Consulting Engineers

STRUCTURAL - CIVIL - STORMWATER - REMEDIAL

... STRUCTURALLY SOUND

Flood Risk Management Report

44 Kooloora Avenue, Freshwater

Job no. 200273

Issue C

25 November 2021

Prepared for: Emma Macindoe Interior Design

Prepared by: Christian Ferry

Flood Risk Management Report

Project no: 200273

Issue: C

Date: 25/11/2021

Client: Emma Macindoe Interior Design

Engineer: Christian Ferry

Principal review: Michael Wachjo

Council: Northern Beaches Council (Region 2)

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Document History

Issue	Engineer	Checked	Description	Date
A	C. Ferry	M.Wachjo	Flood Risk Management Report	08.09.2020
B	H.Stubley	C.Ferry	Flood Risk Management Report	25.11.2021
C	**H.Stubley**	**C.Ferry**	**Flood Risk Management Report**	**25.11.2021**

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Summary

Northern Beaches Consulting Engineers were engaged by Emma Macindoe Interior Design to prepare a revised Flood Risk Management report. The purpose of the report is to determine the effects of a proposed development on the existing flooding regime within the development site and neighbouring properties. The development site is located at 44 Kooloora Avenue in Freshwater. The subject site is located within an existing flood zone, however, the area within which the development site is located has not been identified as a flood affected area in any of Council's available land zoning mapping or flood information, and therefore has not been strictly assessed against the Northern Beaches Council (Warringah area) flood controls. The criteria used in this report was established in the Stormwater Pre-DA meeting (SPLM2020/0001) with Northern Beaches Council.

To effectively assess the anticipated flooding effects, a hydraulic model was constructed using DRAINS software to determine the peak flood depth within the subject site up to the 1% Annual Exceedance Probability (AEP) storm event. The hydraulic modelling results were used to determine any potential adverse flooding effects associated with the development up to the 1% AEP storm event.

Concluding the results from the DRAINS analysis, further calculations were prepared to determine the extent of flood storage losses as a result of the proposed works. The development is not expected to cause a net loss of flood storage or adverse flooding effects to neighbouring properties should the recommendations in this report be adopted. The results from the analysis are detailed in the report below.

1. Introduction

Northern Beaches Consulting Engineers were engaged by Emma Macindoe Interior Design to undertake a hydrologic and hydraulic investigation into the effects of a proposed residential development at 44 Kooloora Avenue in Freshwater. The assessment involved analysing localised flooding behaviour within the Freshwater catchment up to the 1% AEP storm event.

Christian Ferry and Michael Wachjo of Northern Beaches Consulting Engineers (NBCE) conducted a site inspection at the above address on 13 November 2019. The site inspection was carried out to both observe and measure the existing drainage infrastructure within the development site and critical elements of Council's stormwater drainage infrastructure within the Freshwater catchment. The premises have been assessed in accordance with the requirements of the Stormwater Pre-DA meeting minutes (SPLM2020/0001) dated 02/07/2020, the Council supplied flood information and the *NSW Government Floodplain Management Manual 2005*.

1.1 Aim

The purpose of this report is to determine the peak flood depth within the subject site up to the 1% AEP storm event within an acceptable design criterion and assess the potential flooding impacts within the development site and neighbouring properties as a result of the proposed works. An analysis was undertaken to assess the extent of flooding envisaged to occur through the subject site and examine strategies to mitigate any impacts from flood waters during heavy rainfall events. Note, the analysis utilised the results of 1% AEP storm event modelling using IFD (Intensity Frequency Duration) design rainfall data based on AR&R 2019 (Australian Rainfall & Runoff) methodology.

The calculations and recommendations presented in this report have been prepared in general accordance with the following policies:

- *Australian Rainfall and Runoff: A Guide to Flood Estimation 2019*
- *NSW Government Floodplain Management Manual 2005*

1.2 Site Characteristics

The 573m^2 site is located on Kooloora Avenue in Freshwater within the Northern Beaches Council (Warringah) LGA and is bounded by residential properties along the north-eastern, north-western and south-eastern boundaries of the site.

Topographical information indicates that the subject site is located within a flood storage area at the bottom of the Freshwater catchment. The base of the Freshwater catchment forms a localised basin, bounded by the vegetated sand dunes west of the Freshwater Beach foreshore which becomes a temporary flood storage zone in heavy rainfall events. The primary cause of flooding is due to the inadequate hydraulic capacity of the existing Council stormwater drainage infrastructure which discharges to Freshwater beach. The impact of the inadequate discharge capacity is exacerbated when peak storm events occur in conjunction with high tides.

The existing stormwater drainage network consists of a series of pits and pipes which conveys public stormwater from the upstream catchment through to the catchment discharge point at the northern end of the Freshwater Beach foreshore. There are currently 2 x 1650mm & a 450mm diameter Council owned reinforced concrete pipeline (RCP) which extends through the subject property frontage towards Freshwater Beach (refer Appendix C for details). These pipes discharge into 2 x 1800mm diameter pipes which outlet onto the Freshwater Beach foreshore. These outlet pipelines convey collected runoff from the upstream catchment which extends west of 44 Kooloora Avenue up to the crest on McDonald street approximately 1350m away.

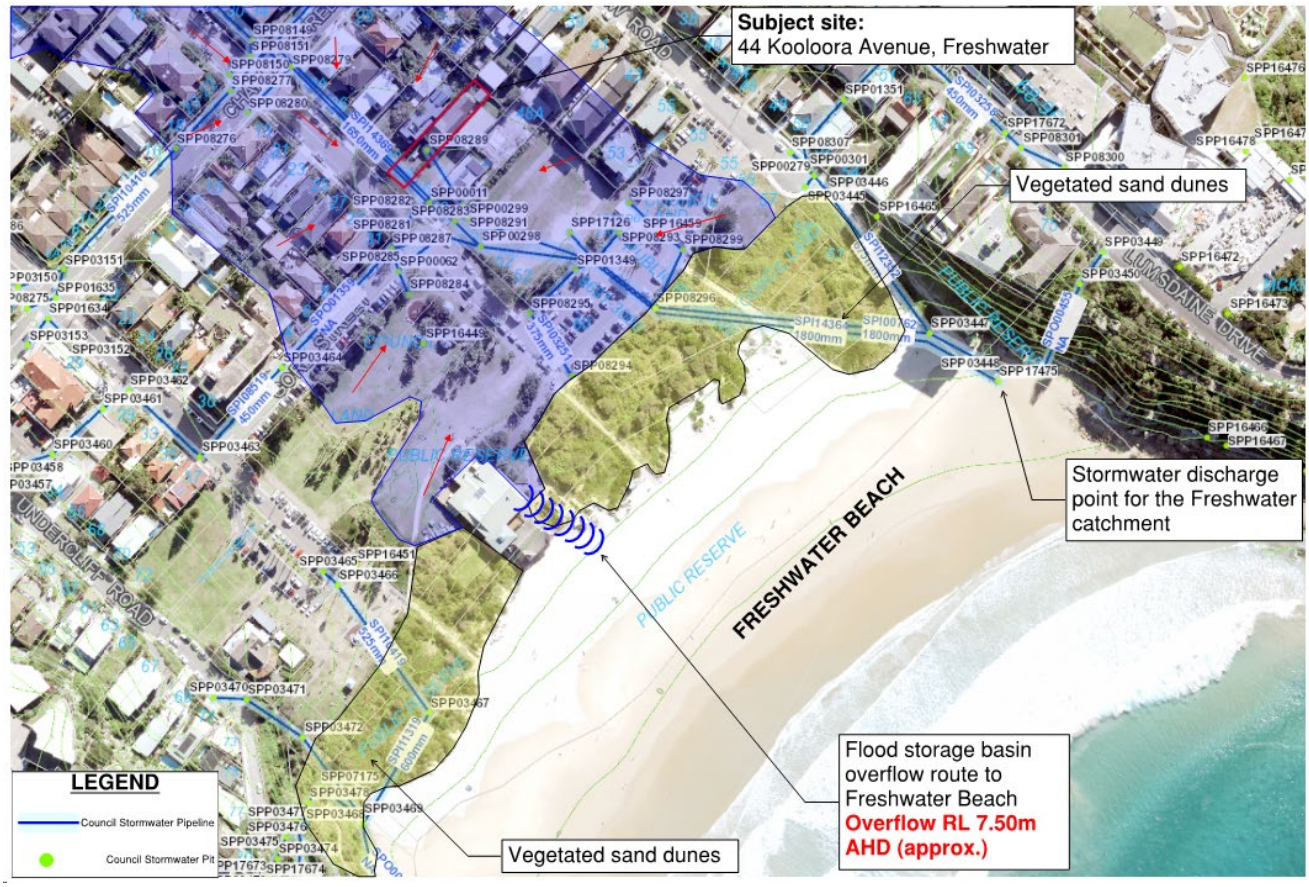


Figure 1 - Subject Site Location and Surroundings. Source: SIX Maps (NSW)

2. Flooding

2.1 Methodology

The flooding extent was modelled using the computer program DRAINS. A combination of LiDAR (Light Detection and Ranging) survey data, survey levels prepared by TTS Total Surveying Solutions and SIX Maps (NSW) government website information were used to estimate the total catchment area. The peak stormwater runoff rates within each of the contributing sub-catchments upstream of the subject site and the resulting flood depth within the flood storage area was modelled in the computer program DRAINS for the 1% AEP storm event.

2.2 Hydraulic Modelling Parameters

Multiple assumptions and parameters were considered in the construction of the hydraulic model. The modelling assumptions and parameters used are based on available survey data and on-site investigations.

2.2.1 Sub-Catchment Assumptions

Five sub-catchments were used in the analysis to effectively determine the flood behaviour within the wider catchment. The following assumptions are based on available survey information and recommended guidelines.

- An impervious ratio of 75% was used for 4 of the upper sub-catchment nodes (refer to Figure 2).
- An impervious ratio of 67% was used for the lower sub-catchment node at the bottom of the freshwater catchment (refer to Figure 2). This catchment also includes large grass park areas at the eastern end of Kooloora avenue.
- A roughness retardance coefficient of 0.012 and 0.33 was used for the impervious and pervious areas, respectively.

2.2.2 Pit and Pipe Blockage Factors

The following assumptions are based on available survey information and accepted guidelines. The below parameters are based upon an approved criterion set by Northern Beaches Council in the Stormwater Pre-Lodgement Meeting Notes (SPLM2020/0001 dated 20/07/2020).

- No blockage factors have been applied to the pipe in the hydraulic model. The velocities through the 2 x 1800mm diameter outlets at Freshwater beach are expected to fall between 3-4m/s during peak storm events. These high velocity rates will facilitate self-cleaning of the pipelines (refer to Appendix F for details).
- A blockage factor of 80% was applied to all sag pits within the hydraulic model.
- A constant outlet water level of 1.475m AHD was used to represent the king tide tailwater condition for the 2 x 1800mm diameter outlets at Freshwater Beach. The king tide level has been conservatively taken as the highest tidal level ever recorded in the Sydney area (refer to Figure 2 below). Source: Manly Hydraulics Laboratory (NSW Government website)

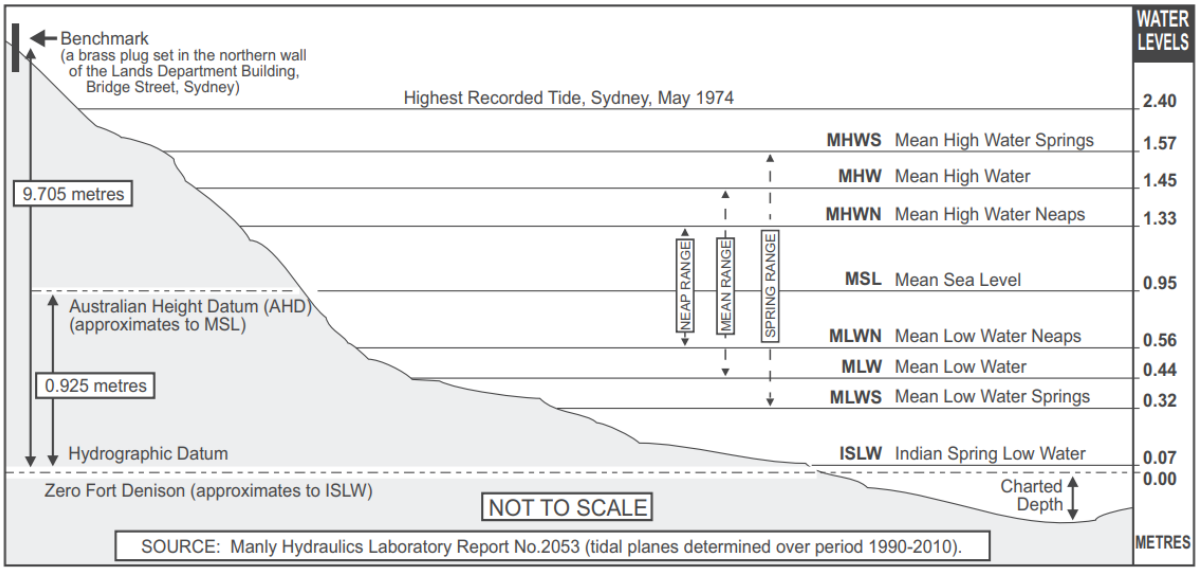


Figure 2 - NSW Tidal Charts (2020). Source: Manly Hydraulics Laboratory (NSW Government website)

2.2.3 Flood Storage Basin Parameters

To effectively represent the flood storage areas within the wider Freshwater catchment, storage basin nodes were used in a hydraulic model to accurately represent each of the critical temporary detention basins within the catchment, as these have a considerable impact on the hydraulic behaviour of stormwater runoff within the wider catchment. For the purpose of this report the following assumptions are made based on the available survey information and on site observations:

- Jacka Park Storage Basin 1 and Jacka Park Storage Basin 2 (Refer Figure 3) are located in Freshwater and are bound by Wyndora Avenue, Eric Street, Glen Street and Oliver Street. The two storage basins at Jacka Park are assumed to collect stormwater runoff from sub catchment A (refer Figure 4).
- Freshwater Storage Basin (Refer Figure 3) is located in Freshwater and bound by Albert Street, Moore Road and Ocean View Road. The Freshwater storage basin is assumed to collect stormwater runoff from sub-catchment E (refer Figure 4) and discharges through the council pipe at Freshwater beach.

Figure 3 - Storage Basin Locations within the Freshwater Catchment. Source: QGIS

2.2 Catchment Analysis

The subject site is located within the Freshwater catchment which conveys stormwater runoff to Freshwater Beach via Council's stormwater drainage infrastructure. The total contributing catchment affecting the subject site was measured in the computer program QGIS 2.18.8 using LiDAR data and is approximately 89.215 Ha.

The contributing catchment consists predominately of low-medium residential development. The catchment extends approximately 1500m upstream and reaches an elevation of approximately 68m AHD. QGIS 2.18.8 was also used to measure the average catchment slope. The manning's roughness 'n' values used for the analysis have been approximated based on observed site conditions (refer Table 1 below). Modelled results from a DRAINS analysis have been used to estimate the peak flow flood depth for the 1% AEP storm event.

Table 1 - Roughness Parameters used for DRAINS

Surface Type	Manning's Roughness (n)
Road / Paving	0.012
Grass	0.33

Five sub-catchments were considered in the analysis to appropriately represent the wider Freshwater catchment. The wider catchment was reduced to five critical sub-catchments for the purpose of providing a more accurate representation of the wider catchment flow behaviour. Each of the sub-catchments are listed below (refer to Figure 4).

- Jacka Park Sub-Catchment (Sub-Catchment A)
- Soldiers Avenue Sub-Catchment (Sub-Catchment B)
- Alfred Street Sub-Catchment (Sub-Catchment C)
- Ocean View Road Sub-Catchment (Sub-Catchment D)
- Freshwater Sub-Catchment (Sub-Catchment E)

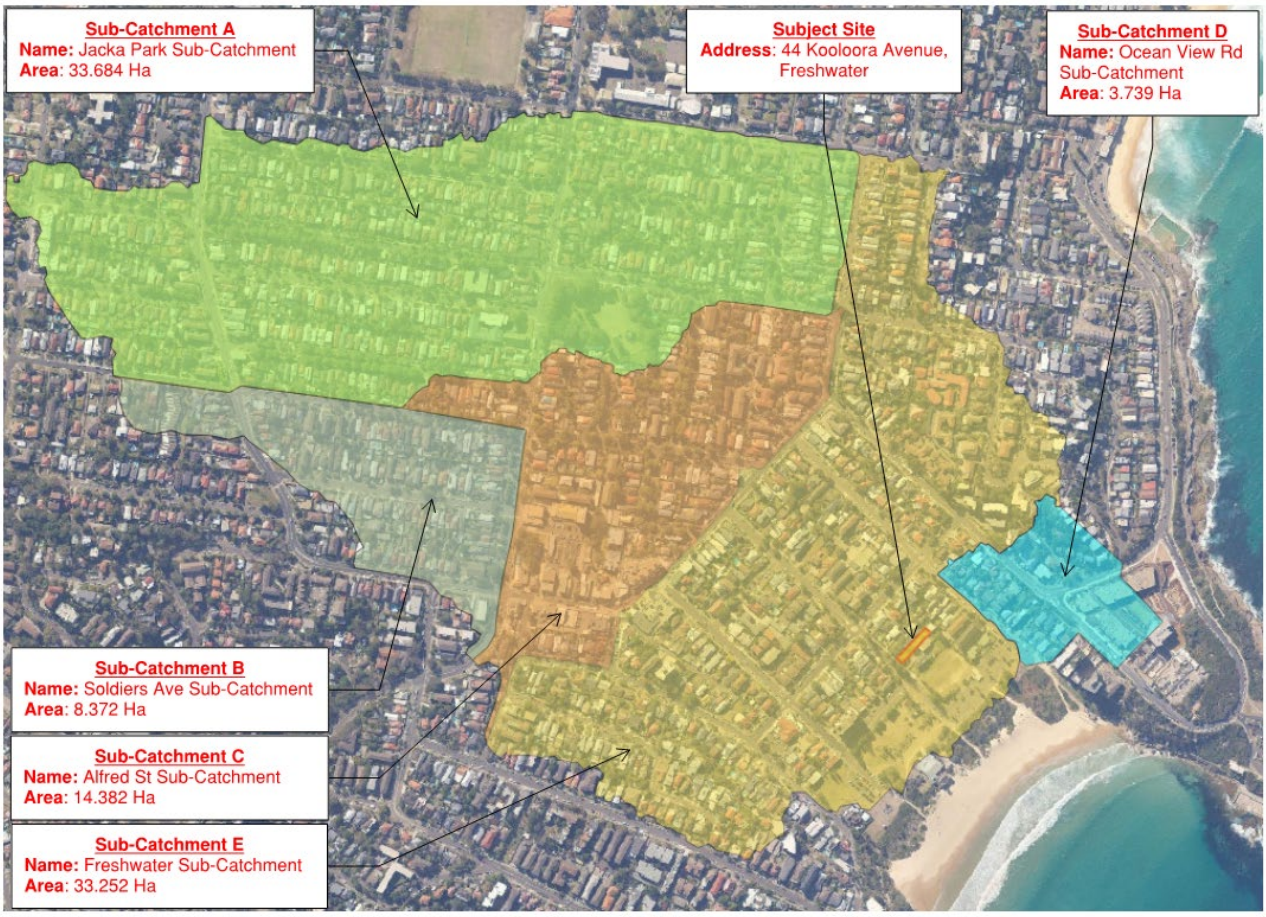


Figure 4 – Critical Sub-Catchments within the Freshwater Catchment. Source: QGIS

3. Analysis & Results

3.1 Peak Flow Results

A DRAINS computation analysis was completed to determine the anticipated runoff through the subject site. The 1% AEP storm event was computed, and the peak runoff rates are shown in Table 2 below:

Table 2 - Catchment Flow Rates for the 1% AEP Storm Event

AEP	Sub-Catchment	Area (Ha)	Piped Flow (m^3/s)	Overflow (m^3/s)
1%	A	33.684	6.82	2.52
1%	B	8.372	0.131	4.02
1%	C	14.382	7.06	9.32
1%	D	3.739	2.13	0
1%	E	33.252	20.2	0

For further detail refer Appendix A.

3.2 Flooding Extent

The 1% AEP peak flood depth has been estimated using the computer program DRAINS. The 1% AEP storm event was computed, and the peak flood depths within the Freshwater Storage Basin within the Freshwater sub-catchment are shown in Table 3 below:

Table 3 - Flood Depths for the 1%, 2%, 5% & 0.2EY Storm Events

AEP / EY	Flood Depth (m AHD)
1% AEP	5.05
2% AEP	4.86
5%	4.63
0.2EY	4.20

3.3 Flood Storage Loss

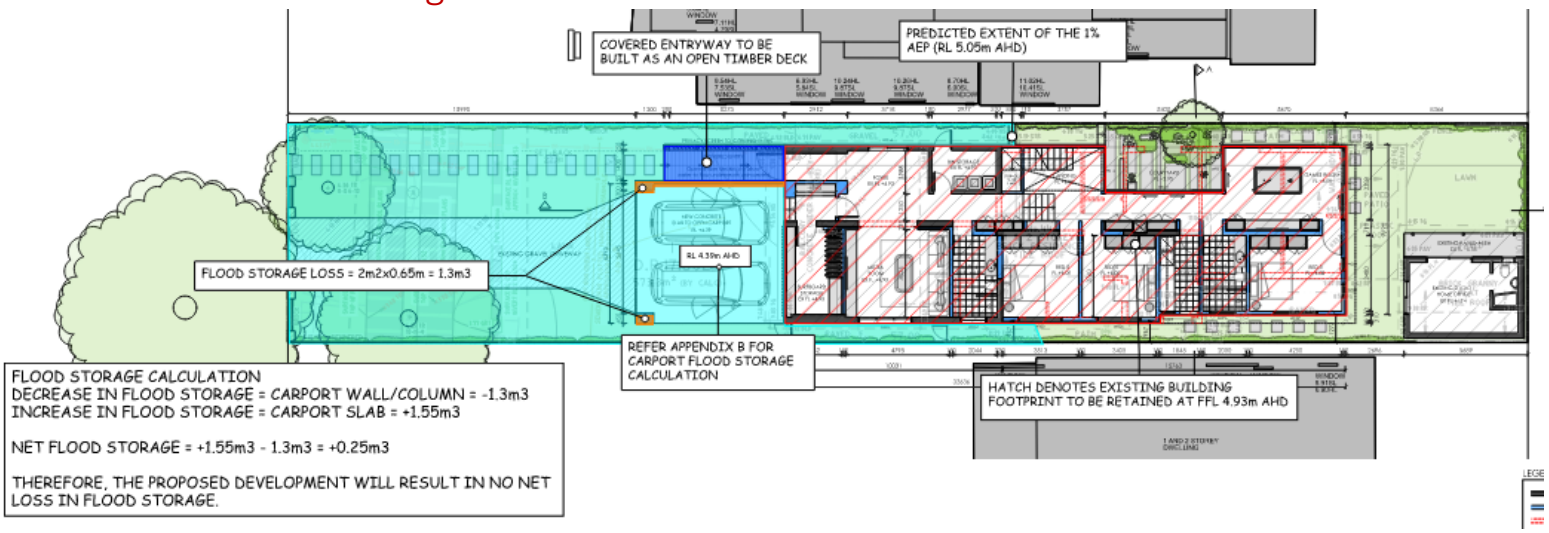


Figure 5 - Flood storage calculation

The footprint of the proposed alterations and additions details a minor extension to the footprint of the existing dwelling with minor alterations to the current landscape. All changes to habitable areas are proposed within the existing building footprint. The majority of the proposed filling at the site appears to be located beyond the flood affected area (within existing areas above the 1% AEP flood level of 5.05m AHD). The proposed covered entryway is to be built as an open timber deck to allow flood waters to flow unimpeded. The proposed carport slab is to be built with an FFL of 4.39m AHD (Refer Appendix B for Carport Flood Storage Calculation) which will result in an increase in flood storage of 1.56m^3. The proposed carport wall and support column will result in a decrease in flood storage of 1.3m^3 (Refer Figure 5 for Flood Storage Calculations). The existing front yard is to remain at current levels. If the above is adopted in construction, the proposed development is anticipated to result in no net loss of flood storage.

4. Recommendations

4.1 Carport

The ponding depth at the proposed carport during the 1% AEP flood event is predicted to exceed 300mm (650mm). Therefore, it is recommended that vehicle barriers or restraints be provided to prevent floating vehicles leaving the site. Protection should be provided for all events up the 1% AEP event.

4.2 Covered Entry Walkway

The proposed covered entry walkaway is to be built as an open timber deck. This is to allow flood waters to unimpeded and result in no net loss of flood storage.

4.3 Building Components and Structural Soundness

The proposed structures are recommended to be designed and inspected by a structural engineer to ensure the structure is adequate to withstand the forces of floodwaters up to the FPL with low velocity. New structures located below the FPL are to be designed to cater for the flood loads. Furthermore, the switchboard and main circuit unit must be fitted above the FPL. All new electrical equipment, power points, wiring, fuel lines, sewerage systems or any other service pipes and connections must be waterproofed and/or located above the FPL and conduits must be laid such that they are free draining. All existing electrical equipment and power points located below the FPL within the subject structure must have residual current devices installed that turn off all supply of electricity to the property when flood waters are detected. New structures located below the FPL are to be adequately flood proofed.

Any new structures are to be constructed of standard building materials of concrete, steel, timber and/or brickwork above the flood levels. Any proposed fencing along the boundaries, alternative to pool type fencing, are to be certified and/or designed by a civil engineer to withstand hydrostatic forces up to and including the 1% AEP storm event. Openings are to be provided, excluding the property frontage, to ensure the 1% AEP floodwater is able to flow through the property unimpeded. Any changes to internal structures below the FPL are to be wet waterproofed.

5. Conclusion

In accordance with accepted engineering practice, NBCE has undertaken a flood study of the stormwater drainage system at 44 Kooloora Avenue in Freshwater and can confirm the accuracy of the calculated results based on the DRAINS modelling. The proposed development will be safeguarded from flooding and will not adversely affect other structures or properties as a result of the proposed development. Please contact the author if further clarification is required.

NORTHERN BEACHES CONSULTING ENGINEERS P/L
Michael Wachjo

BE(Civil) MIEAust

\\NBADS\Company\Synergy\Projects\200273 44 KOOLOORA AVENUE, FRESHWATER\ENG Design\Flood\Report\200273 - 44 Kooloora Ave - Flood Report 2021-11-25 Revision B.docx

APPENDIX A

DRAINS Results

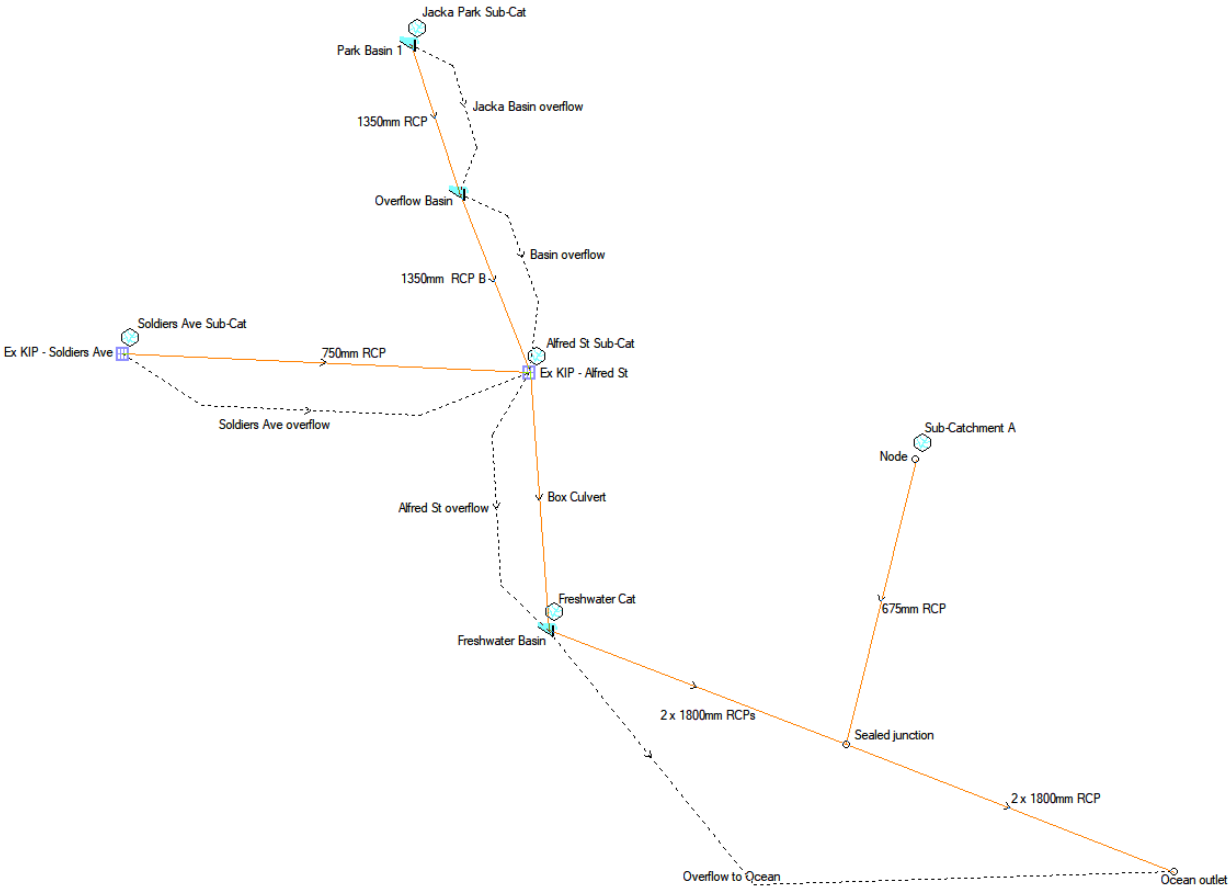


Figure 6 - DRAINS model: Catchment configuration

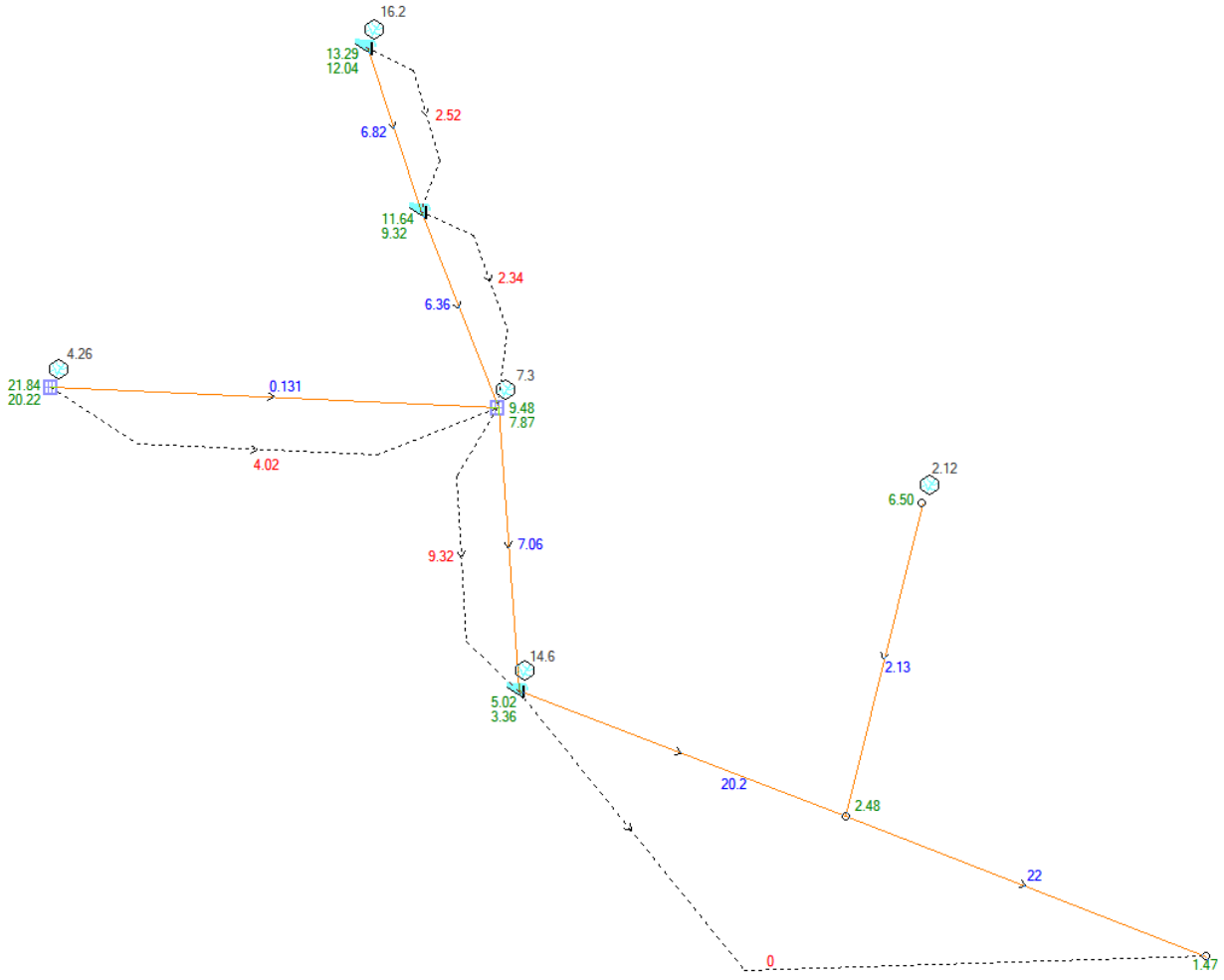
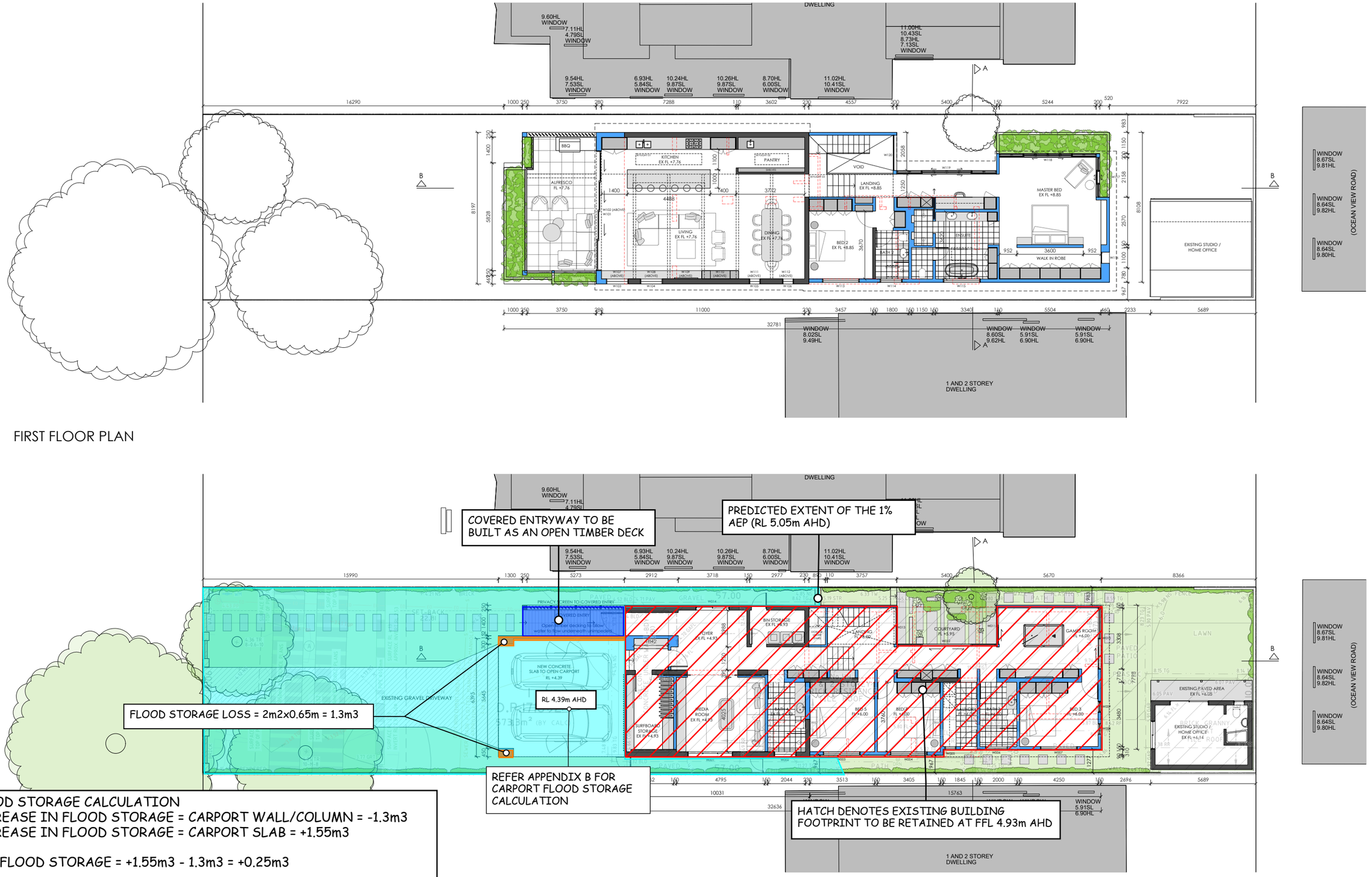


Figure 7 - DRAINS model: Catchment Flows for 1% AEP Storm Event. Source: DRAINS

APPENDIX B

Flood Storage Calculations



FIRST FLOOR PLAN

FLOOD STORAGE CALCULATION
DECREASE IN FLOOD STORAGE = CARPORT WALL/COLUMN = -1.3m3
INCREASE IN FLOOD STORAGE = CARPORT SLAB = +1.55m3

NET FLOOD STORAGE = +1.55m3 - 1.3m3 = +0.25m3

THEREFORE, THE PROPOSED DEVELOPMENT WILL RESULT IN NO NET LOSS IN FLOOD STORAGE.

LEGEND
- EXISTING WALLS TO BE RETAINED
- PROPOSED NEW WALLS
- EXISTING WALLS TO BE DEMOLISHED

emma macindoe
interior design
0413069379 emmamacdesigns@gmail.com

CLIENT: NICOLE & ADRIAN STEWART

TITLE: PROPOSED FLOOR PLAN AND LANDSCAPE PLAN

ADDRESS: 44 KOOLOORA AVENUE, FRESHWATER NSW

GENERAL NOTES
All works to be in accordance with Australian Standards, The Building Code of Australia, other relevant codes and with manufacturers' instructions.
This drawing is copyright and may not be used without consent.
Do not scale off drawing. Verifiy all dimensions on site prior to construction.
To be read in conjunction with all other consultants' drawings.
The designer to be immediately notified of any discrepancies.

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DRAWING: DA04

ISSUE: 3

DATE: 23/11/2021

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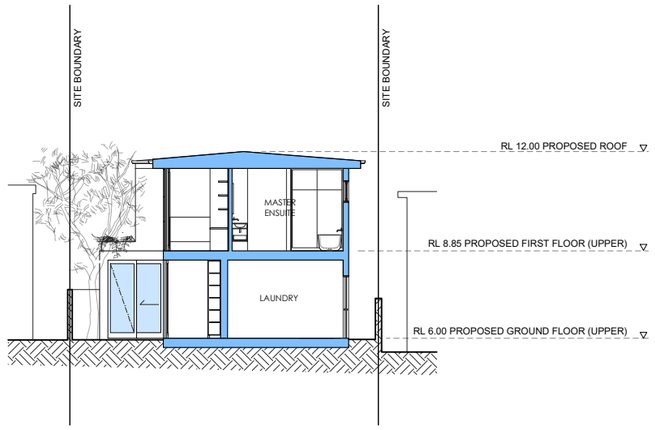
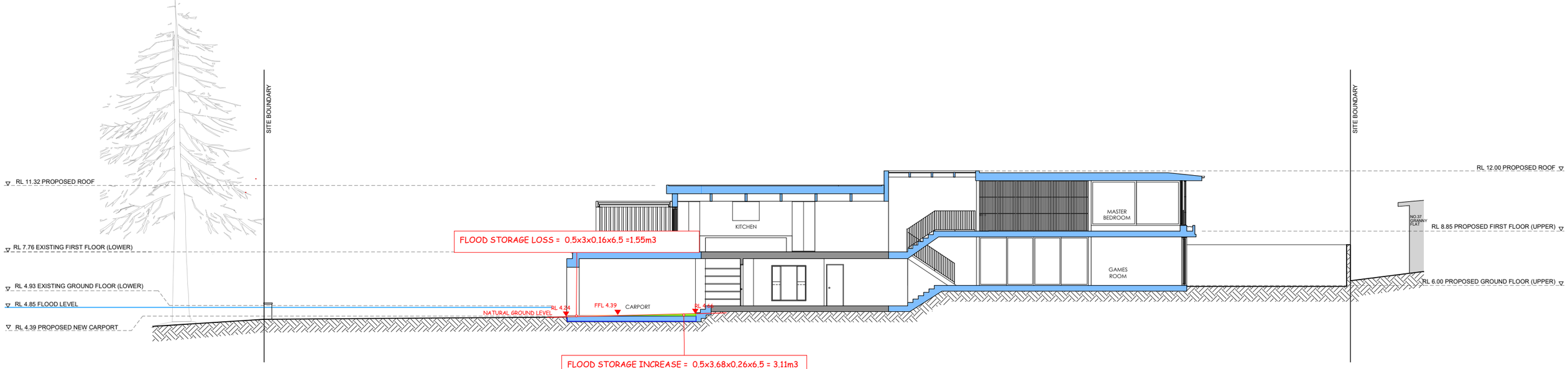
DRAWN BY: F.G.R.



SECTION A



SECTION B

NO NET LOSS OF FLOOD STORAGE ANTICPATED

TOTAL STORAGE INCREASE = +3.11 - 1.56m = 1.56m3

LEGEND

- EXISTING WALLS TO BE RETAINED
- PROPOSED NEW WALLS
- EXISTING WALLS TO BE DEMOLISHED

emma macindoe
interior design
0413069379 emmamacdesigns@gmail.com

CLIENT
NICOLE & ADRIAN STEWART

TITLE
PROPOSED SECTIONS

ADDRESS
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GENERAL NOTES
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DA07

ISSUE 3

DATE 23/11/2021

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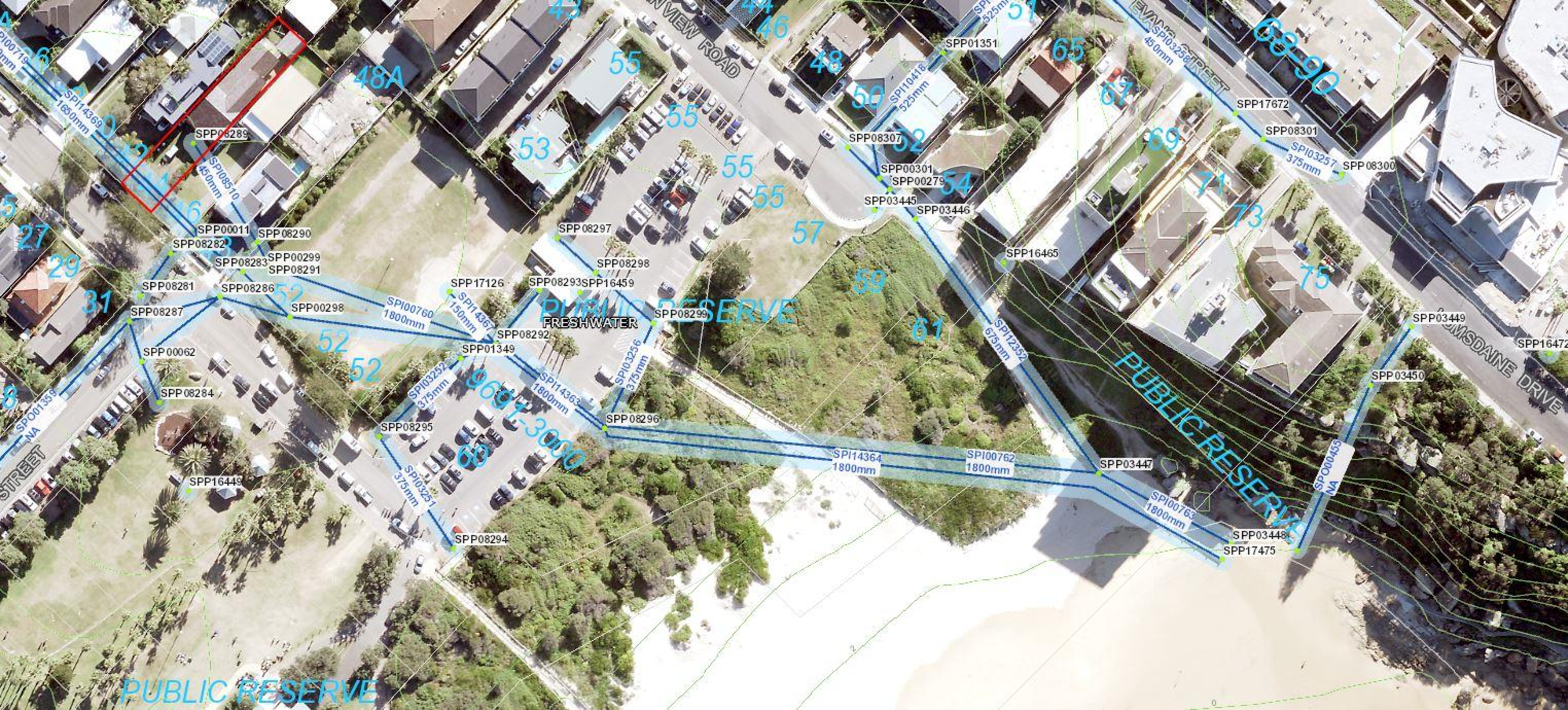
APPENDIX C

Council Mapping Information



PUBLIC RESERVE
FRESHWATER
PUBLIC RESERVE
PUBLIC RESERVE
9691-3000
LUMSDAINE DRIVE
EVANS STREET
STREET
VIEW ROAD
68-90
SPI14369 1650mm
SPI08510 450mm
SPI00760 1800mm
SPI14367 150mm
SPI14363 1800mm
SPI03252 375mm
SPI03256 375mm
SPI03251 375mm
SPI14364 1800mm
SPI00762 1800mm
SPI00763 1800mm
SPI12352 675mm
SPI10418 525mm
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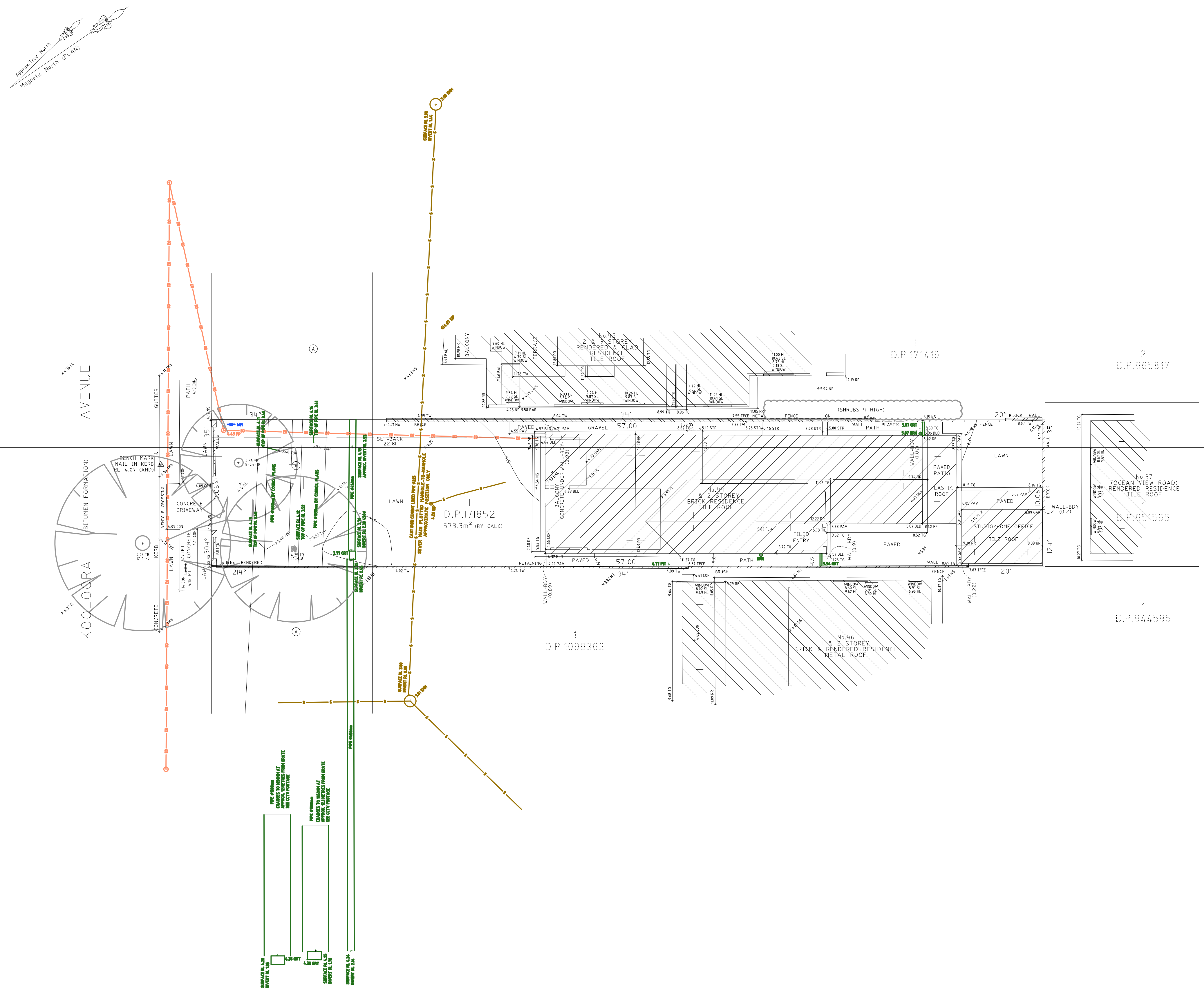
APPENDIX D

Site survey plan & Architectural plans

A0



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SCALE 1:100

Ⓐ PROPOSED EASEMENT TO DRAIN WATER 6m TO 7.7m WIDE & VARIABLE WIDTH BY DP636528.

TITLE INDICATES THAT LOT 1 IN D.P.171852 IS SUBJECT TO:

- RESERVATIONS AND CONDITIONS IN THE CROWN GRANT(S).

NOTES

- A FIELD SURVEY OF THE BOUNDARIES HAS BEEN CONDUCTED.
- WALL TO BOUNDARY DIMENSIONS SHOWN HEREON MUST NOT BE USED FOR CONSTRUCTION.
- IF CONSTRUCTION ON OR NEAR BOUNDARIES IS REQUIRED IT IS RECOMMENDED THAT THE BOUNDARIES OF THE LAND BE MARKED OR THE BUILDING SET OUT.
- TREE SIZES ARE ESTIMATES ONLY.
- THIS PLAN HAS BEEN PREPARED FOR THE EXCLUSIVE USE OF ADRIAN & NICOLE STEWART.
- RELATIONSHIP OF IMPROVEMENTS TO BOUNDARIES IS DIAGRAMMATIC ONLY. WHERE OFFSETS ARE CRITICAL THEY SHOULD BE CONFIRMED BY FURTHER SURVEY.
- EXCEPT WHERE SHOWN BY DIMENSION LOCATION OF DETAIL WITH RESPECT TO BOUNDARIES IS INDICATIVE ONLY.
- ONLY VISIBLE SERVICES HAVE BEEN LOCATED. UNDERGROUND SERVICES HAVE NOT BEEN LOCATED. DIAL BEFORE YOU DIG SERVICES (ph 1100) SHOULD BE USED AND A FULL UTILITY INVESTIGATION, INCLUDING A UTILITY LOCATION SURVEY, SHOULD BE UNDERTAKEN BEFORE CARRYING OUT ANY CONSTRUCTION ACTIVITY IN OR NEAR THE SURVEYED AREA.
- SEWER MAIN PLOTTED FROM SYDNEY WATER SEWER DIAGRAM. LOCATION SHOULD BE MARKED ON SITE IF CRITICAL.
- CRITICAL SPOT LEVELS SHOULD BE CONFIRMED WITH SURVEYOR.
- THIS PLAN IS ONLY TO BE USED FOR THE PURPOSE OF DESIGNING NEW CONSTRUCTIONS.
- CONTOURS SHOWN DEPICT THE TOPOGRAPHY. THEY DO NOT REPRESENT THE EXACT LEVEL AT ANY PARTICULAR POINT. ONLY SPOT LEVELS SHOULD BE USED FOR CALCULATIONS OF QUANTITIES WITH CAUTION.
- CONTOUR INTERVAL - 0.5 metre. - SPOT LEVELS SHOULD BE ADOPTED.
- POSITION OF RIDGE LINES ARE DIAGRAMMATIC ONLY (NOT TO SCALE).
- THE INFORMATION IS ONLY TO BE USED AT A SCALE ACCURACY OF 1:100.
- DO NOT SCALE OFF THIS PLAN / FIGURED DIMENSIONS TO BE TAKEN IN PREFERENCE TO SCALED READINGS.

MURRAY LEARMONT
REGISTERED SURVEYOR BOSSI NUMBER 1462

LEGEND:

BAL = BALCONY
BLD = EXTERNAL BUILDING
CL = CENTRELINE
CON = CONCRETE
DS = DOOR SILL LEVEL
FL = FLOOR LEVEL
GAFL = GARAGE FLOOR LEVEL
GAR = GARAGE
GRT = GRATE
HL = HEAD LEVEL
NS = NATURAL SURFACE
PAR = PARAPET
PAV = PAVING
PIT = TOP OF PIT
RF = TOP OF ROOF
RR = ROOF RIDGE
SIP = SEWER INSPECTION PIT
SL = SILL LEVEL
SMH = SEWER MAN HOLE
STR = STAIRS
SWSL= STORMWATER SURFACE LEVEL
SSL = SEWER UNDERGROUND
TFCE = TOP OF FENCE
TG = TOP OF GUTTER
TIL = TILE
TKB = TOP OF KERB
TPIT = TELSTRA PIT
TR = TREE
TW = TOP OF WALL
WM = WATER METER
EO = ELECTRICITY OVERHEAD
S = SEWER UNDERGROUND
TREE SPREAD-DIAMETER-HEIGHT

HORIZONTAL DATUM:
CO-ORDINATE SYSTEM: ASSUMED
MARKS ADOPTED: N/A

VERTICAL DATUM:
DATUM: AUSTRALIAN HEIGHT DATUM (AHD)
B.M. ADOPTED: SSM 772
R.L. 4.254 (ORDER L2)
SOURCE: S.C.I.M.S. (07/02/19)

4	TITLE NOTES UPDATED	13/11/2021
3	STORMWATER UPDATED	30/01/20
2	STORMWATER & SEWER INVESTIGATION	17/01/20
1	FIRST ISSUE	15/02/19

CLIENT:
ADRIAN & NICOLE STEWART
c/- BREWSTER HJORTH ARCHITECTS
L1 4-14 FOSTER STREET
SURRY HILLS NSW 2000

BOUNDARY IDENTIFICATION SHOWING DETAIL & LEVELS OVER LOT 1 IN D.P.171852 No. 44 KOOLOORA AVENUE FRESHWATER NSW 2096

PO Box 463 Dee Why
NSW 2099
2/99A South Creek Road,
Dee Why NSW 2099
Telephone: (02) 9971 4802
Facsimile: (02) 9971 4822
E-mail: info@cmssurveyors.com.au

LGA: NORTHERN BEACHES			SHEET 1 OF 2
SURVEYED	DRAWN	CHECKED	APPROVED
H.H./M.E.	R.N.	H.H./M.E.	A.F.
SURVEY INSTRUCTION	SCALE	DATE OF SURVEY	
18354A	1:100 @ A0	08/02/19 & 10/01/20	
DRAWING NAME			ISSUE
18354Adetail			4
CAD FILE			
18354Adetail 4.dwg			

Glazing requirements	Show on DA Plans	Show on CC/CDC Plans & specs	Certifier Check
Windows and glazed doors			
The applicant must install the windows, glazed doors and shading devices, in accordance with the specifications listed in the table below. Relevant overshadowing specifications must be satisfied for each window and glazed door.	✓	✓	✓
The following requirements must also be satisfied in relation to each window and glazed door:		✓	✓
Each window or glazed door with improved frames, or pyrolytic low-e glass, or clear/air gap/clear glazing, or toned/air gap/clear glazing must have a U-value and a Solar Heat Gain Coefficient (SHGC) no greater than that listed in the table below. Total system U-values and SHGCs must be calculated in accordance with National Fenestration Rating Council (NFRC) conditions. The description is provided for information only. Alternative systems with complying U-value and SHGC may be substituted.		✓	✓
For projections described in millimetres, the leading edge of each eave, pergola, verandah, balcony or awning must be no more than 500 mm above the head of the window or glazed door and no more than 2400 mm above the sill.	✓	✓	✓
For projections described as a ratio, the ratio of the projection from the wall to the height above the window or glazed door sill must be at least that shown in the table below.	✓	✓	✓
Pergolas with polycarbonate roof or similar translucent material must have a shading coefficient of less than 0.35.		✓	✓
Pergolas with fixed battens must have battens parallel to the window or glazed door above which they are situated, unless the pergola also shades a perpendicular window. The spacing between battens must not be more than 50 mm.		✓	✓
Pergolas with adjustable shading may have adjustable blades or removable shade cloth (not less than 80% shading ratio). Adjustable blades must overlap in plan view.		✓	✓
Overshadowing buildings or vegetation must be of the height and distance from the centre and the base of the window and glazed door, as specified in the 'overshadowing' column in the table below.	✓	✓	✓

Windows and glazed doors glazing requirements

Window / door no.	Orientation	Area of glass inc. frame (m2)	Overshadowing Height (m)	Overshadowing Distance (m)	Shading device	Frame and glass type
W1	SW	15.81	0	0	pergola (adjustable shade) >=900 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W2	SW	2.23	0	0	projection/height above sill ratio >=0.23	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W3	SE	2.41	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W4	SE	2.41	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W5	SE	1.41	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W6	SE	1.41	2000	1.9	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W7	SE	0.71	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W8	SE	0.71	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W9	SE	0.71	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W10	SE	0.71	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W11	SE	0.71	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W12	SE	0.71	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W13	SE	1.4	2000	1.7	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W14	SE	0.84	2000	1.7	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W15	SE	1.4	2000	1.7	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W16	NE	1.41	0	0	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W17	NE	5.44	5.88	5.55	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W18	NW	11.6	0	0	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W19	NW	13.43	0	0	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W20	NE	5.11	5.88	5.55	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W21	SE	4.5	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W22	SE	0.71	0	0	projection/height above sill ratio >=0.29	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W23	SE	1.6	5000	1.7	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W24	SE	1.6	5000	1.7	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W25	SE	0.71	5000	1.7	eave/verandah/pergola/balcony >=750 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W26	SE	0.71	5000	1.7	eave/verandah/pergola/balcony >=750 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W27	SE	1.6	5000	1.7	eave/verandah/pergola/balcony >=750 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W28	NE	1.35	0	0	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W29	NE	1.35	0	0	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W30	NE	8.31	0	0	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W31	SW	4.61	0	0	none	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W32	NW	14.56	0	0	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)
W33	NE	4.92	2.98	5.55	none	timber or uPVC, double Lo-Tsol/air gap/clear, (U-value: 2.3, SHGC: 0.19)
W34	NW	3.33	5.5	1.66	eave/verandah/pergola/balcony >=450 mm	timber or uPVC, single Lo-Tsol low-e, (U-value: 3.7, SHGC: 0.36)

Glazing requirements	Show on DA Plans	Show on CC/CDC Plans & specs	Certifier Check
Skylights			
The applicant must install the skylights in accordance with the specifications listed in the table below.	✓	✓	✓
The following requirements must also be satisfied in relation to each skylight:		✓	✓
Each skylight may either match the description, or, have a U-value and a Solar Heat Gain Coefficient (SHGC) no greater than that listed in the table below.		✓	✓

Skylights glazing requirements

Skylight number	Area of glazing inc. frame (m2)	Shading device	Frame and glass type
S1 (Kitc)	2.14	no shading	timber, low-E internal/argon fill/clear external, (or U-value: 2.5, SHGC: 0.456)
S2 (PTRY))	0.94	no shading	timber, low-E internal/argon fill/clear external, (or U-value: 2.5, SHGC: 0.456)
S3 (St2)	5.7	no shading	timber, low-E internal/argon fill/clear external, (or U-value: 2.5, SHGC: 0.456)
S4 (EnSh)	0.36	no shading	timber, double clear/air fill, (or U-value: 4.3, SHGC: 0.5)
S5 (EnVa)	0.77	no shading	timber, low-E internal/argon fill/clear external, (or U-value: 2.5, SHGC: 0.456)

DEVELOPMENT APPLICATION

44 KOOLOORA AVE., FRESHWATER NSW

PREPARED ON BEHALF OF:

NICOLE & ADRIAN STEWART

Project address	
Project name	44 Kooloora Ave Freshwater
Street address	44 Kooloora Avenue Freshwater 2096
Local Government Area	Northern Beaches Council
Plan type and number	Deposited Plan 171852
Lot number	1
Section number	
Project type	
Dwelling type	Separate dwelling house
Type of alteration and addition	My renovation work is valued at $50,000 or more, and does not include a pool (and/or spa).

Fixtures and systems	Show on DA Plans	Show on CC/CDC Plans & specs	Certifier Check
Hot water			
The applicant must install the following hot water system in the development: solar (electric-boosted) system that is eligible to create Renewable Energy Certificates under the (Commonwealth) Renewable Energy (Electricity) Regulations 2001 (incorporating Amendment Regulations 2005 (No. 2)).	✓	✓	✓
Lighting			
The applicant must ensure a minimum of 40% of new or altered light fixtures are fitted with fluorescent, compact fluorescent, or light-emitting-diode (LED) lamps.		✓	✓
Fixtures			
The applicant must ensure new or altered showerheads have a flow rate no greater than 9 litres per minute or a 3 star water rating.		✓	✓
The applicant must ensure new or altered toilets have a flow rate no greater than 4 litres per average flush or a minimum 3 star water rating.		✓	✓
The applicant must ensure new or altered taps have a flow rate no greater than 9 litres per minute or minimum 3 star water rating.		✓	

INDEX

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PAGE 03:	DA03 - PROPOSED ROOF PLAN	1:200
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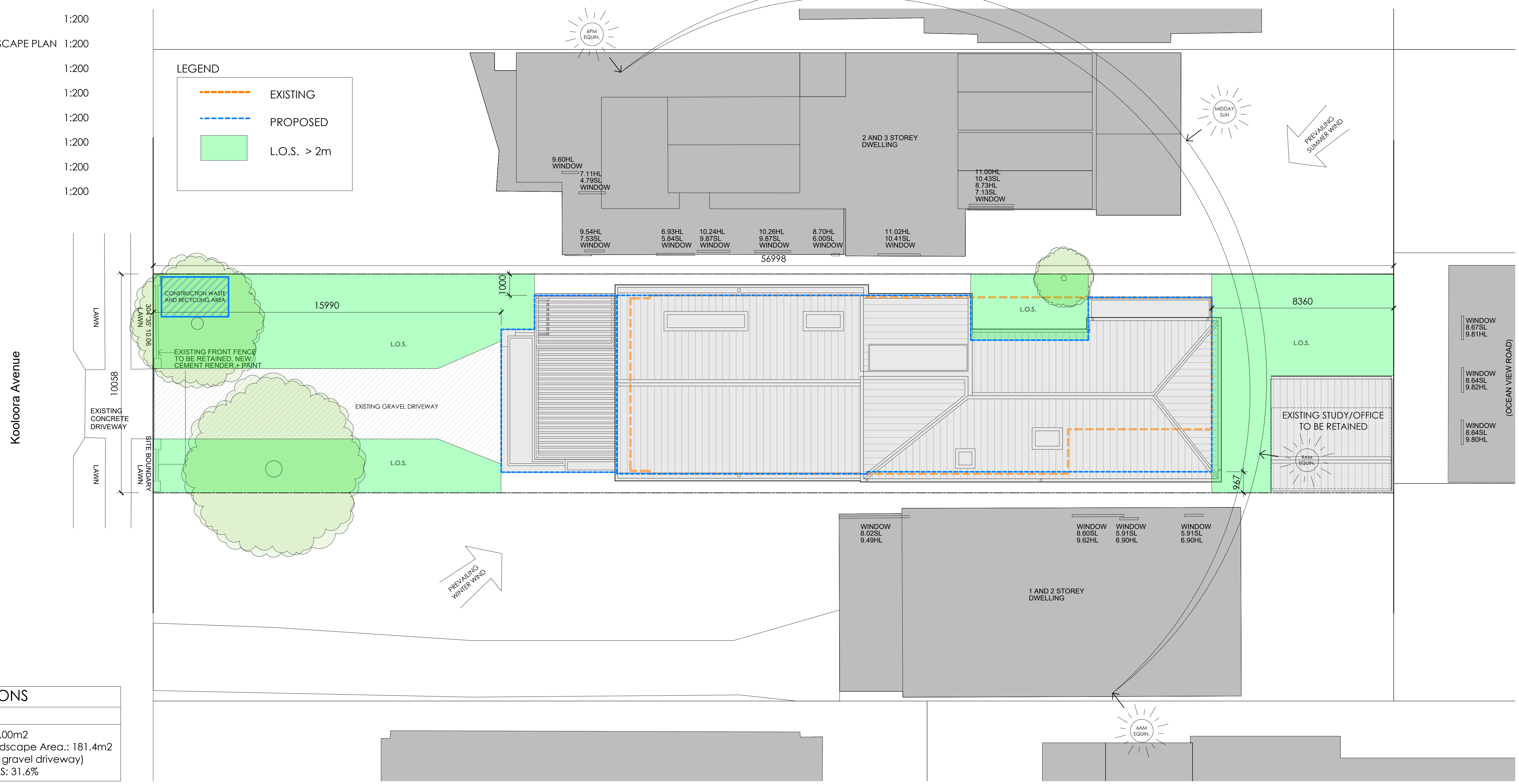
NORTHERN BEACHES COUNCIL CONTROLS

LOT 1 DP 171852
Parcel formerly in Warringah Local Government
Land Zone: R2 Low Density Residential
Maximum Building Height: 8.5m
Land Slip Risk Map - Area A
DCP - Landscaped Open Space: 40% of site
DCP - Maximum Wall Height: 7.2m
DCP - Building Envelope: 5m

SITE CALCULATIONS

EXISTING AREAS:
DETACHED STUDY (habitable): 20m²
DETACHED STUDY (covered porch): 8m²
GROUND (not including detached study): 126m²
GARAGE: 71m²
FIRST: 105m²
ALFRESCO: 24m²
TOTAL: 354m²

PROPOSED AREAS:
DETACHED STUDY (habitable): 20m²
DETACHED STUDY (covered porch): 8m²
GROUND (not including detached study): 197m²
CARPORT & ENTRANCE: 54m²
FIRST: 198m²
ALFRESCO: 29m²
PLANTERS: 18m²
TOTAL: 544m²



LANDSCAPE CALCULATIONS	
EXISTING	PROPOSED
Site Area: 573.00m2 Existing Landscape Area.: 172.5m2 (not including gravel driveway) Existing L.O.S: 30.1%	Site Area: 573.00m2 Proposed Landscape Area.: 181.4m2 (not including gravel driveway) Proposed L.O.S: 31.6%

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CLIENT
NICOLE & ADRIAN STEWART

TITLE
SITE PLAN & SITE ANALYSIS

ADDRESS
44 KOOLOORA AVENUE, FRESHWATER NSW

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DRAWING	ISSUE	SCALE
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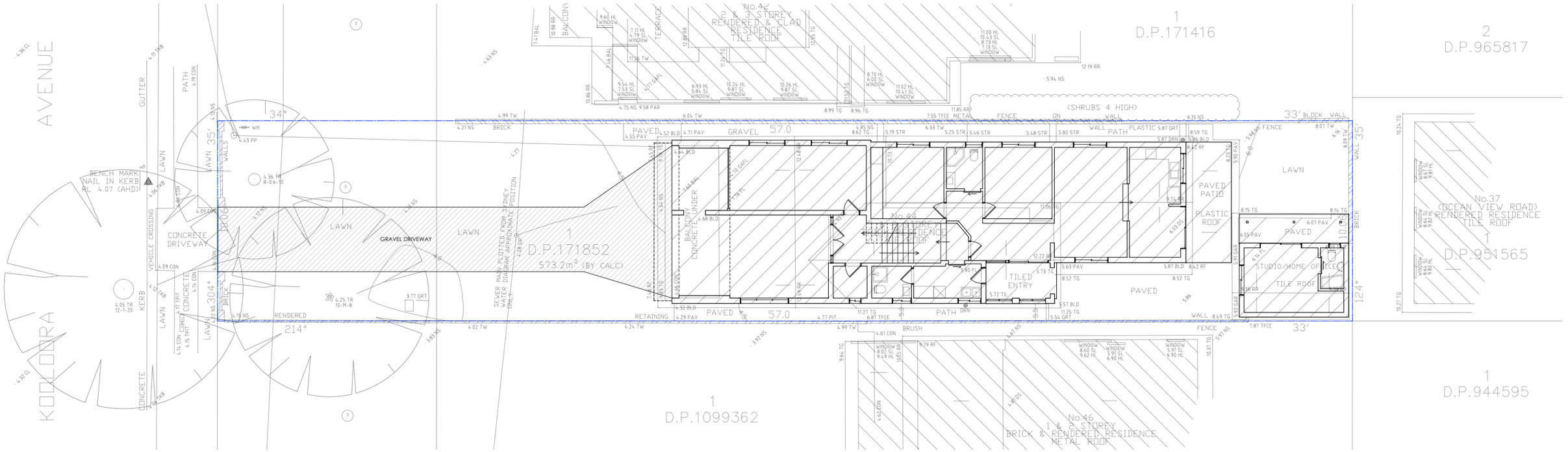
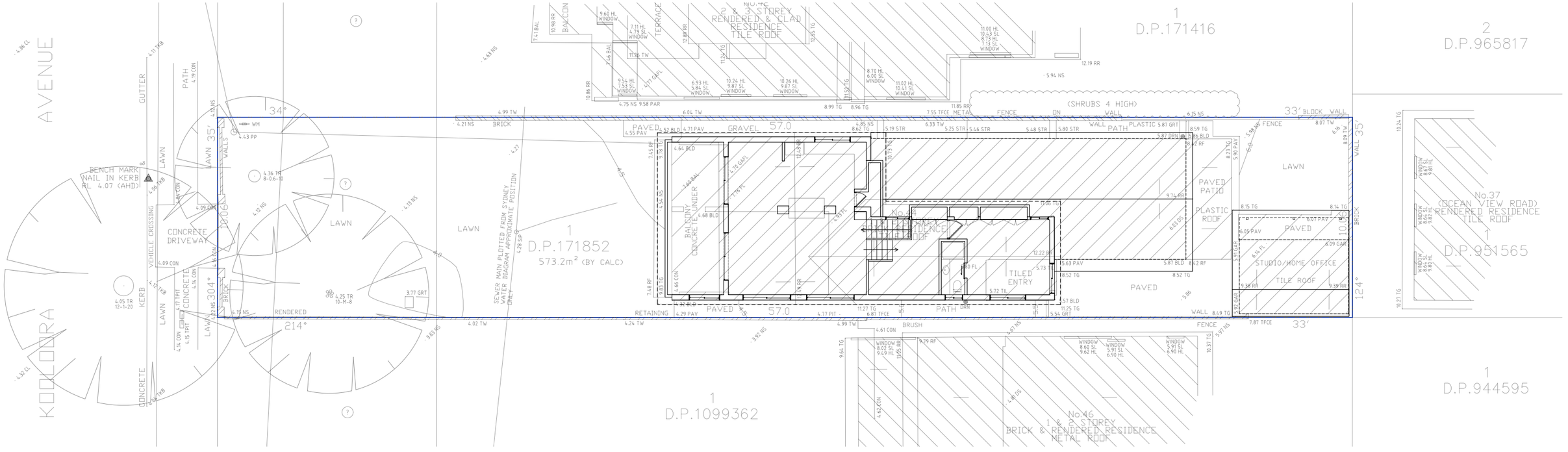


EXISTING GROUND FLOOR PLAN



EXISTING FIRST FLOOR PLAN

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TITLE
EXISTING FLOOR PLANS

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DA02

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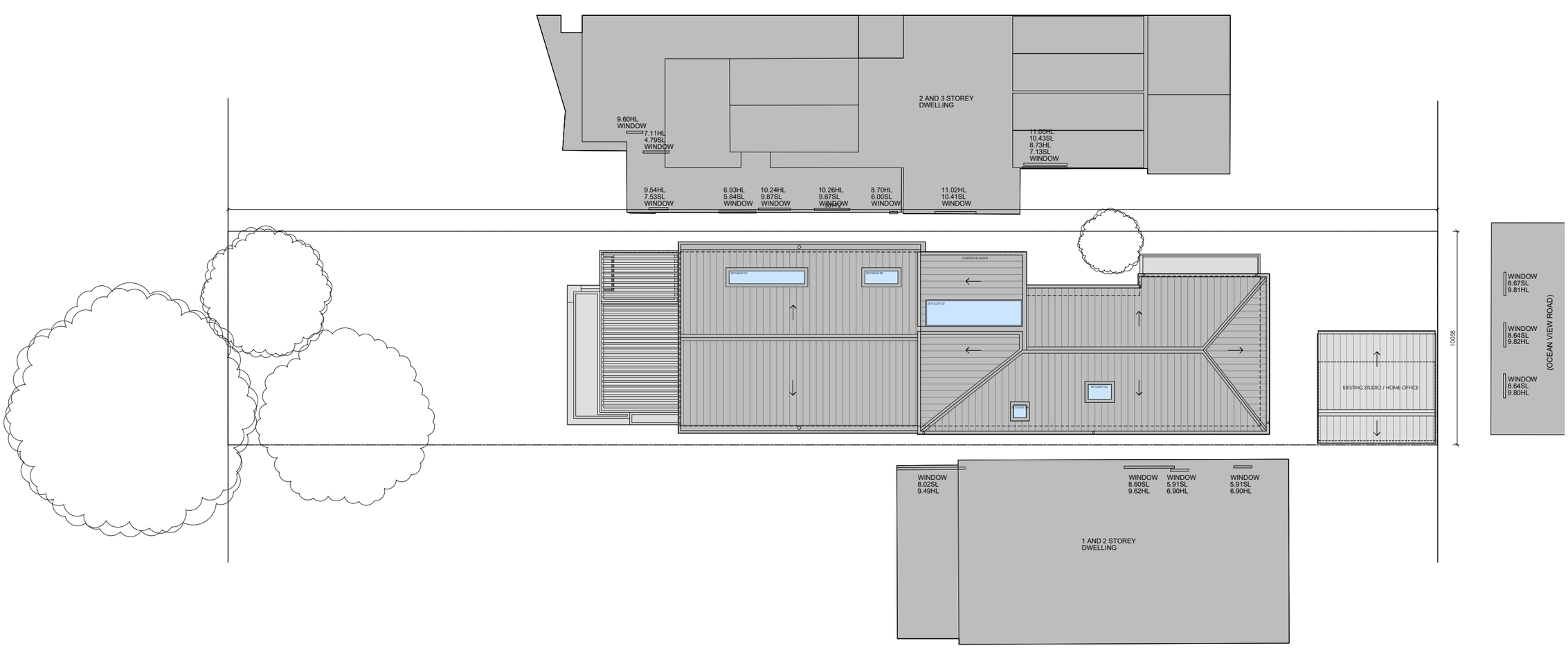

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CLIENT
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TITLE
PROPOSED ROOF PLAN

ADDRESS
44 KOOLOORA AVENUE, FRESHWATER NSW

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0m 1m 2m 5m

DRAWING
DA03

ISSUE 3

DATE 23/11/2021

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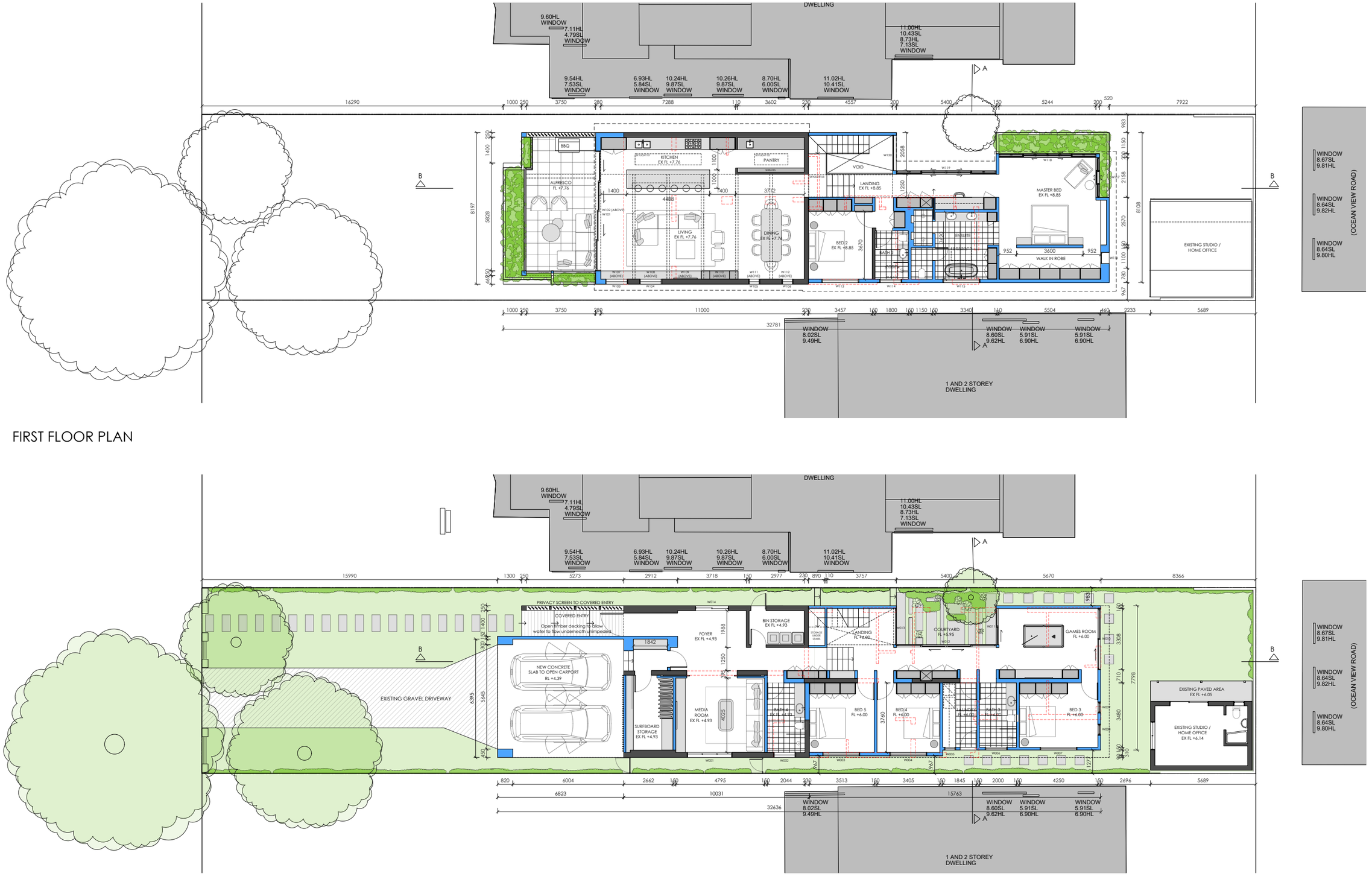

FIRST FLOOR PLAN

GROUND FLOOR PLAN

LEGEND

- EXISTING WALLS TO BE RETAINED
- PROPOSED NEW WALLS
- EXISTING WALLS TO BE DEMOLISHED

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CLIENT: NICOLE & ADRIAN STEWART

TITLE: PROPOSED FLOOR PLAN AND LANDSCAPE PLAN

ADDRESS: 44 KOOLOORA AVENUE, FRESHWATER NSW

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0m 1m 2m 5m

DRAWING: DA04

ISSUE: 3

DATE: 23/11/2021

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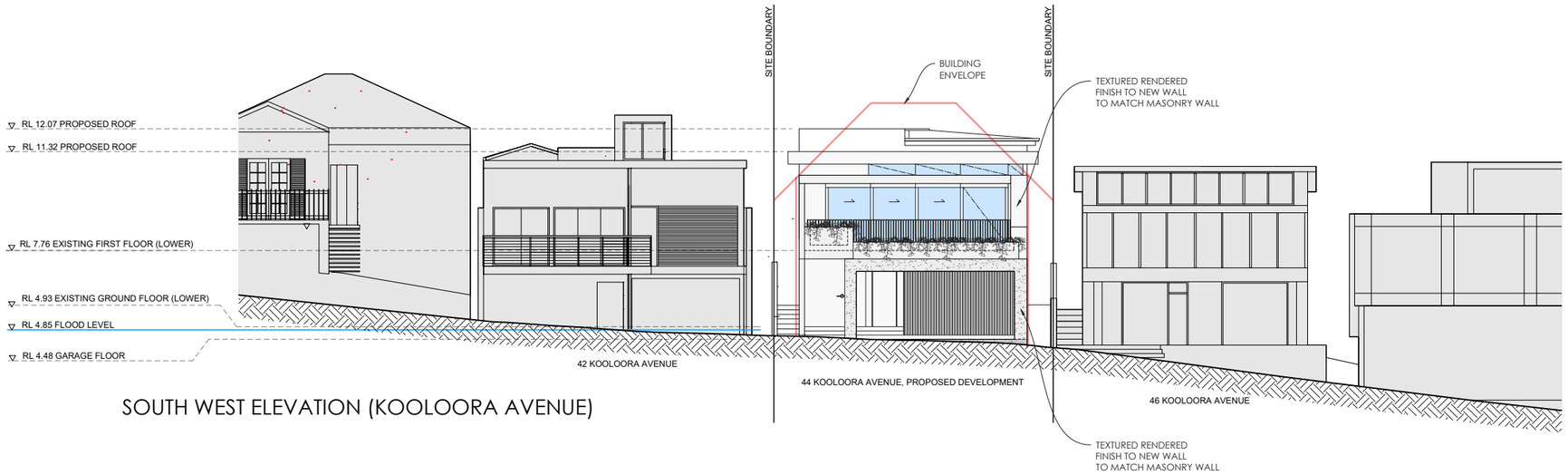
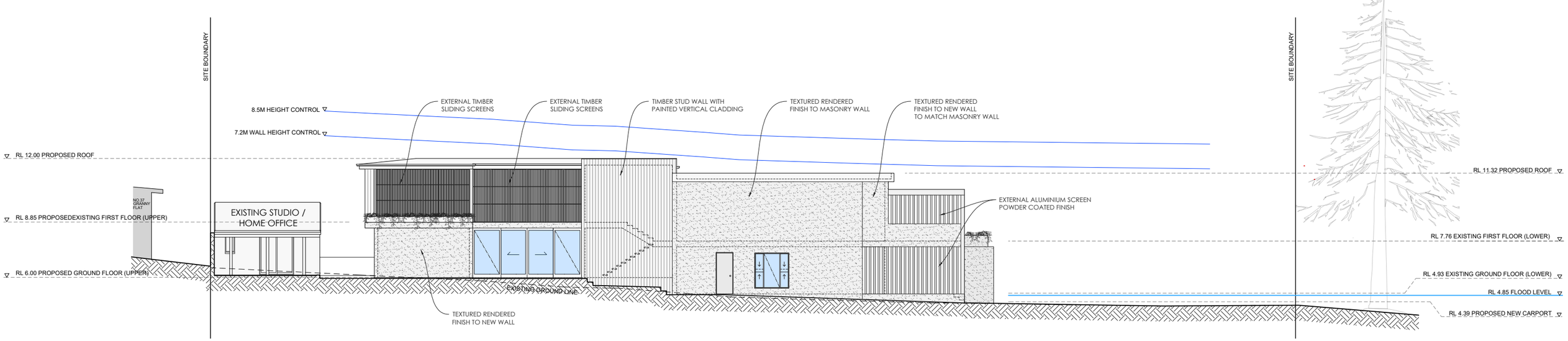


SOUTH WEST ELEVATION (KOOLOORA AVENUE)



NORTH WEST ELEVATION

LEGEND

- EXISTING WALLS TO BE RETAINED
- PROPOSED NEW WALLS
- EXISTING WALLS TO BE DEMOLISHED

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CLIENT
NICOLE & ADRIAN STEWART

TITLE
PROPOSED ELEVATIONS

ADDRESS
44 KOOLOORA AVENUE, FRESHWATER NSW

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0m 1m 2m 5m

DRAWING
DA05

ISSUE 3

DATE 23/11/2021

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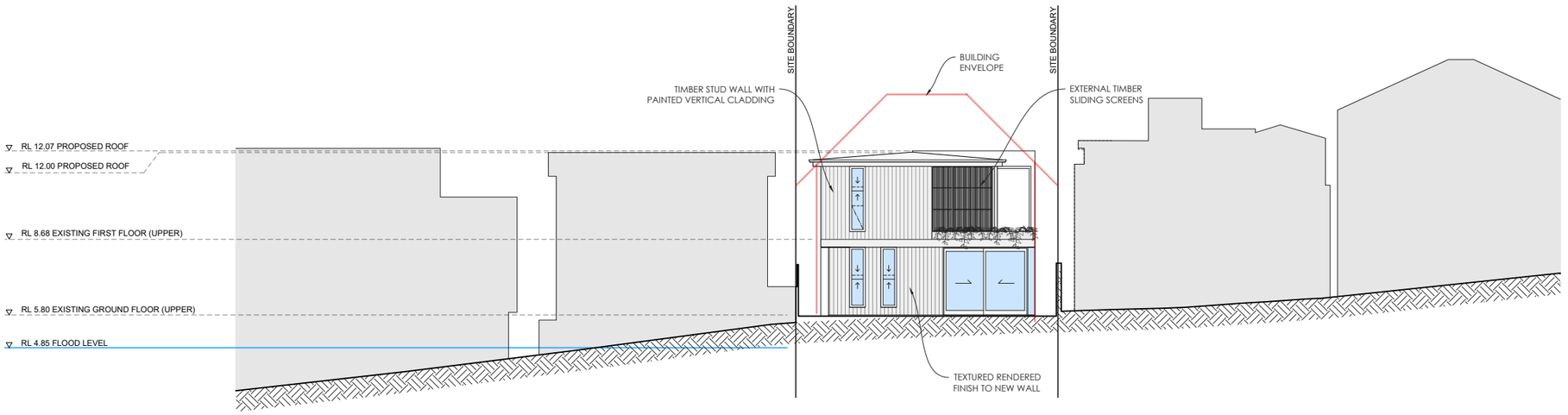
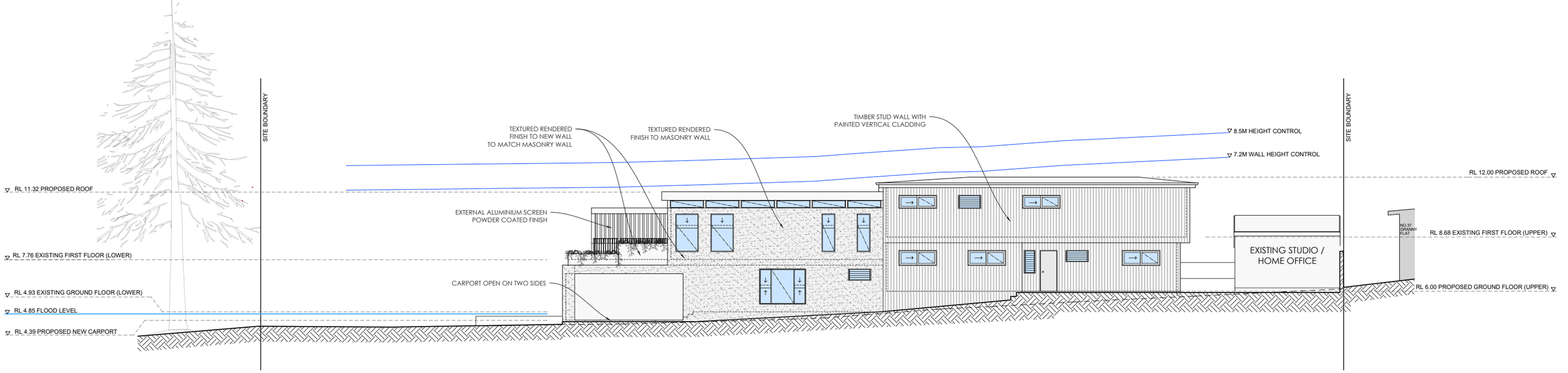


NORTH EAST ELEVATION



SOUTH EAST ELEVATION

LEGEND

- EXISTING WALLS TO BE RETAINED
- PROPOSED NEW WALLS
- EXISTING WALLS TO BE DEMOLISHED

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CLIENT
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TITLE
PROPOSED ELEVATIONS

ADDRESS
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0m 1m 2m 5m

DRAWING
DA06

ISSUE 3

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DATE 23/11/2021

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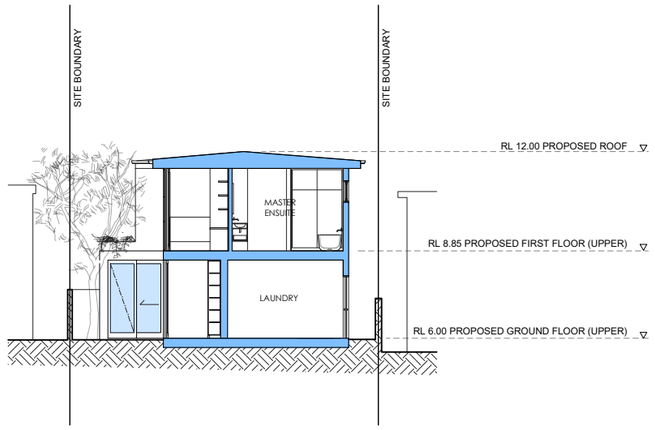
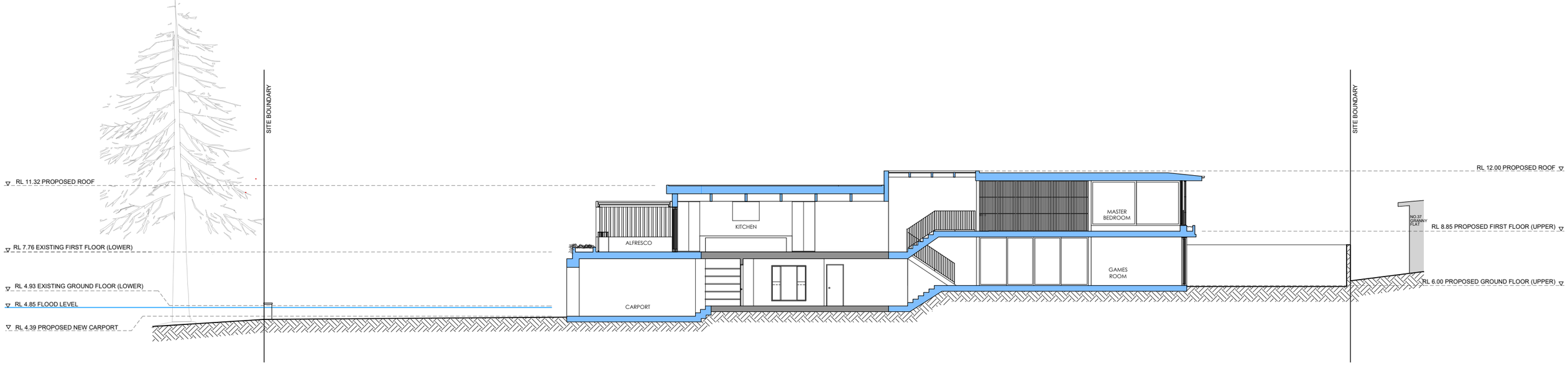


SECTION A



SECTION B

LEGEND

- EXISTING WALLS TO BE RETAINED
- PROPOSED NEW WALLS
- EXISTING WALLS TO BE DEMOLISHED

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CLIENT
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TITLE
PROPOSED SECTIONS

ADDRESS
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0m 1m 2m 5m

DRAWING
DA07

ISSUE 3

DATE 23/11/2021

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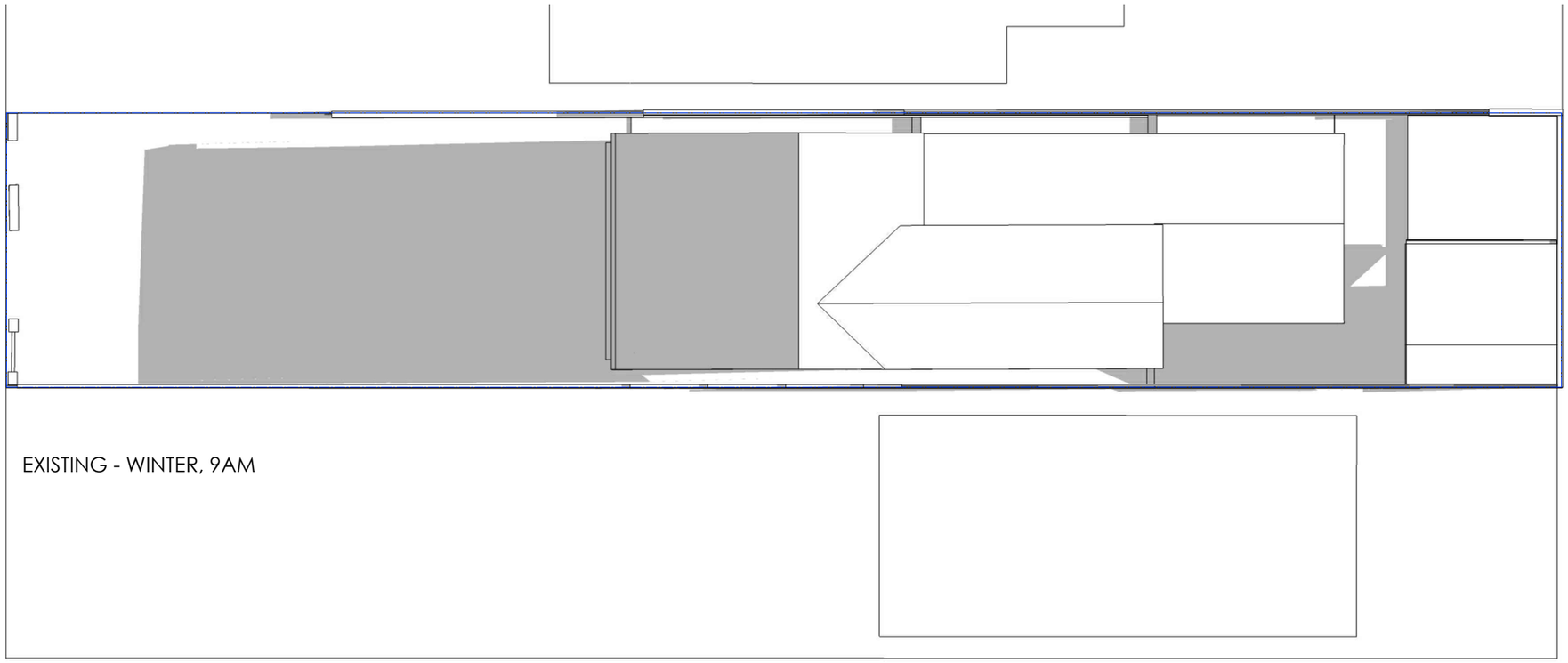
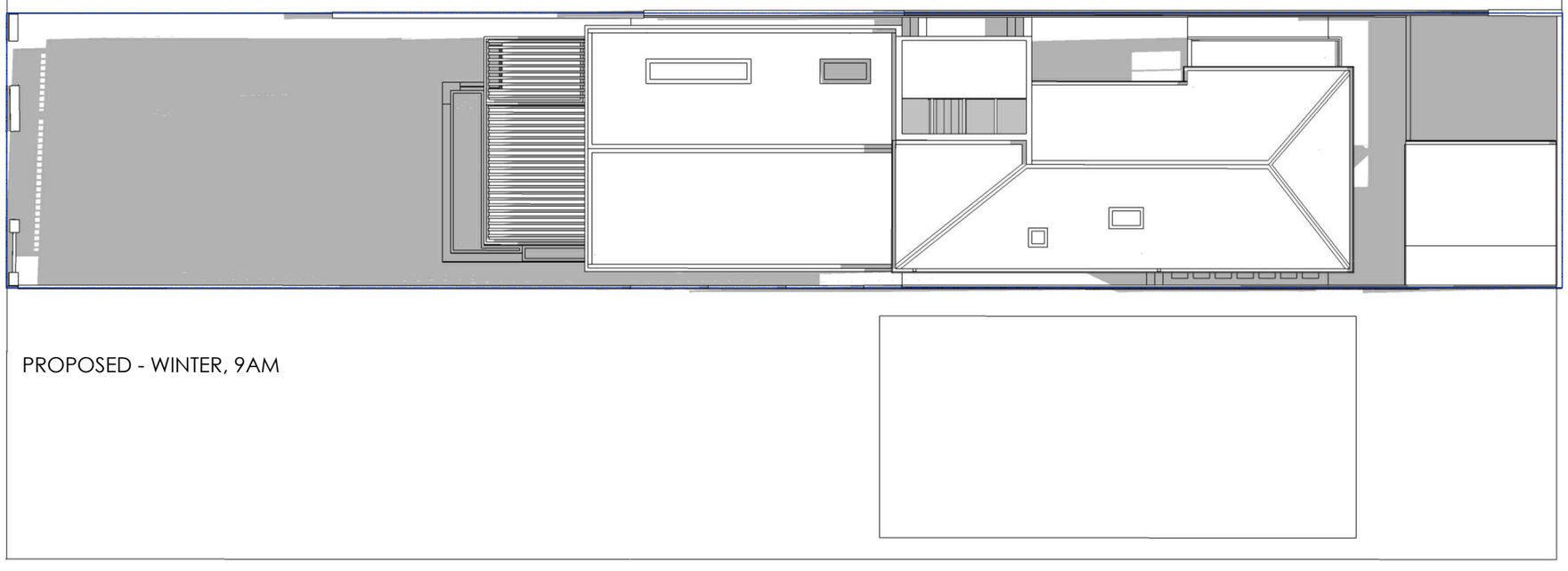


EXISTING - WINTER, 9AM



PROPOSED - WINTER, 9AM

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CLIENT
NICOLE & ADRIAN STEWART

TITLE
SHADOW DIAGRAM - WINTER, NOON

ADDRESS
44 KOOLOORA AVENUE, FRESHWATER NSW

GENERAL NOTES
All works to be in accordance with Australian Standards, The Building Code of Australia, other relevant codes and with manufacturers' instructions.

Do not scale off drawing. Verifiy all dimensions on site prior to construction.
To be read in conjunction with all other consultants' drawings.
The designer to be immediately notified of any discrepancies.

0m 1m 2m 5m

DRAWING
DA11

ISSUE 3

DATE 23/11/2021

SCALE 1:200 @ A3
1:100 @ A1

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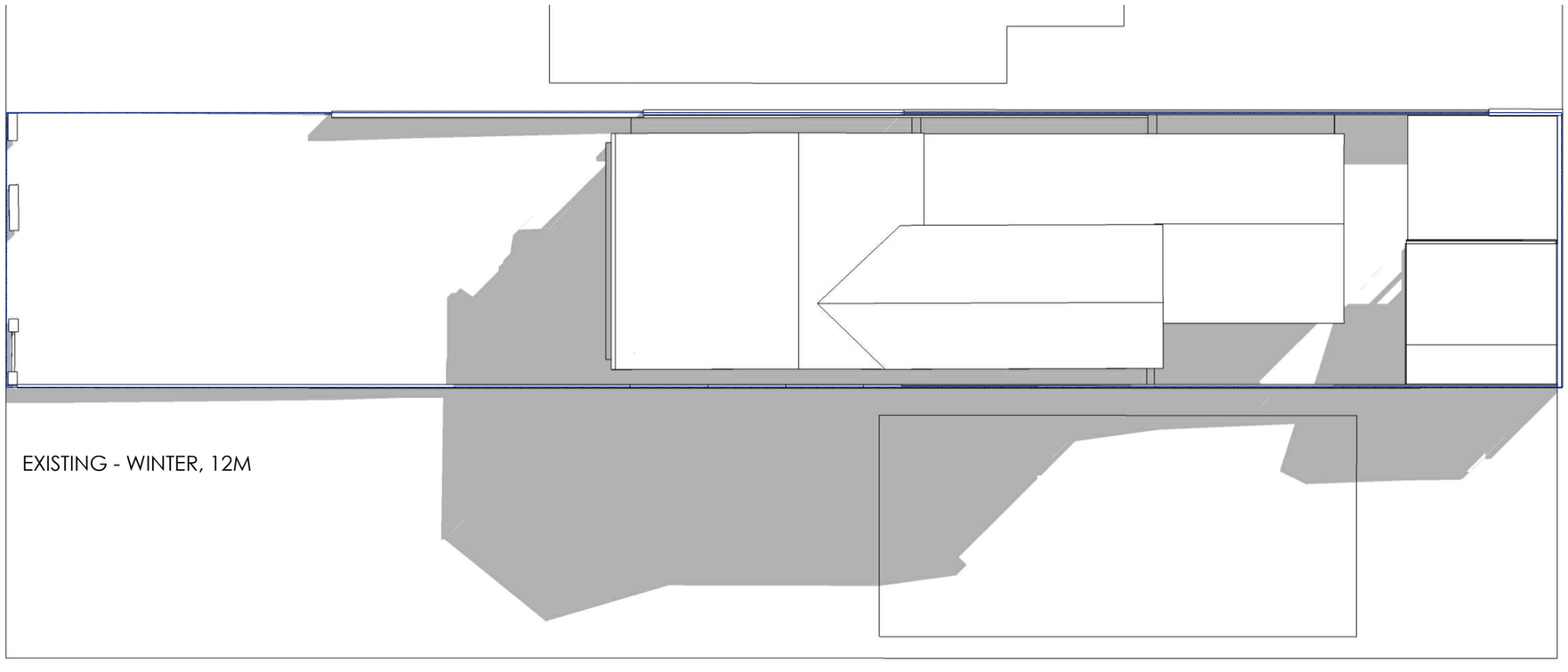

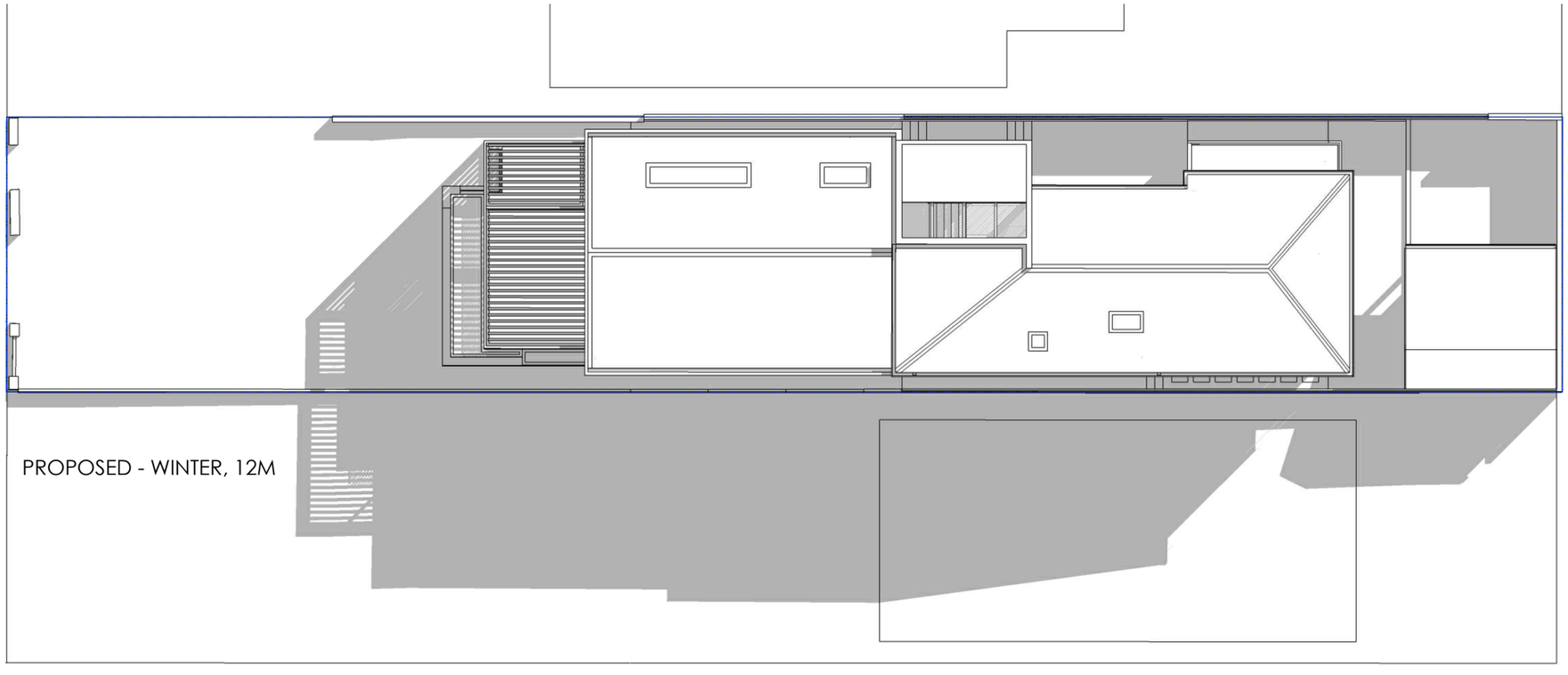

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ISSUE 3

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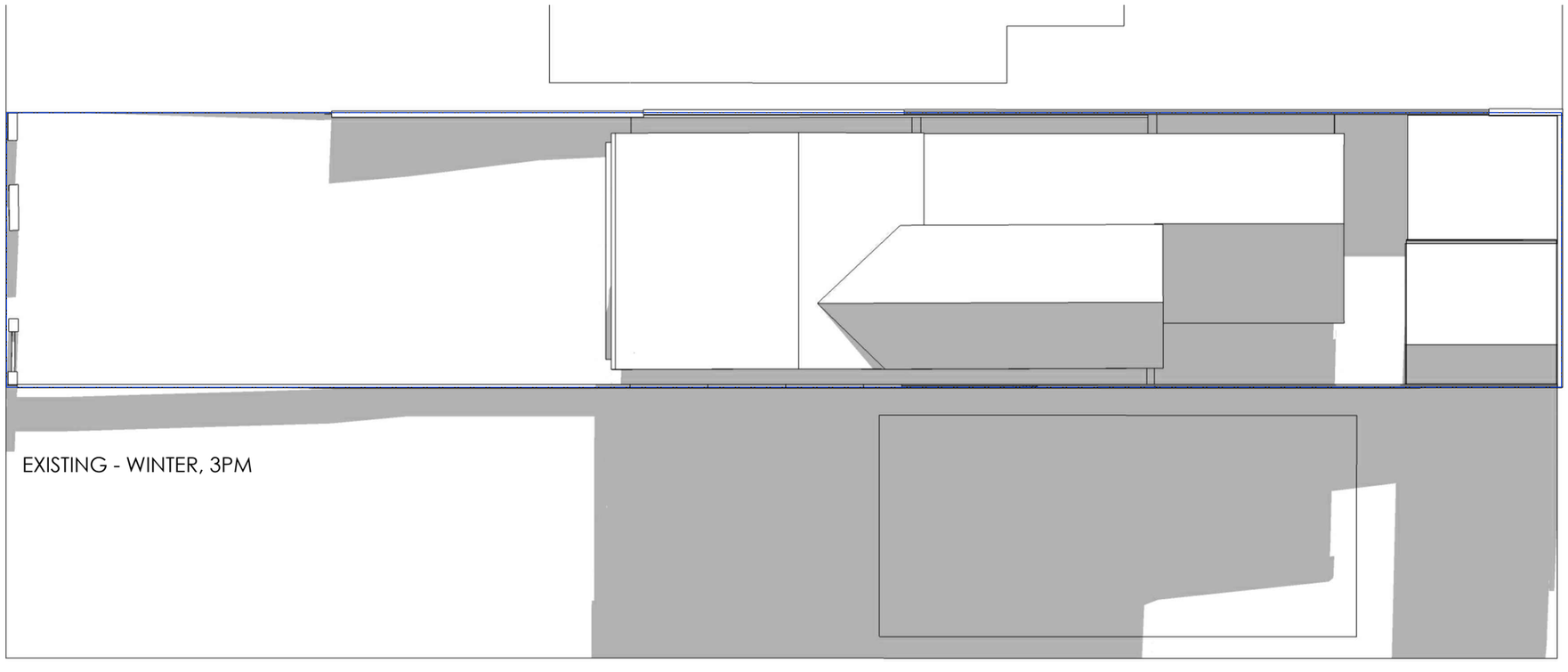
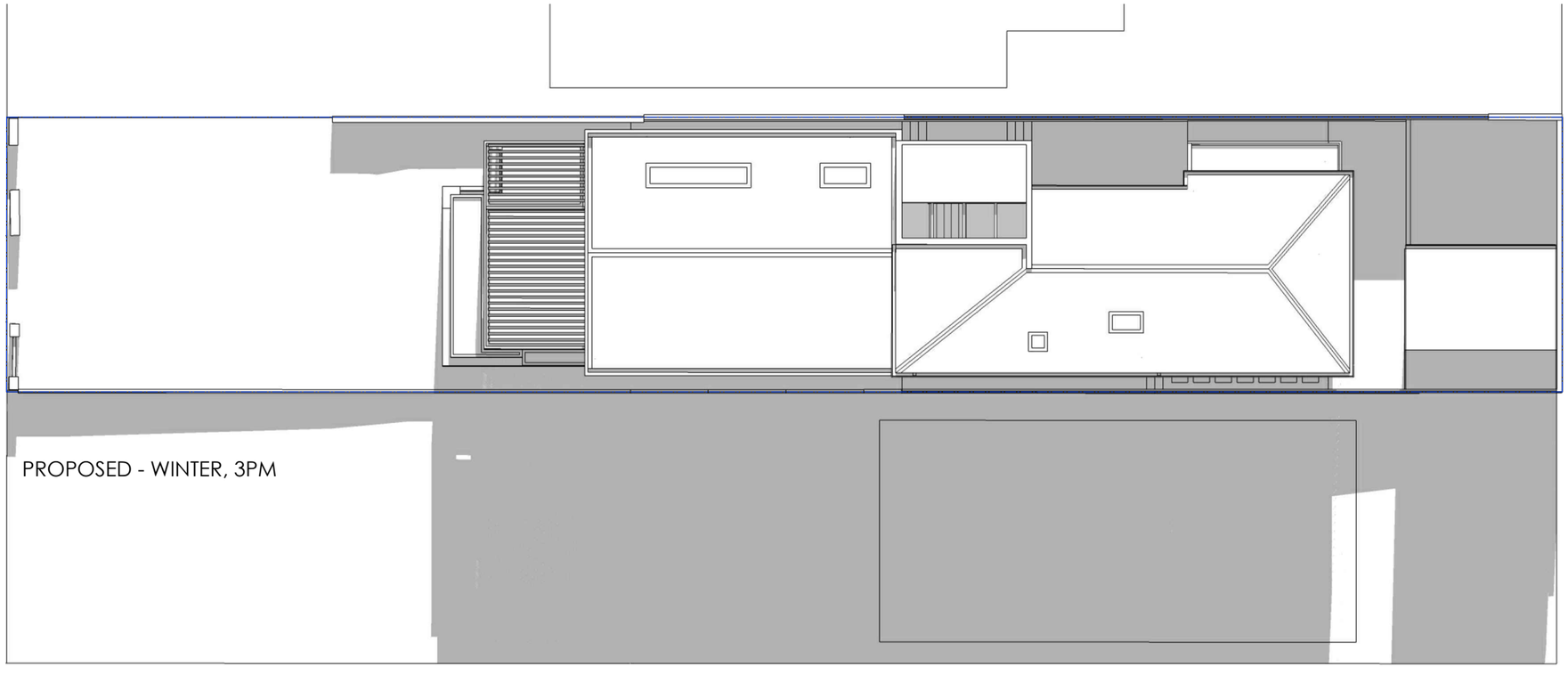


EXISTING - WINTER, 3PM



PROPOSED - WINTER, 3PM

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ISSUE 3

DATE 23/11/2021

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APPENDIX E

Pipeline Velocity Self-Cleaning Information

Pg 1: Brisbane City Council, “Stormwater Outlets in Parks and Waterways [Guidelines]”, Version 2, 2003, Chapter 3, pg 5

Pg 2: Concrete Pipe Association of Australasia , “Hydraulics of Precast Concrete Conduits”, Reprinted 2012, Pg 42

PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS

- Consequences of adverse flooding impacts are investigated for full grate blockage.

A4.6 Detention Storage

Where the public space is also used for stormwater detention storage, the design intents and safety aspects satisfy the requirements of Council's Subdivision and Development Guidelines.

A4.7 Pipe Velocity

The velocity of stormwater flows in pipes or box sections is adequate to maintain self-cleaning, and the velocity prevents scouring and erosion of the conduit especially the invert.

- The desirable minimum design velocities are limited to 1.2 m/s for partial flow and 1.0 m/s for full flow conditions.
- The desirable maximum design velocities are limited to 4.7 m/s for partial flow and 4.0 m/s for full flow conditions (energy dissipation may be required).

A4.8 Outlet Velocity

The average outlet velocity (V_o) for the nominated design discharge (Q_o) is determined. Typically Q_o also corresponds to the design storm event for the pipe. However, for reasons of cost or practicality, it may be necessary to design scour protection for a lower discharge event. The permissible maximum flow velocities (m/s) for the different types of exposed soil immediately downstream of the outlet are given below. These figures assume slope gradient <10%, peak velocities maintained for period less than 6 hours, and good (ie 80%) ground cover. Soil erodibility factor, $K \leq 0.019$ corresponds to low erodibility. $0.020 \leq K \leq 0.045$ and $K>0.045$ correspond to moderate and high erodibilities respectively.

	Permissible maximum flow velocity (m/s)		
	Soil erodibility (K) - Low	Moderate	High
Bare soil	0.7	0.5	0.3
Tussock grasses	1.3	0.9	0.5
Other improved perennials	1.6	1.3	0.9
Couch, carpet & other sward-forming grass	2.0	1.8	1.4
Kikuyu grass	2.5	2.2	1.9

Visual intrusion of this stormwater outlet is minimised

4. STORMWATER DRAINAGE

4.1 INTRODUCTION

4.1.1 HEAD LOSSES

The design flow is established as outlined in Section 2, and it is customary in the hydraulic design to assume the pipes flowing full.

The design must take into consideration:

(i) resistance to flow in conduits

(ii) losses at inlets and junction pits, bends and other deviations from straight lines of uniform cross section and flow.

Investigations have shown that the latter source of losses can be of greater significance than the energy losses on uniform straight runs, particularly on short lengths of pipeline [4.1, 4.2].

4.1.2 MINIMUM AND MAXIMUM VELOCITIES

Much of the debris entering stormwater drains is heavier than water, and to ensure some measure of self cleansing a minimum velocity of about 0.5 to 1 m/s at full and half full flow or a boundary shear of 1.5 N/m^2 is recommended [4.1, 4.3]. (Refer also to Section 1.4 and 3.4.4.)

Maximum velocities are discussed in Section 3.4.3. Generally velocities should be kept below 8 m/s if possible.

4.1.3 TOPOGRAPHY

Topographic conditions are significant for the design. In very flat country of minimal fall, layout and details minimising head losses are important in order to avoid excessively deep drains.

In hilly country with steep grades design must consider the possibility of erosion.

4.2 RESISTANCE TO FLOW IN CONDUITS

4.2.1 STRAIGHT DRAINS

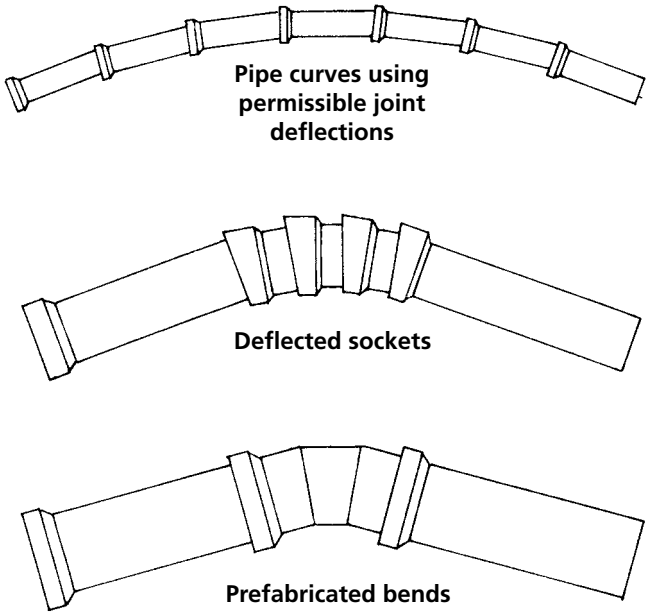
For straight, precast concrete pipes or box culverts flowing full with clean water a k value of 0.15 would be appropriate when using the Colebrook-White equation. Having regard to the effect of the debris a value of 0.6 seems reasonable (Figure 1.10) but it must be realised that no tests under these conditions are known to exist.

Figures 1.8 – 1.11 can be used for box culverts (full or part-full flowing) by substituting 4R for diameter D, where R is the hydraulic radius for the cross section.

4.2.2 CURVED DRAINS

4.2.2.1 PIPES

It is common for drainage pipelines to be laid straight, but there are circumstances when curves or bends are desirable. Concrete pipes can be laid satisfactorily with deflections at the joints to construct curved pipelines with curve radii of 100–300 pipe diameters. Joint deflections range from 0.6 to 3.0˚ dependent on diameter. (See Figure 4.1.)



PIPE CURVES AND BENDS
Figure 4.1

Splayed pipes and bends can be produced to provide curve radii down to about 5 pipe diameters.

Energy losses in curves formed by joint deflections are only slightly higher than those in straight lines and can be treated as such or an extra allowance of

$$0.1\,\frac{v^2}{2g}$$

can be added for curve deflections over 20˚.

Lobster-back bends show losses with k_b –values ranging up to 1.3 for 90˚ single splay bends. This and other examples are shown in Table 1.2.

4.2.2.2 BOX CULVERTS

Most box culverts are made with simple butt joints without any claims to watertightness. The joint itself, consequently, offers little scope for joint deflection.