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Hydrogeological Risk Assessment Report

Land to rear of Broadwater Apartments, Southdownview Road, Worthing BN14 8NN

On behalf of Paul Basham Associates

Report Reference: GWPR6352/HRA/December 2024			Status: Final
Issue	Prepared By	Checked By	Verified By
V1.01			
	Roger Foord BA (Hons) MSc DIC CGeol. FGS CIHM Senior Engineer	Miltiadis Mellios MSc(Eng) CGeol FGS MIEnvSc GMICE Principal Engineer	Francis Williams MGeol (Hons) FGS CEnv CGeol Director

Site Investigations | Environmental Consultants | Geotechnical Engineers

2 The Long Barn, Norton Farm, Selborne Road, Alton, Hampshire GU34 3NB
0333 600 1221 enquiries@groundandwater.co.uk **groundandwater.co.uk**

Registered Office: Kineton House, 31 Horse Fair, Banbury, Oxfordshire OX16 0AE Registered in England No. 07032001

Hydrogeological Risk Assessment Report	
REPORT REFERENCE	GWPR6352/HRA/December 2024. The conditions and limitations of this report can be viewed within Appendix A. A technical glossary has also been provided within Appendix B.
AIMS	The aim of this report is to provide information on the hydrogeological regime in the vicinity of the site and to provide a Conceptual Model in relation to the protection of controlled waters through development of the site.
SITE & AREA DETAILS	The total site comprised a ~0.93ha approximately rectangular shaped plot of land located close to the centre of the western boundary of the Broadwater Industrial Estate in north-east Worthing, West Sussex. A site location plan is given in Figure 1. The site comprises a large parking area, mainly covered by tarmac hardstanding. The footprint of a former building, with concrete hardstanding and areas of Made Ground, is noted in the south-central part of the site, with a small strip of soft landscaping extending north. Access to the site is via a tarmac drive off Southdownview Road to the south-west. The north-east, east and south-east banked edges of the site comprised semi-mature/mature trees and grassed/overgrown, soft landscaping. Residential apartments are present to the west, with industrial works/large offices to the north, east and south of the site. The site has a lower elevation than areas to the north, east and south, hence the embankments on the east of the site. The site appears flat and level, with a very slight slope to the south. An aerial view of the site is given in Figure 2.
PROPOSED DEVELOPMENT	At the time of reporting, December 2024, the proposed development was understood to comprise the construction of a total of 11No. industrial units in three zones. 4No. along the western boundary, 2No. in the centre and 5No. along the south-east boundary. Parking areas, with isolated soft landscaping, will make up the remainder. It is understood the soft landscaped banks to the north-east will remain, with replacement planting undertaken. A proposed development plan is displayed within Figure 3.
HISTORICAL MAPPING	At the time of the earliest available map (1875) the site comprised a part of an undeveloped open plot of land, likely agricultural land/fields. A stream was shown crossing the north-east corner of the site. The site environs generally comprised undeveloped agricultural land/fields. Old Dairy Pond was shown ~160m south of the site. A stream was shown flowing west to east ~ 50m to the north with a south-easterly flowing stream noted ~250m north-east. By the 1912 historical mapping, parts of the stream to the immediate north were no longer shown. Southdown View Road was shown to the immediate west of the site. Greenhouses associated with nurseries were shown 100 - >250m to the north-west of the site. Possible residential properties were shown ~50m to the south. During the 1930, widespread residential development took place >175m south-west of the site as Broadwater was developed. By the 1950s the site was shown as being part of the Homelands Nursery. The Southdowns View Nursery, Hillview Nursery and Park Nurseries were also shown to the immediate north of the site. Throughout the 1960s, residential development in Broadwater to the south-west had expanded to the western side of Southdowns View Road. By the 1970s, the site was no longer part of a nursery and a square shaped structure labelled as Electricity Board Offices was shown close to the centre of the site and the remainder of the site was

open. The nurseries to the immediate north-west had been redeveloped with various light industrial units including a depot, factories, works and a grocery depot. Several circular tanks were shown >100m to the north. Electricity Board Offices were shown to the immediate west of the site. A sheet metal works, ready mix concrete depot and a civil engineering depot were shown to the east. Electricity sub-stations were also shown within a 100m radius of the site.

Since the 1980s and through to the present day numerous works and depots have been constructed >30m to the east and >100m to the south of the site.

The building previously show on-site was demolished sometime between 2021 and the present day.

Historical maps, obtained from GroundSure, can be viewed within Appendix D.

GROUNDSURE DATASHEETS – ENVIRONMENTAL INSIGHT

Datasheets, obtained from GroundSure, can be viewed within Appendix E.

Environmental Insight	
Source	Nearest Distance from Site/ Type
Past Land Use	
Historical industrial land uses	2x on-site and 16 off-site records within a 250m radius: 1x on-site -record of an unspecified depot (1981), 1x on-site record for nurseries (1962 – 1969). 1x off-site record for unspecified commercial/industrial 4m north-east (1981), 6x off-site records for nurseries 15m west (x2); 136m, 169m west; 52m south-west and 144m north-west (1950 – 1969), 1x off-site record for unspecified works 18m east (1981).. 1x off-site record for unspecified depot 47m south-west (1981). 1x off site record for chemical research laboratories 73m north (1969 – 1971). 3x off-site records for unspecified tanks 78m, 139m and 183m north (1981), 1x off-site record for unspecified heap 86m east (1981). 1x off-site record for refuse heap 155m east (1981) 1x off-site record for an unspecified works 221m south (1969 – 1971).
Historical Tank Database	40x off-site records within a 250m radius: 28x records of unspecified tanks 81m, 91m, 104m, 105m, 109m (x2), 138m, 144m, 174m, 179m 180m, 183m, 185m, 202m, 203m, 204m, 220m, 233m and 242m north.; 98m south; 132m, 181m, 185m, 187m and 214m north-west; 165m and 221m north-east (1978 – 1997). 14x off-site record for tanks 130m north-east; 136m, 150m, 157m, 158m, 175m, 185m and 224m north-west; 184m, 201m, 203m, 206m, 211m and 223m north (1968 - 1997).
Historical Energy Features Database	10x off-side records within a 250m radius: 10x off-site records of electricity sub-stations 4m, 52m south-west; 62m, 64m and 148m south-east; 84m east; 143m, 211m and 227m north; south.210m (1968 – 1997).
Historical Garages Database	1x off-site record within a 250m radius. 1x off-site record for a car body repair works 50m north-west (1972).
Waste and Landfill	
Historical landfill (EA/NRW records)	1x off-site record within a 250m radius. 1x off-site record for decoy Farm, Dominion Way, Worthing: waste type – inert, commercial, household (07/09/70 – 31/12/77) 118m south-east.
Waste exemptions	13x off-site records within a 250m radius: 2x off-site records for not on a farm using waste exemption category 57m north (x2); 2x off-site records for Dominion Trade Centre, Unit 7 Dominion Way West for not on a farm treating waste exemption category 61m north-west (x2);

	4x off-site records for Units 3-5, Dominion Way for not on a farm treating waste exemption category 108m east (x5); 1x off-site record for Easting Close, Worthing for a not on a farm treating waste exemption category 153m east; 1x off-site record for Units E-F, Decoy Worthing West for a non-agricultural waste only storing waste exemption category 175m south; 1x off-site record for 162 Dominion Road, Worthing for a not on a farm using waste exemption category 234m south-west; 2x off-site records for Units 1-2 Southdownsview Works, 12 Southdownsview Road, Worthing for a not on a farm storing waste exemption category 244m south;
Current Industrial Land Use	
Recent Industrial Land Uses	1x on-site record and 32x off-site records within a 250m radius. 1x on-site record for an electricity sub-station 1x off-site record for medical equipment supplies and pharmaceuticals 40m south 10x off-site records for electricity sub-stations 60m, 113m south-west; 76m, 138m, 139m, 158m south-east; 91m and 247m east; 109m north-east; 214m south; 1x off-site record for mechanical engineers 86m south-east; 1x off-site record for measurement and inspection equipment 89m east; 1x off-site record for electric motors and generators 90m north-west; 2x off-site records for business parks and industrial estates 93m north-west; and 239m south-east; 1x off-site record for rubber, silicones and plastics 108m east; 1x off-site record for ambulance and medical transportation services 114m south-west; 1x off-site record for food and beverage industry machinery 119m south-east; 1x off-site record for service industry equipment repairs 119m south-east; 1x off-site record for cleaning equipment and supplies 121m south; 1x off-site record for a water pumping station 141m south-east; Ix off-site record for telecommunications features 150m east; 1x off-site record for electrical components 162m south-east; 1x off-site record for electrical equipment repair and servicing 162m south-west; 1x off-site record for construction completion services 173m south; 1x off-site record for cutting, drilling and welding services 176m south; 1x off-site record for precision engineers 180m south-east; 1x off-site record for bearing, gear and drive elements 195m south; 1x off-site record for metal manufacturers, fabricators and stockholders 195m south; 1x off-site record for unspecified works or factories 225m north; 1x off-site record for office and shop equipments 227m north-west;
Licensed pollutant release (Part A(2)/B)	1x off-site record within a 250m radius. 1x off-site record at Arc Southern, Eastings Close, off Dominion Way Worthing for the use of bulk cement - revoked 118m east.
Licensed Discharges to controlled waters	18x off-site records within a 250m radius. 1x off-site record for Plots 1 and 2 Worthing Trading Estate: miscellaneous discharges – surface water; freshwater river 62m south-east; 1x off-site record for Hazelwood Trading Estate: miscellaneous discharges – surface water; freshwater river 73m south-east; 1x off-site record for Site of Park Nursery Southdownsview Road: miscellaneous discharges – surface water; freshwater river 90m north-east; 1x off-site record for Nursing and Hygiene Supplies, Riverside House, Eastings Close: sewage discharges – final treated effluent not water company; freshwater river 103m east; 3x off-site records for Clarendon Road, Worthing: miscellaneous discharges – surface water; freshwater river 138 - 150m north;

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	1x off-site record for Plots 6 Worthing Trading Estate: miscellaneous discharges – surface water; freshwater river 148m east; 2x off-site records for Land East of Ziebart Limited, Dominion Way, Worthing: miscellaneous discharges – surface water; freshwater river 150 – 160m east; 4x off-site records for Plots 6 Worthing Trading Estate: miscellaneous discharges – surface water; freshwater river 154 - 158m east and 166m south-east; 1x off-site record for Ready Mix Concrete Plant, Harrison Road, Worthing: miscellaneous discharges – surface water; freshwater river 174m south-east; 1x off-site record for Computer Site, Southdownview Road, Worthing: miscellaneous discharges – surface water; freshwater river 180m south-east; 2x off-site records for Hazelwood Nursery Site, Dominion Way Worthing: miscellaneous discharges – surface water; Teville Stream 181m east and 195m north-east.
Pollution Incidents (EA/NRW)	3x off-site records within a 250m radius. 1x off-site record 44m north-east 13/11/2002: oils and fuel - diesel, minor to no impact; 1x off-site record 93m north-east 19/03/20003: oils and fuel, minor to no impact; 1x off-site record 99m north-east 31/07/2010: inorganic chemical products – alkalis significant to no impact;
Pollution inventory substances	2x off-site records within a 250m radius. 2x off-site records for Smithkline Beecham Limited 39m north
Pollution inventory waste transfers	1x off-site record within a 250m radius. 1x off-site record for Smithkline Beecham Limited 39m north
Hydrogeology	
Superficial Aquifer	1x on-site and 1x off-site record within a 250m radius 1x on-site record for a Secondary Undifferentiated Aquifer. 1x off-site record for a Secondary A Aquifer 172m south-west.
Bedrock Aquifer	2x on-site records 1x on-site record for a Principal Aquifer. 1x on-site record for a Secondary A Aquifer.
Groundwater Vulnerability	2x on-site records: 1x Secondary superficial aquifer – medium vulnerability, leaching class: intermediate. 1x Principal bedrock aquifer – low vulnerability, leaching class: intermediate.
Groundwater Vulnerability – Soluble Rock Risk	69% of grid square covered by maximum risk Significant soluble rocks are likely to be present. Problems unlikely except with considerable surface or subsurface water flow.
Groundwater Abstractions	2x off-site records within a 250m radius. 1x off-site active records for Northbrook PS Point 2 for potable water supply 242m north-west. 1x off-site historical record for Northbrook PS Point 2 for general use relating to secondary category 242m north-west.
Potable Abstraction	1x off-site record within a 250m radius. 1x off-site active records for Northbrook PS Point 2 for potable water supply 242m north-west.
Source Protection Zones	1x on-site record. 1x on-site record for a Type I inner catchment SPZ
Hydrology	
Water Network (OS MAsterMap)	1x on-site record and 10x off-site records within a 250m radius. 1x on-site record for an inland river not influenced by normal tidal action; 10x off-site records for an inland river not influenced by normal tidal action 75m, 77m north-east; 138m (x2), 138m (x2), 149m (x2) and 153m east; 187m south-east.
Surface Water Features	4x records within a 250m radius.

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	No details given.
WFD Surface Water Body Catchments	1x on-site record: 1x Teville Stream Catchment on-site.
WFD Surface Water Bodies	1x off-site record within a 250m radius: 1x Teville Stream 133m east.
WFD Groundwater Bodies	1 record within a 250m radius: 1x Worthing Chalk on-site.
Agricultural Designations	
Agricultural Land Classification	1x on-site record and 1x off-site record within a 250m radius: 1x Urban on-site, 1x Grade 1 agricultural land 210m north-east.
Habitat Designation	
Priority Habitat Inventory	**1x off-site record within a 250m radius:** **1x deciduous woodland 132m east.**

GROUNDSURE DATASHEETS – GEOLOGICAL INSIGHT

Datasheets, obtained from GroundSure, can be viewed within Appendix E.

Geological Insight	
Source	Nearest Distance from Site/ Type
Artificial and Made Ground (1:10,000 Scale)	1x off-site record within a 250m radius. 1x off-site record for Made Ground (undivided) 158m east.
Superficial Geology (1:10,000 Scale)	1x on-site record and 3x off-site records within a 250m radius: 1x on-site record – Alluvium (silty clay). 1x off-record – Raised Beach Deposits (sand and gravel) 149m west. 2x off-site records – Head (diamicton) 156m west and 177m north-east.
Bedrock Geology (1:10,000 Scale)	2 on-site records: 1x on-site record for Tarrant Chalk Member (chalk), 1x on-site record for Woolwich and Reading Beds Formation (clay).
Superficial Geology and Permeability (1:50,000 scale)	1x off-site record within a 250m radius. 1x off-site record for Made Ground (undivided) 155m east. Flow Type: n/a, Maximum Permeability: n/a, Minimum Permeability: n/a.
Bedrock Geology and Permeability (1:50,000 scale)	1x on-site record and 2x off-site records within a 250m radius: 1x on-site record – Alluvium (clay, silt, sand and peat). Flow Type: intergranular, Maximum Permeability: moderate, Minimum Permeability: very low. 1x off-site record – Head (clay, silt, sand and gravel) 157m west. Flow Type: n/a, Maximum Permeability: n/a, Minimum Permeability: n/a. 1x off-record – Raised Beach Deposits (sand and gravel) 172m south-west. Flow Type: n/a, Maximum Permeability: n/a, Minimum Permeability: n/a.
Boreholes	
BGS recorded boreholes	10x off-site records within a 250m radius: 88m south-east (5.50m depth) 114m south-east (7.10 depth), 116m south-east (9.60 depth); 126m south (8.60 depth); 141m east (15.80 depth); 150m south (8.70 depth); 158m south-east (7.70 depth); 181m south-east (8.60 depth); 187m south (10.50 depth); 239m south-east (10.50 depth);
Natural Hazard Findings	
Shrink-Swell Clay	Low hazard on-site and moderate hazard 7m south-west.
Running Sands	Low hazard on-site.
Compressible Deposits	High hazard on-site.
Collapsible Deposits	Negligible hazard on-site.
Landslides	Very Low hazard on-site.

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Ground Dissolution of Soluble Rocks	Negligible to Very Low hazard on-site.
Mining, Ground Working and Natural Cavities	
Records of Surface Ground Workings	4x off-site records within a 250m radius: 1x off-site record for an unspecified heap 86meast (1981), 2x off-site records for a pond 117m and 164m south (1875 – 1896), 1x off-site record for a refuse heap 155m east (1981).
Records of Non-coal Mining	2x off-site records within a 250m radius: 2x off-site records 157m west and 164m north-east for Chalk. Underground mine workings are uncommon, although the geology is similar to that worked elsewhere. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered.
Radon	
Is the property in a Radon Affected Area as defined by the Health Protection Agency (HPA) and if so what percentage of homes are above the Action Level?	The site is in a Radon Affected Area, as 1 - 3% of properties are above the Action Level.
Is the property in an area where Radon Protection are required for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment?	Basic radon protective measures are necessary.
Estimated Background Soil Chemistry	
Records of BGS estimated background soil chemistry	2x on-site records: Arsenic: 15 - 25mg/kg Bioaccessible Lead 100mg/kg (60mg/kg bioaccessible) Cadmium: 1.8mg/kg Chromium: 60 – 90mg/kg Nickel: 15 – 30mg/kg

ANTICIPATED GEOLOGY

The British Geological Survey (BGS) maps and DEFRA online maps for the area suggest that the site was located on bedrock deposits of the Tarrant Chalk Member. The bedrock deposits are capped by superficial Alluvial deposits. A layer of River Terrace Deposits (RTD) or Head Deposits (HD) will be found underlying the Alluvium, before hitting the chalk.

The geology shown on available BGS Borehole records within a close vicinity to the site are tabulated below.

Summary of Groundwater Encountered in BGS Boreholes			
Borehole Reference and Depth (m bgl)	**Approximate Distance From Site (m)**	**Strata Depth (m bgl)**	**Groundwater Depth (m bgl)**
TQ10 SE73 8.60m bgl	140m south	Topsoil 0.00 – 0.10 Made Ground (fly ash) 0.10 – 0.70/1.30m Peaty gravelly clay Alluvium: 0.70/1.30 – 4.30m Clay with silt/chalk fragments (RTD/HD): 4.30 – 7.60m. Chalk 7.60 – 8.60m	No data.
TQ10 SE72 8.70m bgl	120m south/south-east	Topsoil 0.00 – 0.20 Made Ground (fly ash) 0.10 – 0.90/1.50m Peaty gravelly clay Alluvium: 0.90/1.50 – 4.40m	Unknown

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		Clay with silt/chalk fragments (RTD/HD): 4.40 – 8.20m. Chalk 8.20 – 8.70m	
TQ10 SE71 7.10m bgl	150m south/south-east	Made Ground (fly ash) 0.00 – 0.30m Made Ground 0.30 – 1.00m Peaty gravelly clay Alluvium: 0.70/1.30 – 2.60m Clay with silt/chalk fragments (RTD/HD): 2.60 – 5.90m. Chalk 5.90 – 7.10m	Water strike at 2.4m bgl.
TQ10 SE79 5.50m bgl	90m south-east	Topsoil and Made Ground 0.00 – 0.60 Peaty gravelly clay Alluvium: 0.60 – 4.5m Chalk (yellow putty) 4.50 – 5.50m	Unknown
TQ10 SE80 9.60m bgl	100m south-east	Topsoil and Made Ground 0.00 – 1.30 Peaty gravelly clay Alluvium: 1.30 – 1.7m Clay with silt/chalk fragments (RTD/HD): 1.70 – 5.50m. Chalk: 5.50 – 9.60m	0.60m bgl
TQ10 SE77 15.80m bgl	170m south-east	Topsoil and Made Ground 0.00 – 0.40 Peaty gravelly clay Alluvium: 0.40 – 4.50m Clay with silt/chalk fragments (RTD/HD): 4.50 – 7.00m. Chalk: 7.00 – 15.80m	1.20m bgl
TQ10 SE78 7.70m bgl	190m south-east	Peaty gravelly clay Alluvium: 0.00 – 3.40m Clay with silt/chalk fragments (RTD/Chalk): 3.40 – 4.80m. Chalk (yellow putty) 4.80 – 7.70m	1.20m bgl
TQ10 SE106 7.90m bgl	180m south-east	Topsoil and Made Ground 0.00 – 1.50 Peaty gravelly clay Alluvium: 1.50 – 2.90m Clayey sandy gravel (RTD): 2.90 – 4.10m. Clay with silt/chalk fragments (RTD/Chalk): 4.10 – 7.90m. Chalk: 7.90 – 8.60m	Unknown
TQ10 SE106 7.10m bgl	190m south-east	Made Ground 0.00 – 1.60 Peaty gravelly clay/clayey gravel Alluvium: 1.60 – 6.00m Clay with silt/chalk fragments (RTD/Chalk): 6.00 – 10.30m.	Unknown

		Chalk: 10.30 – 10.50m	
TQ10 SE106 7.90m bgl	180m south-east	Topsoil and Made Ground 0.00 – 1.50 Peaty gravelly clay Alluvium: 1.50 – 2.90m Clayey sandy gravel (RTD): 2.90 – 4.10m. Clay with silt/chalk fragments (RTD/Chalk): 4.10 – 7.90m. Chalk: 7.90 – 8.60m	Unknown

Based on the BGS Geological and Borehole data the ground model for the site is as follows:

Topsoil/Made Ground likely to 1.0 – 1.5m, deeper in localised areas.

Peaty Alluvial Clays to ~3.0m bgl.

Alluvial Gravels with peaty clay/clay horizons: 7 – 8m bgl.

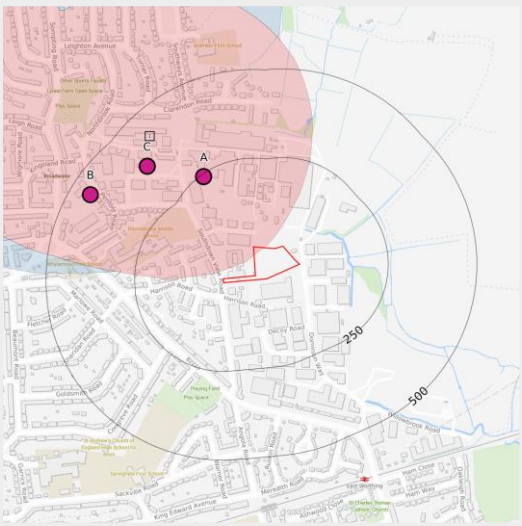
Chalk.

HYDROLOGY AND HYDROGEOLOGY

The superficial Alluvial Deposits underlying the site are a Secondary Undifferentiated Aquifer, with medium vulnerability. The bedrock chalk is a Principal Aquifer, with medium vulnerability. The site has a combined superficial/bedrock classification.

The site is affected by soluble rocks risk.

The majority of the site is not located within a Source Protection Zone. The extreme north-west corner of the site (see below), is located within the Inner Catchment (SPZ1).



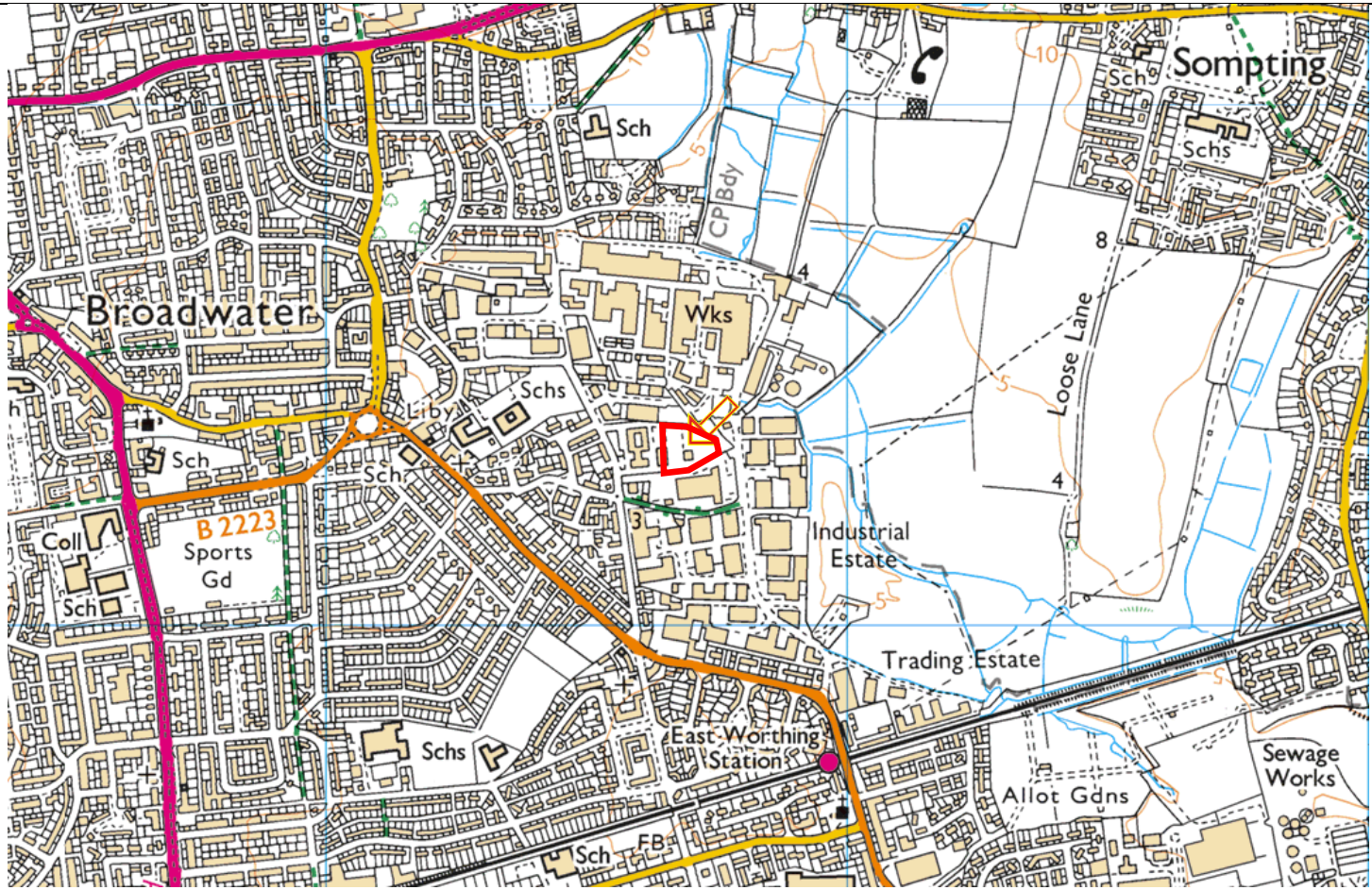
The north-west corner of Unit 1 **may** extend into the SPZ1.

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	The nearest water abstractions to the site are 242m north-west. They are operated by Southern Water and extract direct from groundwater for a potable water supply. Further portable water abstraction are located 377m North-west and 444m west. The site is located within a WFD Groundwater Body associated with the Worthing Chalk. The overall rating (2019) was POOR. The site is located in a nitrate vulnerable zone. No surface water abstractions are noted within a 2000m radius. The Groundsure Datasheets indicate a surface water feature to be located in the north-east corner of the site, associated with the bank, so it is assumed at a higher level than the site. This feature has a buffer zone (3500mm) in accordance with Figure 3 (proposed development plan). The next nearest surface water feature to the site is Willowbrook, ~70 – 80m north-east of the site. It is understood this inland river is not influenced by normal tidal action. The site is not at risk from river and coastal flooding. Flood Zone 2 and 3 are located 30 – 40m north-east. Surface water flooding issues are noted in around the boundary of the site, and onsite in the north-west and south-west, and slightly encroaching in the south-east. Based generally on a 1 in 1000 return period and 0.1 – 0.3m flood depth. The site is located in a high risk area for groundwater flooding. The Hydrology/Hydrogeological Model for the site is as follows: Groundwater is shallow (~1.0 – 1.5m bgl) within a combined Alluvial (Secondary B, Medium Vulnerability) and Chalk (Principal Aquifer, Medium Vulnerability). South-east flowing water courses are noted on the north-east edge of the site and 70 – 80m north-east, but these appear at a slightly higher level. The site is located within 250m of portable abstraction but appears to be on the edge/just beyond, the source protection zones associated with it. The potential influence of the abstractions, in terms of groundwater flow, cannot be dismissed and therefore it is likely that groundwater flows north-west towards the points. The site being within a chalk aquifer means it is vulnerable, however, the risk to the aquifer is reduced given the vast majority of the site is outside the SPZ. Only a very small portion of the north-west corner at worst. The groundwater vulnerability underlying the site is classed a Medium.
CONCLUSIONS	A review of the history of the site has shown that the site remained as open undeveloped farmland until the early 1950s when the site fell within boundaries of the Homelands Nursery and at the same time additional nurseries were located to the north. During this time residential development had taken place to the south-west as Broadwater expanded. By the early 1970s the site was occupied by a structure labelled as Electricity Board Offices close to the centre with the remainder open land. All of the nurseries in the area had been developed with various light industrial units including depots, works and factories of different kinds. Details can be seen in the Groundsure Datasheets and in the summary tables above. There was no change to the site until the demolition of the offices sometime between 2021 and 2024. Elsewhere, expansion of the industrial estate had taken place to the south and east of the site.

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	The maps and the datasheets revealed that an easterly/south-easterly flowing stream was located on and close to the eastern boundary and north-east corner of the site. Based upon a review of available BGS borehole records the site is anticipated to be located on a variable thickness of Made Ground overlying Alluvial soils which in turn will rest upon River Terrace Deposits and/or Head Deposits which in turn rest upon the Tarrant Chalk Member which is anticipated to be encountered at ~7 – 8m bgl. Perched groundwater is expected within the superficial deposits at depths of ~2m bgl with the main Principal Aquifer expected at depth within the Tarrant Chalk Member. Consequently, based upon the desk based review of the history of the site and its environs and the hydrogeological setting of the site it was considered that the risk from the site itself to the underlying aquifers and the stream on the eastern boundary of the site was considered low to medium risk. The surrounding industrial uses since the 1970s were more likely to have or to have had an effect on the groundwater quality of the area. It is considered that CFA piling would be the best and acceptable option for this site and no detailed piling risk assessment is required.

FIGURES **12**
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FIGURES



NOT TO SCALE

Project: Land to rear of Broadwater Apartments, Southdownview Road, Worthing BN14 8NN	**Figure 1**
Client:	**Date:** December 2024
Site Location Plan	**Ref:** GWPR6352

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APPROXIMATE SITE AREA

NOT TO SCALE

Project: Land to rear of Broadwater Apartments, Southdownview Road, Worthing BN14 8NN	**Figure 2**
Client:	**Date:** December 2024
Aerial View of Site	**Ref:** GWPR6352

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APPROXIMATE SITE AREA

NOT TO SCALE

Project: Land to rear of Broadwater Apartments, Southdownview Road, Worthing BN14 8NN	**Figure 3**
Client:	**Date:** December 2024
Proposed Development - Plan View	**Ref:** GWPR6352

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APPENDIX A: Conditions and Limitations

The ground is a product of continuing natural and artificial processes. As a result, the ground will exhibit a variety of characteristics that vary from place to place across a site, and also with time. Whilst a ground investigation will mitigate to a greater or lesser degree against the resulting risk from variation, the risks cannot be eliminated.

The report has been prepared on the basis of information, data and materials which were available at the time of writing. Accordingly any conclusions, opinions or judgements made in the report should not be regarded as definitive or relied upon to the exclusion of other information, opinions and judgements.

The investigation, interpretations, and recommendations given in this report were prepared for the sole benefit of the client in accordance with their brief; as such these do not necessarily address all aspects of ground behaviour at the site. No liability is accepted for any reliance placed on it by others unless specifically agreed in writing.

Any decisions made by you, or by any organisation, agency or person who has read, received or been provided with information contained in the report ("you" or "the Recipient") are decisions of the Recipient and we will not make, or be deemed to make, any decisions on behalf of any Recipient. We will not be liable for the consequences of any such decisions.

Current regulations and good practice were used in the preparation of this report. An appropriately qualified person must review the recommendations given in this report at the time of preparation of the scheme design to ensure that any recommendations given remain valid in light of changes in regulation and practice, or additional information obtained regarding the site.

Any Recipient must take into account any other factors apart from the Report of which they and their experts and advisers are or should be aware. The information, data, conclusions, opinions and judgements set out in the report may relate to certain contexts and may not be suitable in other contexts. It is your responsibility to ensure that you do not use the information we provide in the wrong context.

This report is based on readily available geological records, the recorded physical investigation, the strata observed in the works, together with the results of completed site and laboratory tests. Whilst skill and care has been taken to interpret these conditions likely between or below investigation points, the possibility of other characteristics not revealed cannot be discounted, for which no liability can be accepted. The impact of our assessment on other aspects of the development required evaluation by other involved parties.

The opinions expressed cannot be absolute due to the limitations of time and resources within the context of the agreed brief and the possibility of unrecorded previous in ground activities. The ground conditions have been sampled or monitored in recorded locations and tests for some of the more common chemicals generally expected. Other concentrations of types of chemicals may exist. It was not part of the scope of this report to comment on environment/contaminated land considerations.

The conclusions and recommendations relate to Land to rear of Broadwater Apartments, Southdownview Road, Worthing BN14 8NN.

Trial hole is a generic term used to describe a method of direct investigation. The term trial pit, borehole or window sampler borehole implies the specific technique used to produce a trial hole.

The depth to roots and/or of desiccation may vary from that found during the investigation. The client is responsible for establishing the depth to roots and/or of desiccation on a plot-by-plot basis prior to the construction of foundations. Where trees are mentioned in the text this means existing trees, recently removed

trees (approximately 15 years to full recovery on cohesive soils) and those planned as part of the site landscaping.

Ownership of copyright of all printed material including reports, laboratory test results, trial pit and borehole log sheets, including drillers log sheets, remain with Ground and Water Limited. Licence is for the sole use of the client and may not be assigned, transferred or given to a third party.

Only our client may rely on this report and should this report or any information contained in it be provided to any third party we accept no responsibility to the third party for the contents of this report save to the extent expressly outlined by us in writing in a reliance letter addressed from us to the third party.

Recipients are not permitted to publish this report outside of their organisation without our express written consent.

The aim of the investigation was understood to be to supply the client and their designers with information regarding the ground conditions underlying the site to assist them in preparing an appropriate scheme for development.

APPENDIX B: Technical Glossary

TECHNICAL GLOSSARY

The list of possible definitions within the report may be seen below. Please note that some definitions may not be relevant to this report.

HYDROGEOLOGY:

A **Principal Aquifer** is a layer of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer.

Secondary aquifers include a wide range of drift deposits with an equally wide range of water permeability and storage capacities.

Secondary (A) Aquifers consist of deposits with permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Minor Aquifers.

Secondary (B) Aquifers consist of deposits with predominantly lower permeability layers with may stoke and yield limited amounts of groundwater due to localised features such as fissures, think permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers.

Secondary Aquifers (Undifferentiated) are assigned in cases where it has not been possible to attribute either category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both a minor aquifer and non-aquifer in different locations due to the variable characteristics of the rock type.

Unproductive Strata are rock layers with low permeability that have negligible significance for water supply or river base flow. These were formerly classified as non-aquifers.

FLOOD ZONES:

Environment Agency Flood Zone 2, defined as; land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of sea flooding.

Environment Agency Flood Zone 3 shows the extent of a river flood with a 1 in 100 (1%0 or greater chance of occurring in any year or a sea flood with a 1 in 200 (0.5%) or greater chance of occurring in any year.

Environment Agency Flood Zone 3 area that benefits from flood defences, defined as; land and property in this flood zone would have a high probability of flooding without the local flood defences. These protect the area against a river flood with a 1% chance of happening each year, or a flood from the sea with a 0.5% chance of happening each year.

GROUNDWATER SOURCE PROTECTION ZONES (SPZS):

Inner zone (SPZ1): This zone is 50 day travel time of pollutant to source with a 50 metres default minimum radius.

Outer zone (SPZ2): This zone is 400 day travel time of pollutant to source. This has a 250 or 500 metres minimum radius around the source depending on the amount of water taken.

Total catchment (SPZ3): This is the area around a supply source within which all the groundwater ends up at the abstraction point. This is the point from where the water is taken. This could extend some distance from the source point.

Zone of special interest (SPZ4): This zone is where local conditions require additional protection.

IN-SITU STRENGTH GEOTECHNICAL TESTING:

Windowless Sample and/or Cable Percussion and/or Rotary Boreholes provide samples of the ground for assessment but they do not give any engineering data. The standard penetration test (SPT) is an in-situ dynamic penetration test designed to provide information on the geotechnical engineering properties of soil. The test uses a thick-walled sample tube, with an outside diameter of 50mm and an inside diameter of 35mm, and a length of around 650mm. This is driven into the ground at the bottom of a borehole by blows from a slide hammer with a weight of 63.5kg falling through a distance of 760mm. The sample tube is driven 150mm into the ground and then the number of blows needed for the tube to penetrate each 75mm up to a depth of 450mm is recorded. The sum of the number of blows is termed the "standard penetration resistance" or the "N-value".

Dynamic Probing involves the driving of a metal cone into the ground via a series of steel rods. These rods are driven from the surface by a hammer system that lifts and drops a 63.5kg (SHDP) hammer onto the top of the rods through a set height, thus ensuring a consistent energy input. The number of hammer blows that are required to drive the cone down by each 100mm increment are recorded. These blow counts then provide a comparative assessment from which correlations have been published, based on dynamic energy, which permits engineering parameters to be generated. (The Dynamic Probe 'Super Heavy' (SHDP) Tests were conducted in accordance with BS 1377; 1990; Part 9, Clause 3.2).