8. Preferred option refinement

8.1 Option refinement process

The refinement of the emerging preferred option post MCA included the following steps and process, which are elaborated on under each of the four corridor section sub-headings further below:

- Review stakeholder feedback on emerging preferred options post MCA and confirm the key design philosophy and design parameters guiding the option refinement
- Undertake additional investigations as required including traffic, land use, geometric
- Update design including and changes to station location/ configuration and intersection layouts

A more detailed description of the option refinement process can be found in the Design Report, in Appendix I.

8.2 Bilinga option refinement

8.2.1 Refined design philosophy

Having reviewed stakeholder feedback, the reconfirmed design philosophy for the Bilinga section included to:

- Maintain, as far as possible, the median between the existing Gold Coast Highway southbound carriageway and Golden Four Drive to provide visual separation, retain mature trees and deliver a road corridor that helps make an entry / gateway statement to the Gold Coast from the airport.
- Maintain Gold Coast Highway posted speed at 80km/h (with a design speed of 90 km/h)
- Provide appropriate cycle infrastructure on parallel roads to the Gold Coast Highway
- Maximise catchment and activation opportunities through the placement of LRT stations between Boyd Street and Airport
- Provide efficient and safe pedestrian access across the corridor and at the LRT stations
- Provide appropriate local access arrangements
- Ensure efficient access to and from the emergency services facilities near Kirribin Street
- Provide flexibility for local bus routes on Golden Four Drive, including opportunities for passengers to transfer between us and Light Rail

8.2.2 Design changes and refinements made

Key elements of the design that were amended or refined in response to the design philosophy above are captured in the following tables.

Table 8-1: Design changes and refinement Bilinga

Design element	Description of change/ final option
Station location and land uses	Existing and potential land uses around the two proposed stations (one at Boyd Street, one at Kirribin Street) were analysed to confirm that the previously proposed station locations are well suited and could result in modest changes to land use, to create greater opportunities for activation. Broader changes to land uses on the western side of the Gold Coast Highway were identified as possible but subject to a detailed assessment by City of Gold Coast
Landscaping/ trees	A tree survey was conducted to assess the general quality of existing Norfolk Island Pines along both sides of the Gold Coast Highway from Tugun to the Gold Coast Airport. This was used to help refine the horizontal alignment, to preserve as many higher value species as possible.
Horizontal alignment	The revised horizontal alignment for the Light Rail now generally runs along the current Gold Coast Highway southbound carriageway with localised track widening at the station locations. This alignment minimises impacts on the existing Norfolk Pine trees in the eastern median. The positioning of the Light Rail alignment has resulted in the relocation of the Gold Coast Highway northbound and southbound alignments to the west, causing impacts to the median on the

Design element	Description of change/ final option
	western side. The alignments for Golden Four Drive and Coolangatta Road are generally as per existing. However, the Coolangatta Road alignment has been amended south of Kirribin Street to provide full movements access to Gold Coast Highway.
Vertical alignment	With the introduction of Light Rail to the corridor, there is no longer sufficient width to provide table drains, with kerb and channel now proposed along the Gold Coast Highway carriageways. To provide sufficient longitudinal grade for drainage in the kerb and channel, a minimum grade of 0.5% has been used. To achieve this minimum, a rolling grade has been introduced to provide intermediate crests and sags along the length of the alignment. To avoid grade differences between the Gold Coast Highway and the Light Rail corridor, the longitudinal grade on the Light Rail alignment generally matches the Gold Coast Highway. The longitudinal grade on Golden Four Drive and Coolangatta Road remains unchanged.
Intersections and local access	The Preferred Option results in some significant changes to intersection locations, layouts and access configurations as follows: ▪ Boyd Street / Coolangatta Road – new signalised T intersection between Boyd Street and Gold Coast Highway with Coolangatta Rd limited to left only to Boyd Street. ▪ Desalination Plant Road / Coolangatta Road / Gold Coast Hwy – new signalised intersection but with movements now limited to providing access between Coolangatta Road (south) and GCH (north) ▪ Loongana Avenue / Coolangatta Road / GCH/ Surf Street/ Golden Four Drive- Closure of Loongana Avenue and Coolangatta Road to GCH, but an all movements signalised double T-intersection of Surf Street/ Golden Four Drive and GCH is provided ▪ Coolangatta Road / GCH (opposite of Gibson Street) – unsignalised left in / left out arrangement remains unchanged ▪ Kirribin Street/ Coolangatta Road/ GCH / Golden Four Drive – closure of all current traffic movement signalised on/ off Gold Coast Highway but with signalised ped crossing retained. ▪ Coolangatta Road / GCH (opposite Graham Street) – new all movements T intersection replacing movements removed at Kirribin ▪ Terminal Drive / GCH – no change to existing unsignalised left in/ left out movements ▪ Terminal Drive South / GCH Golden Four Drive – signalised intersection remains but with movement to/ from Golden Four Drive removed and diagonal LRT movement added
Barrier treatments	As the design speed of the Gold Coast Highway is to remain 90km/h and width constraints exist within the corridor, safety barriers are required in the median between the Gold Coast Highway carriageways, between the southbound carriageway and the Light Rail corridor and between the northbound carriageway and Coolangatta Road. Following project team discussions, it was determined that where there is sufficient width for safety barrier deflection semi-rigid barriers (e.g. W-Beam or Wire Rope Safety Barrier) is appropriate, but where deflection width is not available, concrete barriers are proposed.
Station configuration	Station layouts were designed to respond to specific site constraints and resulted in the following configurations: ▪ Boyd Street is a side platform arrangement which suited this particular site due to inadequate space for additional pedestrian pathways around the station. The side platform configuration also helps shield neighbouring residents to the east from noise and light spill from the station, particularly at night. Pedestrian access is provided at both ends of the platforms ▪ Bilinga (Kirribin Street) is an island platform configuration which provides space for a vegetated buffer or station plaza between the southbound LRT track and Golden Four Drive to help soften the station. Pedestrian access is provided at both ends of the platforms
Property access and impacts	▪ There are no direct property impacts (land requirements) ▪ The design philosophy along Golden Four Drive and Coolangatta Road was to maintain the existing kerb alignment and heights to minimise impacts on property accesses. There are no identified changes to property accesses along these roads. ▪ The property access arrangements for the Airport Central commercial development and the Hope Petrol Station between Terminal Drive South and Terminal Drive North have been reconfigured to suit the proposed Gold Coast Highway alignment

Design element	Description of change/ final option
Active transport	The design philosophy for provision of active transport within the Bilinga sections is based around the Safe Systems Approach, where exposure, likelihood and severity are reduced through design. This has included providing controlled pedestrian movements at a number of new pedestrian actuated crossings (PAC) across the Gold Coast Hwy and limiting cycle movements to the parallel roads of Coolangatta Road and Golden Four Drive to separate bike riders from the 80km/h traffic of Gold Coast Hwy. Through consultation with City of Gold Coast it was determined that the most appropriate all ages and abilities cycle facility (i.e., off road path) should be the existing Oceanway, with Golden Four Drive providing an alternative routes for faster and more confident bike riders. Nevertheless, the design response allows for marked cycle lanes on Golden Four at intersections that are affected by the project with space for retrofitting separators at a later date if required
Public Transport (bus)	Urban bus stops have been provided within close proximity to the LRT stations and existing locations. The overall bus network strategy post LRT implementation is to be reviewed as part of further design development. Bus stops have only been allowed for on Golden Four Drive due to the functional downgrade of Coolangatta Road to a local access connection and it no longer providing a two-way connection to Boyd Street.

8.3 Airport option refinement

8.3.1 Refined design philosophy

Having reviewed stakeholder feedback, the reconfirmed design philosophy for the Airport section included:

- Align with the Gold Coast Airport Master Plan where possible
- Leverage off a more resolved heavy rail alignment into the precinct
- Provide a central public transport hub incorporating Light Rail, buses and heavy rail
- Provide a single Light Rail station
- Provide high quality and convenient connections to the airport terminal building and surrounding land uses
- Minimise impacts on the Southern Cross University campus and the Australian Federal Police facilities
- Minimising security risks on the airport terminal building
- Provide a Light Rail satellite depot

The resolution of the design to address these above points involved a parallel study into feasible heavy rail alignments into the airport precinct, given the uncertainty that existed post MCA in this regard. A detailed technical memorandum captures these investigations and can be found in Appendix F. The key findings insofar as they relate to design changes and refinement is documented below.

8.3.2 Design changes and refinements made

Key elements of the design that were amended or refined in response to the design philosophy and subsequent heavy rail alignment and stations options analysis are captured in the following table.

Table 8-2: Design changes and refinement Airport

Design element	Description of change/ final option
Station location and land uses	Consistent with the A1 options selected through the MCA, the final Airport LRT station is located centrally within the airport precinct, in close proximity (approx. 150m) to the new terminal building southern extension as well as hotel (Rydges) and Southern Cross University. The LRT station (as part of an ultimate multi-modal passenger transport facility) is located centrally to significant amounts of land currently underutilised as at grade car parking but which could be developed into a future airport business and commercial precinct.

Design element	Description of change/ final option
Horizontal alignment	The Light Rail alignment runs along the southern side of Terminal Drive South to provide easier access to the public transport hub west of Tom Norris Drive. It was positioned to avoid impact on the airport parking facilities south of Terminal Drive South. The alignment turns through 90° to run parallel to the western boundary of the existing carpark at the airport frontage. Tom Norris Drive alignment is relocated to be positioned between the carpark and the Light Rail corridor. The bus interchange is to the west of the Light Rail corridor with a future heavy rail corridor identified between the Light Rail corridor and the bus interchange. It is assumed that the future heavy rail infrastructure would be elevated within this zone. The Light Rail alignment passes through the Tom Norris Drive/Arthur Butler Parade intersection running to the north of the Southern Cross University campus before joining Musgrave Street at the Gold Coast Highway intersection. The existing Eastern Avenue alignment has been amended to connect to Terminal Drive South at the Tom Norris Drive intersection as a four way intersection.
Vertical alignment	The vertical grading for Terminal Drive South and the Light Rail alignment generally follows the existing road grading. The alignment is generally at existing surface levels through the station area and across the Tom Norris Drive/Arthur Butler Parade intersection. The height of the Light Rail and Gold Coast Highway alignments was determined by the grading requirements of the rail alignment within the satellite depot. The alignment within the depot was positioned at or above the existing surface to avoid drainage/flooding issues. The grading within the depot led to the height for the turn-out to/from the main Light Rail corridor. The turn-out to the depot must be on a consistent grade which, in this case, was 3%, which is an extension of the superelevation on the Gold Coast Highway.
Intersections and local access	The Preferred Option results in some notable changes to the road network relative to today including intersection locations, layouts and access configurations through the Airport section. However, these changes were largely driven by early internal road layout concept sketches provided by QAL as part of their emerging masterplan refresh process. This includes: ▪ The consolidation of Tom Norris Drive/ Terminal Drive with Terminal Drive/ Eastern Avenue into a four-way signalised intersection. The change is that LRT is now proposed to pass across the southern approach to this proposed future intersection (parallel with the Terminal Drive towards airport movement. ▪ Replacement of the existing Tom Norris Drive/ Arthur Butler Parade roundabout with a relocated and upgraded four-way signalised intersection. The change is that that LRT is now proposed to pass diagonally through the intersection ▪ All current vehicular accesses to buildings and carparks would be retained even if relocated
Station configuration	The airport LRT station consists of side platforms with pedestrian access from both ends of the platforms. Side platforms provide better interaction with the other adjacent facilities provided within the public transport hub including Kiss n Ride/ taxi facilities on Tom Norris Drive to the north-east and the bus interchange/ future heavy rail station to the south-west.
Light Rail depot	The satellite Light Rail depot was positioned within the existing road reserve to the north of the Southern Cross University campus. This location and configuration were chosen to avoid impacts on Gold Coast Airport properties. This arrangement provides capacity for 8 Light Rail vehicles stored on four tracks (two per track). Vehicular access to the depot is from the northbound carriageway of the Gold Coast Highway again to minimise impacts on airport properties and operations.
Active transport	Two key pedestrian spines are provided within the design, parallel to Light Rail. ▪ A 3m shared path along the southern side of Light Rail between the Gold Coast Highway/ Musgrave Street and Tom Norris Drive provides a strong pedestrian and cycle connection between the Airport/ University precinct and Kirra to the east, including the Oceanway path. ▪ A 2m wide footpath along the south eastern side of Light Rail (parallel to Terminal Drive south between its intersection with Gold Coast Highway and the Rydges hotel caters for this

Design element	Description of change/ final option
	already strong pedestrian design line between the airport terminal and the beach, residential and tourist accommodation precinct to the east.
Public Transport (bus)	The airport LRT station is support by a bus station and layover facility design to cater for local bus movements not replaced by Light Rail. Given the uncertainty over the specific number and frequency of bus routes that will serve this facility, a nominal allowance of 80m of bus stop kerb length is currently proposed which could provide for up to 4 buses simultaneously (depending on vehicle size and type of operations). In addition, a further 80m of kerb length is provided on the right hand side of the bus access road where out of service buses can layover such as for drivers to take rest breaks.

8.4 Kirra option refinement

8.4.1 Refined design philosophy

In order to refine the design philosophy for the Kirra section stakeholder feedback on the shortlisted K3-2 option from the MCA was reviewed and a follow-up workshop with Council stakeholders was held on 24 November 2021. From this, the following refined design philosophy was developed:

- Provide an efficient and attractive Light Rail corridor in the Coolangatta Road central median and through the Lanham Street Park
- Provide an efficient and legible road connection between Gold Coast Highway, Musgrave Street, Golden Four Drive and Coolangatta Road
- Minimise property, parking and access impacts particularly on Coolangatta Road
- Focus all ages and abilities cycle facilities on Winston Street linking the Lanham Street connection to the Oceanway with secondary on road facilities along Coolangatta Road / Golden Four Drive
- Provide two Kirra stations, located at the northern and southern ends of Coolangatta Road in areas that consider existing and future land uses, activation potential and wider catchment connections
- Provide safe and attractive pedestrian access across the corridor and at the LRT stations

8.4.2 Design changes and refinements made

Key elements of the design that were amended or refined in response to the design philosophy are captured in the following table.

Table 8-3: Design changes and refinement Kirra

Design element	Description of change/ final option
Station location and land uses	A detailed land use and future catchment analysis was undertaken to identify the relative merits of a 1-station versus a 2-station solution for Kirra. These potential benefits were assessed against potential patronage and journey time implications. Overall, the analysis supported a two-station solution as it could deliver significantly more people within 5-minute walk time of LRT, resulting in solid daily boardings and with minimal impact on travel times. Based on the available evidence and considering feedback from workshop 4, a two station solution was recommended for Kirra, with the (South) Kirra station moved approximately 200m further south-east (closer to Miles Street) compared to the location shown in the earlier concept sketches.
Horizontal alignment	The existing horizontal alignment configuration in the Musgrave Street area, including the existing overpass structure and associated abutment approaches, will be removed and replaced with at-grade intersections at Gold Coast Hwy/ Musgrave Street and Musgrave Street / Golden Four Drive / Coolangatta Road. The Light Rail alignment runs in the median of Musgrave Street and then turns 90° through the Musgrave Street / Golden Four Drive / Coolangatta Road intersection to continue in the median along Coolangatta Road where the North Kirra station is located.

Design element	Description of change/ final option
	At the Kirra Station location at the eastern end of Coolangatta Road, the Light Rail alignment transitions to the northern side of Coolangatta Road, crosses Miles Street to continue through the Lanham Street Park. The alignment follows the original heavy rail corridor alignment through Lanham Street Park. The existing cul-de-sac service road servicing Nos. 1 – 11 Coolangatta Road will be reversed with access provided from Miles Street.
Vertical alignment	The height of the Light Rail alignment as it crosses the Gold Coast Highway is dictated by the grading requirements of the Light Rail satellite depot and associated turn-outs and crossovers and well as flood heights on the Gold Coast Highway. The vertical grading along Coolangatta Road between Musgrave Street and Appel St/Lord St matches the existing kerb heights to minimise impacts to existing property accesses. The area between Appel Street/Lord Street and Miles Street is subject to flooding. Due to impacts on property accesses and private property, it was not considered feasible to raise the heights of the existing intersections at Appel Street/Lord Street and Miles Street. The grading of the Light Rail alignment therefore generally matches the existing levels at the intersections but with Kirra Station raised.
Flooding	▪ Whilst the 1% AEP was a target for track level this would have required the raising of Appel Street and Miles Street by 250 to 350 mm at the location of the Light Rail crossing resulting in numerous property impacts and wider overland drainage path issues. Instead, based on agreement with TMR, the final design includes a Kirra Station located at 3.58m AHD therefore achieving 1% AEP immunity but with the road crossings of Coolangatta/ Appel and Miles Street matching existing levels (around 3.2m AHD) which are typically at the 5% AEP level.
Intersections and local access	The Preferred Option results in some changes to the road network including intersection locations, layouts and access configurations as follows: ▪ Coolangatta Road and Musgrave Street with GCH (south of Airport) – currently a complex network of separated movements and one grade separated movement to be replaced with a single all movements T intersection ▪ Lang Street / Golden Four Drive / Coolangatta Road – the Coolangatta Road section is removed leaving a simple T intersection between Lang Street and Golden Four Drive ▪ Musgrave Street / Coolangatta Road / Golden Four Drive – intersection remains a four way signalised all movements intersection but with the Coolangatta Road north approach removed and instead Golden Four Drive is connected instead providing simpler and more legible access to the North Kirra precinct from the Gold Coast Highway ▪ Charlotte Street / Coolangatta Road/ Creek Road - New signalised intersection retaining a right into Charlotte, but no right out (alternative = Ocean St). Creek St becomes left in left out but with the ability to U-turn at Charlotte Street intersection ▪ Coolangatta Road mid-block u turn facilities - Removed due to Light Rail requiring the space in the median ▪ Haig Street / Coolangatta Road – New signalised intersection retaining all movements ▪ Appel Street / Coolangatta Road / Lord Street - New signalised intersection retaining all current movements as well as new ahead and right turn movements from Appel Street Cul-de-sac of Coolangatta Road service road south of Lord Street with new access from Miles Street Miles Street / Coolangatta Road/ Tweed Street – existing intersection and movements retained
Station configuration	The North Kirra Station is configured with an island platform which was selected due to its more spatially efficient cross section within this road median. The station has pedestrian access at both ends, connected to the signalised road intersections of Musgrave/ Coolangatta/ Golden Four Drive to the north and Coolangatta/ Charlotte to the south. The (south) Kirra station is configured as side platforms, due to its location within a parkland setting whereby the platforms can be better integrated with the surrounding greenspace and adjacent path network. Pedestrian access is provided at both ends of the platforms connecting

Design element	Description of change/ final option
	to Coolangatta Road/ Miles Street to the east and Coolangatta Road/ Appel Street / Lord Street to the west.
Property access and impacts	The design philosophy along Coolangatta Road was to maintain the existing kerb alignment and heights to minimise impacts on property accesses. There are no identified changes to property accesses along Coolangatta Road between Musgrave Street and Miles Street. Due to the reconfiguration of the Musgrave Street/ Golden Four Drive/ Coolangatta Road intersection, seven existing driveways on the eastern side of Golden Four Drive between Lang Street and Musgrave Street reconfiguration to suit the proposed layout. Similarly, a further two existing driveways on the northern side of Coolangatta Road, east of Lord Street will require extension due to the reconfiguration of the service road cul-de-sac. Due to the alignment of the Light Rail corridor as it crosses Miles Street a property impact (partial land resumption) is expected at No. 20 Miles Street.
Active transport	The final design solution involves the following features from north to south: ▪ A 3m wide off road shared path) is provided along the western side of the Gold Coast Highway connecting to the existing pathway south of the border to create a continuous high-quality off-road connection to Tweed Heads West and beyond filling a missing link in the strategic cycle network ▪ Off-road one-way cycle tracks (LTS) are provided along both sides of Musgrave Street between Pacific Parade and the Coolangatta Road, then become shared paths between Coolangatta Road and the Airport – these provide a critical connection to this major jobs/ education precinct from the coastal active transport network ▪ On road cycle lanes on Coolangatta Road – forming a continuous facility connecting to the existing on road cycle lanes on Golden Four Drive. A reduced traffic speed is also proposed for the current section of Coolangatta Road that is posted at 60 km/h to create a continuous 50km/h corridor. This is likely to offer a Level of Traffic Street 3 (LTS3) which is considered adequate for confident, experienced riders who want a faster more direct route. At Miles Street on road bike riders can continue east up Tweed Street, south or north on Miles Street or access the off-road separated path through the old rail cutting. ▪ Parallel to Coolangatta Road, an all ages and abilities cycle facility (LTS1) is proposed by Council along the southern side of Winston Street. This provides the most direct connection between the Oceanway (also LTS1) to the north/west and the enhanced connection via the old rail cutting to the south/east (also LTS1). ▪ On road cycle lanes are provided on Miles Street, a key north-south connection between Tweed Heads West and Kirra which is likely to provide an LTS2/3 facility. Depending on future cycle network planning, additional lane separators could be added to make these partially protected cycle lanes; and A separated pathway through the old rail cutting, comprised of a 3m two-way cycle track and a 2m footpath which is LTS1. This provides a more direct and relatively flat connection between Coolangatta (particularly southern Coolangatta)/ Tweed Heads and destinations to the north, complementing the Oceanway which has a high recreational value but is relatively indirect
Public Transport (bus)	No changes are assumed for TfNSW route 601 which will continue to use Miles Street. However, replacement bus stops are required due to LRT construction and these will be located as close as possible to the LRT station at Miles Street to maximise interchange opportunity for the large Tweed Heads West catchment to the south. Given the low frequency of service (2 buses per hour) in lane bus stops immediately north of the LRT crossing are proposed Tram Replacement Bus services are assumed to follow the LRT route on Coolangatta Road with the need for bus stops at the north-western end of Coolangatta Road near Charlotte Street and an additional pair at the eastern end, utilising the relocated route 601 stops on Miles Street. This is because Tram Replacement Bus services are assumed to use Miles Street and Marine Parade to access Coolangatta due to the lack of any roadway running parallel to Light Rail through the old rail cutting. Given the infrequent nature of these and likely off-peak usage in lane bus stops are proposed.

8.5 Coolangatta option refinement

8.5.1 Refined design philosophy

In order to refine the design philosophy for the Coolangatta section stakeholder feedback on the shortlisted C3 option from the MCA was reviewed and a follow-up workshop with Council stakeholders was held on 24 November 2021. From this, the following refined design philosophy statements were developed:

- Reuse the existing protected rail corridor between Miles Street and Lanham Street.
- Provide a direct and efficient Light Rail corridor between Chalk Street and Lanham Street
- Enhance the amenity and public realm of Chalk Street (a key station interface and pedestrian access route)
- Maintain local street access for Garrick Street, Lanham Street, Musgrave Street and McLean Street
- Maintain access along and property access to Chalk Street from McLean Street
- Minimise impacts on McLean Street/Griffith Street roundabout
- Minimise impacts on car parking and mitigate where possible through offsets within the study area
- Provide flexibility for the Light Rail corridor to be extended further south towards Tweed Heads
- Improve the safety and attractiveness of the precinct for pedestrians and bike ride activity (such as through speed reductions)
- Minimise impacts on existing Norfolk Pine trees along the frontage of 45 McLean Street
- Provide a highly visible and legible LRT terminus station with good pedestrian access to Griffith Street

8.5.2 Design changes and refinements made

Key elements of the design that were amended or refined in response to the design philosophy are captured in the following table.

Table 8-4: Design changes and refinement Coolangatta

Design element	Description of change/ final option
Station location and land uses	Three potential station locations were investigated namely McLean St, Mid Block and Warner Street. Following stakeholder discussion on the 24 November 2021, Option 3 (Warner Street) was confirmed as the preferred station location. This location was identified as offering the best opportunity for a highly visible and legible station with direct access north to the beach and south to the surrounding catchment. It was also the best located geographically to serve the wider Coolangatta town centre including destinations further east along Griffith Street including Twin Towns.
Horizontal alignment	The Light Rail corridor exits the Lanham Street Park at the Coolangatta Police Station and Court House between Musgrave Street and Lanham Street. It then crosses McLean Street and continues on the southern side and parallel to Chalk Street before terminating at Coolangatta Station, west of Warner Street. The corridor is positioned to enable it to continue further south into Tweed Heads. The alignment suits options which continue along Chalk Street and Gerrard Street. The horizontal alignments for McLean Street, Musgrave Street and Lanham Street are generally as per existing with all existing local road connections maintained.
Vertical alignment	The Light Rail alignment exits the existing Lanham Street Park cutting and crosses McLean Street at existing heights. The vertical grading of the alignment generally matches the existing as it runs parallel to Chalk Street
Intersections and local access	The Preferred Option results in some minor changes to intersection locations, layouts and access configurations as follows: ▪ Garrick/ Lanham – no change (remains an unsignalised all movements T intersection) ▪ McLean Street South / Lanham Street west – no change (remains an unsignalised all movements T intersection)

Design element	Description of change/ final option
	▪ Lanham Street west/ McLean Street north/ Lanham Street east – existing unsignalised all movement intersection signalised with all movement retained. ▪ McLean Street north/ Musgrave Street - Remains unsignalised but the right turn movement out of Musgrave has been removed with vehicles needing to use the roundabout to head east
Station configuration	▪ Coolangatta LRT station is an island platform arrangement, 8m in width, which is consistent with Helensvale Station and wider than a typical 4.8m island platform. The LRT tracks extend approximately 20m beyond the end of the platform to accommodate a buffer stop arrangement (again, consistent with Helensvale LRT station) Pedestrian access to provided to both ends of the LRT platforms, with a signalised crossing of Chalk Street and the LRT tracks at the western end of the platforms and a raised zebra crossing (wombat) of Chalk Street at the eastern end of the platforms
Property access and impacts	Minimal impacts to property accesses in Coolangatta. Key property requirement is the Police Station/ Magistrates Court on Musgrave Street
Public carparking	In total there are approximately 382 car parking spaces on the southern side of Chalk Street, southern side of Musgrave Street and in the off-street Chalk/ Lanham carparks. The final design of the Light Rail tracks and station requires the removal of 186 of these, while the potential station plaza area would require the removal of a further 18 carparks. 130 carparks at the western end would be retained unchanged while a further 106 carparks could be provided where the Twin Towns kindergarten is currently located and by reconfiguring the eastern carpark. A net increase of 34 carparks on the southern side of Musgrave Street (west of Mclean Street) is also proposed. Overall, this would result in 270 carparks being retained/ provided relative to the existing 382, equating to 70% of the current capacity. Based on the City of Gold Coast commissioned occupancy surveys this would be more than sufficient to cater for peak demands.
Active transport	The refined design in Coolangatta includes new relocated or formalised pedestrian crossing facilities including: ▪ New signalised pedestrian crossings of McLean and Lanham Street as part of the LRT intersection with McLean Street ▪ Relocated zebra crossings on Lanham Street east aligning with new crossings of the LRT tracks and to provide access between the bus stops and the LRT station ▪ Provision of 1 addition zebra crossing and 1 additional signalised mod block crossing of Chalk Street to align with pedestrian crossings of the LRT tracks ▪ Relocated and raised (wombat) crossing of Musgrave St closer to McLean St on the pedestrian desire line The final design also includes new facilities to enhance cycle connections to and through Coolangatta, complementing the existing Oceanway, as follows: ▪ Off road, separated path through the old rail cutting as far east as the new signalised intersection of Lanham Street/ McLean Street/ LRT corridors, forming an all ages and abilities cycle facility (LTS1) (refer Item 1) East of the rail cutting a Shared Use Pathway along the southern verge of Lanham Street and Scott Street provides an all ages and abilities cycle facility (LTS1). Priority for pedestrians and bike riders crossing Dutton Street help reinforce this as an LTS1 facility
Public Transport (bus)	▪ New bus stops have been provided on each side of Lanham Street with clear line of sight to the LRT station to allow easy bus-LRT interchange and also to cater for tram replacement buses in close proximity, when required ▪ Each bus stop is 35m long capable of accommodating 2 buses simultaneously, assuming semi-independent operation. A 50m long layover bay (capable of accommodating 2 buses with independent manoeuvring) is also proposed on the southern side of Lanham, west of the north-westbound bus stop to cater for a potential extension of Tweed route 600.

8.6 Risks and issues

A risk register was developed and can be found in Appendix K. Key findings are captured under the following sections, whereby risks and issues as well as associated recommendations for mitigation are highlighted.

Some overall project wide risks and issues are listed below

- Project scope and limitation: the study scope and purpose has been designed to inform corridor planning and likely future land requirements only. It was not undertaken to a level of detail sufficient to justify any particular investment in infrastructure.
- Costs and affordability: Initial construction costs estimates used to support option selection are unlikely to be sufficiently robust for future planning and investment decisions particularly with significant price rises in material and labour across the construction industry
- Level of information including PUP and survey: This is currently relatively coarse, resulting in a risk of additional costs to address currently unforeseen issues. Undertake further investigations (survey, PUP) to inform future design to mitigate this risk
- Drainage and flooding – the level of detail and analysis undertaken in this design phase was limited and there was no modelling. Further design stages will need to resolve flooding and drainage issues.
- Transport and traffic modelling: Modelling tools used will need to be reviewed in future project stages to take into account changes in traffic volumes, population and employment. There are also identified opportunities for using a refined suite of modelling tools, in the latest software versions to provide a better, more consistent corridor level assessment from Burleigh Heads through to Coolangatta
- Road safety risks including driver confusion in areas where LRT right of way intersects with traffic lanes. Consider detail signage and line marking treatment to reduce driver mistakes
- Pedestrian safety risks particularly on or near the Gold Coast Highway where the posted speed remains 80 km/h. Investigate further measures and controls to reduce both the likelihood of a pedestrian-vehicle conflict and the consequence should it occur.

Some high-level risks identified for the four project sections are tabulated in Table 8-5:

Table 8-5: risks and opportunities

Area	Risk/Issues
Whole of corridor	Technology: investigate what provisions could be included as part of future design stages to enable wire-free Light Rail operations on all or part of the study corridor. This could include a review of latest vehicle requirements/ capabilities as well as opportunities for alternate traction power and charging infrastructure.,
Bilinga	Community/ political - Risk of community acceptance of the extent of changes to local access particularly to/ from Coolangatta Rd- potential need to amend design and add more costly access arrangements. Environmental/ community - Risk of greater vegetation loss than indicated on plans, due to either construction impacts or risks imposed by large tree close to the LRT alignment (overhead wires) Traffic/ safety - Closely spaced intersections between Desalination Plant Road / GCH and Boyd Street/Gold Coast Highway and potential for queue overspill – may require further investigation of both infrastructure and operational (signal coordination) measures Traffic/ access - Design vehicles unable to undertake all turn movements along Gold Coast Highway and Coolangatta Road due to tight geometry – may require a wider access strategy or further design development
Airport	Internal access road - Uncertainty about the future design, location and operations of the internal airport access roads including levels. Pedestrian access – the connection between Airport and transport hub may need further review including the form of crossing over the bus access road. Opportunity to improve quality of connection through wider footpaths and frequent/improved shelter.

Area	Risk/Issues
	Depot operations – The LRT access to depot is limited to a south facing connection – potential need to investigate north facing track access options if this operational flexibility is required Tenure/ legal - risk of any proposed transport infrastructure on Federally leased airport land not being fully protected from incompatible uses – requires consultation with the federal Department of Infrastructure, Transport, Regional Development and Communication (Airport branch) around legal mechanism for protection as well as consultation with Queensland Airports Limited as lessee.
Kirra	Pedestrian and cycle connections – Connection between Airport and Oceanway is beyond the scope of the project and is unresolved as it relies on decision about other Oceanway connections by CoGC – continue to work with council to resolve the wider precinct strategy Flood immunity - LRT would not have immunity to a 1% AEP flood event. Further hydraulic modelling required to understand if wider measures such as additional culverts/ pipes) can improve the immunity of the current LRT design or to investigate ways to raise the LRT corridor and accept additional property impact where the road may need to be re-graded. A related opportunity is that any flood mitigation works undertaken to support future LRT implementation may improve existing local flooding issues. Geotechnical risks associated with retaining wall design and construction methods – further site investigations required to inform these Land – the removal of the Musgrave Street flyover and the consolidation of complex traffic movements into a simpler set of intersections releases a large area of road reserve land between the Gold Coast Highway and Musgrave Street which could be investigated for alternative uses including commercial uses, active public recreational uses (such as parkland/ playgrounds) or passive uses such as vegetated buffer zone.
Coolangatta	Electrical safety – risks to human safety where residences/people located on Gordon Lane that are at/above the OLE Level. Barrier treatments such as anti- throw screen fencing on top of barrier will need to be considered Pedestrian/ cyclist safety – general risks associated with increased level of pedestrian and cyclist activity around McLean Street and Lanham Street increased the likelihood of conflicts with vehicles. Whilst partly controlled through formal crossings consider reduced speed limits such as 30-40 km/h to reduce consequence of such conflicts Amenity/ urban realm –the current design has not yet optimised the amenity, activation and passive surveillance for passengers in the vicinity of the LRT station. Significant opportunities exist through a comprehensive precinct master planning exercise to identify the preferred ultimate arrangement of car parking and other land uses (including buildings with active ground floor frontages) fronting or in close proximity to the LRT station to improve the safety and attractiveness of the urban realm in this Major Regional Activity Centre. Extension feasibility risk – whilst the current terminus is orientated to facilitate simple onward extensions towards Tweed Heads the current planning does not identify or explicitly protect for property required east of Warner Street to further extend LRT. There is a significant opportunity to continue to work with TfNSW to identify a pathway to route protection to support this potential future extension.