

**Proposed Commercial Building Development  
Bushfire Assessment & Compliance Report  
Lot 22 DP 843294  
Taronga Conservation Society Australia  
Bradleys Head Road  
Mosman NSW 2088**



9 November 2015



|                     |                                                                                              |                                                                                                                                                                         |
|---------------------|----------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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**Appendix 1 Maps and Site Plans**

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## General Introduction

The following report outlines an assessment for the statutory compliance of the proposed building development to occur within Taronga Conservation Society Australia (also known as Taronga Zoo), Bradleys Head Road, Mosman NSW 2088 - Lot 22 DP 843294 (herewith 'the subject property'), and at least 140m beyond (herewith 'the study area'). Appendix 1 / Map 1 denote the subject property and study area.

The Building Code of Australia, 2014 (BCA) does not provide for any **bushfire specific** performance requirements for types of developments other than 'Residential and Special Fire Protection Purposes (SFPP)' within bushfire prone areas. This development does not fit neatly into these categories. As such the *Australian Standard 3959:2009 (Construction of buildings in bushfire prone areas)* **does not** apply as a set of 'deemed to satisfy' provisions. The general fire safety construction provisions are taken as acceptable solutions, but the aims and objectives of *Planning for Bushfire Protection. A guide for councils, planners, fire authorities and developers (2006)* – NSW Rural Fire Service (PBP 2006), apply to other matters such as access, water and services, emergency planning and landscaping / vegetation management.

However, the proposed development, as described below, contains certain building uses / elements which would be considered as 'similar' to some SFPP developments (e.g. education centres for school children and overnight accommodation) and would also generally be considered as having elements where large numbers of the public may assemble at times (e.g. modified existing lecture theatre and new function spaces). This includes new overnight accommodation - for up to 42 places for students and teachers / staff. It should be noted that the Zoo already offers some overnight accommodation (e.g. current 'Roar and Snore' program).

Section 4.2.6 (in part) states '*These types of developments (i.e. Class 9 buildings) should be considered on their merits under s79BA and 79C of the EP&A Act, with consideration of the specific objectives listed in s4.2.3. Overall, those Class 9 buildings not being a SFPP should be considered as if they were a SFPP. These buildings will not have specific bushfire provisions applying under the BCA, but their location should be carefully considered. In such cases the aims and objectives of PBP should be used to assess the merits of the proposal*'.

The 'specific objectives' within s4.2.3 are achieved by compliance with the 'Performance Tables' within s4.2.7. The provision of road access, water supply and other services should also comply with the 'specific objectives' of s4.1.2.

This development will be constructed within the existing Zoo facility. It will replace a large number of existing buildings (generally a series of older smaller buildings including demountable buildings etc.), and generally incorporate them into a new facility. As such, the existing density, use and amenity of the area is generally retained within a new purpose built structure (over 3 levels), integrated into the surrounding exhibits and infrastructure (including an existing theatre).

This would be considered as 'infill development', and does not constitute an unacceptable development type (Bushfire Protection Measures, Chapter 3 PBP 2006) within a bushfire prone area.

As infill development, the proposed development will be able to fully comply with the Acceptable Solutions provided within PBP 2006, and, as a considered opinion, can also meet the Specific Objectives for 'Infill development'.

Methodology for this site assessment for bushfire attack is based on PBP 2006. Terrain (slope) considered by this assessment is based on the Department of Lands Online Six Viewer contours, site plans and a site inspection (4/9/2015) of the subject property.

Vegetation extent within the subject area has been derived from available aerial photo interpretation (API) and a site inspection (4/9/2015) conducted prior to finalising this report.

The extent and location of the proposed building development is based on drawings prepared by NBRIS & Partners, Milsons Point, (Taronga Institute of Science & Learning, Drawing Reference 14490 DD 00 – 02 / 100 – 104 / 401 / 404, Issue 2, Dated 22/9/2015).

Photographic evidence (dated 4/9/2015) of the subject property and surrounds is appended to this report (Appendix 2 – Site Photos).

## **1.0 Property Details**

**Applicants Name:** Taronga Conservation Authority Australia  
(Herewith, 'the proponent')

**Council:** Mosman Council (Mosman LGA)

**Lot:** 22      **DP:** 843294

**Address/Location:** Taronga Conservation Authority Australia  
Bradleys Head Road  
Mosman NSW 2088.

**Bushfire Prone Land: YES**

**Aspect:** The site generally has a South Westerly aspect.

The subject property is mapped as being bushfire prone as currently shown by the Mosman Council Bushfire Prone Land Map (*s146 EP&A Act 1979*). The site is constrained by 'Category 1 & Category 2 Bushfire Vegetation', and the site also contains areas located within the '30m & 100m Vegetation Buffer Zones'.

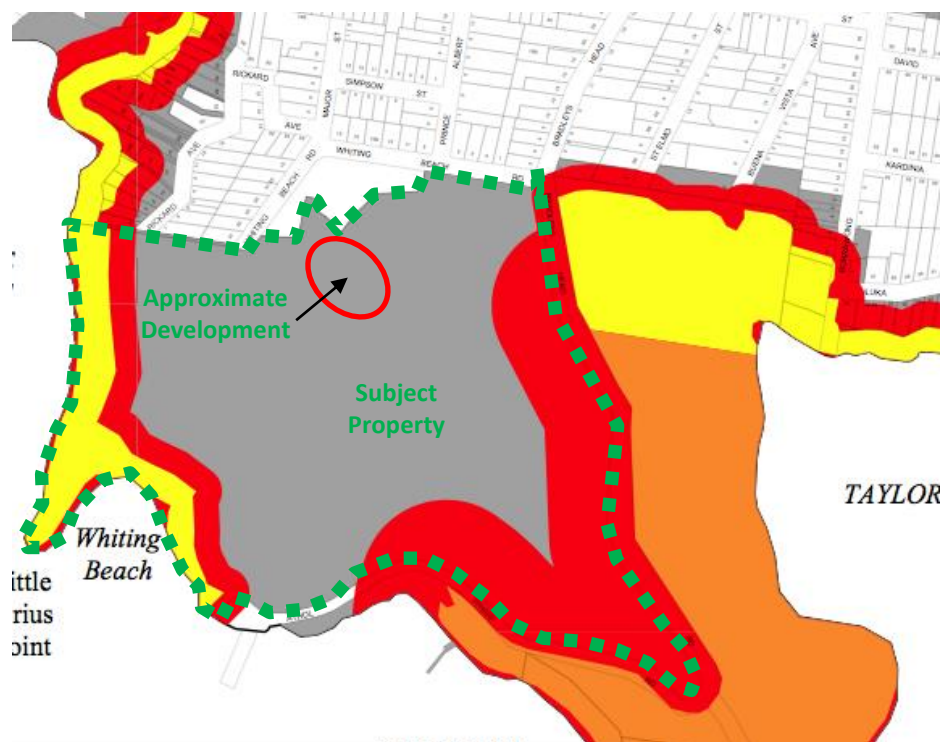
In this regard, any new building development should conform to the specifications and requirements of the document '*Planning for Bushfire Protection (2006)*', produced by the NSW Rural Fire Service, that are relevant to the development; as otherwise required under section 79BA of the *Environmental Planning & Assessment Act (NSW)*.

However, no part of the proposed building envelope is constrained by either 'Category 1 or Category 2 Bushfire Vegetation', nor is located within any of the '30m & 100m Vegetation Buffer Zones'.

#### Other Known Constraints:

A desktop assessment of the publicly available council mapping and planning enquiry system has found no other constraints to be considered in regard to development upon the subject property.

No other known significant environmental features have been noted, recorded or advised of as part of this assessment.



Extract Mosman Council Bushfire Prone Land Map

## 2.0 Type of Proposal

- |                                                      |                                                             |                                         |
|------------------------------------------------------|-------------------------------------------------------------|-----------------------------------------|
| <input checked="" type="checkbox"/> New Construction | <input checked="" type="checkbox"/> Alterations / Additions | <input type="checkbox"/> Dual Occupancy |
| <input type="checkbox"/> Rural Residential           | <input checked="" type="checkbox"/> Commercial              | <input type="checkbox"/> Isolated Rural |

## Proposal Description

The proposed building development is to construct a new 'Taronga Institute of Science & Learning' – which is a new structure that will incorporate a series of existing buildings and learning areas into a modern new facility. As such, the existing density, use and amenity of the area is generally retained within a new purpose built structure (over 3 levels), integrated into the surrounding exhibits and infrastructure (including an existing theatre).

Included are as follows:

### Lower Ground Level

- Lecture Theatre (existing – modified to integrate only)
- Equipment and Freezer rooms
- Laboratories and Kitchen

### Ground Level

- Learning and Training Centres (Various Rooms)
- Outdoor Learning Areas
- Animal Holding Areas (temporary/short term / transit holding only)

### First Floor Level

- Offices / Open Workspaces / Meeting Rooms
- Outdoor Function Space
- Stores and General Infrastructure

The extent and location of the proposed building development is based on drawings prepared by NBR & Partners, Milsons Point, (Taronga Institute of Science & Learning, Drawing Reference 14490 DD 00 – 02 / 100 – 104 / 401 / 404, Issue 2, Dated 22/9/2015).

## 3.0 Bushfire Attack

### 3.1 Vegetation (bushfire hazard) within 100m of the proposed building

The bushfire vegetation within the study area is mapped as 'Bushfire Prone Vegetation Category 1 & Category 2' on Council Bushfire Prone Land Maps.

The primary bushfire vegetation constraining the subject site is located within the adjacent bushland known as 'Sydney Harbour National Park', remote from the proposed building envelope, and generally NE – SE of the subject allotment. The vegetation is mapped as 'Sydney Sandstone Gully Forest'.

An inspection of the vegetation community shows the dominant species within the study area are eucalypts on sandstone topography.

Based on a determination of vegetation formation using the Keith 2004 Identification Key, the bushfire vegetation having the potential to affect the subject development, based on a site visit, is most representative of 'Dry Sclerophyll Forest (Open Forest)'.

In terms of Addendum: Appendix 3 (PBP 2010) Section A.3.5 requires a conversion of vegetation types used in this assessment from Keith 2004 to Specht (AUSLIG 1990). Table A.3.5.1 converts 'Dry Sclerophyll Forest' to 'Forest'.

The subject development would potentially (currently) be prone to remote bushfire attack primarily from the NE – SE direction.

The secondary bushfire vegetation constraining the subject site is located within the subject site, remote from the proposed building envelope, to the NW – SW, along Little Sirius Cove. The vegetation is also mapped as 'Sydney Sandstone Gully Forest'.

Based on a determination of vegetation formation using the Keith 2004 Identification Key, the bushfire vegetation having the potential to affect the subject development, based on a site visit, is most representative of remnant 'Dry Sclerophyll Forest (Open Forest)'.

Vegetation within this limited area, within the site, is considered to be 'Remnant' vegetation (as per PBP 2006 sA2.3) due to the limited areas of vegetation and limited fire runs towards the subject development. The '**Remnant**' vegetation would be assessed as equivalent to 'Rainforest'.

In terms of Addendum: Appendix 3 (PBP 2010) Section A.3.5 requires a conversion of vegetation types used in this assessment from Keith 2004 to Specht (AUSLIG 1990). Table A.3.5.1 converts 'Rainforest' to 'Rainforest'

The approximate/estimated extent of this bushfire vegetation (hazard) is clearly denoted below.

PBP 2006 states, *'for the purposes of assessment, the following are not considered a hazard or as a predominant vegetation class/formation and can be included within an asset protection zone;*

- *non-vegetated areas including roads, footpaths, cycle ways, waterways, buildings, rocky outcrops and the like; and*
- *Reduced vegetation including maintained lawns, golf course fairways, playgrounds or sports fields, vineyards, orchards, cultivated ornamental gardens and commercial nurseries.*

The majority of the subject property (Taronga Zoo) is generally considered clear of persistent bushfire vegetation.

The proposed development is located within a large Zoo facility (Taronga Zoo), within well-established commercial areas. The zoo does contain large areas of cultivated and ornamental gardens (including many native species etc.). However, the site is well managed, and is not considered to contain any bushfire risks internally.

### 3.2 Distance/Separation between building line and bushfire hazard

Considering the category of development (assessed in the same manner as a SFPP), the minimum specified APZ / setback distances determined for bushfire safety compliance are derived on the basis of Table A2.6 (PBP 2006). The minimum available distances for an APZ in this instance are;

**Table A2.6 Appendix 2 PBP 2006**

| Direction | Vegetation     | Minimum APZ Distance       | Slope                         | k/Wm <sup>2</sup> |
|-----------|----------------|----------------------------|-------------------------------|-------------------|
| NE - SE   | Forest         | Min 100m<br>(Actual >170m) | >10 – 15 degrees<br>Downslope | 10                |
| NW - SW   | Remnant Forest | Min 65m<br>(Actual >250m)  | >15 – 18 degrees<br>Downslope | 10                |

Based on the analysis of slope and vegetation extent likely to persist adjacent to the subject buildings, the subject development is able to facilitate the required APZ distances between the adjacent bushfire hazard and new development.

The above APZ distance / area for the proposed subject building development is better denoted Appendix 1 – Map 2.

PBP 2006 acceptable solutions for APZ (SFPP) compliance states that;

- *an APZ is provided in accordance with the relevant tables / figures [within PBP 2006],*
- *exits are located away from the hazard side of the building,*
- *the APZ is wholly within the boundaries of the development site (exceptional circumstances\* otherwise permitting),*
- *mechanisms are in place to provide for the maintenance of the APZ over the life of the development,*
- *the APZ is not located on lands with a slope exceeding 18 degrees, &*
- *the APZ is managed and maintained in accordance with the requirements of 'Standards for Asset Protection Zones (RFS 2005).*

*\* As an acceptable exceptional circumstance, PBP states an APZ may be located on adjoining land;*

- where it can be demonstrated that there is a strong likelihood of the adjoining land being developed for future residential or other compatible purposes (e.g. staged development or Urban Development Program or Strategies with supporting development control plans), or
- where easements are also required on adjoining land for the purposes of providing access for utilities, right of way, as fire trails, and drainage. These are to be kept clear of free standing vegetation.

Considering the above, the subject development can facilitate APZ acceptable solutions in as far as providing APZ areas in accordance with PBP 2006. Table 1.0 below outlines APZ compliance or non-compliance where applicable.

| <b>Table 1.0 – Subject Building Development APZ Compliance</b>                                                          | <b>All Buildings</b>           |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| <i>an APZ is provided in accordance with the relevant tables / figures</i>                                              | Recommended and able to comply |
| <i>exists are located away from the hazard side of the building</i>                                                     | Recommended and able to comply |
| <i>the APZ is wholly within the boundaries of the development site (exceptional circumstances otherwise permitting)</i> | ✓                              |
| <i>mechanisms are in place to provide for the maintenance of the APZ over the life of the development</i>               | Recommended and able to comply |
| <i>the APZ is not located on lands with a slope exceeding 18 degrees</i>                                                | ✓                              |
| <i>the APZ is managed and maintained in accordance with the requirements of 'Standards for Asset Protection Zones'</i>  | Recommended and able to comply |

### 3.3 Effective slope that will influence bushfire behaviour

The effective slope within the bushfire vegetation, that would influence bushfire behaviour, has been assessed as predominately;

| <b>Direction</b> | <b>Effective Slope</b>      | <b>Vegetation</b> |
|------------------|-----------------------------|-------------------|
| NE – SE          | >10 – 15 Degrees Down Slope | Forest Vegetation |
| NW – SW          | >15 – 18 Degrees Down Slope | Remnant Forest    |

### 3.4 Fire Danger Index (FDI) for Local Government Area (LGA)

☒ 100                      ☐ 80                      ☐ 50

Mosman Council – Greater Sydney Region (Table A2.3 PBP, 2006)

### 3.5 Determination of Bushfire Attack Level (AS 3959:2009)

| Building | Vegetation     | Slope                      | Minimum Distance | BAL Exposure Level |
|----------|----------------|----------------------------|------------------|--------------------|
| NE - SE  | Forest         | >10 – 15 degrees Downslope | >170m            | BAL LOW            |
| NW - SW  | Remnant Forest | >15 – 18 degrees Downslope | >250m            | BAL LOW            |

### 4.0 Construction Standards (AS 3959-2009 – BCA DTS)

#### 4.1 AS 3959:2009 Construction for Bushfire Attack Level

| Building                        | Vegetation     | Slope                      | Minimum Distance | BAL Exposure Level |
|---------------------------------|----------------|----------------------------|------------------|--------------------|
| Institute of Science & Learning | Forest         | >10 – 15 degrees Downslope | >170m            | BAL LOW            |
|                                 | Remnant Forest | >15 – 18 degrees Downslope | >250m            | BAL LOW            |

**PBP states:** ‘Where more than one façade is exposed to a hazard, then the façade with the highest construction requirement is used to determine the appropriate level of construction. All other facades may be reduced by one level of construction unless that façade is also subject to the same bush fire attack level’.

The Building Code of Australia, 2014 (BCA) does not provide for any **bushfire specific** performance requirements for ‘other’ development within bushfire prone areas. As such the *Australian Standard 3959:2009 (Construction of buildings in bushfire prone areas)* does not apply as a set of ‘deemed to satisfy’ provisions. The general fire safety construction provisions are generally taken as acceptable solutions.

The design of the new development will enhance fire brigade access arrangements to the entire facility (i.e. new large hardstand areas and secondary access from Whiting Beach Road) and will have a compliant firefighting water supply system (i.e. hydrant ring main as per AS2419.1-2005 etc.).

In addition, the existing structures in this area (older buildings, demountable buildings, animal enclosures etc.), which have limited fire protection measures installed, will be demolished/removed providing for a better outcome overall for bushfire protection within the site, which is one of the main objectives for infill development as per s4.3.2 PBP 2006 i.e. *‘to provide better bushfire protection on a redevelopment site, than the existing situation’*.

Further, it will be a recommendation of this report to update the site specific ‘Bushfire Evacuation Plan’ and ‘Vegetation Management Plan’, further enhancing the bushfire protection measures that will benefit the entire existing and proposed development.

## **5.0 Water Supplies**

### **5.1 Reticulated Water Supply**

The subject development site is currently connected to the reticulated town water supply which services Taronga Zoo and the surrounding residential area.

Apart from the above, the proponent has not provided any specific advice (at the time of this assessment) regarding the reticulated water infrastructure and mains size, supply pressure or guarantee of delivery.

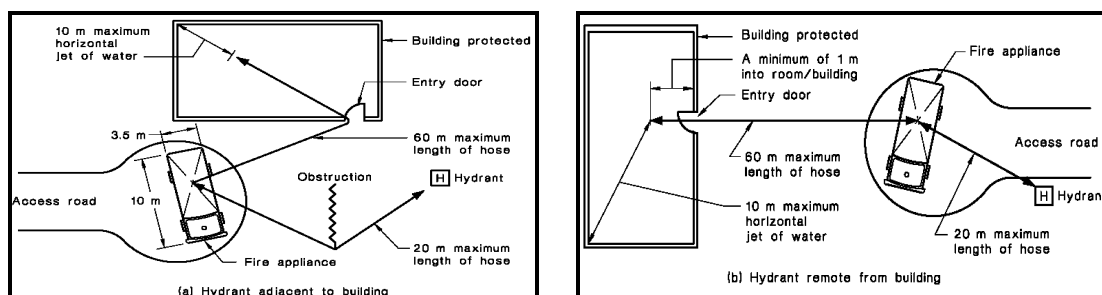
This report notes a number of connection points located within the adjoining road reserve areas (e.g. Bradleys Head Road and Whiting Beach Road).

In addition the development is currently serviced by a hydrant ring main with numerous connection points within the site boundaries. This hydrant system is complimented by a complying fire hose reel system installed throughout the entire development (where required).

Considering the location of the subject development denoted by this report (and corresponding access paths/driveways), the subject development would easily be <90m from the nearest and reasonably available fire hydrant connection points.

Based on AS2419 requirements, hydrant connection points should be located so as to be no greater than 90m from the furthest most point of buildings or areas that may require protection or water supply during a fire event.

The new structure will comply with all general fire safety provisions, including water supply. It will incorporate sufficient hydrant coverage (external ring main and internal hydrants if required), including an internal hose reel system as required.



(Source: AS2419.1- External Fire Hydrant Location)

PBP performance criteria for fire fighting water supply area (considered relevant to the subject development) states that:

- *water supplies are easily accessible and located at regular intervals (for a reticulated supply),*
- *fire hydrant spacing, sizing and pressures comply with AS 2419.1 – 2005, &*
- *the provisions of parking on public roads in section 4.1.3 in relation to parking are met.*

## 5.2 Distance to hydrant from subject proposed development

Recommended travel distances will continue to comply with AS2419.1-2005 as part of the overall general fire safety provisions.

## 5.3 Existing or planned water supply provided for fire fighting purposes

☒ **Yes**      ☐ **No**      ☒ **Proposed**

As stated above, a reticulated supply (internal ring main system) which meets the provisions of AS2419.1-2005 and the BCA (2014) will satisfy the provisions of PBP 2006.

## 6.0 Gas Supplies

Reticulated Gas: ☒ **Yes**      ☐ **No**

Bottled Gas: ☐ **Yes**      ☒ **No**

Recommendations include requirements for any extension of the existing reticulated gas supply.

## **7.0 Electricity Supplies**

It is not proposed, as part of this development application, to alter the existing electrical supply system in any manner.

Most electrical transmission lines within the site are located underground.

Supply, for the proposed development, will also be located underground.

## **8.0 Vehicle Access/Egress**

### **External public roads**

The subject property is locally accessed from Bradleys Head Road, and Whiting Beach Road. The primary vehicle entry / access point for the development area is off Whiting Beach Road and the commercial / public car parking area within the northern most part of the zoo.

All public roadway areas noted on approach to, and departure from, the subject property are well formed and sealed two way public roadways (with cleared verge areas, constructed drainage and ample room for passing or parked traffic), which also service the surrounding residential area of Mosman.

All public roadway areas (within the study area) servicing the subject development site do not exceed 5 degrees slope and would currently and easily have the capacity to handle an increase in traffic associated with a potential bushfire emergency affecting the area. The above assuming that normal emergency services and traffic supervision is being conducted during an emergency bushfire event.

### **Internal roads**

Currently, all internal roads servicing the development, are sealed all weather roads >7m wide, with cleared verge areas, constructed drainage and ample room for passing. Heavy vehicles currently access the site on a regular basis, and there is no public vehicular access to the development area. A large public carpark is located off Bradleys Head Road, remote from the development site.

Internal access to the site, and to the proposed building, will be improved as part of this development, with the demolition of numerous existing buildings, which will generally be incorporated into the proposed new structure.

The location and extent of the driveways and car parking areas are as otherwise denoted Appendix 1 – Site Plan.

### **Public roads link to fire trails and have two-way access**

The subject development site does not propose nor necessarily require any fire trail access to service the subject development site.

### **Adequacy of access and egress for emergency response**

Given the design and construction of the internal road system within this development, and the proposed enhancements (i.e. better access overall), the internal road system could be considered an extension of the public road system (quality of surface finish, widths, rollover kerbing, drainage etc.).

Provided that the APZ areas are maintained as per the recommendations stated by this report, it is a considered opinion that access or egress for the subject development site would be adequate for the purposes of bushfire safety compliance and emergency response.

## **9.0 Adequacy of maintenance plans and emergency procedures**

### **Bushfire Maintenance Plan**

It should be duly noted, that currently, the vegetation and gardens within the subject development are maintained to a very high level. All vegetation and gardens are well managed and the current 'Vegetation Management Plan/System' would require only minor modification to ensure that this incorporates any new gardens and areas associated with the proposed development.

Similarly, all buildings within the current development appear to be well maintained. Any general fire safety provisions, installed as part of this development application, would also be subject to the relevant legislation within the BCA, including ongoing maintenance and compliance checks etc. (i.e. Annual Fire Safety Schedule / Statements etc.).

The revised plan should at least address;

- A proposed schedule of landscape maintenance and activities which ensure the provisions of proposed fire / asset protection management zones, &
- A proposed schedule of building maintenance and activities which ensure the correct installation or function of building design / materials incorporated for all general fire safety provisions.

## Fire emergency procedures

PBP 2006 acceptable solutions for emergency and evacuation planning requirements (relevant to the subject development) include;

- *An emergency/evacuation plan is prepared consistent with the RFS guidelines for the Preparation of Emergency/Evacuation Plan.*
- *Compliance with AS 3745-2010 'Planning for Emergencies in Facilities'.*
- *An Emergency Planning Committee is established to consult with residents (and their families in the case of aged care accommodation and schools) and staff in developing and implementing an Emergency Procedure Manual.*
- *Detailed plans of all Emergency Assembly Areas including "onsite" and "offsite" arrangements as stated in AS 3745- 2010 are clearly displayed, and an annual (as a minimum) trial emergency evacuation is conducted.*

Considering the above, it is recommended that the exiting emergency and evacuation procedures plan be revised to ensure it encompasses the proposed uses and occupancy of the new development. This should continue to be incorporated into and complement the existing emergency procedures.

### 10.0 Adequacy of sprinkler systems

Sprinkler systems are neither recommended nor necessarily required for the subject development site.

### 11.0 An assessment of how the development complies with the acceptable solutions, performance requirements and relevant specific objectives within Chapter 4 of PBP 2006

#### 11.1 Performance criteria / acceptable solution compliance

The following table outlines how the subject development complies (or otherwise) with PBP provisions for a Special Fire Protection Purposes development. Compliance is stated as;

- **YES** – the subject development currently facilitates the acceptable solution for bushfire safety,
- **REASONABLY ASSUMED** – the subject development can reasonably facilitate the acceptable solution for bushfire safety, predicated on assumptions of the existing and future design, and activities that are recommended occur,
- **NOT APPLICABLE (N/A)** – the acceptable solution is not applicable to the design or construction of the subject development,
- **NOT CONSIDERED** – the acceptable solution for bushfire safety is considered unnecessary or otherwise overly exceeds the relative risk associated with a bushfire event affecting the subject development. Bushfire safety compliance is based on performance criteria,
- **NO** – the subject development will not facilitate the acceptable solution for bushfire safety compliance. Bushfire safety compliance is based on performance criteria or alternate solution.

**Table 4.0 Derived from PBP 2006 Chapter 4; 4.2.7 – Standards for Bush Fire Protection Measures for Special Fire Protection Purpose Development**

| Performance Criteria                                                                                                                                                                                                      | Acceptable Solution                                                                                                                                                                                                     | Compliance                | Assessment / Comment                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>radiant heat levels of greater than 10kW/m<sup>2</sup> will not be experienced by occupants or emergency services workers entering or exiting a building</b>                                                           | <i>an APZ is provided in accordance with the relevant tables and figures in PBP</i>                                                                                                                                     | Yes                       | Recommendation Nos. 1 & 2 of this report.                                                                                                         |
|                                                                                                                                                                                                                           | <i>exits are located away from the hazard side of the building</i>                                                                                                                                                      | Yes                       |                                                                                                                                                   |
|                                                                                                                                                                                                                           | <i>the APZ is wholly within the boundaries of the development site</i>                                                                                                                                                  | Yes                       |                                                                                                                                                   |
| <b>applicants demonstrate that issues relating to slope are addressed: maintenance is practical, soil stability is not compromised and the potential for crown fires is negated</b>                                       | <i>mechanisms are in place to provide for the maintenance of the APZ over the life of the development</i>                                                                                                               | Yes                       | Recommendation Nos. 1 & 2 of this report.                                                                                                         |
|                                                                                                                                                                                                                           | <i>the APZ is not located on lands with a slope exceeding 18 degrees</i>                                                                                                                                                | Yes                       |                                                                                                                                                   |
| <b>APZs are managed and maintained to prevent the spread of a fire towards the building</b>                                                                                                                               | <i>in accordance with the requirements of 'Standards for Asset Protection Zones (RFS 2005)</i><br><br><i>(Note - a Monitoring and Fuel Management Program should be required as a condition of development consent)</i> | <i>Reasonably Assumed</i> | Recommendation Nos. 1 & 2 of this report.                                                                                                         |
| <b>vegetation is managed to prevent flame contact and reduce radiant heat to buildings, minimise the potential for wind driven embers to cause ignition and reduce the effect of smoke on residents and fire-fighters</b> | compliance with Appendix 5 (PBP)                                                                                                                                                                                        | <i>Reasonably Assumed</i> | Recommendation Nos. 1 & 2 of this report.                                                                                                         |
| <b>internal road widths and design enable safe access for emergency services and allow crews to work with equipment about the vehicle.</b>                                                                                | <i>internal roads are two-wheel drive, sealed, all-weather roads</i>                                                                                                                                                    | Yes                       | The existing internal road system has been constructed to a high standard, and can easily satisfy the Performance Criteria for Internal Roadways. |
|                                                                                                                                                                                                                           | <i>internal perimeter roads are provided with at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb) and shoulders on each side, allowing traffic to pass in opposite directions</i>              | Yes                       |                                                                                                                                                   |
|                                                                                                                                                                                                                           | <i>roads are through roads. Dead end roads are not more than 100 metres in length from a through road, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end</i>       | Yes                       |                                                                                                                                                   |
|                                                                                                                                                                                                                           | <i>traffic management devices are constructed to facilitate access by emergency services vehicles.</i>                                                                                                                  | <i>Reasonably Assumed</i> |                                                                                                                                                   |
|                                                                                                                                                                                                                           | <i>a minimum vertical clearance of four metres to any overhanging obstructions, including tree branches, is provided.</i>                                                                                               | <i>Reasonably Assumed</i> |                                                                                                                                                   |

| Performance Criteria                                                                                                                                                         | Acceptable Solution                                                                                                                                                                                                                                                                                                                                                 | Compliance         | Assessment / Comment                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                                                              | <i>curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress</i>                                                                                                                                                                                                                                              | Yes                |                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                              | <i>the minimum distance between inner and outer curves is six metres</i>                                                                                                                                                                                                                                                                                            | Yes                |                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                              | <i>maximum grades do not exceed 15 degrees and average grades are not more than 10 degrees</i>                                                                                                                                                                                                                                                                      | Yes                |                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                              | <i>cross-fall of the pavement is not more than 10 degrees</i>                                                                                                                                                                                                                                                                                                       | Yes                |                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                              | <i>roads do not traverse through a wetland or other land potentially subject to periodic inundation (other than flood or storm surge)</i>                                                                                                                                                                                                                           | Yes                |                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                              | <i>roads are clearly sign-posted and bridges clearly indicate load ratings</i>                                                                                                                                                                                                                                                                                      | Yes                |                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                              | <i>the internal road surfaces and bridges have a capacity to carry fully-loaded firefighting vehicles (15 tonnes)</i>                                                                                                                                                                                                                                               | Reasonably Assumed |                                                                                                                                                                                                                                                                                 |
| <b>Reticulated water supplies are easily accessible and located at regular intervals</b>                                                                                     | <i>access points for reticulated water supply to SFPP developments incorporate a ring main system for all internal roads</i>                                                                                                                                                                                                                                        | Yes                | <p>Recommendation No. 4 of this report.</p> <p>Reticulated water supply to the subject development is to fully comply with AS2419 and all general fire safety provisions.</p> <p>An existing 'ring main' system will be enhanced in need to achieve compliance with AS2419.</p> |
|                                                                                                                                                                              | <i>fire hydrant spacing, sizing and pressures comply with AS2419. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority, once development has been completed. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles</i> | Reasonably Assumed |                                                                                                                                                                                                                                                                                 |
|                                                                                                                                                                              | <i>the provisions of public roads in section 4.1.3 (PBP) in relation to parking are met</i>                                                                                                                                                                                                                                                                         | Reasonably Assumed |                                                                                                                                                                                                                                                                                 |
| <b>location of electricity services will not lead to ignition of surrounding bush land or the fabric of buildings or risk to life from damaged electrical infrastructure</b> | electrical transmission lines are underground                                                                                                                                                                                                                                                                                                                       | Yes                | <p>Recommendation No. 5 of this report.</p> <p>Electrical services within the subject development site are generally located underground.</p> <p>Connection to the new developments will also be located underground</p>                                                        |
| <b>location of gas services will not lead to ignition of surrounding bush land or the fabric of buildings</b>                                                                | <i>reticulated or bottled gas is installed and maintained in accordance with AS 1596 - 2002 and the requirements of relevant authorities. Metal piping is to be used.</i>                                                                                                                                                                                           | Reasonably Assumed | <p>Recommendation No. 6 of this report.</p> <p>Any future reticulated or bottled gas supply is to be installed and maintained according to the 'Acceptable Solutions' of PBP 2006</p>                                                                                           |
|                                                                                                                                                                              | <i>all fixed LPG tanks are kept clear of all flammable materials and located on the non hazard side of the development</i>                                                                                                                                                                                                                                          | Reasonably Assumed |                                                                                                                                                                                                                                                                                 |

| Performance Criteria                                                                                                                    | Acceptable Solution                                                                                                                                                                                                              | Compliance                | Assessment / Comment                 |
|-----------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------|
|                                                                                                                                         | <i>If gas cylinders need to be kept close to the building, the release valves must be directed away from the building and away from any combustible material, so that they do not act as catalysts to combustion</i>             | <i>Reasonably Assumed</i> |                                      |
|                                                                                                                                         | <i>polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used</i>                                                                                                                         | <i>Reasonably Assumed</i> |                                      |
| <b><i>an Emergency and Evacuation Management Plan is approved by the relevant fire authority for the area</i></b>                       | <i>an emergency/evacuation plan is prepared consistent with the RFS guidelines for the Preparation of Emergency / Evacuation Plan</i>                                                                                            | <i>Reasonably Assumed</i> | Recommendation No. 7 of this report. |
|                                                                                                                                         | <i>compliance with AS 3745-2010 'Planning for Emergencies in Facilities'</i>                                                                                                                                                     | <i>Reasonably Assumed</i> |                                      |
|                                                                                                                                         | <i>compliance with AS 4083-1997 'Planning for emergencies - for health care facilities'</i>                                                                                                                                      | <i>N/A</i>                |                                      |
| <b><i>suitable management arrangements are established for consultation and implementation of the emergency and evacuation plan</i></b> | <i>an Emergency Planning Committee is established to consult with residents (and their families in the case of aged care accommodation and schools) and staff in developing and implementing an Emergency Procedures manual.</i> | <i>Reasonably assumed</i> | Recommendation No. 7 of this report. |
|                                                                                                                                         | <i>detailed plans of all Emergency Assembly Areas including "onsite" and "offsite" arrangements as stated in AS 3745-2010 are clearly displayed, and an annual (as a minimum) trial emergency evacuation is conducted.</i>       | <i>Reasonably assumed</i> |                                      |

## 11.2 PBP 2006 'Specific Objective' assessment

| PBP 2006 Specific Objective                                                                                                                                              | Assessment / Comment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>(i) afford occupants of any building adequate protection from exposure to a bush fire</i>                                                                             | Where the recommendations stated by this report are reasonably and adequately incorporated (where practicable), persons remaining within the subject development site during a significant bushfire event would be afforded the benefit bushfire protection ' <i>measures in combination</i> '. In this respect, fire fighters or occupants remaining within the subject development site or else defending an asset or building during a passing bushfire event should reasonably be better afforded a greater level of protection than otherwise currently exists. |
| <i>(ii) provide for a defensible space to be located around buildings</i>                                                                                                | Where the recommendation relating to APZ management as stated by this report is reasonably and adequately incorporated (i.e. continued property maintenance), existing building structures located within close proximity to the primary bushfire hazard would be afforded an increased level of defensible space.                                                                                                                                                                                                                                                   |
| <i>(iii) provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition</i> | Where the recommendations relating to construction standards & APZ area stated by this report are reasonably and adequately incorporated (where practicable), proposed building structures located within close proximity to the primary bushfire hazard would be afforded a greater chance of withstanding or avoiding direct flame contact and material ignition.                                                                                                                                                                                                  |

|                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>(iv) ensure that safe operational access and egress for emergency service personnel and residents is available</i>                               | Where the recommendations relating to APZ areas as stated by this report are reasonably and adequately incorporated, both emergency services personnel and occupants should be afforded safe access / egress within the subject development site for firefighting or evacuation purposes.                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <i>(v) provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ)</i> | <p>Where the recommendations relating to construction standards and APZ area stated by this report are reasonably and adequately incorporated (where practicable), it would be reasonable to assume that regular maintenance works within the subject development would ensure ongoing management and maintenance of bush fire protection measures.</p> <p>Should the standard or upkeep of APZ areas, vegetation maintenance or vehicle access (required for bushfire safety compliance) become compromised during the life of the subject development site, it would also be reasonable to assume such matters would be addressed by the Council or local Fire Authorities through their standard policies and processes.</p> |
| <i>(vi) ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bush fire fighting)</i>                | <p>Where the recommendations stated by this report are reasonably incorporated, the potential water supply servicing the development site should be adequate for the purposes of bushfire safety compliance.</p> <p>Similarly, where the installation or connection to electrical and gas services incorporates the recommendations as stated by this report, both emergency services personnel or occupants assisting in bush fire fighting should safely be able to manage potential electrical and gas hazards associated during a bushfire event.</p>                                                                                                                                                                       |
| <i>(vii) provide for the special characteristics and needs of occupants [SFPP Development]</i>                                                      | Where all recommendations relating to emergency evacuation procedures (planning) as stated by this report are reasonably and adequately incorporated, persons located within the subject development site during or preceding a bushfire event should be reasonably aware of safe access / egress options and associated activities to be undertaken.                                                                                                                                                                                                                                                                                                                                                                           |
| <i>(viii) provide for safe emergency evacuation procedures [SFPP Development]</i>                                                                   | As above.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

## 12.0 Bushfire Safety & Compliance Recommendations

The following recommendations (Table 12.1) are proposed for bushfire safety & protection for the development of the proposed Taronga Institute of Science & Learning (and all associated infrastructure) within the Taronga Conservation Society Australia, Bradleys Head Road Mosman.

These recommendations are based upon (i.e. as compared too) the relevant provisions (acceptable solutions or performance criteria) for a ‘*Special Fire Protection Purpose*’ development in a bushfire prone area and the NSW Rural Fire Service guideline entitled *Planning for Bushfire Protection 2006*.

**Table 12.1 – Bushfire Safety / Compliance Recommendations**

| No. | PBP Standard                           | Recommendation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-----|----------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | Asset Protection Zone                  | <p><i>The entire development area, identified as Inner Protection Area (IPA), should be managed in terms of PBP A2.2 (vi) which states: ‘The IPA is critical to providing a defensible space and managing heat intensities at the building surface.</i></p> <p><i>The IPA should provide a tree canopy cover of less than 15% and should be located greater than 2 m from any part of the roofline of a dwelling. Garden beds of flammable shrubs are not to be located under trees and should be no closer than 10 m from an exposed window or door. Trees should have lower limbs removed up to a height of 2 m above the ground’.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2   | Bushfire Maintenance<br>(Landscaping ) | <p><i>The existing Vegetation Management Plan be revised to incorporate the new development area and associated gardens for the subject development site which, at least, clearly identifies;</i></p> <ul style="list-style-type: none"> <li><i>A proposed schedule of landscape maintenance and activities which ensure the provisions of proposed fire / asset protection management zones.</i></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 3   | Building Construction Standard         | <p><i>All new construction / buildings will comply with the ‘general fire safety provisions’ of the BCA (2014). Inclusive of:</i></p> <ul style="list-style-type: none"> <li><i>Internal Ring Main system</i></li> <li><i>Fire Hose Reel System</i></li> <li><i>Fire Detection System (i.e. smoke detectors to relevant AS)</i></li> <li><i>Emergency Procedures Manual</i></li> <li><i>Fire separation achieved through passive compartment construction</i></li> <li><i>Any other general fire safety provisions considered necessary for this building classification (BCA).</i></li> </ul> <p><i>It is also noted that two ‘Community Fire Units’ are established within the Taronga Zoo grounds. These units provide essential equipment to assist the trained staff (approximately 20 PAX) in dealing with and mitigating bush fire risk. This equipment includes portable fire pumps, hose lines / branches and safety equipment.</i></p> <p><i>Based on the assessment given within Section 4.1 of this report, there is ‘no specific bushfire construction standards’ recommended.</i></p> |
| 4   | Fire Fighting Water                    | <p><i>Fire hydrant spacing, sizing and pressures should comply with AS 2419.1 – 2005 and all ‘general fire safety provisions’ of the BCA (2014).</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 5   | Electrical Connection                  | <p><i>Any new or re-located power line connections to service the subject development are to be located underground.</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

| No. | PBP Standard                                     | Recommendation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----|--------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6   | LPG Gas Cylinders                                | <p><b><i>As applicable, any future proposed gas supply connections should be designed &amp; located in accordance with PBP 2006.</i></b></p> <p><b><i>Bottled gas should be installed and maintained in accordance with AS1596 - 2002 and the requirements of relevant authorities. Metal piping is to be used.</i></b></p> <p><b><i>Fixed LPG tanks should be kept clear of all flammable materials and preferably located on the non hazard side of the residential building.</i></b></p> <p><b><i>If gas cylinders need to be kept close to the building, the release valves must be directed away from the building and away from any combustible material, so that they do not act as catalysts to combustion.</i></b></p>                                                                                                                                                                                                                                                                                                                                                                                      |
| 7   | Emergency Management Planning and Implementation | <p><b><i>The existing bushfire specific emergency/evacuation plan is to be revised to ensure it encompasses the proposed uses and occupancy of the new development, and is prepared consistent with the RFS guidelines for the Preparation of Emergency / Evacuation Plan</i></b></p> <p><b><i>This is to be incorporated into the facilities current Emergency Planning procedures, which should comply with AS 3745-2010 'Planning for Emergencies in Facilities'</i></b></p> <p><b><i>If not already established, an Emergency Planning Committee is established to consult with staff in developing and implementing an Emergency Procedures manual.</i></b></p> <p><b><i>Detailed plans of all Emergency Assembly Areas including "onsite" and "offsite" arrangements as stated in AS 3745-2010 are clearly displayed, and an annual (as a minimum) trial emergency evacuation is conducted.</i></b></p> <p><b><i>It is noted that a review of the Emergency Response Plan for the site is currently underway, and will be implemented prior to the completion of the proposed development in 2018.</i></b></p> |

### 13.0 Conclusion/Summary

Based on the above assessment and the 7 recommendations to protect persons and property from danger that may arise from a bushfire, the Consent Authority should determine that this development proposal can comply with *Planning for Bushfire Protection 2006*, as required under section 79BA of the *Environmental Planning and Assessment Act 1979* (when measured against the 'Specific Objectives' and 'Performance Criteria' for 'Special Fire Protection Purposes').

As a considered opinion, the recommended mitigation measures and construction requirements as stated in this report would reasonably address the aims and objectives of PBP 2006, consistent within the relative and current bushfire risk to the subject development site.

The recommended mitigation measures include the establishment of an Asset Protection Zone / Defendable Space, maintained as an IPA (Recommendation No.1) and the use of standard fire safety provisions for the relevant building classification. In this regard, the subject development can reasonably facilitate PBP objectives in as far as;

- Affording occupants of any building adequate protection from exposure to bushfire;
- Providing for a defendable space to be located around buildings;
- Providing appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and/or material ignition;
- Ensuring that safe operational access and egress for emergency service personnel and residents is available;
- Providing for ongoing management and maintenance of bushfire protection measures, including fuel loads in the APZ; and
- Ensuring that utility services are adequate to meet the needs of fire fighters (and others assisting in bush fire fighting).

Should any of the above information require clarification or further discussion, please contact the author.



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## References/Further Reading

*Australian Standard 3959 (2009), Construction of buildings in bushfire prone areas* – Standards Australia.

*Building Code of Australia (2014)* – Australian Building Codes Board, Canprint.

*Environmental Planning and Assessment Act (1979)* – NSW Government Printer.

- Section 79BA Consultation and Development Consent Certain Bushfire Prone Land
- Section 146 Bushfire Prone Land

*Rural Fires Act (1997)* – NSW Government Printer

*Landscape and building design for bushfire areas (2003)* – Ramsay G C & Rudolf L, CSIRO Publishing, Collingwood Victoria.

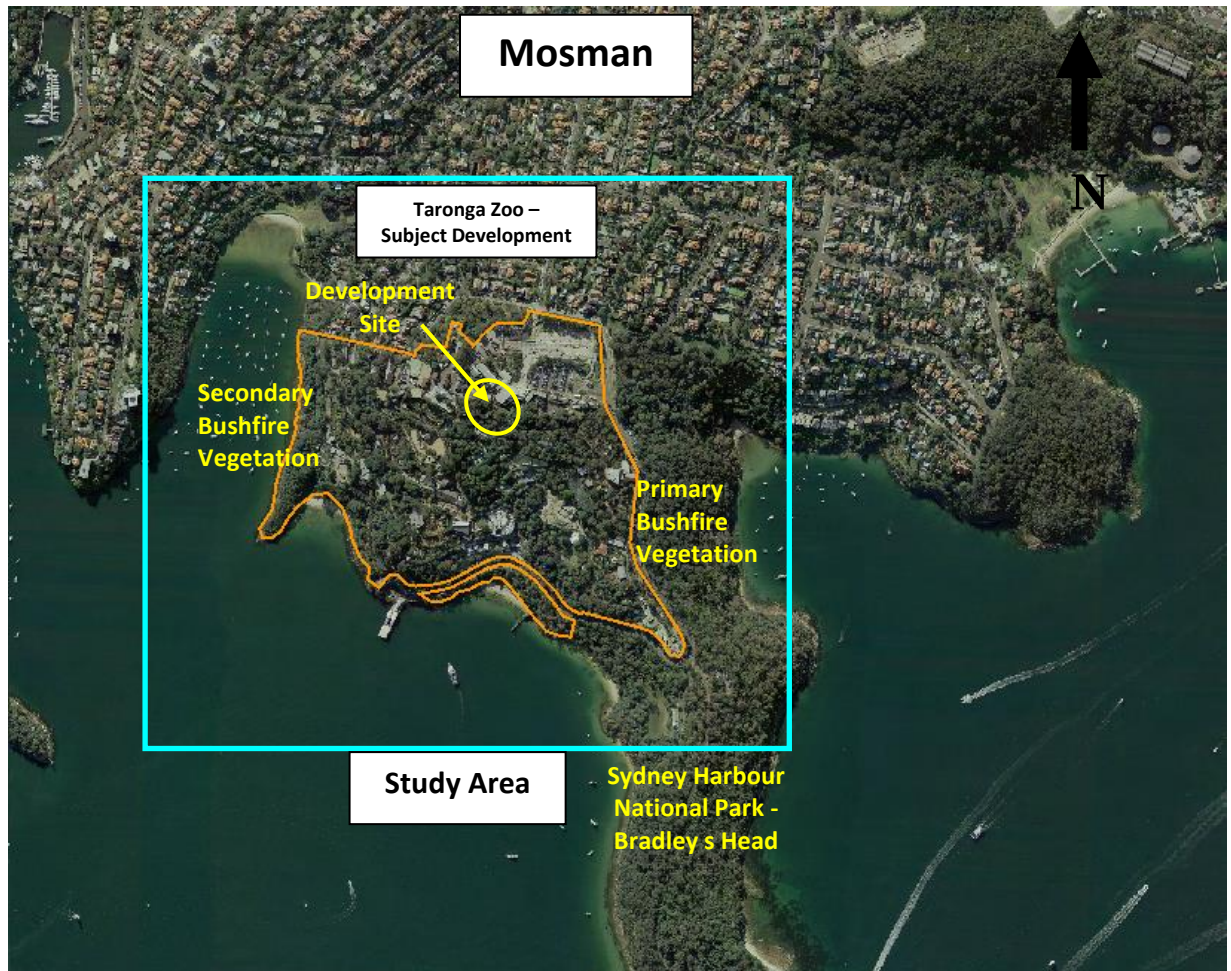
*Ocean shores to desert dunes: the native vegetation of NSW and the ACT (2004)* – Keith D, NSW Dept of Environment and Conservation, Hurstville NSW.

*Planning for Bushfire Protection. A guide for councils, planners, fire authorities and developers (2006)* – NSW Rural Fire Service.

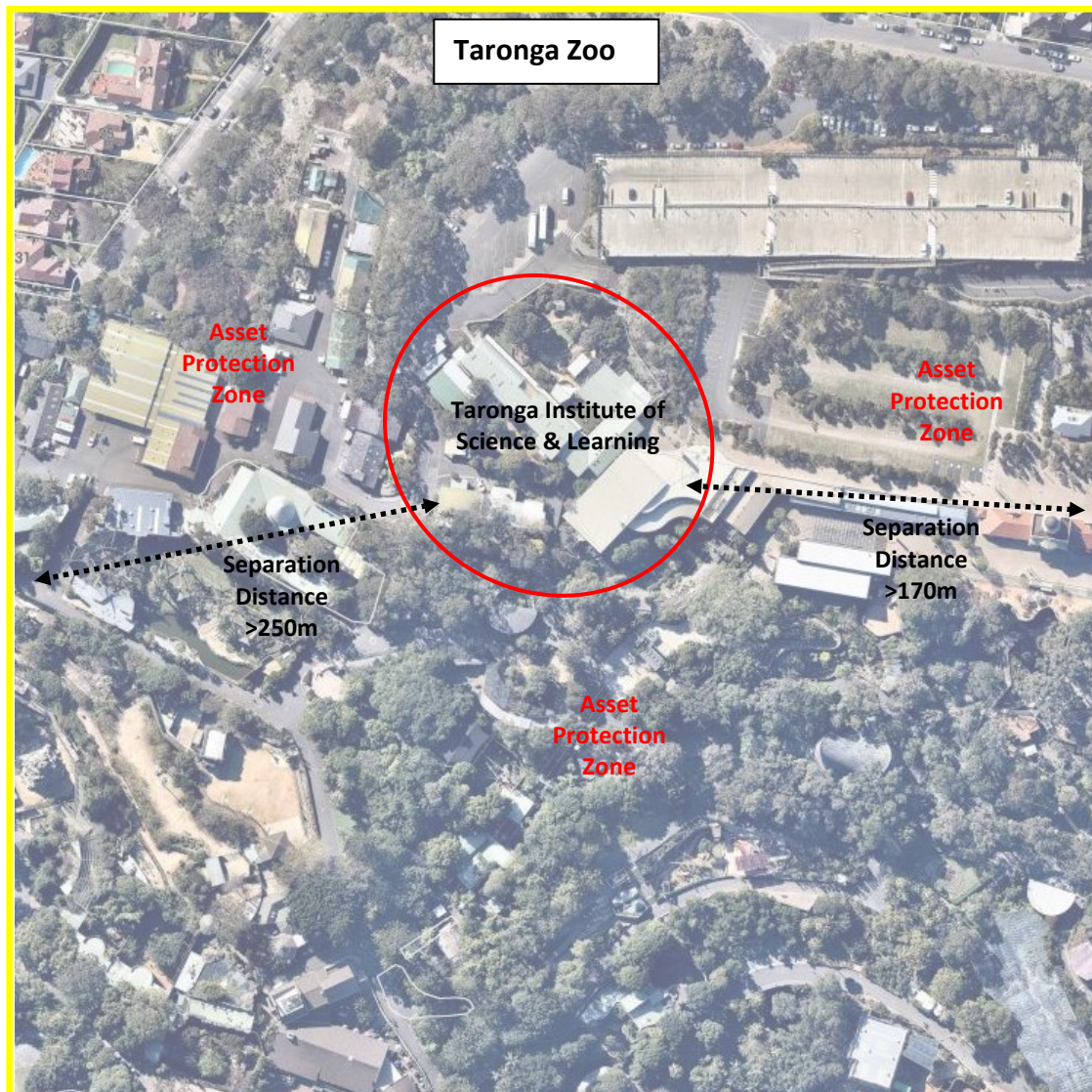
*Standards for Asset Protection Zones* – NSW Rural Fire Service

## Appendix 1

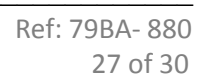
### Map 1 – Overview / Access Arrangements



## Map 2 – Development Area / Subject Buildings



## NBRS+PARTNERS





### Appendix 3 – Site Photos



**Main service entrance, Taronga Zoo**



**Main public entrance, Taronga Zoo**



**Hard stand area N of service entrance**



**Typical Internal road**



**Internal fire safety measures**



**Typical twin head pillar hydrant**



**Current learning enclosure**



**Current development to be relocated**



**Current development to be relocated**



**Current development to be relocated**



**Typical dry forest vegetation, in National Park, looking NE**



**Typical dry forest vegetation, in National Park, looking SE**