

Project Name and Location:

300m long, up to 6m high reinforced slope with soil bag facing at Lawley Village Phase 10, Telford

Year of construction:

March 2021

Designer name (Company):

Kenneth Knox
Geoman Ltd.

Used software (GEO5):

MSE Wall
Slope Stability

Project description:

This is a 70° green faced reinforced slope, which foregoes the usual coir mat and steel panel systems for vegetated soil bags. While more lightweight and flexible than typical concrete segmental MSE facing systems, they are analysed in much the same way, so MSE Wall was ideal for this.

The temporary excavations were conducted without a design in place, and desiccation of the clay around a single tree on the retained side lead to collapse of a short length of the cut overnight. This was ultimately sheet piled to allow the failed material to be removed safely.

Spoil had been banked up against the remaining length of the temporary cut to buttress it. Of particular concern was a pinch point that was part way through the installation of soil nails prior to the failure. We were asked to provide temporary works design to allow the remainder of the soil nailing to be completed, and were able to model each stage of excavating the spoil in Slope Stability to ensure the excavation would be safe for the remainder of the works.





GeoGrow



Rootlok

Vegetated Wall System



An aerial photograph showing a construction site on a hillside. A red dashed line traces a path along the slope, indicating the location of a vegetated wall system. The site includes various construction materials, equipment, and partially completed structures. The surrounding area consists of residential housing and green spaces.

GeoGrow

Rootlok
Vegetated Wall System





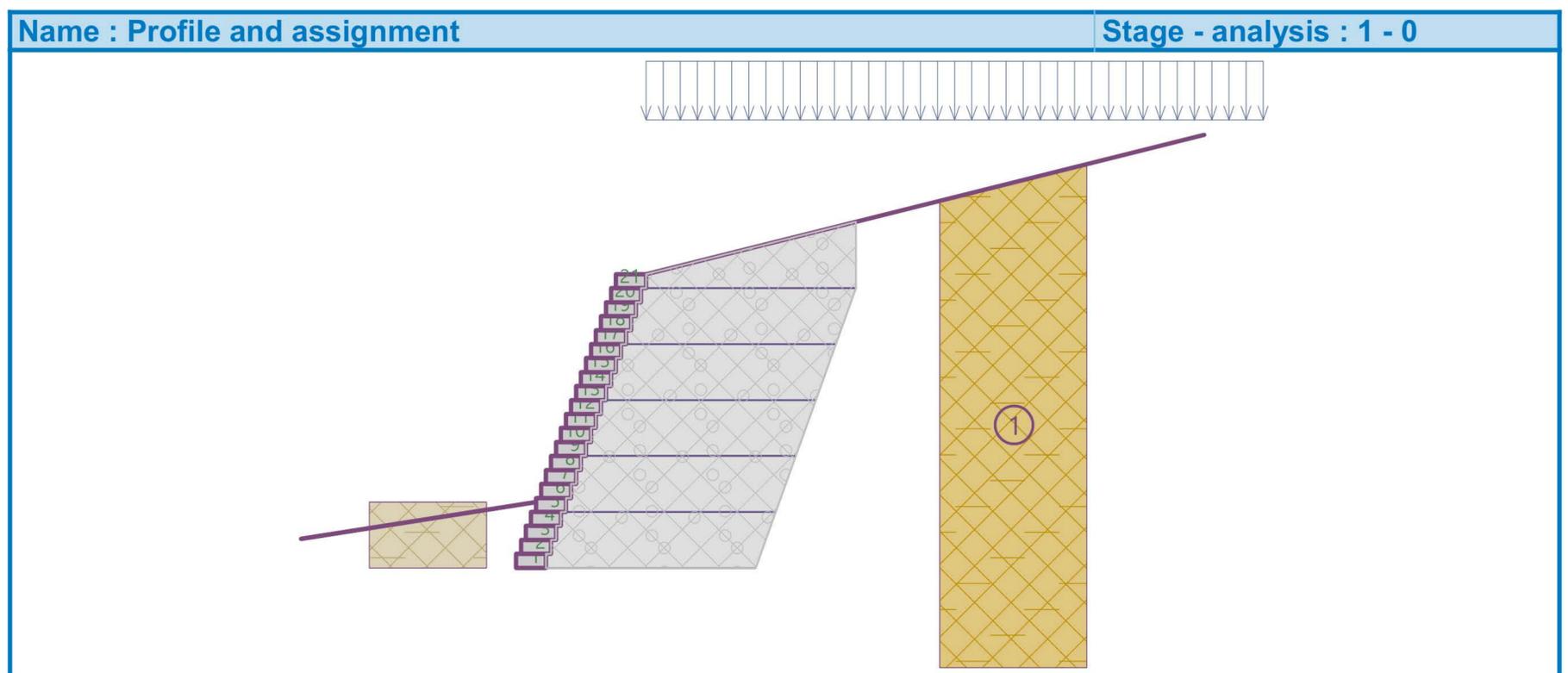
Angle of internal friction : $\varphi_{ef} = 28.00^\circ$
 Cohesion of soil : $c_{ef} = 0.00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 18.67^\circ$
 Saturated unit weight : $\gamma_{sat} = 20.00 \text{ kN/m}^3$

Class 6I fill

Unit weight : $\gamma = 19.00 \text{ kN/m}^3$
 Angle of internal friction : $\varphi_{ef} = 35.00^\circ$
 Cohesion of soil : $c_{ef} = 0.00 \text{ kPa}$
 Angle of friction struc.-soil : $\delta = 23.33^\circ$
 Saturated unit weight : $\gamma_{sat} = 20.00 \text{ kN/m}^3$

Geological profile and assigned soils

No.	Thickness of layer t [m]	Depth z [m]	Assigned soil	Pattern
1		- 0.00 .. ∞	Made Ground	



Terrain profile

Terrain behind construction has the slope 1: 4.00 (slope angle is 14.04 °).

Water influence

Ground water table is located below the structure.

Input surface surcharges

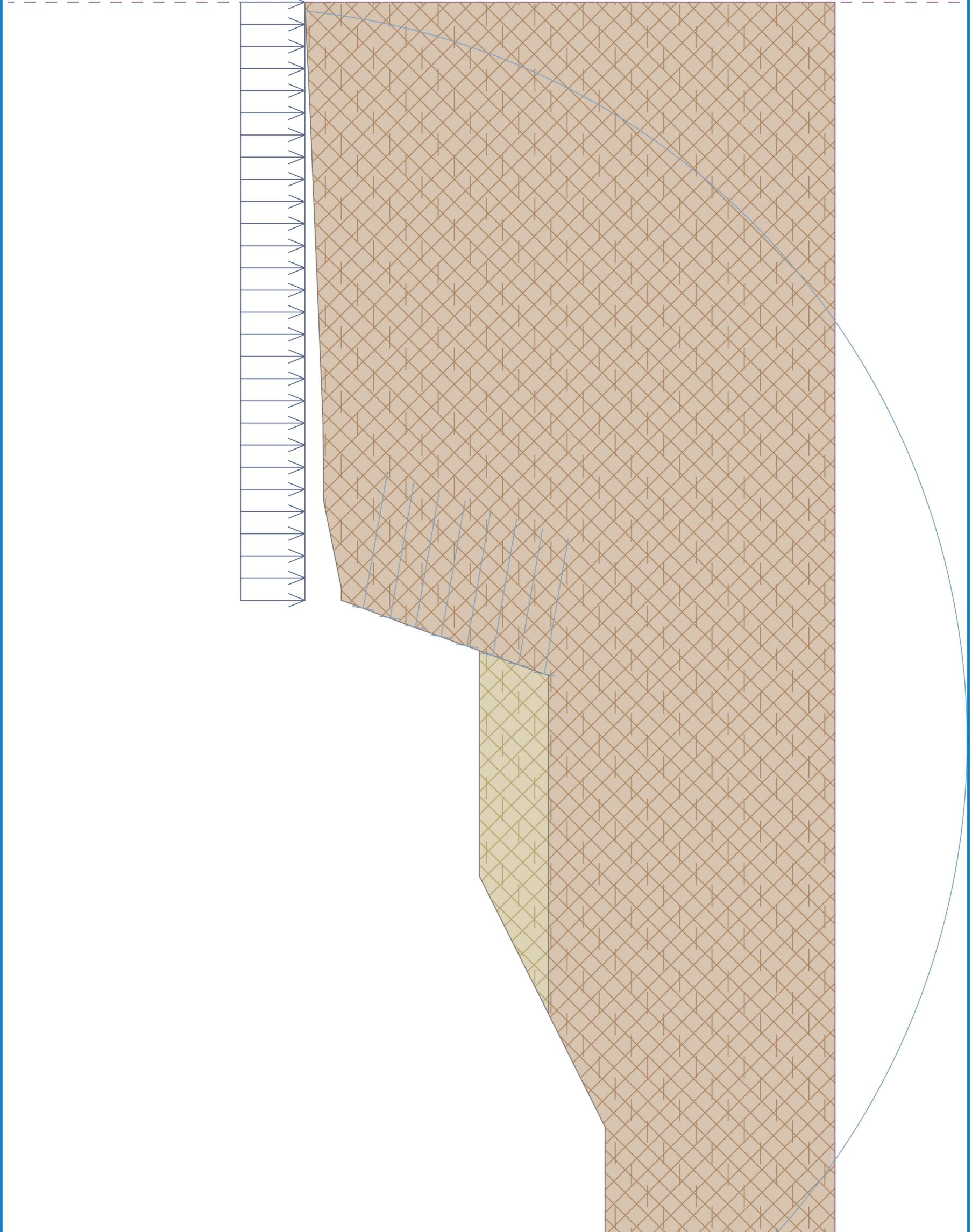
No.	Surcharge		Action	Mag.1 [kN/m²]	Mag.2 [kN/m²]	Ord.x x [m]	Length l [m]	Depth z [m]
	new	change						
1	Yes		variable	10.00				on terrain

No.	Name
1	10kPa



Name : Analysis

Stage - analysis : 4 - 1





Resisting horizontal force $H_{res} = 171.56$ kN/m
Active horiz. force $H_{act} = 89.39$ kN/m

Slip along geotextile is **SATISFACTORY**

Calculation of internal stability No. 1 (Stage of construction 1)

Calculated forces and strength of reinforcements

No.	Name	F_x [kN/m]	Depth z [m]	R_t [kN/m]	Utiliz. [%]	T_p [kN/m]	Utiliz. [%]
1	Fortrac 55/30-20T (BBA)	-7.16	5.60	23.62	30.33	277.15	2.58
2	Fortrac 55/30-20T (BBA)	-10.36	5.04	23.62	43.87	230.56	4.49
3	Fortrac 55/30-20T (BBA)	-9.26	4.48	23.62	39.21	188.16	4.92
4	Fortrac 55/30-20T (BBA)	-8.16	3.92	23.62	34.56	149.96	5.44
5	Fortrac 55/30-20T (BBA)	-7.06	3.36	23.62	29.90	115.95	6.09
6	Fortrac 55/30-20T (BBA)	-5.96	2.80	23.62	25.25	86.14	6.92
7	Fortrac 55/30-20T (BBA)	-4.86	2.24	23.62	20.59	60.52	8.04
8	Fortrac 55/30-20T (BBA)	-3.77	1.68	23.62	15.94	39.10	9.63
9	Fortrac 55/30-20T (BBA)	-2.67	1.12	23.62	11.28	21.87	12.19
10	Fortrac 55/30-20T (BBA)	-1.94	0.56	23.62	8.20	8.84	21.91

Check for tensile strength (reinforcement No.2)

Tension strength $R_t = 23.62$ kN/m
Force in reinforcement $F_x = 10.36$ kN/m

Reinforcement for tensile strength is **SATISFACTORY**

Check for pull out resistance (reinforcement No.10)

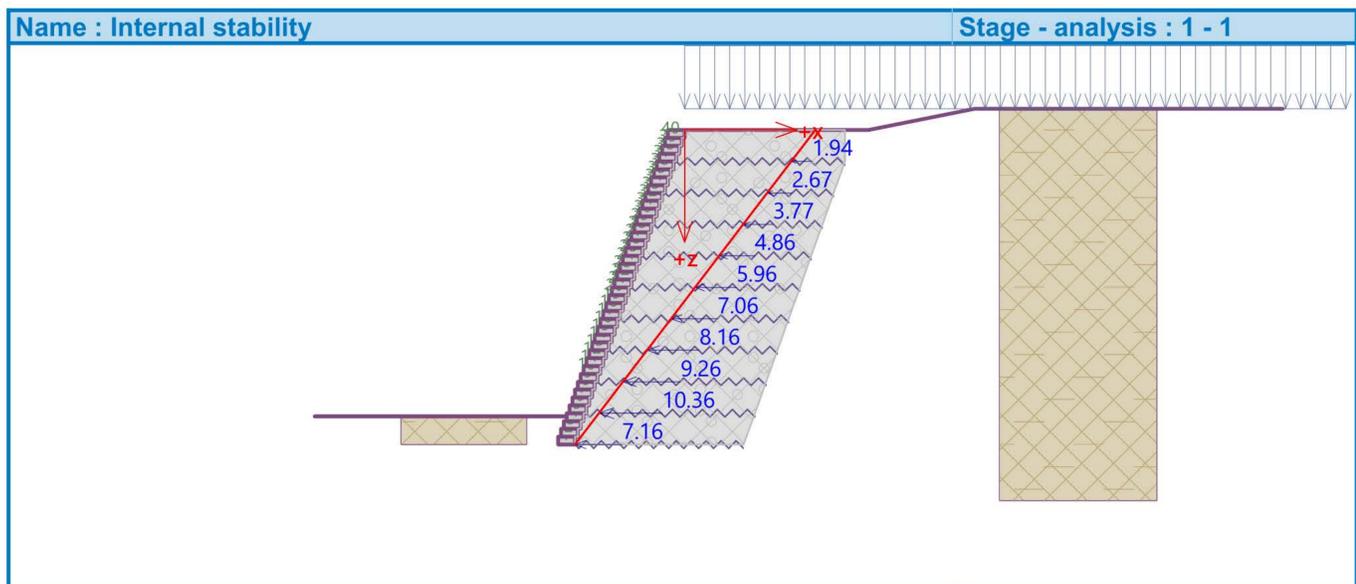
Pull out resistance $T_p = 8.84$ kN/m
Force in reinforcement $F_x = 1.94$ kN/m

Reinforcement for pull out resistance is **SATISFACTORY**

Overall verification - reinforcement is **SATISFACTORY**

Pattern

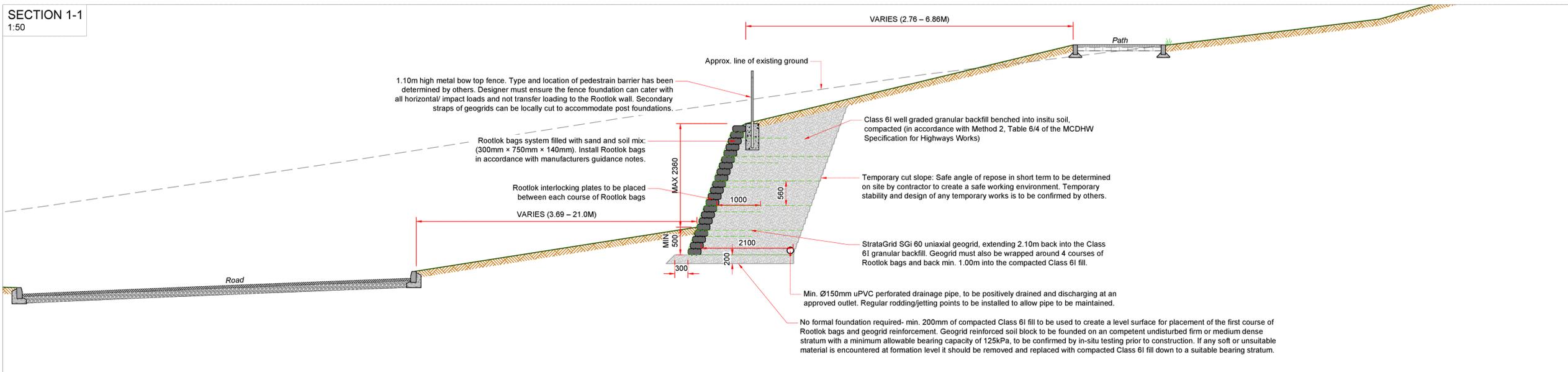
analysis : 1 - 0



Surcharge change

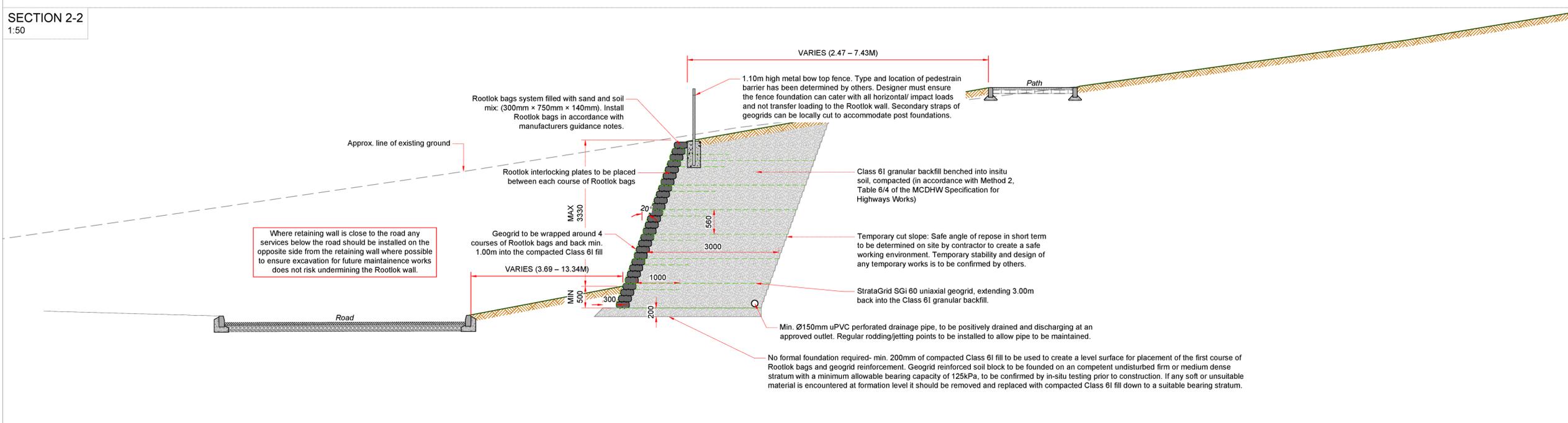
No.	Surcharge		Action	Mag.1 [kN/m ²]	Mag.2 [kN/m ²]	Ord.x x [m]	Length l [m]	Depth z [m]
	new	change						
1	Yes		variable	10.00				on terrain
No.	Name							
1	10kPa							

SECTION 1-1
1:50



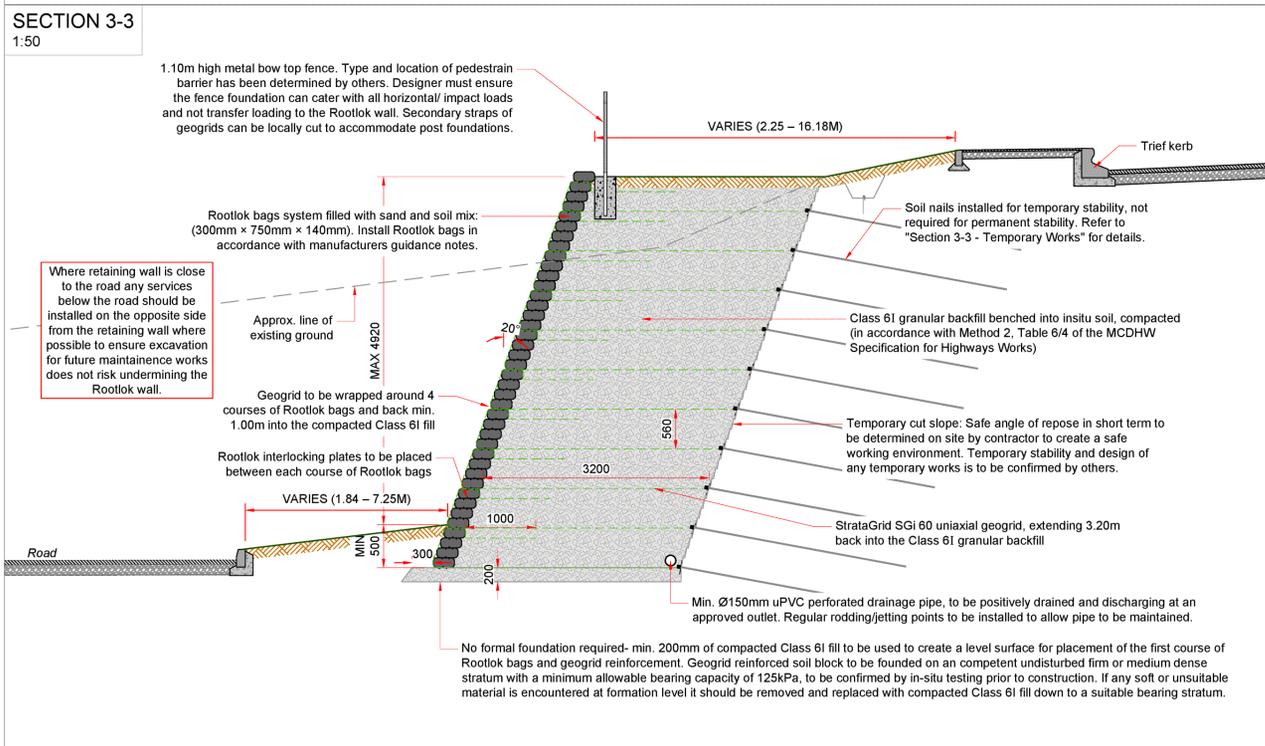
- NOTES:**
- All dimensions in mm's unless otherwise specified.
 - WALL SPECIFICATION:**
Facing units to consist of Geogrow Ltd. Rootlok bags system filled with sand and soil mix: (300mm x 750mm x 140mm) as per manufacturers details. Interlocking plates to be provided between courses of Rootlok bags.
Soil reinforcement to consist of StrataGrid SGI 60 geogrid, installed at maximum 500mm vertical centres (4 bags) and wrapped around and back min. 1.00m into the reinforced fill.
 - INSTALLATION:**
Please refer to standard manufacturer's installation guidelines. A specialist installer, approved by Geogrow Ltd. and experienced with constructing reinforced earth slopes should be employed to install works.
 - BACKFILL TO THE ROOTLOK WALL:**
Imported well graded granular fill compliant with Class 61 fill, as defined by Series 600 of the MCHW Specification for Highway Works, must be used as the reinforced backfill. Suitable material must be placed and compacted in accordance with the MCHW Specification for Highway Works, Series 600, Table 6/4 Method 2.
The Principal Contractor is responsible for the selection of this material to ensure compliance with the geotechnical characteristics specified in the 'Series 600' of the MCHW Specification for Highway Works, as shown on the relevant drawings and in the design documents/calculations, namely:
Class 61 fill: $\phi' = 35^\circ$, $\gamma = 19kN/m^3$ and $c' = 0kPa$
Quality control testing should follow the principles set out in HA 44/91 and under responsibility of the Principal Contractor and Client's Consulting Engineer.
 - FOUNDATION FOR ROOTLOK WALL:**
To achieve a suitable foundation for the Rootlok wall, excavation must take place down to competent stratum consisting of competent firm or medium dense stratum and allow for the placement and compaction of a minimum 0.20m thickness of selected granular material (e.g. Class 61 with assumed properties of $\phi' = 35^\circ$, $\gamma = 19kN/m^3$ and $c' = 0kPa$).
Formation level must be on original firm or medium dense stratum and any soft loose or unsuitable material (such as peat or alluvium) present at or below formation level that does not comply with the assumed soil parameters, must be excavated out down to competent stratum and replaced with compacted Class 61 granular material.
The Principal Contractor must confirm the suitability of the founding material prior to construction commencing. In-situ plate bearing tests are to be carried out to confirm the allowable bearing capacity, or hand shear vane tests should the in-situ soil be cohesive.
 - DRAINAGE**
A 150mm ϕ perforated drainage pipe should be placed along the full length of the slope as shown on the cross-sections. This should be fully rodtable/jettable and connected to appropriate site drainage outlet. Intermediate rodding points are required to ensure the full length of drainage can be accessed. The drainage should be regularly maintained.
 - SITE / IN-SITU SOILS:**
It is assumed the in-situ soils have the following properties as a minimum:
Foundation/Retained (competent firm or medium dense MADE GROUND or GLACIAL TILL):
 $\phi' = 28^\circ$, $\gamma = 20 kN/m^3$ and $c' = 0 kPa$
The Principal Contractor/Client's Consulting Engineer is responsible for ensuring the in-situ soils complying with the geotechnical characteristics as shown on the relevant drawings and in the design calculations.
 - TYPICAL FRONT FACE:**
The maximum front face angle is indicated on the adjacent sections.
SHW advice (CI, 610.5) concerning restriction of compaction plant within 2.00m of the front face shall be followed. If face movement should occur, the next course shall be set back as necessary to ensure that overall face batter remains at or below the permitted maximum.
 - PEDESTRIAN/VEHICULAR BARRIERS:**
All pedestrian and vehicular protection to be included at the crest of the reinforced earth slope to be designed by others. Pedestrian barriers are subject to detailed design by a suitably qualified consulting engineer and are outside Geoman's scope.
 - STABILITY OF TEMPORARY EXCAVATION**
This solution is for the permanent works only, and is issued on the basis that a safe system of works is provided for construction. Temporary excavations have the potential to fail rapidly and without warning. The Principal Contractor/Rootlok slope installer must produce a method statement and risk assessment for the works to be approved by the Client's Consulting Engineer.
With the exception of the areas covered by Section 3-3 (approx. CH30 - 80m) temporary stability and design of any temporary works is entirely outside our scope and should be confirmed by others.
 - STATUTORY APPROVALS (GEOTECHNICAL CERTIFICATION)**
The Client/Client's Consulting Engineer must check to see if any statutory approvals such as Geotechnical Certification are required for proposed works. If approvals are required, this must be gained prior to construction. If construction proceeds prior to necessary approvals being required then it does so at the Client's own risk.
 - VEGETATION ESTABLISHMENT**
The Rootlok bags must be infilled with a sand and topsoil mix as recommended by the manufacturers. The Principal Contractor must accept it will be their responsibility to ensure successful vegetation achieved by careful construction, inclusion of suitable seeded topsoil and ensuring the Rootlok bags do not dry out. The face of the Rootlok slope is to be hydroseeded within 2 weeks of construction.
 - HEAVY CONSTRUCTION TRAFFIC OPERATING CLOSE TO THE WALL**
It should be ensured that the face batter is not compromised by the use of heavy compaction plant machinery too close to the front face of the wall. If construction plant is to traffic the crest area of the wall, a suitable haul road design must be undertaken and set back and adequate distance from the rear of the wall (designed by others). If construction plant operates on the unprotected retained material, distortion/bulging of the wall may occur.
 - TREE ROOT PROTECTION ZONE**
A tree root protection zone is located to the rear of the reinforced slope, as shown on SK18-5219-01. In this area the temporary excavation for the Rootlok wall must not fall within the tree root protection zone. Collapse of the temporary cut near the TRP zone occurred prior to construction of the wall, reducing the space available to batter back the temporary excavation. Permanent sheet piles to be designed by others are to be installed prior construction of the Rootlok wall to allow for the safe excavation of the slipped material (CH130 - 161.77m).
 - NOTES ON CALCULATIONS/DRAWINGS:**
These plans and the accompanying design documentation should be thoroughly checked by the Client's Consulting Engineer. Any apparent errors, omissions or variations should be reported immediately to Geoman Ltd. Construction of these walls shall not commence unless and until the Client/Client's Consulting Engineer has considered the Geoman Design Submission Document (CDS Ref: 18-5219) to ensure that there are no errors, omissions or conflict with the scheme design.
The installer must have received a copy of the material supplier's risk assessment prior to the start of construction and take account of the content in their method of construction.
This drawing, or design proposal, remains the copyright of Geoman Ltd and is not to be copied or disclosed to any persons other than the person to whom it is originally intended.

SECTION 2-2
1:50

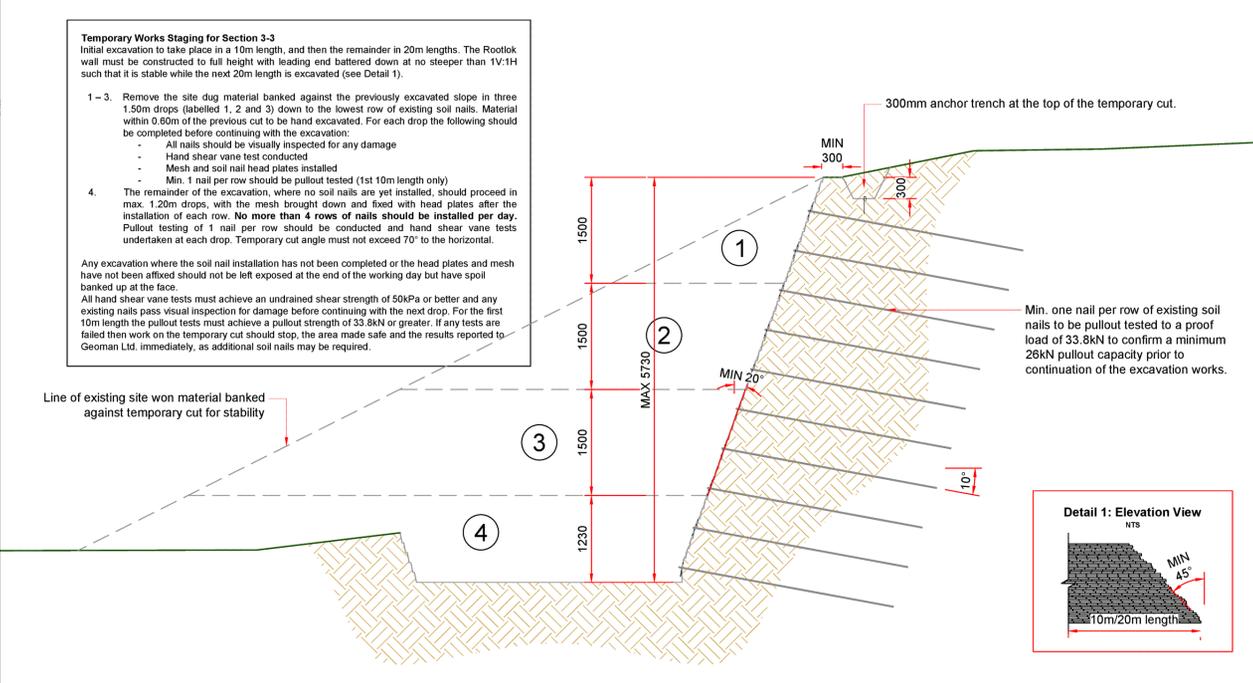


- NOTES:**
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SECTION 3-3
1:50



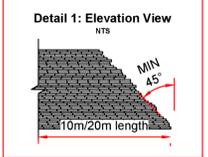
SECTION 3-3 - TEMPORARY WORKS
1:50



Temporary Works Staging for Section 3-3
Initial excavation to take place in a 10m length, and then the remainder in 20m lengths. The Rootlok wall must be constructed to full height with leading end battered down at no steeper than 1V:1H such that it is stable while the next 20m length is excavated (see Detail 1).

- Remove the site dug material banked against the previously excavated slope in three 1.50m drops (labelled 1, 2 and 3) down to the lowest row of existing soil nails. Material within 0.50m of the previous cut to be hand excavated. For each drop the following should be completed before continuing with the excavation:
 - All nails should be visually inspected for any damage
 - Hand shear vane test conducted
 - Mesh and soil nail head plates installed
 - Min. 1 nail per row should be pulout tested (1st 10m length only)
- The remainder of the excavation, where no soil nails are yet installed, should proceed in max. 1.20m drops, with the mesh brought down and fixed with head plates after the installation of each row. No more than 4 rows of nails should be installed per day. Pulout testing of 1 nail per row should be conducted and hand shear vane tests undertaken at each drop. Temporary cut angle must not exceed 70° to the horizontal.

Any excavation where the soil nail installation has not been completed or the head plates and mesh have not been affixed should not be left exposed at the end of the working day but have spoil banked up at the face.
All hand shear vane tests must achieve an undrained shear strength of 50kPa or better and any existing nails pass visual inspection for damage before continuing with the next drop. For the first 10m length the pulout tests must achieve a pulout strength of 33.8kN or greater. If any tests are failed then work on the temporary cut should stop, the area made safe and the results reported to Geoman Ltd. immediately, as additional soil nails may be required.



FOR APPROVAL

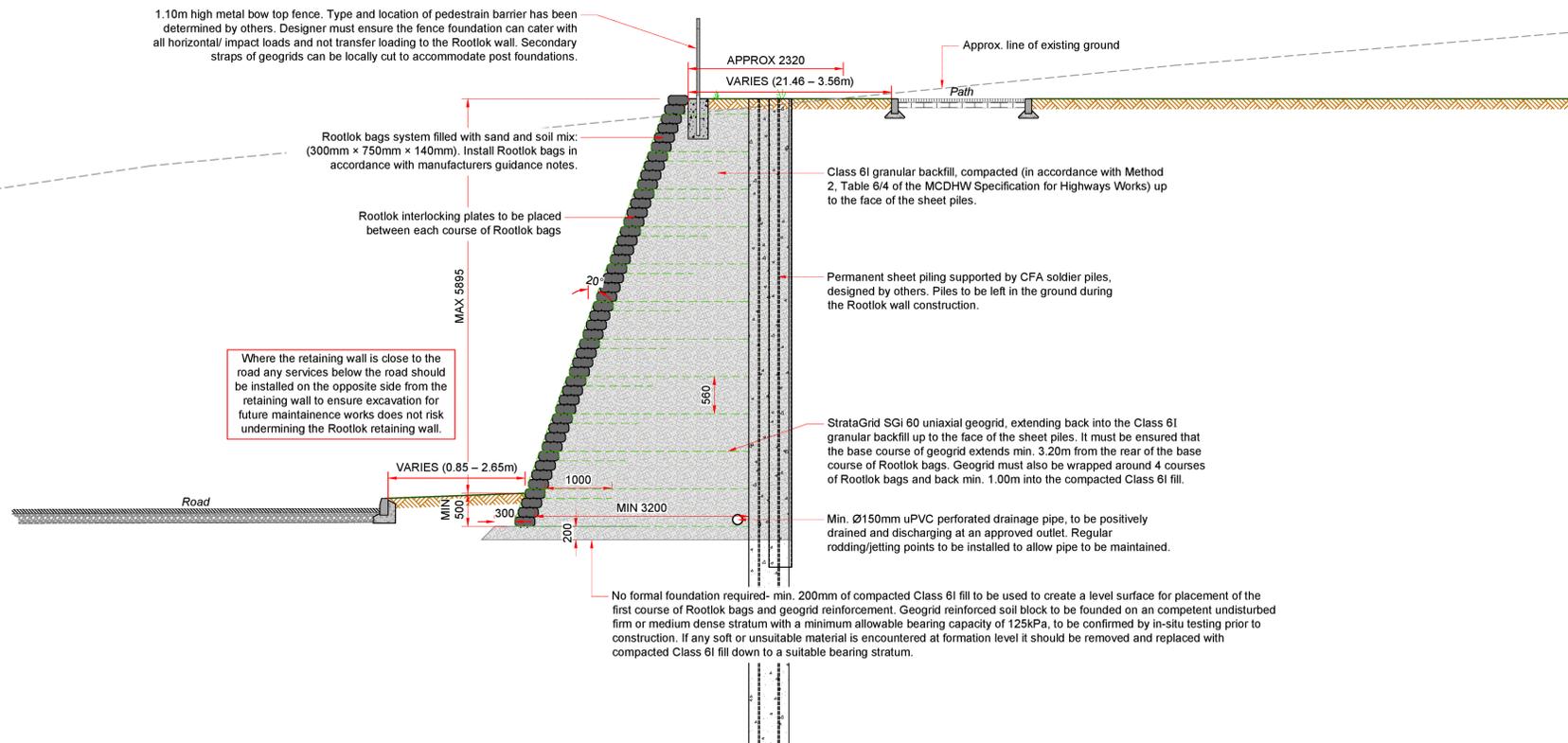
G	Changed Forcra to StrataGrid	KK	31/07/20
F	Various amendments	KK	02/10/19
E	Leveling pad amended	KK	16/08/19
D	Wall 1 removed	KK	08/05/19
C	Various amendments	KK	29/04/19
B	Line of wall amended	KK	12/04/19
A	Class 7D backfill added	KK	08/04/19
0		KK	21/03/19

Rev. Issue / Revision: _____ Drawn: Date: _____
Designer: **GEOMAN**
14 Elmwood Avenue, Balfas, BT8 6AZ, 0280 664041 geoman@geoman.co.uk

Project Title: **LAWLEY PHASE 10**
Client: **GEOGROW LTD**
Drawing Title: **ROOTLOK RETAINING WALL GENERAL ARRANGEMENT (3 OF 4)**
Designed: KK Date: 21/03/19 Project No: 18-5219
Drawn: KK Date: 21/03/19
Checked: JH Date: 29/04/19 Scale: AS INDICATED AT A1
Drawing No: **SK18-5219-03** Revision: **G**

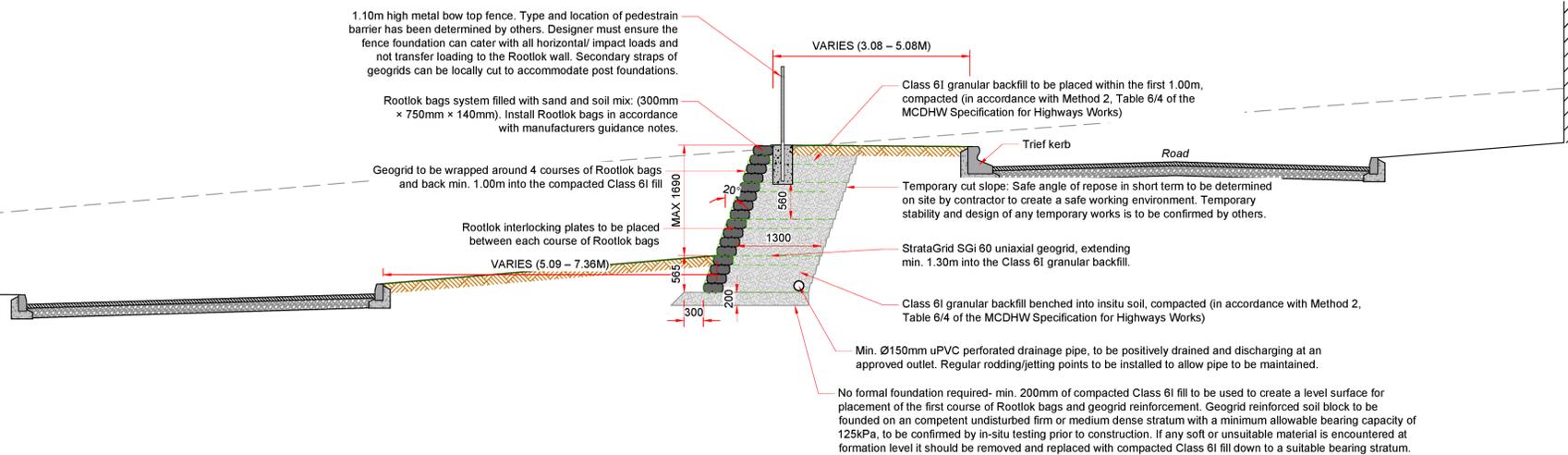
SECTION 4-4

1:50



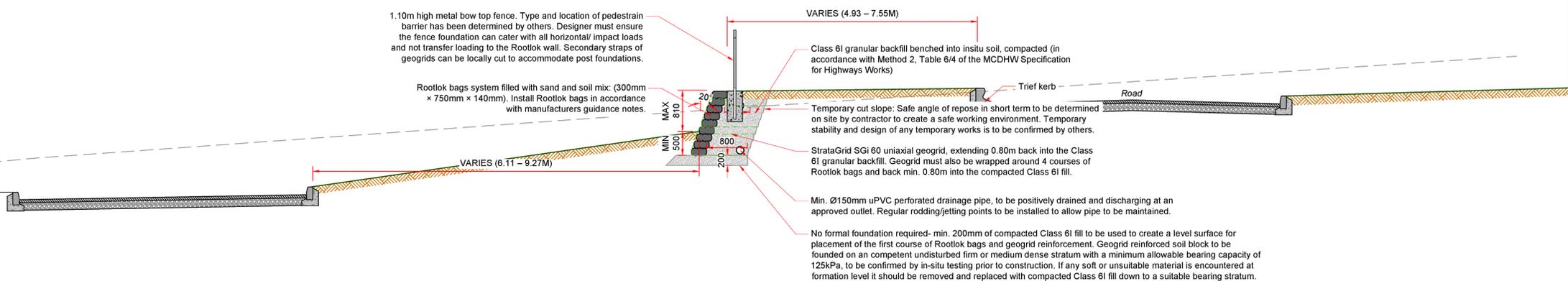
SECTION 5-5

1:50



SECTION 6-6

1:50



NOTES: 1) All dimensions in mm's unless otherwise specified.

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5) FOUNDATION FOR ROOTLOK WALL: To achieve a suitable foundation for the Rootlok wall, excavation must take place down to competent stratum consisting of competent firm or medium dense stratum and allow for the placement and compaction of a minimum 0.20m thickness of selected granular material (e.g. Class 61 with assumed properties of $\phi' = 35^\circ$, $\gamma = 19kN/m^3$ and $c' = 0kPa$).

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The Principal Contractor must confirm the suitability of the founding material prior to construction commencing. In-situ plate bearing tests are to be carried out to confirm the allowable bearing capacity, or hand shear vane tests should the in-situ soil be cohesive.

6) DRAINAGE: A 150mm ϕ perforated drainage pipe should be placed along the full length of the slope as shown on the cross-sections. This should be fully roddable/jettable and connected to appropriate site drainage outlet. Intermediate rodding points are required to ensure the full length of drainage can be accessed. The drainage should be regularly maintained.

7) SITE / IN-SITU SOILS: It is assumed the in-situ soils have the following properties as a minimum: Foundation/Retained (competent firm or medium dense MADE GROUND or GLACIAL TILL): $\phi' = 28^\circ$, $\gamma = 20 kN/m^3$ and $c' = 0 kPa$

The Principal Contractor/Client's Consulting Engineer is responsible for ensuring the in-situ soils complying with the geotechnical characteristics as shown on the relevant drawings and in the design calculations.

8) TYPICAL FRONT FACE: The maximum front face angle is indicated on the adjacent sections. SHW advice (CI 610.5) concerning restriction of compaction plant within 2.00m of the front face shall be followed. If face movement should occur, the next course shall be set back as necessary to ensure that overall face batter remains at or below the permitted maximum.

9) PEDESTRIAN/VEHICULAR BARRIERS: All pedestrian and vehicular protection to be included at the crest of the reinforced earth slope to be designed by others. Pedestrian barriers are subject to detailed design by a suitably qualified consulting engineer and are outside Geoman's scope.

10) STABILITY OF TEMPORARY EXCAVATION: This solution is for the permanent works only, and is issued on the basis that a safe system of works is provided for construction. Temporary excavations have the potential to fail rapidly and without warning. The Principal Contractor/Rootlok slope installer must produce a method statement and risk assessment for the works to be approved by the Client's Consulting Engineer.

With the exception of the areas covered by Section 3-3 (approx. CH30 - 80m) temporary stability and design of any temporary works is entirely outside our scope and should be confirmed by others.

11) STATUTORY APPROVALS (GEOTECHNICAL CERTIFICATION): The Client/Client's Consulting Engineer must check to see if any statutory approvals such as Geotechnical Certification are required for proposed works. If approvals are required, this must be gained prior to construction. If construction proceeds prior to necessary approvals being required then it does so at the Client's own risk.

12) VEGETATION ESTABLISHMENT: The Rootlok bags must be infilled with a sand and topsoil mix as recommended by the manufacturers. The Principal Contractor must accept it will be their responsibility to ensure successful vegetation achieved by careful construction, inclusion of suitable seeded topsoil and ensuring the Rootlok bags do not dry out. The face of the Rootlok slope is to be hydroseeded within 2 weeks of construction.

13) HEAVY CONSTRUCTION TRAFFIC OPERATING CLOSE TO THE WALL: It should be ensured that the face batter is not compromised by the use of heavy compaction plant machinery too close to the front face of the wall. If construction plant is to traffic the crest area of the wall, a suitable haul road design must be undertaken and set back and adequate distance from the rear of the wall (designed by others). If construction plant operates on the unprotected retained material, distortion/bulging of the wall may occur.

14) TREE ROOT PROTECTION ZONE: A tree root protection zone is located to the rear of the reinforced slope, as shown on SK18-5219-01. In this area the temporary excavation for the Rootlok wall must not fall within the tree root protection zone. Collapse of the temporary cut near the TRP zone occurred prior to construction of the wall, reducing the space available to batter back the temporary excavation. Permanent sheet piles to be designed by others are to be installed prior construction of the Rootlok wall to allow for the safe excavation of the slipped material (CH130 - 161.77m).

15) NOTES ON CALCULATIONS/DRAWINGS: These plans and the accompanying design documentation should be thoroughly checked by the Client's Consulting Engineer. Any apparent errors, omissions or variations should be reported immediately to Geoman Ltd. Construction of these walls shall not commence unless and until the Client/Client's Consulting Engineer has considered the Geoman Design Submission Document (CPRS Ref: 18-5219) to ensure that there are no errors, omissions or conflict with the scheme design.

The installer must have received a copy of the material supplier's risk assessment prior to the start of construction and take account of the content in their method of construction.

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FOR APPROVAL

H	Restored Section 4-4 to 3.20m wide	KK	16/09/20
G	Changed Fortrac to StrataGrid	KK	31/07/20
F	Various amendments	KK	02/10/19
E	Levelling pad amended, soil nail pullout increased	KK	16/08/19
D	Wall 1 removed, Section 6-6 added	KK	08/05/19
C	Various amendments	KK	29/04/19
B	Line of wall amended	KK	12/04/19
A	Class 7D backfill added	KK	08/04/19
0		KK	21/03/19

Rev. Issue / Revision: Drawn: Date:

Designer: **GEOMAN**
14 Elmwood Avenue, Bulford, B75 6AZ, 02950 66491, geoman@geoman.co.uk

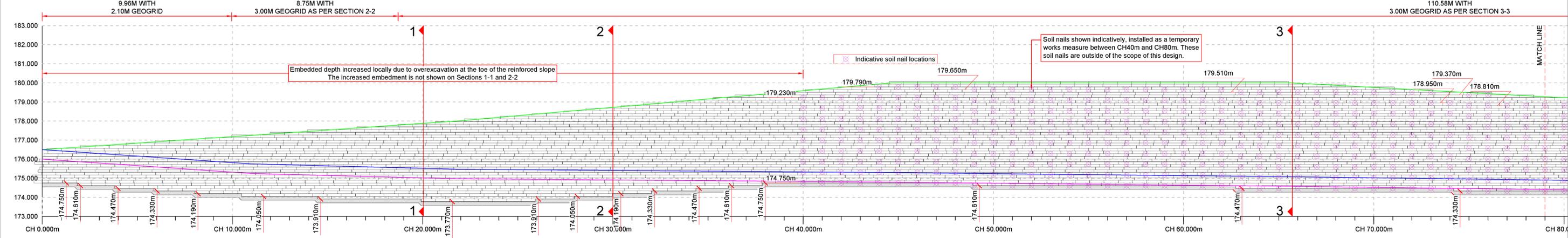
Project Title: **LAWLEY PHASE 10**

Client: **GEOGROW LTD**

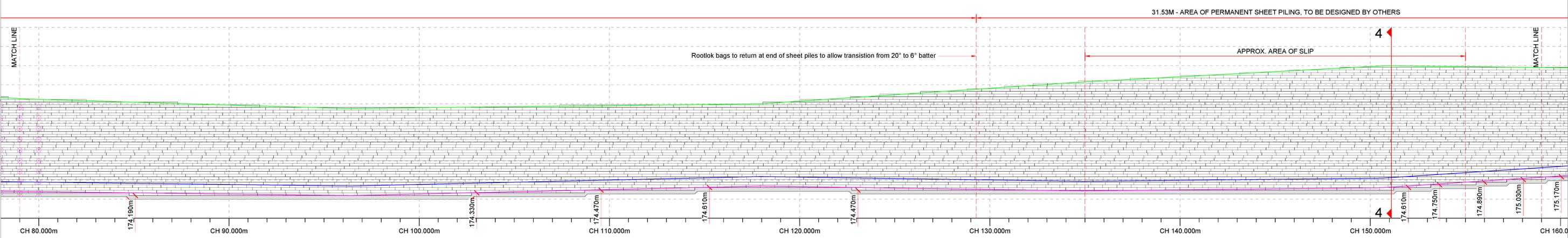
Drawing Title: **ROOTLOK RETAINING WALL GENERAL ARRANGEMENT (4 OF 4)**

Designed:	KK	Date:	21/03/19	Project No:	18-5219
Drawn:	KK	Date:	21/03/19		
Checked:	JK	Date:	29/04/19	Scale:	AS INDICATED AT A1
Drawing No:	SK18-5219-04			Revision:	H

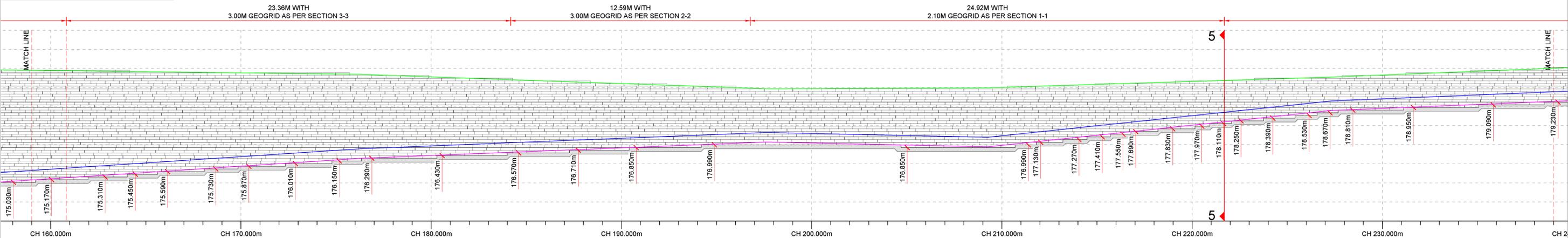
INDICATIVE ELEVATION (1 OF 4)
1:100



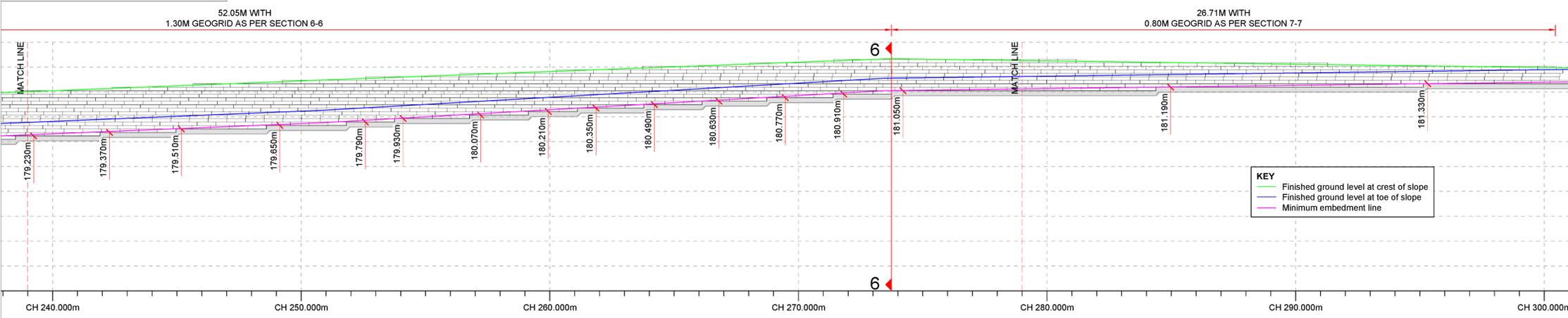
INDICATIVE ELEVATION (2 OF 4)
1:100



INDICATIVE ELEVATION (3 OF 4)
1:100



INDICATIVE ELEVATION (4 OF 4)
1:100



KEY

- Finished ground level at crest of slope
- Finished ground level at toe of slope
- Minimum embedment line

FOR APPROVAL

NOTES:
FULL NOTES INCLUDED ON GEOMAN LTD DRAWINGS
SK18-5219-01, -03 AND -04. THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH THE NOTES INCLUDED ON GEOMAN LTD DRAWINGS SK18-5219-01, -03 AND -04.

1) All dimensions in mm unless otherwise specified.

2) WALL SPECIFICATION:
Facing units to consist of Geogrow Ltd. Rootlok bags system filled with sand and soil mix (300mm x 750mm x 140mm) as per manufacturers details. Interlocking plates to be provided between courses of Rootlok bags.

3) INSTALLATION:
Please refer to standard manufacturer's installation guidelines. A specialist installer, approved by Geogrow Ltd. and experienced with constructing reinforced earth slopes should be employed to install works.

4) NOTES ON CALCULATIONS/DRAWINGS:
These plans and the accompanying design documentation should be thoroughly checked by the Client's Consulting Engineer. Any apparent errors, omissions or variations should be reported immediately to Geoman Ltd. Construction of these walls shall not commence unless and until the Client/Client's Consulting Engineer has considered the Geoman Design Submission Document (GSDS Ref: 18-5219) to ensure that there are no errors, omissions or conflict with the scheme design.

The installer must have received a copy of the material supplier's risk assessment prior to the start of construction and take account of the content in their method of construction.

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Rev	Issue / Revision:	Drawn: Date:
I	Additional info about sheet pile area added	KK 11/09/20
H	Changed Fortrac to StrataGrid	KK 31/07/20
G	Various amendments	KK 02/10/19
F	Additional embedment CH0-40m, levelling pad adj.	KK 16/08/19
E	Line of wall amended	KK 11/07/19
D	Wall 1 removed	KK 08/05/19
C	Various amendments	KK 29/04/19
B	Line of wall amended	KK 12/04/19
A	Minor amendments	KK 08/04/19
C		KK 21/03/19

Designer: **GEOMAN**
44 Elmwood Avenue, Belfast, BT9 5AZ, Q290 84541 | geoman@geoman.co.uk

Project Title: **LAWLEY PHASE 10**

Client: **GEOGROW LTD**

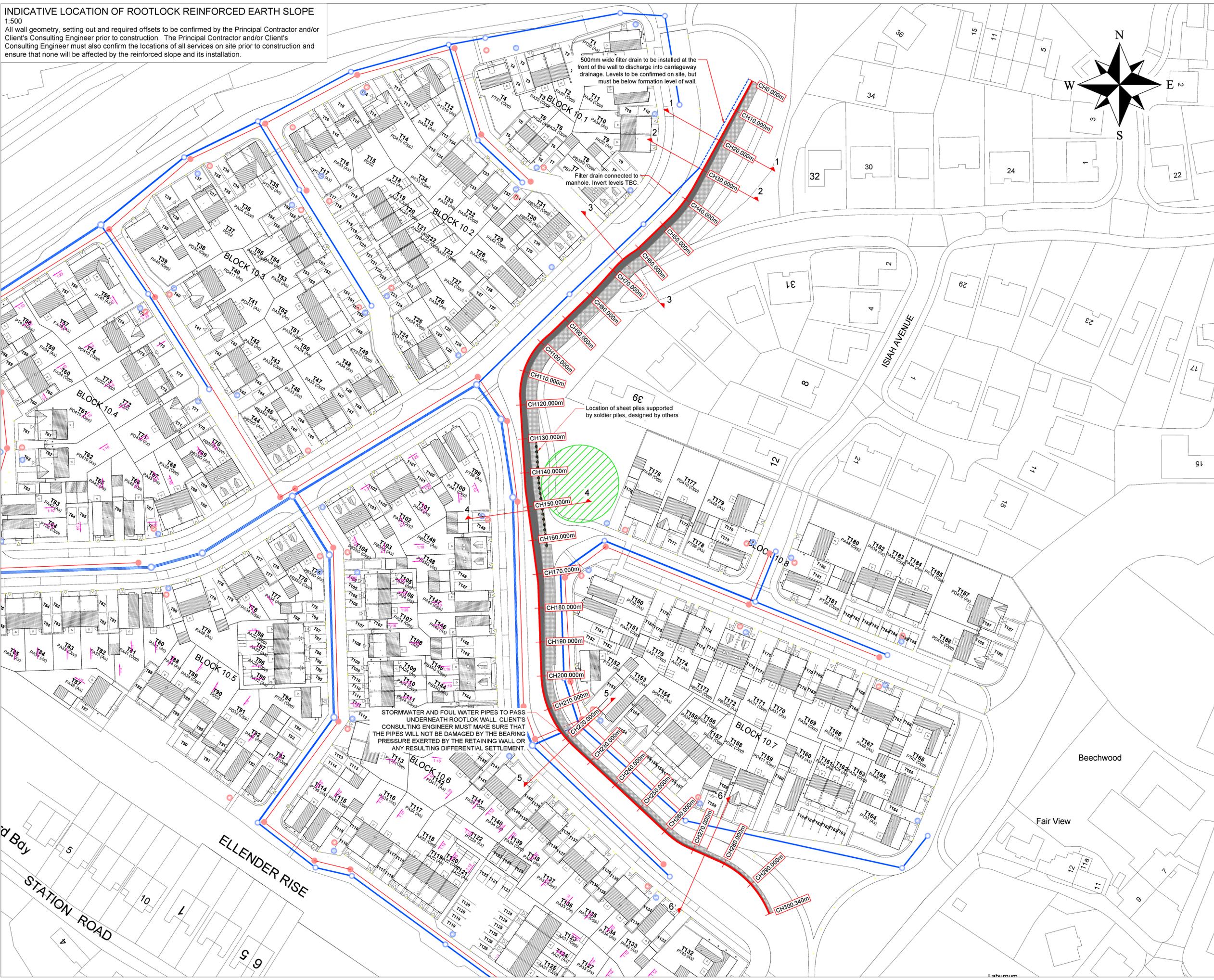
Drawing Title: **ROOTLOK RETAINING WALL GENERAL ARRANGEMENT (2 OF 4)**

Designed: KK	Date: 21/03/19	Project No: 18-5219
Drawn: KK	Date: 21/03/19	Scale: AS INDICATED AT A1
Checked: JH	Date: 29/04/19	Revision: 1

Drawing No: **SK18-5219-02**

INDICATIVE LOCATION OF ROOTLOCK REINFORCED EARTH SLOPE 1:500

All wall geometry, setting out and required offsets to be confirmed by the Principal Contractor and/or Client's Consulting Engineer prior to construction. The Principal Contractor and/or Client's Consulting Engineer must also confirm the locations of all services on site prior to construction and ensure that none will be affected by the reinforced slope and its installation.



500mm wide filter drain to be installed at the front of the wall to discharge into carriageway drainage. Levels to be confirmed on site, but must be below formation level of wall.

Filter drain connected to manhole. Invert levels TBC.

Location of sheet piles supported by soldier piles, designed by others

STORMWATER AND FOUL WATER PIPES TO PASS UNDERNEATH ROOTLOCK WALL. CLIENT'S CONSULTING ENGINEER MUST MAKE SURE THAT THE PIPES WILL NOT BE DAMAGED BY THE BEARING PRESSURE EXERTED BY THE RETAINING WALL OR ANY RESULTING DIFFERENTIAL SETTLEMENT.

NOTES:
1) All dimensions in mm's unless otherwise specified.

2) WALL SPECIFICATION:
Facing units to consist of Geogrow Ltd. Rootlock bags system filled with sand and soil mix: (300mm x 750mm x 140mm) as per manufacturer's details. Interlocking plates to be provided between courses of Rootlock bags.
Soil reinforcement to consist of StrataGrid SGI 60 geogrid, installed at maximum 500mm vertical centres (4 bags) and wrapped around and back min. 1.00m into the reinforced fill.

3) INSTALLATION:
Please refer to standard manufacturer's installation guidelines. A specialist installer, approved by Geogrow Ltd. and experienced with constructing reinforced earth slopes should be employed to install works.

4) BACKFILL TO THE ROOTLOCK WALL:
Imported well graded granular fill compliant with Class 6/1, as defined by Series 600 of the MCHW Specification for Highway Works, must be used as the reinforced backfill. Suitable material must be placed and compacted in accordance with the MCHW Specification for Highway Works, Series 600, Table 6/4 Method 2.

The Principal Contractor is responsible for the selection of this material to ensure compliance with the geotechnical characteristics specified in the 'Series 600' of the MCHW Specification for Highway Works, as shown on the relevant drawings and in the design documents/calculations, namely:
Class 6/1 fill: $\phi = 35^\circ$, $\gamma = 19kN/m^3$ and $c' = 0kPa$

Quality control testing should follow the principles set out in HA 44/91 and under responsibility of the Principal Contractor and Client's Consulting Engineer.

5) FOUNDATION FOR ROOTLOCK WALL:
To achieve a suitable foundation for the Rootlock wall, excavation must take place down to competent stratum consisting of competent firm or medium dense stratum and allow for the placement and compaction of a minimum 0.20m thickness of selected granular material (e.g. Class 6/1 with assumed properties of $\phi = 35^\circ$, $\gamma = 19kN/m^3$ and $c' = 0kPa$).

Formation level must be on original firm or medium dense stratum and any soft loose or unsuitable material (such as peat or alluvium) present at or below formation level that does not comply with the assumed soil parameters, must be excavated out down to competent stratum and replaced with compacted Class 6/1 granular material.

The Principal Contractor must confirm the suitability of the founding material prior to construction commencing. In-situ plate bearing tests are to be carried out to confirm the allowable bearing capacity, or hand shear vane tests should the in-situ soil be cohesive.

6) DRAINAGE
A 150mm ϕ perforated drainage pipe should be placed along the full length of the slope as shown on the cross-sections. This should be fully rodable/jettable and connected to appropriate site drainage outlet. Intermediate rodding points are required to ensure the full length of drainage can be accessed. The drainage should be regularly maintained.

7) SITE / IN-SITU SOILS:
It is assumed the in-situ soils have the following properties as a minimum: Foundation/Retained (competent firm or medium dense MADE GROUND or GLACIAL TILL):
 $\phi = 28^\circ$, $\gamma = 20 kN/m^3$ and $c' = 0 kPa$

The Principal Contractor/Client's Consulting Engineer is responsible for ensuring the in-situ soils complying with the geotechnical characteristics as shown on the relevant drawings and in the design calculations.

8) TYPICAL FRONT FACE:
The maximum front face angle is indicated on the adjacent sections. SHW advice (CI 610.5) concerning restriction of compaction plant within 2.00m of the front face shall be followed. If face movement should occur, the next course shall be set back as necessary to ensure that overall face batter remains at or below the permitted maximum.

9) PEDESTRIAN/VEHICULAR BARRIERS:
All pedestrian and vehicular protection to be included at the crest of the reinforced earth slope to be designed by others. Pedestrian barriers are subject to detailed design by a suitably qualified consulting engineer and are outside Geoman's scope.

10) STABILITY OF TEMPORARY EXCAVATION
This solution is for the permanent works only, and is issued on the basis that a safe system of works is provided for construction. Temporary excavations have the potential to fail rapidly and without warning. The Principal Contractor/Rootlock slope installer must produce a method statement and risk assessment for the works to be approved by the Client's Consulting Engineer.

11) STATUTORY APPROVALS (GEOTECHNICAL CERTIFICATION)
The Client/Client's Consulting Engineer must check to see if any statutory approvals such as Geotechnical Certification are required for proposed works. If approvals are required, this must be gained prior to construction. If construction proceeds prior to necessary approvals being required then it does so at the Client's own risk.

12) VEGETATION ESTABLISHMENT
The Rootlock bags must be infilled with a sand and topsoil mix as recommended by the manufacturers. The Principal Contractor must accept it will be their responsibility to ensure successful vegetation achieved by careful construction, inclusion of suitable seeded topsoil and ensuring the Rootlock does not dry out. The face of the Rootlock slope is to be hydroseeded within 2 weeks of construction.

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It should be ensured that the face batter is not compromised by the use of heavy compaction plant machinery too close to the front face of the wall. If construction plant is to traffic the crest area of the wall, a suitable haul road design must be undertaken and set back and adequate distance from the rear of the wall (designed by others). If construction plant operates on the unprotected retained material, distortion/bulging of the wall may occur.

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A tree root protection zone is located to the rear of the reinforced slope, as shown on SK18-5219-01. In this area the temporary excavation for the Rootlock wall must not fall within the tree root protection zone. Collapse of the temporary cut near the TRP zone occurred prior to construction of the wall, reducing the space available to batter back the temporary excavation. Permanent sheet piles to be designed by others are to be installed prior construction of the Rootlock wall to allow for the safe excavation of the slipped material (CH130 - 161.77m).

15) NOTES ON CALCULATIONS/DRAWINGS:
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The installer must have received a copy of the material supplier's risk assessment prior to the start of construction and take account of the content in their method of construction.

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FOR APPROVAL

J	Added filter drain at front of wall CH0 - 30m	KK	28/10/20
H	Amended sheet/soldier pile location	KK	11/09/20
G	Changed geogrid from Fortrac to StrataGrid	KK	31/07/20
F	Various amendments	KK	02/10/19
E	Line of wall amended	KK	11/07/19
D	Wall 1 removed	KK	06/05/19
C	Various amendments	KK	23/04/19
B	Line of wall amended	KK	12/04/19
A	Extents of bags & geogrid indicated, risk to pipes	KK	06/04/19
Q		KK	21/03/19
Rev.	Issue / Revision:	Drawn:	Date:

Designer:
GEOMAN
44 Elmwood Avenue, Burslem, ST6 6AZ 0290 664941 geoman@geoman.co.uk

Project Title:
LAWLEY PHASE 10

Client:
GEOGROW LTD

Drawing Title:
**ROOTLOCK RETAINING WALL
GENERAL ARRANGEMENT (1 OF 4)**

Designed:	KK	Date:	21/03/19	Project No:	18-5219
Drawn:	KK	Date:	21/03/19		
Checked:	JW	Date:	29/04/19	Scale:	AS INDICATED AT A1
Drawing No:	SK18-5219-01	Revision:	J		