Potential areas of overshadowing from the overhead footbridge would occur on commercial properties during the afternoon (during the winter solstice). Refer to Figure 21, Figure 22 and Figure 23. This is not considered to have a significant impact.. Landscape treatments would reduce the visual impact of the overpass structure, and tie in with the natural character of the western approach.

Lifts: Three new lift towers would be attached to the new overhead footbridge. The scale impact of the lift shafts has been minimised by limiting the height of the lift shafts to around two (2) metres above the top of the footbridge roof.

The tall lifts and stairs are located on the southern side of the footbridge on the eastern and western forecourts to open up the forecourts to lines of sight and vistas from surrounding areas. Both lifts incorporate glass view panels. The centre or platform lift faces north. It would have a structural steel form with external cladding also incorporating glass view panels. The lifts would be designed with a maximum capacity for 17 people.

Bus and kiss and ride: The bus and kiss and ride zones would be reconfigured. Bus stops would be moved closer to the forecourt entrances. A formalised eastbound bus zone would be provided in Mulga Road, and the westbound stop would have a new bus shelter. Formalised kiss and ride spaces would be provided including an accessible parking space, and these would be closer to the forecourt entrances.

Pedestrian access: The existing pedestrian crossing in Oatley Parade would be retained. A refuge island would be created on Mulga road to improve pedestrian safety. Traffic calming would also improve pedestrian safety.

Platform canopies: A modification at the Sydney end of the platform would be required in order to allow for the construction of the footbridge and its integration with the new stairs. A section would need to be demolished to make way for the lift. New canopies would be provided on either side of the stairs in order to maintain continuous cover from the new lift waiting area. This canopy would be of a flat roof construction with a soffit cladding.

The design is required to maintain form and materials to provide continuity between the new and old structures. Materials such as galvanised steel structures and Colorbond metal roof would be used to construct sections of the canopy, enabling a seamless appearance to be achieved.

Bicycle: On the eastern side, bicycle rack parking would be provided. On the western side covered bicycle parking would be provided, with the addition of lockers.

Commuter parking: The upgrade of the existing car park aims to retain existing trees to the street frontage where possible to soften the appearance of the car park. The design includes a compliant accessible car parking space with line marking.

Flora and fauna: Landscape impacts on the eastern side include removal of four palm trees, and on the western side, approximately 14 trees would need to be removed. Trees would be offset in accordance with the TfNSW *Vegetation Offset Guide*. The railway embankment would be revegetated and mulched, and low ground cover planting would be provided at forecourt edges where suitable. Larger plantings would interface between the forecourts and Douglas Cross Gardens on the eastern side. The plant species palette selected would be a combination of natives and exotics and would be selected in consultation with the relevant Council.

Platform: The heritage station building is to be retained, with little impacts to the exterior of the building, with the exception of the addition of a separate entrance into the ticket office via a new door on the western side.

The relocation of seating and bins on Platform 1 and 2 currently adjacent to the station building would be necessary to maintain accessible paths. Seats would be relocated to the Sydney and Country ends of the platform with wind breaks incorporated in the construction. Readers for the Opal ticketing system would be located at the bottom of the stairs and in front of the lift at platform level.

Balustrades, handrails and anti-throw screens: Balustrades, handrails and anti-throw screens would be galvanised with a light silver finish.

Street furniture: Street furniture would be installed in consultation with Councils.

Wayfinding and signage: The upgrade of wayfinding signage for Oatley Station Precinct is a necessary part of the station upgrade and would improve customer experience. Existing signage would be relocated and modified. New signage would address changes to the interchange with regard to other upgrade works (including bus stops, accessible parking, lifts, stairs, taxi rank, kiss and ride and bicycle parking). Wayfinding signage to the commuter car park, and identification signage (including signage for Opal readers) would be provided.

Graffiti minimisation: Additional measures have been applied to reduce graffiti, ,including through sealing station surfaces and by providing station security through effective design and CCTV cameras.

Overall, weather protection is improved and the Proposal would result in a significant improvement in pedestrian amenity. The Proposal would see reallocation of existing road space in accordance with interchange guidelines, where modes of transport are prioritised in favour of sustainable modes. The new entry forecourts would facilitate self orientation through natural way-finding.

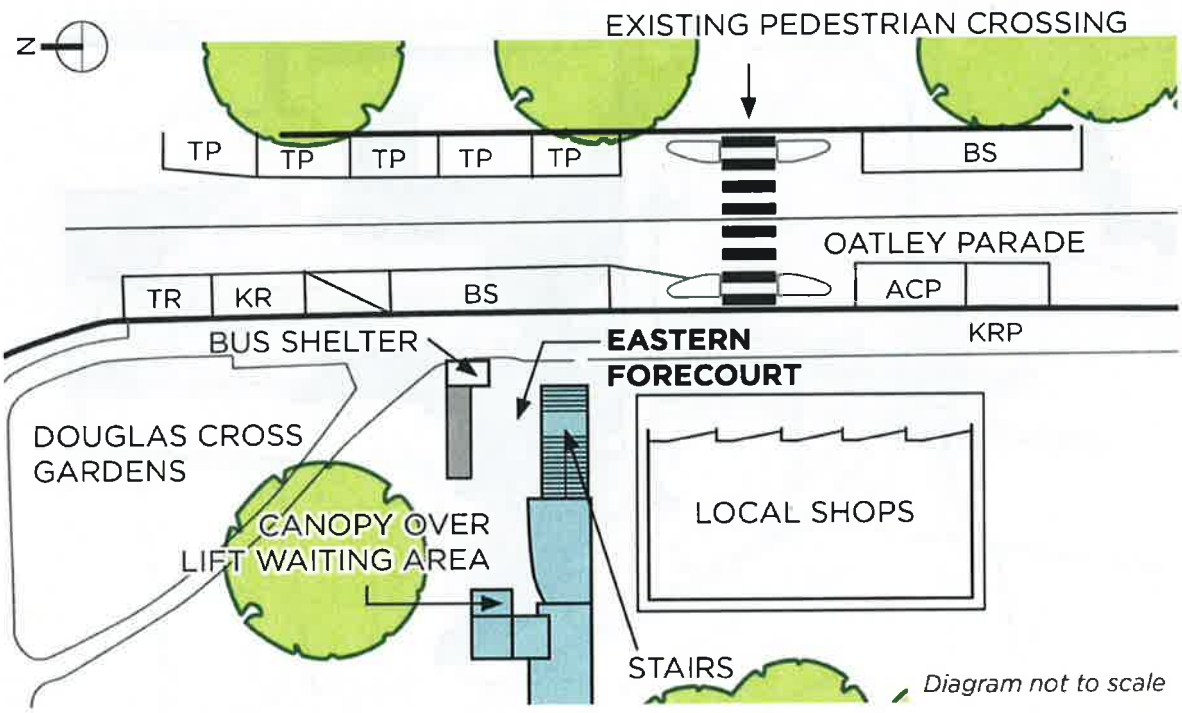

Figure 19: Reference Design eastern forecourt (subject to detailed design)

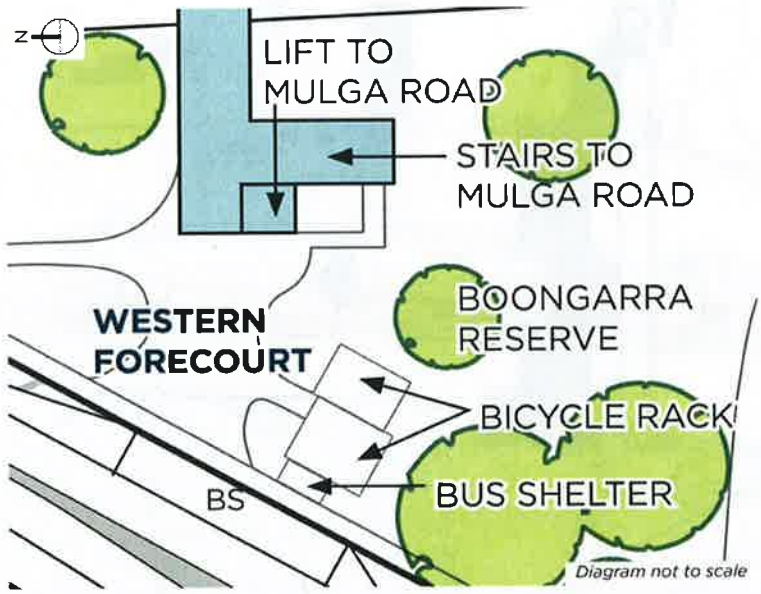

Figure 20: Reference Design western forecourt (subject to detailed design)

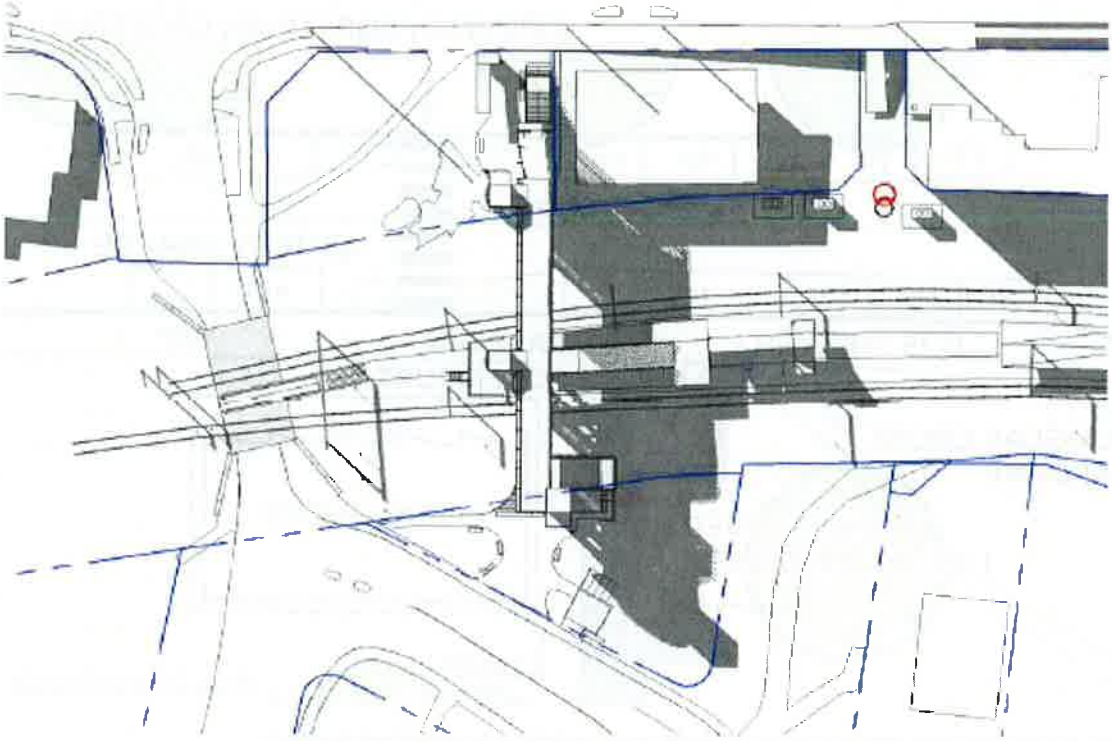

Figure 21: Shadow diagram - June 9am

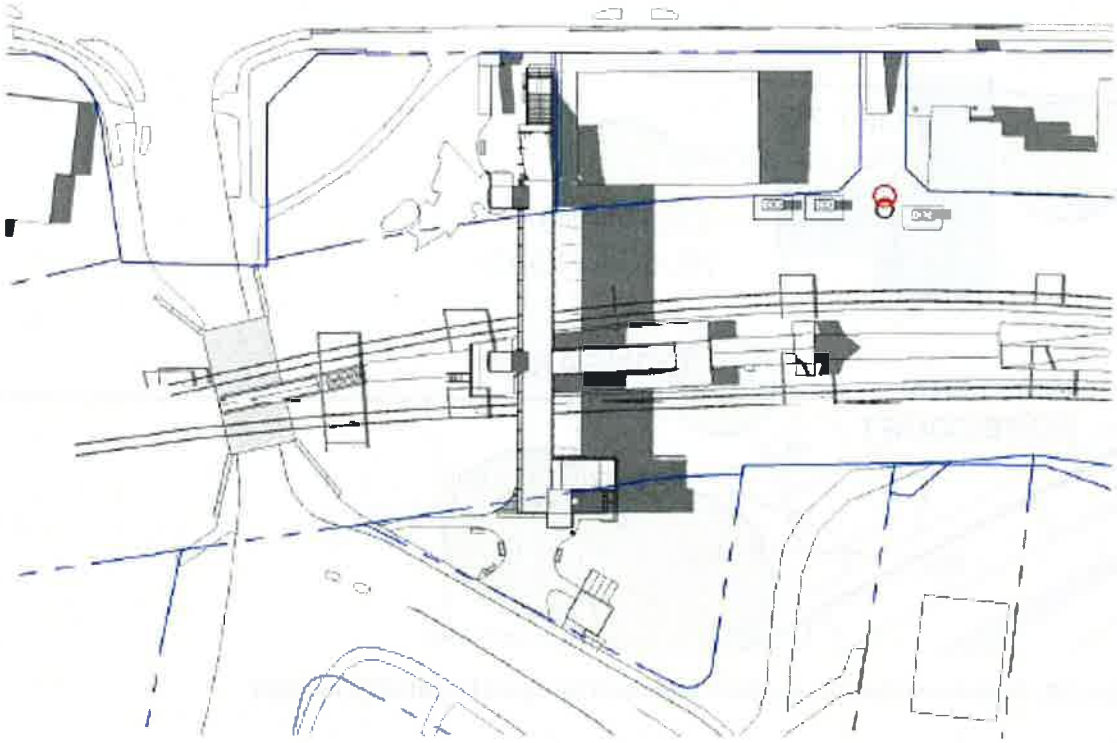

Figure 22: Shadow diagram - June 12pm

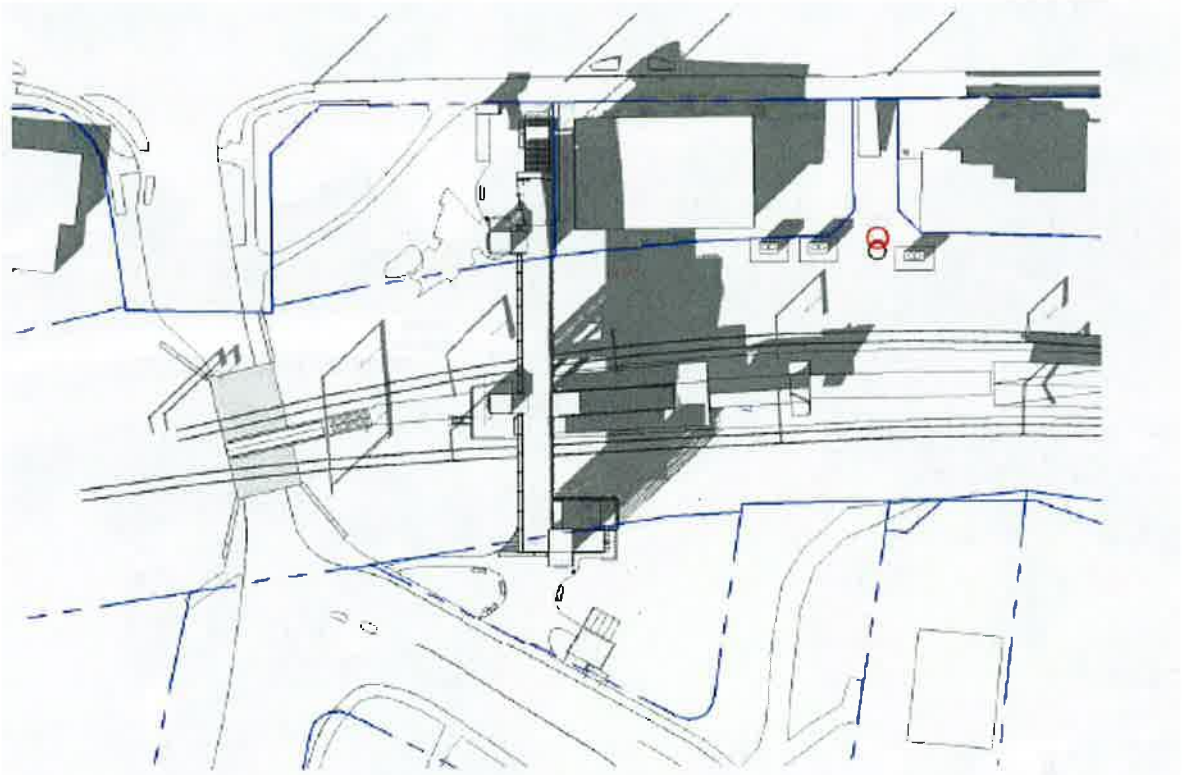

Figure 23: Shadow diagram - June 3pm

A *Potential Visual Impact, Oatley Station Upgrade Project* report was prepared in February 2014 for TfNSW by RPS. Below is a figure indicating key views, and their impacts are discussed in Table 15 below.

Figure 24: Site viewpoint plan

Figure 25: View from Douglas Cross Gardens (looking south), indicating proposed new works (Viewpoint 7)

Figure 26: View from River Road at the corner of Oatley Parade (looking south), indicating proposed new works (Viewpoint 6)

Figure 27: View from the Memorial Gardens in Oatley Parade (looking west) indicating proposed new works (Viewpoint 8).

Figure 28: View from Boongarra Reserve looking east, indicating proposed new works (Viewpoint 3).

Figure 29: View looking south from the reserve in River Road, indicating the proposed new works (Viewpoint 1).

Table 15: Viewpoint analysis

View-point*	Analysis	Impact Rating
1	Visual receivers in this location are likely to be pedestrians passing through the open space to the east of River Road, with the potential for intensive recreational use during weekend periods, both passive and active. However views to the site are restricted for much of the open space. Due to the size and frequency of vegetation in this area it is unlikely that the proposed development would impose any visual impact.	Insignificant
2	It is likely that visual receivers in this location would be vehicles travelling at low speeds, however viewing time is likely to be limited to a few seconds as the vehicle moves closer to the site and into the driver's frame of vision before passing beneath the underpass or turning away from the site into Mulga Road. It is likely that receivers would also be in the form of passengers choosing to 'park and ride'. For these receivers it is unlikely that the development would have a negative impact but rather improve legibility to the station. It is clear that the prominence of the proposed infrastructure would be high due to the scale of the structures required. However there would not be a total loss of the vegetation in this area and this would assist in absorbing and balancing the bulk of the structure.	Low
3	Visual receivers in this area would likely be pedestrians, recreational users, parishioners and residential property owners. This view is likely to have medium exposure due to the frequency and type of use and duration of viewing periods. Not unlike view sheds from points 2 and 4, the visual prominence of the proposal would be moderate. However due to the longer viewing periods it is likely that the impact would be greater. At present the extent of the view encompasses the historic underpass framed by vegetation and open space. The prominence of the proposed structure would impact on the quality of this view with the scale of the new structure likely to diminish the underpass as the focal point. The design of the structure has considered the form and materials of the proposed structure to ensure they compliment the underpass rather than detract from its visual appeal.	Low
4	It is likely that visual receivers in this location would be vehicles travelling at low speeds, however viewing time is likely to be limited to a few seconds as the vehicle moves closer to the site and into the driver's frame of vision before passing beneath the underpass or turning away from the site into River Road. It is likely that receivers would also be in the form of passengers choosing to 'park and ride'. For these receivers it is unlikely that the development would have a negative impact but rather improve legibility to the station. It is clear that the prominence of the proposed infrastructure would be high due to the scale of the structures required. However the remnant vegetation and vegetation lining the rail corridor would not be totally lost in this area and this would assist in absorbing and balancing the bulk of the structure. Due to the prominence of the proposal at this point and the moderately high exposure, the impact is considered to be	Medium

View-point*	Analysis	Impact Rating
	medium.	
5	Receivers in this location would be predominantly pedestrians moving towards the road crossing on Oatley Parade. Views of the site don't become available until moving closer to the park edge. At this point the site would have a medium level of exposure. However the visual prominence of the proposal is likely to be tempered by the existing vegetation of the adjacent Douglas Cross Gardens. The distance from the site and the existence of adjacent residential buildings in the composition of the view would mean that the proposal would be integrated into the site's character.	Low
6	Receivers in this location would be predominantly pedestrians moving towards the road crossing on River Road. At this point the site would have a high level of exposure due to the proximity of the viewer. This view also encompasses views from nearby residential occupiers. Vehicles are likely to have views for short durations only However the visual prominence of the proposal is likely to be tempered by the existing vegetation of the adjacent Douglas Cross Gardens. Notwithstanding, the visual impact on this view shed without mitigation, would be considered high. However it is important to note that design guidelines have been implemented to ensure the proposal can be integrated into the site with a lower level of impact. The proposal allows for as much existing vegetation as possible to remain allowing the new structures to be more easily absorbed into the landscape. The materials used also allow the structure to appear opaque therefore reducing the bulk of its appearance. The form of the structure also reflects the nearby arches of the heritage underpass and so allows the new structure to be more easily integrated into the surrounding landscape. These design modifications result in a medium visual impact rating.	Medium
7	This view shed is the most visually prominent due to the proximity of visual receivers to the site, the scale of the proposal in relation to the human scale of the receivers and the duration of the periods of use in the Park. It is also given a high visual exposure rating because of the assumed value placed on the character of the park setting. The visual impact on this view shed without mitigation is considered high, however it is important to note that design guidelines have been implemented to ensure the proposal can be integrated into the site with a lower level of impact. The proposal allows for as much existing vegetation as possible to remain allowing the new structures to be more easily absorbed into the landscape. The materials used also allow the structure to appear opaque and therefore reduces the bulk of its appearance. The form of the structure also reflects the nearby arches of the heritage underpass and therefore allows the new structure to be more easily integrated into the surrounding landscape. These design modifications result in a medium visual impact rating.	Medium

View-point*	Analysis	Impact Rating
8	Receivers in this location would be predominantly pedestrians moving towards the road crossing on Oatley Parade. It is likely that the duration of exposure would be for brief periods for the majority of users, however for those using the nearby bus stop exposure could be for extended periods. Exposure is therefore considered to be medium. The visual prominence of the proposal is also considered to be a moderate level due to scale of the proposal and the proximity of the receivers to the site. The impact is considered have medium modification with the urban design features of the proposal likely to be integrated into the nearby commercial character of the site at this point. It should also be noted that filtered views of the proposal would be available from various points throughout the park however, none are considered to have an importance rating higher than Medium.	Medium
9	Receivers in this location would be predominantly pedestrians moving towards the site and vehicles likely to have views for short durations only. The exposure of the site would be low to medium and visual impact is considered low due to the dominance of the commercial buildings in the foreground of the view shed. This would assist in screening the bulk of the structure however this may also contribute to a cumulative impact.	Low Significance

6.2.2. Mitigation measures

- Unnecessary loss or damage to vegetation partially affected or unaffected by the Proposal would be avoided by protecting trees prior to construction and/or trimming vegetation where possible to avoid total removal
- Rehabilitation planting would be undertaken as early as possible to replace vegetation that provided screening to adjacent residential properties and sensitive visual receivers
- Light spill from the rail corridor into adjacent visually sensitive properties would be minimised by directing construction lighting into the construction areas while ensuring that the site complies with Australian Standards but is not over-lit. This includes the sensitive placement and specification of lighting to minimise any potential increase in light pollution.
- Work/site compounds would be screened, with shade cloth or similar material where necessary to minimise visual impacts from external viewpoints
- Temporary hoardings, barriers, traffic management and signage would be removed when no longer required
- Dense, robust mass plantings would be provided to difficult-to-access areas to minimise maintenance requirements
- Any areas of 'blank' wall would be softened by appropriate plantings and/or artwork to meet visual amenity and sustainability guidelines
- Finishes and materials would be complementary to the existing locality and landscape, would minimise reflective surfaces with a preferred use of muted/less intrusive colours, and would involve consultation with Councils

- Maintenance of structures and forecourts as a result of this Proposal would be the responsibility of Sydney Trains on completion
- Way-finding signage would be installed as per TfNSW guidelines
- Specifically designed lighting equipment would be installed to minimise the upward spread of light near to and above the horizontal. Care would be taken when selecting luminaries to ensure that appropriate units are chosen and that their location would reduce spill light and glare to a minimum.

Refer to Table 27 for a consolidated list of proposed mitigation measures.

6.3. Noise and Vibration

A *Noise and Vibration Impact Assessment* for the Proposal was carried out by Ausenco Services Pty Ltd (Ausenco) in March 2014. The findings of the report are summarised below.

6.3.1. Associated Policies and Guidelines

Noise and vibration guidelines and standards for construction and operation of projects that are referenced in this study include:

- AS1055, 1997 Acoustics–Description and Measurement of Environmental Noise
- Bayerisches Landesamt für Umwelt 2007, Parking Area Noise
- British Standard 6472 Guide to evaluation of human exposure to vibration in buildings
- British Standard 7385 Evaluation and measurement for vibration in buildings
- DEC 2006 Assessing Vibration – a technical guideline
- DECCW 2009 Interim Construction Noise Guideline (ICNG)
- DECCW 2011, Road Noise Policy
- DIN 4150-3 1999, Structural Vibration Part 3 Effects of Vibration on Structures
- EPA 2000, NSW Industrial Noise Policy
- NSW DEC 2006, Environmental Noise Management Assessing Vibration: a technical guideline
- OEH 2010 Application Notes to NSW Industrial Noise Policy
- RSA 2014, Report 13126R1R0
- TfNSW 2012, Construction Noise Strategy.

6.3.2. Existing environment

Oatley Railway Station is located in an urban setting, with mainly retail/commercial on the eastern side of the station and industrial on the western side. The predominant sources of noise in the vicinity of the railway station include road traffic on Oatley Parade and River Road and adjoining local streets, as well as train noise from operations in the rail corridor, including freight trains.

The ambient noise environment at the site is relatively quiet and largely dominated by the natural environment and road and rail traffic movements. The results of continuous unattended noise monitoring at this location show levels typical of a suburban noise environment with low evening and night-time noise levels dominated by the natural environment and road traffic on surrounding roads. Daytime noise levels are likely to be influenced by road traffic on adjacent roads, and rail traffic.

6.3.3. Noise-sensitive receivers

The nearest potentially affected noise sensitive receivers are provided in Table 16 and Figure 30 as R1 to R7. There are also other nearby commercial and residential receivers located in Oatley Parade, Oatley Avenue, River Road and Mulga Road.

Operator attended ambient noise monitoring was undertaken on 24 January 2014 at noise monitoring locations NM1, NM2 and NM3 (refer to Figure 30). Continuous unattended noise monitoring was undertaken for the week following 16 January 2014 at NM1 and NM2. A summary of the operator attended noise survey is provided in Table 16. Results of the unattended continuous noise monitoring are contained in Table 18.

Table 16: Nearest potentially affected sensitive receivers

Receiver	Address	Description
R1 (NM3)	Oatley Parade, Oatley	Residential Receivers – 2 Storey Apartment Building
R2	Oatley Avenue, Oatley	Residential Receivers – 3 Storey Apartment Building
R3	Oatley Avenue, Oatley	Mixed Use Residential / Retail Receivers – Ground Floor Retail Space, First & Second Floor Residences
R4 (NM2)	Uniting Care Retirement Village	Residential Receivers – Single Level Apartments
R5 (NM1)	Mulga Road, Oatley	Residential Receiver – 2 Storey Detached House
R6	River Road, Oatley	Residential Receivers - 2 Storey Apartment Building
R7	Oatley Parade Retail Shops	Commercial Receivers – Single Level Shops

Table 17: Operator attended noise monitoring results

Location	Time	L_{Aeq}	L_{A90}	L_{A10}	Comments
NM1 River Road, Oatley	11:42	57	48	59	Road traffic 57-66 Rail 58-61 Local Fauna 55-57 Steady State 48-49
NM2 Uniting Care Retirement Village	12:36	59	46	62	Road Traffic 62-70 Rail 55-61 Steady State 46-47

Location	Time	L_{Aeq}	L_{A90}	L_{A10}	Comments
NM3 Oatley Parade, Oatley	12:14	63	57	67	Road Traffic 62-70 Rail 64-73 (freight train pass-by was measured at 73 (Steady State 55-56)

Notes:
All values expressed as dB(A) and rounded to nearest 1 dB(A)
L_{Aeq} is the equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.
L_{A90} is the noise level present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).
L_{A10} is the noise level present for 10% of time. Commonly referred to the average maximum noise level.

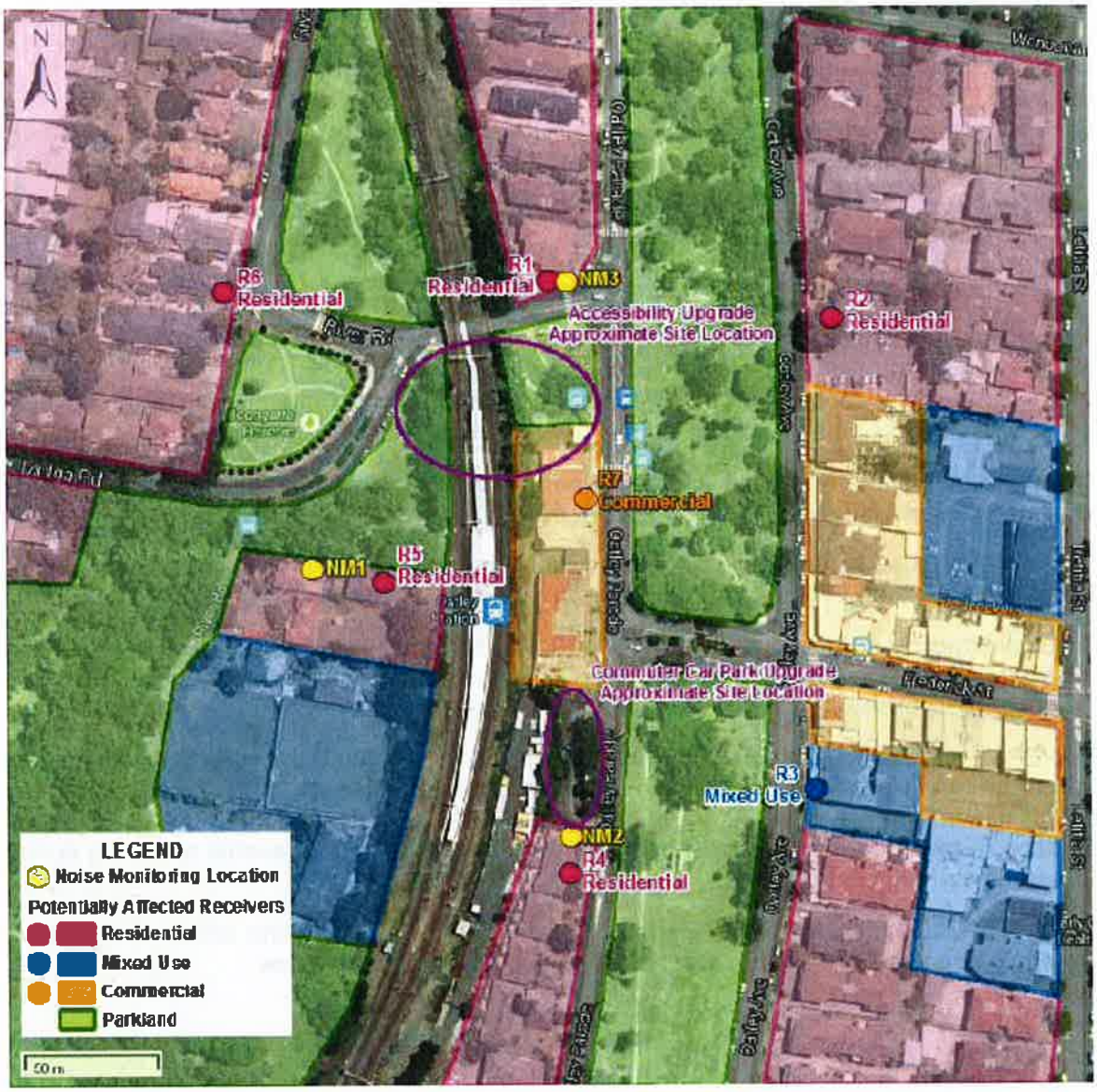

Figure 30: Site locality diagram

Table 18: Continuous unattended noise logging results (dB(A))

Location	Measurement Descriptor	Daytime (0700 – 1800)	Evening (1800 – 2200)	Night-time (2200 – 0700)
NM1 River Road, Oatley	L_{Aeq}	56	55	51
	RBL (Background L_{A90})	44	37	30
NM2 Uniting Care Retirement Village	L_{Aeq}	56	54	48
	RBL (Background L_{A90})	42	40	35

Notes:
All values expressed as dB(A) and rounded to nearest 1 dB(A)
L_{Aeq} is the equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.
L_{A90} is the noise level present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).

6.3.4. Vibration-sensitive receivers

Construction vibration assessment criteria

The effects of vibration in buildings can be divided into three main categories – those in which the occupants or users of the building are inconvenienced or possibly disturbed, those where the building contents may be affected and those in which the integrity of the building or the structure itself may be prejudiced.

Guidance on appropriate plant and equipment and associated recommendations for safe working distances is provided in a number of publications, as detailed below.

The recommended safe working distances for building structural damage and human comfort are identified in the EPA's *Assessing Vibration: a technical guideline* (DEC, 2006).

The *Construction Noise Strategy* (TfNSW, 2012a) recommends the minimum safe working distances for large hydraulic hammers to be 22 metres for cosmetic damage and 73 metres for human response.

The EPA's *Assessing Vibration: a technical guideline* (DEC, 2006) provides guideline values for continuous, transient and intermittent events that are based on a Vibration Dose Value (VDV) rather than a continuous vibration level. The VDV is dependent upon the level and duration of the short-term vibration event, as well as the number of events occurring during the daytime or night-time period.

Guidance is also provided in the German Standard (DIN4150:3) for the effects of long term vibration. The relevant vibration criterion are provided in Table 19 below.

Table 19: DIN4150:3 guideline vibration velocity values for evaluating effects of long term vibration

Type of structure	Vibration at horizontal plane of highest floor
Dwellings and buildings of similar design and/or occupancy	5mm/s
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	10mm/s
Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings under preservation order)	2.5mm/s

Notes:
Guideline values presented at Peak Particle Velocity (PPV)
Vibration at horizontal plane of highest floor applies to all frequencies.

Table 20: Recommended safe working distances for vibration intensive plant

Plant Item	Rating/Description	Cosmetic Damage (BS7385)	Human Response (DEC)
Small Hydraulic Hammer	300 kg (5 to 12T) excavator	2 m	7 m
Medium Hydraulic Hammer	900 kg (12 to 18T) excavator)	7 m	23 m
Large Hydraulic Hammer	1600 kg (18 to 34T) excavator	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Handheld	1 m (nominal)	Avoid contact with structure

Notes:
Table data reproduced from TfNSW's Construction Noise Strategy
BS 7385 – British Standard 7385 Evaluation and measurement for vibration in buildings
DEC = Department of Environment and Conservation NSW (now EPA)

Heritage structures

Heritage buildings are considered to be sensitive to vibration impacts. Oatley Station and its associated structures are listed on the State Heritage Register.

At this stage in the proposal, the vibration assessment of station is considered in the same manner as other buildings along the proposal area in close vicinity to the works (ie judicious selection of plant and equipment would be necessary for vibration intensive activities) due to the potential for vibration from construction works.

It is recommended that during the later stages of the design process, building surveys of this sensitive structure be carried out in order to assess the potential for increased susceptibility to building damage from vibration. Should the building be considered more susceptible to vibration, reduced vibration criteria levels may be applicable and subsequently adopted during the selection process for suitable equipment to be used in the vicinity of this building.

6.3.5. Construction Noise Impact Assessment Framework

Terminology

- $L_{A1(1minute)}$ the "typical maximum noise level" for an event, used in the assessment of potential sleep disturbance during night-time periods. Alternatively, assessment may be conducted using the L_{Amax} or maximum noise level.
- $L_{Aeq(15minute)}$ the "energy average noise level" evaluated over a 15-minute period. This parameter is used to assess the potential construction noise impacts.
- L_{A90} the "background noise level" in the absence of construction activities. This parameter represents the average minimum noise level during the daytime, evening and night-time periods respectively. The $L_{Aeq(15\ minute)}$ construction Noise Management Levels (NMLs) are based on the L_{A90} background noise levels. The L_{A90} is usually synonymous with the Rating Background Level (RBL).

The subscript "A" indicates that the noise levels are filtered to match normal human hearing characteristics (i.e. A-weighted).

Residential receivers

The *Interim Construction Noise Guideline* (ICNG) sets out ways to deal with the impacts of construction noise on residences and other sensitive land uses. It does this by presenting assessment approaches that are tailored to the scale of construction projects.

For construction work during standard daytime hours, a $L_{Aeq(15minute)}$ Noise Management Level (NML) + 10 dBA applies for residential receivers. This is aimed to represent community reaction to construction noise. Refer to Table 17 for the daytime NMLs at the nearest residential receivers.

Where the predicted levels exceed the NML, all feasible and reasonable work practices should be applied to minimise the potential noise impacts. Where $L_{Aeq(15minute)}$ construction noise levels are predicted to exceed 75 dBA, a receiver may be considered "highly noise affected" and additional measures, such as the implementation of respite periods, may be implemented.

Residents are usually most annoyed by work at night-time as it has the potential to disturb sleep. Factors that may be important in assessing the extent of impact on sleep include how often high noise events occur at night, the predicted maximum noise levels at night, whether there are times when there is a clear change in the noise environment (such as early morning shoulder periods), and the degree of maximum noise levels above the background levels at night.

Commercial receivers

The ICNG explains that due to the broad range of sensitivities that commercial or industrial land can have to noise from construction, the process of defining management levels is separated into three categories:

- industrial premises: external $L_{Aeq(15minute)}$ 75 dBA
- offices, retail outlets: external $L_{Aeq(15minute)}$ 70 dBA
- other businesses that may be very sensitive to noise, where the noise level is project specific.

Other sensitive land uses

The ICNG's quantitative assessment method includes guidance on how to establish NML's for some 'other sensitive land uses' such as such as educational institutions, aged care facilities and hospitals, however a suitable management level is not specified for all classifications of sensitive land use.

Where other sensitive land uses are identified within a construction noise catchment, the following guidance is given:

> *The proponent should undertake a special investigation to determine suitable noise levels on a project-by-project basis; the recommended 'maximum' internal noise levels in AS 2107 Acoustics – Recommended design sound levels and reverberation times for building interiors may assist in determining relevant noise levels* (Standards Australia 2000).

6.3.6. Operational Noise Impact Assessment Framework

The noise limits for operational noise emissions are derived from the NSW EPA's Industrial Noise Policy (INP).

The INP provides criteria for the assessment of noise impacts associated with industrial activities. It aims to balance the need for industrial activity with the desire for quiet within the community. The INP sets two separate noise criteria: one to account for intrusive noise and the other to protect the amenity of particular land uses. These criteria are to be met at the most-affected boundary of the receiver property.

To provide for protection against intrusive noise, the INP states that the L_{Aeq} noise level of the source, measured over a period of 15 minutes, should not be more than 5 dB above the ambient (background) L_{A90} noise level, measured during the daytime, evening and night-time periods at the nearest sensitive receivers.

To provide protection against impacts on amenity, the INP specifies suitable maximum noise levels for particular land uses and activities during the daytime, evening and night-time periods.

6.3.7. Potential Impacts

(a) Construction phase

Construction noise impacts

To provide detailed assessment of potential noise impacts from construction works, a noise propagation model was established utilising Sound PLAN (version 7.2) software.

In practice, the predicted noise levels would depend upon the number of plant items and equipment operating at any one time and their precise location relative to the receiver of interest. A receiver would therefore experience a range of values, representing the variation in construction noise depending upon the location of the particular construction activity and the likelihood of the equipment of interest operating simultaneously.

Accordingly, the predictions represent worst-case scenarios, as the predicted noise levels include the cumulative impact from all works occurring at the same time. It is also noted that the works would not be likely to be continuous for extended periods of time, noise levels would be expected to be lower than the calculated levels.

A summary of the predicted day and evening $L_{Aeq\ (15minute)}$ noise levels at the nearest potentially affected receivers in the vicinity of the proposed works is provided in Table 21 and Table 22. A comparison with the relevant NMLs is also presented.

Table 21: Predicted construction noise impacts, Standard Working Hours – Oatley Railway Station Upgrade, $L_{Aeq\ (15\ minute}$

Scenario	Receiver	Predicted	RBL	NML	RBL Exceedence
Demolition of existing structure and site clearing	R1	**87**	42	52	45
	R2	**72**	42	52	30
	R3	**67**	42	52	25
	R4	**69**	42	52	27
	R5	**77**	44	54	33
	R6	**76**	44	54	32
	R7	**78**	n/a	70	n/a
Relocation of services and preparation of structure	R1	**74**	42	52	32
	R2	**60**	42	52	18
	R3	**54**	42	52	12
	R4	**56**	42	52	14
	R5	**63**	44	54	19
	R6	**62**	44	54	18
	R7	**66**	n/a	70	n/a
Construction of Access Bridge, Deck Support System, Lift Shafts and Stairs	R1	**78**	42	52	36
	R2	**63**	42	52	21
	R3	**58**	42	52	16
	R4	**60**	42	52	18
	R5	**67**	44	54	23
	R6	**66**	44	54	22
	R7	**69**	n/a	70	n/a
Construction of external cladding	R1	**73**	42	52	31
	R2	**58**	42	52	16
	R3	**53**	42	52	11
	R4	**55**	42	52	13
	R5	**62**	44	54	18
	R6	**61**	44	54	17
	R7	**64**	n/a	70	n/a

Notes:
All values expressed as dB(A) and rounded to nearest 1 dB(A)
Standard Hours are 7am – 6pm Mon – Fri and 8am – 1pm Saturday
Predicted Noise Levels highlighted in RED denotes Highly Noise Affected in accordance to the ICNG
RBL exceedance highlighted in denotes Noticeable (0-10 dB(A)), denotes Clearly Audible (10-20 dB(A)), ORANGE denotes Moderately Intrusive (20-30 dB(A)) and denotes Highly Intrusive (> 30 dB(A))

A worst case exceedance of the daytime (standard construction hours) $L_{Aeq\ (15minute)}$ background noise level of up to 45 dBA is predicted at the most affected sensitive receiver R1 during scenario 'demolition of existing structure and site clearing'. It is noted that these works are restricted to the daytime periods only.

Table 22: Predicted construction noise impacts, Standard Working Hours – Oatley Commuter Car Park Upgrade, $L_{Aeq\ (15\ minute)}$

Scenario	Receiver	Predicted	RBL	NML	RBL Exceedence.
Site clearing and bulk earthworks	R1	**63**	42	52	21
	R2	**63**	42	52	21
	R3	**70**	42	52	28
	R4	**84**	42	52	42
	R5	**49**	44	54	5
	R6	**61**	44	54	17
	R7	**68**	n/a	70	n/a
Excavation and installation of drainage	R1	**53**	42	52	11
	R2	**53**	42	52	11
	R3	**59**	42	52	17
	R4	**73**	42	52	31
	R5	**41**	44	54	-
	R6	**51**	44	54	7
	R7	**57**	n/a	70	n/a
Pavement works including laying concrete and asphaltic surface and footpaths	R1	**61**	42	52	19
	R2	**61**	42	52	19
	R3	**68**	42	52	26
	R4	**81**	42	52	39
	R5	**50**	44	54	6
	R6	**59**	44	54	15
	R7	**66**	n/a	70	n/a
Line-markings and signposting	R1	**45**	42	52	3
	R2	**45**	42	52	3
	R3	**53**	42	52	11
	R4	**68**	42	52	26
	R5	**60**	44	54	-
	R6	**43**	44	54	-
	R7	**50**	n/a	70	n/a
Landscaping	R1	**50**	42	52	8
	R2	**50**	42	52	8
	R3	**57**	42	52	15

Scenario	Receiver	Predicted	RBL	NML	RBL Exceedence.
	R4	**71**	42	52	29
	R5	**35**	44	54	-
	R6	**48**	44	54	4
	R7	**55**	n/a	70	n/a

Notes:
All values expressed as dB(A) and rounded to nearest 1 dB(A)
Standard Hours are 7am – 6pm Mon – Fri and 8am – 1pm Saturday
Predicted Noise Levels highlighted in RED denotes Highly Noise Affected in accordance to the ICNG
RBL exceedance highlighted in denotes Noticeable (0-10 dB(A)), BLUE denotes Clearly Audible (10-20 dB(A)), ORANGE denotes Moderately Intrusive (20-30 dB(A)) and denotes Highly Intrusive (> 30 dB(A))

A worst case exceedance of the daytime (standard construction hours) $L_{Aeq(15minute)}$ background noise level of up to 45 dBA is predicted at the most affected sensitive receiver R1 during scenario 'demolition of existing structure and site clearing'. It is noted that these works are restricted to the daytime periods only.

Several receivers surrounding the construction works are expected to potentially be highly noise affected when equipment is operating immediately adjacent during 'Demolition of existing structure and site clearing' works associated with the Oatley Railway Station Accessibility Upgrade and 'Site clearing and bulk earthworks' and 'Pavement works including laying concrete and asphaltic surface and footpaths' works associated with the Oatley Commuter Car Park Upgrade.

In order to minimise the potential noise and vibration impacts upon nearby sensitive receivers, most construction works are proposed to be undertaken during standard daytime construction periods (7.00am to 6.00pm Monday to Friday, and 8.00am to 1.00pm on Saturdays).

Works outside of Standard Working Hours

Some works would be undertaken outside of standard construction hours. It is anticipated that approximately nine (9) track possessions would be required to undertake the project, and these would be likely to require works to be undertaken out of standard daytime construction hours.

Such works include 'Concrete Pour, Piling and Installation of Pre-cast Sections of Overhead Footbridge' activities. These activities form part of the 'Relocation of Services and Preparation of Structure' and 'Construction of Access Bridge, Deck Support, System, Lift Shafts and Stairs' works. Noise impacts from these works have been predicted and assessed against the evening and night-time Noise Management Levels (NML).

The worst-case exceedences of the evening and night-time NMLs of up to 33 dB(A) and up to 38 dB(A) are predicted respectively at the most affected sensitive receivers (R1, R4 and R5) during Construction of Access Bridge, Deck Support, System, Lift Shafts and Stairs works.

It is likely that deliveries may also take place outside standard daytime construction hours. Due to the low existing background noise levels, due to RMS or other safety requirements, deliveries outside standard construction hours may potentially exceed the out of hours NMLs.

Implementation of all reasonable and feasible measures identified in the Construction Noise Strategy (TfNSW 2012) would see impacts as a result of noise and vibration minimised where possible.

Construction vibration impacts

The major potential sources of vibration from the proposed construction activities are during rock breaking, piling boring, hydraulic hammering and jack hammering.

As a guide, safe working distances for typical items of vibration intensive plant are listed in Table 20. These safe working distances presented in Table 16 are indicative only and would vary depending on the particular item of plant and local geotechnical conditions. They apply to typical buildings under typical geotechnical conditions.

Based on the indicative plant and equipment to be used, and the distance to adjacent sensitive receivers, exceedances of the human comfort vibration levels at potential sensitive receivers as a result of construction activities.

Key items of heritage significance are the heritage platform building and the signal hut (to the south of the platform). Based on distances of separation present, there is the potential for recommended safe working distances to be encroached for activities undertaken near the heritage platform building.

Vibration intensive plant utilised near heritage structures (mobile sources, hydraulic hammering, jack hammering, vibratory rolling or similar) would be required to be managed to prevent structural damage occurring. Mitigation includes the preparation and implementation of a site-specific Construction Noise and Vibration Management Plan (NVMP) in accordance with the requirements of the Construction Noise Strategy. Refer to Section 6.3.8 for further details.

(b) Operational phase

Oatley Railway Station

It is understood that operations of Oatley Railway Station would remain unchanged due to the proposed upgrade. Therefore, operational noise impact from Oatley Railway Station is unlikely to increase following the completion of the station accessibility upgrade.

Any mechanical plant (such as ventilation) installed due to the proposed station accessibility upgrade would be designed to achieve the project specific operational noise criteria presented in Table 23 and free from annoying sound characteristics such as tonality, low frequency, impulsiveness and intermittency.

As an indication, based on the night time INP Intrusiveness noise goal at 12 Oatley Parade (nearest receivers), the overall L_{Aeq} Sound Power Level emissions from the station accessibility upgrade noise sources should not exceed 74 dB(A) for night time, 80 dB(A) for evening and 83 dB(A) for daytime operations.

Table 23: Industrial Noise Policy criteria for operational noise emissions at residential receivers (dB(A)

Time of day	ANL (period)	RBL L_{A90} (15minute)	Measured $L_{Aeq\ (15minute)}$	Intrusive Criteria $L_{Aeq\ (15minute)}$	Amenity Criteria $L_{Aeq\ (Period)}$
Daytime (0700 – 1800)	55	42	56	47	47
Evening (1800 – 2200)	45	40	54	45	44
Night-time (2200 – 0700)	40	35	48	40	38

Notes:
All values expressed as dB(A) and rounded to nearest 1 dB(A)
L_{Aeq} is the equivalent continuous (energy average) A-weighted sound pressure level. It is defined as the steady sound level that contains the same amount of acoustic energy as the corresponding time-varying sound.
L_{A90} is the noise level present for 90% of time (background level). The average minimum background sound level (in the absence of the source under consideration).
ANL Acceptable Noise Level for a suburban area

Commuter car park

Operational noise emissions have been predicted based on the concept design for the commuter car park. Acoustic modelling of the car park noise emissions was carried out using the methodology of Bayerisches Landesamt für Umwelt's report Parking Area Noise.

The Parking Area Noise prediction methodology utilises an L_{Aeq} based source sound power level that is representative of one complete vehicle movement in one hour for normal parking motions (i.e. entering the car park, searching for a car parking space, open and closing car doors, re-starting the engine and exiting the car park). The major variables accounted for in this methodology therefore include the number of vehicle movements, the location of the car park relative to noise sensitive receivers and the surface finish (e.g. sealed asphalt, unsealed gravel and associated).

Predicted average and maximum noise levels from the operation of the expanded commuter car park are presented in Table 24 and Table 25 respectively.

Table 24: Predicted commuter car park Noise Levels (average) at Nearest Sensitive Receivers (dB(A))

Receiver	Receiver Type	Period	$L_{Aeq,\ 15\ minute}$	$L_{Aeq,\ Period}$	INP Criteria	Exceedance
R1	Residential	Day	34	30	47	Nil
		Night	25	23	38	Nil
R2	Residential	Day	34	30	47	Nil
		Night	25	23	38	Nil

Receiver	Receiver Type	Period	$L_{Aeq, 15\ minute}$	$L_{Aeq, Period}$	INP Criteria	Exceedance
R3	Residential	Day	40	36	47	Nil
		Night	38	31	29	Nil
R4	Residential	Day	47	42	38	Nil
		Night	38	33	31	Nil
R5	Residential	Day	47	40	36	Nil
		Night	38	31	29	Nil
R6	Residential	Day	47	33	29	Nil
		Night	38	24	22	Nil
R7	Commercial	Day	47	40	36	Nil

Notes:
All values expressed as dB(A) and rounded to nearest 1 dB(A)
INP – Industrial Noise Policy (NSW EPA)
Noise Levels for the evening period are not covered in the Parking Area Noise prediction methodology and are therefore not provided.
A conservative 10 dB attenuation from the existing 2.1 metres high solid masonry along the northern boundary of the Uniting Care Retirement Village has been taken into account in the predicted levels.

Table 25: Predicted maximum noise events from Commuter Car Park at residential receivers (dB(A))

Receiver	Maximum Noise Level $L_{A1\ (1\ minute)}$	Sleep Disturbance External Screening Assessment Level	Exceedance
R1	34 to 44	50	Nil
R2	29 to 44	50	Nil
R3	36 to 51	50	Nil
R4	37 to 52	50	2
R5	25 to 40	45	Nil
R6	18 to 33	45	Nil

Note:
Noise source includes cars accelerating/starting/closing doors/moving.
All values expressed as dB(A) and rounded to nearest 1 dB(A)

Average noise levels from the commuter car park are shown to comply with the Proposal-specific noise criteria shown at Table 23. As the commuter car park noise levels are predicted to comply with the noise goals during the daytime and night-time periods, it can be assumed that the noise levels during the evening period are likely to achieve compliance.

With regard to short-term noise events such as door closings, cars accelerating, engine starts etc, noise propagation calculations have been undertaken in order to predict the $L_{A1(60second)}$ noise levels from such activities at the nearest sensitive receivers. The $L_{A1(60second)}$

is comparable to the typical maximum noise level of a particular event and are used to determine whether a particular noise event has the potential to cause sleep disturbance.

Where construction noise works are required during the night time period, the 'Application Notes – NSW Industrial Noise Policy' guidance for sleep disturbance or sleep arousal would be applied to assess the proposed works.

The predicted $L_{A1\ (1\ minute)}$ noise levels show 1 to 2 dB(A) exceedances of the 50 dB(A) sleep disturbance criteria during car accelerating and car starting events at receivers R3 and R4. Predicted $L_{A1\ (1\ minute)}$ noise levels at receivers R1, R2, R5 and R6 are predicted to comply with the sleep disturbance criteria.

Guidelines that contain additional advice relating to potential sleep disturbance impacts have been considered, including the Road Noise Policy (RNP). The RNP provides a review of research into sleep disturbance. From the research to date, the RNP concludes that:

> *"maximum internal noise levels below 50 dB(A) to 55 dB(A) are unlikely to awaken people from sleep*
>
> *One or two events per night, with maximum internal noise levels of 65 dB(A) to 70 dB(A), are not likely to affect health and wellbeing significantly."*

It is generally accepted that internal noise levels in a dwelling with the windows open are 10 dB lower than external noise levels. Based on a worst case minimum attenuation, with windows open, of 10 dB, worst case short term internal noise levels are at a level that according to the RNP review is unlikely to cause awakening reactions.

Accordingly, as the predicted noise levels only marginally exceed the screening criterion, the impact is considered to be negligible.

Additional road traffic

Only a very minor increase in traffic flow in the surrounding road network would be expected due to the proposed car park upgrade (with a proposed net increase of 17 car spaces). The increase in traffic flow would generally be limited to peak commuter times.

On this basis, the noise level contribution from any additional road traffic to and from the car park would be insignificant when compared to existing levels of traffic noise.

6.3.8. Mitigation measures

During design

- Reference should be made to ASA Engineering Standard ESB 002 Station Design and Standard Requirements which set out guidelines for the incorporation of acoustically absorptive finishes which can control reverberance and improve speech intelligibility from the Station Public Address system.

Construction

- Prior to construction, a site-specific Construction Noise and Vibration Management Plan (NVMP) would be prepared and implemented in accordance with the requirements of the Construction Noise Strategy (TfNSW, 2012a), and the EPA's *Interim Construction Noise Guideline*. The NVMP would take into consideration measures for

reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable.

- Works would be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Works outside these hours may be undertaken if approved by TfNSW. An Out of Hours Work approval would need to be obtained from TfNSW for any works outside normal work hours.
- Construction noise would be managed in accordance with the EPA's Interim Construction Noise Guidelines and TfNSW's Construction Noise Strategy.
- To reduce the construction noise impact from human activities, reasonable and feasible noise mitigation options should be considered, including:
  - Regularly training workers and contractors (such as at toolbox talks) on the importance of minimising noise emissions and how to use equipment in ways to minimise noise
  - Using only the equipment necessary for the upgrade works at any one time
  - Avoiding any unnecessary noise when carrying out manual operations and when operating plant
  - Avoiding/limiting simultaneous operation of noisy plant and equipment within discernible range of a sensitive receiver where possible.
  - Switching off any equipment not in use for extended periods e.g. heavy vehicles engines should be switched off whilst being unloaded.
  - Avoiding deliveries at night/evenings wherever practicable
  - No idling of delivery trucks
  - Keeping truck drivers informed of designated vehicle routes, parking locations and acceptable delivery hours for the site
  - Minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios on site. No dropping of materials from height where practicable, throwing of metal items and slamming of doors.
- To reduce the construction noise and vibration impacts from mechanical activities, reasonable and feasible noise mitigation options should be considered, including:
  - Maximising the offset distance between noisy plant and adjacent sensitive receivers.
  - Directing noise-emitting plant away from sensitive receivers.
  - Using non-tonal reversing alarms, ('quackers') for all plant regularly used on site (greater than one day)
  - Regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc.
  - Fitting mufflers/silencers to pneumatic tools (e.g. breakers) and use residential-grade mufflers on plant.
  - Using quieter and less vibration emitting construction methods where feasible and reasonable.

- Affected pre-schools, schools, universities and other identified sensitive receivers would be consulted in relation to noise mitigation measures to identify any noise sensitive periods, e.g. exam periods. As much as reasonably practicable noise intensive construction works in the vicinity of affected educational buildings are to be minimised.
- Work would be conducted behind temporary hoardings/screens wherever practicable. The installation of construction hoarding should take into consideration the location of residential receivers to ensure that 'line of sight' is broken, where feasible.
- Where the $L_{Aeq\ (15minute)}$ construction noise levels are predicted to exceed 75 dBA, respite periods would be observed. This would include restricting the hours that the very noisy activities can occur.
- Planning of the higher Noise Management Level exceedance activities/locations to be undertaken predominantly during less noise-sensitive periods, where practicable.
- Where attended noise monitoring indicate noise levels are in excess of levels reported within this report and where it is practical and safe to do so, temporary noise screens (or equipment placement) shall be used to shield noisy, fixed works.
- Consultation as per the TfNSW Construction Noise Strategy would be adopted. These would be in line with the following:

Time Period		Mitigation Measures Predicted $L_{Aeq(15min)}$ Noise Level above RBL			
		0 to 10 dB(A) Noticeable	10 to 20 dB(A) Clearly audible	20 to 30 dB(A) Moderately intrusive	>30 dB(A) Highly intrusive
Standard	Mon-Fri (7am-6pm) Sat (8am-1pm) Sun/ Public Hol (Nil)	Nil	Nil	Letterbox drop, Monitoring	Letterbox drop, Monitoring
OOHW Period 1	Mon-Fri (6pm-10pm) Sat (7am to 8am & 1pm-10pm) Sun/ Public Hol (8am -6pm)	Nil	Letterbox Drop	Monitoring, Letterbox Drop	Monitoring, Individual Briefing, Letterbox Drop Project Specific Respite Offer, Phone Calls, Specific Notification
OOHW Period 2	Mon-Fri (10pm-7am) Sat (10pm-7am) Sun/ Public Hol (6pm-8am)	Letterbox Drop	Monitoring, Letterbox Drop	Monitoring, Individual Briefing, Letterbox drop, Phone Calls, Specific Notification	Alternate Accommodation, Monitoring, Individual Briefing, Letterbox Drop, Phone Calls, Specific Notification

Vibration

- Subject to landowner agreement, building condition surveys would be completed on the following buildings/structures prior to proximate piling, excavation or bulk fill or any vibratory impact works including jack hammering and compaction ("Designated Works"):
  - All buildings/structures/roads within a plan distance of 50 metres from the edge of the Designated Works; and
  - All heritage listed buildings and other sensitive structures within 150 metres from the edge of the Designated Works, unless otherwise determined following geotechnical and vibration assessment as endorsed by a qualified geotechnical engineer and as approved by the DPE as not likely to be adversely affected.

  Property condition surveys need not be undertaken if a risk assessment indicates buildings/structures/roads would not be affected as determined by a qualified geotechnical and construction engineering expert with appropriate registration on the National Professional Engineers Register prior to commencement of Designated Works.
- When proposed works within the safe working distances to heritage structures are proposed, works would be carefully planned and monitored to prevent structural damage occurring. Attended vibration monitoring or vibration trials would be undertaken when proposed works are within the safe working distances to heritage structures to ensure that levels remain below the most stringent 2.5mm/s criterion(Table 19).
- Continuous vibration monitoring is to be undertaken during vibration intensive activities, by setting up a continuous vibration logger at one metre from any heritage structure or item
- Additional vibration monitoring to retain structural integrity would be carried out when construction activities are at the nearest point to the heritage station building. This monitoring may signal to the contractor by way of a buzzer or flashing light, when levels approach/exceed the recommended limits for structural damage.

  Management measures may include modification of construction methods such as using smaller plant, establishment of larger minimum working distances, and if necessary, time restrictions for the most excessive vibration activities.
- Noise and vibration emissions shall be qualitatively assessed throughout works and additional measures shall be implemented to prevent jeopardising the intelligibility of the PA system and the safety of commuters and staff as a result.
- Recommended Safe Working Distances for Vibration Intensive Plant in relation to human comfort levels for residential receivers, as per Table 23 would be followed. Where plant and equipment are proposed to be used within the recommended safe working distances to sensitive receivers, works would be carefully planned and monitored. Attended vibration monitoring or vibration trials would be undertaken at the commencement of construction to ensure that levels remain below the applicable criterion.

Refer to Table 27 for a consolidated list of proposed mitigation measures.

6.4. Indigenous Heritage

A search of OEH's AHIMS Web Services (Aboriginal Heritage Information Management System) was undertaken on 31 January 2014. This search indicated that no Aboriginal sites are recorded in or near the Proposal, and no Aboriginal places have been declared in or near the Proposal.

The Proposal is located in an area that has been highly modified for a range of uses. The site has low archaeological potential and therefore it is considered unlikely that any Indigenous heritage items would be located in the vicinity of the proposal, due to the past history of disturbance.

6.4.1. Potential impacts

(a) Construction phase

As no known Indigenous heritage items are located in the vicinity of the proposal works and the potential for unknown items is low, the proposal is unlikely to affect Indigenous heritage during construction.

(b) Operational phase

As no known Indigenous heritage items are located in the vicinity of the proposal works and the potential for unknown items is low, the proposal is unlikely to affect Indigenous heritage during operation.

6.4.2. Mitigation measures

As no known Indigenous heritage items are located in the vicinity of the proposal works, no additional mitigation measures are proposed other than those listed in Table 27.

6.5. Non-indigenous Heritage

The Oatley Railway Station Group is listed on the State Heritage Register, the RailCorp s.170 register and the Kogarah LEP 2012.

Two heritage items nearby are also listed on the Kogarah LEP: Oatley Memorial Gardens and Oatley Memorial Clock (outside the study area).

6.5.1. Existing environment

Oatley Railway Station Group is listed on the SHR (01214), the RailCorp s.170 register and the Kogarah LEP (2012). It is of state significance for aesthetic and historical reasons. The lever room and weatherboard platform building are of particular significance under the *Assessing Heritage Significance 2001* criteria of 'Research Potential' and 'Rarity'.

The Oatley Station Group is of historic significance as part of the 19th century NSW government initiative to construct a State rail network, and as a component of the Illawarra Line which was the first rail line linking the southern coastal region to Sydney and prompted suburban development throughout the region. The establishment of Oatley Station in 1885

led to the growth of the suburb of Oatley, and the station has continued to be of significance as a town centre for the suburb and a part of the local community identity.

The present-day station complex, its relationship to the Oatley Memorial Gardens (which occupy the original rail alignment) and modifications made to the station building in 1905, illustrate the process of re-routing the railway line in 1905. As one of the earliest surviving structural complexes in the town of Oatley, located in a prominent, elevated position within a landscaped setting, the station makes a contribution to the late 19th and early 20th century streetscape character of the town.

The station building is externally, a mostly intact and rare example of the standard station building designed by the Government Architect, known as the 'Initial Island Platform Design'. It contains a rare intact signal room, complete with early 20th century signalling equipment, which is historically significant as an illustration of early railway technology.

The following key aspects of the station form part of the heritage listings:

- 1905 station platform
- 1890 station building which was reconstructed at the current location following relocation of the station in 1905
- 1918 extension to the station building containing the signal room
- Movable heritage items within the station building such as signal panel and levers
- 1905 Mulga Road (River Road) underbridge and pedestrian underpass
- 1920s concrete drop-slab location hut to the south east of the platform
- Douglas Cross Gardens
- Boongarra Reserve to the west of the station.

The Oatley Memorial Gardens located to the east of the station are listed on the Kogarah LEP 2012. No other structures or features within the study area were considered to have heritage significance. No items within the study area are listed on the Hurstville LEP.

The bus shelter near Douglas Cross Gardens, the buildings at 2-12A Oatley Parade (restaurants and café), the buildings at 3-12 Oatley Parade (service station and motor mechanic) and 4-12C Oatley Parade do not have any heritage value. The former Oatley Bowling Club site also has no heritage significance.

Figure 31: Oatley Station SHR heritage curtilage

6.5.2. Potential impacts

The following aspects of the Proposal could impact on the significance of the heritage items:

- **Platform building:** The proposed works to the station building are largely confined to the installation of a new doorway to the ticket office.

  In order to avoid an addition to the heritage-listed building, the service and maintenance facilities would be incorporated into the proposed lift towers and footbridge. Consideration has been given to positioning the new elements some distance from the station building, within the structure of the lift and footbridge, in order avoid visual and physical impacts to the station building.

  It is proposed to convert the existing public toilets into the communications room. This room would require the relocation of the existing northern wall of the toilets approximately one (1) metre to the north. This is very close to the original location of the waiting room wall but within the footprint of the older toilet. The floor of the early toilet was removed during the station upgrade in the 1990s and replaced with new concrete.

  The room would require installation of conduits into the ceiling which is not expected to have any heritage impact. Ventilation grilles would be required to be installed and may be visible from outside the structure. These may impact on the original cladding on the

south wall of the station building. However, cladding has been altered over time and it is not possible to determine if original or early cladding still exists in these locations.

The installation of a new access on the western side of the station would impact partially on fabric potentially dating to the 1890s or the 1905 re-construction of the station, although this location was originally a window opening, removed in 1991, and it is unlikely that the weatherboard in this location is original. The installation of a doorway in this location, therefore, is unlikely to constitute a highly intrusive visual element, providing the finish of the proposed door is in keeping with the existing doorways.

- **Canopies:** Physical impacts to the platform would involve the partial removal of a steel canopy installed in 1992, and the reinstallation of an extended canopy to cover more of the platform. The canopy is not original fabric and the impact of this aspect of the Proposal on the overall heritage significance to the precinct is considered to be minimal.
- **Platform surface:** The platform surface consists of recent bitumen surface over an early loose gravel surface, which has been substantially modified. There would need to be some localised grading of the platform in the location of the new doorway, adjacent to the entry to the lift, at the foot of the stairs and adjacent to the entry to the Family Accessible Toilet. There would be tactile indicators installed along both sides of the island platform along with yellow line marking which would also require minor resurfacing.

  If new concrete coping at the platform edge was required as a result of the re-grading, the new coping would be clearly distinguishable from the old fabric, but would maintain a utilitarian aesthetic.

  Whilst the level of the existing platform may be altered, the works would be in keeping with the railway context in terms of elevation and finish. The proposed works would not have a negative visual impact on the station, or affect the heritage significance of the precinct.
- **Platform:** The installation of the lift towers and stairs would impact on the northern end of the platform, listed as being an early structure with some alterations.

  The base of the proposed lift shaft would measure approximately 2.5 by 2.5m and the base of the stair is approximately 3m in width. Some excavation of the platform would be required for the installation of these elements, and therefore may impact on the original fabric of the island platform.
- **Stairs:** Access to the platform is currently via the original stairway to/from the River Road underpass. The stairs are conceptually important to the identity of the station and its connection to the surrounding built environment. There would be a loss of access via the original stairs due to safety constraints around the proposed lift tower access at the northern end of the platform. There would be alteration of the visual relationship between the station and the proposed lift tower on the western side of the railway line, within Boongarra Reserve.

  The existing stair access cannot be adapted to be DDA compliant because of the narrow platform width and the pedestrian circulation requirements outside the new lift, and because of the limitations of the existing footpath beneath the underpass.

  The existing stairway is not compliant with current BCA and ASA standards and also leads to a narrow footpath with safety and compliance issues, whereby pedestrians on

the western side of the station are being channelled into an unsafe road environment with crossing points with poor sight lines and conflicting traffic movements.

For the continued functionality of the heritage item as an operational railway station, access to the station needs to be DDA compliant. This can only be achieved through the construction of alternative access i.e. lifts external to the station. Locating any new access further from the heritage item would be in conflict with its purpose and may create a greater visual impact on the station environment as a whole.

It is proposed to retain the stairs and to install Bostwick style gates at the top and bottom to prevent access. A subtle heritage link/feature may be incorporated into the design.

- **Overhead footbridge:** The proposed new overhead footbridge would incorporate the oviform arch of the underpass into the footbridge design, echoing the frame of the original access along the length of the canopy and northern side of the structure.

  The oversized proportions of the lift towers would be broken down into more sympathetic forms. These vertical elements also serve to fracture the continuity of the footbridge, reducing the impact to the concept of the island platform.

  Construction of the overhead footbridge at Oatley would affect the station precinct and have visual impact on the surrounding environment. The areas of impact, including the proposed eastern and western entrances of the station, all fall within the SHR curtilage for the station. The overhead footbridge and associated structures would not have a direct impact on the fabric of the weatherboard station building, as it is to be located approximately 20m north of the building on the station platform. Similarly, the points of impact of the proposed structure would not affect significant fabric on the station platform or at the location of the proposed entrances. However, the overhead footbridge may affect the heritage significance of the Station Group under the aesthetic criterion.

  The overhead footbridge would afford a new perspective on the station. The island status of the station would be emphasised, with views to the north and south showing the curve of the lines and the platform itself. There is an opportunity to enhance the aesthetics of the existing stairwell by removing the canopy and any extraneous material so that the connection between the underpass and the platform is maintained visually. This visual connection would be further improved by the glass elevator and footbridge that would afford a new perspective on the original configuration.

- **Underpass:** The visual relationship between the underbridge and the surrounding environment is likely to be impacted by the construction of the overhead footbridge and associated lift towers.

  The current design aims to minimise the impact of the structures by locating the stairs on the western side of the station away from the underpass, on the southern side of the footbridge. The stairs would be partially situated in the embankment and out of prominent view, reducing the visual impact. It is understood that the design of the new elements would attempt to incorporate visual links that create a meaningful relationship between the old and new structures.

- **Views and vistas:** The proposed overhead footbridge would have an impact on views into and out of the heritage railway station precinct. The proposal would intrude upon views on the western side of the railway line, in the vicinity of the proposed Boongarra Reserve forecourt, stairs and lift shaft. Views into the station precinct are currently

screened by mature vegetation, although the platform building is visible through gaps in the vegetation screen. The Proposal would remove some of this vegetation, opening up views into the station from the west.

While the proposed overhead footbridge would be designed to blend in with the surrounding landscape, and new landscaping would also partially mitigate visual impacts, the proposed overhead footbridge would be a visual contrast with the weatherboard platform building through its required bulk and scale.

The overhead footbridge may provide pedestrians with views into the station precinct, and add to the heritage significance of the place by allowing the heritage aesthetics of the platform building to be appreciated from a height, and in conjunction with the gently curving platform and train line south. However, the building and platform may be partly screened by the existing and proposed canopy, and any benefits of this view are difficult to determine at the current design stage.

- **The station and environs:** Construction of the overhead footbridge at Oatley would affect the station as a whole and have some impact on the surrounding environment.

  The new overhead footbridge would be the dominant feature in the landscape, particularly from the western side.

  The areas of impact, including the eastern and western entrances of the station, all fall within the SHR curtilage. The overhead footbridge and associated structures would not have a direct impact on the fabric of the weatherboard station building, as they are to be located approximately 20m north of the building on the station platform.

  Similarly, the points of impact of the proposed structure would not affect significant fabric on the station platform or at the location of the proposed entrances. However, the overhead footbridge may significantly affect the heritage significance of the Station Group under criterion C (aesthetic). The significance of the group under criterion C (aesthetic) has been described on the SHR as:

  > *Oatley Railway station is of aesthetic significance for its landscape setting, flanked by parks to east and west at its northern end, and for its simple yet attractive Federation Queen Anne style-influenced weatherboard platform building.*

  The current overhead footbridge design has attempted to minimise impact to the heritage value of the Oatley Station Group through the use of forms that are sympathetic to the surrounding built environment and that are clearly distinguishable from the heritage fabric of the station building and original components of the platform and surrounds.

  Despite the impacts to the surrounding landscape, the station would retain its parkland setting on the eastern and western sides. The currently under-utilised grassy reserve immediately west of the embankment would become the western entrance to the station. The introduction of garden beds and new trees would both re-invigorate the space and serve to break up the vertical form of the lift tower on the western side.

  On the eastern side of the station there would be some limited impacts to the configuration of the Douglas Cross Garden. Lift Tower 1 would require partial reconstruction of the pond on its eastern side. All other features of Douglas Cross Garden would be retained as far as possible.

There is no visual connection between the Memorial Gardens and the station building due to existing buildings and dense vegetation. It is not anticipated that the proposed alterations to the platform and station buildings would impact on the heritage significance of the Memorial Gardens.

There is no visual connection between the Memorial Clock and the Proposal.

6.5.3. Mitigation measures

- A section 60 approval under the *Heritage Act 1977* would be obtained from the NSW Heritage Council prior to works commencing

  The final design would be sympathetic to the original design of the heritage building. The materials and colour palette for the overhead footbridge would be sympathetic to the heritage context of the railway station. Colour is to be used to separate the overhead footbridge structure from the pale weatherboard building, and the use of modern, light materials would further reduce the visual bulk of the overhead footbridge.

  The visual impact of the ventilation grilles required for the communications room would be reduced if the condensors are able to be located in the ceiling cavity, and this is the preferred option with the least impact. The grilles would be powder coated to match the existing building finish.

- For any alterations to the platform building, as much as practicable of the original fabric of the building, and internal features would be retained in situ. Any new partitions are to be timber-framed to allow future removal. Any ceiling services are to be suspended/limited to avoid penetrations into the ceiling, and service penetrations into external walls are to be minimised.

- The Contractor would be required to prepare a Construction Environmental Management Plan that specifically addresses the heritage impacts and required mitigation measures

- Non-Indigenous heritage items and the SHR curtilage would be identified on the construction contractor's Environmental Constraints Maps (ECMs)

- The Contractor is to provide a heritage induction to workers before construction begins, informing them of the location of known heritage items and guidelines to follow if unanticipated heritage items or deposits are located during construction

- Construction impacts, such as vibration and dust on adjacent items must be avoided. In particular, the Contractor would prepare details of how impacts of dust and vibration from the construction work at the entrance to the Ticket Office would be minimised – this would be specifically addressed in the CEMP

- To effectively mitigate potential impacts of vibration on Oatley Station and other heritage items, activities that cause vibration would be managed in accordance with German Standard DIN 4150 – Part 3 (DIN 1999) which has specific standards relating to heritage

- If previously unidentified Indigenous or non-indigenous heritage/archaeological items are uncovered during the works, all works must cease in the vicinity of the material/find and TfNSW is to be contacted immediately. Works in the vicinity of the find must not re-commence until clearance has been received from TfNSW

- Changes to the form, fabric and landscape setting of the Oatley Railway Station would be submitted to the Heritage Office and Sydney Trains, to be recorded in the Heritage inventory for this item
- An Archival Record would be made of the Station Building in accordance with the following guidelines: *How to Prepare Archival Records of Heritage Items* (NSW Heritage Office 1998) and *Photographic Recording of Heritage Items Using Film or Digital Capture* (NSW Heritage Office 2006). In addition, internal and external scanning of the station building is to be undertaken with a #D laser device, in a suitable electronic data format (i.e. CAD software or equivalent).
- Copies of the 'as built' construction plans, photographs illustrating the completed works and the Archival Record would be lodged with Heritage Office and Sydney Trains Environment Division as a documentary record of changes to the station precinct
- Should platform re-grading be required adjacent to the platform station building, the fabric of the station building would be protected via a geo-textile fabric or similar. adequate measures would be taken to protect existing steps, posts, door jambs and weatherboard panels from direct contact with any new surface materials.
- The original fabric of the River Road underbridge and pedestrian subway is to be retained
- The existing stairs would be retained visually and closed off with metal mesh gates (possibly with Bostwick style steel gates similar to those at Museum Station, if compliant to current Standards)
- The stairwell is to be restored to its original condition by removing the section of canopy between the end of the platform and the top of the stairs so that the connection between the underpass and the platform is maintained visually.
- All intact equipment presently located in the signal room associated with lever operations is to be retained and conserved. As far as practicable, clear views into the signal room would be enhanced, including by relocation of the vending machines and pay phone at the northern end of the platform building.
- Unnecessary loss of screening vegetation and trees alongside the railway corridor and within the Douglas Cross Gardens is to be avoided where possible.
- Landscaping and vegetation within the Douglas Cross Gardens is to be retained where possible. Any damaged or removed elements would be replaced once works are completed.
- Heritage values would be maintained by use/reuse of local stone and the planting palette to reflect the character of Oatley and its surrounding context e.g. similar materials from the Douglas Cross Gardens would be utilised in the eastern forecourt spaces to maintain consistency
- Any areas of 'blank' stair wall would be softened in appearance and would meet sustainability outcomes through artwork and large plantings to the base of the bike rack
- The disturbed embankment on the western side of the corridor is to be stabilised and re-vegetated and shored up. Replacement landscaping is to mitigate the visual impact of removed vegetation and tie the new construction to the surrounding area.
- Surfaces of heritage items are to be protected as appropriate through use of plywood sheeting or similar, particularly during any platform works

- TfNSW would provide alternative locations for the existing vending machines and pay phone, so that the lever room and its fittings at the northern end of the platform building can be visually inspected by the community from the platform
- A minimum of one heritage interpretive panel (at A1 size or greater) would be located in a conspicuous location on the platform
- The finishes to the heritage building would be treated in a similar colour and finish to the existing, and any new fixtures (electrical or plumbing conduits) are to be sympathetically attached to the walls (i.e. colour and fixings)

Refer to Table 27 for a consolidated list of proposed mitigation measures.

6.6. Socio-economic impacts

Oatley Station is on the boundary between the LGAs of Hurstville and Kogarah. The 2011 population for Oatley was 10,098, with an average of 1.9 children per family and 2.7 people per household, and with a median age of 41 years.

Oatley is an established residential area, with substantial parklands. There is an industrial area in the north-west, and a commercial area east of the railway station.

Major features of the area which provide drivers for public transport demand include the numerous schools (including the nearby Georges River College Oatley Senior Campus) and recreational facilities such as Oatley Park, Oatley Baths, Lime Kiln Bay Bushland Sanctuary, Myles Dunphy Bushland Reserve, Meade Park, Simpson Reserve, Renown Park, Moore Reserve & Wetlands, Oatley Memorial Gardens, Oatley Pleasure Grounds, Oatley Point Reserve, Colebourne Street Reserve, and Wyong Street Reserve.

Oatley Station and its interchange facilities have the potential to provide access to jobs in the Sydney CBD as well as within the sub region: including Sutherland and the Hurstville and Kogarah major centres. The South Subregion strategy aims to provide capacity for 5,000 additional jobs in Hurstville to 2031, and an additional 2,000 jobs are targeted in the Kogarah Town Centre. Kogarah is also the focus for St George Hospital which is targeted for additional health, medical, educational and finance related industry jobs.

6.6.1. Existing environment

Oatley is ranked the 125th busiest station in the Sydney Trains network, with weekday station entries and exits of 3,440 customers.

Besides Journey To Work (JTW), other users of public transport are likely to be school-age children and older people. Overall, Oatley has a larger percentage of 'Older Workers and pre-retirees' and a smaller percentage of 'Young workforce' and 'Parents and homebuilders' than the Greater Sydney average.

Compared to Greater Sydney, the eastern side of Oatley (Kogarah LGA) has larger percentage of:

- Empty nesters and retirees (60-69 years)
- Seniors (70 to 84 years)
- Elderly aged (85 years and over).

Compared to Greater Sydney, the eastern side of Oatley (Kogarah LGA) has smaller percentage of:

- Tertiary education and independence (18 to 24 years).

The western or Hurstville LGA side of Oatley has a larger percentage of 'Primary schoolers' than the Greater Sydney average.

Overall, in 2011 there was a higher proportion of persons in employment and a lower proportion of unemployed. In terms of disability, the average percentage of those needing assistance with core activities in Oatley overall is 3.55% compared to Greater Sydney's 4.4%.

Sources: www.censusdata.abs.gov.au
http://profile.id.com.au/hurstville and http://profile.id.com.au/kogarah

Data indicates that there is 10% population growth and 15% employment growth forecast up to 2036 in the travel zones immediately adjacent to the station. However, no major developments are proposed in the area, with the exception of the possible aged care facility on the former bowling green, which would have a negligible impact in terms of future patronage demand for Oatley Station.

6.6.2. Potential impacts

(a) Construction phase

The proposed works could have potential impacts to local businesses, pedestrians and drivers during the construction phase of the interchange upgrade. This would potentially include:

- Changes to access arrangements including pedestrian diversions
- Relocation of buses, taxis, and kiss and ride during construction
- Pedestrian/vehicle conflicts
- Temporary changes to parking conditions
- Temporary loss of parking spaces
- Construction noise and visual impacts.
- Short delays to commuters accessing the platforms, or to pedestrians using the underpass to cross the corridor
- The existing retail area immediately outside the station in Oatley Parade could have disruptions to trading at certain times, due to changes to pedestrian or delivery activities associated with construction
- The demolition of the existing bus shelter and gardener's store room would impact on these users
- Potential for damage to existing utilities, including high voltage electricity lines.

(b) Operational phase

The long term operational impacts of the Proposal would primarily be positive for the Oatley Town Centre and surrounding area. The Proposal would provide improved amenity with links between different modes of transport, making access more convenient and efficient.

The Proposal would also facilitate extension of transport networks to connect the population to the existing and proposed expanded employment opportunities at the major centres of Hurstville/Kogarah and Sutherland. Access to local recreational facilities would also be enhanced. This would support a reduction in cross-regional trips, resulting in reduced need to use private cars.

The Proposal has been designed having regard to the four key principles established in the Crime Prevention through Environmental Design (CPTED) criteria as follows:

- Natural surveillance – clear sight lines would be provided within through the station entry forecourts. The wider through areas, improved lighting and additional number of commuters using the facility would improve surveillance.
- Access control –pedestrian access points would be located in more highly visible locations
- Territorial reinforcement – the proposed works to the concourse and the forecourts are extensions to the existing rail infrastructure facilities and are appropriate for the interchange precinct and town centre, and
- Space/activity management – the proposed station upgrade has been designed to avoid creating spaces that would compromise the safety of users and adjoining residents.

There are unlikely to be any long term negative socio-economic impacts as a result of the proposed works. Impacts are likely to be positive in terms of amenity, including public safety, security, views, and a sense of wellbeing.

6.6.3. Mitigation measures

- The proposed sustainability criteria for the project would encourage the contractor to purchase goods and services locally, helping to ensure the local community benefits from the construction of the Proposal.
- A number of noise mitigation measures would be implemented to minimise impacts on local businesses. Refer to Section 6.3 for discussion on the potential for noise impacts and for the environmental safeguards for construction noise.
- A CTMP would be developed to address changed traffic and pedestrian conditions. Refer to Section 6.1 for details.
- The Consultation Strategy would identify all potential stakeholders and the methods for consultation with these groups during construction. The plan would also encourage feedback and facilitate opportunities for the community and other stakeholders.
- Contact details for a 24-hour construction response line, project infoline and email address would be provided for ongoing stakeholder contact throughout the construction phase.

- Provide protective screening in accordance with RTA TD2002/RS02 to elevated walkways and concourse areas particularly where persons traverse above or immediately adjacent to the rail corridor
- Assess and treat areas of particular relevance where the public can climb or potentially fall from structures including interfaces with other structures and the potential for shortcutting or skylarking
- Consider enclosed walkway or at minimum increased railing heights
- Designs to use anti-climb materials such as panelling, glazing or close weld mesh, and vertical rather than horizontal supporting structure
- Close off areas directly underneath existing or proposed stairs (e.g. wall, grill or other type of barrier) in a manner that prevents access and / or loitering
- Design the lift shafts with glazing such that passengers are visible at all times.
- As part of the detailed design development, hold a Security Risk Workshop to further assess risk. This would, for example, determine camera placements to reduce blind spots as a result of new works, and consider lighting levels and the like, to ensure the design adequately delivers on security requirements for the station and interchange.

Refer to Table 27 for a consolidated list of proposed mitigation measures.

6.7. Biodiversity

6.7.1. Existing environment

A *Flora and Fauna Assessment* (Biosis, February 2014) was undertaken to assess the current state of the terrestrial flora and fauna in the vicinity of Oatley Railway Station. The results of that assessment, (which covers an area more extensive that the construction footprint of the Proposal) is summarised below.

The study area is within the:

- Sydney Basin Bioregion
- Georges River catchment
- Sydney Metro Catchment Management Area (CMA)
- Hurstville and Kogarah Local Government Area (LGA) (note: the LGA boundary runs straight through the train station).

Oatley is predominately a residential suburb, with a number of natural bush areas and remnant trees in gardens and along streets. Of particular note to this project is Myles Dunphy Reserve, which is located to the south-west of the station. Myles Dunphy Reserve forms a large patch of remnant native vegetation in good condition, and is known to support a number of threatened flora and fauna species and threatened ecological communities.

The proposed project footprint is located either side of the rail corridor along the entirety of the Oatley Station platform. Within the development footprint, much of the remnant native vegetation has been removed or altered with remaining native vegetation in a patchy and highly fragmented state.

These modified vegetation communities would support opportunistic and resilient native fauna, often associated with urban habitats. Due to the presence of the rail corridor, connectivity between Mulga Road and Oatley Parade is almost non-existent other than for mobile avifauna species.

The vegetation and fauna habitat throughout the majority of the study area has been modified by changes in landuse throughout the local area. Remnant vegetation has predominantly been cleared to make way for residential, commercial and recreational development. Such development includes the commuter carpark, Oatley Memorial Park, the rail corridor and the Douglas Cross Gardens on the corner of Oatley Parade and River Road.

The study area supports four separate vegetation communities based on condition and floristic composition, including two native vegetation communities and two exotic vegetation communities, including:

- Degraded hinterland sandstone gully forest (native)
- Mown exotic grasses and ornamental plantings (exotic)
- Modified eucalypt woodland (native)
- Exotic closed woodland (exotic).

Figure 32 shows the boundaries of the respective vegetation assemblages.

Degraded Hinterland Sandstone Gully Forest

The degraded hinterland sandstone gully forest within the study area was present in the form of scattered remnant trees, confined to the southern boundary of Boondarra Reserve.

Mature Blackbutt *Eucalyptus pilularis*, Narrow-leaved Scribbly Gum *Eucalyptus racemosa* and a single Sydney Red Gum *Angophora costata* formed the canopy.

The midstory was limited to scattered Cheese Tree *Glochidion ferdinandi* with a groundstorey of mown exotic grasses including Rhodes Grass *Chloris gayana*, Common Couch *Cynodon dactylon*, Goose Grass *Eleusine tristachya*, Paspalum *Paspalum dilatatum* and Buffalo Grass *Stenotaphrum secundatum*.

Additionally, scattered lawn exotics including Burr Medic *Medicago polymorpha*, White Clover *Trifolium repens*, Dandelion *Taraxacum officinale* and Catsear *Hypochaeris radicata*.

During flowering periods the canopy tree species may provide some level of suitable foraging resources for threatened species, such as Cockatoos (i.e. Gang-gang Cockatoo *Callocephalon fimbriatum*, Glossy Black-cockatoo *Calyptorhynchus lathami* and Major Mitchell's Cockatoo *Lophochroa leadbeateri*). However it is considered somewhat unlikely due to the limited extent of suitable habitat and proximity of this area to the railway (< 20m) and urban nature of the surrounds.

These feed trees may also provide some limited foraging resources for the Grey-headed flying-fox (GHFF) *Pteropus poliocephalus*, however, given the availability of significant areas of larger, better quality habitat in the locality, the significance of the scattered habitat resources in this area is considered to be low.

The trees in this area are not anticipated to be impacted by the proposed works. This community was not considered to represent the *TSC Act* listed *Endangered Ecological*

Community Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion.

Mown Exotic Grasses and Ornamental Plantings

Mown exotic grasses and ornamental plantings surround the site of the Proposal – Douglas Cross Gardens, parts of the Oatley Memorial Gardens, and Boongarra Reserve. These recreational areas and associated disturbed soils, contained mown exotic grasses and ornamental plantings. The topsoils have been modified by historic vegetation removal and introduction of topsoil and organic matter.

This community was comprised almost exclusively of exotic species. The canopy was sparse, but included Brush Box *Lophostemon confertus*, Monterey Cypress *Cupressus macrocarpa* and Jacaranda *Jacaranda mimosifolia*. Pepper Tree *Schinus areira* are common throughout the recreational areas along with scattered Cocos Palm Syagrus romanzoffiana and Chinese Elm *Ulmus parvifolia*. Dominant shrubs include *Abelia* sp., *Photinia* sp., Agapanthus *Agapanthus praecox* and *Strelitzia reginae*.

Typical groundstorey species present included Rhodes Grass *Chloris gayana*, Common Couch, Goose Grass, Paspalum *Paspalum dilatatum* and Buffalo Grass, Summer Grass *Digitaria ciliaris*, Paspalum and Panic Veldtgrass *Ehrharta erecta*.

Scattered exotic forbs included Red-flowered Mallow *Modiola caroliniana*, White Clover, Scarlet Pimpernel *Anagallis arvensis*, Oxalis sp and Catsear. The high proportion of exotic species and maintained nature of this community means that it is of little ecological value.

The mown exotic grasses and ornamental plantings vegetation community provides little in way of suitable native vegetation and habitat for threatened fauna. This community has been planted around a fast-flowing man-made fountain, which was observed to provide breeding habitat for the Striped marsh frog *Limnodynastes peronii* with floating egg masses attached to overhanging vegetation observed. This area is not considered to provide any potential habitat for any threatened frogs

None of the flora and fauna identified are listed as threatened under the Commonwealth *EPBC Act* or NSW *TSC Act*.

Modified Eucalypt Woodland

The modified eucalypt woodland is located around the existing commuter car park, in between areas of hard stand. The modified eucalypt woodland is comprised of two likely remnant Sydney Red Gums along with a planted Spotted Gum *Corymbia maculata*, Tallowwood *Eucalyptus microcorys* and Pepper Tree. A row of Weeping Bottlebrush *Callistemon viminalis* have been planted along the fenceline of the commuter car park which, along with Mickey Mouse Plant *Ochna serrulata,* form the midstory.

The shrub storey and ground storey is almost entirely exotic and includes species such as Panic Veldtgrass, Rhodes Grass, Black-berry Nightshade *Solanum nigrum*, Bridal Creeper *Asparagus asparagoides*, Morning Glory *Ipomoea indica*, Asparagus Fern and the noxious Lantana, Green Cestrum and Boneseed *Chrysanthemoides monilifera* subsp. *monilifera.*

This area provides some level of suitable habitat for threatened species, such as roosting habitat for tree-hollow dependent microbats, such as the Eastern freetail-bat *Mormopterus norfolkensis.*

Figure 32: Vegetation Communities and Fauna Habitat Features of the Study Area

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The Sydney Red Gums, in particular, provide good quality habitat trees for microbats - with large deposits of exfoliating bark, sections of dead wood and protruding stags and some small spouts and hollows providing multiple potential entry points for microbats. Seasonal flowering of the trees in this area may also provide suitable foraging habitat for the GHFF, and a number of nectarivorous birds, albeit limited.

The Modified Eucalypt Woodland is not representative of any threatened/endangered ecological community under the Commonwealth EPBC Act or NSW TSC Act.

Exotic Closed Woodland

The closed exotic woodland included a combination of planted native and exotic species and opportunistic weeds. Lombardy Poplar *Populus nigra*, Swamp Oak *Casuarina glauca* and two Tallowwood trees form the canopy with a dense mid storey of Cheese Tree, Camphor Laurel, Green Cestrum, Lantana and Mickey Mouse Plant.

This dense mid storey has lead to a relatively sparse shrub and ground storey strata; however Crofton Weed *Ageratina adenophora*, Small-leaved Privet *Ligustrum sinense*, Black-berry Nightshade and Fennel *Foeniculum vulgare* were recorded.

Exotic vines and scramblers including Bridal Creeper, Asparagus Fern and Morning Glory were recorded growing along the chainlink fence. To the west of the fence, a row of juvenile Turpentine *Syncarpis glomulifera* have been planted.

The exotic closed woodland vegetation community fronting the railway corridor provides very little in way of suitable habitat for threatened species.

Conclusion

The Flora and Fauna Assessment (Biosis, January 2014) finds that:

- The study area is of minimal value for threatened species, with no threatened flora species recorded or considered likely to occur.
- The study area supports potential foraging and breeding habitat for one threatened fauna species; suitable microbat hollows for the Eastern Freetail-bat were observed in a number of trees surrounding the car park, including two Sydney Red Gums, and one Spotted Gum.
- No threatened ecological communities were recorded.
- Five species listed as noxious within Hurstville and Kogarah City Council LGAs were recorded within the study area.
- The overall impact of the proposed upgrade of Oatley Station to native flora and fauna is considered to be low.

It is unlikely that the proposed works would result in a significant impact to threatened species, populations or communities and additional approvals are not required.

6.7.2. Potential impacts

(a) Construction phase

The key impacts for the construction phase have been identified and are discussed below.

The direct impact zone is defined as the construction footprint, forming a corridor from the bus shelter on Oatley Parade west to Mulga Street, in addition to the commuter car park on Oatley Parade (see Figure 10).

Around 22 trees have a high likelihood of requiring removal for construction of the project. Of these, four are of low value (*Syagrus romanzoffiana* or Cocos palms). These are located on the eastern side of the station. Four trees require removal from the commuter car park – two *Angophora costata* or Sydney Red Gums, one *Schinus areira* or Pepper Tree and one *Callistemon viminalis* or Weeping Bottlebrush.

The remaining trees are on the west side of the station - five are of moderate value (*Glochidon ferdinani* or Cheese Tree), seven are juvenile planted trees (*Syncarpia glomulifera* or Turpentine), and there are two *Cinnamomum camphora* or Camphor Laurels.

A further three trees have a moderate likelihood of removal (*Populus nigra* or Lombardy Poplar) and these are trees that may be removed without Council permission. The exact number of trees to be removed is not definite at this Reference Design stage but is unlikely to change significantly.

Direct impacts would be:

- Vegetation clearing of 0.06 ha, required by the proposed alignment of the bridge and lift infrastructure, including:
  - 0.01 ha of Mown Exotic Grasses and Ornamental Plantings
  - 0.04 ha of Modified Eucalypt Woodland.
  - 0.01 ha of Exotic Closed Woodland.

  Around 22 trees are likely to be removed on both sides of the station, as indicated in Figure 33 below.
- The extension of the commuter car park is likely to require the clearing of the Sydney Red Gum and Pepper tree in the centre, and potentially the row of Spotted Gum and Tallowwood and the mature Sydney Red Gum in the northern corner. This includes potential roosting habitat for microbats, including the Eastern Freetail-bat.
- The current scope of the Proposal does not include the removal of any mature vegetation from within the Degraded hinterland sandstone gully forest community. Although not considered to represent an Endangered Ecological Community (EEC), these trees provide ecological value and recommendations are made regarding their protection.
- In addition to the impacts outlined above, various compound/lay down areas would be required for the storage of equipment and infrastructure. The location of these compound areas is yet to be confirmed; however potential areas within the study area have been identified and categorised based on their ecological values (see Figure 16).

- The proposed bank stabilisation works are unlikely to result in any impacts to native vegetation or fauna habitat; however as the bank may currently be stabilised by mature trees and shrubs, the stumps of these trees and shrubs would be kept in place to provide stability. During construction works, the bank would be shored up.

  The indirect impact zone is considered to include the entirety of the study area (less direct impacts), totaling approximately 1.5 ha of largely landscaped exotic vegetation, including:

  - 0.19 ha of Degraded Hinterland Sandstone Gully Forest
  - 0.02 ha of Modified Eucalypt Woodland
  - 1.06 ha of Mown Exotic Grasses and Ornamental Plantings
  - 0.23 ha of Exotic Closed Woodland.

Indirect impacts are likely to be greatest in close proximity to the subject site, however the proposal has the potential to have indirect impacts at greater distance particularly where stockpiling or equipment storage is required.

Potential indirect impacts to vegetation includes the following:

- Damage to remnant native trees during movement of soil by machinery across the site.
- Damage to native vegetation resulting from machinery and soil compaction.
- Introduction of noxious weed species or spread of those currently occurring within the study area construction plant and equipment.
- The introduction of soil pathogens.
- Soil contamination resulting from fuel spills or other contamination.

Table 26: Details of potentially affected trees

Tree #	Scientific name	Common name	Height (m)	DBH (m)	Likeli-hood of removal	Council preservation status	Comment
1	*Corymbia maculata*	Spotted gum	12	0.5	Moderate	Protected	Retain if possible
2	*Corymbia maculata*	Spotted gum	15	0.5	Moderate	Protected	Retain if possible
3	*Corymbia maculata*	Spotted gum	15	0.5	Moderate	Protected	Retain if possible
4	*Eucalyptus microcorys*	Tallowood	12	0.6	High	Protected	Likely to require removal as part of the project
5	*Corymbia maculata*	Spotted gum	12	0.3	Moderate	Protected	Retain if possible

Tree #	Scientific name	Common name	Height (m)	DBH (m)	Likeli-hood of removal	Council preservation status	Comment
6	*Corymbia maculata*	Spotted gum	15	0.6	High	Protected	Likely to require removal as part of the project
7	*Callistemon viminalis*	Weeping Bottlebrush	4	0.4	High	Protected	Likely to require removal as part of the project
8	*Angophora costata*	Sydney Red Gum	12	0.5	High	Protected	Likely to require removal as part of the project
9	*Schinus areira*	Pepper Tree	8	0.5	High	Protected	Likely to require removal as part of the project
10	*Angophora costata*	Sydney Red Gum	12	0.9	High	Protected	Likely to require removal as part of the project
11	*Schinus areira*	Pepper Tree	8	0.6	Low	Protected	Low value
12	*Schinus areira*	Pepper Tree	8	1	Low	Protected	Low value
13	*Syagrus romanzoffiana*	Cocos Palm	7	0.4	High	Protected	Likely to require removal as part of the project
14	*Syagrus romanzoffiana*	Cocos Palm	7	0.4	High	Protected	Likely to require removal as part of the project
15	*Syagrus romanzoffiana*	Cocos Palm	7	0.4	High	Protected	Likely to require removal as part of the project
16	*Syagrus romanzoffiana*	Cocos Palm	7	0.4	High	Protected	Likely to require removal as part of the project
17	*Schinus areira*	Pepper Tree	8	0.7	Low	Protected	Low value
18	*Populus nigra*	Lombardy Poplar	21	0.9	Moderate	Not Protected	Low value
19	*Glochidion*	Cheese	5	0.3	Moderate	Protected	Retain if

Tree #	Scientific name	Common name	Height (m)	DBH (m)	Likeli-hood of removal	Council preservation status	Comment
	ferdinandi	Tree					possible
20	*Glochidion ferdinandi*	Cheese Tree	10	0.8	High	Protected	Moderate value
21	*Glochidion ferdinandi*	Cheese Tree	8	0.5	High	Protected	Moderate value
22	*Cinnamomum camphora*	Camphor Laurel	6	0.3	High	Protected	Low value
23	*Glochidion ferdinandi*	Cheese Tree	10	0.6	High	Protected	Likely to require removal as part of the project
24	*Glochidion ferdinandi*	Cheese Tree	8	0.5	High	Protected	Likely to require removal as part of the project
25	*Glochidion ferdinandi*	Cheese Tree	8	0.3	High	Protected	Likely to require removal as part of the project
26	*Cinnamomum camphora*	Camphor Laurel	12	0.8	High	Protected	Likely to require removal as part of the project
27	*Populus nigra*	Lombardy Poplar	21	0.6	Moderate	Not Protected	Low value
28	*Populus nigra*	Lombardy Poplar	18	0.6	Moderate	Not Protected	Low value
29	*Eucalyptus microcorys*	Tallowood	20	0.6	Moderate	Protected	Retain if possible
30	*Eucalyptus microcorys*	Tallowood	16	0.6	Low	Protected	Retain if possible
31	*Populus nigra*	Lombardy Poplar	20	0.3	Moderate	Not Protected	Low value
32	*Syncarpia glomulifera*	Turpentine	6	0.2	Moderate	Protected	Juvenile planted tree
33	*Syncarpia glomulifera*	Turpentine	6	0.2	Moderate	Protected	Juvenile planted tree
34	*Syncarpia glomulifera*	Turpentine	6	0.2	Moderate	Protected	Juvenile planted tree

Tree #	Scientific name	Common name	Height (m)	DBH (m)	Likeli-hood of removal	Council preservation status	Comment
35	*Syncarpia glomulifera*	Turpentine	8	0.2	Moderate	Protected	Likely to require removal as part of the project
36	*Syncarpia glomulifera*	Turpentine	8	0.2	High	Protected	Likely to require removal as part of the project
37	*Syncarpia glomulifera*	Turpentine	8	0.2	High	Protected	Likely to require removal as part of the project
38	*Syncarpia glomulifera*	Turpentine	8	0.2	High	Protected	Juvenile planted tree
39	*Syncarpia glomulifera*	Turpentine	7	0.2	High	Protected	Juvenile planted tree
40	*Syncarpia glomulifera*	Turpentine	11	0.2	High	Protected	Likely to require removal as part of the project
41	*Syncarpia glomulifera*	Turpentine	9	0.2	High	Protected	Likely to require removal as part of the project
42	*Syncarpia glomulifera*	Turpentine	9	0.2	High	Protected	Likely to require removal as part of the project
43	*Syncarpia glomulifera*	Turpentine	11	0.2	Low	Protected	Juvenile planted tree

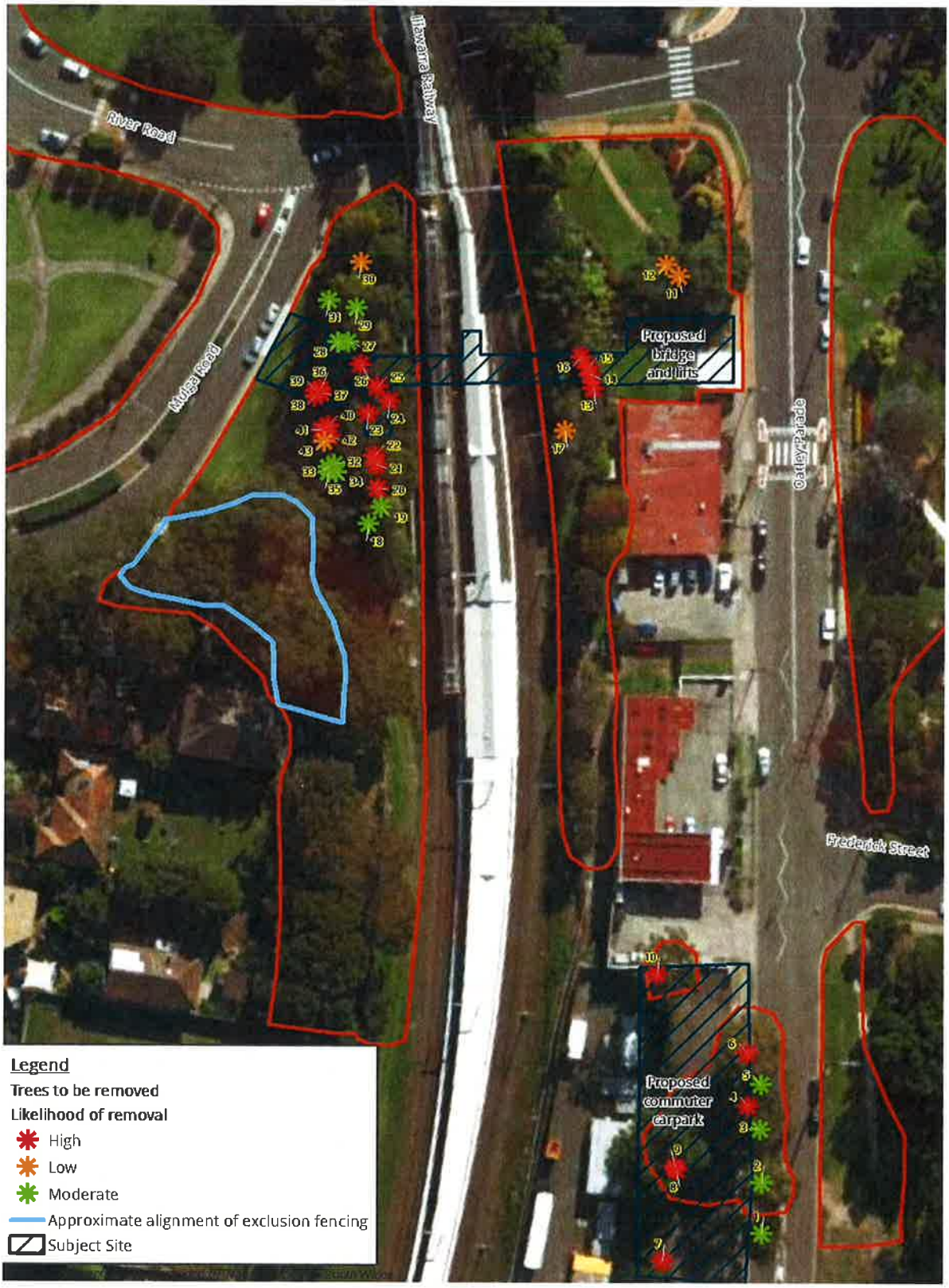

Figure 33: Trees to be removed (subject to detailed design)
3233333_5.DOC

Fauna impacts

In association with the above, the proposed railway station upgrade would cause some localised disturbance to potential fauna habitat associated with the railway corridor, including:

- Three hollow-bearing trees which provide some scattered seasonal potential foraging habitat for various avifauna species, such as the Grey-headed flying-fox, and multiple small hollows, stags, spouts and fissures that provide potential roosting resources for microbats including the Eastern Freetail-bat.
- Foraging resources, such as the Cheese Trees, which may support a variety of frugivorous (fruit eating) birds.

(b) Operational phase

As the site is so urbanised, it is not considered that there is potential for the proposal to create or extend any barriers to any movement between populations of flora and fauna.

Generally, new vegetation would be used to replace vegetation removed, in line with TFNSW's *Vegetation Offset Guide*. The plant species palettes developed for the Oatley Station Accessibility Upgrade would be based on a number of guiding documents and existing site plant species. Generally, to enhance biodiversity:

- Existing vegetation would be retained where possible
- Native species palette would be used where appropriate
- There would be compliance with appropriate standards for soils, mulches etc.

On the eastern side of the station:

- Potential for a "green wall" to the forecourt to soften any areas of blank stair wall would be investigated
- Proposed species would be a combination of natives and introduced species selected to complement the existing vegetation within the Douglas Cross Gardens
- A terraced rock garden bed would be provided to capture the change of grade between the forecourt and Douglas Cross Gardens.

On the western side of the station:

- Existing vegetation would be retained where possible
- The disturbed embankments would be re-vegetated
- Advanced trees would be planted to filter views, provide a gateway to the station overpass entrance and reduce the scale of the proposed overpass.

In the commuter car park:

- Existing vegetation would be retained and protected where possible
- To soften hard treatments, low planting would be introduced.

6.7.3. Mitigation measures

- The principal mechanism to reduce impacts on biodiversity values within the study area would be to minimise removal of native vegetation and fauna habitat by restricting the encroachment of the works on adjacent native vegetation.
    - There would be no disturbance or damage to threatened species, endangered ecological communities, or critical habitat.
    - Any vegetation to be removed that has not been assessed in this REF would be subject to separate approval in accordance with TFNSW's Application for Removal or Trimming Vegetation
- Offsets and/or landscaping would be undertaken in accordance with TFNSW's *Vegetation Offsets Guide* and with consideration of Sydney Train's *Revegetation Guide* and *Biodiversity Offsets Calculator* (as appropriate) to ensure the replacement of approximately 22 removed trees. This would result in the need for a replacement of around 90 trees within the vicinity. Replacement vegetation selection would be undertaken in consultation with the relevant local Council if appropriate.
- Proposed planting would be both exotic and indigenous and native plant species with low maintenance and low water requirements would be considered if deemed appropriate for the site's soil and climatic conditions
- All native vegetation planted on-site would consist of locally endemic native species, unless otherwise agreed by the PME, and following consultation with the relevant Local Authorities, where relevant.
- A Site Arborist meeting Australian Qualifications Framework (AQF) Level 5 would be retained to provide advice for any potentially sensitive works in the vicinity of retained trees
- In the event of any tree to be retained becoming damaged during construction, the Site Arborist should be informed to inspect and provide advice on remedial action
- The Contractor is to provide all workers with an environmental induction prior to commencing work on-site. This induction would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches. In particular, construction staff would be made aware of the location and importance of the remnant trees within the degraded hinterland sandstone gully forest.
- Tree protection zones, including root protection zones and canopy protection zones, should be established around remnant trees (particularly within the Degraded hinterland sandstone gully forest) in accordance with AS 4970 – 2009.
    - The trunk of trees to be retained would be armoured with 2m lengths of 50x100mm hardwood timbers spaced at 150mm centres and secured by 8 gauge wires or steel strapping at 300mm spacing, in line with Australian Standard AS4970-2009 Protection of Trees on Development Sites
    - Tree protection works would be inspected and approved by the Site Arborist prior to works commencing
    - The TPZ trunk protection should be maintained intact until the completion of all work on the site

- The trees to be removed would be clearly demarcated on-site (where appropriate) prior to construction to avoid unnecessary vegetation removal
- Native trees to be removed to be chipped and reused as leaf mulch (as per AS 4454 and AS 4419) and placed within tree protection fencing
- In the case where any access is required within the TPZs for building purposes, the fence should be set back 1.5m from the construction and the soil surface between the fence and the building should be protected by plywood sheets or strapped planking
- Storage of materials, mixing of materials, vehicle parking, disposal of liquids, machinery repairs and refuelling, site office and sheds, and the lighting of fires, stockpiling of soil, rubble or any debris shall not be carried out within the TPZs of existing trees to be retained. No backfilling would occur within the TPZs of existing trees
- The vegetation within the Exotic closed woodland community of the subject site is of relatively low ecological value; however it is currently stabilising the western railway embankment. The current extent of this stabilisation is unknown; therefore its removal should be carried out in a precautionary manner. Where possible, stumps should be left in situ and poisoned with an appropriate herbicide to prevent regrowth. If complete removal of trees providing substantial stabilisation is required, addition advice regarding engineering works may need to be sought.
- Construction compounds would be located in the lowest category area that is viable, according to the following:
    - Category 1 – Ideal.
        - Includes areas of hard standing with no ecological value.
    - Category 2 – Preferred.
        - Includes mown exotic grasses that would recover quickly from disturbance.
    - Category 3 – Possible.
        - Includes landscaped vegetation with relatively little ecological value. Category 3 areas should only be used where no viable alternative Category 1 or 2 sites are available.
    - Category 4 – No Go Zones.

  Where Category 1 areas are not available and Category 2 is required, areas of native vegetation should be rehabilitated following construction activities. The removal of native or mature canopy species for compound purposes should be avoided.
- Prevent the dispersal of weed seed or soil born pathogens into native vegetation through the implementation of vegetation hygiene protocols for footwear, vehicles, heavy plant and machinery.
- Be aware of nesting fauna within shrubby vegetation. Avoid permanent removal of these occupied habitats wherever possible. Where vegetation removal/maintenance must take place, an ecologist should be contacted to assist in relocation of fauna or otherwise wait until the nesting fauna have moved on.
- Appropriately designed sediment and erosion controls should be installed and maintained during excavation works to prevent any potential sediment runoff entering Myles Dunphy Reserve.

- Investigation of the potential to improve the quality of the Exotic closed woodland community either side of the overhead footbridge alignment by engaging a bush regeneration contractor to remove exotic species, particularly noxious weeds from this area, and revegetate these areas with endemic native species.

Refer to Table 27 for a consolidated list of proposed mitigation measures.

6.8. Contamination, landform, geology and soils

A *Geotechnical Interpretive Report* and a *Targeted Soil and Groundwater Investigation Report* were carried out by GHD in February 2014. An *Oatley Station Precinct Accessibility, Targeted Contamination Assessment* was conducted by GHD in August 2013.

The geotechnical investigations were carried out between November and December 2013, and comprised the drilling of seven (7) geotechnical boreholes.

In conjunction with the geotechnical investigation, a contamination assessment was carried out from the same borehole locations. One additional borehole located towards the northern extent of the car park was carried out specifically for contamination assessment purposes.

The results of the reports are discussed below.

6.8.1. Existing regional environment

The desktop review of the historical and environmental setting indicated that the site has been used for rail related activities since aerial photographs have been available (1930). There is no evidence of contaminating activities on site with the exception of the railway works. A brick pit is thought to have been located approximately 200 m to the north of the site for approximately 100 years (1884-1981). A service station is present to the east of the site.

Regional geology

The geological series sheet 9130 for Sydney at 1:100,000 scale indicates that the site is underlain by Hawkesbury Sandstone. Hawkesbury Sandstone is described as typically comprising medium to coarse grained quartz sandstone with very minor shale and laminite lenses. The geological map also identifies the presence of Quaternary Age alluvium to the south east of the station associated with the gentle valley feature draining into the Georges River. Further west of the site, Ashfield Shale is present. Ashfield Shale is described as comprising black to dark grey shale and laminite.

Soil landscape

Soils are moderately deep (50-150 cm). The soil landscape series sheet 9130 for Sydney, at 1:100,000 scale, indicates that the site is underlain by the Lucas Heights residual soil landscape. Blacktown group residual soils are located east of the site.

The Lucas Heights soil landscape is described as moderately deep well drained stony soils in gently undulating crests and ridges on plateau surfaces.

The Blacktown soil landscape is described as shallow to moderately deep, moderately reactive highly plastic subsoils, poorly drained and on gently undulating rises of shale.

6.8.2. Existing site conditions

Local to the station, the ground slopes westward down towards Myles Dunphy Bushland Reserve leading to a slight cross fall in topography across the rail corridor. The station itself sits on an embankment of approximately 3m to 4m in height at the existing underpass grading southwards to shallow cut at the station platform.

Proposed footbridge and forecourts

Based on the geotechnical investigation undertaken, the subsurface profile generally comprised fill, underlain by a shallow residual soil profile overlying Hawkesbury Sandstone bedrock.

In-situ testing in the eastern forecourt indicates that the fill materials encountered is variably compacted ranging from very loose to medium dense. In the western forecourt footprint, in-situ testing indicates that the fill materials are generally moderately to well compacted.

Point load rock strength testing was undertaken on rock core samples recovered from bore holes at the proposed lift shaft footprint, in order to evaluate intact rock strengths. The assessed rock strengths are generally medium to high.

It is assumed that formation of the lift shafts would require excavations up to 2.5m deep. Materials expected to be encountered during excavation would comprise topsoil, fill materials, residual sands and clays, and sandstone bedrock of medium and high strength. It is expected that excavation of overburden materials would be achieved using conventional earthmoving equipment, such as backhoes and tracked excavators. Excavation of medium and high strength sandstone bedrock would be considerably more difficult, and is likely to require rock picks, pneumatic rock breakers, rock saws or rock grinders.

Commuter car park

Boreholes within the commuter car park encountered a pavement profile overlying variable fill materials. The pavement profile comprised an asphalt wearing course of about 60mm thickness overlying gravelly sand road base to depths varying from 0.25m to 0.32m. Fill materials comprising silty sand with inclusions of bricks, gravels, and shale cobbles were encountered to a depth of 0.7m.

Sandstone bedrock was encountered at one point at a depth of 1.1m from the existing ground surface. Shale (logged as fill) was encountered to depths exceeding 0.7m, terminating due to auger refusal. Given the presence of Ashfield Shale bedrock in the near vicinity, there is a potential that a shallow natural shale cap is present near surface overlying the sandstone bedrock, in which case, the shale fill as logged could well be natural shale bedrock.

Residual gravelly silty sand was encountered below a depth of 0.7m.

6.8.3. Contamination

GHD undertook a search of the listing of NSW contaminated sites notified to EPA on 10 January 2014. The search did not return any records in the listing for the site, the suburb Oatley or the neighbouring suburb of Penshurst. However, Moore Reserve was listed (see below).

GHD undertook a search of the POEO Environment Protection License Register on 5 February 2014. The search did not show any records for the site or the neighbouring suburbs of Penshurst and Hurstville Grove.

A licence has been issued to Ausgrid at 33 Judd Street, Oatley (approximately 500m north of the site). The licence pertains to waste generation, in particular of asbestos and mercury contaminated waste. The subject of this licence is not considered to contribute contamination to the site as the licence includes management requirements for the waste. This facility is also quite some distance from the site with regard to the mobility of asbestos and mercury.

No visual or olfactory evidence of soil contamination was found during the field work. Groundwater was encountered after the installation of the groundwater wells at three bore holes. During sampling no evidence of contamination was observed.

No contaminated lands records are listed for the site. However, an area approximately 600 m to the east of the site is listed. Moore Reserve, Morshead Drive, Hurstville Grove is currently being managed under an agreed voluntary remediation proposal. Moore Reserve was historically used as a municipal landfill and now has legacy issues with contamination of soils and groundwater with heavy metals and nutrients as well as the production of landfill gas.

Although Moore Reserve is within one kilometre of the site, it is hydraulically down-gradient of the site with the sites topography at approximately 30 m AHD and Moore Reserve at 10 m AHD. As such, this area is not considered to have the potential to be a source of contamination at the site.

The following conclusions are made:

- From a chemical contamination perspective, the risks posed by contamination in the areas investigated to human health (construction workers) during proposed construction works, were considered to be low and acceptable
- From a chemical contamination perspective, the materials in the area investigated were considered suitable to remain on site under existing commercial/industrial land use
- Asbestos containing materials are present in western embankment (only one fragment of non-friable material observed), the potential extent of which was not confirmed and
- The preliminary in-situ chemical waste classification of the soil samples analysed was General Solid Waste. However any asbestos containing soil materials (if encountered) would also need to be classified as Asbestos Waste.

Based upon the site setting and current targeted investigation at the site it is considered that the potential for contamination to adversely affect that proposed development is low. There is the potential for fragments of bonded asbestos to be encountered within embankment fill materials (if required to be disturbed), however this can be managed through a construction environment management plan.

6.8.4. Potential impacts

The following geotechnical and construction considerations need to be considered at detailed design:

- Ability to appropriately excavate materials for the lift shafts and provision of safe temporary excavation batters

- Permanent retention of lift shaft excavations
- Ingress of groundwater seepage and hydrostatic pressures for the lift shaft structure
- Foundations for the proposed footbridge structure including stairs and lift well and footing options
- Foundations for the proposed fully suspended car park - as an alternative to fully suspended car park slab, earthworks for at grade commuter car park extensions, including permanent batter slopes or retaining structures for the commuter car park extension.

However, there may be potential areas of environmental concern:

- Potential presence of contamination in the uncontrolled fill in the railway corridor;
- Potential weathering of hazardous building material or remnants of building rubble of rail infrastructure and buildings;
- Historical rail usages, track works, asbestos brake pads, oil lubricants and point hydraulics within the rail corridor;
- Potential disposal/deposition of ash/coal within the rail corridor;
- Waste debris and potential waste dumping;
- Applications of pesticides/herbicides in the rail corridor and around buildings; and
- Potential leakages of engine oil in the car park.

6.8.5. Mitigation measures

- Erosion and sediment control plans would be prepared in accordance with *Managing Urban Stormwater: Soils and Construction* (Landcom/Department of Housing). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. Measures would include:
  - Stabilised surfaces would be reinstated as quickly as practicable after construction
  - All stockpiled materials would be stored in bunded areas, covered appropriately and kept away from waterways to avoid sediment entering the waterways.
  - Sediment would be prevented from moving off-site and sediment laden water prevented from entering any watercourse, drainage line or drainage inlet.
  - Any material transported onto pavement surfaces would be swept and removed at the end of each working day.

  Erosion and sediment control measures would be implemented and maintained to:

  - prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets
  - reduce water velocity and capture sediment on site
  - minimise the amount of material transported from site to surrounding pavement surfaces
  - divert clean water around the site.

- Other erosion and sedimentation controls to consider:
  - Review stormwater drains on site, and cover or use water quality control measures.
  - Minimise water use.
- Work areas will be stabilised progressively during the works.
- Erosion and sedimentation controls would be checked and maintained on a daily basis (including clearing of sediment from behind barriers). Controls are also to be inspected before, during and after heavy rainfall events.
- Erosion and sediment control measures would not to be removed until the works are complete or areas are stabilised.
- Selection of rock cutting/breaking equipment would be based on the likely impact of vibration to existing infrastructure in the vicinity of the proposed excavation.
- The CEMP would have a Contamination Sub-plan that would include an unexpected finds protocol, that is to be implemented during the upgrade work.
- Excavation/demolition/waste materials are to be appropriately managed in accordance with relevant National Environment Protection Council (NEPC) and NSW EPA guidelines, including but not limited to the Waste Classification Guidelines (NSW EPA, 2009).
- Sampling and laboratory testing is to be undertaken prior of any spoil being removed from site of the upgrade work to further characterise site contamination and to assist in waste classification of material to be excavated.
- A hazardous materials assessment is to be carried out on the Platform 1 heritage building before any construction works commence.

Refer to Table 27 for a consolidated list of proposed mitigation measures.

6.9. Hydrology and water quality

The local topography is dominated by a gently sloping valley associated with local drainage to Gungah Bay in Georges River. Groundwater is expected to discharge into Gungah Bay which is a marine receptor.

In general groundwater was fresh. Groundwater laboratory results indicated that heavy metals exceeded both the GIL-marine water criteria (copper and zinc) and the GIL-drinking water criteria (nickel). All other analytes were below the adopted site criteria or the laboratory PQL. These exceedances are not considered to pose a risk to human or ecological health for the following reasons:

- Human health: Groundwater is not be used for drinking and the magnitude of the exceedances are such that accidental contact during construction works would not pose any risks to workers.
- Ecological health: it is considered that the concentrations of copper and zinc are indicative of background concentrations in the aquifer. The risk to Gungah Bay is therefore considered to be low.

There is a potential that groundwater seepage could enter the lift pit excavation, particularly towards the base of the excavation where ground water was identified at depths of between about 2.18m and 2.89m relative to existing ground surface levels. Given that the groundwater was observed within the bedrock and towards the base of the lift excavation it is not anticipated that significant groundwater inflow into the excavation. Groundwater inflow during excavation, if encountered, would be adequately handled by a conventional sump and pump system.

6.9.1. Potential impacts

The Proposal is unlikely to impact upon the hydrology of the proposal site or the surrounding area. The detailed design would take stormwater management into consideration. There would be an increase in impervious areas and would there be changes to the existing layout at the station precinct. The proposal may impact upon Council's drainage infrastructure, and consultation with Councils would be required at the detailed design stage.

The area of development within the 100-year flood extents is minimal and located on the fringe of the flow paths. It is therefore expected that there would be minimal impact on flooding conditions in surrounding areas. Free drainage of flows around the development should be maintained such that localised ponding does not occur.

Activities which would disturb soils include tree removal, drilling for lift footings, establishment of ramps and stairs, reallocation of road space for buses, and kiss and ride, and additional commuter parking in Oatley Parade, and reallocation of road space for commuter parking on Mulga Road.

Such activities have the potential to impact upon local water quality and drainage as a result of erosion through runoff and sedimentation downstream. Given the existing sealed surfaces there is relatively low risk. Regardless, mitigation measures have been provided below to further minimise the potential for impacts to water quality as a result of erosion and sedimentation.

There is the potential to contaminate local water quality as a result of an incidental spill over exposed soils, or during periods of rainfall. Measures have been provided below to minimise the potential for this impact.

6.9.2. Mitigation measures

- Visual monitoring of local water quality (i.e. turbidity, hydrocarbon spills/slicks) would be undertaken on a regular basis to identify any potential spills
- Erosion and sediment control measures would be regularly inspected (particularly following rainfall events) to ensure their ongoing functionality
- Where sufficient space is available on site all fuels, chemicals and liquids would be stored a minimum of 40 metres away from:
    - rivers, creeks or any areas of concentrated water flow
    - flooded or poorly drained areas
    - slopes above 10%.
- All fuels, chemicals and liquids to be stored in appropriate impervious bunded area.
- Refuelling of plant and equipment would occur in impervious bunded areas located a minimum of 40 metres from drainage lines or waterways where sufficient space is available on site
- Vehicle wash down and/or cement truck washout would occur in a designated bunded area or offsite in accordance with OEH's guidelines for concrete washouts
- Emergency spill kits would be kept on site at all times. All staff are to be made aware of the location of spill kits and trained in their use
- Erosion and sediment control plans would be prepared in accordance with *Managing Urban Stormwater: Soils and Construction Guidelines* (Landcom/Department of Housing). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. Measures would include:
    - Stabilised surfaces would be reinstated as quickly as practicable after construction
    - All stockpiled materials would be stored in bunded areas, covered appropriately and kept away from waterways to avoid sediment entering the waterways
    - Sediment would be prevented from moving off-site and sediment laden water prevented from entering any watercourse, drainage line or drainage inlet
    - Any material transported onto pavement surfaces would be swept and removed at the end of each working day
    - Clean water would be diverted around the work site.
- Erosion and sediment control measures would be left in place until the works are complete and areas are stabilised
- Excavated soils for disposal/reuse would be tested during construction to determine appropriate waste classification. Further toxicity characteristics leaching procedure testing would also be undertaken in the field while construction is being undertaken to

fully classify the waste if it is not able to be classified as virgin excavated natural material (VENM).

Refer to Table 27 for a list of consolidated proposed mitigation measures.

6.10. Air Quality

6.10.1. Existing environment

Based on a review of the existing land uses surrounding the proposal, the existing air quality is considered to be characteristic of an urban environment. There are several sources that may be contributing to the air quality in the study area as discussed below.

Regional sources

The Office of Environment and Heritage (OEH) monitor air quality across NSW. Ground-level ozone (a key component of photochemical smog which appears as white haze in summer) remains an issue for Sydney and concentrations generally continued to exceed national air quality standards on up to 16 days a year between 2009 and 2011.

There is growing evidence about the adverse health impacts of airborne particles. Particle pollution or Particulate Matter (PM) (appearing as brown haze) generally meets standards in Sydney except when bushfires or dust storms occur, though concentrations exceeded national air quality standards on up to 18 days a year from 2009 to 2011.

A search of the 2011/2012 National Pollutant Inventory database (NPI) data within Postcode 2223. The most commonly reported substances for this location are: Total Volatile Organic Compounds; Toluene (methylbenzene); Xylenes (individual or mixed isomers); Ethylbenzene; Benzene.

The Proposal is not expected to impact overall regional air quality.

Local sources

A search of the National Pollutant Inventory database (NPI) 2011-2012 indicated that there are no facilities that have reported emissions in the 2223 postcode.

A number of non-industrial sources in the study area have the potential to influence the local air quality to varying degrees. These include:

- vehicle exhaust from the surrounding road network, with particular focus on routes where there are a large number of heavy vehicles
- lawn mowing (public open spaces)
- train exhaust from diesel services along the existing rail corridor
- domestic solid fuel burning.

These activities are likely to create emissions of Particulate Matter, Oxides of Nitrogen, Sulphur dioxide, Carbon monoxide, Volatile Organic Compounds and heavy metals.

The Proposal is not expected to impact overall local air quality.

Sensitive receptors

Potentially affected receptors within the vicinity of the site proposal include the following:

- Pedestrians and commuters within the Oatley Interchange and Oatley Town Centre
- Customers and operators of businesses within the adjacent Oatley Parade retail/commercial area and in Oatley Town Centre
- Adjacent River Road residents (to the west of the station and adjacent to Boongarra Reserve.

6.10.2. Potential impacts

(a) Construction phase

During construction, air quality impacts would be associated with the generation of dust and emissions from stationary and moving on-site machinery and associated vehicular traffic.

Air emission sources

Particulate emissions would be associated with a number of stationary and mobile sources as well as potential wind erosion of areas of exposed soil.

Anticipated sources of dust and dust-generating activities from the proposal are as follows:

- Operation of earth moving/pile driving equipment, and cranes
- Dust from loading spoil material on trucks and excavators
- Wind erosion from exposed surfaces at disturbed areas.

The total amount of dust generated would depend on the properties of the soil material (silt and moisture content), the activities undertaken and the prevailing meteorological conditions.

Vehicular emissions are also likely during the construction phase of the proposal. These emissions are associated with the combustion of diesel fuel and petrol. Emission rates and impact potential depend on the number and power output of the combustion engines, the quality of the fuel and the condition of the combustion engines.

Impacts from air emission sources

The activities which would result in areas of soils exposed would include the works in Oatley Parade and Mulga Road and to the construction of the lift shafts.

The anticipated levels of Particulate Matter generated during construction is not likely to be excessive, given the small scale of the activity and provided suitable control measures are implemented, as outlined below. Particulate concentrations could be expected to decrease significantly with distance from the source. However, during unfavourable meteorological conditions, such as dry and windy conditions, dust emissions could be higher.

The likely airborne dust load generated during a typical construction day would be small and therefore would be unlikely to result in reduced local air quality at the nearest potentially affected receptors, given the relatively small construction footprint, and with the implementation of proposed control measures.

(b) Operational phase

Air emission sources

The proposal would not result in any significant changes to the number or frequency of trains operating within the rail corridor. Nor would it result in the number or frequency of vehicles accessing the area.

Conversely, increased patronage of the rail system would likely reduce commuter vehicle movements on local roads and therefore reduce vehicle emissions in the long term, would have some beneficial effects on local and regional air quality.

Impacts from air emission sources

Impacts on air quality during the operation of the proposal are considered minimal as the Proposal would not result in any significant increase in train or vehicular movements.

6.10.3. Mitigation measures

- Measures (including watering or covering exposed areas) to minimise or prevent the generation of air pollution and dust would be implemented
- Works (including the spraying of paint and other materials) would not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely
- Vehicles transporting waste or other materials must be covered after loading to prevent wind blown dust emissions and spillages and their tailgates sealed during transportation
- Any visible dust leaving the construction site area as a result of construction works would be managed as per the project CEMP to be prepared by the Contractor
- Hardstand material, rumble grids or other appropriate measures would be installed at entry and exit points to minimise tracking of dirt onto roadways where practicable
- Contractor to ensure that vehicles, plant and equipment are maintained in accordance with their maintenance schedule and are regularly inspected to ensure efficient operation
- Contractor to conduct daily inspections and surveillance to identify any vehicle, plant or equipment that is causing visible emissions
- Visual monitoring would be undertaken during construction to identify potential Contamination. If Contamination or the potential for Contamination is identified, a Contamination Investigation Report (CIR) would be prepared

  The CIR would determine the nature, extent and degree of any contamination within the project area in accordance with the applicable EPA guidelines
- Should the CIR indicate that remediation is necessary to reduce or remove risks posed by contaminants in particular locations, then the land affected by construction must be remediated in accordance with a site specific Remedial Action Plan (RAP) prepared

  The RAP is to be prepared in accordance with the relevant EPA guidelines

- The potential for additional contamination eg. visible spills and unbunded areas would be monitored during regular inspections
- Methods for management of emissions would be incorporated into project inductions, training and pre-start talks
- Site rehabilitation of disturbed areas would be undertaken progressively as soon as practicable to prevent or minimise wind-blown dust
- Disturbed areas are to be stabilised as soon as practical to prevent or minimise wind-blown dust
- Vehicle and machinery movements during construction would be restricted to designated areas and sealed/compacted surfaces where practicable
- Visual monitoring of dust to be undertaken, where visible levels of dust are high, on-site activities are to be reviewed, with additional control measures and/or varied site operations implemented if required, in consultation with the TFNSW team
- All site vehicles and machinery would be switched off or throttled down to a minimum when not in use
- Hardstand material, rumble grids or other appropriate measures would be installed at entry and exit points to minimise tracking of dirt onto roadways where reasonable and feasible.

Refer to Table 27 for a consolidated list of proposed mitigation measures.

6.11. Cumulative impacts

Cumulative impacts may result when a number of construction or development projects are undertaken concurrently and in close proximity to one another. During construction the works would be coordinated with any other construction activities in the area with Hurstville and Kogarah City Councils, Sydney Trains and any other developers identified to minimise cumulative construction impacts such as traffic and noise.

Traffic associated with the construction works is not anticipated to have a significant impact on the surrounding road network. Operational traffic and transport impacts would have minimal impact on the performance of the surrounding road network.

Based on this assessment it is anticipated that the cumulative impacts would be minor provided that consultation with relevant stakeholders and mitigation measures in Section 7 are implemented.

Refer to the Table 27 for a consolidated list of proposed mitigation measures.

6.11.1. Mitigation measures

- Given the location of Oatley Station on the border between Hurstville and Kogarah Councils, specific traffic management measures would require a co-ordinated approach
- During construction the works would be coordinated with any other construction activities in the area (with Hurstville and Kogarah City Councils, RailCorp/Sydney Trains, ARTC and any other developers identified) to minimise cumulative construction impacts such as traffic and noise where feasible and reasonable.

6.12. Climate change and sustainability

6.12.1. Greenhouse gas emissions

TfNSW is committed to ensuring that the development, expansion and management of the transport network is sustainable and resilient to climate change.

The project is to conduct a detailed climate change impact assessment that would be utilised to remove and/or mitigate the extreme, high and medium risks that are identified and inform the design of this project.

This assessment would include assessing project specific risks from changes to the following climate variables:

- Temperature
- Sea Level Rise
- Humidity
- Precipitation
- Wind
- Storms
- Fire
- Flooding
- Hydrological Drought
- Soil Deterioration

An increase in greenhouse gas emissions, primarily carbon dioxide, would be expected during construction of the Proposal due to exhaust emissions from construction machinery and vehicles transporting materials and personnel to and from site.

The detailed design process would undertake a AS14064-2 (Greenhouse Gases - project level) compliant carbon footprinting exercise in accordance with TFNSW's 'Greenhouse Gas Inventory Guide for Construction Projects'. The carbon footprint would to be used to inform decision making in design and construction.

Due to the small scale of the Proposal and the short term temporary nature of the individual construction works, it is considered that greenhouse gas emissions resulting from the construction of the Proposal would be minimal. Furthermore, greenhouse gas emissions generated during construction would be kept to a minimum through the implementation of the standard mitigation measures detailed in Section 7.

It is anticipated that, once operational, the Proposal may result in an increase in use of public transport and a relative decrease in use of private motor vehicles by commuters to travel to and from Oatley town centre. A modal shift in transport usage may reduce the amount of fuel consumed by private motor vehicles with a corresponding reduction in associated greenhouse gas emissions in the local area.

6.12.2. Climate change

Climate change has the potential to change weather patterns and could result in increased temperatures and decreased precipitation in the Sydney region, as well as an increase in intensity of rainfall events due to weather.

Such changes in weather in the region are unlikely to impact on the operation of Oatley Railway Station.

6.12.3. Sustainability

The design of the upgraded interchange would be based on the principles of sustainability, with the incorporation of the TFNSW Sustainable Design Guidelines for Rail (Version 3.0) and the TFNSW Environmental Management System (EMS).

Appendix 3 provides details in relation to sustainable design features which would be incorporated into the Proposal and these can be summarised as follows:

- Various construction and materials selection measures, including:
  - Water efficient fittings
  - Use of recycled water
  - Reduced power use
  - Photo-electric switches.
- Protection for customers and electrical equipment from wind and rain during storm events

Further positive operational impacts in relation to climate change and sustainability are associated with the Proposal, include encouraging a reduction in private vehicle use and increasing the accessibility of public transport services.

6.12.4. Waste

Resource management hierarchy principles would be followed:

- avoid unnecessary resource consumption as a priority
- avoidance is followed by resource recovery (including reuse of materials, reprocessing, recycling and energy recovery)
- disposal is undertaken as a last resort.

Waste minimisation features would be incorporated into the Proposal and these can be summarised as follows:

- Reduction of waste to landfill (via recycling or reuse):
  - Ensuring that at least 95 percent of construction waste generated during site preparation and construction is diverted from landfill
  - Enabling waste segregation in the design process by including space for the collection and segregation of waste with appropriate marking (e.g. signage) and

controls (e.g. lockable lids), located away from sensitive receptors (e.g. water courses).

- Excavation/demolition/waste materials to be appropriately managed in accordance with relevant National Environment Protection Council (NEPC) and NSW EPA guidelines, including but not limited to the *Waste Classification Guidelines* (NSW EPA, 2009).

Waste material taken off site would be appropriately classified and managed in accordance with the Waste Classification Guidelines (OEH, April 2008). All waste documentation is to be collated in accordance with these guidelines and provided to TFNSW as requested.

6.12.5. Mitigation measures

- The detailed design process would undertake a AS14064-2 (Greenhouse Gases - project level) compliant carbon footprinting exercise in accordance with TFNSW's 'Greenhouse Gas Inventory Guide for Construction Projects'. The carbon footprint would to be used to inform decision making in design and construction.
- The detailed design process would undertake a Climate Change Impact Assessment in accordance with to determine the hazards/risks associated with future climatic conditions. Issues including protecting customers and electrical equipment from wind and rain during storm events, size of guttering, cross flow ventilation, reflective surfaces etc would be considered in the design.
- The detailed design process would be undertaken with reference to the TFNSW Sustainability Design guidelines for Rail (Version 3.0) with a view to obtaining a Silver rating or better.
- Resource management hierarchy principles and waste minimisation features would be incorporated into the Proposal
- Waste material would not to be left on site once the works have been completed
- Working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day.

Refer to Table 27 for a consolidated list of proposed mitigation measures.

7. Environmental management

This chapter of the REF identifies how the environmental impacts of the Proposal would be managed through environmental management plans and mitigation measures. Section 7.2 lists the proposed mitigation measures for the Proposal to minimise the impacts of the Proposal identified in Chapter 6.

7.1. Environmental management plans

A construction environmental management plan (CEMP) for the construction phase of the Proposal would be prepared in accordance with the requirements of the Transport Projects Division's Environmental Management System (EMS). The CEMP would provide a centralised mechanism through which all potential environmental impacts relevant to the Proposal would be managed, and would outline a framework of procedures and controls for managing environmental impacts during construction.

The CEMP would incorporate as a minimum all environmental mitigation measures identified below in Section 7.2, any conditions from licences or approvals required by legislation, and a process for demonstrating compliance with such mitigation measures and conditions.

7.2. Mitigation measures

Mitigation measures for the Proposal are listed below in Table 27 below. These proposed measures would minimise the potential adverse impacts of the Proposal identified in Chapter 6, should the Proposal proceed.

Table 27: Proposed mitigation measures

ID no.	Environmental safeguards
	General
1	An Environmental Design Constraints Map would be prepared prior to commencement of detailed design.
	Traffic and Site Access
2	Prior to the commencement of construction, a CTMP would be prepared as part of the CEMP which addresses, as a minimum, the following: o Adequate road signage at construction work sites that interface with roads to inform motorists and pedestrians of the work site ahead to ensure that the risk of road accidents and disruption to surrounding land uses is minimised o A Pedestrian Management Plan to maximise safety and access for pedestrians and cyclists, including details of alternative access arrangements to the station platforms o Adequate sight lines to allow for safe entry and exit from the site; o Impacts and changes to on and off street parking and requirements for any temporary replacement provision o Location of construction compounds o Routes to be used by heavy construction-related vehicles to minimise impacts on sensitive land uses and businesses

ID no.	Environmental safeguards
	○ Details for the relocation of kiss and ride, taxi ranks and bus stops if required, including appropriate signage to direct patrons , and ○ Measures to manage traffic flows around the area affected by the project, including as required regulatory and direction signposting, line marking and variable message signs and all other traffic control devices necessary for the implementation of the CTMP. Consultation with the relevant roads authority would be undertaken during preparation of the CTMP, where required. The performance of all project traffic arrangements must be monitored during construction.
3	Heavy vehicles would be restricted to specified routes, with the aim of minimising impacts on local roads, high pedestrian areas and school zones. Where feasible, route markers would be installed for the guidance of heavy vehicles along designated routes.
4	The impacts of construction traffic and on deliveries on the local road network and the impacts on intersection operation would be minimised by undertaking construction vehicle traffic movements outside of AM and PM peak road traffic periods and outside of school peak periods where feasible Signs would be provided at each access point to assist in deliveries to each work site
5	Limit off-site construction vehicle parking to designated areas. Areas of temporary on-street parking during peak construction events would be identified in the CTMP to minimise the impact on surrounding properties and businesses Where possible, alternative means of transport to and from the site for construction workers would be promoted e.g. encourage the use of public transport, car share or use of shuttle bus services.
6	The queuing and idling of construction vehicles in residential streets to be minimised.
7	Pedestrian access to the station platforms to be maintained at all times trains are operational.
8	Temporary traffic management to be in place at the Oatley Parade/River Road, River Road/Mulga Road and Oatley Parade/Frederick Street intersections for critical activities. Traffic control staff to limit access to priority vehicles during critical activities if required
9	Access to all private properties/businesses adjacent to the works would be maintained during construction, unless otherwise agreed by consultation with specific relevant property owners.
10	Safe and efficient interchange facilities to be maintained for passengers arriving by car, bus, taxi, bicycle or on foot. Temporary way finding signage to be installed to guide passengers around the railway station and construction activities.
11	Appropriate signage would be installed to meet the various stages of construction. Any pedestrian diversions or bus or commuter parking relocation required during works would be implemented in consultation with the Sydney Trains Station Manager, TfNSW and the 131500 Transport Infoline (www.transportnsw.info) Adequate signage would be in place to advise Contractor's contact details
12	A pre and post construction assessment of road pavement assets would be conducted in areas likely to be used by heavy construction vehicles.
13	Where required, community engagement activities would be conducted to warn the community and local residents of vehicle movements and anticipated effects on the local

ID no.	Environmental safeguards
	road network relating to site works in accordance with the CEMP.
	Urban design, landscape and visual amenity
14	Unnecessary loss or damage to vegetation partially affected or unaffected by the Proposal would be avoided by protecting trees prior to construction and/or trimming vegetation where possible to avoid total removal.
15	Rehabilitation planting would be undertaken as early as possible to replace vegetation that provided screening to adjacent residential properties and sensitive visual receivers.
16	Finishes and materials would be complementary to the existing locality and landscape and would minimise reflective surfaces with a preferred use of muted/less intrusive colours.
17	Avoid unnecessary loss or damage to vegetation protecting trees prior to construction and/or trimming vegetation to avoid total removal.
18	Dense, robust mass plantings would be provided to difficult-to-access areas to minimise maintenance requirements.
19	Any areas of 'blank' wall would be softened by appropriate plantings and/or artwork to meet visual amenity and sustainability guidelines.
20	Finishes and materials would be complementary to the existing locality and landscape, would minimise reflective surfaces with a preferred use of muted/less intrusive colours, and would involve consultation with Councils.
21	Specifically designed lighting equipment would be installed to minimise the upward spread of light near to and above the horizontal. Care would be taken when selecting luminaries to ensure that appropriate units are chosen and that their location would reduce spill light and glare to a minimum.
22	Light spill from the rail corridor into adjacent visually sensitive properties would be minimised by directing construction lighting into the construction areas and ensuring the site complies with Australian Standards, but is not over-lit. This includes the sensitive placement and specification of lighting to minimise any potential increase in light pollution.
23	Temporary hoardings, barriers, traffic management and signage would be removed when no longer required.
24	Work/site compounds would be screened, with shade cloth (or similar material) (where necessary) to minimise visual impacts from elevated locations.
25	Maintenance of structures and forecourts as a result of this Proposal would be the responsibility of Sydney Trains on completion.
26	Way-finding signage would be installed as per TfNSW guidelines.
	Noise and Vibration
27	Reference should be made to ASA Engineering Standard ESB 002 Station Design and Standard Requirements which sets out guidelines for the incorporation of acoustically absorptive finishes which can control reverberance and improve speech intelligibility from the Station Public Address (PA) system.
28	Prior to construction, a site-specific Construction Noise and Vibration Management Plan (NVMP) would be prepared and implemented in accordance with the requirements of the Construction Noise Strategy (TfNSW, 2012a). The NVMP would take into consideration measures for reducing the source noise levels of construction equipment by construction planning and equipment selection where practicable.

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29	Works would be carried out during normal work hours (i.e. 7am to 6pm Monday to Friday; 8am to 1pm Saturdays). Works outside these hours may be undertaken if approved by TfNSW. An Out of Hours Work approval would need to be obtained from TfNSW for any works outside normal work hours.
30	Construction noise would be managed in accordance with the EPA's Interim Construction Noise Guidelines and TfNSW's Construction Noise Strategy.
31	To reduce the construction noise impact from human activities, reasonable and feasible noise mitigation options should be considered, including: – Regularly training workers and contractors (such as at toolbox talks) on the importance of minimising noise emissions and how to use equipment in ways to minimise noise – Using only the equipment necessary for the upgrade works at any one time – Avoiding any unnecessary noise when carrying out manual operations and when operating plant – Ensuring spoil is placed and not dropped into awaiting trucks. – Avoiding/limiting simultaneous operation of noisy plant and equipment within discernible range of a sensitive receiver where possible. – Switching off any equipment not in use for extended periods e.g. heavy vehicles engines should be switched off whilst being unloaded. – Avoiding deliveries at night/evenings wherever possible – No idling of delivery trucks – Keeping truck drivers informed of designated vehicle routes, parking locations and acceptable delivery hours for the site – Minimising talking loudly; no swearing or unnecessary shouting, or loud stereos/radios on site. No dropping of materials from height where practicable, throwing of metal items and slamming of doors.
32	To reduce the construction noise and vibration impacts from mechanical activities, reasonable and feasible noise mitigation options should be considered, including: – Maximising the offset distance between noisy plant and adjacent sensitive receivers – Directing noise-emitting plant away from sensitive receivers – Installing alternative reverse alarms, such as 'quackers' where possible – Regularly inspecting and maintaining plant to avoid increased noise levels from rattling hatches, loose fittings etc. – Using non-"beeper" reversing/movement alarms such as broadband (non-tonal) alarms or ambient noise-sensing alarms – Fitting mufflers/silencers to pneumatic tools (e.g. breakers) and use residential-grade mufflers on plant – Use of quieter and less vibration emitting construction methods where feasible and reasonable.
33	Affected pre-schools, schools, universities and other identified sensitive receivers would be consulted in relation to noise mitigation measures to identify any noise sensitive periods, e.g. exam periods. As much as reasonably possible noise intensive construction works in the vicinity of affected educational buildings are to be minimised.
34	Work would be conducted behind temporary hoardings/screens wherever practicable. The installation of construction hoarding should take into consideration the location of

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	residential receivers to ensure that 'line of sight' is broken, where feasible.
35	Where the $L_{Aeq\ (15minute)}$ construction noise levels are predicted to exceed 75 dBA, respite periods would be observed. This would include restricting the hours that the very noisy activities can occur.
36	Planning of the higher Noise Management Level exceedance activities/locations to be undertaken predominantly during less noise-sensitive periods, where practicable.
37	Where attended noise monitoring indicate noise levels are in excess of levels reported within this report and where it is practical and safe to do so, temporary noise screens (or equipment placement) shall be used to shield noisy, fixed works.
38	Consultation as per the TfNSW Construction Noise Strategy would be adopted. These would be in line with the following:

Time Period		Mitigation Measures/Predicted $L_{Aeq(15min)}$ Noise Level above RBL			
		0 to 10 dB(A) Noticeable	10 to 20 dB(A) Clearly audible	20 to 30 dB(A) Moderately intrusive	>30 dB(A) Highly intrusive
Standard	Mon-Fri (7am-6pm) Sat (8am-1pm) Sun/ Public Hol (Nil)	-	-	Letterbox drop, Monitoring	Letterbox drop, Monitoring
OOHW Period 1	Mon-Fri (6pm-10pm) Sat (7am to 8am & 1pm-10pm) Sun/ Public Hol (8am -6pm)	-	Letterbox Drop	Monitoring, Letterbox Drop	Monitoring, Individual Briefing, Letterbox Drop Project Specific Respite Offer, Phone Calls, Specific Notification
OOHW Period 2	Mon-Fri (10pm-7am) Sat (10pm-7am) Sun/ Public Hol (6pm-8am)	Letterbox Drop	Monitoring, Letterbox Drop	Monitoring, Individual Briefing, Letterbox drop, Phone Calls, Specific Notification	Alternate Accommodation, Monitoring, Individual Briefing, Letterbox Drop, Phone Calls, Specific Notification

39 Subject to landowner agreement, building condition surveys would be completed on the following buildings/structures prior to proximate piling, excavation or bulk fill or any vibratory impact works including jack hammering and compaction ("Designated Works"):

a) All buildings/structures/roads within a plan distance of 50 metres from the edge of the Designated Works; and

b) All heritage listed buildings and other sensitive structures within 150 metres from the edge of the Designated Works unless otherwise determined following geotechnical and vibration assessment as endorsed by a qualified geotechnical engineer and as approved by the DPE as not likely to be adversely affected.

Property condition surveys need not be undertaken if a risk assessment indicates buildings/structures/roads would not be affected as determined by a qualified geotechnical and construction engineering expert with appropriate registration on the National

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	Professional Engineers Register prior to commencement of Designated Works.
40	When proposed works within the safe working distances to heritage structures are proposed, works would be carefully planned and monitored to prevent structural damage occurring. Attended vibration monitoring or vibration trials would be undertaken when proposed works are within the safe working distances to heritage structures to ensure that levels remain below the most stringent 2.5mm/s criterion (Table 19).
41	Continuous vibration monitoring is to be undertaken during vibration intensive activities, by setting up a continuous vibration logger at one metre from any heritage structure or item.
42	Additional vibration monitoring would be carried out when construction activities are at the nearest point to the heritage station building. This monitoring may signal to the contractor by way of a buzzer or flashing light, when levels approach/exceed the recommended limits for structural damage. Management measures may include modification of construction methods such as using smaller pieces of equipment, establishment of larger minimum working distances, and if necessary, time restrictions for the most excessive vibration activities.
43	Noise and vibration emissions shall be qualitatively assessed throughout works and additional measures shall be implemented to prevent jeopardising the intelligibility of the PA system and the safety of commuters and staff as a result.
44	Recommended Safe Working Distances for Vibration Intensive Plant in relation to human comfort levels for residential receivers, as per Table 23 would be followed. Where plant and equipment are proposed to be used within the recommended safe working distances to sensitive receivers, works would be carefully planned and monitored. Attended vibration monitoring or vibration trials would be undertaken at the commencement of construction to ensure that levels remain below the applicable criterion.
	Non-Indigenous Heritage
45	A section 60 approval under the Heritage Act 1977 would be obtained from the NSW Heritage Council prior to works commencing The final design would be sympathetic to the original design of the heritage building. The materials and colour palette for the overhead footbridge would be sympathetic to the heritage context of the railway station. Colour is to be used to separate the overhead footbridge structure from the pale weatherboard building, and the use of modern, light materials would further reduce the visual bulk of the overhead footbridge. The visual impact of the ventilation grilles required for the communications room would be reduced if the condensors are able to be located in the ceiling cavity, and this is the preferred option with the least impact. The grilles would be powder coated to match the existing building finish.
46	For any alterations to the platform building, as much as possible of the original fabric of the building, and internal features would be retained in situ. Any new partitions are to be timber-framed to allow future removal. Any ceiling services are to be suspended/limited to avoid penetrations into the ceiling, and service penetrations into external walls are to be minimised.
47	The Contractor would be required to prepare a Construction Environmental Management Plan that specifically addresses the heritage impacts and required mitigation measures.
48	Non-Indigenous heritage items and the SHR curtilage would be identified on the construction contractor's Environmental Constraints Maps (ECMs).
49	The Contractor is to provide a heritage induction to workers before construction begins,

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	informing them of the location of known heritage items and guidelines to follow if unanticipated heritage items or deposits are located during construction.
50	Construction impacts, such as vibration and dust on adjacent items must be minimised. In particular, the Contractor would prepare details of how impacts of dust and vibration from the construction work at the entrance to the Ticket Office would be minimised – this would be specifically addressed in the CEMP.
51	To effectively mitigate potential impacts of vibration on Oatley Station and other heritage items, activities that cause vibration would be managed in accordance with German Standard DIN 4150 – Part 3 (DIN 1999) which has specific standards relating to heritage.
52	If previously unidentified Indigenous or non-indigenous heritage/archaeological items are uncovered during the works, all works must cease in the vicinity of the material/find and TfNSW is to be contacted immediately. Works in the vicinity of the find must not re-commence until clearance has been received from TfNSW.
53	Changes to the form, fabric and landscape setting of the Oatley Railway Station would be submitted to the Heritage Office and Sydney Trains, to be recorded in the Heritage inventory for this item.
54	An Archival Record would be made of the Station Building in accordance with the following guidelines: How to Prepare Archival Records of Heritage Items (NSW Heritage Office 1998) and Photographic Recording of Heritage Items Using Film or Digital Capture (NSW Heritage Office 2006). In addition, internal and external scanning of the station building is to be undertaken with a #D laser device, in a suitable electronic data format (i.e. CAD software or equivalent).
55	Copies of the 'as built' construction plans, photographs illustrating the completed works and the Archival Record would be lodged with Heritage Office and Sydney Trains Environment Division as a documentary record of changes to the station precinct.
56	Should platform re-grading be required adjacent to the platform station building, the fabric of the station building would be protected via a geo-textile fabric or similar. Adequate measures would be taken to protect existing steps, posts, door jambs and weatherboard panels from direct contact with any new surface materials.
57	The original fabric of the River Road underbridge and pedestrian subway is to be retained
58	The existing stairs would be retained visually and closed off with metal mesh gates (possibly with Bostwick style steel gates similar to those at Museum Station, if compliant to current Standards).
59	The stairwell is to be restored to its original condition by removing the section of canopy between the end of the platform and the top of the stairs so that the connection between the underpass and the platform is maintained visually.
60	All intact equipment presently located in the signal room associated with lever operations is to be retained and conserved. As far as practicable, clear views into the signal room would be enhanced, including by relocation of the vending machines and pay phone at the northern end of the platform building.
61	Unnecessary loss of screening vegetation and trees alongside the railway corridor and within the Douglas Cross Gardens is to be avoided where possible.
62	Landscaping and vegetation within the Douglas Cross Gardens is to be retained where possible. Any damaged or removed elements would be replaced once works are completed.

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63	Heritage values would be maintained by use/reuse of local stone and the planting palette to reflect the character of Oatley and its surrounding context e.g. similar materials from the Douglas Cross Gardens would be utilised in the eastern forecourt spaces to maintain consistency.
64	Any areas of 'blank' stair wall would be softened in appearance and would meet sustainability outcomes through artwork and large plantings to the base of the bike rack.
65	The disturbed embankment on the western side of the corridor is to be re-vegetated and shored up. Replacement landscaping is to mitigate the visual impact of removed vegetation and tie the new construction to the surrounding area.
66	Surfaces of heritage items are to be protected as appropriate through use of plywood sheeting or similar, particularly during any platform works.
67	TfNSW would provide alternative locations for the existing vending machines and pay phone, so that the lever room and its fittings at the northern end of the platform building can be visually inspected by the community from the platform.
68	A minimum of one heritage interpretive panel (at A1 size or greater) would be located in a conspicuous location on the platform.
69	The finishes to the heritage building would be treated in a similar colour and finish to the existing, and any new fixtures (electrical or plumbing conduits) are to be sympathetically attached to the walls (i.e. colour and fixings).
	Indigenous Heritage
70	If previously unidentified Indigenous heritage items are uncovered during the work, all work in the vicinity of the find would cease and appropriate advice be sought from OEH in order to mitigate potential impacts. Construction activities and machinery would be restricted to the designated work areas.
	Socio-Economic Impacts
71	The proposed sustainability criteria for the project would encourage the contractor to purchase goods and services locally, helping to ensure the local community benefits from the construction of the Proposal.
72	A number of noise mitigation measures would be implemented to minimise impacts on local businesses. Refer to Section 6.3 for discussion on the potential for noise impacts and for the environmental safeguards for construction noise.
73	A CTMP would be developed to address changed traffic and pedestrian conditions. Refer to Section 6.1 for details.
74	The Consultation Strategy would identify all potential stakeholders and the best practice methods for consultation with these groups during construction. The plan would also encourage feedback and facilitate opportunities for the community and stakeholders to have input into the project, where possible.
75	Contact details for a 24-hour construction response line, project infoline and email address would be provided for ongoing stakeholder contact throughout the construction phase.
76	Provide protective screening in accordance with RTA TD2002/RS02 to elevated walkways and concourse areas particularly where persons traverse above or immediately adjacent to the rail corridor.
77	Assess and treat areas of particular relevance where the public can climb or potentially fall from structures including interfaces with other structures and the potential for shortcutting

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	or skylarking by schoolchildren.
78	Consider enclosed walkway or at minimum increased railing heights.
79	Designs to use anti-climb materials such as panelling, glazing or close weld mesh, and vertical rather than horizontal supporting structure.
80	Close off areas directly underneath existing or proposed stairs (e.g. wall, grill or other type of barrier) in a manner that prevents access and / or loitering.
81	Design the lift shafts with glazing such that passengers are visible at all times.
82	As part of the detailed design development, hold a Security Risk Workshop to further assess risk. This would, for example, determine camera placements to reduce blind spots as a result of new works, and consider lighting levels and the like, to ensure the design adequately delivers on security requirements for the station and interchange.
	Biodiversity
83	The principal mechanism to reduce impacts on biodiversity values within the study area would be to minimise removal of native vegetation and fauna habitat by restricting the encroachment of the works on adjacent native vegetation. There would be no disturbance or damage to threatened species, endangered ecological communities, or critical habitat. Any vegetation to be removed that has not been assessed in this REF would be subject to separate approval in accordance with TFNSW's Application for Removal or Trimming Vegetation (Form PE-FO-078/5.0)
84	Offsets and/or landscaping would be undertaken in accordance with TFNSW's Vegetation Offsets Guide and with consideration of Sydney Train's Revegetation Guide and Biodiversity Offsets Calculator (as appropriate) to ensure the replacement of approximately 22 removed trees. This would result in the need for a replacement of around 90 trees within the vicinity. Replacement vegetation selection would be undertaken in consultation with the relevant local Council if appropriate.
85	Proposed planting would be both exotic and indigenous and native plant species with low maintenance and low water requirements would be considered if deemed appropriate for the site's soil and climatic conditions.
86	All native vegetation planted on-site would consist of locally endemic native species, unless otherwise agreed by the PME, and following consultation with the relevant Local Authorities, where relevant.
87	A Site Arborist meeting Australian Qualifications Framework (AQF) Level 5 would be retained to provide advice for any potentially sensitive works in the vicinity of retained trees.
88	In the event of any tree to be retained becoming damaged during construction, the Site Arborist should be informed to inspect and provide advice on remedial action.
89	The Contractor is to provide all workers with an environmental induction prior to commencing work on-site. This induction would include information on the ecological values of the site, protection measures to be implemented to protect biodiversity and penalties for breaches. In particular, construction staff would be made aware of the location and importance of the remnant trees within the degraded hinterland sandstone gully forest.
90	Tree protection zones, including root protection zones and canopy protection zones, should be established around remnant trees (particularly within the Degraded hinterland

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	sandstone gully forest) in accordance with AS 4970 – 2009.
91	The trunk of trees to be retained would be armoured with 2m lengths of 50x100mm hardwood timbers spaced at 150mm centres and secured by 8 gauge wires or steel strapping at 300mm spacing, in line with Australian Standard AS4970-2009 Protection of Trees on Development Sites – Tree protection works would be inspected and approved by the Site Arborist prior to works commencing – The TPZ trunk protection should be maintained intact until the completion of all work on the site.
92	The trees to be removed would be clearly demarcated on-site (where appropriate) prior to construction to avoid unnecessary vegetation removal.
93	Native trees to be removed to be chipped and reused as leaf mulch (as per AS 4454 and AS 4419) and placed within tree protection fencing.
94	In the case where any access is required within the TPZs for building purposes, the fence should be set back 1.5m from the construction and the soil surface between the fence and the building should be protected by plywood sheets or strapped planking.
95	Storage of materials, mixing of materials, vehicle parking, disposal of liquids, machinery repairs and refuelling, site office and sheds, and the lighting of fires, stockpiling of soil, rubble or any debris shall not be carried out within the TPZs of existing trees to be retained. No backfilling would occur within the TPZs of existing trees.
96	The vegetation within the Exotic closed woodland community of the subject site is of relatively low ecological value; however it is currently stabilising the western railway embankment. The current extent of this stabilisation is unknown; therefore its removal should be carried out in a precautionary manner. Where possible, stumps should be left in situ and poisoned with an appropriate herbicide to prevent regrowth. If complete removal of trees providing substantial stabilisation is required, addition advice regarding engineering works may need to be sought.
97	Construction compounds would be located in the lowest category area that is viable, according to the following: – Category 1 – Ideal. ▪ Includes areas of hard standing with no ecological value. – Category 2 – Preferred. ▪ Includes mown exotic grasses that would recover quickly from disturbance. – Category 3 – Possible. ▪ Includes landscaped vegetation with relatively little ecological value. Category 3 areas should only be used where no viable alternative Category 1 or 2 sites are available. – Category 4 – No Go Zones Where Category 1 areas are not available and Category 2 is required, areas of native vegetation should be rehabilitated following construction activities. The removal of native or mature canopy species for compound purposes should be avoided.
98	Prevent the dispersal of weed seed or soil born pathogens into native vegetation through the implementation of vegetation hygiene protocols for footwear, vehicles, heavy plant and machinery.
99	Be aware of nesting fauna within shrubby vegetation. Avoid permanent removal of these occupied habitats wherever possible. Where vegetation removal/maintenance must take

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	place, an ecologist should be contacted to assist in relocation of fauna or otherwise wait until the nesting fauna have moved on.
100	Appropriately designed sediment and erosion controls should be installed and maintained during excavation works to prevent any potential sediment runoff entering Myles Dunphy Reserve.
101	Investigation of the potential to improve the quality of the Exotic closed woodland community either side of the overhead footbridge alignment by engaging a bush regeneration contractor to remove exotic species, particularly noxious weeds from this area, and revegetate these areas with endemic native species.
	Contamination, landform, geology and soils
102	Erosion and sediment control plans would be prepared in accordance with Managing Urban Stormwater: Soils and Construction Guidelines (Landcom/Department of Housing). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. Measures would include: – Stabilised surfaces would be reinstated as quickly as practicable after construction – All stockpiled materials would be stored in bunded areas, covered appropriately and kept away from waterways to avoid sediment entering the waterways. – Sediment would be prevented from moving off-site and sediment laden water prevented from entering any watercourse, drainage line or drainage inlet. – Any material transported onto pavement surfaces would be swept and removed at the end of each working day. Erosion and sediment control measures would be implemented and maintained to: – prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets – reduce water velocity and capture sediment on site – minimise the amount of material transported from site to surrounding pavement surfaces – divert clean water around the site. (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).
103	Other erosion and sedimentation controls to consider: – Review stormwater drains on site, and cover or use water quality control measures. – Minimise water use.
104	Work areas would be stabilised progressively during the works.
105	Erosion and sedimentation controls would be checked and maintained on a daily basis (including clearing of sediment from behind barriers). Controls are also to be inspected before, during and after heavy rainfall events.
106	Erosion and sediment control measures would not to be removed until the works are complete or areas are stabilised.
107	Selection of rock cutting/breaking equipment would be based on the likely impact of vibration to existing infrastructure in the vicinity of the proposed excavation.
108	The CEMP would have a Contamination Sub-plan that would include an unexpected finds protocol, that is to be implemented during the upgrade work.

ID no.	Environmental safeguards
109	Excavation/demolition/waste materials are to be appropriately managed in accordance with relevant National Environment Protection Council (NEPC) and NSW EPA guidelines, including but not limited to the Waste Classification Guidelines (NSW EPA, 2009).
110	Sampling and laboratory testing is to be undertaken prior of any spoil being removed from site of the upgrade work to further characterise site contamination and to assist in waste classification of material to be excavated.
111	A hazardous materials assessment is to be carried out on the Platform 1 heritage building before any construction works commence.
	Hydrology and Water Quality
112	Erosion and sediment control plans would be prepared in accordance with Managing Urban Stormwater: Soils and Construction Guidelines (Landcom/Department of Housing). The erosion and sediment control plans would be established prior to the commencement of construction and be updated and managed throughout as relevant to the activities during the construction phase. Measure would include: – Stabilised surfaces would be reinstated as quickly as practicable after construction – All stockpiled materials would be stored in bunded areas and kept away from waterways to avoid sediment entering the waterways. – Sediment would be prevented from moving off-site and sediment laden water prevented from entering any watercourse, drainage line or drainage inlet. – Any material transported onto pavement surfaces would be swept and removed at the end of each working day. – Clean water would be diverted around the work site.
113	Erosion and sediment control measures would be regularly inspected (particularly following rainfall events) to ensure their ongoing functionality.
114	Erosion and sediment control measures would be left in place until the works are complete and areas are stabilised.
115	Works would be avoided where practicable during rainfall (or whilst the ground remains sodden) to minimise vehicle disturbance to the topsoil.
116	Visual monitoring of local water quality (i.e. turbidity, hydrocarbon spills/slicks) would be undertaken on a regular basis to identify any potential spills.
117	Where sufficient space is available on site all fuels, chemicals and liquids would be stored a minimum of 40 metres away from: – rivers, creeks or any areas of concentrated water flow – flooded or poorly drained areas – slopes above 10%.
118	All fuels, chemicals and liquids to be stored in appropriate impervious bunded area.
119	Refuelling of plant and equipment would occur in impervious bunded areas located a minimum of 40 metres from drainage lines or waterways where sufficient space is available on site.
120	Vehicle wash down and/or cement truck washout would occur in a designated bunded area or offsite in accordance with OEH's guidelines for concrete washouts.

ID no.	Environmental safeguards
121	Emergency spill kits would be kept on site at all times. All staff are to be made aware of the location of spill kits and trained in their use.
122	Excavated soils for disposal/reuse would be tested during construction to determine appropriate waste classification. Further toxicity characteristics leaching procedure testing would also be undertaken in the field while construction is being undertaken to fully classify the waste if it is not able to be classified as virgin excavated natural material (VENM).
	Air Quality
123	Measures (including watering or covering exposed areas) to minimise or prevent the generation of air pollution and dust would be implemented.
124	Works (including the spraying of paint and other materials) would not to be carried out during strong winds or in weather conditions where high levels of dust or air borne particulates are likely.
125	Vehicles transporting waste or other materials must be covered after loading to prevent wind blown dust emissions and spillages and their tailgates sealed during transportation.
126	Any visible dust leaving the construction site area as a result of construction works would be managed as per the project CEMP to be prepared by the Contractor.
127	Hardstand material, rumble grids or other appropriate measures would be installed at entry and exit points to minimise tracking of dirt onto roadways where practicable.
128	Contractor to ensure that vehicles, plant and equipment are maintained in accordance with their maintenance schedule and are regularly inspected to ensure efficient operation.
129	Contractor to conduct daily inspections and surveillance to identify any vehicle, plant or equipment that is causing visible emissions.
130	Visual monitoring would be undertaken during construction to identify potential Contamination. If Contamination or the potential for Contamination is identified, a Contamination Investigation Report (CIR) would be prepared. The CIR would determine the nature, extent and degree of any contamination within the project area in accordance with the applicable EPA guidelines.
131	Should the CIR indicate that remediation is necessary to reduce or remove risks posed by contaminants in particular locations, then the land affected by construction must be remediated in accordance with a site specific Remedial Action Plan (RAP) prepared. The RAP is to be prepared in accordance with the relevant EPA guidelines.
132	The potential for additional contamination eg. visible spills and unbunded areas would be monitored during regular inspections.
133	Methods for management of emissions would be incorporated into project inductions, training and pre-start talks.
134	Site rehabilitation of disturbed areas would be undertaken progressively as soon as practicable to prevent or minimise wind-blown dust.
135	Disturbed areas are to be stabilised as soon as practical to prevent or minimise wind-blown dust.
136	Vehicle and machinery movements during construction would be restricted to designated areas and sealed/compacted surfaces where practicable.
137	Visual monitoring of dust to be undertaken, where visible levels of dust are high, on-site

ID no.	Environmental safeguards
	activities are to be reviewed, with additional control measures and/or varied site operations implemented if required, in consultation with the TFNSW team.
138	All site vehicles and machinery would be switched off or throttled down to a minimum when not in use.
139	Hardstand material, rumble grids or other appropriate measures would be installed at entry and exit points to minimise tracking of dirt onto roadways where reasonable and feasible.
	Cumulative Impacts
140	Given the location of Oatley Station on the border between Hurstville and Kogarah Councils, specific traffic management measures would require a co-ordinated approach.
141	During construction, the works are to be coordinated with any other construction activities in the area (with Campbelltown City Council, RailCorp/Sydney Trains, ARTC and any other developers identified) to minimise cumulative construction impacts such as traffic and noise where feasible and reasonable.
	Climate change and Sustainability
142	The Contractor is to undertake a detailed design process - undertake a AS14064-2 (Greenhouse Gases - project level) compliant carbon footprinting exercise - in accordance with TFNSW's 'Greenhouse Gas Inventory Guide for Construction Projects'. The carbon footprint is to be used to inform decision making in design and construction.
143	The detailed design process would undertake a Climate Change Impact Assessment in accordance with to determine the hazards/risks associated with future climatic conditions. Issues including protecting customers and electrical equipment from wind and rain during storm events, size of guttering, cross flow ventilation, reflective surfaces etc would be considered in the design.
144	The detailed design process would be undertaken with reference to the TFNSW Sustainability Design guidelines for Rail (Version 2) with a view to obtaining a Silver rating or better.
145	Resource management hierarchy principles and waste minimisation features would be incorporated into the Proposal.
146	Waste material would not to be left on site once the works have been completed.
147	Working areas would be maintained, kept free of rubbish and cleaned up at the end of each working day.

8. Conclusion

This REF has been prepared in accordance with the provisions of Part 5 of the EP&A Act, taking into account to the fullest extent possible, all matters affecting or likely to affect the environment as a result of the Proposal.

The Proposal would provide benefits including:

- Three lifts, three new sets of stairs, and a new overhead footbridge providing cross-corridor and platform access
- Landscaped forecourts featuring seating
- Improved bus and bicycle facilities
- Improved accessible customer facilities including a new Family Accessible Toilet
- 'Kiss and ride' and accessible parking spaces
- Opal card readers
- Increased accessibility for commuters with mobility impairment, those with shopping/luggage and parents with prams
- Improved interchange with other modes of transport
- Safety improvements including extra lighting and security measures, safer traffic/pedestrian arrangement including accessible parking spaces, taxi stops and kiss and ride zones
- Extension of the existing off-street commuter car park from 16 spaces to 33 spaces.

The Proposal is consistent with the NSW Government's Metropolitan Plan for Sydney 2036, NSW 2021 and Long Term Transport Master Plan, and is an integral part of the Transport Access Program. The Proposal would encourage greater use of public transport.

The key likely impacts of the Proposal are as follows:

- Disruptions to vehicle and pedestrian movements during construction
- Loss of around 22 trees
- Impacts on the heritage-listed building on Platform 1
- Noise and vibration during construction, and
- Short-term visual impacts during construction and long-term visual impacts during operation.

The benefits are considered to outweigh the adverse environmental impacts of the Proposal.

This REF has considered and assessed these impacts in accordance with clause 228 of the EP&A Regulations and the requirements of the EPBC Act (refer to Chapter 7, and Appendices). Should the project proceed, these impacts would be effectively managed through the proposed Oatley Station Upgrade CEMP, mitigation measures (refer to Chapter 7) and the conditions of approval. As a result, these environmental impacts are not considered to be significant. Accordingly an EIS is not required.

The Proposal has also taken into account the principles of ESD (refer to Section 5.6). These would be considered further during the detailed design, construction and operational phases

of the proposal. This would ensure the proposal is delivered to maximum benefit to the community, is cost effective and minimises any adverse impacts on the environment.

References

GHD Consultants, January 2014, *Traffic, Transport and Access Impact Assessment* (TTA&IA)

RPS, April 2014, *Potential Visual Impact, Oatley Station Upgrade Project*

GHD Consultants, December 2013, *Landscape and Urban Design Report*

Ausenco, *March 2014, Noise and Vibration Impact Assessment*

Artefact, November 2012, *Constraints Analysis for Heritage Assessment*

Artefact, March 2014, *Statement of Heritage Impact (SoHI)*

Biosis, March 2014, *Flora and Fauna Assessment*

GHD Consultants, February 2014, *Geotechnical Interpretive Report*

GHD Consultants, February 2014, *Targeted Soil and Groundwater Investigation Report*

GHD Consultants, August 2013, *Oatley Station Precinct Accessibility, Targeted Contamination Assessment*.

GHD Consultants, March 2014, *Oatley Station Precinct Final Concept Design Submission*

Appendix 1 – Consideration of Clause 228 factors

The table below demonstrates TfNSW's consideration of the specific factors of clause 228 of the EP&A Regulation in determining whether the Proposal would have a significant impact on the environment.

Factor	Impacts
Any environmental impact on a community? Comment: Some short-term impacts would be anticipated during construction, particularly in relation to noise, traffic and pedestrian access and visual impacts. Mitigation measures outlined in Table 27 would be implemented to manage and minimise any adverse impacts. There would be positive long-term impacts resulting from improved amenities and increased access for commuters.	☑ minor ☑ negative ☑ short term
Any transformation of a locality? Comment: The Proposal would impact the locality visually, but the visual character and functions would be retained. The locality surrounding the Station would be impacted in a positive manner by providing a community focal point, improving place-making and providing legibility for the interchange functions.	☑ moderate ☑ positive ☑ long term
Any environmental impact on the ecosystem of the locality? Comment: With the proposed mitigation conditions in place, the Proposal is unlikely to impact the local ecosystem as confirmed in Section 6. Some tree removal would be required but such impacts are not expected to adversely affect any local ecosystems.	☑ minor ☑ negative ☑ short term
Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? Comment: Some short-term impacts are anticipated during construction, particularly in relation to noise and visual impacts. During operation the Proposal would have some impact to the visual amenity of the station and local area but would have positive safety and access outcomes. These include the introduction of accessible parking, formalised kiss and ride, new bus zone and shelter, bicycle storage and realigned roadways.	☑ minor ☑ positive ☑ long term
Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations? Comment: The Proposal would have a positive effect on place-making and is designed to be sympathetic to the existing heritage items. The impacts on the heritage platform building have been minimised. The new overhead footbridge provides the opportunity to view the curved island platform and removal of vending machines and pay phone would allow the community to better appreciate the heritage platform building. Overall, effects are positive.	☑ moderate ☑ positive ☑ long term
Any impact on the habitat of protected fauna (within the meaning of	Nil

Factor	Impacts
the National Parks and Wildlife Act 1974)? Comment: The Proposal is unlikely to have any impact on the habitat of protected fauna.	
Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? Comment: The Proposal is unlikely to have an impact on endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air.	Nil
Any long-term effects on the environment? Comment: The overall impact of the proposed upgrade of Oatley Station to native flora and fauna is considered to be low. It is unlikely that the proposed works would result in a significant impact to threatened species, populations or communities. There would be a change to the visual environment with the introduction of the overhead footbridge, however choice of materials and finishes and landscaping would mitigate impacts.	☑ minor ☑ negative ☑ long term
Any degradation of the quality of the environment? Comment: The Proposal is unlikely to have any degradation of the quality of the environment.	☑ minor ☑ negative ☑ short term
Any risk to the safety of the environment? Comment: Construction of the Proposal would be managed in accordance with a CEMP to reduce any risks to the environment.	☑ minor ☑ negative ☑ short term
Any reduction in the range of beneficial uses of the environment? Comment: Local users would be impacted by temporary changed access arrangements during construction. A traffic Management Plan would be developed as part of the CEMP to manage traffic and access issues. During operation, the Proposal is unlikely to have any reduction in the range of beneficial uses of the environment.	☑ minor ☑ negative ☑ short term
Any pollution of the environment? Comment: There is potential for some short-term noise, air soil and water pollution during construction of the Proposal. These would be managed through the mitigation measures in Table 27. During operation, the Proposal is unlikely to cause any pollution to the environment.	☑ minor ☑ negative ☑ short term
Any environmental problems associated with the disposal of waste? Comment: The Proposal is unlikely to cause any environmental problems associated with the disposal of waste. All waste would be managed and disposed of in accordance with the OEH *Waste Classification Guidelines* (April 2008). Mitigation measures would be implemented to ensure waste is reduced, recycled or reused where applicable.	☑ minor ☑ negative ☑ short term
Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? Comment: The Proposal is unlikely to have any increased demands on	☑ minor ☑ negative

Factor	Impacts
limited resources.	☑ short term
Any cumulative environmental effect with other existing or likely future activities? Comment: Cumulative effects of the Proposal are described in Section 6. Where feasible, environmental management measures would be coordinated to reduce cumulative construction impacts. The Proposal is unlikely to have any significant long term cumulative impacts.	☑ minor ☑ negative ☑ short term
Any impact on coastal processes and coastal hazards including those under project climate change conditions? Comment: The Proposal is not located on the coastline and has not been identified as within an area that would be subjected to increased sea level rise.	Nil

Appendix 2 – Consideration of matters of national environmental significance

The table below demonstrates TfNSW's consideration of the matters of NES under the EPBC Act to be considered in order to determine whether the Proposal should be referred to the Commonwealth Department of the Environment.

Factor	Impacts
Any impact on a World Heritage property? Comments: There are no World Heritage properties in the vicinity of the Proposal.	☑ nil ☐ minor ☐ significant
Any impact on a National Heritage place? Comments: There are no National Heritage places in the vicinity of the Proposal.	☑ nil ☐ minor ☐ significant
Any impact on a wetland of international importance? Comments: There are no wetlands of international significance in the vicinity of the Proposal.	☑ nil ☐ minor ☐ significant
Any impact on a listed threatened species or communities? Comments: It is unlikely that the development of the Proposal would significantly affect threat-listed species or ecological communities.	☑ nil ☐ minor ☐ significant
Any impacts on listed migratory species? Comments: It is unlikely that the development of the Proposal would significantly affect threat-listed migratory species.	☑ nil ☐ minor ☐ significant
Any impact on a Commonwealth marine area? Comments: The works are not in the vicinity of a Commonwealth marine area.	☑ nil ☐ minor ☐ significant
Does the Proposal involve a nuclear action (including uranium mining)? Comments: The Proposal does not involve a nuclear action.	☑ nil ☐ minor ☐ significant
Additionally, any impact (direct or indirect) on Commonwealth land? Comments: The Proposal would not be undertaken on or near to any Commonwealth land.	☑ nil ☐ minor ☐ significant

Appendix 3 – Sustainable design initiatives

Initiative	Description	Applicable to Proposal
Energy and greenhouse		
C.1 Carbon footprint	Undertake AS14064-2 (Greenhouse Gases - project level) compliant carbon footprinting exercise for all projects with a capital investment value over $5 million in accordance with TFNSW's 'Greenhouse Gas Inventory Guide for Construction Projects'. The carbon footprint is to be used to inform decision making in design and construction. Use standard carbon coefficient values for construction material and fuel usage.	Yes
C.2 Building orientation and form	Optimise the building orientation and form to allow for maximum daylight levels.	Yes (N/A car park)
C.3 Five star appliances	Purchase plug-in equipment with at least five star Minimum Energy Performance Standards (MEPS) rating (fridges, air conditioners, etc) or an Energy Star accreditation (IT equipment).	Yes (station) No (interchange) (N/A car park)
1.17 Photo-electric switches	Install control systems for lighting that dim or switch-off lights according to the amount of daylight the zone is receiving. The lights can also switch on in order to maintain a minimum level of lighting. Lights should be off when areas are closed or unoccupied.	Yes
1.20 LED lights	Incorporate energy efficient LED lighting. In tunnels, allow lighting system to use low light or lights off while meeting lighting requirements.	Yes
1.22 Lighting scheme	Prepare a lighting scheme by a suitably qualified lighting designer. Pay attention to zoning between lighting demands of different areas and strategic placement of lighting fixtures to maximise ground coverage.	Yes
1.25 Natural ventilation	Naturally ventilate structures (refer to AS1668.2-2002 (type 3)). Consider prevailing winds.	Yes
1.44 Vertical transport	Install energy efficient vertical transport systems (e.g. ramps; variable speed drive escalators that enable a 'slow-mode', so that they oscillate at lower speeds when not in use and increase in speed when users step into the foot panel at the entry to the escalator; and variable voltage variable frequency (VVVF) control gear for lifts. (Station Guidelines for Vertical Transport).	Yes No (car park)
1.45 Stair placement to encourage use	Locate stairs along desire lines to encourage use. Provide stairs instead of escalators unless there is a 6m rise or greater, or a platform clearance or congestion issue. Maintain ramps or	Yes

Initiative	Description	Applicable to Proposal
	lifts for access for those with a disability.	
Climate resilience		
C.5 Climate change impact assessment	Perform a climate change impact assessment for each project worth over $5M using current scientific predictions (i.e. Intergovernmental Panel on Climate Change (IPCC), Commonwealth Scientific and Industrial Research Organisation (CSIRO) etc) to determine the hazards/risks associated with future climatic conditions. Refer to 'Climate Change Impacts and Risk Management: A Guide for Business and Government' and the 'AGIC Guidelines for Climate Change Adaptation' for guidance.	Yes
C.6 Design for climate change	In projects worth over $5 million, design to take into account the outcomes of the climate change impact assessment.	Yes
2.3 Passenger comfort	Review levels of passenger comfort to take account of climate change (e.g. provision of additional shelter from winds and driving rain and increased shading from sun in locations where customers wait for trains).	Yes
2.9 Protect sensitive assets	Protect sensitive assets (e.g. lifts) from the effects of extreme climate and weather.	Yes No (car park)
Water		
C.11 Water balance study	Undertake a water balance study including groundwater where applicable to inform feasibility for reuse initiatives.	Yes (N/A car park)
C.14 Monitor and record construction water	Meter water consumption at site office and all of the outlets available to the construction site.	Yes
5.1 Rain water	Store rain from roofs or shade structures in water tanks. Connect water tanks to a new or existing non-potable water reticulation system. Connect sub-meter to all outflow pipes from tanks.	Yes
5.10 Planting	Select plant species that require minimal or no irrigation after establishment.	Yes No (station)
Materials and waste		
C.8 Reduce waste to landfill	Ensure that at least 90 percent of construction waste generated during site preparation and construction is diverted from landfill and either recycled or reused.	Yes
C.9 Reuse spoil	Ensure that 100 percent of usable spoil material	Yes

Initiative	Description	Applicable to Proposal
	is beneficially reused.	
3.6 Reduce cement	Reduce the absolute quantity of Portland cement by at least 30%, as an average across all concrete mixes, by substituting it with supplementary cementitious materials (such as a fly ash, ground granulated blast furnace slag or alkali-activated cements).	Yes
3.9 Recycled aggregate	Use recycled aggregate in non-structural uses (e.g. building base course, sub-grade to any car parks and footpaths, backfilling to service trenches, kerb and gutter).	Yes
3.14 Sustainable structural steel	Source at least 60% of structural steel from a steel fabricator / contractor accredited by the Environmental Sustainability Charter of the Australian Steel Institute.	Yes
3.15 Lower embodied energy bar and mesh	Source at least 60% of bar and mesh that is produced through energy reduction processes such as Polymer Injection Technology.	Yes
3.17 Low VOC paints and finishes	Specify low volatile organic compound (VOC) paints and finishes.	Yes
3.18 Low VOC adhesives and sealants	Specify all adhesives and sealants as low-VOC.	Yes
3.29 Segregation of waste	Enable waste segregation in the design process by including space for the collection and segregation of waste with appropriate marking (e.g. signage) and controls (e.g. lockable lids), located away from sensitive receptors (e.g. water courses).	Yes
3.31 Mulching	Mulch all appropriate waste vegetation (no weeds) where justified by volume or make sure it is sent to an off-site compost facility.	Yes
3.34 Prevent electrolysis	Prevent or minimise the effects of stray current electrolysis from electrified railway that increase the rate of corrosion. Such as by: selecting suitable building materials, avoiding using metal finishes in the vicinity of high voltage electricity, using masking agents or coatings to prevent exposure of metals, and preventing direct contact between metallic parts.	Yes
3.39 Member spacing	Optimise the spacing of structural members in beam and post type designs.	Yes
Initiative	Description	Applicable to Proposal

Initiative	Description	Applicable to Proposal
Biodiversity and heritage		
C.10 Biodiversity offsetting	For non significant impacts (inside or outside the rail corridor) offsetting is to be in accordance with either RailCorp's Biodiversity Offset requirements or Transport Project's Vegetation Offsetting Guide as appropriate.	Yes No (station)
4.2 Ecological value opportunities	Maximise ecological values through landscape species choice, and planting density and configuration. Make sure that appropriate weed management strategies are undertaken to avoid migration or contamination on and offsite.	Yes (interchange/car park) No (station)
4.8 Green roofs and walls	Install green roof and/or green walls, maximising the extent of native vegetation.	No
4.9 Heritage items in the vicinity	Design for the interrelationship between new development/redevelopment and proximate buildings of heritage/cultural significance.	Yes
4.10 Heritage interpretation	Develop and implement a heritage interpretation strategy, e.g. incorporate interpretive signage at the station, which provides information on the heritage of the area.	Yes No (interchange/car park)
Pollution control		
6.4 Avoid dangerous goods and hazardous materials	Use Material Safety Data Sheets (MSDS) to avoid dangerous goods and hazardous materials.	Yes
6.17 Avoid glare and light pollution	Minimise ambient light levels and glare towards neighbouring properties (e.g. avoid or obstruct up lighting). Refer to ASA standard 3.11.3.3 for guidance and make sure that design complies with AS4282 'Control of the Obtrusive Effects of Outdoor Lighting'. Do not exceed minimum requirements of AS1158 for illuminance levels for 95% of outdoor spaces.	Yes
Community benefit		
C.16 Community involvement in planning	Actively engage with stakeholders including the community during planning.	Yes
C.17 Planning framework	Plan and design projects to take into considerations existing planning strategies in consultation with relevant authorities.	Yes
7.4 Weekend use	Allow for communal parking space use during non-peak commuting hours.	Yes
7.07 Plan station entries	Plan stations entries that connect directly to existing key desire lines, pedestrian routes or for the most efficient pedestrian routes.	Yes

Initiative	Description	Applicable to Proposal
7.08 Bicycle and pedestrian links	Optimise local pedestrian links to and between community facilities, such as sports grounds etc. Plan pathways within the asset to connect directly with existing pedestrian routes, centre activities and station entries. Design station building in a way to prevent it becoming a visual or psychological barrier to crossing the railway.	Yes
7.14 Wayfinding strategy	Develop and implement a wayfinding strategy for the catchment area within 800 metres of the station.	Yes
7.19 Kiss and ride	Provide for kiss and ride at the station.	Yes
7.20 Taxi stand and/or bus stop	Provide shelter for nearby taxi stands and bus stops.	Yes
7.28 Bicycle lockers and/ or racks	Provide sheltered bicycle lock ups and/or lockers in or near entrance to the station. Allow for at least 5% of staff use at maintenance facilities. See Section 3.9.3.1 of the Sydney Trains Station Design Standard Requirements for further information on bicycle parking requirements at stations.	Yes (interchange) No (station/car park)
7.29 Bicycle storage security	Locate bicycle storage area in an area with a high level of passive surveillance and/or prominent CCTV.	Yes (interchange) No (station/car park)
7.34 Safe pedestrian movement	Make sure that safe movement is promoted for pedestrians and cyclists by minimising vehicle crossings of paths, providing clear signage, and providing freedom from obstacles such as poles, trees etc.	Yes
7.39 Reduce vandalism	Minimise risks from vandalism during design, such as: designing pedestrian bridges and walkways with a high degree of surveillance or railings, restrict window openings and limit to a maximum 80mm opening.	Yes
7.40 Reduce graffiti	Minimise graffiti risks during design, such as: treatment of fencing and other surfaces with anti-graffiti paint or coatings, vegetation cover to deter graffiti or providing designated walls for graffiti.	Yes
7.52 Asset vegetation	Provide vegetation to reduce heat islanding and increase visual attraction.	Yes (interchange/car park) No (station)