

Gales-Kingscliff Pty Ltd

ABN: 75 093 540 080

Cudgen Lakes Sand Extraction Project

Traffic and Transport Assessment

Prepared by

Veitch Lister Consulting Pty Ltd

October, 2007

**Specialist
Consultant
Studies
Compendium**

Part 7

Gales - Kingscliff Pty Ltd

ABN: 75 093 540 080

Cudgen Lakes Sand Extraction Proposal

Traffic and Transport Assessment

Prepared for: R.W. Corkery & Co. Pty. Limited
75 Kite Street
PO Box 80
ORANGE NSW 2800

Tel: (02) 6362 5411
Fax: (02) 6361 3622
Email: mail@rwcorkery.com

On behalf of: Gales – Kingscliff Pty Ltd
20 Ginahgulla Road
BELLEVUE HILL NSW 2023

Tel: (02) 9327 2481
Fax: (02) 9387 8230
Email: segals@galesgroup.com.au

Prepared by: Veitch Lister Consulting Pty Ltd
PO Box 1054
TOOWONG QLD 4066

Tel: (07) 3870 4888
Fax: (07) 3870 4446
Email: gary.hunter@veitchlister.com.au

October, 2007

COPYRIGHT

© Veitch Lister Consulting Pty Ltd, 2007
and
© Gales - Kingscliff Pty Ltd, 2007

All intellectual property and copyright reserved.

Apart from any fair dealing for the purpose of private study, research, criticism or review, as permitted under the Copyright Act, 1968, no part of this report may be reproduced, transmitted, stored in a retrieval system or adapted in any form or by any means (electronic, mechanical, photocopying, recording or otherwise) without written permission. Enquiries should be addressed to Veitch Lister Consulting Pty Ltd.

CONTENTS

	Page
EXECUTIVE SUMMARY.....	7-5
1 INTRODUCTION.....	7-7
1.1 Background.....	7-7
1.2 Purpose of this Report	7-7
1.3 Structure of this Report	7-7
2 TRAFFIC CONTEXT	7-9
2.1 Regional Context.....	7-9
2.2 Road Hierarchy	7-10
3 EXISTING TRAFFIC CONDITIONS	7-11
3.1 Road Network Performance	7-11
3.2 Intersection Performance	7-11
3.3 Traffic Composition	7-13
4 PROJECT DESCRIPTION	7-15
4.1 Project Elements.....	7-15
4.2 Project Operations	7-15
4.3 Project Scale and Timeframe.....	7-16
5 TRAFFIC GENERATION ESTIMATES.....	7-19
5.1 Introduction	7-19
5.2 Site Establishment	7-19
5.3 External Pipelines	7-20
5.4 Normal Operations.....	7-21
5.5 Resulting Land Use.....	7-23
6 TRAFFIC IMPACT ASSESSMENTS	7-25
6.1 Impact Scenarios	7-25
6.2 Site Establishment - 2008	7-25
6.3 Normal Operations - 2011	7-27
6.4 Normal Operations - 2023.....	7-31
6.5 Altona Drive	7-33
APPENDIX A : ENVIRONMENTAL ASSESSMENT REQUIREMENTS.....	7-37
APPENDIX B : FIGURES.....	7-41

List of Tables

	Page
Table 3.1 Performance of Surrounding Road Links in 2007.....	7-11
Table 3.2 Performance of Existing Intersections (in 2006).....	7-12
Table 4.1 Proposed Hours of Operation	7-16
Table 5.1 Site Establishment Traffic Estimates.....	7-19
Table 5.2 Maximum External Traffic Levels During Site Establishment.....	7-21
Table 5.3 Maximum Operational Traffic	7-22
Table 6.1 Performance of 'Existing' Intersections in 2008 Ambient Scenario.....	7-26
Table 6.2 Percentage Change in Peak Hour Volumes in 2008, due to Site Establishment	7-27
Table 6.3 Performance of 'Existing' Intersections in 2008 Site Establishment Scenarios...	7-27
Table 6.4 Performance of 'Existing' Intersections in 2011 Ambient Scenario.....	7-28
Table 6.5 Percentage Change in Peak Hour Volumes in 2011, due to Project Operations	7-29
Table 6.6 Performance of 'Existing' Intersections in the 2011 Operational Scenarios.....	7-30
Table 6.7 Performance of Chinderah Roundabout, in 2023 Ambient Scenario	7-32
Table 6.8 Performance of the Chinderah Roundabout, in 2023 Operational Scenarios	7-32
Table 6.9 Percentage Change in Peak Hour Volumes in 2023, due to Operational Traffic	7-32
Table 6.10 Volumes of Traffic on Altona Drive, during Project Operations.....	7-34

List of Figures (in Appendix B)

- Figure 1.1** : Location of Gales' Land and the Sand Extraction Site
- Figure 2.1** : Regional Context and Road Hierarchy
- Figure 3.1** : Relevant Daily Traffic Counts
- Figure 3.2** : Forecast Daily Volumes, 2001
- Figure 3.3** : Intersection Peak Hour Turning Movements (Feb. 2006)
- Figure 3.4a** : Intersection 1 (Pacific Highway / Tweed Coast Road)
- Figure 3.4b** : Intersection 2 (Tweed Coast Road / Crescent Street)
- Figure 3.4c** : Intersection 3 (Tweed Coast Road / Cudgen Road)
- Figure 3.4d** : Intersection 4 (Crescent Street / Altona Drive)
- Figure 4.1** : Elements of the Sand Extraction Project
- Figure 4.2a** : Proposed New Intersection
- Figure 4.2b** : Initial / Interim Access Arrangements
- Figure 4.3** : Draft Ultimate Land Use Concept
- Figure 6.1** : Expected Road Improvements
- Figure 6.2** : Forecast Growth in Peak Hour Turning Movements (2001 – 2011)
- Figure 6.3** : Estimated Peak Hour Turning Movements (Ambient Scenario, 2008)
- Figure 6.4** : Site Establishment Traffic – Alternate Peak Hour Traffic Distributions
- Figure 6.5** : Estimated Peak Hour Turning Movements (Ambient Scenario, 2011)
- Figure 6.6a** : Peak Hour Operational Traffic (Northern Scenario)
- Figure 6.6b** : Peak Hour Operational Traffic (Southern Scenario)
- Figure 6.6c** : Peak Hour Operational Traffic (Western Scenario)
- Figure 6.7a** : Forecast Growth in Peak Hour Turning Movements (2011 – Ultimate)
- Figure 6.7b** : Forecast Peak Hour Turning Movements (2023 Ambient Scenario)
- Figure 6.8** : Chinderah Interchange Roundabout (Existing and Suggested Future Layouts)
- Figure 6.9a** : Initial Improvements to Altona Drive
- Figure 6.9b** : Interim Improvements to Altona Drive

EXECUTIVE SUMMARY

As a means to effect the development of their substantial land holdings in the Kingscliff, Chinderah and Cudgen area, Gales - Kingscliff Pty Ltd have proposed to establish a sand extraction operation on two of those sites. The Project is envisaged to yield about 5 million cubic metres of sand over a period of 11 to 16 years.

The extracted sand would be processed and used for two different purposes:

- Pumped via pipelines to fill the various Gales' development sites, and
- Processed (ie. washed and screened) on-site and sold to the construction industry.

In addition to the out-going products, the project operations would also involve the receipt of virgin excavated material, much of which would be utilised on-site to line a proposed lake.

This report has examined the traffic implications of all stages of the Project, in a number of time horizons. The various stages of the Project that were reviewed, and the maximum daily traffic movements (external to the site) estimated to be generated by each, were:

<u>Project Stage</u>	<u>Vehicles per day</u>
1. Site establishment (initial stages)	65 vpd
2. Site establishment (mid-stages) plus laying of external pipelines	40 vpd
3. Normal and irregular operations	216 vpd
4. Resulting land use	30 vpd

Based on the above and the expected changes to the road network in the vicinity of the site, traffic impact assessments were undertaken for the following scenarios:

<u>Project Stage</u>	<u>Horizon</u>
1. Site establishment (initial stages)	2008
2. Normal and irregular operations	2011
3. Normal and irregular operations	2023

Subject to inherent works proposed by the Proponent, and road improvements planned by Tweed Shire Council being completed to their currently anticipated program, the traffic impact assessments indicate that the surrounding road network would generally be able to support the additional traffic related to the site establishment and project operations.

The exceptions, and the measures needed to ameliorate the anticipated conditions, are:

1. Improvements to the priority controlled intersection of Tweed Coast Road and Crescent Street would be desirable by 2011, irrespective of the sand extraction project. The desirable improvements and their suggested responsibilities are:
 - Amend the right turn off Tweed Coast Road from a type 'AUR' to a type 'CHR' treatment (Tweed Shire). This would appear to only involve lane markings.
 - Ban the right turn from Crescent Street to Tweed Coast Road (Tweed Shire).
 - Implement a 200m acceleration lane for the left turn from Crescent Street to Tweed Coast Road (Early construction of part of Council's proposed works).
2. Minor improvements to the roundabout at the interchange (between the Pacific Highway and Tweed Coast Road) would be needed by 2023, irrespective of the Project (NSW RTA). Again, this would only involve lane markings.

3. The project's access road (Altona Drive) and its intersection with Crescent Street will need minor improvements and realignment, at various stages of the project (The Proponent).

1 INTRODUCTION

1.1 Background

Gales - Kingscliff Pty Ltd (the “Proponent”) and partner company Gales Holdings Pty Ltd are the owners of significant parcels of undeveloped land at Kingscliff, Chinderah and Cudgen in Tweed Shire, as shown in **Figure 1.1**. As a pre-requisite step to development of some of that land, the sites would need to be filled. To that end, the Proponent proposes to establish a sand extraction operation on the two western-most lots - collectively referred to in this report as the ‘Project Site’. Two separate extraction sites are intended, namely:

- a Northern Extraction Site of approximately 9 hectares; and
- a Southern Extraction Site of approximately 37 hectares.

Current plans anticipate the sand being extracted at up to 650,000m³ per annum, with approximately 2.5 million m³ proposed to be used to raise the land levels of selected Gales’ sites with the balance of the sand (about 2.5 million m³) to be sold to the construction industry.

Sand extracted for use as fill sand would be transported by pipeline, whilst sand sold to the construction industry would be transported by road haulage. Although the sand extracted to fill the Gales’ sites would be pumped, there would still be some traffic generated by the establishment and maintenance of this pumping operation (ie. in addition to the haulage of the sand sold to industry). As a result, the traffic impacts of the Project need to be examined and, if necessary, mitigated and/or controlled.

Veitch Lister Consulting have been engaged by Gales - Kingscliff Pty Ltd to undertake the required traffic impact assessments of the Project.

1.2 Purpose of this Report

The purpose of this report has been to:

- examine existing traffic volumes and conditions in the vicinity of the Project Site;
- examine the traffic implications of differing stages of the Project; and
- assess the traffic impacts of the critical stages of the Project.

1.3 Structure of this Report

This report has 6 chapters and 2 appendices. The remaining contents are:

- **Chapter 2** examines the existing / future traffic context in the vicinity of the Project Site;
- **Chapter 3** examines existing traffic conditions in the vicinity of the Project Site;
- **Chapter 4** describes the Project in terms of matters relevant to traffic and transport;
- **Chapter 5** examines the potential traffic generation of differing stages of the Project;
- **Chapter 6** documents assessments of the traffic impacts of the Project;

- **Appendix A** provides cross-references to the Environmental Assessment Requirements raised by the Director-General; and
- **Appendix B** contains Figures.

2 TRAFFIC CONTEXT

Traffic volumes and patterns are the result of travel interaction between differing land uses. Accordingly, before examining traffic conditions in the vicinity of the Project Site, it is appropriate to examine the land uses in the region which generate and attract the traffic, and also to review the road network which serves the interaction (refer **Figure 2.1**).

2.1 Regional Context

Kingscliff is a coastal village with a population of approximately 5,600 persons, located about 15-minutes drive south of Coolangatta. It lies toward the northern end of the Tweed Coast. The Tweed Coast consists of a series of coastal villages including Chinderah, Casuarina, Cabarita, Hastings Point, and Koala Beach / Pottsville, plus a strip of rural hinterland (east of the Pacific Highway).

In simplistic geographic terms, Tweed Shire consists of three sub-areas being:

- Murwillumbah and the surrounding rural areas;
- The Tweed Coast; and
- The 'Urban' area (north of the Tweed River).

Whilst 'isolated' to some extent from each other, these three sub-areas interact with and are co-dependent on each other in differing ways, eg:

- The Tweed Coast is dependent on the urban north for employment opportunities and higher order goods and services, and is partially dependent on Murwillumbah for schooling capacity.
- Murwillumbah is the service centre for the rural parts of the Shire, but is also the administrative centre for the whole Shire.
- To a large extent, the urban north is self-contained and is perhaps more of an extension of the Gold Coast than an integral part of the Shire.

The above will change. The Tweed Coast is expected to grow from its current (2001) population of 16,000 to around 45,000 persons over the next 20 to 25 years. In association with this population growth, the establishment of commercial centres and possibly other higher order administrative and social services (such as a hospital) would see it become substantially more self-contained for employment and for goods and services. Nevertheless, despite this greater self-containment, traffic volumes both on the coast and to/from Murwillumbah and the urban north are expected to grow significantly.

2.2 Road Hierarchy

The principal road serving the region is the Pacific Highway, which passes through Tweed Shire, linking Sydney and Brisbane. Although a National Highway, its regional and local functions are predominant, being:

- Regional – by linking Byron Bay to the Gold Coast and Coolangatta Airport; and
- Local – by linking Murwillumbah and the Tweed Coast to the urban north.

The principal roads in the immediate vicinity of the Project Site are:

- Tweed Coast Road (a sub-arterial), which links the coastal villages and connects them to the Pacific Highway at Chinderah in the north and also at Wooyung in the south; and
- Cudgen Road, which is one of two sub-arterials providing east-west connectivity between the Coast and Murwillumbah.

3 EXISTING TRAFFIC CONDITIONS

3.1 Road Network Performance

A number of (average daily) traffic counts, on roads in the vicinity of the Project Site, are available to VLC. However, many of those counts are excessively dated. A selection of the most relevant and reasonably current counts is shown in **Figure 3.1**.

A more complete picture of (estimated) daily traffic volumes in the area is shown in **Figure 3.2**. This graphic is sourced from VLC's 2001 traffic model of Tweed Shire.

The performance of the existing road network in the vicinity of the Project Site has been examined, by estimating the current daily volumes and nominal daily capacities of the links concerned, as in the **Table 3.1**.

Table 3.1
Performance of Surrounding Road Links in 2007

Road / Location	Lanes	Daily Capacity	Est. 2007 Volume	V/C*
<i>Pacific Highway:</i>				
At Tweed River	6	120,000	42,000	0.35
North of Chinderah	6	120,000	32,000	0.27
South of Chinderah	4	70,000	25,000	0.36
South of Tweed Valley Way	4	70,000	17,500	0.25
<i>Tweed Coast Road:</i>				
North of Cudgen Road	2	15,000	12,000	0.80
South of Cudgen Road	2	15,000	9,000	0.60
<i>Cudgen Road:</i>				
East of Tweed Coast Road	2	12,000	7,000	0.58
West of Tweed Coast Road	2	10,000	1,750	0.18
<i>Crescent Street</i>	2	3,000	500	0.17

*V/C = volume to capacity ratio

The above indicates that most of the key road links in the vicinity of the Project Site, that are likely to experience traffic impacts from the Project, are currently operating well within their capacities (at a daily level).

3.2 Intersection Performance

There are four intersections in the vicinity of the Project Site, through which much of the traffic generated by the Project would pass. Beyond these intersections, the generated traffic would disperse and have insignificant impacts. The four intersections are:

1. Pacific Highway / Tweed Coast Road;
2. Tweed Coast Road / Crescent Street;
3. Tweed Coast Road / Cudgen Road; and
4. Crescent Street / Altona Drive.

In order to examine the performance of these intersections, in the current and future scenarios, VLC arranged for turning movement counts to be undertaken by Carter Rytenskyld during the area's weekday peaks (as determined from the Shire's tube count data), as follows:

- PM count on Thurs 9 Feb 2006, from 3.00pm to 5.00pm (weather = fine); and
- AM count on Fri 10 Feb 2006, from 7.30am to 9.30am (weather = fine)

The peak 1-hour turning movement demands observed at the four intersections are shown in **Figure 3.3**. Their current layouts are shown in **Figures 3.4a, b, c & d**.

The performance of these four intersections, operating under the 2006 peak hour demands shown in **Figure 3.3**, has been assessed using SIDRA. These assessments are summarised in **Table 3.2**.

Table 3.2
Performance of Existing Intersections (in 2006)

Intersection	Type	Degree of Saturation		Level of Service ⁽¹⁾	
		AM	PM	AM	PM
1. Pacific Hway / Tweed Coast Rd	R'bout	0.39	0.33	B / B	B / B
2. Tweed Coast Rd / Crescent St	Priority	0.37	0.34	A / D	A / C
3. Tweed Coast Rd / Cudgen Rd	Signals ⁽²⁾	0.73	0.82	C / D	C / D
	Signals ⁽³⁾	0.66	0.59	C / D	C / D
4. Crescent St / Altona Dr.	Priority	0.03	0.02	A / B	A / B

- Notes :
1. Intersection Overall / Worst Major Movement
 2. With pedestrian crossing critical, at optimum cycle time = 80 secs.
 3. With pedestrian crossing ignored, at optimum cycle time = 60 secs.

The above indicates that three of the four intersections are currently operating well within their capacities and therefore provide excellent levels of service. The exception is the signalised intersection at Cudgen Road, which provides an adequate level of service.

The alternative assessments for this signalised intersection need explanation. As shown in **Figure 3.4c**, the current layout and signal phasing provide for a pedestrian crossing movement across the north leg of the intersection, which determines the length of the 3rd phase (C) and the overall cycle time. However, the pedestrian demands observed to use this crossing were minimal (less than 10 groups were observed in 4 hours of survey). In practice, therefore, the pedestrian movement and its required 'green / clearance' time can effectively be ignored, permitting the intersection to operate more efficiently on a shorter cycle time.

Despite its adequate performance as a priority controlled intersection, the layout of Intersection 2 (Tweed Coast Road / Crescent Street) does not fully comply with Austroads' standards for auxiliary turn lanes. A review of the observed peak hour volumes and the facilities available for each turning movement (against the requirements in Section 6.8 of *Part 5 (Intersections at Grade)* of their *Guide to Traffic Engineering Practice*) indicates the following:

- Right turn off Tweed Coast Road – the observed peak hour volumes for this movement were 33 and 25 vehicles per hour, respectively. Reference to Figure 6.41 of the guide

suggests a type 'CHR' treatment (ie. a channelised right turn lane) is justified. The required modification would appear to only involve signs and markings.

- Left turn off Tweed Coast Road – with no traffic observed to make this manoeuvre, the type 'BAL' treatment (ie. basic left turn) is adequate.
- Left turn from Crescent Street – the guide provides no specific volume 'threshold' for a left-turn acceleration lane other than to suggest they are appropriate where left turn volumes are 'high' or where it is desirable to provide free-flowing conditions. Given that the maximum volume making this turn was 50 vehicles per hour and has a low (0.08) degree of saturation, an acceleration lane does not currently seem justified.

3.3 Traffic Composition

The immediate area is served by two principal bus routes:

- Route 601, operating half-hourly between Pottsville and Tweed Heads via Kingscliff, on a route close to the coastline (ie. along Kingscliff Street – refer **Figure 1.1**).
- Route 603, operating hourly between Pottsville and Tweed Heads, which (on its southbound journey) travels via Tweed Coast Road, through Cudgen on Crescent Street, then east on Cudgen Road to Kingscliff, before heading south along the coast. The northbound service is the reverse.

The traffic count data, which VLC has for roads in the area, does not include a breakdown by vehicle type. However, as part of the peak hour intersection counts arranged by VLC in February 2006, the volumes were (meant to be) recorded as 'light' and 'heavy' vehicles (where "light" = cars, vans, utes and motorcycles, and "heavy" = all others).

However, the recorded data indicates excessive variation in heavy vehicle proportions along Tweed Coast Road, for differing directions / hours (eg. from 1.0% to 10.5%). This degree of variation leads VLC to believe that the counting staff had been inadequately briefed.

From this author's observations, the proportion of heavy vehicles is reasonably consistent along Tweed Coast Road, and is considered slightly above average for a road of this type (a sub-arterial), potentially as a result of construction activity in the Casuarina area. Based on this author's observations and experience, the proportion of heavy vehicles using the northern sections of Tweed Coast Road is estimated to be between 7 and 9%.

The proportions of heavy vehicles recorded using Crescent Street were more reliable. The observed proportions were higher (15 to 18%), due to the low overall volumes and:

- up to 3 scheduled and 2 school buses in an hour, in each direction; and
- up to 3 truck movements to/from Altona Drive in any 1 hour.

(This page is intentionally blank)

4 PROJECT DESCRIPTION

4.1 Project Elements

The key elements of the Project are shown in **Figure 4.1**, namely:

- a southern extraction area, of approximately 37 hectares;
- a northern extraction area, of approximately 9 hectares;
- a processing area, of approximately 4 hectares; and
- two external pipeline corridors, one extending northward and the other eastward.

Additionally, during the Project, works within the southern extraction area will encroach across the existing public road (Altona Drive), which provides access to 'Hanson Tweed Sand', the new Kingscliff Waste Water Treatment Plant site, as well as the Project Site. Accordingly, it is proposed to realign Altona Drive and form a new intersection with Crescent Street (about 50m north of the existing intersection), progressively during the Project, as follows:

- The existing Altona Drive and intersection would be used for site establishment and the early stages of the extraction operations (NB. all initial production would be pumped to Gales' fill sites. No construction sand products being produced and distributed in these early stages).
- Prior to commencing construction sand product distribution, the proposed new intersection on Crescent Street would be constructed (as shown in **Figure 4.2a**) and an interim deviation used to connect the existing road to it (as shown in **Figure 4.2b**).

The Project would also involve rehabilitation of the land affected, including backfilling the northern site to existing ground levels. At this stage of the Proponent's master-planning of their Kingscliff, Chinderah and Cudgen land holdings, it is anticipated that the Project Site will ultimately be developed as a major recreational precinct, as shown in **Figure 4.3**. This envisages sports fields and facilities north of the realigned Altona Drive and a recreational lake and parklands south of it. These ultimate uses do not form part of this current project, and would be the subject of separate planning approvals in the future.

4.2 Project Operations

The Project operations would involve the following:

- a) After removal of relevant soil and overburden, sand would be extracted and transported from the two sites, as follows:

Northern Extraction Site: All sand would be extracted by mechanical means and transported overland to the processing area.

Southern Extraction Site: Loamy sand lying above the water table would be extracted by mechanical means and transported overland to the processing area. Sand below the watertable would be hydraulically recovered and pumped to either the processing area or via one of the two external pipelines to one of the nominated fill sites. (A

tailwater return pipe would return the water and any fines from any of the pumping destinations).

- b) The sand, which is transported or pumped to the processing area, would be washed and/or screened to produce saleable products (eg. a fine-grained sand and a loamy sand).
- c) The Project would be licensed to receive virgin excavated natural material (VENM). Much of this material would be used on site (to backfill the northern extraction area or placed on the edges of completed sections of the lake). Some of the VENM would be processed and blended with the in-situ sands to create graded sand (ie. having a pre-determined range and mix of grain sizes).
- d) Both the in-situ sand products and the blended products would be sold to the construction industry and distributed by road haulage vehicles (NB. small load retail sales are not proposed).

4.3 Project Scale and Timeframe

The extraction areas are estimated to yield about 5.0 million m³ of sand. Maximum extraction rates, throughout the life of the Project, would be in the order of 650,000m³ per annum. Of this, up to 200,000m³ (or 300,000 tonne) would be for supply to the construction industry with the remaining 450,000m³ of capacity used intermittently to fill the Gales' development sites in accordance with future development approvals.

Actual extraction rates will be dependent on market requirements. If the above (maximum) rates were achieved, the Project would operate for at least 11 years. If the timing of Gales' development approvals do not permit contiguous use of the pumped fill capacity, the extraction stages of the project may last 15 or more years. While site rehabilitation and final land formation would be undertaken intermittently in parallel with the extraction operations, these activities would continue beyond the completion of sand extraction.

Except for routine maintenance and security activities, the Project (both establishment and operation) would be undertaken 6 days a week. The intended hours of operation of differing activities are summarised below.

Table 4.1
Proposed Hours of Operation

Activity	Monday to Friday	Saturday	Sunday
Site Establishment	6.30am – 7.00pm	6.30am – 4.00pm	-
Dredging (to processing area)	6.00am – 10.00pm	7.00am – 4.00pm	-
Dredging (to fill sites)	6.30am – 6.30pm	7.00am – 1.00pm	-
Excavation (soil or sand)	7.00am – 6.00pm	7.00am – 1.00pm	-
Product Distribution	7.00am – 6.00pm	7.00am – 1.00pm	-
VENM Receipts	7.00am – 6.00pm	7.00am – 1.00pm	-
Site Maintenance	6.30am – 7.00pm	6.30am – 4.00pm	9.00 am – 4.00pm

Once fully operational, the Project would provide employment on site for 5 full-time staff, plus up to 14 truck drivers (who would not necessarily be based on-site) would be involved in

delivering products and importing VENM. Up to 8 additional staff would be employed, on an intermittent basis, when new sections of overburden are stripped or when sand is mechanically excavated (including from the northern extraction site).

The following fixed and mobile plant items would be permanently based on site:

Fixed Plant

A 300mm cutter-suction dredge
A screening / blending plant
A washing plant
A weighbridge

Mobile Plant

Two 950 front-end loaders
One 30 tonne excavator
One water truck
Two off-road trucks

In addition to the fleet of up to 14 on-road haulage vehicles, a street-sweeper and a fuel-tanker would be utilised daily, but not necessarily based on-site.

(This page is intentionally blank)

5 TRAFFIC GENERATION ESTIMATES

5.1 Introduction

The potential traffic impacts of the Project would differ at various stages of its establishment and operation. The four principal stages or activities that need to be considered are:

- Site Establishment;
- Laying of External Pipelines;
- Normal Operations; and
- Ultimate Land Use.

5.2 Site Establishment

Site establishment would potentially commence in early 2008, and would involve the activities and associated vehicular movements described in **Table 5.1**.

Table 5.1
Site Establishment Traffic Estimates

Activity	Estimated Vehicle Numbers & Types
1. Surveying and setting-out of site boundaries and works areas.	4-6 light vehicle movements per day, for 2-3 weeks, then intermittently.
2. Installation of a security fence around both the extraction sites and the processing area.	A gang of about 6 fencers, generating about 16 private vehicle movements and 2-4 truck movements per day, for up to 2 weeks.
3. Removal of topsoil (from both the processing area and the initial dredging area) and using it to create bunds.	Initial delivery of 3-4 plant items (by long loader), then up to 4 operators and 1 supervisor making about 16 private vehicle movements per day, for up to 2 weeks.
4. Establishment of the dredge within the initial pond	Delivery of dredge (in component parts) would involve 5-6 large loads, some of which would be 'over-size' and require specialist traffic control. Assembly and set-up would involve a crane and 5-6 workers, generating about 20 vehicle movements, for about 1 week.
5. Establish water supply and the initial sand pipeline to the processing area.	4-5 workers, generating about 16 private vehicle movements and 3-4 trucks per day delivering materials, for about 1 week.
6. Filling of the processing area (approx. 20,000m ³ of sand required).	Activity would be internal to site. Only traffic would be about 10 private vehicle movements, related to the 3-4 staff, for about 3 weeks.
7. Construction of the processing area, including internal roads.	6-8 workers, generating about 24 private vehicle movements and 12 truck movements per day, for about 3 weeks.
8. Erection of offices / workshop, plus installation of the screening / washing plants and weighbridge.	6-8 workers, generating about 24 private vehicle and 4 truck movements per day, for about 4 weeks. Delivery of the fixed plant items would involve 8-10 large loads.

Clearly, not all of the establishment activities could occur simultaneously, as some are pre-requisites to others. A preliminary program of work suggests that the maximum traffic activity would occur in Week 3 when Activities 1, 2, 3 & 4 are potentially being undertaken in parallel.

The total daily traffic associated with these four activities would be up to 65 vehicle movements per day (vpd). Of these, only about 7 would be heavy vehicles. The majority of the balance of this traffic would be related to commuting by the 18 or so workers, resulting in about 18 inbound movements in the morning peak hour and 18 outbound movements in the afternoon.

5.3 External Pipelines

The external pipelines would consist of a 300mm delivery pipe and a 500mm return pipe, made of HDPE or steel. Within the Proponent's lands, the pipes would be generally laid upon the ground surface. However, the section of the northern pipeline beside the Tweed Coast Road would be laid in a shallow trench with 350mm cover. The 5 road crossings and 4 property access crossings would all be under-bored (this avoids the need for half-road closures and alternating one-way traffic control, necessary to effect a trenched crossing).

The pipe laying process itself would involve 2 or 3 workers, off-loading and placing 10 to 12m lengths of pipe using a flat deck truck fitted with a Hyab, and then joining them. Accordingly, the traffic generation associated with this activity is estimated, as follows:

- Truck – 2 'commuting' movements, plus 4 positioning movements, per day
- Workers – 6 commuting movements, plus 4 work/personal related movements, per day
- Backhoe / Other supplementary plant – 2 positioning movements, every 2nd or 3rd day.

The trench to accommodate the section of the northern pipeline beside the Tweed Coast Road would be excavated within the western verge. The grass verges along this section of the Tweed Coast Road are 8-14m in width. The truck, workers and backhoe would, therefore, be able to undertake the necessary excavation and pipe laying well clear (ie. > 2m) of the edge of the road carriageway. Except for the truck/backhoe entering and leaving the verge area at the beginning and end of each day's work, no traffic control (other than warning signage) would be necessary.

The under-boring of roads and property accesses would be undertaken from 'boring pits', most of which could be established on the Proponent's land (ie. clear of the road reserve and well clear of the road carriageways). However, excavation of the pits and establishment of equipment in them, for the 4 property access crossings along the west side of the Tweed Coast Road, will involve periods of manual traffic control under temporary speed limits. These boring operations would be undertaken by a separate work crew from those performing the pipe laying. The crew would involve only about 2 workers and 2 plant items. These plant items would be positioned and established once for each road crossing, and not moved until the crossing had been completed. The 2 workers could be expected to make 4 commuting trips and about 4 personal / work-related trips per day.

In summary, the external pipe laying activity would involve (for the most part) 2 work crews, generating about 12 commuting trips (6 per peak hour) and 14 other trips throughout the working day.

However, this external pipe laying could be expected to be undertaken in parallel with the latter stages of the Site Establishment. It is most likely that the external pipe laying would commence immediately after the internal pipeline to the processing area has been established (ie. whilst the processing area is being filled). Based on the various traffic generation estimates in **Table 5.1**, the potential maximum traffic generation of the separate / joint construction activities would be as in **Table 5.2**, following.

Table 5.2
Maximum External Traffic Levels During Site Establishment

Activity	Estimated Daily Traffic	AM Peak Hour	PM Peak Hour
1. Site Establishment Only (Activities 1, 2, 3 & 4)	65 movements	18 inbound	18 outbound
2. Combined Activities Site Establishment (Activity 6)	10 movements	4 inbound	4 outbound
External Pipe Laying	30 movements	6 inbound	6 outbound
Total	40 movements	10 inbound	10 outbound

The above indicates that the traffic generation of the earlier stages of the site establishment would be more critical, in terms of traffic volumes/impacts, than the intermediate stage when the external pipe laying is also being undertaken. As a result, only the impacts of the early stages of the site establishment need to be assessed.

5.4 Normal Operations

Once established, the regular daily traffic activity of the Project would involve the following:

- Staff Movements – 5 staff making 10 commuting and about 6 personal / work trips per day (using light vehicles).
- Site Servicing – about 6 truck movements (delivering fuel and supplies) and about 10 work related movements by staff (using light vehicles) could be expected each day.
- Pipeline Inspection / Operation - 2 return trips (ie. 4 movements) along whichever external pipeline is operational (possibly undertaken using a motorbike).
- Product Distribution – It is proposed that the maximum volume of sand products distributed would be up to 200,000 m³ per annum. It has been conservatively estimated by others (R.W Corkery & Co.) that this would involve about 50 truckloads or 100 truck movements per day, on average. There would, however, be day to day variability and, based on this average, the 85th percentile volumes have been estimated as 130 movements per day. (NB. These estimates have been based on 20-tonne truckloads, for 5.5 days per week and 50 weeks per year. In reality, much of the products would likely be distributed using truck and trailer units with capacities of 30-33 tonne. Actual movements may, therefore, be as low as 2/3^{rds} of the above).
- VENM Importation – It has also been estimated that about 30,000 m³ of VENM would be imported / received by the Project per annum, in the long term. This incoming material would involve about 12 truckloads or 24 truck movements per day, on average. The 85th percentile volumes have similarly been estimated at 40 movements per day.

In addition to these regular activities, there would also be periods (every 2 to 3 months) when additional workers and plant are engaged on-site for about a week, to strip overburden and to excavate loamy sand from above the watertable within the southern extraction site and transport it (internally) to the processing area.

This intermittent activity would involve about 3 workers (2 plant operators, and 1 truck driver) who would generate 6 commuting trips and about 4 personal or work-related trips per day (generally in light vehicles). Although the 2 additional plant items would remain on-site during the week, it is possible that the truck driver would be a sub-contractor and hence use the truck for commuting.

In summary, the maximum traffic volumes likely to be generated (externally), in periods when the both the regular and irregular activities are being undertaken, would be as in **Table 5.3**.

Table 5.3
Maximum Operational Traffic

Activity	Maximum External Traffic Movements		
	Week Days	AM Peak Hr.	PM Peak Hr.
1. Staff	16 movements	5 inbound	5 outbound
2. Site Servicing	16 movements	1 in / 1 out	1 in / 1 out
3. Pipeline Inspection / Operation	4 movements	1 in / 1 out	1 in / 1 out
4. Product Distribution	130 movements*	7 in / 6 out	6 in / 7 out
5. VENM Importation	40 movements*	2 in / 2 out	2 in / 2 out
6. Excavation (Intermittent)	10 movements	3 inbound	3 outbound
Total	216 movements	19 in / 10 out	10 in / 19 out

Notes: * 85th percentile

These maximum volumes are considered very conservative, for the following reasons:

- The 85th percentile volumes for both product distribution and for VENM importation have been added. These two markets are independent and the volumes associated with each will vary from day-to-day and month-to-month. It is highly unlikely that their respective maximums or even their 85th percentile volumes would both occur on any one day.
- It would be likely, in the pursuit of economic efficiency, that some of the imported VENM would be delivered as back-load by some of the product distribution trucks. The degree to which this back-loading could be achieved is, however, uncertain at this stage and nevertheless could be expected to vary with time, as the VENM sources change. For impact assessment purposes, no back loading has been assumed.
- As indicated in **Table 4.1**, most of the operational activities would start before the observed morning peak hour (8.00 – 9.00 am) and finish after the afternoon/evening peak hour (3.00 - 4.00 pm). Accordingly, most staff commuting trips would occur prior to and after the local peak periods. Nevertheless, they have been included in the peak hour traffic estimates.
- The intermittent excavation activities would only occur on about 30 days in any year.

In all probability, the above maximum external traffic volumes would hardly ever occur (perhaps once a year only). Even with no back loading, average daily external traffic would typically be around 160 vehicle movements per day. Nevertheless, the assessments of operational traffic impacts (in the next Chapter) have been based on these worst case, maximum traffic generations.

It should also be noted that, in addition to the preceding 'external' traffic, there would also be 'internal' traffic movements between the southern extraction site and the processing area. On a daily basis, these 'internal' traffic movements would include:

- 10 to 12 work-related movements, by staff; and
- about 24 truck movements, related to carriage of VENM from the processing area to the southern extraction area and/or carriage of loamy sand from the southern extraction area to the processing area (source: R.W. Corkery & Co.).

As examined in more detail in the next Chapter, these 'internal' traffic movements would simply cross the existing or re-aligned Altona Drive, at priority controlled crossroad intersections with the site access roads on either side.

5.5 Resulting Land Use

The land uses that would ultimately be established on the two parcels of the Proponent's land (north and south of the realigned Altona Drive) are still the subject of a master-planning exercise for the whole of the Proponent's landholdings in the Kingscliff, Chinderah and Cudgen area. At this stage, and as shown in **Figure 4.3**, the proposed uses would include the following:

- A recreation lake, with walking tracks and picnic facilities;
- A boat house;
- An equestrian club;
- Multi-purpose sports fields;
- Athletics tracks;
- A tennis club; and
- A bowls club.

Except for the lake and its fringes, which would be a direct result of this current application for the sand extraction project, all of the other potential uses would be the subject of future planning or development applications. The impacts of these other potential uses are best considered at that future time, when more definitive concepts as to type, scale and location have been developed.

Accordingly, for the purposes of this current project application, it is assumed that only a recreational lake is established south of the realigned Altona Drive. It is further assumed that the processing area is rehabilitated and, in conjunction with the balance of the Proponent's land on the north side of Altona Drive, is left as privately owned but publicly accessible open space (grassland). Such a lake and grassland, offering passive recreational opportunities only, would attract minimal traffic on weekdays (perhaps only 20 to 30 vehicular trips, including maintenance activities). On weekends, however, it could potentially attract 100 to 150 vehicles per day.

These potential traffic volumes are smaller than those estimated for the operational phase of the Project. Accordingly, the 'resulting' use would have lesser impacts than the Project and do not need to be specifically assessed.

(This page is intentionally blank)

6 TRAFFIC IMPACT ASSESSMENTS

6.1 Impact Scenarios

It was identified in the previous Chapter that neither the external pipe laying nor the resulting land use would be critical, in terms of traffic generation / impacts, relative to the other stages of the Project. Accordingly, the critical stages of the Project that need to be assessed are:

- the initial stages of site establishment; and
- normal operations of the Project.

The assessments of the impacts of the site establishment have been undertaken for a 2008 horizon in which the surrounding road network is unchanged from that which exists today.

In examining the 'operational' activities, it would be normal practice to assess the traffic impacts in a scenario, toward the end of the Project, in which ambient traffic volumes are at their greatest. Such a scenario would normally provide the most adverse traffic conditions, against which to assess the impacts of the Project. However, in this case and as shown in **Figure 6.1**, the surrounding road network is expected to change, as follows:

- Tweed Shire Council plans to duplicate the Tweed Coast Road from the Pacific Motorway to Casuarina, within a 5-10 year timeframe (ie. 2011-2016). It is anticipated, given that the higher traffic volumes on Tweed Coast Road, north of Cudgen Road, are approaching the existing road's capacity, that the northern section will be upgraded first (probably toward the beginning of the above timeframe).
- Initial master planning of the Proponent's lands has identified a range of road improvements and additions, including a possible extension of Altona Drive to Tweed Coast Road along with a subsequent further extension through to Turnock Street. (Closure of the northern section of Crescent Street would be associated with the 1st stage of this possible extension). However, both of these potential new road links would be the subject of further planning and approvals.

As a result, the road network in the vicinity of the extraction site could be expected to change significantly in about 2012. Given that the Project could continue operating until 2023, it will be necessary to consider 2 operational scenarios:

- In 2011, with the surrounding road network as it currently exists, except with the interim deviation of Altona Drive and its new intersection with Crescent Street.
- In 2023, with Tweed Coast Road duplicated and the realignment of the existing Altona Drive completed.

6.2 Site Establishment - 2008

By reference to VLC's traffic models of Tweed Shire (for 2001 and 2011), daily traffic volumes on the Tweed Coast Road, north of Cudgen Road, are forecast to grow by about 7.5% pa. over this period. The growth in peak hour turning movements at the four key intersections, as forecast by these two VLC models, is shown in **Figure 6.2**.

For these 2008 assessments, the ambient peak hour turning movements (at the four intersections) can be estimated by adding 2/10th of the forecast growth to those surveyed in early 2006 (as per **Figure 3.3**). The resulting 2008 peak hour turning movements are shown in **Figure 6.3**. NB. Although construction of Stage 1 of the Kingscliff Waste Water Treatment Plant has commenced since the February 2006 traffic surveys, it is expected to be completed by the end of 2007 (accordingly, no allowance needs to be made for additional traffic from this activity in 2008).

As noted earlier, the only change to the road network in the area by 2008 would be the construction of the interim deviation of Altona Drive and its new (relocated) intersection with Crescent Street (as shown in **Figure 4.2a**). The performance of the four key intersections in the vicinity of the extraction site (operating under the 2008 ambient demands) have been assessed using SIDRA. The results are summarised below.

Table 6.1
Performance of 'Existing' Intersections in 2008 Ambient Scenario

Intersection	Type	Degree of Saturation		Level of Service ⁽¹⁾	
		AM	PM	AM	PM
1. Pacific Hwy / Tweed Coast Rd	R'bout	0.42	0.36	B / B	B / B
2. Tweed Coast Rd / Crescent St	Priority	0.41	0.36	A / D	A / C
3. Tweed Coast Rd / Cudgen Rd	Signals ⁽²⁾	0.80	0.89	C / D	C / E
	Signals ⁽³⁾	0.68	0.63	C / D	C / D
4. Crescent St / Altona Dr. (new)	Priority	0.03	0.02	A / C	A / B

Notes :
1. Intersection Overall / Worst Major Movement
2. With pedestrian crossing critical, at optimum cycle time = 80 secs.
3. With pedestrian crossing ignored, at optimum cycle time = 60 secs.

By comparing the 2008 performance measures (above) with those for the existing 2006 situation (per **Table 3.2**, on page 7-12), it can be noted that the three intersections along Tweed Coast Road would all experience a small increase in degree of saturation. However, the 2008 results, above, indicate that all four intersections would still operate within acceptable limits.

It was estimated in **Table 5.2** (page 7-21) that the maximum traffic likely to be generated by the site establishment activities in the peak hours would be 18 inbound vehicles in the AM and 18 outbound in the PM. A majority of these commuting trips are likely to be to/from the north (ie. Banora Point, and beyond). However, for the purposes of these impact assessments, two worst case trip distributions will be assumed, as in **Figure 6.4**:

- A. all to/from the north
- B. all to/from the south.

(NB. If all travelled to/from the west, they would use Cudgen Road South, and only have impacts at Intersection 4, as per Scenario B).

The impact of these potential additional commuting volumes have been expressed in percentage terms, relative to the expected ambient peak hour demands on sections of Tweed Coast Road, in **Table 6.2**. This analysis indicates that the additional peak hour volumes would generally be less than 3% of the ambient demands.

Table 6.2
Percentage Change in Peak Hour Volumes in 2008, due to Site Establishment

Location	Dir'n	Ambient Volume		Max. Establishment Volume		% Change (max.)	
		AM	PM	AM	PM	AM	PM
Sth of Pacific M'way	Nb	828	738	-	+18	-	+2.4%
	Sb	612	659	+18	-	+2.9%	-
Nth of Cudgen Rd	Nb	716	618	-	-	-	-
	Sb	438	625	-	-	-	-
Sth of Cudgen Rd	Nb	662	510	+18	-	+2.7%	-
	Sb	238	451	-	+18	-	+4.0%

The performance of the four key intersections has been assessed, when operating under the increased 2008 demands of the site establishment scenario (ie. the ambient demands in **Figure 6.3**, plus the alternative extra demands in **Figure 6.4**). The results are summarised in **Table 6.3**.

Table 6.3
Performance of 'Existing' Intersections in the 2008 Site Establishment Scenarios

Intersection	Type	Degree of Saturation		Level of Service ⁽¹⁾	
		AM	PM	AM	PM
Scenario A:					
1. Pacific Hway / Tweed Coast Rd	R’bout	0.42	0.38	B / B	B / B
2. Tweed Coast Rd / Crescent St	Priority	0.41	0.36	A / D	A / D
4. Crescent St / Altona Dr.	Priority	0.04	0.03	A / C	A / B
Scenario B:					
3. Tweed Coast Rd / Cudgen Rd	Signals ⁽²⁾	0.80	0.89	C / D	C / E
	Signals ⁽³⁾	0.68	0.63	C / D	C / D
4. Crescent St / Altona Dr.	Priority	0.04	0.03	A / C	A / B

- Notes :
1. Intersection Overall / Worst Major Movement
 2. With pedestrian crossing critical, at optimum cycle time = 80 secs.
 3. With pedestrian crossing ignored, at optimum cycle time = 60 secs.

The above indicates there would be very little, if any, change in performance at any of the intersections as a result of the additional site establishment traffic in 2008. Only those performance measures shown in bold, above, are changed from those in the 2008 ambient scenario (per **Table 6.1**). All intersections would operate satisfactorily.

6.3 Normal Operations - 2011

For these 2011 assessments, the 'ambient' peak hour turning movements, at the four intersections, have been estimated by adding one half (5/10) of the forecast growth in turning movements (per **Figure 6.2**) to those observed in early 2006 (per **Figure 3.3**). The resulting ambient 2011 peak hour turning movement demands are shown in **Figure 6.5**.

The performance of the four key intersections, operating under the 2011 ambient demands, has been assessed using SIDRA. The results are summarised in **Table 6.4**.

Table 6.4
Performance of ‘Existing’ Intersections in 2011 Ambient Scenario

Intersection	Type	Degree of Saturation		Level of Service ⁽¹⁾	
		AM	PM	AM	PM
1. Pacific Hwy / Tweed Coast Rd	R'bout	0.48	0.40	B / B	B / B
2. Tweed Coast Rd / Crescent St	Priority	0.50	0.40	A / E	A / D
3. Tweed Coast Rd / Cudgen Rd	Signals ⁽²⁾	0.86	0.88	C / E	C / E
	Signals ⁽³⁾	0.76	0.75	C / D	C / D
4. Crescent St / Altona Dr.	Priority	0.03	0.02	A / B	A / B

- Notes :
1. Intersection Overall / Worst Major Movement
 2. With pedestrian crossing critical, at optimum cycle time = 80 secs.
 3. With pedestrian crossing ignored, at optimum cycle time = 60 secs

It can be noted by comparing the above results to those for the 2008 ambient scenario (**Table 6.1**, on page 7-26), that the three intersections along Tweed Coast Road would all experience moderate decreases in performance, as a result of the intervening traffic growth. Although 3 of the 4 intersections would perform adequately, the priority controlled intersection at Tweed Coast Road / Crescent Street would provide a poor level of service (E) for traffic turning out of Crescent Street. The average delays and level of service for traffic exiting Crescent Street, in the respective peak hours, would be:

- Left-turn out = 36 seconds (E) and 26 seconds (D)
- Right-turn out = 81 seconds (F) and 78 seconds (F)

The above delays to left-turn movements are not excessive, but they are in the ‘grey zone’ where some drivers would increase their ‘risk taking’ (ie. reduced gap tolerances). The expected delays to right-turn movements would, however, be excessive and would encourage drivers to take excessive risk. There are complicating issues associated with the alleviating these anticipated conditions, for each movement:

Left Turn – the desirable improvement would be to provide a higher speed radius for the turn and a northbound acceleration lane of about 200 metres on the Tweed Coast Road. Unless the intersection is to be signalised (which would appear ‘unwarranted’), such a treatment would need to be provided as part of the proposed duplication of Tweed Coast Road. Given that the duplication works would have commenced or would commence soon after this timeframe, then Council should make the improvement of this intersection a priority within the works contract.

Right Turn – to alleviate the delays for the right turn would either require traffic signals or a ‘seagull’ median arrangement to be implemented. Given that signals appear ‘unwarranted’ (in 2011, at least), a ‘seagull’ arrangement may need to be implemented as part of the duplication works. Alternatively, Council should consider banning this right turn movement, as an interim measure, if not permanently. The impacts of this ban would be:

- Light vehicles – there is no inherent need to make this right turn, as it is shorter and more convenient for light vehicles to head south on Crescent Street, then east on Cudgen Road, to get to their destination. (NB. the two vehicles, which were observed to make this right turn during the February 2006 surveys, were 2 moto-cross riders on a ‘joy-ride’).

- Heavy vehicles – there is a (10 tonne) vehicle weight limit implemented on the southern section of Crescent Street. This would prevent heavy vehicles leaving Altona Drive from using the alternate route available to light vehicles. Given the greater mass and reduced acceleration of these vehicles, it is likely that they would already experience difficulty in safely making such a right turn from Crescent Street in existing peak hours. Accordingly, banning heavy vehicles from making this right turn may already be justifiable. Their alternative route would be to turn left onto the Tweed Coast Road and travel north to the roundabout at the Pacific Highway before returning southward.

For the purposes of assessing the impacts of the project operations in this 2011 timeframe, it will be assumed that Council have not managed to advance the intersection works and have simply banned the right turn from Crescent Street.

The maximum traffic, likely to be generated by the regular and irregular operations of the Project, was estimated in Section 5.4 and summarised in **Table 5.3** (on page 7-22). Again, it is difficult to predict, with any certainty, where the generated traffic would be to and from, particularly since both the destination of products and the sources of VENM could vary from day-to-day and month-to-month. Accordingly, it has been considered appropriate to assess the impacts of a number of 'worst case' scenarios, in which all of the generated traffic takes the same route. The three trip distribution scenarios are shown in the following figures:

- **Figure 6.6a** – all peak hour traffic to/from the north
- **Figure 6.6b** – all peak hour traffic to/from the south. However, due the weight restriction on Crescent Street South and the potentially banned right turn, all outbound heavy vehicles would need to travel via the roundabout under the Pacific Highway.
- **Figure 6.6c** – all peak hour traffic to/from the west. Again, due to the preceding restraints on heavy vehicle movements, they would need to travel via the Pacific Highway.

These (maximum) additional volumes resulting from operation traffic have been expressed in percentage terms, relative to the expected ambient peak hour demands on sections of Tweed Coast Road, in **Table 6.5**.

Table 6.5
Percentage Change in Peak Hour Volumes in 2011, due to Project Operations

Location	Dir'n	Ambient Volume		Max. Operational Volume		% Change (max.)	
		AM	PM	AM	PM	AM	PM
Sth of Pacific M'way	Nb	914	810	+10	+19	+1.0%	+2.3%
	Sb	688	742	+19	+10	+2.8%	+1.3%
Nth of Cudgen Rd	Nb	803	670	+10	+9	+1.2%	+1.3%
	Sb	484	701	+9	+10	+1.9%	+1.4%
Sth of Cudgen Rd	Nb	752	581	+19	+10	+2.5%	+1.7%
	Sb	284	532	+10	+19	+3.5%	+3.6%

The above analysis indicates that the additional peak hour volumes would be in a range of 1.0 – 3.6% of the ambient demands.

The performance of the four intersections have again been assessed, operating under the peak hour demands resulting in all three operational scenarios (ie. the ambient volumes in **Figure 6.5**, plus the additional traffic in one of the above scenarios). The results of these assessments are summarised in **Table 6.6**.

Table 6.6
Performance of 'Existing' Intersections in the 2011 Operational Scenarios

Intersection	Type	Degree of Saturation		Level of Service ⁽¹⁾	
		AM	PM	AM	PM
Scenario A (north):					
1. Pacific Hwy / Tweed Coast Rd	R'bout	0.49	0.42	B / B	B / B
2. Tweed Coast Rd / Crescent St	Priority	0.50	0.40	A / E	A / D
4. Crescent St / Altona Dr.	Priority	0.04	0.03	A / B	A / B
Scenario B (south):					
1. Pacific Hwy / Tweed Coast Rd	R'bout	0.49	0.42	B / B	B / B
2. Tweed Coast Rd / Crescent St	Priority	0.47	0.39	A / E	A / D
3. Tweed Coast Rd / Cudgen Rd	Signals ⁽²⁾	0.86	0.91	C / E	C / E
	Signals ⁽³⁾	0.77	0.75	C / D	C / D
4. Crescent St / Altona Dr.	Priority	0.04	0.04	A / B	A / C
Scenario C (west):					
1. Pacific Hwy / Tweed Coast Rd	R'bout	0.48	0.41	B / B	B / B
2. Tweed Coast Rd / Crescent St	Priority	0.50	0.40	A / E	A / D
4. Crescent St / Altona Dr.	Priority	0.04	0.04	A / B	A / C

- Notes :
1. Intersection Overall / Worst Major Movement
 2. With pedestrian crossing critical, at optimum cycle time = 80 secs.
 3. With pedestrian crossing ignored, at optimum cycle time = 60 secs.

Comparing the above with the results for the 2011 ambient scenario (as in **Table 6.4** on page 7-28), it is apparent that the additional traffic related to project operations would have very little, if any, impact on the peak hour performance of any of the intersections. Only those performance measures shown in bold, above, would change from those in the 2011 ambient scenario. Despite these very conservative assessments (in terms of additional traffic volumes and their distribution), 3 of the 4 intersections would still operate satisfactorily.

The exception would, again, be the intersection of Tweed Coast Road and Crescent Street and, more particularly the left-turn movement from Crescent Street. The maximum impacts (of any of the operational traffic scenarios) on the average delays to and levels of service for this movement would be:

- AM peak – from 36 seconds (E) to 39 seconds (E); and
- PM peak – from 26 seconds (D) to 28 seconds (D)

As can be noted, the potential increases in average delays (as a result of the additional movements) would be minimal. Nevertheless, all three traffic distribution scenarios would involve an increase in the number of heavy vehicles making this left turn (up to 12 additional road haulage vehicles in either peak hour). As a result, the acceleration lane that would be desirable in the 2011 ambient scenario would definitely be justified in this operational scenario.

6.4 Normal Operations - 2023

Significant volumes of new development can be expected in the Kingscliff and Tweed Coast area by 2023 (including the majority of the Proponent's land-holdings). As a result, some significant increases in traffic volumes, particularly along the Tweed Coast Road, are also expected. The upgrading of Tweed Coast Road (from the Pacific Motorway to Casuarina) is being planned and designed to accommodate not only these 2023 demands, but also the longer-term volumes expected from the ultimate development of the Coastal area.

All but one of the intersections that will exist along this length of the road will have been designed and constructed to accommodate these ultimate traffic demands. As a result, these intersections (whether upgraded or new) can be expected to have some degree of spare capacity in 2023, with which to accommodate the remaining, longer-term growth in traffic. Accordingly, this anticipated spare capacity would be able to accommodate the relatively small additional peak hour demands associated with the project operations.

The exception is the Tweed Coast Road interchange with the Pacific Motorway at Chinderah, for which no improvements are planned. It is therefore appropriate to assess its ability to handle both the ambient and operational demands expected in 2023.

To estimate the peak hour turning movements at this roundabout in 2023, reference has been made to VLC's traffic models of Tweed Shire for both 2011 and the 'ultimate development' scenario. Based on current growth rates in the Shire, the 'ultimate development' levels should be reached in about 2030-2035. However, the Tweed Coast is currently experiencing disproportionately high growth and may approach 'ultimate development' in advance of the balance of the Shire. Whether this eventuates, and by how much in advance, will be very dependent on progress with a major development area known as Kings Forest, that may ultimately accommodate 11,000 persons or about 25% of the Coast's ultimate population.

As a result, it is difficult to predict what proportion of the 'ultimate growth' in local traffic would occur by 2023. For conservatism, and also to demonstrate the long-term viability of the roundabout, it has been assumed that 'ultimate development' (of the Coastal area) would be achieved by 2023. The growth in peak hour turning movements at the Chinderah roundabout, as forecast by the 2011 and 'ultimate development' models, is shown in **Figure 6.7a**. These volume increases have been added to those forecast for the 2011 ambient scenario (per **Figure 6.5**) to derive the 2023 ambient forecasts shown in **Figure 6.7b**.

The performance of the existing roundabout, operating under these estimated 2023 demands, has been assessed. The results show that the current configuration (schematically shown in **Figure 6.8a**) would have inadequate capacity, with degrees of saturation of 1.21 and 0.92 in the respective peak hours.

A review of the SIDRA outputs suggests that the density of the heavy right turn movement (from Tweed Coast Road to the eastbound on-ramp) would limit the capacity of the 2 respective critical movements. Although there are 2 approach lanes from the south, this heavy movement has to be restricted (by lane markings) to the right hand lane, due to there being a single circulatory lane on the north side of the roundabout.

Given this, an appropriate improvement would be to widen the north side of the roundabout to provide a second circulatory lane, allowing the right-turn demands to be spread over two lanes. An additional cost-effective improvement would be to provide a second approach lane for the comparably heavy left turn movement from the westbound off-ramp, as part of the Tweed Coast Road duplication works. The suggested arrangements are shown (schematically) in **Figure 6.8b**.

The performance of this improved roundabout, operating under the 2023 ambient demands, would be much better as shown in **Table 6.7**.

Table 6.7
Performance of Chinderah Roundabout, in 2023 Ambient Scenario

Roundabout Configuration	Degree of Saturation		Level of Service ⁽¹⁾	
	AM	PM	AM	PM
Existing (2006 arrangement)	1.21	0.92	D / F	C / E
Improved (Figure 6.8b)	0.66	0.65	B / C	B / C

Notes : 1. Intersection Overall / Worst Major Movement

The impact of the Project's operational traffic, upon the improved roundabout, has been assessed by adding the additional peak hour movements (per **Figures 6.7a, b, or c**) to the 2023 ambient demands. The resulting performance measures are shown in **Table 6.8**.

Table 6.8
Performance of the Chinderah Roundabout, in 2023 Operational Scenarios

Operational Traffic Scenario	Degree of Saturation		Level of Service ⁽¹⁾	
	AM	PM	AM	PM
Scenario A (to/from north)	0.67	0.66	B / C	B / C
Scenario B (to/from south)	0.67	0.65	B / C	B / C
Scenario C (to/from west)	0.73	0.65	B / C	B / C

Notes : 1. Intersection Overall / Worst Major Movement

The above indicates that 2 of the 3 potential transport scenarios would have negligible impacts on the performance of the improved roundabout. The third scenario (C) would have a more noticeable impact in the morning peak hour, but the roundabout would still operate satisfactorily.

The percentage change in peak hour traffic volumes on Tweed Coast Road, south of the Motorway, is shown in **Table 6.9**.

Table 6.9
Percentage Change in Peak Hour Volumes in 2023, due to Operational Traffic

Location	Dir'n	Ambient Volume		Max. Operational Volume		% Change (max.)	
		AM	PM	AM	PM	AM	PM
Sth of Pacific	Nb	1517	1574	+10	+19	+0.7%	+1.2%
M'way	Sb	1295	1234	+19	+10	+1.5%	+0.8%

As could be expected, the percentage change is lower in 2023 than in 2011, due to the significant increase in the ambient traffic. The same observation could be expected for the other sections of Tweed Coast Road (for which the ambient peak hour demands have not been specifically estimated for this scenario).

6.5 Altona Drive

The previous sections of this Chapter have considered the Project's external impacts. However, Altona Drive is a separate and special case, in that it would not only carry the external traffic movements but also the Project's 'internal' traffic movements.

The alignment and standard of Altona Drive would change during the course of the Project. Assessments of the adequacy of Altona Drive (to handle the combined 'external' and 'internal' traffic volumes) must consider 3 scenarios:

- The initial site establishment scenario, and the early stages of sand extraction when no construction sand products are being distributed or VENM being received. In these scenarios, no improvements to Altona Drive or its intersection with Crescent Street are proposed.
- The middle (or interim) stages of the project operations, once distribution of construction sand products has commenced and VENM is being received. It is proposed, by this stage, to have constructed the new intersection with Crescent Street and the interim deviation linking it back to the existing alignment (as shown in **Figure 4.2b**).
- The latter stages of project operations, once Altona Drive has been re-aligned.

Initial Stages

The existing standard of the access road and intersection is as follows:

- The intersection was improved as pre-requisite work to the construction of the WWTP. The seal width on Crescent Street has been widened on the approaches to the intersection, to better accommodate truck-turning paths, but no auxiliary lanes are provided.
- The initial 15 metres of Altona Drive has a 7-8 metre seal width, which is just enough for opposing single unit trucks to pass, but not opposing double units.
- The balance of the road as far as the WWTP site (about 900 metres) has a sealed width varying between 4 and 6 metres. A single passing place has been formed about 100 metres east of the WWTP site access, leaving an approximate 800-metre length, over which even opposing cars would have difficulty passing.

The maximum potential traffic generation during site establishment will be around 65 vehicle movements per day, and the traffic generation during the initial stages of sand extraction (before construction sand product distribution and VENM importation) would be around 60 vehicle movements per day (refer **Table 5.3**, page 7-22). These volumes would be in addition to the ambient volumes using the road, as follows:

- WWTP, once completed and operational - about 10 vehicle movements per day.
- Hanson Tweed Sand – typically around 40 vehicle movements per day, but occasionally up to 200 vehicle movements per day.

The existing road is considered barely adequate for the minimum volumes of around 100 vehicle movements per day that would normally result during site establishment and the initial stages of sand extraction. It would be inadequate for the occasions that Hanson's operate at their peak.

It is considered that the following minimum improvements to the road (as shown in **Figure 6.9a**) would be required as a pre-requisite to site establishment:

- Widen and lengthen the section at the Crescent Street intersection to 9 metres minimum sealed width, for a distance of at least 30 metres from the intersection.
- Add at 1 extra passing place, mid-way between the above and the processing area access road. Sign post all 'entry points' to the intervening one-way sections with "300m to next passing place" / "Wait here for oncoming vehicles to clear".

Interim Stage

Prior to commencing the production and distribution of sand products or receipt of VENM, the new intersection with Crescent Street would be constructed, along with the 'interim deviation' (as per **Figure 4.2b**). In this 'full production' scenario, the potential volumes of traffic using differing sections of Altona Drive would be as estimated in Table 6.10.

Table 6.10
Volumes of Traffic on Altona Drive, during Project Operations

Traffic Source	Daily Traffic Movements	Volume on Intervening Section	
		Daily	Peak Hour
Hanson Tweed Sand	40-200 vpd		
(intervening section)		40-200 vpd	4-20 vph
WWTP	10 vpd		
(intervening section)		50-210 vpd	5-21 vph
Processing Area	Up to 216 vpd		
(intervening section)		Up to 426 vpd	Up to 43 vph
Crescent Street	(up to 426 vpd)		

Note: All these volumes are 'external', travelling to/from Crescent Street.

In addition to this 'external' traffic, there would also be up to 24 vehicle movements per day, travelling between the southern extraction area and the processing area (see 1st para, page 7-23). This traffic would cross Altona Drive, from one access road to the other, at a temporary intersection.

Internal Intersection Standard - Although a majority of the traffic on Altona Drive would be to/from the processing area access road, the opposing volumes (ie. to/from the WWTP or Hanson Sand) would be low and, as a result, auxiliary turning lanes would not be warranted. Despite this, the sealed width of Altona Drive would need to be flared to about 9 metres on the approaches to the access roads' intersection and generous corner radii provided, so as to allow turning movements by tandem truck units without crossing the centre-line.

Standard of Altona Drive – The single additional passing place on the main section of Altona Drive (as recommended for the initial scenario) is unlikely to provide adequate capacity for the increased volumes in this full operational scenario. Accordingly, it is recommended that a

further passing place be constructed, as in **Figure 6.9b**, such that there is approximately 150 metres between passing opportunities.

Final Stage

When Altona Drive is realigned later in the project, the full 900 metre length between Crescent Street and the WWTP access would be formed with a 7 metre wide sealed carriageway and 1 metre unsealed shoulders on both sides. (This arrangement is in anticipation that, ultimately when the potential future master-plan uses are established, a 9 metre wide pavement with kerb and channel would be justified).

When this realignment is effected, the access road to the processing area will not move (but will of course be shortened). The other site access roads and gates will similarly be repositioned, but still form crossroad intersections with Altona Drive.

As was recommended for the interim situation, the sealed width of Altona Drive should be flared out to the ultimate 9 metre width on the approaches to the site access intersections, and generous corner radii (of at least 15 metres) should be provided for the left turn out of each. Similarly, the width of the site access roads should be adequate to allow truck and trailer units to turn in and out without crossing the centre-line of either road.

(This page is intentionally blank)

APPENDIX A :

Coverage of Environmental Assessment Requirements and Environmental Issues

(This page is intentionally blank)

Table A-1
Coverage of Environmental Assessment Requirements and Environmental Issues in the
Traffic and Transport Assessment

ENVIRONMENTAL REQUIREMENTS RAISED BY THE DIRECTOR-GENERAL RELATING TO TRAFFIC AND TRANSPORT (06.01.06)		
		Relevant Section(s)
Key Assessment Requirements , namely: <ul style="list-style-type: none"> <i>Traffic and Transport</i> - Assess the potential impacts of the project (including any potential cumulative impacts that may arise from the combined operation of the project with the existing or approved operations at the Bolster Quarry), and describe what measures would be implemented to avoid, minimise, mitigate, offset, manage and/or monitor these impacts. 		Chapter 6
References Refer to the: <ul style="list-style-type: none"> <i>Guide to Traffic Generating Development and Road Design Guide</i> (Roads & Traffic Authority), or relevant Austroad standards. 		Austroads TEP Pt.5
ENVIRONMENTAL REQUIREMENTS RAISED BY GOVERNMENT AGENCIES RELATING TO TRAFFIC AND TRANSPORT		
Government Agency	Paraphrased Requirement	Relevant Section(s)
Department of Planning (6 December 2004)	Clearly define the proposal to transport sand to the Company's land to the east of the Tweed Coast Road in the EIS, including any pipelines.	Chapter 4
Department of Environment and Conservation (15 October 2004)	Provide maps showing the locality of the proposed development in a regional and local context. Base local context maps on 1:25 000 topographic plans.	Figure 2.1 & Figure 4.1
	Provide a description of: <ul style="list-style-type: none"> the existing environment on the subject and surrounding land; the proposed development and ancillary works; and the manner in which the environment will be modified by the proposal. 	Chapter 3 Chapter 4 Chapter 6
	Clearly identify on an appropriately scaled plan the area subject to development.	Figure 4.1
	Document surveys and assessments that have been undertaken by suitably qualified persons and provide the qualifications and experience of the person(s) undertaking the work.	Section 3.2 & Figure 3.3
	Describe dates, site locations, design, methodology, analysis techniques, and weather conditions at the time of the assessments and surveys. The limitations of surveys should be identified and the results interpreted accordingly.	Section 3.2 & Section 3.3
	Substantiate conclusions drawn in surveys and assessments with evidence resulting from those surveys and assessments.	Section 3.2
Department of Primary Industries (Mineral Resources) (12 November 2004)	Outline transport routes for the material to the market.	Indeterminate

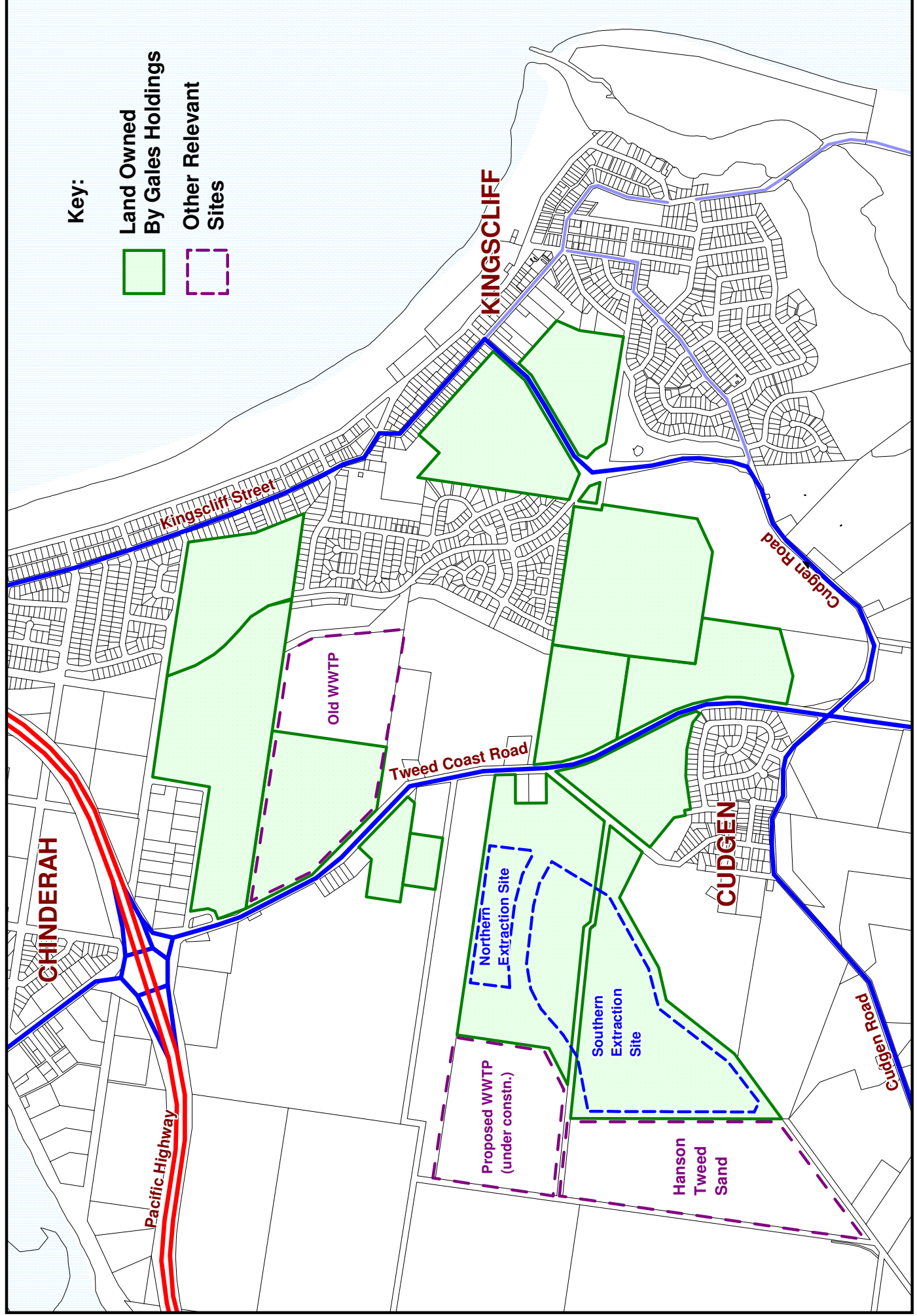
Table A-1 (Cont'd)
 Coverage of Environmental Assessment Requirements and Environmental Issues in the
 Traffic and Transport Assessment

ENVIRONMENTAL REQUIREMENTS RAISED BY GOVERNMENT AGENCIES RELATING TO TRAFFIC AND TRANSPORT		
Government Agency	Paraphrased Requirement	Relevant Section(s)
Tweed Shire Council (30 September 2004)	Consider. – Access road impacts, including protection of the road during and after the life of the sand extraction.	Section 6.5
	– Traffic management report including preliminary design investigations including the following – Crescent Street industrial grade standard, 13 metre seal and batters, left turn onto Tweed Coast Road acceleration lane to Austroads standards, channelised right turn lane from Tweed Coast Road into Crescent Street, allow for four lane upgrade of Tweed Coast Road, widening at intersection of Crescent Street and access road to allow through traffic to pass trucks turning right, integrated development information to support S.138 application ie. Plans for works including pipeline route.	Chapter 6
	– Provide detailed traffic analysis on Pacific Highway interchange ramps may need to be increased and liaison with the RTA is required.	Section 6.4
	– Provide a detailed analysis regarding traffic movements ie. trucks, staff etc.	Chapter 5
	– Undertake ongoing liaison and consultation with Council's Manager of design Mr Ian Munro and Council's sewage treatment plant Project Manager Mr Ian Norris regarding road network and treatment plan issues.	Initiated
Department of Primary Industries (Agriculture) (7 October 2004)	Discuss traffic and road sharing issues particularly with existing agricultural industry use of roads.	By others
Roads and Traffic Authority (15 September 2004)	Undertake a traffic impact study that takes into consideration the key issues listed in Table 2.1 – Traffic Impact Studies of the RTA's Guide to Traffic Generating Developments.	All relevant Issues covered
	Upgrade the Junction of Tweed Coast Road and Crescent Street to AUSTROADS standards and include provision for increased heavy vehicle loadings and turning traffic.	Confirmed. In Section 6.3
	Provide details in relation to the site operations including access conditions, sight distances, parking, servicing and commercial activities which cater for heavy vehicle turning paths.	Figures 3.4a,b,c
	Assess the impact on any public transport infrastructure and routes such as school buses.	Section 3.2
	Assess the impact of the increased road traffic and pipeline noise.	By others
	Outline provisions made to prevent the fouling of the road pavements.	By others

APPENDIX B:

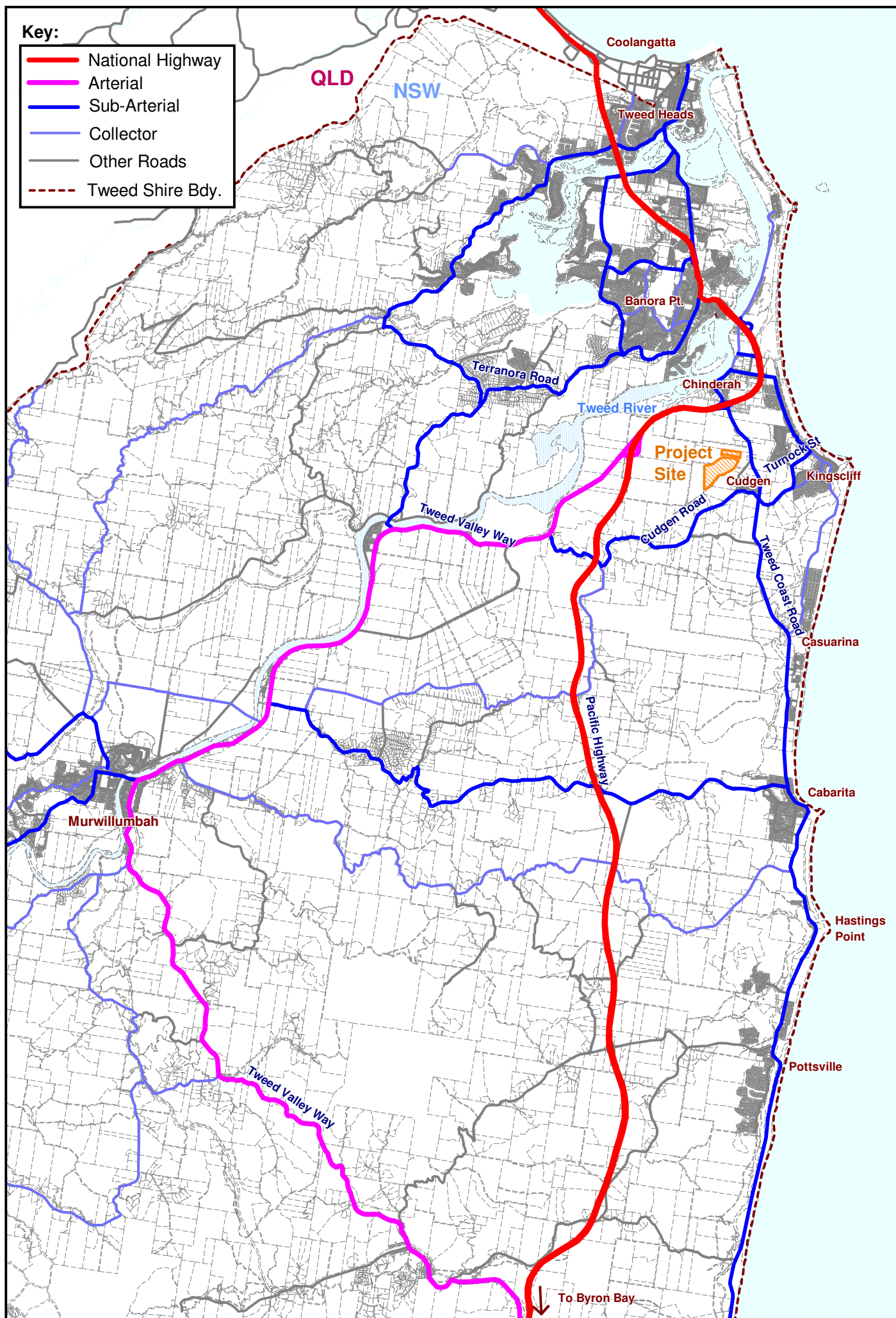
FIGURES

(This page is intentionally blank)



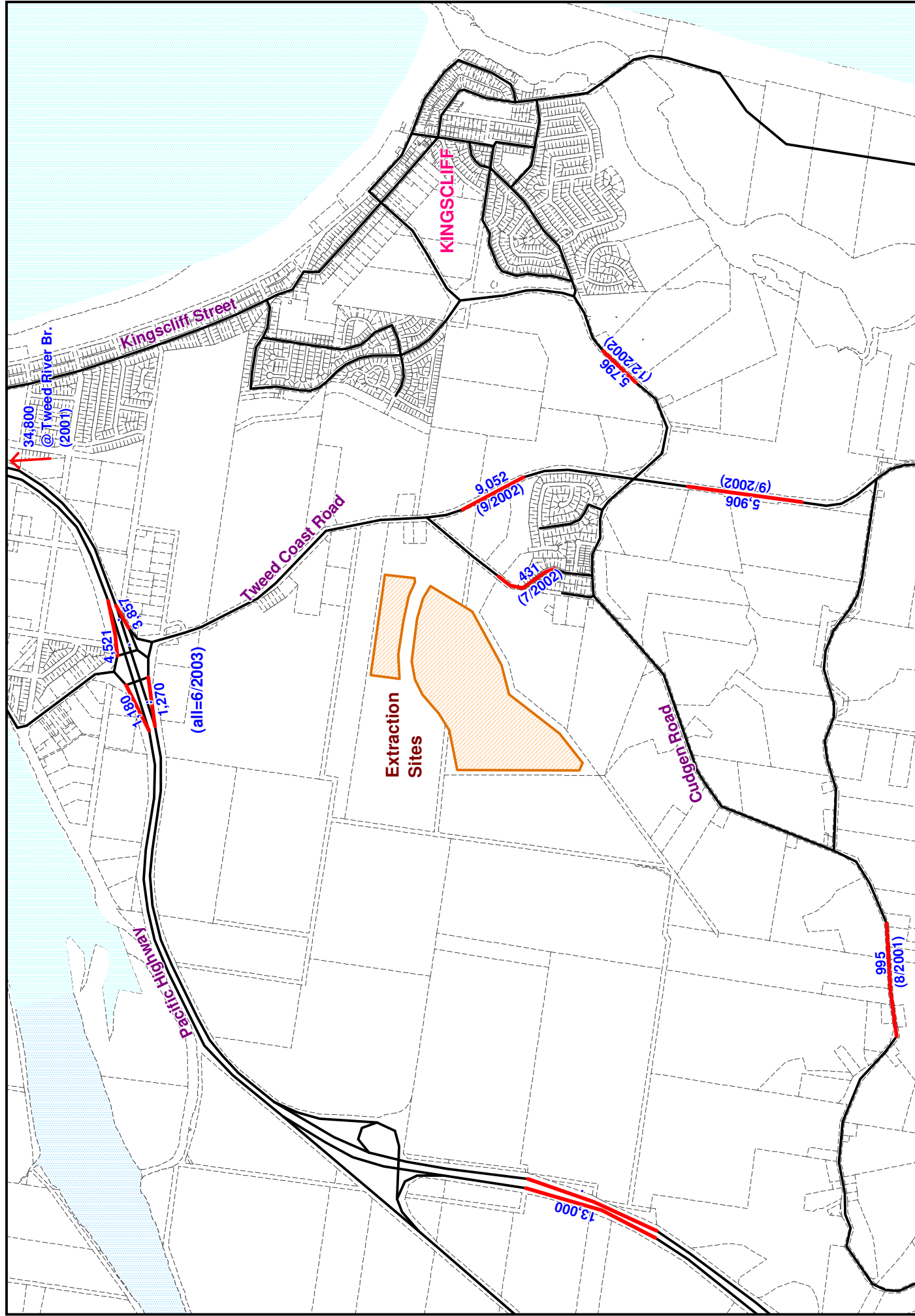
Location of Gales' Land and the Sand Extraction Site

Figure 1.1



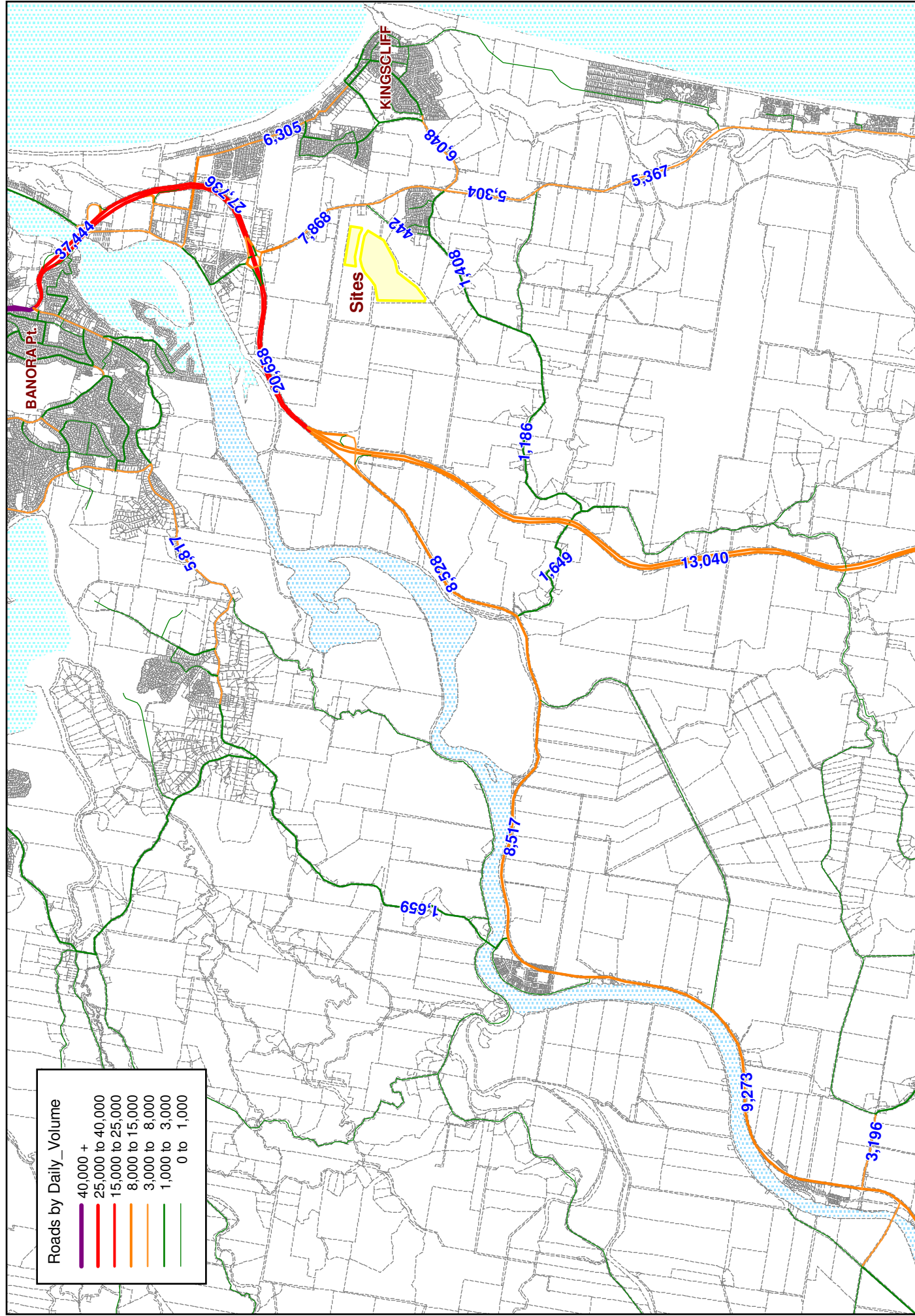
Regional Context and Road Hierarchy

Figure 2.1



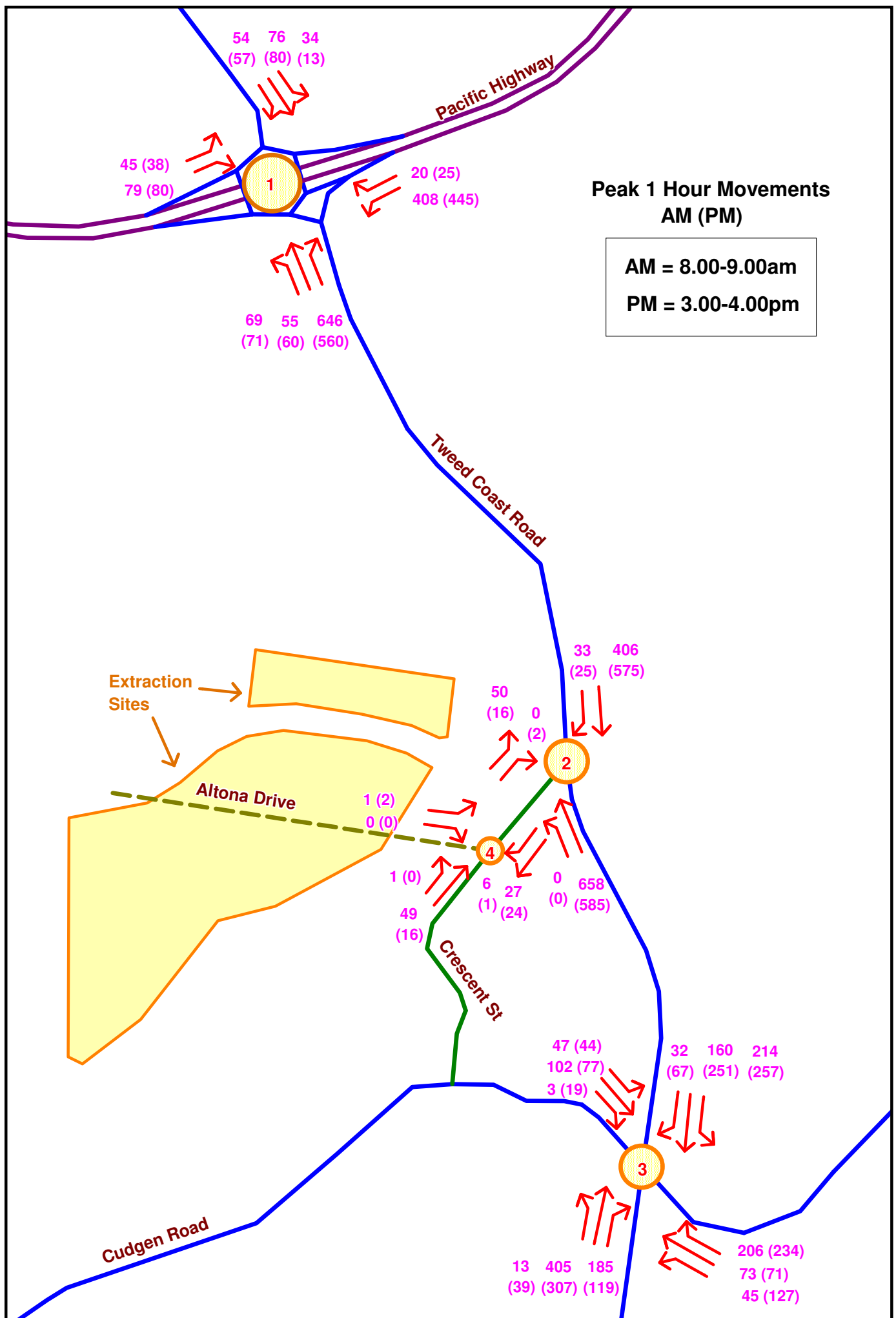
Relevant Daily Traffic Counts

Figure 3.1



Forecast Daily Volumes, 2001

Figure 3.2

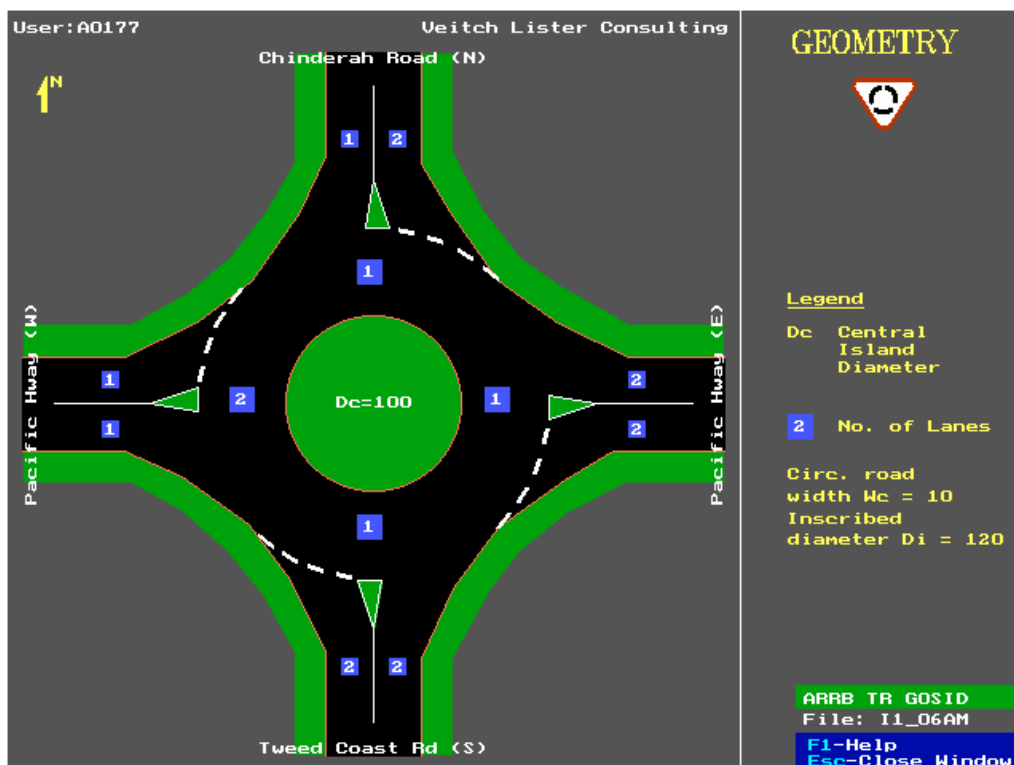


Intersection Peak Hour Turning Movements (Feb. 2006)

Figure 3.3



a) Aerial Photo



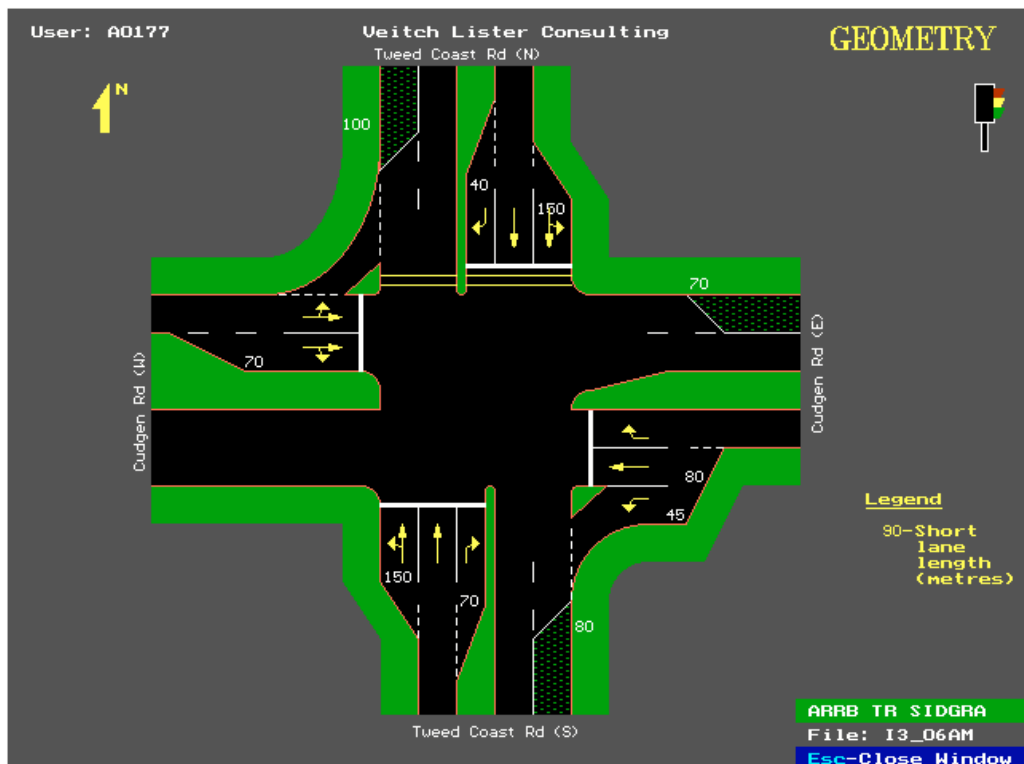
b) Schematic Layout



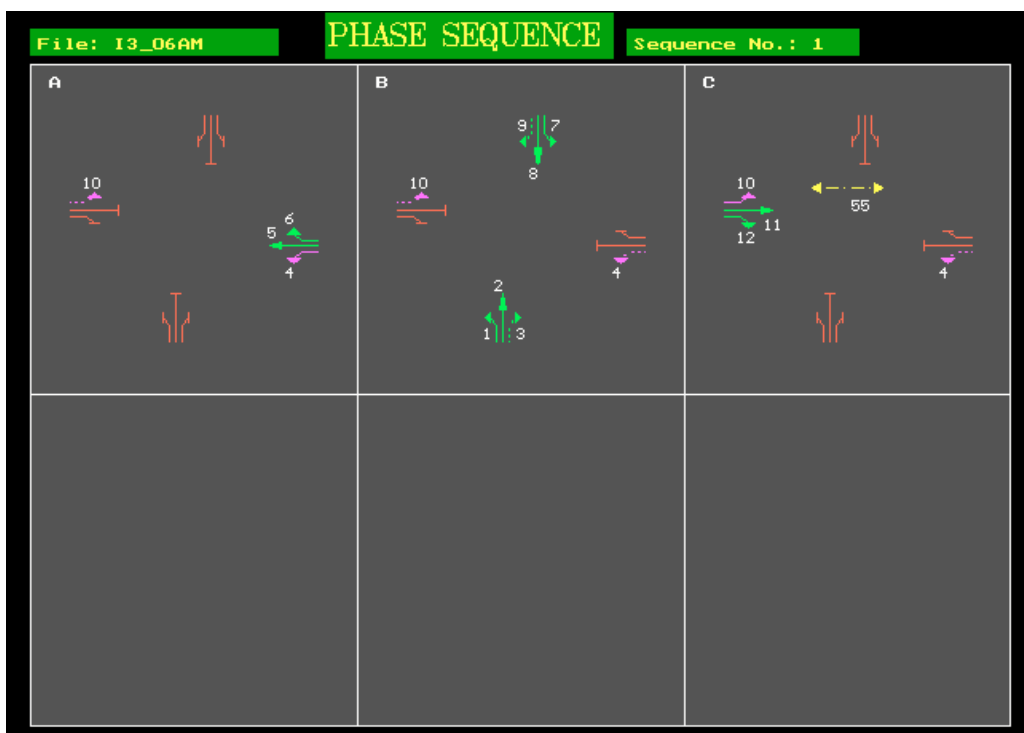
a) Aerial Photo



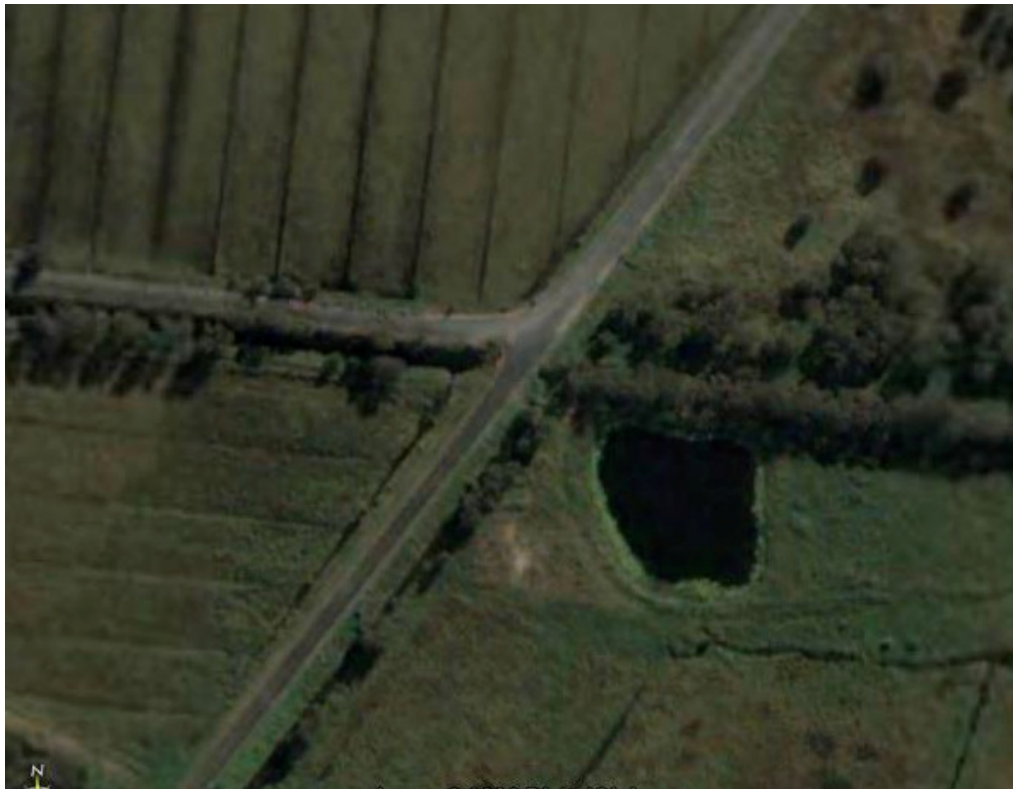
b) Schematic Layout



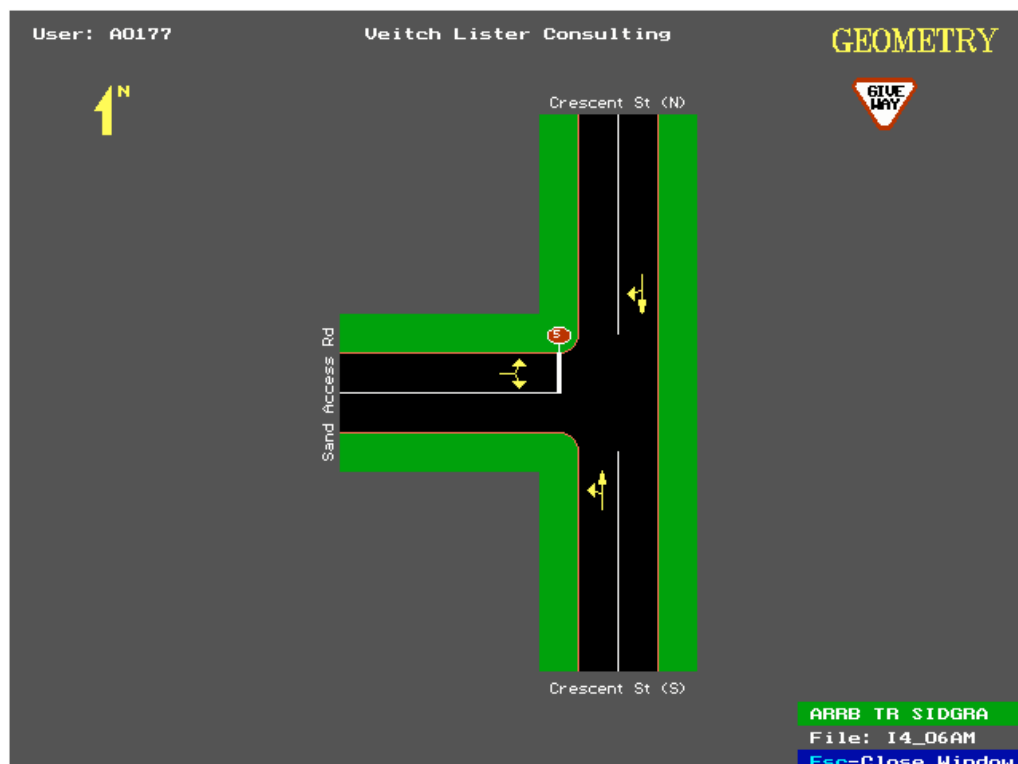
a) Schematic Layout



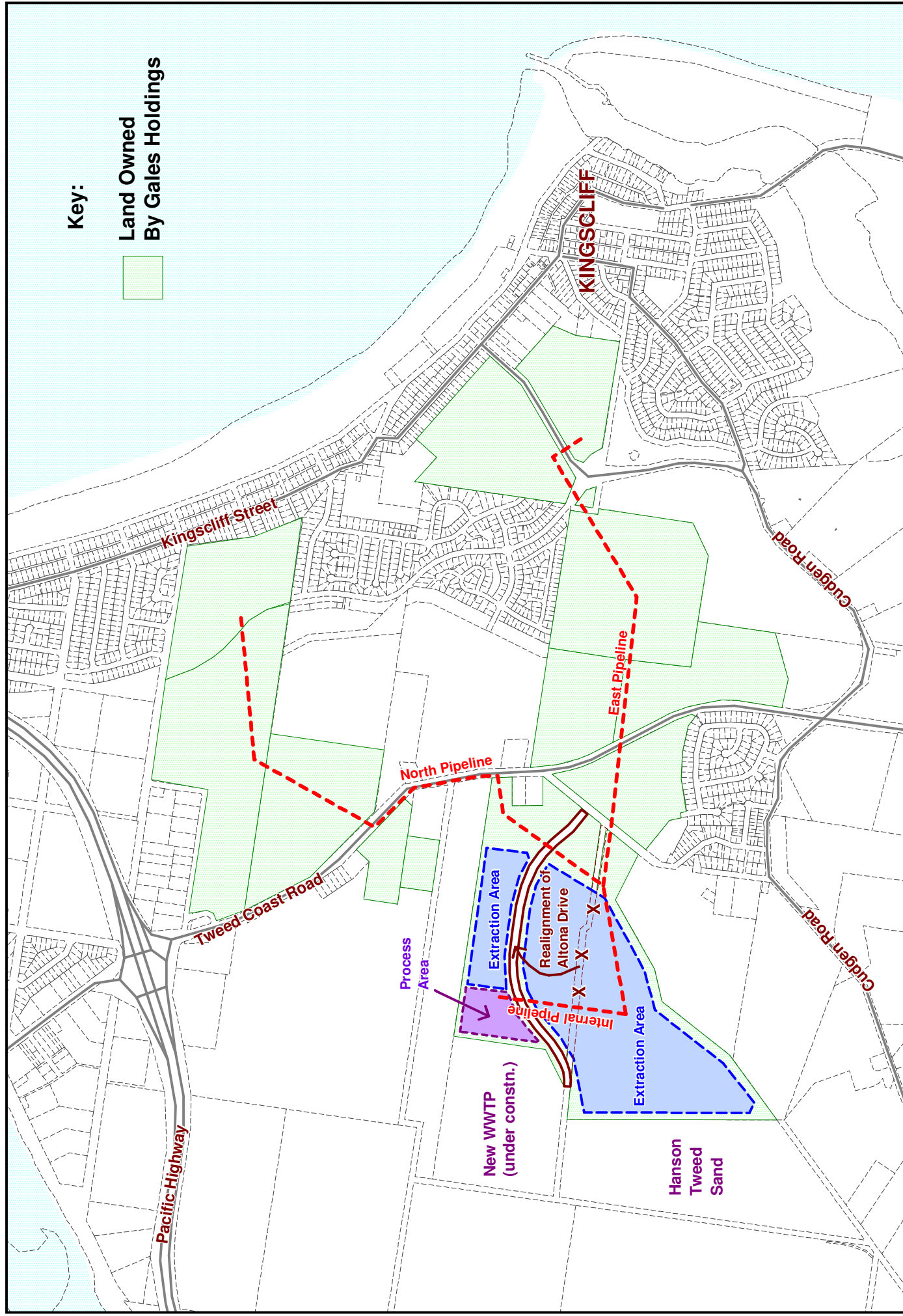
b) Existing Signal Phasing Plan



a) Aerial Photo

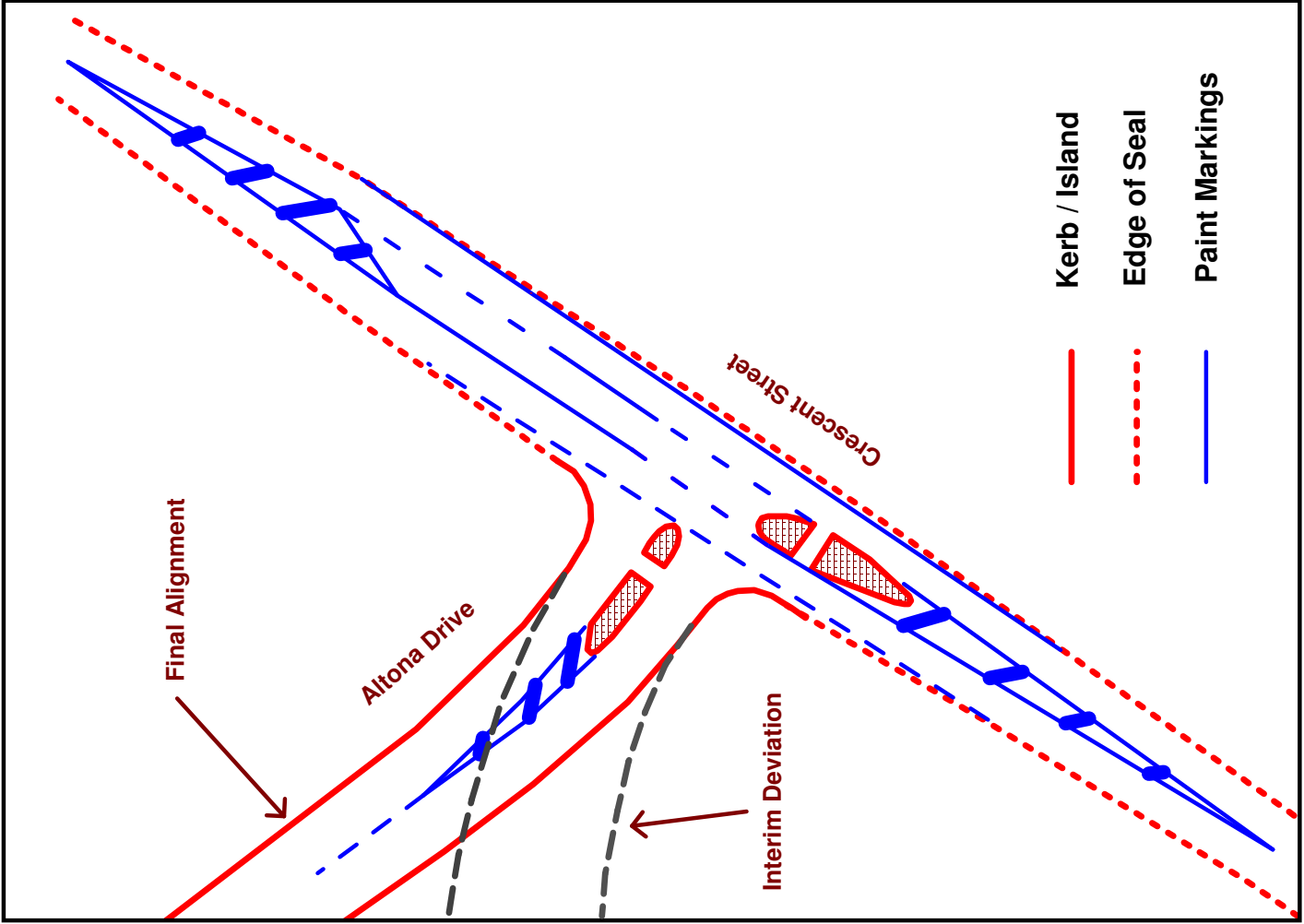


b) Schematic Layout



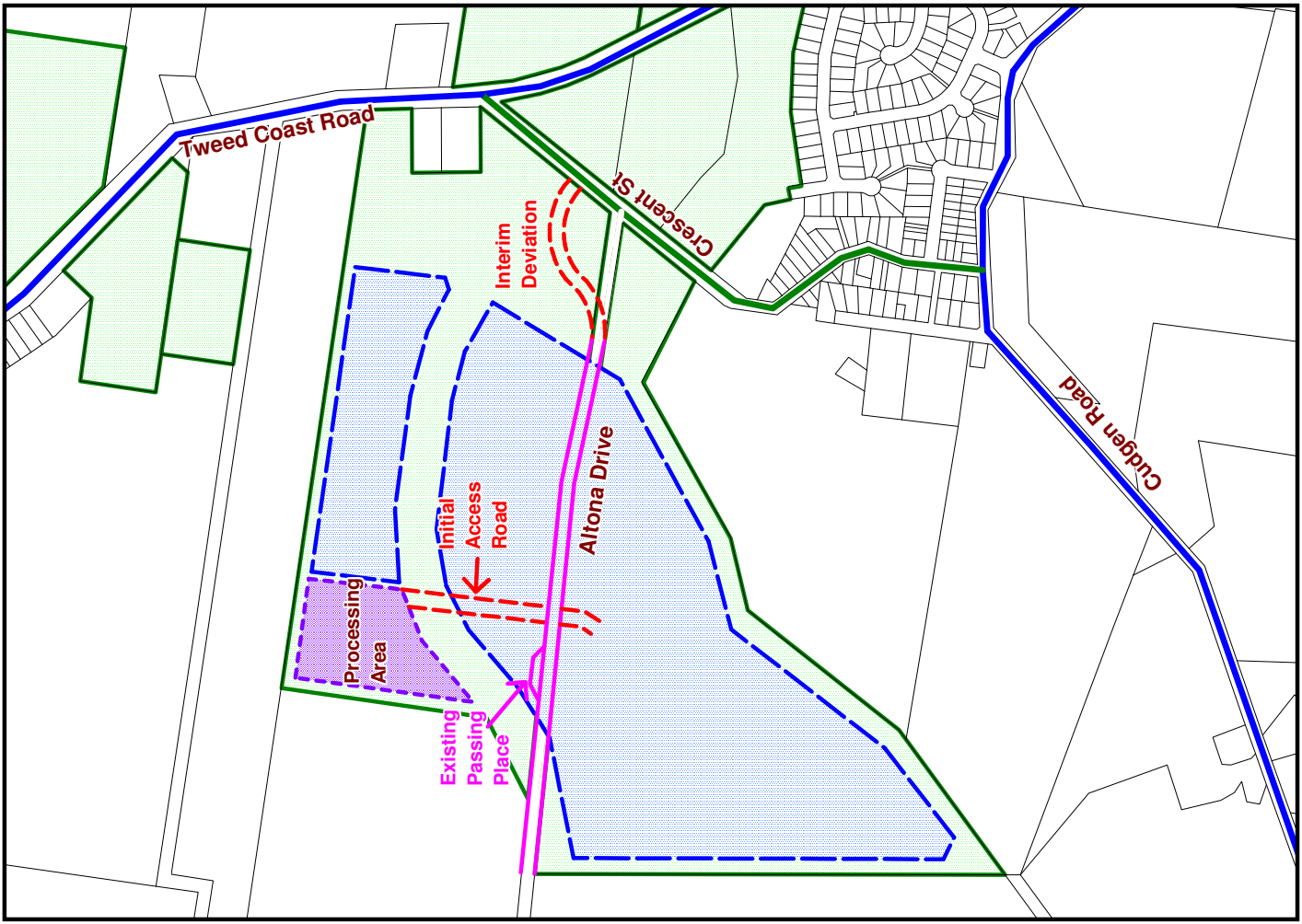
Elements of the Sand Extraction Project

Figure 4.1



Proposed New Intersection

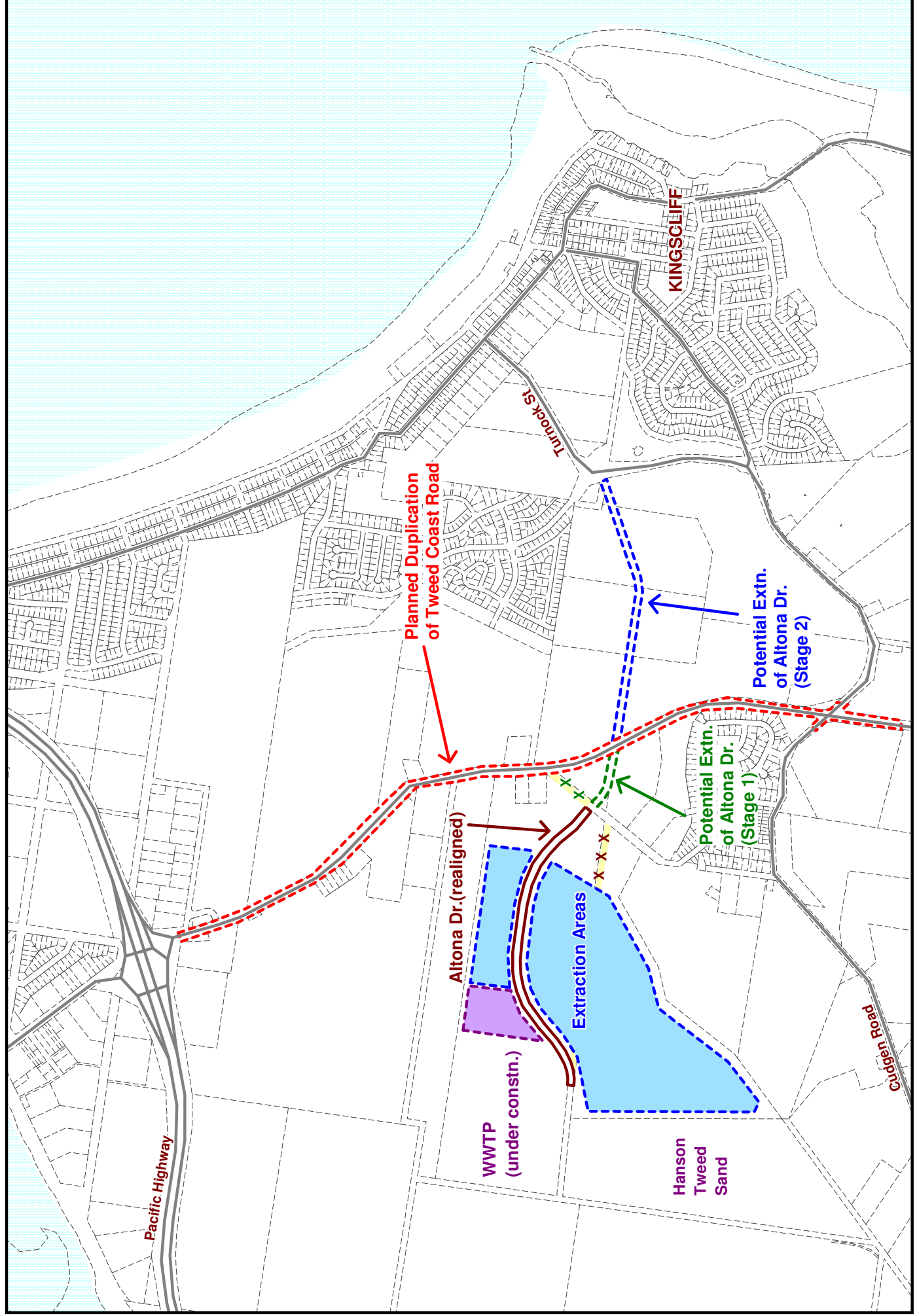
Figure 4.2a



Initial / Interim Access Arrangements

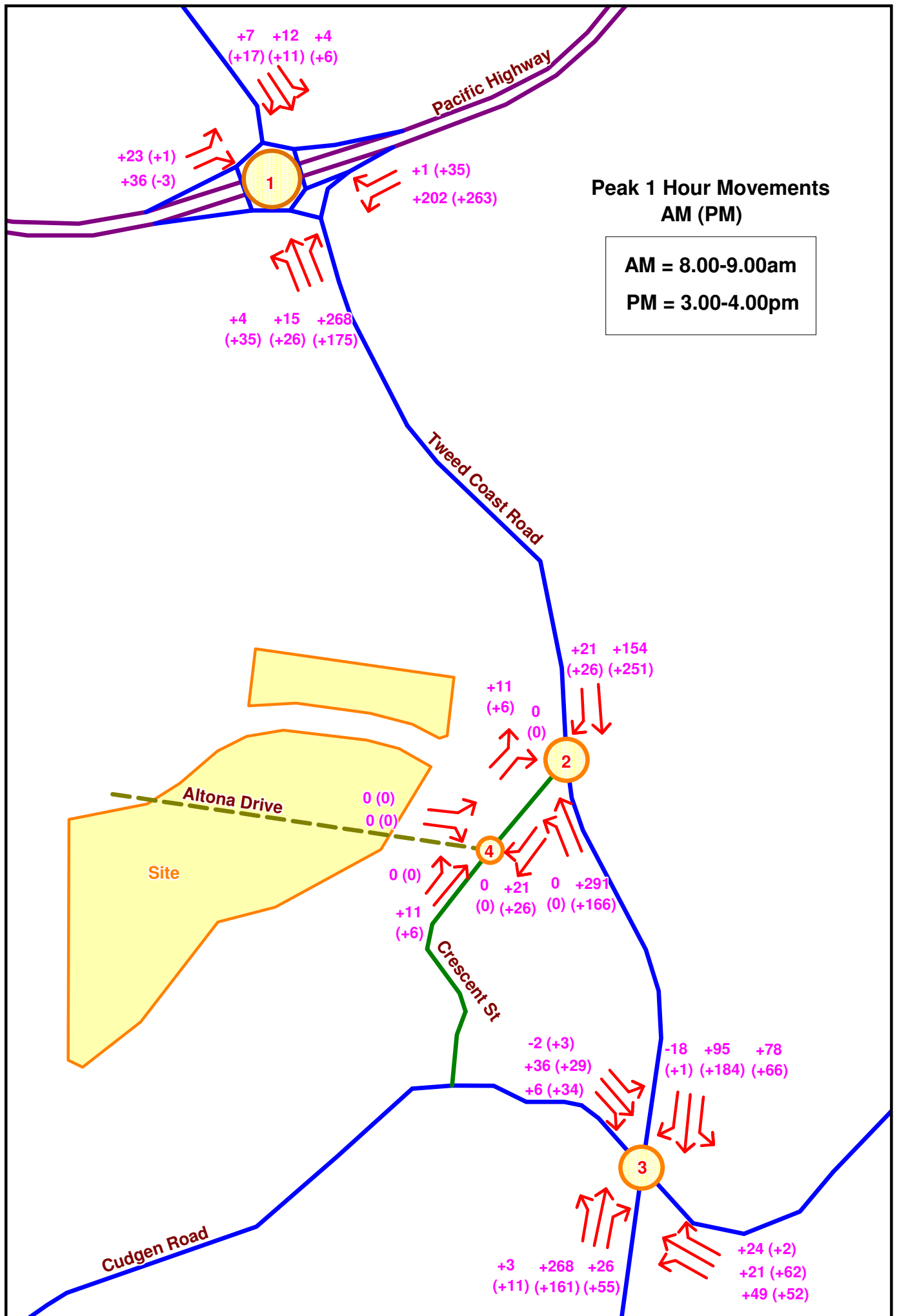
Figure 4.2b





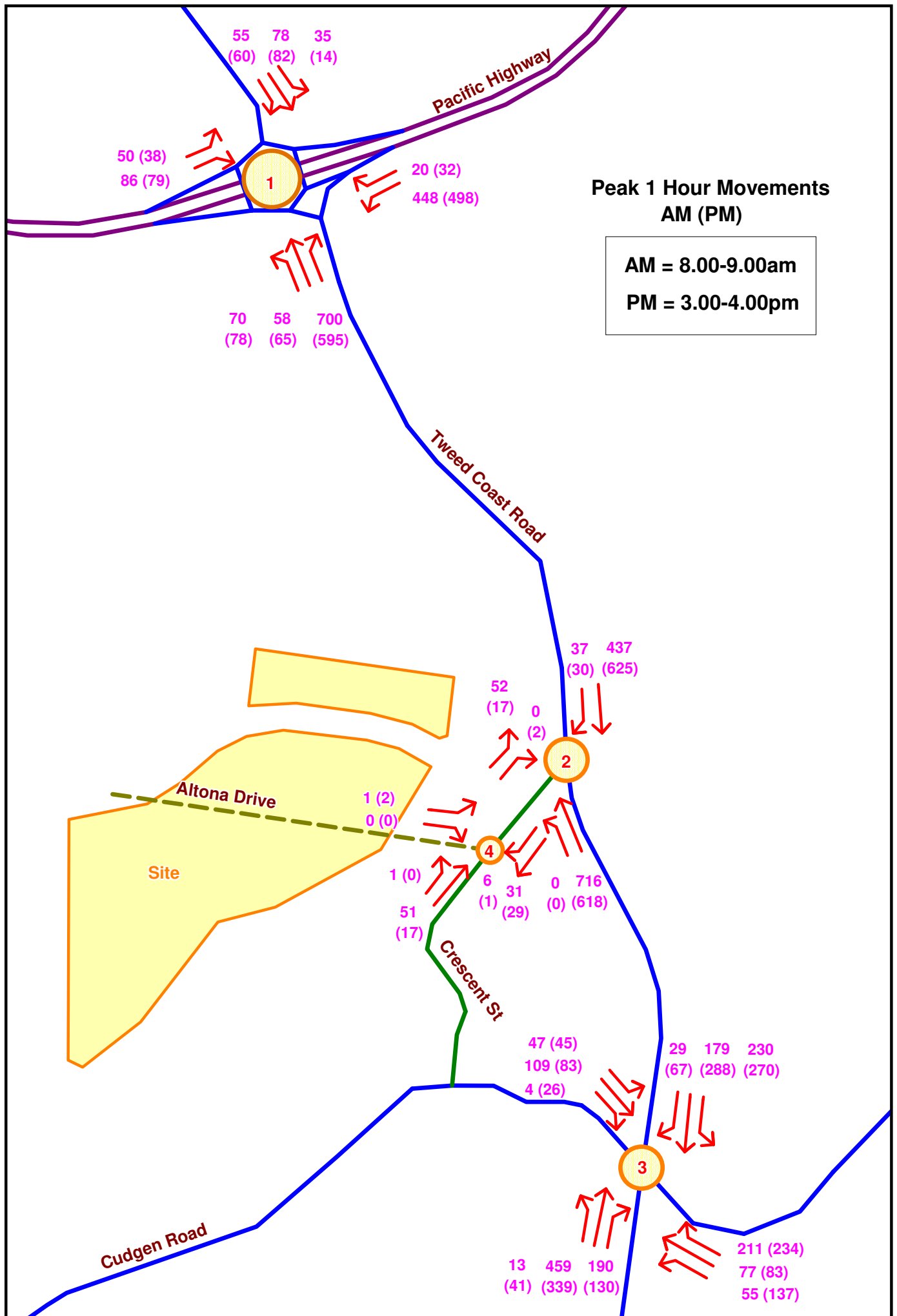
Planned and Potential Road Improvements

Figure 6.1



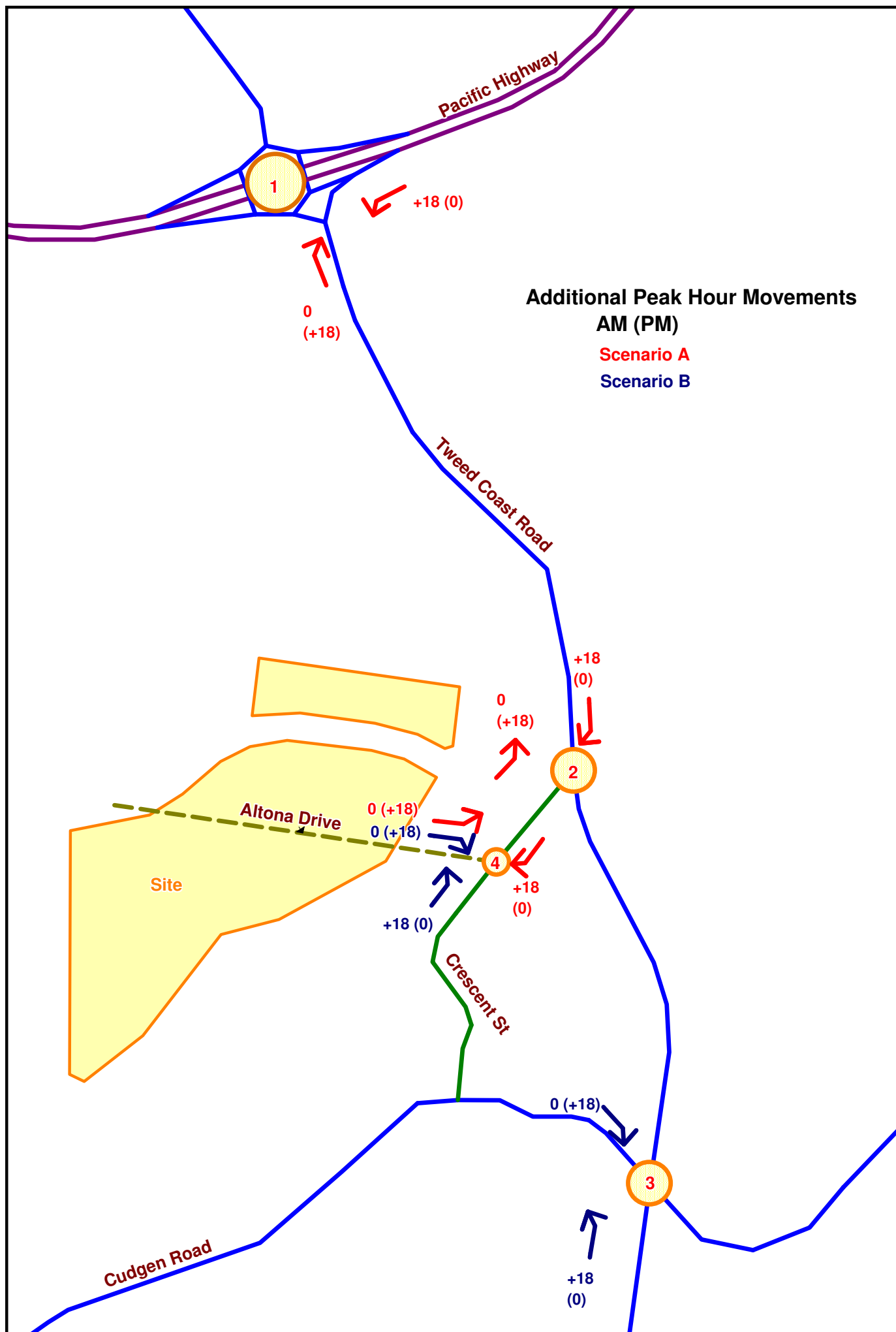
Forecast Growth in Peak Hour Turning Movements (2001 - 2011)

Figure 6.2



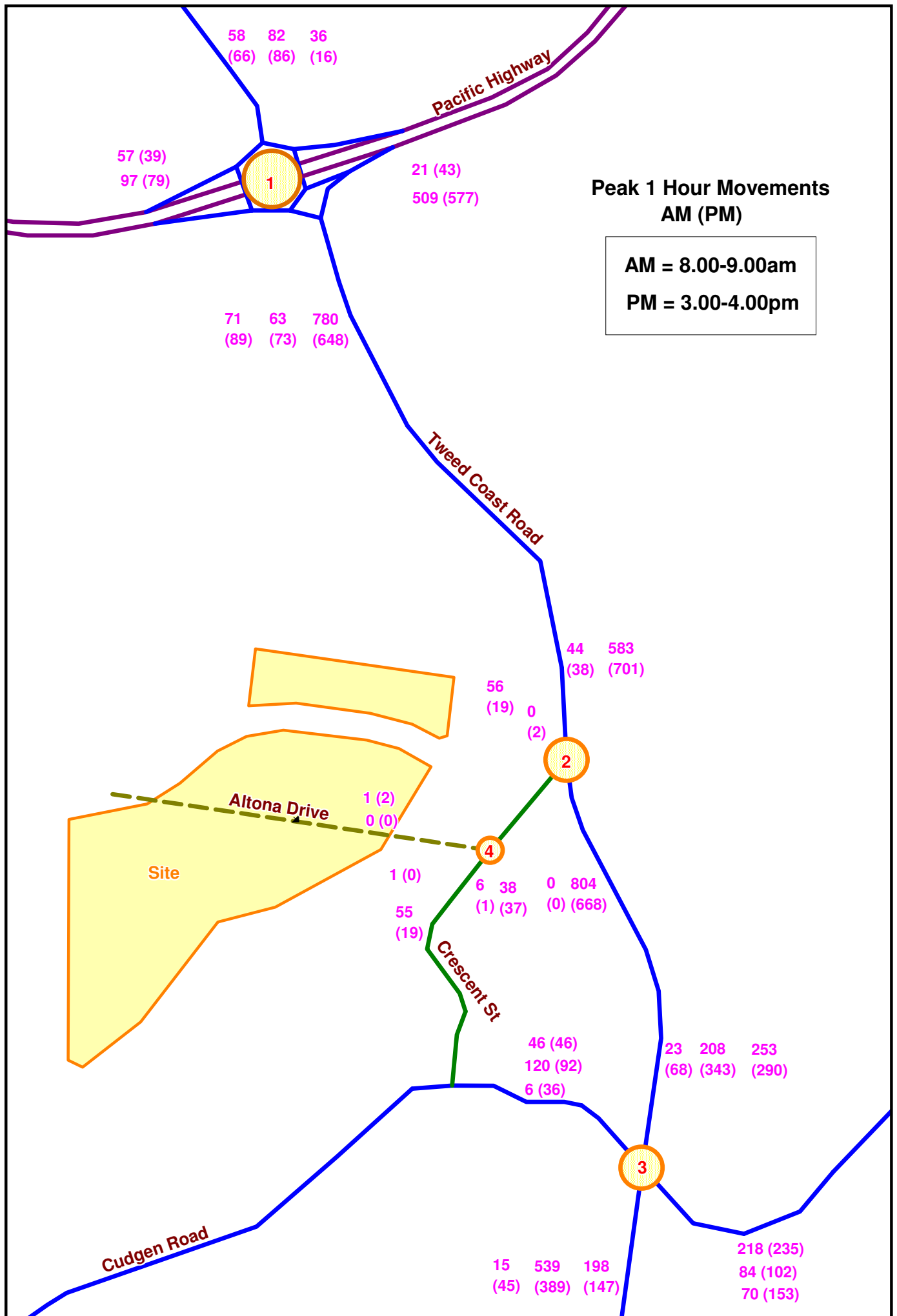
Estimated Peak Hour Turning Movements (Ambient Scenario, 2008)

Figure 6.3



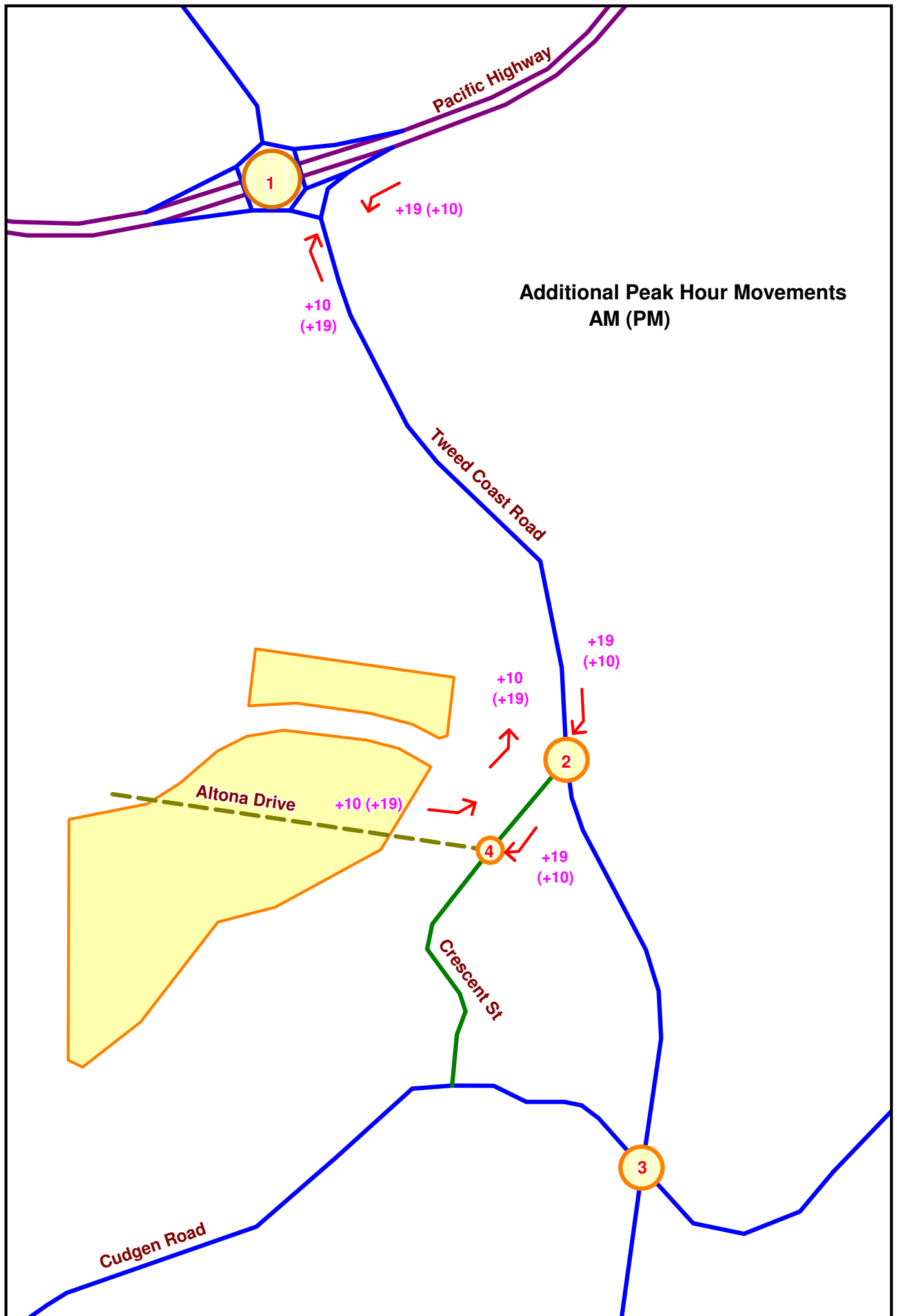
Site Establishment Traffic - Alternate Peak Hour Traffic Distributions

Figure 6.4



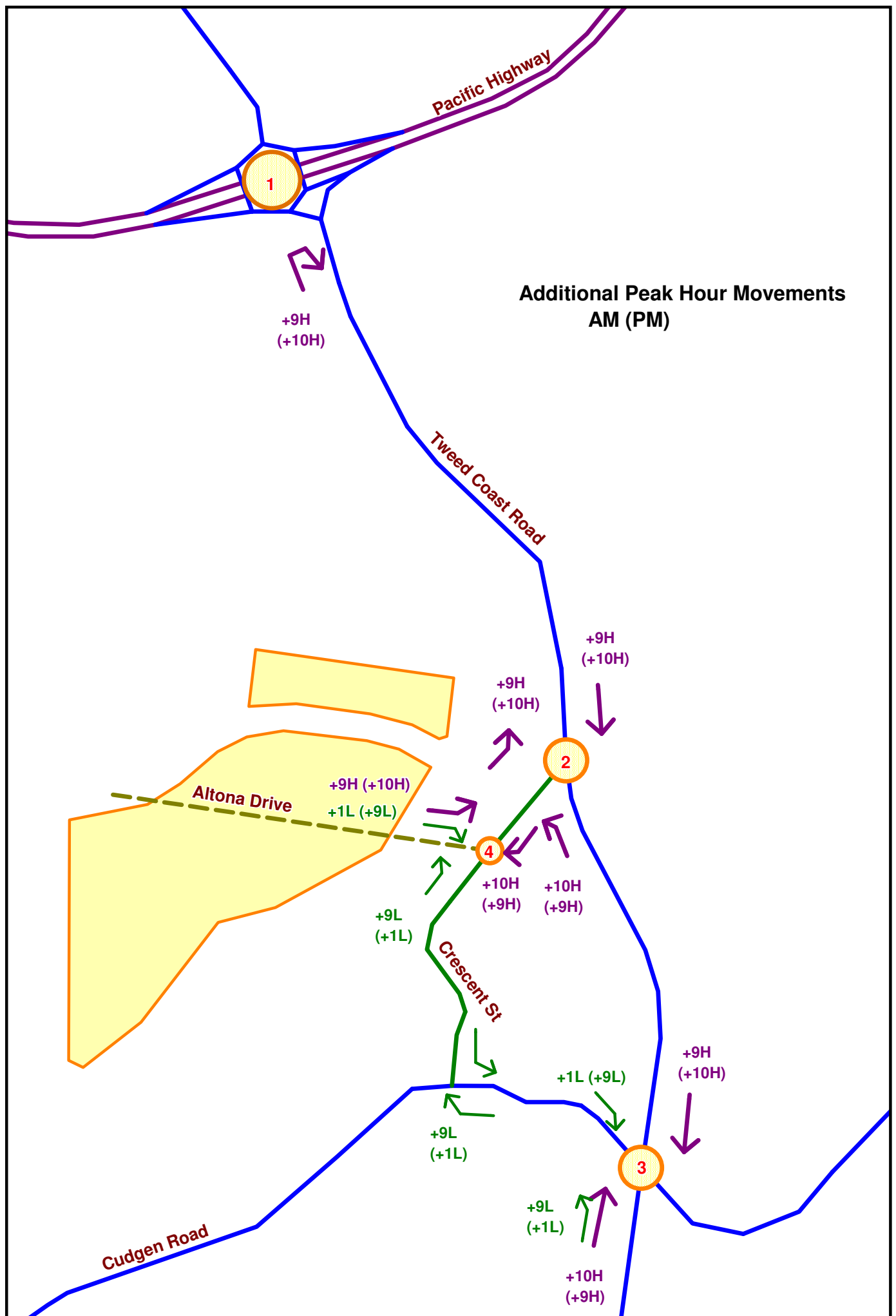
Estimated Peak Hour Turning Movements (Ambient Scenario, 2011)

Figure 6.5



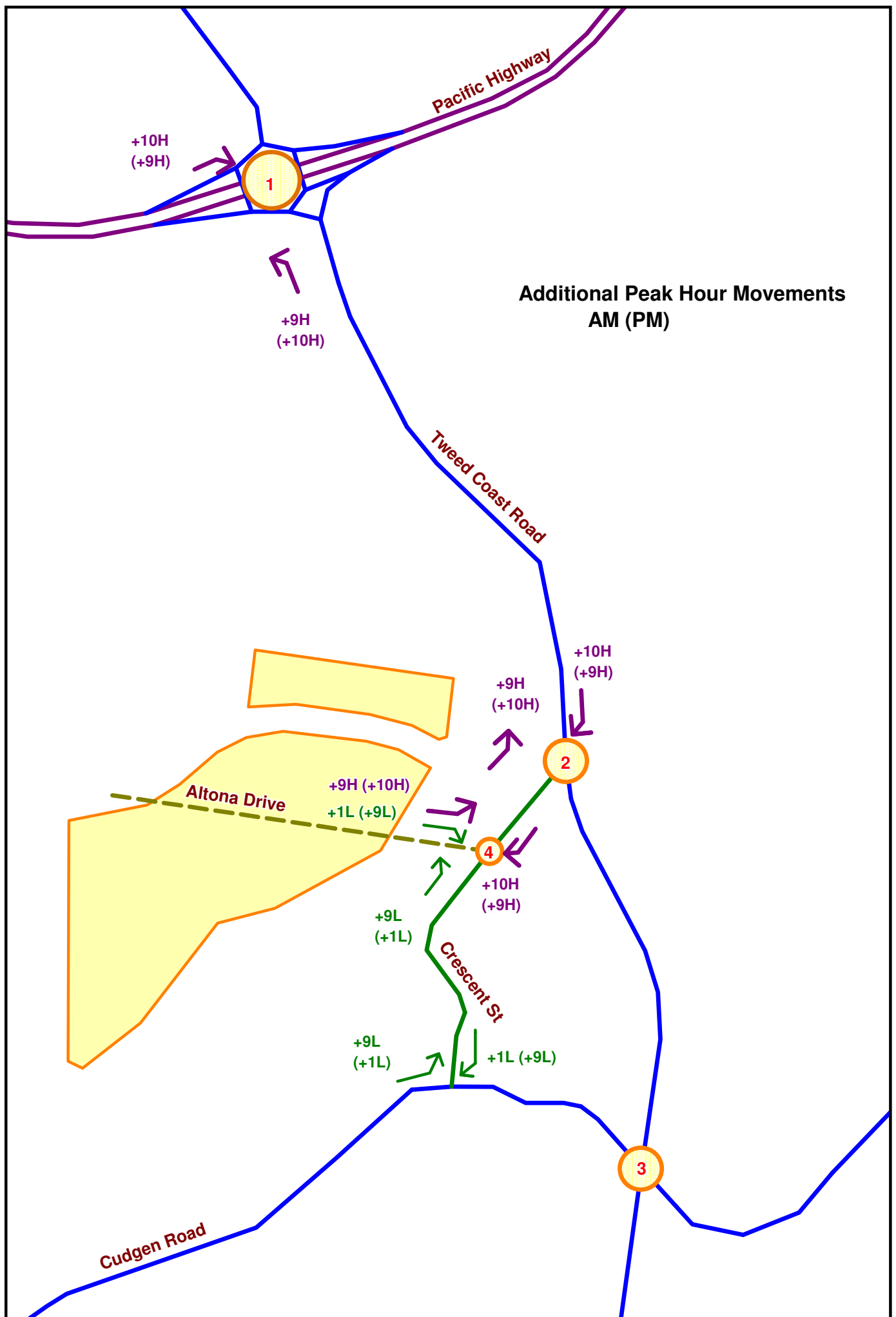
Peak Hour Operational Traffic (Northern Scenario)

Figure 6.6a



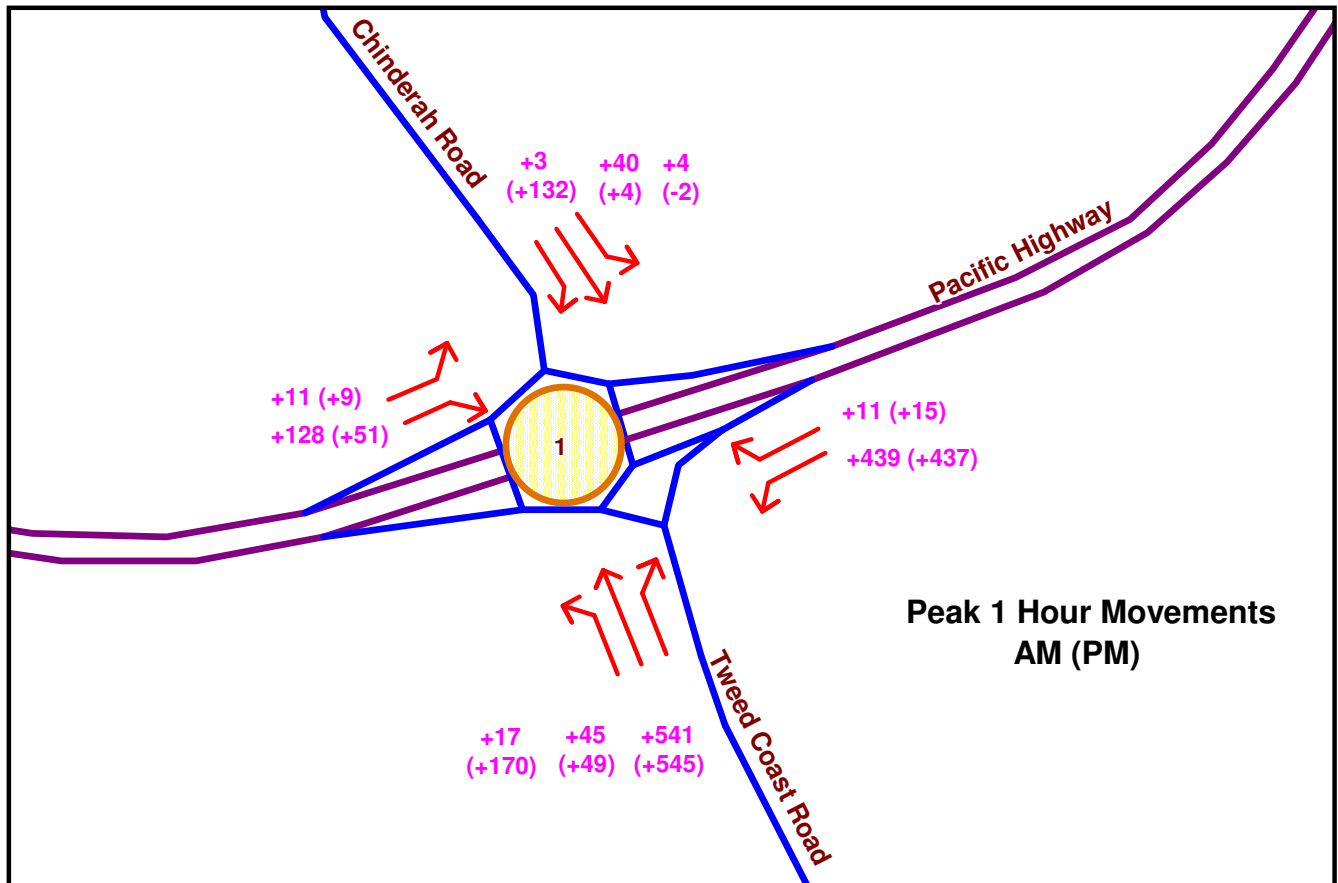
Peak Hour Operational Traffic (Southern Scenario)

Figure 6.6b



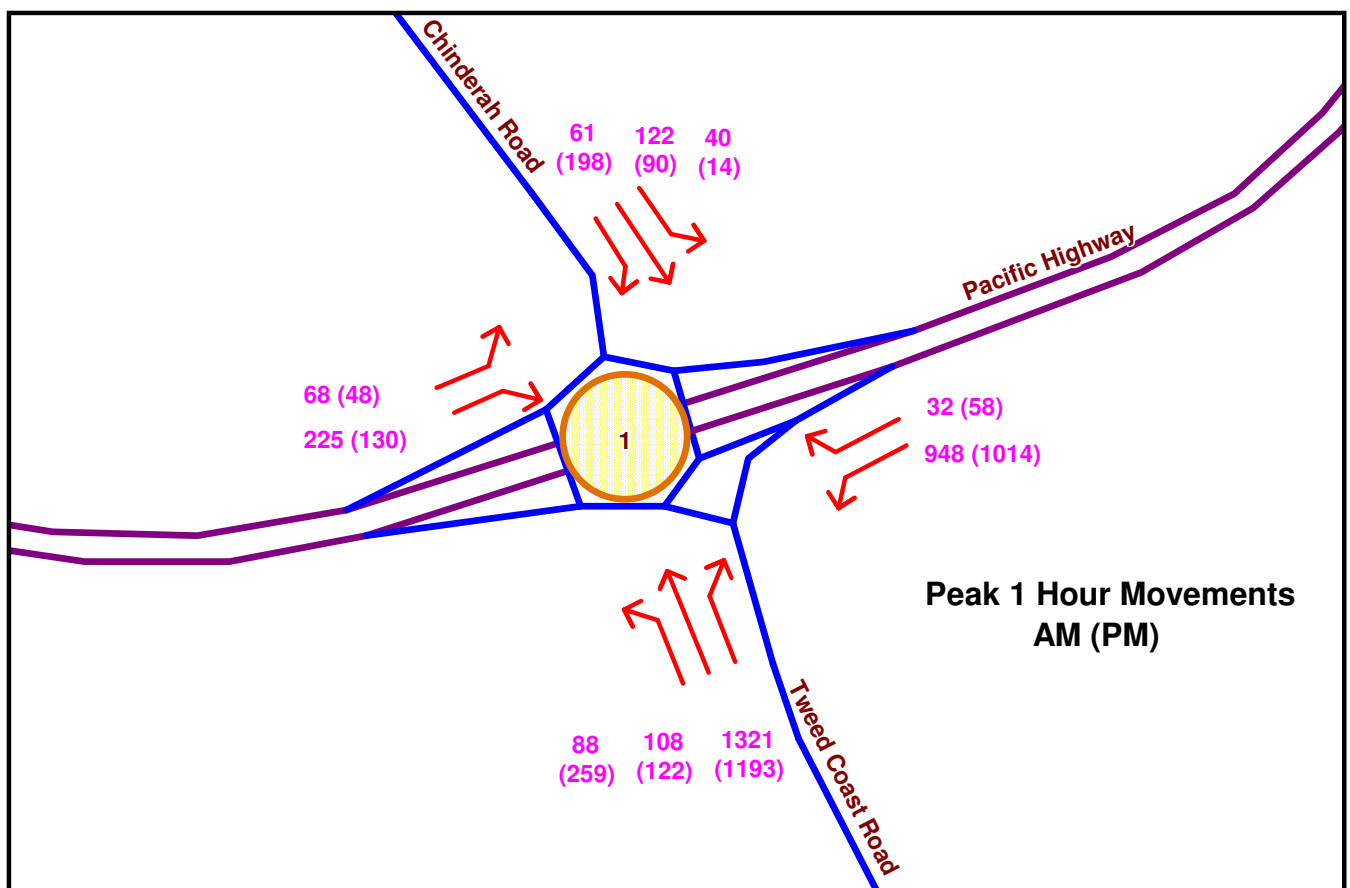
Peak Hour Operational Traffic (Western Scenario)

Figure 6.6c



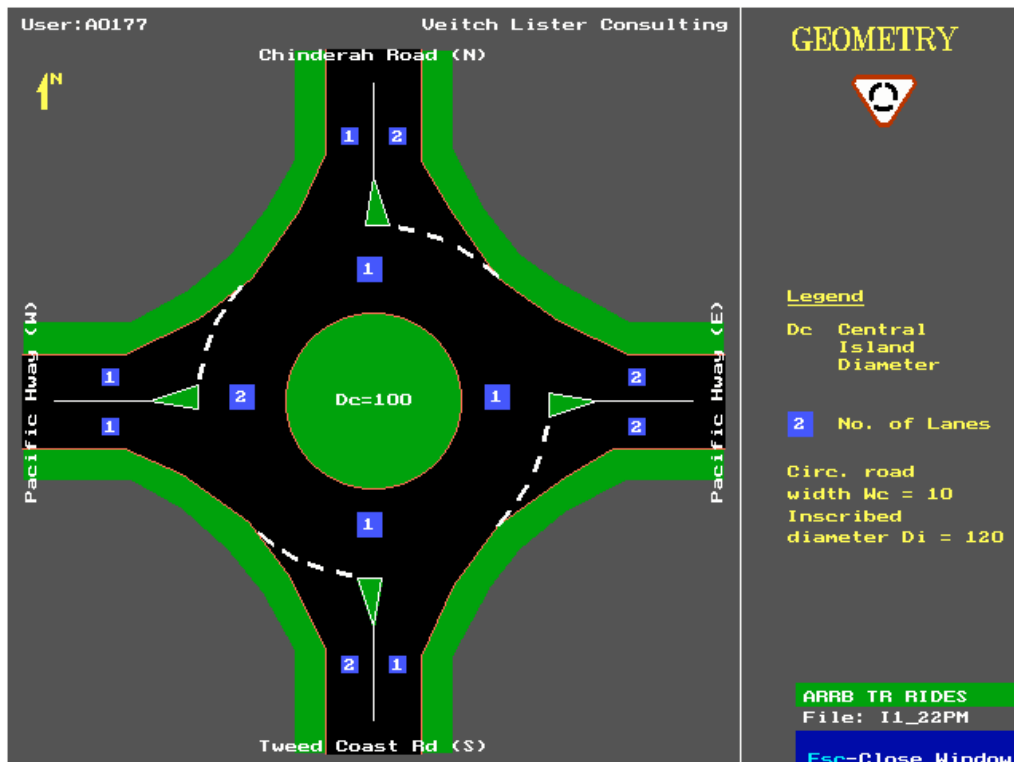
Forecast Growth in Peak Hour Turning Movements (2011 - Ultimate)

Figure 6.7a

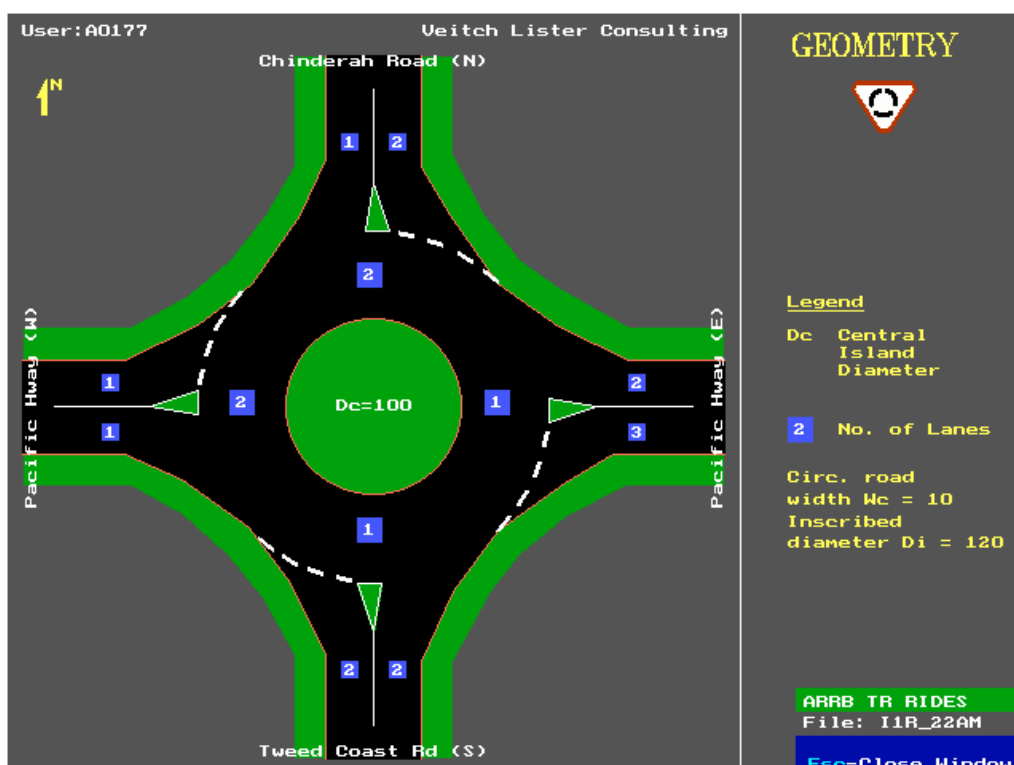


Forecast Peak Hour Turning Movements (2023 Ambient Scenario)

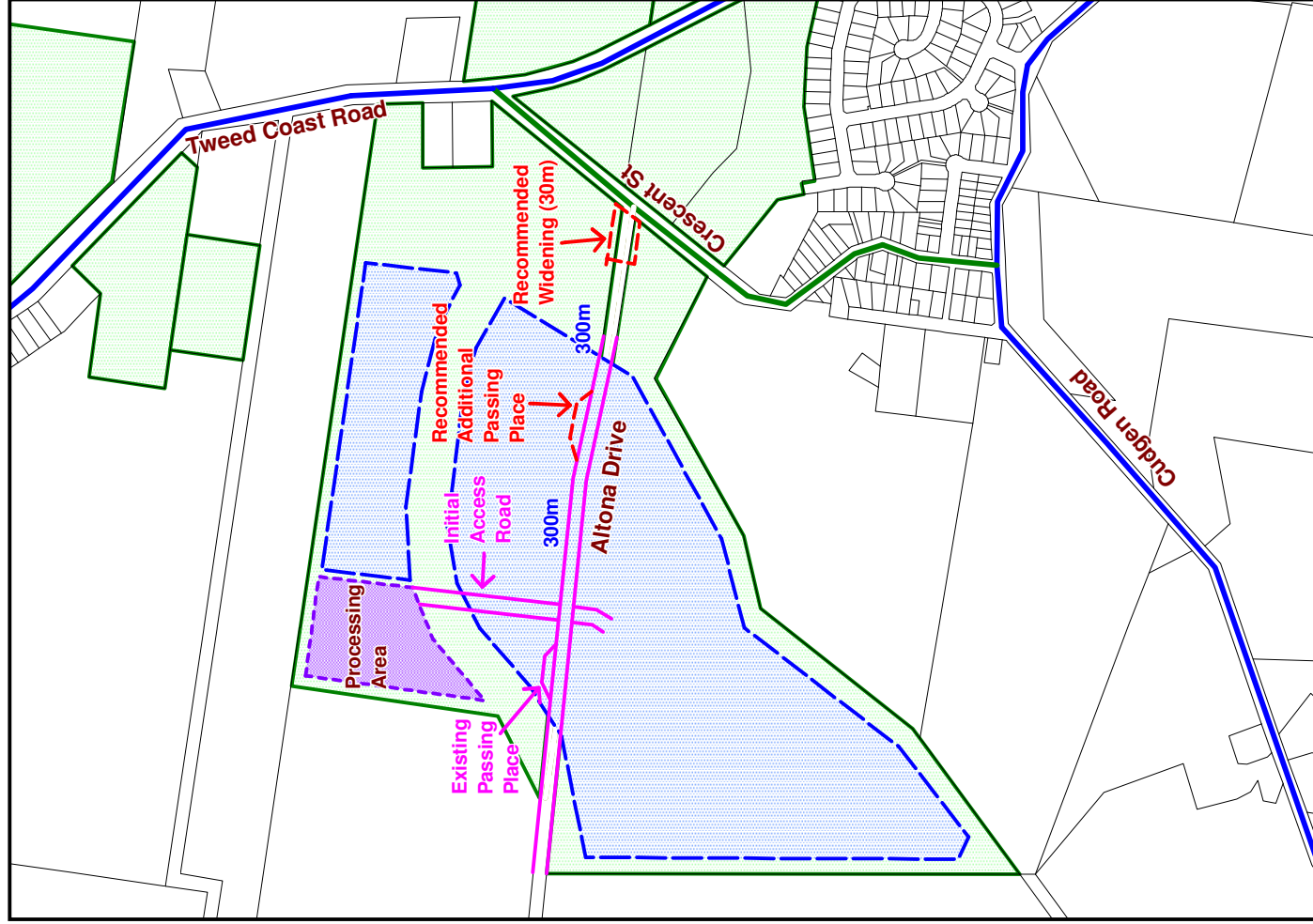
Figure 6.7b



a) Existing Intersection Layout

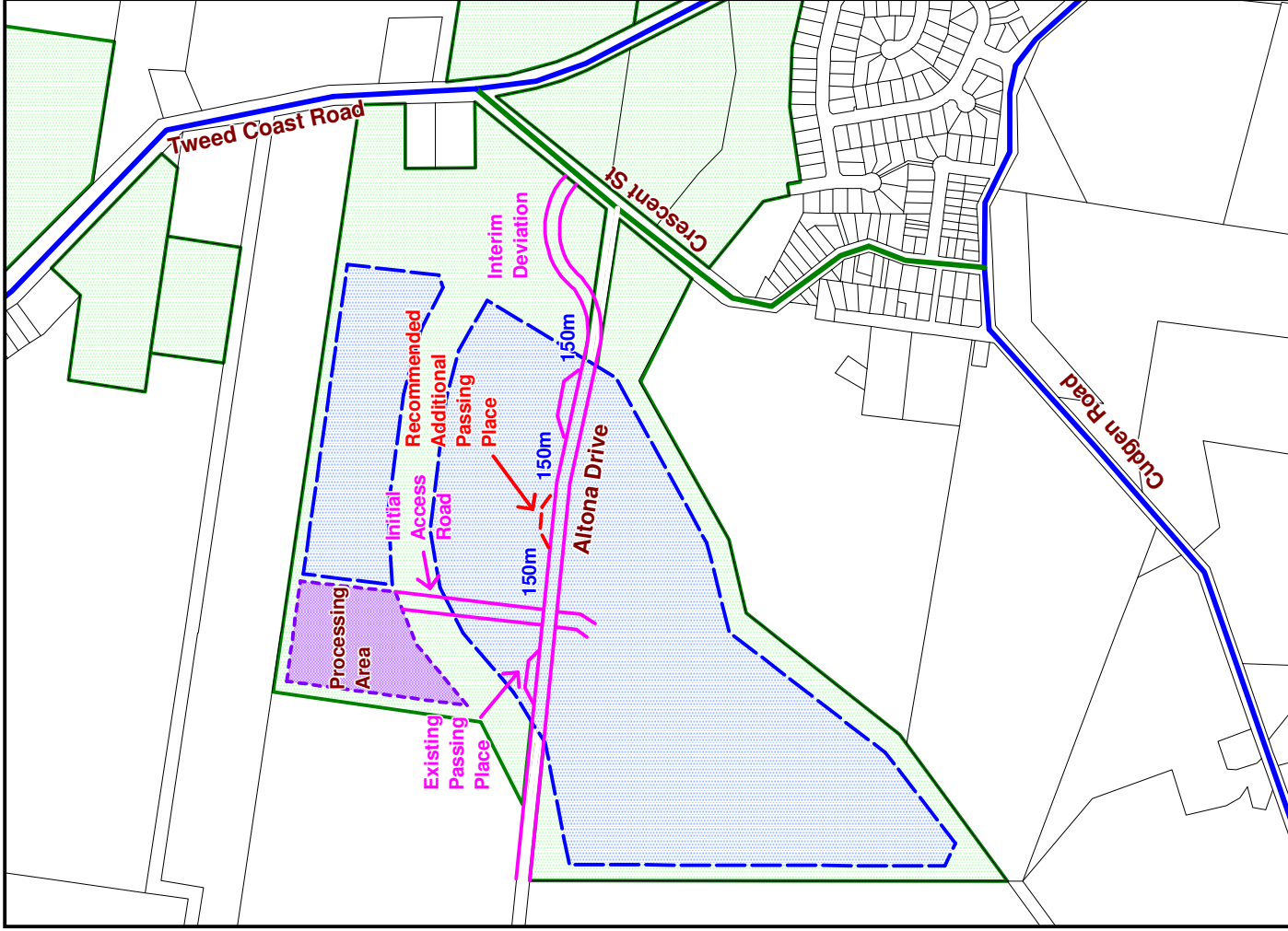


b) Suggested Future Layout



Initial Improvements to Altona Drive

Figure 6.9a



Interim Improvements to Altona Drive

Figure 6.9b