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Western Ring Route – Waterview Connection

Assessment of Avian Ecological Effects

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Quality Assurance Statement

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1. Introduction

1.1 Background

The NZ Transport Agency (NZTA) proposes to complete the Western Ring Route (WRR) Motorway project. This will involve upgrading State Highway 16 (SH 16) by way of widening the existing corridors, between St Lukes Road and Te Atatu Road, and extending State Highway 20 (SH 20) from Maioro Street (Mt Roskill) to the Northwestern Motorway (SH 16), near Great North Road (the Project). These upgrades make the Project the key project to complete the WRR. Once completed, the WRR will create an alternative Motorway between Manukau and Albany by linking three state highways – the Southwestern (SH 20), Northwestern (SH 16), and Upper Harbour (SH 18) highways.

In 2009 the NZTA confirmed its intention that the Project would be lodged with the Environmental Protection Authority as a Proposal of National Significance. The Project includes works previously investigated and developed as two separate projects: being the SH 16 Causeway Project and the SH20 Waterview Connection. The key elements of the Project are:

- Completing the Western Ring Route (which extends from Manukau to Albany via Waitakere);
- Improving resilience of the SH 16 Causeway between the Great North Road and Rosebank Interchanges to correct historic subsidence and "future proof" it against sea level rise;
- Providing increased capacity on the SH 16 corridor (between the St Lukes and Te Atatu Interchanges);
- Providing a new section of SH 20 (through a combination of surface and tunnelled road) between the Great North Road and Maioro Street Interchanges; and
- Providing a cycleway throughout the surface road elements of the The Project corridor.

1.2 Purpose and Project Description

The purpose of this report is to provide an assessment of the Project on the existing environment as it pertains to avifaunal ecology (i.e. birdlife) and an assessment of the significance of these effects. Where this assessment identifies potential adverse effects on this environment that are more than minor, the report provides a scope of works to avoid, remedy or mitigate these effects. Where there is uncertainty regarding the likely effects or the significance of the effects, the report identifies an approach for monitoring and (where necessary) mitigation.

1.3 Site Characteristics and Surveys

The report describes the avifauna that is characteristic of Sectors 1 to 9 inclusive of the proposed motorway development. Within the Project Area there is an overall habitat difference between the maritime area of Sectors 1 to 5 inclusive and the urban area (residential and parkland) of Sectors 6 to 9 inclusive (Figure 1.1).

Terrestrial birds were only surveyed via formal counts in Sectors 5, 7 and 9 (Sector 8 comprises tunnels that will have little, if any, effect on urban birds). In Sectors 1 to 4 inclusive and Sector 6, small remnant areas of native and exotic habitat (including grazed pasture and motorway edges) were checked for the presence or potential presence of any notable terrestrial species during various surveys.

Marsh birds were surveyed in areas of potentially suitable maritime habitat (i.e. saltmarsh, rushes, fringing mangroves and Motorway edges) in the Sector 2 to 5 areas inclusive.

This report amalgamates the results of a number of surveys that were completed by Boffa Miskell Ltd and Bioresearches Group Ltd in the 2000 to 2010 period. The survey times and periods are noted in Section 3. The Boffa Miskell surveys encompassed the terrestrial habitats along SH 20, terrestrial and marsh bird habitats at Oakley Creek and areas of coastal habitat in Waterview Estuary and between Whau Creek and Point Chevalier. The Bioresearches surveys were focussed on SH 16 and included a coastal bird survey of the area beside the Causeway, checks for marsh bird presence in SH 16 edge areas and high tidal surveys of a bird roosting area adjacent to the proposed site of Construction Area No. 1 at Te Atatu.

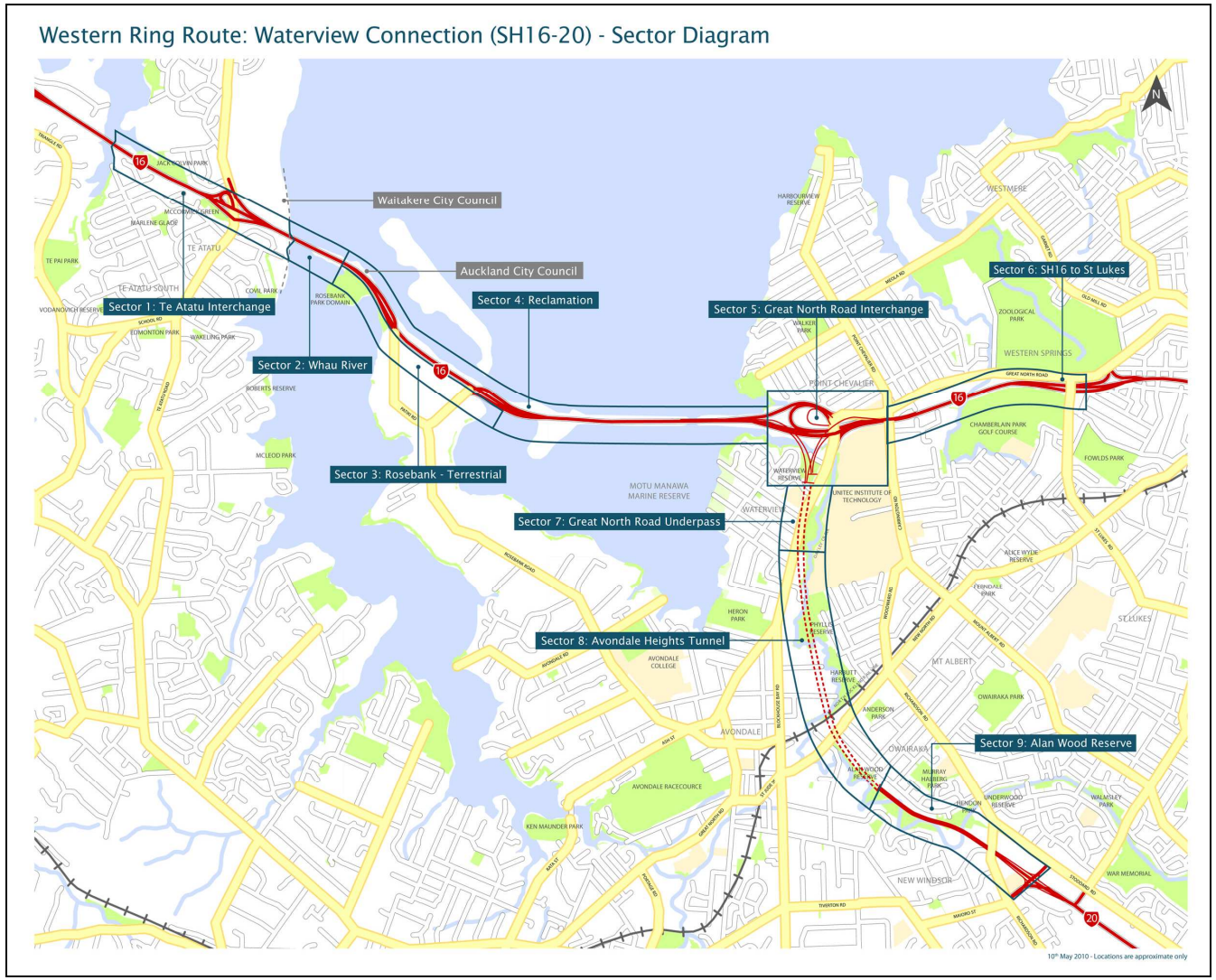

Figure 1.1 - Western Ring Route: Waterview Connection (SH 16-20) Sector diagram

2. Avifauna Habitats

2.1 Terrestrial Habitats

Overall there are two broad terrestrial habitat groups that will be affected by the Project. Firstly, the habitats of the Oakley Creek mouth, Oakley Creek itself, Alan Wood Reserve and the St Lukes Section (i.e. Sectors 5, 6, 7, and 9) consist of urban habitat types (e.g. mature exotic and weed trees, native plantings, regenerating bush, open grassland, playing fields and remnant rock forest). Secondly, the SH16 areas (i.e. Sectors 1 to 4 inclusive) typically consist of a maritime habitat of mangroves, saltmarsh, flax, wattle and other peripheral shrubs that have developed in response to the presence of the existing Motorway footprint.

These are both broad habitat types that are utilised by a range of common urban birds that are typical of developed residential areas. Full descriptions of the vegetation are presented in the Assessment of Terrestrial Vegetation Effects Report.

2.2 Coastal Habitats

Oakley Creek discharges into the Waterview Estuary. The Estuary is a relatively modified marine environment as a result of the construction of SH16, which had a significant effect on flow dynamics and tidal flushing (Figure 2.1).

The Motu Manawa Marine Reserve surrounds the majority of the Causeway and Pollen Island. An extensive area of intertidal and sub-tidal flats is present on the northern side of the Causeway. These flats are an important feeding area for a wide variety of shorebird species, both resident and visitors, with the latter including both national and international migratory species (such as South Island pied oystercatcher and eastern bar-tailed godwit, respectively).

The Waterview Estuary and areas surrounding Pollen Island are classified as a Coastal Protection Area 1 (CPA1) in the Auckland Regional Plan: Coastal. Pollen Island is considered a nationally important landform because it contains the best remaining largely unmodified area of its type in the Waitemata Harbour (i.e. salt-marsh, mangroves, shell banks and estuarine/ harbour mud flats). This area supports a diverse range of plant and animal communities. In particular the shell banks support a range of migratory and endemic coastal birds, including some threatened species. The Department of Conservation (DOC) has classified the area as an Area of Significant Conservation Value (ASCV) and a large part of the estuary is contained within the Marine Reserve. Plates of the habitats adjacent to the Causeway are shown in Section 11.

2.3 Marsh Habitats

The Coastal Marine Area (CMA) and Pollen Island itself contain habitat consisting of a mosaic of rush marsh, mangroves, and marginal vegetation that are utilised by banded rail and fernbird. Traherne Island, both in its

northern section and within its southern part within Waterview Estuary also contains potential habitat for those species. Waterview Inlet contains mainly marine and marginal, riparian scrub that could be utilised by banded rail in particular.

2.4 Discussion

The above analysis describes broad habitat types. Birds using those habitat types are generally referred to as "terrestrial birds", "coastal birds" and "marsh birds". However there are species of birds that utilise a range of habitat types, for example, pukeko can be found in public parks, freshwater wetlands or marsh habitats and in intertidal areas. Similarly both red-billed and black-backed gulls utilise coastal and terrestrial (or inland) habitats; "typically terrestrial" species such as starling, blackbird and myna also feed in upper intertidal habitats and a range of terrestrial species can use mangrove vegetation at times. In this report "terrestrial birds" for example refers to birds using the terrestrial habitats and, while most of the species will be typically terrestrial, some species that are also able to exploit other habitats will be included in that Section.

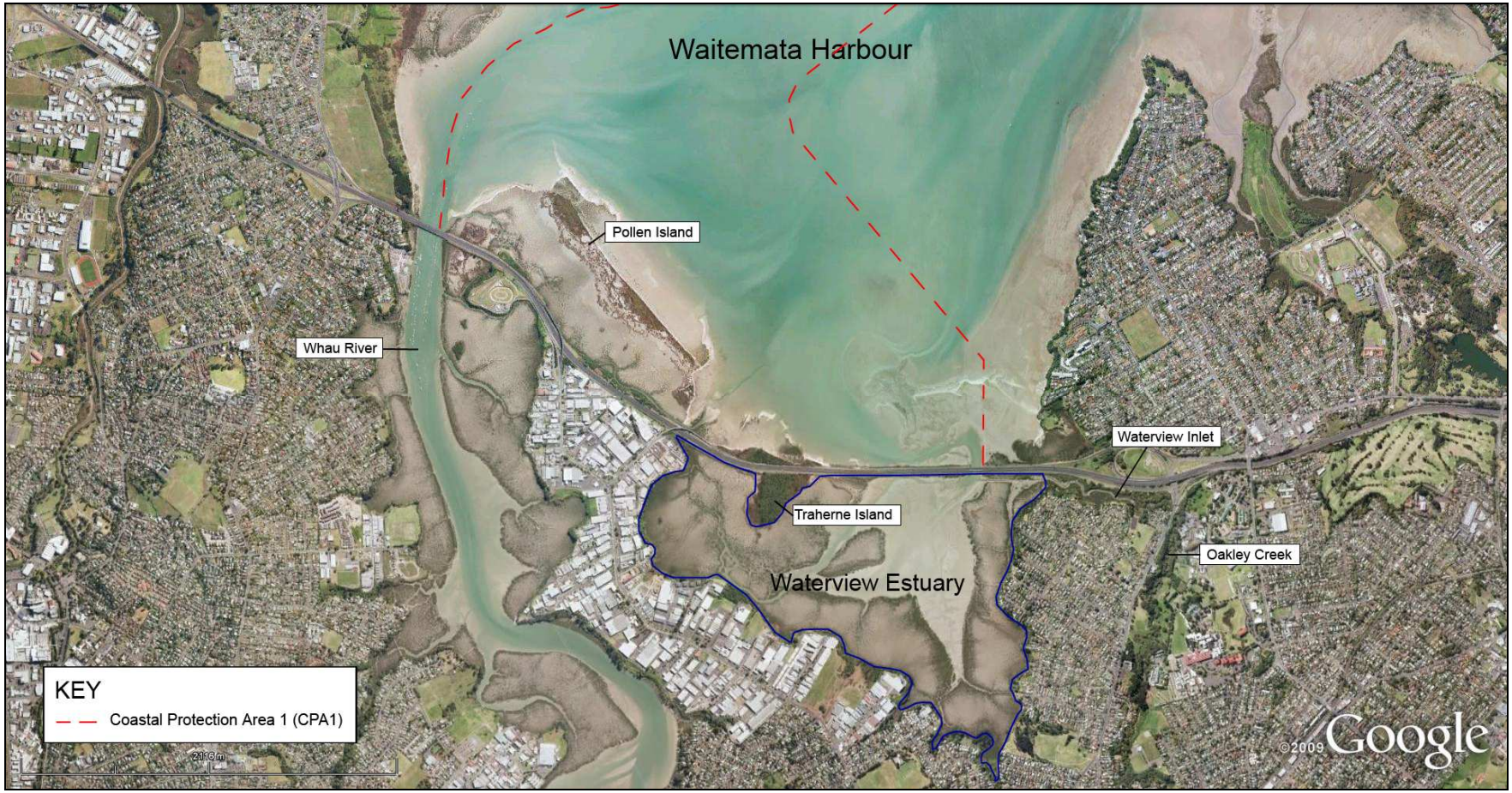

Figure 2.1 – Coastal Areas of Sectors 1 – 5

3. Methods

3.1 Terrestrial Birds

The following investigations refer to sampling sites within Sectors 4, 5 and 9 of the Project Area. Sector 8 will be in tunnels and have little, if any, effect on birds. Having assessed the habitat available for the terrestrial birds and their locations in Sectors 1, 2, 3, 6, and 7, no formal surveys were considered warranted. It is not anyway feasible to undertake five-minute counts that rely on birds being both heard (predominantly) and seen, immediately adjacent to a relatively noisy motorway. No notable species would utilise those areas and no notable habitats were present. All the areas that were surveyed are shown on Figure 3.4.

3.1.1 2000–2003 Surveys

The first bird investigations included the riparian bush of the Oakley Creek Walkway, between Cowley Street and Heron Park. The methods used here involved distance sampling along the length of the walkway on two occasions (27-11-00 and 05-01-01). In March 2003, these avifauna studies along the Oakley Creek walkway were supplemented by further bird investigations, specifically site utilization studies. The aim of this work was to build upon the earlier surveys of 27-11-00 and 05-01-01.

Those same bird surveys included a substantial portion of the southern regions of the Project Area, focusing on Alan Wood Reserve and Hendon Park in Sector 9. The methodology for these areas involved a site utilisation survey, whereby birds observed and/or heard to be present over the course of several site visits were noted. This methodology was consistent with the character of the sites sampled, given the marked paucity of trees and almost complete dominance of open space in this area (i.e. making visual observation very easy).

The 2001 surveys also included several other parks in the vicinity, but outside of the bounded Sectors of the Project Area. The inclusion of these sites provided comparative data for determining the relative importance of the reserves within the wider Project Area as a resource for birds.

In March 2003, the earlier (2001) studies were supplemented by further bird counts. These involved bird count transects at each discrete patch of vegetation along both the Oakley Creek walkway (located in Sector 5, 7 and 8 between New North Road and Waterview) and the Rosebank escarpment. The methodology involved walking along a transect within each of these sites, recording bird species present either via their song or direct observation.

3.1.2 2006 Survey

Birds were sampled for in a number of parks and reserves in Sectors 8 and 9. The survey technique also used site utilisation studies, whereby all birds that were observed and/or heard to be present were noted. This methodology was entirely appropriate to the character of the sites sampled, given the marked paucity of trees

(with the exception of woody weeds and exotic species) and predominance of open space (i.e. again making visual observation a very straight-forward exercise).

3.1.3 2008 Surveys

Bush and grassland birds were assessed using standard 5-minute point counts. These surveys were conducted at both ends of the SH20 part of the Project Area, with the sampling sites in Sector 4 being predominantly in (exotic) bush around the mouth of Oakley Creek, while those in Sector 9 existed within exotic tree-land, rank grasslands and weed fields.

Specific behaviour patterns were also noted. For instance, whether the bird(s) were feeding, swimming, undertaking courtship displays, traversing the site, etc. Traversing birds were not included in the analysis. Each count lasted for 5 minutes, preceded by a two minute stand down period to allow activity to settle following observer arrival. During the stand down period the observer recorded time, temperature, wind direction, wind speed, precipitation, cloud cover and visibility.

3.2 Coastal Birds

3.2.1 Overview Coastal Bird Survey

Surveys were undertaken to verify the existing diversity and abundance of all bird species in the wider vicinity of the Project Area. Survey effort focused on coastal and wetland birds with the aim of putting the Project Area into perspective.

A total of ten sites were surveyed over a four month period. These are described in Table 3.1 and illustrated in Figure 3.1 and Figure 3.2.

Coastal birds were surveyed during the period December 12th 2007 to April 8th 2008 at the sites shown in Figure 3.1 and Figure 3.4. Twelve low tide counts and three high tide counts were undertaken during this time across all ten survey compartments, each count lasting approximately two and a half hours. Sites were surveyed during both neap (6 low and 1 high) and spring tides (6 low and 2 high) in an effort to adequately cover activity throughout the tidal cycle. Site 9 was not surveyed on January 14th (low tide) due to a locked gate preventing access to the viewing platform.

Figure 3.1 – Coastal bird survey sites

Figure 3.2 - The mouth of Oakley Creek at low tide (left) and high tide (right) showing the temporary nature of intertidal feeding habitats that are characteristic of the Project Area.

Table 3.1 - Coastal monitoring site locations (refer Figure 3.1)

Site Number	Location	Aspect	Specifics
1	Whau River Entrance	Seaward	Break in road barrier south of bridge
2	Pollen Island	Seaward	Grass verge before Rosebank Road off ramp
3	Pollen Island/ Traherne Island	Seaward	Shell bank after Rosebank Road on ramp
4	Oakley Creek/Avondale catchment/Estuary outfall	Seaward	Verge before Great North Road sign (East to shingle bank)
5	Reserve at end of Walker Road, Point Chevalier	Seaward	West to Shingle bank
6	Point Chevalier Yacht Club	Seaward	South to Site 05, seaward (North) to MLWS [1]
7	Side of Motorway at main estuary outfall	Estuary	South side of channel
8	Side of Motorway at end of barrier	Estuary	North side of channel to Traherne Island
9	Carpark at end of Copsey Road	Estuary	East to Site 08
10	End of Oakley Creek	Estuary	Waterview

Detailed descriptions of coastal monitoring site locations are provided below:

- **Site 1** is at the farthest northern reach of the embayment and subject to variation in response to a separate catchment (Whau River).

- **Sites 2-6** are all on the seaward side of the Causeway and are subject to marine environment influence. Fetch (wave generation) length in a generally northern direction is in the order of 5-8 km.

[1] MLWS : mean low water spring (tide level)

- **Sites 2-5** are typified by chenier banks at and above MHWS [2] and indicate an abundant supply of shell gravel in the immediate vicinity. Vegetation adjacent the banks is a mix of salt marsh and mangrove of varying density and extent. The extent of this is in the range of 5-500m and decreases eastward

- along the profile to seaward the embayment is tidal with extensive mudflats and ebb tidal deltas separated by channels.
- **Sites 5-6** at the west perimeter of the bay graduate into cliffs and wave-cut platforms of exposed Waitemata Group sandstone/mudstone strata with decreasing sediment overlay seaward (north).
- **Sites 7-10** are the estuarine side of the Motorway Causeway and are dominated by extensive mudflats and mangrove habitats.
- **Site 7** is the combined outlet of the Oakley Creek and the greater estuary to landward of the spillway. It combines the eastern bank of the main channel and the flood-tide delta. Adjacent vegetation is dense mangrove with a narrow foreshore of mud bank.
- **Site 8** is the western side of the channel through to the extensive salt marsh surrounding Traherne Island and south to approximately the centre of the estuary from the Causeway. It is predominantly a level mudflat with a single well-established channel running in a generally southward direction.
- **Site 9** is the upper south-western region of the greater estuary and takes in the area adjoining site 8 to the north. Vegetation is dense mangrove with well-defined mud flats between. Landward is the Rosebank Road industrial area.
- **Site 10** is similar to and adjoins site 9 through a westerly perspective from an urban street.

Due to the tidal variation in coastal bird movements, these species were assessed via low tide (feeding) counts and high tide (roosting) counts. For the purposes of this study, only birds recorded within the mudflats or mangrove or salt marsh swathes were considered. Birds seen traversing the area were not recorded (except noteworthy occurrences which were recorded separately – e.g. flock of wrybills). The ten survey sites were regularly monitored via the use of binoculars and 20× zoom spotting scope to record the diversity and abundance of coastal bird species utilising the area (see Bibby *et al.* 2000 Ch. 9 for full methods).

During each visit, each site was consecutively surveyed for a period of approximately 5-10 minutes (depending on numbers present). Counts were undertaken within two hours of high or low tide. Monitoring sites were selected to provide the best possible coverage of habitat across the area. Although no clear boundaries were set between count areas, double-counting was minimised. This was because the counting area of each site was generally not visible from other count stations due to distance or physical boundaries. Although birds generally moved during counting, most movement was within sites and double-counting was avoided by conducting counts in quick succession.

[(2)] mean high water spring (tide level).

3.2.2 Causeway Coastal Bird Survey

The section of SH 16, from Waterview to Traherne Island, was divided into four 200 m long areas to provide a total of eight habitat blocks on the northern (i.e. 1N – 4N) and southern (i.e. 1S – 4S) sides of the Motorway Causeway (Figure 3.3). In March 2007 bird counts were undertaken in each of these blocks by walking along the Motorway edges. Hourly counts of those blocks were completed over tidal periods as follows -

northern side	- 15th, 23rd, 28th March 2007 (total of 21 hourly counts in four blocks)
southern side	- 12th, 21st, 27th March 2007 (total of 20 hourly counts in four blocks)

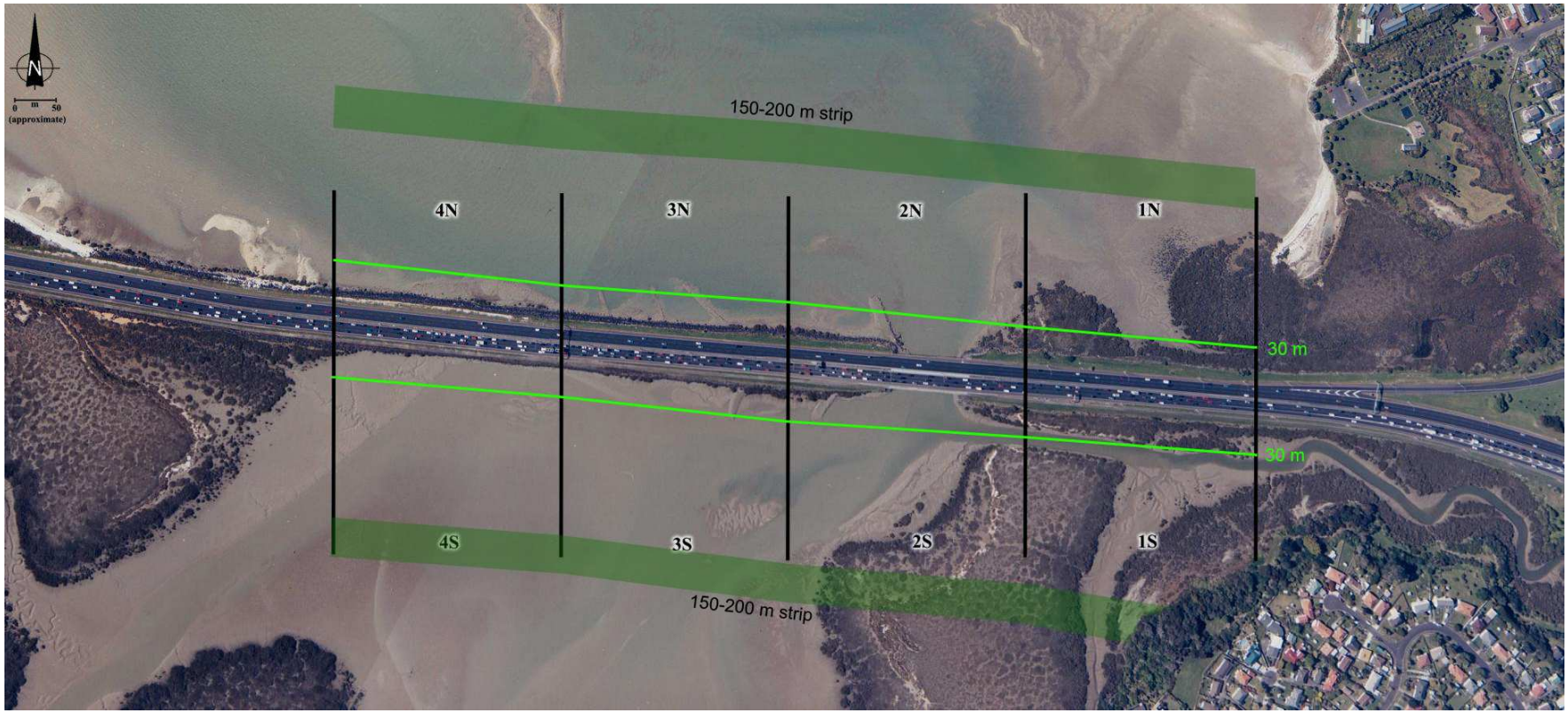

Figure 3.3 - Aerial photograph of the Motorway Causeway showing the location of the 8 coastal bird count blocks on the northern (1N - 4N) and southern sides (1S – 4S)

In each block, during each count, all coastal birds and their activities were recorded in two zones (a) to c.150 – 200 m out from the Causeway and (b) to c.30 m out from the Causeway (i.e. on the Causeway sides of the low tidal channels where applicable). The latter counts provided an indication of the numbers and species of birds that could be directly affected by construction activities on a regular basis, while birds from 150 – 200 m from the Causeway could potentially be affected intermittently by sudden, loud noise increases. The two zones are shown on Figure 3.3.

A total of 41 counts were completed. Also recorded was the birds' use of the habitat according to the following codes –

FI	feeding in the intertidal area
FW	feeding in or over the water
REI	resting in the intertidal area
REW	resting on the water
ROI	roosting in the intertidal or maritime area at high tide
ROG	roosting/resting on grass beside the Motorway
ROP	roosting/resting on poles or other structures

No nesting by coastal birds would occur within the survey area. The surveys were completed following the breeding season and during the period generally considered the most appropriate (i.e. January to March inclusive) in which to complete coastal bird counts so that accurate results can be presented.

Counts were undertaken using Nikon 10 x 42 Monarch binoculars and a Nikon Spotting Scope (60 mm lens; 15-45 zoom). Before each count the general weather conditions were recorded, air temperature was measured using a quartz dig-thermo (-10 to +110°C) thermometer and wind speed and barometric pressure were recorded with a Silva Alba Windwatch.

The survey times and conditions were as follows (LW = low water; HW = high water) –

12 March 2007 **(southern side)**	0830 – 1330 hours inclusive (DST) LW 0739 hrs 1.1 m HW 1351 hrs 2.7 m NE wind to 3 – 8 kts; cloudy with sunny intervals and a brief showery period. Habitat sheltered from wind. (DST = daylight saving time).
15 March 2007 **(northern side)**	1030 – 1630 hours inclusive (DST) LW 1036 hrs 1.1 m HW 1644 hrs 2.7 m SW wind to 5 – 8 kts; sunny with occasional showers. Habitat sheltered from wind.
21 March 2007 **(southern side)**	0900 – 1500 hours inclusive (standard time) HW 0854 hrs 3.5 m LW 1459 hrs 0.2 m NE wind to 3 kts, then a change to SW to 3 kts; sunny conditions with cloud clearing from midday. Habitat both sheltered and exposed to wind.

23 March 2007 (northern side)	0930 – 1530 hours inclusive HW 1035 hrs 3.4 m LW 1637 hrs 0.3 m SW wind to 3 kts, then a change to NE to 4 kts; fine, clear, sunny. Habitat both sheltered and exposed to wind.
27 March 2007 (southern side)	0800 – 1400 hrs inclusive LW 0802 hrs 1.0 m HW 1415 hrs 2.9 m NE wind to 6 kts; sunny with cloud. Habitat sheltered from wind.
28 March 2007 (northern side)	0900 – 1500 hrs inclusive LW 0907 hrs 1.0 m HW 1518 hrs 2.8 m NE wind to 4 – 6 kts; overcast and light rain. Habitat exposed to wind.

The air temperature and barometric pressure were as follows (raw data are shown in Appendix B):

	NORTHERN SIDE (n = 21)	SOUTHERN SIDE (n = 20)	OVERALL (n = 41)
AIR TEMPERATURE (°C)			
mean	**20.3**	**21.9**	**21.1**
measured range	**17.0 – 22.5**	**18.0 – 24.8**	**17.0 – 24.8**
BAROMETRIC PRESSURE (kPa)			
mean	**102.0**	**101.9**	**101.9**
measured range	**101.0 – 103.1**	**101.0 – 102.3**	**101.0 – 103.1**

(kPa x 10 = millibars)

3.2.3 Construction Area No. 1

Construction Area No. 1 (refer to Figure 4.5) was a later addition to the survey area and includes an area that is a "traditional" high tidal roost for a variety of wading birds. This area was checked under different high tidal heights and the number and species of birds recorded. The survey area includes the Construction Area itself and the paddocks between that area and SH 16. At the time of report preparation 11 surveys had been completed.

3.3 Marsh Birds

Marsh bird surveys were conducted around the Oakley Creek mouth (Sector 4 and 5) at seven sampling sites. Two sites were located to the immediate north of the Motorway and the remaining five sites located south of

the Motorway (Figure 3.4). Marsh birds were assessed using two techniques. First, surveying along a 100 m transect through potential habitat, including mudflats and mangroves. Walking transects were conducted during low tides when mangrove areas were able to be traversed on foot. The presence or sign (e.g. footprints, feathers) of any marsh bird seen or heard during the survey was noted (following Elliot 1987). Secondly, more cryptic bird species were surveyed for using playback (lure) tapes. Playbacks were conducted during the early morning and early evening (within three hours of sunrise/sunset) on 6th, 12th and 13th May 2009. Each playback involved playing taped calls of banded rail into appropriate habitat.

An inspection of the seaward margins of the area, between the Rosebank Road on-ramp and the Whau River crossing, was made to look for evidence of fernbird and banded rail; similarly the presence of both species was checked along the Traherne Island edge on the southern side. A lure tape survey had been conducted in March 2001 throughout Traherne Island (Don, Gardner) specifically to locate fernbird but none was found.

Surveys immediately beside busy Motorways using lure tapes are not feasible because of the masking effect of the background noise. Motorway edge surveys must therefore rely on direct observation of birds or their signs (e.g. footprints). There was no habitat within the footprint that would provide suitable conditions for other marsh birds such as spotless crake, marsh crake or australasian bittern.

Figure 3.4 – Areas assessed for coastal, marsh, and terrestrial birds.

4. Results

4.1 Terrestrial Birds

4.1.1 Birds Observed in Sectors 4, 5 and 9

Although the following results refer to formal surveys in the Sector 4, 5, and 9 areas, the diversity of terrestrial birds also reflects that present in the mixed vegetation areas of Sectors 1 to 3 and Sectors 6 to 8.

The birds directly observed to have been present within the Project footprint over the course of the earlier (2000 – 06) surveys are shown in Table 4.1. In total there were 16 species, comprised of 7 native and 9 introduced birds). Red-billed gull is listed as a threatened species, with a classification of Nationally Vulnerable (Miskelly *et al*., 2008).

The Reclamation and Great North Road Interchange Sectors (i.e. Sectors 4 and 5) each supported three native bird species (grey warbler, silvereye and pukeko at Sector 4 and red-billed gull, silvereye and white-faced heron at Sector 5). However, it is noted that NZ dotterel (an endemic shore bird) has attempted in the past to nest in the cloverleaf at the Great North Road Interchange - inclusion of this species brings the total for that area to four native species.

The area to the east of Richardson Road in Sector 9 supported pukeko, masked lapwing (or spur-winged plover) and red-billed gull.

In terms of abundance, these earlier surveys indicated that the only common native bird species present was red-billed gull, in particular at the Great North Road Interchange site. This same site also supported reasonable numbers of white-faced heron. All other sites supported only low numbers of native birds.

In relation to the introduced species, starling and house sparrow were the most ubiquitous species, being particularly abundant at the mouth of Oakley Creek (Sector 5). The latter species (i.e. house sparrow) was also common at the Great North Road Interchange.

Table 4.1 Birds Observed in Sectors 4, 5 and 9

Species	Reclamation (Sector 4)	Great North Road Interchange (Sector 5)	Alan Wood Reserve (Sector 9)
Native Species			
black-backed gull			present
red-billed gull		abundant	common
grey warbler	rare		
silvereye	present	present	
masked lapwing (spur-winged plover)			present
pukeko	rare		present
white-faced heron		common	
Introduced Species			
blackbird	present	common	rare
chaffinch		rare	
mallard			present
myna	present		
skylark	rare		
song thrush		present	
house sparrow	common	common	
spotted dove	rare		
starling		rare	abundant

(The Threat Status of these species is presented in Appendix A)

In May 2008, terrestrial birds were surveyed again at the mouth of Oakley Creek and the Great North Road Interchange, using seven listening/observation posts. Silvereyes (native) were the most common species

encountered, comprising 37% of observations. Other common species were house sparrow (21%), blackbird (10%) and feral (rock) pigeon (10%). The three later species are all introduced.

Additional native species observed here included kingfisher, grey warbler, pied oystercatcher, fantail, harrier, pied shag, little shag, tui, welcome swallow and white-faced heron. Introduced species observed to be present included starling, eastern rosella, goldfinch, chaffinch and myna.

The 2008 bird surveys in the southern section of the Project Area utilised 5-minute bird counts on three separate occasions (i.e. April, May and June). The dominant species observed was starling. The other species observed included feral pigeon, silvereye, pukeko, goldfinch, mallard, black-backed gull, blackbird, welcome swallow, house sparrow and myna.

It is concluded that Sectors 4, 5 and 9, within the Project Area, did not provide significant habitat for indigenous avifauna.

4.1.2 Birds Observed in the Wider Project Area (i.e. outside Sector boundaries)

In addition to discussion on the birds present at sites directly affected by the Project's footprint it is also appropriate to include a description of all bird species that have been observed to date within the entire Project Area (and its wider environs). This provides a more comprehensive appreciation of the full range of terrestrial birds that may, from time to time, utilise the stands of vegetation that will be directly affected by the Project including edge areas along SH 16 (i.e. Traherne and Pollen Islands). This included Sectors 1 – 3 and 6 & 7 where specific counts were not undertaken because of the noise conditions and poor habitat quality.

The Ornithological Society of NZ Inc. records for the 10km^2 grid that the Project Area is located within includes a total of 39 bird species that typically utilise terrestrial habitats. Of these 24 are introduced species. Furthermore, 2 of the 15 native species listed would not be present on a regular basis here (being falcon and bellbird), and a further one (NZ pigeon) would probably only be an infrequent visitor. In addition, morepork is likely at times.

The most commonly occurring species in the wider Project Area were all introduced (i.e. house sparrows, myna, blackbird and starling), although there were also significant numbers of one native species, being silvereye. Other conspicuous (but not abundant) native species recorded were kingfisher and fantail. All other native birds were only rarely observed to be present. However, in addition to this, on one occasion in 2006, an abundance of black-backed gulls (i.e. 48) were observed to be roosting at Alan Wood Reserve.

In total therefore, 32 bird species have been observed within the wider Project Area, with 17 being native and 15 being introduced species. The native species are black-backed gull, red-billed gull, fantail, grey warbler, NZ kingfisher, silvereye, spur-winged plover (masked lapwing), pukeko, welcome swallow, white-faced heron, tui, little shag, harrier, South Island pied oystercatcher, pied shag, NZ pigeon and NZ dotterel.

The introduced species are blackbird, chaffinch, eastern rosella, goldfinch, greenfinch, Australian magpie, mallard, myna, skylark, song thrush, house sparrow, spotted dove, starling, pheasant and rock pigeon.

Only one of the native bird species is of conservation concern, being NZ dotterel ("*Nationally Vulnerable*"). No observations of NZ dotterel were made over the course of the surveys, and its inclusion is the result of anecdotal information regarding irregular nesting attempts within the cloverleaf at the Great North Road Interchange.

The most widely distributed birds within the Project Area are blackbirds and house sparrows, followed by three native species; pukeko, silvereye, and grey warblers. Starlings, Indian myna, song thrush and fantails are also widely distributed.

The high incidence of pukeko within the wider Project Area reflects the ample ideal habitat within the parks adjoining Oakley Creek. Likewise, silvereye and fantail are typically well established in urban environments, especially where there is abundant woody vegetation (both canopy and understorey species).

The great majority of the birds that were observed or heard in the avian surveys are common passerine species that are typical of the habitat types in an urban setting, although some require specific habitat types to be present, such as pheasant and waterfowl species. The majority of the native species are not present in notably high numbers, and this reflects the limited habitats and resources that are available to them in the Project Area.

4.2 Coastal Birds

4.2.1 Overview Coastal Bird Survey

Diversity and abundance

A total of 10,857 individual records were made at low tide and an additional 544 at high tide. This represents an average per visit of 181 birds at high tide (range = 45-362) and 905 at low tide (range = 275-1767). Thus bird abundance increases five times between high and low tide. The only species to be recorded more frequently at high than low tide were black-backed gull and spur-winged plover. Most birds were recorded either resting or feeding on mudflats or intertidal structures (e.g. wooden posts) or vegetation (e.g. mangroves).

18 species were recorded during counts. Half of these (9) are waders, with the remaining species consisting of gulls (2), terns (2), shags (3), herons (1) and waterfowl (1).

12 species were recorded at high tide (Figure 4.1). Most common among these was pied oystercatcher, followed by black-backed gull, white-faced heron, pied shag and pied stilt. Species not recorded at high tide included banded dotterel, New Zealand dotterel, bar-tailed godwit, lesser knot, mallard, and little shag.

All 18 species were recorded at low tide. Again, pied oystercatcher was the most common species, followed by red-billed gull, white-faced heron, bar-tailed godwit, and pied shag.

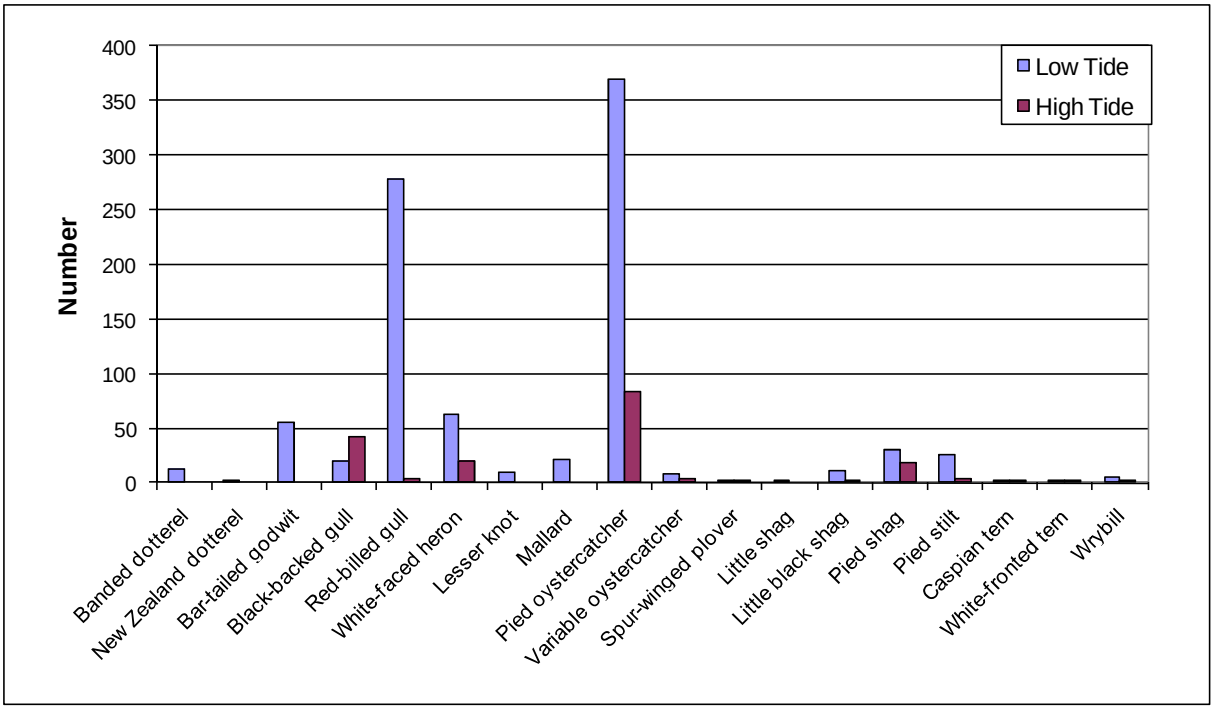

Figure 4.1 - Average number of each bird species recorded at all sites per count

At low tide, site 4 was easily the most popular feeding site with an average of 373 birds recorded per count (Figure 4.2). However, sites 1 (average = 171) and 8 (average = 79) were also popular. Large feeding aggregations were frequently seen beyond the range of this survey immediately north of site 1.

Site 4 was the most popular high tide roost with an average of 123 birds per count. Sites 1 (average = 21) and 7 (average = 16) were also frequently utilised roosts.

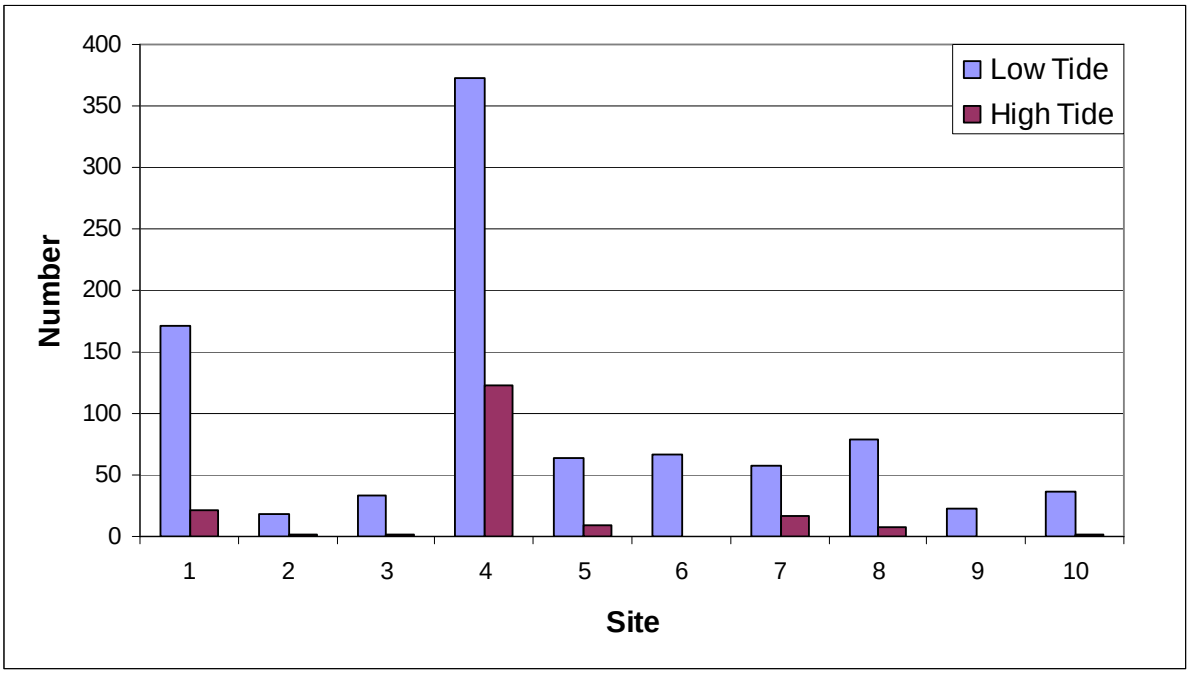

Figure 4.2 - Average number of coastal birds recorded at each site per count

Species Distribution (Waders)

- *Banded dotterel* was recorded only at low tide at sites 1 and 10. Site 1 was more frequently visited (average = 10) than site 10 (average = 2).
- *New Zealand dotterel* was recorded only at low tide at site 1 (average = 2).
- *Bar-tailed godwit* was recorded only at low tide at sites 1, 3, 4, 5, 6 and 8. Most birds were feeding at sites 1 (average = 31) and 4 (average = 16) with small numbers at sites 3, 5, 6, and 8 (range = <1 to 3 birds). On February 5th a flock of >1000 bar-tailed godwits was seen flying south over sites 8 and 9. A smaller flock (60 birds) was seen flying the same route on February 22nd.
- *Lesser knot* was recorded only at low tide at sites 1 (average = 8) and 4 (average = 2).
- *Pied oystercatcher* was recorded at every site (except site 10) at low tide. At high tide the species was recorded only at site 4 (average = 83). Low tide numbers were also highest at site 4 (average = 272), with large numbers also regularly recorded at sites 7 and 8 (averages = 25 and 36, respectively). Other sites included average numbers in the range of <1 to 12 per count.
- *Variable oystercatcher* was recorded at sites 1, 2, 4, 5, 6, 7, and 8 at low tide, and at sites 1, 3, 4, and 5 at high tide. Average numbers at each site were low at both low and high tide (range = <1 to 3).
- *Spur-winged plover* was recorded in very low numbers (range = <1 to 2) at both low tide (sites 1 and 5) and high tide (site 1).
- *Pied stilt* was recorded at every low tide site (except site 3); however, at high tide only site 5 was patronised. The highest low tide numbers were recorded at sites 10, 8 and 9 (averages = 10, 9, and 5, respectively) with other sites averaging <1 bird per count. High tide counts at site 5 averaged 4 birds.

- *Wrybill* was recorded in low numbers at low tide at sites 1, 9 and 10 (averages = 3, 1 and <1, respectively) and at high tide at site 5 (average = <1). On February 5th a flock of >150 wrybill was seen flying south over sites 8 and 9. On March 14th a flock of approximately 25 birds departed site 1 flying northwest over the Te Atatu Peninsula immediately prior to counting.

Species Distribution (Other coastal species)

- *Black-backed gull* was recorded at every site at low tide, and at sites 1, 2, 4 and 5 at high tide. Low tide numbers at each site were low (range = <1 to 6). At high tide, numbers were highest at sites 4 (average = 31) and 1 (average = 10), with very few birds recorded at sites 2 and 5 (average = <1).
- *Red-billed gull* was recorded at every site (except site 9) at low tide, while at high tide birds were recorded at sites 4 and 5. High tide numbers were very low at each site (range = <1 to 3). Site 1 was most popular at low tide (average = 83), followed by sites 4, 6 and 5 (averages = 60, 53, and 51, respectively). Lower numbers were recorded at sites 2, 3, 7, 8 and 10 (range = <1 to 12).
- *White-faced heron* was recorded at every site at low tide, and at sites 1, 4, and 7 at high tide. High tide numbers were low at sites 1 and 4 (averages = 2 and 1, respectively), but higher at site 7 (average = 16). Ten's of birds regularly roosted on shellbank platforms among mangroves at site 7. Roosting birds were probably underestimated at sites such as 9 and 10 where viewing distances were particularly long. At low tide, count numbers were highest at sites 10, 9 and 4 (averages = 20, 14, and 9, respectively). At the remaining sites average numbers ranged from <1 to 7.
- *Mallard* was recorded at low tide sites 4, 7, 8 and 10. Most birds were recorded at site 8 (average = 15) with few birds recorded at other sites (range = 2 to 3).
- *Little shag* was recorded at low tide in very low numbers at sites 1, 4, 6, 7, and 8 (average = <1 for each site).
- *Little black shag* was generally recorded in low numbers at low tide (sites 1, 4, 6, 7, 8, and 10) and high tide (site 10). Low tide counts at site 7 obtained the highest numbers (average = 8) with other counts being in the range of <1 to 2. Site 7 was a popular feeding site attracting flocks of 20-30 birds.
- *Pied shag* was recorded more frequently at low tide (sites 1, 3, 4, 6, 7, 8 and 10) than high tide (sites 1, 2, 4, and 8). Low tide sites 7 and 1 were most popular (averages = 18 and 11, respectively). At site 7 the sandbank south of the bridge (see Figure 3.2) is a popular roost site, as are the sandbank and wooden structures north of the bridge at site 1. Other low tide sites averaged <1 bird per count. Among high tide sites, site 8 was most popular (average = 8), followed by sites 1, 4 and 2 (Range = <1 to 5).
-
- *Caspian tern* was recorded in low numbers at both low tide (sites 1, 3, 4, 5, 6, 7 and 8) and high tide (sites 1 and 4). Averages at each site ranged from <1 to 2 birds per count.
- *White-fronted tern* was recorded very infrequently at low tide at sites 1, 4, 7, and 8, and again at site 7 at high tide (average = <1 per count for each site).

4.2.2 Causeway Coastal Bird Survey

The results from the Causeway coastal bird survey relate to the effects of road development activities in Sector 4: Reclamation.

4.2.2.1 Species Diversity

The March 2007 surveys recorded the species of birds which were using the marine habitats in Sector 4. The species recorded are shown in Table 4.2.

A total of nineteen species were recorded in the counts and there were no incidental species recorded. Pukeko (*Porphyrio porphyrio melanotus*) were present in the Oakley Creek riparian habitat to the east of block 1S. Two species were endemic (variable oystercatcher and wrybill); fourteen were native, two introduced and one an overseas migrant.

Seven species were recorded that are considered to be "at risk" but not threatened, on a national basis (Miskelly *et al* 2008). Five threatened species were recorded: red-billed gull, pied shag, caspian tern, reef heron and wrybill. Of those, wrybill would arguably be considered the species of most concern because it is an endemic species and it does not appear to have a stable population – "probably declining slowly; range contracting; small fraction of population managed" (Wilson, 2006) and breeding distribution continues to contract (Wilson, 2008).

The national status of the other species is as follows (Heather & Robertson, 2005).

eastern bar-tailed godwit	:	abundant Arctic migrant
feral pigeon	:	introduced
mallard	:	introduced
masked lapwing*	:	abundant native
NZ kingfisher	:	abundant native
southern black-backed gull	:	abundant native
white-faced heron	:	abundant native
(* or spur-winged plover)		

Overall species diversity was relatively high and twelve of the sixteen native/endemic species are presently considered to be either "at risk" or "threatened" by a recent revision of their conservation status (Miskelly *et al.*, 2008).

Table 4.2 Species of birds recorded during the Causeway coastal bird surveys

COMMON NAMES	SCIENTIFIC NAME	RECORDED NORTHERN SIDE	RECORDED SOUTHERN SIDE
australasian pied stilt; poaka ✝ (b)	*Himantopus himantopus leucocephalus*	–	✓
black shag; kawau ✝	*Phalacrocorax carbo novaehollandiae*	–	✓
caspian tern; taranui ●	*Sterna caspia*	✓	✓
eastern bar-tailed godwit; kuaka	*Limosa lapponica baueri*	✓	–
feral pigeon	*Columba livia*	–	✓
little black shag ✝	*Phalacrocorax sulcirostris*	✓	✓
little shag; kawaupaka ✝	*Phalocrocorax melanoleucos brevirostris*	✓	✓
mallard	*Anas platyrhynchos platyrhynchos*	✓	✓
masked lapwing (spur-winged plover)	*Vanellus miles novaehollandiae*	–	✓
NZ kingfisher; kotare	*Todiramphus sancta vagans*	✓	✓
pied shag; karuhiruhi ●	*Phalacrocorax varius varius*	✓	✓
red-billed gull; tarapunga ● (a)	*Larus novaehollandiae scopulinus*	✓	✓
reef heron; matuku-moana ●	*Egretta sacra sacra*	✓	–
southern black-backed gull; karoro	*Larus dominicanus dominicanus*	✓	✓
South Island pied oystercatcher; torea ✝ (b)	*Haematopus ostralegus finschi*	✓	✓
variable oystercatcher; toreapango✝	*Haematopus unicolor*	✓	✓

white-faced heron	*Ardea novaehollandiae novaehollandiae*	✓	✓
white-fronted tern; tara ✝	*Sterna striata striata*	✓	✓
wrybill; ngutuparore ●	*Anarhynchus frontalis*	–	✓

● **THREATENED SPECIES** (Miskelly *et al* 2008)
caspian tern : nationally vulnerable; secure overseas.
pied shag : nationally vulnerable.
red-billed gull : nationally vulnerable.
reef heron : nationally vulnerable; secure overseas; stable.
wrybill : nationally vulnerable; range restricted.

✝ **AT RISK SPECIES** (Miskelly *et al* 2008)

pied stilt; declining; secure overseas.
black shag; secure overseas; sparse; naturally uncommon.
little black shag; secure overseas; range restricted; naturally uncommon.
little shag; increasing; naturally uncommon.
South Island oystercatcher; declining.
variable oystercatcher; recovering.
white-fronted tern; data poor; declining.

(a) documented population decline at three largest colonies – Three Kings, Mokohinaus and Kaikoura.

(b) conversion of sheep farms to dairy farms and a consequent decrease in nesting habitat quality.

4.2.2.2 Species Occurrence and Abundance

Raw and summarised data are shown in Appendices C, D, E and F inclusive. The total number of records for the northern and southern side of the Causeway are shown in Table 4.3 and the survey area totals and percentages are shown in Table 4.3 and Table 4.4 (A & B), respectively. The total number of records was 3491 with 1835 on the northern side and 1656 on the southern i.e. a significant bias towards the northern side (chi-squared = 9.2 $p<0.01$).

Table 4.3 Total records per species per area (not total numbers of birds present at any one time).

	NORTHERN SIDE (N)	SOUTHERN SIDE (S)	TOTAL SURVEY AREA
australasian pied stilt	-	130	130
black shag	-	2	2
caspian tern	6	5	11
eastern bar-tailed godwit	51	-	51
feral pigeon	-	2	2
little black shag	18	15	33
little shag	8	14	22
mallard	28	10	38
masked lapwing	-	4	4
NZ kingfisher	2	2	4
pied shag	119	298	417
red-billed gull	229	77	306
reef heron	1	-	1
southern black-backed gull	141	50	191
South Island pied oystercatcher	1065	692	1757

variable oystercatcher	7	15	22
white-faced heron	150	147	297
white-fronted tern	10	12	22
wrybill	-	181	181
TOTAL	1835	1656	3491

Table 4.4 (A) Percentage records per species indicating the relative dominance of each species.

%	NORTHERN SIDE	%	SOUTHERN SIDE	%	TOTAL SURVEY AREA
58.2	pied oystercatcher	43.0	pied oystercatcher	51.1	pied oystercatcher
		17.9	pied shag		
12.5	red-billed gull	10.9	wrybill	11.9	pied shag
8.2	white-faced heron	8.9	white-faced heron	8.8	red-billed gull
7.7	black-backed gull	7.9	pied stilt	8.5	white-faced heron
6.5	pied shag	4.6	red-billed gull	5.5	black-backed gull
				5.2	wrybill
2.8	bar-tailed godwit	3.0	black-backed gull	3.7	pied stilt
1.5	mallard			1.5	bar-tailed godwit
				1.1	mallard
0.9	little black shag	0.9	little black shag	0.9	little black shag
		0.9	variable oystercatcher		
		0.8	little shag		
		0.7	white-fronted tern		
		0.6	mallard	0.6	little shag
				0.6	variable oystercatcher
				0.6	white-fronted tern
0.5	white-fronted tern				
0.4	little shag				
0.4	variable oystercatcher				

0.3	caspian tern	0.3	caspian tern	0.3	caspian tern
		0.2	masked lapwing		
0.1	kingfisher	0.1	kingfisher	0.1	kingfisher
		0.1	black shag	0.1	masked lapwing
		0.1	feral pigeon		
				0.06	black shag
				0.06	feral pigeon
0.05	reef heron				
				0.03	reef heron

Table 4.4 (B) Summary of the information displayed in Table 4.4 (A) indicating the most dominant species.

SPECIES DOMINANCE	NORTHERN SIDE	SOUTHERN SIDE	TOTAL SURVEY AREA
1st	pied oystercatcher	pied oystercatcher	pied oystercatcher
2nd	red-billed gull	pied shag	pied shag
3rd	white-faced heron	wrybill	red-billed gull
4th	black-backed gull	white-faced heron	white-faced heron
5th	pied shag	pied stilt	black-backed gull
6th	-	-	wrybill

Three dominant species were common to both sides of the Causeway – South Island pied oystercatcher, white-faced heron and pied shag. Red-billed gull and black-backed gull were more prominent on the northern side and wrybill and pied stilt more prominent on the southern side.

The most notable results in relation to coastal birds in the Causeway area were the area's use by pied shag (more dominant than gulls and most waders overall), red-billed gull and wrybill (all threatened species). South Island pied oystercatcher, white-faced heron and black-backed gull were frequent throughout the area.

The northern side specifically was characterised by South Island pied oystercatcher, white-faced heron, gulls (red-billed, black-backed) and bar-tailed godwit while on the southern side South Island pied oystercatcher, white-faced heron, pied shag, wrybill and pied stilt were the characteristic species.

The incidence of pied shag was higher on the southern side (chi-squared = 5.33; $p<0.05$) and the incidence of gulls higher on the northern side (chi-squared = 5.71; $p<0.05$).

The percentage occurrence results based on the presence of each species in each count, regardless of how many individuals of that species were present, as a percentage of the total counts are shown in Table 4.5.

The most frequently occurring species, regardless of the numbers of individuals, were white-faced heron, pied shag and gulls which were all present throughout the tidal cycle. Little shag and South Island pied oystercatcher occurred in 40 – 50% of the counts. Little shag was often present throughout the tidal cycle, but in very low numbers, whereas South Island pied oystercatcher was only present when feeding habitats were exposed but occurred in relatively high numbers.

Table 4.5 Percentage occurrence of the species recorded in the survey areas

%	NORTHERN SIDE (N)	%	SOUTHERN SIDE (S)	%	TOTAL SURVEY AREA
100.0	white-faced heron	100.0	white-faced heron	100.0	white-faced heron
95.0	pied shag		pied shag	97.5	pied shag
80.0	black-backed gull	65.0	red-billed gull	70.0	black-backed gull
75.0	red-billed gull	60.0	black-backed gull		red-billed gull
40.0	little shag	50.0	little shag	45.0	little shag
	S.I. pied oystercatcher	45.0	S.I. pied oystercatcher	42.5	S.I. pied oystercatcher
30.0	bar-tailed godwit	40.0	pied stilt	32.5	white-fronted tern
	white-fronted tern	35.0	white-fronted tern	27.5	variable oystercatcher
20.0	caspian tern		variable oystercatcher	20.0	pied stilt
	variable oystercatcher	25.0	little black shag	15.0	bar-tailed godwit
15.0	mallard	15.0	wrybill	15.0	caspian tern
5.0	little black shag	10.0	black shag		little black shag

	N.Z. kingfisher		caspian tern	12.5	mallard
	reef heron		mallard	7.5	wrybill
			masked lapwing	5.0	black shag
`		5.0	feral pigeon		masked lapwing
				2.5	feral pigeon
					N.Z. kingfisher
					reef heron

The maximum numbers of each species per block are shown in Table 4.6 for the habitats to about 200 m from the Causeway (i.e. the 30 m and 150 – 200 m zones combined). Also indicated are the preferred blocks and areas for the various species, e.g. the key area for pied stilt and wrybill was 2S to 4S inclusive whereas bar-tailed godwit were only recorded in the 2N to 4N area inclusive. Pied shag was most common at blocks 2S and 2N that encompass the Motorway bridge – those areas are key local feeding and roosting habitats for pied shag. Both species of gulls were also most common adjacent to the bridge. White-faced heron occurred in similar numbers throughout but was most numerous in block 2S where low mangrove habitat was used for roosting at high tide.

Table 4.7 shows the maxima recorded in the area to c.30 m from the Causeway; that area could be expected to be most susceptible to any construction effects (e.g. physical modification or machinery noise). Maximum numbers were mostly low throughout. Where maximum numbers were high, they were transient and related to specific stages of the tide. 31 red-billed gull occurred in one count in block 2N one hour before low tide but were absent in the preceding count and only three were present in the subsequent count. Similarly the South Island pied oystercatchers in blocks 2S and 3S were present from about high water (HW) + 4 hours to HW + 5 hours but were absent at low tide as additional habitat became exposed further from the Causeway. No oystercatchers were recorded feeding in that area during the two other surveys over a rising tide. (Note that most South Island pied oystercatchers vacate the area during the breeding season – from about August to December-January).

No wrybill were recorded close to the Causeway; wrybill were only recorded in blocks 3S and 4S and remained on the southern side of the low tide channel that is parallel with the Causeway. Wrybill were also observed in the southern part of the inlet beyond the survey blocks – most individuals also vacate the area for the above breeding season.

Table 4.6 Maximum number recorded per block in the area from 0 m to c. 200 m from the Causeway

SPECIES	NORTHERN BLOCKS				SOUTHERN BLOCKS			
	1N	2N	3N	4N	1S	2S	3S	4S
australasian pied stilt	–	–	–	–	–	11	15	13
black shag	–	–	–	–	1	–	–	1
caspian tern	2	1	–	–	1	–	2	–
eastern bar-tailed godwit	–	12	1	11	–	–	–	–
feral pigeon	–	–	–	–	–	2	–	–
little black shag	–	18	–	–	5	3	1	–
little shag	–	1	1	1	1	2	1	1
mallard	–	14	–	–	9	1	–	–
masked lapwing	–	–	–	–	–	–	2	–
N.Z. kingfisher	1	–	1	–	–	–	–	–
pied shag	2	11	5	5	–	28	8	1
red-billed gull	24	31	4	47	–	12	7	1
reef heron	–	1	–	–	–	–	–	–
southern black-backed gull	10	25	5	15	–	3	4	4
South Island pied oystercatcher	–	204	103	49	–	82	97	–
variable oystercatcher	1	3	1	1	–	3	2	–
white-faced heron	5	7	4	7	6	12	3	5
white-fronted tern	–	2	–	2	1	2	2	–
wrybill	–	–	–	–	–	–	59	49

Table 4.7 Maximum number and species recorded per block in the area from 0 m to c. 30 m

from the Causeway

SPECIES	NORTHERN BLOCKS				SOUTHERN BLOCKS			
	1N	2N	3N	4N	1S	2S	3S	4S
australasian pied stilt	–	–	–	–	–	–	11	–
eastern bar-tailed godwit	–	1	–	–	–	–	–	–
little black shag	–	4	–	–	–	–	–	–
little shag	–	1	1	1	–	1	1	–
mallard	–	14	–	–	–	–	–	–
N.Z. kingfisher	–	–	1	–	–	–	–	–
pied shag	–	9	2	5	–	16	1	–
red-billed gull	–	31	–	–	–	8	9	–
southern black-backed gull	–	–	–	2	–	–	3	–
South Island pied oystercatcher	–	11	–	–	–	56	81	–
variable oystercatcher	–	–	–	1	–	1	1	–
white-faced heron	4	5	1	3	1	–	3	3
white-fronted tern	–	–	–	–	–	–	–	1

Table 4.8 and Table 4.9 show the maxima for either side of the Causeway for the areas to c.200 m and c.30 m respectively; works on the Causeway would likely encompass its entire length during the construction process rather than small segments. Generally the numbers of birds utilising that area were both low and transient (most species) or relatively high but transient in the case of South Island pied oystercatcher. That species is also relatively tolerant of noise and can be common adjacent to airport runways (G. Don *pers. obs*).

Species that are not transient but utilise parts of the area close to the Causeway during most stages of the tide are shags, especially little shag and pied shag, N.Z. kingfisher (sparse) and white-faced heron.

Of those species, pied shag is likely to be the most affected during high tide periods because its main southern roost is the rock rubble at the southwest corner of the Causeway Bridge abutments and its main northern roost is in a similar situation on the opposite side of the Causeway.

4.2.2.3 Total numbers

Total numbers of birds recorded are shown in Appendix F as follows –

- all species combined – total survey area
- wading birds – total survey area
- all species combined – 0 to 30 m area only

Table 4.8 Maximum numbers recorded on either side of the Motorway to c. 200 m from the Causeway (Note 1)

SPECIES	NORTHERN SIDE	SOUTHERN SIDE
australasian pied stilt	-	28
black shag	-	1
caspian tern	2	3
eastern bar-tailed godwit	23	-
feral pigeon	-	-
little black shag	18	8
little shag	1	2
mallard	14	9
masked lapwing	-	2
N.Z. kingfisher	2	-
pied shag	17	31
red-billed gull	65	12
reef heron	1	-
southern black-backed gull	36	7
South Island pied oystercatcher	267	179
variable oystercatcher	4	4
white-faced heron	18	14
white-fronted tern	2	2
wrybill	-	63

(Note 1: these numbers are different from those in Table 4.6 because the maximum numbers recorded in each block were not coincidental).

Table 4.9 Maximum numbers recorded on either side of the Motorway to c. 30 m from the Causeway (Note 1)

SPECIES	NORTHERN SIDE	SOUTHERN SIDE
australasian pied stilt	-	11
eastern bar-tailed godwit	1	-
little black shag	4	-
little shag	1	1
mallard	14	-
N.Z. kingfisher	1	-
pied shag	16	16
red-billed gull	31	12
southern black-backed gull	2	3
South Island pied oystercatcher	11	137
variable oystercatcher	1	2
white-faced heron	9	6

(Note 1: these numbers are different from those in Table 4.7 because the maximum numbers recorded in each block were not coincidental).

Based on a high total number of 41 counts, the distribution of birds on both the northern and southern sides of the Causeway (refer Appendix G) was not random ($p<0.001$) especially in the zone to c.30 m from the Causeway. On both sides the least utilised area was block 1 (i.e. both 1N and 1S) with the highest proportions of birds generally in blocks 2 and 3, at and adjacent to the Causeway Bridge, respectively. The relatively high number of counts enables this pattern to be defined with a very good level of confidence.

On the northern side most birds recorded in the 0 – c.30 m zone were in the bridge block 2N but on the southern side there was a greater spread throughout blocks 2S and 3S where the proportions of birds were essentially the same and accounted for 97.5% of the birds recorded.

Overall there was a bias towards blocks 2 and 3 where the proportions were similar for the 0 to c.200 m zone. In the 0 to c.30m zone there was a bias towards the block containing the bridge (i.e. block 2) reflecting its importance as a habitat for shags.

Therefore the area where the potential for construction activity to affect coastal birds would be highest is that encompassed by blocks 2 and 3. That area consists of a total of about 800m of upper intertidal habitat but its overall use by birds is increased because of the presence of the bridge and the intertidal habitats that have developed as a result of the Causeway. As noted above, the higher numbers recorded in blocks 2 and 3 in the 0 to c.30 m zone tended to be transient and relatively low.

Within the 0 to c.200 m zone the patterns for total birds and wading birds were similar. On the northern side to 200 m the lowest average numbers were in block 1N, which contains a high proportion of mangroves, with similar average numbers in the remainder of the area. On the southern side to 200 m there were low average numbers in block 1S which also contains predominantly mangrove habitat but a similarly low average number in block 4S. Overall, however, the average numbers of birds were similar throughout. In the 0 to 30 m zone the average numbers were also similar but low throughout.

Appendix H shows the survey results illustrated in graphical form as follows – (a) the average numbers of birds recorded per survey block and (b) the numbers of birds recorded throughout a tidal cycle. Figure 4.3 illustrates the difference between numbers of birds in the 0 – 30 m zone versus the 0 –200 m zone.

The tidal pattern for all species and wading birds is the same except that wading birds are virtually absent (white-faced heron only) outside the low tide period. At low tide wading birds predominate. On the northern side the period of greatest habitat use is from 4 hours after high tide to 3 hours after low tide i.e. a 5 hour period or about 40% of the 12 hour tidal cycle. On the southern side the pattern is similar but the influx of wading birds occurs one hour earlier on a falling tide as a result of the earlier exposure of feeding habitat so the main period of use is about 50% of a tidal cycle.

The highest numbers occur three hours after the onset of feeding activity in both situations – i.e. at low water on the southern side but one hour after low water on the northern side.

The numbers of all species of birds in the 0 to c.30 m zone are low overall regardless of tidal state, the exception being on the southern side from 3 to 5 hours after high water. Birds enter the area as intertidal feeding habitat becomes exposed but move beyond the 30 m zone, mainly to the southern side of the low tide

channel, by the time of low water when numbers are highest in that area. Numbers of birds are only relatively high on the southern side and then only for about two hours of a twelve hour tidal cycle.

Figure 4.3 illustrates the difference between the total numbers of birds recorded in the 0 to c.200 m zone compared with total numbers that would be immediately adjacent to the proposed works area. It also shows the difference in the proportion of a 12 hour tidal cycle when the highest numbers of birds were present – 6 hours (50%) for the 0 to c.200 m zone but only about 2 hours (c.17%) for the 0 to c.30 m zone. The peak in total numbers occurred five hours after high tide in the 0 to c.30 m zone and at low tide in the 0 to c.200 m zone, once the entire habitat had become exposed.

Birds in the 0 – 30 m south zone tended to be transient and involve mainly South Island pied oystercatchers. Those birds either moved across to the large southern bank as the tide receded or flew across the Motorway to the northern side.

No wrybill were recorded in the 0 – 30 m zone on either the northern or southern side. Wrybill only occurred on the southern side and only on the large bank that is 50 m from the Causeway. Wrybill were present in that area from low tide to two hours after low tide and remained on the large southern bank.

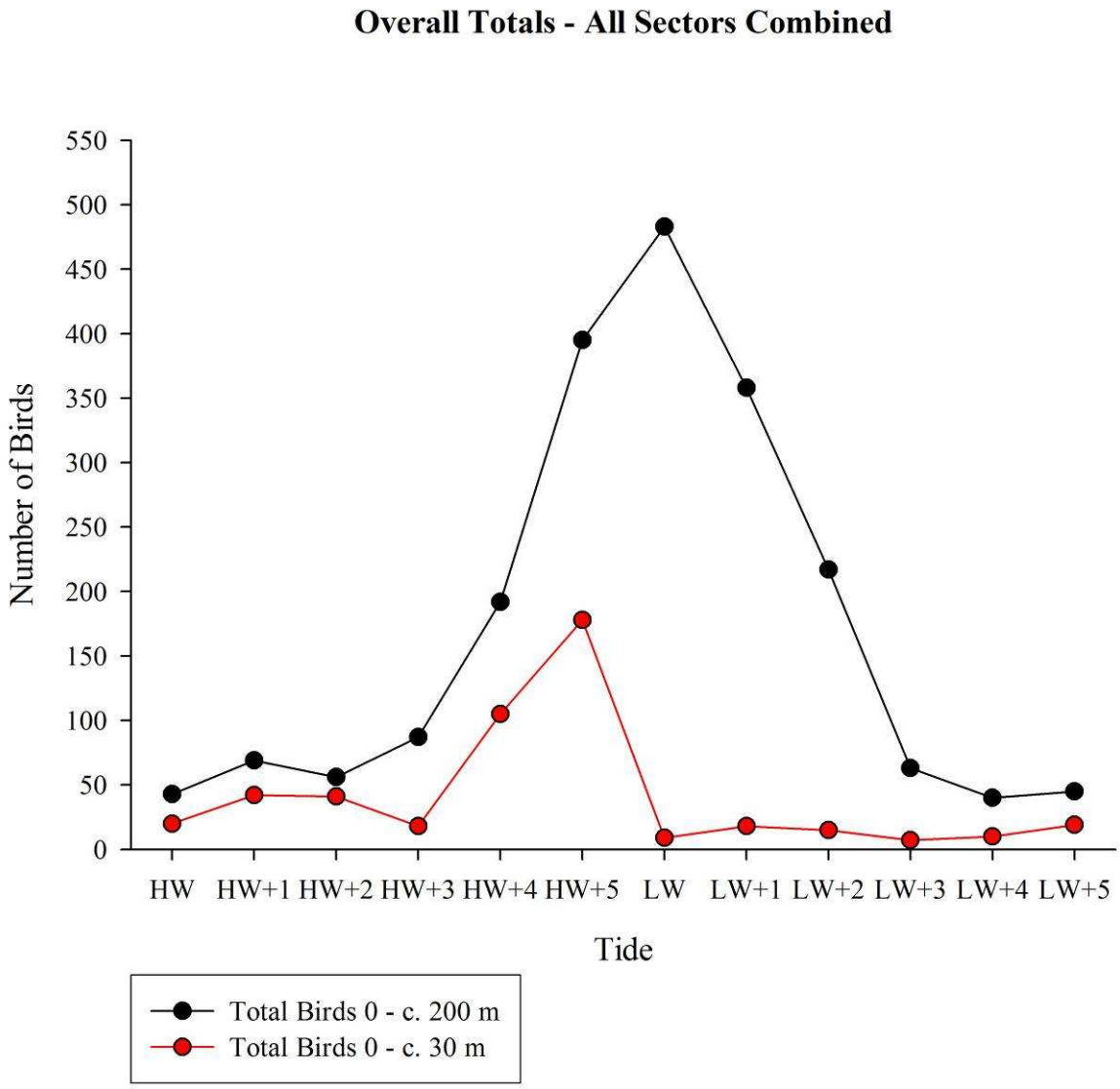

Figure 4.3 - Overall totals of all species recorded in the entire survey area throughout a tidal cycle

4.2.3 Bird Groups

The numbers and percentages of the major bird groups (gulls, shags, terns, ducks, waders, "other" and kingfisher) are shown in Table 4.10 and 4.11.

In Table 4.10 the percentages of each bird group (i.e. gulls, shags etc) across the rows add up to 100 (excluding the total percentage).

Table 4.10 indicates that the predominant area for gulls was block 2N adjacent to the main inlet channel and block 4N, where red-billed gull were recorded feeding and black-backed gull frequently rested. Block 2S was the dominant shag habitat followed by block 2N both of which included the bridge. The bridge channel is a significant local feeding habitat for pied shag in particular, and the abutments provided shag roosting and resting areas. Terns were most prominent in the block 2N channel area on the northern side of the bridge.

The majority of the wader "population" was recorded in block 3S which is utilised by wrybill in particular, followed by the intertidal banks in the offshore areas of blocks 2N to 4N inclusive. The higher proportion of the wader population occurred on the northern side but wrybill was only recorded on the southern side.

Table 4.10 - Distribution of bird groups in the survey area – percentage of total "population" per block

		BLOCK								
		1N	2N	3N	4N	1S	2S	3S	4S	TOTAL
GULLS	no.	57	154	32	128	–	56	56	15	498
	%	11.4	30.9	6.4	25.7	–	11.2	11.2	3.2	14.4
SHAGS	no.	3	104	16	21	10	305	19	5	483
	%	0.6	21.5	3.3	4.3	2.1	63.1	3.9	1.2	13.9
TERNS	no.	4	7	0	4	2	4	11	–	32
	%	12.5	21.9	–	12.5	6.3	12.5	34.3	–	0.9
DUCKS	no.	0	28	0	0	9	1	–	–	38
	%	–	65.3	–	–	32.1	2.6	–	–	1.1
WADERS	no.	53	534	390	283	32	355	608	154	2409
	%	2.2	22.2	16.2	11.7	1.3	14.7	25.2	6.5	69.5
OTHER	no.	–	–	–	–	–	2	–	–	2
	%	–	–	–	–	–	100.0	–	–	0.1
KINGFISHER	no.	1	–	1	–	–	–	–	–	2
	%	50.0	–	50.0	–	–	–	–	–	0.1
	TOTAL NO.	118	827	439	436	53	723	694	174	3464
	%	3.4	23.9	12.7	12.6	1.5	20.9	20.0	5.0	

In Table 4.11 the percentages down each column (i.e. 1, 2, 3 and 4) add up to 100 (excluding the percentages for total number). Table 4.11 shows the proportions of each bird group in each block rather than as a

proportion of the recorded population. Waders dominated the avifauna in all four areas. Subdominants were gulls in blocks 1 and 4 and shags in block 2 as percentages of the avifauna in those blocks.

Table 4.11 Proportions of bird groups in each survey block: northern and southern areas combined.

		BLOCK				
		1	2	3	4	mean
GULLS	no.	57	210	88	143	498
	%	33.3	13.5	7.8	23.4	14.4
SHAGS	no.	13	409	35	26	483
	%	7.6	26.4	3.1	4.3	13.9
TERNS	no.	6	11	11	4	32
	%	3.5	0.7	0.9	0.7	0.9
DUCKS	no.	9	29	0	0	38
	%	5.3	1.9	-	-	1.1
WADERS	no.	85	889	998	437	2409
	%	49.7	57.4	88.1	71.6	69.5
OTHER	no.	0	2	0	0	2
	%	-	0.1	-	-	0.1
KINGFISHER	no.	1	0	1	0	2
	%	0.6	-	0.1	-	0.1
	TOTAL NO.	171	1550	1133	610	3464
	%	4.9	44.7	32.7	17.7	

The avifauna was dominated overall by waders (69.5%) followed by similar proportions of gulls (14.4%) and shags (13.9%) with the latter being a notable characteristic of the survey area. The proportions of birds were not random with most birds using blocks 2 and 3 (chi-squared = 36.2; $p < 0.001$). Similar proportions were

recorded in blocks 2 and 3 (chi-squared = 1.9; not significant). The total number of records, however, was highest in block 2 that contains the Causeway Bridge and main channel of the inlet (chi-squared = 64.8; $p < 0.001$).

4.2.4 Habitat use

Habitat use of the Causeway survey area as percentage of the various activities is summarised in Table 4.12 and summarised in Figure 4.4.

Feeding was the most frequent activity overall at 69.9% compared with resting and roosting 30.1%.

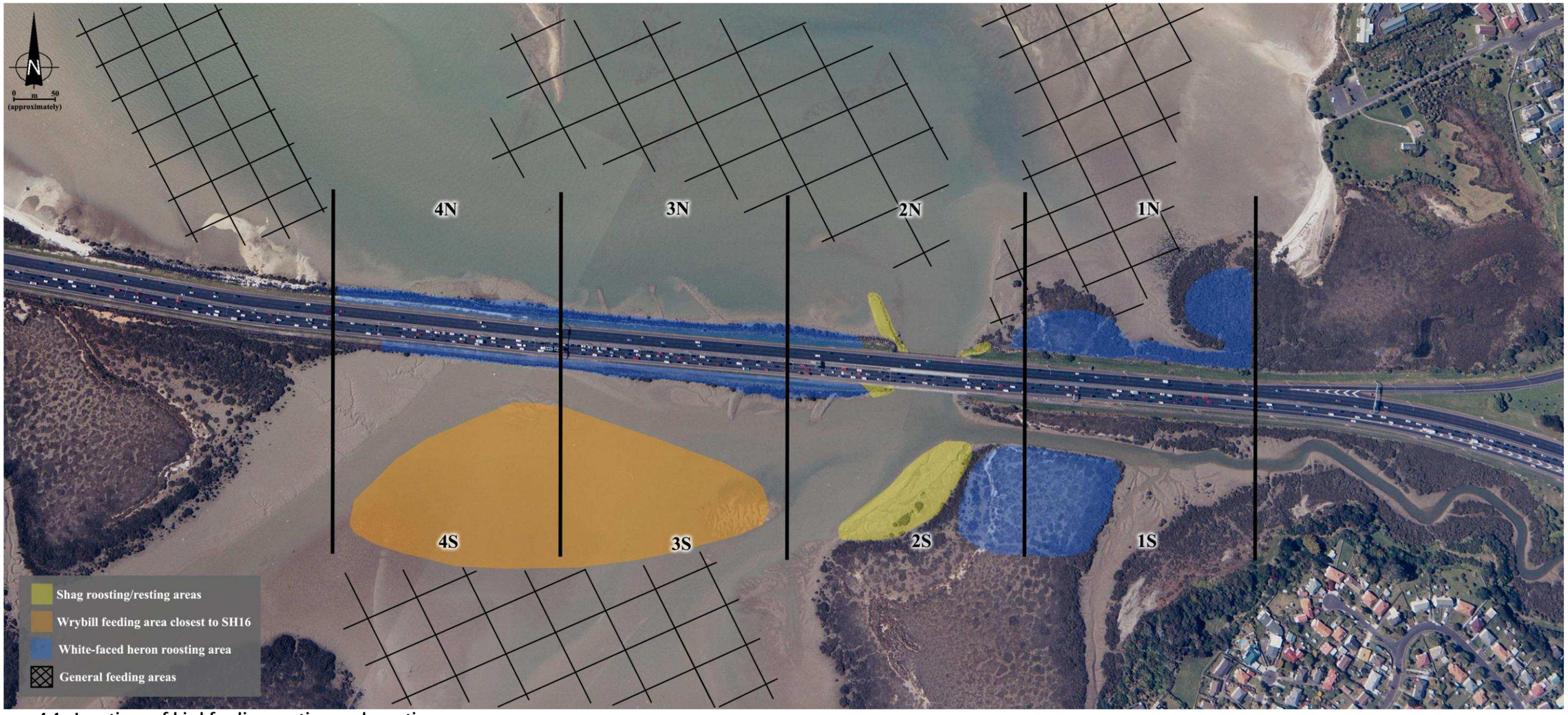

Figure 4.4 - Locations of bird feeding, resting, and roosting areas

The combined block averages for the northern and southern sides were similar for feeding and resting/roosting.

Table 4.12 Habitat use as percentages of various activities

	ACTIVITY❋								
	FI	**FW**	**REI**	**REW**	**ROI**	**ROG**	**ROP**	**TOTAL F (1)**	**TOTAL R (1)**
1N	41.1	4.8	28.2	15.3	8.9	1.7	–	45.9	54.1
2N	66.1	4.8	12.5	9.2	6.1	–	1.3	70.9	29.1
3N	90.9	1.8	2.9	2.6	1.8	–	–	92.7	7.3
4N	81.9	2.1	8.9	2.1	4.8	0.2	–	84.0	16.0
N average	70.0	3.4	13.1	7.3	5.4	0.5	0.3	73.4	26.6
1S	28.8	11.9	20.3	15.3	22.0	1.7	–	40.7	59.3
2S	47.0	3.5	37.9	–	10.1	–	1.5	50.5	49.5
3S	84.1	1.3	13.7	–	0.9	–	–	85.4	14.6
4S	87.1	2.2	9.6	–	–	1.1	–	89.3	10.7
S average	61.8	4.7	20.4	3.8	8.3	0.7	0.4	66.5	33.5
	N + S Overall averages –							69.9	30.1

(**1**) **F** = feeding; **R** = resting/roosting

❋ FI feeding in the intertidal area
FW feeding in or over the water
REI resting in the intertidal area
REW resting on the water
ROI roosting in the intertidal or maritime area at high tide
ROG roosting/resting on grass beside the Motorway
ROP roosting/resting on poles or other structures

Resting in the intertidal area and on the water was a relatively common activity in blocks 1N and 1S, especially of gulls, while roosting in the intertidal habitat (ROI) was most prominent in block 1S as a result of notable numbers of white-faced heron roosting in the low mangroves over the high water period.

Resting and roosting in the intertidal area was also a common use of the block 2S area mainly as a result of shags resting on the intertidal mud bank immediately south of the bridge and shags also roosting near the southwest bridge abutments during high tide periods.

The activity that would be potentially disrupted most frequently by construction would be roosting at high water in the intertidal area (e.g. rock rubble, mangroves), on the grass or on adjacent structures (e.g. bridge railings). That would apply to low numbers of birds (mainly shags, gulls and white-faced heron) in all blocks except block 1S where the roosting habitat is to the south of the low tide channel and reasonably well buffered. The most notable roosting activity, but only in the context of the survey area, was by shags, mainly pied shag, on rock rubble near the southwestern bridge abutment and on channel edge rocks adjacent to the northwestern bridge abutment although the latter area was water-covered one hour before high water during a 3.4 m tide. Overall, the numbers of birds using the upper intertidal maritime zone and Causeway grass for roosting during high tide periods were low.

The Project footprint indicates an average footprint extension into the intertidal habitat of c.20 m from the existing rock rubble wall to both the north and south but increasing to c.50 m in the block 4S area although the alignment only extends to c.20 m. While an extension of c.20 m would result in disruption to only a small number of feeding birds, an intrusion of c.50 m on the southern side would potentially displace wrybill from that feeding area, especially during the construction phase.

4.2.5 Construction Area No. 1

This construction area will be situated adjacent to the existing Te Atatu Interchange (Sector 1) on its northern side, in paddocks presently within Harbourview Park (Figure 4.5). At the time of preparation of this report, eleven inspections had been completed at high tide because it is a “traditional roosting site” for coastal birds.

Results of the inspections are shown in Table 4.13 and refer to the three paddocks that are closest to SH16 including the paddock that contains two power pylons and is beside the Motorway.

Wadding birds recorded were banded dotterel, New Zealand dotterel, wrybill, South Island pied oystercatcher, white-faced heron, masked lapwing, pied stilt and variable oystercatcher. Notable numbers to date are 117 banded dotterel, 20 NZ dotterel, 88 pied stilt, 9 wrybill and 351 South Island pied oystercatcher. The maximum total number of birds was 481 on 15 July 2010. Pied oystercatchers are common when the ground is softer and soil invertebrate food is more readily available. It is a significant local roosting area.

Table 4.13 Te Atatu bird roost survey results

Common Name	Scientific Name	Number Recorded										
		25 March 2010	30 March 2010	15 April 2010	19 April 2010	20 April 2010	30 April 2010	14 May 2010	20 May 2010	15 June 2010	29 June 2010	15 July 2010
banded dotterel, tuturiwhatu ✱	*Charadrius bicinctus bicinctus*	54	77	2	-	-	89	81	81	75	102	117
black-backed gull, karoro	*Larus dominicanus dominicanus*	-	-	-	-	-	-	-	-	-	2	2
spur-winged plover	*Vanellus miles novaehollandiae*	-	-	2	2	-	2	5	2	2	6	1
pied stilt, poaka ✝	*Himantopus himantopus leucocephalus*	-	-	-	-	-	-	-	-	88	4	-
N.Z. dotterel, tuturiwhatu ✱	*Charadrius obscurus aquilonius*	20	14	16	9	7	11	10	6	5	11	3
red-billed gull, tarapunga ✱	*Larus novaehollandiae scopulinus*	-	-	-	-	-	-	-	-	8	10	-
South Island pied oystercatcher ✝	*Haematopus ostralegus finschi*	-	-	-	121	69	48	-	186	270	329	351
variable oystercatcher, toreapango ✝	*Haematopus* unicolor	-	-	-	-	-	-	-	-	4	10	7
white-faced heron	*Ardea novaehollandiae novaehollandae*	-	-	1	-	1	1	-	1	6	-	-
wrybill, ngutuparore ✱	*Anarhynchus frontalis*	-	9	-	-	-	-	-	-	-	-	-
	Total	74	100	20	132	77	151	96	276	458	474	481

✱ threatened species; nationally vulnerable

✝ at risk species

Figure 4.5 - Location of Construction Area No.1, containing a traditional shore bird roost.

4.3 Marsh Birds

Call playbacks undertaken around the Oakley Creek mouth resulted in no banded rail being heard or seen. The 100 m transect was often crisscrossed with footprints, with the most common or conspicuous of these belonging to white-faced heron and rats. No banded rail footprints or other signs (e.g. feathers) were observed. Despite the presence of Motorway edge habitats in this area, no evidence of banded rail or fernbird was found on either side of the Motorway between the Great North Road Interchange and Whau Creek. Both fernbird and banded rail occur on Pollen Island and banded rail has been reported from the southern end of Traherne Island by the Royal Forest & Bird Society Inc. A key consideration to increasing the habitat quality of both Traherne and Pollen Islands will be animal pest control.

5. Discussion

5.1 Terrestrial Birds

The terrestrial avifauna is characterised by common species of native and introduced birds, most of which are typical of developed, urban environments. No strictly terrestrial species of conservation concern would utilise the habitats on a regular basis and that includes NZ pigeon (kereru) that is now regarded as "not threatened" (Miskelly *et al*, 2008).

Red-billed gull (threatened species) was recorded in inland areas and is likely to exploit any food organisms present in areas being earth-worked. It would not be adversely affected by the construction or operation of the route.

No particularly notable terrestrial habitat would be affected but the mosaic of large trees, coastal scrub and amenity plantings around Waterview Inlet provides an area of vegetation that is significant for common birds on a local neighbourhood basis.

There will be clearance of vegetation, both native and exotic and a reduction in the area of existing habitat in the urban area and at the coastal fringe. The area of Oakley beyond the works zone would be more fragmented than it is at present as a result of the new Interchange but issues of edge effects and disturbance do not apply in this situation as they are characteristics of the existing environment and are unlikely to change.

Loss of vegetation could be mitigated by additional planting or increasing habitat values elsewhere (e.g. Traherne Island which is owned by NZTA).

Any potential direct mortality to nesting birds within the Project Area could be avoided by scheduling vegetation clearance outside the September to December period.

Changes to light and noise levels are unlikely to be a significant ecological issue for urban birds as they inhabit a relatively high light and noise environment at present.

While it should not be over-stated, the bush at the mouth of Oakley Creek is contiguous with the wider Oakley Creek walkway in the northern sector of the Project Area, and in itself contributes to the wider habitat that this bush provides for the birds of the local area (both native and introduced), albeit common species.

The bush comprising the Oakley Creek walkway is one of the few places within the wider Project Area which provides an abundance of habitat for birds, both in terms of extent and the stature of the trees. This habitat provides feeding, roosting and nesting resources for avifauna (both native and introduced). However, notwithstanding the above, it is emphasised that the riparian bush at the mouth of Oakley Creek comprises only a very small fraction of this wider bush area.

The southern sectors of the Project Area (i.e. Sectors 7 and 9) do not have the same degree of vegetated cover as that part located to the west of Great North Road, but do have large open spaces that are utilised by a different suite of bird species, although the majority of these are introduced (in particular starling). Nonetheless, the flat and open parts of the reserves east of Great North Road (i.e. Alan Wood Reserve) are utilised by a small group of native species (i.e. black-backed gull, red-billed gull and masked lapwing) for roosting and (on occasion) feeding purposes, but only the former species (i.e. black-backed gull) has been observed in these open spaces in any numbers.

At the mouth of Oakley Creek, terrestrial bird communities are dominated by silvereyes. Other common species present here are house sparrow, blackbird and feral pigeon. Kingfisher are also conspicuous here, and both fantail and grey warbler are present.

The majority of terrestrial birds present within the Project Area are introduced common urban species well adapted to exploit disturbed habitats and open spaces. The most commonly occurring species throughout is blackbird, being present at almost all of the sites surveyed. Overall, the most abundant species are house sparrows, blackbirds, starlings and silvereye. On one occasion black-backed gulls were abundant on the sports fields at Alan Wood Reserve with 48 individuals being present, and red-billed gull were abundant once at the Great North Road Interchange (32 individuals).

5.2 Coastal Birds

The 2007 – 2008 surveys indicated the range of coastal birds using the mudflats and their usual feeding and roosting locations within the study area. All but one species recorded during previous surveys were re-verified. The only species not seen was reef heron. However, reef heron was recorded only once in previous surveys (Site 4, April 2006) and may represent a vagrant. Two previously unrecorded species were noted in this 2007 – 2008 survey: lesser knot and banded dotterel. Both of these species have been previously recorded by other surveyors (i.e. OSNZ) in and around the area.

During the 2007-08 counts the most popular site for coastal birds at both low and high tide was site 4 as shown on Figure 3.1. This was also found to be the case in 2003. At low tide this site provides good feeding grounds among shelly mud. The Causeway Bridge provides a bottleneck which concentrates feeding opportunities for species (especially shags) feeding on fish. Low shell banks to the north of the site provide high tide roosts up until the last hour of high tide when congregated birds scatter elsewhere. Site 1 was the next most popular area at both tides. This area provides similar habitat features – bridge bottleneck, shelly mud substrate, high tide roost areas. In this case, permanent high tide roosts are available upon shell banks on adjacent Pollen Island. For similar reasons, sites 7 and 8 were also well patronised during low, and to a lesser extent, high tide.

The remaining sites presented less favourable feeding habitat for most species, providing a substrate of sand, shelly sand, or fine mud. The primary exceptions to this rule are white-faced heron and pied stilt which seem to prefer fine mud substrates for feeding. These species were particularly prominent on open mudflats at sites 8, 9 and 10. Also of note were sightings of wrybill and banded dotterel feeding in mudflat runnels draining into the south end of sites 9 and 10. These shallow freshwater inputs appear to be favoured by these species. In 2001 wrybill were seen feeding in close proximity to the Waterview Inlet, while in 2008 a pair was once seen roosting on the shelly beach adjacent to the Motorway at site 5.

Threatened and at risk native or endemic species recorded included pied oystercatcher, banded dotterel, New Zealand dotterel, red-billed gull, black shag, little black shag, caspian tern and wrybill. In addition, significant numbers of migrant waders were recorded, including bar-tailed godwit and lesser knot.

5.2.1 Causeway Bird Survey

The bird activity that would be potentially disrupted most frequently by motorway construction would be roosting at high water in the intertidal area (e.g. rock rubble, mangroves), on the Motorway grass or on adjacent structures (e.g. bridge railings). That would apply to low numbers of birds (mainly shags, gulls and white-faced heron with occasional variable oystercatcher) in all sectors except Sector 1S (Figure 3.3) where the roosting habitat is to the south of the low tide channel and reasonably well buffered. The most notable roosting activity, but only in the context of the Causeway survey area, was by shags, mainly pied shag, on rock rubble near the southwestern bridge abutment and on channel edge rocks adjacent to the northwestern bridge abutment (Figure 4.4) although the latter area was water-covered one hour before high water during a 3.4 m tide. Overall, the numbers of birds using the upper intertidal maritime zone and Causeway grass for roosting during high tide periods were low and this effect is therefore considered to be no more than minor. The loss of a small area of potential wrybill feeding habitat across the channel on the southern side of the Motorway Causeway is considered to be an adverse effect but relatively minor based on the works footprint that is available and the extensive area of the same habitat type nearby.

5.3 Marsh Birds

No typical fernbird habitat would be affected by the Project's footprint and no fernbirds were located along the edges of the existing Motorway. No banded rail were recorded using playback (lure) tapes or observed. Banded rail is an at risk species (data poor; naturally uncommon; Miskelly *et al.*, 2008) that was recorded as recently as 2004 on Pollen Island (Russell, 2004) with abundant fernbirds. No banded rail were located using a lure tape at dawn on 13 November 2009 in "ideal" potential habitat in Henderson Creek near the Motorway and adjacent to Jack Colvin Park. Nevertheless it is assumed that banded rail may use mangrove and mangrove fringe habitat at times throughout this area but especially in the vicinity of Traherne and Pollen Islands.

The 2008 surveys did not indicate the presence of banded rail in the area bordering the Oakley Creek mouth. Surveys in 2003 were similarly unsuccessful. OSNZ data for the period 1999-2004 (Robertson *et al.*, 2007) indicates that one banded rail was recorded within a 10km radius of this site indicating that the species may still be in residence nearby or occasionally visit or attempt to colonise this area. May is not an ideal time to survey for this species as birds may undertake post-breeding movements and are also less likely to respond to taped calls. Surveying in May does not, therefore, provide conclusive evidence of the absence of this species from this specific area but lends weight to the hypothesis that, if it is present, its numbers are probably low.

It is recommended that the Ecological Management Plan that is prepared for Traherne Island includes provisions for animal pest control in mitigation for habitat loss in that area. That would benefit potential species such as fernbird and banded rail as well as common terrestrial birds. In addition animal pest control

should also occur along the CMA frontage from Traherne Island North, to Whau Creek to similarly mitigate the loss of habitat in that area. Species that would benefit from animal pest control would be fernbird and banded rail together with any breeding coastal birds such as New Zealand dotterel, pied stilt and variable oystercatcher.

6. Potential Adverse Effects On Avifauna

6.1 Clearance of Vegetation

The removal of indigenous vegetation may result in direct adverse ecological effects in a number of ways. Firstly, it reduces the overall size of a habitat, and if significant enough this may affect the functionality of that habitat.

Secondly, it may alter the shape of a habitat and result in more pronounced or greater penetration of edge effects (such as light, wind, weed and pest intrusion) into the existing habitat interior, with consequent impacts on natural processes.

Thirdly, it may result in the removal of important food sources for indigenous wildlife (in particular bird species).

In this regard, there are two key factors to consider when addressing the issue of vegetation clearance in relation to the expected magnitude of adverse effects, as follows:

(i) the extent of the clearance (i.e. how much is going to be removed);
(ii) the type of vegetation to be cleared (i.e. is it native or exotic and what is its resource value and quality).

Where clearance involves the removal of large areas of good quality native bush, then the adverse effects of such clearance may be higher. Conversely, where it involves lesser quality and younger stands of native vegetation (eg. plantings) then the effects are less significant, and where it involves the removal of weedfields or invasive exotic trees, then the ecological effects can be positive although such species can also provide food and habitat for birds.

6.2 Clearance of Significant Individual Trees

While in general it is far more important to focus assessments of ecological effects on habitats, communities and wider ecosystems rather than on individual specimens, in some special circumstances individual trees may be worthy of attention, especially if they are a large, providing significant roosts, nesting sites and/ or local food sources for birds in an urban environment.

6.3 Direct Mortality of Birds

The clearance of vegetation and other habitat features may result in the direct loss (i.e. mortality) of eggs and young birds still in nests. The potential for that effect is accentuated when the clearance of trees takes place

within the bird breeding season, and is of most concern in relation to notable native bird species such as nesting kereru and tui.

The risks associated with this issue can be minimized by undertaking the clearance of trees and other nesting habitat outside of the bird breeding season.

Birds can also be killed as a result of bird strike on vehicles. That effect is likely to be highest where a new roadway is constructed across undeveloped habitat rather than in an urban area where birds have acclimated to the presence of vehicles and roadways. The presence of poles or fences along roadway edges to force birds to maintain altitude is an effective means of reducing mortality (Jacobson, 2005).

6.4 Habitat Reduction

Loss of terrestrial vegetation also results in a reduction in the availability of habitat and resources (i.e. food, breeding sites) for birds. In most cases neighbouring habitats are already well utilised by their own resident communities, and displaced individuals or groups from an affected area may have difficulty in relocating.

The magnitude of this effect is directly related to the extent of the vegetation lost, the quality and type of resources it offered, the range of birds affected, the availability of alternative similar resources nearby, and the accessibility of those alternative resources. In general birds with low dispersal abilities (eg. fernbird) and/or specialist resource needs are the groups potentially most adversely affected by habitat loss.

6.5 Edge Effects

Another factor which needs to be considered in terms of assessing the potential ecological effects associated with new highways is the extent to which new edges will be created within areas of existing habitat / vegetation, and the likely adverse effects which may eventuate as a result.

Edge effects refer to the differences in micro-climatic conditions as well as vegetation composition and structure that exist between forest margins and forest interior. These micro-climatic variables are generally those associated with air temperature, solar radiation, relative humidity and wind. These can alter the natural processes and species composition of habitat interiors.

Studies have shown that edge effects may penetrate up to 50m into habitat interiors. This issue is important when edge effects reduce the extent of habitat interior conditions, but is not such a significant issue where the areas to be affected are already substantially characterised by edge conditions, species and processes. Edge effects are likely to be more of an issue in forested habitats which would be truncated by a new Motorway, and are generally of far less concern in relation to new highways in urban areas where edge conditions, species and processes are likely to already dominate.

6.6 Habitat Fragmentation

Fragmentation (and habitat isolation) occurs when some barrier is created that reduces existing flows of species, individuals, genes, nutrients or energy. It is an important effect for nature conservation if it leads to potential or actual reductions in the long term survival of some (or all) of the species present on either side of the barrier, or to their ability to respond to changing conditions. Overall, with fragmentation (brought on by the creation of a barrier) the resilience of the ecosystem, the habitat and the population is reduced.

Where barriers are effective at isolating patches of habitat the consequences can be significant, especially in causing the isolation of populations. This in turn may manifest itself in several ways, including reduced populations, species exclusions, immigration of species favoured by newly created edges, changes in community composition, changes in species richness, and reduced genetic diversity within species.

Roads may constitute barriers to some birds and the busier and wider the road then the more effective it is as a barrier. However, as is the case with edge effects, this is more of an issue in native forest habitats which would be truncated by a new Motorway, and is generally not an issue in relation to new highways in urban areas where fragmentation and isolation are already characteristics of the habitats available to birds (refer Road Ecology – Science and Solutions, 2003).

6.7 Disturbance Effects

With regard to terrestrial birds the location of the proposed new motorway is in close proximity to the Oakley Creek bush, and also traverses open spaces intermittently utilised by native birds as roosts and foraging areas (at the northern and southern portals). Given this there is a potential risk in relation to disturbance effects (i.e. construction and operational phase noise, light and movement disturbances).

International literature suggests that road-traffic noise can be an important factor in alterations to breeding bird densities in woodlands, and for bird densities overall in similar types of habitat. However, the extent of such disturbance varies considerably according to both species and traffic volume.

The international literature also suggests that visual disturbances are only potentially significant with regard to wetland bird species. With regard to other bird groups the disturbances associated with the visibility of cars, direct mortality (i.e. road-kill) and pollution are considered to be insignificant.

With regard to coastal birds overseas studies have concluded that certain types of shorebirds can be particularly susceptible to disturbance activities and/or events associated with the construction and operation of roads, such as traffic noise and movement of vehicles. The sensitivities to these types of disturbances also appear to be accentuated during the breeding season, with the potential for loss of suitable breeding habitat but that situation would not apply to this Project because it does not affect the breeding habitat of coastal birds (refer Reijnen & Foppen 1994, 1995, 1997 & 2006; Reijnen *et al* 1995a & b, 1996; Foppen & Reijnen 1994; Spellerberg & Morrison, 1998).

There are essentially three categories of potential effects of traffic noise on birds – (1) behavioural and/or physiological effects, (2) damage to hearing from over-exposure, and (3) masking of communication signals. Overall the information that is presently available on the effect of traffic noise on birds is inconclusive

regarding the interaction of those categories, if any, and which is the most detrimental (refer Dooling & Popper, 2007). In summary "there are no studies definitely identifying traffic noise as the critical variable affecting bird behaviour near roadways and highways". Birds are considered to be more resistant to short-term and permanent hearing loss or damage generally because they are able to regenerate the sensory hair cells of the inner ear, unlike mammals. Birds are therefore able to recover from intense acoustic over-exposure. Continuous noise can mask detection and recognition of bird calls; masking of calls is greater when the noise concerned is in the same spectral region i.e. "traffic will cause less masking than other environmental noises of equal overall level but that contain energy in a higher spectral region around 2 – 4 kHz" (eg. insects, other bird calls – Dooling & Popper 2007).

In general humans can detect traffic and construction noise at a greater distance from a roadway than the typical bird and a typical human will be able to hear a bird calling in noisy conditions at twice the distance of a typical bird. A similarity is that birds will alter their behaviour for communicating in a noisy environment resulting in a doubling to quadrupling of the efficiency of hearing, however, any road-derived noise that is audible to birds may have effects that are independent of and beyond those discussed above.

Studies of the effects of masking communication have generally indicated an overall noise guideline of 60 dB (Dooling & Popper 2007) but critical ratios of various species can vary as much as 10 dB while others must be able to employ short-term behavioural adaptations to be unaffected at 70 dB (decibels).

In 2001 a joint investigation by Marshall Day Acoustics and Bioresearches in habitats alongside the "Matata Straight" of State Highway 2 near Matata indicated that high ecological value open water habitats in the western part of the Matata Wildlife Refuge were subject to noise levels of mainly 45 to 60 dB. That area contained pied stilt, white heron, black shag, pukeko and a variety of waterfowl. At the eastern end fernbirds were present within 30 – 50 m of the roadway in noise conditions of 55 – 60 dB (Bioresearches, 2001).

Artificial lighting, especially white and red light, can affect the orientation of migrating birds of all bird groups particularly when the sources are tall structures such as buildings, lighthouses and offshore installations (Poot *et al* 2008). In this case, however, the majority of flight movements would be relatively low altitude around the Upper Waitemata Harbour and across the Auckland Isthmus, both of which are already well-lit environments, as are the existing Northwestern Motorway and associated local roadways. Artificial roadway lighting has also been found to have a negative influence on breeding black-tailed godwit in open grassland (de Molenaar *et al* 2002) but no significant coastal bird breeding habitat is present immediately adjacent to the Project Area.

The feeding patterns of wading birds at least, are dictated by tidal patterns and feeding therefore occurs under a wide range of light conditions. Species that are tactile feeders are unlikely to be affected while visual feeders may be advantaged at night by increased ambient light levels over a wider area of feeding habitat. Some shorebird species vary their feeding strategy according to feeding habitat conditions.

6.8 Loss of Intertidal Habitat

Roadway construction can include the need for works within the Coastal Marine Area. These works can include bridges, piers in the intertidal habitat, temporary and permanent reclamation, and ancillary works such as temporary silt fences.

6.9 Construction and Operational Phase Discharges

There can be discharges to the marine environment during both the construction and operational phases of roadways. Those discharges have the potential to adversely affect intertidal feeding areas for birds as a result of siltation, the accumulation of contaminants and a decrease in water clarity.

7. Evaluation of Project Effects on Avifauna

This section discusses the probable effects of the The Project on the avifauna within and adjacent to the Project's footprint.

7.1 Clearance of Vegetation

The effects assessment for terrestrial vegetation concluded that there will be very minor vegetation clearance, with most of the removal involving already compromised edge habitats. Therefore the level of terrestrial habitat removal and the significance of that removal will both also be relatively minor, particularly as the affected species are all common birds that have adapted to exploit patchy urban environments.

In Sector 9 virtually all the habitat that will be removed consists of fields, exotic trees and kikuyu grass. The mature pohutukawas would remain. In the northern part of SH 20 the vegetation that would be removed is predominantly exotic (eg. macrocarpas, willows, privet) with various amenity plantings. The mature trees (probably planted) in the Unitec property (pohutukawas and exotics) will remain.

At the Great North Road Interchange (Sector 5) the habitats consist predominantly of tree privet, hawthorn, woolly nightshade (all bear fruit or berries used as a food source by urban birds), willows and poplars. Although a local adverse effect will result, its ecological significance will be less than minor.

From Great North Road Interchange to Te Atatu, on either side of the existing Motorway, the terrestrial and coastal vegetated habitat that will be removed consists of edge areas colonised by grass, scattered mangroves, exotic plants, weed species and a few dozen semi-mature and young karaka.

On an areal basis the predominant vegetated habitat that will be removed will be exotic. While representing a lower value habitat overall than native vegetation, exotic trees and shrubs still provide nesting opportunities and often a seasonal abundance of food (eg. privet berries) for terrestrial birds. Overall, however, the extent of vegetated habitat removal and its effect on common urban species will both be minor. The proposed landscape plantings will provide both nesting and feeding opportunities for terrestrial birds.

7.2 Clearance of Significant Individual Trees

No significant individual native trees will be removed and therefore no especially notable nesting, roosting or feeding resource for terrestrial birds will be affected. The large native and exotic trees in the Unitec property and large English oaks on the southern side of Oakley Creek will remain. There are individual trees such as gum, macrocarpa, flowering cherry and pine that will likely require removal and although largely planted specimens, they do form part of the overall urban habitat for common birds. On balance, however, the ecological significance of the removal of those trees as it pertains to urban terrestrial birds will be minor.

7.3 Direct Mortality of Birds

There is the potential for birds to be killed by direct collision with vehicles and for egg and juvenile mortality as a result of vegetation clearance removing nests during the breeding season.

Most breeding season mortality could be avoided by restricting any substantial vegetation clearance (eg. at the Great North Road Interchange/Oakley Creek) to the period outside September to December inclusive, which is the main breeding season. That is qualified however by noting that the species concerned are all terrestrial birds, none of which are considered to be "at risk" or "threatened".

Mortality of birds as a result of collision occurs at present on SH16 and with additional lanes and higher traffic densities the probability of collision is likely to increase. The area where that could be most significant ecologically would be along the Causeway where wading birds, especially South Island pied oystercatchers, typically start to feed on the southern side adjacent to the Causeway and then fly over the Motorway to the northern side as feeding areas became exposed. It was clear, however, that the fence along the present cycleway and the other structures (sign gantry, light poles) assisted in ensuring that those birds attained and maintained a safe clearance height over the Motorway footprint. During the Causeway surveys no birds were observed to be at a sufficiently low height to risk collision and no carcasses were found. In terms of the Project it is understood that the light standards will be situated within the median barrier as at present so similar conditions will prevail i.e. the partial barrier is likely to induce birds to attain a safe height well above the traffic when crossing the Motorway.

Therefore while there will be a level of direct mortality, it is unlikely to be significantly higher than at present and will mainly involve common terrestrial species of birds.

7.4 Intertidal Habitat Reduction

Habitat reduction as a result of vegetation removal has been discussed above (Section 7.1). The Project includes the need for works within the Coastal Marine Area. These works will include bridges, piers in the intertidal habitat (eg. Oakley Creek), temporary and permanent reclamation (eg. Causeway) and ancillary works such as temporary silt fences. There will be a loss of intertidal habitat as a result. The combined area of reclamation is significant although it is mostly along the existing Motorway edge. There will be a strip of non-vegetated intertidal habitat that will be removed on either side of the Causeway generally to about 20 m from the toe of the existing rock rubble sides. Exceptions are two additional and wider channel realignment areas (to 40 m) approximately 80 m in length on the southern side within Waterview Inlet, and one c.180 m long area that would be c.50 m wide also on the southern side of Waterview Estuary at the west end of the Causeway. Those additional areas are required for the purposes of realignment of the low tidal channels. The Causeway bird surveys indicated that relatively low numbers of birds utilised the area to 30 m from the existing Causeway and that their presence in that zone tended to be transient and only until intertidal feeding areas further beyond the Causeway became exposed. The inner channel of Waterview Estuary is incised, mangrove-lined and utilised by a very low number and diversity of birds. Overall, the loss of the c.20 m strip of feeding habitat that is used only intermittently by a low number and diversity of birds is a minor effect. Similarly the channel realignment in the mangrove-dominated Waterview Inlet is also considered a minor effect in terms of habitat loss and habitat alteration. It is noted that these edge habitats have developed as a result of the Causeway.

The wider channel realignment area on the southern side of the western end of the Causeway in Waterview Estuary will intrude in a minor way onto the extensive low tide bank on the southern side of the Motorway (Figure 7.1) that is used for feeding by wrybill in particular, mainly during low spring tides when that bank is fully exposed (Figure 4.4). That will be an adverse effect but also relatively minor – it will possibly affect a very small area of an intertidal bank that consists of soft mud. The bank extends across the Estuary to the south; the proportion of the area that will be removed is small and modelling results indicate that no significant change to the overall size of the remainder of the bank will occur. The key species that utilises that large area of bank, and particularly the zone nearest the Causeway, is wrybill which is relatively resilient to disturbance. A helicopter trial involving an aircraft overflying wrybill at low altitude had little effect on feeding birds in similar habitat in Mangere Inlet (Bioresearches, 2007) and wrybill will also continue to feed in the affected area of Waterview Estuary.

The aspect of habitat reduction that is of more significance is the loss of roosting habitat. While the availability of feeding habitat is unlikely to be limiting to the numbers of birds using the habitats adjacent to the Causeway, roosting areas are sparse, especially during higher neap or spring tides. White-faced herons, occasional variable oystercatchers and shags use the rock rubble of the Causeway for roosting; shags, especially pied shags, use the Causeway Bridge abutments and a key intertidal shag resting area is located directly south of the Causeway Bridge. Those roosting areas will either be removed (Causeway rock rubble, bridge abutments) or possibly rendered unsuitable as a result of construction noise. As the presence of pied shags is a key avifaunal feature of the Bridge area and pied shag is a threatened species, a recommendation is that a temporary roosting structure (eg. posts and rails or a floating platform) is provided in the vicinity of the Causeway Bridge during the construction period. That proposal has been included in the Ecological Management Plan.

Therefore while there will be a reduction in non-vegetated feeding habitat that loss is considered minor (small area, low bird numbers, low diversity of birds). The areas that will be lost are mainly separated from the main low tide feeding banks by low tide channels (Figure 7.1) and are generally the less preferred by the birds. There will be a decrease in the high tide roosting opportunities as a result of construction and that should be mitigated for the duration of the works. Following the works it is probable that the Causeway sides will continue to be used by roosting birds.

There is also the possibility of chronic displacement of birds away from the Motorway footprint as a result of a combination of habitat loss, the Motorway moving closer to preferred feeding areas and the potential disturbances arising (e.g. noise, lighting, traffic and pedestrian movement). At present birds feed along the immediate edge of the Motorway but numbers are generally low relative to numbers further beyond the Motorway. Rather than a Motorway effect in isolation, however, that appeared to result from a combination of factors i.e. the small size of the available feeding area, the habitat characteristics (e.g. mud with scattered rocks and pacific oysters) and the fact that those areas are the first areas exposed on the falling tide and therefore the first areas that present feeding opportunities. Feeding birds use the 0-30 m area in the southern side of the Motorway for about 2 hours on a falling tide. It is possible that some displacement may occur, especially as a result of fright reactions, but that would be temporary. Displacement of birds from the key feeding banks on either side of the Motorway is unlikely under normal operating conditions; those areas are buffered by low tide channels parallel with the Motorway on either side. Most displacement will apply to the narrow strips of intertidal habitat beside the Project Area footprint that are the result of the Causeway. Those

areas support relatively small numbers of birds and it is unlikely that the availability of feeding habitat is limiting in the wider area. The low level of roosting alongside the Motorway during high tide periods will not diminish provided suitable edge areas are present.

7.5 Edge Effects

The areas of vegetated terrestrial habitat within the Project footprint are characterised by an absence of habitat interior conditions so there is no issue regarding the possibility of edge effects changing the habitat conditions for birds. The birds present are common terrestrial species that are able to utilise a habitat that is typically patchy with groves of trees and individual trees that are subject to edge effects.

7.6 Habitat Fragmentation

The Project will not traverse any forested wildlife corridor or large area of habitat that could result in a higher level of habitat fragmentation than is already present. The privet-dominated habitat near the Great North Road Interchange and Oakley Creek is already isolated by Great North Road, which is four lanes wide. Similarly the more linear habitats beside the Motorway from the Great North Road Interchange to Te Atatu would retain their present form.

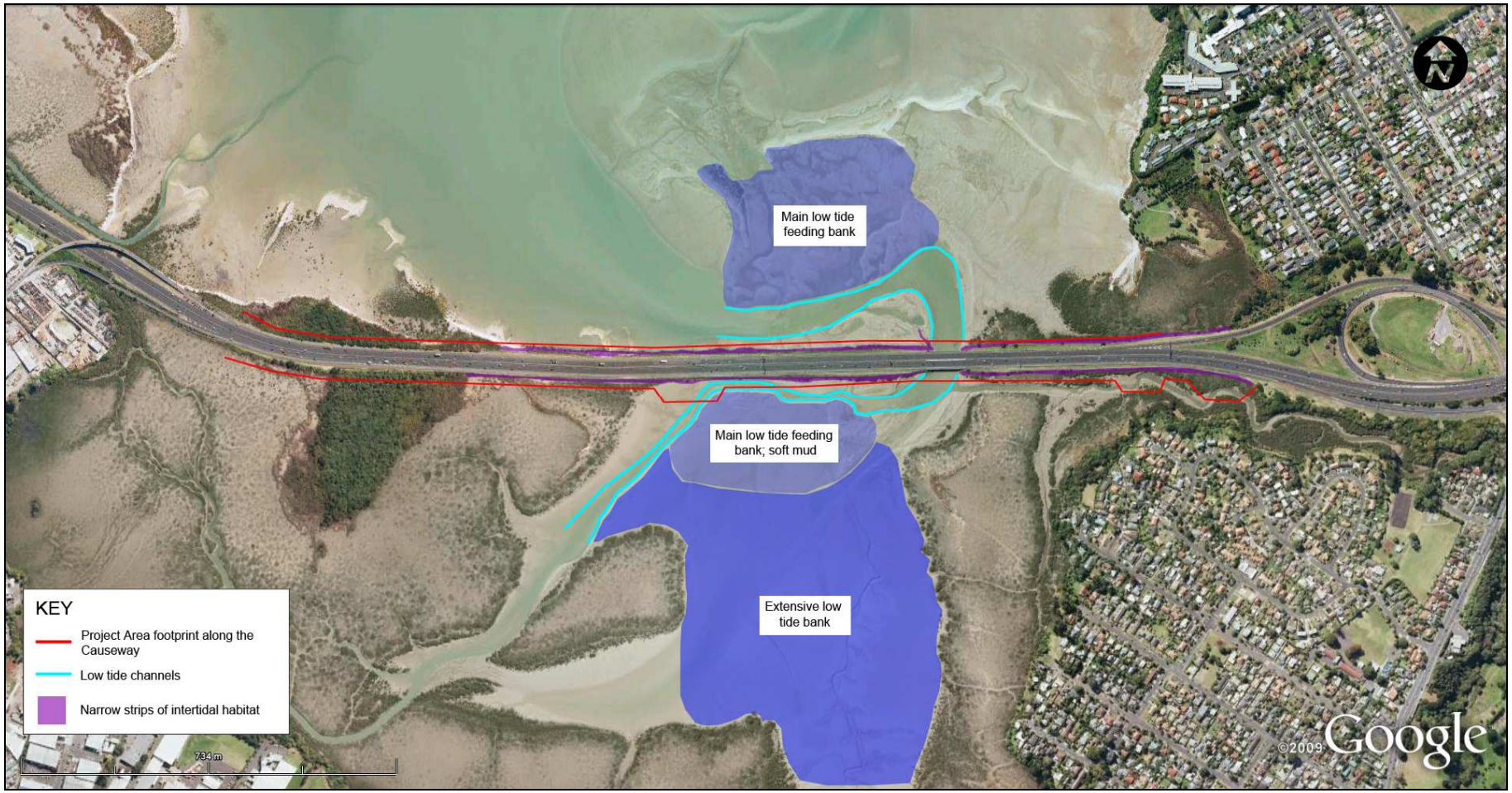

Figure 7.1 - Areas of importance along the Waterview Connection (SH 16-20) Causeway.

7.7 Disturbance Effects

7.7.1 Noise

For Sectors 5, 6, 7 and 9 where the route runs mainly through fragmented and scattered terrestrial habitat, the mitigation measures proposed for protection of the residents' noise environment will also ensure that no significant increase occurred as far as the ecological processes and behaviour of common terrestrial birds were concerned. Birds in the vicinity of the route will have acclimated to specific traffic noise and also general background and short-term noise associated with an urban environment (eg. lawnmovers, chain saws).

As a comparative guide the following dB levels apply to common situations – lawn mower 95 dB+; chainsaw 110 dB+; power tools 104-113 dB; water blaster 95-103 dB; trail bike 110 dB; busy street or loud radio 80dB; heavy truck 90 dB; normal conversation 60 dB; soft whisper 30 dB (National Foundation for the Deaf, 2010).

Causeway construction noise levels are predicted to be as high as 85 dB at 20 m distance during piling but generally around 70-75 dB at 20 m (Marshall Day Acoustics).

At present along the Causeway the average daily noise level (from midnight to midnight; eq 24 h) is about 68dB 50 m from the footprint edge. Following construction it will still be 68 dB in the vicinity of the main southern feeding bank (refer Figure 7.1) but the 68 dB zone will extend further out from c.75 m to c.100 m.
During construction there are likely to be frequent fright reactions, for example as a result of sheet pile placement, that will displace birds from the vicinity of the works. That would be a short-term and temporary effect without any significant long-term consequences. Indications from a helicopter start-up trial (Bioresearches, 2007) were that startled birds simply moved a short distance and resumed feeding.

On the southern side of the Causeway a relatively small increase in the extent of noisier operating conditions away from the Motorway is unlikely to displace feeding birds because they have been recorded feeding in that ambient noise environment and in even higher levels (eg. 70-76 dB immediately adjacent to the Motorway edge rubble wall) at present. The aspect of noise effects on feeding birds is not as much of a potential issue on the northern side because the main low tide feeding bank is further offshore away from the Motorway and will remain mostly in the 60-64 dB range.

It is noted that at present the birds roosting along the rock rubble walls at the Motorway edges (i.e. white-faced heron, variable oystercatcher and shags) and at the Causeway Bridge abutments are in the 74-76 dB zone; the noise environment will be similar in those areas and no significant change in roosting behaviour will occur.

At Traherne Island on the northern side, the 68-76 dB zone will be of the same extent as at present i.e. about 75 m from the roadway. That situation covers all of the vegetated area of Traherne Island on the northern side. A change to the adjacent bare mudflats on the northern side of Traherne Island is that the 66 dB zone will extend a greater distance offshore than at present (75 – 80 m) to about 150 m. Overall there will be no significant change to the noise level in the vegetated habitats of the northern section of Traherne Island.

Ambient noise levels around the larger southern part of Traherne Island will decrease as a result of noise mitigation associated with the Rosebank Road onramp. In particular the northwestern corner of this part of Traherne Island will be subject to lower ambient noise. Overall, the change in ambient noise would be minimal with the distance to the 60 dB contour being about the same or about 40 m less in comparison with the existing situation. Therefore there will be no significant increase in ambient noise levels in either the northern or southern part of Traherne Island; noise conditions for birds using those habitats would remain similar.

For the area from Traherne Island to Whau Creek, including the CMA frontage, the post-construction situation would be similar but the distance to the 60 dB (i.e. quieter) contour will increase. Out from the Patiki Road onramp on the northern side there will be an increase in the width of the 62-64 dB contour of about 25 m so the 60 dB area will commence about 300 m from the roadway rather than at 275 m. Pollen Island itself is about 300 m from the Motorway at its nearest point and up to a maximum of 600 m away so the vegetated, non-mangrove habitat utilised by species such as fernbird and banded rail will remain in the 60dB and below zone. The important area for wading birds on the seaward side of Pollen Island is about one kilometre from the Motorway and will not be affected.

Therefore for the majority of the CMA area there will be an increase in the average noise level and noisier conditions will extend out by an additional 25 m from the Motorway. The affected area will mainly involve mangrove habitat (potential banded rail feeding area) and the vegetated area of Pollen Island itself will not be affected. The increase would be in the order of 2-4 dB which to the human ear is a minor change, based on 3 dB being a "barely perceptible change" and 5 dB representing a "clearly noticeable change" (Galen Carol Audio San Antonio, Texas, 2007).

In contrast there will be a reduction in average noise levels at the Whau Bridge crossing (as a result of new 0.8 m safety barriers) from 68-70 dB to 64-66 dB, a change of about 4 dB on average, also relatively minor. Therefore on balance the areas of the CMA on the northern side of the Motorway between Traherne Island and Whau Creek are likely to be subject to increases in the average noise level; that increase will mainly apply to mangrove habitat, would be relatively minor and be expected to have little effect on bird presence, diversity and behaviour.

7.7.2 Light

The mainly suburban portion of the route (i.e. Sectors 5, 6, 7 and 9) is through an already well lit environment that contains an avifauna that has adapted to relatively high ambient levels at night. Those areas can still be utilised by nocturnal birds such as morepork despite the lights from dwellings and roadways (G. Don *pers. obs.*). The same diversity of birds will continue to utilise areas adjacent to the new roadway and there is unlikely to be any reduction in bird abundance as new efficient lighting will be roadway-focused rather than illuminating areas of nearby parkland for example. As with ambient noise, measures in mitigation regarding lighting that are primarily directed at protecting local residents will also be beneficial to birds using those areas.

Along the section from the Great North Road Interchange to Te Atatu Interchange, the light poles will be mounted in the central median and will support asymmetrical projection floodlights that only have a small

proportion of their light straying above the horizontal plane. The lighting is expected to have the same "golden white" High Pressure Sodium (HPS) light as existing sources. Overall the lighting will appear the same as that already existing on the Causeway but with less upward light spill, less glare and stretching across an increased road surface of nine lanes. The light level on either side of the Project Area and beyond its footprint is not expected to be any different from the existing situation.

It is understood a similar lighting situation is that on the Northern Motorway adjacent to the old Auckland Harbour Bridge toll booth site on the northern side of the Bridge near the Police Station; the difference there however is that the floodlight visors are upward facing whereas along the Project Area they will be parallel with the ground. That area is adjacent to "Sulphur Bay" an area that supports a high diversity of coastal birds within Shoal Bay. Sulphur Bay has been the site of successful nesting by New Zealand dotterel, 15 m from the traffic (Pye, 1998). NZ dotterel has also attempted to nest within the, then, Onewa Road Motorway Interchange (Pye, 2001) and within the Great North Road Interchange, all high light (and noise) environments. Despite the presence of a high level of artificial lighting from the northern Harbour Bridge abutment and along the foreshore to inner Shoal Bay, that area is rated as a "significant area for wading birds" (Auckland Regional Plan: Coastal Maps; Plan Change 4; Series 8; No. 3; September 2003).

Therefore if there is any effect on the adjacent intertidal areas as a result of changed lighting, it will be minor and, based on the Shoal Bay situation and the existing characteristics of the avifauna adjacent to the Project Area, it will not diminish the significance of those areas as coastal bird habitats. There will be less upward light so the attraction to any migrating seabirds such as petrels will diminish, even if that source is significant relative to even taller light sources throughout Auckland and Waitakere Cities.

7.8 Construction Discharges

Erosion and sediment control will be managed via standard techniques according to guidelines established by the Auckland Regional Council. The intertidal habitats utilised by coastal birds for feeding are accreting environments. The surface sediments are subject to periodic disturbance as a result of wind-induced wave action. That effect and the input of catchment-derived stormwater and diffuse runoff during rainfall events can result in nearshore waters becoming extremely turbid under existing conditions.

If well-managed sediment control devices are implemented, construction will not result in discharges that (a) rendered the intertidal habitats unsuitable for feeding and (b) in isolation, adversely affected visual feeders such as terns and shags as a result of turbidity increases. The effects of discharges during construction are unlikely to be any greater than the natural variations in water quality conditions that occur at present during rainfall events.

7.9 Operational Discharges

Stormwater quality will be higher than at present as a result of storage of 100 year ARI (average recurrence interval) flows in drainage gutters, Motorway shoulders and ponds. At present there is no stormwater management in place for the Project Area. Treatment will be via swales, stormwater treatment and attenuation ponds and other devices as required. The stormwater management will also follow guidelines established by

the Auckland Regional Council that are designed to avoid significant adverse effects on receiving environments, including those that contain feeding habitats of coastal birds.

A benefit of the proposed stormwater management will be that runoff from both the new and existing roadway surfaces will be captured and treated. In that regard there will be a benefit to the marine habitats. There will not be a degradation of intertidal feeding habitats of coastal birds as a result of treated stormwater discharges. It is noted that the receiving environment adjacent to the Causeway is considered a "significant area for wading birds" (Auckland Regional Plan : Coastal Maps; Plan Change 4; Series 8 No. 4; September 2003) despite uncontrolled discharges from the Motorway itself and the wider catchment. The stormwater treatment ponds will provide habitat for common species such as mallard and pukeko. Pukeko presently utilise a small constructed pond adjacent to Jack Colvin Park for example, and are relatively common along Auckland motorway verges.

8. Avoidance, Remediation and Mitigation

The overall conclusion is that the effect of the Project on terrestrial, coastal and marsh birds will be minor and will not result in a decrease in the diversity of birdlife. Any effects that do result are likely to be temporary and low level and would be mitigated by the proposals outlined below.

Following the investigation of Construction Area No. 1 at Te Atatu and the advice to the Project Team that it included a traditional high tide roosting area for coastal birds, the size of the Construction Area was reduced to accommodate the bird roost as depicted in Figure 4.5. It is therefore considered that an adverse effect on the coastal birds at this roost site has been avoided.

A number of species of coastal birds use the habitats adjacent to the Causeway including the population of pied shags (threatened species) that feeds mainly under the bridge and uses the bridge abutments and adjacent areas for roosting at high water. The roosting areas will either be removed during construction or rendered unusable as a result of frequent disturbance. It is recommended that mitigation is provided in the form of temporary roosting structures (eg. posts, rails, floating platform) during the construction period adjacent to the Causeway Bridge.

At this stage temporary rather than permanent roosting structures have been proposed because it is considered that pied shags will use the new bridge abutments once construction has ceased.

Major vegetation clearance should be scheduled to occur outside the bird breeding season (September to December) as far as practicable to avoid the destruction of nests containing eggs and juveniles. Replanted areas will provide new habitat for terrestrial birds.

The Ecological Management Plan for the Project will include provision for vegetation management (specifically weed control) and animal pest control on Traherne Island (northern and southern sides) and on the CMA frontage from Traherne Island North to Whau Creek to mitigate the cumulative effects of habitat removal along the Sector 2, 3 and 4 footprint. That provision and its details will be presented in the Traherne Island/Te Kou Natural Heritage Restoration Plan. That would benefit birds such as fernbird and banded rail, any nesting coastal birds such as New Zealand dotterel, pied stilt and variable oystercatcher on Pollen Island and common terrestrial species.

Mitigation and monitoring proposals relating to birds from the Ecological Management Plan are shown in Appendix J.

9. Summary and Conclusions

The overall conclusion is that the effect of the Project on terrestrial, coastal and marsh birds will be minor and will not result in a decrease in the diversity of birdlife. Any effects that do result are likely to be temporary and low level would be mitigated by the proposals outlined in Section 8 of this report.

Terrestrial birds are those commonly found in urban and coastal edge habitats and consist of common native and introduced species. There are no significant adverse effects predicted in relation to any at risk or threatened terrestrial birds as a result of the Project. The effect of the Project on common terrestrial birds could be minimised by scheduling more major vegetation clearance (eg. Oakley Creek) to occur outside the bird breeding season.

Banded rail were not recorded within the Project Area. Though this does not confirm the species' absence, cumulative evidence suggests that if present, numbers are probably very low. No fernbird were recorded within the Project Area. Any loss of potential banded rail habitat will be mitigated by animal pest control on Traherne Island and along the CMA frontage.

Coastal bird surveys confirmed that the area surrounding the Waterview Inlet is a notable feeding and roosting habitat for waders and other coastal bird species. The area of mudflat and shellbank habitat surrounding the Inlet is well used owing to a combination of substrate structure, provision of roost sites and the fish-concentrating effect of the Causeway Bridge. The area supports a year-round population of threatened bird species, with numbers especially elevated during spring and summer by the presence of seasonal national and international migrants.

The provision of temporary roosting sites for pied shags has been recommended in mitigation. No adverse effects on the mangrove roosting areas, used by white-faced heron, is likely and shags will continue to feed in the Causeway Bridge area and beneath it. Overall the diversity and numbers of birds using the area of the Waterview Inlet adjacent to the Project Area will not diminish except during intermittent construction events such as sudden noise increases. The effects will be short-term and temporary.

The coastal bird activity that will be potentially disrupted most frequently by construction will be roosting at high water in the intertidal area (e.g. rock rubble, mangroves), on the Motorway grass or on adjacent structures (e.g. bridge railings). That will apply to low numbers of birds (mainly shags, gulls, white-faced heron and occasional variable oystercatcher) in all survey blocks except block 1S where the roosting habitat is to the south of the low tide channel and reasonably well buffered. The most notable roosting activity, in the context of the survey area, is by shags (especially pied shags) on rock rubble near the southwestern Bridge abutment and on channel edge rocks adjacent to the northwestern bridge abutment, although the latter site is water-covered one hour before high water during 3.4 m tides and is therefore not a useful spring tide roost.

Overall, the numbers of birds using the upper intertidal maritime zone, Motorway grass and adjacent structures for roosting during high tide periods are low and this effect is therefore considered to be no more than minor. The loss of a small area of wrybill feeding habitat across the channel on the southern side of the Motorway Causeway is considered to be an adverse effect but also relatively minor based on the Project Area in comparison with the extensive area of that habitat type nearby.

The area referred to as 'Construction Area No. 1' has been amended to accommodate an area for roosting birds thereby avoiding an adverse effect on coastal birds.

There will be frequent fright reactions during the construction phase and birds will be displaced from the works areas on occasions. That effect will be temporary and short-term. There may be displacement from the intertidal areas beside the Causeway but not from the main feeding banks that are separated from the Causeway by low tidal channels. That effect is considered minor as the availability of feeding habitat is unlikely to be limiting within the wider area.

Coastal birds feed and roost in high operational noise conditions at present adjacent to the Causeway and that will not change. Overall there will be an increase in the lateral extent of noisier conditions. At Traherne Island, however, there will be no significant change but operational noise levels will increase in the mangrove-dominated habitat of the CMA. No increase will occur on Pollen Island itself or in the significant wading bird area beyond the Island. The increases in noise will be relatively minor and will not result in birds vacating the affected areas of habitat.

The change in the ambient light conditions is not likely to adversely affect coastal birds or reduce their nocturnal use of adjacent habitats. The vertical light environment and the risk of bird collision with lights will not change.

In general there will be inevitable disruption to birds utilising the existing Causeway and Motorway edges, especially during the construction phase. Following completion of the works, coastal birds will acclimatise to the altered situation and continue to use those edge areas as at present. The key feeding habitats will not be reduced significantly, no major high tidal roost for wading birds would be affected, no breeding area is affected and shags will continue to use the built structures for roosting.

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11. Plates

Plate 1 - Intertidal habitats at the western end of the survey area (4N) and beyond; northern side; viewed towards the west from the eastern end of Traherne Island at the edge of the Motorway.

Plate 2 - Coastal bird count block 4N and beyond; northern side; viewed towards the west.

Plate 3 - View towards the east from western end of survey area; northern side; showing offshore banks.

Plate 4 - View towards the east from block 3N; northern side.

Plate 5- Water covered roosting area extending out from triangular marker; northern side; view towards the west.

Plate 6- Typical maritime zone; coastal bird count block 1N; view towards the east.

Plate 7- Typical maritime zone; coastal bird count block 3N; view towards the west.

Plate 8- White-faced heron roosting at high water; coastal bird. count block 3N (little shag obscured LHS)

Plate 9- White-faced heron roosting at high water; coastal bird count block 2S.

Plate 10 - Block 4S viewed towards the west.

Plate 11- Main intertidal feeding areas across low tide channel; southern side; view towards the south; mostly coastal bird count block 3S.

Plate 12- Southern side view to the west from coastal bird count block 1S; shag resting area to left.

Plate 13-Shag resting area as shown in Plate 12.

Plate 14- Shag roosting area at high water; adjacent south-western Causeway Bridge corner.

Plate 15 - Shag resting area of plate 13 at about half tide.

Plate 16 - Shag resting area of plate 13 at high tide.

Plate 17 Typical maritime zone; coastal bird count block 1S; view towards the east.

Plate 18 Pied shag feeding under southern side of the Causeway Bridge; coastal bird count block 2S.

Plate 19 - Low tide channel; coastal bird count block 1S; view towards the east.

Plate 20 - Pied shag; white-fronted tern; red-billed gull; southern side of the Causeway Bridge; coastal bird count block 2S.

Plate 21 - Roosting dotterels and wrybills near the Te Atatu Interchange – proposed Construction Area No.1.

Plate 22 - Roosting dotterels and wrybills near the Te Atatu Interchange – proposed Construction Area No.1.

Plate 23 - Wrybills, banded dotterel and NZ dotterel – near Construction Area No. 1.

Plate 24 – Mixed roosting flock of New Zealand dotterel and banded dotterel – near Construction Area No. 1.

Plate 25 – South Island pied oystercatcher in northern paddock – seaward side - near Construction Area No. 1.

Plate 26 – South Island pied oystercatcher in northern paddock – motorway onramp side – near Construction Area No. 1.