Sydney, Northern Beaches & beyond. Geotechnical Consultants

87 Alexandra Crescent, Bayview

Comments on Updates to Plans

We have reviewed the existing geotechnical report, the plans used to carry out the report, and the updated plans for DA shown on 11 architectural drawings prepared by Lindsay Little & Associates, job number 1281/19, drawings numbered A02 G, A03 H, A04 G to A08 G, A09F, A10 G, A11 G and SCP-01E, dated 4/1/24.

The changes include:

- Move the proposed upper lift from the SE to NE side of the house and remove the proposed accessway for this lift. The maximum depth of the excavation under the house for the cellar store and lift remains at ~2.5m deep.
- Convert the garage roof to a concrete roof with planter box above.
- Other minor internal and external alterations and additions.

The changes to the plans slightly reduce the overall risk of the project but do not alter the recommendations in the report carried out by this firm numbered J2784E and dated the 15th December, 2022.

White Geotechnical Group Pty Ltd.

Reviewed By:

Dion Sheldon
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NATHAN GARDNER
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GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1 – To be submitted with Development Application

Development Application for ______________________________
Name of Applicant

Address of site **87 Alexandra Crescent, Bayview**

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk ***Declaration made by geotechnical engineer or engineering geologist or coastal engineer (where applicable) as part of a geotechnical report***

I, Ben White *on behalf of* White Geotechnical Group Pty Ltd
(Insert Name) (Trading or Company Name)

on this the 15/12/22 certify that I am a geotechnical engineer or engineering geologist or coastal engineer as defined by the Geotechnical Risk Management Policy for Pittwater - 2009 and I am authorised by the above organisation/company to issue this document and to certify that the organisation/company has a current professional indemnity policy of at least $10million.

I:
Please mark appropriate box

☒ have prepared the detailed Geotechnical Report referenced below in accordance with the Australia Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009

☒ am willing to technically verify that the detailed Geotechnical Report referenced below has been prepared in accordance with the Australian Geomechanics Society's Landslide Risk Management Guidelines (AGS 2007) and the Geotechnical Risk Management Policy for Pittwater - 2009

☐ have examined the site and the proposed development in detail and have carried out a risk assessment in accordance with Section 6.0 of the Geotechnical Risk Management Policy for Pittwater - 2009. I confirm that the results of the risk assessment for the proposed development are in compliance with the Geotechnical Risk Management Policy for Pittwater - 2009 and further detailed geotechnical reporting is not required for the subject site.

☐ have examined the site and the proposed development/alteration in detail and I am of the opinion that the Development Application only involves Minor Development/Alteration that does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.

☐ have examined the site and the proposed development/alteration is separate from and is not affected by a Geotechnical Hazard and does not require a Geotechnical Report or Risk Assessment and hence my Report is in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009 requirements.

☐ have provided the coastal process and coastal forces analysis for inclusion in the Geotechnical Report

Geotechnical Report Details:

Report Title: Geotechnical Report **87 Alexandra Crescent, Bayview**

Report Date: 15/12/22

Author: BEN WHITE

Author's Company/Organisation: **WHITE GEOTECHNICAL GROUP PTY LTD**

Documentation which relate to or are relied upon in report preparation:

Australian Geomechanics Society Landslide Risk Management March 2007.
White Geotechnical Group company archives.

I am aware that the above Geotechnical Report, prepared for the abovementioned site is to be submitted in support of a Development Application for this site and will be relied on by Pittwater Council as the basis for ensuring that the Geotechnical Risk Management aspects of the proposed development have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature

Name Ben White

Chartered Professional Status MScGEOLAusIMM CP GEOL

Membership No. 222757

Company White Geotechnical Group Pty Ltd

GEOTECHNICAL RISK MANAGEMENT POLICY FOR PITTWATER
FORM NO. 1(a) - Checklist of Requirements for Geotechnical Risk Management Report for Development Application

Development Application for ______________________________
Name of Applicant

Address of site **87 Alexandra Crescent, Bayview**

The following checklist covers the minimum requirements to be addressed in a Geotechnical Risk Management Geotechnical Report. This checklist is to accompany the Geotechnical Report and its certification (Form No. 1).

Geotechnical Report Details:

Report Title: Geotechnical Report **87 Alexandra Crescent, Bayview**

Report Date: 15/12/22

Author: BEN WHITE

Author's Company/Organisation: WHITE GEOTECHNICAL GROUP PTY LTD

Please mark appropriate box

☒ Comprehensive site mapping conducted **29/06/20**
(date)
☒ Mapping details presented on contoured site plan with geomorphic mapping to a minimum scale of 1:200 (as appropriate)
☒ Subsurface investigation required
- ☐ No Justification ______________________
- ☒ Yes Date conducted **29/06/20**

☒ Geotechnical model developed and reported as an inferred subsurface type-section
☒ Geotechnical hazards identified
- ☒ Above the site
- ☒ On the site
- ☒ Below the site
- ☐ Beside the site

☒ Geotechnical hazards described and reported
☒ Risk assessment conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
- ☒ Consequence analysis
- ☒ Frequency analysis

☒ Risk calculation
☒ Risk assessment for property conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Risk assessment for loss of life conducted in accordance with the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Assessed risks have been compared to "Acceptable Risk Management" criteria as defined in the Geotechnical Risk Management Policy for Pittwater - 2009
☒ Opinion has been provided that the design can achieve the "Acceptable Risk Management" criteria provided that the specified conditions are achieved.
☒ Design Life Adopted:
- ☒ 100 years
- ☐ Other ______________________
  specify

☒ Geotechnical Conditions to be applied to all four phases as described in the Geotechnical Risk Management Policy for Pittwater - 2009 have been specified
☒ Additional action to remove risk where reasonable and practical have been identified and included in the report.
☐ Risk assessment within Bushfire Asset Protection Zone.

I am aware that Pittwater Council will rely on the Geotechnical Report, to which this checklist applies, as the basis for ensuring that the geotechnical risk management aspects of the proposal have been adequately addressed to achieve an "Acceptable Risk Management" level for the life of the structure, taken as at least 100 years unless otherwise stated, and justified in the Report and that reasonable and practical measures have been identified to remove foreseeable risk.

Signature ______________________

Name Ben White

Chartered Professional Status MScGEOLAusIMM CP GEOL

Membership No. 222757

Company White Geotechnical Group Pty Ltd

GEOTECHNICAL INVESTIGATION:

Alterations and Additions at **87 Alexandra Crescent, Bayview.**

1. Proposed Development

1.1 Convert the existing carport into a garage and extend on the NE side by excavating to a maximum depth of ~3.9m.

1.2 Construct a lift on the downhill side of the house with accessway that connects the garage with the lift by excavating to a maximum depth of ~6.4m.

1.3 Construct a new lift with accessway connecting the lower ground floor of the house to the first floor by excavating to a maximum depth of ~2.5m.

1.4 Various other minor internal and external alterations to the existing house.

1.5 Details of the proposed development are shown on 10 drawings prepared by Lindsay Little & Associates, job number 1281/19. Drawings numbered A02 to A08 and A10 to A11 are dated 2/11/22. Drawing number A09 is dated 26/7/22.

2. Site Description

2.1 The site was inspected on the 29th of June, 2020, the 11th October, 2021 and the 12th October, 2021.

2.2 This residential property is located off the turning circle at the end of the street. It is on the high side of the road and has a N aspect. It is located on the steeply graded upper middle reaches of a hillslope. The natural slope rises at an angle of ~29° from the downhill property boundary to the downhill side of the house. The slope then eases to an angle of ~19° before reaching a sandstone bedrock cliff face up to ~7m high. The slope above the property decreases in grade and the slope below the property gradually eases.

2.3 At the road frontage a concrete driveway runs to a carport cut into the slope (Photo 1). The cut is supported by sandstone block, brick and concrete block retaining walls up to ~3.4m high (Photos 1 to 3). The highest portion of the sandstone block wall is supported by a brick wall in front of the base of the retaining wall (Photo 2). The retaining walls are considered to be stable. Between the carport and the house is a steep and thickly vegetated slope (Photo 1). The part three storey rendered brick and weatherboard clad house is supported by brick walls and brick piers Photos (1 & 4). The supporting walls and piers stand vertical and show no significant signs of movement (Photo 5). Uphill of the house a cut in the slope provides a level platform for the house. The cut is supported by concrete block and sandstone flagging retaining walls up to ~2.7m high. (Photos 6 & 7). The W portion of the concrete block retaining wall is tilting at up to ~4° from vertical. See 'Section 16 Ongoing Maintenance'. A Medium Strength Sandstone bedrock cliff face up to ~7m outcrops above the cut for the house (Photo 8). A portion of the cliff face is undercut by up to ~4.4m (Photo 9). The undercut is considered stable. No geotechnical hazards were observed on the neighbouring properties that could impact on the subject property as seen from the street and subject property.

3. Geology

The Sydney 1:100 000 Geological sheet indicates the site is underlain by the Newport Formation of the Narrabeen Group with the contact point of Hawkesbury Sandstone expected to be at the base of the sandstone rock face above the house. It is interpreted from ground tests and observations of the outcropping rock that the proposed works are underlain by the Newport Formation of the Narrabeen Group.

4. Subsurface Investigation

Two bore holes (BH) were drilled at the location of the proposed lift and lift accessway to determine the depth and strength of the rock. The drill used was a hand portable rig running an NMLC core barrel. Six Dynamic Cone Penetrometer (DCP) tests were put down to determine the relative density of the overlying soil and the depth to weathered rock. The locations of the tests are shown on the site plan. It should be noted that a level of caution should be applied when interpreting DCP test results. The test will not pass through hard buried objects so in some instances it can be difficult to determine whether refusal has occurred on an obstruction in the profile or on the natural rock surface. This may have occurred for DCP4. Due to the possibility that the actual ground conditions vary from our interpretation there should be allowances in the excavation and foundation budget to account for this. We refer to the appended "Important Information about Your Report" to further clarify. The results are as follows:

BORE HOLE 1 (~RL72.9) **–** BH1 (Photo 11)

Depth (m)	**Material Encountered**
0.0 to 1.0	**FILL**.

Start of Bore Hole at 1.0m:

1.0 to 2.2	**CLAY**, brown orange and grey, stiff.
2.2 to 2.4	**EXTREMELY LOW STRENGTH SHALE**, grey.
2.4 to 3.0	**VERY LOW STRENGTH SHALE**, grey and black/dark brown.
3.0 to 4.14	**LOW STRENGTH SHALE**, black/dark brown, grey and orange, parting at variable intervals of between 2cm to 13cm.
4.14 to 4.31	**CORE LOSS**.
4.31 to 7.1	**LOW STRENGTH SHALE**, black/dark brown and grey, with grey sandstone laminite, parting at variable intervals of between 2cm to 12cm.

End of hole @ 7.1m in Low Strength Shale. No watertable encountered.

BORE HOLE 2 (~RL73.0) **–** BH2 (Photo 12)

Depth (m)	**Material Encountered**
0.0 to 0.6	**CLAY**.

Start of Bore Hole at 0.6m:

0.6 to 1.3	**EXTREMELY LOW STRENGTH SHALE**, grey, brown and orange.
1.3 to 1.76	**VERY LOW STRENGTH SHALE**, grey and black/dark brown.
1.76 to 1.83	**CORE LOSS**.
1.83 to 2.7	**VERY LOW STRENGTH SHALE**, grey, black/dark brown and orange, with thin grey sandstone laminite, parting at variable intervals of between 4cm to 12cm.
2.7 to 4.28	**LOW STRENGTH SHALE**, black/dark brown, grey and orange, parting at variable intervals of between 4cm to 12cm.
4.28 to 4.39	**CORE LOSS**.
4.39 to 4.84	**LOW STRENGTH SHALE**, black/dark brown and grey, parting at variable intervals of between 2cm to 8cm.
4.84 to 4.94	**CORE LOSS**.
4.94 to 7.2	**LOW STRENGTH SHALE**, black/dark brown, grey and orange, with thin grey sandstone laminite, parting at variable intervals of between 2cm to 8cm.

End of hole @ 7.2m in Low Strength Shale. No watertable encountered.

DCP TEST RESULTS ON NEXT PAGE

DCP TEST RESULTS – Dynamic Cone Penetrometer						
Equipment: 9kg hammer, 510mm drop, conical tip.				Standard: AS1289.6.3.2 - 1997		
Depth(m) Blows/0.3m	**DCP 1** (~RL72.7)	**DCP 2** (~RL72.9)	**DCP 3** (~RL71.5)	**DCP 4** (~RL75.5)	**DCP 5** (~RL77.8)	**DCP 6** (~RL74.8)
0.0 to 0.3	2	3	4	18	3	16
0.3 to 0.6	9	11F	6	4	12	13
0.6 to 0.9	8	5	14	#	19	17
0.9 to 1.2	15	6	12		25	22
1.2 to 1.5	30	8	40		#	20
1.5 to 1.8	20	12	#			31
1.8 to 2.1	21	13				36
2.1 to 2.4	40	33				#
2.4 to 2.7	#	#				
2.7 to 3.0						
	End of Test @ 2.4m	End of Test @ 2.4m	End of Test @ 1.5m	Refusal @ 0.4m	Refusal @ 1.0m	End of Test @ 2.1m

#refusal/end of test. F=DCP fell after being struck showing little resistance through all or part of the interval.

DCP Notes:

DCP1 – End of Test @ 2.4m, DCP still very slowly going down, white impact dust on dry tip.

DCP2 – End of Test @ 2.4m, DCP still very slowly going down, dark brown rock fragments on moist tip.

DCP3 – End of Test @ 1.5m, DCP still very slowly going down, dark brown sandy soil on moist tip.

DCP4 – Refusal @ 0.4m, DCP thudding, orange and white rock fragments on dry tip.

DCP5 – Refusal @ 1.0m, DCP bouncing, orange impact dust on moist tip.

DCP6 – End of Test @ 2.1m, DCP still very slowly going down, light and dark brown sandy soil on damp tip.

5. Geological Observations/Interpretation

The slope materials are colluvial at the near surface and residual at depth. In the test locations, the ground materials consist of fill and topsoil over firm to stiff clays. Fill provides a level platform on the downhill side of the house. Below the filled areas the clays merge into the weathered zone of the under lying rocks at depths of between ~0.6m to ~2.4m below the current surface. The weathered zone of the underlying rock is interpreted as Extremely Low to Low Strength Shale. It is to be noted that this material is a soft rock and can appear as a mottled stiff clay when it is cut up by excavation equipment.

The bore hole results indicate the proposed lift and lift accessway are underlain by firm to stiff clays and shale of variable strength with some thin fine to medium grained sandstone laminite layers.

In summary the ground conditions were as follows:

Depth (m)	**Material Encountered**
0.0 to 1.5	**CLAY**.
1.5 to 3.0	**VERY LOW STRENGTH SHALE** (Class IV)
3.0 to 7.0	**LOW STRENGTH SHALE** (Class III)

No free water encountered.

Note: In the location of BH1 ~1.0m of fill was present over the natural profile.

6. Groundwater

Normal ground water seepage is expected to move over the buried surface of the rock and through the cracks.

Due to the slope and elevation of the block, the water table in the location is expected to be many metres below the proposed works.

7. Surface Water

No evidence of surface flows were observed on the property during the inspection. It is expected that normal sheet wash will move onto the site from above the property during heavy down pours. Due to the steep slope above this is expected to flow at high velocities. If the owners know, or become aware in the future, that overland flows enter the property during heavy prolonged rainfall events our office is to be informed so appropriate drainage measures can be recommended and installed. It is a condition of the slope stability assessment in Section 8 (**Hazard One**) that this be done.

8. Geotechnical Hazards and Risk Analysis

No geotechnical hazards were observed beside the property. The steep slope that falls across the property and continues above and below is a potential hazard (**Hazard One**). The proposed excavations are a potential hazard (**Hazard Two**).

Geotechnical Hazards and Risk Analysis - Risk Analysis Summary

HAZARDS	Hazard One	Hazard Two
TYPE	The steep slope that falls across the property and continues above and below failing and impacting on the property.	The proposed excavations for the garage extension, lift and lift accessways (to a maximum depth of ~6.4m) collapsing onto the worksite, impacting the neighbouring properties and undercutting the subject house before retaining walls are in place.
LIKELIHOOD	'Unlikely' (10^{-4})	'Likely' (10^{-2})
CONSEQUENCES TO PROPERTY	'Medium' (12%)	'Medium' (30%)
RISK TO PROPERTY	'Low' (2×10^{-5})	'High' (2×10^{-3})
RISK TO LIFE	8.3×10^{-7}/annum	3.6×10^{-5}/annum
COMMENTS	This level of risk is 'ACCEPTABLE' provided the recommendations in **Section 7 & 16** are carried out.	This level of risk to life and property is 'UNACCEPTABLE'. To move the risk to 'ACCEPTABLE' levels, the recommendations in **Section 13** are to be followed.

(See Aust. Geomech. Jnl. Mar 2007 Vol. 42 No 1, for full explanation of terms)

9. Suitability of the Proposed Development for the Site

The proposed development is suitable for the site. No geotechnical hazards will be created by the completion of the proposed development provided it is carried out in accordance with the requirements of this report and good engineering and building practice.

10. Stormwater

The fall is to Alexandra Crescent. All stormwater from the proposed development is to be piped to the street drainage system through any tanks that may be required by the regulating authorities.

11. Excavations

Three excavations are required for the proposed works:

1. An excavation to a maximum depth of ~3.9m is required to convert the existing carport into a garage and extend to the NE.
2. An excavation to a maximum depth of ~6.4m is required to construct the proposed lower lift and accessway.
3. An excavation to a maximum depth of ~2.5m is required to construct the proposed upper lift and accessway.

The excavations are expected to be through fill, soil and clay with Extremely Low Strength Shale expected at depths of between ~0.6m to ~2.4m below the current surface. Extremely Low to Low Strength Shale is expected to extend to the bases of the excavations.

It is envisaged that excavations through fill, soil, clay and Shale up to Low Strength can be carried out with an excavator and toothed bucket.

12. Vibrations

It is expected the proposed excavation will be carried out with an excavator and toothed bucket and the vibrations produced will be below the threshold limit for building or infrastructure damage.

13. Excavation Support Requirements

As this job is considered technically complex and due to the depth of the excavation, we recommend it be carried out by builders and contractors who are well experienced in similar work and can provide a proven history of completed work. We recommend a pre-construction meeting between the structural engineer, the builder, and the geotechnical consultant to discuss and confirm the excavation plan and to ensure suitable excavation equipment will be on site.

Bulk Excavation for Garage

An excavation to a maximum depth of ~3.9m is required to convert the existing carport into a garage and extend to the NE. The excavation comes flush with the E common boundary.

The excavation requires the demolition of part of the existing sandstone block, brick and concrete block retaining walls (Photo 3).

Due to the depth of the excavation and its proximity to the E common boundary all sides of the excavation will require ground support installed prior to the commencement of the excavation and demolition of the existing retaining walls. See the Carport Plan attached for the minimum extent of the required shoring shown in blue.

A spaced pile retaining wall is one of the suitable methods of support but will require a specialist piling rig mounted on an excavator, so the drilling can be carried out from the existing parking area. Pier spacing is typically ~2.0m but can vary between 1.6 to 2.4m depending on the design. As the excavation is lowered in 1.5m lifts infill sprayed concrete panels or similar are added between the piers to form the wall. Drainage is to be installed behind the panels. To drill the pier holes for the walls, a pilling rig that can excavate through Medium to High Strength Rock will be required. The piers can be temporarily supported by embedment below the base of the excavation or with a combination of embedment and propping. The walls are to be tied into the Garage Slab to provide permanent bracing after which any temporary bracing can be released.

The geotechnical consultant is to inspect the drilling process of the entire first pile and the ground materials at the base of all pier holes/excavations installed for ground support purposes.

The existing retaining walls (Photo 3) are to be demolished from the top down as the excavation is progressed.

Bulk Excavation for Lifts and Accessways

An excavation to a maximum depth of ~6.4m is required to construct the proposed lower lift and accessway. The excavation will come flush with the downhill side of the subject house and deck.

Another excavation to a maximum depth of ~2.5m is required to construct the proposed upper lift and accessway. The excavation comes underneath the subject house.

This work is considered technically complex and will need to be carried out in stages involving short lifts of excavation followed by ground support works. This type of work is also labour intensive and relatively slow due to the stop start nature of the required staged process. These factors combine to make the works relatively expensive and subject to cost blow outs.

We envisage over the line of the excavation under the house, that the existing supporting house piers will be removed and supported with beams that span the proposed cut. Where the excavation is under brick house walls the walls will need to be needled and supported by concrete beams or similar support. This support will be designed by the structural engineer and needs to be installed before the excavation is commenced under the house.

For safety purposes we envisage the excavation stages will involve lowering the excavation ~1.5m in depth and progressing laterally a maximum of ~3.0m before installing support. Support will likely involve a sprayed concrete wall supported by rock bolts drilled and grouted into the excavation face. The total shoring operation would involve nailing ~150mm wide strip drain to the excavation face for back wall drainage, covering the drainage in mesh supported by bolts grouted into the excavation face, then spraying the cut face with concrete to form the wall. The structural engineer is to detail the wall design.

During the excavation process, the geotechnical consultant is to inspect the cut face in 1.5m intervals as it is lowered to ensure ground materials are as expected and that additional support is not required.

Advice Applying to All Excavations

The excavation is to be carried out during a dry period. No excavations are to commence if heavy or prolonged rainfall is forecast.

All excavation spoil is to be removed from site following the current Environmental Protection Agency (EPA) waste classification guidelines.

14. Retaining Structures

For cantilever or singly propped retaining structures it is suggested the design be based on a triangular distribution of lateral pressures using the parameters shown in Table 1.

TABLE 1 ON NEXT PAGE

Table 1 – Likely Earth Pressures for Retaining Structures

Unit	Earth Pressure Coefficients				
	Unit weight (kN/m³)	'Active' K_a	'At Rest' K_0	Passive	Bond Stress
Fill and Topsoil	20	0.40	0.55	N/A	N/A
Residual Clays	20	0.35	0.45	Kp = 2.0 'ultimate'	20kPa 'ultimate'
Extremely Low Strength Shale	22	0.25	0.38	Kp = 2.5 'ultimate'	50kPa 'ultimate'
Very Low Strength Shale	22	0.22	0.35	400kPa 'ultimate'	100kPa 'ultimate'
Low Strength Shale	24	0.20	0.35	1000kPa 'ultimate'	300kPa 'ultimate'

For rock classes refer to Pells et al "Design Loadings for Foundations on Shale and Sandstone in the Sydney Region". Australian Geomechanics Journal 1978.

It is to be noted that the earth pressures in Table 1 assume a level surface above the structure and do not account for any surcharge loads, so these will have to be accounted for in wall design. It also assumes retaining structures are fully drained. It should be noted that the passive pressures and bond stresses are ultimate values and should have an appropriate safety factor applied. No passive resistance should be assumed for the top 0.4m to account for any disturbance from the excavation. Ground materials and relevant earth pressure coefficients are to be confirmed on site by the geotechnical consultant.

All retaining structures are to have sufficient back-wall drainage and be backfilled immediately behind the structure with free-draining material (such as gravel). This material is to be wrapped in a non-woven Geotextile fabric (i.e. Bidim A34 or similar), to prevent the drainage from becoming clogged with silt and clay. If no back-wall drainage is installed in retaining structures, the likely hydrostatic pressures are to be accounted for in the structural design.

15. Foundations

The proposed lifts, accessways and garage extension are expected to be seated in Extremely Low Strength Shale or better on the uphill side. On the downhill side where the shale drops away with the slope, piers will be required to maintain a uniform bearing pressure across the structure. This ground material is expected at depths of between ~0.6m to ~2.4m below the current surface. A maximum allowable bearing pressure of 600kPa can be assumed for footings on Extremely Low Strength Shale or better.

The foundations of the existing carport and house are currently unknown. Ideally, footings should be founded on the same footing material across the structure. Where the footing material does change across the structure construction joints or similar are to be installed to prevent differential settlement, where the structure cannot tolerate such movement in accordance with a 'class M' site.

As the bearing capacity of shale reduces when it is wet, we recommend the footings be dug, inspected, and poured in quick succession (ideally the same day if possible). If the footings get wet, they will have to be drained and the soft layer of wet shale on the footing surface will have to be removed before concrete is poured.

If a rapid turnaround from footing excavation to the concrete pour is not possible, a sealing layer of concrete may be added to the footing surface after it has been cleaned.

NOTE: If the contractor is unsure of the footing material required it is more cost effective to get the geotechnical professional on site at the start of the footing excavation to advise on footing depth and material. This mostly prevents unnecessary over excavation in clay like shaly rock but can be valuable in all types of geology.

16. Ongoing Maintenance

The concrete block retaining wall (Photo 6) is to be monitored by the owners on an annual basis or after heavy prolonged rainfall events, whichever occurs first. A photographic record of these inspections is to be kept. Should further movement occur the wall is to be remediated so it meets current engineering standards. We can carry out these inspections upon request.

Where slopes are steep and approach or exceed 30°, such as on this site, it is prudent for the owners to occasionally inspect the slope (say annually or after heavy rainfall events, whichever occurs first). Should any of the following be observed: movement or cracking in retaining walls, cracking in any structures, cracking or movement in the slope surface, tilting or movement in established trees, leaking pipes, or newly observed flowing water, or changes in the erosional process or drainage regime, then a geotechnical consultant should be engaged to assess the slope. We can carry out these inspections upon request.

The risk assessment in **Section 8** is subject to this ongoing maintenance being carried out.

17. Geotechnical Review

The structural plans are to be checked and certified by the geotechnical engineer as being in accordance with the geotechnical recommendations. On completion a Form 2b will be issued. This form is required for the Construction Certificate to proceed.

REQUIRED INSPECTIONS ON NEXT PAGE

18. Inspections

The client and builder are to familiarise themselves with the following required inspections as well as council geotechnical policy. We cannot provide geotechnical certification for the Occupation Certificate if the following inspections have not been carried out during the construction process.

- The geotechnical consultant is to inspect the ground materials while the first pile for the pile wall is being dug to assess the ground strength and to ensure it is in line with our expectations. All finished pier holes are to be inspected and measured before concrete is placed.

- During the excavation process, the geotechnical consultant is to inspect the cut face in 1.5m intervals as it is lowered to ensure ground materials are as expected and that additional support is not required.

- All footings are to be inspected and approved by the geotechnical consultant while the excavation equipment and contractors are still onsite and before steel reinforcing is placed or concrete is poured.

White Geotechnical Group Pty Ltd.

Reviewed By:

Dion Sheldon
BEng(Civil)(Hons),
Geotechnical Engineer.

Ben White M.Sc. Geol.,
AusIMM., CP GEOL.
No. 222757
Engineering Geologist.

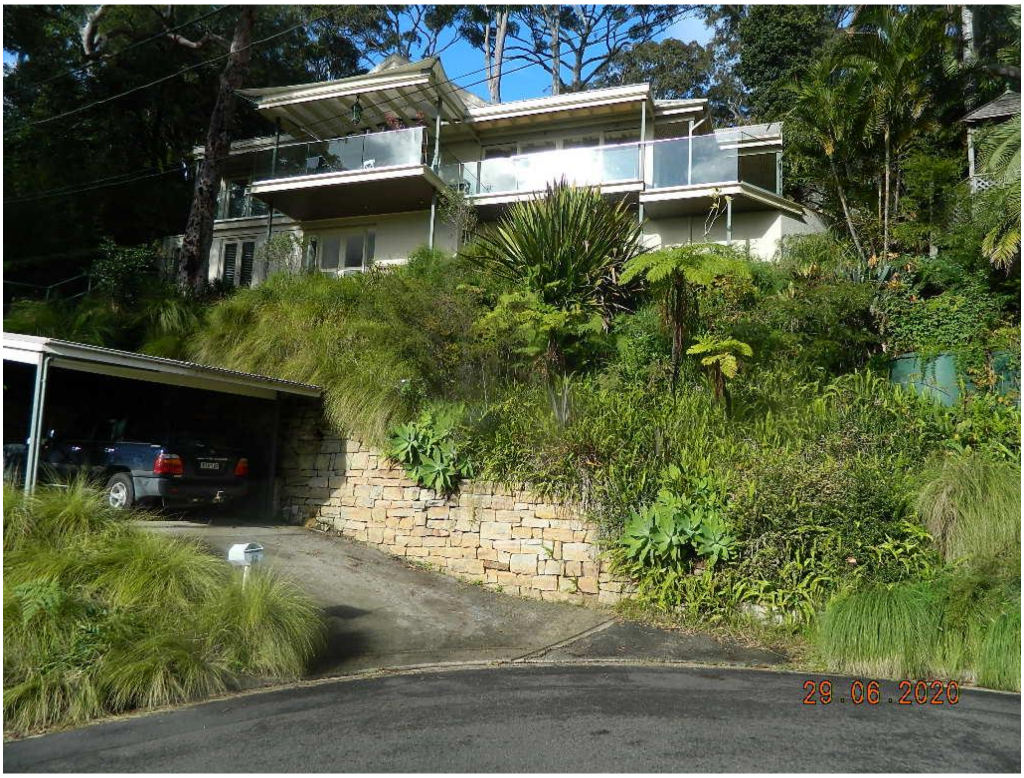


Photo 1

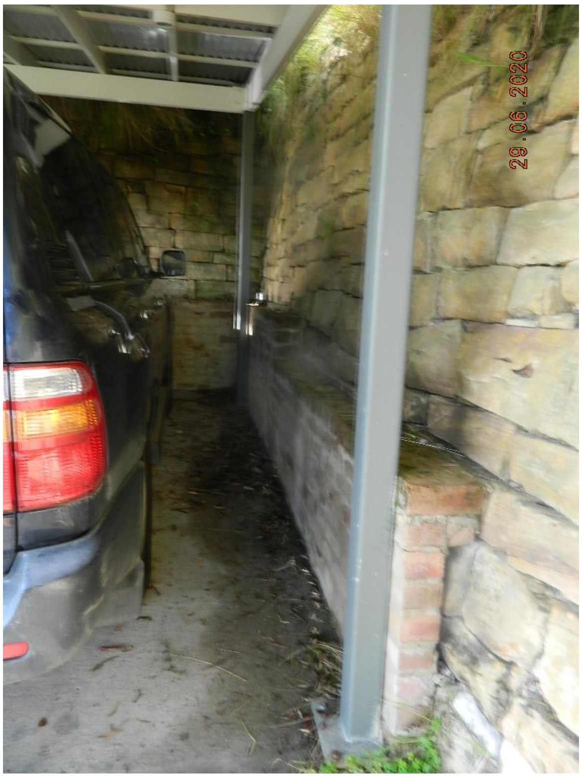


Photo 2

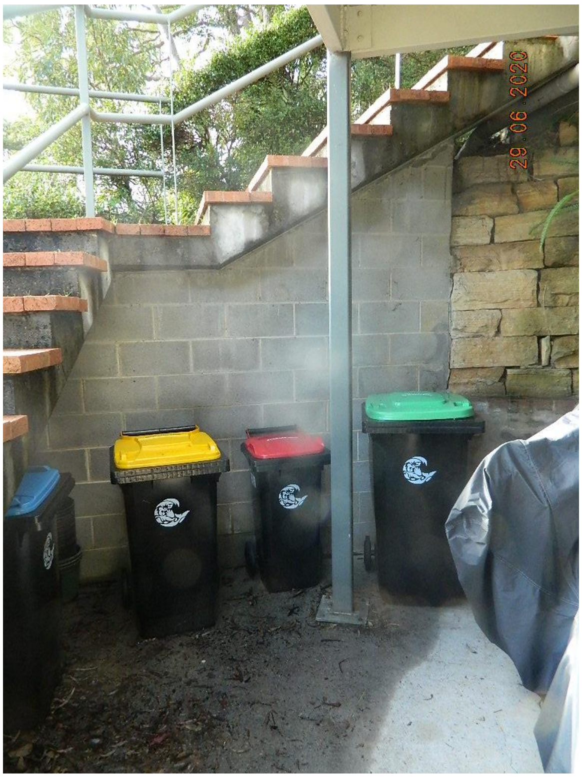


Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

Photo 9

Photo 10

Photo 11: BH1


7m
6m
5m
4m
3m
2m
1m
BH2 START @0.6m
BH2 END @7.2m
CORE LOSS
CORE LOSS
CORE LOSS
12/10/2021

Photo 12: BH2

Important Information about Your Report

It should be noted that Geotechnical Reports are documents that build a picture of the subsurface conditions from the observation of surface features and testing carried out at specific points on the site. The spacing and location of the test points can be limited by the location of existing structures on the site or by budget and time constraints of the client. Additionally, the test themselves, although chosen for their suitability for the particular project, have their own limiting factors. The testing gives accurate information at the location of the test, within the confines of the test's capability. A geological interpretation or model is developed by joining these test points using all available data and drawing on previous experience of the geotechnical consultant. Even the most experienced practitioners cannot determine every possible feature or change that may lie below the earth. All of the subsurface features can only be known when they are revealed by excavation. As such, a Geotechnical report can be considered an interpretive document. It is based on factual data but also on opinion and judgement that comes with a level of uncertainty. This information is provided to help explain the nature and limitations of your report.

With this in mind, the following points are to be noted:

- If upon the commencement of the works the subsurface ground or ground water conditions prove different from those described in this report, it is advisable to contact White Geotechnical Group immediately, as problems relating to the ground works phase of construction are far easier and less costly to overcome if they are addressed early.

- If this report is used by other professionals during the design or construction process, any questions should be directed to White Geotechnical Group as only we understand the full methodology behind the report's conclusions.

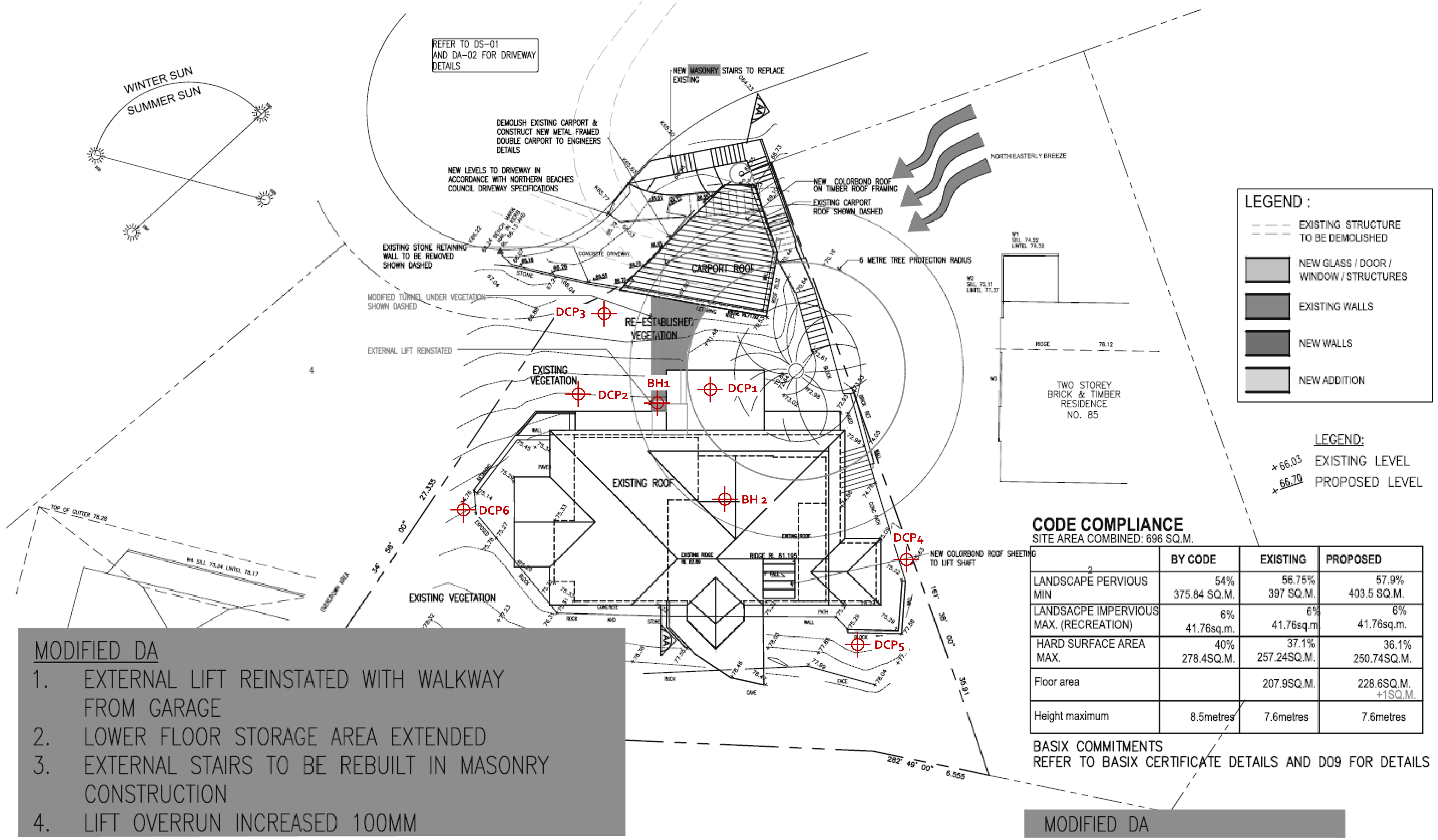
- The report addresses issues relating to your specific design and site. If the proposed project design changes, aspects of the report may no longer apply. Contact White Geotechnical if this occurs.

- This report should not be applied to any other project other than that outlined in section 1.0.

- This report is to be read in full and should not have sections removed or included in other documents as this can result in misinterpretation of the data by others.

- It is common for the design and construction process to be adapted as it progresses (sometimes to suit the previous experience of the contractors involved). If alternative design and construction processes are required to those described in this report, contact White Geotechnical Group. We are familiar with a variety of techniques to reduce risk and can advise if your proposed methods are suitable for the site conditions.

SITE PLAN – showing test locations



CODE COMPLIANCE
SITE AREA COMBINED: 696 SQ.M.

	BY CODE	EXISTING	PROPOSED
LANDSCAPE PERVIOUS MIN	54% 375.84 SQ.M.	56.75% 397 SQ.M.	57.9% 403.5 SQ.M.
LANDSACPE IMPERVIOUS MAX. (RECREATION)	6% 41.76sq.m.	6% 41.76sq.m	6% 41.76sq.m.
HARD SURFACE AREA MAX.	40% 278.4SQ.M.	37.1% 257.24SQ.M.	36.1% 250.74SQ.M.
Floor area		207.9SQ.M.	228.6SQ.M. +1SQ.M.
Height maximum	8.5metres	7.6metres	7.6metres

BASIX COMMITMENTS
REFER TO BASIX CERTIFICATE DETAILS AND D09 FOR DETAILS

MODIFIED DA

AMENDMENTS
ISSUE A 26.10.20 DA REVISED-CARPORT ALTERED
ISSUE B 18.2.22 MODIFIED DA APPLICATION
ISSUE C 14.3.22 TUNNEL MODIFIED
ISSUE D 26.7.22 MODIFIED DA APPLICATION-REVISED DRIVEWAY/GARAGE LEVELS
ISSUE E 2.11.22 MODIFIED DA LIFT ALTERED

ALL DIMENSIONS TO BE CHECKED ON SITE BY BUILDER PRIOR TO CONSTRUCTION
FIGURE DIMENSIONS TO BE USED IN PREFERENCE TO SCALE
ALL BOUNDARIES AND LEVELS SUBJECT TO SURVEY PLAN
RETAIN ALL TREES UNLESS OTHERWISE NOTED

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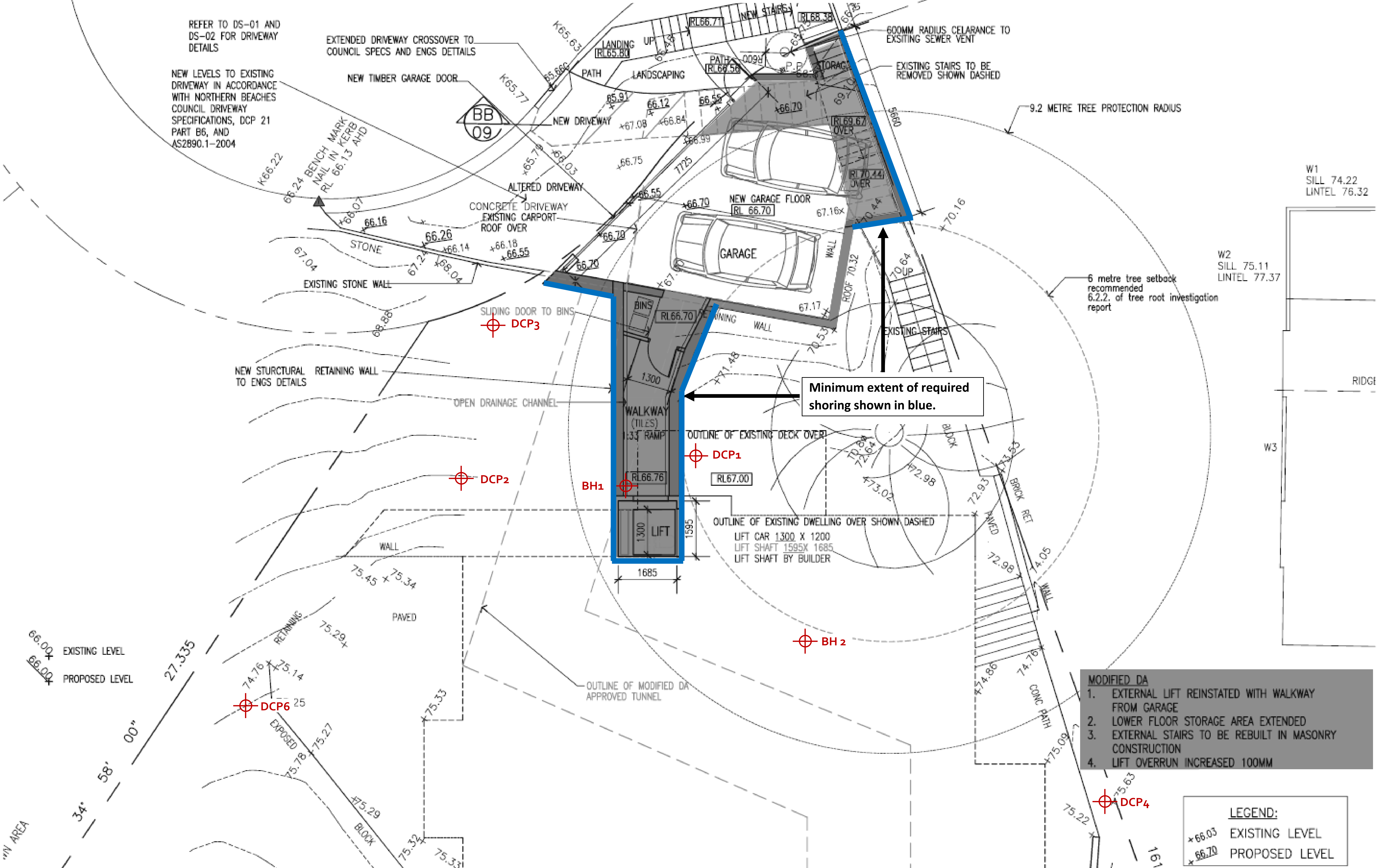
Directors: Denis Leach – Nominated Architect Reg No. 3980; Harvey Little – Licence No.36549; Email: harveylittle@lindsaylittle.com.au

ALTERATIONS AND ADDITIONS TO EXISTING RESIDENCE
87 ALEXANDRA CRESCENT BAVIEW
FOR: ARNAUD AND JANE DIEMONT

JOB No.	SCALE	DRAWN	DATE	DRAWING TITLE	DRAWING NO
1281/19	1:200	J.S.	JUNE 2020	SITE ANALYSIS PLAN	A02 F

CARPORT PLAN – showing test locations



AMENDMENTS

ISSUE B	18.2.22	MODIFIED DA APPLICATION
ISSUE C	14.3.22	TUNNEL MODIFIED
ISSUE D	26.7.22	MODIFIED DA APPLICATION-REVISED DRIVEWAY/GARAGE LEVELS
ISSUE F	2.11.22	MODIFIED DA LIFT ALTERED

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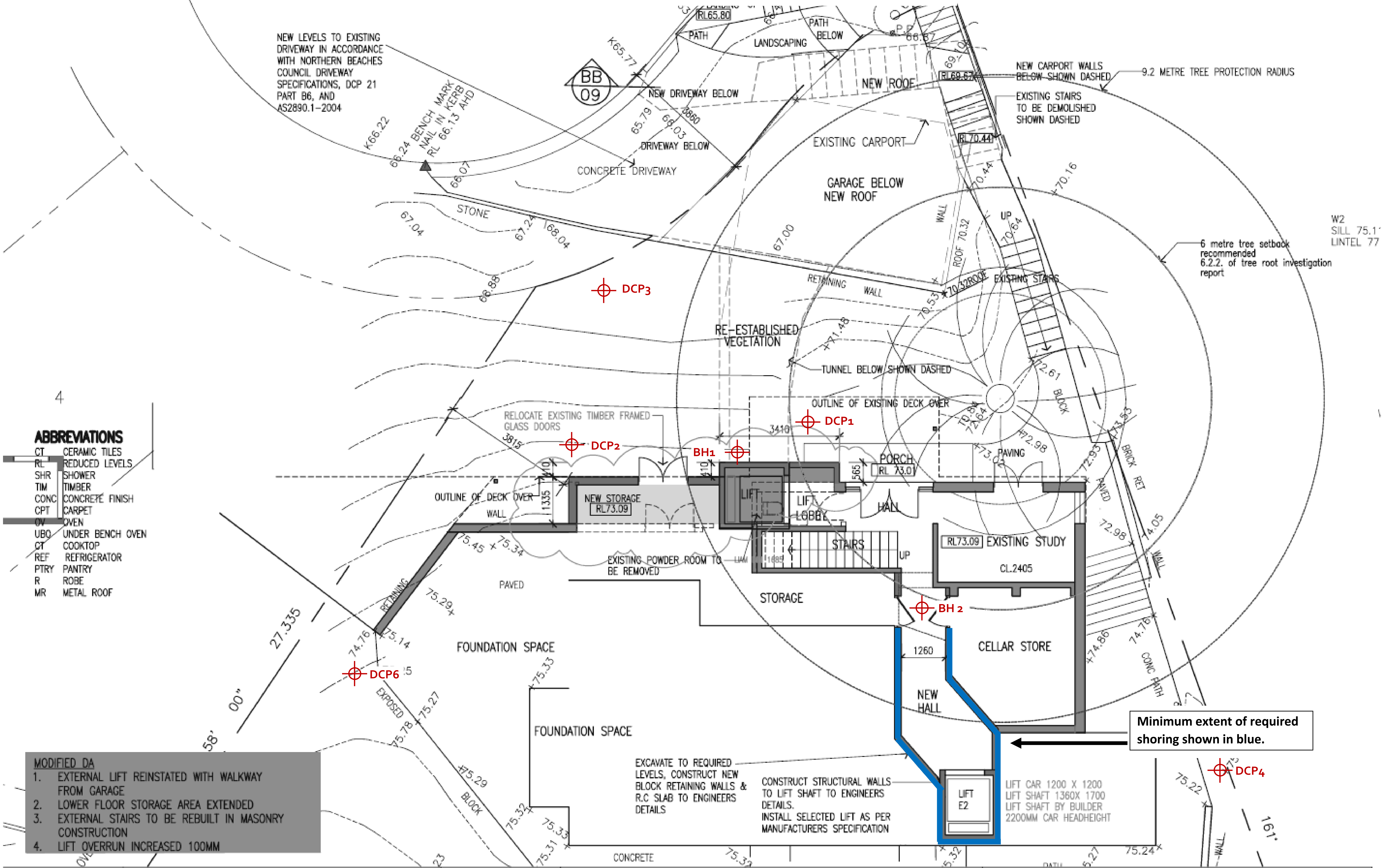
JOB No.	SCALE	DRAWN	DATE	DRAWING TITLE	DRAWING NO
1281/19		J.S.	JUNE 2020	CARPORT PLAN	A03 F

LOWER GROUND FLOOR PLAN – showing test locations



AMENDMENTS

ISSUE A	26.10.20	DA REVISED–CARPORT ALTERED
ISSUE B	18.2.22	MODIFIED DA APPLICATION
ISSUE C	14.3.22	TUNNEL MODIFIED
ISSUE D	26.7.22	MODIFIED DA APPLICATION–REVISED DRIVEWAY/GARAGE LEVELS
ISSUE E	2.11.22	MODIFIED DA LIFT ALTERED

ALL DIMENSIONS TO BE CHECKED ON SITE BY BUILDER PRIOR TO CONSTRUCTION
FIGURE DIMENSIONS TO BE USED IN PREFERENCE TO SCALE
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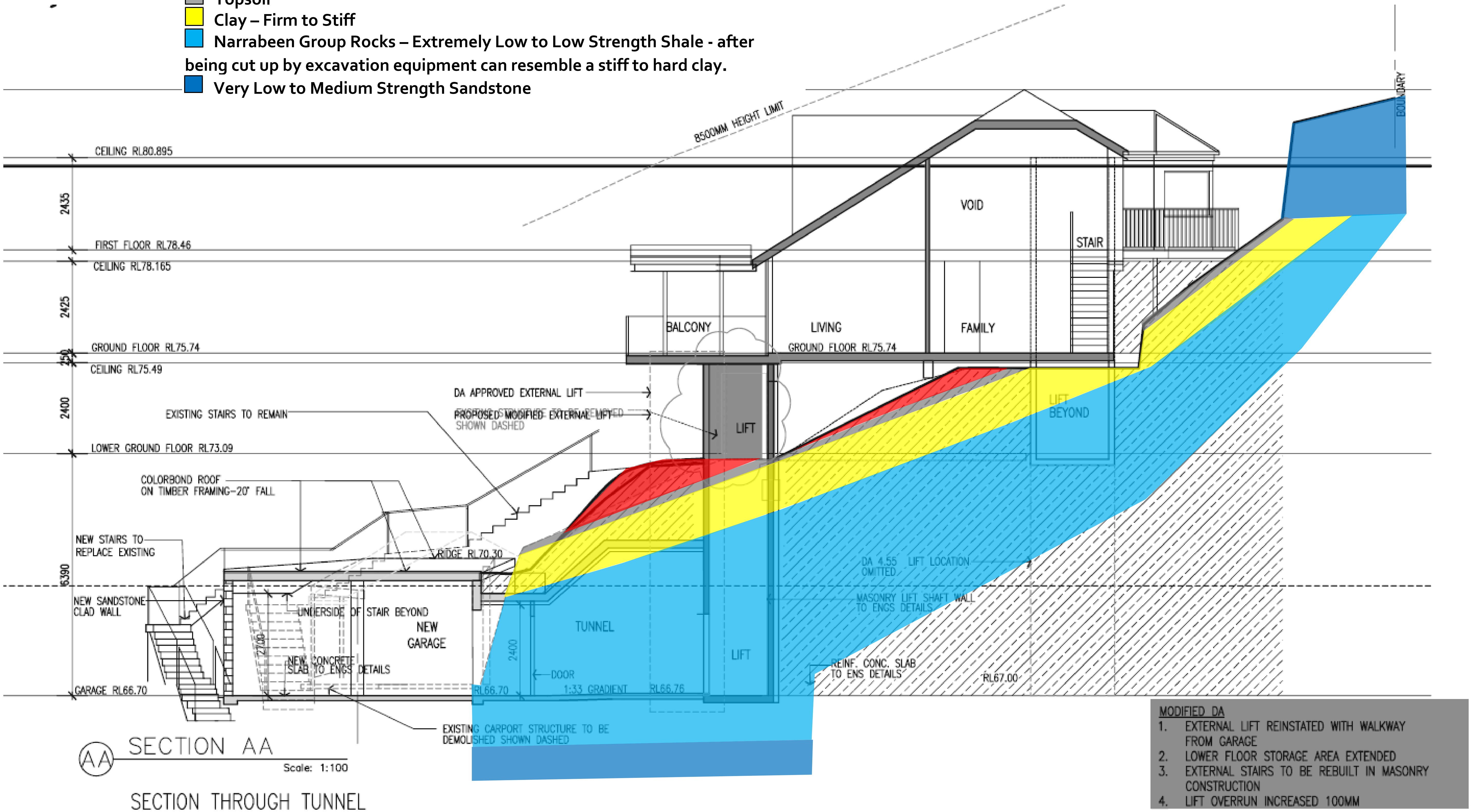
JOB No.	SCALE	DRAWN	DATE	DRAWING TITLE	DRAWING NO
1281/19	1:100	J.S.	JUNE 2020	LOWER GROUND FLOOR PLAN	A04 E

TYPE SECTION – Diagrammatical Interpretation of expected Ground Materials

- Fill
- Topsoil
- Clay – Firm to Stiff
- Narrabeen Group Rocks – Extremely Low to Low Strength Shale - after being cut up by excavation equipment can resemble a stiff to hard clay.
- Very Low to Medium Strength Sandstone



AMENDMENTS
ISSUE A 26.10.20 DA REVISED–CARPORT ALTERED
ISSUE B 18.2.22 MODIFIED DA APPLICATION
ISSUE D 26.7.22 MODIFIED DA APPLICATION–REVISED DRIVEWAY/GARAGE LEVELS
ISSUE E 2.11.22 NEW MODIFIED DA– EXTERNAL LIFT REINSTATED

ALL DIMENSIONS TO BE CHECKED ON SITE BY BUILDER PRIOR TO CONSTRUCTION
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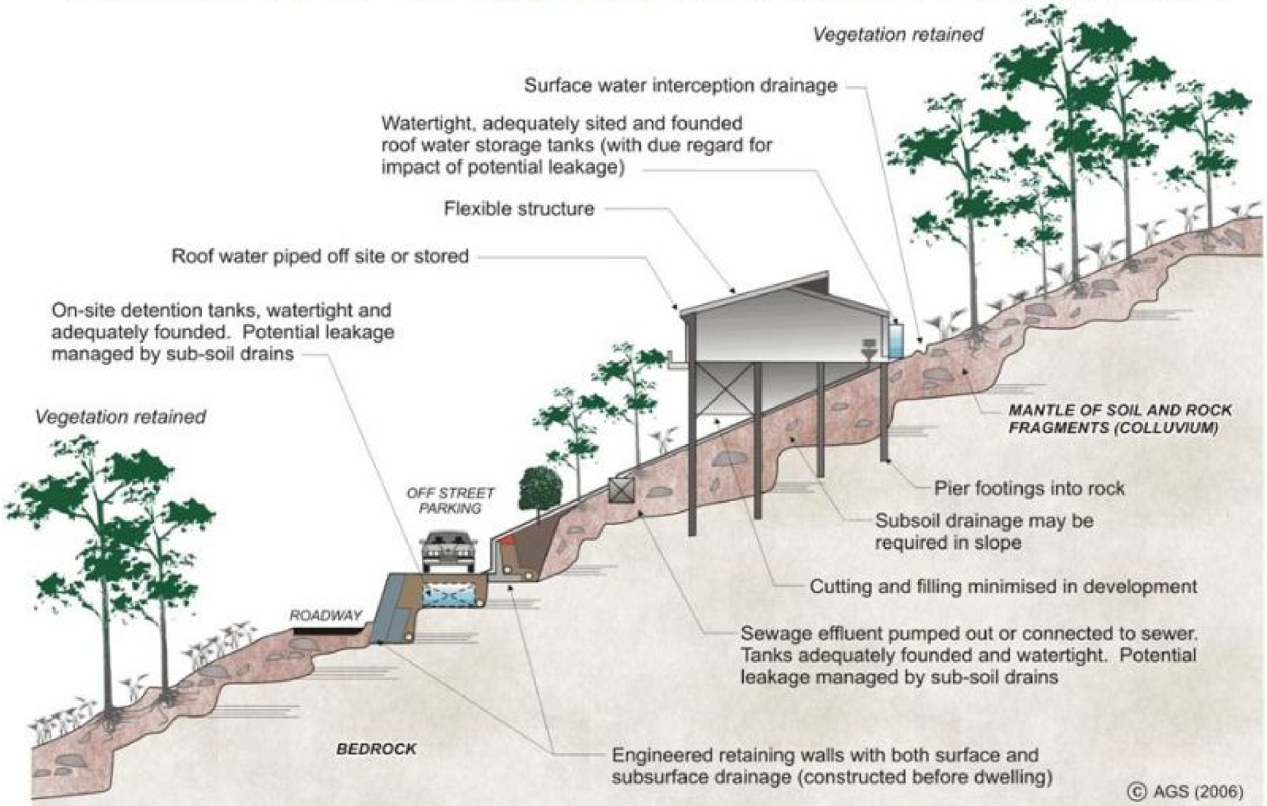
JOB No.	SCALE	DRAWN	DATE	DRAWING TITLE	DRAWING NO
1281/19	1:100	J.S.	JUNE 2020	SECTION AA	A11E

EXAMPLES OF GOOD HILLSIDE PRACTICE



EXAMPLES OF POOR HILLSIDE PRACTICE