PART B
Description of the Proposal

5 Identification of the preferred option

Chapter 5 describes the basis for the development of the alternatives in the process of developing the concept design of the Proposal including design criteria and principles, consideration of various influences on design development and the approach to the design principles and issues. A discussion of the alternatives considered is also included.

The concept design for the Proposal would be developed further during the detailed design following consideration of submissions from stakeholders, the community, detailed investigation of ground conditions, surveys and review of constructability constraints including rail possessions. Changes may also be required to address the approval conditions for the Project.

5.1 Background to design development

The East Hills Line has been progressively extended and its capacity increased since its opening as an electrified double track line to Kingsgrove in 1931. That section from Wolli Creek to Kingsgrove was quadruplicated by 2001 while studies to extend the four track configuration beyond Beverly Hills were prepared from the mid-1990s. The addition of two tracks from the termination of the existing four-track section as far as Revesby is now included as a major component of the Rail Clearways Program for implementation by 2010.

Numerous studies have been completed in relation to different sections or components of the East Hills Line leading to the present Proposal, including:

- *East Hills Rail Amplification-Turrella to Riverwood Environmental Impact Statement,* prepared by Connell Wagner, August 1996;
- *Kingsgrove to Revesby Quadruplication Working Paper,* prepared by Transport Infrastructure Development Corporation, July 2005;
- *Kingsgrove to Revesby Track Quadruplication Investment Evaluation,* prepared by RailCorp, August 2005;
- *Revesby Turnback Review of Environmental Factors,* prepared by Connell Wagner, November 2005;
- *Clearways Program-Revesby Turnback Traction Supply Substation Location Options Report,* prepared by Maunsell/Connell Wagner, July 2006;
- *Clearways Program-Kingsgrove to Revesby Quadruplication Option Development Report, Volume 1,* prepared by Maunsell/Connell Wagner, May 2006;
- *Clearways Program-Kingsgrove to Revesby Quadruplication Geotechnical Desktop Study,* prepared by Maunsell/Connell Wagner, July 2006;

- *Clearways Program-Kingsgrove to Revesby Quadruplication Preliminary Concept Design Report, Volume 1,* prepared by Maunsell/Connell Wagner, September 2006;
- *Clearways Program-Kingsgrove to Revesby Quadruplication Preliminary Concept Design Report, Volume 2-Background Data,* prepared by Maunsell/Connell Wagner, September 2006;
- *Clearways Program-Kingsgrove to Revesby Quadruplication Phase 1 Contamination Report,* prepared by Maunsell/Connell Wagner, October 2006;
- *Clearways Program-Kingsgrove to Revesby Quadruplication Significance of Impact Assessment Report,* prepared by Connell Wagner, November 2006;
- *Clearways Program-Kingsgrove to Revesby Quadruplication Part 3A Project Application Report,* prepared by Connell Wagner, January 2007; and
- *Clearways Program-Kingsgrove to Revesby Quadruplication Stage 1 Constructability Review,* prepared by Tenix Projects, March 2007.

These studies, along with inputs from the design and construction team, have provided the basis for the design considered in this document and its environmental assessment. This chapter summarises the development of the proposal options and the choice of a preferred alternative. The following chapter describes the Proposal, following design development, which has resulted in a number of changes to the preferred alternative.

5.2 Influences on the design

5.2.1 Site features and constraints

There are a number of existing features which are affected by and/or constrain the new trackwork and associated infrastructure required for the Proposal. The development of the concept design was influenced by the consideration of the following factors which have impacts on its feasibility and cost.

- The layout and capacity of the existing rail infrastructure and services within the corridor including overhead wiring, signalling, high voltage electricity services, controls and communications would be affected by the new works and temporary construction staging.
- Existing intermediate stations and station facilities at Beverly Hills, Narwee, Riverwood and Padstow, although not physically affected by the proposed arrangements (except where structural works are necessary for adjacent bridges), must remain operational throughout the construction of the Project.
- New track alignment and design speed would be constrained by the existing track alignment and geometry in places.
- Significant embankments, cuttings and retained structures would require construction within constrained locations in the rail corridor.

- Results of detailed geotechnical information and service/utility locations would affect the final design and construction methodology.
- A number of major road/rail bridge crossings and other smaller bridges and culvert crossings, many of which have clearances which do not conform to current standards, would need to be modified to accommodate the new tracks under traffic and/or in proximity to stations and major arterial roads and local streets.
- Existing RailCorp maintenance vehicle access tracks would be affected.
- Environmental sensitivity of the wetlands area along Salt Pan Creek where bridge works would be required.
- A major ethane gas pipeline traverses the length of the Project and crosses the rail corridor at a number of locations. This would require protection during construction of earthworks and retaining structures.
- Relocation of the RailCorp signal maintenance depot at Riverwood Station to an appropriate site adjacent to the East Hills Line would be necessary.
- Connection into the live East Hills Line east of Beverly Hills Station and to the west of Revesby station would need to be undertaken.
- Space would be required for construction work sites along both sides of the rail corridor with access for heavy equipment.

A number of specific features also influence the concept design at Revesby including:

- The works for the Proposal would require connection to new trackwork and station works currently underway at Revesby Station as part of the Revesby Turnback Project.
- The existing station and station facilities at Revesby must remain operational throughout the construction of the Proposal.
- Transport interchange arrangements including facilities for taxis, buses and kiss-and-ride users would need to be relocated as a result of the proposed overhead concourse with major changes to the Blamey Street configuration and alignment.

5.2.2 Operations and user requirements

The primary objective of the Proposal is to provide two additional tracks between Kingsgrove and Revesby to allow complete separation of the local train services (all stops) and express train services.

Key train and customer services requirements are to:

- increase capacity to run additional local and express services on the East Hills Line including provision for future services from the planned South West Rail Link;
- provide for up to eight trains per hour terminating at Revesby independent of through services;

- improve service reliability by separating service types and providing infrastructure to support out of course train running;
- provide journey time improvements on trips to south-west Sydney;
- manage safe and reliable turnback operations at Revesby; and
- make no significant changes to the operation of other stations on the East Hills Line.

There are also a number of additional items identified by RailCorp to be addressed by the Proposal including requirements for track centres, bridge clearances, services works and operating speeds.

5.3 Design principles and considerations

5.3.1 Project inputs

Project inputs used for the concept design include:

- Scope of work as defined in the *Kingsgrove to Revesby Quadruplication Working Paper* prepared by Transport Infrastructure Development Corporation, dated July 2005.
- RailCorp due diligence information including reference information and background reports.
- RailCorp and other relevant authority design standards, codes and guidelines.
- RailCorp, RTA, local councils, utility authorities and other authority details of existing infrastructure.
- Topographic survey and geotechnical investigation data.
- Community and stakeholder review and comment on the developing design.

5.3.2 Environmental inputs

The key design issues identified during the environmental investigations for the Proposal were:

- the presence of extensive residential and other sensitive land uses adjoining or close to the rail corridor;
- the need for visual amenity to be considered in the design of new structures adjoining or close to areas from which they would be visible to the public including large numbers of passengers;
- the presence of a number of public crossings (pedestrian and vehicular) over and under the rail corridor;

- station access and facilities, commuter car parking and transport interchange facilities at the stations;
- traffic impacts during full or partial road closures during construction;
- consideration of visual effects of noise barriers;
- the high environmental sensitivity associated with the crossing located at Salt Pan Creek;
- the narrow width of the rail corridor and limited vehicular access for construction traffic; and
- constructability considerations including identification of track possessions.

5.4 Design response to principles and issues

The concept design has responded to the design principles and site constraints set out in **Sections 5.2** and **5.3**.

5.4.1 Alignment

The Proposal would involve approximately 7.1 kilometres of new Up Main and 7.7 kilometres of new Down Main lines plus approximately 600 metres of realigned track to be constructed alongside the existing East Hills tracks within the current rail corridor. One new track would be typically constructed on each side of the existing tracks except in the approaches to and over the new bridge at Salt Pan Creek where two new tracks would be located on the southern side of the corridor. This would require the relocation of all four tracks over this section. The Proposal would start at the end of the existing four-track section, approximately 500 metres to the east of Beverly Hills Station, continuing until approximately 700 metres beyond Revesby Station where the new tracks would merge with the existing dual track rail configuration to East Hills.

5.4.2 Bridges

The design of new bridge structures would be influenced by the construction methods required, aimed predominantly at minimising closure time for parts or whole of the affected roads, particularly King Georges Road and Davies Road. It would be necessary to minimise the number of track possessions and road closure periods by the use of appropriate design concepts and construction methods. The construction methods described in **Chapter 7** are based on the development of the initial concept design. These would be further refined and modified during detailed design.

The design of structures and construction methods is also dictated by the presence of the ethane gas pipeline. The precise location of the pipeline will be identified and design of structures refined following detailed services searches prior to the start of construction.

All bridge structures would be designed to minimise noise and vibration impacts. The new bridge required at the crossing of Salt Pan Creek would be multi-span supported on bored or driven piles in the creek bed. Other construction methods are also possible. The new bridges would provide the same vertical clearance as the existing structures.

The design of bridges would comply with the clearances specified in RailCorp engineering standards, the loading requirements of the Australian Bridge Code AS5100.2 and the height clearances of the RTA as appropriate and where possible.

5.4.3 Public crossings

Public crossings (pedestrian and vehicular) over and under the rail corridor would be maintained where possible. However, when roads are required to be fully closed for bridge works, no pedestrian or vehicular access would be allowed. Full or partial road closures would be required for bridge construction at:

- King Georges Road (southbound carriageway)
- Memorial Drive (full closure)
- Belmore Road (full closure)
- Doyle Road (full closure)
- Davies Road (southbound followed by northbound closure)

The existing pedestrian underpass at Narwee Station would be extended to accommodate the widening of the active rail corridor. No public crossings would be permanently removed. Pedestrian access to Narwee underpass would be maintained where possible during the extension works. However, access would be disrupted at times during the works and may require one side of the underpass to be closed for a period of time. Broad Arrow Road underbridge provides a short (less than 100 metres) diversion for pedestrians.

5.4.4 Stations

Station function and access to all the stations along the rail corridor would be maintained including access during and after construction, although some pedestrian diversions may be required for works at Narwee Station (for the pedestrian underpass) and Padstow (during the bridge works). Commuter parking facilities would be affected during construction of the Proposal and the final configuration could result in some net loss.

Transport interchange facilities at Revesby Station would be reconfigured and the upgrading works would comply with Australian standards for easy access. No other works to station facilities are proposed at Beverly Hills and Narwee (except lengthening of the existing pedestrian underpass) and minor modifications to the existing platforms to accommodate the realigned tracks at Riverwood and Padstow Stations.

5.4.5 Signalling and electrical works

In addition to the provision of new signals and associated equipment, the works would include the development of a new RailCorp signalling depot to replace the existing facility at Riverwood.

The principal electrical works would comprise the construction of a substation at Revesby and the relocation underground of a number of electrical feeders.

The installation of a new 33kV power feeder from the Bankstown substation to the site of the new Revesby substation would be subject to a study undertaken during detailed design development.

5.4.6 Noise attenuation

There is little potential in the corridor to minimise noise impacts by distance between the source and adjacent receivers. Where the Proposal would expose sensitive receptors to increased noise levels, attenuation would be provided where the mitigation measures are considered to be feasible and reasonable to apply to the impacts occurring as a result of its operation in accordance with the *Interim Guideline for the Assessment of Noise from Rail Infrastructure Projects* (Department of Environment and Climate Change 2007). An assessment would be made where noise at 2021 exceeds defined trigger levels relating to both an increase in noise and its absolute level. The assessment process defined in the guideline is described in **Chapter 13**.

5.4.7 Urban and landscape design

An urban and landscape design strategy has been developed to guide the design treatment of the rail corridor including the provision of guidelines for the subsequent design and construction processes. Due to the relative narrowness of the corridor and the nature of the adjacent urban area through which it passes, the opportunities for enhancing the local character of the surrounding landscape and integrating the works into the local urban fabric are limited. The strategy:

- recommends measures to minimise areas and items of high visual impact;
- encourages a high standard of design of structures, particularly those at stations where visibility is high and along the rail corridor where visual changes would be experienced;
- integrates mitigation measures in the local landform and landscape as far as possible;
- includes consultation with RailCorp and other stakeholders; and
- includes consultation with community and residents adjacent to rail corridor.

Urban form

- enhances local character as far as possible using landscaping and built structures appropriate for the location;
- undertakes community consultation to present the available options (level of screening and materials) for visual and/or noise barriers in the areas identified for such measures;
- considers appropriate screening including soft landscaping appropriate for its location;
- provides planting in any reserves or open spaces adjacent to the corridor in consultation with the relevant council;
- avoids visual monotony along straight sections of noise barriers using offsets and, if possible changes of level;

- considers the visual appearance of noise barriers (from both sides) and includes provisions, such as adjacent soft planting to discourage graffiti; and
- considers the design of noise barriers to suit the surroundings where impacts would be positive in reducing overshadowing and where public access is limited to reduce the occurrence of graffiti.

Environment and biodiversity

- enhances existing indigenous vegetation communities by appropriate revegetation of degraded areas;
- instigates appropriate measures to protect any retained vegetation both during and after construction. These include marking, fencing and diverting stormwater channels;
- considers infill planting along Salt Pan Creek and other areas in consultation with local councils as part of the landscaping and rehabilitation of the area; and
- examines how habitats can be improved where construction works have required the removal of existing vegetation including the provision of vegetation cover on slopes and embankments and aquatic planting, where appropriate, to control and reduce runoff.

The rail corridor

- designs new structures to integrate with the existing so that individual elements combine to form a coherent whole;
- uses batters and a range of slopes within a cut to achieve an integrated landscape and topography. Batter slopes should be as shallow as possible to allow for planting. Terracing is preferable to high retaining walls where feasible;
- uses vegetation to stabilise fill and cut embankments where allowable;
- considers the aesthetic aspects of retained and strengthened structures in highly visible areas; and
- minimises the use of unscreened shotcrete in all visible areas.

5.5 Design alternatives

The design alternatives considered during the development of the Proposal relate to a variety of configurations for the addition of dual tracks within the existing corridor between Kingsgrove and Revesby.

All options considered and assessed in detail provide two new tracks mainly within the existing corridor between Kingsgrove and Revesby stations. There were three main options with a number of variations:

An initial option (the concept design) was developed in response to the objectives of the Proposal established by RailCorp and to accommodate the constraints imposed by the physical conditions within the existing corridor and the operational requirements included

in the relevant Australian and RailCorp standards. This is known as Option 1A and is shown on **Figure 5.1.**

A number of alternatives were subsequently developed to determine whether improvements could be made to the basic design. Two principle alternatives were identified. These are known as Options 2A and 3A and are shown on **Figures 5.2** and **5.3** respectively. Variations were also developed on each of the main options.

Each of the alternatives along or adjacent to the existing corridor is constrained by the limited width available and the need to share the major crossing points along the corridor. Differences in vertical alignment were also limited by the narrowness of the corridor and the need to include crossovers at a number of points along it to provide an acceptable degree of operational flexibility. There are therefore only three main options available. These are:

- Option 1A-one new track on each side of the two existing tracks **(Figure 5.1)**;
- Option 2A-two new tracks on the Up side of the existing Up Main **(Figure 5.2)**; and
- Option 3A-two new tracks on the Down side of the existing Down Main **(Figure 5.3)**.

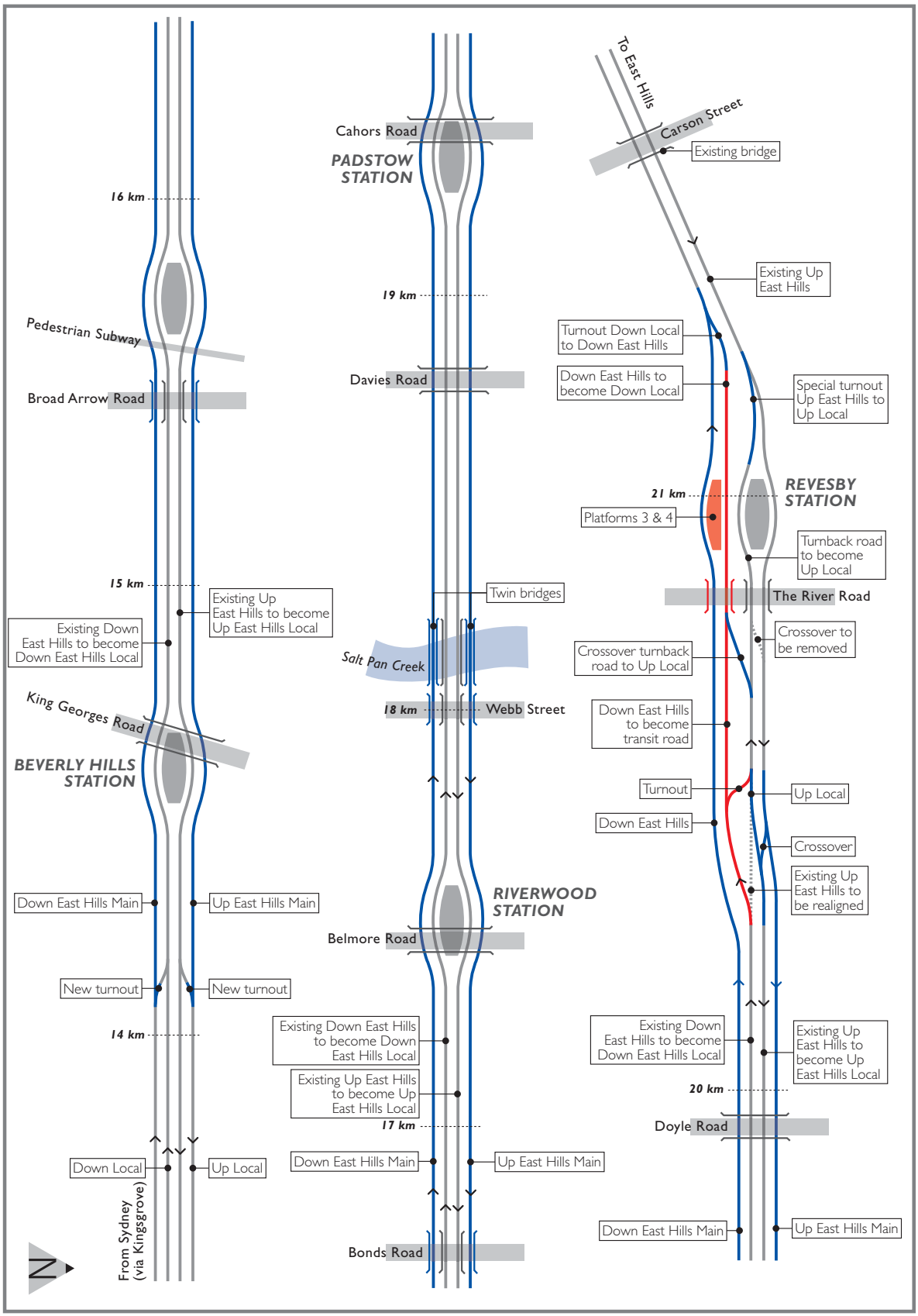
Option 1A comprised a new Up Main Line on the Up side of the existing Up Main and a new Down Main Line on the Down side of the existing Down Main. Four alternative track arrangements for some sections of the route within the Option 1A base scheme were identified and assessed. Options 1B and 1C are similar to 1A except that a new single bridge is located on Up/Down side of the existing Salt Pan Creek bridges.

Options 1D and 1E are similar to 1A except that the new twin tracks are located on the Up/Down side between Narwee and Riverwood Stations.

Option 2A comprised two new tracks on the Up side of the existing Up Main. The new tracks would become the Up Main and Up Local and the existing tracks would become the Down Main and Down Local. Two alternative track arrangements for some sections of the route within the Option 2A scheme were identified and assessed.

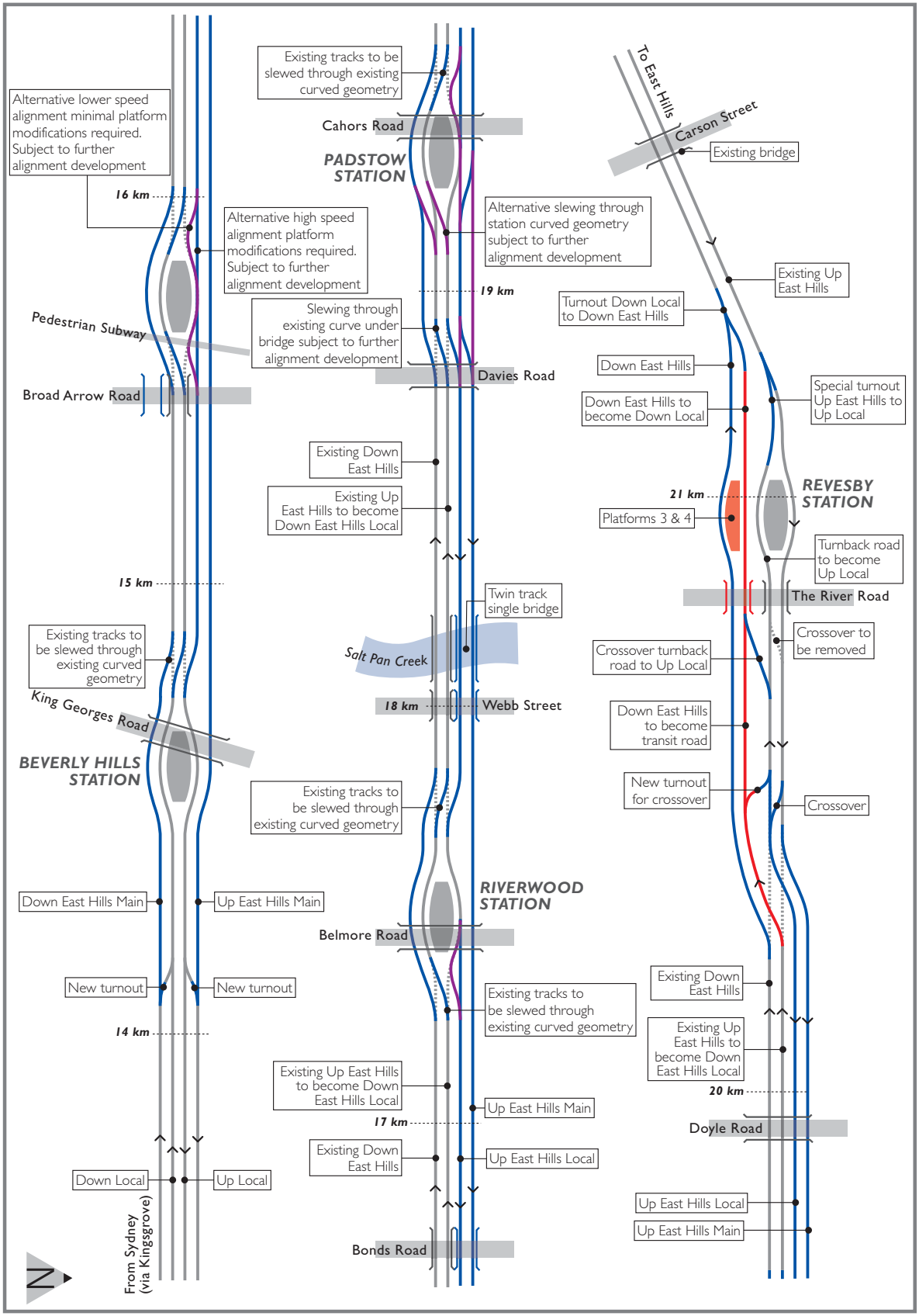
Options 2B and 2C are similar to 2A except that the two new tracks become new Up and Down mains and the existing tracks become Up and Down Locals. Option 2B has grade separated junctions at the east and west ends near Beverly Hills and Revesby Stations. Option 2C has a grade separated junction at Beverly Hills and an at grade junction at Revesby.

Option 3A was similar to Option 2A except that the new twin tracks were on the Down side rather than the Up side. Two alternative track arrangements for some sections of the route within the Option 3A scheme were identified and assessed. These are similar to Options 2B and 2C.



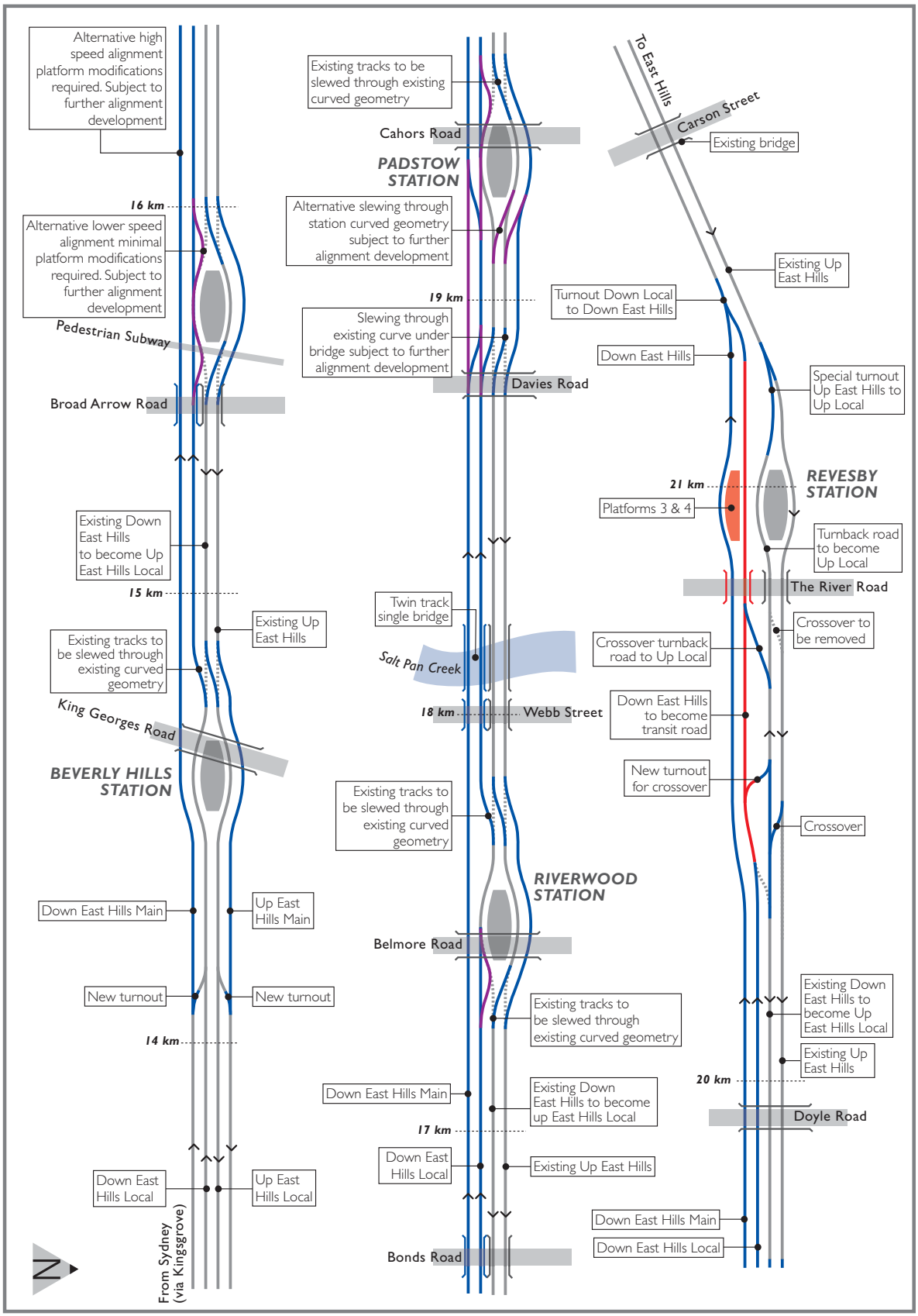
2008 Turnback works
2010 quadruplication
Existing track work

Figure 5.1 **Quadruplication Option 1a**



2008 Turnback works
2010 quadruplication
2010 sub-options
Existing track work

Figure 5.2 **Quadruplication Option 2a**



2008 Turnback works
2010 quadruplication
2010 sub-options
Existing track work

Figure 5.3 **Quadruplication Option 3a**

5.6 Assessment of the options

The options were assessed against a range of issues:

- Engineering - track alignment, earthworks, drainage, utilities, bridgeworks, retaining walls, signalling, electrical, overhead wiring and stations.
- Environmental - noise and vibration, flora and fauna, traffic and parking, water quality, air quality, heritage, community and social and property.
- Operational requirements.
- Construction program and staging.
- Cost.

Engineering
Option 1A was expected to result in impacts on both the Up and Down sides particularly in relation to rail infrastructure works, earthworks, retaining walls and bridge works. Similar works would be required along both sides of the corridor.

Option 2A would result in greater impacts on the Up side. Significant slewing of existing tracks (Option 2A) or grade separated crossings (Options 2B and 2C) would also be required increasing the extent of additional engineering works required. Option 2A has relatively few impacts on the Down side compared with Option 1.

Option 3A would result in greater impacts on the Down side. Significant slewing of existing tracks (Option 3A) or grade separated crossings would also be required increasing the extent of additional engineering works required. Option 3A has relatively few impacts on the Up side compared with Option 1.

Options 2A and 3A were expected to result in greater engineering impacts than Option 1A particularly in relation to the additional works required for the track slewing. This would typically result in higher costs.

Environmental
Options 2A and 3A would be likely to have marginally greater impacts than Option 1A due to the proximity of the additional two tracks to adjacent residents on one side of the corridor.

Operational
Operational issues were expected to be more significant for Options 2A and 3A during construction due to track slewing works and during post-construction where grade separation is included in the scheme. Changes in track configuration would require additional driver and operations staff training.

Construction program and staging
All options require a number of weekend track possessions to stage the works adequately and minimise disruptions. All options, other than Option 1A require additional construction works (and staging) due to track slewing and/or grade separation works.

Cost

Option 1A and its variations would be considerably less expensive than the other options mainly due to the more elaborate track configuration required, additional complications at the existing overbridges and, particularly the necessity to acquire private land along one side of the corridor.

Cost and operational considerations were considered to be the most significant issues in the assessment. All options which include both the new tracks along one side of the corridor are at a disadvantage due to the operational difficulties introduced by the necessity to slew the tracks to connect back into the existing track configuration and the substantial additional costs required to purchase properties adjacent to the existing corridor to provide the necessary space for the pair of new tracks.

The variations on the principle options comprised a series of changes to the basic approaches including moving both the new tracks to one side of the corridor over sections of the Project rather than over the whole length of the corridor with various crossovers at each end to rejoin the existing tracks. This inevitably involves slewing the tracks or introducing additional crossovers including, in some cases, grade-separation.

This results in additional costs and construction and operational complexities. In addition, the location of twin tracks on one side of the existing corridor would require more land than is available on that side resulting in the need to acquire areas of private property further increasing costs and exacerbating social impacts.

None of the variations assessed was considered to result in worthwhile improvements over Option 1A in terms of operational improvements or cost savings. Environmental impacts were expected to be similar overall while the need to acquire additional land alongside the corridor would result in higher costs and detrimental social impacts. Option 1A was therefore preferred as the basis for development of the concept design.

Option 1A has been developed in more detail and is described in **Chapter 6.**