Earthworks Specification

Main Avenue, Kirklees

Client:	Strata Homes & Thirteen Group
Document Type:	Report
Document No.:	1152-ACE-GEO-ES-002
Revision:	000
Date:	2024/09/18

Version History & Foreword

This report has been prepared by Apex Consulting Engineers with reasonable skill, care and diligence, within the best practice and guidance current at the time of issue, within the scope of works which have been agreed with the client.

This report is confidential to the client and Apex Consulting Engineers accepts no responsibility whatsoever to third parties to whom this report, or any part thereof is presented, unless this is formally agreed in writing by a Director of Apex Consulting Engineers before any reliance is made. Any such party relies upon the information at their own risk. Apex Consulting Engineers disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

The report is written in the context of the development proposals submitted to Apex by the Client as part of the appointment. Any changes to the development proposals may necessitate significant revisions to this report.

The report (including appendices) should be read in its entirety. Apex cannot be held responsible for any sections of this report being taken out of context. This includes information submitted separately via download link (i.e. full copies of environmental search data from Envirocheck) which are not included as part of the main PDF due to their file size.

Apex reserve the right to amend this Report in the light of further information that may become available.

Revision	Date	Notes	Prepared by	Checked by	Approved by
000	2024/09/18	First Issue	M Thompson	BEL	M Thompson

Contents

1. INTRODUCTION

1.1 Context & proposed development

This report has been prepared for Strata Homes & Thirteen Group.

The purpose of this report is to provide a specification for the placement of fill materials at Strata's proposed development at Main Avenue, Kirklees.

It is understood that proposals include development of residential housing. A Viability Layout (drawing ref. 22-CL1-SEGA-MAK-01-VL, dated 20th July 2022) has been provided by Strata and is included in Appendix A. It shows 45no. traditional low-rise semi-detached/detached houses with gardens, POS, adoptable roads and sewers.

The entire site generally slopes downwards in a northeasterly direction. Based on the topographic survey provided, the highest point on site is 164.5mAOD in the south-west, and the lowest point is c. 145mAOD in the north-east. Slopes gradients range from c. 1 in 3.5 in the south to c. 1 in 12 in the north. Given the topography, a cut & fill exercise is anticipated in order to accommodate the proposed development.

1.2 Previous reports

Apex have been provided with copies of the following reports relating to this site:

- *Phase I Geo-Environmental Risk Assessment, Land to the East of Main Avenue, Cowlersley, Huddersfield* (ref. 220322.2) issued to Thirteen Group in May 2022 by Roberts Environmental Limited (REL).

- *Phase II Geo-Environmental Site Investigation and Risk Assessment, Land to the East of Main Avenue, Cowlersley, Huddersfield* (ref. 22022.1) issued to Thirteen Group in May 2022 by Roberts Environmental Limited (REL).

It is understood that Strata Homes has reliance on these reports. In addition, Apex have issued the following report in relation to this site:

- *Ground Appraisal Report, Main Avenue, Kirklees* (ref. 1152-GEO-GAR-001) Revision 001 dated 20th August 2024.

2. ROLES AND RESPONSIBILITIES

During the following Sections, the following definitions apply for each party:

- **Client:** Strata Homes and Thirteen Group
- **Contractor:** The party responsible for sourcing and placement of suitable fill materials in accordance with this Specification.
- **Supervising Engineer:** A suitably qualified Geotechnical Engineer appointed to supervise and monitor the works, ensuring that the requirements of this Specification are met.

3. SELECTION & TESTING OF FILL MATERIAL

3.1 General

For the purpose of this Specification, the following definitions apply:

Engineered Fill: Materials where high performance is required, including:

- Fill material beneath highways & drainage infrastructure
- Areas where limited settlement of fill material is critical

Non-engineered fill: Materials where high performance of fill materials is not required; including:

- Fill beneath landscaped areas
- Fill beneath gardens

The above lists are not exhaustive. Where Non-Engineered Fill is placed in line with this Specification, there is no guarantee as to the degree of settlement which will occur; however, providing the recommendations are followed, risks of significant differential settlement should be limited.

In order to determine material classes and ascertain compaction requirements, geotechnical analysis shall be undertaken on samples of the materials to be used by the Contractor; testing is to be undertaken by a UKAS accredited laboratory; further details are given below.

3.2 Unsuitable fill materials

The following are not considered suitable fill materials for the proposed earthworks:

- Soil with a liquid limit of >90% of Plasticity Index of >65%.
- Chalk with >10% fine fraction (<400µm).
- Contaminated or non-inert materials
- Expansive material
- Biodegradable/potentially putrescible wastes, including topsoil, wood and peat
- Frozen/waterlogged material
- Material with significant volumes of oversize rendering it unsuitable for compaction; in such circumstances, prior screening and crushing of oversize may be required
- Materials which may cause harm to proposed infrastructure such as those posing a risk to foundations, drainage runs due to high sulphate contents/low pH values
- Material containing scrap metal
- Potentially expansive material (eg slag)

3.3 Engineered Fill

For engineered fill, suitable material shall adhere to the requirements of the following material classes as specified in Table 6/1 of SHW 600.

- "Class 1A, 1B or 1C General Granular Fill"
- "Class 2A, 2B or 2C General Cohesive Fill"
- "Class 6F1 Selected granular material (fine grading)"
- "Class 6F2 Selected granular material (coarse grading)"
- "Class 6F3 Selected granular material"
- "Class 6F4 Selected granular material (fine grading) - imported on to the Site"
- "Class 6F5 Selected granular material (coarse grading) - imported on to the Site"

Fill material used should be selected and placed in accordance with the Specification for Highways Series 600[1] (SHW 600).

Testing requirements – Engineered Fill

A summary of the testing requirements for Engineered Fill, depending on its classification, is provided below for reference:

MATERIAL	CLASS	TESTING REQURIEMENTS	TECHNIQUE	RELEVANT CLAUSES (SHW 600)	TESTING FREQUENCY
General Granular Fill	1A	Grading & uniformity coefficient	BS 1377: Part 2 or BS EN 13242	-	Twice per week
		MCV	BS 1377: Part 2	632	1-2 tests per 1,000m^3 of material (max. 5 per day)
	1B	Grading & uniformity coefficient	BS 1377: Part 2 or BS EN 13242	-	Twice per week
		MCV	BS 1377: Part 2	632	1-2 tests per 1,000m^3 of material (max. 5 per day)
	1C	Grading & uniformity coefficient	BS 1377: Part 2 or BS EN 13242	-	Twice per week
		Los Angeles coefficient	-	635	1-2 tests per 1,000m^3 of material (max. 5 per day)
	2A	Grading	BS 1377: Part 2	-	Twice per week

[1] Manual of Contract Documents for Highway Works – Volume 1 Specification for Highway Works, Series 600 Earthworks (February 2016)

MATERIAL	CLASS	TESTING REQURIEMENTS	TECHNIQUE	RELEVANT CLAUSES (SHW 600)	TESTING FREQUENCY
General Cohesive Fill		Plastic Limit			1-2 tests per 1,000m³ of material (max. 5 per day)
		MCV	BS 1377: Part 2	632	1-2 tests per 1,000m³ of material (max. 5 per day)
		Undrained shear strength of remoulded material	-	633	1-2 tests per 1,000m³ of material (max. 5 per day)
	2B	Grading	BS 1377: Part 2	-	Twice per week
		Plastic Limit			1-2 tests per 1,000m³ of material (max. 5 per day)
		MCV	BS 1377: Part 2	632	1-2 tests per 1,000m³ of material (max. 5 per day)
		Undrained shear strength of remoulded material	-	633	1-2 tests per 1,000m³ of material (max. 5 per day)
	2C	Grading	BS 1377: Part 2	-	Twice per week
		Plastic Limit			1-2 tests per 1,000m³ of material (max. 5 per day)
		MCV	BS 1377: Part 2	632	1-2 tests per 1,000m³ of material (max. 5 per day)
		Undrained shear strength of remoulded material	-	633	1-2 tests per 1,000m³ of material (max. 5 per day)
	2D	Grading	BS 1377: Part 2	-	Twice per week
		Plastic Limit			1-2 tests per 1,000m³ of material (max. 5 per day)
Selected Granular Material (fine grading)	6F1	MCV	BS 1377: Part 2	632	One per 400t of material
		Undrained shear strength of remoulded material	-	633	As required by the Supervising Engineer
		mc	BS 1377: Part 2 or BS EN 1097-5	-	One per 400t of material
		Los Angeles coefficient	-	635	Weekly
		Class Ra (asphalt) content	-	710	As required by the Supervising Engineer following visual inspection.

MATERIAL	CLASS	TESTING REQURIEMENTS	TECHNIQUE	RELEVANT CLAUSES (SHW 600)	TESTING FREQUENCY
		Bitumen content	BS EN 12697-1 or BS EN 12697-39	-	As required by the Supervising Engineer following visual inspection.
Selected granular material (coarse grading)	6F2	Grading	BS 1377: Part 2 or BS EN 1097-5	-	One per 400t of material
		Optimum mc	BS 1377: Part 4	-	One per 400t of material
		mc	BS 1377: Part 2 or BS EN 1097-5	-	One per 400t of material
		Los Angeles coefficient	-	635	Weekly
		Class Ra (asphalt) content	-	710	As required by the Supervising Engineer following visual inspection.
		Bitumen content	BS EN 12697-1 or BS EN 12697-39	-	As required by the Supervising Engineer following visual inspection.
Selected granular material	6F3	Grading	BS 1377: Part 2 (on-site) or BS EN 933-2 (imported material)	-	One per 400t of material
		Optimum mc	-	613	One per 400t of material
		mc	BS 1377: Part 2 or BS EN 1097-5	613	One per 400t of material
		Class Ra (asphalt) content	-	710	As required by the Supervising Engineer following visual inspection.
		Bitumen content	BS EN 12697-1 or BS EN 12697-39	-	As required by the Supervising Engineer following visual inspection.
Selected Granular Material (fine grading) – imported on to the Site	6F4	Size designation and overall grading category	BS EN 13285 – 0-31.5 and G_E	-	One per 400t of material
		Maximum fines and oversize categories	BE EN 13285 UF_{15} and OC_{75}	-	One per 400t of material
		Los Angeles coefficient	BS EN 13242 – LA_{60}	-	Weekly
		Volume stability of blast furnace slag	BS EN 13242 – free from dicalcium	-	As required by the Supervising Engineer

MATERIAL	CLASS	TESTING REQURIEMENTS	TECHNIQUE	RELEVANT CLAUSES (SHW 600)	TESTING FREQUENCY
			silicate and iron disintegration		following visual inspection.
		Volume stability of steel (BOF) and EAF) slag	BS EN 13242 – V_5	-	As required by the Supervising Engineer following visual inspection.
		Other aggregate requirements	BS EN 13242 – $Category_{NR}$ (no requirement)	-	As required by the Supervising Engineer following visual inspection.
		Laboratory dry density and optimum water content	BS EN 13285, Clause 5.3 – declared values	-	One per 400t of material
		Water content	BS EN 1097-5	-	One per 400t of material
		Class Ra (asphalt) content	-	710	As required by the Supervising Engineer following visual inspection.
		Bitumen content	BS EN 12697-1 or BS EN 12697-39	-	As required by the Supervising Engineer following visual inspection.
Selected Granular Material (coarse grading) – imported on to the Site	6F5	Size designation and overall grading category	BS EN 13285 – 0-31.5 and G_E	-	One per 400t of material
		Maximum fines and oversize categories	BE EN 13285 UF_{12} and OC_{75}	-	One per 400t of material
		Los Angeles coefficient	BS EN 13242 – LA_{50}	-	Weekly
		Volume stability of blast furnace slag	BS EN 13242 – free from dicalcium silicate and iron disintegration	-	As required by the Supervising Engineer following visual inspection.
		Volume stability of steel (BOF) and EAF) slag	BS EN 13242 – V_5	-	As required by the Supervising Engineer following visual inspection.
		Other aggregate requirements	BS EN 13242 – $Category_{NR}$ (no requirement)	-	As required by the Supervising Engineer following visual inspection.
		Water content	BS EN 1097-5	-	One per 400t of material
		Class Ra (asphalt) content	-	710	As required by the Supervising Engineer

MATERIAL	CLASS	TESTING REQURIEMENTS	TECHNIQUE	RELEVANT CLAUSES (SHW 600)	TESTING FREQUENCY
					following visual inspection.
		Bitumen content	BS EN 12697-1 or BS EN 12697-39	-	As required by the Supervising Engineer following visual inspection.

In addition to the above, any materials which are to be placed as Engineered Fill within the **uppermost 450mm of a finished surface of a permanent road** shall be subjected to **frost heave testing**. Testing shall comprise at least 2 tests on each material class in accordance with Clause 602 of SHW600.

3.4 Proposed Landscaping

For areas of proposed landscaping, the following testing shall be undertaken:

MATERIAL	CLASS	TESTING REQURIEMENTS	TECHNIQUE	RELEVANT CLAUSES (SHW 600)	TESTING FREQUENCY
Landscape Fill	4	Grading	BS 1377: Part 2	620	Daily
		MCV	BS 1377: Part 2	632, 620	Daily
Topsoil	5A	Grading	-	618	Daily
	5B	General purpose grading	BS 3882	-	Daily

3.5 Non-engineered Fill

Where Non-Engineered Fill is be placed (see Section 3.1 for the definition of such areas), there are no set testing requirements. However, the source of the material should be provided to the Supervising Engineer who will also carry out a visual inspection, including (if necessary), excavations into any stockpiles to check its suitability in line with the points stated in Section 3.2.

3.6 Interpretation of laboratory testing results

Laboratory results shall be assessed by the Supervising Engineer as they arrive to determine the suitability of material for placement as Engineered Fill.

Results of the geotechnical analysis will be used to determine each material's class in accordance with Table 6/1 and Table 6/2 of SHW 600 such that compaction requirements can be determined.

Grading

Results of the grading tests shall be used to determine the suitability of the laboratory compaction tests and to assess compaction requirements on site. For material to be suitable for laboratory compaction tests, at least 90% of the material shall pass the 37.5mm sieve and/or at least 70% of the material shall pass the 20mm sieve.

Where the above conditions are not met, use of the compaction test results to assess suitability of the material as Engineered Fill may not be possible, and field trials may required instead at the Supervising Engineer's discretion.

Compaction tests

For compaction tests, material shall be deemed to be suitable for use as Engineered Fill where the tests show that the material's in-situ moisture content sits within the allowable moisture content range for achieving >95% of its maximum dry density and <5% air voids.

Where the above conditions are not met, the material may need additional preparation prior to use as Engineered Fill, such as drying on site. In some circumstances, the material may still be used (at the discretion of the Supervising Engineer) subject to field trials showing successful placement of material.

Other tests

For the remaining tests outlined in the table in Section 3.3; limits outline in the SHW600 shall be used to determine suitability for use as Engineered Fill. Should any test results show non-compliance with the limits set out in SHW600, the material should not be placed unless justification is given by the Supervising Engineer.

4. PLACEMENT OF FILL MATERIAL

4.1 General

The Contractor shall determine appropriate compaction methods based on the material classification which shall be ascertained through the geotechnical analysis stated in Section 3.1 above.

Within each layer, no mixing of material types shall take place.

The Contractor should ensure that the method of compaction and plant used poses no significant risk to nearby buildings/infrastructure.

Surface water run off should be managed by the Contractor in such a way as to not pose significant deterioration of the fill materials.

4.2 Placement of Engineered Fill

Testing shall include laboratory compaction tests, the method for which shall be determined by the proposed compaction plant being used on site.

Prior to placement of fill material, the sub-formation should be exposed and proof-rolled in accordance with SHW sub-clause 6.13.11(i).

Compaction requirements shall be as per those stated in Table 6/4 in SHW600; prior to beginning placement, the Contractor shall state to the Supervising

Engineer the proposed method of placement, the material to be used (including provision of all compliance testing stated in Section 2), and the plant to be used.

Fill should be placed in a controlled manner in horizontal layers of consistent thickness. The layer thicknesses and number of passes shall be determined based on the results of the geotechnical analysis stated above and the proposed compaction plant in accordance with Table 6/4 of SHW600.

For the placement of Engineered Fill, the following methods are acceptable:

MATERIAL	CLASS	COMPACTION METHOD*
General Granular Fill	1A	Method 2
	1B	Method 3
	1C	Method 5
General Cohesive Fill	2A	Method 1^
	2B	Method 2
	2C	Method 2
	2D	Method 3
Selected Granular Fill	6F1/6F4 (fine grading)	Method 6
	6F2/6F5 (coarse grading)	Method 6
	6F3	Method 6 (maximum layer thickness of 200mm)

* in accordance with Table 6/4 of SHW600
^ only for materials with liquid limit less than 50. Only deadweight tamping or vibratory tamping rollers/grid rollers shall be used.

Placement of fill shall be as soon as practicably possible after exposure of the sub-formation. Any areas exposed to inclement weather shall be protected by placement of a granular running layer. Should deterioration of the exposed sub-formation occur prior to placement of fill, any affected materials shall be removed to the Supervising Engineer's satisfaction.

Within 7 days of placement, a series of in-situ dry density tests (for example, sand replacement tests) shall be performed. The results should show that 95% of the maximum dry density has been achieved and be within the range of 0-5% air voids for the material type placed, ascertained via compaction testing as detailed in Section 3. Where the results show non-compliance, materials may need to be removed to the satisfaction of the Supervising Engineer at the Contractor's expense.

Highways

In addition to the requirements listed in Section 4.2 above, beneath highways, prior to placement of fill, a series of plate bearing tests shall be undertaken at formation level of the proposed highway at a spacing of no less than every 25m

along the highway route. The plate bearing tests shall be used to ascertain CBR values and should use a 600mm diameter plate.

Where CBR values of <3% are recorded, material shall be excavated to a depth of either:

- The depth of competent stratum below where CBRs of 3% or above are proven via in-situ testing; or,
- To a maximum depth of 2m from formation level of the deepest sewer invert.

Within 7 days of placement of fill, a series of plate bearing tests shall be undertaken at finished level at intervals of no more than 25m along the highway to ascertain CBR values. Where results of <3% are recorded, material may need to be removed and replaced to the Supervision Engineer's satisfaction at the Contractor's expense.

4.3 Placement of Non-engineered Fill

Prior to placement of Non-Engineered Fill, soft/unsuitable materials should be removed and the base of the excavation/areas of filling be proof-rolled.

Where there are significant thicknesses of soft material are present which cannot be removed economically, placement of a stone blanket prior to infilling may be appropriate, subject to confirmation the Supervising Engineer.

Adverse weather conditions may result in degradation of fill materials; where this is the case, all efforts should be made to "protect" exposed fill material. Any soft spots resulting from adverse weather should be removed, and fill be re-placed once conditions are more favourable.

Placement of Non-Engineered Fill should be done in layers of maximum 200mm thickness; fragments of oversize material should not exceed 2/3 of the layer thickness; any such material should be removed prior to placement.

Each layer should be subjected to at least two passes of compaction by a vibratory roller of at least 3,000 kg/m mass width. Where evidence of poor compaction is noted, such as excessive rutting or "bow waves" beneath rollers, filling should cease and the material be removed, prior to placement of appropriate alternative fill materials.

5. SUPERVISION AND VERIFICATION

During earthworks, the Contractor shall maintain records of the following:

- Source information for each material type used
- Geotechnical analysis undertaken in accordance with this Specification for each material type

- Detailed site records of material movements, including topographical survey information showing the destination of each material type
- A daily record summary of the site operations throughout earthworks include all plant and personnel involved
- Copies of all in-situ testing undertaken in accordance with this Specification, including the locations and topographical level of each test undertaken (recorded by survey)

Supervision of the earthworks shall be undertaken on a part-time basis by the Supervising Engineer. They will review geotechnical testing results (both laboratory and in-situ) provided by the Contractor and make known any non-compliant results to both the Contractor and Client, along with recommended remedial measures.

During site visits, the Supervising Engineer shall maintain records of:

- Daily activities during their visit, including plant and equipment used
- Photographic records

On completion of works and receipt of all necessary information listed above, the Supervising Engineer shall prepare a Verification Report detailing the earthworks undertaken, compliance with this Specification and any deviation from it, along with appropriate justification.

6. RECOMMENDATIONS

Once earthworks design is finalised, and a Contractor has been appointed, this Specification can be revised to include contract-specific testing requirements based on plant and equipment information provided by the Contractor.

This Specification should be submitted to the Local Planning Authority and the Warranty Provider for their comment and approval.

Apex Consulting Engineers

Unit 3 Acres Hill Business Park
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Appendix A – Drawings

Project

MAIN AVE, KIRKLEES

Title

001 - SITE LOCATION PLAN

Job No.

1152

A4

APEX CONSULTING ENGINEERS

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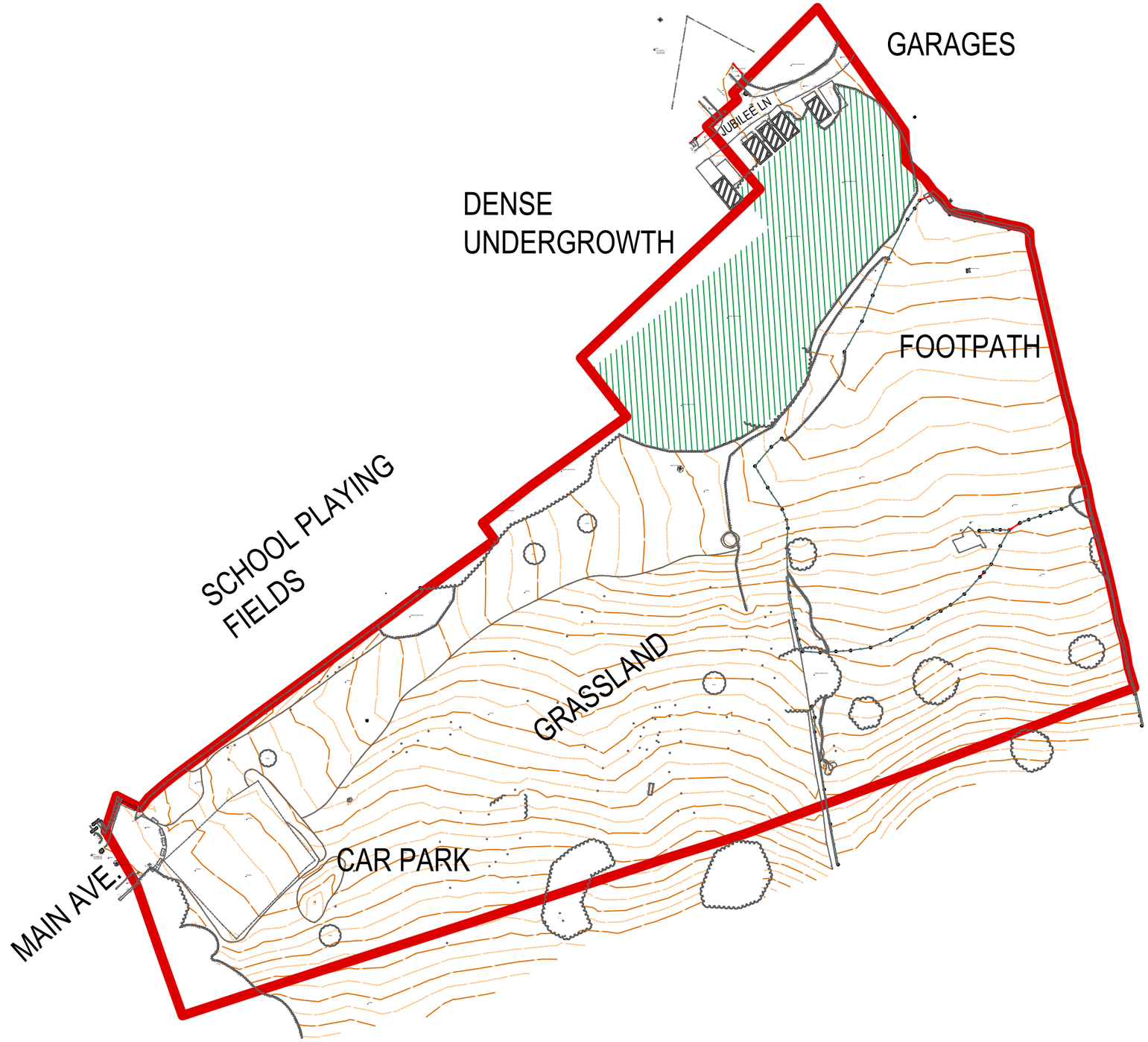

NORTH

APPROX. SITE BOUNDARY

Client	Project	Scale
STRATA HOMES	MAIN AVENUE, KIRKLEES	1:1,000 @ A3
		Date
		JUNE 2024
	Title	
	002 - SITE FEATURES	
A3		

APEX CONSULTING ENGINEERS
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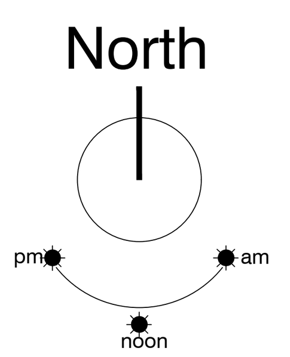
MAIN AVENUE | VIABILITY LAYOUT

All work to be carried out in accordance with the requirements of the Building Regulations, Water Authority and the Construction (Design and Management) Regulations currently in force.

Do not scale from this drawing. Architect to be notified of any discrepancies.

Verify relevant dimensions on site before commencing work or preparing shop drawings. This drawing is copyright.

Rev	Date	Description	By	Checked
A	-	-	-	-



ACCOMMODATION SCHEDULE

SITE NAME:												
DRAWING NUMBER:												
HOUSE TYPE	SALES NAME	NUMBER	SQ.FEET	TOTAL SQ.FEET	SQ.METRES	TOTAL SQ.METRES	%	REGULATORY COMPLIANCE	BEDS	PEOPLE	STOREY HEIGHT	PLOT NO's
AFFORDABLE (#MIY)												
MY A-251	T1	8	806	6448	74.88	599.03	17.8%	M4/1 / NDSS	2	3	2	
3-601	3B4PCT-933	7	933	6531	86.68	606.74	15.6%	M4/1	3	4	2	
3-300	T2	30	923	27690	85.75	2572.46	66.7%	M4/2 / NDSS	3	4	2	
AFFORDABLE TOTAL:		45										
TOTALS:		45		40669		3778	100%					
Area Gross:		2.14	Hectares									
Area Gross:		5.29	Acres									
Non Developable/POS area		0.8	Hectares									
Non Developable/POS area		1.98	Acres									
Developable area		1.34	Hectares			AFFORDABLE	100%					
Developable area		3.31	Acres									
Density:		33.58	Units / Hectare									
Density:		13.59	Units / Acre									
Sq.ft/acre		12,282	Sq.ft/acre									
Sq. Metres/Hectare		2,820	Sq. Metres/Hectare									

strata

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scale: 1:500 @ A1 | drawn by: LA | date: 20.07.22

HOUSETYPE RANGE: MIY
SPECIFICATION TYPE: TBC
LAND CLUSTER: 1 (YORKS W)
LAND SEGMENT: A
DRAWING STAGE: 1-VIABILITY
LANDSCAPE SPEC: BRONZE

Project: Main Avenue, Kirklees

Drawing: Viability Layout

Planning Ref: N/A

Drawing Number: 22-CL1-SEGA-MAK-01-VL | Revision: -