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Report No. 12-316.R28

Capestone Stage 21
Residential Development

Assessment and Control of
Rail Noise Intrusion

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23 March 2020	Rev1	Re-assessment of rail noise intrusion onto Stage 21 for lot layout shown in Veris Drawing No 30105-21-LC, Issue B, Sheets 1-3 (all dated 09 March 2020). Includes change to earthworks design and the corresponding change to alignment of acoustic barrier to rail line in response to change to earthworks design.

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SUMMARY

Urbex has lodged an application with Moreton Bay Regional Council over land located on Capestone Boulevard, Mango Hill. The subject site is Stage 21 of the Capestone Estate. The application seeks approval for the development of 156 allotments for residential premises on the subject site.

The site adjoins Capstone Boulevard. The site also adjoins the Redcliffe Peninsula Rail Line (RPRL, formerly Moreton Bay Rail Link). Because of the proximity of the subject site to Capestone Boulevard and RPRL, Council requested that an assessment of the extent of noise intrusion from road and rail traffic onto the subject site be conducted.

Accordingly, Acoustics RB Pty Ltd was engaged by Urbex to conduct the required Road Traffic Noise Assessment and Rail Noise Assessment, and if necessary, to make recommendations for the control of any excessive road and/or rail noise intrusion.

To address Council's requirements, two reports have been prepared: one to deal with road traffic noise intrusion and one to address rail noise intrusion. This report, Report No. 12-316.R28, deals with rail noise intrusion. Report No. 12-316.R29 addresses the impact of road traffic noise intrusion.

It should be noted that this is the first revision of Report No. 12-316.R28. The original version of the report was issued on 01 November 2019. That version of the report was based on the site layout that was current in November 2019 (ie Veris Drawing No 30105-BLE32 Issue C, Sheets 1 and 2). Since that time, the lot layout over the subject site has been changed. The current layout is shown in Veris Drawing No 30105-21-LC, Issue B, Sheets 1-3 (all dated 09 March 2020). In addition, changes have been made to the earthworks levels of lots within Stage 21 located in close proximity to the rail to account for the revised internal road and pathway network.

From the results of this rail noise assessment, it has been determined that:-

- The extent of rail noise intrusion onto the site is such that compliance with the 65dBA $L_{Aeq,24hr}$ and 87dBA $L_{Amax\ passby}$ noise level limits set by QR under the *QR Code of Practice for Railway Noise Management* will be achieved on all lots.
- The construction of the stepped 2.0m-2.5m high barrier shown in Figure 4 will attenuate rail noise intrusion onto all lots. In particular, at lower facade height, the barrier will be will be very effective in completely eliminating the Noise Category 2, 3 and 4 contours from the ground floor level facades of the lots within Stage 21.
- The barrier will also be effective in attenuating the rail noise intrusion onto the site at upper (ie second level) facade height. With this barrier in place, it can be seen that the stepped 2.0m-2.5m high barrier of Figure 4 in place, there will be intrusion of the Noise Category 3 (ie **purple**) contour onto only thirteen Stage 21 lots, ie Lots 1-12 and 19. The remainder of the lots will be situated in the Noise Category 0, 1 and 2 bands.
- The actual noise categories applying to the 86 lots of Stage 21 located within the proposed TNC are presented in Tables 3-5. As permitted under the site-specific assessment provisions of QDC MP 4.4, the noise categories shown in Tables 3-5 may be used to guide the subsequent acoustical design of the residences on these lots at BA.
- Notwithstanding, it is important to note that, on many lots, it is fully expected that the placement of the residential building on the lot will be such that, even though a small part of the lot will be subject to the designated noise category shown in Tables 3-5, the residence itself will be set back sufficiently from the boundary such that the next lower noise category will apply to the residence.

It is noted that under Condition 11 *Railway Traffic Noise* of Negotiated Preliminary Approval No. 2003/10335/1 "The developer is not required by Council to construct any noise attenuation measures". Notwithstanding, to achieve control rail noise intrusion onto the 86 lots of Stage 21 and located within the proposed TNC, it is recommended that the stepped 2.0m-2.5m high Transport Noise Barrier shown in Figure 4 be constructed along the common boundary with the rail reserve.

As required by QR, the barrier will need to be designed and constructed in accordance with QR Civil Engineering Technical Requirement CIVIL-SR-014 *Design of Noise Barriers Adjacent to Railways*.

PNU Property Note - Acoustic (Rail) Report Advice (Building Design Standards) – Stage 21

The following notation will be recorded on Council's database for proposed Lots 1-57, 68-79, 87-100, 121, 122 and 900:

> *A suitably qualified acoustic consultant should conduct an assessment of the building design and construction for building to be constructed on Lot xxx. Residential dwellings are to be sited and constructed to comply with Queensland Development Code (QDC) Mandatory Part (MP) 4.4 'Buildings in transport noise corridors'. The Noise Category/s applicable to Lot xxx is to be determined by reference to Tables 3-5 of the approved noise report, ie Acoustics RB Pty Ltd Report No. 12-316.R28 Capestone Stage 21 Residential Development – Assessment and Control of Rail Noise Intrusion dated 1 November 2019.*

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1.0 Introduction

Urbex has lodged an application with Moreton Bay Regional Council over land located on Capestone Boulevard, Mango Hill. The subject site is Stage 21 of the Capestone Estate. The application seeks approval for the development of 156 allotments for residential premises on the subject site.

Stage 21 is located to the north-east of the previously-approved Stages 11 and 12 of Capestone Estate and to the north of the previously-approved Stage 13. The site adjoins Capstone Boulevard. The site also adjoins the Redcliffe Peninsula Rail Line (RPRL, formerly Moreton Bay Rail Link).

Because of the proximity of the subject site to Capestone Boulevard and RPRL, Council requested that an assessment of the extent of noise intrusion from road and rail traffic onto the subject site be conducted.

Accordingly, Acoustics RB Pty Ltd was engaged by Urbex to conduct the required Road Traffic Noise Assessment and Rail Noise Assessment, and if necessary, to make recommendations for the control of any excessive road and/or rail noise intrusion.

To address Council's requirements, two reports have been prepared: one to deal with road traffic noise intrusion and one to address rail noise intrusion. This report, Report No. 12-316.R28, deals with rail noise intrusion. Report No. 12-316.R29 addresses the impact of road traffic noise intrusion.

2.0 Council Requirements

2.1 Historical

On 19 December 2006, Council (ie the former Pine Rivers Shire Council) issued a Negotiated Decision Notice under s3.5.17 of the Integrated Planning Act for preliminary approval for a material change of use over the entirety of the Capestone site. Negotiated Preliminary Approval No. 2003/10335/1 refers.

Conditions 11 and 37 of that Negotiated Preliminary Approval as well as Item 17.10 of *Changed Preliminary Approval No 2003/10335/MISC/1* each have relevance to the assessment and control of road and rail noise intrusion onto the subject site. These conditions are reproduced below and overpage.

> ***11 Railway Traffic Noise***
>
> *The Developer shall provide a traffic noise report to ameliorate noise from the adjoining possible future railway as required by Council's Local Planning Policy LP 25. For the purposes of the policy, the possible rail corridor is a transport corridor controlled by the Queensland Department of Transport. The noise levels to be achieved shall be those specified for "New Corridors and Facilities" in the "QR Code of Practice for Railway Noise Management".*
>
> *The developer is not required by Council to construct any noise attenuation measures.*
>
> *Council's Subdivisions Engineer shall place appropriate worded property notes on all residential lots were the predicted noise level exceeds that were standard dwelling construction (would) be adequate to achieve the recommended design sound levels and the relevant Australian Standard. The property notes are intended to allow landowners to decide the type construction they may wish to build to limit possible future railway noise intrusion into the dwellings.*

37 Acoustic Report

The Acoustic Assessment prepared by Cardno MBK within the response entitled "Response to Information Request Flooding, Water Quality, Noise, Water Supply and Sewerage and Geotechnical Issues" received by Development Services date stamped 16 December 2004 is considered acceptable in principle. Further detailed Acoustical Impact reports will be required to be submitted by the applicant to the time of lodging future applications to obtain Development Permits over the site.

2.2 Changed Preliminary Approval No 2003/10335/MISC/1

Item 17.10 of Changed Preliminary Approval No 2003/10335/MISC/1 states:

Residential Development in the vicinity of the North South Arterial Road or the Public Transport Corridor is provided with an acceptable level of residential amenity particularly in relation to potential noise, air quality and visual impacts. At the time of submitting Code Assessable Material Change of Use applications for Development Permits to facilitate the creation of residential premises in the vicinity of the North South Arterial Road or the Public Transport Corridor the applicant shall demonstrate that measures have been incorporated into the layout or design to provide for an acceptable level of residential amenity particularly in relation to potential noise, air quality and visual impacts. Design solutions may include but are not limited to dense vegetated buffer areas, separation distances, topographic feature, internal local movement network components (local roads or pedestrian/cycle ways) and appropriately designed structures and buildings.

2.3 Previous Version of Report

It should be noted that this is the first revision of Report No. 12-316.R28.

The original version of the report was issued on 01 November 2019. That version of the report was based on the site layout that was current in November 2019 (ie Veris Drawing No 30105-BLE32 Issue C, Sheets 1 and 2).

Since that time, the lot layout over the subject site has been changed. The current layout is shown in Veris Drawing No 30105-21-LC, Issue B, Sheets 1-3 (all dated 09 March 2020). In addition, changes have been made to the earthworks levels of lots within Stage 21 located in close proximity to the rail to account for the revised internal road and pathway network.

3.0 Existing Situation and Proposed Development

The location of the subject site is shown in Figure 1A. Figure 1B shows the location of the site within Capestone Estate.

The real property description of the site is Part of Lot 2 on SP281064, Part of Lot 394 on SP290274 and Part of Lot 394 on SP311412. The local authority is Moreton Bay Regional Council. As noted above, however, before amalgamation the site was previously located within the shire boundaries of the former Pine Rivers Shire.

In Figure 1, it can be seen that Stage 21 is located to the north-east of the previously-approved Stages 11 and 12 of Capestone Estate and to the north of the previously-approved Stage 13.

The layout of lots over Stage 21 is presented in Figures 2A-2C.

As is evident in Figure 1, Stage 21 adjoins Capstone Boulevard to the SW, but is well removed from Anzac Avenue to the north-west (ie at least 450m distant). The site also adjoins the Redcliffe Peninsula Rail Line (RPRL, formerly known as the Moreton Bay Rail Link, MBRL).

As shown in Figure 2A and 2B, and as noted above, it is proposed to develop Stage 21 to accommodate 156 residential allotments. Of these, one (ie Lot 900) is proposed to be developed for medium density housing. Of the remaining 155 lots, all have been designed to accommodate detached dwellings.

4.0 Requirements of Regulatory Authorities

4.1 Overview

At Condition 11 *Railway Traffic Noise*, Council has made reference to the preparation of a traffic noise report to be prepared in accordance with Council's Local Planning Policy LP 25 *Noise Attenuation on Residential Land*.

At Condition 37, Council requires that further detailed acoustical impact reports be prepared. Whilst not stated explicitly, Condition 37 applies to the assessment of road traffic noise intrusion. Item 17.10 of Changed Preliminary Approval No 2003/10335/MISC/1 also requires that the impact of road traffic noise intrusion be assessed.

Planning Policy LP 25 *Noise Attenuation on Residential Land* deals specifically with the control of road traffic noise intrusion onto residential land. The policy applies to all residential development adjacent to State-controlled roads, transit/transport corridors and Council-controlled roads from "collector" classification upwards.

It should be noted that, in the intervening period since the imposition of Conditions 11 and 37, Queensland Development Code (QDC) Mandatory Part (MP) 4.4 *Buildings in a Transport Noise Corridor* has been gazetted. This Code commenced on 1 September 2010. The current version of QDC MP 4.4 commenced on 17 August 2015, replacing the version gazetted in 2010. The provisions of the Code will now control the extent to which residences located on noise-affected lots within a Transport Noise Corridor (TNC) will need to be acoustically upgraded.

In addition, in November 2013 the Department of Transport and Main Road (DTMR) *Transport Noise Management Code of Practice Volume 1 – Road Traffic Noise* commenced. This Code of Practice places specific requirements on the method of assessment of noise intrusion from road traffic on State-controlled roads. Limits for acceptable levels of noise intrusion are set under DTMR's *Policy for Development on Land Affected by Environmental Emissions from Transport and Transport Infrastructure Version 2* dated May 2013.

Subsequently, in March 2019, DTMR issued *Interim Guideline – Operational Railway Noise and Vibration – Government Supported Transport Infrastructure*. The Interim Guideline re-states the limits for acceptable levels of noise intrusion from rail movements. It also provides guidance on the appropriate modelling and measurement methodologies to be used when assessing the impact of noise and/or vibration intrusion.

At the time of commencement of PSP6, ie in December 2006, PSP6 quite correctly applied to land adjoining transit/transport corridors. For land adjoining State-controlled roads, the provisions of DTMR's *Code of Practice* would now apply to the assessment of road traffic noise intrusion at DA. The provisions of QDC MP 4.4 apply at BA to all residential development within a TNC.

Accordingly, because a local authority cannot impose a requirement which conflicts with the requirements of QDC MP 4.4 or seeks to alter or modify the application of a Queensland Development Code, the provisions of QDC MP 4.4 as they apply to any particular lot located within a TNC will override those of any particular code, guideline or policy generated by Council to the degree that any of this document/s seeks to impose acoustical design requirements which differ from those imposed under QDC MP 4.4.

In view of the above, PSP6 will have applicability to only those lots which are located outside a TNC. For lots located within a TNC, assessment in accordance with DTMR's *Code of Practice* and QDC MP 4.4 would be appropriate.

Note:

This distinction does not prevent QDC MP 4.4 being applied to lots located outside a TNC if there is a valid mechanism to allow this to occur. It simply precludes the application of PSP6 to lots within the TNC [1].

4.2 Specific Requirements for Stage 21

Under the provisions of Section 246Z of the *Building Act 1975*, a Transport Noise Corridor (TNC) has been designated along both sides of Anzac Avenue. A graphical depiction of the TNCs associated with State-controlled roads is available from the Department of State Development, Manufacturing, Infrastructure and Planning (DSDMIP) State Planning Policy (SPP) Interactive Mapping System (IMS) website.

An extract from the website showing the Anzac Avenue TNC in the vicinity of the subject site is presented in Figure 3A. As is evident in this figure, Stage 21 lies well outside the Anzac Avenue TNC.

On 29 January 2020, the State, by way of Gazettal Notice, designated a TNC along both sides of RPRL. According to the notice, depending on the noise contour mapping, land within 250m of the boundary of the railway with adjacent land is designated as being within the TNC.

By reference to the DSDMIP SPP IMS mapping (refer also Figure 3B), it can be observed that only land within 250m of the centreline of the nearest rail track is located inside the TNC. It should be noted that this mapping is the first attempt by DTMR to document, by way of noise modelling, the extent of rail noise intrusion onto Capestone.

4.3 QDC MP 4.4 Buildings in a Transport Noise Corridor

4.3.1 Overview

The stated purpose of QDC MP 4.4 is "to ensure habitable rooms of Class 1, 2, 3 and 4 buildings located in a Transport Noise Corridor are designed and constructed to reduce transport noise."

Table 1 of QDC MP 4.4 sets Noise Categories depending upon the external noise level to which the dwelling is subjected when measured 1m from the facade of the proposed or existing building.

The noise category levels of Table 1 are reproduced overpage.

[1] Although not directly relevant to the development of Capestone, Council's SC 6.16 *Planning Scheme Policy – Noise* became effective on 1 February 2016, with amendment 1 taking effect from 3 July 2017. This Policy currently requires that assessment of noise intrusion from railways and major roads for development onto land subject the current planning scheme be conducted in accordance with QDC MP 4.4. This is notwithstanding the fact that the particular site may not be located with a TNC and, hence, in the absence of valid trigger to invoke QDC MP4.4, the provisions of QDC MP4.4 would not apply. Whether it is possible to extend the application of QDC MP 4.4 beyond its purpose is a town planning/legal question.

Noise Category	State-Controlled Roads and Designated Local Government Roads, $L_{10(18hour)}$ (dBA)	Railway Land Single Event Maximum Noise Level, $L_{Amax\ passby}$ (dBA)
Category 4	≥ 73 dBA	≥ 85 dBA
Category 3	68 - 72 dBA	80 - 84 dBA
Category 2	63 - 67 dBA	75 - 79 dBA
Category 1	58 - 62 dBA	70 - 74 dBA
Category 0	≤ 57 dBA	≤ 69 dBA

Table 1 – Noise Category Levels Reproduced from QDC MP 4.4

Recognising the discontinuities and resultant practical uncertainties evident in the noise level class intervals set in Table 1 [2], DTMR issued a directive requiring that, in the case of State-controlled roads, the class intervals be adjusted. The updated road traffic class intervals are presented in Table 2 together with, for consistency, the class intervals for rail noise reconciled in the same manner. These updated class intervals have recently been included in the SPP mapping.

Noise Category	State-Controlled Roads and Designated Local Government Roads, $L_{10(18hour)}$ (dBA)	Railway Land Single Event Maximum Noise Level, $L_{Amax\ passby}$ (dBA)
Category 4	≥ 73 dBA	≥ 85 dBA
Category 3	68-73 dBA	80-85 dBA
Category 2	63-68 dBA	75-80 dBA
Category 1	58-63 dBA	70-75 dBA
Category 0	≤ 58 dBA	≤ 70 dBA

Table 2 – Corrected Noise Categories - QDC MP 4.4

Note:

At Condition 11 of the Negotiated Preliminary Approval, Council has requested that "the noise levels to be achieved shall be those specified for *New Corridors and Facilities* in the *QR Code of Practice for Railway Noise Management*". These noise level limits are the Planning Levels set by QR at Section 4.2 of *QR Code of Practice for Railway Noise Management*, viz:-

- 65dBA $L_{Aeq,24hr}$, and
- 87dBA Single Event Maximum SPL ($L_{Amax\ passby}$)

Under the *QR Code of Practice*, these limits apply at "1m in front of the most exposed part of an affected Noise Sensitive Place". When applying these limits, the limits are to be met at all ground floor level facades, ie facades which can be protected using barriers of not unreasonable height.

Clearly, the $L_{Amax\ passby}$ noise level limit is higher than the lower-bound of the most stringent QDC MP 4.4 noise category, ie Noise Category 4. It follows, therefore, that if the predicted noise categories on the most-affected residential lots due to the operation of the RPRL are lower than Noise Category 4, compliance with the $L_{Amax\ passby}$ limit set by Condition 11 would be achieved as a result.

[2] The discontinuities are the gaps between the upper bound of one Noise Category and the lower bound of the next higher Noise Category. Discontinuities give rise to resultant practical uncertainties. For example, should the residence subjected to an external noise level of 62.5dBA $L_{10(18hour)}$ be ascribed a Noise Category 1 designation or a Noise Category 2 designation? To resolve this uncertainty, the upper bound of one Noise Category must be equivalent to the lower bound of the next higher Noise Category. The corrected Noise Categories are presented in Table 2 and are also presented on mapping from the SPP IMS website, refer Figure 3A and Figure 3B.

4.3.2 Determination of Noise Categories

As noted above, for rail lines with a gazetted TNC, the noise categories applicable to any particular site adjoining the rail reserve can be determined by reference to the DSDMIP SPP IMS website. Alternatively, the noise categories may be determined in accordance with the alternative site-specific noise level assessment method of Schedule 3 of QDC MP 4.4. In addition, QDC MP 4.4 also permits building upgrade requirements to be determined either (i) by application of noise categories determined from the DSDMIP SPP IMS website, or (ii) from the actual noise categories resulting from the alternative site-specific noise assessment.

When applying the alternative site-specific noise assessment method to the determination of either the noise categories or the building upgrade requirements that apply to any specific residence located within a TNC, due consideration may be given to the following matters:-

1. Site topography.
2. Beneficial shielding provided by any barriers – either existing or required to be constructed as a condition of the approval of the Development Application over the subject site.
3. Acoustical shielding provided by existing and approved buildings, where "approved buildings" refers to (i) buildings for which formal building approval has been granted, or (ii) in the case of the specific building/s being assessed, where building approval is being sought.
4. Determination of the relevant noise category may be made on a facade-specific basis, but where the total area of the facade of a habitable space is exposed to two or more noise categories, the higher noise category would apply to the whole facade of the particular habitable space.

In addition, and as a result of advice provided by DTMR, the following refinements to the site-specific noise assessment may also be applicable:-

5. In April 2012, updated advice from DTMR resulted in further refinement of the acoustical design procedures. This updated advice contends that in situations where noise contours can be plotted at fine gradation around the external facades of the building being assessed, such that noise levels can be determined with precision at individual building facade elements, the calculation procedures of AS3671 - 1989 *Acoustics - Road Traffic Noise Intrusion - Building Siting and Construction* may be adopted in lieu of the noise categories and the minimum R_w values presented in Schedule 1 of QDC MP 4.4 to determine the precise level of building upgrade required to be implemented to achieve compliance with the internal sound level of AS/NZS 2107:2016 *Acoustics – Recommended Design Sound Levels and Reverberation Times for Building Interiors* [3] that is applicable to the specific space.

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[3] The minimum R_w values presented in Schedule 1 of QDC MP 4.4 were determined for a generic building design by applying the calculation techniques of AS3671 – 1989 to achieve compliance with the satisfactory internal sound levels of AS/NZS 2107:2016. Refer tabulation of *Referenced Documents* of QDC MP 4.4. Because it was necessary to cover a moderately wide range of functional variances for each particular space (ie number of exposed facades, floor areas, areas of glazing, ceiling height, presence of roof/ceiling construction, presence of entry door, etc) in doing so, as well as deal with (i) a 5dBA spread of noise levels within each noise category and (ii) generalised (and usually conservative) offsets between (a) L10(18hour) and $L_{Aeq,1hrnight}$ values and (b) L10(18hour) and $L_{Aeq,1hrday}$ values, a significant degree of conservatism was built into the minimum R_w values of Schedule 1.

In addition, the minimum R_w values of Schedule 1 have been determined on the basis that equal levels of acoustic energy are transmitted via each of the specific building elements. In practice, the acoustical performance of wall and roof/ceiling constructions, even under "standard construction" conditions, often exceeds the minimum R_w values of Schedule 1. As a result of this, a re-balancing of the R_w performance requirement for glazing can be undertaken without increasing the level of noise intrusion and without jeopardising compliance with the relevant internal sound levels of AS/NZS 2107:2016.

When due consideration is also given to the actual level of noise exposure at the facade, rather than adoption of the applicable 5dBA noise category band, a further refinement of the R_w performance requirement for glazing can be conducted, again without jeopardising compliance with the relevant internal sound level requirement. As a result, when these refinements are adopted, it has been determined that, in almost all instances, the glazing to habitable spaces will not need to be upgraded to the degree stated in Schedule 1. Furthermore and in particular, for spaces with relatively low areas of glazing and exposed to noise levels at or around 63dBA L10(18hour) for road traffic noise intrusion, it has been determined routinely that full compliance with the relevant internal sound levels of AS/NZS 2107:2016 can be achieved without requiring any upgrade beyond standard construction be made to the acoustical performance of the glazing.

Notes:

Each of these items of advice has been endorsed in DTMR's *Transport Noise Management Code of Practice*, November 2013.

AS3671 – 1989, as its name suggests, provides guidance on dealing with road traffic noise intrusion. There is currently no equivalent standard to deal with rail noise intrusion into habitable spaces. Notwithstanding, even though AS3671 – 1989 is not directly applicable to the control of rail noise intrusion, it can be demonstrated that it is a relatively simple matter to apply standard acoustical theory and calculation techniques to the processes of AS3671 – 1989 to yield acceptable outcomes for noise intrusion from electric trains.

5.0 Methodology

5.1 Overview

Having regard to each of Matters 1-4 above, the noise model for Stage 21 of the Capestone Estate has been configured to generate the QDC MP 4.4 noise categories that will apply as a result of rail noise intrusion onto each of the lots of Stage 21 that are located within the future TNC.

The prediction of rail noise intrusion onto the site has been conducted using the Kilde 130 [4] noise level prediction algorithms endorsed by Queensland Rail and as applied by the SoundPLAN[5] computer program.

The inputs into the Kilde 130 rail noise model have been derived from on-site attended sound level measurements as well as from relevant information provided by QR. In addition, due regard has been given to the number of daily passbys of each train type along the RPRL.

The rail noise model was configured to predict both $L_{Aeq,24hr}$ and $L_{Amax\ passby}$ noise levels. As required under Schedule 3 of QDC MP 4.4, the facade-corrected $L_{Amax\ passby}$ noise levels are to be used as the basis for determining the extent of rail noise intrusion [6].

Due account was also taken of the site topography including the latest site earthworks levels across Stage 21 of the Capestone Estate as well as (i) the noise barriers constructed by the developer along the rail reserve boundary of lots in other stages of the Capestone Estate and (ii) the noise barrier constructed by QR along the NW side of the rail corridor in the region adjacent to Stage 21.

Further details on these matters are presented in Sections 5.2 and 5.3 following.

5.2 Noise Model and Modelling Inputs and Assumptions

As noted above, the prediction of airborne rail traffic noise intrusion onto the site has been conducted using the Kilde 130 noise level prediction algorithms endorsed by Queensland Rail and as applied by the SoundPLAN computer program. The input to the noise model included the lot layout and earthworks contours which were imported directly from electronic files provided by the Project Civil Engineer.

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[4] *Nordic Rail Traffic Noise Prediction Method* prepared for The Nordic Council of Ministers' Noise Group, NBG, December 1984. The Kilde 130 methodology is the set of noise prediction algorithms endorsed by QR.

[5] SoundPLAN is an integrated software package for noise and air pollution evaluation developed in Germany by Braunstein + Berndt GmbH. It has been configured to predict the extent of (i) rail noise intrusion by application of the Kilde 130 rail noise intrusion algorithms, (ii) by application of the CRTN '88 road traffic noise intrusion algorithms and (ii) by application of the CONCAWE industrial noise emission algorithms. It is in use in more than 48 countries and has had widespread application throughout Australia. It is endorsed by DTMR, MBRC, Brisbane City Council, Queensland DES and most other State environmental authorities.

[6] Notwithstanding the slight differences in definition between $L_{Amax\ passby}$ as applied by SoundPLAN and Single Event Maximum Noise Level as designated by QR, for the purposes of assessment against the requirements of QDC MP 4.4, both metrics can be considered to be interchangeable.

Further inputs were derived from information provided by QR with respect to rail alignment, train type, acoustic source height for each type of train, train length, train speeds and source noise levels for the relevant type of train, ie MaxL at 10m and 25m and SEL[7] at 25m. In addition, due regard was given to the number of daily rail movements on the RPRL.

The noise model was configured to predict both $L_{Aeq(24hour)}$ and $L_{Max\ passby}$ noise levels. As required by the QDC, the facade-corrected $L_{Amax\ passby}$ noise levels are to be used as the basis for determining the extent of rail noise intrusion[8].

The calculations also took account of the various site-specific variables which influence the level of rail noise emission onto the site.

These included:-

- Topographical shielding
- Distance from rail tracks
- Shielding provided by existing structures, if any
- Vertical and horizontal alignment of rail line
- Reflection from opposite facades, if any
- Angle of view to rail line
- Receptor height

5.3 Validation of Noise Model

This Kilde 130 methodology has been shown to achieve good correlation with measured noise levels, especially at short distance from the rail line. Notwithstanding, in instances where the rail line exists, it is appropriate to undertake a validation process for any new or updated assessment of rail noise intrusion to confirm the suitability of the Kilde 130 algorithms at the site. Ideally, such validation should take account of both the $L_{Aeq(24hour)}$ and $L_{Max\ passby)}$ noise level parameters.

To allow the noise model to be validated, both attended and unattended noise level monitoring was undertaken. The attended noise level measurements were conducted over two peak rail traffic periods, ie (i) from 7:30am to 10:00am on Wednesday 4 September 2019 and (ii) from 7:15am to 10:30am on Thursday 5 September 2019. The noise levels generated by an approximately equal number of inbound and outbound train passbys were measured.

In addition, unattended noise level measurements were conducted over the intervening period, ie from 7:30am Wednesday 4 September 2019 to 10:30am on Thursday 5 September 2019. From this data, the noise levels generated by clearly identifiable train passbys were able to be derived during periods when the otherwise prevailing ambient noise levels were relatively low. The movements on the line for the periods of time of the unattended on-site noise level measurements were cross-checked against the timetable service.

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[7] SEL is the $L_{Aeq,1s}$ value which has the same energy sound pressure level as the $L_{Aeq,T}$ value measured during the passage of the particular train being assessed for the duration, T, of that passage.

[8] Notwithstanding the slight differences in definition between $L_{Amax\ passby}$ as applied by SoundPLAN and Single Event Maximum Noise Level as designated by QR, for the purposes of assessment against the requirements of QDC MP 4.4, both metrics can be considered to be interchangeable.

In total, the noise generated by 35 train passbys was able to be measured directly during the attended noise level measurements. On each occasion, the $L_{Aeq,T}$[9] and MaxL[10] noise levels were recorded electronically. In both cases, the sampling and noise level derivation method of QR's *Attachment A - Railway Noise Assessment Report Structure and Specific Issues* has been adopted.

The measured free-field noise levels at Locations A and B are presented below:-

- $L_{Amax\ passby}$: Location A: 76.9dBA, Location B: 76.4dBA
- $L_{Aeq(24hour)}$: Location A: 53.2dBA, Location B: 53.9dBA

The corresponding facade-corrected noise levels[11] at Locations A and B are as follows:

- $L_{Amax\ passby}$: Location A: 79.4dBA, Location B: 78.9dBA
- $L_{Aeq(24hour)}$: Location A: 55.7dBA, Location B: 56.4dBA

In all instances, it can be seen that compliance has been achieved with the 65dBA $L_{Aeq,24hr}$ and 87dBA Single Event Maximum SPL ($L_{Amax\ passby}$) noise level limits.

By reference to Figure 3B, the corresponding predicted facade-corrected $L_{Amax\ passby}$ noise levels shown in the QDC MP 4.4 noise category bands have been determined to be as follows:-

- Noise Category $L_{Max\ passby}$: Location A: 82.5dBA, Location B: 84.5dBA

It can be seen that the noise levels shown in the QDC MP 4.4 noise category bands are 3-5dBA higher than those measured on-site. It should be noted that this outcome is not unusual. On numerous occasions, it has been determined that the actual level of noise intrusion onto sites adjacent to rail lines trafficked by electric trains have been overstated on the QDC MP 4.4 noise category bands shown on the SPP website.

In view of this outcome, the rail noise model was configured to achieve close agreement with the actual noise levels measured on-site. When validation runs were conducted, it was determined that the predicted $L_{Amax\ passby}$) noise levels agreed to within 0.3dBA of the measured noise levels. This is a very good result and significantly better than the required ±2dBA tolerance set by QR.

In view of this, it is reasonable to expect that the resultant noise level contours predicted by the noise model will closely match the actual noise levels expected across the site.

Finally, notwithstanding the fact that compliance with the 65dBA $L_{Aeq,24hr}$ and 87dBA $L_{Amax\ passby}$ noise level limits will be achieved throughout, it was appropriate to evaluate various barrier options with the objective of minimising the extent of rail noise intrusion onto the site. More specifically, the objective was to remove Noise Categories 2 and 3 from the lower level of all residences within the TNC associated with the RPRL. The optimum barrier to achieve this outcome was determined to be a stepped 2.0m-2.5m high noise barrier will be constructed along part of the rail reserve boundary of the site. The alignment of the barrier is shown in Figure 4 attached. This barrier has been included in the noise model for Stage 21 and its effectiveness assessed.

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9 $L_{Aeq,T}$ is the equivalent energy sound pressure level of the passage of a train measured over the measurement time period, T (sec), where T is selected to ensure that the measured sound pressure level is due to the passage of the train without any significant contribution from the otherwise prevailing ambient noise sources.

10 MaxL is the instantaneous maximum noise level measured during the passage of a train when the noise level is due to the train itself and not extraneous noise.

11 An adjustment of 2.5dBA is to be made to free field noise levels to generate the corresponding facade-corrected noise levels at the same location.

Note:

QDC MP 4.4 allows the beneficial shielding of approved residences to be taken into account, where "approved residences" refers to those which have been constructed, for which approval for construction has been granted, or in the case of the specific building being assessed, where building approval is being sought. This is in contrast to the assessment of road traffic noise intrusion conducted under PSP6 whereby Council permits rectangular 'block' residences to be constructed on the proposed new lots. In this instance, because no residences have yet been constructed on Stage 21, the assessment of the extent of rail noise intrusion onto the site must be conducted under "greenfield" conditions, ie without any residences in place.

5.4 Noise Control Plots

A set of six noise contour plots has been prepared. These noise contour plots are described below:-

- Figure 5: Rail Noise Categories for ground floor level facades of residences, no barrier in place.
- Figure 6: Rail Noise Categories for first floor level facades of highset residences, no barrier in place.
- Figure 7: Rail Noise Categories for ground floor facades of residences with stepped 2.0m-2.5m high barrier in place.
- Figure 8: Rail Noise Categories for first floor level facades of highset residences with stepped 2.0m-2.5m high barrier in place.
- Figure 9: Rail Noise Categories for second floor level of dwelling(s) on Lot 900 with stepped 2.0m-2.5m high barrier in place.
- Figure 10: Rail noise Categories for the third floor level of dwelling(s) on Lot 900 with stepped 2.0m-2.5m high barrier in place.

These figures are attached.

From the results presented in Figure 5 (ie ground floor level facades with no barrier in place), it can be seen that the lots located within the proposed RPRL TNC would be situated primarily in the Noise Category 0, Noise Category 1, Noise Category 2 and Noise Category 3 bands. The maximum degree of noise intrusion will occur on Lots 8-12 and 19 where Single Event Maximum Sound Pressure Levels up to 81dBA $L_{Amax\ passby}$ may be encountered. That is, even at the maximum degree of exposure, compliance with the 87dBA $L_{Amax\ passby}$ limit set by QR under the *QR Code of Practice for Railway Noise Management* would be achieved throughout.

In Figure 6, it can be seen that, if a barrier is not constructed, there will be a greater degree of noise intrusion to residences at the first floor level. All lots within the future TNC will be located within the Noise Category 0, Noise Category 1, Noise Category 2 and Noise Category 3 bands when considering the impact of rail noise at the first floor level of the highset residences.

The maximum level of noise intrusion on any lot (ie Lots 8-12 and 19) will be 85dBA $L_{Amax\ passby}$. Consequently, while Noise Category 3 may apply to the first floor level of highset residences on these lots, the noise levels across the lots would still not exceed the 87dBA $L_{Amax\ passby}$ upper bound set by QR.

Figure 7 shows the extent of road traffic noise intrusion onto the ground floor level facades of the lots of Stage 21 that are located within the future TNC after the barrier shown in Figure 4 is constructed.

From a comparison of the noise contours presented in Figures 5 and 7, it can be seen that the stepped 2.0m-2.5m high barrier detailed in Figure 4 will be very effective in completely eliminating the Noise Category 2, 3 and 4 contours from the residential allotments of Stage 21.

Figure 8 shows the extent of rail noise intrusion the first floor level of highset residences and the second level of multi-level units.

When the noise contours presented in Figures 6 and 8 are compared (ie the first floor level facades of highset residences), it can be seen that the stepped 2.0m-2.5m high barrier of Figure 4 will be of limited effectiveness in attenuating the degree of rail noise intrusion at the first floor level facades. Importantly, however, there will be no intrusion of the 85dBA (ie **blue** Noise Category 4) contour onto any allotments of Stage 21.

With the stepped 2.0m-2.5m high barrier in place, there will be intrusion of the Noise Category 3 (ie **purple**) contour onto only thirteen Stage 21 lots, ie Lots 1-12 and 19. The remainder of the lots will be situated in the Noise Category 0, 1 and 2 bands.

Figures 9 and 10 present the extent of rail noise intrusion at the second floor level and third floor level, respectively, of residential development on the medium density lot, ie Lot 900.

5.5 Resultant Noise Categories

Having regard to the results presented in Figures 7-10 together with the minimum boundary setback distances, the actual noise categories that would apply to the ground level of the future dwellings can be determined directly.

The results are presented in Table 3 overpage.

For ease of comparison, the resultant noise categories have been colour-coded to the contours shown in Figure 7.

Note:

> Throughout Tables 3 and 4, an asterisk next to a noise category indicates that the lot is located within two noise category bands and that there is a degree of intrusion of the higher noise category onto the lot, which depending on standard building setbacks coupled with the actual placement of the dwelling on the lot, may in some instances result in the higher noise category applying to the lower/upper level of the residence. In these circumstances, and to apply a moderate degree of conservatism, the higher noise category has been ascribed to the particular lot.

Lot No	Noise Category	Lot No	Noise Category	Lot No	Noise Category
1	1	30	0	69	0
2	1	31	0	70	0
3	1	32	0	71	0
4	1	33	0	72	0
5	1	34	0	73	0
6	1	35	0	74	0
7	1	36	0	75	0
8	1	37	0	76	0
9	1	38	0	77	0
10	1	39	1	78	0
11	1	40	1	79	0
12	1	41	1	87	0
13	1*	42	1	88	0
14	0	43	1	89	0
15	0	44	1	90	0
16	0	45	1	91	0
17	1	46	1	92	0
18	1	47	1	93	0
19	1	48	1*	94	0
20	1*	49	1*	95	0
21	0	50	0	96	0
22	0	51	0	97	0
23	0	52	0	98	0
24	0	53	0	99	0
25	0	54	0	100	0
26	0	55	0	121	0
27	0	56	0	122	0
28	0	57	0	900	2
29	0	68	0		

Table 3 – QDC MP 4.4 Rail Noise Categories
Ground Floor Level of Residences on Lots 1-57, 68-79, 87-100, 121, 122 and 900
Stepped 2.0m-2.5m High Acoustic Barrier to Site (refer Figure 7)

Similarly, having regard to the information presented in Figure 8 and the relevant assumptions regarding setbacks, the actual noise categories that would apply to the first floor level facades of the highset residences on each of the same lots of Stage 21 within the future TNC can be determined in the same manner.

The results are presented in Table 4 overpage.

Lot No	Noise Category	Lot No	Noise Category	Lot No	Noise Category
1	3*	30	0	69	1*
2	3*	31	0	70	1*
3	3*	32	0	71	0
4	3*	33	0	72	0
5	3*	34	0	73	0
6	3*	35	0	74	0
7	3*	36	0	75	0
8	3*	37	1*	76	0
9	3*	38	1*	77	0
10	3*	39	2	78	0
11	3*	40	2	79	0
12	3*	41	2	87	0
13	2	42	2	88	0
14	2*	43	2*	89	0
15	1	44	1	90	0
16	1	45	1	91	0
17	2	46	1	92	0
18	2	47	1	93	0
19	3*	48	1	94	0
20	2*	49	1	95	0
21	1	50	1*	96	0
22	1	51	0	97	0
23	1	52	0	98	0
24	1*	53	0	99	0
25	1*	54	0	100	0
26	0	55	0	121	0
27	0	56	0	122	0
28	0	57	0	900	2
29	0	68	1		

Table 4 – QDC MP 4.4 Rail Noise Categories
First Floor Level of Residences on Lots 1-57, 68-79, 87-100, 121, 122 and 900
Stepped 2.0m-2.5m High Acoustic Barrier to Site (refer Figure 8)

The noise categories applying to the second floor and third floor levels of Lot 900 are presented in Table 5.

Note:

Noise category bands will apply to the built form. For the purposes of Table 5, however, the highest noise category is required to be reported notwithstanding the fact the facades of the building/s to be constructed on the lot may be located well outside this highest band.

Lot No	Noise Category at Second Floor Level	Noise Category at Third Floor Level
900	3	3

Table 5 – Expected QDC MP 4.4 Rail Noise Categories
Second Floor and Third Floor Levels of Dwellings on Lot 900
Stepped 2.0m-2.5m High Acoustic Barrier to Site (refer Figure 9 and Figure 10)

Notes:

1. The Noise Category determinations presented above in Tables 3 and 4 have been derived directly from the noise contour plots presented in Figures 7 and 8 and in accordance with the advice from DTMR as outlined in Section 4.2 above. These noise categories may be used at BA to guide the acoustical design of residences to be constructed on the lots within the future TNC.
2. It is important to note that, on many lots, the noise category that has been designated for the particular lot in each of Tables 3-5 has been the result of a very minor incursion of the higher/highest of the two or more noise category bands onto the lot. In many instances, it is fully expected that the placement of the residential building on the lot will be such that, even though a small part of the lot will be subject to the designated noise category, the dwelling/s itself – either in whole or in large part – will likely be set back sufficiently from the boundary such that the next lower noise category will apply to the residence.

6.0 Conclusions

From the results of the assessment presented above, the following conclusions can be drawn:-

- The extent of rail noise intrusion onto the site is such that compliance with the 65dBA $L_{Aeq,24hr}$ and 87dBA $L_{Amax\ passby}$ noise level limits set by QR under the *QR Code of Practice for Railway Noise Management* will be achieved on all lots.
- The construction of the stepped 2.0m-2.5m high barrier shown in Figure 4 will attenuate rail noise intrusion onto all lots. In particular, at lower facade height, the barrier will be will be very effective in completely eliminating the Noise Category 2, 3 and 4 contours from the ground floor level facades of the lots within Stage 21.
- The barrier will also be effective in attenuating the rail noise intrusion onto the site at upper (ie second level) facade height. With this barrier in place, it can be seen that the stepped 2.0m-2.5m high barrier of Figure 4 in place, there will be intrusion of the Noise Category 3 (ie **purple**) contour onto only thirteen Stage 21 lots, ie Lots 1-12 and 19. The remainder of the lots will be situated in the Noise Category 0, 1 and 2 bands.
- The actual noise categories applying to the 86 lots of Stage 21 located within the proposed TNC are presented in Tables 3-5. As permitted under the site-specific assessment provisions of QDC MP 4.4, the noise categories shown in Tables 3-5 may be used to guide the subsequent acoustical design of the residences on these lots at BA.
- Notwithstanding, it is important to note that, on many lots, it is fully expected that the placement of the residential building on the lot will be such that, even though a small part of the lot will be subject to the designated noise category shown in Tables 3-5, the residence itself will be set back sufficiently from the boundary such that the next lower noise category will apply to the residence.

7.0 Recommendations

7.1 Construction of Barrier

It is noted that under Condition 11 *Railway Traffic Noise* of Negotiated Preliminary Approval No. 2003/10335/1 "The developer is not required by Council to construct any noise attenuation measures". Notwithstanding, to achieve control rail noise intrusion onto the 86 lots of Stage 21 and located within the proposed TNC, it is recommended that the stepped 2.0m-2.5m high Transport Noise Barrier shown in Figure 4 be constructed along the common boundary with the rail reserve.

As required by QR, the barrier will need to be designed and constructed in accordance with QR Civil Engineering Technical Requirement CIVIL-SR-014 *Design of Noise Barriers Adjacent to Railways*.

7.2 Property Note

To assist Council with the preparation of conditions of approval for Stage 21, and to maintain consistency with advice provided for earlier stages in Capestone, it is suggested the following property note detailed below be adopted.

PNU Property Note - Acoustic (Rail) Report Advice (Building Design Standards) – Stage 21
The following notation will be recorded on Council's database for proposed Lots 1-57, 68-79, 87-100, 121, 122 and 900: *A suitably qualified acoustic consultant should conduct an assessment of the building design and construction for building to be constructed on Lot xxx. Residential dwellings are to be sited and constructed to comply with Queensland Development Code (QDC) Mandatory Part (MP) 4.4 'Buildings in transport noise corridors'. The Noise Category/s applicable to Lot xxx is to be determined by reference to Tables 3-5 of the approved noise report, ie Acoustics RB Pty Ltd Report No. 12-316.R28 Capestone Stage 21 Residential Development – Assessment and Control of Rail Noise Intrusion dated 1 November 2019.*

Report prepared by:

Hugh Brown,
Project Engineer
BEng(Mech)(Hons)

Reviewed and approved by:

Russell Brown,
Director
RPEQ 2799

Figure 1A – Site Location

Figure 1B – Noise Level Measurement Locations

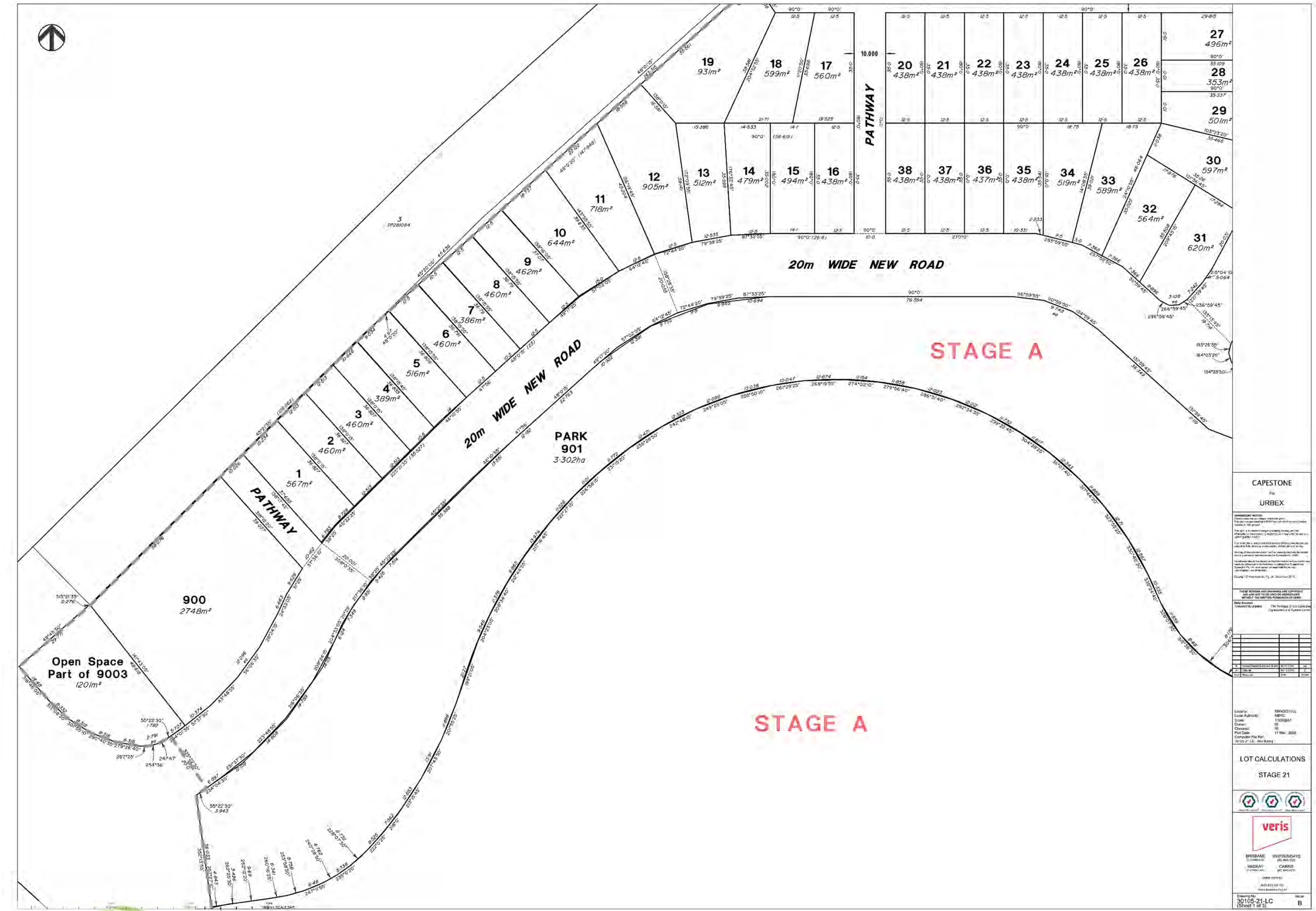

Figure 2A – Lot Layout – Sheet 1

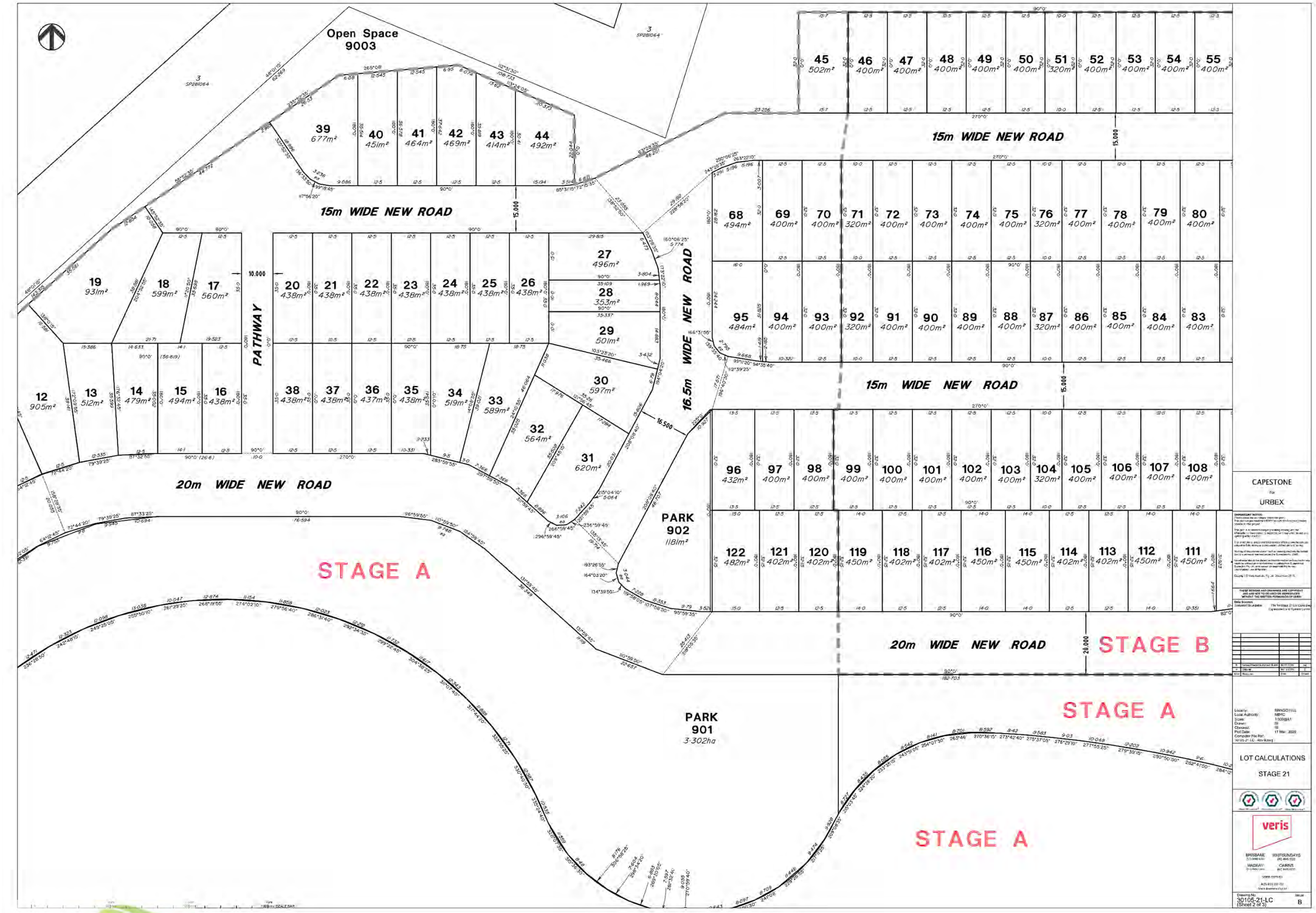

Figure 2B – Lot Layout – Sheet 2

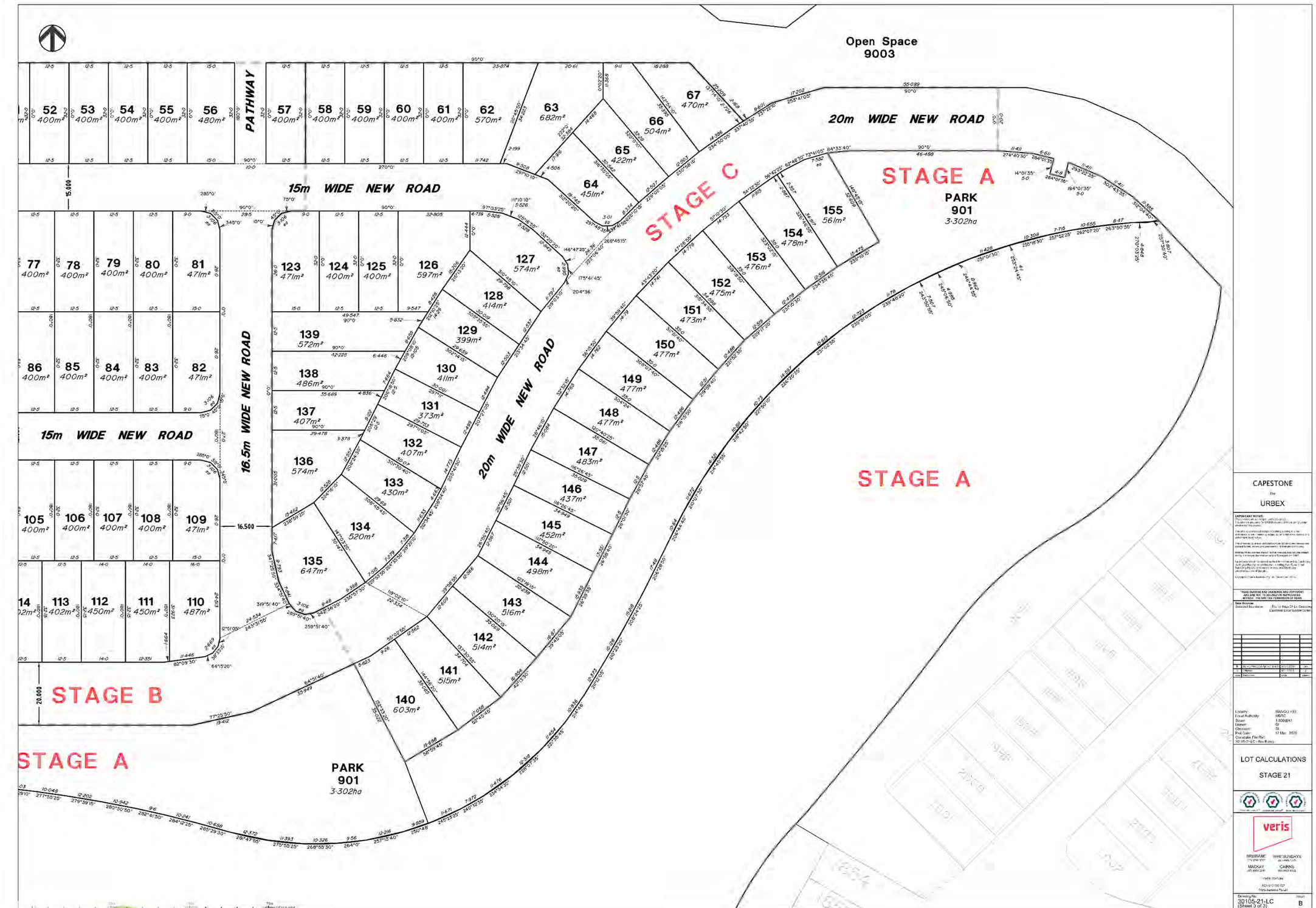

Figure 2C – Lot Layout – Sheet 3

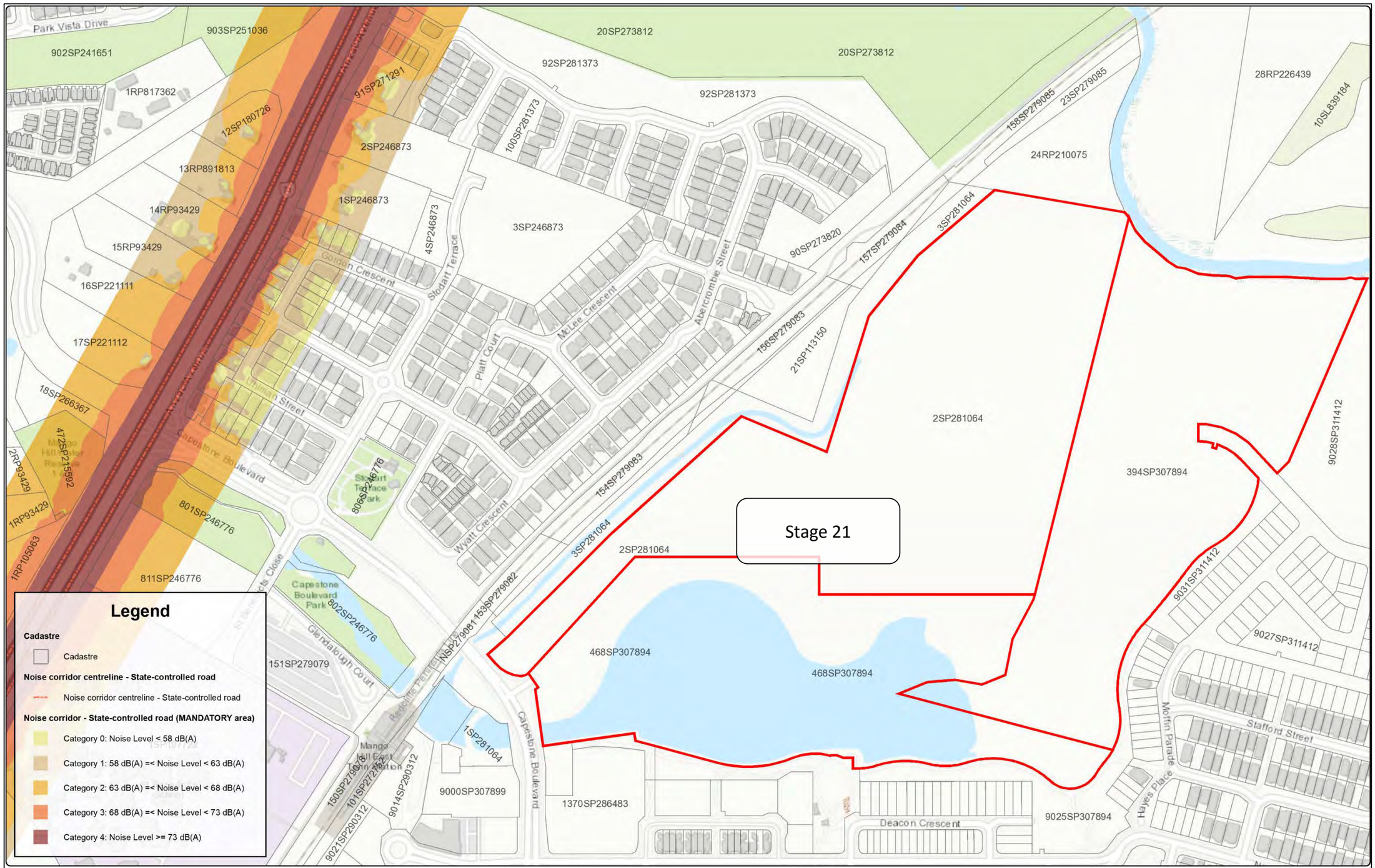

Figure 3A – Anzac Avenue Transport Noise Corridor Relative to Stage 21

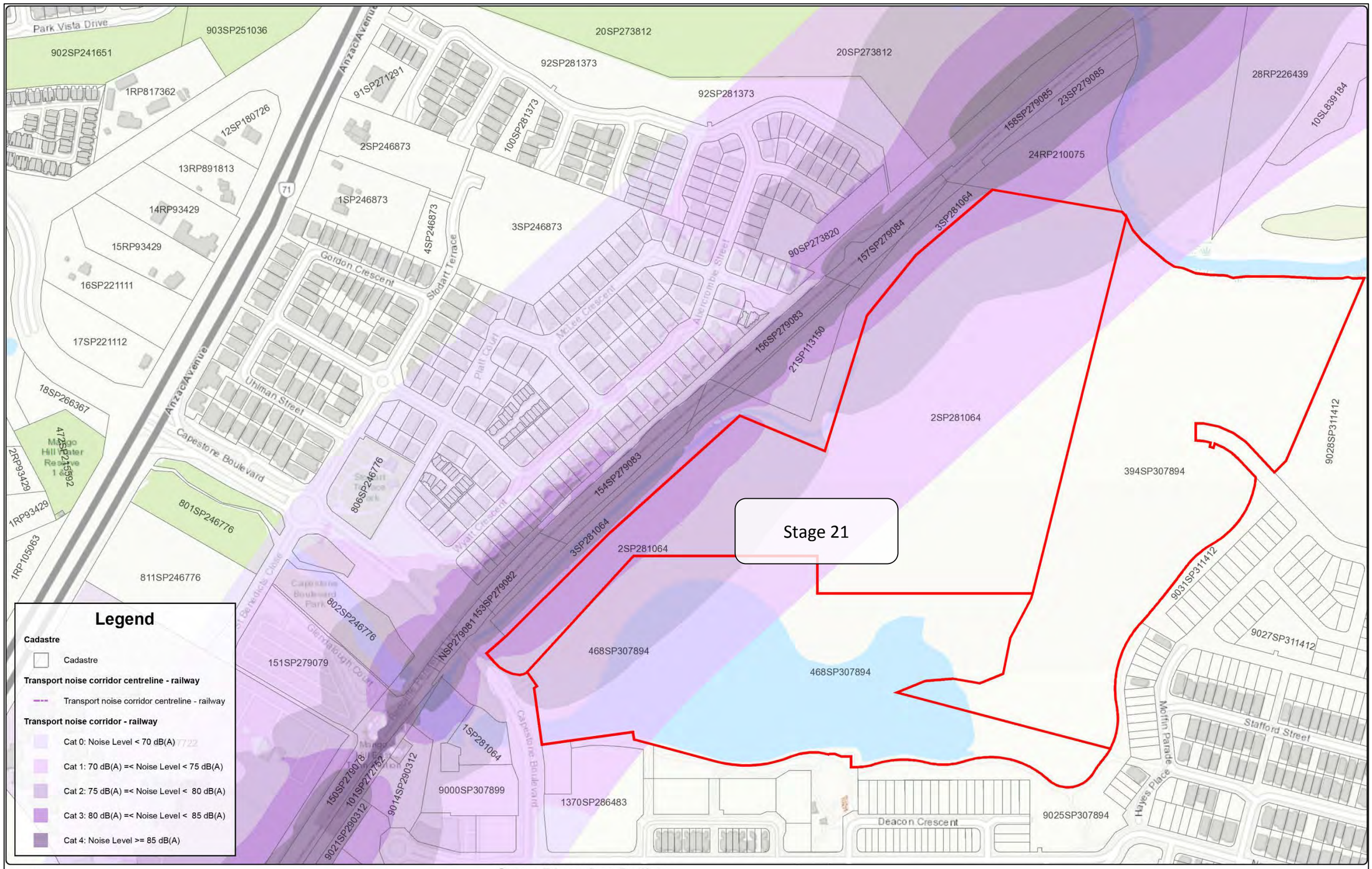

Figure 3B – Redcliffe Peninsular Rail Line Transport Noise Corridor Relative to Stage 21

Figures 4 – 10

Acoustics RB Pty Ltd

Report No 12-316.R28.Rev1 Figure 4

Alignment of Acoustic Barrier to Stage 21

2.0m High Acoustic Barrier Shown in Bold Green
2.2m High Acoustic Barrier Shown in Bold Purple
2.5m High Acoustic Barrier Shown in Bold Red

Length of Return to Along SW Boundary of Lot 1 = 15m

N

Abercrombie Street

Open Space
9003

15m WIDE NEW ROAD

PATHWAY

16.5m WIDE NEW ROAD

20m WIDE NEW ROAD

PARK
902

PARK
901

STAGE 21A

ular Rail Line

A3 Scale 1:1000

0 5 10 20 30 40 50 60 70 80 90 100 m

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28/04/2020

Acoustics RB Pty Ltd

Report No 12-316.R28.Rev1 Figure 5

Facade-Corrected $L_{Max\ passby}$ Noise Levels
and QDC MP4.4 Noise Categories

Rail Traffic Noise

No Acoustic Barrier to Stage 21

First Floor Level Facades
Receiver Height = 1.8m Above Finished Ground Level

N

Redcliffe Peninsular Rail Line

Extent of RPRL TNC

Stage 2A2

STAGE 2

STAGE 21A

STAGE 21B

STAGE 21C

Stage 1

Open Space 9003

Part of 9003

PARK 901

PARK 902

PARK 9025

McKee Crescent

Abercrombie Street

Cowley Street

Platt Court

Wyatt Crescent

CAPESTONE BOULEVARD

15m WIDE NEW ROAD

20m WIDE NEW ROAD

PATHWAY

A3 Scale 1:2500

0 10 20 40 60 80 100 120 140 160 180 200 m

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA)
and Noise Category

	<= 70	Noise Category 0
70 <	<= 75	Noise Category 1
75 <	<= 80	Noise Category 2
80 <	<= 85	Noise Category 3
85 <		Noise Category 4

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Acoustics RB Pty Ltd

Report No 12-316.R28.Rev1 Figure 6

Facade-Corrected $L_{Max\ passby}$ Noise Levels
and QDC MP4.4 Noise Categories

Rail Traffic Noise

No Acoustic Barrier to Stage 21

First Floor Level Facades
Receiver Height = 4.6m Above Finished Ground Level

N

Redcliffe Peninsular Rail Line

Extent of RPRL TNC

Stage 2A2

McKee Crescent

Abercrombie Street

Cowley Street

Platt Court

Wyatt Crescent

CAPESTONE BOULEVARD

Open Space 9003

Open Space Part of 9003

PARK 901

PARK 902

PARK 9025

STAGE 21A

STAGE 21B

STAGE 21C

Stage 1

20m WIDE NEW ROAD

15m WIDE NEW ROAD

16.5m WIDE NEW ROAD

PATHWAY

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA)
and Noise Category

	<= 70	Noise Category 0
70 <	<= 75	Noise Category 1
75 <	<= 80	Noise Category 2
80 <	<= 85	Noise Category 3
85 <		Noise Category 4

A3 Scale 1:2500

0 10 20 40 60 80 100 120 140 160 180 200 m

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Acoustics RB Pty Ltd

Report No 12-316.R28.Rev1 Figure 7

Facade-Corrected $L_{Max\ passby}$ Noise Levels
and QDC MP4.4 Noise Categories

Rail Traffic Noise

2.0m-2.5m High Barrier to Stage 21

Ground Floor Level Facades
Receiver Height = 1.8m Above Finished Ground Level

N

Redcliffe Peninsular Rail Line

Extent of RPRL TNC

Stage 2A2

McKee Crescent

Abercrombie Street

Cowley Street

Platt Court

Wyatt Crescent

Capestone Boulevard

STAGE 21A

STAGE 21B

STAGE 21C

Stage 1

Open Space 9003

Open Space Part of 9003

PARK 901

PARK 902

PARK 9025

15m WIDE NEW ROAD

20m WIDE NEW ROAD

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA)
and Noise Category

	<= 70	Noise Category 0
70 <	<= 75	Noise Category 1
75 <	<= 80	Noise Category 2
80 <	<= 85	Noise Category 3
85 <		Noise Category 4

A3 Scale 1:2500

0 10 20 40 60 80 100 120 140 160 180 200 m

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Acoustics RB Pty Ltd

Report No 12-316.R28.Rev1 Figure 8

Facade-Corrected $L_{Max\ passby}$ Noise Levels
and QDC MP4.4 Noise Categories

Rail Traffic Noise

2.0m-2.5m High Barrier to Stage 21

Ground Floor Level Facades
Receiver Height = 4.6m Above Finished Ground Level

N

Redcliffe Peninsular Rail Line

Extent of RPRL TNC

Stage 2A2

STAGE 21A

STAGE 21B

STAGE 21C

Stage 1

Open Space 9003

Part of 9003

PARK 901

PARK 902

PARK 9025

20m WIDE NEW ROAD

15m WIDE NEW ROAD

PATHWAY

McKee Crescent

Abercrombie Street

Cowley Street

Platt Court

Wyatt Crescent

CAPESTONE BOULEVARD

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA)
and Noise Category

	<= 70	Noise Category 0
70 <	<= 75	Noise Category 1
75 <	<= 80	Noise Category 2
80 <	<= 85	Noise Category 3
85 <		Noise Category 4

A3 Scale 1:2500

0 10 20 40 60 80 100 120 140 160 180 200 m

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28/04/2020

Acoustics RB Pty Ltd

Report No 12-316.R28.Rev1 Figure 9

Facade-Corrected $L_{Max\ passby}$ Noise Levels
and QDC MP4.4 Noise Categories

Rail Traffic Noise

2.0m-2.5m High Barrier to Stage 21

Ground Floor Level Facades
Receiver Height = 7.4m Above Finished Ground Level

N

Redcliffe Peninsular Rail Line

Extent of RPRL TNC

Stage 2A2

McKee Crescent

Abercrombie Street

Cowley Street

Platt Court

Wyatt Crescent

STAGE 21A

STAGE 21B

STAGE 21C

Stage 1

Open Space 9003

PARK 901

PARK 902

PARK 9025

Open Space Part of 9003

900

CAPESTONE BOULEVARD

20m WIDE NEW ROAD

15m WIDE NEW ROAD

PATHWAY

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA)
and Noise Category

	<=	70	Noise Category 0
70 <	<=	75	Noise Category 1
75 <	<=	80	Noise Category 2
80 <	<=	85	Noise Category 3
85 <			Noise Category 4

A3 Scale 1:2500

0 10 20 40 60 80 100 120 140 160 180 200 m

Moreton Bay Regional Council

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28/04/2020

Acoustics RB Pty Ltd

Report No 12-316.R28.Rev1 Figure 10

Facade-Corrected $L_{Max\ passby}$ Noise Levels
and QDC MP4.4 Noise Categories

Rail Traffic Noise

2.0m-2.5m High Barrier to Stage 21

Ground Floor Level Facades
Receiver Height = 10.2m Above Finished Ground Level

N

Redcliffe Peninsular Rail Line

Extent of RPRL TNC

Stage 2A2

McKee Crescent

Abercrombie Street

Cowley Street

Platt Court

Wyatt Crescent

STAGE 21A

STAGE 21B

STAGE 21C

Stage 1

Open Space 9003

Open Space Part of 9003

PARK 901

PARK 902

PARK 9025

900

15m WIDE NEW ROAD

20m WIDE NEW ROAD

PATHWAY

CAPESTONE BOULEVARD

Facade-Corrected $L_{Max\ Passby}$ Noise Level (dBA)
and Noise Category

	<=	70	Noise Category 0
70 <	<=	75	Noise Category 1
75 <	<=	80	Noise Category 2
80 <	<=	85	Noise Category 3
85 <			Noise Category 4

A3 Scale 1:2500

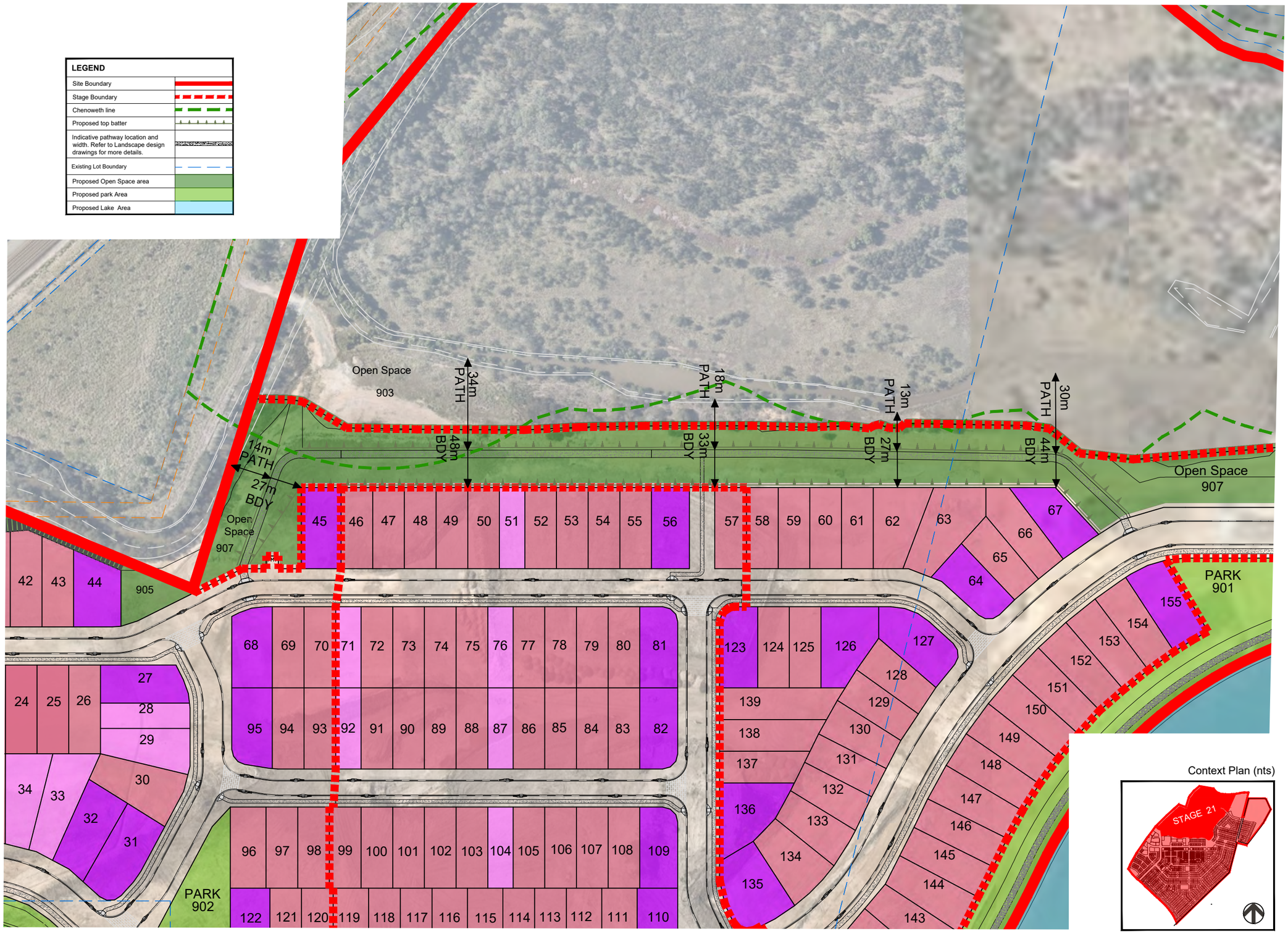
0 10 20 40 60 80 100 120 140 160 180 200 m

Moreton Bay Regional Council

Approved Subject to Conditions of Decision Notice DA/39643/2019/V23R

28/04/2020

LEGEND	
Site Boundary	
Stage Boundary	
Chenoweth line	
Proposed top batter	
Indicative pathway location and width. Refer to Landscape design drawings for more details.	
Existing Lot Boundary	
Proposed Open Space area	
Proposed park Area	
Proposed Lake Area	



0 50 mm 100 mm 150 mm SCALE BAR

Context Plan (nts)

Capestone

For

Urbex

IMPORTANT NOTES:
(These notes are an integral part of this plan)
This plan was prepared to support a Reconfiguration of Lot application for the land situated at Mango Hill. The Contours, boundaries, creek line, flood lines, building locations have all been scaled and should not have any reliance based on them as they are only intended as a general guide. The configuration of allotments shown on this plan is subject to Local Authority (and relevant State Government Authority) approvals, detailed design, final survey, and registration of survey plans. Any comments contained on this plan should be confirmed by the relevant authorities. The dimensions, areas and lotal number of lots shown hereon are subject to field survey and also to the requirements of Council and any other authority which may have requirements under any relevant legislation. In particular, no relevance should be placed on the information on this plan for any financial dealings involving the land.

Data Sources

Cadastral Boundaries	30105-LP26-J.dwg 30105-GP83-D.dwg
Aerial Image	Nearmap (6/11/2019)

Issue	Revisions	Date	Drawn
A	Original	24.02.2020.	DC

Locality:	Mango Hill
Local Authority:	MBRC
Scale:	1:1000
Drawn:	DC
Checked:	GC
Plot Date:	24 Feb, 2020
Computer File Ref:	30105-creek distances.dwg

CAPESTONE
Stage 21
Plan of Distances to Waterbody

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