history of the site, what to look out for, and what measures to take in the event that a suspect item is encountered. It should also be noted that the conclusions of this report are based on the scope of works outlined in the ‘Proposed Works’ section of this report. Should the scope of works change or additional works be proposed, 1st Line Defence should be contacted to re-evaluate the risk.

20. Proposed Risk Mitigation Methodology

20.1. General

The following risk mitigation measures are recommended to support the proposed works at Worcester Close:

| Type of Work | Recommended Mitigation Measure |
|--------------|--|
| All Works | <ul style="list-style-type: none">• UXO Risk Management Plan
It is recommended that a site-specific plan for the management of UXO risk be written for this site. This plan should be kept on site and be referred to in the event that a suspect item of UXO is encountered at any stage of the project. It should detail the steps to be taken in the event of such a discovery, considering elements such as communication, raising the alarm, nominated responsible persons etc. Contact 1st Line Defence for help/more information.• Site Specific UXO Awareness Briefings to all personnel conducting intrusive works.
As a minimum precaution, all personnel working on the site should be briefed on the basic identification of UXO and what to do in the event of encountering a suspect item. This should in the first instance be undertaken by a UXO Specialist. Posters and information on the risk of UXO can be held in the site office for reference. |

In making this assessment and recommending these risk mitigation measures, if known, the works outlined in the 'Scope of the Proposed Works' section were considered. Should the planned works be modified or additional intrusive engineering works be considered, 1st Line Defence should be consulted to see if a re-assessment of the risk or mitigation recommendations is necessary.

1st Line Defence Limited

26/09/2022

This Report has been produced in compliance with the Construction Industry Research and Information Association (CIRIA) C681 guidelines for the writing of Detailed UXO Risk Assessments.

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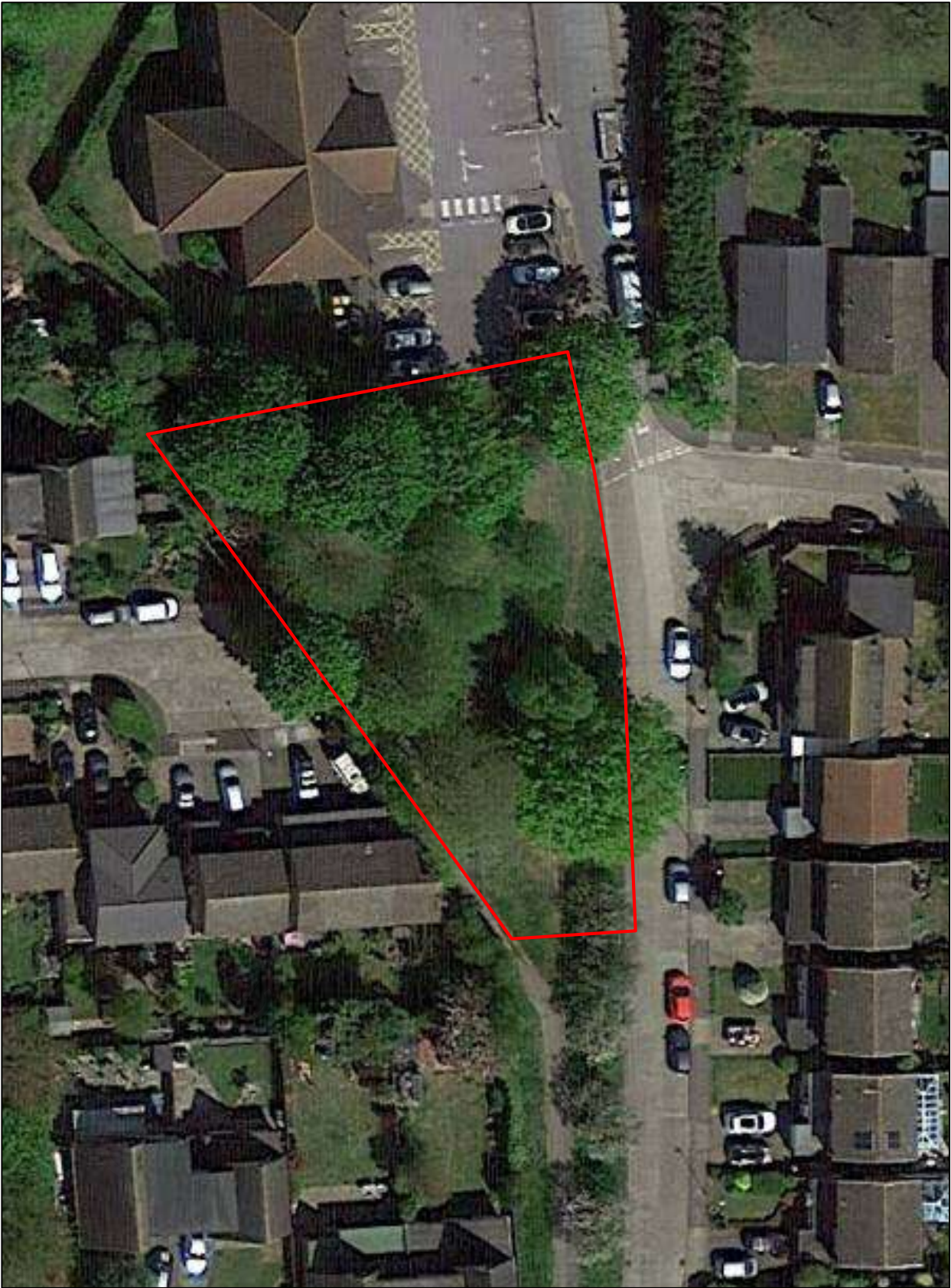
Project: **Worcester Close**

Ref: **DA16287-00**

Source: Google Maps

 **Approximate site boundary**





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Source: Google Earth™ Mapping Services

 **Approximate site boundary**





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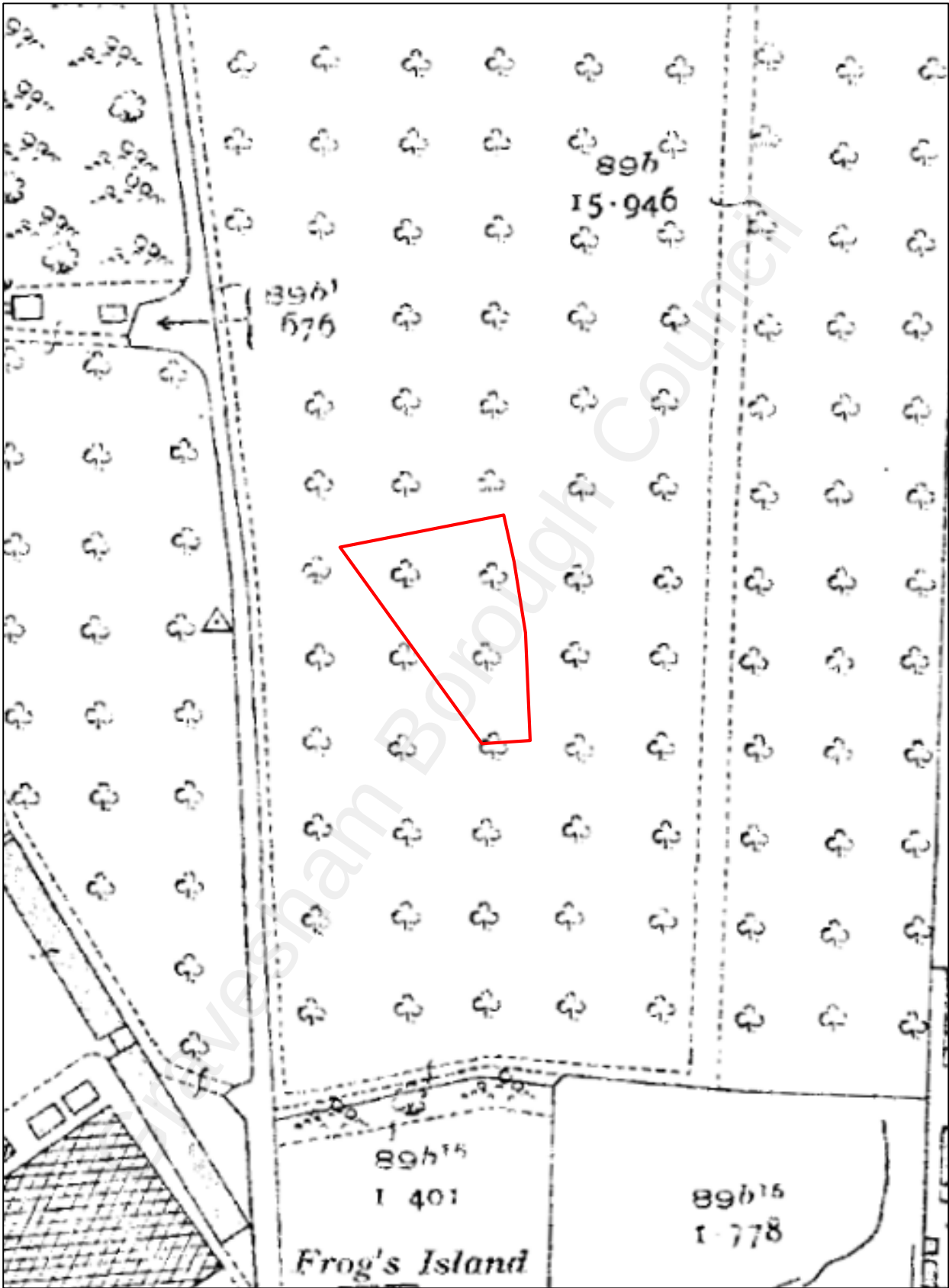
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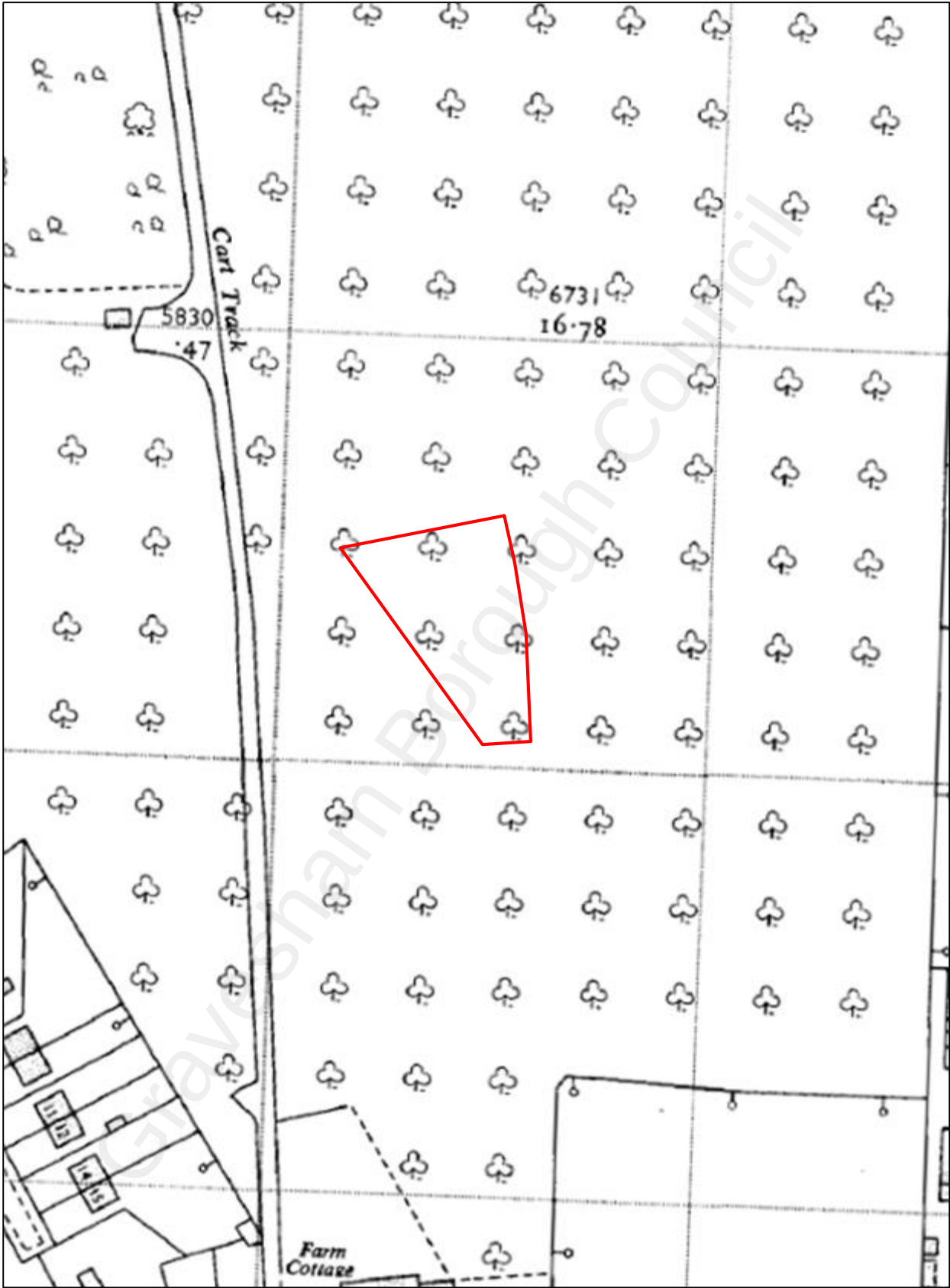
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Source: **Landmark Maps**

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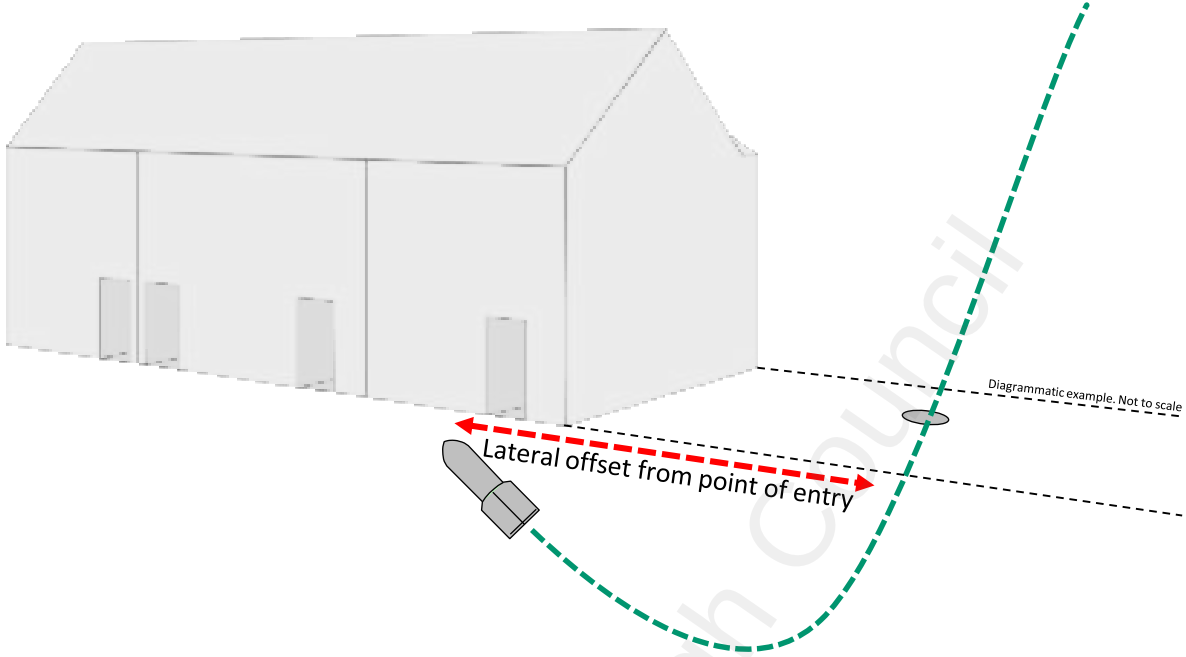
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Ref: **DA16287-00**

Source: **Landmark Maps**

 **Approximate site boundary**

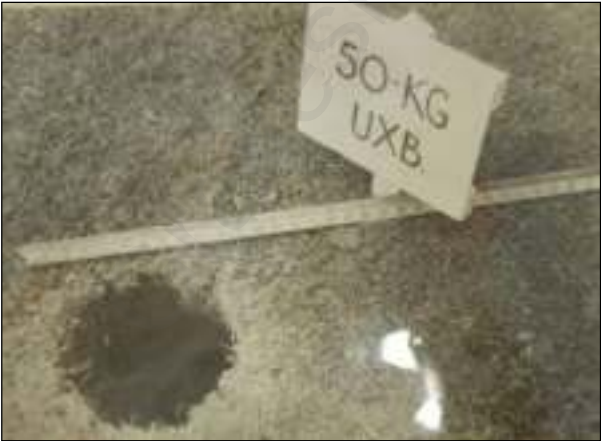








Top: J-curve Effect - Due to angle of entry, unexploded bombs would often end their trajectory at a lateral offset from point of entry, often ending up beneath adjacent extant structures/sites. The photograph above shows 250kg bomb found in Bermondsey pointing upwards, demonstrating ‘J-curve’



One of the most common scenarios for UXO going unnoticed was when a UXB fell into a ‘bomb site’ (such as the area shown **Top Left**), the entry hole of the bomb obscured by any debris and rubble present. Note that the entry hole of a 50kg UXB could be as little as 20cm in diameter (**Left**).



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Source: Various sources

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BBC
NEWS

Bermondsey bomb: World War Two device safely removed

An unexploded World War Two bomb found in south London has been driven away to a safe site and police and Army engineers.

The 500lb (227kg) device was found in a garden in the Bermondsey area of London.

March 2015

BBC
NEWS

Bethnal Green WW2 bomb: Experts remove unexploded device

An unexploded World War Two bomb that prompted the evacuation of 200 people in east London has been made safe and removed by the military.

The 500lb (227kg) device was found in a garden in the Bethnal Green area of London.

August 2016

BBC
NEWS

Bath WW2 bomb scare: Device defused, police say

A 500lb World War Two bomb found on the site of a former school in Bath has been defused and made safe.

The device, which was found by the owner of the site, was defused by police and Army engineers.

May 2016

BBC
NEWS

London City Airport reopens after WW2 bomb moved

London City Airport has reopened after an unexploded World War Two bomb was safely moved from the area.

The bomb was found by a member of the public and was moved by the military.

May 2015

BASF has confirmed that an explosive device, most likely a World War II-era bomb, caused the blast that left one person injured Tuesday at a plant construction site in Germany.

The explosion was reported at BASF's Ludwigshafen toluene diisocyanate (TDI) plant, which recently broke ground for a 300,000 metric tons per year TDI production plant and other construction to expand its facilities.



BASF Provides Some Details

Responding to a request from FaintSquare /news for more information on Wednesday (Feb. 27), BASF's manager of media relations and corporate communications Europe, Ursula von Stetten, wrote in an email, "So here [are] the facts: The detonation took place at 10:30 a.m. One person was injured, the injury is not serious. He will be kept in the hospital for some days."

"Cause of the detonation was an explosive device, presumably a bomb deriving from the Second World War. The device detonated when grounding work was done. No details on [a] delay [are] available. At the moment, the exact circumstances of the incident are [being] evaluated."

1st March 2013

WWII bomb injures 17 at Hattingen construction site



Seventeen people were injured on Friday when a construction crew unwittingly detonated a buried World War II-era bomb in Hattingen.

An excavator apparently drove over a 250-kilogramme (550 pound) American bomb, damaging surrounding buildings. Most of the injured suffered auditory trauma from the blast, and the excavator operator suffered injuries to his hands, police in the German state of North Rhine-Westphalia said.

"The hole was astoundingly small for such a large bomb full of so many explosives," Armin Gebhard, head of the Amsberg department for military remnant removal, told The Local. "But of course it damaged all the surrounding buildings too. We are really happy it wasn't worse."

19th September 2013



World War II bomb kills three in Germany



A special investigation is working to find out the cause of the explosion, which authorities are investigating as a possible terrorist attack. The explosion occurred at a construction site in the town of Bielefeld, Germany, on Friday.

The first explosion took place before the building project was started. It was a 20-year-old bomb that was discovered by workers. The bomb was found in a trench that was about 100 years old. It was found by a worker who was digging for a foundation. The bomb was found in a trench that was about 100 years old. It was found by a worker who was digging for a foundation.

2nd June 2010



June 2006

SPIEGEL ONLINE

Direct Kills One

World War II Bomb Explodes on German Motorway

A highway construction worker in Germany accidentally struck an unexploded World War II bomb, causing an explosion which killed him and wounded several passing cars.



A World War II bomb has exploded during construction work on a German highway, killing one worker and injuring several motorists who were driving past the site.

The worker had been cutting through the road surface near the south-western town of Aschaffenburg when the machine struck the bomb and triggered the explosion. They were unsure what type of bomb it was. The explosion seems to have been too small for it to have been an aircraft bomb, the police spokesman said.

23rd October 2006



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Ref: DA16287-00

Source: Various news sources

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This is just one photograph from the German reconnaissance coverage of the Britain, which highlighted known Luftwaffe bombing targets. The above photo was taken 4th June 1939 and highlights a power station in Gravesend, approximately 4.2km north of the site.



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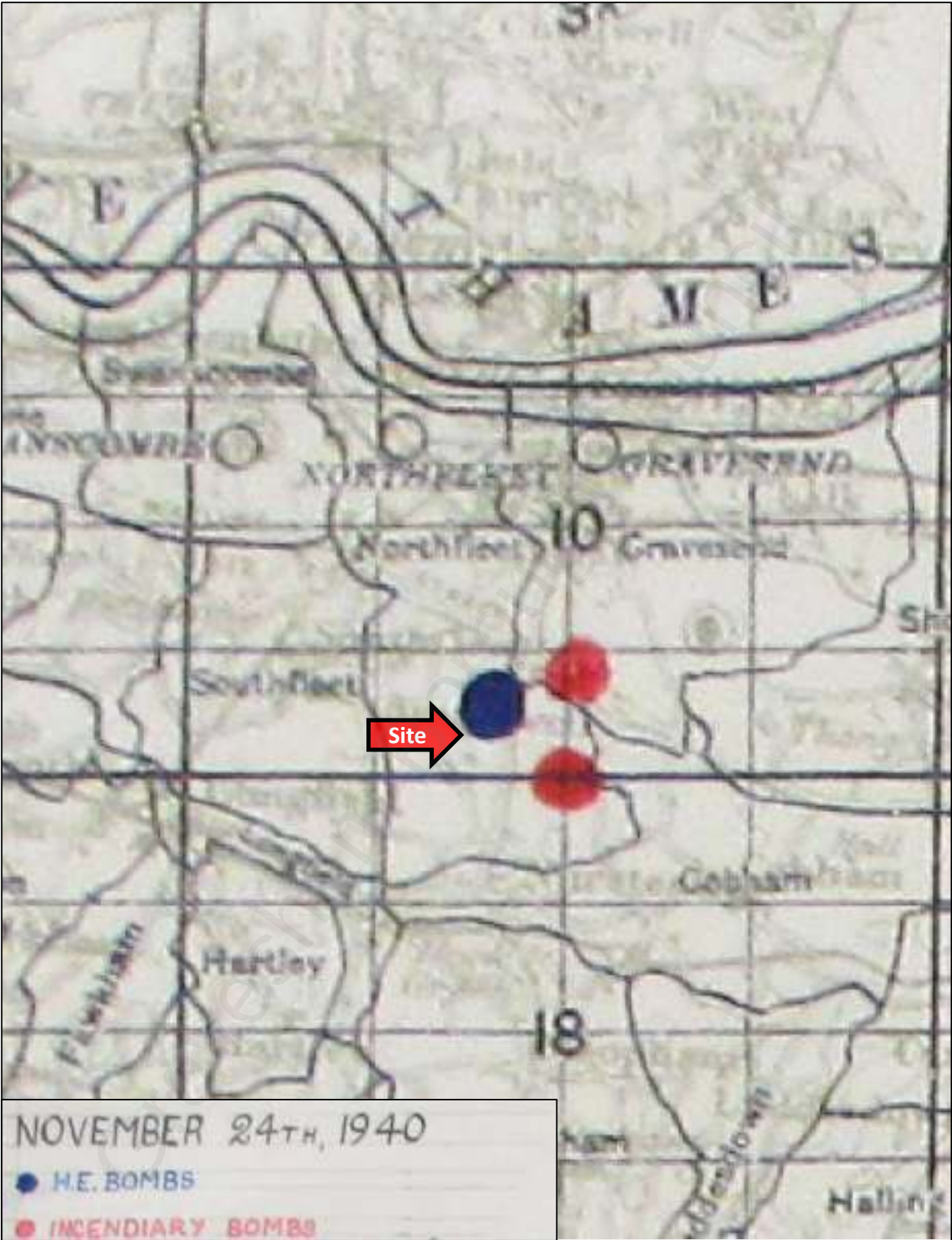
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Source: Kent History & Library Centre





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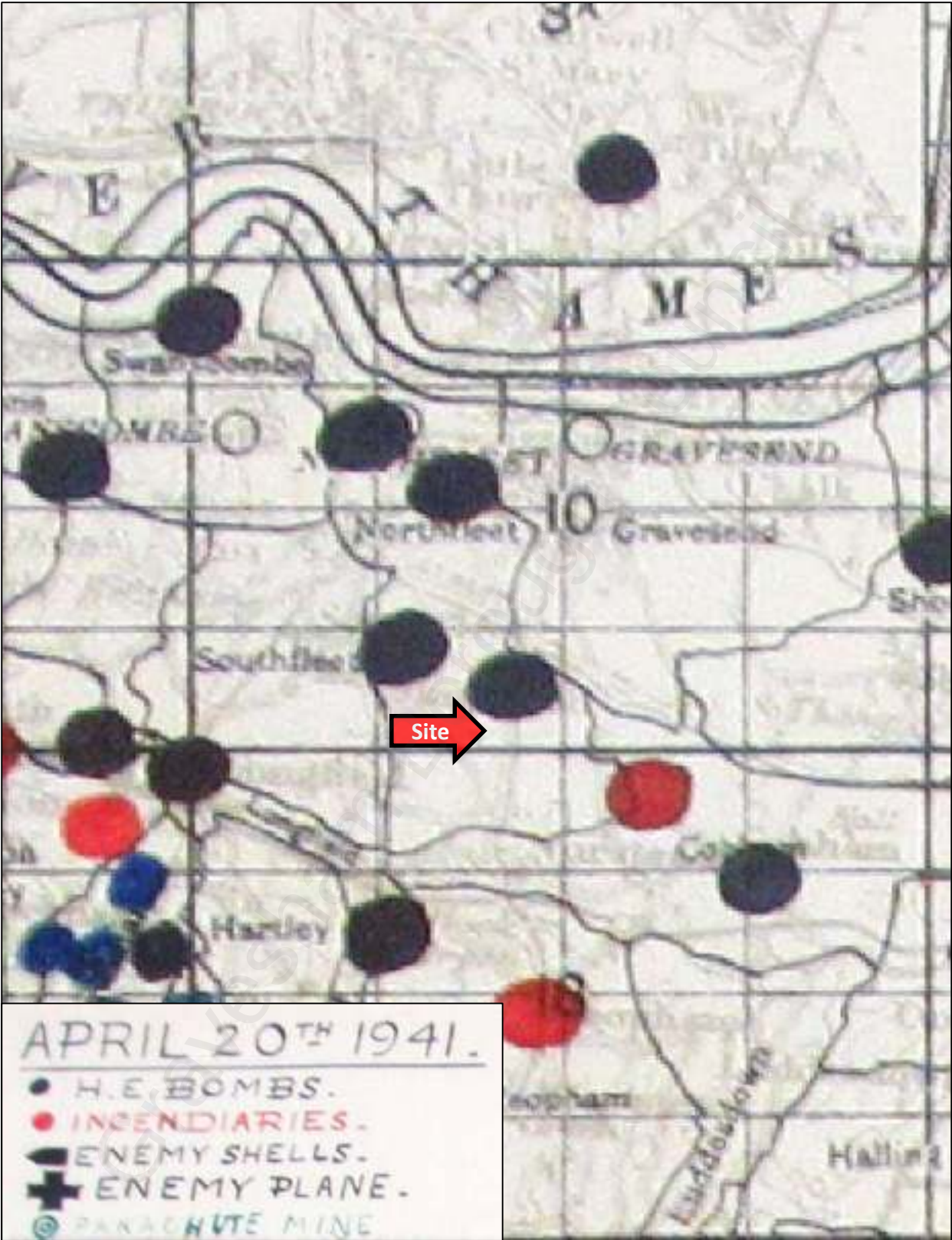
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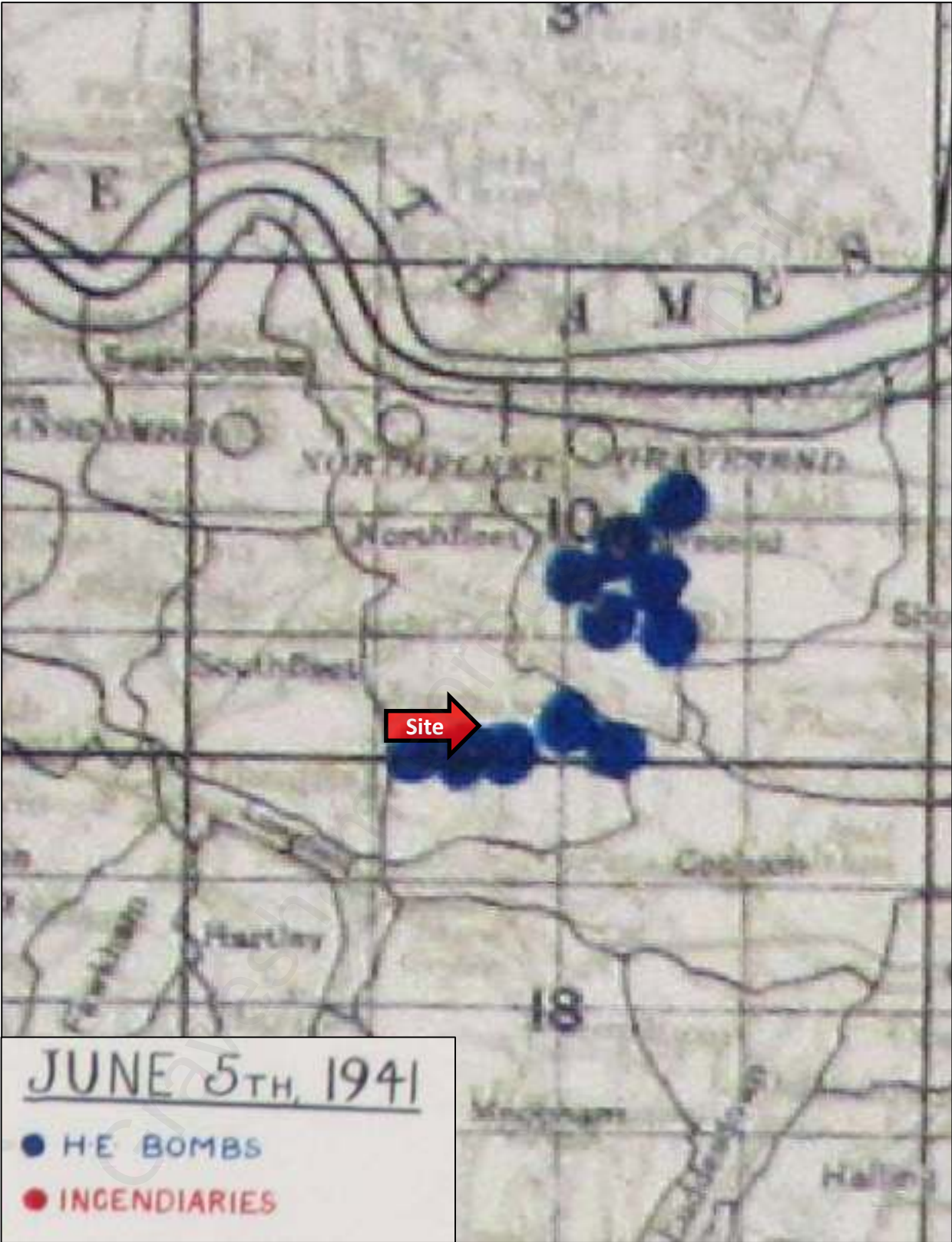
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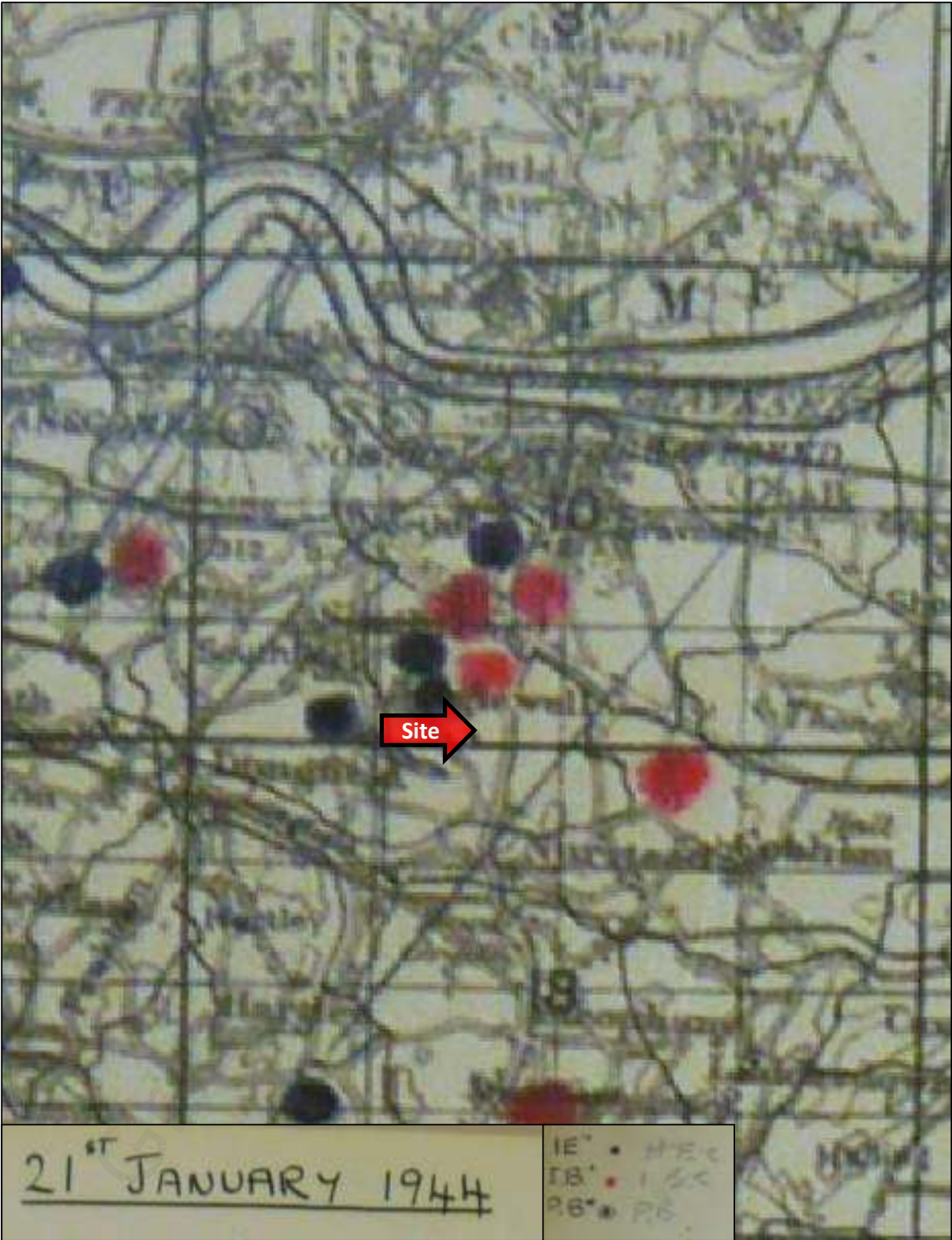
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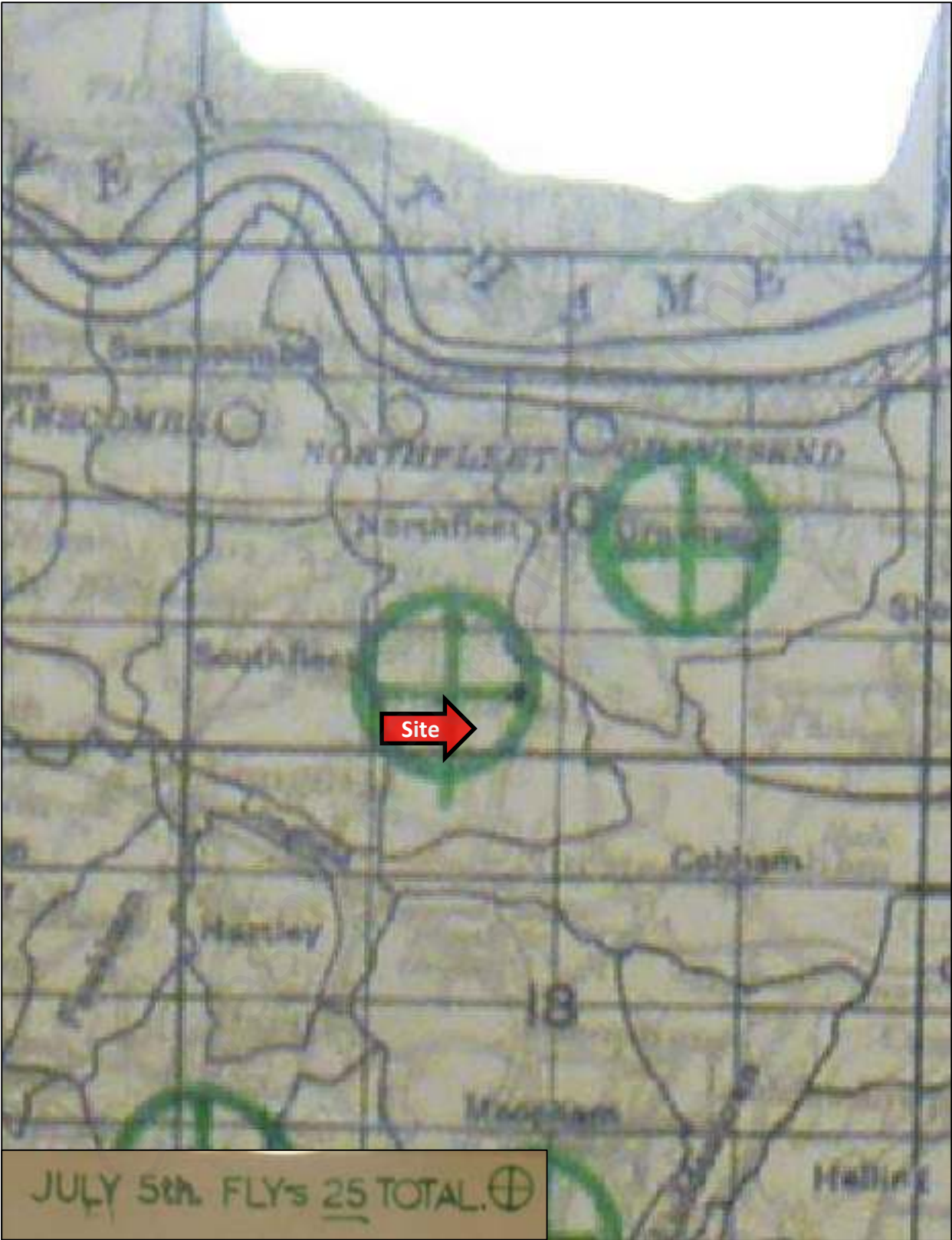
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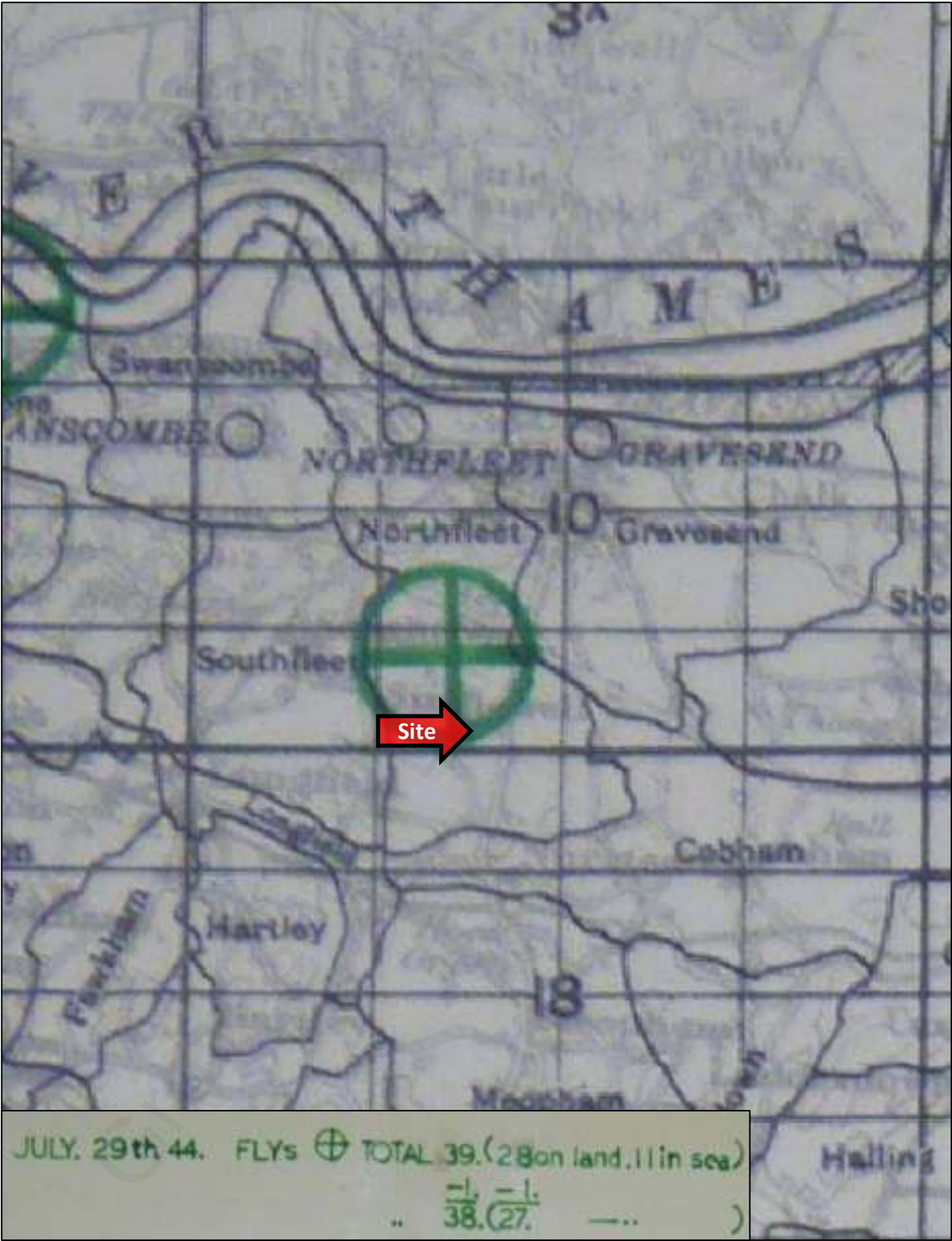
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| | | | | | | | | |
|---|-------------------------|-------|-------|------------|-------|------|----|---|
| 1 | 24.11.40 | 15.20 | 15.35 | NORTHFLEET | 13.05 | H.E. | 6 | m.m.R. 080846 |
| 2 | 24.11.40 | 17.40 | 17.41 | NORTHFLEET | 23.00 | H.E. | | ONE H.A. SHELL EXPLODED
AT 4-4. 071137.
ONE HOUSE SLIGHTLY
DAMAGED. |
| 3 | 24.11. | 01.53 | 01.59 | NORTHFLEET | 00.45 | H.E. | 1 | DOWNS ROAD H.E. 075835
INSTEAD RISE H.E. 077836
WATER MAIN DAMAGED |
| 4 | 24.11. | 02.29 | 02.49 | NORTHFLEET | | | | RIGHT FURTHER H.E. IN N. I. L.
OPEN GROUND.
ELECTRICITY MAINS
DAMAGED. INSTEAD ONE |
| 5 | June 5 th 41 | 11.58 | 12.02 | NORTHFLEET | 00.45 | H.E. | 14 | Ref. 01.53 + 02.39.
MRS. 074/885 - 076/887 |



1ST LINE DEFENCE

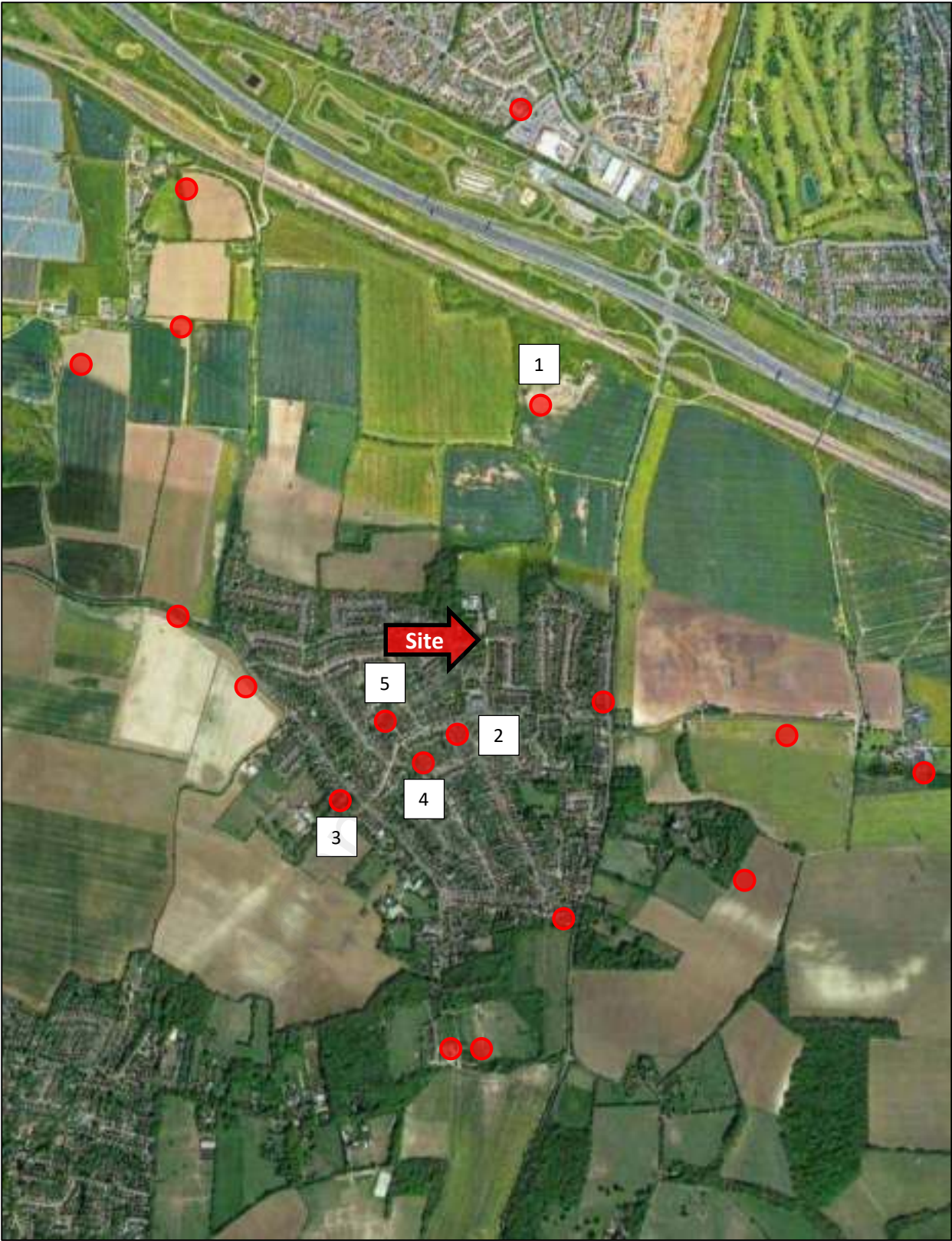
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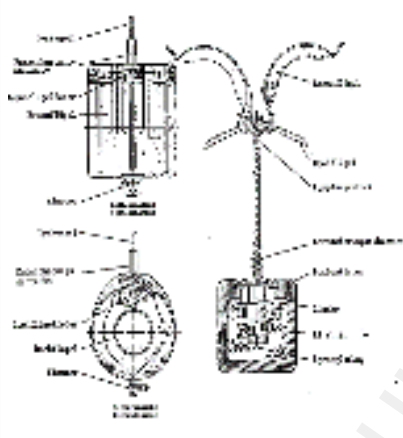
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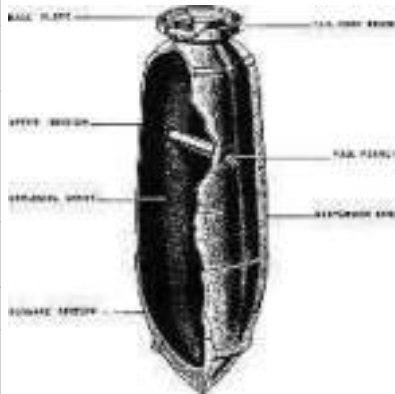
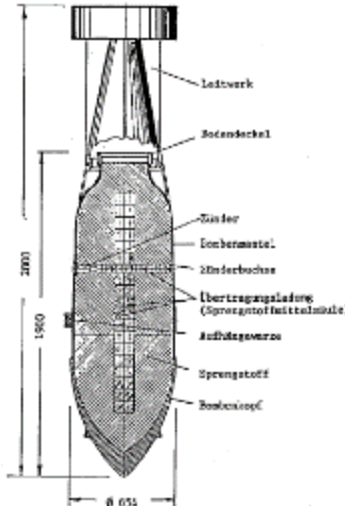
SD2 Butterfly Bomb

| | | | | |
|------------------|--|--|---|--|
| Bomb Weight | 2kg (4.41lb) |  |  | |
| Explosive Weight | 7.5oz (212.6 grams) of TNT surrounded by a layer of bituminous composition. | | | |
| Fuze Type | 41 fuze (time) , 67 fuze (clockwork time delay) or 70 fuze (anti-handling device) | | | |
| Bomb Dimensions | Length 240 mm
Width 140 mm
Height 310 mm | | | |
| Body Diameter | 3in (7.62 cm) diameter, 3.1in (7.874) long | | | |
| Use | It was designed as an anti-personnel/fragmentation weapon. They were delivered by air, being dropped in containers that opened at a predetermined height, thus scattering the bombs. | | | |
| Remarks | The smallest and most common conventional German bomb. Nearly 70% of bombs dropped on the UK were 50kg. | | | |

Parachute Mine (Luftmine B / LMB)

| | | | | |
|------------------|---|--|--|--|
| Bomb Weight | 987.017kg (2176lb) |  |  | |
| Explosive Weight | 125-130kg (276-287lb) | | | |
| Fuze Type | Impact/ Time delay / hydrostatic pressure fuze | | | |
| Bomb Dimensions | 1640 x 512mm (64.57 x 20.16in) | | | |
| Body Diameter | 368mm (14.5in) | | | |
| Use | Against civilian, military and industrial targets. Designed to detonate above ground level to maximise damage to a wider area. | | | |
| Remarks | Parachute Mines were normally carried by HE 115 (Naval operations), HE 111 and JU 88 aircraft types. Deployed a parachute when dropped in order to control its descent. | | | |

SC 1000kg

| | | | |
|------------------|---|--|---|
| Bomb Weight | 996-1061kg (1,058-1,146lb) |  |  |
| Explosive Weight | 530-620kg (551-573lb) | | |
| Fuze Type | Electrical impact/mechanical time delay fuze. | | |
| Filling | Mixture of 40% amatol and 60% TNT, but when used as an anti-shipping bomb it was filled with Trialen 105, a mixture of 15% RDX, 70% TNT and 15% aluminium powder. | | |
| Bomb Dimensions | 2800 x 654mm (77 x 25.2in) | | |
| Body Diameter | 654mm (18.5in) | | |
| Use | SC type bombs are General Purpose Bombs used primarily for general demolition work. Constructed of parallel walls with comparatively heavy noses. They are usually of three piece welded construction | | |

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[illegible][illegible]

QF 3.7 Inch WWII Anti-Aircraft Projectile

| | |
|-------------------|---|
| Projectile Weight | 28lb (12.6 kg) |
| Explosive Weight | 2.52lbs |
| Fuze Type | Mechanical Time Fuze |
| Dimensions | 3.7in x 14.7in (94mm x 360mm) |
| Rate of Fire | 10 to 20 rounds per minute |
| Use | High Explosive Anti-Aircraft projectile. 4.5in projectiles were also used in this role. |
| Ceiling | 30,000ft to 59,000ft |



40mm Bofors Projectile

| | |
|-----------------------|------------------------------------|
| Projectile Weight | 1.96lb (0.86kg) |
| Explosive Weight | 300g (0.6lb) |
| Fuze Type | Proximity and Mechanical Time Fuze |
| Rate of Fire | 120 rounds per minute |
| Projectile Dimensions | 40mm x 310mm (1.6in x 12.2in) |
| Ceiling | 23,000ft (7000m) |



Unrotated Projectile (UP) – Z Battery

| | |
|-------------------|---|
| Projectile Weight | 84lb (24.5kg) |
| Warhead Weight | 4.28lb (1.94kg) |
| Warhead | Aerial Mine with a No. 700 / 720 fuze |
| Filling | High Explosive |
| Dimensions | 1930mm x 82.6mm (76 x 3.25in) |
| Use | As a short range rocket-firing anti-aircraft weapon developed for the Royal Navy. It was used extensively by British ships during the early days of World War II. The UP was also used in ground-based single and 128-round launchers known as Z Batteries. |



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