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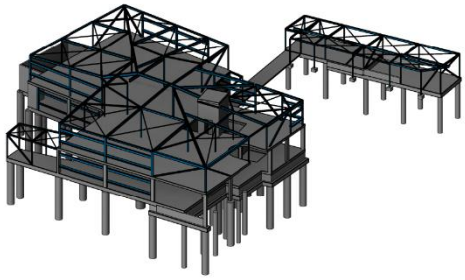

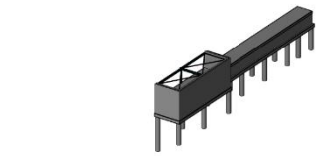

STRUCTURAL SSDA REPORT

SINSW Kingscliff High School

33 Oxford Street, Kingscliff NSW 2487

Ref: SY190972
Rev: 2
Date: 31/03/2021

PREPARED FOR
Schools Infrastructure NSW
MBB Group Pty Ltd
Level 14, 49-51 York Street
Sydney NSW 2000

Structural Design Brief

Revision Schedule

Date	Revision	Issue	Prepared By	Approved By
18.02.2021	1	For Tender	S. Chapple	L. Sykes
31.03.2021	2	Response to SEARS	S. Chapple	L. Sykes

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EXECUTIVE SUMMARY

The purpose of this report is to define the structural design parameters and highlight potential design risks within the project. This report will be used as a forum for feedback between design participants. Unless revised by subsequent advice, the structural design will proceed as outlined in this report.

The existing Kingscliff High school is located at the end of the cul de sac on Oxford Street Kingscliff. It is located approximate 350m from Cudgen Creek to the east and just over 1km from South Kingscliff Beach also to the east.

The scope of works referenced within this report includes:

- New CAPA Building (BLD O)
- Extension to the existing Admin Building (A)
- Internal refurbishment and fitout works to existing Building C AND Building G
- New Covered Outdoor Learning Area (COLA)

The geotechnical advice we have received for the site outlines sub-surface conditions consisting of a relatively deep layer of fill over silty sand. The fill layers are unsuitable for supporting high level foundations, as such all new buildings have been designed to be supported for CFA piles (bored piers not suitable). The ground floor slabs have also been designed as suspended for this reason.

The CAPA building involves the construction of a first floor suspended RC slab with steel roof framing above. All other new buildings are single story with a steel framed roof extending directly off the ground floor slab. Some structural modifications to the existing steel structures are required for internal fitout purposes, as indicated in the structural documentation.

This structural design brief is to be read in conjunction with Northrop structural drawings and specification notes.

1. Introduction

1.1 General

This Schematic Design Report has been prepared by Northrop Consulting Engineers Pty Ltd (Northrop), the engineering consultants for Kingscliff High School, located at Oxford St, Kingscliff NSW 2487.

This report outlines the proposed site and engineering requirements for Kingscliff High School and identifies risk mitigation measures for the project.

1.2 Site Description

The existing Kingscliff High school is located at the end of the cul de sac on Oxford Street Kingscliff.

The site is located approximate 350m from Cudgen Creek to the east and just over 1km from South Kingscliff Beach also to the east.

The site is bounded by dense bushland to the east and south, surrounding the ovals at the southern end. To the west is a small creek which separates the high school precinct with TAFE NSW facilities.

The site slopes from Oxford street at the northern end, down to the oval at the southern end of the precinct.

The northern portion of the site contains most of the teaching buildings staggered down the natural ground slope. To the west of these buildings an existing on grade car park adjoins the link bridge through the creek leading to Block J (a building originally within TAFE NSW campus).

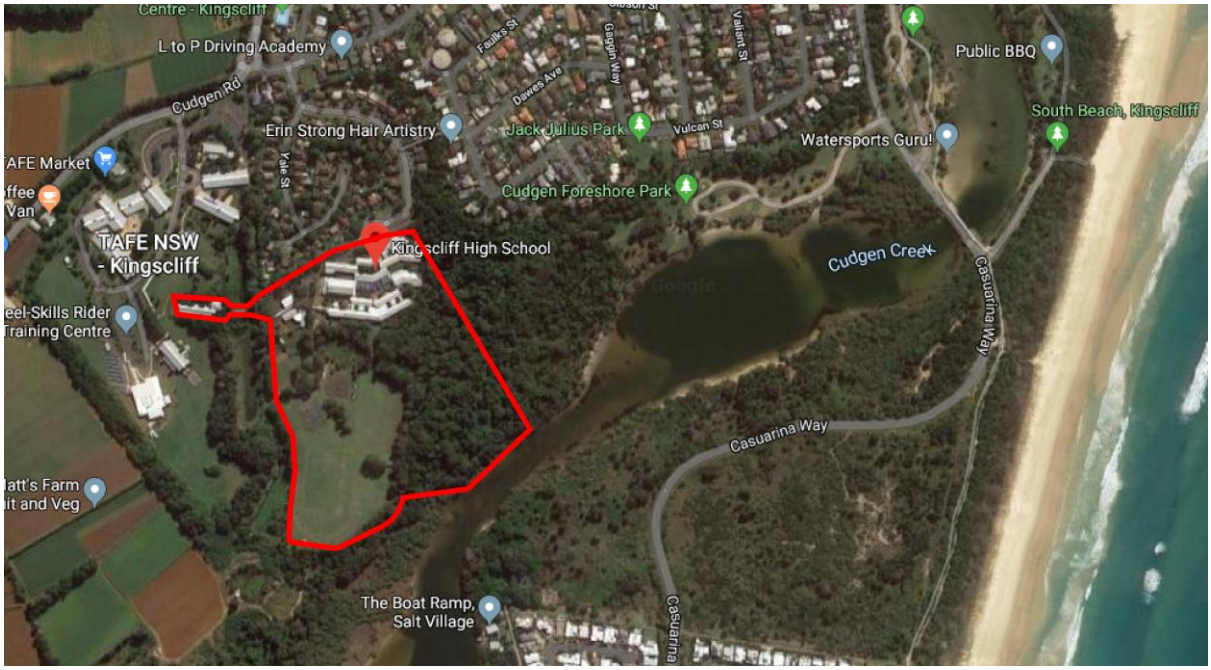

Figure 1: Site Aerial Image

1.3 Project Description

A schematic design has been developed by SJB Architects which outlines the scope of the works including the following:

- New CAPA Building (BLD O)
- Extension to the existing Admin Building (A)
- Internal refurbishment and fitout works to existing Building C AND Building G
- New Covered Outdoor Learning Area (COLA)

The proposed site plan is shown below.

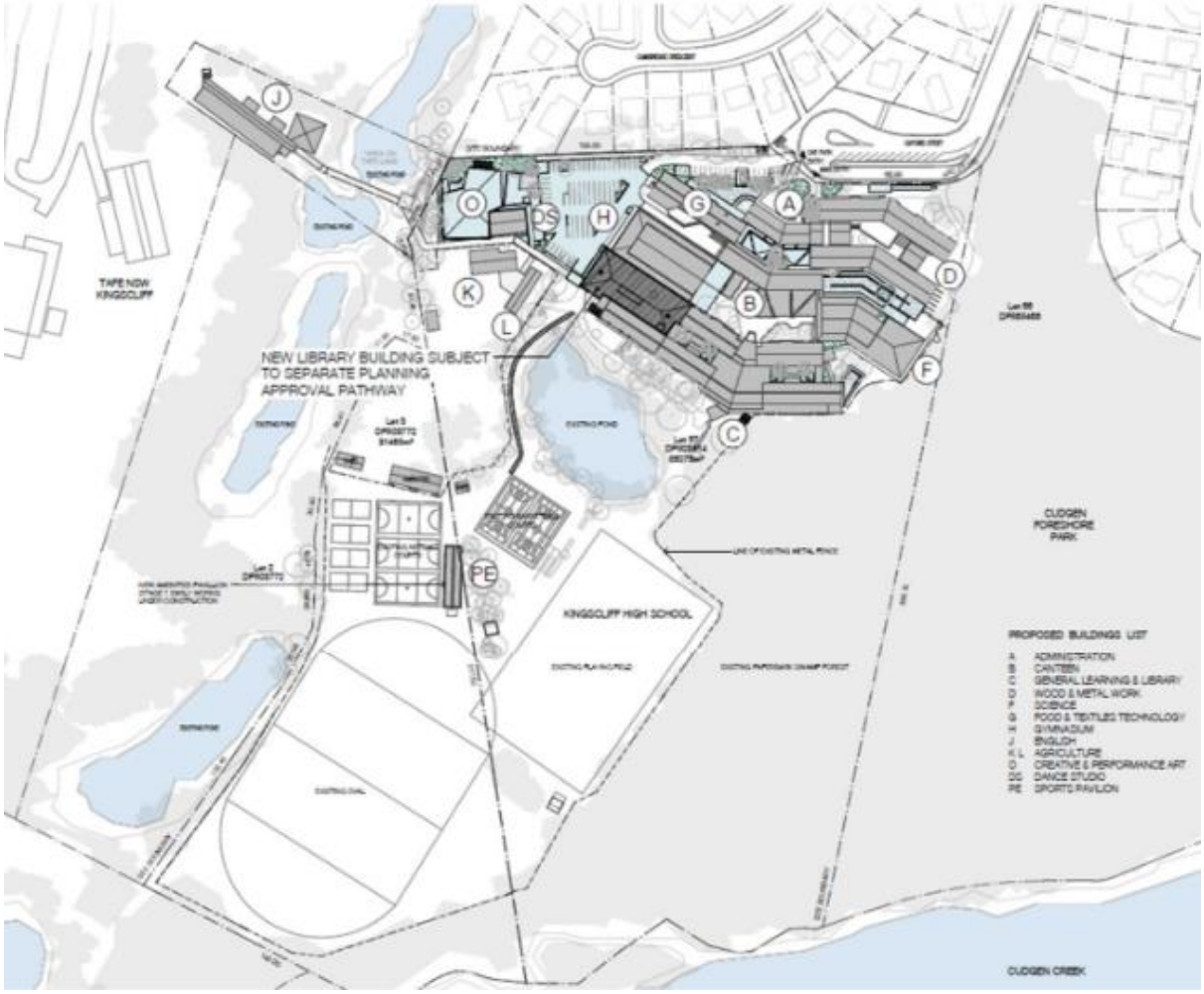

Figure 2: Site Plan by SJB Architects

1.4 Referenced Documents

Sheet Number	Sheet Name	Current Revision
SK-1-0001	DA COVER PAGE	2
SK-1-0100	LOCATION PLAN - EXISTING	1
SK-1-0101	LOCATION PLAN - PROPOSED	2
SK-1-0105	SITE ANALYSIS	1
SK-1-0106	PLANNING APPROVALS DIAGRAM	2
SK-1-0111	SITE PLAN - EXISTING AND DEMOLITION - GROUND	2
SK-1-0112	SITE PLAN - EXISTING AND DEMOLITION - LEVEL 1	1
SK-1-0113	SITE PLAN - EXISTING AND DEMOLITION - ROOF	1
SK-1-0114	SITE PLAN - PROPOSED - GROUND	3
SK-1-0115	SITE PLAN - PROPOSED - LEVEL 1	2
SK-1-0116	SITE PLAN - PROPOSED - ROOF	2
SK-1-0151	STAGING DIAGRAMS - SHEET 1	2
SK-1-0152	STAGING DIAGRAMS - SHEET 2	1
SK-1-0201	BUILDING A - GROUND, ROOF PLANS & ELEVATIONS	1
SK-1-0202	BUILDING O - FLOOR PLANS	1
SK-1-0203	BUILDING O - ELEVATIONS & SECTIONS	1
SK-1-0204	BUILDING C - CLASSROOMS GROUND FLOOR PLAN	2
SK-1-0205	BUILDING C - CLASSROOMS LEVEL 1 FLOOR PLAN	2
SK-1-0206	BUILDING C - CLASSROOMS ROOF PLAN	2
SK-1-0207	BUILDING C - CLASSROOMS ELEVATIONS	1
SK-1-0208	BUILDING C - CLASSROOMS SECTIONS	1
SK-1-0211	BUILDING G - GROUND, ROOF PLAN & ELEVATIONS	1
SK-1-0231	COLA - GROUND, ROOF PLANS & ELEVATION	1
SK-1-3201	GFA CALCULATIONS	1
SK-1-3202	GFA PLAN - EXISTING GROUND	1
SK-1-3203	GFA PLAN - EXISTING LEVEL 1	1
SK-1-3204	GFA PLAN - PROPOSED GROUND	2
SK-1-3205	GFA PLAN - PROPOSED LEVEL 1	2
SK-1-5001	MATERIALS	2
SK-1-6001	VIEW ANALYSIS	2
SK-1-6002	VIEW ANALYSIS	1

Table 1: Referenced Documents

1.5 Referenced Standards and Guidelines

All engineering shall be in accordance to the following standards:

1.5.1 General:

NCC 2019	National Construction Code of Australia 2019
EFSG	NSW Department of Education Educational Facilities Standards and Guidelines - https://efsg.det.nsw.edu.au/welcome

1.5.2 Structural Engineering

NCC	National Construction Code of Australia
AS1170 Parts 0, 1, 2, 4-2002	Structural Design Actions
AS2159-2009	Piling – Design and Installation
AS3600-2018	Concrete Structures
AS4100-1998	Steel Structures
AS3700-2018	Masonry Structures

2. Site Conditions

2.1 Geotechnical

A geotechnical investigation and subsequent report for this project was completed by Douglas Partners, refer to report no. 98084.00.R.002[0] dated April 2020.

The investigation comprised of drilling three bore holes (6-8) in the locations nominated in the figure below in order to provide advise on the following:

- Subsurface conditions
- Site classification in accordance with AS2870 (2011)
- Indicative presence or otherwise of acid sulphate soils (ASS)
- Suitability of high and deep level foundations, allowable bearing pressure, skin friction and estimated settlements

Notes:

1. Test locations are approximate only and are shown with reference to existing site features.
2. Drawing Not To Scale.
3. Drawing adapted from Neamap imagery dated 6 November 2019.

Figure 3 - Borehole Locations

The findings from the report can be summarized as follows:

- The site is located within Quaternary aged alluvium deposits comprising gravel, sand, silt, clay
- The subsurface conditions encountered in the bore holes can be summarized as indicated in the figure below:

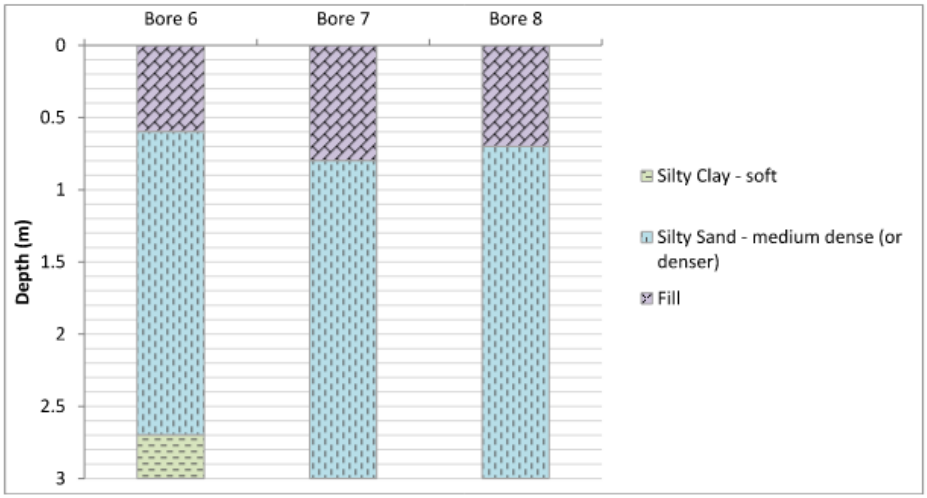

Figure 3: Graphical summary of subsurface conditions.

Figure 4 - Bore Hole Results Summary

- Groundwater was encountered within all bores during drilling at depths between 0.8m and 1.8m.
- Due to the presence of 'uncontrolled' fill up to 0.8m depth, the site in its present state would be classified as 'Class P'
- If existing fill is removed the ground movements are expected to be in the order of up to 20mm, consistent with a 'Class S' site.
- The above site classifications have been provided as a guide only and further review is needed following bulk earthworks.
- High level footings need to be founded below the fill layers (encountered up to 0.8m)
- Allowable bearing pressures for high level footings are summarized in the table below:

Table 5: High Level Footing Design Bearing Pressures (Allowable)

Material Description	Allowable Bearing Pressure (kPa)
'Uncontrolled' Fill	Not recommended
'Controlled' Fill(i)	100
Sand – medium dense (or denser) (ii)	125 (strip footing) 250 (pad footing)

Note (i) Assuming controlled fill is placed under 'Level 1' requirements under inspection and testing by DP in accordance with the recommendations of this report.

(ii) Founded at a minimum 1 m depth.

Table 2 - Allowable Bearing Capacities

- For deeper foundations CFA or screw piles can be adopted. Bored piers are not recommended.
- Deeper bore holes and further geotechnical advice is required if a piled option is required.
- An allowable end bearing of 200kPa in dense sands can be adopted for CFA piles. Higher bearing capacities will require further investigations and deeper bore holes.
- The likelihood of ASS to occur is considered to be generally low or nil

3. Design Criteria

3.1 National Construction Code

Northrop's engineering designs for this project will be prepared in accordance with the 2019 National Construction Code (NCC), in particular, NCC 2019 Volume One (The Building Code of Australia, Class 2 to Class 9 Buildings). With respect to the NCC, we understand the building classifications for this project are:

Building Area	NCC Classification
School	9b

Table 3: Building Classification

3.2 Design Codes and standards

Structural engineering services will be generally designed and developed in accordance with (but are not limited to) the following standards:

Standard	Description
NCC	National Construction Code of Australia
AS1170 Parts 0, 1, 2, 4	Structural Design Actions
AS2159	Piling – Design and Installation
AS3600	Concrete Structures
AS4100	Steel Structures
AS3700	Masonry Structures

Table 4: Design Standards considered in Structural Engineering Services

3.3 Loadings

3.3.1 Dead Loads

Material	Loading
Reinforced concrete generally	24kN/m³
Water (in Storage Tanks)	9.8kN/m³
Masonry (concrete block)	22kN/m³
Masonry (brick)	19kN/m³
Soil (in planters)	20kN/m³
Glazed panels (windows, doors)	30kN/m³
Structural Steel	77kN/m³
Timber	10kN/m³. minimum
Tiling and grout	To be determined but not less than 0.75kPa

Ceilings and miscellaneous dead load	0.25kPa minimum
Services Ducts, Lighting etc.	0.25kPa minimum
Lightweight Partitions	1.0kPa

Table 5: Dead Load Parameters

3.3.2 Imposed Loads

Use	Live Load	Superimposed Dead
Learning areas – General	3.0kPa	1.5kPa
Corridors, hallways, lobbies	5.0kPa	1.5kPa
Office	3.0kPa	1.5kPa
Library	4.0kPa	1.5kPa
Laboratories and workshops	3.0kPa	1.5kPa
Sports and Performance Hall, Communal Hall	5.0kPa	1.0kPa
Stage	7.5kPa	1.0kPa
Plant	5.0kPa	1.5kPa
Roof (non-trafficable)	0.25kPa	0.5kPa

Table 6: Imposed Load Parameters

Pattern live load is to be considered for both strength and deflection in accordance with the relevant Australian Standards.

3.3.3 Wind Loads

Criteria	Value
Location	Kingscliff NSW
Region	B
Importance Level	3
Design Event for Safety (ULS)	1:1000
Design Event for Serviceability	1:20
V_{1000}	60m/s
V_{20}	38m/s
M_s	1.0
M_t	1.0
Terrain Category	TC1.5
Design Wind Speed	63m/s

Table 7: Wind Load Parameters

3.3.4 Earthquake loads

Criteria	Value
Location	Kingscliff NSW
BCA Importance Level	3
Design Event for Safety (ULS)	1:1000
Probability Factor, K_p	1.3
Hazard Factor, Z	0.05
Subsoil	Sand/Uncontrolled Fill (TBC by Geotech)
Site Subsoil Class	Ee (TBC by Geotech)
Earthquake Design Category	EDC II

Table 8: Earthquake Load Parameters

3.3.5 Deflection Limits

Element	Acceptance Criteria	Limit
Overall Building	Lateral deflection due serviceability to wind loads	Height/500
	Inter storey drift due to serviceability wind loading	Height/500
	Inter storey drift due to seismic loading	Height/100 Under Ultimate Load
Floor Elements Generally	Total Deflection	Span/300* Cantilevers Span/150*
Floor elements with masonry or brittle partitions	Incremental Deflection	Span/500* Cantilevers Span/250*
Transfer Elements	Incremental Deflection	Span/750**

Table 9: Deflection Limit Parameters

* Limited to 25mm

**Limited to 15mm

3.4 Design Life

The building is to be designed and detailed for a minimum design life of 50 years.

3.5 Fire Design

As noted in the NCC, the type of construction for each of the buildings depends on the number of floors as outlined below:

Rise in storeys	Type of Construction
4 or more	A
3	A
2	B
1	C

Table 10: Type of Fire Design Construction based on Number of Floors

Typically the FRL for the concrete elements will be 120 mins.

Unless noted otherwise in our documentation the roofs do not require fire rating due to Type B construction.

Refer to the Northrop specification notes for further information.

4. Structural System

4.1 Building O - New CAPA Building

4.1.1 General

Refer to structural drawings for the structural scheme of this building. This scheme has been provided for tender purposes only.

4.1.2 Foundations

The bore hole logs provided by the geotechnical engineer indicate the area under the proposed Building O consists of 600mm worth of fill over sand (BH6). This fill is unsuitable for supporting high level foundations (pad footings). As such CFA foundation piles located under vertical load bearing elements will be required and founded within suitable bearing material below. We have assumed a bearing capacity of 700kPa could be achieved a low level based on the existing building structural documentation that we have received. The depth of the required piles will be dependent on further geotechnical information being provided. Screw piles may also be used in lieu of concrete piles subject to geotechnical information.

4.1.3 Slabs on Ground

The ground floor slab has been designed as a suspended slab formed on the fill as form, due to the presence of fill. The slab is reinforced (no post tensioning) and will be poured over 0.2mm polythene sheet. The concrete strength is to be 40MPa. Internal ground beams and external perimeter beams have been introduced to support walls over and to stiffen the slab from potential shrink swell of the natural ground. Further investigation post tender may enable a re-design whereby the fill layers are removed and replaced with engineered fill. This would enable a more conventional slab on ground to be established.

4.1.4 Vertical Elements

The vertical load bearing elements for these buildings will consist of concrete columns supporting the first floor. The concrete columns will be 250x450 in dimension with 40MPa concrete. 200 thick (40MPa) RC walls will also be used around lift cores, stairs and as shown on plan to support the first-floor slab.

Steel columns will be used to support the steel roof above and will be located internally to be protected from the weather. A combination of 89SHS, 150SHS and 20SHS columns have been used.

4.1.5 Suspended floors

A conventionally reinforced slab has been adopted for the first floor. A conventional slab has been utilized for this building rather than post-tensioning as it is the only suspended slab on the High School project. It is therefore not economical to design this slab as post-tensioned which requires a specialist contractor. The slab is 250/280 thick spanning between columns as indicated on plan and will be 40MPa throughout.

4.1.6 Roof

The roof framing is structural steel rafters spaced at no more than 8.0m centres supporting purlins and metal roof sheeting.

It is assumed all mechanical plant is located on the floor and not the roof. The roof is to be sized to support solar PV cells and maintenance access only.

The stiffness of the lift core and structural steel bracing will be utilized to provide the lateral resistance for the roof.

All steelwork shall be clad and HDG as noted in our specification notes.

4.1.7 Lateral Stability

Stability for lateral loading (wind and earthquake loads) is achieved by utilizing lift core and other RC walls below the first floor.

Stability for the steel roof will be achieved using roof bracing, wall bracing and the lift cores walls.

4.2 Administration Building Extensions

4.2.1 General

Refer to structural drawings for the structural scheme of this building. This scheme has been provided for tender purposes only.

4.2.2 Foundations

Whilst we have not received any bore hole locations in close proximity to this new extension, based on the trend of the other boreholes across the site, we would expect to find fill for the upper layer of soil below these buildings. This fill is unsuitable for supporting high level foundations (pad footings). As such a combination of 600/900DIA foundation piles located under vertical load bearing elements will be required and founded within suitable bearing material below. The depth of the required piles will be dependent on confirmation of the required bearing capacity by the geotechnical engineer.

Due to the close proximity of the existing retaining wall to the south of the building it is necessary for the building to be supported on piles which are founded below the depth of the existing wall footing. This will ensure the existing wall is not surcharged with additional loads.

4.2.3 Slabs on Ground

The ground floor slab has been designed to be supported off piles in order to relieve the pressure off the ground and not overload the existing retaining wall to the south. The slab will be 40MPa with internal and perimeter ground beams as shown on plan.

4.2.4 Vertical Elements

Steel columns will be used to support the steel roof above and where possible will be located internally to be protected from the weather. SHS columns located within the internal wall skin will be adopted.

All steelwork shall be clad and HDG as noted in our specification notes.

4.2.5 Roof

The roof framing is structural steel rafters spaced at no more than 8.0m centres supporting purlins and metal roof sheeting.

It is assumed all mechanical plant is located on the floor and not the roof.

Structural steel bracing will be utilized to provide the lateral resistance for the roof.

In one location the new roof is located below the existing roof structure of the neighboring building. In this location the existing roof framing will need to be modified as noted and re-treated as required.

All steelwork shall be clad and HDG as noted in our specification notes.

4.3 Internal Refurbishment Works (General)

4.3.1 Wall Demolition

As part of the fitout works existing internal walls are to be demolished to enlarge the existing classroom spaces. This will occur Building G and Building C. Based on our site observations these internal walls are non-load bearing, with the steel roof over being supported off independent steel columns. For this reason demolition of these walls is most likely possibly without the need for major structural intervention. Prior to demolition all walls are to be inspected with ceiling removed to confirm this is the case.

In some instances, there are internal intermediate steel columns located within the walls supporting the steel frame. We suggest maintaining these steel column locations where possible. If not possible the steel rafter will need to be upgraded as noted in our documentation. To complete this work the existing roof sheeting, purlins and any roof bracing will need to be temporarily removed and reinstated once the new rafter is in place.

4.3.2 Existing Slab Capacity

In locations where the existing buildings are being re-purposed the existing and proposed live loading remains the same. As such we see no reason as to why the existing suspended slabs would not be suitable for the proposed use.

5. Bushfire Requirements

A Bushfire Risk Assessment has been completed by Blackash Bushfire Consulting in order to assessment the existing and future conditions on the site. As part of the assessment Bushfire attack levels were determined and recommendations for bushfire management outlined which included:

- The siting/position of the new CAPA building in the northwest corner, maximizing the distance from bushfire prone vegetation such that is achieves greater than 100m from bushfire prone vegetation, and in zone mapped as BAL Low
- Upgrade the existing MPU building to a higher level of protection, to protect against ember entering the MPU during emergency assembly, enhancing the building for the purpose of assembly and evacuation
- Construct any new external buildings elements to the relevant standard of bushfire attack level or BAL (AS3959:2018)
- Retrofit the interface buildings (buildings located adjacent to the bushfire prone vegetation) to offer basic ember protection (screen openable windows, protect eaves and gaps)
- Enhance emergency and evacuation planning for a range of scenarios and trigger points, with the new CAPA building and retrofitted MPU building as acceptable assembly buildings in the event of bushfire evacuation.

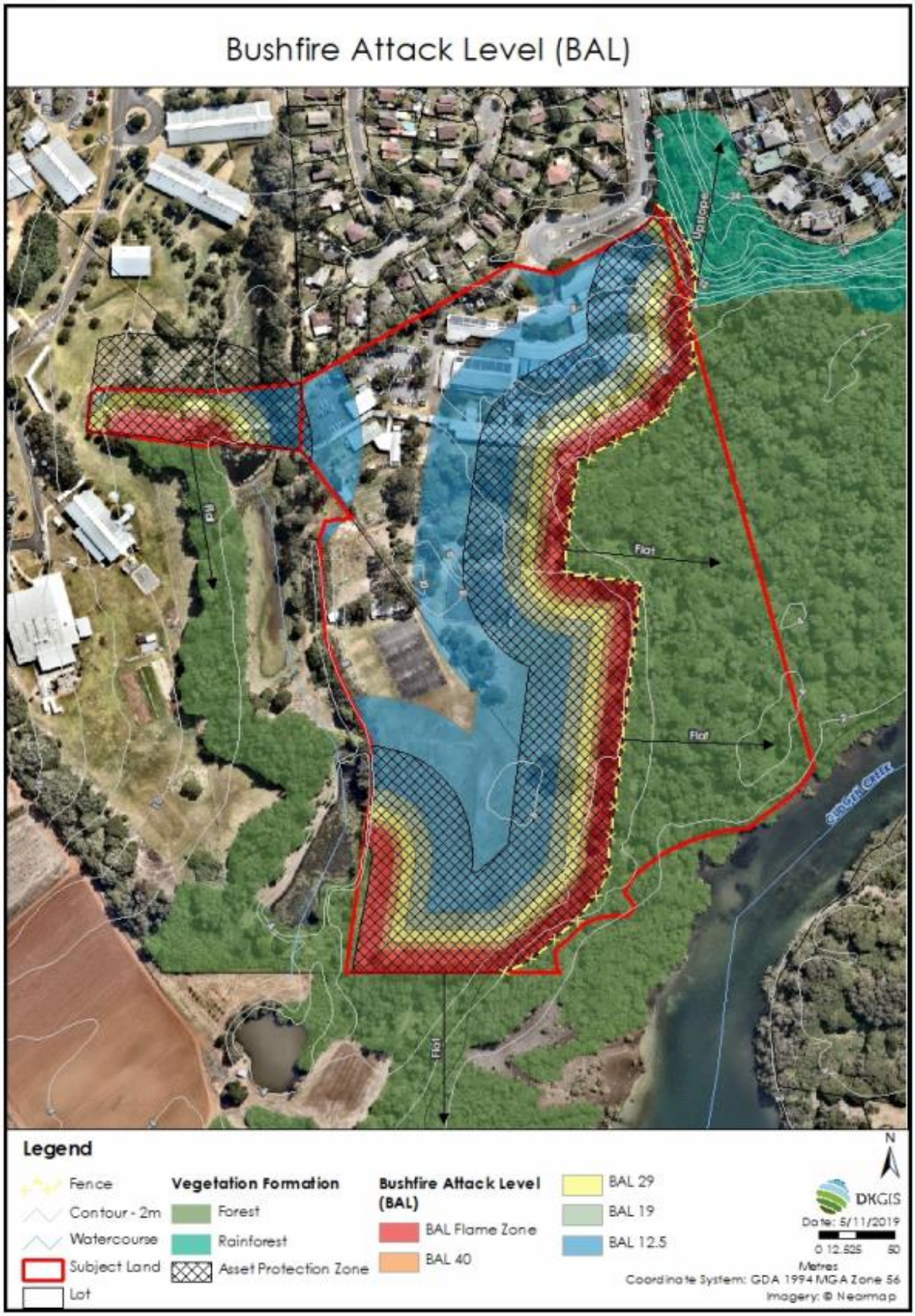

Figure 5 - BAL Levels