

Requirements by
Transit New Zealand for
Designation of State Highway 2
(Tauranga Eastern Arterial)
and
Tauranga District Council for
Bell Road Interchange

Prepared for
Transit New Zealand and
Tauranga District Council

Volume 3

Options Report

**Tauranga Eastern Arterial
Roading Study**

Prepared for
Transit New Zealand

June 1998

OPTIONS REPORT

Tauranga Eastern Arterial Roading Study

Prepared for

TRANSIT NEW ZEALAND

By

BECA CARTER HOLLINGS & FERNER LTD

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EXECUTIVE SUMMARY

1. This report describes the various alternative alignments that have been considered for the upgrade of State highway 2 (SH2) between Domain Road and the Whakatane turn-off. The project is called the Tauranga Eastern Arterial.
2. The aim of the Tauranga Eastern Arterial project is to improve the safety and efficiency of SH2 which currently carries traffic volumes of 14,300 vehicles per day. This stretch of highway has many traffic problems including:
 - congestion of the two lane facility aggravated by increasing traffic volumes;
 - large numbers of trucks;
 - lack of passing lanes;
 - conflict between local and arterial traffic flows in Te Puke and Waitangi settlements;
 - environmental detraction and reduced safety to pedestrians, cyclists and shoppers in the settlements of Waitangi and Te Puke;
 - congestion and danger with Papamoa traffic entering the State highway (SH) at Domain Road; and
 - a high accident rate in places
3. Six options were developed to avoid as many of the identified constraints as possible. Options A, A1, A2 and A3 utilise the sandhills along Bell Road to maximise the cheaper construction costs. Option B takes the most direct line across the Kaituna lowlands and attempts to get the greatest benefit from the shortest length. Option C consists of an upgrade of the existing alignment of the SH to four lands.
4. The study process included public consultation in the form of newsletters, Open Days and cottage meetings. This provided opportunity for the public to provide factual information and opinion and the chance for them to converse with the consultants and learn of the issues involved. The consultants also operated an 'open door' and 'open phonenumber'.

In addition, a Community Advisory Group representing various technical and social groups was also formed to enable the exchange of information and again the collection of opinion and factual information.

Meetings have been held with the seven hapu groups who were asked to advise on their alignment preferences and sites of cultural significance.

Consultation with affected landowners and interest groups will continue during the Assessment of Environmental Effects phase.

5. All options were assessed in terms of ecological, landscape, archaeological, cultural, social and noise impacts. A ranking of least preferred, next preferred and most preferred was given for each option. The following is a brief description of the assessments:

Ecological

The predominant habitat traversed by all options, excluding C, is developed farmland with Options A, A1 and A2 passing through riparian and wetland habitat in close proximity to the Kaituna River. Option A3 would pass through part of the Kaituna Reserve; a part which has been modified as a result of grazing over many years and works associated with the constructed wildfowl habitat. Options furthest from the Kaituna Reserve were favoured although Option A3 provides an opportunity to enhance through mitigation the wetland values.

Landscape

The A options would be sited on low embankments for much of their length which would blend in fairly well with the low lying landscape surrounding them. The main visual effects with all options will be in the Kaituna River corridor, where the river needs to be crossed, and the resulting visual effects on neighbouring fishing and reserve areas. The visual effects of A are preferred.

Archaeological

Options A1 and A2 are least preferred because they would traverse the East Homestead where archaeological sites have been identified. C is most preferred because it is located in a highly modified area. B is preferred over the A options because it avoids entirely the lower Kaituna River which has Pa and sites of high archaeological and cultural value, although neither impacts on archaeological sites with high cultural and scientific values.

Cultural

No consensus was received from hapu groups as to the preferred alignment. Option C was not favoured because of the severe impact on the Waitangi community.

Social

Option C, although preferable from a Te Puke commercial point of view and from a rural production point of view, it has severe effects in terms of physical impact on properties along the existing highway. The A options provide an opportunity for an interchange for future urban development in Papamoa East. Options A1, A2 and A3 maximise the opportunities for urban and rural development by being aligned on the edge of the sandhill country at Bell Road and follow property boundaries more closely. Option A3 has the least impact on rural production. Option B would affect the least number of commercial/rural buildings.

The A3 option is slightly better than other options because it is a compromise between using highly valued farmland developed by a drainage scheme and using a degraded wetland with potential for enhancement. The option attempts to minimise impacts on both resources and has potential for ecological enhancement.

Noise

All options, except C, have the effect of reducing noise exposure of houses on the current SH2. Although the overall impact of the A and B options is similar, Option A3 emerges as the best option in terms of noise impact.

Economics

The benefit/cost analysis for all A options is similar and therefore one A option was compared to the B, C and sandhills routes (the sandhills route being an option from earlier studies). For the additional costs involved neither the Sandhill or Option B offer any additional benefits to Option A3. Option A3 has a preliminary estimated cost of \$99 million and a Benefit/Cost ration (B/C ratio) of 1.8. Option B would cost \$112 million with a B/C ratio of 1.5. Option C would cost \$159 million and have a B/C ratio of 0.4.

6. From the assessment of environmental issues, two options, A3 and B, were considered alongside the economic evaluation. This evaluation found that, while the Benefit/Cost ratio (B/C ratio) of the two options were close, Option A3 provided the cheaper solution and was therefore considered to be most economical.

RECOMMENDATION

Option A3 is the favoured option. Beca Carter Hollings & Ferner Ltd (BCHF) recommends that Transit New Zealand (Transit NZ) proceed with an Assessment of Environmental Effects programme of Option A3 leading to the lodgement of a designation.

1. INTRODUCTION

1. INTRODUCTION

1.1 BACKGROUND

This report is the assessment of highway options that would provide a much-improved level of service for motorists travelling on SH2 between Domain Road and the Whakatane turn-off. The project is commonly called the Eastern Arterial. The study area includes Te Puke, Waitangi and the rural surrounds from Papamoa to the Whakatane turn-off. It should be noted that a designation is already effective from Domain Road northwest to the Te Maunga junction. That designation provides for four lanes. In the later stages of the Eastern Arterial, interchanges will be added to the Domain Road - Te Maunga section.

The objective of Transit NZ's eastern arterial roading study is to designate, under the Resource Management Act 1991, the recommended route to protect the land from further and/or more intensive utilisation which may compromise the future construction and operation of the highway. This report considers six alternative alignments. An Assessment of Effects of the favoured option will be completed before the designation is lodged with the Tauranga and Western Bay of Plenty District Councils.

The eastern arterial project aims to improve the safety and efficiency of SH2 which currently carries traffic volumes of 14,300 vehicles per day (as at Kopuroa Canal Bridge).

This stretch of highway has the following traffic problems:

- Increasing traffic volumes. This will reduce the level of service of the road resulting in capacity problems including difficulties in accessing side roads and properties from the highway.
- Large numbers of large trucks, especially logging trucks, which cause significant environmental and social effects through the main street of Te Puke.
- A lack of passing lanes.
- SH2 passes through two settlements, Te Puke and Waitangi, creating a detraction to the environment and increasing danger to pedestrians, cyclists and shoppers.
- Papamoa is a steadily growing residential area that feeds onto the SH at Bell Road and Domain Road. Domain Road especially has produced congestion and increasing danger.
- High accident rate in places.

The study area is made up of three distinct communities - one urban and the other two rural in nature but comprising on one hand large scale farms, predominantly dairy, around the Kaituna River, and on the other hand small scale intensive horticulture, especially kiwifruit situated towards Te Tumu Road. See Figure 1.1.

Papamoa south to Tara Road and along the coast to the Kaituna River is within Tauranga District. The rest of the study area is within the Western Bay of Plenty District.

FIGURE 1.1 - STUDY AREA



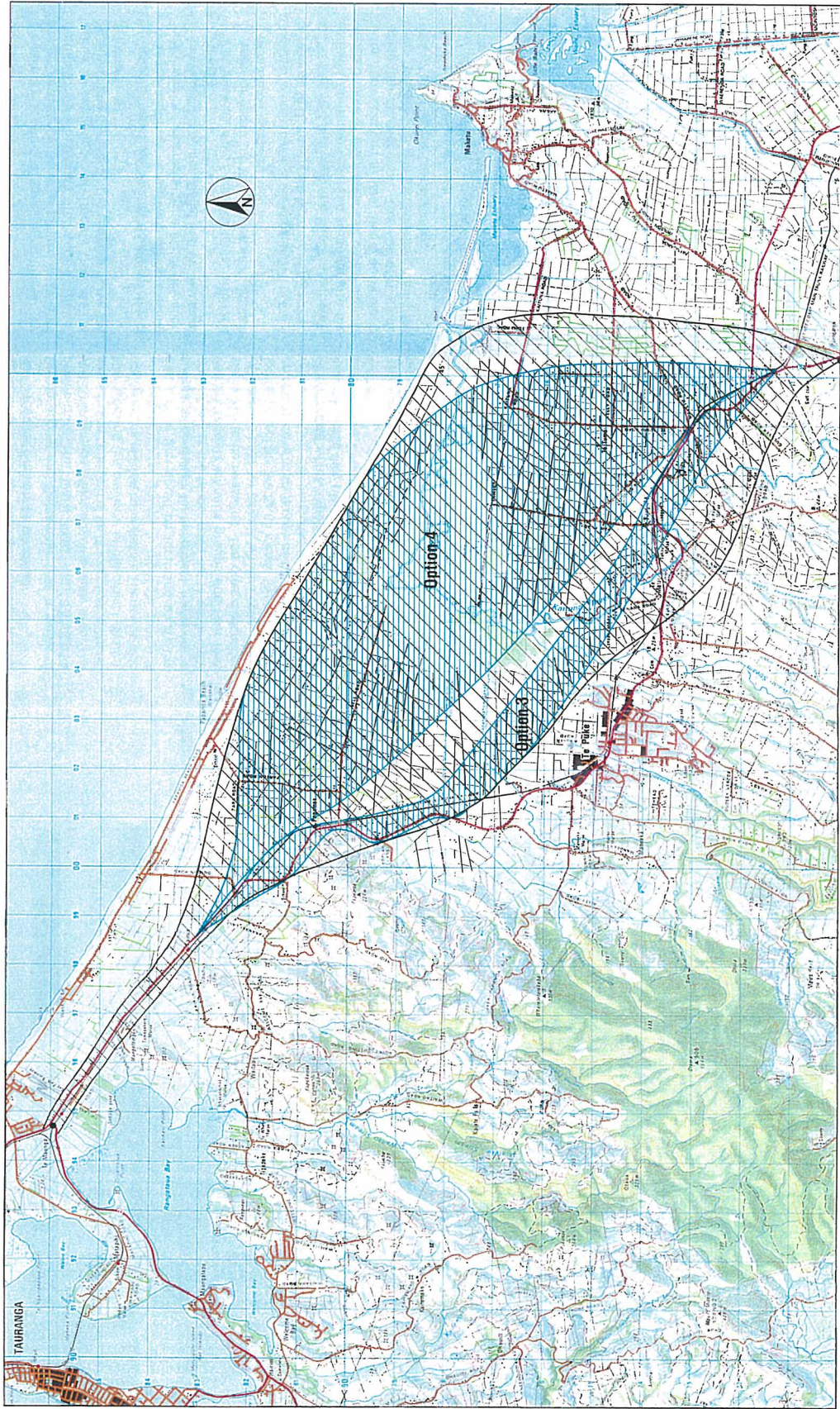
AREAS OF CONSIDERATION

Upgrading existing route plus associated localised improvement

OPTION 1:

OPTIONS 3 & 4:

BAND OF INTEREST:



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The land affected in Tauranga District is all zoned Rural. In Western Bay the rural land is zoned Rural G except for the industrial zoning of AFFCO's Rangiuru Freezing Works, Marae Papakaianga zones for Waitangi and Tuhourangi Marae and the Lower Kaituna Wildlife Management Reserve between the Kaituna Road and Kaituna River.

The SH as it runs through Te Puke is bounded by industrial, residential and commercial zones.

There are two major tourist attractions near Te Tumu Road - Kiwifruit Country and the Te Puke Vintage Auto Barn. There are several coolstores or packhouses servicing the kiwifruit industry within the study area.

1.2 THE STUDY PROCESS

The study process leading to the Resource Management Act application needs to be rigorous and determine that:

- The SH upgrade proposed is necessary to achieve the desired improvement in the level of service.
- There has been adequate consideration given to alternative routes.
- It is unreasonable to expect an alternative route, other than that recommended, to achieve the purposes of the work.

To this end Phase One of the project involved the identification of constraints to the development of a SH and the identification of options. Phase Two involved the consideration of the merits of options, one of which included the upgrade of the SH.

Phase Three of this project will involve an Assessment of Environmental Effects of the preferred alignment, consideration of mitigation measures and preparation of documentation to lodge a designation under the Resource Management Act 1991.

Further consents under the Act are likely to include earthworks and stormwater discharge, and these will be obtained before construction of each stage when final design plans are completed.

The study team comprises:

Highway Design

Geotechnical Assessment

Traffic Modelling

Benefit/Cost Analysis

Social Assessment

Public Consultation

Beca Carter Hollings & Ferner Ltd

Noise Assessment

Marshall Day Associates

Landscape/Visual Assessment

LA4

Archaeological Assessment

Des Kahotea

Ecological Assessment

Bioresearches

Property Valuation

Middleton Valuations

Economic Impact Assessment

McDermott Fairgray Group Ltd

2. DESCRIPTION OF THE PROBLEM

2. DESCRIPTION OF THE PROBLEM

SH2 is the main east coast highway between Waihi and Katikati to the north of Tauranga and Whakatane to the south. The section of SH2 investigated in this study is to the east of Tauranga, from the Te Maunga roundabout (RS 164) to the SH33 Paengaroa intersection (RS 189). As has been stated earlier a designation for four laning the highway from Te Maunga to Domain Road is effective.

The highway from Te Maunga to Te Puke is a two lane rural highway with a 100 kph speed limit. The speed limit drops to 70 kph to the west of Te Puke and to 50 kph through Te Puke. The SH through Te Puke currently has 4 lanes through the majority of the township and has two roundabouts; at the intersections of Jocelyn Street and Oxford Street. To the east of Te Puke, the speed limit increases to 80 kph and to 100 kph to the east of No 1 Road. Except for a 70 kph speed limit through Waitangi, the remainder of SH2 to Paengaroa Junction has a 100 kph limit, operating as a rural highway.

Currently, SH2 between Te Puke and Domain Road carries an annual average daily traffic volume (AADT) of 14,300. This volume increases significantly during certain periods of the week and year, reaching about 17,000 vehicles per day (vpd).

Currently the main problems with the SH comprise:

- The mixed nature of the traffic which the highway carries, being major arterial route traffic, commuter traffic as well as local trips can result in capacity and safety problems with commuter and local traffic generally travelling slower and accessing roads and properties from the highway. Through traffic can get frustrated at travelling through areas of high side friction with associated lower speeds. From an analysis of the roadside and number plate survey data, it appears that major arterial traffic to and from Rotorua and points south, and Whakatane and points east, constitute approximately 50% of the traffic travelling on SH2 north of Te Puke. The remaining traffic originates and terminates in Te Puke and its environs and comprises commuter traffic, generally between Te Puke and Tauranga, Mount Maunganui and Papamoa, and other local traffic.
- SH2 passing through the built-up area of Te Puke. The high number of accesses, the on-street parking, pedestrian movements, intersections (two roundabouts), local traffic entering the highway and the general urban/commercial environment of the highway with the associated speed limit of 50 kph results in a poor level of service. This is evident from the road recently being narrowed to 2 lanes to try to create a safer and slower environment. Despite the peak hour flows being in the order of 1,000 vehicles per hour per direction, well below the theoretical capacity of about 1,800 vehicles per hour, the resulting delays mean that the road had to be returned to a 4 lane highway.
- The large number of logging trucks using the road highway. This concerns both pedestrians and other highway traffic with the associated perceived safety concerns, especially with crossing the main street and the environmental and social concerns of heavy vehicles using the main street through Te Puke.
- The general low level of service between Paengaroa and Te Maunga. This relates to the highway being a two lane facility carrying approximately 14,000 vehicles per day with a

12% heavy commercial vehicle content. A lack of passing opportunities along the road results in a lower overall speed along the highway.

- Accesses from the highway causing conflicting traffic manoeuvres which are made more unsafe due to many having insufficient sight distances. The study area contains a wide range of land use, including residential and industrial/commercial in Te Puke, residential in Papamoa and Papamoa Beach, with the remainder being mainly rural. Many areas of Papamoa Beach have been recently developed with a significant amount of subdivision occurring. A large area just to the north of Te Puke have been identified as possible industrial areas. These will all add to the demands on the SH.
- Vertical and horizontal geometric alignment deficiencies in and around Te Puke, around the area of Bell Road and at the intersection with Domain Road.
- In the last five years, traffic has been increasing on this section of SH2 at over 5% per annum. From an analysis of the growth in traffic on the SH over the past 5 years, the projected growth rate from 1997 is 5.7% per annum east of Domain Road and 6.2% through Rangiuru. This high growth rate will have a significant effect on the need for improvements to the highway with the traffic volume being critical to when further capacity is required. Even if it were assumed that a certain proportion of the trucks were removed from the road network, it would mean that the options would still have the same relationship regarding each other albeit that it might be delayed for a few years. From an analysis on traffic growth volumes, if it were assumed that 40% of the trucks currently travelling on SH2 were transferred to rail as some people in the community have suggested, it would probably put back the project by only 1 to 2 years.

**3. DESCRIPTION OF THE ROUTE
SELECTION PROCESS**

3. DESCRIPTION OF THE ROUTE SELECTION PROCESS

3.1 PREVIOUS STUDIES AND OPTIONS

There were two principal reports prepared for Transit NZ identifying options for a Te Puke bypass.

The first, Transit NZ's Te Puke Bypass Scoping Report, was prepared by Works Consultancy in February 1992. This evaluated 5 options and the SH upgrade (see Figure 3.1) with a view to relieving the traffic problems identified in Te Puke and on the SH to the north and east of Te Puke.

Options 1 and 2 were short bypasses leaving SH2 at Manoeka Road and Kopuroa Canal and returning at Strang Road. These, together with the internal bypass (Option 5), were not recommended for further investigation. It was considered that they would create traffic conflict where they left and rejoined the SH, and would not solve Waitangi's traffic problem.

The base option, the upgrade of the SH, was recommended for further investigation. Although it would perpetuate existing traffic conflicts and be unlikely to maintain existing levels of service for road users, it would be used as a "do minimum" option for comparison.

Option 3 was considered the most economic and Option 4, the highest cost route, was considered to have long term transportation advantages. Despite the significant property and wildlife impacts it had support from the Regional Council, District Council and the Maori community. Both of these options solved the problems at Waitangi and were recommended for further investigation.

The report recommended that a Project Investigation Report (PIR) be prepared and this was done by Works Consultancy in October 1993.

This report looked at 4 options (see Figure 3.2). It was established that the problems affecting Te Puke, Waitangi and the SH to the north and east were the same as in 1992.

The options were:

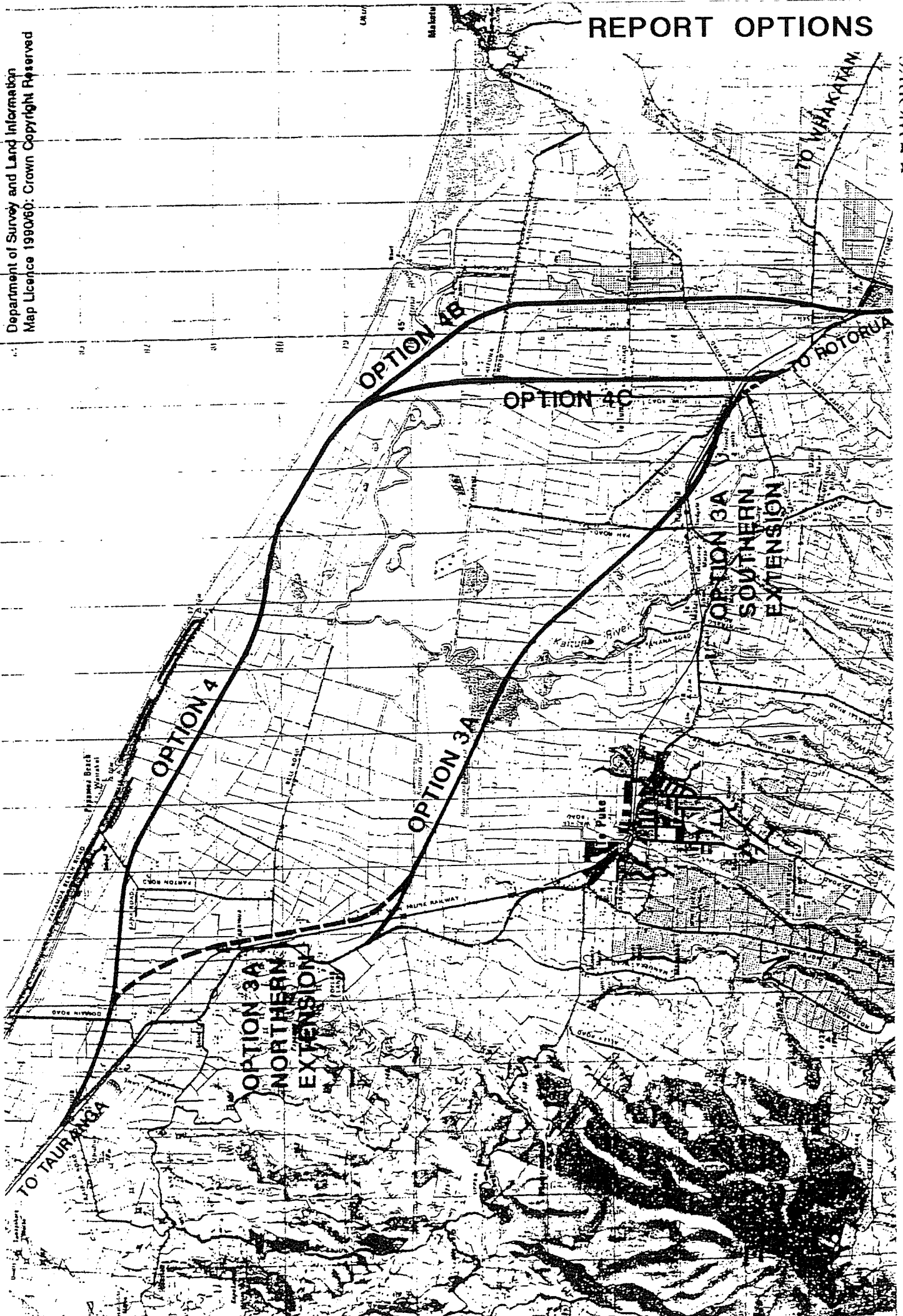
- Do Minimum
- Upgrade Existing
- Option 3A (and extensions to the north and south)
- Option 4B and C

The assessment of environmental effects concluded that upgrading the existing SH which included an internal bypass to the east of Te Puke's commercial area would have the least environmental effects. However it did not have the benefits associated with the other options and would not therefore attract funding.

FIGURE 3.2 - PROJECT INVESTIGATION

REPORT OPTIONS

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WORKS
Corporation

Option 3A was the next best environmentally. It affected less land, had less agricultural effect, less impact on business in Te Puke, least visual impact and was the shortest.

Option 4B and C required the most land, affected the greatest number of properties and had the greatest agricultural and horticultural impact. It bisected Maori ancestral land and had less support from the business community as it had the most effect on reducing through traffic in Te Puke.

The report concluded that upgrading the existing SH and Option 3A ranked marginally ahead of the others after implementation of mitigation measures, and recommended Option 3A plus both extensions be designated.

The Project Investigation Report pointed out that early funding of the project was unlikely and that it may be "10 years of more" before construction would commence.

It suggested a short term upgrade providing passing lanes, improvements to intersections and commercial and private entranceways on the SH, and intersection improvements, road marking, another pedestrian crossing and improvements to the existing one within Te Puke township. These would not adversely affect the bypass economics.

Another alternative was the construction of a short bypass, leaving the SH at Oroua Street, passing under Jocelyn Street and rejoining the SH east of King Street. This was considered to be uneconomic.

An independent review was undertaken by Bloxam Burnett & Olliver Ltd in 1995 because of the major costs and concerns with the 22km of Option 3A. This report looked at the problems in the study area and identified the central problem being the large amount of traffic, especially heavy commercial vehicles, through Te Puke creating problems within the township.

The report focussed on Te Puke and the possibility of providing early benefits and therefore recommended a shorter internal bypass called Option 6, with a variation called Corridor Z be investigated. Option 6 (not the option identified in the PIR) left the SH at Collins Lane and travelled in a straight line north of Te Puke, rejoining the SH just past Pah Road. Corridor Z left the SH just past Te Matai Road and rejoined just past Pah Road.

These options diverted traffic around the central Te Puke shopping centre and Waitangi and did not address the wider transportation issues.

The report recommended that the designation of Option 3 did not proceed and that further investigation of Option 6 occur.

For a number of years whilst consideration has been given to major bypass options for Te Puke, there has been ongoing consideration of alternatives to the major project including upgrading of the existing highway through the main street and the provision of a short bypass within Te Puke bypassing only the main shopping centre.

To enable a clear resolution to this option to be achieved Transit NZ, in 1996/97, undertook some detailed investigations of a short bypass of the main shopping centre and included in that consideration a Willingness to Pay study. The results of the Willingness to Pay study indicated that there was some displayed community benefits to be obtained by constructing a short bypass. Subsequent consultation with the Western Bay of Plenty District Council and the community of Te Puke indicated that they would not be prepared to accept this short bypass because it simply shifted the problems of noise and inconvenience to another part of the town.

In a further attempt to improve the existing situation through the Te Puke township, various trials were undertaken of single and two lane options which provided better pedestrian and traffic movement facilities during late 1997. The outcome of these trials was that the single lane option which provided the highest level of benefits to the pedestrians and significantly improved the level of safety for them, created major traffic delays which resulted in that option being unacceptable. A decision was therefore taken to return to the previous situation of two through lanes in each direction through Te Puke township, but with some enhanced pedestrian facilities.

3.2 NETWORK 96

During 1996 a group of interested parties, including local authority politicians and private interests, undertook a study to look at the opportunities for the construction of the Eastern Arterial (Te Puke Bypass) on the basis of a quasi commercial footing. This investigation also included other major arterial routes in and around Tauranga and was known as Network 96. The Eastern Arterial option considered by this group involved the alignment which had originally been identified in earlier investigations by Works Consultancy Services as the preferred option, being the Sandhills Route. Development of these proposals did not ultimately proceed to any firm conclusion following various submissions to both central and local government.

The option which was selected for promotion by Network 96 had not been subject to any rigorous environmental impact study.

3.3 OPTION SELECTION PROCESS

In the preliminary phase of the project the study area was investigated from several key points to refine the land area that was to be looked at and to ensure that the options that were promoted were feasible and practical. The key factors that were considered were:

- geotechnical features
- Maori spiritual and cultural issues
- ecological features
- highway design guidelines
- possible future industrial zones

- **Geotechnical**

There are four main types of soils within the Eastern Arterial study area. These were defined in 1967 on the Bay of Plenty Catchment Commission Plan No. M200, Kaituna and Lake Catchments, Soil Types of Te Puke Basin. The location depth and type of these soils has since been confirmed in isolated places by Works Consultancy Services (SH2 Te Puke Bypass Geotechnical Assessment Report No. 1753) and other boreholes in the area. The soil types are as follows:

- Sands found within the coastal dune area and alluvial sands along existing and old stream and river paths.
- Volcanic ashes found in the upland areas such as around Te Puke and Te Tumu and Young Roads.
- Both fresh water and estuarine swamp soils found in the low lying areas overlying sands or volcanic ashes.
- Organic peat deposits found in particular around Tara Road, Bell Road and along the straight section of highway south of Poplar Lane.

The most suitable of these soils for road foundations are the volcanic ashes and the dune sands. The swamp soils are soft and can create stability and settlement problems for road embankments. These problems increase with the depth of the soft soils. The organic peats in the area range from one metre to more than ten metres deep. They will cause high settlements of road embankments which will take place over a long period of time. Construction over peat areas is also difficult due to their very low strength.

Areas of peat and deep swamp deposits will place significant constraints on road development and high construction and maintenance costs. Shallower swamp deposits will place some constraints on road development. The dune sands and volcanic ashes will not place significant constraints on road development.

- **Maori Spiritual and Cultural Issues**

Maori spiritual and cultural values are important because when the designation application is lodged the Councils will consider the notice under the RMA and that requires in section 6, 7 and 8 the following:

Section 6 - recognising and providing for matters of national importance including the relationship of Maori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga.

Section 7 - having regard to Kaitiakitanga and recognition and protection of the heritage values of sites, buildings, places, or areas.

Section 8 - taking into account the principles of the Treaty of Waitangi.

The study area has significance for a large number of hapu within three iwi groupings. The following hapu groups were consulted with:

Ngaiterangi - Nga Potiki

Te Arawa - Waitaha

Tapuika

Ngati Whakaue

Ngati Pikiao

Ngati Makino

Ngati Pukenga

Ngati Kapawa and Ngati Tuohonoa- Te Tumu Kaituna beneficiaries

The coastal margin is regarded as significant because it is an area of past occupation, food gathering and battle sites.

The Waitaha and Tapuika representatives indicated that they preferred options that were away from the high ground to the south of Te Puke or Waitangi. Significant sites are likely to be in a band of land from the long swamp (highway) through to the coast. It was the route taken along the higher part of the swamp by battle groups. There are also likely to be sites in the Collins Lane area, by the Kopuroa Canal by the highway, around Partons Road east side and on higher firmer ground closer to the swamp.

It was noted that there is a recorded urupa site at the confluence of the Kaituna and Waiari Stream.

In addition the Tapuika representatives considered that the highway should avoid wetlands and the former swamp corridor from Pah Road. Archaeological sites were considered in conjunction with this information. In some cases the hapu had sites of significance that were outside of the study area.

The loss of Maori land titles for the highway was also of concern - particularly because many of the groups lost land after the Maori wars and they have very little left. Transit NZ is aware of the protracted process of acquiring Maori land titles for Public Works.

- **Ecological Features**

Ecological values are also important particularly because Section 6 of the Act requires recognition and provision for the following matters of national importance:

- (a) Preservation of the natural character of the coast, wetlands, rivers and their margins.
- (c) Protection of areas of significant indigenous vegetation and fauna.
- (d) Maintenance and enhancement of public access to and along rivers.

Perhaps the most significant ecological site in the study area is the Kaituna Wildlife Management Reserve. This reserve is situated at the end of Pah Road and is the

remains of a once extensive wetland. There are very few wetlands remaining in New Zealand and therefore this area has special significance.

In addition the dune systems between the Kaituna river-mouth and Papamoa and the mouth of the Kaituna itself are all important wildlife habitats. Whitebait spawning areas are found in the Reserve and the Kaituna River. Bridging of the river will be required and the design and operation of the crossing will need to ensure that the habitat is protected.

The Papamoa dunes retain a high degree of natural character within the rural coastal setting and this should be protected from inappropriate development.

We have also been advised that the ox-bows (which are old river meanders) south-west of the Wildlife Reserve are also of significance and therefore the options have been aligned to avoid these areas.

- **Highway Design Guidelines**

The design speed of the alignment is 100 kph which is desirable given the general layout and the proposed geometry.

The road will be designed to have a minimum horizontal radius of 500 metres. In constrained situations an absolute minimum radius of 400 metres with up to 8% super elevation can be used.

The road is to have total access control which means that the only access points are the interchanges/ramps. All local traffic remains on the local network so all roads bisected by the route have to be realigned/bridged. Access to all existing roads and properties will be maintained.

It is for these reasons that it is not practicable to use existing road alignments for the new arterial. This would result in parallel service roads being required to give individual property access which as well as the additional cost would mean that most of the existing property frontages would be required for either the arterial or the service road.

- **Possible Future Urban Areas**

The Western Bay of Plenty District Council is currently studying the opportunities for an industrial zone either north-west of Te Puke or in the vicinity of Rangiuru.

An industry can benefit from ready access to the highway and thereby to the Port and other centres.

The Papamoa East suburb extends along the coast and there is significant opportunity for development back from the Coast particularly east of Parton Road. SH's should avoid close proximity to urban areas wherever possible to reduce the potential adverse noise and visual effects on householders. It is also noted that all the land

eastwards to the Kaituna Cut is perceived to be potentially residential in the long term.

3.4 THE OPTIONS

The constraints were mapped and are shown in Figure 3.3.

The options were developed to avoid as much of the constraints as possible and are shown on Figure 3.4.

In the development of options careful consideration was given to the locations at which these options would join the existing SH. In the case of the western end (Domain Road) the commencement for the option to leave the existing SH alignment is considered to be most appropriate in the vicinity of the Domain Road intersection. It is at this point that the existing highway deviates to the south crossing the railway. Any commencement point for an option further southeast of this point would result in additional crossing of the railway as well as the fact that the route would encounter significant weak swampy ground conditions. At the eastern end it was resolved that the junction with the existing highway should be as close as practicable to the existing junctions of SH2 and 33. Any connection to existing SH2 west of this location would result in potential conflict with developments such as a large kiwifruit packhouse, Kiwifruit Country, Rangiuuru Freezing Works and the Maori settlement of Rangiuuru. Therefore a location for junction with the existing highway between Gulliver Road and the junction of SH's 2 and 33 has been chosen for the purpose of the option selection. The traffic is distributed almost evenly between SH2 East and SH33.

As can be seen Option C was the SH upgrade to four-laning with associated service roads which inherently required the reorganisation of much of the Te Puke main street. This is considered to be such a major impact that it is unlikely to be feasible. However for comparative purposes it must be considered.

Option B took the most direct line possible across the Kaituna lowlands attempting to get the greatest benefit from the shortest route (thereby less travel time) but suffers costs in terms of construction difficulties on peat soils.

Option A uses the sandhills along Bell Road to maximise the cheaper construction costs and turns inland before the Kaituna Reserve heading across some peatland before returning onto better lands in the vicinity of the SH33 interchange location.

The variations of Option A (being A1, A2 and A3) attempted to:

- maximise the length road on sandhills country to reduce costs
- more finely locate the road between the good urban and rural country towards the coast from Bell Road to help land owners maximise their urban and rural development
- place the alignment over farm lands to reduce the impact on individual farm management arrangements

- to use the edge of the Kaituna Reserve, the farmland, only in the land swap scenario so that the public retains the wetland asset in perpetuity.

The sandhills route is the descriptive name given to Option 4 of the previous Opus International (ex Works Consultancy Services) Reports. Option 4 was one of several options considered in the early 1990s. Although the 1993 Opus Report recommended that Option 3A be designated this action was not taken by Transit NZ, because the incremental cut off of the B/C ratio was increased from 2 to 3 this changed the decision from Option 3A to 4.

In 1995, following a review of the work to that time (the BBO 1995 report), Transit NZ decided that a scheme assessment of the Papamoa Sandhills Route be undertaken noting that

“This is a strategic option to also serve the development of Papamoa but that other options may still need to be further investigated if the cost estimate for the Papamoa Sandhills Route rises significantly from the current estimate”.

Option 4 was 19/21 km long as distinct to 17.2km for an Option 3 and this can have a significant bearing on the cost. Further consultation on the matter of an internal bypass was also undertaken. Transit NZ did not proceed with Option 4 because the project did not achieve the B/C ratio cut off for funding.

The brief given to the BCHF consultants in 1996 highlighted the need to look at all options bearing in mind the results of past studies and the importance of proving under the Resource Management Act (RMA) that the favoured option was a reasonable choice.

The consultants in reviewing the past studies considered the “sandhills route” in a similar way to the development of options for consideration. That is by way of identifying the constraints in the area.

The sandhills route is considered to have the following constraints.

- **Ecological**

The RMA requires under Section 6 the preservation of the natural character of the coastal environment and rivers from inappropriate development and the protection of outstanding features and landscapes and significant indigenous vegetation.

The sandhills route bisects the narrowing coastal margin from the end of the urban area to the Kaituna Cut and would cross the Kaituna River. We have been advised that the ecological values along the river are greater as one moves downstream from the Kaituna Reserve.

The Option would traverse an area of freshwater wetland vegetation which is one of the last remnants of Kawa Swamp which previously covered much of the Maketu Plains. This area is contiguous with the high value DoC Reserve wetland area and may have similar botanical attributes. The area traversed by Option 4B in particular has been

identified in Beadel, 1994 as a high value area within the Coastal Zone of the Ecological District. In addition this general area of the lower Kaituna River has a high wildlife value ranking (Rasch, 1989).

On the basis of overall resources, the Option's crossing areas are likely to have similar values to those within the contiguous north-eastern section of the DoC Reserve habitat.

Any such alignment would need to be set back from both the coastal dune system and the river bank area. As the coastal land narrows this becomes more and more difficult.

• **Maori Cultural**

Again Section 6 requires the recognition of Maori cultural values and we have been advised that the coastal area was valued as a source of food by many tribes and as a consequence it is an area of former occupation and battles. As such there is a higher likelihood of encountering archaeological sites than options that cross the former swamp.

There are four recorded Pa sites on the coastal side of the Kaituna River between the Reserve and the river mouth which confirms this advice. There could well be more sites and potentially urupa.

• **Social**

Transit NZ advised that their consultation had confirmed that local owners were not prepared to lose land for the purposes of a highway.

Gaining Maori land for public works is a long and involved process incorporating Maori Land Court procedures and the consent of land owners or their Trustees. An option which requires Maori land may take years to negotiate and thereby the project runs the risk of being delayed or at worst never proceeding.

Because the sandhills route is longer it would affect more landowners particularly as such an alignment affects all the smaller blocks fronting Te Tumu Road. More residents would be affected by noise and there would be greater disruption to the rural sector in terms of agricultural and horticultural lost production.

All options are required to meet Transit NZ design guidelines.

Based on new aerial photography (December 1997) a computerised digital terrain model (DTM) was developed ie. the ground contours and all features such as trees, buildings, fences, etc., are stored in a computer model. This enabled computer modelling of various alternatives to be easily developed and assessed. The alternatives were first developed on the aerial photo with ground contours, and then detailed in the computer model.

Transit NZ's brief is to designate sufficient land to provide for a four-lane divided highway.

The standards adopted for the scheme design have been based on AUSTRROADS Rural Road Design Guide (1993) with the following specific criteria:

- There is to be no property or side road access directly on to the new route.
- All road junctions other than the terminus of the route north of Paengaroa are to be grade separated.
- The typical cross-section will be:

- 4 x 3.5m traffic lanes
- 2 x 2.5m outer shoulders
- 2 x 1.5m inner shoulders
- 1 x 9m grass median in 100km/h area
- 1 x 1m median with concrete barrier in the 80km/h area.

This equates to a carriageway width, including the central median, of 31m in the 100 km/h areas and 23m in the 80km/h areas.

Batter slopes will vary dependent upon the geotechnical considerations of each locations.

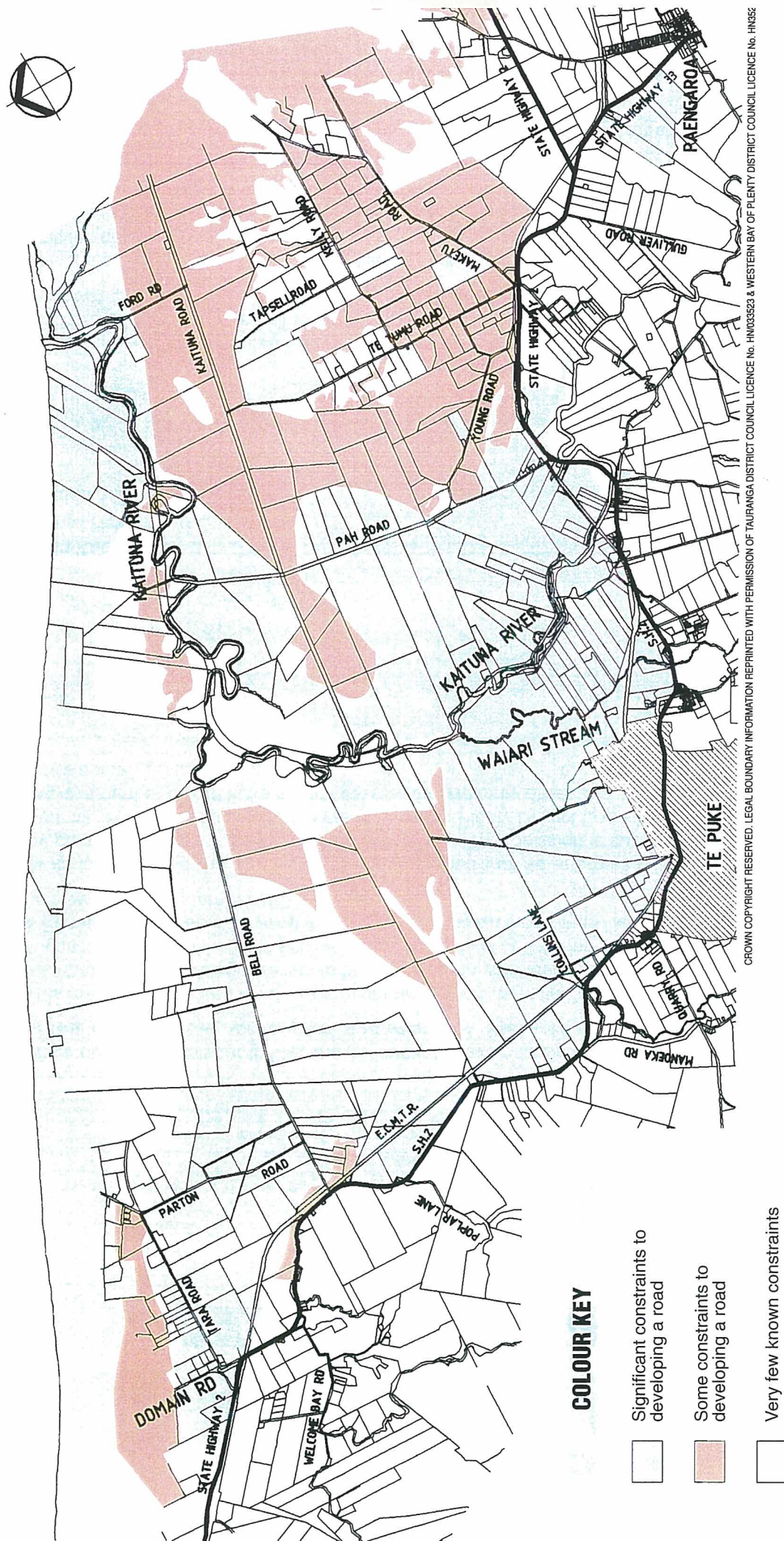
The selection of alignments was influenced by:

- Ground shape
- Ground stability
- Existing developments (buildings, commercial centres, schools, etc)
- Recorded historical and archaeological sites
- Ability for the various options to be constructed in stages.

The key issue in the selection of a new roading link is achieving the shortest option with good geometric alignment to gain the greatest cost savings for the road users. This key goal is often significantly influenced by the issues scheduled above.

Where possible alignments have been kept clear of existing development, but where this was not possible we have tended to settle on options which require the total removal of that development rather than passing close by which may leave properties subject to significant effects.

FIGURE 3.3 - CONSTRAINTS MAP



COLOUR KEY

- Significant constraints to developing a road
- Some constraints to developing a road
- Very few known constraints

NOTE: Not to scale

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4. ASSESSMENT OF THE OPTIONS

4. ASSESSMENT OF THE OPTIONS

4.1 INTRODUCTION

The preliminary assessment of options has been based on identified constraints and engineering design plans developed from a digital terrain mode, as detailed in Section 3.

The plans were provided to all team members involved in the preliminary assessment. Each team member considered the range of options after completing site visits and, where appropriate, took samples or readings. The methodologies used by each expert are explained in the relevant Sections. **For comparison purposes each analysis scored the options; least preferred, next preferred, and most preferred. The option with many "most" scores and redeeming features is/are considered alongside the economic factors to determine a preferred alignment.**

The results of the scoring system are always considered alongside the provisions of the RMA, particularly Section 6 which deals with the matters of national importance. If an option has elements that are compromised (particularly in terms of Section 6) then a "red flag" warning system indicates possible compliance difficulties. The Phase One constraints identification process attempted to remove all potential red flag items from options.

The principal aim of this report is to make a recommendation as to the preferred alignment based on a balancing of **all** considerations. It is recognised that any alignment would cause effects on the various components of the environment and would undoubtedly cause stress to some people.

The range of parameters are based on both the RMA and Transit NZ's obligations for providing for safe and efficient SH's as set out in the Transit NZ Act. The B/C analysis scores reflects Transit NZ's objectives. If such a factor was ignored it could lead to the unreasonable situation where a route which is of no traffic benefit, or is so costly that it would not be build, could be the outcome of the selection process.

The team has been assisted by the inputs received from the Community Advisory Group; a collection of organisations which have technical or local knowledge useful to the study. The organisations represented on this group currently are:

- Eastern Fish & Game Council
- New Zealand Police
- Department of Conservation
- New Zealand Automobile Association Inc.
- New Zealand Road Transport Association
- Federated Farmers
- Environment BOP (Bay of Plenty Regional Council)
- Tauranga District Council
- Western Bay of Plenty District Council
- Focus Te Puke
- Te Puke Ratepayers Association

- Te Puke Community Board
- Port of Tauranga Ltd
- Royal Forest and Bird Protection Society
- Ngati Whakaue ki Maketu
- Tapuika
- Ngati Pikiiao and Ngati Makino
- Ngati Potiki
- Ngati Pukenga
- Waitaha
- Te Runanga o Ngaiterangi Iwi
- Ngati Kapaura
- Te Arawa Maori Trust Board.

This group has met twice (8 September and 15 October 1997) to discuss the study process, the constraints and preliminary options. Several organisations responded with submissions on the six options. These responses are recorded in the following subsections.

There is a commitment to public information on the study's progress and to give people the opportunity to provide feedback. Newsletters have been despatched to approximately 1,650 residents in the study area on five occasions to date. It is intended that such provision of information continues.

The public information programme included open days which were held in November 1997 at Paengaroa, Te Puke and Papamoa to enable people to see plans of the three options proposed at that time. Approximately 250 people visited the Open days. Options A1, A2 and A3 were developed after the first Open day, and so were only offered for comment through Newsletter No. 5.

It is intended to hold additional open days to provide information from this report, and to give an opportunity for comment on the results of the preferred alignment to be studied in depth in the project's next phase.

The opportunity for cottage meetings in homes was offered to landowners and three meetings were held.

4.2 ECOLOGICAL

4.2.1 INTRODUCTION

The following evaluation is based on broad ecological features of six route options and focuses on ecological concerns in isolation from any other aspects.

On an area basis the predominant habitat type which would be traversed by Options A, A1, A2, A3 and B would be developed farmland.

4.2.2 EXISTING HABITAT

Option C

Option C, essentially a widening of SH2, would not traverse any terrestrial habitats of particular note. Modifications of waterway crossings, however, would be required over the Kirikiri Stream (joins Raparapahoe Canal), Ohineangaanga Stream, Waiari Stream and the Kaituna River. All those crossing points have been modified to varying degrees by the existing crossings and it is considered that, overall, the construction impacts of extensions would be less than those for an entirely new crossing.

A negative relative impact of this Option would be that highway-derived runoff would impinge on the greatest length of the downstream Kaituna River habitats and also on the Waiari Stream.

Option B

Option B would involve passage through about 1 km of swampy riparian habitat and grazed pasture which is broadly contiguous with more downstream wetland areas which include the Kaituna Wetland, administered by DoC.

At present the precise ecological values of the wetland area are under question. The area is owned by DoC but managed jointly by DoC and Eastern Fish and Game. It is understood the latter has undertaken excavations in the western part of the wetland to create wildfowl habitat (i.e. areas of open water). The area of DoC "wetland" adjoining the proposed alignment Option A3 is therefore modified as a result of both grazing over many years and works associated with the constructed wildfowl habitat. It is understood the area is used for duck shooting.

For the purposes of consistency, however, the DoC wetland area remains a significant ecological element for the purposes of this evaluation. Clearly, however, the south-western section of the "wetland" has been modified and does not have equivalent ecological values to the north-western sector adjacent to the Kaituna River.

Option B would also require new crossings over the Kopuroa Canal, possibly the Raparapahoe Canal (Kirikiri Stream) and the Kaituna River above two large oxbows. This option, however, would be downstream from the Waiari/Kaituna confluence, reducing roadway-derived runoff to the Waiari Stream, and that runoff would impinge on a shorter downstream section of the Kaituna River. The movement of the overall route, and in particular the Kaituna River crossing, to the north, would result in the source of roadway-derived contaminants being closer to the Kaituna Wetland area.

On balance the potential construction impacts through the low lying land and associated with a new Kaituna River crossing, on the Kaituna Wetland area, are unlikely to be greater than those associated with Option C.

Options A, A1, A2 and A3

Options A, A1 and A2 would require about a 2 km traverse through pasture, riparian and wetland habitat in close proximity (but upstream) to the Kaituna Wetland.

Although the length of the Kaituna River impinged directly by roadway-derived runoff would be the least (one main crossing), the source of that potential contamination would be in closest proximity to the Kaituna Wetland habitats. The Option A1/A2 alignment over the Kaituna River would avoid the oxbow area but is the closer alignment to that area. The routes would essentially run parallel with the Niccol property oxbow habitat which has higher values than the more northern oxbow area.

The potential construction impacts would be highest in this area because of the habitat types traversed and their proximity to the DoC wetland habitat. The alignments of Options A1 and A2 in the vicinity of Pah Road are of little relative consequence in comparison with the Option A alignment in terms of habitat disturbance, but alignment A1/A2 would be very close to the Niccol property wetland (upper oxbow) and the western end of the DoC wetland near the Kaituna Road - Pah Road intersection although the latter area consists of grazed pasture. The A1/A2 alignment would also require the crossing of a gate-controlled stream at the end of Bell Road, and the Waimarae Stream which flows into the north-western corner of the DoC wetland. This alignment option ranks lower than Option A as a result.

Option A3 would traverse the oxbow area to the east of the "Niccol property oxbow" wetland. The Niccol oxbow is of higher value than the area of oxbow between the end of Bell Road and the main river.

This option would, however, require a crossing of the gate-controlled oxbow area, the main Kaituna River and the Waimarae Stream. It would also impact upon a relatively small isolated stand of mixed kahikatea-exotic vegetation in a paddock within the boundary of the DoC "wetland", and would be the closest alignment option to the wetland area. The alignment would not, however, result in any wetland habitat discontinuity.

On ecological grounds in isolation, alignment Option A3 would be the least preferred in terms of habitat modification and/or destruction.

Were any of these options to proceed it is likely that significant measures in mitigation would be required both during construction and regarding stormwater treatment to prevent direct adverse impacts on the nearby wetland areas.

Summary

On an ecological basis the rankings would be as follows in terms of **existing habitat modification and/or destruction**:

| | |
|-----------------------|-------------------|
| Most preferred | Option C |
| First next preferred | Option B |
| Second next preferred | Option A |
| Third next preferred | Options A1 and A2 |
| Least preferred | Option A3 |

4.2.3 STORMWATER MANAGEMENT

Beyond the construction phase the aspect of most concern regarding nearby habitat quality would be stormwater control, particularly with respect to discharges adjacent to bridged waterways. In this regard it is probably not practicable to retrofit, for example pond/wetland systems, to the existing SH2 alignment.

For Option B there would be the opportunity to manage stormwater from roadway surfaces given the nature of the surrounding terrain.

Any stormwater management systems for Options A, A1 and A2, however, would need to be set well back and away from the existing wetland area to avoid further habitat loss and may not be practicable. It is understood, however, that the drainage patterns in that area are away from, rather than towards, the wetland area which is perched.

In terms of the relative potential of the six options to reduce significantly the discharge of roadway-derived contaminants to adjacent waterways, especially the Kaituna River, Option B is the clear preference.

Second preference would be Option C on the basis that at least some retrofitting to key sections (e.g. Kaituna River, Waiari Stream) could be achieved, followed by Option A where any discharge could be directed to the Kaituna River rather than through the DoC wetland. Options A1 and A2 are even closer to wetland areas (Niccol, DoC) and of those two options, Option A1 would be less preferred because of its additional area of roadway surface east of Pah Road, and therefore the increased potential to generate contaminated runoff. For both A1 and A2, however, stormwater could be directed away from the DoC wetland because of existing drainage patterns.

Option A3 would be similar overall to alignment Option A2 in terms of area of roadway surface and the ability to direct stormwater away from the DoC wetland area.

Summary

Therefore, **on the assumption that stormwater management is being considered and is practicable**, the overall ranking order would be:

| | |
|-----------------------|-------------------|
| Most preferred | Option B |
| First next preferred | Option C |
| Second next preferred | Option A |
| Third next preferred | Options A2 and A3 |
| Least preferred | Option A1 |

Although Option B would move the source of roadway-derived contamination closer to the high value wetland habitat, with stormwater management, the present loadings to significant sections of the Raparapahoe Canal (Kirikiri Stream), Ohineangaanga Stream, Waiari Stream and Kaituna River would decrease markedly and the overall roadway-derived loading to the lower Kaituna River would be reduced to the minimum practicable.

In terms of mitigation, such an initiative would be significant but only seems practicable in the case of Option B in terms of providing the greatest overall benefit.

4.2.4 EXISTING HABITAT ENHANCEMENT

At present the DoC wetland is relatively dry and is perched above the surrounding terrain. Water from the river must be pumped into the wetland so that its wetland characteristics are maintained.

It is understood that near alignment Option A3 the most significant ecological values of the wetland are the northern section adjacent to the Kaituna River. The south-western area is grazed pasture while the "middle section" (approximately) is being utilised by Eastern Fish and Game for the development of constructed wetlands for wildfowl. These consist of significant excavations in the teatree-willow dominated habitats. The precise habitat values of the works areas are not known to the study team at this time.

Option A3 would traverse the south-western section of the DoC wetland property. However, the specific area is presently dominated by grazed pasture except for two isolated, fenced stands of kahikatea and exotic trees. The southern end of the smaller stand would be impacted by Option A3.

There is an opportunity as a result of an alignment along the Option A3 route, to increase the water table within the DoC wetland area and also to increase the proportion of wetland habitat immediately north of the alignment, either by allowing natural development under a new hydrological regime or by active rehabilitation.

A raised water table may also negate the requirement for further large scale excavations in the "middle area" to create waterfowl habitat.

Two other areas in which a similar approach could be considered would be the pasture between the western corner of the wetland and the river, and between the oxbow loop on the western side of the river bend; a large area of contiguous wetland habitat would result which would represent a significant net conservation gain and measure in mitigation.

4.2.5 SUMMARY

Overall, if the combined aspects of both habitat destruction and longer term operational effects are considered, there would be little difference between Options B and C which would be the most preferred. Those would be followed by Option A and then by Option A2. Options A1 and A3 would be similar but have a lower ranking in overall preference than the remainder, however of the four A Options, the potential for existing habitat enhancement and extension is highest with Option A3.

4.3 LANDSCAPE

4.3.1 INTRODUCTION

This assessment - Phase 2 - is a coarse screening visual and landscape assessment of a range of options including A, B and C. These include a slight change of alignment to Option B, two new options A1 and A2, and a more recent A3. Option C involves an upgrade of SH2.

Options A and B (and variants) would consist of 4 lanes, two in each direction separated by a grassed median, 9 metres wide, and a shoulder on each side of the grassed median strip of 1.5 metres. The outer edges of the road will each have a shoulder of about 2.5 metres and a berm.

Details of the SH2 upgrade (Option C) have not yet been finalised. It will be necessary in places to provide not only a four lane highway, enlarging the existing road by two lanes, but also service roads possibly on both sides of the proposed arterial, in order to provide access for the various properties along the route. This would result in the equivalent of a six lane highway in places.

4.3.2 PREVIOUS LANDSCAPE STUDY

One landscape study has been undertaken in the past few years which covers a small part of the study area. Entitled Tauranga District Landscape Study Aug 1995¹, it divided Tauranga District into a number of landscape types and landscape character areas. There were two landscape types - Coastal Plain and Harbour (coastal hills and plateaux), and 25 landscape character areas which were defined by vegetation, land use and hydrological pattern.

The study only covered a small part of the area to be considered in this assessment. Part of one of the alignments passes through one of the landscape character areas identified in this study. The description of this landscape character area was fairly general and suggested key issues for each of them. The landscape character area in which one of these options falls was identified as landscape character area 6 - Rural Flatlands. *This area was typified by an extensive open flat pastoral landscape. Views are interrupted by willow shelter belts and small raised landforms on which many dwellings have been built in the past* (Page 14). The study stated that parts of this area were undergoing rapid change from rural to suburban with the rapid encroachment of along the Papamoa Beach coastline.

Much of this area was once wetland fed by the Kaituna River and there are sand dunes along the coast. The landscape is crossed by a network of drainage channels. In terms of this landscapes ability to absorb new developments the study states that:

¹Tauranga District Landscape Study . Boffa Miskell Ltd Auckland, for Tauranga District Council 1995

The flat and relatively exposed nature of this landscape provides little immediate opportunity for the visual integration of new development. The study identifies urban encroachment as the most likely form of future development, and recommends that detailed assessments of landforms and vegetation should be carried out before any development is carried out.

The study goes on to say:

“SH 2 which forms the southern edge of this unit, and southern entry to the district forms a significant viewing environment. The visual character of this important entry and the nature of the adjacent existing and future land use activity,needs to be considered with respect to creating an appropriate quality entry to the city. “

The key recommendations from this study for this area were:

- the protection and management of the existing vegetation;
- provision and design of an open space network related to landform features;
- it is the “entry” point to District, and SH2 is an important transport corridor.

No ‘Outstanding Natural Features and Landscapes’ were identified in this area in this study.

4.3.3 THE WIDER LANDSCAPE CONTEXT

The landscape through which these options pass is sited on the coastal river flats east of Tauranga. The overriding quality of this landscape is its flatness, with, to the south, the Papamoa Range rising out of the very flat plain to heights of 200 - 300 metres above sea level. These landforms are the most visually obvious landscape features - rounded hills with both woodlots and clumps of mature trees on them. These hills are also peppered with pa sites particularly around Papamoa. SH2 currently follows the base of these hills, and defines the point where the river flats meet the hills, and acts as the southern entry point into Tauranga District. The SH is slightly elevated and affords views north across the flats to the coastal sand dunes.

Another landscape feature, which is more difficult to discern in the wider landscape, is the Kaituna River which meanders through the area and has formed ox bow lakes in places around which willows and other water loving vegetation has grown and birds roost. The Kaituna Wetland Reserve is sited along this river and is a Department of Conservation reserve. There are remnant groups of mature kahikatea in places near the river.

To the north is the coastline with its sand dunes, clumps of pine in places and wetland immediately to the south.

East of Pah Road, north of Rangiuuru, the character of the landscape changes from open pastoral grazed land to enclosed fruit growing areas, and the landform becomes more

undulating. Further east from this the kiwifruit areas become more intermittent and the landscape again becomes pastoral.

South of Te Puke and Te Matai, outside the study area, the landform becomes more indented, with strongly defined valleys interspersed by flat ridges, which has been turned into a fruit growing area in the past 15 years.

The wider landscape therefore falls into five fairly distinct landscape character areas:

1. the coastal sand dunes immediately south of the beach - Papamoa Beach;
2. the coastal/pastoral flats;
3. the enclosed kiwifruit area;
4. Papamoa Hills to the south
5. Area of strongly defined valleys interspersed by flat ridges south of Te Matai

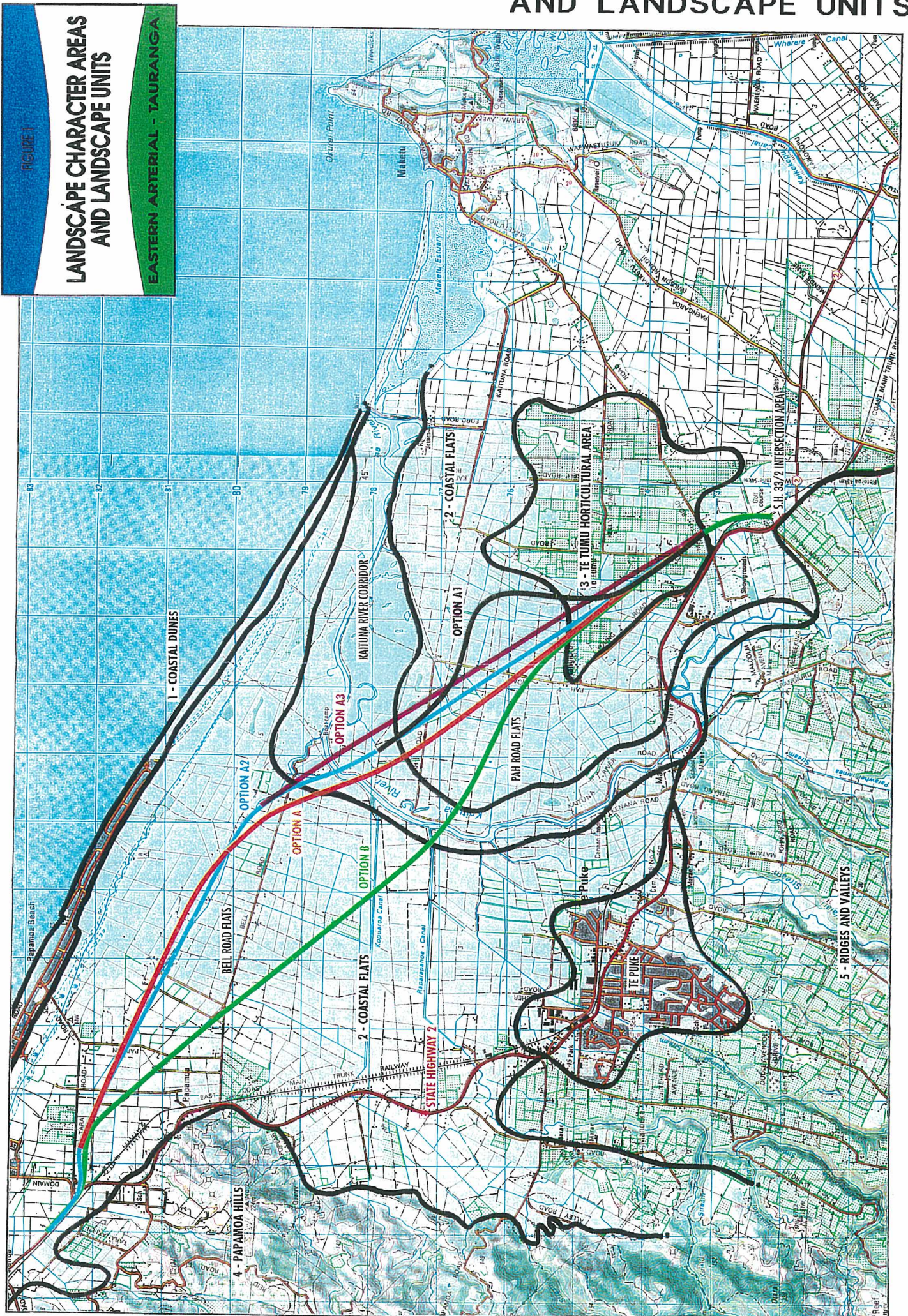
The proposed arterial will affect two of these character areas - the coastal pastoral flats and the enclosed kiwifruit area. Within these two landscape character areas there are smaller landscape units :

| Landscape Character Area | Landscape Units |
|---------------------------------|---|
| Coastal Flats | <ul style="list-style-type: none"> • <i>Bell Road Flat</i> • <i>Kaituna River and immediate surroundings</i> • <i>Pa Road Flat</i> |
| Te Tumu Road Horticultural Area | <ul style="list-style-type: none"> • <i>Te Tumu Horticultural Area</i> • <i>Gulliver Road Pastoral Flats</i> |

These landscape character areas and units are identified in **Figure 4.1 - Landscape Character Areas and Units**.

- The visual openness and visual exposure of the northern and western part of the study area. The lack of landform or vegetation screening and the general lack of development through the area;
- Kaituna River and the ox bow lakes and vegetation surrounding them;
- Kaituna Wetland Reserve
- Groups of mature kahikatea in places;
- The visually enclosed nature of parts of the eastern area, with high shelter belts to provide visual screening and some houses and shed development within it.
- The fact that this landscape forms the southern entry point to Tauranga District.

FIGURE 4.1 - LANDSCAPE CHARACTER AREAS AND LANDSCAPE UNITS



4.3.4 ASSESSING THE VISUAL EFFECTS OF THE OPTIONS

In order to achieve a methodology which was rigorous enough to compare different options and their relationship to the same landscape feature or unit, a rating system was devised which included both the visual effect and the length of each option.

The key landscape characteristics and features to be considered when looking at possible development within these landscape units are:

Part 1 of this assessment process involves rating the landscape quality of the landscape unit, the specific visual implications of each option and obtaining an overall visual effect rating.

Use of a matrix sheet offers one way in which the various facets of visual change - qualitative change, visual contrast etc - can be pulled together and evaluated in a manner which gives due weight to each. The visual effects of the option as it passes through the different landscape units, have been scored using the assessment sheet. Appendix A details the methodology of assessment.

4.3.5 PRELIMINARY VISUAL/LANDSCAPE ASSESSMENT

This section gives a more detailed description of the landscape units and a preliminary assessment of the effects of the various options as they pass through each unit.

4.3.5.1 Options A, A1, A2, A3, and B

Landscape Character Area - Coastal Flats

Bell Road/Pah Road Flats

These coastal flats comprise open exposed pastoral land, with the occasional hedge, poplar, willow shelter belts and drainage channels, and clumps of kahikatea to the east of the river. The landscape quality is generally fairly low, as are landscape heritage values from the pakeha perspective. There are farm houses in places though scattered fairly widely through the area, a few with mature trees around them. This unit has a wide visual catchment because of its flatness.

Overall therefore from the quality and visual catchment points of view this landscape unit has a **low/moderate** sensitivity. However, its openness means that development of any height or prominence could be seen from a long distance.

All the A options would pass through two houses and would be very close to a group of three at the Domain Road/SH2 intersection in a 4 metre deep cutting, and will then move out onto a 1.2 metre high fill through parts of the area south of Tara Road. Parts of it would also be at ground level. Some shelter belts and individual trees may be removed in places. Approaching Bell Road all options would be on a 3 metre high embankment. Views of these options may be available distantly from the lower slopes of the Papamoa Hill, and from some houses in the Bell Road area. Where houses are

within 100 metres of the proposed road, earth mounds may be provided to reduce the sound for those houses. The mounds could be 10 metres wide by 2 metres or more high. Where houses are more than 100 metres away, the earth mound could be 6 x 1.5 metres in extent. (See also Section 4 - Noise Assessment.) The visual effects of these mounds would be to screen parts of the road from the surrounding areas, and also to screen views out from the new arterial. These mounds can be planted with trees. All local roads would pass over the new options on bridges.

Through the Kaituna Road/Pah Road area the proposed A options would be on an embankment between 1 and 2 metres high and except for A1 option would all have very similar effects. A1 meanders through the area in a manner that is not related to any landscape feature or contours and is likely to be more visible than the straight through options.

Overall the visual effect for all options through this unit would be **moderate**, though A1 would have a higher impact rating within the moderate range than the other A options.

Option B would be positioned further south than the A options, and would be more visible to more houses on Bell Road, and from houses on the lower slopes of Papamoa Hill. Otherwise in design terms it is very similar. Sound attenuation berms will be needed through parts of this area.

Kaituna River and Immediate Surroundings

The Kaituna River is lined with stock banks with walking track along the tops. The stock banks make the river hard to see from further afield. There are willows and rushes and flaxes alongside it in places. There are a number of ox bow lakes which have become detached from the river in the past 15 years. The river and the ox bow lakes are a significant landscape feature in the area, and are used for recreational fishing and walking. Adjacent to the river there are a few remaining clumps of kahikatea.

The Kaituna Wetland Reserve is sited along part of the Kaituna River and incorporates some of the ox bow lakes. It is also characterised by large areas of native vegetation including cabbage trees, kahikatea, and a range of other native wetland plants.

The visual quality of this landscape unit is moderate, though it has high recreational values and is the only landscape feature in the flat plain. The visual catchment and audience would be low owing to the screening of the stock banks and lack of houses in the area. The key characteristic of this landscape is its "remoteness".

Overall this landscape unit has a **moderate** sensitivity.

Option A passes through this unit close to the recreational fishing area at the end of Bell Road, on a 4 metre high embankment, crossing the Kaituna River on a 200 metre long bridge. It then passes onto a 3 metre high embankment. The Kaituna River landscape unit is about 1.5 kilometre wide at this point. The alignment would be prominent in the immediate area, and contrasts with the patterns and alignments of existing features.

Amelioration potential is reasonably good provided that tree planting could be used to screen the bridge within the flood prone corridor. Overall the visual effects are in the **middle of the moderate range**.

Option A1/A2 would swing further north than Option A on the approach to the river, and would run parallel to part of the ox bow before crossing the river. This option would pass very close to the recreational fishing area at the end of Bell Road, on a 3.8 metre high embankment, parallel to the river for about 200 metres, before crossing the Kaituna River on an 80 metre long bridge. It then would move onto a high embankment. The Kaituna River landscape unit is about 1.5 kilometre wide at this point. This option will be more visually prominent to people using the river for recreational purposes than Option A, because of the effects of the embankment close to the ox bow for some distance. The amelioration potential for this option would not be as good as for Option A because of the extent of planting that would be required to screen the length of road in this landscape unit. Overall the visual effects would be at the **high end of the moderate range**.

Option A3 also swings north of Option A and passes *through* the recreational fishing area at the end of Bell Road, through the centre of one of the main ox bows on the river and across the river itself on an 80 metre long bridge. This option crosses the river corridor on a 4 - 5 metre high embankment, and the bridge is about 7 metres high. This option would visually effect a longer stretch of the river environment than other options because it would affect both sides of the ox bow and the river. Amelioration for this option would involve extensive planting of the ox bow lake and the river to screen it. This option also passes through part of Kaituna Wetland Reserve.

Overall the visual effects would be at **high**.

Option B on its more southerly route runs straight across this landscape unit, crossing two canals on bridges, and the river on a 120 metre long bridge. The river corridor is narrower at this point. The alignment will be prominent in this area, and contrasts with the patterns and alignments of existing features. Amelioration potential will be reasonably good provided tree planting is permitted within the river corridor. Overall the visual effects are in the **middle of the moderate range**, but overall slightly less impact than the A options.

The main differences between the A Options and Option B through this unit is that the A options affect the recreational fishing area, the ox bow lake and the river and in the case of Option A3 the Kaituna Wetland Reserve. Option B crosses the river on two small bridges, and one long bridge in an area that is less visible to the public, and does not affect the landscape features of ox bow lakes and wetland reserve.

Landscape Character Area - Te Tumu Horticultural Area

Te Tumu Horticultural Area

This landscape is divided into small enclosed spaces by shelter belts of Cryptomeria and others, containing kiwi and other fruit. Kiwifruit Country - a large retail outlet and

tourist attraction - is sited on Young Road, just off the SH2. The main landscape characteristic in this part of the study area is one of enclosure, with houses, gardens and sheds enclosed within the shelter belts.

The visual quality of this landscape unit is moderate. It has some cultural importance because of the cultural associations of kiwifruit with the Tauranga area. The visual catchment would be small because of the containment achieved by shelter belts, though the audience which currently passes through the area will be small to moderate.

Overall this landscape unit has a **moderate** sensitivity.

The four A Options and Option B would affect this unit in the same way. The four-lane road slices obliquely through the patterns of small horticultural fields. The road would be sited on a series of very low cuts and fills. It would not be visually prominent because it would be enclosed within the existing shelter belts, and would not affect existing views. The potential for landscape mitigation is very good. The whole alignment could be screened by shelter belts.

Therefore the overall visual effects would be at the **low end of the moderate scale**.

SH33/2 Intersection/Gulliver Road

This landscape unit is rather disturbed visually. It contains the railway line, overhead power lines, a radio mast in the distance, and the intersection of SH2 and 33. The visual quality is therefore low. There are no landscape features which have endemic or cultural associations from the pakeha perspective. The landscape is very open and therefore the visual catchment is wide, and more people see this unit from the two main roads and railway running through it.

Overall the visual sensitivity of this landscape is fairly **low**.

The A Options and Option B affect this unit in the same way. The 4 lane road would be on a low embankment gradually rising to a height of 7.5 metres to cross the railway line on a bridge. The main visual effects would be the introduction of a road and railway bridge into the area.

The potential for amelioration is good, partly because there are real opportunities to improve and enhance the landscape of this area. Groups of trees or shelter belts similar to those already in the area could screen the new road and bridge. Therefore the overall visual effects are **at the low end of the moderate scale**.

4.3.5.2 Option C - State Highway 2 Upgrade

The SH2 upgrade would follow the landscape unit boundary between the Papamoa Hills and the other landscape units described earlier. Full details of this option have not yet been released. In discussion with the design engineers they have stated that it will be necessary in places to provide not only a four lane highway, enlarging the existing road by two lanes, but also to provide service roads possibly on both sides of

the proposed arterial for much of its length, in order to provide access for the various properties along the route. This would result in the equivalent of a six lane highway in places.

In landscape and visual terms the existing highway is very well positioned in relation to the overall landscape as it meanders along the base of the hills, marking the transition between the hills and the flats, and offering good views out over the coastal flats in places. For people travelling from the south it creates an attractive meandering entry to the District. However, having to create the equivalent of a 6 lane highway along much of this route would result in the removal of all the existing trees and vegetation alongside the road probably on both sides, and would severely effect the existing character of both the landscape in general and the centre of Te Puke, with its central median containing large mature trees.

This option is also longer than the others. Though this option has not been assessed in detail, it would appear on the information currently to hand that the visual and landscape effects of this option would be **high**.

Results

The following table - **Table 4.1 - Preliminary Visual Effects Assessment Scoresheet - A Options and B**, shows the results of the assessment, combining the visual effects assessment with the length of road passing through each unit.

Table 4.1 - Preliminary Visual Effects Assessment Scoresheet - A Options and B

| OPTIONS | VISUAL EFFECT | LENGTH (Km) | TOTAL |
|-------------------------|---------------|-----------------------|--------------|
| OPTION A | | | |
| <i>Landscape Units</i> | | | |
| • Bell Road/Pah Rd flat | 2.7 | 10.2 | 27.5 |
| • Kaituna River | 4.72 | 1 | 4.7 |
| • Te Tumu Horticultural | 2.6 | 2.8 | 7.2 |
| • SH33/2 intersection | 2.25 | 1.05 | 2.36 |
| | | Overall Total: | 41.4 |
| OPTION A1 | | | |
| <i>Landscape Units</i> | | | |
| • Bell Road/Pah Rd flat | 3.3 | 11.4 | 37.6 |
| • Kaituna River | 5.8 | 2 | 11.6 |
| • Te Tumu Horticultural | 2.6 | 2.3 | 5.98 |
| • SH33/2 intersection | 2.25 | 1.03 | 2.3 |
| | | Overall Total: | 57.48 |

| | | | |
|-------------------------|------|-----------------------|--------------|
| OPTION A2 | | | |
| <i>Landscape Units</i> | | | |
| • Bell Road/Pah Rd flat | 2.7 | 10.6 | 28.6 |
| • Kaituna River | 5.8 | 2.06 | 11.94 |
| • Te Tumu Horticultural | 2.6 | 2.3 | 5.98 |
| • SH33/2 intersection | 2.25 | 1.03 | 2.3 |
| | | Overall Total: | 48.82 |
| OPTION A3 | | | |
| <i>Landscape Units</i> | | | |
| • Bell Road/Pah Rd flat | 2.7 | 10.3 | 27.8 |
| • Kaituna River | 6.4 | 2.3 | 14.7 |
| • Te Tumu Horticultural | 2.6 | 2.35 | 5.98 |
| • SH33/2 intersection | 2.25 | 1.02 | 2.29 |
| | | Overall Total: | 50.77 |
| OPTION B | | | |
| <i>Landscape Units</i> | | | |
| • Bell Road/Pah Rd flat | 2.9 | 10.5 | 30.45 |
| • Kaituna River | 4.4 | .6 | 2.64 |
| • Te Tumu Horticultural | 2.6 | 2.6 | 6.76 |
| • SH33/2 intersection | 2.25 | 1.05 | 2.37 |
| | | Overall Total: | 42.22 |

In terms of length there is very little to choose between the options, though Option A1 is longer because of the bend that it takes to the north. For much of their length the A options would be sited on a low embankment which will blend in fairly well with the low lying landscape surrounding it. The main visual effects with all options will in the Kaituna River corridor where the road options cross the river on a variety of different lengths of bridges and the resulting visual effects on the neighbouring fishing and reserve areas. From the visual and landscape perspective, Options A or B are the preferred options through this landscape unit.

The visual effects results for Option B are slightly higher than Option A because of its visibility to more houses in the Bell Road area, and from some parts of the existing SH, and the houses on the rising land to the south. This option involves three shorter bridges across two canals and the river, and is shorter overall than Option A.

In order of preference from the visual and landscape effects point of view is:

- Most preferred - **Option A**
- Next preferred - **Option B**
- Next preferred - **Option A2**
- Next preferred - **Option A3**
- Least preferred - **Option A1 and Option C**

4.4 ARCHAEOLOGICAL

4.4.1 INTRODUCTION

This report deals with the archaeological resource and is orientated to sites specifically located on the route of two new road Options A and B and Option C which is an upgrade of SH2 and the refinements of A being A1, A2 and A3. Included in the assessment is the immediate environmental context which can explain site location or absence. Assessment values for this report in each option, is based on:

- site type - pa, pits, terraces, etc.
- what is known about the site type - archaeological information
- environmental context - natural resources (soils, shellfish, fish, birds etc.)
- landscape - cultural use (gardening, fishing, settlements etc.)

Previous Archaeological Surveys

In the 1960s and 1970s, archaeological site identification and recording was undertaken by amateur archaeologists for the purposes of recording important archaeological sites, which were generally pa, for information and identification if the site was destroyed. The Tauranga County was systematically surveyed between 1980 and 1985 during a four year site survey initiated by the NZ Historic Places Trust because of site destruction that was occurring with the establishment of kiwifruit orchards. An intensive archaeological field survey was undertaken of Tauranga District Council in 1996 of residential and future residential areas of Papamoa for Tauranga District Council and New Zealand Historic Places Trust because of the impact of rapid residential development of archaeological sites.

Sites that have been recorded to date on the options and routes are: Pa, middens, terraces, made soil (garden soil), pits and find spots which are common site types recorded in the Tauranga area.

4.4.2 ARCHAEOLOGICAL LANDSCAPE

Wrigley describes the area of the route of the road options as part of the Te Puke lowlands encompassing the area of land seaward of Te Puke extending from Papamoa Beach in the west to Maketu Estuary in the east. The northern part comprises a belt of coastal sand dunes aligned parallel to the coast and varying in width from 100 to 1350 m. Between these units is a low lying (2 - 6m a.s.l.) area comprising drained swampland, peatland, tidal flats, river terraces, and flood plains, all formed since the

Holocene sea level attained its present position c. 6500 years ago¹. There are three major physiographic zones, the Holocene dunes (coastal), wetland/riverine region of the Kaituna River and inland (northern extent of the Kaharoa Plateau) generally all areas with high archaeological site densities but in specific localities.

The options between Tara Road at Papamoa and the Kaituna River are located on old dune system (Option A) on higher ground and former wetlands (Option B). From the Kaituna River to Maketu Road there is former wetland (Option B), and older dunes (Option A). The road runs parallel to the coast then heads to the Kaituna River. The coastal zone is soils of older dunes which were utilised for gardening. Archaeological monitoring of residential areas is showing that the coastal zone was an area of intensive occupation exploiting the marine resources of ocean and softshore, soils for gardening formed from old dunes and wetlands in the vicinity. The Kaituna River flowed through a former large wetland area and the river itself was an important system for communication. The higher ground at the former Pukaingataru Block (Young, Te Tumu and Maketu Roads) is separated from Maketu by drained wetland and is the edge of an important distribution of inland sites that follow the inland course of the Kaituna River.

Recent archaeological monitoring and site surveys of Papamoa from Te Maunga to the end of Bells Road has revealed the coastal zone as an area of intensive occupation with large and smaller settlements sites (kainga)², pa and extensive use of the old dune soils for gardening. On the higher Papamoa hills there a high density of pa and terraces but this area is separated from the coast and Kaituna River by wetland. Not much is known along the options from the Kaituna River to Rangioru as no further archaeological work has been undertaken since the field surveys of the early 1980s.

Ancestral settlement and utilisation of the coastal strip had altered vegetation from possibly original coastal broadleaf-podocarp forests at first ancestor contact to a period 500 B.P.(ca. 1500 AD) of native grasses and manuka dominated scrub a product of intensive occupation and use³. The wetland and riverine areas was rich in food and natural material resources but was not altered through use or exploitation. The wetland area surrounding the lower Kaituna became important resource area as flax became a commodity for trade for muskets in the 1820s. The introduction of muskets in warfare and use of muskets against Tauranga and Rotorua Lakes iwi by northern taua in the 1820s muskets saw the establishment of traders in flax and muskets in Tauranga and eventually Maketu. Ngaiterangi hapu and Te Arawa iwi and hapu from the Rotorua Lakes located themselves on the lower Kaituna River but tension quickly arose as Ngaiterangi hapu who owned and controlled the region saw their mana over the lands being eroded by the more numerous Te Arawa iwi who were setting up communities to process the flax for trade. The tension between the two tribes quickly flared into a regional war. Maketu became an area of intense conflict and battles between Ngaiterangi and their allies Waikato and Te Arawa from the inland lake districts during

¹ Wrigley 1990

² Frederickson, Barber, Best 1995; Kahotea 1993; McGovern Wilson 1995; Gumley & McFadgen; Frederickson, Kahotea, Felgate 1996

³ Wallace 1995

the 1830s as Te Arawa sought to re-establish their mana over Maketu. Waitaha and Ngati Tapuika went inland during this period, and when the fighting declined they came back to pa on the Kaituna at Kenana. The inland Te Arawa now occupied and dominated the Maketu region and Waitaha located themselves on the Kaituna at Kenana away from the Ngaiterangi boundary. Waitaha then moved and occupied Te Puke as a settlement. Peace was established between Ngaiterangi and Te Arawa in 1845 and a boundary was established at Wairakei on the coast. The significance of this boundary is that it was selected as the area where an important Ngaiterangi chief, Hikareia, was killed after a major battle at Te Tumu.

The confiscation of lands by the Colonial Government in 1864 at Tauranga after the battles of Gate Pa and Te Ranga was the commencement of Pakeha colonisation of the region. The administration of the confiscated lands and the operation of the Native Land Court investigating "Native Title" under new Native land Acts at Maketu led to the purchase of land by the Government who then made these lands available for Pakeha settlement.

In 1872 a steam powered flax mill began operation at Waihi near Maketu and by 1880s extensive operations began in the Te Puke-Maketu - Pongakawa districts⁴. The number of mills fluctuated and mills were located on the Kaituna River at the end of Bells Road and Te Paroa. The banks of the Kaituna were considered some of the best flax in New Zealand but the mills closed down by the 1930s. The reduction of wetland and conversion to pasture and fires led to the closing of mills and exploitation of wetland flax. The flax industry did not have much impact on the landscape as the native flax was harvested from a naturally grown resource and the plant regrew after cutting.

The purchase of the Papamoa Block No. 1 from Ngapotiki a hapu of Ngaiterangi was completed by the Government in 1893 and the Te Puke Block in 1878 from Waitaha and made a special settlement. Settlement of the Papamoa area was initiated by a group of local people from Te Puke and Tauranga who formed the Papamoa Homestead Association to purchase land. 1699 hectares was purchased in 1895 and divided into farms. By 1914 the BOP Times had described:

"Some thousands of acres northward of the main road, from the Waitao River to Kopuroa and out to the coast, consist mostly of rich swamp. This area known as Lower Papamoa...the expenditure of capital and labour in drainage and farming operations has converted it into the most fertile plain in the Tauranga County. Mixture of cattle and sheep farming with dairying."

Development of the area was hindered by lack of roading as the wetland was a natural barrier between Papamoa and Te Puke. The Kaituna River was utilised for the transport of goods to and from Te Puke. Alteration of the course of the lower Kaituna as part of the drainage of the wetlands was implemented in the 1920's and was finalised in the 1980's with wide channel created for sections. Draining of the wetland for pastoral farming created the biggest landscape change and the last area to be developed from

⁴ Stokes 1986

wetland occurred in the 1970's, the properties between the Kaituna Road and Kaituna River.

Kiwifruit orchards the more recent land activity were established on properties along Young, Te Tumu and Maketu Roads in the late 1970s and 1980s.

4.4.3 METHOD

Review of archaeological site information forms and ground survey of option routes.

Recorded sites are in the following locations:

- higher ground above the Kaituna wetland, which is an area of old dunes similar to area on coastal belt - East property.
- area on edge of wetland on firmer Pukaingataru Block.
- west side of SH2 (between Welcome Bay Road and Poplar Lane)
- No. 1 Road and Maketu Road.

See Figure 4.2 and 4.3.

No unrecorded sites were observed along the option routes that were examined but some recorded sites were confirmed.

4.4.4 ANALYSIS

Options A and B do not impact on archaeological sites with high cultural and scientific values. The Options avoid the lower Kaituna which has Pa and sites of cultural significance such as battle sites.

Recorded sites are located on the East property on Kaituna Road and properties on Te Tumu and Maketu Roads. The sites on the East property are on higher ground, an old dune system and access to this area would have been by the Waiamarae Stream (Figure 4.4) a small tributary of the Kaituna.

The description of sites in the Site Record Inventory although limited in site description information suggests evidence for settlement such as kainga in the locality. Survey of the East property revealed that archaeological evidence still remains (see Figure 4.5)

The slopes of Papamoa hill along SH2 from Welcome Bay Road to Poplar Lane has a high density of sites associated with pa and other forms of occupation sites there. The siting of houses and buildings, orchard and farm activity and SH2 may have impacted on archaeological sites.

FIGURE 4.2 - ARCHAEOLOGICAL SITES PAPAMOA

NZHPT Tauranga County

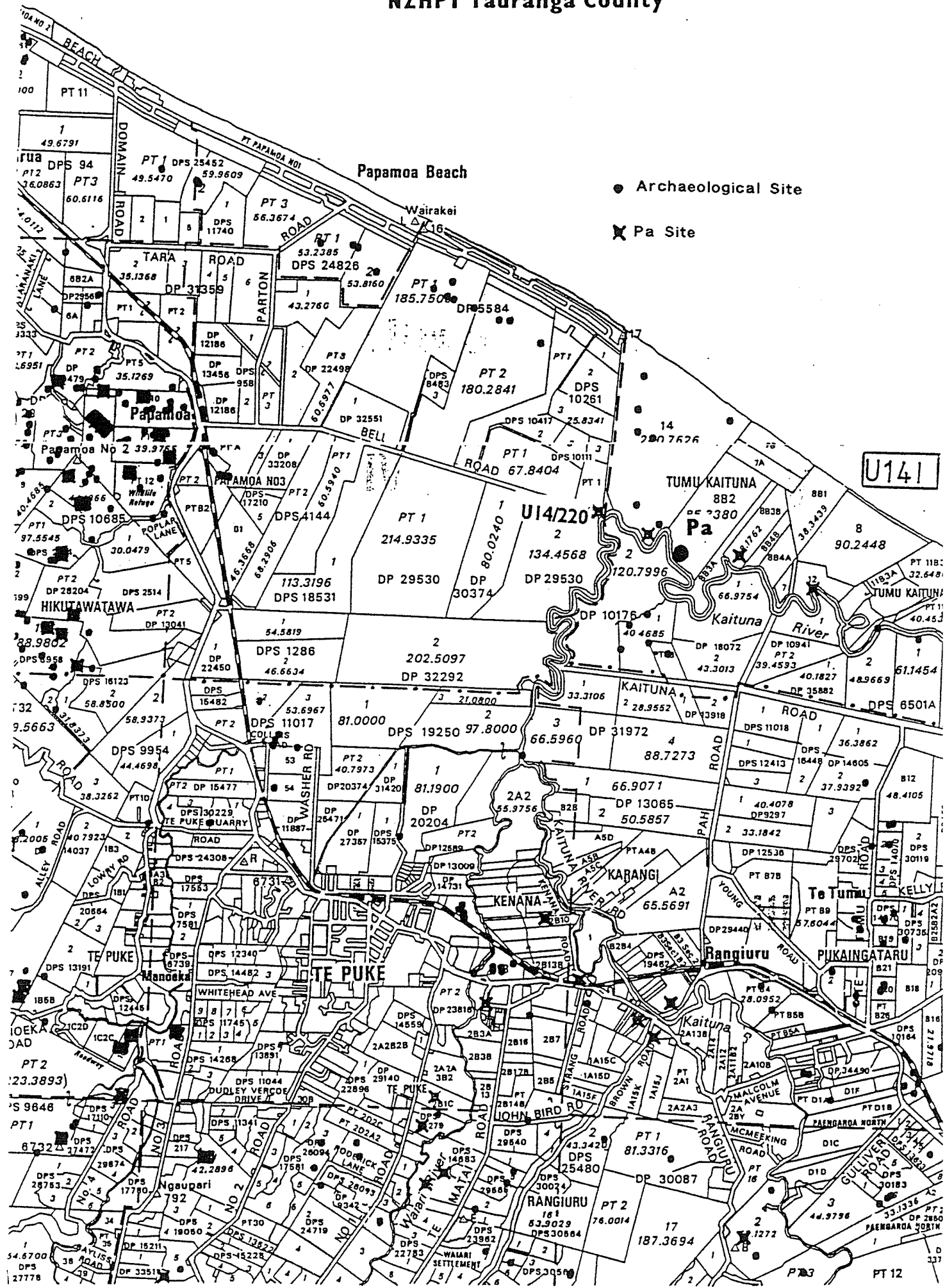


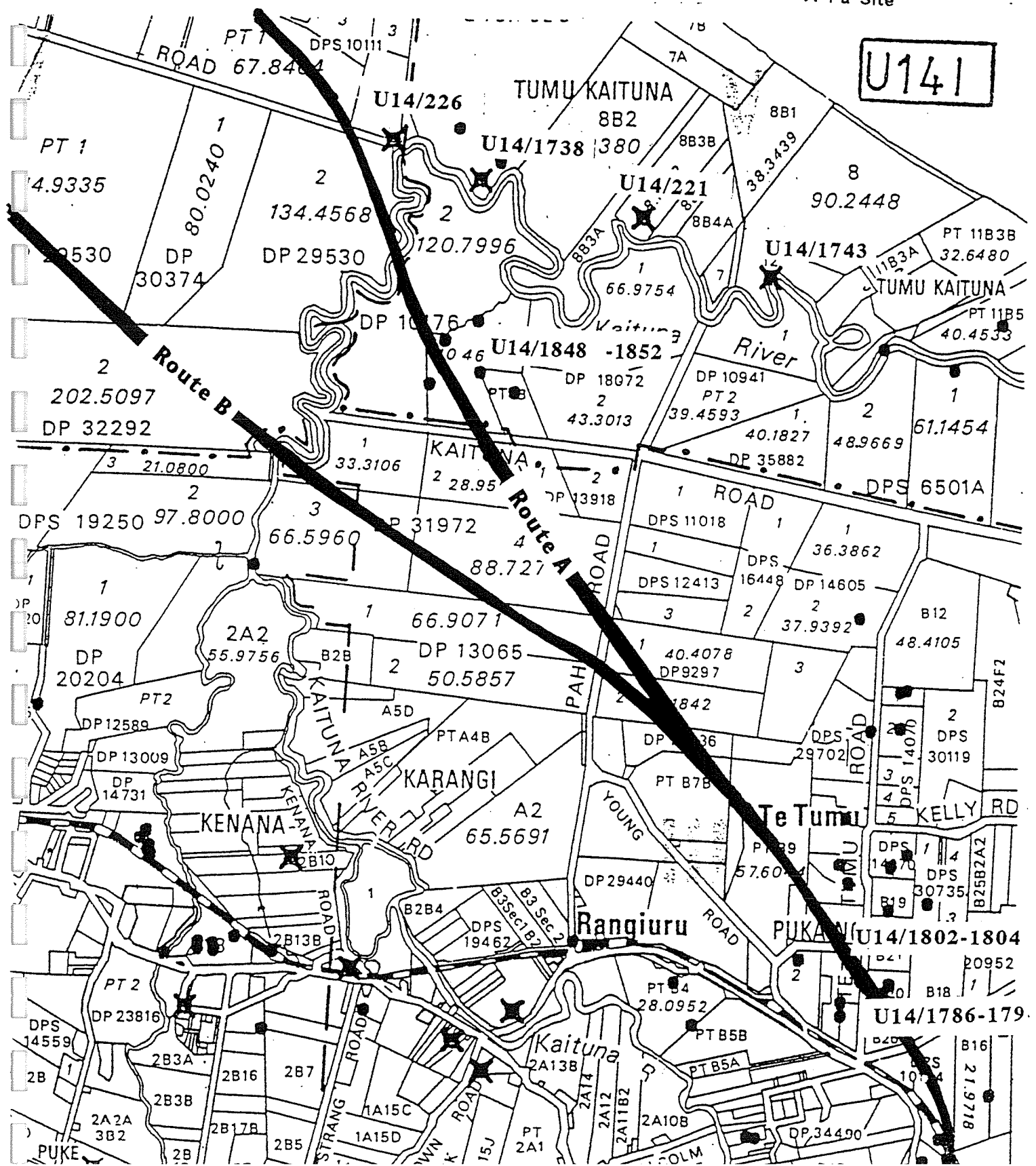
FIGURE 4.3 - ARCHAEOLOGICAL SITES

KAITUNA RIVER - PAKAINGATARU

Archaeological Sites Kaituna River - Pakaingataru

NZHPT Tauranga Historic Inventory

- Archaeological Site
- ✱ Pa Site



Although no sites have been identified in the former Kaituna wetland, archaeological sites are common in wetland areas throughout the country relating to the settlement and exploitation of the wetland areas for food and material resources, location of pa and other settlement features. Archaeological signature is not readily discernible in the Kaituna wetland, although wooden artefacts may be cached or structures remain preserved in waterlogged ground.

Research, fieldwork and consultation conducted by the author in the Papamoa and Te Tumu area reveal that there are areas of significant cultural values but these appear to be along the lower reaches of the Kaituna River.

Options A1 and A2

Options A1 and A2 basically follow the route of Option A but divert from Option A to continue along high ground to the end of Bells Road to cross Kaituna River east of Option A and converge with Option A on property on Young Road. Features of the A1 and A2 route are:

- The area of the options from end of Bells Road and the property of Te Mara Partnership on Youngs Road is former wetland.
- A1 and A2 crosses the Kaituna where it has been widened for flood control.
- Archaeological sites on the East property - vicinity of homestead.
- Absence of surface features for archaeological sites on former wetland area.

The impact of Options 1 and 2 will be slightly less than Option A where it avoids and crosses the Kaituna River. Where Options A1 and A2 diverge from each other south of Kaituna Road and then converge on the same route on the property off Youngs Road, there is no difference in values as this is former wetland area with no determinable archaeological features.

Option A3

Option A3 crosses Kaituna River at the end of Bells Road and runs further east of Options A1 and A2. Features of this route are:

- Possible existence of sites in the vicinity of the old Kaituna River.
- Avoidance of recorded archaeological sites in the vicinity of East homestead.
- The possibility of sites existing along the old dune system, northeast of East homestead.
- The route from Kaituna Road to Te Mara Partnership northern boundary is former wetland.

The values for Option A3 remain the same as Option A although the options cross in different locations.

The presence and likelihood of sites along Options A, A1, A2 and A3; and Options B and C are:

FIGURE 4.4 - U14/220

Air Maps 1994 179204



FIGURE 4.5 - KAITUNA RIVER

Air Maps 1994 179204



Options A, A1 and A2

- a. higher ground between Tara and Parton Road
- b. higher ground - from Parton Road to edge of wetland before Bell Road
- c. higher ground - banks of the former course of the Kaituna River
- d. higher ground - East property

Option A3

- a. higher ground between Tara and Parton Road
- b. higher ground - from Parton Road to edge of wetland before Bell Road
- c. higher ground - banks of the former course of the Kaituna River
- d. higher ground - vicinity of East property

Option B

- a. higher ground - banks of the former course of the Kaituna River.

The presence and likelihood of sites along Option A and B are:

- a. higher ground at northern end of Tara Road
- b. Pukaingataru (Young, Te Tumu and Maketu Roads)

Option C (SH2)

- a. Papamoa (Welcome Bay Road - Poplar Lane)
- b. Te Kahika - Kenana - Waitangi - Rangiuuru (Waiari River - Maketu Road)

4.4.5 CONCLUSION

| | |
|-------------------------------|--|
| Most Preferred Option | Option C (SH2) |
| Next Preferred Option | Option B |
| Least Preferred Option | (in order) <ul style="list-style-type: none"> i. Option A3 (excluding U14/220) ii. Option A iii. Option A1, 2 |

A1, A2 are the least preferred as they would traverse the East homestead where archaeological sites on the property have been identified.

The comments of weighting for the above options is based on a conservation ethic in minimising any disturbance to archaeological sites. Options A, A1, A2, A3 and B are new routes where impact is confined to the construction of the road.

Papamoa and Rangiuuru (Te Kahika, Kenana, Waitangi) have high cultural significance and archaeological values and the SH2 has impacted on the lower slopes of Papamoa as

well as Rangiuuru along the Kaituna River. Part of the impact of SH2 is property development along the highway as property owners in the past located residences and buildings along the highway for direct access. Consideration for any widening of SH2 is the location of significant sites such as Kenana a nineteenth century pa and settlement.

The difference between Option A and B is that where they cross over the Kaituna River. Option B avoids the lower Kaituna River with high archaeological and cultural values.

The location of both recorded sites and areas where there is a likelihood of archaeological sites, is at start of the two options along Tara Road and the area of Te Tumu and Maketu Roads. The Kaituna River will have the same archaeological values for both options but Option A on the East property off Kaituna Roads has recorded sites giving this route greater archaeological values.

4.4.6 RECOMMENDATION

Once the Option has been determined, a site survey to record or identify the likelihood of sites should be conducted and recommendations for the level of archaeological monitoring be made from this survey rather than report. This should include any cultural evaluation of area to determine level of monitoring. Cultural significance can be attributed to the four areas of sites identified in this report if the heritage values the archaeological sites reflect are:

- **Significant cultural values can be attributed to the site.**
- **The site is a particular settlement type or site of occupation or has other features or attributes that can be considered for heritage conservation.**

4.5 CULTURAL ASSESSMENT

The groups consulted on the options have been listed in Section 3. All iwi and hapu groups were contacted early in 1997 to determine the appropriate means of consultation for each group. The hapu groups were also invited to attend the Community Advisory Group meetings at which the constraints and first three options were discussed prior to publication.

In addition when the first three options were published in Newsletter No. 4 all hapu groups were contacted again and each chose consultation processes appropriate to their group. For some this meant discussing the options amongst the hapu and responding verbally, and for others hui were held and members of the consultant team attended. For Ngati Pikiao and Ngati Makino an article was placed in the hapu news sheet and the Open Day display was placed in the Rotorua offices for members to consider.

The following is a resume of responses from each hapu, moving from Tauranga to Paengaroa.

Nga Potiki (Ngaiterangi)

Preliminary hui were held on 29 April 1997 and 7 June 1997 and verbal advice as to spiritual and cultural sites received.

The hapu has advised that Nga Potiki are opposed to development of any kind in their hapu area including upgrading of highways. They prefer to have their claim with the Crown resolved prior to considering the detail of the highway project and they don't want to be part of the urban area.

Ngati Pukenga

Preliminary hui was held on 30 April 1997 and verbal advice as to spiritual and cultural sites was received. A meeting was attended on 26 November 1997 and Ngati Pukenga have formally advised that they do not have a problem with options A, B or C but would prefer Option A - the route closest to the sea. When the three variations of Option A were published they formally advised that they preferred A or A2 because they were more direct routes and they were alignments that were away from the wetlands.

Waitaha (Te Arawa)

A preliminary hui was held on 12 May 1997 and verbal advice as to spiritual and cultural sites was received. Waitaha did not require a formal hui to consider the options and have not formally responded on the six options. We have been advised that in the past Waitaha have supported Tapuika.

Tapuika (Te Arawa)

Preliminary hui was held on 12 May 1997 and verbal advice given on the spiritual and cultural areas of significance. The hapu representative enabled information about the project to be put over the local Maori radio station.

A hui for Tapuika and Ngati Whakaie was held at Moku Marae, Waitangi on 7 December 1997 at which the project and the first three options were discussed. No formal response on the three options has been received. It was clear from the hui that the hapu wished to be the authorised artefact collectors during the earthworks phase. It was also made clear that Maori land titles are to be avoided, and that Option C was not favoured because of the adverse effect on the Waitangi community.

Ngati Kapawa (Te Arawa)

A hui was held on 17 June 1997 in conjunction with Ngati Pikiiao and Ngati Makino, and on 23 July 1997 verbal advice was received about significant cultural and spiritual sites on the Te Tumu Kaituna Blocks 7 to 14. The hapu representative has formally advised that the hapu favour Option B with Option A a second preference. In both cases they favour the introduction of a flyover over the wetlands and the Kaituna River.

Ngati Pikiaro and Ngati Makino (Te Arawa)

Preliminary hui was held on 6 May 1997 with the hapu representative and the publication of information in the hapu newspaper was organised. A formal hui was held on 17 June 1997 at the Haumaitawhiti Marae (Rotorua environs). Verbal advice was received from the hapu representative as to significant cultural and spiritual sites.

The three options were published in the hapu newspaper and the hapu representative provided a formal response. There had been little response to the Panui magazine and he advised that generally the road alignments do not affect Ngati Pikiaro lands until nearer the junction at Paengaroa.

Ngati Whakaue (Te Arawa)

A hui was held on 7 May 1997 at the Whakaue Marae at which the hapu gathered expressed concern for the potential loss of their lands particularly the Te Tumu blocks and the likely pressure for development at Maketu as the travelling time to Tauranga will consequently reduce.

The hapu advised the consultants to use the heritage plans completed for the District Council as the spiritual and cultural sites of importance.

The hui at the Moka Marae on 7 December 1997 was a joint one with Tapuika and no formal response has been received. It was clear from the hui that the hapu wished to be authorised artefact collectors during the earthworks phase. It was also made clear that Maori land titles are to be avoided.

CONCLUSION

No clear direction has been received from the hapu groups as to the preferred alignment. Ngati Kapawa, Tapuika, and we believe Ngati Whakaue and Waitaha, do not favour Option C. The formal responses from Ngati Pukenga and Ngati Kapawa favour Options A, A2 and B, and therefore they have been give a 'most' ranking.

4.6 SOCIAL ASSESSMENT**4.6.1 INTRODUCTION**

The social assessment of the options is based on several matters. First there is the consideration of basic data including how many land titles are affected and how many dwellings, commercial and rural buildings are within a 100m band of the roadway. The band of influence is a guide to the degree of social disruption to lifestyles and amenity values. It inherently reveals the number of dwellings that would be removed and this may mean the shifting of a family and an enterprise. Given that on the large rural holdings the shifting of a dwelling may not necessarily be off site.

Secondly, analysis has been completed on the loss of dairy and horticultural production for each alignment. This has been based on the land area required for the road. Analysis of the economic impacts on the Te Puke business sector has also been undertaken including the potential for economic activity at other centres.

The third element is social effects to the individual householders.

These six options were developed in two phases with variations on Option A evolving in response to the issues that the community raised at the initial round of consultation. The issues are:

- to consider the ecological values of the Kaituna reserve and the oxbows, particularly the use of the agricultural part of the reserve
- to reduce the impacts on the management of individual farm blocks
- to use more of the sandhills country for an alignment based on geotechnical information
- to consider the potential for an interchange at Papamoa East for the long term urban development
- the lack of community confidence for construction of a road on peat soils
- to avoid Option C SH upgrade because of the severe impact on the Te Puke and Waitangi communities and all other land owners who have located relatively close to the SH.

The latter aspect means that Option C and the remainder are distinctly different and therefore the social issues are divided in the same way.

The differences in community issues between the five rural options are minor to almost negligible. There are no built up areas or townships across the Kaituna lowlands, simply rural communities east and west of the Kaituna River. In the east there is a pocket of intensive horticultural production and in the west there is a pocket of horticulture and lifestyle blocks on the periphery of the urban area at Domain Road.

4.6.2 CONSULTATION PROCESS

The three initial options were published in Newsletter No 4 and Open Days were held at Paengaroa, Te Puke and Papamoa. In addition Cottage Meetings (three) were held on request and numerous phone calls and individual meetings were conducted. Submissions (104) were received from the public. The public response to the options was evenly spread with no clear mandate for a particular option.

Three further options were developed and presented to the landowners directly affected through Cottage Meetings and by way of Newsletter No. 5 which provided the opportunity for community comment. Forty two submissions were received on the variations to Option A. The majority were concerned with the ongoing protection and enhancement of the Kaituna Wildlife Reserve.

4.6.3 BUSINESS EFFECTS

A four lane highway through Te Puke and Waitangi would severely disrupt and dislocate the community. The road would act as a barrier with alternative roading links requiring more land and buildings to be relocated. This would be particularly severe in the small town of Waitangi where social facilities are on both sides of the existing road. Option C also affects three cemeteries which will have emotional effects for some sectors of the community.

The four versions of Option A provide the opportunity for an interchange to the longer term residential area of Papamoa east.

An analysis was completed of the land taken out of rural production by each option. The land area to be removed from production was valued in terms of dairy or horticultural productivity.

Kaituna lowland options involve the loss of agricultural production which may in some cases jeopardise the viability of the block and farm management, particularly races, will require reorganisation. This will be very disruptive to farm management over several seasons as the highway is built. The loss of agricultural and horticultural production has been analysed as follows:

| | |
|----|-----------------|
| A | \$591,750/annum |
| B | \$722,250/annum |
| A1 | \$621,500/annum |
| A2 | \$575,250/annum |
| A3 | \$413,250/annum |

In addition all versions of Option A would require the removal of a major coolstore/packhouse facility. However such a service may relocate or other operators take on the additional demand. It is therefore a transfer of business activity rather than a loss.

Option C has relatively minor effects on agricultural production because the option involves the acquisition of a 10 metre strip off all properties. Option B affects rural productivity the most.

An economic analysis of the Te Puke business sector has been undertaken.

An arterial route which bypasses Te Puke and Waitangi is expected to have four main impacts which are:

1. Reduced economic activity in Te Puke as passing trade no longer stops and shops there (i.e. net inflow is reduced).
2. Increased economic activity in Te Puke as local consumers are no longer put off visiting the CBD by heavy traffic flows (i.e. net outflow is reduced).
3. Increased activity in other localities (e.g. Mount Maunganui, Paengaroa) for travellers if Te Puke is bypassed (i.e. net inflow is increased).
4. Reduced activity in those other localities due to increase in heavy traffic flows (i.e. net outflow is increased).

The analysis looked at Te Puke's business sector activities in the context of the local market and the "passing trade" market "opportunity to spend" factors. This involves reconciling current retail supply and demand within the Te Puke catchment, to identify the degree of sales leakage to other centres. The amount spent by travellers as passing trade

has been estimated to show the extent of the town's reliance on the highway bringing travellers through.

Having estimated Te Puke's degree of reliance on passing trade (11% of the town's total retail sales, and some 70 jobs), the next step was to assess likely impacts of the Arterial Road options on Te Puke.

Mount Maunganui and Tauranga are likely to lose some of the trade they currently attract from the Te Puke catchment, but gain diverted passing trade. Because Te Puke is expected to experience a net loss under Option A, A1, A2, A3 and B, then Tauranga and Mount Maunganui will experience a net gain. Since this gain will represent a small component of their total trade levels, the effects on the retail and trade sectors as a whole in the two towns are likely to be insignificant.

Option C is expected to result in a smaller loss of passing trade through Te Puke and an increase in sales leakage for the town. This will have some positive impacts on Tauranga and Mount Maunganui, which attract Te Puke household demand, of a similar nature to Option A, A1, A2, A3 and B (most of Te Puke's loss of \$2.6 million in retail sales).

Under Option C, the effect on Paengaroa will be considerably less because the diversion of passing trade from Te Puke will be less.

Overall, it is expected that the reduction in **sales leakage** would be less than the amount lost in passing trade. The overall net loss is estimated at \$3.7 million, and the distribution across the store-types reflects mainly their shares of total sales. Food retailing will benefit from the bypass options, as will general merchandise.

The overall drop in sales by \$3.7 million would be associated with a net employment loss of around 30 employees. The auto services store-type will be severely affected as around 25% of its current sales is derived from passing trade, and a reduction of over \$5 million in sales can be anticipated.

It is clear that the Te Puke retail and other trade sector loses a significant amount of sales because local residents shop instead in Tauranga and Mount Maunganui - in part due to poor environmental conditions in the Te Puke main business area. However, Te Puke residents go elsewhere for reasons other than heavy traffic in their main streets, including more competitive shopping environments in the larger centres. All of the options involve trade-offs for Te Puke, and are likely to see retail sales diverted from Te Puke, principally to Tauranga and Mount Maunganui.

This leakage represents reduced employment opportunities in Te Puke and reduced economic activity both to retailers and the industries servicing them (including transport, suppliers, building owners etc).

However, the change is unlikely to have a net regional impact, since the employment and economic activity is transferred to other centres within the region, especially Tauranga. Therefore, the impacts represent a cost to the town of Te Puke and its community (including the business community).

Further, the comparison is just one of direct impacts. These impacts will continue to flow through the Te Puke economy in the form of indirect and induced effects. While it is not possible to create robust multipliers to show the total effects in such a small economy, it is clear that the total impacts will be greater than the direct impacts - reduced local business activity and employment with impact the activity in other businesses not directly affected by the arterial route changes.

Overall, it would be expected that Te Puke retail sales would decrease by \$3.5 million per annum, the combined effects of the \$0.87 million loss of passing trade, and the \$2.6 million increase in sales leakage. This loss of retail trade will affect 30 jobs in the Te Puke retail sector.

Because it would have slightly lower direct net impacts on Te Puke, Option C may be seen as the most preferred option - it has the lowest negative direct impact. Option A, A1, A2, A3 and B have similar impacts, reducing the amount of passing trade through Te Puke which is partly offset by reduced sales leakage.

However, the differences in outcomes are small, and it is not expected that the degree of trade impact on the Te Puke economy (and therefore the community) will be critical in the decision process.

While Option C has shown to be the most preferred relative to the other options, it must be noted that all options are expected to result in negative impacts on Te Puke.

4.6.4 PROPERTIES AFFECTED

As explained in Section 4.6.1, consideration has been given to a 100m band of influence on each side of the proposed routes as an indication of likely social disruption and change in the character of the locality. This is not to be confused with potential noise contour effects. Table 4.2 provides a breakdown of the potential effects.

Table 4.2 - Route Comparisons - Properties Affected

| Option | Dwellings 100m Band | Comm/Rural Buildings 100m Band | Titles Directly Affected |
|--------|------------------------|--------------------------------------|--------------------------------|
| A | 21 (4) ¹ | 22 | 47 |
| A1 | 15 (3) | 24 | 57 |
| A2 | 16 (4) | 22 | 53 |
| A3 | 19 (4) | 20 | 51 |
| B | 18 (3) | 16 | 52 |
| C | 248 (0) | 309 | 380 |

Key: ¹ homes removed

Option C, as expected, affects a far greater community being 248 dwellings within a 100m band of the roadway and 309 commercial/rural/public buildings and enterprises. It would appear from the preliminary plans that no dwellings would be removed. Option C also affects a significantly greater number of titles - approximately 380.

The distinctions between the five remaining options are not great. All options other than C require the removal of 3 - 4 homes. Option B affects the least structures but not the least titles.

4.6.5 SOCIAL EFFECTS

- A significant proportion of those affected by options had a preference for "Option 4". Option 4 is not a part of this study but is an option previously considered by Transit NZ in the early 1990s. This option, also known as the Sandhills Route, took a similar line across the sandhills parallel to Parton Road and then continued in an eastward direction beyond the Kaituna Reserve and turned inland to run along Te Tumu Road to intersect with the highways north of Paengaroa. This has been discussed in Section 3 of this report. Option 4 was mentioned by 21 of the 104 initial responses as their preferred route. The major factor in this opinion is the fact that it would be built on sandhills and avoid the swamp, providing a better roading surface. It was perceived to affect fewer owners. The concern at cutting up large dairy units and the corresponding decrease in economic viability was considered important. This option was considered more cost effective by some although this has been disproved in Section 3.
- Many in the community commented on the need for a bypass in the short term, asking that it be built "as soon as possible". It was pointed out that there is already congestion on the road, that the SH is already dangerous with its lack of passing lanes and that both Te Puke and Waitangi are under pressure.

There were suggestions that the logs be sent by rail to eliminate logging trucks from the road, and action be taken to decrease the speed of the trucks.

- There is considerable concern that options avoid Maori land and disadvantage Pakeha landowners.
- The community are concerned about the poor stability of the peat which would make construction more difficult and costly and maintenance an on-going problem. This was considered a point against Route B. Options that maximised the use of sandhills were seen as commonsense.
- Drainage must be taken into account in choosing and designing the final route. The Kaituna Flood Protection Scheme was mentioned as responsible for the high productivity of the dairy farms affected by it. The scheme is still being paid off, and some considered that the scheme should be reimbursed by Transit NZ where land compensation acquisition affects the Regional Council's financial package. Drainage is a very important factor for farmers and that there must be minimal effects from the road on water quality, the existing drainage and flood protection works, and drainage into the Kaituna River.

- There are divergent views on the value of the Kaituna Wetlands, particularly at the western side of the Kaituna Reserve where farmland is included. We understand the farmland is currently revenue producing and that ultimately the plan is to restore the ground. Some considered the wetlands were important and required preservation. Fish & Game NZ were concerned about disturbance to wildlife, particularly game birds and their habitat with increased noise, light and traffic and the possible imposition of unjust restrictions on users of the wetlands. EBOP, the Bay of Plenty Conservation Board and Western Bay of Plenty Fish & Game Club wished to avoid any adverse impact on the wetlands. Others see the wetland as partially formed and not of great botanical value. The majority of submissions received after Newsletter No. 5 concerned the loss of reserve land inherent in Option A3, although it is clear that the potential for land swaps and enhanced reserve drainage is not commonly understood.
- Option C was considered a poor choice by those living on the SH, in Waitangi and Te Puke, but a good choice especially by those affected by Options A and B. There were suggestions for a short bypass of Te Puke which has been considered by the community in 1997.
- There were comments on individual design points, for example on and off ramp design, roundabouts.
- There was major concern about the effect of the options on the farming enterprises affected, both dairy and horticultural. This was the reason for many choosing Option 4 as their preferred alternative. The initial options (A and B) did not follow property boundaries, but bisected the farms making farming the land much more difficult, physically and economically, particularly the practicality of stock underpasses and effective land drainage. The potential loss or partial loss of a farm is viewed with great anguish and grief by many farmers who have worked the land for years, invested in the land drainage system etc. and potential hope to hand the farm on to family members.

If farming units are considered instead of land titles, the range of impacted properties between the lowland options remains similar.

- The A options were seen by the Western Bay of Plenty District Council as providing a useful barrier between proposed residential and industrial areas.
- The recreational value of the river has not featured in responses. The recreational value of the Kaituna Reserve has been highlighted by the second series of submissions following Newsletter No. 5.

4.6.6 CONCLUSION

The determination of the preferred option in social terms is extremely difficult. The preferred options is a matter of minimising the adverse effects.

Option C, although preferable from a Te Puke commercial point of view and from a rural production point of view, does not have acceptable effects in terms of physical impact on properties along the existing highway. The development of four lanes and

service roads along the existing highway would have severe social and cultural effects, particularly in Te Puke and Waitangi.

The margins between other options are minimal. The number of houses directly affected in all remaining five options is very similar (3 or 4). The opportunity for a Papamoa East interchange for future urban development does add weight to an Option A (1, 2, 3) preference. Options A1, A2 and A3 maximise the opportunities for urban and rural development on the land seaward of Bell Road by being aligned on the edge of the sandhill country. They also follow property boundaries in this area more closely. Option A3 has the least impact in terms of rural production losses, and on the eastern side of the river it has been aligned to minimise disruption to the farms it affects. Option B would affect/disrupt the least number of commercial/rural buildings within the study band. However Option B does not have the least impact in terms of dwellings within the study band, titles directly affected or rural production losses. Although Option B affects fewer farms the impacts on those farms are considered to be far greater. All A and B options adversely affect Te Puke retail sales with an estimated loss of \$3.5 million and 30 jobs in the retail sector.

Although Option A3 impinges on the reserve, the alignment is a compromise for the highly valued farming area, developed by a drainage scheme, and the much reduced and highly valued wetland that remains as a residue from the drainage scheme. A3 is an option that attempts to minimise impacts on both rural production and ecological values, particularly the long term potential for enhancement. For these reasons Option A3 would be considered to be slightly better than the others and has been ranked as "Most Preferred".

4.7 NOISE

4.7.1 INTRODUCTION

The noise emission for each option has been predicted using standard noise models and the effects of that noise on potentially affected residents has been assessed using data on human response to transport noise.

4.7.2 EXISTING NOISE ENVIRONMENT

To assist with the prediction of the impact of noise from the proposed options noise surveys of the existing environment were carried out.

The area through which options A, A1, A2, A3 and B pass has a typical rural noise environment with a very low background noise with occasional intruding noise from traffic on local roads, or farming machinery. A noise monitor was placed on the Steiner property in Bell Road. This monitored noise continuously and recorded a summary each hour for a week (11-18 December 1997). A typical plot of noise level over a 24 hour period is shown in Figure 4.6. The noise levels are low, averaging 45dBA⁵ (L_{eq}) during the day and 30-35dBA at night. This would be a low noise environment according to Transit NZ guidelines. Refer paragraph 4.6.5.1.

⁵ dBA - A measurement of sound pressure level which has its frequency characteristics modified by a filter so as to more closely approximate the frequency bias of the human ear.

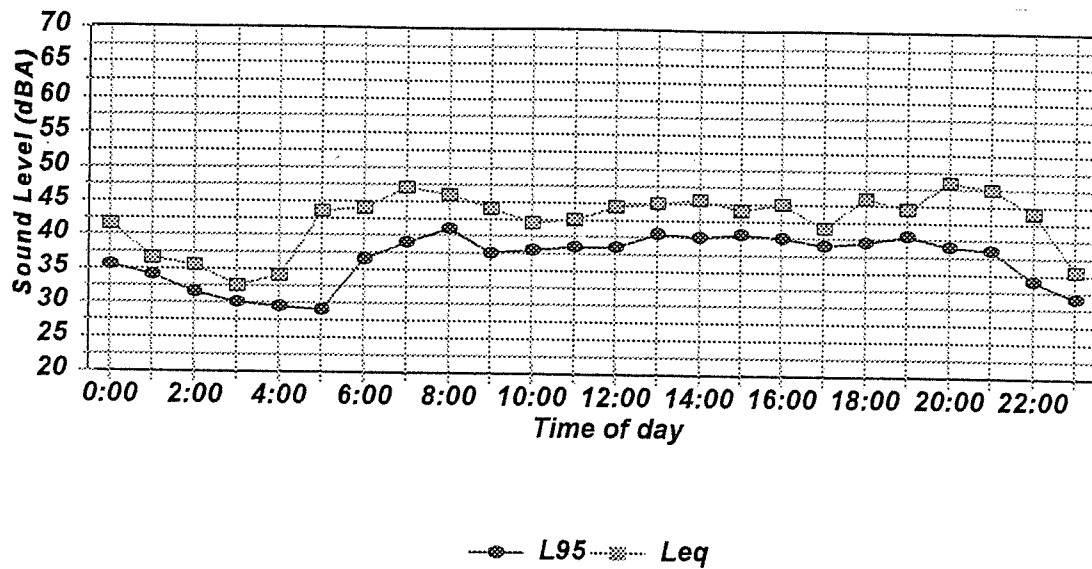


Figure 4.6 - Ambient Noise Survey Te Puke: Steiner - Bell Road

A noise monitor was placed in the Espin property near the Paengaroa end of routes A, A1, A2, A3 and B (18-23 December). A typical plot of noise levels over a 24 hour period is shown in Figure 4.7. The noise levels are still low, but a little higher than the Steiner site in Bell Road. This location would also be classified as low noise environment according to Transit NZ guidelines.

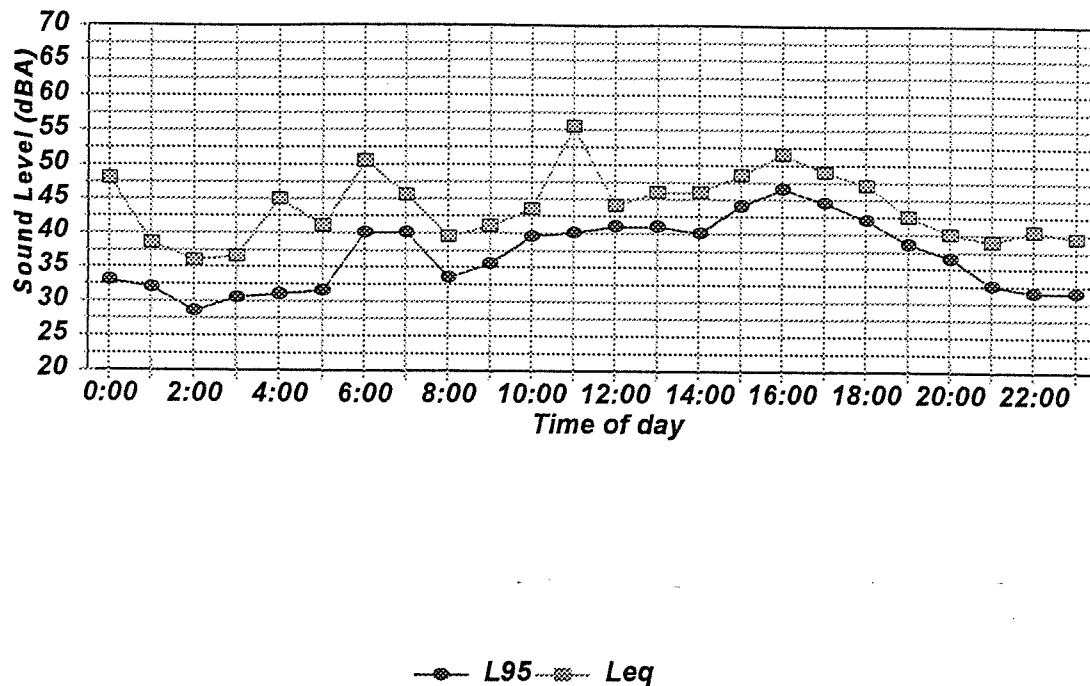


Figure 4.7 - Ambient Noise Survey Te Puke: Espin - Te Tumu Road

The noise environment in the vicinity of option C (the existing SH2) is dominated by road traffic noise from SH2. A noise monitor was placed in Landscape Road at the eastern end of Te Puke, approximately 40 metres from SH2 (5-11 December). A typical plot of noise levels over a 24 hour period is shown in Figure 4.8. It can be seen that the average noise levels (L_{eq}) during the day are between 55 and 60 dBA, with the background noise (L_{95})⁶ between 40 and 45 dBA. At night the traffic noise falls dramatically and average noise levels are typically between 35 and 40 dBA. The night time background is 30 dBA or less. Further away from the roadway the noise levels will be less, until at greater than 500 metres the noise from traffic would be insignificant.

According to Transit NZ's Guidelines, houses closer than 40 metres would be in a high noise environment, between 40 and 200 metres from the highway would be classified as a medium noise environment, and houses further than 200 metres would be in a low noise environment.

⁶ L_{95} - The noise level which is equalled or exceeded for 95% of the measurement period. L_{95} is an indicator of the mean minimum noise level and is used in New Zealand as the description for background noise (usually in dBA).

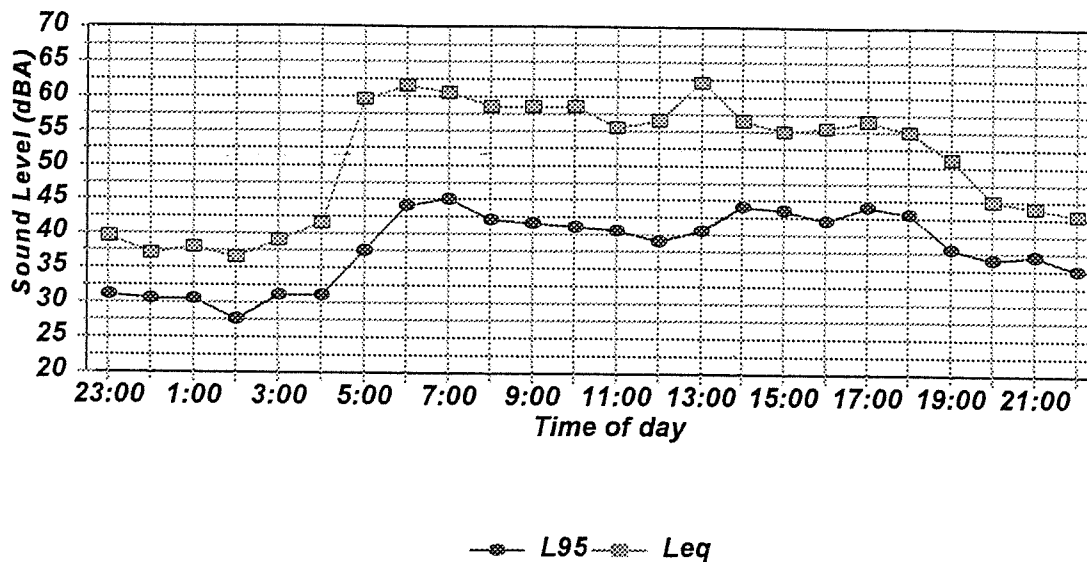


Figure 4.8 Ambient Noise Survey Te Puke: 12 Landscape Road

In summary options A, A1, A2, A3 and B pass through quiet rural areas which currently have very low noise levels. Option C, which is the existing SH, has a noisy environment within 40 metres of the highway, and a quiet environment more than 200 metres away from the highway with a graduation of effects in between.

4.7.3 DISTRICT PLAN RULES

The Tauranga and Western Bay of Plenty District Plans do not contain any rules pertaining to noise from roads or highways except that the Western Bay of Plenty Plan, in clause 13.2.3 (f), states that the Council shall have regard to the Transit NZ guidelines. Both plans refer to NZS6803P for construction activities (see Section 4.7.7).

It is clear from the rules governing other noise sources that the area is regarded as a relatively quiet area requiring quite stringent control of noise. The Transit NZ guidelines (see Section 4.7.5) requiring a design level of 55dBA are consistent with this policy.

4.7.4 PREDICTION OF TRAFFIC NOISE

The generation and propagation of traffic noise is well understood and there are a number of established methods for predicting traffic noise. For freely flowing traffic the Department of Transport in Britain have published a detailed model [1] which can be

used to predict the L_{10}^7 (18 hour) noise level. Transit NZ has commissioned research to adapt this to New Zealand conditions [2].

These two models have been used to predict the noise contours for each option. The prediction models use the following variables:

- traffic flows
- traffic composition (heavy vehicle ratio)
- gradient and average speed
- distance from kerb
- height of receiver above ground
- type of ground between road and receiver
- acoustic screening (hills, earth bunds, noise barriers)
- road surface

The data used for the calculations were as follows:

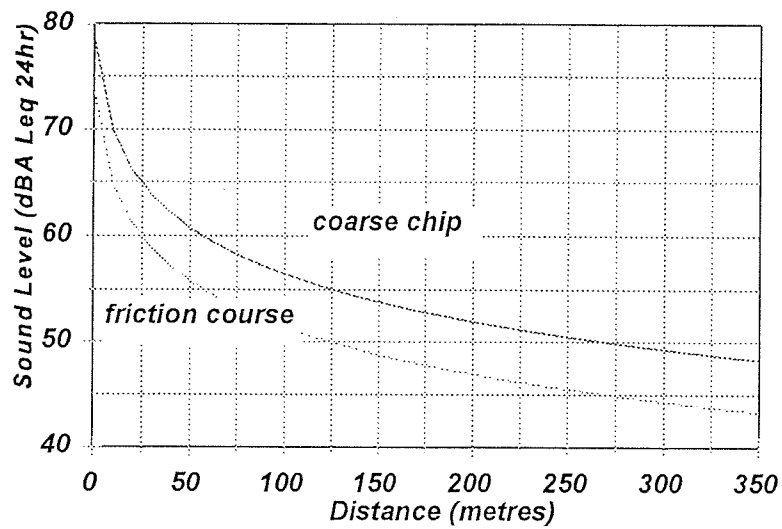
| | | |
|---------------------------|---------------------------|----------------------------|
| traffic flow (year 2011): | Options A, A1, A2, A3 & B | 9,230 vpd |
| | Old route | 13,510 vpd (north Te Puke) |
| | | 10,690 vpd (south Te Puke) |
| | Option C | 22,730 vpd (north Te Puke) |
| | | 19,910 vpd (south Te Puke) |

A graph showing the predicted noise level versus the distance from the edge of the road is given in Figure 4.9. Note that coarse chip is the normal road surface for such roads and the higher cost of friction course would normally only be justified where there is a specific need. Figure 4.9 can be used to predict the noise levels of any particular residence before any mitigation work is carried out. It should be noted however, that Transit NZ guidelines will require mitigation for houses adjacent to options A, A1, A2, A3 or B to limit noise levels to 55dBA (L_{eq} 24 hour)⁸.

Figure 4.10 is a typical set of noise contours for Option A near the Paengaroa end.

⁷ L_{10} - The noise level which is equalled or exceeded for 10% of the measurement period. L_{10} is an indicator of the mean maximum noise level and is used in New Zealand as the description for intrusive noise (in dBA).

⁸ L_{eq} (24 hour) - The noise level averaged over a 24 hour period (on a log/energy basis).



Noise level as a function of distance
from the roadway (9230v/day 100kph)

Figure 4.9 - Noise Level as a Function of Distance



Figure 4.10 - Predicted Noise Contours For Option B Near Paengaroa

4.7.5 ASSESSMENT OF NOISE IMPACT

4.7.5.1 Introduction

Noise from road traffic is the most widespread form of noise pollution in New Zealand. Its effects are felt in all urban areas and within several hundred metres of major roads such as SH2. It has many effects including annoyance, interference with listening to conversation, TV or radio, disturbance of sleep and loss of sense of quietness. A table of effects developed from an OECD report on transportation noise [3] is given below. This summarises in a very shortened form the principal effects of traffic noise.

| Noise Level Exposure (L_{eq}) | Description of Effects |
|-----------------------------------|--|
| > 65 dBA | Constrained behaviour patterns arise, symptomatic of serious damage caused by noise |
| 60-65 dBA | Behaviour designed to reduce annoyance is exhibited, although this is not too constraining. However, the effects on sleep and especially the level of annoyance increase very appreciably. |
| 55-60 dBA | Noise impact is limited but some disturbance is probably occasioned to more sensitive individuals, in particular older persons |
| < 55 dBA | Damage caused by noise is very slight, sound conditions enable the most noise sensitive activities to be carried on normally. |

A graph showing the percentage of the population annoyed by different levels of transportation noise is shown in Figure 4.11.

Transit NZ has produced a set of draft guidelines [5] which set out the design criteria for SH improvements. However, it must be noted that these are not assessment criteria, rather they define noise levels that must be achieved at the design stage. The design noise levels vary depending on the existing noise environment.

4.7.5.2 Methodology

The basic methodology used in this study was to predict the noise level at each affected dwelling, then compare the effect of each route by comparing the numbers of dwellings exposed and the magnitudes of exposure for each option. However to enable an overall comparison between routes a method was developed for comparing different exposures. This method evaluates whether for instance 40 houses exposed to 68 dBA is a worse effect than 30 houses exposed to 72 dBA. The curve in Figure 4.11 relating exposure to annoyance has been used. This shows that at 72 dBA people are 50% more likely to be highly annoyed than at 68 dBA, so the exposure of 30 houses to 72 dBA is likely to result in more people in total being annoyed than 40 houses exposed to 68 dBA. This annoyance curve has been used as a weighting on each level of exposure so that a total annoyance score can be derived for each option. The annoyance score is representative of the number of people likely to be highly annoyed by the traffic noise for that option.

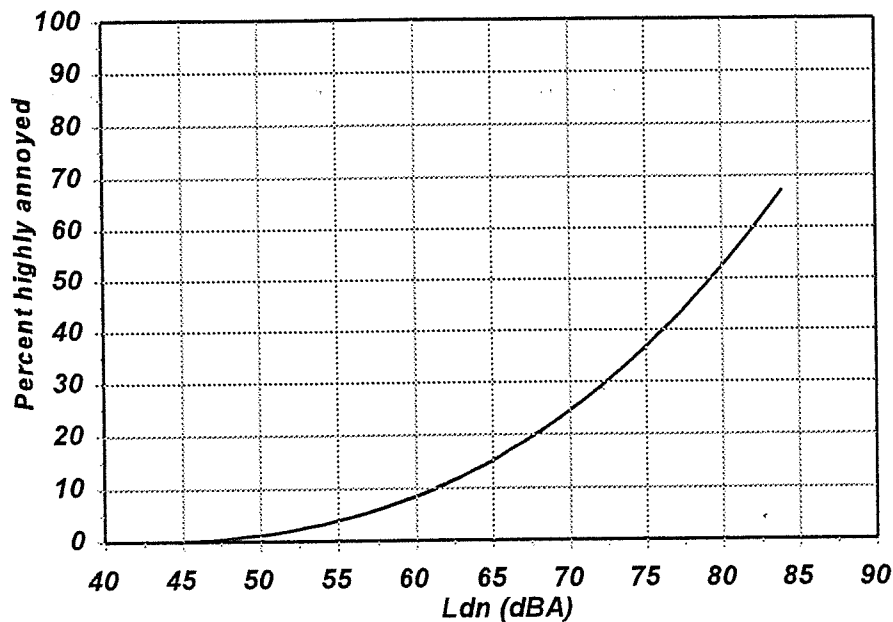


Figure 4.11 - Community Response to Noise

This approach enables a comparison to be made of different situations such as a few people exposed to high noise levels compared to a larger number exposed to moderate levels. It also enables reductions in noise level to be accounted for in the comparison. For instance options A, A1, A2, A3 and B will reduce traffic flows along the current SH2 alignment and so lower noise levels for houses close to the road. This is a positive benefit associated with these options.

4.7.5.3 Allowance for Mitigation

If the preferred option is constructed, noise mitigation work will be required. For the comparison of options, simple mitigation such as choosing appropriate road surfaces, ensuring smooth traffic flow and avoiding very close separations was assumed.

However, full mitigation including berms and barriers was not assumed. This is because noise mitigation tends to obscure the differences between routes by reducing the worst exposures. However, this reduction in exposure comes at the cost of increasing other effects (such as reduction of visual amenity, additional cost of earth berms, extra run off and water pollution due to construction of earth berms, additional land requirements required for construction of mitigation work etc). Thus, two routes may appear equal in effect with mitigation work in place, but the best route is the one that requires the least mitigation work, since this will reduce the side effects of the mitigation resulting in the best overall solution.

4.7.6 EVALUATION OF IMPACT

4.7.6.1 Overall Assessment

The techniques and data discussed in the preceding sections were used to analyse the effect of each option. The existing noise level at each affected house was estimated from the noise surveys carried out, and the predicted noise level for each option was estimated using traffic flow data. The affected houses were then classified according to whether the effects were major or minor, and an overall impact rating was calculated for each option.

Options A, A1, A2, A3 and B directly affect about 70 - 80 houses which are currently in a quiet rural environment, and indirectly have a beneficial affect on about 110 houses adjacent to SH2 by reducing traffic noise on that route. Option C directly affects about 110 houses which are currently already exposed to noise from SH2.

To show the differences between the options, the impact of each route was classified according to the following rules:

- Those dwellings for which the proposed option increased the percentage of highly annoyed by more than 12% were classified as severely affected. Thus dwellings not previously exposed to traffic noise but now predicted to be exposed to more than 60 dBA were classified as severely affected, but dwellings previously exposed to 60 dBA would have to increase to 68 dBA to be severely affected.
- Dwellings for which the percentage of highly annoyed increased between 6 and 12% were classified as moderately affected.
- Dwellings for which the % highly annoyed increased by 0-6% were classified as minorly affected.
- Reductions in annoyance were similarly classified as minor, moderate and significant.

The number of houses within each category of effect are given in Table 4.4 for options A, A1, A2, A3 and B. For Option C, within the ten year time span considered in this analysis the predicted increase in traffic will lead to only a minor increase in impact on the existing dwellings. Over a longer time span such as 40 years the impact would be moderate.

| Description of Effect | Affected Dwellings | | | | | |
|-----------------------|--------------------|-----------|-----------|-----------|----------|----------|
| | Option A | Option A1 | Option A2 | Option A3 | Option B | Option C |
| Severe negative | 8 | 4 | 5 | 0 | 5 | 0 |
| Moderate negative | 8 | 7 | 4 | 8 | 5 | 0 |
| Minor negative | 42 | 43 | 50 | 47 | 45 | 107 |
| Minor benefit | 17 | 14 | 14 | 15 | 20 | 0 |
| Moderate benefit | 107 | 107 | 107 | 107 | 107 | 0 |
| Significant benefit | 0 | 0 | 0 | 0 | 0 | 0 |

The overall impact values are given in the table below.

| Option | Traffic Noise Impact Value | | Total Impact Value |
|--------|------------------------------|----------------------|--------------------|
| | Houses adjacent Existing SH2 | Houses away from SH2 | |
| A | 14.2 | 4.9 | 19.1 |
| A1 | 14.2 | 4.1 | 18.2 |
| A2 | 14.2 | 4.2 | 18.4 |
| A3 | 14.2 | 3.9 | 18.0 |
| B | 14.2 | 4.4 | 18.6 |
| C | 20.8 | 0 | 20.8 |

It can be seen that options A, A1, A2, A3 and B have a very similar overall rating, with a small advantage for option A3. All options have the effect of reducing noise exposure of houses on the current SH2 (from 20.8 to 14.2) and thus all have a lower noise rating than Option C. The order of preference simply in terms of traffic noise impact is; Option A3, A1, A2, B, A, and C.

It must be remembered that in this analysis there is no consideration of social equity. Many people who have bought houses near SH2 have bought knowing and accepting the noise environment, while conversely people buying properties near options A and B have had an expectation of a quiet environment. The analysis given in the table above assumes that a reduction in existing noise along SH2 can offset increases elsewhere. If reductions in noise on the existing route were ignored on the grounds of social equity then the order of preference would be C, A3, A1 or A2, B, A.

However it must also be remembered that this analysis has assumed limited mitigation. If mitigation were carried out in accordance with Transit NZ guidelines the effect would be to reduce the impact of options A, A1, A2, A3 and B because the guidelines would require mitigation of noise to no more than 55 dBA (L_{eq} 24 hour), at which level the effects are minor.

On balance it is our opinion that the ability to mitigate the noise of the new routes to 55 dBA or less counterbalances or offsets considerations of equity and therefore our overall preference would be A3, A1 or A2, B, A then C.

4.7.6.2 Assessment of Night Time Effects

At night the major effect of traffic noise is disturbance of sleep. A considerable amount of research has been carried out on the effects of traffic noise on sleep and it has been found that it is the maximum noise levels which disturb sleep rather the average noise levels. Thus it is the heavy vehicles which determine night time noise effects since they produce the highest maximum noise levels, even though they may be a small proportion of the total vehicle flow.

Vallet [6] has suggested noise limits of 50 dBA as the maximum noise level inside a bedroom to avoid sleep disturbance. An average New Zealand house will reduce noise levels by 20 dBA with closed windows, or 10-15 dBA with open windows, therefore an external noise limit of 60 to 65 dBA would be sufficient to avoid sleep disturbance even with open windows. From measurements carried out by Marshall Day Associates it can be shown that the mean maximum noise level of heavy vehicles is 65dBA at 120m. Transit NZ's design guidelines require mitigation for houses closer than 12m. Note that Transit NZ's design guidelines are less stringent than our assessment criteria, assuming a quieter vehicle and permitting some degree of sleep disturbance. However, for the purpose of assessment it is more appropriate to take a more conservative approach.

To assess the noise effects at night time the number of residents within 120m of each route have been counted and are given in the table below.

| Number of houses affected by night time noise peaks | |
|---|----|
| Option A | 21 |
| Option A1 | 24 |
| Option A2 | 22 |
| Option A3 | 18 |
| Option B | 16 |

Option B has the fewest houses affected, whereas option A1 has the most.

It is noted that for option C the situation would not change from that which currently exists.

4.7.7 CONSTRUCTION NOISE

The construction of any of these options will involve powerful earthmoving machinery driven by large diesel engines which generate high noises. Table 4.6 shows the range of noise levels typically generated by earthmoving machinery.

4.7.8 CONCLUSIONS

Noise effects from six options for the alignment of SH2 between Domain Road and Paengaroa have been studied. Options A, A1, A2, A3 and B are new routes through quiet rural environments which directly affect between 70 and 80 dwellings by potentially increasing noise levels significantly. There is an indirect benefit from all of these options of reducing noise on the current SH2 alignment for about 110 dwellings. Option C is the current alignment, which will be widened. The effect of this option will be a gradual deterioration in the existing noise environment for about 110 dwellings.

From an overall point of view, the order of preference on noise considerations alone would be options A3, A1, A2, B, A then C. There is only a small variation between options A1, A2, A3, and B and all options could be mitigated so that the effects of noise would be very minor for all current dwellings along the new route and would meet Transit NZ design guidelines. Option C would be difficult to mitigate to the same degree because of the closeness of some existing houses.

Construction of any option would result in high levels of noise being generated. Mitigation of construction noise would be necessary in order to avoid unreasonable exposure to some residents.

4.8 SUMMARY OF ENVIRONMENTAL FACTORS

Table 4.6 shows the overall rating of the six options. Options C and A1 have least preferred ratings for 50% or more of the factors and it is therefore recommended that they be dropped from further consideration.

The table below indicates that there is not a clear winner in the environmental analysis of the options. There are four favoured options, A, A2, A3 and B. As Option B has not scored any "least" preferred, environmentally it appears to marginally win. With regards to the "A" options remaining, if the ratings are then ignored, the remaining three can be compared against each other in terms of the assessed advantages and disadvantages.

Of these, Option A3 was preferred over the other two archaeologically (if it avoids the Pa site), socially and in terms of noise.

It is difficult to assess the cultural preference as this has not been made clear. Three "mosts" were given based on the responses received. However this could be attributed to the NIMBY syndrome.

Although least preferred ecologically, it should be noted that A3 offers the greatest potential for existing habitat enhancement and is well located for the provision of a future interchange to the developing Papamoa East suburb.

As with options A1 and A2, A3 is aligned to maximise the opportunity for urban development having moved south from the original A version. In addition, it is notable that A3 would incur the least losses in rural production and came about as a result of consultation with land owners on the other A options. In the Bell Road area consultation with landowners indicated greater acceptance with the A1, A2, A3 alignment which followed the sandhills more keenly. Consultation did not reveal a clear preference in the A variations east of the river. The visual effect of Option A3 is not favourable in comparison to Option A and A2.

There are therefore two options (A3 and B) which should be considered alongside the economic evaluation that follows.

Table 4.6 - Rating of Environmental Factors

| | A | A1 | A2 | A3 | B | C |
|-----------------------------|---------|---------------------|---------------------|----------------------|--------|---------|
| Ecological | Next P | Least P | Next P | Least P ² | Most P | Most P |
| Landscape | Most P | Least P | Next P | Next P | Next P | Least P |
| Archaeological | Least P | Least P | Least P | Least P ¹ | Next P | Most P |
| Cultural | Most P | Next P | Most P | Next P | Most P | Least P |
| Social | Next P | Next P ³ | Next P ³ | Most P ³ | Next P | Least P |
| Noise | Next P | Next P | Next P | Most P | Next P | Least P |
| 50% or more dissatisfaction | | * | | | | * |

KEY

P = preferred

- ¹ Pa site incorrectly recorded. Requires further investigation to verify location of pa to the northeast of recorded location. Best of the A versions if the alignment avoids the area by approximately 50 metres.
- ² Potential for existing habitat enhancement and extension is highest amongst the A Options which are closest to the Kaituna Reserve.
- ³ These options do provide the opportunity for a future interchange to the developing Papamoa East suburb and maximise the opportunity for urban and rural development by being aligned along the edge of the sandhill land which is better for construction.

4.9 ECONOMICS - BENEFITS AND COSTS

4.9.1 INTRODUCTION

Two separate studies were undertaken as part of the economic evaluation of the options considered for the Tauranga Eastern Arterial:

The initial study, the "50 year strategic analysis" was undertaken to investigate the timing of particular options or the components of a project option. The criteria assumed for this timing was taken to be when the user cost benefits were found to be 4 times the capital costs. User cost benefits were assumed to arise from travel time cost savings, accident cost savings and vehicle operating cost savings. The capital costs were assumed to include the costs of construction and maintenance. The criteria used is in accordance with Transfund's requirements for a fundable project, that is that the benefit cost ratio is equal or greater than 4, with the costs and benefits being included over a 25 year period starting from the time when construction starts. A 50 year analysis period was assumed so that any project which was not considered fundable for some time would be included in the analysis. This study allowed the analysis of the staging of certain options, for example, a 2 lane bypass followed by widening to 4 lanes at a later date could be tested to determine when each separate project was viable.

The second study comprised a simple benefit cost ratio analysis which was used to compare the benefits and costs of the options if construction was assumed to start as soon as possible. This was undertaken to provide a comparable benefit cost ratio between the options. This study was also undertaken using the procedures set out in Transfund's Project Evaluation Manual, with the evaluation including the cost values of capital and maintenance, and user costs arising from travel time, accidents and vehicle operating costs.

4.9.2 TRAFFIC MODEL

A traffic model was used to provide the basis for determining the user costs. The traffic model was developed using the TRIPS transportation modelling software. Trip origin-destination matrices were determined from roadside interview and number plate surveys undertaken in 1997. These surveys were designed in order that information concerning the origin and destination of journeys, and the purpose of the journey was gathered. The data from the surveys was input into a large database and the addresses matched to zones representing the Tauranga District Council and Western Bay of Plenty District Council planning areas. Trip demand matrices which give the number of journeys wanting to travel between each pair of zones was subsequently output from the database.

The roading network included in the traffic model includes all the major roads in the study area. The zones described above, representing small areas were linked into the roading network at strategic locations, generally representing a collector road in that area. When the trip demand matrices were assigned to the network model, the TRIPS program simulates each journey between the origin and destination zones. The optimal route is determined from a combination of the shortest travel time and distance travelled. The program uses an iterative procedure in order to determine the routes, as if all trips travelled on the shortest route by distance, another route may become faster due to congestion on the shorter route.

Future year trip demand was determined from an analysis of the growth rates in each zone and of the observed growth rate on the roads both within and outside the study area. In the same way that the original trip demand matrices were assigned to the

roading network, so the future year matrices were assigned to possible future roading networks.

The traffic models were developed for four daily periods (morning peak, inter-peak, evening peak and off-peak periods) and for nine periods in time, i.e. the years 1997, 2001, 2006, 2011, 2016, 2021, 2031, 2041 and 2051. The modelling program is able to output travel time, distance, flows and speeds on all the roads included in the modelled network. These values were used to compute total travel time costs, vehicle operating costs and accident costs for all of the options tested. Annual user costs were calculated for each of the modelled years and a year-by-year time stream of annual costs developed by interpolation of the results at each year. These user cost streams were used in both studies, comparing the costs with either the previous implemented roading scenario for the first study, or the do-minimum scenario for the second study.

The following sections detail the results and conclusions from each study.

4.9.3 50 YEAR STRATEGIC ANALYSIS

The 50 year strategy study investigated the bypass options as well as widening of the existing road (Option C). The bypass options investigated included Option A3 (the Alternative Route) and Option B (the Swamp Route). Option A (the Sandhill Route) was not included in this part of the study as, with it being longer and more costly than the Alternative Route, it would only have shown that it would be viable at a later date.

Strategies were investigated which comprised the staging of different components of an option. The following table indicates the years in which the separate components within each strategy would become viable. Some facilities were assumed to be required for traffic management, safety, social and environmental reasons rather than being strictly justified by their B/C, for example the installation of a signalised intersection at SH2/Cameron Road in Te Puke, and the installation of a roundabout at SH2/Domain Road.

| STRATEGY | OPENING YEAR |
|---|--------------|
| Strategy I (incorporating Option C) | |
| Existing | |
| Construct Passing Lanes N2, N3, S1, S2 | 1998 |
| Install signalised intersection at SH2/Cameron Road | 2005 |
| Install roundabout at SH2/Domain Road | 2005 |
| Construct Passing Lanes N1, N4 and S3 | 2010 |
| Install roundabout at SH2/SH33 intersection | 2015 |
| Include widening SH2 from Te Maunga to Domain to 4 lanes | 2016 |
| Include widening SH2 from Domain through Te Puke to 4 lanes | 2023 |
| Include widening SH2 from Te Puke to Paengaroa to 4 lanes | 2043 |

| Table 4.7 - Projects Included In Each Strategy | |
|--|---------------------|
| STRATEGY | OPENING YEAR |
| Strategy II (incorporating Option C) | |
| Existing | |
| Construct Passing Lanes N2, N2, S1, S2 | 1998 |
| Install signalised intersection at SH2/Cameron Road | 2005 |
| Install roundabout at SH2/Domain Road | 2005 |
| Construct Passing Lanes N1, N4 and S3 | 2010 |
| Install roundabout at SH2/SH33 intersection | 2015 |
| Include widening SH2 from Domain through Te Puke | 2023 |
| Include widening SH2 from Te Maunga to Domain to 4 lanes | >2047 |
| Include widening SH2 from Te Puke to Paengaroa to 4 lanes | >2047 |
| Strategy III (incorporating Option A3) | |
| Existing | |
| Construct Passing Lanes N2, N3, S1, S2 | 1998 |
| Install signalised intersection at SH2/Cameron Road | 2005 |
| Install roundabout at SH2/Domain Road | 2005 |
| Construct Option A3 (Alternative Route) with 2 lanes, at grade intersections | 2011 |
| Widen SH2 from Te Maunga to Domain to 4 lanes | 2021 |
| Widen Bypass between Domain and Bell to 4 lanes | >2047 |
| Strategy IV (incorporating Option B) | |
| Existing | |
| Construct Passing lanes N2, N3, S1, S2 | 1998 |
| Install signalised intersection at SH2/Cameron Road | 2005 |
| Install roundabout at SH2/Domain Road | 2005 |
| Construct Option B (Swamp Route) with 2 lanes, at grade intersections | 2011 |
| Widen SH2 from Te Maunga to Domain to 4 lanes | 2022 |
| Widen Bypass between Domain and Bell to 4 lanes | >2047 |
| Strategy V (incorporating Option A3) | |
| Existing | |
| Construct Passing Lanes N2, N3, S1, S2 | 1998 |
| Install signalised intersection at SH2/Cameron Road | 2005 |
| Install roundabout at SH2/Domain Road | 2005 |
| Construct Option A3 (Alternative Route) with 2 lanes, grade separated intersections | 2012 |
| Widen SH2 Te Maunga to Domain to 4 lanes | 2022 |
| Widen Option 2 between Domain and Bell to 4 lanes | >2047 |
| Strategy VI (incorporating Option B) | |
| Existing | |
| Add in Passing Lanes N2, N3, S1, S2 | 1998 |
| Include Cameron Road signals | 2005 |
| Include Domain Road roundabout | 2005 |
| Construct Option B (Swamp Route) as 2 lanes, grade separated intersections | 2011 |
| Widen SH2 between Te Maunga and Domain to 4 lanes | 2022 |
| Widen Option B from Domain to Bell to 4 lanes | >2047 |
| Strategy VII (incorporating Option A3) | |
| Existing | |
| Construct Passing Lanes N2, N3, S1, S2 | 1998 |
| Install signalised intersection at SH2/Cameron Road | 2005 |
| Install roundabout at SH2/Domain Road | 2005 |
| Construct Option A3 (Alternative Route) with 4 lanes, grade separated intersections, widen SH2 from Te Maunga to Domain Road | 2014 |

| STRATEGY | OPENING YEAR |
|---|--------------|
| Strategy VIII (incorporating Option B) | |
| Existing | |
| Construct Passing Lanes N2, N3, S1, S2 | 1998 |
| Install signalised intersection at SH2/Cameron Road | 2005 |
| Install roundabout at SH2/Domain Road | 2005 |
| Construct Option B (Swamp Route) with 4 lanes, grade separated intersections, widen SH2 from Te Maunga to Domain Road | 2016 |

An incremental analysis of the total 50 year present value of user costs and capital costs was undertaken and indicated that the optimal strategy was Strategy III (incorporating Option A3), based on a critical incremental B/C ratio of 3. This strategy includes the Alternative Route (Option A3) with at-grade intersections. The strategy including the Alternative Route with grade-separated intersections, Strategy V, was found to be only marginally less economical than Strategy III. The following table provides a summary of the results of the incremental analysis.

| Least Cost Option | Benefits \$ million | Costs \$ million | Next Option | Benefits \$ million | Costs \$ million | Incremental | | BCR |
|--------------------------|---------------------|------------------|--------------------------|---------------------|------------------|---------------------|------------------|------|
| | | | | | | Benefits \$ million | Costs \$ million | |
| Strategy II (Option C) | 40 | 10 | Strategy I (Option C) | 46 | 11 | 6 | 2 | 3.4 |
| Strategy I (Option C) | 46 | 11 | Strategy VIII (Option B) | 117 | 23 | 70 | 12 | 6.0 |
| Strategy VIII (Option B) | 117 | 23 | Strategy VII (Option A3) | 127 | 24 | 10 | 0 | 21.1 |
| Strategy VII (Option A3) | 127 | 24 | Strategy V (Option A3) | 137 | 24 | 10 | 1 | 10.8 |
| Strategy V (Option A3) | 137 | 24 | Strategy IV (Option B) | 137 | 25 | (0) | 1 | -0.4 |
| Strategy V (Option A3) | 137 | 24 | Strategy III (Option A3) | 141 | 26 | 4 | 1 | 3.3 |
| Strategy III (Option A3) | 141 | 26 | Strategy VI (Option B0) | 141 | 27 | (0) | 1 | -0.3 |
| Strategy III (Option A3) | 141 | 26 | | | | | | |

4.9.4 BENEFIT COST ANALYSIS

The Sandhill Route, Swamp Route (Option B) and Alternative Route (Option A3) were all analysed to determine the B/C ratios from an analysis period comprising 25 years from 1 July 1998 to 30 June 2023. Based on the costs of a 2 or 4 lane expressway with a 9m grassed median, the costs and B/C ratios of the options (excluding the Te Maunga to Domain Road section) are as follows:

| Option | Cost \$ million | B/C Ratio |
|---|-----------------|-----------|
| Widening of Existing Alignment (Option C) | 159 | 0.4 |
| Sandhill Route (4 lanes) | 115 | 1.1 |
| Swamp Route (4 lanes)(B) | 112 | 1.5 |
| Alternative Route (4 lanes)(A3) | 99 | 1.8 |

Note: B/C ratio includes intangible benefits from Te Puke WTP survey

Compared to the Alternative Route (Option A3), the Sandhill Route and the Swamp Route (Option B) have incremental B/C ratios of -5.2 and -1.1 respectively. This means that for the additional costs, neither the Sandhill Route nor the Swamp Route (B) offer any additional benefits.

The sandhills route is longer than the current A and B options. While its extra length traverses over sand, there is still a substantial length of peat and wetland this alignment will need to cross over as it swings inland from the coast. A cost estimate was carried out on the sandhills route along the same basis as that for the other options. The sandhills route is more costly to construct than Option B and Option A alignments, and in particular is approximately 20% more expensive than Option A3. Additional service roads would have to be provided along Tara Road and Te Tumu Road, further adversely affecting the economics in comparison to the other options.

The net present value of benefits associated with Option A3 over the B/C analysis period was calculated to be \$148.26 million, 6% greater than the \$140.12 million associated with Option B. Whilst the B/C ratios of Option A3 and Option B are close, Option A3 provides the cheaper solution and is therefore considered to be the most economical.

5. CONCLUSION

5. CONCLUSION

This study assesses the six highway options that could provide an improved level of service for motorists travelling SH2 between Domain Road and the Whakatane turnoff as well as reducing the significant effect that this through traffic has on the Te Puke township.

After consultation and environmental evaluation options C and A1 were found to have real disadvantages. Option C, being an upgrade of the SH by 10 metre widening, produces severe impacts on the Te Puke and Waitangi townships as well as along the route which, through historical events, has many dwellings and enterprises along the route. Option A1 has ecological, landscape and archaeological difficulties.

Whilst ecological difficulties are acknowledged for Option A3 it does have potential for environmental enhancement. In archaeological terms, A3 is most preferred of the A options as it has been acknowledged that a Pa site has been incorrectly recorded and is likely to be to the north east. It is reasonable we understand to enable an Option A3 to bypass the Pa site by some 50 metres.

Option A3 is therefore the most preferred of the A options and was therefore considered, along with Option B, in the economic analysis.

Of these remaining two options (A3 and B), the economic analysis revealed that Option B although a more direct route would cost \$13 million more than Option A3. The B/C's difference between Option B and Option A3 is small i.e. 1.5 as distinct to 1.8.

Environmental effects at Domain Road and Paengaroa junctions are unavoidable as it is necessary to link up at the SH at both ends. These communities will therefore be affected.

The conclusion is that Option A3 is favoured in cost terms although the B/C at this point is only slightly better than Option B. This is because the very large cost estimates engulf the benefits. The cost difference is approximately 14%, which is not insignificant. Neither would meet the current B/C threshold of four. However, over time this would certainly change. Environmentally Option A3 has slightly less impact on rural properties and rural production losses than Option B. Although it clips the edge of the Kaituna Reserve it is across a paddock in rural production with limited ecological value subject to the avoidance of the Kahikatea stands. There is at this stage perceived to be a real opportunity for the roading project to enhance the drainage of the wetland reserve and thereby the habitat.

6. RECOMMENDATION

6. RECOMMENDATION

We recommend that a variation of A3 be investigated through an Assessment of Environmental Effects which:

- ensures a noise and habitat buffer of the reserve;
- avoids the Kahikatea stand within the reserve;
- avoids the Pa site;
- enhances the reserve drainage;
- maximises use of sandhill country to reduce construction costs;
- minimises impacts on dairy farm management; and
- protects the flood protection scheme.

We recommend that Transit NZ support continued discussions with local residents and environmental groups to gain a consensus as to how to achieve the enhancement and perhaps extension of the wetland reserve area.

Our recommendation is that Option A3 be proceeded with for full assessment of environmental effects and designation.

APPENDIX A
Visual Assessment Methodology

APPENDIX A

VISUAL ASSESSMENT METHODOLOGY

Regardless of which option is being assessed the main aspects to be considered are as follows:

PART A SENSITIVITY OF THE VIEW AND SITE TO CHANGE

Visual quality:

An assessment of the **quality** of the landscape through which the route passes. Quality is hard to define but generally involves some assessment of the landscapes uniqueness, vividness and unity.

Landscape Heritage:

Evaluating the extent to which the unit conveys a sense of identity because of its endemic or cultural associations eg. remnant kauri forest, old pa sites.

The Visual Catchment and audience:

Evaluating the type and size of population who will see the option in the landscape unit, the viewing distance to the development site, and other factors which indicate its sensitivity in terms of both viewing audience and the inherent exposure of the audience to the site because of its physical character.

PART B - "THE OPTIONS" SPECIFIC IMPLICATIONS

In this part of the assessment an analysis is made of the options':

Visual prominence:

Arising from its visibility and location;

Visual contrast and integration :

How well does the option fit into the existing scene in terms of composition, and relationship to elements and features in the landscape?;

View Blockage and Obstruction:

Does the option intrude into existing views or across landscape elements or features?

Amelioration Potential:

Are there opportunities to merge or integrate the development into the landscape setting?.

For each landscape unit, ratings are attributed to these variables with the underlying continuum of **no/low** to **high** visual/aesthetic effect on the basis of each score.

The total scores denote the **overall visual effects rating**, which has the following range of potential ratings and effects within each landscape unit . The definitions of these effects are as follows:

| | |
|------------------------|--------------------------------------|
| no effect | <i>no visual effects</i> |
| low effect | <i>minor visual effect under RMA</i> |
| moderate effect | <i>significant visual effect</i> |

high effect

high visual effect - large scale mitigation or redesign will be required.

severe effect

unacceptably high visual effects.

In general terms visual effects in the **no** effect to **moderate** effect range are acceptable in landscape and visual terms, provided mitigation is carried out in cuttings and on visually intrusive embankments. It may be necessary to discuss a redesign of some parts of road with the engineers to try to reduce the visual impacts in some instances. For those units where **high** effects result, significant mitigation is required, and/or a redesign of parts of the road. Where a **severe** effect is created, the effects would be unacceptable in visual and landscape terms.

Part 2 of the process involves measuring the length of the option as it passes through the landscape unit.

The final rating for each option, or part option, is obtained by multiplying the visual effect rating by the length. This final rating is used as the basis for deciding the most preferred, next preferred and least preferred options as required by the project brief.

APPENDIX B
McDermott & Fairgray Report

McDERMOTT FAIRGRAY GROUP LTD
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McDERMOTT FAIRGRAY

ECONOMIC IMPACT ASSESSMENT OF THE EASTERN ARTERIAL ROADING PROJECT



Prepared for

Beca Carter Holdings & Ferner Ltd

By

McDermott Fairgray Group Ltd

December 1997

away than Option B), they will not affect the economic impact assessment findings of the earlier report. The Te Puke retail and other trade sector loses a significant amount of sales because local residents shop instead in Tauranga and Mount Maunganui – in part due to poor environmental conditions in the main business area and also because of more competitive shopping environments in larger centres outside of the town. The bypass trades off better environment with lower retail sales.


In terms of direct impacts on the Te Puke economy, the most preferred option remains option C as it has the lowest negative direct impact.

Summary of Options

| | Most Preferred | Next/Least Preferred |
|---------------------------------|-----------------------|-----------------------------|
| Option | C | A, A1, A2, A3 or B |
| Direct Passing Trade Impact | | |
| <i>Retail Sales (\$'000)</i> | (869) | (8,480) |
| <i>Retail Employment (FTEs)</i> | (8) | (69) |
| Direct Sales Leakage Impact | | |
| <i>Retail Sales (\$'000)</i> | (2,590) | 4,790 |
| <i>Retail Employment (FTEs)</i> | (22) | 39 |
| Net Direct Impacts | | |
| <i>Retail Sales (\$'000)</i> | (3,450) | (3,690) |
| <i>Retail Employment (FTEs)</i> | (30) | (30) |

If you have any further queries, please do not hesitate to contact me.

Yours sincerely



Douglas Fairgray
MANAGING DIRECTOR

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1. INTRODUCTION

1.1 Objective

McDermott Fairgray Group Ltd has been commissioned by Beca Carter Holdings & Ferner Ltd to undertake an economic impact assessment into the Eastern Arterial roading options.

The study objective is to analyse the likely economic impacts of the three possible options for the Eastern Arterial roading project on the surrounding community. The results of this comparative assessment study, together with public consultation with the community and local iwi, and input from other expert studies, will be used to assist Transit New Zealand in determining the most viable option.

1.2 Background

Transit New Zealand has been undertaking roading studies in the Te Puke area over the past years to find solutions to the following issues:

- Conflict between passing traffic and parking manoeuvres in the Te Puke main street
- Safety of pedestrians crossing the main street
- Environmental and social concerns for the effects of heavy vehicles in the main street
- A lack of passing areas and low overall speed in the Paengaroa to Te Maunga stretch of highway
- An ever increasing number of highway access points with insufficient sight distance
- Vertical and horizontal alignment deficiencies in the vicinity of Te Puke and Bell Road

- Safety of pedestrians from the school and marae at Waitangi crossing the highway

Currently, State Highway 2 passes through the Te Puke central business areas, with high volumes of traffic, including heavy vehicles. Negative impacts created by the volume of heavy traffic include noise, dust, fumes, animal wastes sprayed onto the road, and danger to pedestrians in the main street of Te Puke due to vehicle speed and traffic density, and exacerbated by the lack of safe crossing points.

Beca Carter has been commissioned by Transit New Zealand to investigate possible alignment improvements to State Highway 2 between the State Highway 29 junction at Te Maunga and the State Highway 33 junction at Paengaroa. The realignment is likely to start in the vicinity of Domain Road, Papamoa and reconnect with the existing highway north of Paengaroa.

Three options have been identified by Beca Carter, that are considered feasible given geometric requirements and physical constraints. These options need to be assessed in greater detail from several points of view; including ecology, landscape, noise, social/economic, archaeological and cultural.

1.3 Methodology

The approach to assessing economic impacts is to identify likely direct effects, and flow-on consequences within the local economy. An arterial route which bypasses Te Puke (and other smaller centres of activity) is expected to have four main impacts.

1. Reduced economic activity in Te Puke as passing trade no longer stops and shops there (i.e. net inflow is reduced)
2. Increased economic activity in Te Puke as local consumers are no longer put off visiting the CBD by heavy traffic flows (i.e. net outflow is reduced)
3. Increased activity in other localities (e.g. Mount Maunganui, Paengaroa) for travellers if Te Puke is bypassed (i.e. net inflow is increased)

4. Reduced activity in those other localities due to increase in heavy traffic flows (i.e. net outflow is increased)

These impacts are not equal in scale or scope, as they would impact unevenly across businesses in Te Puke and elsewhere geographically and sectorally.

The first step has been to analyse the local Te Puke business structure to identify the relative importance of each type of activity, its reliance on passing trade and local trade. This has been done by assessing the Te Puke retail demand and supply levels to determine the extent of under or over supply relative to their catchment size. Activities which are over represented in the economy, and for which there is likely to be demand from passing travellers are assumed to be reliant to some degree on passing trade for their livelihood.

The second step has been to develop scenarios of likely impact for the three alternative options for the eastern arterial. Likely reductions in activity by businesses in Te Puke with high dependence on passing traffic will constitute negative impacts, as employment and income for the town are reduced. Conversely, increased activity by other businesses would constitute positive impacts.

The business and employment levels in Te Puke have also been closely examined to identify those activities apparently under represented, whose trade is likely to benefit from an improvement in the main street environments. There are obviously other reasons for under representation in trade activity and employment – notably proximity to Tauranga, and the drawing power of outlets in that city.

Total and net impacts for the three options have been estimated, combining the positive and negative outcomes in each case.

The results are presented as the most preferred, next preferred and least preferred options, in terms of economic impacts.

2. CURRENT SITUATION - TE PUKE

2.1 Scope

This section looks at Te Puke's business sector activities in the context of the local market and the "passing trade" market "opportunity to spend" factors. This involves reconciling current retail supply and demand within the Te Puke catchment, to identify the degree of sales leakage to other centres. The amount spent by travellers as passing trade has been estimated to show the extent of the town's reliance on the highway bringing travellers through.

2.2 Passing Trade

State Highway 2 passes through the central business area in Te Puke, giving travellers an opportunity to stop in the township to utilise the local amenities, fill up on petrol, or visit the local shops for convenience and other purchases. Such expenditure by travellers who would not normally purchase any goods in Te Puke is known as passing trade. Passing trade occurs because there exists the opportunity to spend for travellers, which is dependent on four main factors:

- *Proximity of town to highway* - A town removed from the highway will be unlikely to attract much passing trade. This is because the opportunity to spend is low. Private motorists and commercial (truck, bus) drivers are unlikely to divert from the main highway to stop in a particular town if it is not along the way. This is particularly so for commercial drivers, who are normally on a schedule. Drivers are more likely to stop at a point on or very close to the highway.
- *Types of shops in towns* - It is not enough for a town in general to be close to the highway. Having the right kind of shops selling appropriate goods or services is essential to stimulate passing trade. For example, few travellers would make major purchases such as a car or whiteware goods if they are just passing through.

This passing trade will be mostly for convenience purchases, not 'big ticket' items. Convenience buying is typified by purchases of generally small or medium scale items, when the opportunity arises. Such purchases by travellers are most likely for a limited range of goods relating to the journey – fuel, food and drink, minor apparel, cosmetics and personal goods and publications, toys etc.

- **Convenience** – Although convenience is influenced by ease of access and visibility, convenience to a potential consumer also includes other aspects such as the retail environment, and the immediate surroundings. Marketers believe that access to amenities and better choice, makes consumers more willing to stop in the first place and part with their money, once stopped.
- **Time and distance from/to nearest town** – Finally, there is the influence of competing opportunity – a key influence on travellers' propensity to stop and spend is the time and distance to the nearest alternative. If there are equal or better amenities in another town which is not too far away, travellers may deem it more convenient to make the next stop there. Similarly, if travellers have just stopped in a nearby town prior to passing, it is unlikely that they will make another stop.

2.3 Te Puke Location and Business Activity

Te Puke is located in the Western Bay of Plenty District, 27 kilometres southeast of Tauranga. In terms of proximity to the highway, it offers good access to travellers as State Highway 2 passes through the central business area, and vehicles can conveniently turn off the highway, into the town.

Te Puke's economic structure has been analysed using Business Directory Statistics on employment levels (FTEs¹) and activity units (ACTs²) in the town. This data provides a basis for estimating total economic activity. Some 25% of Te Puke's economically significant activity units are in the Property and Business Services sector, with the retail and hospitality sector accounting for 21% (Table 2.1). In terms of employment, however, the retail and hospitality sector is the largest and employs 23% of Te Puke's 2,303 FTEs.

Table 2.1: Te Puke Business Activity 1996

| Major ANZSIC Divisions | ACT | Distribution of ACT | FTE | Distribution of FTE |
|---|------------|---------------------|--------------|---------------------|
| A Agriculture, Forestry and Fishing | 38 | 7.4% | 238 | 10.3% |
| B Mining | 0 | 0.0% | 0 | 0.0% |
| C Manufacturing | 39 | 7.6% | 344 | 14.9% |
| D Electricity, Gas and Water Supply | 0 | 0.0% | 0 | 0.0% |
| E Construction | 65 | 12.7% | 200 | 8.7% |
| F Wholesale Trade | 25 | 4.9% | 81 | 3.5% |
| G Retail Trade | 96 | 18.7% | 461 | 20.0% |
| H Accommodation, Cafes and Restaurants | 12 | 2.3% | 69 | 3.0% |
| I Transport and Storage | 24 | 4.7% | 75 | 3.3% |
| J Communication Services | 8 | 1.6% | 21 | 0.9% |
| K Finance and Insurance | 18 | 3.5% | 71 | 3.1% |
| L Property and Business Services | 126 | 24.6% | 220 | 9.6% |
| M Government Administration and Defence | 7 | 1.4% | 15 | 0.7% |
| N Education | 10 | 1.9% | 168 | 7.3% |
| O Health and Community Services | 26 | 5.1% | 275 | 11.9% |
| P Cultural and Recreational Services | 6 | 1.2% | 18 | 0.8% |
| Q Personal and Other Services | 13 | 2.5% | 47 | 2.0% |
| Total | 513 | 100.0% | 2,303 | 100.0% |

Source: Annual Business Directory Update Survey (ABDU), February 1996

Note: Most of agriculture and livestock production and unregistered businesses are excluded.

¹ FTEs or full-time equivalent persons engaged is the total number of full-time employees and working proprietors plus half the part-time employees and working proprietors. People working 30 hours or more per week are defined to be full-time.

² An activity unit (business activity) is a separate operating unit engaged in New Zealand in one, or predominantly one, kind of economic activity from a single physical location or base. Economically significant businesses are defined as having either annual GST expenses or sales exceeding \$30,000 or employing more than 2 full-time equivalent persons.

Table 2.2: Te Puke Retail and Hospitality Sector Breakdown

| Storetype | ACT | Distribution of ACT | FTE | Distribution of FTE |
|----------------------------------|------------|---------------------|------------|---------------------|
| Food | 15 | 13.9% | 101 | 19.1% |
| Footwear | 1 | 0.9% | 3 | 0.6% |
| Clothing and Softgoods | 8 | 7.4% | 21 | 4.0% |
| Furniture and Floorcoverings | 2 | 1.9% | 12 | 2.3% |
| Appliances | 4 | 3.7% | 12 | 2.3% |
| Hardware | 2 | 1.9% | 12 | 2.3% |
| Chemist | 4 | 3.7% | 20 | 3.8% |
| Department | 0 | 0.0% | 0 | 0.0% |
| Recreational | 3 | 2.8% | 9 | 1.7% |
| Accommodation, Hotels and Liquor | 6 | 5.6% | 45 | 8.5% |
| Cafes, Restaurants and Takeaways | 17 | 15.7% | 65 | 12.3% |
| Other Stores | 19 | 17.6% | 48 | 9.1% |
| Automotive | 4 | 3.7% | 33 | 6.2% |
| Auto Services | 23 | 21.3% | 149 | 28.1% |
| Total Retail | 108 | 100.0% | 530 | 100.0% |

Note: The footnotes and sources to Table 2.1 apply also to this table.

Table 2.2 shows the structure of Te Puke’s retail and hospitality sector by storetype. The BD identifies 108 retail and hospitality outlets, employing 530 FTEs in Te Puke. There is a strong representation of auto services in both activity units and employment in Te Puke. Cafes, restaurants and takeaways, and food retailing outlets such as supermarkets and dairies are also strongly represented in Te Puke.

The presence of a reasonable selection of retail and hospitality stores, and adequate convenience, indicates good opportunity to spend for travellers passing through Te Puke.

The final factor influencing opportunity to spend is the time and distance to or from alternative stopover points. Along State Highway 2, both Mount Manganui and Tauranga itself offer at least equal amenity and convenience to travellers. Mount Maunganui is only 16 kilometres distance (12-15 minutes) while Tauranga is only 27 kilometres. If either Tauranga or Mount Maunganui is the destination for travellers passing through Te Puke, or the origin of travellers heading southeast, there is less scope for them to make a convenience stop at Te Puke. For travellers continuing on

their journey through State Highway 2 or State Highway 29, Tauranga is a stop option with greater amenities and opportunities to spend, though less convenient.

Travellers to/from the southeast of Te Puke face longer journeys to the nearest alternative town. Along State Highway 2, Edgecumbe is the nearest locality 60 kilometres away, and Whakatane, the largest town in the eastern Bay of Plenty, another 8 kilometres further.

For travellers heading south, Rotorua presents the first opportunity, some 57 kilometres from Te Puke.

2.4 Te Puke Retail Activity

The proof of Te Puke's potential as a stopover for passing motorists, however, lies in the actual trade which is generated. This has been estimated from Te Puke's actual and expected employment levels in key trade activities.

2.4.1 Te Puke Local Retail Demand

Demand for Te Puke's retail (retail and hospitality) services derives from two main sources: local households and businesses in the Te Puke catchment area, and passing trade.

The Te Puke catchment area extends from the Papamoa hills to the west, southward toward the forested areas on the Mamaku plateau, and eastward to Paengaroa and beyond. This catchment area has been defined on the basis that residential households and businesses would expect to access a significant share of their retail and service needs from Te Puke.

The Te Puke catchment contains an estimated 4,500 resident households (1996 Census) with 2,300 in the Te Puke township, and the balance living in small rural settlements and on farms within the district. The resident households spent an

estimated \$90.3 million on retail goods for the year ended June 1997. That estimate was derived from the *McDermott Fairgray Household Market Model*, which incorporates the latest household expenditure information from the HES 1997 (Household Economic Survey) and the retail trade statistics.

Retail expenditure by businesses in the catchment area (estimated based on employment) is a further \$16.2 million. Together, total retail demand arising in the catchment is \$106.5 million (Table 2.3).

Table 2.3: Te Puke Catchment Retail Spend by Storetype (June Year 1997)

| Storetype | Household Spend (\$'000) | Business Spend (\$'000) | Total Demand (\$'000) |
|----------------------------------|-----------------------------|----------------------------|--------------------------|
| Food | 28,440 | 188 | 28,620 |
| Footwear | 670 | 15 | 680 |
| Clothing and Softgoods | 3,930 | 116 | 4,050 |
| Furniture and Floorcoverings | 2,850 | 199 | 3,050 |
| Appliances | 3,930 | 185 | 4,120 |
| Hardware | 2,100 | 295 | 2,400 |
| Chemist | 3,670 | 60 | 3,730 |
| Department | 5,660 | 109 | 5,770 |
| Recreational | 4,390 | 82 | 4,470 |
| Accommodation, Hotels and Liquor | 2,540 | 2,719 | 5,260 |
| Cafes, Restaurants and Takeaways | 4,180 | 286 | 4,470 |
| Other Stores | 5,800 | 169 | 5,970 |
| Automotive | 12,130 | 5,665 | 17,790 |
| Auto Services | 10,010 | 6,076 | 16,090 |
| Total | 90,320 | 16,160 | 106,480 |

Source: Derived from McDermott Fairgray Household Market Model

Note: Spend estimates are exclusive of GST. Numbers may have been rounded and therefore may not sum precisely. Personal services are excluded.

2.4.2 Te Puke Retail Supply

The actual level of retail sales in the town of Te Puke has been estimated according to outlet numbers and employment in each retail type based on the average national labour productivity (\$ per person engaged) for each storetype, adjusted for productivity differences between Te Puke and the national average.

Estimated productivity and number of persons (FTEs) engaged in each storetype suggests that total retail sales in Te Puke outlets for the year ended 1997 was \$81.8 million (Table 2.4).

Table 2.4: Te Puke Retail Sales by Storetype (June Year 1997)

| Storetype | Sales (\$'000) |
|----------------------------------|-----------------------|
| Food | 17,060 |
| Footwear | 300 |
| Clothing and Softgoods | 2,460 |
| Furniture and Floorcoverings | 2,500 |
| Appliances | 2,820 |
| Hardware | 1,680 |
| Chemist | 3,360 |
| Department | - |
| Recreational | 4,180 |
| Accommodation, Hotels and Liquor | 6,030 |
| Cafes, Restaurants and Takeaways | 2,820 |
| Other Stores | 3,090 |
| Automotive | 14,100 |
| Auto Services | 21,430 |
| Total | 81,830 |

Note: The footnotes and sources to Table 2.3 apply also to this table.

2.4.3 Retail Leakage

The estimated retail demand of \$106.5 million exceeds the estimated retail sales of \$81.8 million, by \$24.7 million. The excess of demand over sales is leakage. This is captured by stores in other parts of the region, primarily Tauranga and Mount Maunganui.

Retail sales leakage is most pronounced in smaller centres such as Te Puke, where limited market size means retailers lack resources or economies of scale that would allow them to provide a complete range of products of competitive prices. This market limitation has a compounding effect. It induces consumers to shop elsewhere, as local needs are not fully satisfied, in turn reducing the market for which local

retailers have to cater, and inducing them to further limit the range of goods and services offered.

Sales leakage from Te Puke also occurs because residents avoid the Te Puke commercial centre due to the unattractive conditions created by heavy traffic travelling through the central business area.

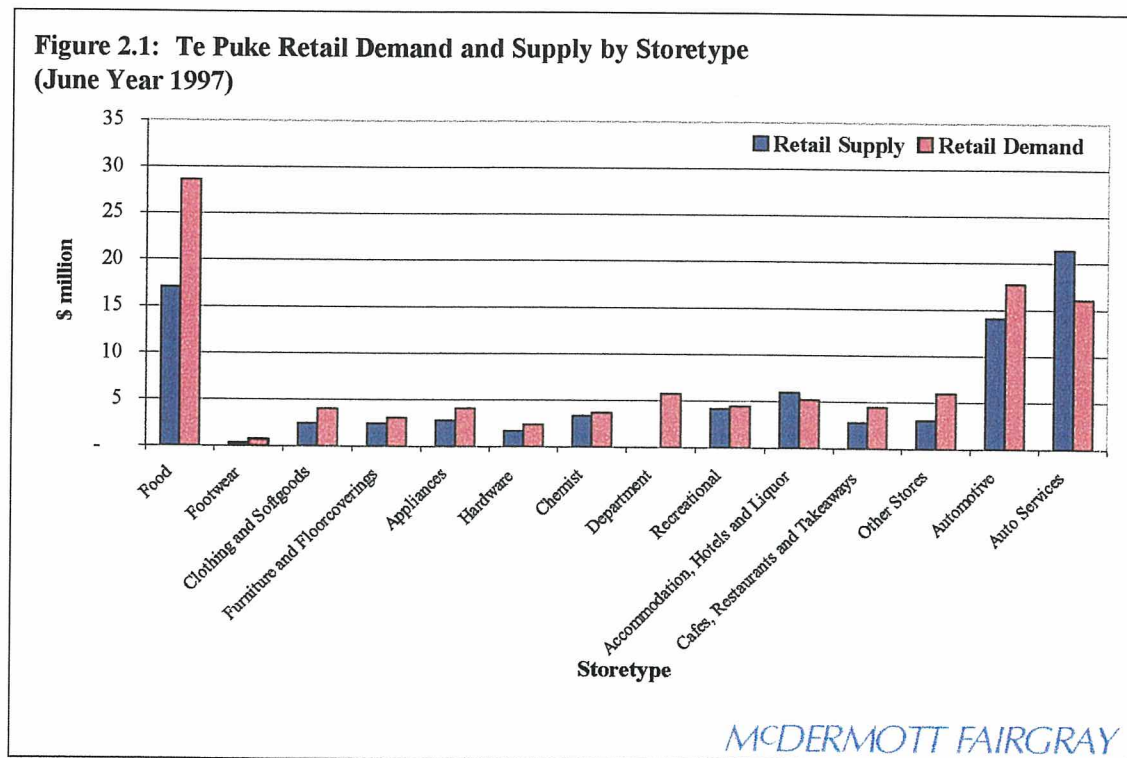
Gross leakage from Te Puke is around \$30.8 million. It is evident across all major retail types except accommodation and auto service. The retail sales leakage in Te Puke is nearly 29% of total retail demand, with the largest amount of leakage occurring in the food category (\$11.6 million or 38% of total leakage). The limited supermarket offering in Te Puke means many households travel to Tauranga or Mount Maunganui on a regular basis for their grocery supplies. Similarly, other stores such as department stores are not established in Te Puke.

Table 2.5: Te Puke Retail Sales Leakage (June Year 1997)

| Storetype | Total Demand (\$'000) | Total Sales (\$'000) | Leakage (\$'000) |
|----------------------------------|--------------------------|-------------------------|---------------------|
| Food | 28,620 | 17,060 | 11,570 |
| Footwear | 680 | 300 | 380 |
| Clothing and Softgoods | 4,050 | 2,460 | 1,590 |
| Furniture and Floorcoverings | 3,050 | 2,500 | 550 |
| Appliances | 4,120 | 2,820 | 1,300 |
| Hardware | 2,400 | 1,680 | 710 |
| Chemist | 3,730 | 3,360 | 380 |
| Department | 5,770 | - | 5,770 |
| Recreational | 4,470 | 4,180 | 290 |
| Accommodation, Hotels and Liquor | 5,260 | 6,030 | - |
| Cafes, Restaurants and Takeaways | 4,470 | 2,820 | 1,650 |
| Other Stores | 5,970 | 3,090 | 2,880 |
| Automotive | 17,790 | 14,100 | 3,690 |
| Auto Services | 16,090 | 21,430 | - |
| Total | 106,480 | 81,830 | 30,760 |

Note: The footnotes and sources to Table 2.3 apply also to this table.

However, not all storetypes experience leakages to other centres, and there are net inflows of sales which offset gross leakage to some extent. The hospitality sector (accommodation and hotels) and auto services, which includes petrol stations, have sales that exceed demand. For those two storetypes, the excess sales of \$6.1 million is attributed to passing trade, and for Te Puke as a whole, net sales leakage is \$24.7 million.



2.4.4 Passing Trade

Having established the net sales leakage situation for each retail type, the next step has been to estimate the proportion of retail sales due to local demand, and the proportion due to passing trade. Passing trade for the hospitality and auto services storetype have been estimated above as the excess supply amount.

The local demand component for the other storetypes have been estimated based on the local residents and businesses' propensity to purchase from Te Puke, and the

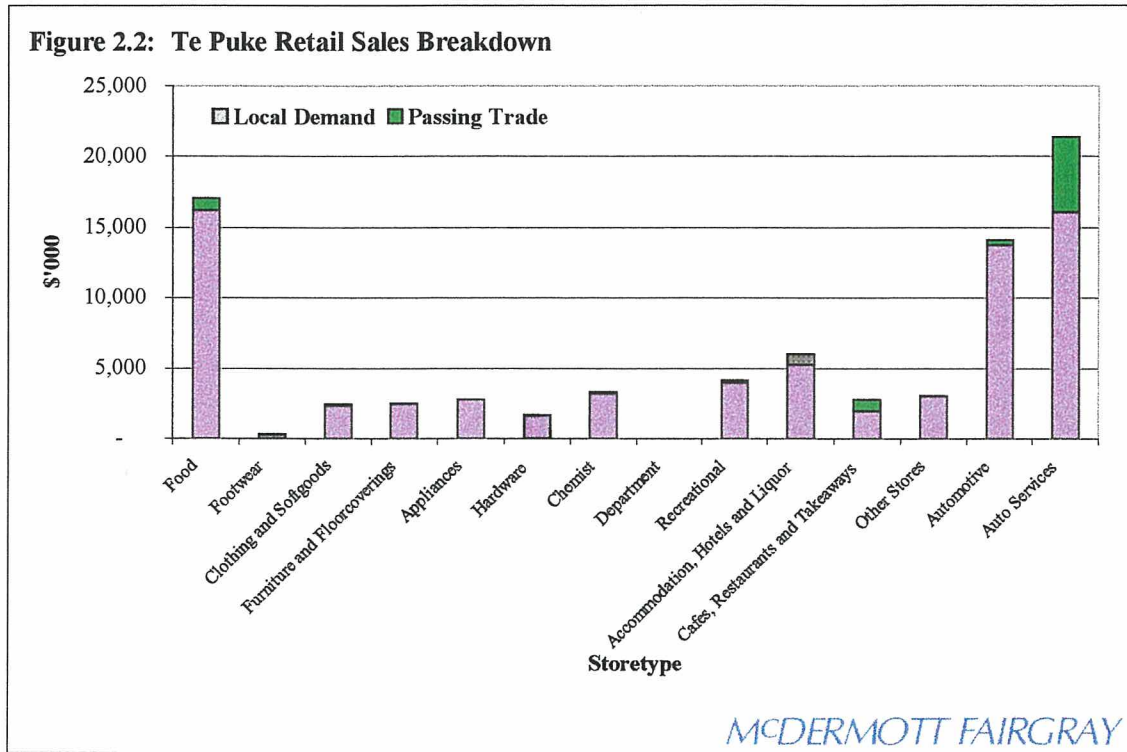
nature of the storetype to attract passing trade. As mentioned earlier in this section, passing trade is dependent on the types of shops. Hence, one would expect a very small share if any of passing trade occurring in the furniture and floorcoverings, appliances, recreational and automotive storetypes since these are big ticket items and usually involve destination shopping. On the other hand, it is expected that food retailing, hospitality and auto services would attract a higher proportion of their sales from passing trade.

Table 2.6 shows the estimated breakdown of Te Puke retail sales into the local demand component and the passing trade component. Passing trade sales for the year ended June 1997 is estimated at \$8.9 million, out of a total of \$81.8 million. Auto services represents the largest passing trade expenditure (\$5.3 million or 60% of total passing trade), with food retailing and cafes, restaurants and takeaways equal second largest (\$0.85 million each or 9.5% of total passing trade). The accommodation and liquor sector accounts for around \$0.77m, or 8.5%.

Table 2.6: Te Puke Retail Sales Breakdown (June Year 1997)

| Storetype | Local Demand (\$'000) | Passing Trade (\$'000) | Total Sales (\$'000) |
|----------------------------------|-----------------------|------------------------|----------------------|
| Food | 16,210 | 850 | 17,060 |
| Footwear | 280 | 10 | 300 |
| Clothing and Softgoods | 2,330 | 120 | 2,460 |
| Furniture and Floorcoverings | 2,440 | 60 | 2,500 |
| Appliances | 2,750 | 70 | 2,820 |
| Hardware | 1,640 | 40 | 1,680 |
| Chemist | 3,190 | 170 | 3,360 |
| Department | - | - | - |
| Recreational | 3,970 | 210 | 4,180 |
| Accommodation, Hotels and Liquor | 5,260 | 770 | 6,030 |
| Cafes, Restaurants and Takeaways | 1,970 | 850 | 2,820 |
| Other Stores | 3,010 | 80 | 3,090 |
| Automotive | 13,750 | 350 | 14,100 |
| Auto Services | 16,090 | 5,340 | 21,430 |
| Total | 72,900 | 8,930 | 81,830 |

Note: The footnotes and sources to Table 2.3 apply also to this table.



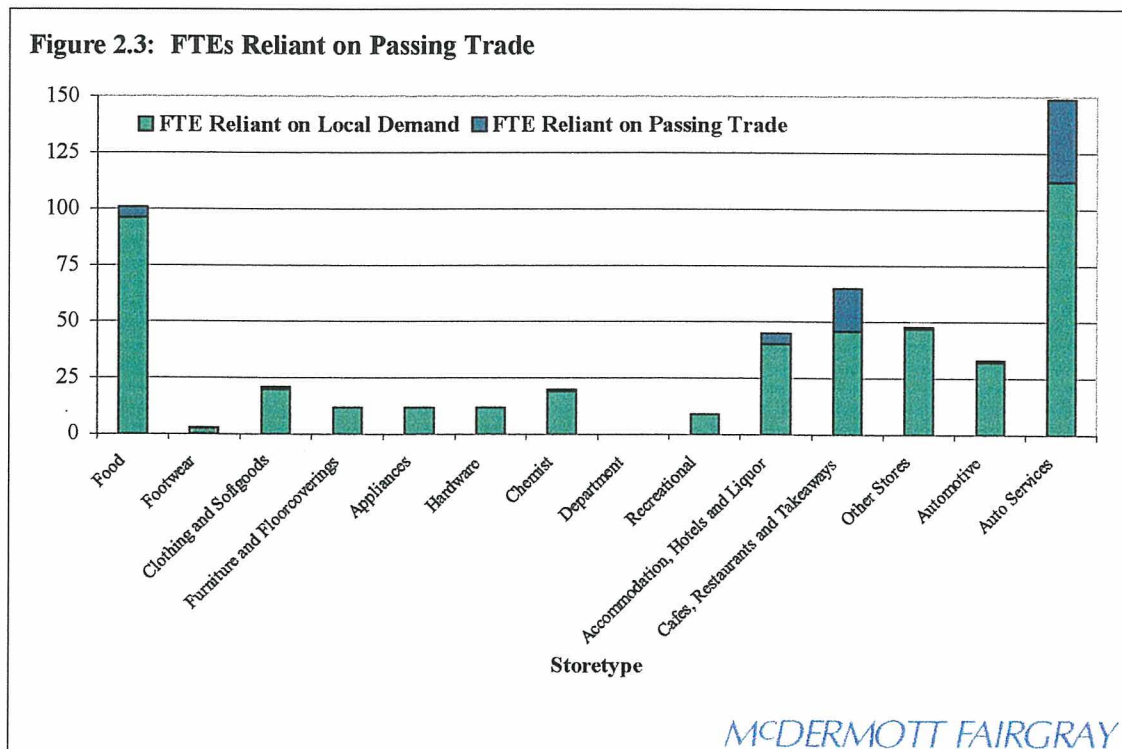
2.5 Te Puke's Reliance on Passing Trade

Overall, passing trade accounts for almost 11% of Te Puke's total retail sales. Based on the number of persons employed per \$ million in sales, a total of 70 retail FTEs are reliant on passing trade in Te Puke. That amounts to 13.2% of total retail employment and just over 3% of the town total employment.

Table 2.7: Te Puke's Estimated Reliance on Passing Trade (June Year 1997)

| Storetype | FTE per \$m sales | FTE Reliant on Passing Trade | Reliant FTE as % of Total |
|----------------------------------|-------------------|------------------------------|---------------------------|
| Food | 6 | 5 | 5.0% |
| Footwear | 10 | - | 0.0% |
| Clothing and Softgoods | 9 | 1 | 4.8% |
| Furniture and Floorcoverings | 5 | - | 0.0% |
| Appliances | 4 | - | 0.0% |
| Hardware | 7 | - | 0.0% |
| Chemist | 6 | 1 | 5.0% |
| Department | - | - | 0.0% |
| Recreational | 2 | - | 0.0% |
| Accommodation, Hotels and Liquor | 7 | 5 | 11.1% |
| Cafes, Restaurants and Takeaways | 23 | 19 | 29.2% |
| Other Stores | 16 | 1 | 2.1% |
| Automotive | 2 | 1 | 3.0% |
| Auto Services | 7 | 37 | 24.8% |
| Total | 6 | 70 | 13.2% |

Note: The footnotes and sources to Table 2.3 apply also to this table.



3. IMPACT ON TE PUKE UNDER VARIOUS OPTIONS

3.1 Scope

Having estimated Te Puke's degree of reliance on passing trade (11% of the town's total retail sales, and some 70 jobs), the next step in this study has been to assess likely impacts of the Arterial Road options on Te Puke.

There are three options being considered. Two (Option A and Option B) would see State Highway 2 bypass Te Puke to the north. The third option (Option C) would be an upgrade of the existing State Highway 2 which passes through the central business area in Te Puke.

In terms of the economic impacts on Te Puke, Option A and Option B will have similar effects, in that they completely bypass the township and the major affect will be a reduction in passing trade. However, Option C will also imply direct impacts, since it is likely to generate disruption in central Te Puke, with further deterioration possible in the CBD shopping and working environment.

3.2 Option A and Option B

There will be two direct impacts that will arise from Options A and B. The first is the loss of passing trade because most motorists and truck drivers will travel along the new highway, and bypass Te Puke. Both options will mean savings in travel time and cost for motorists and truck drivers, so most will take the choice to travel the new road. Commercial drivers would seek to minimise their time on the road. Few leisure travellers are likely to be enticed to visit Te Puke due to the lack of tourism amenities and attractions. With the majority of travellers choosing to bypass Te Puke on the

new highway, the opportunity to spend will be greatly reduced and a significant portion of current passing trade will be lost.

The second direct impact is the reduction in the sales leakage out of Te Puke. It was estimated that \$30.8 million or 29% of total retail demand is captured by retail outlets in other centres. One of the primary causes of this is that local residents avoid the Te Puke central business area due to the effects of heavy traffic flows. A survey on Te Puke resident's attitudes towards the central business area undertaken in 1996 by McDermott Fairgray³ found that 26% of respondents avoided the central business area constantly or frequently because of the traffic conditions.

If the bypass option is taken and heavy traffic flow is diverted away from the Te Puke central business area, then it is expected that net sales leakage will be reduced. Local residents will be more willing to patronise their local retailers, without the negative externalities created by the heavy traffic.

While the loss of passing trade will reduce trade and economic activity in Te Puke, the reduction in leakage will have the opposite effect.

3.2.1 Reduced Passing Trade

Table 3.1 shows the estimated direct impact of Option A and Option B on Te Puke through the reduction in passing trade. It is expected that around 95% of total current passing trade will be lost as a result of a bypass to the north. This would result in a decrease in local retail sales in the order of \$8.5 million annually and a subsequent loss of around 69 jobs in the retail sector.

³ McDermott Fairgray Group Ltd, "Te Puke Internal By-pass: Environmental and Social Benefits Study", August 1996.

Table 3.1: Direct Impact of Option A and Option B: Loss of Passing Trade

| Storetype | Loss of Passing Trade (\$'000) | Loss of Employment (FTE) |
|----------------------------------|--------------------------------|--------------------------|
| Food | 810 | 5 |
| Footwear | 10 | 0 |
| Clothing and Softgoods | 120 | 1 |
| Furniture and Floorcoverings | 60 | 0 |
| Appliances | 70 | 0 |
| Hardware | 40 | 0 |
| Chemist | 160 | 1 |
| Department | - | 0 |
| Recreational | 200 | 0 |
| Accommodation, Hotels and Liquor | 730 | 5 |
| Cafes, Restaurants and Takeaways | 800 | 19 |
| Other Stores | 70 | 1 |
| Automotive | 330 | 1 |
| Auto Services | 5,070 | 36 |
| Total | 8,480 | 69 |

Note: Spend estimates are exclusive of GST. Numbers may have been rounded and therefore may not sum precisely. Personal services are excluded.

This loss of trade would result directly from reduced traffic flow through Te Puke. The trade outlets most dependent on passing trade – auto services – will be the most severely affected, losing an estimated \$5.1 million a year. This loss of revenue will lead to a reduction in employment as it will no longer be sustainable to maintain the current workforce. Impacts are also likely to be felt by the restaurant and takeaway sector, the accommodation sector, and the general food sector where dairies and grocery outlets will be affected.

3.2.2 Reduced Sales Leakage

However, there will be some offset to this loss of trade. The reduction of heavy traffic flows is expected to stimulate more local demand and reduce the amount of leakage. Currently, sales leakage is estimated at 29% of total demand, and amounts to around \$30.8 million per year. If the personal and household services storetype⁴ is included, the total leakage figure would be \$31.6 million.

⁴ Personal and household services were excluded from earlier analysis because they were deemed to attract negligible passing trade. However, local demand for them will increase if conditions in the central business area is improved.

Table 3.2: Direct Impact of Option A and Option B: Reduced Sales Leakage

| Storetype | Reduced Sales Leakage (\$'000) | Additional Employment Needed |
|----------------------------------|-----------------------------------|---------------------------------|
| Food | 2,310 | 14 |
| Footwear | 60 | 1 |
| Clothing and Softgoods | 240 | 2 |
| Furniture and Floorcoverings | 110 | 1 |
| Appliances | 260 | 1 |
| Hardware | 180 | 1 |
| Chemist | 110 | 1 |
| Department | - | 0 |
| Recreational | 70 | 0 |
| Accommodation, Hotels and Liquor | - | 0 |
| Cafes, Restaurants and Takeaways | 330 | 8 |
| Other Stores | 430 | 7 |
| Automotive | 550 | 1 |
| Auto Services | - | 0 |
| Personal and Household Services | 130 | 3 |
| Total | 4,790 | 39 |

Note: Spend estimates are exclusive of GST. Numbers may have been rounded and therefore may not sum precisely. Personal and household services have been included.

The likely effect has been estimated by allowing for some reduction in total leakage across each retail type, but not a complete reversal of the current situation.

This recognises that much of the leakage arises for other reasons. A significant share of the leakage arises because shopping facilities handy in Tauranga, Mount Maunganui (or Rotorua) offer a wide range of store choices, more inventory to choose from, and price competitiveness. Nevertheless, it is likely that the reduction in heavy traffic flows, because of the bypass, would see sales leakage reduced. It is estimated that the reversal in leakage would amount to around \$4.8m, or 15% of the current leakage level and would sustain around 39 jobs. The sales leakage would be spread across most retail types, including food retail and general comparison stores.

3.2.3 Net Impact of Option A and Option B

The direct positive impacts and the direct negative impacts resulting from a bypass would have a net impact, as indicated in Table 3.3.

Overall, it is expected that the reduction in sales leakage would be less than the amount lost in passing trade. The overall net loss is estimated at \$3.7 million, and the distribution across the storetypes reflects mainly their shares of total sales. Food retailing will benefit from the bypass options, as will general merchandise.

The overall drop in sales by \$3.7 million would be associated with a net employment loss of around 30 employees. The auto services storetype will be severely affected as around 25% of its current sales is derived from passing trade, and a reduction of over \$5 million in sales can be anticipated.

Table 3.3: Net Impact on Retail in Te Puke under Option A and Option B

| Storetype | Net Sales Change (S'000) | Affected Employment (FTE) |
|----------------------------------|-----------------------------|------------------------------|
| Food | 1,500 | 9 |
| Footwear | 40 | 1 |
| Clothing and Softgoods | 120 | 1 |
| Furniture and Floorcoverings | 50 | - |
| Appliances | 190 | 1 |
| Hardware | 140 | 1 |
| Chemist | (50) | - |
| Department | - | - |
| Recreational | (130) | - |
| Accommodation, Hotels and Liquor | (730) | (5) |
| Cafes, Restaurants and Takeaways | (470) | (11) |
| Other Stores | 360 | 6 |
| Automotive | 220 | - |
| Auto Services | (5,070) | (36) |
| Personal and Household Services | 130 | 3 |
| Total | (3,690) | (30) |

Note: Spend estimates are exclusive of GST. Numbers may have been rounded and therefore may not sum precisely. Personal and household services have been included.

3.3 Option C

Under Option C, travellers will still pass through Te Puke's central business area, although the highway through the central area will be upgraded to improve traffic flows. Any upgrade is likely to involve some expansion of the highway, and this may have significant impact on businesses adjacent to it, and on footpaths and on-street parking spaces which may be reduced.

3.3.1 Passing Trade

The likely impact on passing trade depends on the degree of change to the Te Puke main street. At present, the street layout with angle parking offers relatively easy accessibility to passing motorists to stop and patronise local shops. If this amenity level is reduced, then there is expected to be a decrease in the level of passing trade to Te Puke. Travellers will continue to pass through the heart of Te Puke, but would not have the same opportunity to spend. Therefore retailers' gains from passing trade would reduce below current levels.

Unlike the current situation, where drivers have to slow down along the Te Puke main street, the opportunity to pass other traffic is lacking, and drivers' chances of spotting both relevant shopping opportunities and a place to stop safely are reasonably good, the enhancement highway will enable drivers to maintain higher speed when passing through Te Puke. While Te Puke will still be on the highway, it is likely that a higher proportion of travellers will pass through the town without making a stop.

Any reduction in on-street parking facilities or stopping areas is likely to reduce the level of passing trade, especially for food and takeaway purchases, and convenience goods. It is unlikely to have as much effect on auto services and fuel outlets, since these are generally not in the core of the CBD, and are less likely to have reduced accessibility from changes to the road layout.

Overall, we would expect Te Puke's capture of passing trade to drop by around 10%. While there would be only a small drop for automotive services, there would be a drop of between 15% to 20% for other types of retail. This is shown in Table 3.4.

Table 3.4: Direct Impact of Option C: Loss of Passing Trade

| Storetype | Loss of Passing Trade (\$'000) | Loss of Employment (FTE) |
|----------------------------------|--------------------------------|--------------------------|
| Food | 171 | 1 |
| Footwear | 3 | 0 |
| Clothing and Softgoods | 25 | 0 |
| Furniture and Floorcoverings | 13 | 0 |
| Appliances | 14 | 0 |
| Hardware | 8 | 0 |
| Chemist | 34 | 0 |
| Department | - | 0 |
| Recreational | 42 | 0 |
| Accommodation, Hotels and Liquor | 39 | 0 |
| Cafes, Restaurants and Takeaways | 169 | 4 |
| Other Stores | 15 | 0 |
| Automotive | 71 | 0 |
| Auto Services | 267 | 2 |
| Total | 869 | 8 |

Note: Spend estimates are exclusive of GST. Numbers may have been rounded and therefore may not sum precisely. Personal services are excluded.

The overall reduction in passing trade would be approximately \$0.9 million a year, resulting in the subsequent loss of 8 retail jobs.

3.3.2 Sales Leakage

The 1996 resident survey revealed local residents' unwillingness to visit the central business area, because of the environmental conditions caused by heavy traffic. Under Option C the conditions for visitors to the central business area are unlikely to be significantly improved despite the gains for passing traffic. Therefore sales leakage is unlikely to be reduced. Further, if the highway upgrade reduces parking areas or footpath space, then the sales leakage is likely to increase above the current level, as the Te Puke CBD may become less attractive to local consumers. And the

cost of travelling to alternative shopping and business destinations (Tauranga, Mount Maunganui) will be reduced because of quicker travel on the upgraded highway.

Therefore, the most likely outcome would be a small increase in sales leakage, by around 10%. This would see leakage increase from the current \$31.6 million including personal services (gross) to around \$34.2 million. The estimated change is shown in Table 3.5.

Table 3.5: Direct Impact of Option C: Increased Sales Leakage

| Storetype | Increased Sales Leakage (S'000) | Loss of Employment (FTE) |
|----------------------------------|------------------------------------|-----------------------------|
| Food | 1,160 | 7 |
| Footwear | 40 | 0 |
| Clothing and Softgoods | 160 | 1 |
| Furniture and Floorcoverings | 60 | 0 |
| Appliances | 130 | 1 |
| Hardware | 70 | 1 |
| Chemist | 40 | 0 |
| Department | - | 0 |
| Recreational | 30 | 0 |
| Accommodation, Hotels and Liquor | - | 0 |
| Cafes, Restaurants and Takeaways | 160 | 4 |
| Other Stores | 290 | 5 |
| Automotive | 370 | 1 |
| Auto Services | - | 0 |
| Personal and Household Services | 90 | 2 |
| Total | 2,590 | 22 |

Note: Spend estimates are exclusive of GST. Numbers may have been rounded and therefore may not sum precisely. Personal and household services have been included.

The increase in sales leakage of around \$2.6 million would affect 22 jobs across the retail sector.

3.3.3 Net Impact of Option C

Overall, we would expect Te Puke retail sales to decrease by \$3.5 million, the combined effects of the \$0.87 million loss of passing trade, and the \$2.6 million increase in sales leakage. This loss of retail trade will affect 30 jobs in the Te Puke retail sector (Table 3.6).

Table 3.6: Net Impact on Retail in Te Puke under Option C

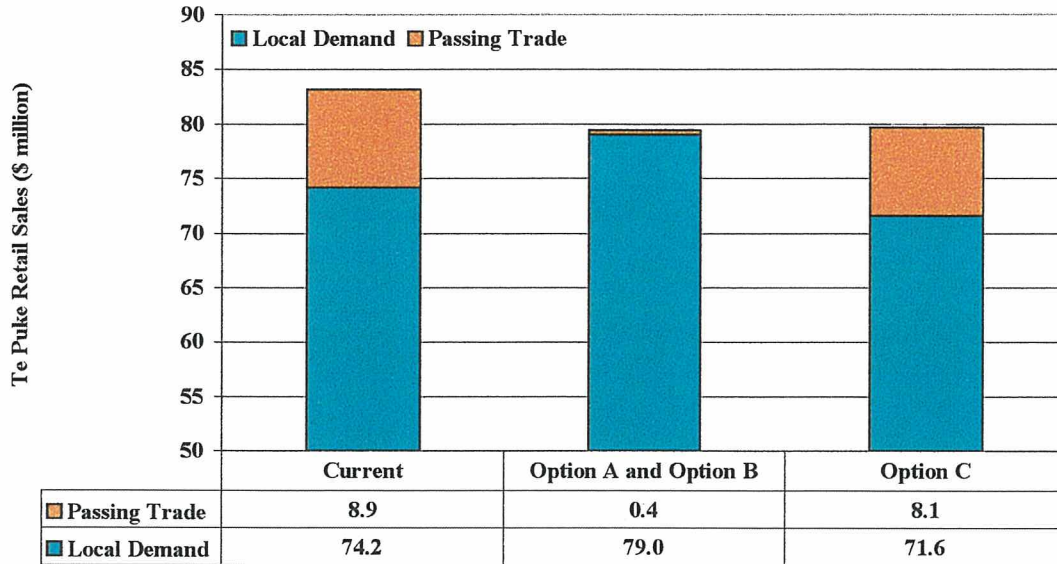
| Storetype | Net Sales (S'000) | Affected Employment (FTE) |
|----------------------------------|----------------------|------------------------------|
| Food | (1,330) | (8) |
| Footwear | (40) | - |
| Clothing and Softgoods | (180) | (2) |
| Furniture and Floorcoverings | (70) | - |
| Appliances | (140) | (1) |
| Hardware | (80) | (1) |
| Chemist | (70) | - |
| Department | - | - |
| Recreational | (70) | - |
| Accommodation, Hotels and Liquor | (40) | - |
| Cafes, Restaurants and Takeaways | (330) | (8) |
| Other Stores | (300) | (5) |
| Automotive | (440) | (1) |
| Auto Services | (270) | (2) |
| Personal and Household Services | (90) | (2) |
| Total | (3,450) | (30) |

Note: Spend estimates are exclusive of GST. Numbers may have been rounded and therefore may not sum precisely. Personal and household services have been included.

3.4 Options Compared

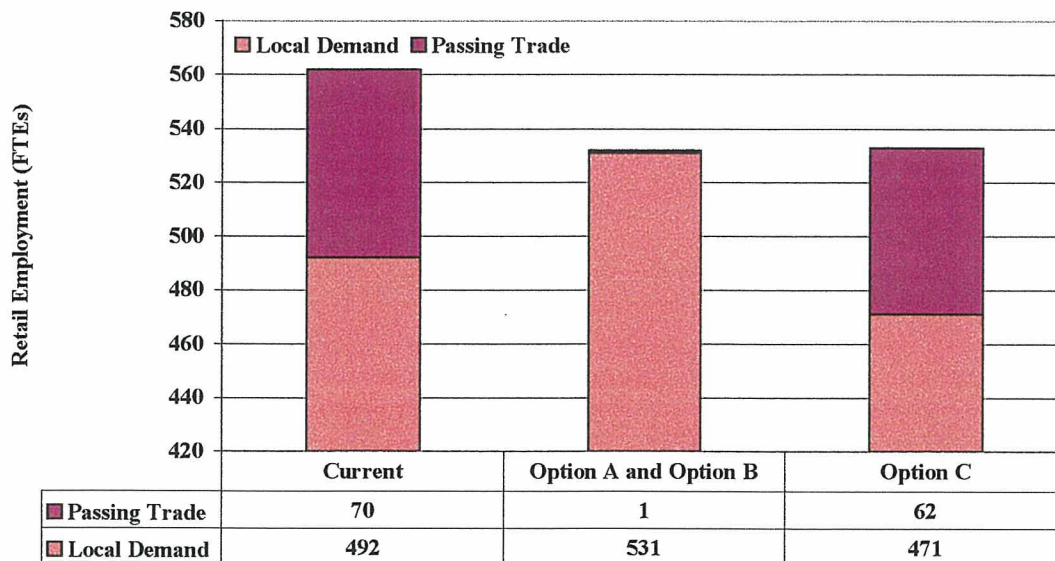
Irrespective of the option selected for the arterial, Te Puke's trade sector is likely to have a net negative outcome. Figures 3.1 and 3.2 present a comparison of the net direct impacts under the various options. All three options are expected to result in lower retail trade for Te Puke due to either loss of passing trade or change in the level of sales leakages. There is little difference in the outcomes overall, in economic terms. This suggests that other factors are relatively more important in the decision.

**Figure 3.1: Current vs Proposed Situations under the Three Options:
Retail Sales**



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**Figure 3.2: Current vs Proposed Situations under the Three Options:
Employment**



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4. IMPACT ON OTHER LOCALITIES

4.1 Scope

The previous section has analysed the impacts of the three options on Te Puke in terms of employment and retail sales. This section looks at the possible impacts of the proposed highways on nearby localities.

4.2 Option A and Option B

As discussed in Section 2, the nearest locality to Te Puke of a reasonable size in terms of retail outlets and amenities are Mount Maunganui, Tauranga, Whakatane, Edgecumbe or Rotorua depending on the direction of the traveller to/from Te Puke.

Option A and B diverts \$8.5 million worth of passing trade away from Te Puke. There exists now an opportunity for other towns to attract some of that trade which will stimulate their local economy.

Currently, major retail centres exist in Mount Maunganui and Tauranga. Under Options A and B, travellers will be able to make their convenience stops at Tauranga or Mount Maunganui or at other locations along the route.

Small centres such as Paengaroa will attract some of the passing trade diverted from Te Puke as a result of the bypass. However, the retail mix in Paengaroa will offer much lesser opportunity to spend for travellers. The centre's retailing activity currently includes 3 hospitality outlets, 1 other store and 1 service station. There is likely to be extra opportunity for more stores to open or existing ones to expand, and the proximity/distance factors mean Paengaroa's location at the junction of State Highway 33 and State Highway 2 where the bypass will meet will mean considerable advantage. Given an expanded retail mix in the town, Paengaroa will be able to

attract a reasonable share of the passing trade no longer served in Te Puke. However, given the town's small local base and high leakage (estimated at 85% of total demand) will mean Paengaroa is unlikely to develop a wide range of retailing. While even a minority share of the passing trade will have a significant direct impact on Paengaroa, most of the passing trade currently served by Te Puke will instead accrue to Mount Maunganui or Tauranga.

Option A and B also impacts on other localities through the reduction in Te Puke's sales leakage by \$4.8 million a year. As mentioned, a significant share of the leakage flows to Mount Maunganui or Tauranga. Therefore, the reduction in sales leakage will result in lower retail sales in those two centres.

Hence, Mount Maunganui and Tauranga are likely to lose some of the trade they currently attract from the Te Puke catchment, but gain diverted passing trade. Because Te Puke is expected to experience a net loss under Option A and B, then Tauranga and Mount Maunganui will experience a net gain. Since this gain will represent a small component of their total trade levels, the effects on the retail and trade sectors as a whole in the two towns are likely to be insignificant.

4.3 Option C

Option C is expected to result in a smaller loss of passing trade through Te Puke and an increase in sales leakage for the town. This will have some positive impacts on Tauranga and Mount Maunganui, which attract Te Puke household demand, of a similar nature to Option A and B (most of Te Puke's loss of \$2.6 million in retail sales).

Under Option C, the effect on Paengaroa will be considerably less because the diversion of passing trade from Te Puke will be less.

Table 5.1: Summary of Options

| | Most Preferred | Next/Least Preferred |
|---------------------------------|-----------------------|-----------------------------|
| Option | C | A or B |
| Direct Passing Trade Impact | | |
| <i>Retail Sales (\$'000)</i> | (869) | (8,480) |
| <i>Retail Employment (FTEs)</i> | (8) | (69) |
| Direct Sales Leakage Impact | | |
| <i>Retail Sales (\$'000)</i> | (2,590) | 4,790 |
| <i>Retail Employment (FTEs)</i> | (22) | 39 |
| Net Direct Impacts | | |
| <i>Retail Sales (\$'000)</i> | (3,450) | (3,690) |
| <i>Retail Employment (FTEs)</i> | (30) | (30) |

Because it would have slightly lower direct net impacts on Te Puke, Option C may be seen as the most preferred option - it has the lowest negative direct impact. Option A and B have similar impacts, reducing the amount of passing trade through Te Puke which is partly offset by reduced sales leakage.

However, the differences in outcomes are small, and it is not expected that the degree of trade impact on the Te Puke economy (and therefore the community) will be critical in the decision process.

While Option C has shown to be the most preferred relative to the other options, it must be noted that all options are expected to result in negative impacts on Te Puke.

APPENDIX C
Bibliography for Archaeological Assessment
Background Tradition
Recorded Sites

APPENDIX C

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Maps

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APPENDIX C

BACKGROUND TRADITION

The Te Arawa waka landed at Maketu and three ancestors from the waka established the occupation of Maketu, Rangiuru, Te Puke and Otawa. The ancestors were Tamatekapua, Tia and Hei. The descendants of Tamatekapua left Maketu for the inland lake district while the descendants of Tia (Ngati Tapuika) and Hei (Waitaha) remained on their lands⁹.

The ancestors of Ngaiterangi of Tauranga under the leadership of Te Rangihouhiri following a coastal route, migrated from the east coast to Maketu and established an occupation of Maketu where they were able to assume the mana over the area. Tapuika remained at Rangiuru and Waitaha on their lands surrounding Otawa from the coast inland. Ngaiterangi then move from Maketu to settle in Tauranga leaving the area to Tapuika and other migratory groups who came to Maketu, who in the main originate from the Mataatua waka of eastern Bay of Plenty, the same origin as Ngaiterangi.

The use of muskets in large scale warfare led to Ngapuhi taua attacking Motiti, Tauranga, Maketu and the Rotorua Lakes exacting retribution on the iwi in these areas in the late 1810's and early 1820's who had killed their northern kin. The impact of the use of muskets against stone and wooden weapons was devastating and acquisition of muskets became a priority for most iwi. The availability of large areas of wetland with flax and the market for flax was quickly made into an item as trade for guns and powder in this region. The vast wetland ares were accessible to trading boats in Tauranga and Maketu.

The inland Te Arawa iwi and hapu moved to the Kawa swamps of Maketu and the lower Kaituna River to work flax for trade. With the establishment of their own trader tension and conflict with Ngaiterangi hapu soon erupted into warfare. Ngati He, Ngaitauwhao and Ngapotiki set up pa along the Kaituna River at Te Karaka, Te Paroa, and Te Tumu to maintain a presence in the area. Ngapuhi under Te Haramiti suffered a major defeat at Motiti in 1831 at the hands of Ngaiterangi and they became allies with Te Arawa to avenge the losses. It gave Te Arawa an opportunity to squeeze out Ngaiterangi at Maketu.

We dressed flax at Kaituna to buy guns to fight Ngaiterangi...¹⁰

Eru T Uremutu of Tapuika described the events that were to unfold as the lower Kaituna River became a battlefield:

Soon after Ngapuhi & 'Whakaue arrived in Maketu, Ngatihei followed them up & occupied Te Tumu. When they had finished the pa, they came along the beach and attacked Maketu, but were defeated. This was the battle of Kaiawha. ...This was the first fall of Te Tumu. Ngaiterangi came again & rebuilt Te Tumu fight ensured & Whakaue

⁹ Stafford

¹⁰ Hohua Te Kapuawaiwaho MMB 3: 133

were driven to the north of the Maketu river when Te Waiatua's father rallied them & they turned on their pursuers.... This was the Ruatahapari fight....

300 of 'Whakauae then marched by Papamoa to the sea beach, when they got to Paroa, they retreated, but 29 of them went to Te Tumu & found fighting raging on the beach between Whakauae & Ngaiterangi. The 29 then burnt the fishing nets of Ngaiterangi in the rear of Te Tumu. Ngaiterangi chased them & overtook them at Horoipia...

Pango now conveyed Titore back to the Bay of Islands taking with him all the heads of the slain, in order that Ngapuhi might see the revenge obtained for Te Haramiti. When they arrived home, they went to Muriwhenua to raise a taua against Ngaiterangi, and came to Maketu 300 strong.

...Ngapuhi now attacked Te Tumu, but were defeated; four were killed... This was in payment for the canoe affair¹¹.

The death of Te Hunga of Matamata by Huka of Te Arawa in 1835 meant an escalation of the tension between Tauranga and Rotorua iwi which flared into a large scale regional war between Waikato and their allies Ngaiterangi, with Te Arawa. This war was to last for ten years. Sections of Waitaha and Tapuika joined their Te Arawa kin against Ngaiterangi and the whole region around Maketu became abandoned to avoid taua who would kill any one in their path. Te Arawa retook the Maketu area from Ngaiterangi and held Maketu until formal peace arrangements were made and a boundary between the two tribes established at Wairakei on the coast. The distribution of lands around Maketu was according to the role of individual Te Arawa iwi in important battles and ancient ties to the ancestor Tamatekapua. An example is the allocation of the Te Tumu Kaituna Block was based on the roles of different Te Arawa iwi in the taking of the pa Te Tumu. The region remained unoccupied until Maketu was re-occupied by Ngati Pikiao of Rotoiti.

The tension between the regions and intensity of the war led to rapid change in settlement pattern as people abandoned areas which exposed them to being picked off by fighting forces, the Kaituna River, Papamoa coast and hills.

¹¹ MMB2 p 151-152

APPENDIX C

RECORDED SITES

Options A, B

| | | |
|----------|-------------------------|------|
| U14/1802 | Stone adze find spot | 1984 |
| U14/1803 | Stone adze find spot | 1984 |
| U14/1804 | Midden and hangi stones | 1984 |
| U14/1786 | Midden | 1984 |
| U14/1787 | Midden and hangi stones | 1984 |
| U14/1788 | Stone adze find spot | 1984 |
| U14/1789 | Obsidian find spot | 1984 |
| U14/1790 | Stone adze find spot | 1984 |
| U14/1791 | Obsidian find spot | 1984 |
| U14/1792 | Obsidian find spot | 1984 |
| U14/1793 | Adze find spot | 1984 |
| U14/1794 | Midden/cooking stones | 1984 |
| U14/1848 | Stone adze find spot | 1984 |
| U14/1849 | Midden/hangi stones | 1984 |
| U14/1850 | Midden/hangi stones | 1984 |
| U14/1851 | Stone adze find spot | 1984 |
| U14/1852 | Hangi stones/find spot | 1984 |
| U14/226 | Pa | |
| U14/1738 | Pa | |
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APPENDIX D
References for Noise Assessment

APPENDIX D

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APPENDIX E
Newsletters