MASON EVANS
Geo-Environmental Consultants

ROTTERDAM WHARF, PORT DUNDAS, GLASGOW

PHASE I

GEO-ENVIRONMENTAL DESK STUDY REPORT

DATE

September 2023

CLIENT

Scottish Opera

APPROVED BY

Andrew McGuire
Associate

www.masonevans.co.uk

Scottish Opera

Rotterdam Wharf,
Port Dundas,
Glasgow

Phase 1 – Geo-Environmental Desk Study Report

Date of Issue:	September 2023
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Project Reference:	P22/271
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APPENDICES

1.0 INTRODUCTION

1.1 Brief

1.1.1 Mason Evans Partnership were commissioned by Struer Consulting Ltd (the Engineer) on behalf of Scottish Opera (the Client) to undertake a Phase 1 Geo-Environmental Desk Study for a site (1.72 Ha) titled 'Rotterdam Wharf, Scottish Opera Glasgow' (refer to Drawing Nos. P22/271/DS/R/F/01 and 02).

1.1.2 It is understood that the development proposal is to consist of a five-storey extension to the existing Scottish Opera building, plus the development of two multi-storey (one 15 and another 18 storeys) residential flatted developments within the northern and southern site areas. In addition, two bridges are being proposed to connect the newly extended Scottish Opera building to the existing canal footpath to the east.

1.1.3 A copy of the proposed development layout is shown in Drawing Nos. P22/271/DS/R/F/03 and 04.

1.1.4 The objectives of the study were:

a) To clarify the historical background of the site with particular regard to any former contaminative usages or development.
b) To provide information on nearby groundwater and surface water courses surrounding the site.
c) To provide an indication of the geological conditions beneath the site and its environs.
d) To recognise any nearby historical pollution incidents which may have resulted in contamination issued to the soils or water environment on site.
e) To identify the possible presence and assess potential risks associated with chemical and gas contamination.
f) To identify the possible presence and assess potential risks associated with historical underground mine workings and quarrying activities.

1.1.5 This report details the findings of our geo-environmental desk study researches.

1.2 Information Sources

1.2.1 The following sources of information have been utilised in the compilation of this report:

- Site Walkover Survey (September 2023) (Appendix A)
- Review of Publicly Available Information (Appendix B)
- Envirocheck Report (with Historical OS Maps) (Appendix C)
- Mining Information (Appendix D)
- Service Plans (Appendix E)
- Historic Borehole Records (Appendix F)

Licence/Customer Account Number (100012695)

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client details:
SCOTTISH OPERA
39 ELMBANK STREET
GLASGOW, G2 4PT

project title:	drawing title:
ROTTERDAM WHARF	SITE LOCATION PLAN

project no:	drawing no:	revision:	date:	drawn by:	approved by:	scale:
P22/271	P22/271/DS/R/F/01		14.09.23	TR	AMcG	Not to Scale

A4 border: 277 x 190

NOTES

Approximate site boundary

REV	DATE	DETAILS

SCOTTISH OPERA
39 ELMBANK STREET
GLASGOW
G2 4PT

PROJECT TITLE

ROTTERDAM WHARF

DRAWING TITLE

EXISTING SITE LAYOUT

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TR	JW	AMcG	14.09.23	1:1000 @ A3

PROJECT No.	DRAWING No.	REVISION
P22/271	P22/271/DS/R/F/02	

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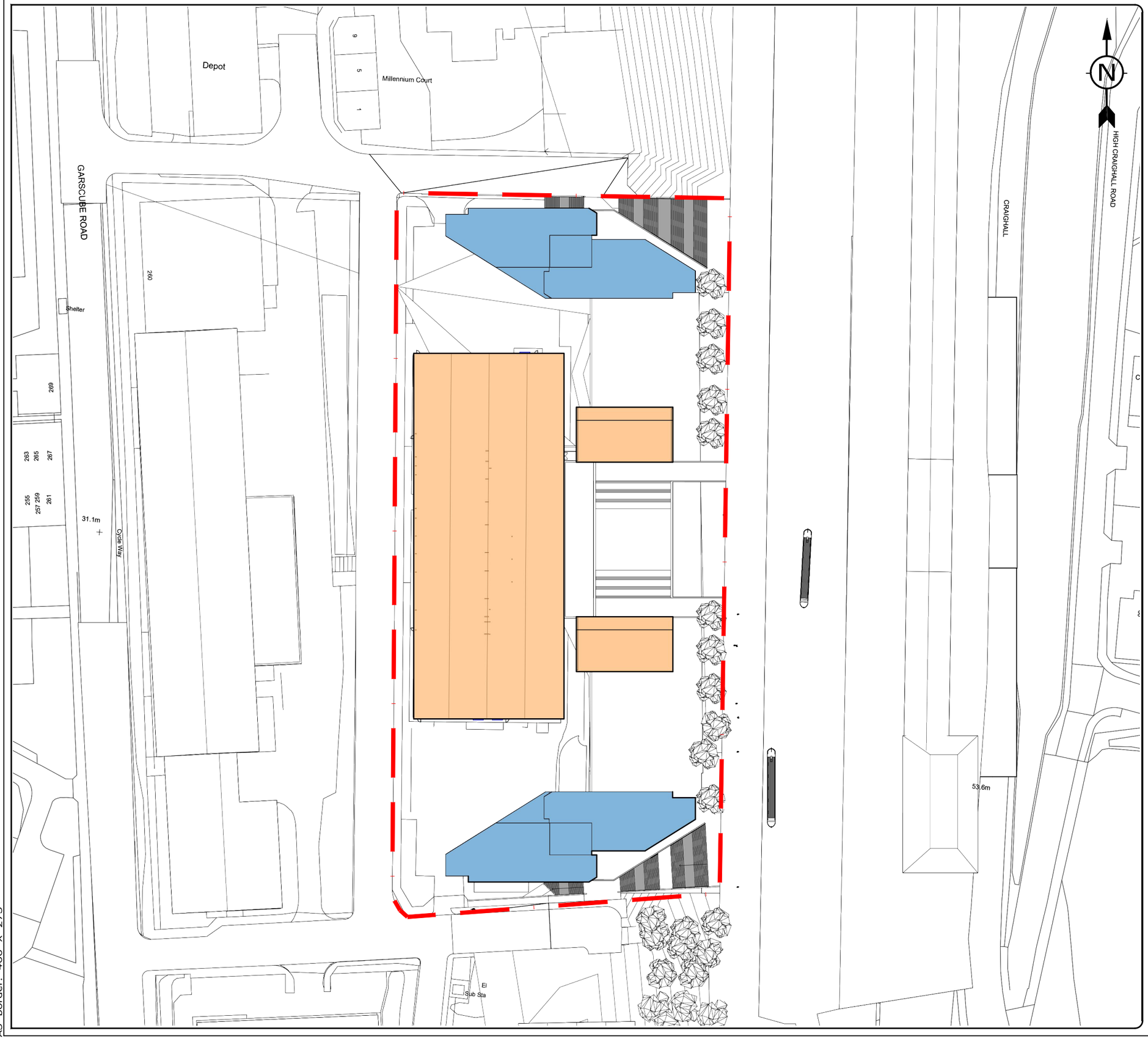

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SCOTTISH OPERA
39 ELMBANK STREET
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G2 4PT

PROJECT TITLE

ROTTERDAM
WHARF

DRAWING TITLE

PROPOSED DEVELOPMENT
LAYOUT PLAN

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PROJECT No.	DRAWING No.	REVISION
P22/271	P22/271/DS/R/F/03	

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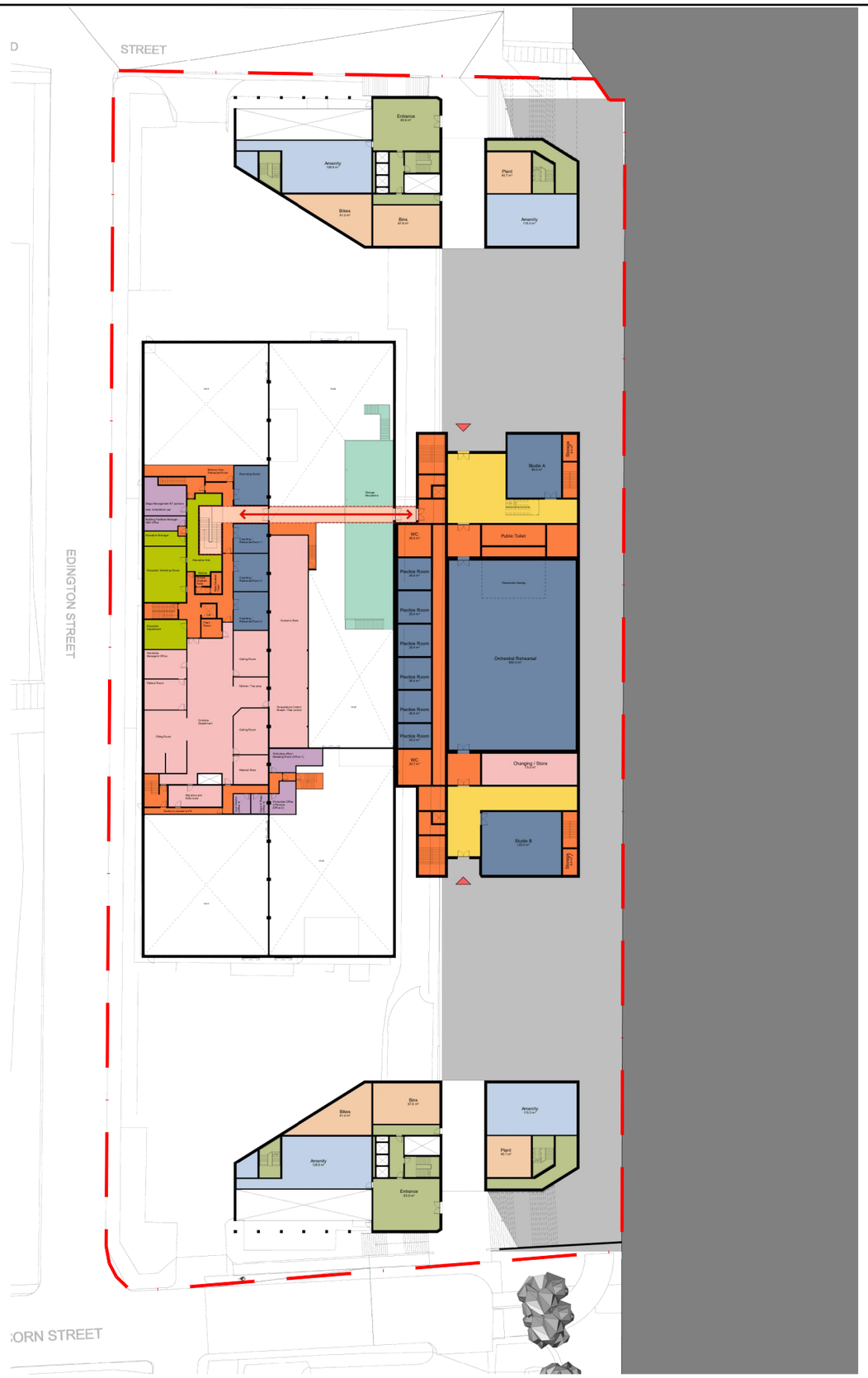
Scottish Opera

- Office Space
- Education
- Practice/Rehearsal Room
- Cafe / Entrance (Public - Semi-public)
- Technical Areas / Workshops
- Wardrobe / Wig Department
- Circulation / Support

PBSA Residential

- Circulation / Entrance
- Support / Office
- Internal Amenity
- External Amenity
- Accommodation Room



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NOTES

Approximate site boundary

REV	DATE	DETAILS

SCOTTISH OPERA
39 ELMBANK STREET
GLASGOW
G2 4PT

PROJECT TITLE

ROTTERDAM
WHARF

DRAWING TITLE

PROPOSED
SITE PLAN

DRAWN BY	CHK'D BY	APP'D BY	DATE	SCALES
TR	JW	AMcG	14.09.23	Not to Scale

PROJECT No.	DRAWING No.	REVISION
P22/271	P22/271/DS/R/F/04	

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1.3 General Methodology

1.3.1 The studies involved documentary researches of available information on the historical background and the geological conditions at the site. This included examination of past and present Ordnance Survey maps, British Geological Survey records and other available information.

1.3.2 These researches have provided a valuable insight into the historical site development and in the surrounding area. Consequently, an indication of potential constraints related to processes associated with its previous land use or the geological conditions has been attained.

2.0 SITE LOCATION AND DESCRIPTION

2.1 Site Details

2.1.1 The summary details of the site as understood from supplied information were as follows:

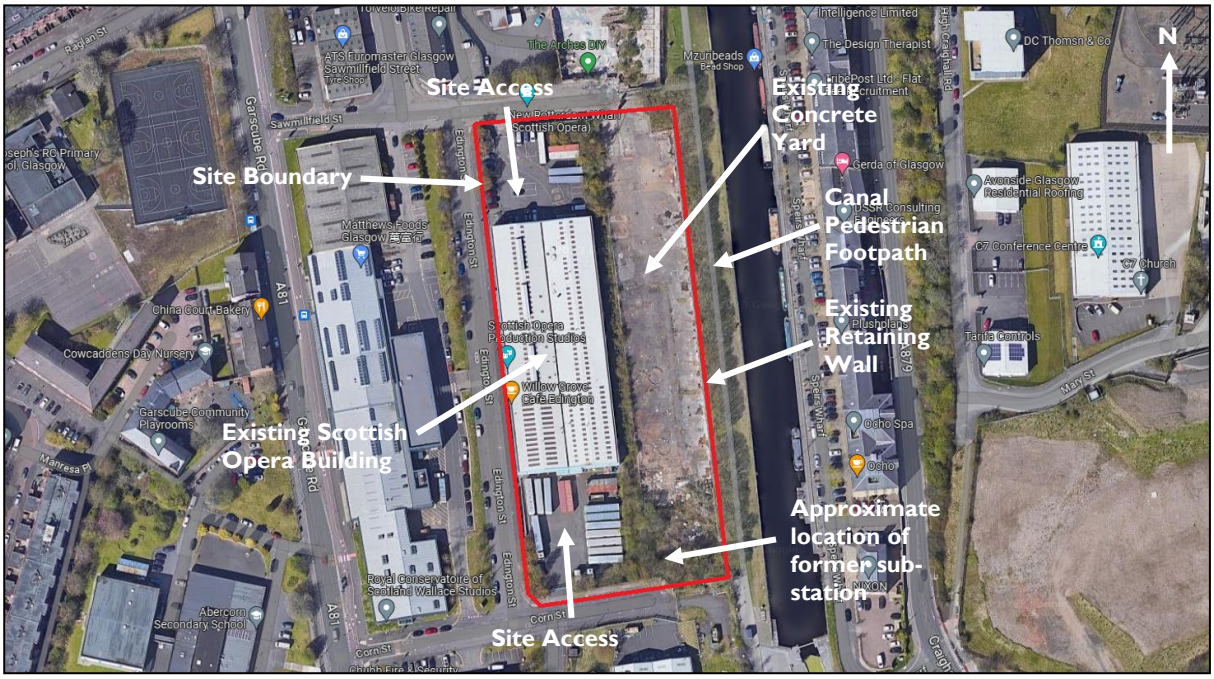
Site Name:	-	Rotterdam Wharf, Port Dundas, Glasgow.
National Grid Reference	-	258750, 666680.
Total Site Area:	-	1.72 Ha (approximately).
Local Authority	-	Glasgow City Council.
Current Usage	-	The site is currently occupied by the Scottish Opera production studio building (central and western site areas), with associated car parking areas within the northern and southern areas, plus a concrete yard in the eastern area.
Access	-	The site is accessible via Sawmillfield Street to the north and Corn Street to the south.
Topography	-	The site topography was noted to be relatively flat across the site. Note that a significant retaining wall exists along the eastern site boundary acting as a boundary between the site and the topographically higher canal pedestrian walkway. Note that a topographic survey was not available at the time of writing.
Surface Conditions	-	The site was predominantly surfaced in hardstanding (tarmac or concrete) with occasional landscaped areas, particularly within the southern area.

2.1.2 For further information on the site details (including photographs) please refer to our site walkover survey included in Appendix A.

2.2 Neighbouring Land Uses (within the immediate surrounding area)

North	-	Sawmillfield Street, with commercial units beyond including a tyre shop, a massage studio, a supermarket, a building materials supply store and a glue factory.
South	-	Corn Street. Chubb Fire & Security business, Civic House with the M8 motorway further beyond.
East	-	Large retaining wall with the Forth and Clyde Canal beyond, followed by residential properties.
West	-	Edington Street followed by commercial units including Matthews Foods supermarket and the Royal Conservatoire Studio with Garscube Road beyond.

Plate 01 - Aerial view of the site (Courtesy of Google Maps, approximately dated 2023)



2.3 **Watercourses**

2.3.1 The nearest SEPA defined surface water body to the site was the Forth and Clyde Canal (ID: 10714), located approximately 15 m to the east, which received an overall water quality score of 'Good' in 2020. It is important to highlight that the canal is topographically higher than the site and is separated by a significant retaining wall. Furthermore, this canal is a man-made contained body of water which will be lined, and therefore there would be no risk of contaminants from the site entering into this surface water feature.

2.3.2 SEPA indicated the groundwater beneath the site to be associated with the 'Glasgow and Motherwell' bedrock aquifer, which was indicated to have an overall status of 'Poor' based on the water quality (Appendix B). SEPA did not indicate a shallow groundwater body to exist in the superficial deposits below the site.

2.4 **Flooding**

2.4.1 The SEPA Flood Map (Appendix B) did not indicate any risk from river or coastal flooding on the site. However, localised areas of the site in the north were noted to be at a low to medium risk of surface water flooding. In addition, the Forth and Clyde Canal to the immediate east was also noted to be at potential low to medium risk of surface water flooding. If further information is required, we would recommend a detailed flood risk assessment be undertaken.

2.5 Public Register Information

2.5.1 Our desk study researches involved data acquisition and the examination of various documents on the geological and historical background of the site. The general findings were as follows: -

- *Waste Disposal Sites* - No recorded landfill sites within 300 m of the site.
- *Contemporary Trade Entries* - No contemporary trade entries were noted on site. However, multiple trade entries were noted within the surrounding 250 m area, most notably including Optura Glazing (optical goods) 90 m to the north-east and a Glue Factory located 80 m to the north of the site (Appendix C).
- *Flooding* - The SEPA Flood Map indicated that localised areas in the north could be susceptible for low to medium risk of surface water flooding (Appendix B).
- *Water Environment* - There were no historical abstraction wells recorded within 250 m of the site.
- *Pollution* - No discharge consents were recorded within 250 m of the site.
- *Mining* - The site is located within a Coal Authority defined 'Development High Risk Area'. (Appendix D). Refer to section 4.4 for further detail on mining.
- *Radon Potential* - Radon gas protection measures are not considered to be applicable for the site and surrounding area as less than 1% of homes are considered to be above the action level.
- *Unexploded Ordnance Risk* - The Zetica UXO risk map (refer to Appendix B) indicated that the site is located within a low-risk area. However, the report did show that there was a previous WWII bomb target in immediate proximity to the site. As such, we would recommend that prior to any future site investigation works that a detailed UXO report be retrieved to provide further information.

2.5.2 As described, the research included consultations with public bodies and regulators, supplemented with research of various documents and related website sources on the geological and environmental context of the site. Much of the information was summarised in the Landmark Envirocheck Report, which is included in Appendix C, with the findings outlined in Table 01 overleaf.

2.5.3 In the compilation of the table, we have listed the key geo-environmental impact sources identified within the Envirocheck report. In each of these cases, we have assigned a notional risk level based on a qualitative assessment of the potential for a defined hazard to impact on the site and its users. Where the risk is estimated to be 'low', we consider that there is sufficient information available to suggest that the indicated source is unlikely to have any material effect on the site and its intended usage. Where a 'moderate' risk is shown, we consider that circumstances could reasonably arise where the site and its users could be impacted by the identified source. In the case of an assigned 'high' risk, we consider that there is sufficient information to indicate that the site will be impacted by the defined source.

Table 01 – Summary of Envirocheck Records of Potential Impact Sources within 250 m of the Site*

Potential Impact Source	Distance (m)	Details	Impact Risk
Mineral Sites	205	An open cast mineral site was recorded 205 m from site targeting sandstone of the Limestone Coal Formation.	Low
Discharge Consents	-	None noted within 250 m.	Low
Radon	-	No radon protective measures are required as the site lies within a lower probability area where less than 1% of homes are above the action level.	Low
Flooding (SEPA Flood Map)	-	The SEPA Flood Map indicated that localised areas of the site are at medium risk of surface water flooding.	Low to Moderate
Current Off-site Contamination Sources (Active Trade Entries)	90 112 115 154 170 203 208 212	Optura Glazing (optical goods manufacturers). L S K Supplies (builders merchants). Novotek (automation systems and equipment). Gaia-Wind (turbine manufacturers). Breedon (Glasgow) Concrete Plant (sand, gravel and other aggregates). Sameday Tyres (tyre dealers). Hope Construction Materials (sand, gravel and other aggregates). Mcqueen Dairies Ltd (dairies).	Low
Registered Radioactive Substances	50	Chubb Alarms Ltd is located 50 m to the south-west which was recorded to have registered radioactive substances in use as one or more closed source(s). Given that any radioactive materials are registered and are contained within this facility, we do not consider that these radioactive materials will have any impact on the site.	Low
Fuel Station Entry	-	None noted within 250 m.	Low
Unexploded Ordnance	-	The site is noted to be within a low risk zone for unexploded ordinance. However, the report did show that there was a previous WWII bomb target in immediate proximity to the site. As such, we would recommend that prior to any future site investigation works that a detailed UXO report be retrieved to provide further information.	Low

* Refer to site sensitivity datasheets and historical maps included in Appendix C.

2.6 Service Information

2.6.1 Buried BT cables were noted to underlie the western site boundary running north to south feeding the current Scottish Opera Building. In the south buried BT cables were recorded to run east to west along the site boundary connecting to the southern end of the Scottish Opera building.

2.6.2 In addition, high voltage buried Scottish Power cables were recorded below southern boundary running west to east. There were also high voltage cables running north to south along the western site boundary.

2.6.3 An A1 low pressure Scottish gas main was recorded on site running from Corn Street in the south of the site to the south of the existing Scottish Opera building. SGN service plans note a sub station to exist within the south-eastern site area, with Scottish Power cables in the southern site boundary also recorded to connect to this station on site.

2.6.4 No services operated by Scottish Water were recorded within the site. Though, fresh and wastewater pipes were indicated in the immediate surrounding area.

2.6.5 Additionally, a street lighting column noted to run adjacent to Edington Road at the site boundary.

2.6.6 A copy of the service plans (dated September 2023) are included in Appendix E.

3.0 HISTORICAL BACKGROUND

3.1 General

3.1.1 An examination of the history of a site can often provide valuable information relating to potential constraints to its development. To facilitate these investigations, copies of historical Ordnance Survey maps contained within the Envirocheck report (Appendix C) and other historical data were examined, with particular attention being focused on former site uses and the presence of any industrial processes in the vicinity of the study area. It should be noted that considerable periods of time have elapsed between successive Ordnance Survey map editions and the possibility that further land uses occurred in the intervening years, which were not recorded on the maps, cannot be discounted.

3.2 Historical Background

Table 02 – Summary of History (Ordnance Survey Map Records)

Ordnance Survey Map Edition (Scale)	The Site	The Surrounding Area
1860 - 1861 (1:500 scale) 1865 (1:10,560 scale)	• **The site was recorded to be occupied by multiple buildings across the site, used as a Timber Yard.**	• The Milton Foundry was recorded immediately west of the site. The Forth and Clyde Canal was recorded immediately east. The Sawmill Field Cotton Mill was located to the north of the site approximately 120 m away. Phoenix Foundry was also noted around 250 m south of the site boundary.
1895 - 1896 (1: 2,500 scale) 1896 - 1897 (1:10,560 scale)	• **The Timber Yard buildings were demolished and new buildings were developed, with the site now being occupied by the Phoenix Iron Works, though was noted to be disused.**	• Iron foundry located around 150 m north-east. • Forth and Clyde Canal located around 15 m to the east. • Residential flats located to the north, west and south of the site. • Sugar refinery located around 80 m north-east. • Sawmill located around 120 m to the north. • To the south and west the site was predominantly occupied by residential flats with roads amongst other unspecified buildings. • Dundas Distillery and grain mills located approximately 100 m to the east. • A disused sugar refinery located around 80 m north-east. • Iron foundry located around 150 m north-east. • Multiple works and industries located in surrounding 500m area. • Forth and Clyde Canal remains around 15 m to the east.
1913 (1:2,500 scale) 1914 (1:10,560 scale)	• **The Iron Works buildings were demolished and replaced with large building labelled as an Electric Generating Station.**	• Chemical works marked around 200m to the west. • Expansion of the city to the north of the site including hospital, schools, and industries. • Immediate 100 m surrounding area remains largely the same as previous.
1932 - 1933 (1:2,500 scale) 1933 (1:10,560 scale)	• No significant changes were recorded.	• Bounded warehouse marked around 100 m east. • Picture theatre immediately east 20 m from site. • Surrounding area remains heavily developed with mix of residential and industrial buildings.
1950 - 1951 (1: 2,500) 1956 - 1957 (1:10,560 scale)	• No changes were recorded.	• Star architectural iron works indicated around 40 m north of the site. • Port Dundas sub station located around 100 m west. • Immediate surrounding area remains same as previous.
1970 - 1987 (1:2,500 scale) 1975 (1:10,560 scale)	• **The building was now indicated to be used as a Maintenance Depot, instead of an Electric Generating Station.**	• No major changes to immediate surrounding area of note.

1991 - 1994 (1:10:560 scale)	• **The maintenance depot building was demolished.**	• No major changes to immediate surrounding area of note.
1999 (1:10,560 scale)	• **Development of the Scottish Opera building on site.**	• No major changes to immediate surrounding area of note. • Surrounding area predominantly residential to the west and south. Forth and Clyde Canal remains to the east.
2006 (1:10000 scale)	• No significant changes.	• No significant changes.
2023 (1:10000 scale)	• No significant changes.	• No significant changes.

3.2.1 Based on a review of information obtained from historical ordnance survey maps, it is indicated that the site has been developed since earliest maps available from 1860. Since that time the site has been used for several developments including a timber yard until approximately 1870, an iron works until approximately 1895, an electricity generating station until approximately 1970, a maintenance depot until approximately 1990 and a Scottish Opera production studio, which remains to the present day.

3.2.2 The immediate surrounding area was noted to be heavily developed from earliest records including: roads, houses, local industrial businesses, schools, and a hospital. With time this area has been developed further in the surrounding area with expansion to the north and multiple businesses noted within 500 m of the site. Industries within the 300 m surrounding area include iron works, chemical works, timber yard as well as many others.

3.2.3 Following these researches we consider the site to be 'brownfield' in nature with the potential for significant soil and groundwater contamination to have taken place.

4.0 DOCUMENTED GROUND CONDITIONS

4.1 General

4.1.1 The conjectured ground conditions at the site have been assessed utilising documentary information sources such as British Geological Survey Maps.

4.2 Superficial Soils

4.2.1 It is considered that MADE GROUND deposits will exist below the site associated with previous historical development. However, further detail of the composition and thickness of the made ground deposits are not currently known.

4.2.2 The British Geological Survey (BGS) Drift Lithology map (Drawing No. P22/271/DS/R/F/05) recorded the natural soils below the site to consist of glacial till (i.e. boulder CLAY). The BGS drift thickness map (Drawing No. P22/271/DS/R/F/06) indicated these deposits to range between approximately 5 m and 20 m becoming thicker from north-west to south-east.

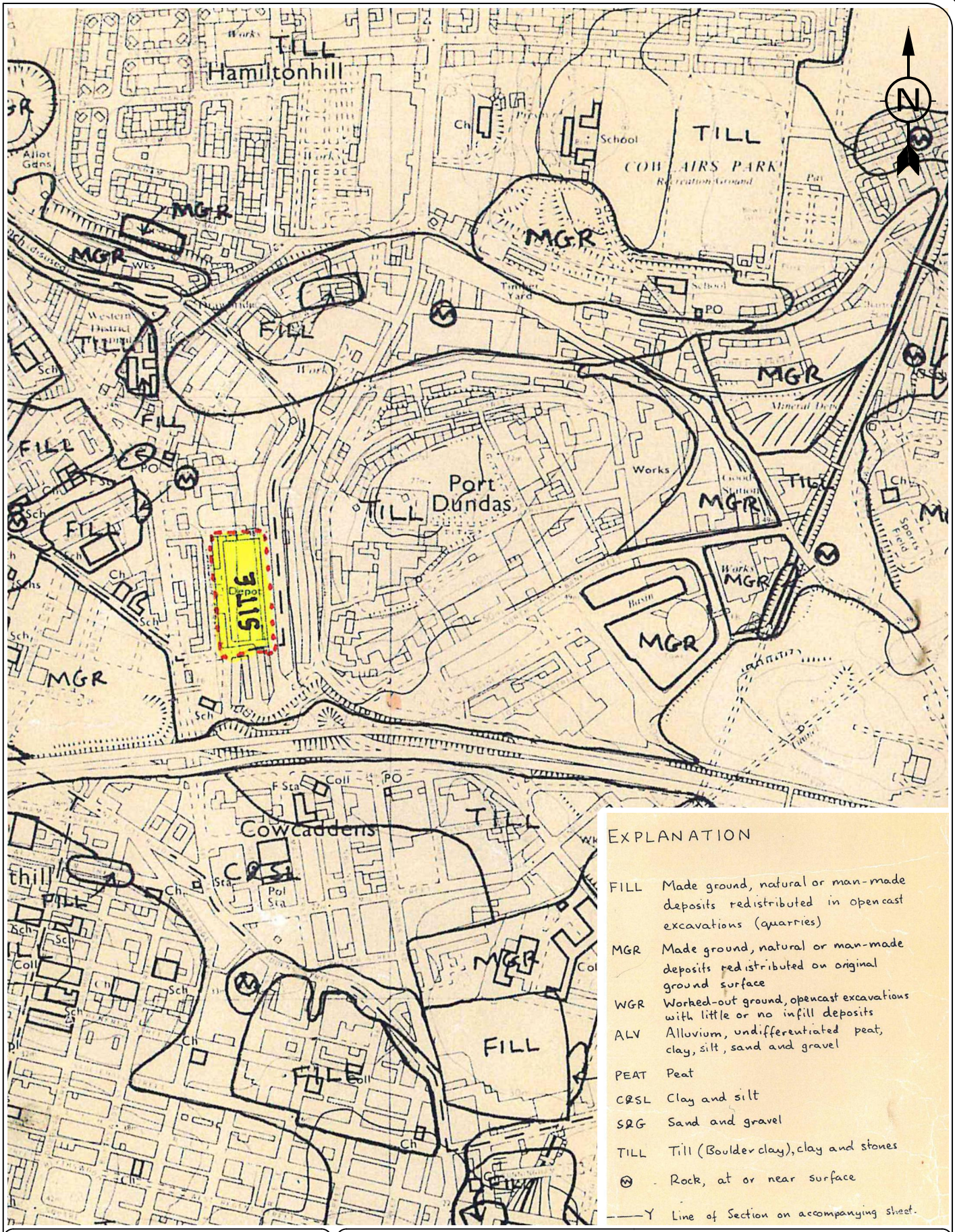
4.2.3 A historical borehole dated November 1960 (NS56NE 3422/26) from within the south-eastern site area recorded concrete from the surface to 0.53 m, underlain by 0.05 m of MADE GROUND described as rubble fill, further underlain by sequences of natural soft and firm CLAY deposits. Bedrock was encountered at 16.90 m depth described as SANDSTONE. It should be noted that made ground deposits may not be typical of this across the full site and will likely be thicker below the locations of the former iron works and electricity generation station buildings.

4.2.4 A copy of the historical borehole records are included in Appendix F.

4.3 Solid Geology

4.3.1 The BGS indicated the solid strata beneath the site to be of the Limestone Coal Group comprising of SANDSTONE, SILTSTONE and MUDSTONE with seams of COAL and IRONSTONE (Drawing No. P22/271/DS/R/F/07).

4.3.2 The Upper Possil Coal (sometimes referred to as the Davy Coal) was conjectured to outcrop within the southern site area aligned south-west to north-east and dipping towards the south-east (i.e. below the site) with an indicated thickness of 0.80 m. The Upper Possil Ironstone or Garscube Wee Coal was conjectured to outcrop to the north of the site and is recorded to dip below the site to the south-east with an indicated thickness of 0.70 m. Furthermore, whilst not shown to outcrop on the geological map, the Batchie Ironstone or Coal was indicated on the stratigraphic column to exist between the Upper Possil / Davy Coal and the Upper Possil Ironstone / Garscube Wee Coal seams with an indicated thickness of up to 0.70 m, and therefore is considered to underlie the site at shallow depth.



EXPLANATION

FILL	Made ground, natural or man-made deposits redistributed in opencast excavations (quarries)
MGR	Made ground, natural or man-made deposits redistributed on original ground surface
WGR	Worked-out ground, opencast excavations with little or no infill deposits
ALV	Alluvium, undifferentiated peat, clay, silt, sand and gravel
PEAT	Peat
CRSL	Clay and silt
SRG	Sand and gravel
TILL	Till (Boulder clay), clay and stones
⊛	Rock, at or near surface
——Y	Line of Section on accompanying sheet.

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project title:
ROTTERDAM WHARF

drawing title:
EXTRACT FROM PUBLISHED GEOLOGICAL SURVEY MAP (DRIFT LITHOLOGY)

project no:	drawing no:	revision:	date:	drawn by:	approved by:	scale:
P22/271	P22/271/DS/R/F/05		14.09.23	TR	AMcG	Not to Scale

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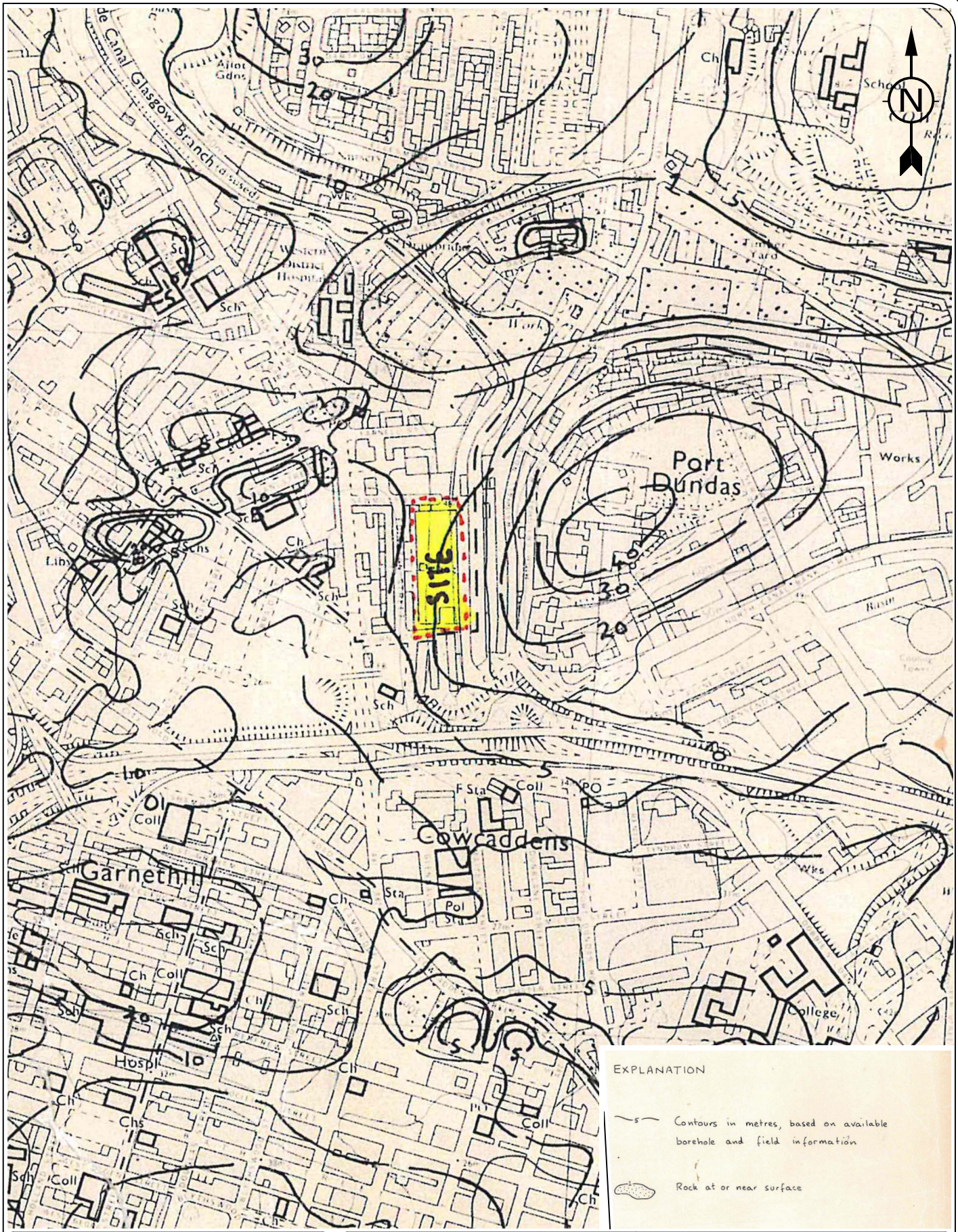

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project title:
ROTTERDAM WHARF

drawing title:
EXTRACT FROM PUBLISHED GEOLOGICAL SURVEY MAP (DRIFT THICKNESS)

project no:	drawing no:	revision:	date:	drawn by:	approved by:	scale:
P22/271	P22/271/DS/R/F/06		14.09.23	TR	AMcG	Not to Scale

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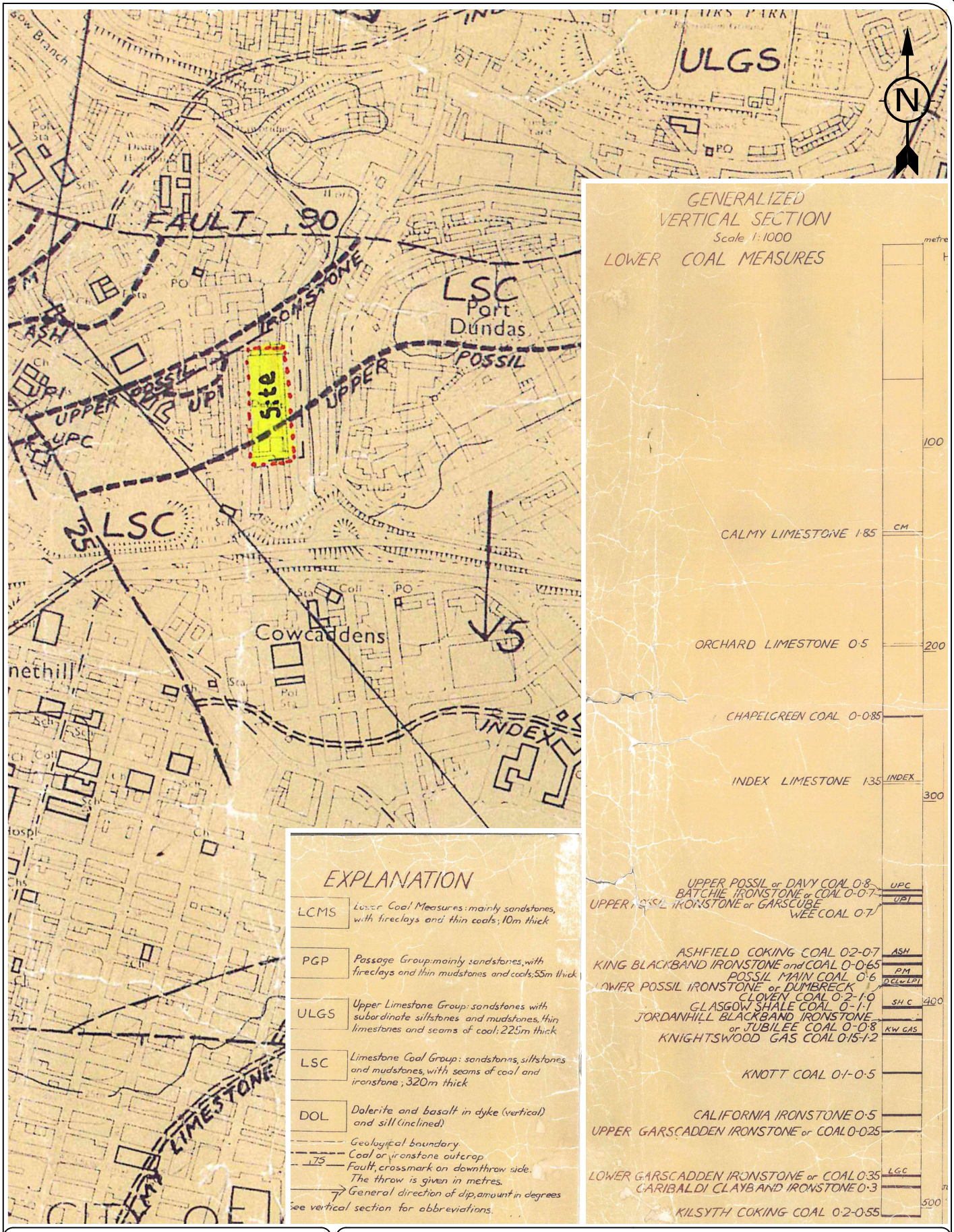

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project title: ROTTERDAM WHARF

drawing title: EXTRACT FROM PUBLISHED GEOLOGICAL SURVEY MAP (SOLID GEOLOGY)

project no:	drawing no:	revision:	date:	drawn by:	approved by:	scale:
P22/271	P22/271/DS/R/F/07		14.09.23	TR	AMcG	Not to Scale

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4.4 Mining and Quarrying

4.4.1 The Coal Authority Interactive Viewer map (refer to Appendix D) indicated that the site lies within a 'Development High Risk Area' and an area of 'Probable Shallow Coal Workings'.

4.4.2 A site-specific Consultants Coal Authority Report (included in Appendix D) stated that there are no records of any past underground mine workings below the site. This is consistent with the BGS mining maps (Drawing Nos. P22/271/DS/R/F/08 and 09) which did not indicate any known records of mining to exist below the site.

4.4.3 Importantly however, The Coal Authority did indicate that there was a potential for unrecorded workings at shallow depth (i.e. < 30 m depth) below the site. We consider that any shallow mineral extraction would be associated with The Upper Possil Ironstone or Garscube Wee Coal (0.80 m thick), the Batchie Ironstone or Coal (up to 0.70 m thick) and/or the Upper Possil / Davy Coal (0.70 m thick) which were indicated to exist below the site at shallow depths.

4.4.4 The Coal Authority did not record any mine entries within the site or immediate surrounding area. However, it should be highlighted that as in all areas of past mining, unrecorded mine entries could exist.

4.4.5 The Coal Authority also did state any known mine gas emissions within 500 m of the site, however it should be noted that any unrecorded mine workings below the site could contribute to mine gas and this will therefore require to be further investigated.

4.4.6 The Coal Authority did not record any open cast mines within 500 m from the site boundary. In addition, upon review of the historical maps, no quarrying activity was recorded to be present within the site or the immediate surrounding area.

4.4.7 To conclude, we consider the site to be at potential risk of ground instability as a result of unrecorded shallow mine workings at the level of the Upper Possil Ironstone or Garscube Wee Coal (0.80 m thick), the Batchie Ironstone or Coal (up to 0.70 m thick) and/or the Upper Possil / Davy Coal. Therefore, mineral ground investigations would be recommended in order to confirm (or otherwise) the presence of any shallow mine workings to exist below the site.