16 Callistemon Close
Warabrook
NSW 2304 Australia

t: +61 2 4028 9700

tetratechcoffey.com

21 December 2021

Our ref: 754-NTLGE220504-1-AC.Rev2

Crescent Newcastle Pty Ltd
C/- Stronach Property
[redacted]

Attention: Mark Purdy

Dear Mark,

Proposed Multi-Storey and Multi Building Development - DA 2019/00061 - 11-17 Mosbri Crescent The Hill - Slope Stability Risk

Crescent Newcastle Pty Ltd (Crescent) is proposing a multi-storey and multi-building development at 11-17 Mosbri Crescent Cooks Hill. Tetra Tech Coffey Pty Ltd (Tetra Tech) have been assisting with the development approval process. This letter has been updated to include commentary on the effect that the proposed storm water management system has on landslide risk.

Douglas Partners (DP) previously included a slope risk assessment (Report 81843.00.R.001.Rev0 November 2015) as part of the rezoning application for the site. At that time, the proposed development comprised two six storey apartment buildings as well as a twelve-storey residential building, each with two levels of basement parking. The DP report found that the risk from slope instability to the proposed development would be low, provided appropriate engineering controls were put in place. These engineering controls include battering of all cuts based on geotechnical recommendations and/or supporting excavations with appropriately designed shoring or engineered retaining walls. The DP report is included in Attachment B.

Subsequently, as part of DA 2019/00061 in response to Subsidence Advisory NSW (SA NSW), the risk of deep-seated instability following a subsidence event was subsequently reviewed by Ditton Geotechnical Services (DgS) (Report COF-009/3(Rev1) dated 31 December 2019). The DgS report concluded that it was unlikely that a large-scale instability or landslip will occur during worst case scenario conditions. Section 2.5 of the DgS report is included in Attachment C.

Tetra Tech has reviewed the above reports. The previous assessments are based on the generally accepted methodology for assessing the risk of slope instability. We concur that the risk of slope instability on the current proposed development will be low provided that slopes and retaining structures are designed and constructed in consideration project specific geotechnical analysis and design inputs.

The proposed stormwater management plan Northrop Civil Engineering Package NL180367, includes the following features:

- A concrete lined dish drain, 0.5m wide generally along the boundaries of the site. This concrete lining will prevent scour of the soil at the top of retaining walls and reduce penetration of water to the back of the retaining walls.
- A pipe with generally granular backfill for flows less than 1 in 100yr.

- An overland flow path generally along the eastern and south boundaries for 1 in 100yr and greater events. This path will be at the base of the retaining wall meaning reducing the potential for water to build up behind the retaining walls.

The above stormwater management features do not appear to increase the build up of water behind retaining walls and as such it is considered that the storm water management system will not increase the risk of instability. The building walls next to the overland flow will need to be designed to accommodate the head of water within the overland flow.

Guidance on the uses and limitations of this report is presented in the attached sheet, *'Important Information about your Tetra Tech Coffey Report'*, which should be read in conjunction with this report.

If you have any questions regarding this report or should you require further assistance on this project, please contact the undersigned.

For and on behalf of Tetra Tech Coffey,

Simon Baker
Senior Geotechnical Engineer

APPENDIX A: LIMITATIONS

IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY REPORT

As a client of Tetra Tech Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Tetra Tech Coffey to help you interpret and understand the limitations of your report.

Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Tetra Tech Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Tetra Tech Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Tetra Tech Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Tetra Tech Coffey to be advised how time may have impacted on the project.

Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how qualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Tetra Tech Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore your report recommendations can only be regarded as preliminary. Only Tetra Tech Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Tetra Tech Coffey cannot be held responsible for such misinterpretation.

Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Tetra Tech Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Tetra Tech Coffey to work with other project design professionals who are affected by the report. Have Tetra Tech Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Tetra Tech Coffey for information relating to geoenvironmental issues.

Rely on Tetra Tech Coffey for additional assistance

Tetra Tech Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Tetra Tech Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Tetra Tech Coffey to other parties but are included to identify where Tetra Tech Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Tetra Tech Coffey closely and do not hesitate to ask any questions you may have.

APPENDIX B: DOUGLAS PARTNERS REPORT 81843.00.R.001.REV0

Douglas Partners
Geotechnics | Environment | Groundwater

Integrated Practical Solutions

Report on
Desktop Geotechnical Assessment

Proposed Apartments
NBN Studio, Mosbri Crescent, The Hill

Prepared for
Nine Network Australia Pty Ltd

Project 81843.00
November 2015

Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	81843.00	Document No.	81843.00.R.001.Rev0
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Site address	NBN Studio, Mosbri Crescent, The Hill		
Report prepared for	Nine Network Australia Pty Ltd		
File name	81843.00.R.001.Rev0		

Document status and review

Status	Prepared by	Reviewed by	Date issued
Rev 0	Richard Merifield	Scott McFarlane	23 November 2015

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Revision	Electronic	Paper	Issued to
Rev 0	1	0	Nine Network Australia Pty Ltd

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		
Reviewer		

bsi. ISO 9001 Quality Management

Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au
15 Callistemon Close
Warabrook NSW 2304
PO Box 324
Hunter Region Mail Centre NSW 2310
Phone (02) 4960 9600
Fax (02) 4960 9601

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Report on Desktop Geotechnical Assessment
Proposed Apartments
NBN Studio, Mosbri Crescent, The Hill

1. Introduction

This report presents the results of a desktop geotechnical investigation for the proposed apartment development to be located at NBN Studios, Mosbri Crescent, The Hill. The work was carried out for Mr Warwick McInnes on behalf of The Nine Network Australia Pty Ltd.

We understand that the proposed development includes the construction of two six-storey and one 12-storey residential apartment buildings. Two levels of basement car parking is currently proposed for each building. Douglas Partners Pty Ltd (DP) were provided a copy of the architectural plans for the proposed development and these are attached in Appendix A.

The purpose of the geotechnical investigation was to address the following:

- Geotechnical suitability of the site;
- Potential slope stability issues;
- Mine Subsidence requirements.

DP have previously undertaken geotechnical investigations at the site for several proposed antenna, Project 31423 and 31423A, dated October 2001 and September 2005 respectively. The previous investigations included three cored boreholes to a depth of up to 10 m as well as comments on slope stability for part of the site. The results of the field work from the previous investigations have been utilised in this report.

2. Site Description and Regional Geology

The site is located at Mosbri Crescent, The Hill and currently contains the NBN studio buildings (refer Figure 1). The existing main NBN studio building covers much of the central part of the site.

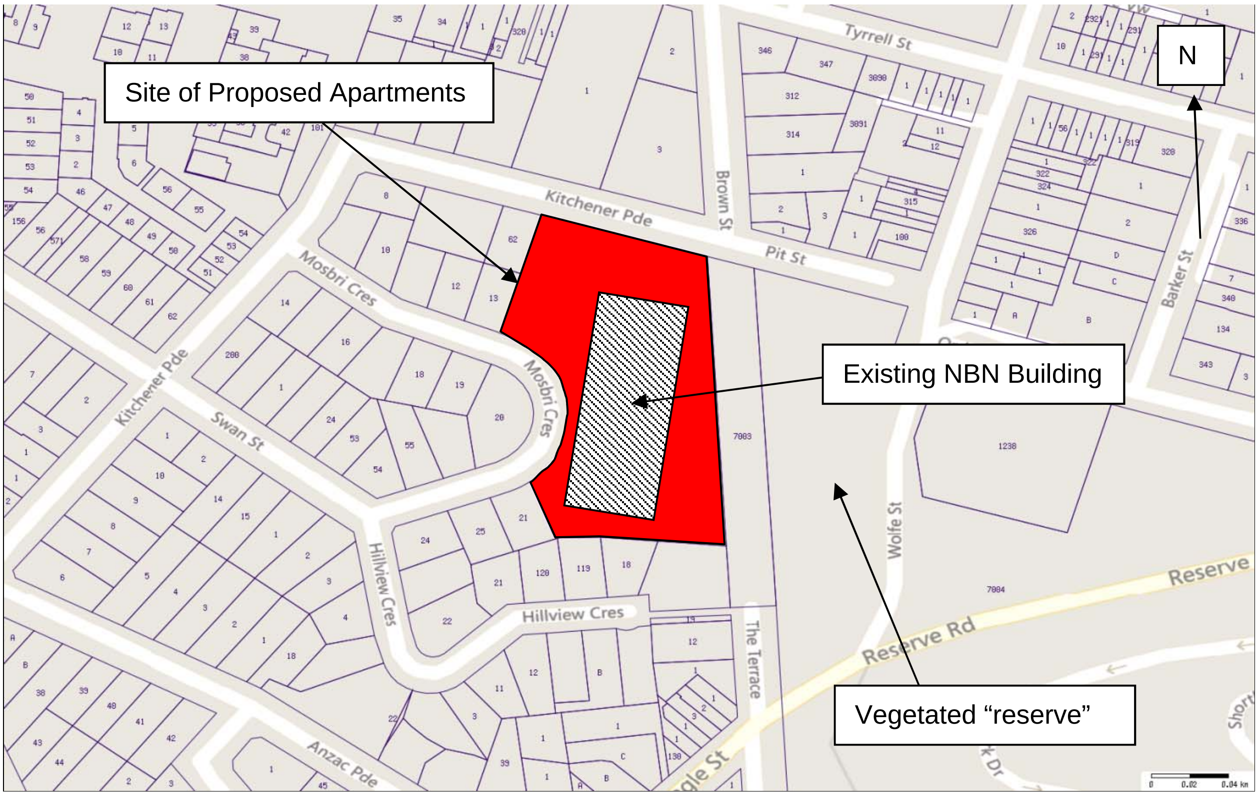


Figure 1: Mosbri Street Site Location

The site has been extensively modified by cutting and filling, typified by a number of existing rock and crib walls extending around much of the existing NBN studio building.

The site is bounded on the east by what appears to be a heavily vegetated reserve and easement that adjoins Wolfe Street.

Reference to the Newcastle Coalfield Surface Geology Map published by BHP indicates that the site is within the area of outcrop of the Shepherds Hill Formation of the Lambton Sub Group of the Newcastle Coal Measures. This formation is of Permian Age and is predominantly siltstone and sandstone with some conglomerate. The Nobbys Tuff occurs at the base of the Shepherds Hill formation and is typically about 1 m thick (Ref 1). In Newcastle the Shepherds Hill formation is typically about 27 m thick (Ref 1). The Shepherds Hill Formation is underlain by the Nobbys Coal Seam and overlain by the Victoria Tunnel Seam.

3. Desktop Assessment and Field Work

3.1 Methods

3.1.1 Desktop Assessment

A review of the existing data in relation to the site was undertaken and included:

- Review of in-house geotechnical data for the area;
- Review of published geological and geotechnical maps, including soil landscape maps and mine record tracings;
- Liaison with the mine subsidence board with regards to any restrictions to the development.

3.1.2 Field Work

A site inspection was carried out by a Principal Geotechnical Engineer on 5 November 2015. The purpose of the inspection was to assess the slope stability and photograph relevant aspects of the site. No assessment was made in relation to the design or structural integrity of the adjacent crib block and rock retaining walls.

3.2 Results

3.2.1 Desktop Assessment

Existing geotechnical investigations at the site (Project 31423 and 31423A, dated October 2001 and September 2005 respectively) included three cored boreholes to a depth of up to 10 m. The following is a general summary of the subsurface conditions previously encountered on site (Project 31423A). A more extensive description is provided in the original reports.

Based on the observations made during the site walkover assessment and the results of previous investigations by DP, the residual soil profile on site generally comprises clay overlying weathered rock.

From (m)	To (m)	Description
0	0.4 / 0.7	Filling / Soil – Typically sandy gravel and silty clay / clayey silt
0.4 / 0.7	2.5 / 3.4	Siltstone – Extremely low to very low strength, medium strength in parts
2.5 / 3.4	6.1 / 6.8	Siltstone – Low to medium strength, very low strength in parts
6.1 / 6.8+		Sandstone – Medium strength or better

No free groundwater was observed during the previous drilling or the recent site visit. It should be noted that groundwater levels are affected by recent weather conditions and soil / rock permeability and may vary with time.

3.2.2 Field Observations

Topography

Elevation contours for the site are shown in Figure 2. Two existing gully lines were observed during the site visit extending from the eastern site boundary adjacent to Wolfe Street through the adjacent vegetated reserve towards the site.

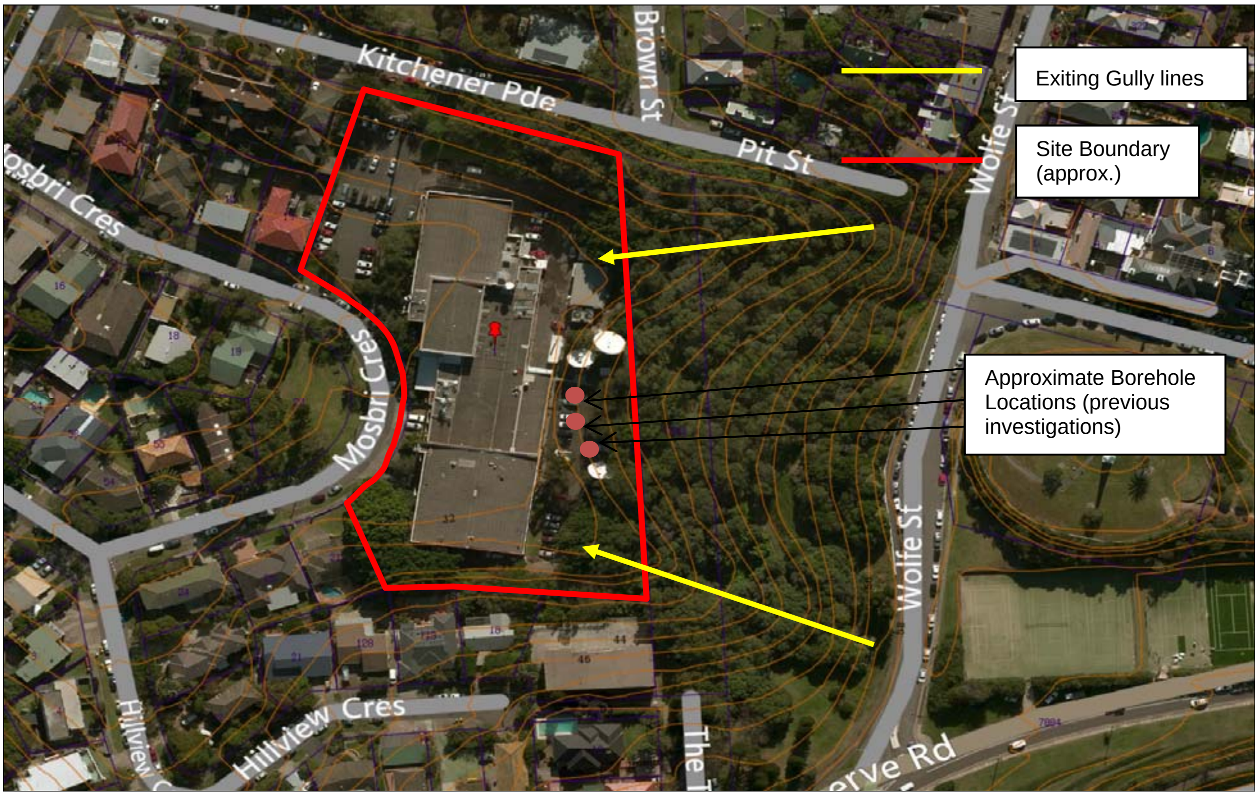


Figure 2: Elevation contours (2 m) at Mosbri Street Site Location

The existing NBN building has been extensively cut into the landscape and is surrounded on the northern, eastern and southern edges by crib retaining walls (refer Figure 3).

Figure 3: Existing Crib Retaining Wall along Eastern edge of existing NBN building (looking north, looking south)

Figure 4: Existing Crib Retaining Wall along Southern Site Boundary (looking west)

Figure 5: Existing Rock Retaining Wall along Eastern Site Boundary

Figure 6: Existing Crib Retaining Wall along Northern Site Boundary (looking east)

In addition to the retaining walls surrounding the main NBN building, the northern, eastern and southern car park / pavement areas are also supported by a mixture of crib and rock retaining walls (refer Figure 4, Figure 5 and Figure 6).

From the eastern boundary of the site the terrain slopes down to the west with a slope of about 14° to 17° which terminates at the crest of a cutting which ranges in height from about 1.25 m to 1.75 m. The bottom 1.25 m of the cutting is battered at a 75° angle and faced with mortared rock blocks. No weep holes were observed in the rock facing (Figure 5). The upper section of the cutting, where present, has been battered to a slope ranging from 35° to 50°. The material exposed on the face of the cut batter is predominantly clay soil with some intermittent exposures of extremely weathered siltstone.

From the toe of the rock facing, the terrain slopes at about 5° to the west for a distance of about 12 m. This area is presently a bitumen paved car park.

Figure 7: Exposed Siltstone along parts of eastern boundary (adjacent to air conditioning containers)

The bitumen car park terminates at a concrete kerb which is about 1 m from the crest of a crib wall. The area between the kerb and the crib wall is also bitumen paved.

The crib wall is about 4.15 m in height with a batter slope of about 75° to 80° (Figure 3). The upper 0.75 m of the crib wall is of different appearance and slightly different batter from the remainder of the wall which may indicate two stages of wall construction.

At the toe of the crib wall a paved area continues to the adjacent studio building.

Vegetation

The northern and southern boundaries are grass covered with she-oaks and other shrubs with a basal diameter of up to 200 mm, several very large diameter trees exist along the very far length of the southern boundary.

Figure 8: Large diameter trees along far southern boundary adjoining Mosbri Crescent

4. Comments

4.1 Mine Subsidence

The site lies within the Newcastle Mine Subsidence District and the approval of the NSW Mine Subsidence Board (MSB) is required for development of the site (refer Figure 9).

Correspondence between DP and the MSB (email dated 4 November 2015, Mr Ian Bullen, Newcastle District Manager) indicates the allotment is undermined by first workings in the Borehole Seam at 95 m in depth. The guideline for the area is a G09 which is three storey construction, so any development above that height would need to be assessed on its merit. The site would require geotechnical assessment to determine the long term stability of the workings. The colliery was the Australian Agricultural Co, there is no details on the Record Trace and / or lease details.

Restrictions will be necessary in relation to the type of development permitted in specific areas. There will also be special requirements in relation to the type of construction, particularly the foundations. The policy of MSB is that it will not issue general guidelines but will only respond to specific development proposals.

DP can undertake a mine subsidence assessment and prepare a specific MSB application on behalf of Nine Network Australia Pty Ltd at the appropriate stage of the development process.

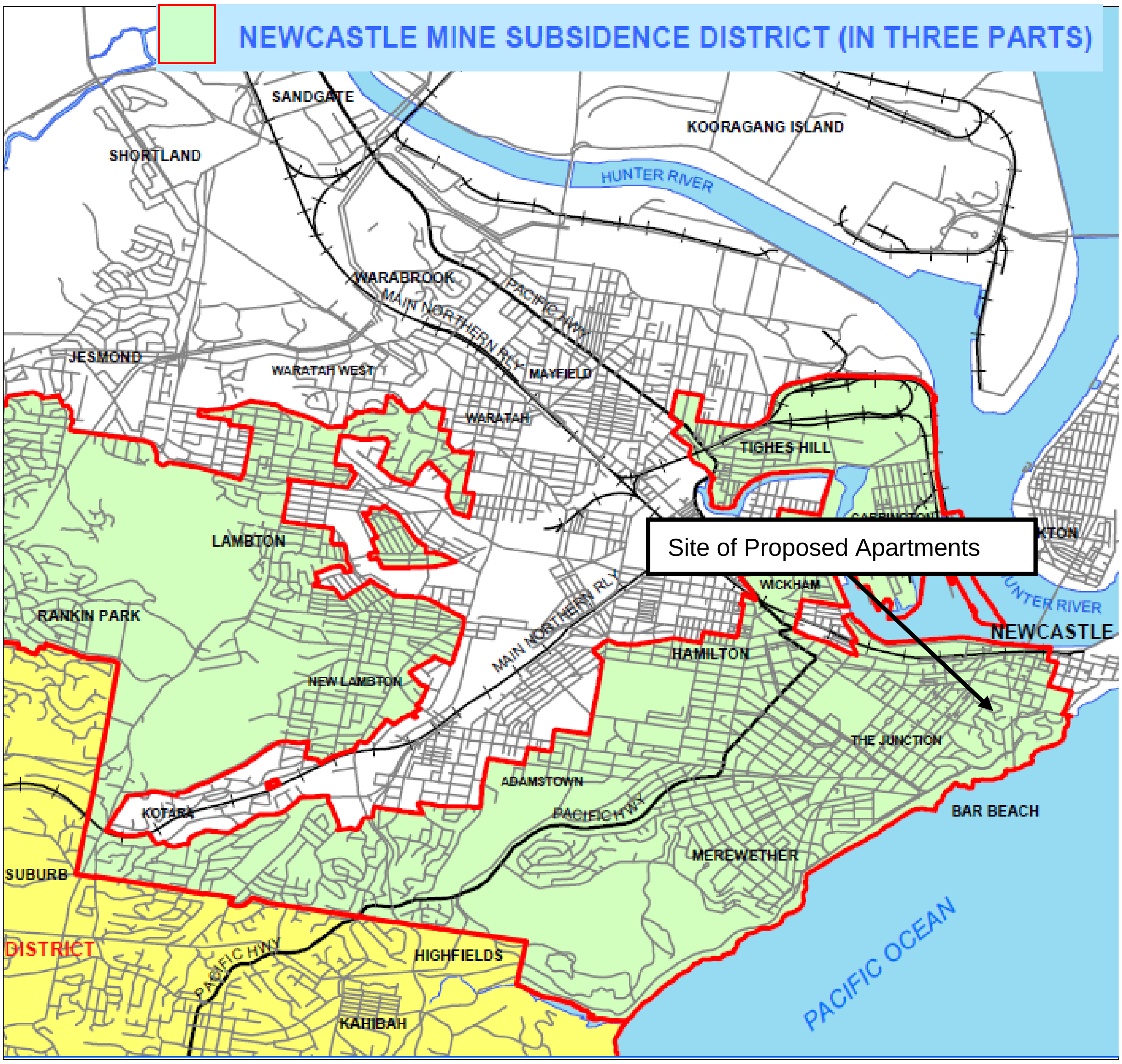


Figure 9: Mine Subsidence Districts and location of existing site (Adapted from MSB Plan No. MSD12b)

4.2 Footings

The following general advice is provided in relation to footings and foundations. It should be pointed out that further subsurface investigations will be required once the final structural building loads are known, in order to determine the design allowable loads for all foundation types.

Shallow Footings

Due to the relatively shallow depth to rock across the site, it is anticipated that founding on strip or pad footings will be appropriate for most smaller structures and possibly larger buildings. Slab on grade construction is also suitable with the appropriate site preparation. For preliminary design it is considered that pad or strip footings founded within the extremely low strength or better bedrock would be suitable for support of small structural loads provided that they are at least 0.5 m deep. For preliminary design footings in extremely low to very low strength rock should be proportioned for a maximum allowable bearing pressure of 700 kPa. Higher allowable bearing pressures may be possible subject to detailed investigation and assessment of total settlements. Concentrated loads, not able to be adequately supported on shallow footings, may be supported on deeper pad footings and/or bored cast in situ concrete piers

Deep Footings

Based on the previous geotechnical investigations at this site (Project 31423 and 31423A, dated October 2001 and September 2005 respectively), it is suggested that bored cast in situ piles socketed into the underlying bedrock would be a suitable pile option at this site. The following table presents preliminary allowable shaft adhesion and end bearing capacity of the bedrock.

Table 1: Preliminary Allowable Design Values for Foundations – Compression

Rock Strength	End Bearing Pressure (kPa)	Shaft Adhesion (kPa)
Extremely low strength	700	70
Very low strength	1000	100
Low Strength	1500	150
Medium strength or better	3500	350

As the depth to rock and depth of weathering is expected to vary across the site, the actual conditions and allowable pressures should be confirmed by further geotechnical investigations.

The allowable shaft adhesion for tensile loading on piles should be reduced by 50%. The shaft adhesion should only be calculated for that part of the socket length which is greater than 1 m below ground surface.

Bored pile excavation should be cleared of all loose material and if water is present in the bore this should be removed or the concrete should be added to the base of the bore using a tremie pipe to displace water above the concrete.

Subsidence Considerations

The selection of foundation types for structures should be based on adequate consideration of the effects of mine subsidence, including grounds tilts and strains, if applicable.

4.3 Slope Stability Assessment

The following sections present a qualitative risk assessment of the proposed site based on guidelines proposed by the Australian Geomechanics Society (AGS) Landslide Risk Management (Ref 2).

An explanation of risk categories and implications to development is attached in Appendix C. The risk of slope instability affecting the site has been assessed on the basis of the geotechnical units with results presented in Section 3.2.1.

It should be noted that there were no overt signs of deep seated instability at the site and its immediate surrounds at the time of the assessment and site inspection. The absence of visually obvious structural distress in the many retaining walls on site is consistent with this observation.

4.3.1 General Observations

The following general observations can be made based on the site walkover undertaken on 5 November 2015:

- Based on the site walkover, no evidence of deep seated or overall slope instability was observed;
- Some evidence of very minor creep or translational sliding was observed in the gullies of the adjoining property to the east (Figure 2);
- In the absence of detailed design and works-as-executed drawings, it is not possible to comment on the suitability of an existing retaining wall. Nonetheless, the existing crib walls immediately surrounding the NBN building (Figure 3 and Figure 6) do not appear to show evidence of significant distress. The crib walls along the southern, eastern and northern site boundaries (Figure 4 and Figure 6) do show signs of localised distress and spalling that has exposed the internal reinforcement. This reinforcement has corroded significantly where spalling has occurred;
- No groundwater seepage was observed on the site during the inspection. During a previous investigation in 2001, the standing water level in a standpipe piezometer about 2.5 m behind the crest of the eastern site boundary rock / crib wall (Figure 5) was 6.6 m below the level of the car park paving (i.e. below the toe of the crib wall).

4.3.2 Identified Hazards and Inferred Consequences

Using the nomenclature presented in Ref 2, the following potential hazards were identified for the site:

1. Hazard 1 relates to creep of colluvial or residual soils affecting structures. This has been assessed to be ‘unlikely’ given previous subsurface investigations indicate shallow depths to rock over the site.
2. Hazard 2 relates to a slow deep seated failure beneath the constructed building. This has been be considered a ‘rare’ event given no known recent or past occurrence of deep seated failure has been observed at the NBN site;

3. Hazard 3 relates to the stability failure of newly proposed fill embankments and batters affecting adjacent properties. Minor fill embankments could be anticipated to accommodate the proposed development and slide debris impacting on downslope areas is identified as a hazard should these fill slopes collapse. This has been assessed to be 'rare' provided engineered batter and/or retaining systems are provided to support all filling when required;
4. Hazard 4 relates to the stability failure of cut embankments and batters (existing retained areas or newly proposed) affecting adjacent properties to the north and south. Cuttings are anticipated to accommodate the proposed development and the failure of these will impact the adjacent residential properties and infrastructure. This has been assessed to be 'unlikely' provided engineered batter and/or retaining systems are provided to support all cuttings when required;
5. Hazard 5 relates to the stability failure of slopes modified by earthworks and the propagation upslope towards the eastern vacant property. This has been assessed to be 'rare' provided engineered batter and/or retaining systems are provided to support all cuttings when required. This consequence of failure was based on the assumption that no development is proposed on the adjoining eastern property which is currently a Council reserve; and
6. Hazard 6 relates to the stability failure of slopes modified by earthworks and the downslope impacts to properties to the west. This has been considered a 'rare' event assuming a thorough engineering assessment of new building foundations and their effects is undertaken.

4.3.3 Property Risk

The site has been assessed with reference to the Australian Geomechanics Society Landslide Taskforce "Practice Note Guidelines for Landslide Risk Management" March 2007 (Ref 2). There are no site specific data that would allow a quantitative assessment of risk. Based on site geomorphology, geology and general history of landslips in the Newcastle/Lake Macquarie area, a qualitative assessment of the risk for property can be made as outlined in Appendix C of Ref 2. A copy of that appendix is included in Appendix C.

Table 2 summarises the results of this assessment, together with a qualitative assessment of the likelihood of occurrence of a landslide after construction, its consequence and risk to the building that has been designed and constructed taking the advice contained in this report into account.

Table 2: Risk Assessment for Property – Proposed Development

Hazard		Likelihood	Consequence	Risk to Proposed Development
1	Slow creep of soils within footprint of the development	Unlikely	Minor	Low
2	Deep seated failure of site affecting current lot and adjacent properties	Rare	Major	Low
3	Stability failure of fill embankment and batters affecting adjacent properties	Rare (provided engineered batter and/or retaining system provided to support all filling)	Major	Low
4	Stability failure of cut embankment and batters affecting adjacent properties to the north and south.	Rare (provided engineered batter and/or retaining system provided to support all cuttings)	Major	Low
5(1)	Stability failure of slopes modified by earthworks – propagation upslope towards eastern property.	Unlikely (provided engineered batter and/or retaining system provided to support cuttings along eastern boundary)	Minor	Low
6	Stability failure of slopes modified by earthworks – downslope impacts to properties to the west.	Rare (provided engineering assessment of new building foundations and their effects is undertaken)	Major	Low

Notes to Table 2:

(1) This was based on no development proposed on the adjoining eastern property which is currently assumes to be a Council reserve.

As a guide, in our experience, low and risks to properties from slope failure are commonly accepted by owners, developers and development regulating authorities. Reference to the AGS guidelines indicates that for residential sites, for which an importance Level 2 would apply in accordance with Ref 2, a low risk level is usually acceptable to society and regulators.

4.3.4 Risk to Life

The AGS Practice Note Guidelines (Ref 2) also provides a framework for landslide risk management, guidance on risk analysis methods and information on acceptable or tolerable risks for loss of life.

Risk analysis can be broken up into four components, namely:

- Hazard identification;
- Frequency analysis;
- Consequence analysis; and
- Risk estimation.

For the loss of life, the individual risk can be calculated using:

$R_{LOL} = P_H \times P_{S:H} \times P_{T:S} \times V_{D:T}$

Where:

- R_{LOL} is the risk, or annual probability of death of an individual;
- P_H is the annual probability of the hazardous event;
- $P_{S:H}$ is the probability of spatial impact by the hazard given the event;
- $P_{T:S}$ is the temporal probability given the spatial impact; and
- $V_{D:T}$ is the vulnerability of the individual.

Table 3 details the results of the assessment undertaken in relation to risk to life of the hazards identified at this site.

Table 3: Risk Assessment for Life – Proposed Development

	Hazard	$P_{(H)}$	$P_{(S:H)}$	$P_{(T:S)}$	$V_{(D:T)}$	Risk $R_{(LOL)}$
1	Slow creep of soils within footprint of the development	1×10^{-4}	1	0.75 (people in building three quarters of the time)	1×10^{-3} (evacuation possible)	7.5×10^{-8}
2	Deep seated failure of site affecting current lot and adjacent properties	1×10^{-5}	1	0.75 (people in building three quarters of the time)	1×10^{-3} (evacuation possible)	7.5×10^{-9}
3	Stability failure of fill embankment and batters affecting adjacent properties	1×10^{-5} (provided engineered batter and/or retaining system provided to support all filling)	0.25 (proposed filling areas for development covering 25% of site area)	0.75 (people in building three quarters of the time)	1×10^{-3} (evacuation possible)	1.8×10^{-9}
				0.05 (people adjacent to fill areas 5% of the time)	0.5	6.3×10^{-8}
4	Stability failure of cut embankment and batters affecting adjacent properties to the north and south.	1×10^{-5} (provided engineered batter and/or retaining system provided to support all cuttings)	0.5 (proposed cuttings for development covering 50% of the site area)	0.75 (people in building three quarters of the time)	1×10^{-3} (evacuation possible)	3.7×10^{-9}
				0.05 (people adjacent to fill areas 5% of the time)	0.5	1.25×10^{-7}
5	Stability failure of slopes modified by earthworks – propagation upslope towards eastern property.	1×10^{-4} (provided engineered batter and/or retaining system provided to support cuttings along eastern boundary)	0.5 (proposed cuttings for development covering 50% of the site area)	0.05 (people adjacent lot (reserve) to the east 5% of the time)	0.5	1.25×10^{-6}

Table 3: Risk Assessment for Life – Proposed Development (cont)

Hazard		$P_{(H)}$	$P_{(S:H)}$	$P_{(T:S)}$	$V_{(D:T)}$	Risk $R_{(LOL)}$
6	Stability failure of slopes modified by earthworks – downslope impacts to properties to the west.	1×10^{-5} (provided engineering assessment of new building foundations and their effects is undertaken)	0.3 (proposed building foundation area covering 30% of the site area)	0.75 (people in downslope properties three quarters of the time)	1×10^{-3} (evacuation possible)	2.3×10^{-9}

Notes to Table 3:

(1) Based on limited access to rear of site as indicated on site plan of proposed development TP-01 attached.

There are no established individual or societal risk acceptance criteria for the loss of life due to a hazardous event such as a landslide or rock fall. Australian Geoguide LR7 of Ref 2 (Included in Appendix C) discusses “acceptable” and “tolerable” levels of risk which have been proposed by several authorities including the ANCOLD Guidelines for Risks from Large Dams, the Australian Geomechanics Society and the Department of Urban Affairs and Planning. The AGS Guidelines (Ref 2) indicates that for most developments in existing urban areas, “tolerable” risk levels can be considered as the “acceptable” risk, with Table 1 of the Practice Note (Ref 2) indicating that a risk of loss of life of 10^{-5} would be tolerable for new constructed slopes and a risk of life of 10^{-4}, would be tolerable for existing slopes and developments.

Based on this information, given that the risk to life is generally less than 10^{-6} for the hazards identified above, the risk to life associated with the proposed development is likely to be acceptable to society and regulators.

5. Conclusion

In summary, the proposed development is considered suitable from a geotechnical perspective provided the following is undertaken at the appropriate stage of the development process:

- Detailed geotechnical site investigations to determine the subsurface conditions at the location of the proposed structures. This information is required for detailed design of foundations, excavations and retaining structures;
- Undertake mine subsidence risk assessment to establish mine subsidence design parameters and guide foundation selection;
- Submission of Mine Subsidence Board (MSB) building application for approval;
- Undertake a condition assessment of existing retaining structures that will not be demolished and are to remain as part of the new development.

6. References

1. Packham G H (ed), 1969; "The Geology of NSW", Geological Society of Australia, 1969.
2. Australian Geomechanics (2009). Practice Note Guidelines for Landslide Risk Management, Vol. 42, No. 1 pp. 63-114, March.
3. "Engineering Geology of the Newcastle – Gosford Region", Australian Geomechanics Society, 1995.

7. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report (or services) for this project at NBN Studio, Mosbri Crescent, The Hill in accordance with DP's proposal dated and acceptance received from Scott Soutar (Station Manager) dated 23rd October 2015. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of Nine Network Australia Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

Douglas Partners Pty Ltd

Appendix A

Proposed Development

SJB Architects

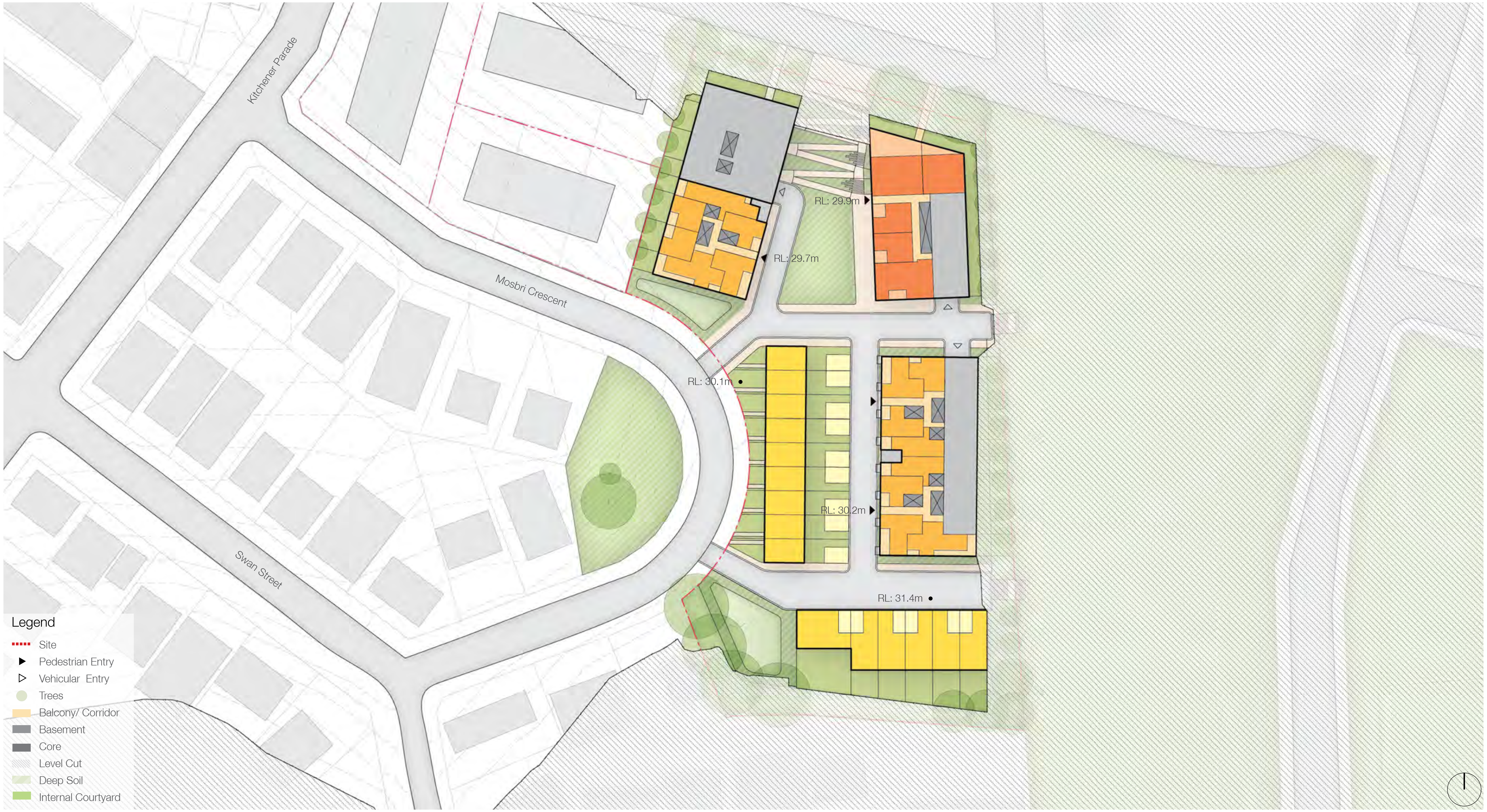
11 Mosbri Crescent

The Hill, Newcastle
Nine Network Australia

27 July 2015 | Version 04

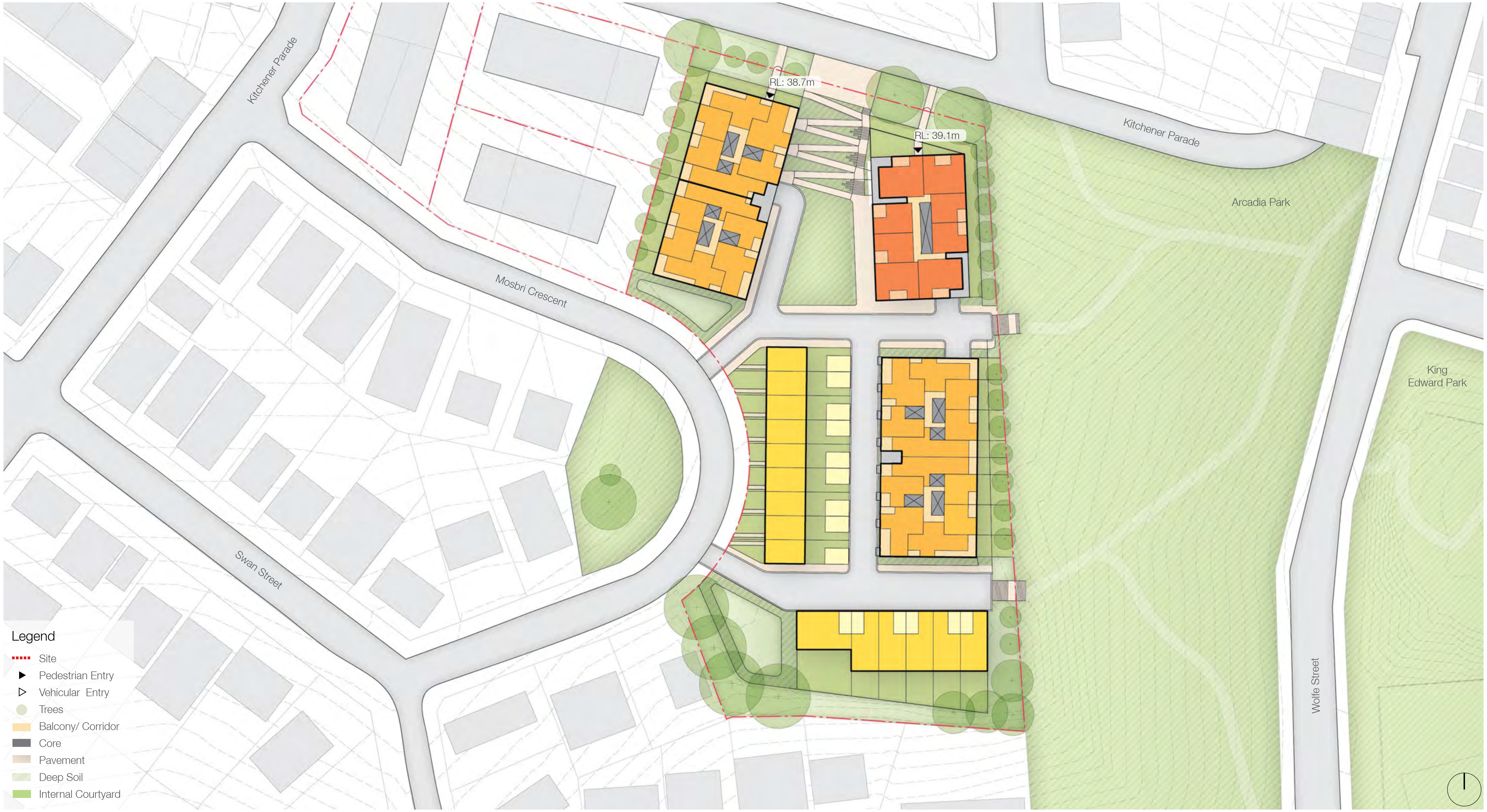
3.7 Option 03 (Preferred) - Basement Plan

3.7 Option 03 (Preferred) - Ground Floor Plan

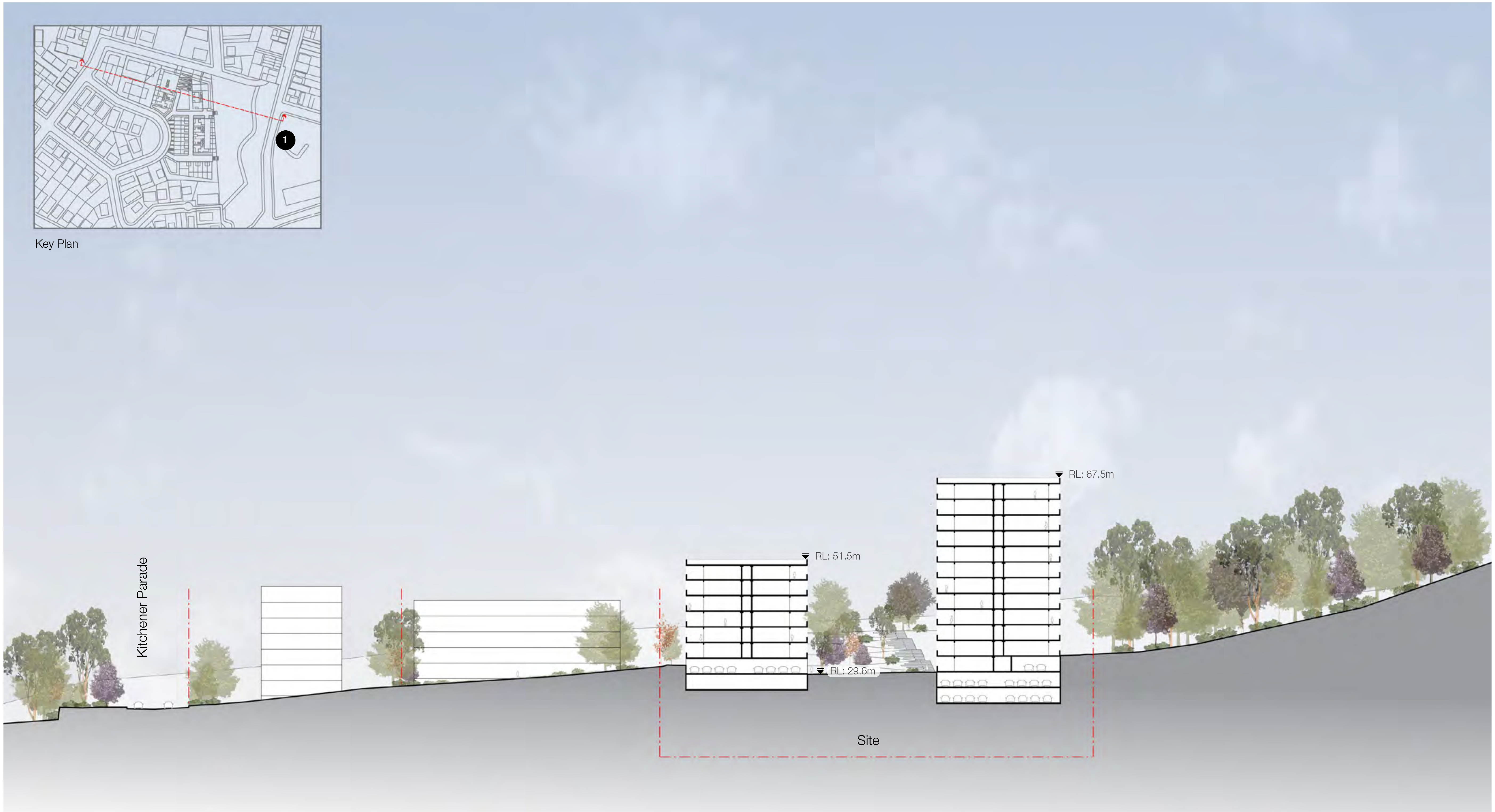


3.7 Option 03 (Preferred) - First Floor Plan

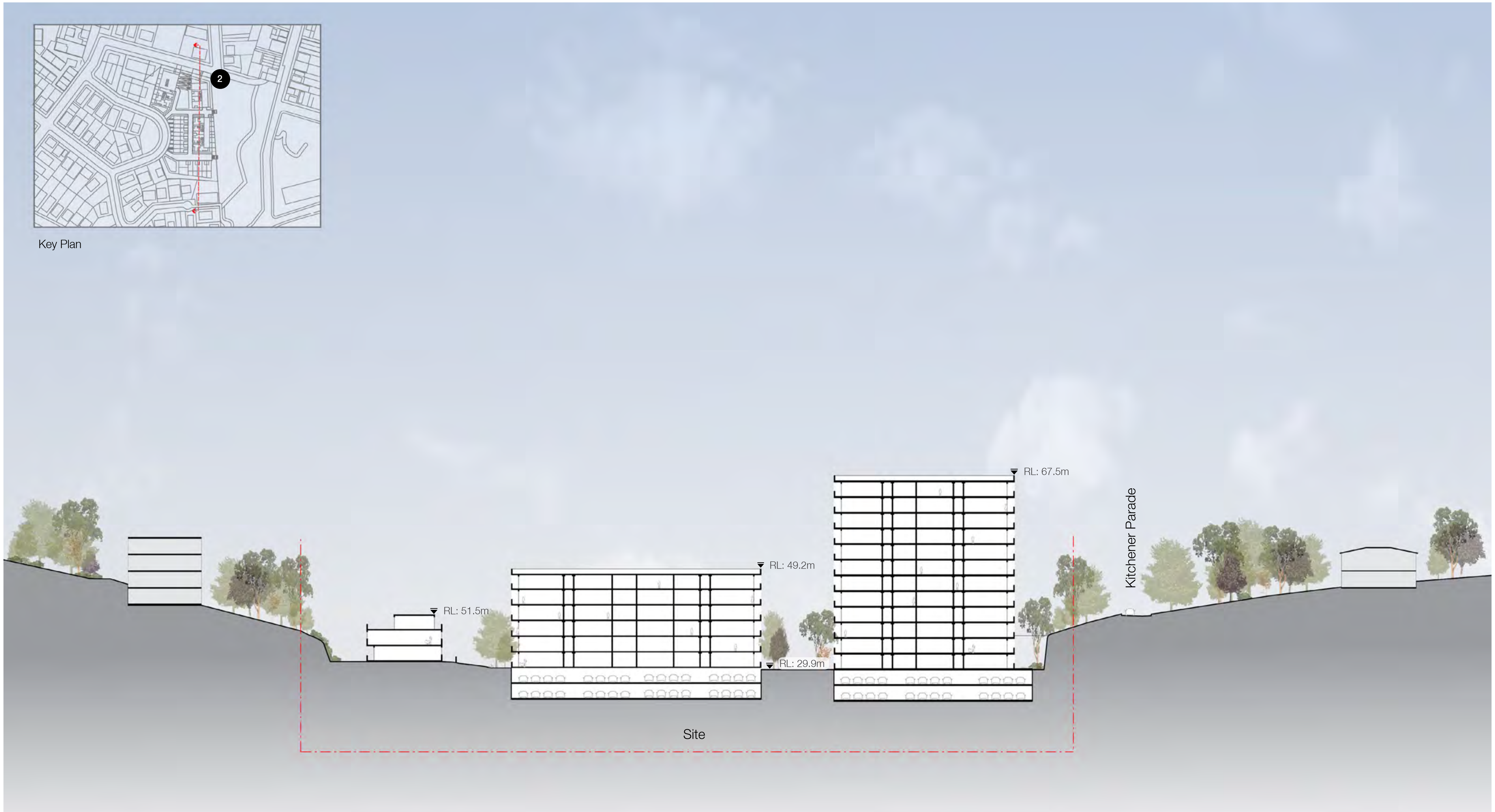
3.7 Option 03 (Preferred) - Typical Floor Plan



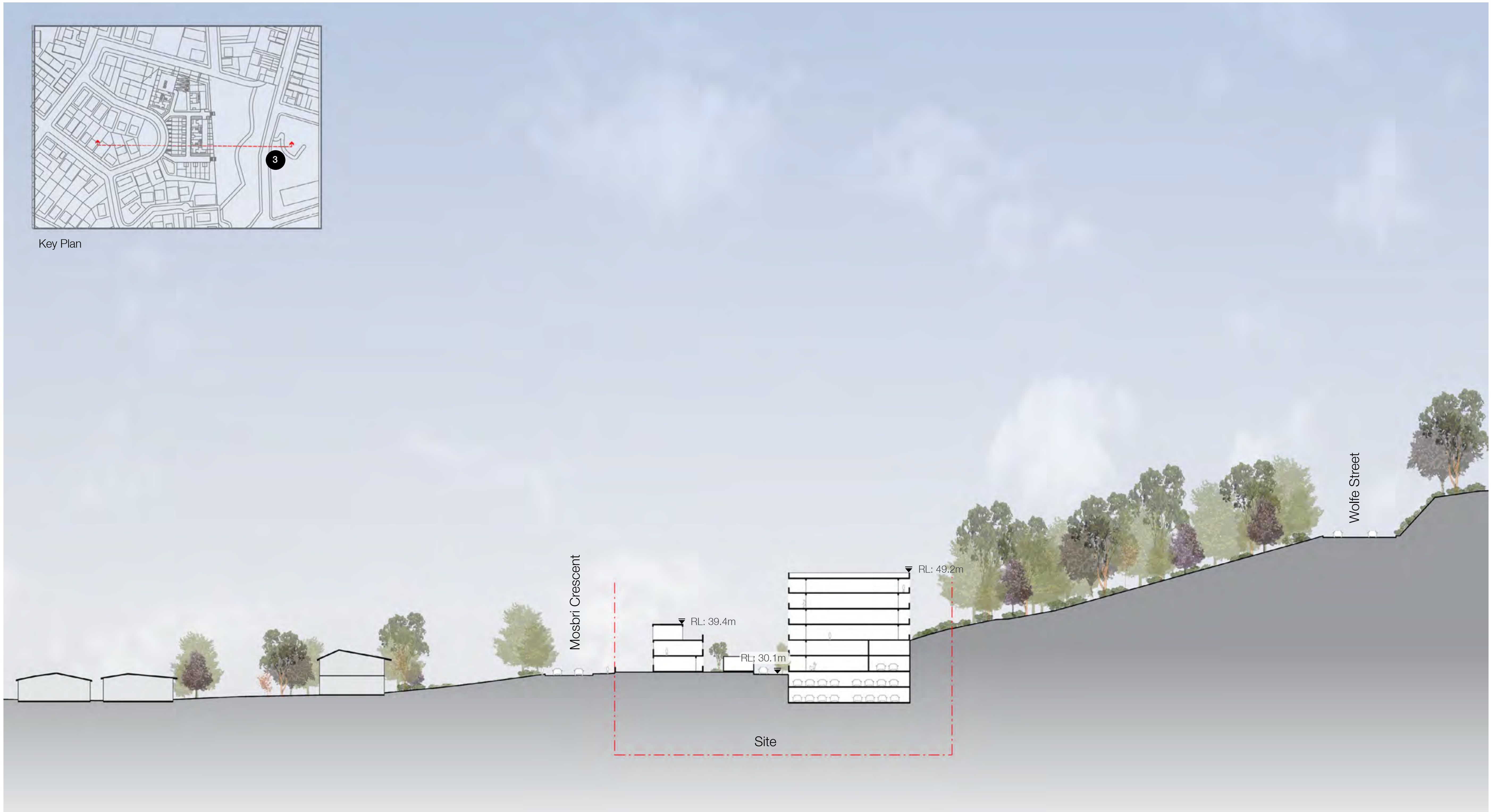
3.8 Option 3 (Preferred) - Section 1



3.8 Option 3 (Preferred) - Section 2



3.8 Option 3 (Preferred) - Section 3



Appendix B

About This Report

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Appendix C

AGS Slope Stability Documents

APPENDIX C: LANDSLIDE RISK ASSESSMENT

QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	Notional Boundary					
10^{-1}	5×10^{-2}	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	5×10^{-3}	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	5×10^{-4}	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	5×10^{-5}	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	5×10^{-6}	100,000 years	200,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10^{-6}		1,000,000 years		The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not *vice versa*.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage		Description	Descriptor	Level
Indicative Value	Notional Boundary			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%	40%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	10%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	1%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%		Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.

(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.

(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not vice versa

APPENDIX C: – QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	**1: CATASTROPHIC 200%**	**2: MAJOR 60%**	**3: MEDIUM 20%**	**4: MINOR 5%**	**5: INSIGNIFICANT 0.5%**
A – ALMOST CERTAIN	10^{-1}	VH	VH	VH	H	M or **L** (5)
B - LIKELY	10^{-2}	VH	VH	H	M	**L**
C - POSSIBLE	10^{-3}	VH	H	M	M	**VL**
D - UNLIKELY	10^{-4}	H	M	**L**	**L**	**VL**
E - RARE	10^{-5}	M	**L**	**L**	**VL**	**VL**
F - BARELY CREDIBLE	10^{-6}	**L**	**VL**	**VL**	**VL**	**VL**

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.
(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		Example Implications (7)
VH	VERY HIGH RISK	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.
H	HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	MODERATE RISK	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L	LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.

LANDSLIDE RISK

Concept of Risk

Risk is a familiar term, but what does it really mean? It can be defined as *"a measure of the probability and severity of an adverse effect to health, property, or the environment."* This definition may seem a bit complicated. In relation to landslides, geotechnical practitioners (GeoGuide LR1) are required to assess risk in terms of the likelihood that a particular landslide will occur and the possible consequences. This is called landslide risk assessment. The consequences of a landslide are many and varied, but our concerns normally focus on loss of, or damage to, property and loss of life.

Landslide Risk Assessment

Some local councils in Australia are aware of the potential for landslides within their jurisdiction and have responded by designating specific "landslide hazard zones". Development in these areas is often covered by special regulations. If you are contemplating building, or buying an existing house, particularly in a hilly area, or near cliffs, go first for information to your local council.

Landslide risk assessment must be undertaken by a geotechnical practitioner. It may involve visual inspection, geological mapping, geotechnical investigation and monitoring to identify:

- potential landslides (there may be more than one that could impact on your site)
- the likelihood that they will occur
- the damage that could result
- the cost of disruption and repairs and
- the extent to which lives could be lost.

Risk assessment is a predictive exercise, but since the ground and the processes involved are complex, prediction tends to lack precision. If you commission a landslide risk assessment for a particular site you should expect to receive a report prepared in accordance with current professional guidelines and in a form that is acceptable to your local council, or planning authority.

Risk to Property

Table 1 indicates the terms used to describe risk to property. Each risk level depends on an assessment of how likely a landslide is to occur and its consequences in dollar terms. "Likelihood" is the chance of it happening in any one year, as indicated in Table 2. "Consequences" are related to the cost of repairs and temporary loss of use if a landslide occurs. These two factors are combined by the geotechnical practitioner to determine the Qualitative Risk.

TABLE 2: LIKELIHOOD

Likelihood	Annual Probability
Almost Certain	1:10
Likely	1:100
Possible	1:1,000
Unlikely	1:10,000
Rare	1:100,000
Barely credible	1:1,000,000

The terms "unacceptable", "may be tolerated", etc. in Table 1 indicate how most people react to an assessed risk level. However, some people will always be more prepared, or better able, to tolerate a higher risk level than others.

Some local councils and planning authorities stipulate a maximum tolerable level of risk to property for developments within their jurisdictions. In these situations the risk must be assessed by a geotechnical practitioner. If stabilisation works are needed to meet the stipulated requirements these will normally have to be carried out as part of the development, or consent will be withheld.

TABLE 1: RISK TO PROPERTY

Qualitative Risk		Significance - Geotechnical engineering requirements
Very high	VH	**Unacceptable** without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low. May be too expensive and not practical. Work likely to cost more than the value of the property.
High	H	**Unacceptable** without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to acceptable level. Work would cost a substantial sum in relation to the value of the property.
Moderate	M	**May be tolerated** in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as possible.
Low	L	**Usually acceptable** to regulators. Where treatment has been needed to reduce the risk to this level, ongoing maintenance is required.
Very Low	VL	**Acceptable**. Manage by normal slope maintenance procedures.

Risk to Life

Most of us have some difficulty grappling with the concept of risk and deciding whether, or not, we are prepared to accept it. However, without doing any sort of analysis, or commissioning a report from an "expert", we all take risks every day. One of them is the risk of being killed in an accident. This is worth thinking about, because it tells us a lot about ourselves and can help to put an assessed risk into a meaningful context. By identifying activities that we either are, or are not, prepared to engage in we can get some indication of the maximum level of risk that we are prepared to take. This knowledge can help us to decide whether we really are able to accept a particular risk, or to tolerate a particular likelihood of loss, or damage, to our property (Table 2).

In Table 3, data from NSW for the years 1998 to 2002, and other sources, is presented. A risk of 1 in 100,000 means that, in any one year, 1 person is killed for every 100,000 people undertaking that particular activity. The NSW data assumes that the whole population undertakes the activity. That is, we are all at risk of being killed in a fire, or of choking on our food, but it is reasonable to assume that only people who go deep sea fishing run a risk of being killed while doing it.

It can be seen that the risks of dying as a result of falling, using a motor vehicle, or engaging in water-related activities (including bathing) are all greater than 1:100,000 and yet few people actively avoid situations where these risks are present. Some people are averse to flying and yet it represents a lower risk than choking to death on food. Importantly, the data also indicate that, even when the risk of dying as a consequence of a particular event is very small, it could still happen to any one of us any day. If this were not so, no one would ever be struck by lightning.

Most local councils and planning authorities that stipulate a tolerable risk to property also stipulate a tolerable risk to life. The AGS Practice Note Guideline recommends that 1:100,000 is tolerable in newly developed areas, where works can be carried out as part of the development to limit risk. The tolerable level is raised to 1:10,000 in established areas, where specific landslide hazards may have existed for many years. The distinction is deliberate and intended to prevent the concept of landslide risk management, for its own sake, becoming an unreasonable financial burden on existing communities. Acceptable risk is usually taken to be one tenth of the tolerable risk (1:1,000,000 for new developments and 1:100,000 for established areas) and efforts should be made to attain these where it is practicable and financially realistic to do so.

TABLE 3: RISK TO LIFE

Risk (deaths per participant per year)	**Activity/Event Leading to Death** (NSW data unless noted)
1:1,000	Deep sea fishing (UK)
1:1,000 to 1:10,000	Motor cycling, horse riding , ultra-light flying (Canada)
1:23,000	Motor vehicle use
1:30,000	Fall
1:70,000	Drowning
1:180,000	Fire/burn
1:660,000	Choking on food
1:1,000,000	Scheduled airlines (Canada)
1:2,300,000	Train travel
1:32,000,000	Lightning strike

More information relevant to your particular situation may be found in other AUSTRALIAN GEOGUIDES:

- GeoGuide LR1 - Introduction
- GeoGuide LR2 - Landslides
- GeoGuide LR3 - Landslides in Soil
- GeoGuide LR4 - Landslides in Rock
- GeoGuide LR5 - Water & Drainage
- GeoGuide LR6 - Retaining Walls
- GeoGuide LR8 - Hillside Construction
- GeoGuide LR9 - Effluent & Surface Water Disposal
  GeoGuide LR10 - Coastal Landslides
- GeoGuide LR11 - Record Keeping

The Australian GeoGuides (LR series) are a set of publications intended for property owners; local councils; planning authorities; developers; insurers; lawyers and, in fact, anyone who lives with, or has an interest in, a natural or engineered slope, a cutting, or an excavation. They are intended to help you understand why slopes and retaining structures can be a hazard and what can be done with appropriate professional advice and local council approval (if required) to remove, reduce, or minimise the risk they represent. The GeoGuides have been prepared by the Australian Geomechanics Society, a specialist technical society within Engineers Australia, the national peak body for all engineering disciplines in Australia, whose members are professional geotechnical engineers and engineering geologists with a particular interest in ground engineering. The GeoGuides have been funded under the Australian governments' National Disaster Mitigation Program.

APPENDIX C: SECTION 2.5 DGS REPORT COF-009/3(REV1)

effect contours move outwards by 8 m to 10 m. This adjustment would be negated if the inflexion point distance of 0.25H was also adopted (an unlikely value based on the Newcastle Coalfield database). The revised model contours were also verified against observed damage at the Cathedral Site; see **Figures 6a to 6e**.

It is considered that an influence function angle tangent of 1.5 and inflexion point distance of 0.32H represent the credible worst case for the Mosbri Cresent Site conditions; see **DgS, 2019**.

2.7.4 Reliability of Subsidence Effect Predictions

Providing worst-case subsidence predictions based on statistical inferences is not possible at this site unless there is a database of grout-modified pillars with failed pillars surrounding them from which to draw on (other than active mine site data with similar conditions and mining geometry from which to infer appropriate confidence limits - refer to the approach applied in **ACARP, 2003** and the U95%CL values applied to the various model input parameters used in this review).

However, with this issue in mind, the review of measured subsidence effects at a longwall mine to the west of Newcastle has provided some insight into the magnitudes of up-slope movements that may occur after grouting. The grout itself will reduce subsidence or vertical movement effects, but unlikely to reduce the horizontal movements across the site. The predicted movements for the site have therefore been based on post-mining movements upslope of three longwall mining cases.

The potential for prediction exceedances will also need to consider the likelihood of general slope instability after mine subsidence (see **Section 2.5**).

2.5 Post-Mining Slope Stability

The likelihood of *en-masse* sliding (i.e. a landslip) of the slope (in which the site is to be situated) after basal sandstone and siltstone beds have been cracked and tilted by a subsidence event has been assessed based on reference to **Das, 1998**, **Hoek 2000** and the landslide risk assessment terminology presented in **AGS, 2010**. A conceptual model of the forces acting on the rock wedge and bedding planes below the site is shown in **Figure 7a**.

Based on field mapping and observation of aerial photographs (Google Earth), there was no evidence of existing or past slope instability noted along the existing slope area.

It is considered that the stability of slope will be dependent on the following key changes to the surface topography due to mine subsidence:

(i) existing slope magnitude and change in bedding gradient due to tilt;

(ii) orientation and depth of cracking due to tensile strain and rigid body rotation of the slope;

(iii) presence of water in and on-going erosion of cracks;

(iv) depth of soil cover;

(v) stabilising effect of vegetation;

(vi) the completion of post-mining crack repair works.

Based on reference to **Fell et al, 1992,** any siltstone units that may be present at the base of sandstone units below the site have been assumed to have a lower bound, drained angle of friction (Ø') of 15° with 'zero' cohesion. Saturated slopes with water filled joints or mining-induced cracks have been assumed representative of worst-case conditions.

Based on the predicted tilt contours presented in DgS, 2019, the expected change to existing gradients will range between 0.5° and 0.7° (i.e. 10 to 12 mm/m tilt). This would indicate that any near-surface rock beds will have their dip increased from about 2° to 3° on west facing slopes below the site.

The predicted cracking widths of up to 30 mm within 15 m of the Mosbri Crescent slope crest suggests that surface water will then be able to enter the slope and temporarily introduce uplift pressures to the sides and base of the downslope wedge. Crack depths are likely to range between 10 m and 20 m, based on measurements at Mine 2.

The weight force of a unit width of a dry or wet, cracked slope with perched water present (in the cracks) acting down the slope versus the frictional resistance against sliding on rough to wavy bedding planes has been calculated as follows:

$W = (d_r g)h^2 ((1-(z/h)^2)\cot(a) - \cot(e))$ = weight of rock slope block with density (d_r), gravity constant (g), slope height (h), crack depth (z), bedding or failure plane slope angle (a) and surface slope angle (e).

$z = H [1-(\cot(e).\tan(a)-b.\tan(a)/h)]$ = maximum tension crack depth for the minimum FoS of the given rock slope geometry.
b = distance to crack from slope crest

b_{max} = maximum crack distance where cracking does not impact slope stability (i.e. z=0)
$= H(1/\tan(a) - 1/\tan(e))$

$U_1 = d_w g z_w^2/2$ = driving force of water (with density d_w) filled crack of depth z_w on the slope block.

$U_2 = d_w g z_w X/2$ = driving force of water (with density d_w) filled crack of depth z_w along the base distance X the slope block.

$X = (H-z)/\sin(a)$ = base length of sliding rock block

$T = W(\sin(a) + \alpha\cos(a)) + U_1\cos(a)$ = driving force of rock block (W), water filled crack (U_1) and design earthquake acceleration factor (α) of 0.09 (proportion of gravity acceleration)

$S = cX + [W(\cos(a) - \alpha\sin(a)) - U_2 - U_1\sin(a)]\tan(\phi)$ = rock block sliding resistance along a potential failure plane with drained cohesion, c' and drained friction angle, ϕ'.

FoS = S/T = factor of safety against sliding.

The pre and post-mining FoS for a range of bedding tilts and design cases are presented in **Figure 7b** and **7c** for a crack located at 20 m and 0 m respectively behind the slope crest.

The slopes in their current condition are assessed to have a 'Low' sliding potential over an extreme range of climatic conditions (i.e. Dry to Saturated) with an FoS range of 5.11 to 2.22. This is confirmed by the absence of slope features that are indicative of existing or past slope instability. Based on a recommended minimum FoS of 1.5 it is assessed that it is 'very unlikely' that a large-scale instability or landslip will occur before a mine subsidence event and dry or wet ground conditions.

If the slope below the site is subjected to an average tilt of 8 to 12 mm/m after subsidence, the FoS against sliding is estimated to range from 2.06 to 2.11 for saturated conditions with water filled cracks located 20 m behind crest of slope. For a deep crack forming at the crest, the FoS against sliding is estimated to range from 1.37 to 1.40. Based on a recommended minimum FoS of 1.25 it is assessed that it is 'unlikely' that a large-scale instability or landslip will occur during this condition.

If the slope below the site is subjected to an earthquake acceleration of 0.09g after subsidence, the FoS against sliding is estimated to range from 1.04 to 1.05 for saturated conditions with a water filled crack located at 20 m behind the slope. Similar values are estimated for a crack located at the crest and is 2/3 full of water (7.3 m above the wedge base or 3.6 m below the surface). Based on a recommended minimum FoS of 1 it is assessed that it is 'unlikely' that a large-scale instability or landslip will occur during this condition.

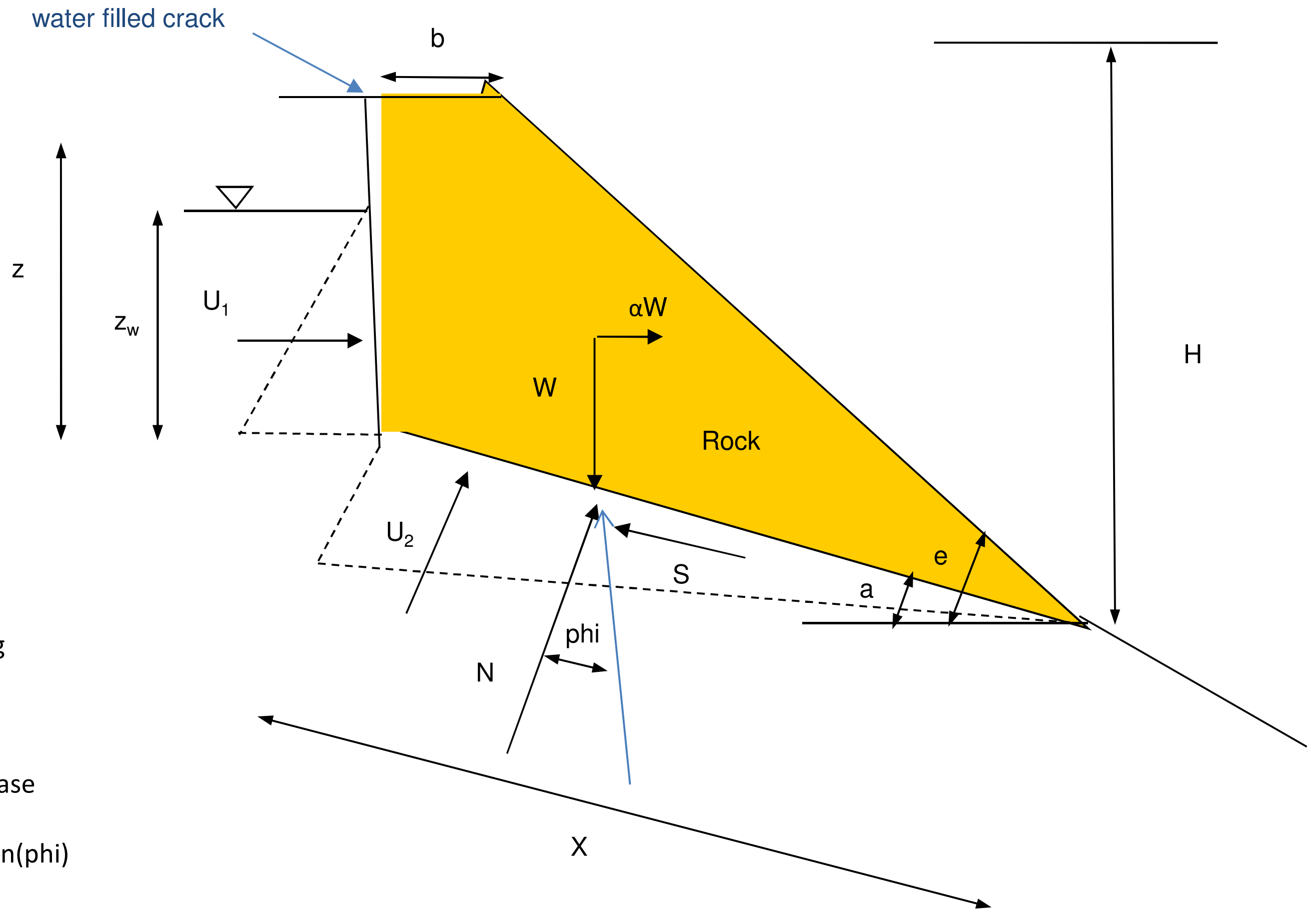
2.6 Points of Note on DgS, 2019

GAPL provide several points of note that have been addressed elsewhere in this document if a response was requested. Outstanding points are listed below:

- Section 7.4 - re: *Average pillar FoS does not determine the response of a system of pillars to load or convergence*. The average FoS is only applied to estimate the stability of an entire panel of irregular pillar geometries and is based on average pillar dimensions and not average FoS. This approach is generally required by the Merit Based Guidelines to assess the potential for a pillar run to occur, and is consistent with UNSW, 1998 probability of failure data for panels (not individual pillars).

- Section 8.4 - re: *Confusing column titles in Table 2A & 2B*. The columns titled "mining heights" should have been referred to as "pillar heights".

- Section 8.5 - re: *No basis for the Factor of Safety of 1.6 for the grout modified pillars is given.* The post-grouted pillar FoS refers to the residual strength of a grout-confined pillar with CWC pillar dimensions after a maximum subsidence of 100 mm. It is possible for the pillar to sustain higher load but subsidence will also be increased



Key:
H = Slope Height
b = distance crack behind crest
e = slope dip angle
a = bedding dip angle
X = Rock Wedge basal Contact Length
W = Rock Wedge Weight
g= gravity constant
α= earthquake acceleration as proportion of g
z = crack depth
z_w = water depth in crack
U_1 = Horizontal Water Pressure Force
U_2 = Normal water pressure force acting on base
N = Normal resistance force acting on base
S = Shear Strength of bedding plane = c' + Ntan(phi)

Ref: Hoek, 2000

DgS	Engineer:	S.Ditton	Client:	Stronach Property COF-009/3
	Drawn:	S.Ditton		
	Date:	15.10.19	Title:	Force Balance Diagram for Assessing Deep-Seated Sliding Potential on Slopes which have been Tilted and Cracked by Mine Subsidence
	Ditton Geotechnical Services Pty Ltd		Scale:	NTS
			Figure No:	6a

APPENDIX D: NORTHROP CIVIL ENGINEERING PACKAGE

MOSBRI APARTMENTS

11-17 MOSBRI CRESCENT
THE HILL, NSW, 2300

- CIVIL ENGINEERING PACKAGE -

NORTHROP

DRAWING LIST

DWG NO	DRAWING TITLE
DA-C00.01	COVER SHEET, DRAWING LIST AND LOCALITY PLAN
DA-C10.01	EROSION AND SEDIMENT CONTROL PLAN
DA-C10.11	EROSION AND SEDIMENT CONTROL DETAILS
DA-C20.01	CIVIL WORKS LOWER GROUND FLOOR
DA-C20.11	CIVIL WORKS GROUND FLOOR
DA-C20.21	CIVIL WORKS LEVEL 2
DA-C30.01	CIVIL DETAILS SHEET 1
DA-C30.02	CIVIL DETAILS SHEET 2
DA-C30.03	CIVIL DETAILS SHEET 3
DA-C30.04	CIVIL DETAILS SHEET 4
DA-C40.01	CUT FILL PLAN
DA-C40.11	BULK EARTHWORKS PLAN
DA-C40.21	BULK EARTHWORKS SECTIONS

VERIFIER: B.CLARK
JOB MANAGER: B.CLARK
DESIGNED: R.JEANS
DRAWN: B.DUGGAN

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR COORDINATION	CH	BC	RC	19.12.18
A	ISSUED FOR APPROVAL	CH	BC	RC	21.12.18
B	RE-ISSUED FOR APPROVAL	CH	BC	RC	08.10.19
C	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

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ARCHITECT: marchesepartners

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Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT: **11-17 MOSBRI CRESCENT THE HILL, NSW, 2300**

DRAWING TITLE: **COVER SHEET, DRAWING LIST AND LOCALITY PLAN**

JOB NUMBER: **NL180367**

DRAWING NUMBER: **DA-C00.01**

REVISION: **C**

DRAWING SHEET SIZE = A1

Date : 16.12.2021 2:17 PM Plotted By : BRAD DUGGAN Found : Y:\YEAR 2018 Jobs\NL180367 - Mosbri Cre\O - Drawings\CIVIL\#CAD\2-CAD FILES\01-DA\01\NL180367-DA-C01.01 COVER.dwg

LEGEND

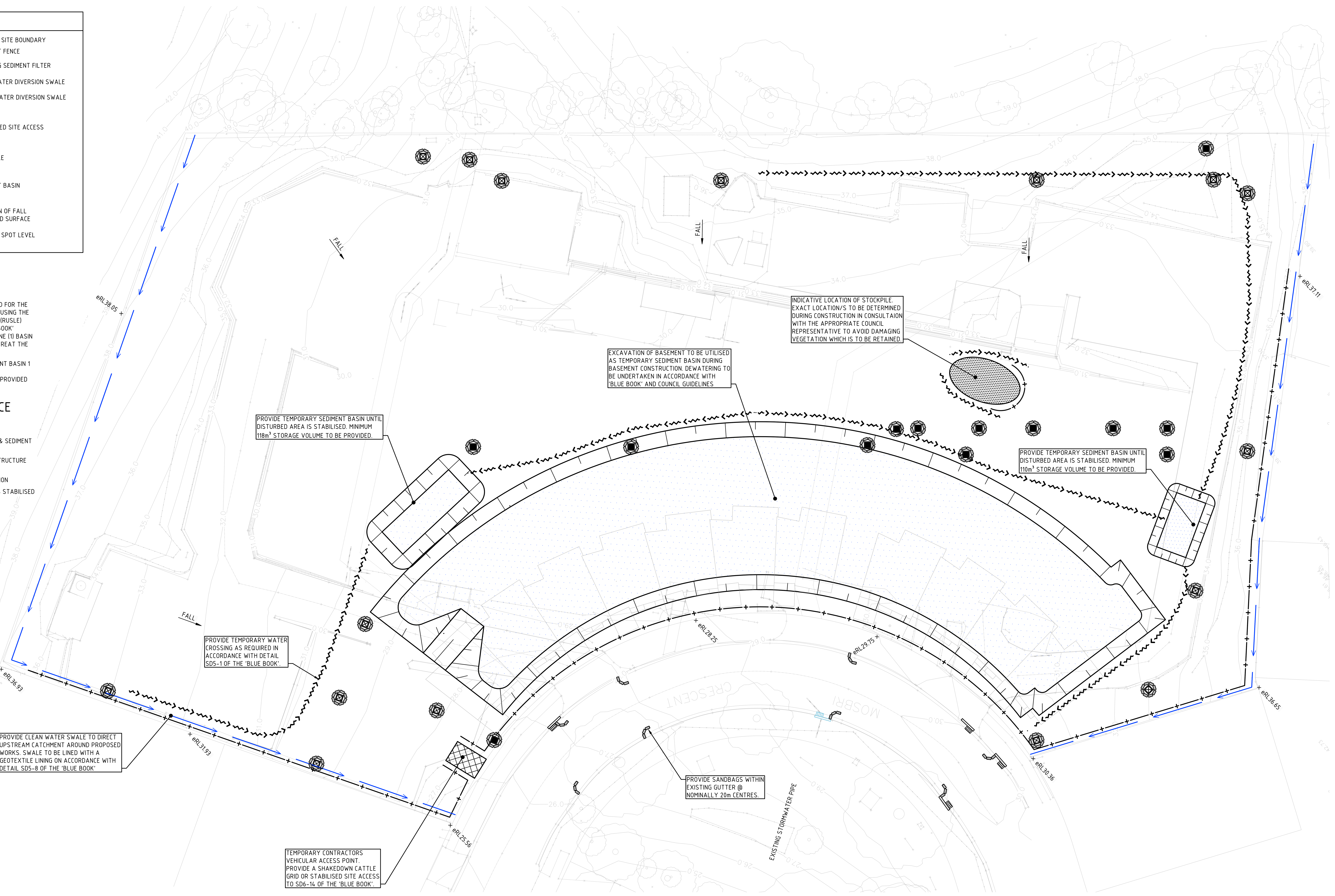
(symbol)	DENOTES SITE BOUNDARY
(symbol)	SEDIMENT FENCE
(symbol)	SANDBAG SEDIMENT FILTER
(symbol)	DIRTY WATER DIVERSION SWALE
(symbol)	CLEAN WATER DIVERSION SWALE
(symbol)	STABILISED SITE ACCESS
(symbol)	STOCKPILE
(symbol)	SEDIMENT BASIN
FALL →	DIRECTION OF FALL IN GRADED SURFACE
+ eRL38.05	EXISTING SPOT LEVEL

SEDIMENT BASIN SIZING

- THE SEDIMENT STORAGE VOLUME REQUIRED FOR THE PROPOSED WORKS HAS BEEN DETERMINED USING THE REVISED UNIVERSAL SOIL LOSS EQUATION (RUSLE) METHOD IN ACCORDANCE WITH THE 'BLUE BOOK' GUIDELINES AS SUMMARISED IN TABLE 1. ONE (1) BASIN HAS BEEN PROPOSED TO INTERCEPT AND TREAT THE SEDIMENT LADEN RUNOFF FROM THE SITE.
- THE SIZE SHAPE AND LOCATION OF SEDIMENT BASIN 1 MAY CHANGE DUE TO PROPOSED STAGING IMPLICATIONS, DETAILS OF WHICH WILL BE PROVIDED AT CC STAGE.

CONSTRUCTION SEQUENCE

- INSTALL STABILISED SITE ACCESS.
- INSTALL CLEAN WATER PUSH BACK BERM.
- INSTALL SAND BAG OR GEOTEXTILE SOCK & SEDIMENT CONTROL FENCES.
- CONSTRUCT DRAINAGE EASEMENT INFRASTRUCTURE AND CONNECT CLEAN WATER RUN-OFF.
- UNDERTAKE ROAD & BUILDING CONSTRUCTION
- REMOVE SEDIMENT CONTROLS ONCE SITE IS STABILISED



DRAWN: B.DUGGAN DESIGNED: R.JEANS JOB MANAGER: B.CLARK VERIFIER: B.CLARK

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR COORDINATION	CH	BC	RC	19.12.18
A	ISSUED FOR APPROVAL	CH	BC	RC	21.12.18
B	RE-ISSUED FOR APPROVAL	CH	BC	RC	08.10.19
C	RE-ISSUED FOR APPROVAL	BD	BC	RC	12.08.20
D	RE-ISSUED FOR APPROVAL	BD	BC	RC	22.04.21
E	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

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SCALE 1:250@ A1 — 0 2 4 6 8 10 12m

NORTHROP
Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT: **11-17 MOSBRI CRESCENT THE HILL, NSW, 2300**

DRAWING TITLE: **EROSION AND SEDIMENT CONTROL PLAN**

JOB NUMBER: **NL180367**

DRAWING NUMBER: **DA-C10.01** REVISION: **E**

DRAWING SHEET SIZE = A1

EROSION AND SEDIMENTATION CONTROL NOTES

1. ALL EROSION AND SEDIMENTATION CONTROL MEASURES MUST BE APPROPRIATE FOR THE SEDIMENT TYPE(S) OF THE SOILS ON-SITE, IN ACCORDANCE WITH THE 'BLUE BOOK' (MANAGING URBAN STORMWATER - SOILS AND CONSTRUCTION. LANDCOM, 2004), OR OTHER CURRENT RECOGNISED INDUSTRY STANDARDS FOR EROSION AND SEDIMENT CONTROL FOR AUSTRALIAN CONDITIONS. THIS INCLUDES SEDIMENT TRAPS AND LINING OF CHANNELS.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR KEEPING A DETAILED WRITTEN RECORD OF ALL EROSION AND SEDIMENT CONTROLS ON-SITE DURING THE CONSTRUCTION PERIOD. THIS RECORD SHALL BE UPDATED ON A DAILY BASIS AND SHALL CONTAIN DETAILS ON THE CONDITION OF CONTROLS AND ANY/ALL MAINTENANCE, CLEANING AND BREACHES. THIS RECORD SHALL BE KEPT ON-SITE AT ALL TIMES AND SHALL BE MADE AVAILABLE FOR INSPECTION BY THE PRINCIPAL CERTIFYING AUTHORITY AND THE SUPERINTENDENT DURING NORMAL WORKING HOURS.
3. INSTALL SEDIMENT PROTECTION FILTERS ON ALL NEW AND EXISTING STORMWATER INLET PITS IN ACCORDANCE WITH EITHER THE MESH AND GRAVEL INLET FILTER DETAIL SD6-11 OR THE GEOTEXTILE INLET FILTER DETAIL SD6-12 OF THE 'BLUE BOOK'.
4. ESTABLISH ALL REQUIRED SEDIMENT FENCES IN ACCORDANCE WITH DETAIL SD6-8 OF THE 'BLUE BOOK'.
5. INSTALL SEDIMENT FENCING, OR OTHER SEDIMENT CONTROL DEVICES, AROUND INDIVIDUAL BUILDING ZONES/AREAS AS REQUIRED AND AS DIRECTED BY THE SUPERINTENDENT OR APPROPRIATE COUNCIL OFFICER.
6. ALL TRENCHES INCLUDING ALL SERVICE TRENCHES AND SWALE EXCAVATION SHALL BE SIDE-CAST TO THE HIGH SIDE AND CLOSED AT THE END OF EACH DAYS WORK.
7. THE CONTRACTOR SHALL ENSURE THAT ALL VEGETATION (TREE, SHRUB & GROUND COVER) WHICH IS TO BE RETAINED SHALL BE PROTECTED DURING THE DURATION OF CONSTRUCTION.
8. ALL VEGETATION TO BE REMOVED SHALL BE MULCHED ON-SITE AND SPREAD/STOCKPILED AS DIRECTED BY THE SUPERINTENDENT.
9. STRIP TOPSOIL IN AREAS DESIGNATED FOR STRIPPING AND STOCKPILE FOR RE-USE AS REQUIRED. ANY SURPLUS MATERIAL SHALL BE SPREAD ON-SITE AS DIRECTED BY THE SUPERINTENDENT OR REMOVED FROM SITE AND DISPOSED OF IN ACCORDANCE WITH EPA GUIDELINES.
10. CONSTRUCT AND MAINTAIN ALL MATERIAL STOCKPILES IN ACCORDANCE WITH DETAIL SD4-1 OF THE 'BLUE BOOK' (INCLUDING CUT-OFF SWALES TO THE HIGH SIDE AND SEDIMENT FENCES TO THE LOW SIDE).
11. ENSURE STOCKPILES DO NOT EXCEED 2.0m HIGH. PROVIDE WIND AND RAIN EROSION PROTECTION AS REQUIRED IN ACCORDANCE WITH THE 'BLUE BOOK'.
12. PROVIDE WATER TRUCKS OR SPRINKLER DEVICES DURING CONSTRUCTION AS REQUIRED TO SUPPRESS DUST.
13. ONCE CUT/FILL OPERATIONS HAVE BEEN FINALIZED ALL DISTURBED AREAS THAT ARE NOT BEING WORKED ON SHALL BE RE-VEGETATED AS SOON AS IS PRACTICAL.

SEDIMENT BASIN SIZING CALCULATION

THE SITE IS LOCATED WITHIN THE KILLINGWORTH SOIL LANDSCAPE, WHICH HAS THE FOLLOWING PROPERTIES (IN ACCORDANCE WITH TABLE C17 OF THE "BLUE BOOK"):

SITE PARAMETERS - NORTH BASIN

CONSTRAINT	VALUE
SEDIMENT TYPE	F
SOIL HYDROLOGY GROUP	A
K = SOIL ERODIBILITY (K-FACTOR)	0.036
R = RAINFALL EROSIVITY (R-FACTOR)	2190
S = 2 YEAR, 6 HOUR STORM INTENSITY	9.93 mm/hr
LS = SLOPE LENGTH/GRADIENT	5.52 (75m SLOPE @ 11% GRADE)
P = EROSION CONTROL PRACTICE (P-FACTOR)	1.3 (TYPICAL)
C = GROUND COVER (C-FACTOR)	1.0 (TYPICAL FOR STRIPPED SITE)
SOIL LOSS (RUSLE METHOD) (tonnes/ha/yr)	566
EROSION HAZARD (TABLE 4.2 BLUE BOOK)	HIGH

SITE PARAMETERS - SOUTH BASIN

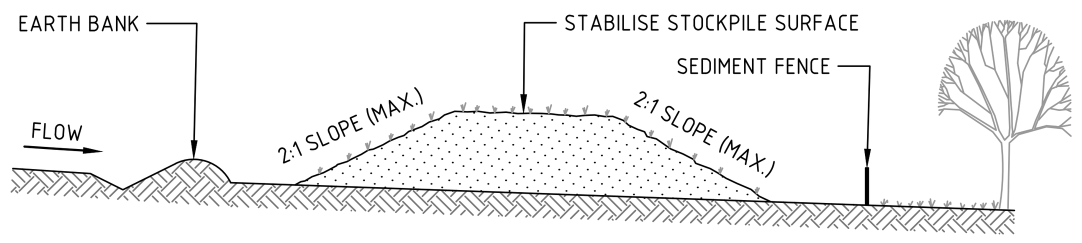
CONSTRAINT	VALUE
SEDIMENT TYPE	F
SOIL HYDROLOGY GROUP	A
K = SOIL ERODIBILITY (K-FACTOR)	0.036
R = RAINFALL EROSIVITY (R-FACTOR)	2190
S = 2 YEAR, 6 HOUR STORM INTENSITY	9.93 mm/hr
LS = SLOPE LENGTH/GRADIENT	4.61 (75m SLOPE @ 11% GRADE)
P = EROSION CONTROL PRACTICE (P-FACTOR)	1.3 (TYPICAL)
C = GROUND COVER (C-FACTOR)	1.0 (TYPICAL FOR STRIPPED SITE)
SOIL LOSS (RUSLE METHOD) (tonnes/ha/yr)	472
EROSION HAZARD (TABLE 4.2 BLUE BOOK)	HIGH

SEDIMENT BASIN SIZING - NORTH BASIN

CONSTRAINT	VALUE	UNITS
CV = VOLUMETRIC RUNOFF COEFFICIENT	0.5	
R = 5 DAY, 75TH PERCENTILE RAINFALL	30.500	mm
A = CATCHMENT AREA	0.600	ha
SETTLING ZONE VOLUME (10xCVxRxA)	73.200	m^3
SOIL LOSS (CALC ABOVE)	103	m^3/ha/yr
A2 = DISTURBED CATCHMENT AREA	435	ha
SEDIMENT STORAGE VOLUME (0.17xSOIL LOSSxA2)	44	m^3
TOTAL BASIN VOLUME REQUIRED	118	m^3

SEDIMENT BASIN SIZING - SOUTH BASIN

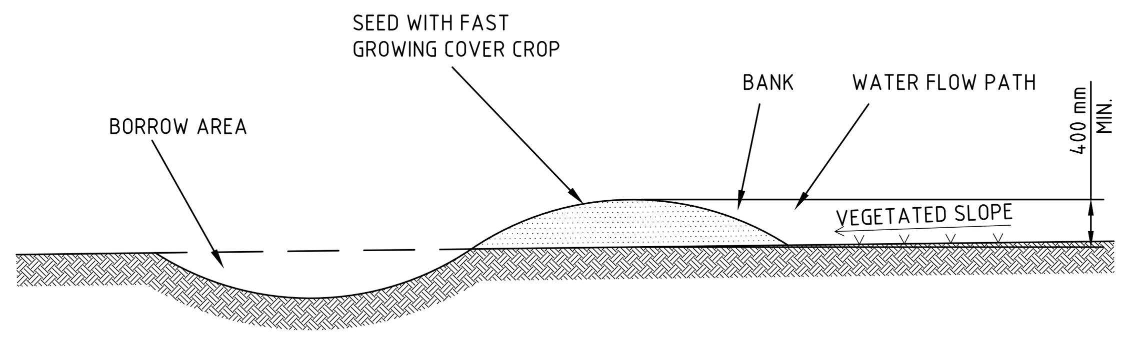
CONSTRAINT	VALUE	UNITS
CV = VOLUMETRIC RUNOFF COEFFICIENT	0.5	
R = 5 DAY, 75TH PERCENTILE RAINFALL	30.500	mm
A = CATCHMENT AREA	0.600	ha
SETTLING ZONE VOLUME (10xCVxRxA)	73.200	m^3
SOIL LOSS (CALC ABOVE)	103	m^3/ha/yr
A2 = DISTURBED CATCHMENT AREA	363	ha
SEDIMENT STORAGE VOLUME (0.17xSOIL LOSSxA2)	37	m^3
TOTAL BASIN VOLUME REQUIRED	110	m^3



CONSTRUCTION NOTES

1. PLACE STOCKPILES MORE THAN 2m (PREFERABLY 5m) FROM EXISTING VEGETATION, CONCENTRATED WATER FLOW, ROADS AND HAZARD AREAS.
2. CONSTRUCT ON THE CONTOUR AS LOW, FLAT, ELONGATED MOUNDS.
3. WHERE THERE IS SUFFICIENT AREA, TOPSOIL STOCKPILES SHALL BE LESS THAN 2m IN HEIGHT.
4. WHERE THEY ARE TO BE IN PLACE FOR MORE THAN 10 DAYS, STABILISE FOLLOWING THE APPROVED ESCP OR SWMP TO REDUCE THE C-FACTOR TO LESS THAN 0.10.
5. CONSTRUCT EARTH BANKS (STANDARD DRAWING 5-5) ON THE UPSLOPE SIDE TO DIVERT WATER AROUND STOCKPILES AND SEDIMENT FENCES (STANDARD DRAWING 6-8) 1 TO 2m DOWNSLOPE.

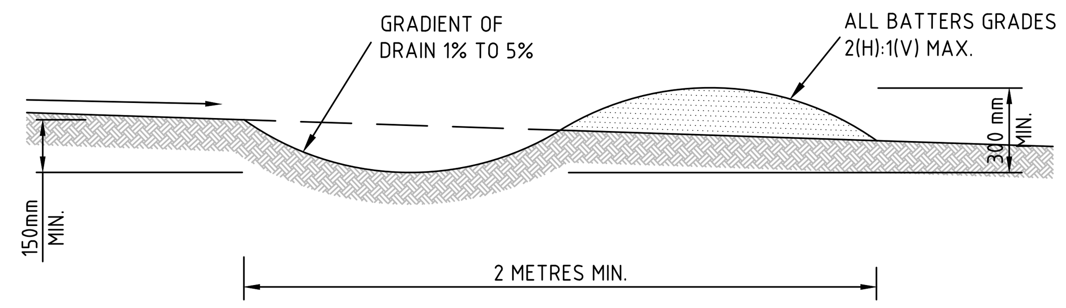
STOCKPILES (SD 4-1)



BACK PUSH BANK

NOTES

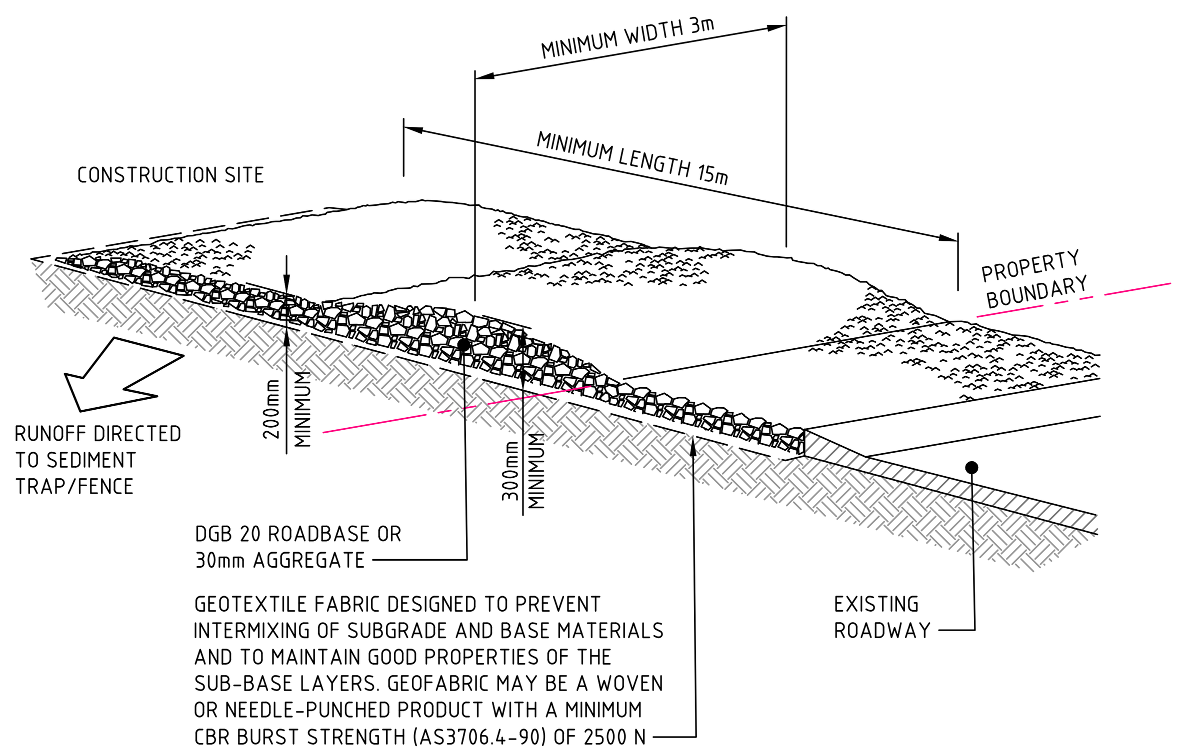
1. TO BE USED FOR CLEAN WATER DIVERSION DRAINS.
2. BORROW AREA TO BE ON DISTURBED (DIRTY) SIDE OF DRAIN.
3. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE - WORK AROUND THEM.
4. ENSURE THE STRUCTURES ARE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT COULD IMPEDE WATER FLOW.
5. BUILD THE DRAINS WITH CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTIONS, NOT V SHAPED.
6. ENSURE THE BANKS ARE PROPERLY COMPACTED TO PREVENT FAILURE.
7. COMPLETE PERMANENT OR TEMPORARY STABILISATION WITHIN 10 DAYS OF CONSTRUCTION.



WATER DIVERSION SWALE

NOTES

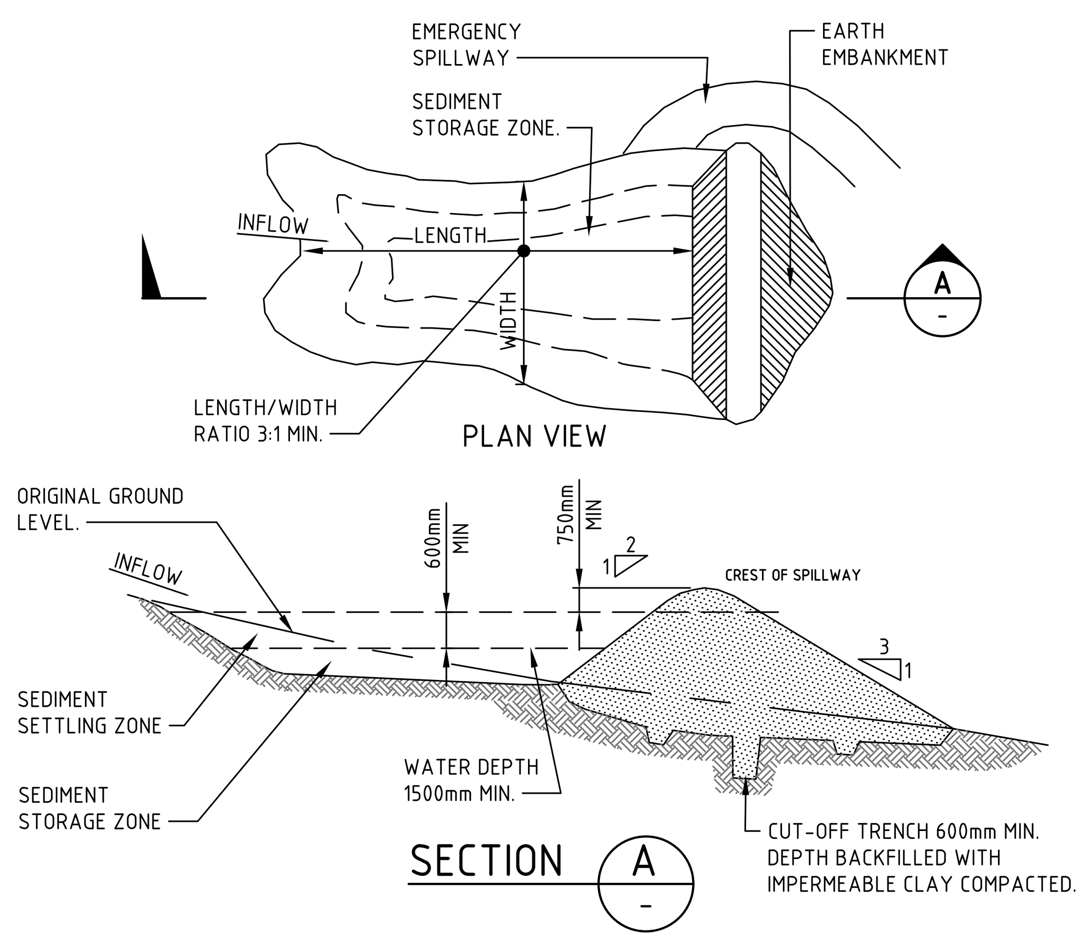
1. TO BE USED FOR DIRTY WATER CUT OFF SWALES & CLEAN WATER DIVERSION DRAINS (IF LINED)
2. PROVIDE GEOFABRIC LINING TO SECTIONS OF CLEAN WATER DIVERSION
3. BUILD WITH GRADIENTS BETWEEN 1 PERCENT AND 5 PERCENT.
4. AVOID REMOVING TREES AND SHRUBS IF POSSIBLE - WORK AROUND THEM.
5. ENSURE THE STRUCTURES ARE FREE OF PROJECTIONS OR OTHER IRREGULARITIES THAT COULD IMPEDE WATER FLOW.
6. BUILD THE DRAINS WITH CIRCULAR, PARABOLIC OR TRAPEZOIDAL CROSS SECTIONS, NOT V SHAPED.
7. ENSURE THE BANKS ARE PROPERLY COMPACTED TO PREVENT FAILURE.
8. COMPLETE PERMANENT OR TEMPORARY STABILISATION WITHIN 10 DAYS OF CONSTRUCTION.



CONSTRUCTION NOTES

1. STRIP THE TOPSOIL, LEVEL THE SITE AND COMPACT THE SUBGRADE.
2. COVER THE AREA WITH NEEDLE-PUNCHED GEOTEXTILE.
3. CONSTRUCT A 200mm THICK PAD OVER THE GEOTEXTILE USING ROAD BASE OR 30mm AGGREGATE.
4. ENSURE THE STRUCTURE IS AT LEAST 15 METRES LONG OR TO BUILDING ALIGNMENT AND AT LEAST 3 METRES WIDE.
5. WHERE A SEDIMENT FENCE JOINS ONTO THE STABILISED ACCESS, CONSTRUCT A HUMP IN THE STABILISED ACCESS TO DIVERT WATER TO THE SEDIMENT FENCE.

STABILISED SITE ACCESS (SD 6-14)

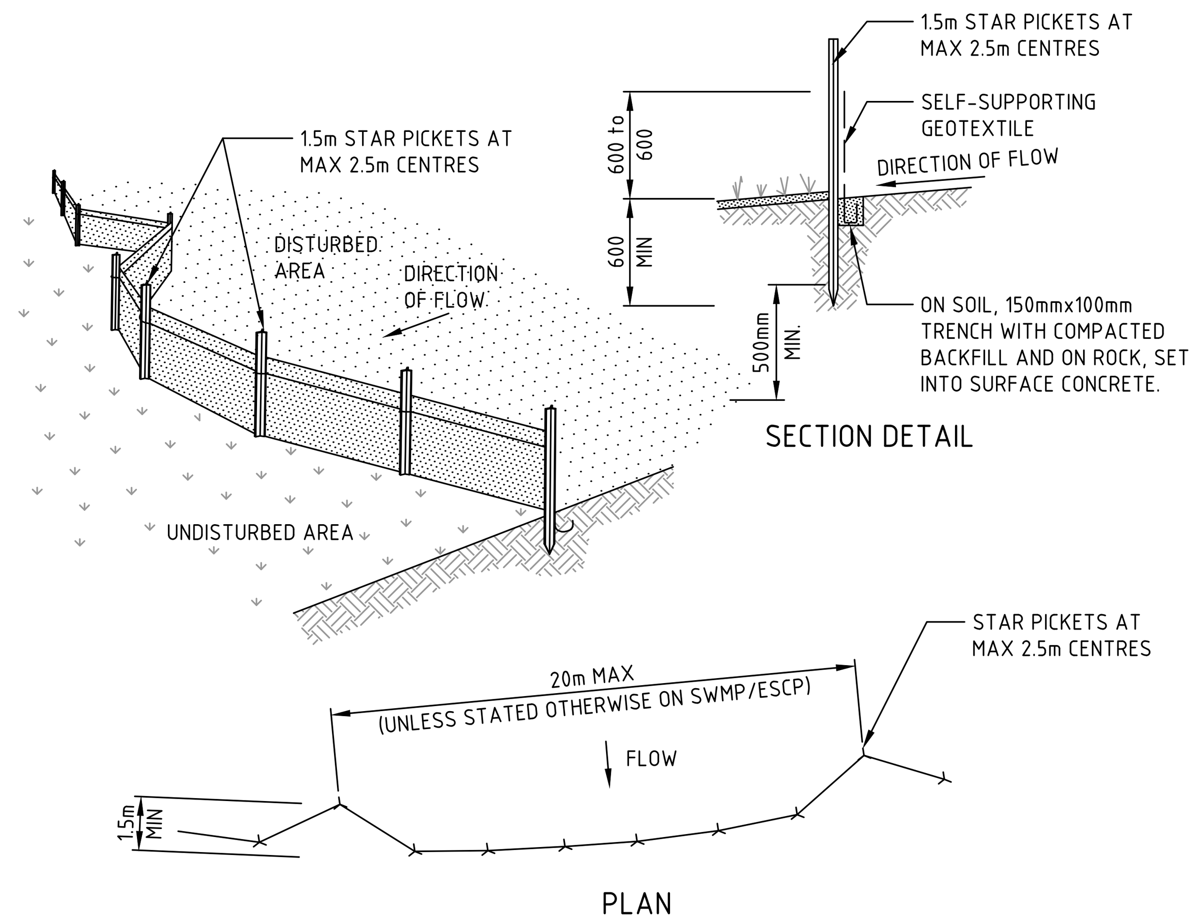


CONSTRUCTION NOTES

1. REMOVE ALL VEGETATION AND TOPSOIL FROM UNDER THE DAM WALL AND FROM WITHIN THE STORAGE AREA.
2. CONSTRUCT A CUT-OFF TRENCH 500mm DEEP AND 1200mm WIDE ALONG THE CENTRELINE OF THE EMBANKMENT EXTENDING TO A POINT ON THE GULLY WALL LEVEL WITH THE RISER CREST.
3. MAINTAIN THE TRENCH FREE OF WATER AND RECOMPACT THE MATERIALS WITH EQUIPMENT AS SPECIFIED IN THE SWMP TO 95 PER CENT STANDARD PROCTOR DENSITY.
4. SELECT FILL FOLLOWING THE SWMP THAT IS FREE OF ROOTS, WOOD, ROCK, LARGE STONE OR FOREIGN MATERIAL.
5. PREPARE THE SITE UNDER THE EMBANKMENT BY RIPPING TO AT LEAST 100mm TO HELP BOND COMPACTED FILL TO THE EXISTING SUBSTRATE.
6. SPREAD THE FILL IN 100mm TO 150mm LAYERS AND COMPACT IT AT OPTIMUM MOISTURE CONTENT FOLLOWING THE SWMP.
7. CONSTRUCT THE EMERGENCY SPILLWAY.
8. REHABILITATE THE STRUCTURE FOLLOWING THE SWMP.

(APPLIES TO 'TYPE D' AND 'TYPE F' SOILS ONLY)

EARTH BASIN - WET (SD 6-4)



CONSTRUCTION NOTES

1. CONSTRUCT SEDIMENT FENCES AS CLOSE AS POSSIBLE TO BEING PARALLEL TO THE CONTOURS OF THE SITE, BUT WITH SMALL RETURNS AS SHOWN IN THE DRAWING TO LIMIT THE CATCHMENT AREA OF ANY ONE SECTION. THE CATCHMENT AREA SHOULD BE SMALL ENOUGH TO LIMIT WATER FLOW IF CONCENTRATED AT ONE POINT TO 50 LITRES PER SECOND IN THE DESIGN STORM EVENT, USUALLY THE 10-YEAR EVENT.
2. CUT A 150mm DEEP TRENCH ALONG THE UPSLOPE LINE OF THE FENCE FOR THE BOTTOM OF THE FABRIC TO BE ENTRENCHED.
3. DRIVE 1.5 METRE LONG STAR PICKETS INTO GROUND AT 2.5 METRE INTERVALS (MAX) AT THE DOWNSLOPE EDGE OF THE TRENCH. ENSURE ANY STAR PICKETS ARE FITTED WITH SAFETY CAPS.
4. FIX SELF-SUPPORTING GEOTEXTILE TO THE UPSLOPE SIDE OF THE POSTS ENSURING IT GOES TO THE BASE OF THE TRENCH. FIX THE GEOTEXTILE WITH WIRE TIES OR AS RECOMMENDED BY THE MANUFACTURER. ONLY USE GEOTEXTILE SPECIFICALLY PRODUCED FOR SEDIMENT FENCING. THE USE OF SHADE CLOTH FOR THIS PURPOSE IS NOT SATISFACTORY.
5. JOIN SECTIONS OF FABRIC AT A SUPPORT POST WITH A 150mm OVERLAP.
6. BACKFILL THE TRENCH OVER THE BASE OF THE FABRIC AND COMPACT IT THOROUGHLY OVER THE GEOTEXTILE.

SEDIMENT FENCE (SD 6-8)

DRAWN: B.DUGGAN DESIGNED: R.JEANS JOB MANAGER: B.CLARK VERIFIER: B.CLARK

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
1	ISSUED FOR COORDINATION	CH	BC	RC	19.12.18
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ARCHITECT: marchesepartners

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Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

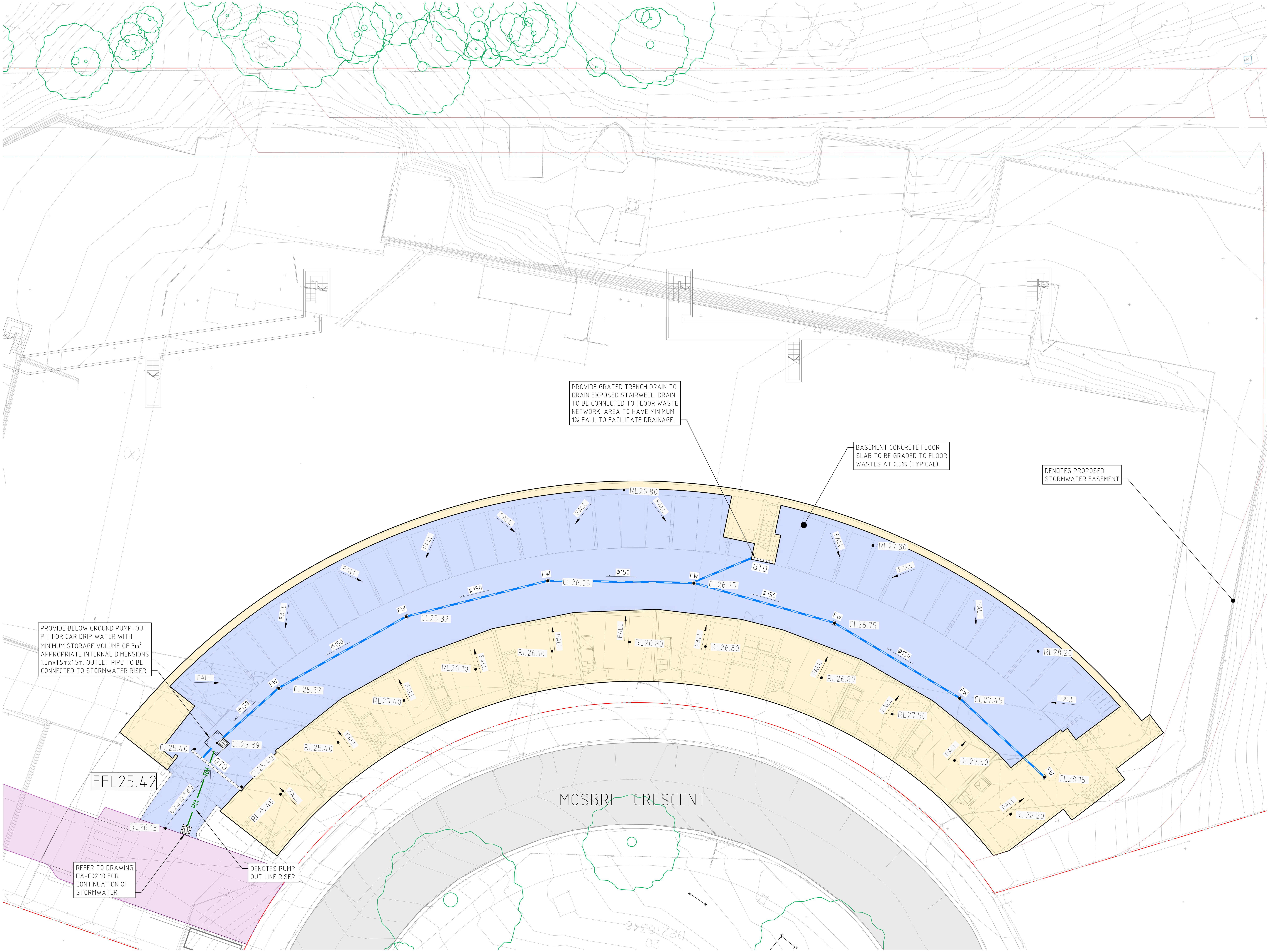
PROJECT: 11-17 MOSBRI CRESCENT THE HILL, NSW, 2300

DRAWING TITLE: EROSION AND SEDIMENT CONTROL DETAILS

JOB NUMBER: NL180367

DRAWING NUMBER: DA-C10.11 REVISION: A

DRAWING SHEET SIZE = A1



LEGEND

	SITE BOUNDARY.
	PROPOSED STORMWATER EASEMENT
	DENOTES SETBACK
	PROPOSED BUILDING. DETAILS TO BE PROVIDED AT CC STAGE.
	PROPOSED WORKS AS PART OF OTHER LEVEL.
	PROPOSED TRAFFICABLE PAVEMENT. DETAILS TO BE PROVIDED AT CC STAGE.
Ø150	PROPOSED STORMWATER PIPE.
RM — RM	PROPOSED WATER RISING MAIN.
	EXISTING STORMWATER PIPE.
GTD	GRATED TRENCH DRAIN
	GRATED INLET PIT / JUNCTION PIT / KERB INLET PIT. DETAILS TO BE PROVIDED AT CC STAGE.
	EXISTING GRATED INLET PIT / JUNCTION PIT/KERB INLET PIT
FW	PROPOSED FLOOR WASTE DETAILS TO BE PROVIDED AT CC STAGE.
FALL	PROPOSED DIRECTION OF GRADE.
FFL25.40	PROPOSED FINISHED FLOOR LEVEL.
RL26.05	PROPOSED SPOT HEIGHT.

DRAWN: B.DUGGAN
DESIGNED: R.JEANS
JOB MANAGER: B.CLARK
VERIFIER: B.CLARK

NOT FOR CONSTRUCTION

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A	ISSUED FOR APPROVAL	CH	BC	RC	21.12.18
B	RE-ISSUED FOR APPROVAL	CH	BC	RC	08.10.19
C	RE-ISSUED FOR APPROVAL	BD	BC	BC	22.04.21
D	RE-ISSUED FOR APPROVAL - SW EASEMENT ADDED	SF	BC	RC	26.04.21
E	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

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SCALE 1:200@ A1
0 2 4 6 8 10m

NORTHROP
Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT: **11-17 MOSBRI CRESCENT THE HILL, NSW, 2300**

DRAWING TITLE: **CIVIL WORKS LOWER GROUND FLOOR**

JOB NUMBER: **NL180367**

DRAWING NUMBER: **DA-C20.01**

REVISION: **E**

DRAWING SHEET SIZE = A1

Date : 16.12.2021 2:18 PM Plotted By : BRAD DUGGAN Found : Y:\YEAR 2018 Jobs\NL180367 - Mosbri Cre\O - Drawings\CIVIL\#CAD\2-CAD FILES\01-DA\01\NL180367-DA-C20.01 CIVIL WORKS BASEMENT.dwg

DRAWN: B.DUGGAN DESIGNED: R.JEANS JOB MANAGER: B.CLARK VERIFIER: B.CLARK

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
C	REVISED AS CLOUDED	BD	BC	RC	05.03.20
D	REVISED FOR S34 - LAYOUT UPDATE	BD	BC	RC	31.07.20
E	REVISED FOR S34 - LAYOUT UPDATE	BD	BC	RC	12.08.20
F	REVISED AS CLOUDED	RG	BC	RC	30.10.20
G	RE-ISSUED FOR APPROVAL	BD	BC	RC	22.04.21
H	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

CLIENT: **CRESCENT NEWCASTLE PTY LTD**

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ARCHITECT: marchesepartners

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SCALE 1:250@ A1

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P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT: **11-17 MOSBRI CRESCENT THE HILL, NSW, 2300**

DRAWING TITLE: **CIVIL WORKS GROUND FLOOR**

JOB NUMBER: **NL180367**

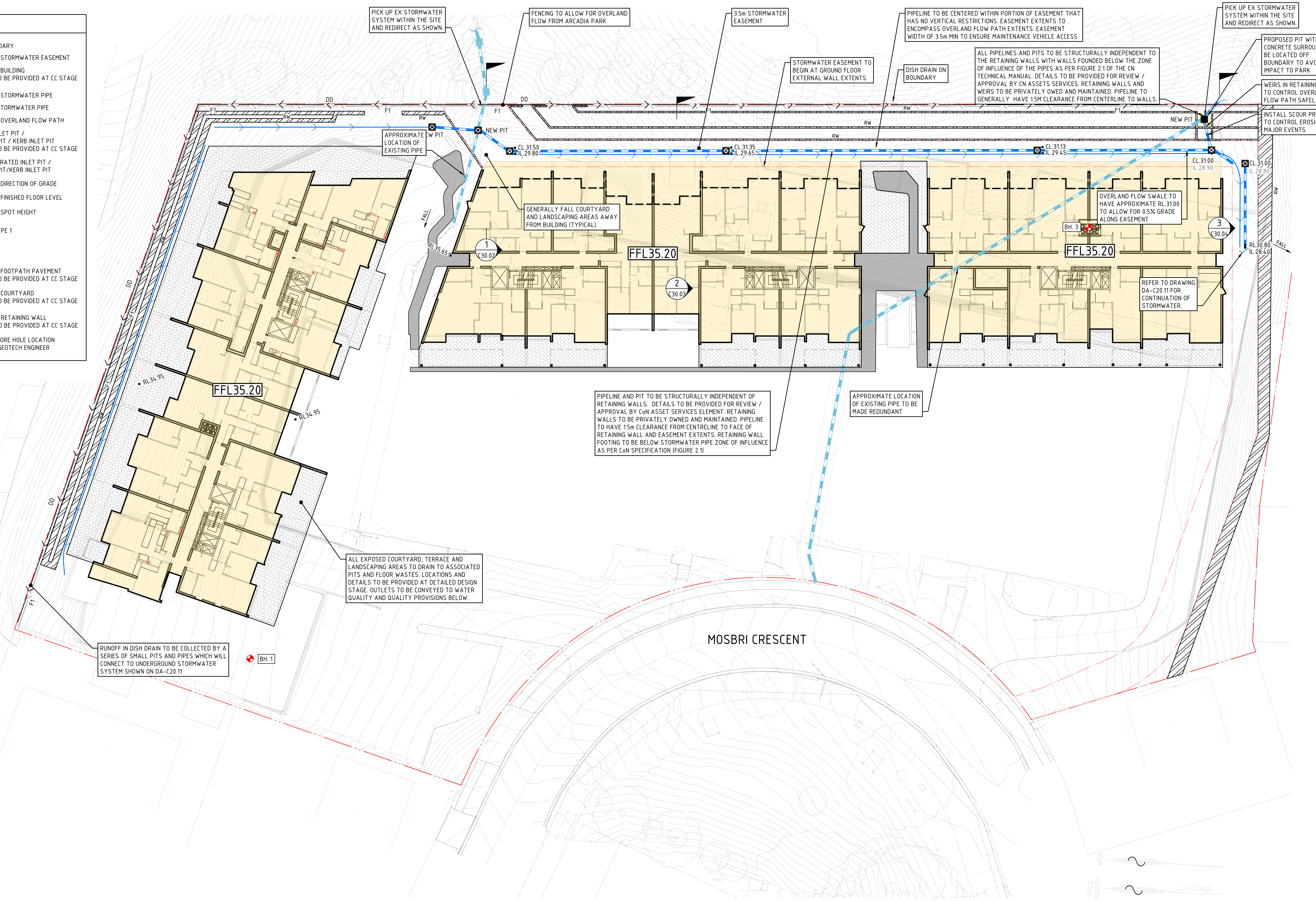
DRAWING NUMBER: **DA-C20.11** REVISION: **H**

DRAWING SHEET SIZE = A1

Date: 16.12.2021 2:18 PM Plotted By: BRAD DUGGAN

LEGEND

- SITE BOUNDARY
- PROPOSED STORMWATER EASEMENT
- PROPOSED BUILDING — DETAILS TO BE PROVIDED AT CC STAGE
- Ø750 — PROPOSED STORMWATER PIPE
- EXISTING STORMWATER PIPE
- PROPOSED OVERLAND FLOW PATH
- GRATED INLET PIT / JUNCTION PIT / KERB INLET PIT — DETAILS TO BE PROVIDED AT CC STAGE
- EXISTING GRATED INLET PIT / JUNCTION PIT/KERB INLET PIT
- FALL — PROPOSED DIRECTION OF GRADE
- FFL35.05 — PROPOSED FINISHED FLOOR LEVEL
- • RL34.95 — PROPOSED SPOT HEIGHT
- F1 — FENCE - TYPE 1
- DD — DISH DRAIN
- PROPOSED FOOTPATH PAVEMENT — DETAILS TO BE PROVIDED AT CC STAGE
- PROPOSED COURTYARD — DETAILS TO BE PROVIDED AT CC STAGE
- RW — PROPOSED RETAINING WALL — DETAILS TO BE PROVIDED AT CC STAGE
- DENOTES BORE HOLE LOCATION — REFER TO GEOTECH ENGINEER



DRAWN: B.DUGGAN
DESIGNED: R.JEANS
JOB MANAGER: B.CLARK
VERIFIER: B.CLARK

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
H	REVISED FOR S34 - SECTION TAGS ADDED	BD	BC	RC	28.10.20
I	BORE HOLE LOCATIONS ADDED	BD	BC	RC	05.11.20
K	BORE HOLE IDENTIFICATION ADDED	BD	BC	RC	05.11.20
L	RE-ISSUED FORAPPROVAL	BD	BC	RC	22.04.21
M	RE-ISSUED FOR APPROVAL - SW EASEMENT ADDED	SF	BC	RC	26.04.21
N	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

CLIENT: **CRESCENT NEWCASTLE PTY LTD**

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ARCHITECT: marchesepartners

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SCALE 1:250@ A1 — 0 2 4 6 8 10 12m

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Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT: **11-17 MOSBRI CRESCENT THE HILL, NSW, 2300**

DRAWING TITLE: **CIVIL WORKS LEVEL 2**

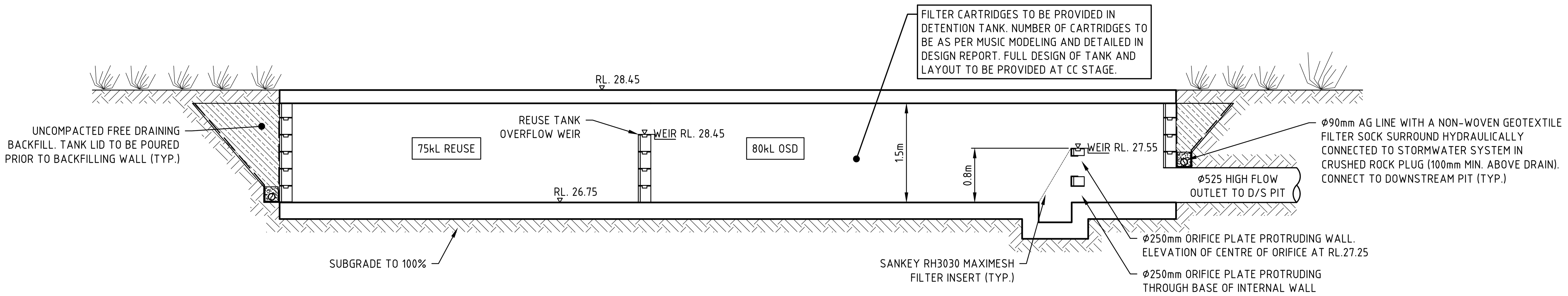
JOB NUMBER: **NL180367**

DRAWING NUMBER: **DA-C20.21**

REVISION: **N**

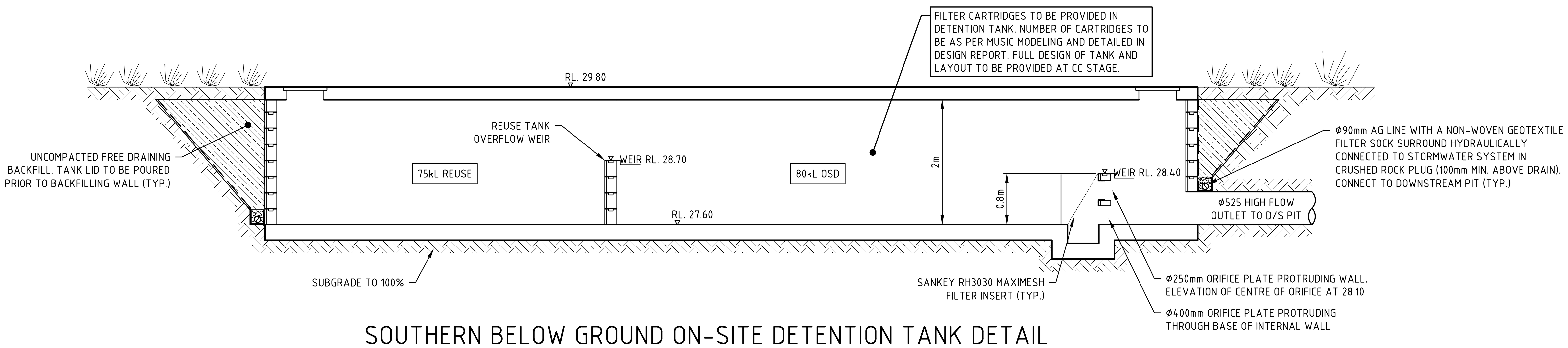
DRAWING SHEET SIZE = A1

Date : 16.12.2021 2:18 PM Plotted By : BRAD DUGGAN Found : Y:\YEAR 2018 Jobs\NL180367 - Mosbri Cre\O - Drawings\CIVIL\#CAD\2-CAD FILES\01-DA\01\NL180367-DA-C20.20 CIVIL WORKS FLOOR 2.dwg



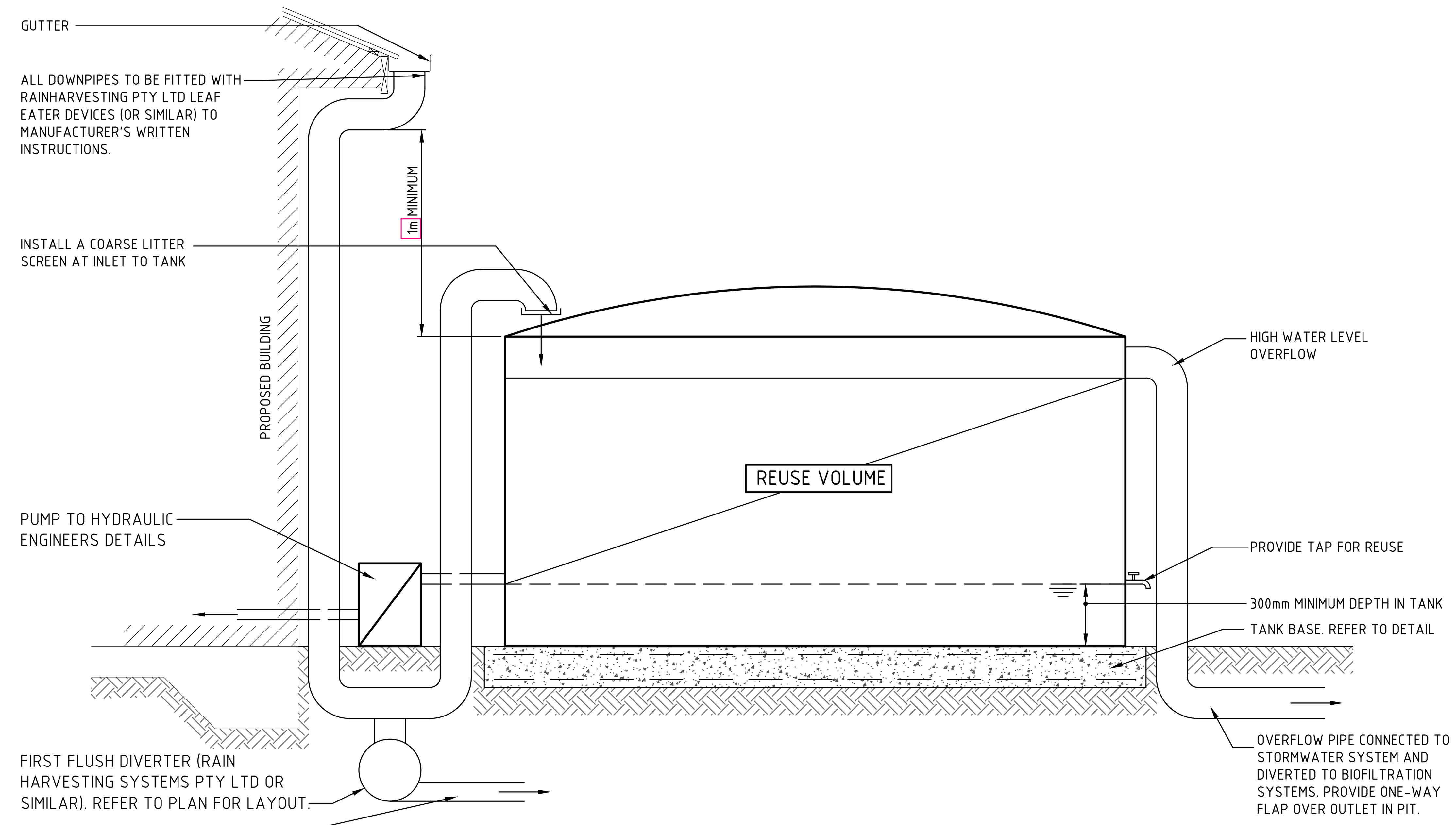
NORTHERN BELOW GROUND ON-SITE DETENTION TANK DETAIL

SCALE 1:50



SOUTHERN BELOW GROUND ON-SITE DETENTION TANK DETAIL

SCALE 1:50



REUSE ABOVE GROUND TANK DETAIL FOR TOWN HOUSES

NOTE: THE ENTIRE PRESSURISED DOWNPIPE SYSTEM SHALL BE AIR TIGHT AND BE ABLE TO WITHSTAND ATMOSPHERIC PRESSURE. THE PIPING SYSTEM SHALL BE MINIMUM SN6 AND FITTINGS WITH INTERNAL ULTRA VIOLET STABILISING (OR APPROVED EQUIVALENT).

DRAWN: B.DUGGAN DESIGNED: R.JEANS JOB MANAGER: B.CLARK VERIFIER: B.CLARK

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	ISSUED FOR APPROVAL	CH	BC	RC	21.12.18
B	RE-ISSUED FOR APPROVAL	CH	BC	RC	08.10.19
C	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

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ARCHITECT: marchesepartners

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SCALE 1:20@A1 — 0.0 0.2 0.4 0.6 0.8 1.0m
SCALE 1:50@A1 — 0.0 0.5 1.0 1.5 2.0 2.5m

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Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT: 11-17 MOSBRI CRESCENT THE HILL, NSW, 2300

DRAWING TITLE: CIVIL DETAILS SHEET 1

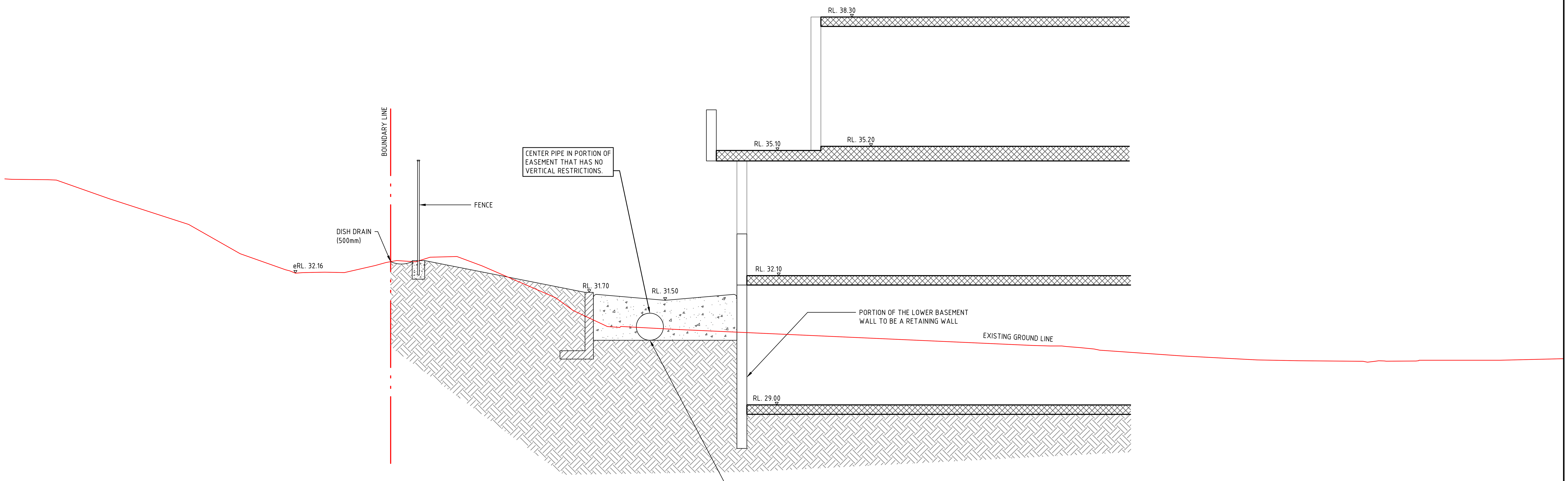
JOB NUMBER: NL180367

DRAWING NUMBER: DA-C30.01

REVISION: C

DRAWING SHEET SIZE = A1

Date : 16.12.2021 2:19 PM Plotted By : BRAD DUGGAN Found : Y:\YEAR 2018 Jobs\NL180367 - Mosbri Cres\D - Drawings\CIVIL\eCAD\2-CAD FILES\01-DA\01\NL180367-DA-C30.01 CIVIL DETAILS.dwg



SECTION 1 / C20.20
SCALE 1:50

DRAWN: B.DUGGAN DESIGNED: R.JEANS JOB MANAGER: B.CLARK VERIFIER: B.CLARK

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	ISSUED FOR APPROVAL	CH	BC	RC	08.10.19
B	RE-ISSUED FOR APPROVAL	BD	BC	RC	12.08.20
C	RE-ISSUED FOR APPROVAL - EXISITNG GROUND LINE ADDED	SF	BC	RC	22.10.20
D	RE-ISSUED FOR APPROVAL	BD	BC	RC	28.10.20
E	RE-ISSUED FOR APPROVAL	BD	BC	BC	22.04.21
F	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

CLIENT
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SCALE 1:50@ A1
0.0 0.5 1.0 1.5 2.0 2.5m

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Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
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PROJECT
11-17 MOSBRI CRESCENT THE HILL, NSW, 2300

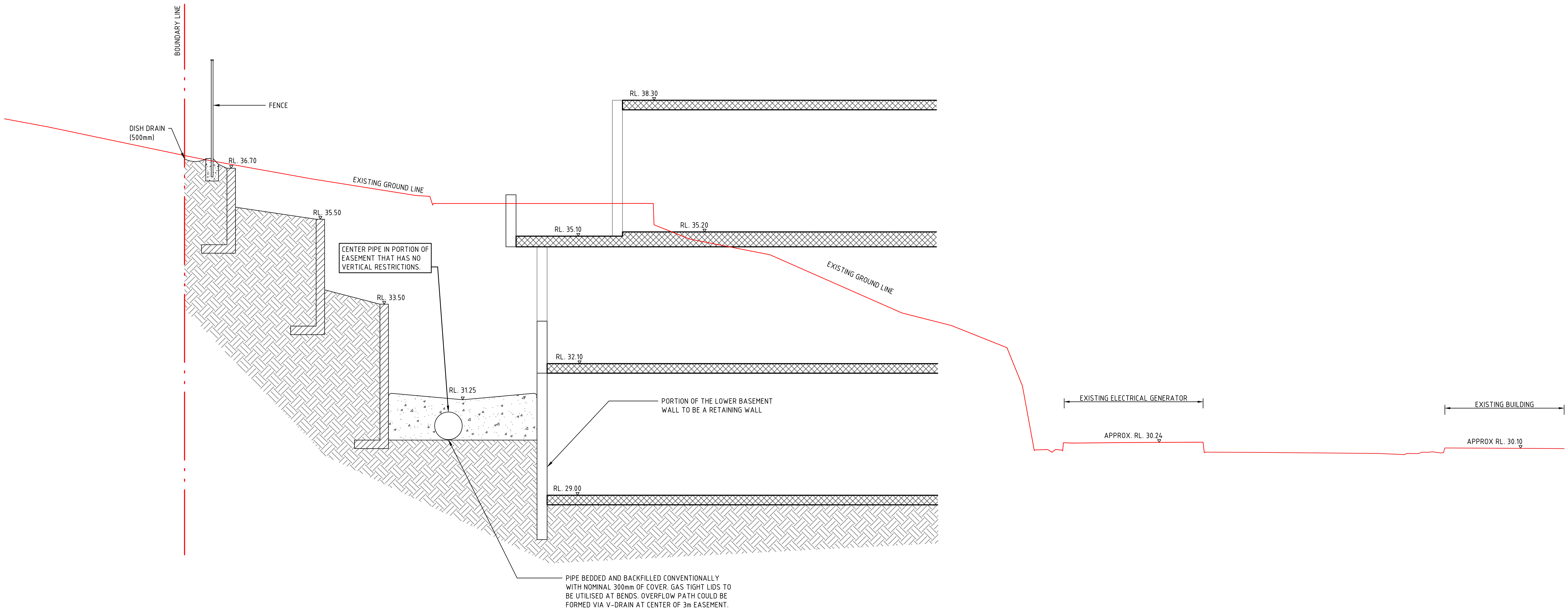
DRAWING TITLE
CIVIL DETAILS SHEET 2

JOB NUMBER
NL180367

DRAWING NUMBER
DA-C30.02

REVISION
F

DRAWING SHEET SIZE = A1



SECTION 2 / C20.20
SCALE 1:50

DRAWN: B.DUGGAN
DESIGNED: R.JEANS
JOB MANAGER: B.CLARK
VERIFIER: B.CLARK

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	ISSUED FOR APPROVAL	BD	BC	RC	28.10.20
B	RE-ISSUED FOR APPROVAL	BD	BC	BC	22.04.21
C	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

CLIENT
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SCALE 1:50@ A1
0.0 0.5 1.0 1.5 2.0 2.5m

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Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT
11-17 MOSBRI CRESCENT THE HILL, NSW, 2300

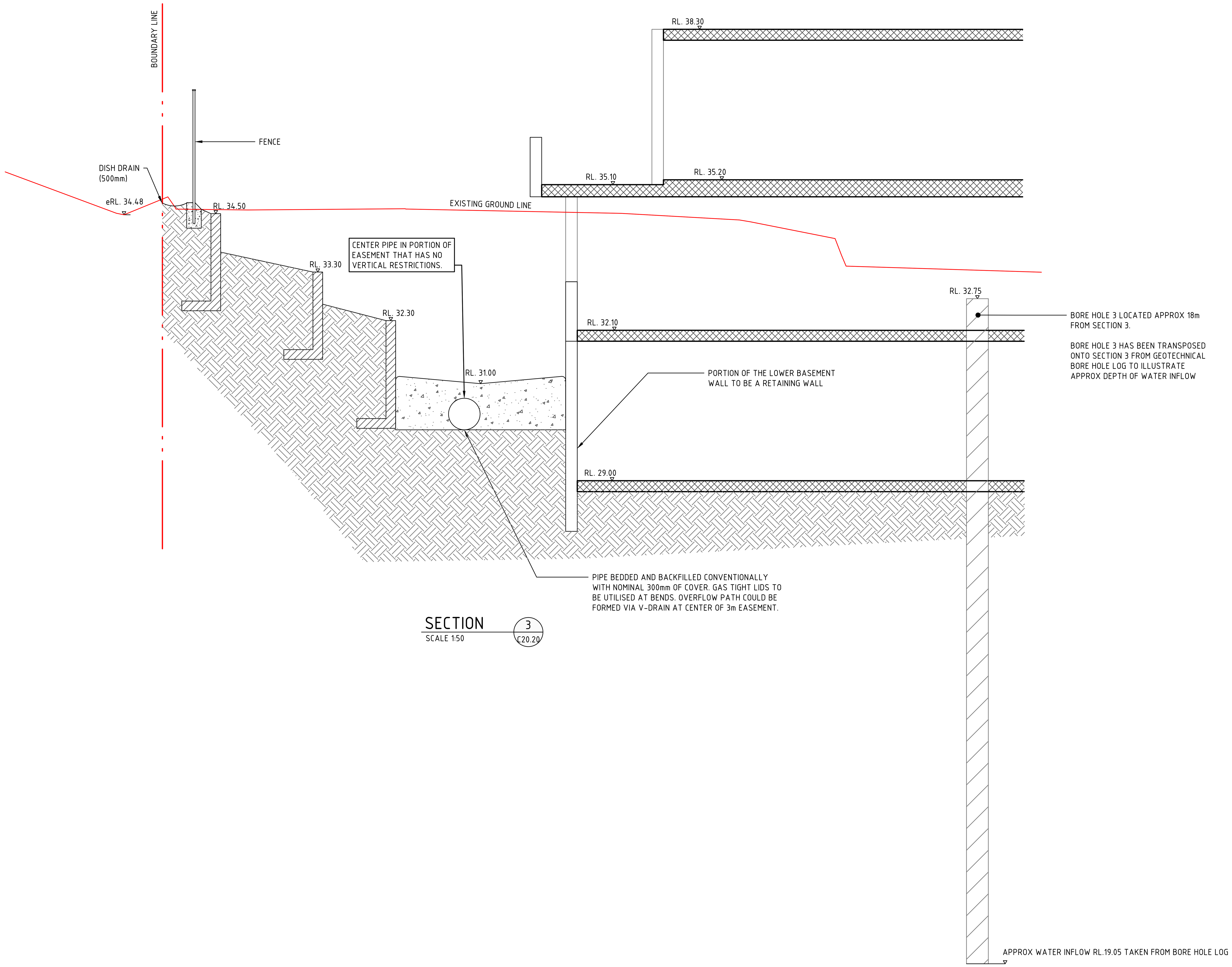
DRAWING TITLE
CIVIL DETAILS SHEET 3

JOB NUMBER
NL180367

DRAWING NUMBER
DA-C30.03

REVISION
C

DRAWING SHEET SIZE = A1



SECTION 3 / C20.20
SCALE 1:50

DRAWN: B.DUGGAN
DESIGNED: R.JEANS
JOB MANAGER: B.CLARK
VERIFIER: B.CLARK

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	ISSUED FOR APPROVAL	BD	BC	RC	28.10.20
B	WATER INFLOW ADDED	BD	BC	RC	05.11.20
C	WATER INFLOW UPDATED	BD	BC	RC	05.11.20
D	RE-ISSUED FOR APPROVAL	BD	BC	BC	22.04.21
E	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

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SCALE 1:50@ A1
0.0 0.5 1.0 1.5 2.0 2.5m

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Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT
11-17 MOSBRI CRESCENT
THE HILL, NSW, 2300

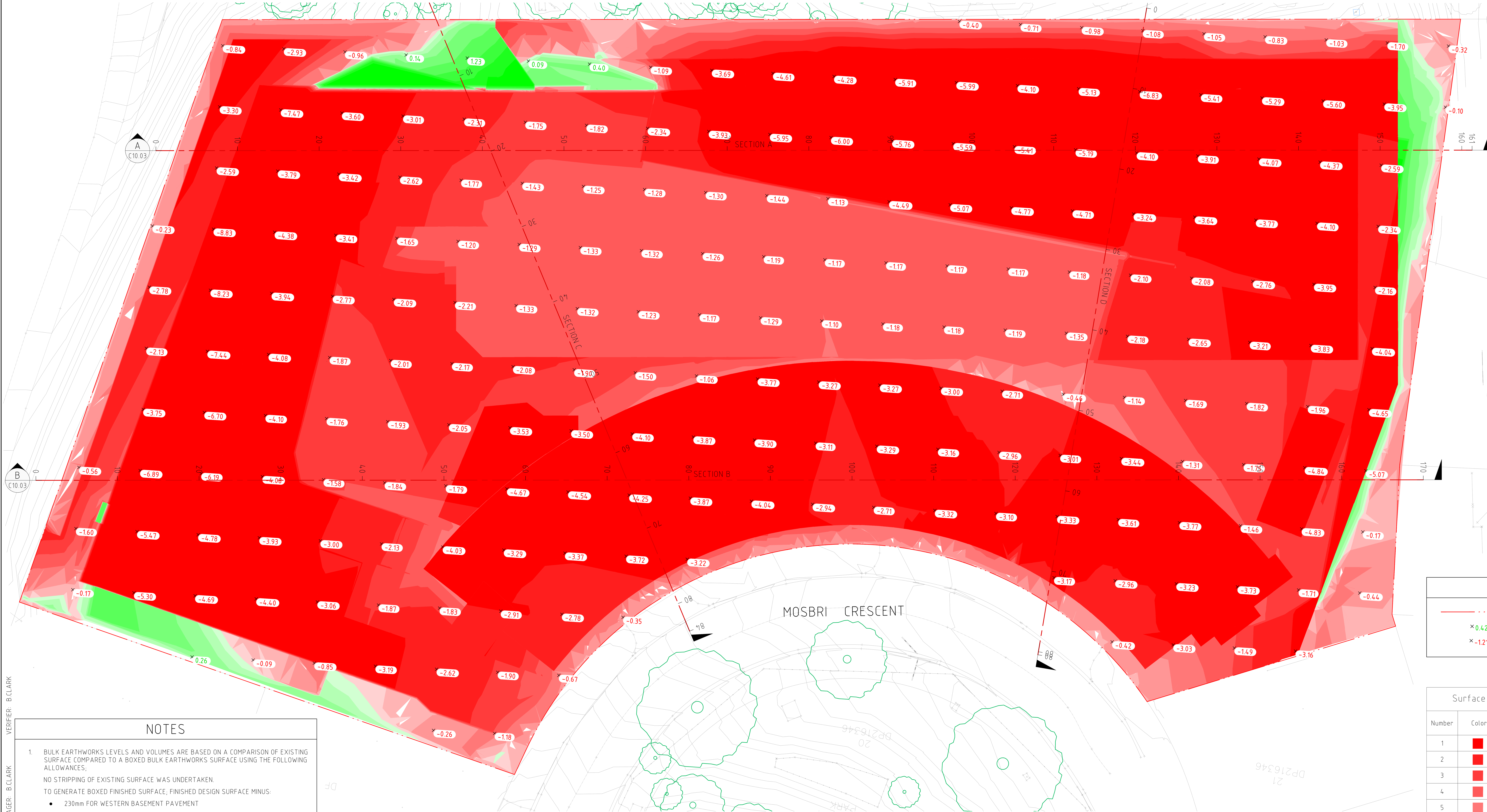
DRAWING TITLE
CIVIL DETAILS SHEET 4

JOB NUMBER
NL180367

DRAWING NUMBER
DA-C30.04

REVISION
E

DRAWING SHEET SIZE = A1



LEGEND

—— · · ——	SITE BOUNDARY.
× 0.42	DENOTES HEIGHT OF FILL
× -1.21	DENOTES DEPTH OF CUT

Surface Analysis: Elevation Ranges

Number	Color	Minimum Elevation (m)	Maximum Elevation (m)
1		-9.150	-3.000
2		-3.000	-2.000
3		-2.000	-1.500
4		-1.500	-1.000
5		-1.000	-0.500
6		-0.500	-0.250
7		-0.250	-0.100
8		-1.000	0.000
9		0.000	0.100
10		0.100	0.250
11		0.250	0.500
12		0.500	1.000
13		1.000	1.500
14		1.500	2.000
15		2.000	3.000
16		3.000	4.200

NOTES

1. BULK EARTHWORKS LEVELS AND VOLUMES ARE BASED ON A COMPARISON OF EXISTING SURFACE COMPARED TO A BOXED BULK EARTHWORKS SURFACE USING THE FOLLOWING ALLOWANCES;

   NO STRIPPING OF EXISTING SURFACE WAS UNDERTAKEN.

   TO GENERATE BOXED FINISHED SURFACE; FINISHED DESIGN SURFACE MINUS:

   - 230mm FOR WESTERN BASEMENT PAVEMENT
   - 210mm FOR LANDSCAPING AND BUILDING SURROUNDS
   - 210mm (AVERAGED) FOR NORTHERN AND NORTH EASTERN BASEMENT PAVEMENTS

3. NO ALLOWANCE HAS BEEN MADE FOR SELECT LAYERS OR UNSUITABLE MATERIAL THAT IS LIKELY TO BE PRESENT.
4. NO ALLOWANCE HAS BEEN MADE FOR TEMPORARY SEDIMENT DAMS
5. NO ALLOWANCE HAS BEEN MADE FOR RETAINING WALLS IN THE LEVELS OR VOLUMES PRESENTED ON THIS PLAN. (eg. FOOTINGS, BACKFILL MATERIAL ETC).
6. NO ALLOWANCE HAS BEEN MADE FOR SERVICE TRENCHES, DRAINAGE TRENCHES, DRAINAGE INFRASTRUCTURE (PITS, CULVERTS, ETC) IN THE LEVELS OR VOLUMES PRESENTED ON THIS PLAN.
7. NO ALLOWANCE FOR ANY TEMPORARY BATTERS DURING WORKS.
8. NO BULKING FACTORS HAVE BEEN CONSIDERED/ALLOWED FOR.
9. THE LEVELS AND VOLUMES ARE BASED ON SUPPLIED SURVEY DATA AND AS SUCH ARE APPROXIMATE ONLY, THE CONTRACTOR SHALL SATISFY THEMSELVES AS TO THEIR ACCURACY.
10. APPROXIMATE BULK EARTHWORKS VOLUMES BASED ON THE NOTES ABOVE ARE AS FOLLOWS;
    - BULK CUT = 34,453m^3
    - BULK FILL = 391m^3
    - BULK CUT/FILL BALANCE (EXCESS) = 34,062m^3

VERIFIER: B.CLARK
JOB MANAGER: B.CLARK
DESIGNED: R.JEANS
DRAWN: B.DUGGAN

NOT FOR CONSTRUCTION

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

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SCALE 1:250@ A1 — 0 2 4 6 8 10 12m

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Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
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Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT: **11-17 MOSBRI CRESCENT THE HILL, NSW, 2300**

DRAWING TITLE: **CUT FILL PLAN**

JOB NUMBER: **NL180367**

DRAWING NUMBER: **DA-C40.01**

REVISION: **A**

DRAWING SHEET SIZE = A1

Date : 16.12.2021 2:22 PM Plotted By : BRAD DUGGAN Found : Y:\YEAR 2018 Jobs\NL180367 - Mosbri Cre\O - Drawings\CIVIL\#CAD\2-CAD FILES\01-DA\01\NL180367-DA-C15.01 CUT FILL.dwg

LEGEND

- SITE BOUNDARY.
- •BE 28.79m — BULK EARTHWORKS SPOT HEIGHT
- •EX 25.95m — EXISTING SPOT HEIGHT
- BEL 29.00 — BULK EARTHWORKS PAD LEVEL
- XX.XX — DESIGN CONTOURS
- XX.XX — EXISTING CONTOURS
- BATTERS
- SHORING

NOT FOR CONSTRUCTION

DRAWN: B.DUGGAN
DESIGNED: R.JEANS
JOB MANAGER: B.CLARK
VERIFIER: B.CLARK

REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

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SCALE 1:250 @ A1 — 0 2 4 6 8 10 12m

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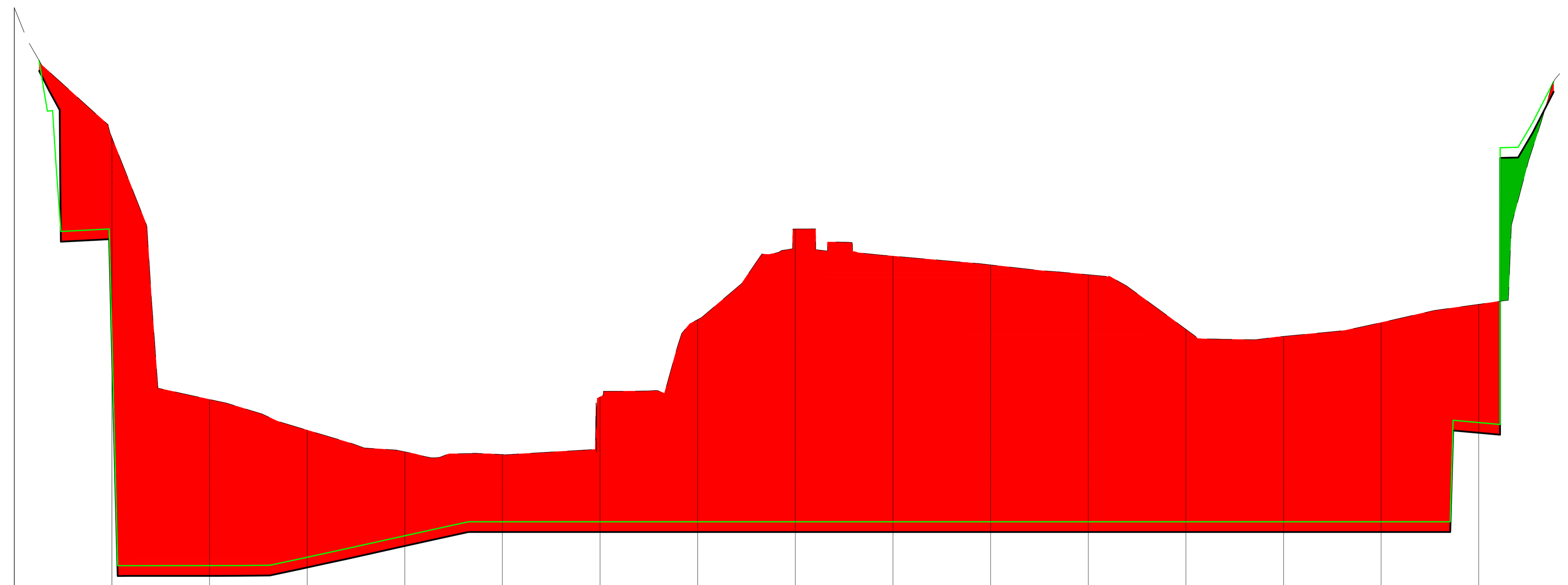
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT: 11-17 MOSBRI CRESCENT THE HILL, NSW, 2300

DRAWING TITLE: BULK EARTHWORKS PLAN

JOB NUMBER: NL180367
DRAWING NUMBER: DA-C40.11
REVISION: A
DRAWING SHEET SIZE = A1

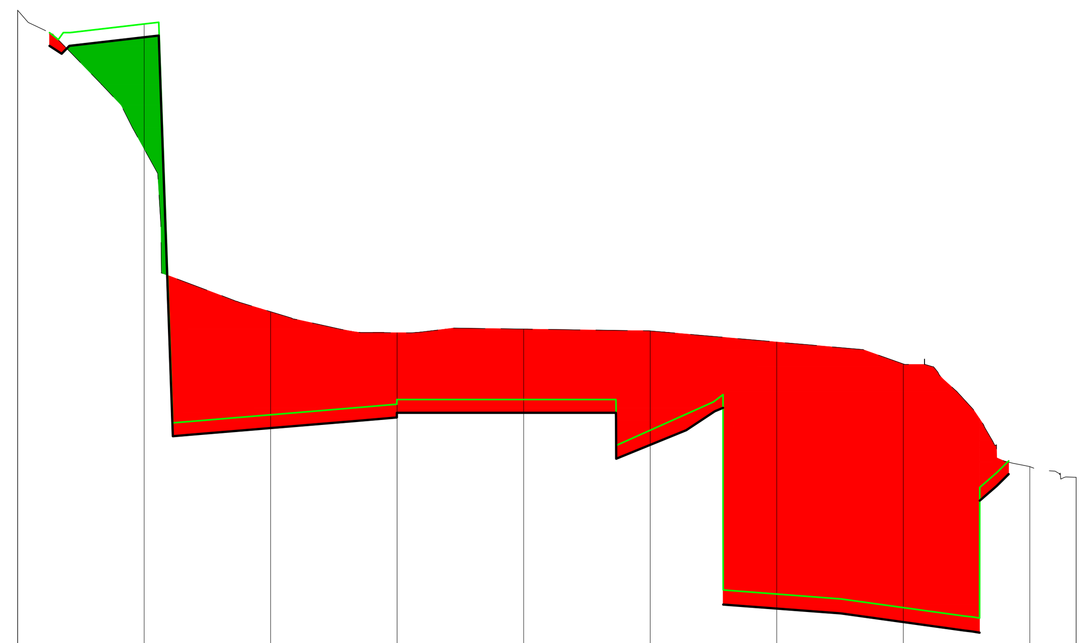
Date : 16.12.2021 2:22 PM Plotted By : BRAD DUGGAN Found : Y:\YEAR 2018 Jobs\NL180367 - Mosbri Cres\O - Drawings\CIVIL\#CAD\2-CAD FILES\01-DA\01\NL180367-DA-C15.01 CUT FILL.dwg



VERTICAL 1:100
HORIZONTAL 1:500.000
Datum 25.000

DESIGN - BEL		32.591	27.892	28.063	28.504	28.790	28.790	28.790	28.790	28.790	28.790	28.790	28.790	28.790	28.790	30.823	37.811		
EXISTING LEVELS	39.536	36.874	31.507	30.880	30.434	30.378	31.561	33.145	35.000	34.445	34.265	34.064	32.947	32.800	33.083	33.457	38.021		
DEPTH		-4.283	-3.615	-2.817	-1.931	-1.588	-2.771	-4.355	-6.210	-5.655	-5.475	-5.274	-4.157	-4.010	-4.293	-2.634	-0.210		
DESIGN - FSL		32.801	28.102	28.273	28.714	29.000	29.000	29.000	29.000	29.000	29.000	29.000	29.000	29.000	29.000	31.033	38.021		
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	157.674	160.000	161.268

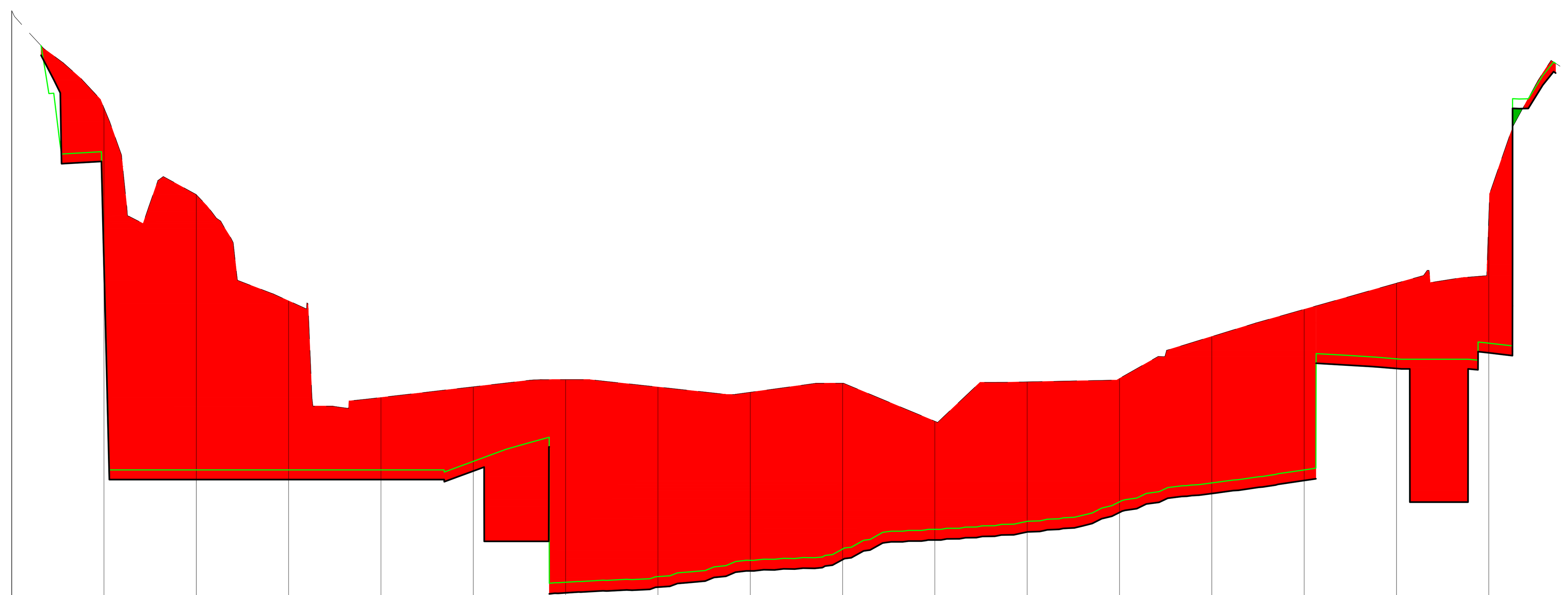
SECTION A - LONG SECTION



VERTICAL 1:100
HORIZONTAL 1:500.000
Datum 25.000

DESIGN - BEL		34.726	28.549	28.790	28.790	28.284	25.696	25.483		
EXISTING LEVELS	35.153	32.962	30.389	30.056	30.114	30.085	29.910	29.563	27.940	27.771
DEPTH		1.764	-1.839	-1.266	-1.324	-1.801	-4.214	-4.080		
DESIGN - FSL		34.936	28.759	29.000	29.000	28.515	25.926	25.713		
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	83.660

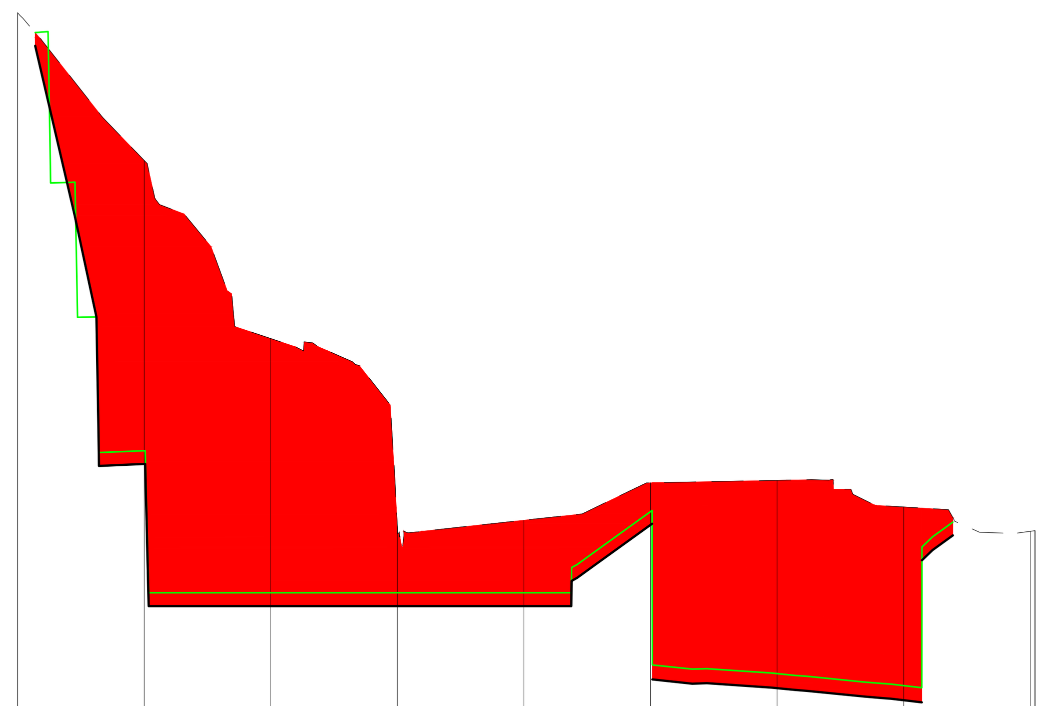
SECTION C - LONG SECTION



VERTICAL 1:100
HORIZONTAL 1:500.000
Datum 25.000

DESIGN - BEL		32.505	27.890	27.890	27.890	28.075	25.433	25.556	25.909	26.153	26.580	26.754	27.178	27.588	27.869	30.299	30.638	27.907	
EXISTING LEVELS	38.060	35.951	34.069	31.767	29.672	29.904	30.058	29.899	29.784	29.981	29.156	30.011	30.086	30.994	31.584	32.150	33.598	31.655	
DEPTH		-3.446	-6.179	-3.877	-1.782	-1.829	-4.625	-4.342	-3.876	-3.828	-2.576	-3.257	-2.908	-3.407	-3.714	-1.852	-2.960	-3.748	
DESIGN - FSL		32.715	28.100	28.100	28.100	28.285	25.663	25.786	26.139	26.383	26.810	26.984	27.408	27.818	28.099	30.509	30.848	36.916	
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	90.000	100.000	110.000	120.000	130.000	140.000	150.000	160.000	141.268	169.997

SECTION B - LONG SECTION



VERTICAL 1:100
HORIZONTAL 1:500.000
Datum 25.000

DESIGN - BEL		31.034	28.790	28.790	28.790	30.072	27.493	27.304		
EXISTING LEVELS	38.162	35.829	33.016	30.051	30.147	30.738	30.777	30.356	29.970	29.980
DEPTH		-4.795	-4.226	-1.261	-1.357	-0.666	-3.284	-3.052		
DESIGN - FSL		31.244	29.000	29.000	29.000	30.282	27.723	27.534		
CHAINAGE	0.000	10.000	20.000	30.000	40.000	50.000	60.000	70.000	80.000	80.375

SECTION D - LONG SECTION

DRAWN: B.DUGGAN DESIGNED: R.JEANS JOB MANAGER: B.CLARK VERIFIER: B.CLARK

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REVISION	DESCRIPTION	ISSUED	VER'D	APP'D	DATE
A	RE-ISSUED FOR APPROVAL	BD	BC	RC	16.12.21

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NORTHROP
Newcastle
Suite 4, 215 Pacific Hwy, Charlestown NSW 2290
P.O. Box 180, Charlestown NSW 2290
Ph (02) 4943 1777 Fax (02) 4943 1577
Email newcastle@northrop.com.au ABN 81 094 433 100

PROJECT
11-17 MOSBRI CRESCENT THE HILL, NSW, 2300

DRAWING TITLE
BULK EARTHWORKS SECTIONS

JOB NUMBER
NL180367

DRAWING NUMBER
DA-C40.21

REVISION
A

DRAWING SHEET SIZE = A1

Date : 16.12.2021 2:22 PM Plotted By : BRAD DUGGAN Found : Y:\YEAR 2018 Jobs\NL180367 - Mosbri Cre\O - Drawings\CIVIL\#CAD\2-CAD FILES\01-DA\01\NL180367-DA-C15.01 CUT FILL.dwg