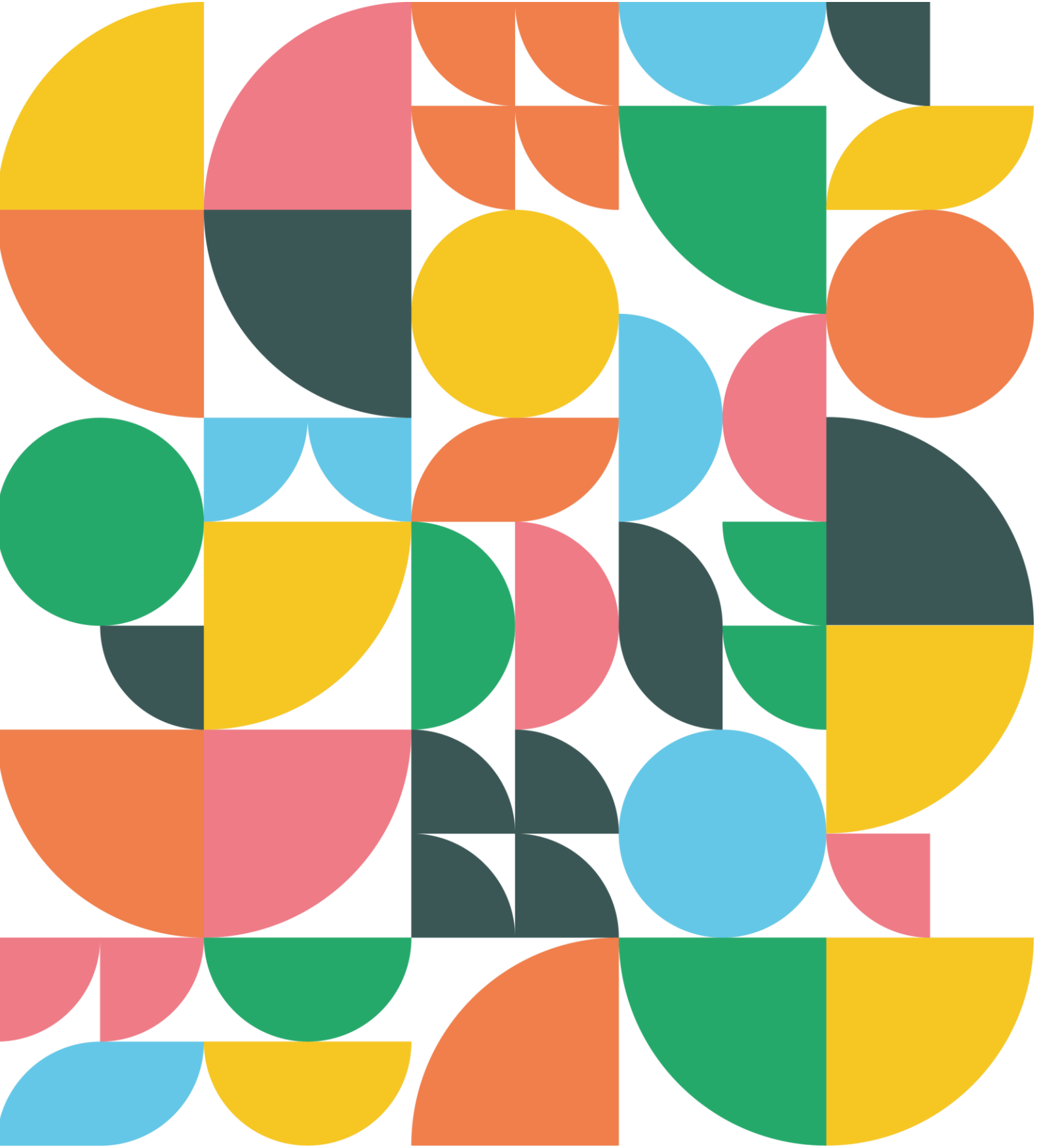


Desktop Study Report

YEX4461- Emerald Quay Club, BN43 5JP

August 22

	Name	Position	Signature	Date
Responsible	Cathleen Cox	Geo-Environmental Engineer	[redacted]	26 August 2022
Reviewed	Kerry Murray	Senior Geo-Environmental Engineer		26 August 2022
Authorised	Matthew Blakey	Managing Director		26 August 2022

Issue	Date	Description	Contributors	Responsible	Authorised
01	26 August 2022	Final Report	CC	KM	MB

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APPENDICES A PROPOSED REDEVELOPMENT PLANS

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APPENDICES C HISTORICAL MAPPING

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Executive Summary

The below table shows a snapshot of the recommendations concerning contamination for the proposed lift development. It is advised that the report is read in its entirety to gain a better understanding of our findings.

	No Investigation	Investigation Required
Soil	✓	
Ground Gas	✓	
Groundwater	✓	

Investigation Not Recommended

A groundworks watching brief and safe working practices should be maintained. For completeness, a enquiry to the CLO regarding the Local Authority records regarding the site, the presence of gas protection measures in the existing property and the status of the off-site land designated under Part 2A.

Investigation of the site may be required for future (if any) redevelopments of the wider site .

Introduction

*Your*Environment was instructed by Orchard Property Management to produce a Phase 1: Desktop Study and Preliminary Risk Assessment Report for Emerald Quay Club, Emerald Quay, Shoreham-by-Sea, West Sussex, BN43 5JP ('the site').

The proposed redevelopment plans are enclosed in Appendix A, and are understood to comprise:

- Construction of two-storey extension of leisure centre on south elevation to provide a disabled access lift. It is noted that the development area comprised a limited proportion of the wider site.

The purpose of this report is to support the discharge of conditions relating to contaminated land from the most recent decision notice associated with the above proposed development, available to view on Adur District Council's planning portal (ref: AWDM/0695/22). Granting of this planning permission was subject to conditions, of which planning conditions 3 and 4 relate to contaminated land. Part of condition 3 requires the submission of a Phase I Desktop Study.

The objectives of this report are to:

- Establish the environmental setting, including sensitivity in relation to human health, surface water, groundwater, and ecological receptors
- Review historical and recent uses to assess the potential for contamination to be present from past and current land-use
- Assess by qualitative means the potential nature and extent of contamination from those uses and the environmental risk and liabilities which may affect the site redevelopment
- Identify the prevalent source-pathway-receptor linkages present on site and the formulation of a Preliminary Conceptual Site Model (PCSM)

During the production of this report the following information sources have been utilised:

- Data obtained from Groundsure
- Historical Ordnance Survey (OS) mapping
- Site walkover
- Zetica bomb risk maps
- Previous reports available on the Adur District Council Planning portal

The full information from these sources can be reviewed within Appendices B & E.

It is noted that the red line boundary for the site (used within the Groundsure Report in Appendix B) encompasses the whole Emerald Quay property, however, the proposed development is only a very limited part of this boundary. This report has been written in context of the proposed development of the lift only, however, the data obtained from Groundsure relates to the whole site, as well as the site walkover completed by YE.

Reference to the development boundary will be made where relevant throughout this report, and can be seen in Appendix A. The PCSM has been completed in respect of the proposed development boundary only (the lift), and consideration should be given during future works if works are completed outside of the proposed development boundary. It is understood that the proposed

development design including foundation requirement for the lift will be dealt with under a separate cover.

The information contained in this report is intended for the use of the named client (or their approved contractors). Should any part of this report be relied on by a third party, that party does so wholly at its own risk and YE disclaims any liability to such parties. Should the purposes for which the report is used, or the proposed use of the site change, this report may no longer be valid and further use of, or reliance upon the report in those circumstances shall be at the client's sole and own risk. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. YE should in all such altered circumstances be commissioned to review and update this report accordingly.

Previous Reports

Upon review of the Adur District Council Planning Portal, there are several previous applications relating to the wider site, dated 1987 and 1989. However, there are no recent or significant previous documents for contaminated land conditions relating to this study site or nearby developments. It is noted that there are four (4no) other planning applications attached to the postcode 'BN43 4JP', however these were not subject to contaminated land conditions, and were for minor property developments such as loft conversions.

Environmental and Geological Setting

Information on the environmental and geological setting of the site is presented in Appendix B.

Site Description

Site size	0.04 hectares (ha)
Grid reference	522242, 104858
Topography	The site is generally flat and level, elevation approximately 225mAOD
Current Land Use	The site is currently operating as a clubhouse/leisure centre for the surrounding residential area.
Proposed Land Use	Construction of two-storey extension of leisure centre on south elevation to provide disabled access lift. Noted that there will be no major changes to the current onsite building.

Site Geology

Site geology has been assessed using information from British Geological Survey (BGS) mapping and is summarised below:

Artificial/Made Ground	There are no records of artificial or Made Ground underlying the site, however there are two (2no) areas of Made Ground recorded within 250m of the site, located 7m and 157m north
Superficial Ground and Drift Deposits	The superficial ground deposits underlying the study site comprise of Storm Beach Deposits (gravel). Tidal River or Creek Deposits (silty clay) are also located 26m north of the site.
Bedrock Geology	Underlying the superficial drift deposits is bedrock comprising the Tarrant Chalk Member (chalk).
Landslips	There are no records within 250m of the site.
Linear Features	There are no records within 250m of the site.

BGS Boreholes	There are four (4no) records within 250m of the site, all located between 90m and 170m west. The records were unable to be viewed at the time of writing.

The following ground stability hazard ratings on site are:

Shrink swell clays	Negligible
Running sands	Moderate
Compressible deposits	Moderate
Collapsible deposits	Very low
Landslides	Very low
Ground dissolution	Very low

Site Hydrogeology and Hydrology

These records are derived from Environment Agency (EA) and BGS data. Details of the source and coverage of specific records are provided in the Appendices.

Principal Aquifer	Layers with high intergranular and/or secondary permeability capable of supporting water supplies at strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as Major Aquifers
Secondary (A) Aquifer	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) Aquifer	Predominantly lower permeability layers which may store/yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water bearing parts of former Non-Aquifers
Secondary Undifferentiated Aquifer	Layers that cannot be attributed to a category A or B rock type. These layers could have previously been described as a minor or a non-aquifer due to their variable characteristics
Unproductive strata	Rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow

Aquifer and geological permeability are summarised below:

Aquifer within Superficial Deposits	As a result of the superficial geology underlying site, the Storm Beach Deposits are designated as a Secondary (A) Aquifer. The superficial deposits to the north of the site (Tidal River or Creek Deposits) are designated as a Secondary Undifferentiated Aquifer.
Permeability of Superficial Deposits	Both the maximum and minimum permeabilities are recorded as being very high. The superficial deposits to the north of the site (Tidal River or Creek Deposits) has a minimum permeability recorded as being very low with the maximum permeability recorded as being high.
Aquifer within Bedrock Geology	As a result of the bedrock underlying the study site, the Tarrant Chalk Member is designated as being a Principal aquifer.
Permeability of Bedrock Deposits	For fracture flow, both the maximum and minimum permeabilities are recorded as being very high.
Groundwater Vulnerability	The groundwater vulnerability in the vicinity of the site is classified as high due to the productive bedrock and superficial aquifers underlying the site, with a high leaching potential from soils.

	Significant soluble rocks are likely to be present. Problems unlikely except with considerable surface or subsurface water flow. 4.0% of the grid square of the site is recorded to be covered by maximum risk.
Water Framework Directive Groundwater Bodies	The site is located within the Worthing Chalk groundwater body. The groundwater body is classified as Poor overall for both chemical and quantitative ratings from the most recent year (2019).
Groundwater Abstraction Licences	There are four (4no) records within 1000m of the site, one of which is active and relates to the transfer between sources identified 156m north of the site dated June 2021. There is one further record 1923m west of the site also active, for dewatering.
Surface Water Abstraction Licences	There are no records within 1000m of the site.
Potable Water Abstraction Licences	There are no potable abstraction licences within 1000m of the site.
Source Protection Zones	There are no records within 250m of the site.
OS Water Network	There is a single record within 250m, located 118m north, which refers to the River Adur (tidal river or stream).
Surface Water Features	A single record was identified within 250m, which refers to the River Adur.
Water Framework Directive (WFD) Surface Water Bodies and Catchments	The site is within the Upper Adur (Adur and Ouse) coastal water body catchment. The River Adur located 118m north of the site is classified as Moderate overall with a Fail chemical rating and Moderate ecological rating from the most recent year (2019).
Flood Risk	The EA identifies the majority of the site as being within a Flood Zone 3 (that is land assessed as having a 1 in 100 or greater from river flooding and 1 in 200 or greater from sea flooding annual probability), with the south of the site being within Flood Zone 2. The EA Risk of Flooding from Rivers and Seas database flood risk rating for the site is low (less than 1 in 100 but greater than or equal to 1 in 1000) chance of flooding in any given year. The surrounding 250m area of the site is also within Flood Zone 2 and 3. There is a negligible risk for surface water flooding to occur at the site, with the highest risk on site identified as 1 in 1000 year chance of flooding, and a moderate risk for groundwater flooding to occur. Further assessment of flood risk is not included within the YE scope of works.

Environmentally Sensitive Areas

These records are derived from EA, Natural England, Historic England, English Heritage, Forestry Commission and UK Government data. Details of the source and coverage of specific records are provided in Appendices.

Environmental and Habitat Designations	The site is within a Site of Special Scientific Interest (SSSI) impact risk zone; however, the proposed development would not require consultation based on the developments listed within the Groundsure Report (Section 10.17). There is one (1no) record of a SSSI within 2000m of the site, located 591m west at Adur Estuary. The site is located within a nitrate vulnerable zone (NVZ) for groundwater (Sussex Chalk) and is also located in a Biosphere Reserve, the Brighton and Lewes Downs. There is one (1no) record of a Local Nature Reserve (LNR) within 250m of the site, located 289m south of the site at Shoreham Beach. In addition, the site is located within a good quality semi-improved grassland Priority Habitat Inventories and a Network Enhancement Zone 2 Habitat Network. There are forty-nine (49no) further records of Priority Habitat Inventories within 250m of the site, the nearest of which refer to further good quality semi-improved grassland areas 9m south. All further records are over 30m from the study site and refer to similar records as well as mudflats. There are also six (6no) further Habitat Networks, the nearest of which refer to associated habitats 77m west and a Network Enhancement Zone 1 84m north. All further records are 140m and over from the study site and refer to similar records as well as restorable habitats.
Visual and Cultural Designations	There are no records within 250m of the site.

Past Land Use and Potential Contaminant Sources

Information on past land use and potential contaminant sources is presented in Appendix B.

Land Use Records

These records are derived from historical mapping and each record corresponds to a particular map revision date. Historical land use records are summarised below:

Land Use	Distance and Direction	Sources Summary
Unspecified works (3)	On site 205m north 214m northwest	Y
Tramway sidings	48m southwest	Y
Unspecified depot (5)	79m and 81m east 169m (2) and 177m north	Y
Timber yard	81m east	Y
Unspecified commercial/industrial	84m east	Y
Hospital	88m southeast	N
Unspecified wharf (4)	118m, 157m and 158m north 139m and 173m northeast	N
Timber pond (3)	148m north 160m and 206m northeast	N
Unspecified Warehouse	169m north	N
Boathouse (2)	217m and 233m west	N

Additional records identified further afield include a further unspecified depots 251m northeast, and 298m east, as well as chemical works 296m, 301m and 302m east, however, these are not considered significant given their age and distance to the site, and redevelopment of the surrounding area.

Current land uses are summarised below:

Land Use	Distance and Direction	Sources Summary
Moorings and unloading facilities (6)	On site 15m and 99m north 96m northwest 218m northeast 228m west	N
Electrical substation (3)	56m southwest 83m east 165m south	N
Electrical equipment repairs and servicing	73m south	N
Published goods	128m southeast	N
Electronic equipment	129m southeast	N
Tank (2)	205m and 212m north	N
Hoppers and silos	225m north	N
Concrete products (2)	225m northeast	N
Musical instrument merchants	234m southeast	N
Vehicle cleaning services	248m north	N
Vehicle repair, testing and servicing	249m north	N

Land Use	Distance and Direction
Historical Tanks	There are fourteen (14no) records within 250m of the site, the nearest of which are 135m and 136m east, and 195m north, dated 1969 to 1994 All further records are over 205m from the study site.
Historical Energy Features	There are eight (8no) records of electrical substations within 250m, the nearest of which are 27m south, 49m southwest and 77m east, dated 1969 to 1994. All further records are over 160m from the study site.
Historical Petrol Stations	There are no records of historical petrol stations within 250m of the site.
Historical Garages	There are three (3no) records of garages within 250m of the site, located 133m south, and 184m and 191m northwest, dated 1950 to 1991. Further afield, there are four (4no) additional records of garages identified between 260m and 277m northwest.
Historical Military Land	There are no records of historical military land within 250m
Current or Recent Petrol Stations	There are no records within 250m of the site. However, further afield, a non-retail branch of Certas Energy was identified 325m northeast, and a record of an obsolete Esso branch was identified 334m northwest.
Electricity Cables	There are no records of high voltage underground electricity cables within 250m
Gas Pipelines	There are no records of high-pressure underground gas pipelines within 250m
Railway Infrastructure	There are three (3no) records of historical tramway sidings within 250m of the site, located 48m, 52m and 55m southwest of the site.

Environmental Permits, Incidents and Registers

These records are derived from local authority, Health and Safety Executive and EA data. Details of the source and coverage of specific records are provided in the Appendices.

These data are summarised below:

Sites Determined as Contaminated Land	There are no records of sites determined as contaminated land under Part 2A of the Environmental Protection Act 1990 within 250m of the site. However, further afield, a former tar distillery 304m east was identified in 2010 as potentially contaminated land, with groundwater issues currently under investigation by the EA. The current status of the investigation is unknown.
Control of Major Accident Hazards (COMAH)	There are no records within 250m of the site. However, further afield, an historical record pertaining to Calor Gas Ltd was identified 254m northeast.
Regulated Explosive Sites	There are no records within 250m of the site. Note that details of some sites may be redacted for security reasons.
Planning Hazardous Substances Consents	There are no records within 250m of the site. However, there are records referring to the storage of liquified petroleum gas identified 425m, 426m, and 474m northeast, dated 1998 and 2001.
Historic IPC Licensed Activities	There are no records within 250m of the site.
Part A (1) Licensed Activities	There are no records within 250m of the site.
Part A (2)/B Licensed Activities and Pollutant Release	A record of other mineral processes was identified 232m north of the site. Additional records include quarry processes and petrol vapour recovery 264m northwest; bulk cement use 284m northeast; and respraying of road vehicles and a waste oil burner 353m northwest.
Radioactive Substance Authorisations	There are no records within 250m of the site.
Licensed Discharges to Controlled Waters	There are seven (7no) records within 250m of the site, the nearest of which refer to miscellaneous discharges (surface water) located 156m, 164m and 166m north. All further records are of a similar nature and are located 170m and over from the site.

Pollutant release to Surface Waters (Red List)	There are no records within 250m of the site.
Pollutant Release to Public Sewer	There are no records within 250m of the site.
List 1 and List 2 Dangerous Substances	There are no records within 250m of the site.
Substantiated Pollution Incidents	There are three (3no) records within 250m of the site, two (2no) of which refer to crude sewage incidents 76m north dated August 2002 which had a minor impact to water. The other refers to a February 2003 incident 106m northwest of the site involving diesel which had minor impacts to water and air.
Pollution Inventory Substances	There are no records within 250m of the site.
Pollution Inventory Waste transfers	There are no records within 250m of the site.
Pollution Inventory Radioactive Waste	There are no records within 250m of the site.

Waste and Landfill

These records are derived from EA, BGS, OS and local authority data. Details of the source and coverage of specific records are provided in the Appendices.

Active or Recent Landfill	There are no records within 500m of the site.
Historic Landfill	There are no records within 500m of the site.
Non-Landfill Waste Records	A single record of historic waste was identified within 250m of the site, which refers to a scrap metal depot 224m north of the site, dated 1968. Additional historical records within 500m include a recycling station 418m northeast and an amenity tip 429m northeast. There are no current or recent licensed waste sites within 250m. However, further afield, there are six (6no) records that refer Shoreham H W R C located 416m northeast of the site for household, commercial and industrial waste transfer stations.

Mining, Ground Workings and Natural Cavities

These records are derived by from BGS, OS, Coal Authority (CA), Peter Brett Associates, Johnson Poole and Bloomer, Cheshire Brine Subsidence Compensation Board, British Gypsum, Mining Searches UK, Kaolin and Ball Clay Association and local authority data. Details of the source and coverage of specific records are provided in the Appendices. The data are summarised below:

Natural Cavities	There are no records within 250m of the site.
Mining Cavities	There are no records within 250m of the site.
BritPits Data (Surface and Underground Mineral Workings)	An active marine sand and gravel wharf was identified 200m northeast of the site. A ceased surface mineral working for clay and shale was also identified 448m northeast of the site.
Historic Mineral Planning Areas	A record of a marine dredged sand and gravel surface mineral working was identified 301m east of the site.
Surface Ground Workings	There are eleven (11no) records within 250m of the site, the nearest of which refer to unspecified wharfs 118m north and 139m northeast (dated 1909 to 1982), and timber ponds 148m north (dated 1896). All further records are over 155m from the study site and refer to similar records.
Underground Workings	There are no records within 250m of the site.
Coal Mining	There are no records held by the CA or by Johnson Poole and Bloomer within 250m.
Non-Coal Mining	Sporadic underground mining of restricted extent for chalk may have occurred 268m north of the study site. Potential for difficult ground conditions are unlikely and localised and are at a level where they need not be considered. There are no records within 250m for brine extraction or gypsum, tin, or clay mining.

Radon and Background Soil Chemistry

These records are derived by from BGS and Public Health England data. Details of the source and coverage of specific records are provided in the Appendices.

Radon

The study site is not located within a Radon Affected Area, as between 1% and 3% of properties are above the Radon Action Level. No radon protective measures are necessary for new properties or extensions to existing ones as described in publication BR211 by the Building Research Establishment.

Background Soil Chemistry (estimated by BGS)

Arsenic	15 mg/kg
Bio-accessible arsenic	No data
Lead	100-200 mg/kg
Bio-accessible lead	60-120 mg/kg
Cadmium	1.8 mg/kg
Chromium	60-90 mg/kg
Nickel	15-30 mg/kg

Unexploded Ordnance (UXO)

The site is in an area considered to be at a low risk from wartime unexploded ordnance, however, UXO finds have been located within 250m of the site. The Zetica bomb risk map is reproduced in Appendix E. The potential for UXO cannot be ruled out and is outside the scope of this report, and further consideration should be sought.

Historic Mapping

The object of this search is to report on the evidence of site history and redevelopment of the site and its environs from available County Series, OS Maps, and aerial photography.

Year	On site	Off site
1873 to 1874	The site is undeveloped and part of a large beach area.	Timber ponds - 250m north River Adur – 110m north
1896 to 1898	No discernible changes.	Boat house - 225m west Chemical works - 300m east Hospital - 150m southeast
1909 to 1912	No discernible changes.	Tramway - 75m southwest
1930 to 1931	Possible quarry in the east of the site.	Possible quarries - 100m and 150m east Residential properties – 150m south Tramway replaced by 'Shingle road'. Hospital no longer present.
1948 to 1954	The site is developed as part of the Ship building yard to the west. Sliding ways towards the east and possible small, detached building in southwest.	Ship building yard – 25m west Boat building yard – 75m west Electrical substation – 50m south Slipway - 60m west Garage - 125m south Quarries no longer present.
1962 to 1966	No discernible changes.	Depot 150m east Several works and depots – 250 north
1968 to 1974	No discernible changes.	Tanks – 135m east Residential properties – 50m south Chemical works 300m east now labelled as Depot. Depot 150m east now labelled as Timber yard.
1978 to 1982	Expansion of ship building yard with an unspecified building onsite.	No relevant changes
1994 to 2001	The Emerald Quay (building) has been constructed as the present day layout.	Pontoons - 25m north Residential properties – 20m east, south, and west. Works and depots 250m north redeveloped.
2003	No discernible changes.	Timber yard 150m east replaced by residential properties.
2009 to 2022	No discernible changes.	Depot 300m east replaced by residential properties.

The Historical OS Maps are available in Appendix C.

Walkover Survey

Date	4th July 2022
Weather	Dry and Sunny
Current Use	The site is currently operating as a clubhouse/leisure centre for the surrounding residential area.
Access	The site is accessible to the north of Emerald Quay.
Topography	The general topography in the area is flat and level.
Structures	The main (and only) building on site is a detached two-storey, brick-built building operating as a clubhouse/leisure centre for the people living in the surrounding houses.
Ground Covering	While the development area only includes the building itself, there is a very small amount of brick flooring that is likely underlain by concrete.
Vegetated Areas	There are no vegetated areas within the study site.
Drainage	No surface drainage covers were identified within the study site.
Services	The site appears to have access to electricity, and likely has access to water.

Direction	**Boundary**
North	No defined boundary (rear of the building)
East	No defined boundary (east of the building)
South	No defined boundary (south of the building)
West	No defined boundary (west of the building)

Direction	**Surrounding Land Use**
North	Residential/River Adur/marina
East	Residential
South	Residential/vehicles facility 125m southeast
West	Residential

Potential on site sources

- None identified.

Potential off-site sources

- Marina / ship building yard (possible hydrocarbons)
- Timber yard, Boat building yard, Chemical works, unspecified depots and works, Tramway sidings and tanks (possible hydrocarbons and other chemicals)
- Vehicle and garage facility (possible hydrocarbons and other chemicals from 'DMC Vehicles Ltd')

Sources, Pathways and Receptors

Potential Sources

Source	Identified by	Location	Description
Made ground associated with Unspecified works on-site and Ship building yard onsite/adjacent	Groundsure report and historical mapping	On site 10m west	Made ground may contain abroad spectrum of contaminants including TPH, PAH asbestos and heavy metals. Made ground may also be a potential source of ground gas generation.
Made ground associated with surrounding former industrial uses including Timber yard, Boat building yard, Chemical works, unspecified depots and works, Tramway sidings and tanks	Groundsure report and historical mapping	150m east 75m west 300m 80m east and 170m north 50-75m southwest 135m east	Due to the industrial nature of the surrounding land use, a wide variety of contaminants are associated such as TPH, BTEX, MTBE, heavy metals, VOCs, SVOCs, PAH, and Asbestos. Chemical works (300m east) has been identified as contaminated land.
Surface ground workings, possible quarries and subsequent infilling	Groundsure report and historical mapping	On site 301m east 100-150m east	Depending on the material used as fill, this material can generate ground gas, and if close enough, with a viable pathway, be a source of contaminants.

The following contaminants are potentially associated with the on-site sources:

- Heavy Metals
- Potential Asbestos Containing Material (PACM's)
- Polycyclic Aromatic Hydrocarbons (PAH)
- Total Petroleum Hydrocarbons (TPH)
- Gas – H (Hydrogen), CH_4 (Methane), CO (Carbon Monoxide), CO_2 (Carbon Dioxide) and H_2S (Hydrogen Sulphide)

The following contaminants are potentially associated with off-site sources:

- Heavy Metals
- Potential Asbestos Containing Material (PACM's)
- Polycyclic Aromatic Hydrocarbons (PAH)
- Total Petroleum Hydrocarbons (TPH)
- Volatile Organic Compounds (VOC)
- Semi Volatile Organic Compounds (sVOC's)
- Benzene, toluene, ethylbenzene, and xylene (BTEX)
- Methyl tert-butyl ether (MTBE)
- Gas – H (Hydrogen), CH_4 (Methane), CO (Carbon Monoxide), CO_2 (Carbon Dioxide) and H_2S (Hydrogen Sulphide)

Pathways

Pathway	Medium	Properties
Direct Contact	Dust, solid and liquid phase	There may be direct contact with potentially impacted soil and Made Ground across the site. There is a possibility of dust fumes being produced during earthworks in the construction phase. Dermal contact and ingestion of potentially contaminated soils during construction or operational phase of the site.
Leaching through Made Ground	Unsaturated flow	Potential for leaching and migration of potential contaminants along preferential flow paths in the ground.
Foundations and Underground Infrastructure and Obstructions	Preferential flow	Contaminants will flow the path of least resistance which can be gaps around foundations, services, and floor construction.
Migration of Ground Gas	Gaseous flow	Infilled land material is likely to be variable in composition. Migration through granular material within superficial deposits is possible.

Receptors

Category	Receptor	Properties
Humans	End users (such as residents and visitors)	Potential contact with contaminated soils in soft landscaping areas, however, it is understood that the majority of the proposed development will be covered in hardstanding. Exposure and potential asphyxiation from ground gas.
	Construction workers	Reworking of contaminant impacted materials in underlying soil during construction works can expose workers to contamination.
Property	Materials and site structures	Foundations and site services may be damaged by potentially aggressive compounds present in soils. It is understood that no water pipes are associated with the lift development,
Controlled Waters	Underlying superficial / bedrock Aquifer and surface water	The site is underlain by a Principal aquifer in the bedrock deposits and a Secondary (A) aquifers in the superficial deposits underlying the site. The River Adur is located 118m north of the site.
Plant (species and uptake)	Various	Attributes will be influenced by factors such as relative quality, scale and rarity.

Preliminary Conceptual Site Model (CSM)

The proposed development of the site is the construction of a limited two-storey extension of leisure centre on south elevation to provide disabled access lift. Therefore, the assessment has been made against a land use of 'commercial'.

Proposed Land use Assessment Criteria

Commercial

Any change in the development proposals for the site involving a change in end use class will result in a requirement for this assessment to be revised.

The assessment has been made in accordance with LCRM (2021).

On Site

Source	*Pathways*	*Receptor*	*Severity*	*Probability*	*Risk*	*Justification*
Made Ground possibly containing metals, TPH and PAH.	Ingestion, dermal contact, inhalation of dusts and vapours	Future end users and site visitors	Medium	Unlikely	Low	As a result of the historic development onsite and in the vicinity, contamination sources maybe present. The current and proposed hardcover at surface, will serve to prevent exposure.
		Construction Workers	Medium	Low likelihood	Moderate to Low	Construction workers may come into direct contact with soils during groundworks, dependent on the foundations for the lift. Safe working practices should be implemented, and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from contact with soils and shallow/perched groundwater (if present).
	Leaching through soils and migration via groundwater or soil pores	Controlled Waters	Medium	Low likelihood	Moderate to Low	The River Adur was identified 118m north, and the coastline is approximately 375m south. An active groundwater abstraction license was identified 156m north for non-potable use and the site is underlain by a Principal Aquifers. However, the hardcover at surface will serve to limit infiltration and mobilisation.
	Permeation of water pipes	Construction materials, future end users and site visitors	Medium	Unlikely	Low	The proposed development is unlikely to require the installation of water supply pipes.

On Site

Source	*Pathways*	*Receptor*	*Severity*	*Probability*	*Risk*	*Justification*
	Uptake	Plant	Mild	Unlikely	Very low	There are no proposed soft landscaping areas within the proposed development area that would be at risk of contaminant uptake.
PACM (Asbestos) at/near ground surface in Made Ground	Inhalation of fibres in airborne dust	Future end users and site visitors	Medium	Low likelihood	Moderate to Low	While no potentially asbestos containing materials were identified onsite during the walkover, YE cannot rule out the presence of potentially asbestos containing fibres within the structures of the existing building. If relevant, an asbestos survey confirming the absence of ACMs relevant to the development area should be sought.
		Construction Workers	Medium	Low likelihood	Moderate to Low	Construction workers may come into direct contact with soils which may contain PACM (if any present), dependent on the groundworks required / foundation requirements for the lift. During future groundworks, safe working practices should be implemented, and appropriate personal protective equipment (PPE) should be used to mitigate any potential risk from residual asbestos in soils.
Ground Gases: From Made Ground: H, CH_4, CO, CO_2 and H_2S	Gas migration and build up within buildings (explosion/ asphyxiation risk)	Future end users and building structures	Medium	Low likelihood	Moderate to Low	A moderate to low risk rating has been assessed as the thickness of Made Ground (if present) is currently unknown. It is possible that there is a history of infilled land below the wider development which presents a potential source of ground gas. However, this was likely infilled over 60 years ago.

On Site						
Source	*Pathways*	*Receptor*	*Severity*	*Probability*	*Risk*	*Justification*
						The presence of gas protection measures within the current property is not confirmed.

Off Site						
Source	*Pathways*	*Receptor*	*Severity*	*Probability*	*Risk*	*Justification*
Land uses in the vicinity possibly containing metals, TPH, PAH, VOC's and sVOC's	Leaching through soils and migration via groundwater or soil pore moisture	Future end users and site visitors	Medium	Unlikely	Low	There is potential for off-site sources to result in a degree of contamination. The permeability of the underlying could facilitate the migration of contamination in groundwater (if present) onsite. The surrounding areas have been redeveloped into residential properties.
	Ingestion, dermal contact, inhalation of dusts/vapours	Future end users and site visitors	Medium	Unlikely	Low	A low risk has been assessed due to the absence of potential sources in the vicinity of the site. The surrounding areas have been redeveloped into residential properties.
Ground Gases: From Made Ground: H, CH_4, CO, CO_2 and H_2S	Gas migration and build up within buildings (explosion/ asphyxiation risk)	Future end users and building structures	Medium	Low likelihood	Moderate to Low	The historical quarrying and infilling activities within vicinity of the site presents a source of ground gas, with the potential for ground gas migration onsite. However, these were likely infilled over 60 years ago.

Recommendations

The potential contaminant linkages as outlined with the Preliminary Conceptual Site Model in line with LCRM 2021 have been identified at moderate to low as the highest risk with respect to human health and controlled waters, based on the proposed development. Based on the information obtained in this report and the proposed development limited to the construction of a lift as part of small portion of the wider site, no further specific Site Investigation (SI) is required for the assessment of contaminated land.

During the ground works, a watching brief should be adopted in line with the strategy below alongside good environmental management practices / safe work protocols to protect construction workers during the construction of the lift.

Any ground works may reveal on-site sources of contamination that were not established in this report. Therefore, the CSM will be updated with contamination data obtained from future ground works.

In the event of future redevelopment works across the wider Emerald Quay property, an SI is recommended and the PCSM would require an updated for the wider property.

Flood and asbestos related risks are understood to be managed under separate cover.

As the location of the site investigation has been identified with a low risk of encountering wartime unexploded ordnance, but UXO finds have been recorded within close proximity to the site, it is recommended advice is sought from an UXO specialist.

Groundworks Watching Brief Strategy

If during construction works any material is noted to show visual and/or olfactory signs of contamination, *Your*Environment must be contacted for advice.

A watching brief should be maintained by the client (or appointed responsible person) at all times during the any groundworks stage. Should any unforeseen contamination, such as oils, ashes, fibrous material or soils/groundwater with an unusual colour or odour, be encountered during groundworks then the following procedure should be implemented:

- Work to cease in that area to prevent exposure to ground workers and potential contaminants being spread around and a photograph taken as evidence of suspected contamination encountered. The Local Authority Environmental Health Department/Contaminated Land Officer (CLO) should be notified that works have ceased and further suspected contamination was identified during the works. In this event, an appropriately qualified geo-environmental consultant shall be appointed by the client to over-see works and implement the actions of the discovery strategy.
- Where relevant, an environmental consultant should be approached to undertake the following:
    - Attending the site to note visual/olfactory signs of contamination;
    - Take further photographs of the identified suspected contamination;
    - Where relevant, collection of soil samples and discussion with the CLO.

- Chemical testing completion to inform a environmental risk assessment and update to the CSM as needed.
- A report outlining the findings should be compiled and issued to the client to present to the CLO.

If the nature and extent of the contamination is unmanageable under the procedure set out above, then a suitable management, mitigation or remediation procedure will be agreed with the CLO. However, this is considered unlikely given the proposed development.

Should no contamination be encountered, a letter will be provided by the client or appointed person to YE stating this, which will be submitted to the CLO.

Consultees

For completeness, it is recommended a Contaminated Land Enquiry to the CLO is completed for the site which includes query on the presence of gas protection measures in the existing property and confirmation of the current status of the Part 2A contaminated land 300m east of the site.

This report should be sent to the relevant Local Authority (LA) to seek their comments and subsequent approval. Works may be delayed, should the LA not be able to provide comment, or the works are commenced prior to obtaining comment.

Notes and Limitations

The following table details the applicable distances relevant to sections to focus on the information directly relevant to the site. Information from outside these radii will be referenced when relevant.

Section	*Reference Distance*
Geology	50m (underlying geology) or 250m (structural features, borehole records)
Hydrogeology	250m (aquifers, surface water) or 1,000m (abstractions)
Environmentally Sensitive Areas	500m (environmental designations) or 250m (habitat, visual and cultural designations)
Land Use Records	250m. Several records may refer to the same feature where it is present over time. Differences in distances quoted from the study site may be due to geolocation errors
Environmental Permits, Incidents and Registers	250m
Waste and Landfill	500m (landfills) or 250m (non-landfill waste operations)
Mining, Ground Working and Natural Cavities	250m
Radon and Background Soil Chemistry	50m
Historic Mapping	100m. Each map represents a snapshot of the site and its environs at the date of the survey. Changes that had occurred at other times may not have been recorded on the maps and could represent an unidentified hazard to the site. The information reported might not represent all pertinent information that could be obtained. The interpretation of the maps and other data commented on in this report is subjective

Framework for Assessment

Risks are assessed within the risk management framework established in Part IIA of the Environmental Protection Act (EPA) 1990 introduced by Section 57 of the Environment Act 1995 which provides a statutory definition of contaminated land. To fall within this definition it is necessary that, as a result of the condition of the land, substances may be present on or under the land such that:

"Significant harm is being caused or there is a significant possibility of such harm being caused; or Pollution of controlled water is being or is likely to be caused."

Risk from contamination is assessed in accordance with the Land Contamination Risk Management Framework (LCRM) prepared by the EA and updated in 2021. This considers possible linkages between contaminant sources and potential receptors which could be harmed or polluted.

The key aspect of the framework is the development of a Conceptual Site Model (CSM) which considers the potential contaminant linkages between potential contaminant sources, the receptors, and the pathways by which the receptors could be exposed to the contaminants.

For a risk of environmental harm to occur due to of ground contamination, ***all*** the following elements must be present:

Source	A substance that can cause pollution or harm
Pathway	A route by which the contaminant can reach the receptor
Receptor	Something which could be adversely affected by the contaminant

If all are present then the risk is a function of the magnitude and mobility of the source, the sensitivity of the receptor and the nature of the migration pathway.

The qualitative risk assessment (QRA) and conceptual site model (CSM) has been undertaken in accordance with Annex 4 of the R&D publication 66, Guidance for the Safe Development of Housing on Land Affected by Contamination (NHBC/EA/CIEH, 2008) which updates and supersedes CIRIA C552: Contaminated Land Risk Assessment, A Guide to Good Practice (Rudland et al., 2001). In addition, risk has been assessed in accordance with LCRM (2021) which supersedes CLR 11 (Environment Agency, 2004).

Where it is considered that there is no credible linkage, this is indicated in the table. In accordance with the R&D66 guidance, if there is no pollution linkage then there is no requirement to apply tests for probability and consequence.

Flood Risk

This report does not replace a hydrogeological survey or Flood Risk Assessment and specialist studies may need to be undertaken to ascertain the risks posed from flooding.

Limitations and Uncertainties

This report has been prepared by Your Environment with all reasonable skill, care and diligence. The work undertaken to provide the basis of this report comprised a study of available documented information from a variety of sources, together with a site walkover of the site.

The opinions given in this report have been dictated by the finite data on which are they based and are relevant only to the purpose for which the report was commissioned.

Information reviewed should not be considered exhaustive and should be accepted in good faith as providing true and representative data with respect to site conditions. Should additional information become available which may influence the opinion expressed in this report, Your Environment reserves the right to review such information and, if warranted, to alter the opinions accordingly.

It should be noted that any risks identified in this report are perceived risks based on the information reviewed; actual risks can only be assessed following a physical investigation of the site. This report is an environmental phase 1 report and does not consider the geotechnical implications.