
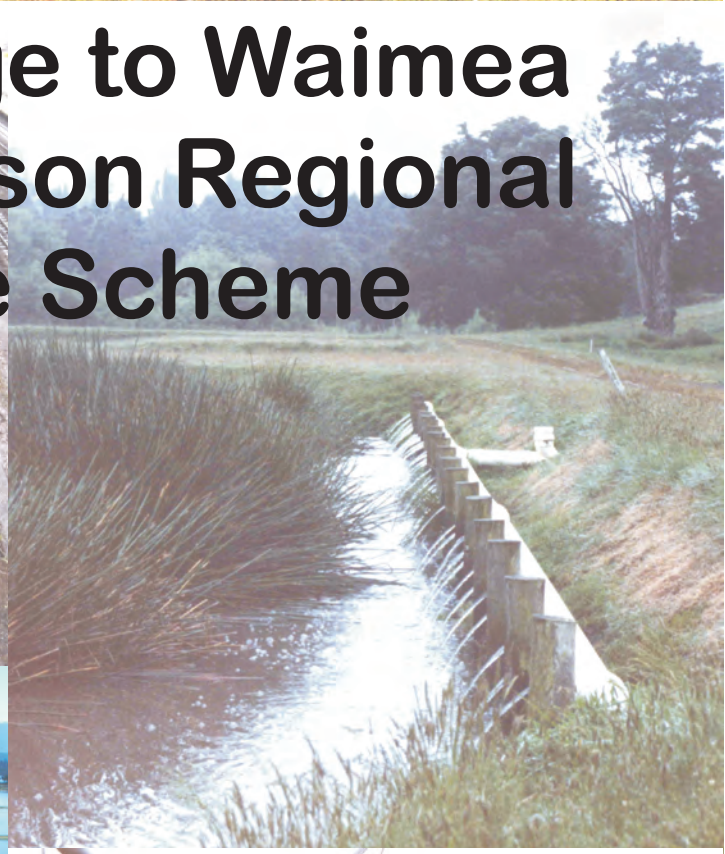



# **Host Communities: siting and effects of facilities**



**An analysis of host community  
experience of the Bells Island  
Waste Water Treatment Plant  
and Discharge to Waimea  
Estuary - Nelson Regional  
Sewerage Scheme**



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Nelson Regional Sewerage Scheme**

**By**

**James Baines  
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**August 2001**

## **ACKNOWLEDGEMENTS**

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The research team wishes to express its gratitude to all those who participated in this case study - the residents, businesses and those enjoying recreational opportunities in the host community around the plant; also to other key informants in the host community, administrators at the Nelson City and Tasman District Councils, and the plant operator.

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# **A: Introduction to this case study**

## **Public Good Science Fund Research**

The research team at Taylor Baines & Associates was contracted by the Foundation for Research Science and Technology to carry out a piece of social research concerning the siting of Waste Water Treatment Plants (WWTP) and disposal facilities. The research has been funded out of the Public Good Science Fund.

Spread over three financial years - 1998 to 2001 - the research programme aims to assist the processes of urban and rural planning (as it applies to future waste disposal infrastructure) by developing a body of knowledge on key social factors that are relevant to the siting and operation of WWTP facilities.

This case study addresses part (Questions 2 & 3 below) of the overall research objectives. In total, the research programme is intended to answer three core questions -

1. Is there a systematic pattern of WWTP siting in NZ. If so, how would you characterise this historical pattern from the social perspective of host communities?
2. How do actual effects compare with effects that were projected at the time of siting?
3. What have been the longer-term effects on host communities of WWTP and disposal operations?

This research on WWTPs is part of a longer-term research programme currently being funded by the Public Good Science Fund into the siting and social impacts of a range of facility types. During the period 1997 to 2000, research was carried out on solid waste facilities - landfills and transfer stations. During 1998 to 2001 the research has focussed on waste water facilities. From 2000 to 2002, additional types of facilities are being investigated (Please refer to the TBA website - [www.tba.co.nz](http://www.tba.co.nz) - for more information.)

The research programme has received the strong endorsement of Local Government New Zealand, the New Zealand Water and Wastes Association, the Ministry for the Environment, as well as several territorial local authorities.

## **Reasons for this research programme on facilities and their host communities**

It is a common experience that assessing the effects of WWTPs and disposal options at the time of site selection is a contentious process. The debates that surround such assessment activities are often informed more by prejudice and a strategic selection of hearsay information than by well-founded evidence.

This research aims to address both questions of possible social bias in site selection and lack of experienced-based information relevant to New Zealand communities. It is to be hoped that these

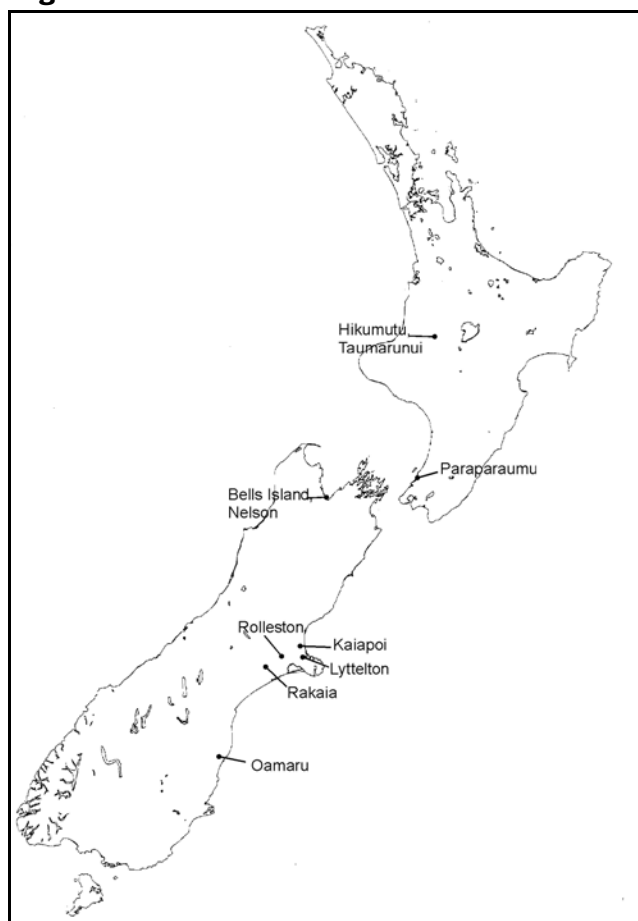
objectives will be served by carrying out the research in a setting which is quite removed from the tensions of resource consent applications, and by a team of independent researchers who have no organisational affiliation with either the developers of such facilities (usually but not always territorial local authorities) or the host communities involved.

## Purpose of the case studies

This case study on the Bells Island WWTP is one of eight such case studies being undertaken as part of this research programme<sup>1</sup>, as in Figure 1. The case studies were selected to provide a range of relatively recent technology in terms of New Zealand applications, and a range of disposal media (rivers, estuaries, ocean, land, wetlands). Because of the requirement to avoid facilities involved in active resource consent proceedings or undergoing construction activities, most of the main metropolitan WWTPs could not be included in the case study work at the present time. As a result, the sample comprises mainly relatively small capacity facilities. However, it does include a variety of technology types and effluent disposal media. This makes the research particularly relevant to the increasing numbers of smaller communities which are being required to develop or upgrade reticulated sewerage systems.

Each case study has been conducted at a time which avoids conflicts with active resource consent proceedings. Care has been taken in the social assessment research method to provide accurate<sup>2</sup> and useful descriptions of the effects experienced by host communities, by canvassing a wide range of local observations, by accessing other relevant data sources where possible to corroborate the observations of neighbours, (and by engaging in a process of feedback preliminary findings for checking and validation by the research participants). As a result, the experience documented in these case studies should neither overstate nor understate the experience of the host communities involved. This is important, if the research is to assist participants in future planning.

**Figure 1: New Zealand Case Studies**



<sup>1</sup> The full list of case studies includes Oamaru, Kaiapoi, Rolleston, Rakaia, Bells Island (Nelson Region), Paraparaumu, Hikumutu (Taumarunui) and Lyttelton.

<sup>2</sup> The use of percentage figures in this case study is not intended to imply statistical analysis. Rather it should be interpreted for comparative purposes merely as indicating the proportion of respondents in any particular area of interviewing who gave a specified response.

Nevertheless, the case studies each represent experience at a particular point in time. The research process itself, and the case studies resulting from the research, have the potential to trigger changes in the way the facilities are operated and managed. Thus it is important to interpret the findings of each case study in the context of the way the facility was operated and managed at the time of the case study fieldwork<sup>3</sup>.

It is also important to keep in mind the perspective of this research - the host community perspective. Primary emphasis has been put on capturing the experience of members of the host community - the community of residents and businesses in relatively close proximity to the Bells Island WWTP. It is their experience of the off-site effects such as odour and noise, and the impacts of such effects that will be useful to others contemplating the siting of a new waste water facility. By the same token, there are likely to be some off-site effects such as risks to groundwater quality that will not necessarily be informed by a focus on neighbours' experience, simply because such phenomena are not often readily detectable to casual observation, even if they do occur.

## Methodology for the case studies

The research method drew on the practical and theoretical approach to social assessment described in Chapter Four of "Social Assessment: theory, process & techniques" (Taylor et al., 1995). Stages in the research included scoping the particular cases to clarify the appropriate time frame and communities of interest, community profiling, a structured survey of nearby residents and business people, in-depth key informant interviews, and accessing a range of existing data sources.

A structured questionnaire was developed to gather detailed information about the experience of many individuals living in the host community. The questionnaire explored people's experience of day-to-day operational effects of the WWTP, their perceptions of how the presence of the WWTP has impacted on the longer-term development of the host community, and their knowledge of what has happened in their community during the years prior to and since the WWTP was established. The detailed analysis is descriptive and sometimes quantitative, but not statistical in nature<sup>4</sup>.

In carrying out the comparative case assessments, the assessment team had to address several issues relevant to interpreting the results and their usefulness in providing valid comparative information. These included the debate about 'perceived' or 'real' effects, the need for corroboration, and the importance of timing or context as a potential influence on individual responses.

The assessments focussed on people's experiences of living or working near waste management facilities. The results are therefore based on a large body of individual perceptions of effects. In some feedback discussions, the distinction was made that these effects are "*only people's perceptions; they're not necessarily real.*" The question arises therefore as to what is the difference between a 'perceived' effect and a 'real' effect. Can 'perceived' effects ever become 'real' effects? In practical terms, the assessments identified clearly the proportions of those interviewed who experienced certain types of effects. Furthermore, wherever possible, the assessment sought to

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<sup>3</sup> The fieldwork dates are noted explicitly in the case study report. Furthermore, the report attempts to describe as fully as possible the operating regime at the time of the case study.

<sup>4</sup> A statistically-based analysis would have increased the scale of field work and cost several fold.

investigate these effects from other respondents and from independent sources (e.g. local key informants; secondary data records) or different perspectives (e.g. the facility operator)<sup>5</sup>. As researchers, it was pleasing to note how, in the great majority of cases, neighbours' experience was strongly corroborated by the perceptions and experience of the facility operator.

A number of factors have a bearing on individual experiences. Different people have different thresholds for noticing effects depending, for example, on their ability to hear or to smell, or on their perception of what is 'exceptional'. Increasing sample size addressed this factor. Different living or recreational patterns are likely to influence people's experience of effects - whether they are on the property all day, every day, or working off the property. Day-time interviewing addressed this factor by increasing the likelihood of including individuals with a relatively high rate of occupancy. People get used to effects after a while - they can seem less exceptional. Following unprompted questions with prompted questions addressed this factor, by allowing interviewees 'a second chance' to respond.

Does the distinction between 'perceived' and 'real' effects matter? The primary purpose and value of comparative case assessment is to answer two types of questions - (i) if neighbours around a facility are experiencing certain effects, and finding that they have unacceptable impacts, what can be done to reduce or eliminate the effect, or make it less likely to happen? and (ii) if neighbours around Existing Facility A experienced certain effects and impacts from its operation, what is the likelihood that neighbours around Potential Facilities B, C or D will experience similar effects and impacts? In either situation, whether such effects are labelled as 'perceived' or 'real' is probably immaterial. However, from a "technical" perspective, replication of reported effects is important to their validation, while from a "political" perspective, the perceptions of just a few people affected can be sufficient to galvanise social action.

It is also important to remember that technical experts are not necessarily in a position to offer any more than assessments of 'perceived' effects. In the case of technical experts, their perceptions are derived with the aid of technical lenses (i.e. frameworks for analysis used by the technical expert). For example, an acoustical engineer can provide measures and predictions of likely noise levels at certain distances away from the source of the noise. The acoustical engineer is not usually in a position to draw any inferences as to likely social impacts associated with these levels of noise.

The tendency for potentially affected parties to distort or exaggerate the likelihood of effects when participating in EIA activities is not an uncommon experience for SIA practitioners. Indeed, in one of the earlier solid waste comparative case studies, background documentation from an environmental tribunal declared this point explicitly. In these comparative case assessments, this factor was addressed by ensuring that all the case studies were carried out on facilities which had no consent applications or reviews in progress.

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As a matter of assessment methodology, we have adopted the stance that unless more than two individual neighbours reported and corroborated the same effect, or unless a neighbour's observation could be corroborated by an independent source, the effect would not be reported in detail, but simply noted. This reflects the stance that, while social assessment acknowledges the importance of individual observations, such observations still need to be subject to verification.

## **Outputs of this research programme**

Outputs from this research have taken the form of public presentations and discussion sessions, as well as a range of hard copy formats.

The latter include a series of research Working Papers, conference papers, and an abbreviated summary document for each case study.

## **The research provider - Taylor Baines & Associates**

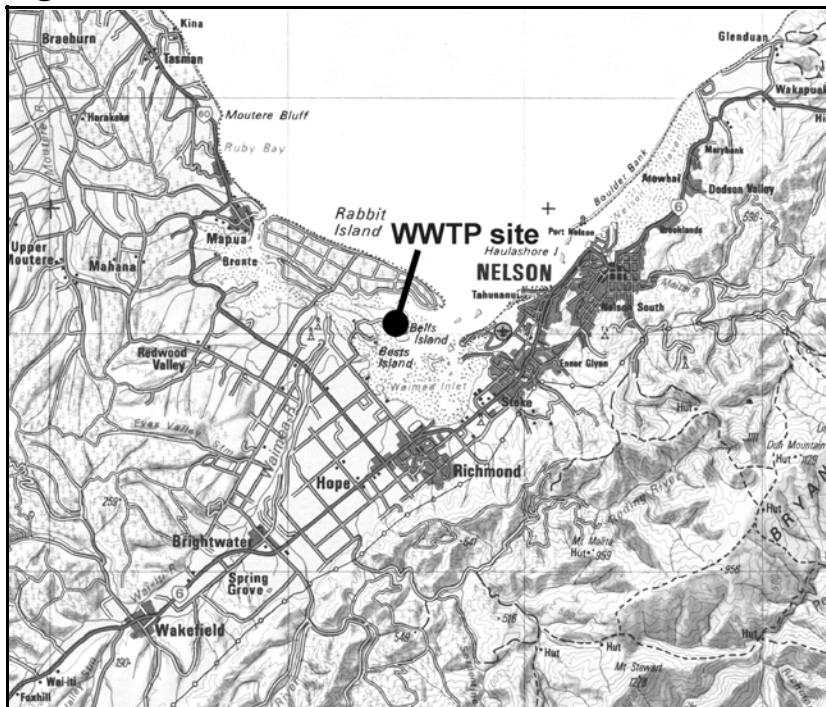
Taylor Baines & Associates has been a private provider of research, consulting and training services since 1989. The firm specialises in social research and the application of social assessment methods to a wide variety of issues in community development.

# B: History and description of the facility

## Location

As the name indicates, the Bells Island WWTP is located on Bells Island in the Waimea Estuary, immediately southwest of Nelson City. Nelson City has another WWTP located north of the City, inside the Boulder Bank near Wakapuaka. Thus the Bells Island WWTP services the southern part of Nelson City and much of the Waimea Plains - essentially the catchment for the Waimea Estuary.

**Figure 2: Bells Island - Location of WWTP**



## Planning

Original planning documents prepared prior to the plant's opening in 1983 could not be located. However, assessment documentation<sup>6</sup> prepared for the renewal of coastal discharge consents in 1993 provides the following cues for environmental and social effects and issues considered pertinent at the time -

- nutrient enrichment of the Waimea Inlet, the presence of toxic compounds in the effluent, and their **impact on the ecology** of the Inlet

<sup>6</sup> Nelson Regional Sewerage Authority (1993): Assessment of consent application for coastal discharge - NN925584 - Nelson Regional Sewerage Authority.

Beca Steven (1992): Assessment of Effects on the Environment, December 1992, prepared for the Nelson Regional Sewerage Authority.

- **loss of recreational amenity** due to accidental discharges of raw sewage
- **health impacts** in contact recreation
- **impact on fisheries** and **closure of commercial shell-fishing grounds**
- **offensive smells** resulting from pond 'failures' (i.e anaerobic)
- **visual effect** of discoloured receiving waters, due to the presence of algae in the ponds
- effects on **mahinga kai**

Given the previous history of raw sewage discharge into Waimea Inlet, it is possible that people with long-term experience of the locality may indeed observe improvements in environmental and amenity values as the dominant long-term trend, although shorter-term fluctuations may still be viewed negatively.

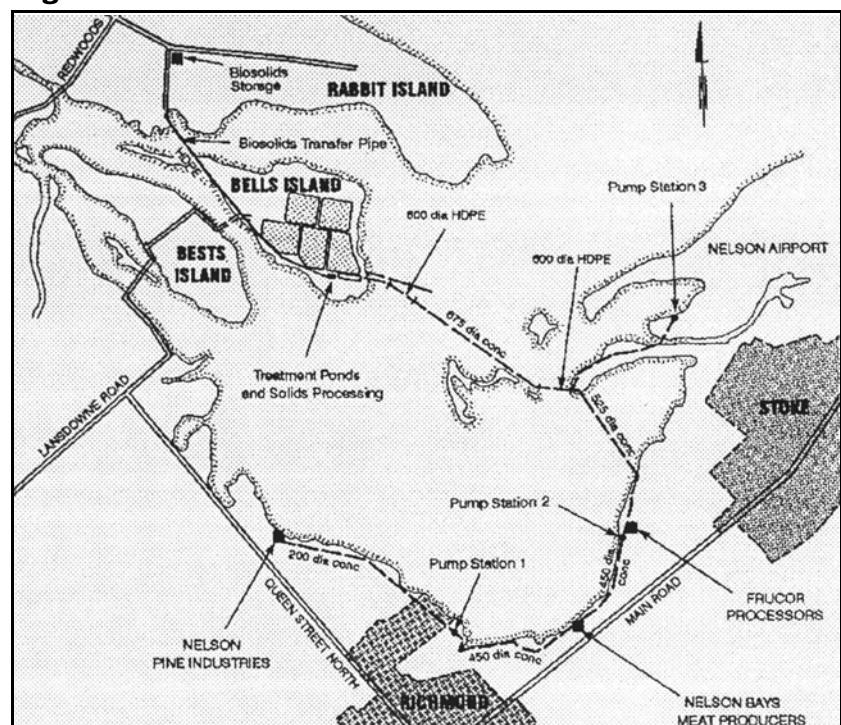
## Site development and waste water treatment operations

The Nelson Regional Sewerage Scheme (Figure 3) was commissioned in 1983. The scheme serves Stoke, Tahunanui, Richmond, the Waimea Basin and Mapua, as well as several major industrial sites around the Estuary including fruit processing plants near Stoke and meat and wood processing plants near Richmond. The collection network involves three major pumping stations around the southeastern perimeter of the Waimea Estuary - at Beach Road, Saxton Road, and near Nelson Airport - each fitted with a bio-filter to reduce the risks of unpleasant odours escaping. There is also a vent on Saxton Island.

Occupying 53 ha of Bells Island on the Waimea Inlet, the initial WWTP comprised a mechanically-mixed aeration basin, three 10 ha facultative ponds in parallel and two 10 ha maturation ponds in series. The treatment plant was designed to treat sewage equivalent to that generated by a domestic population of about 100,000 people.

A review of the treatment plant in 1986 showed that although average flows were lower than predicted, the pollution loads were greater than the design allowed for. This occurred because the three main industrial contributors to the scheme (freezing works, chip mill

**Figure 3: Bells Island Site Plan**



and juice factory) were discharging waste water substantially 'stronger' than previously estimated<sup>7</sup>. The effect of this increased loading was reduced levels of treatment and an accumulation of solids in the facultative ponds. By the early 1990s the WWTP organic load had reached one and a half times the design capacity. Peak loads in April/May, caused by the seasonal nature of the juice factory and the freezing works operation combined with difficult plant operating conditions - low wind speeds, low water temperatures and a die-off of certain species of algae - to overload the ponds, causing them to turn anaerobic and smell offensively. To reduce the risk of future pond failures, wind exposure around the ponds was maximised by removing vegetation close to the ponds, and mechanical aerators were added to the facultative ponds. The ponds were de-sludged in the summers of 1993/94 and 1994/95, which improved their capacity. However, despite the new surface aerators, they again became anaerobic in the winter of 1995, not recovering until late September when the industrial loading reduced and pond temperatures began to increase.

To permit the ponds to operate within their design capacity, the WWTP was upgraded in 1996 by installing a primary screen, a clarifier and an ATAD<sup>8</sup> plant. The ATAD plant was the first of its kind in New Zealand, and the only one operating at the present time. Even so, the operator reported a major event in the winter of 1997, caused by excessive organic loadings from the industrial waste sources, which pushed the WWTP beyond the limits of its capacity. On this occasion, it was reported by several people interviewed that unpleasant odours were noticed in many parts of Nelson City.

There have also been occasions when peak flows to the WWTP have led to raw sewage overflows during periods of heavy rainfall. For example, in 1990, more than 50 overflows of raw sewage from the Regional Sewerage Scheme occurred, the majority of which were due to peak hydraulic loads during rainfall events. Others were caused by power failure or pump failure. Sewerage pipe ruptures have also led to overflows from the Scheme though much less frequently.

The existing WWTP operations involve a sequence of steps, shown graphically in Figure 4. Raw sewage passes through 3 mm, step-shaped, laminated screens that collect inorganic solid material (screenings) to form a mat. These screenings are transferred to a screw press to squeeze out excess liquid, and the resulting solid mass is taken to the landfill for disposal once a week. Screened sewage spends approximately two and a half days in the aeration basin where dissolved organic materials are converted into solids which can more easily be separated out in the clarifier.

At this point, the solid wastes are removed for separate treatment and disposal, while the liquid effluent goes to facultative ponds where bacteria and nutrients promote vigorous growth of algae. Solid by-products sink to the bottom of the ponds. The maturation ponds stabilise the effluent, reducing bacteria numbers and providing storage. After a total of 30 days, fully treated waste water is discharged through the outfall diffuser into mid channel in the Estuary. This occurs for periods of three hours at the beginning of the out-going tide, twice each day. Saltwater kills the algae in the effluent rapidly, before being flushed out into Tasman Bay. There is a 'mixing' zone downstream from the effluent diffuser, inside which the effluent is mixed and diluted to comply with recreational

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<sup>7</sup> Biochemical Oxygen Demand (BOD) levels in the waste streams exceeded design figures by a factor of 1.65 (Beca Steven, 1992)

<sup>8</sup> Autothermal Thermophilic Aerobic Digestion (ATAD). There are two tanks for this purpose.

bathing standards. Testing by the Cawthron Institute indicates that “a relatively low percentage of the effluent discharged returns on the in-coming tide”.

Solid waste from the clarifier passes through rotary drum thickeners to reduce the sludge volume before it is stored prior to being digested in the ATAD plant in batches. Batches of solid material are introduced once each day. Temperatures inside the digestors rise to about 55 degrees C, for the purpose of controlling bacteria and viruses, and breaking down volatile solids which can be the source of unpleasant odours. The resulting biosolids (stabilised sludge) are transferred to a storage tank before being pumped across the Waimea Estuary to holding four tanks on adjacent Rabbit Island. Tankers then transport it to the forest where it is sprayed under the trees and used as fertiliser.

## The present situation (2000)

The plant is operated by the Nelson Regional Sewerage Authority (NRSA), a Joint Venture between Nelson City Council and Tasman District Council. In general, the Nelson City Council provides operational support for the WWTP and the Tasman District Council has responsibility for administration and consent compliance.

The Bells Island WWTP is staffed by two people on a 7 days/week basis. For Monday to Friday, two staff are present between the hours of 7.30 am and 4.00 pm, while at weekends and on public holidays one person is usually present between 7.00 am and 12 noon.

The plant operator described the aeration basin as running at full capacity<sup>9</sup>. It can cope with the capacity requirement to store the incoming volumes of sewage. However, there are times when it is unable to aerate the raw sewage to normal standards of treatment. Under these conditions, increased loading for treatment goes onto the facultative ponds and ATAD unit.

The ponds have a distinct seasonal cycle. Typical pond temperatures in the summer range between 15 and 21 degrees C, while in the winter they range between 8 and 12 degrees C. The transition between summer and winter regimes, which usually takes about two weeks to complete, involves a change in the species of algae. Algae produce oxygen which is necessary for the aerobic bacteria to function. If there is a shortage of algae during the transition, the risk of bad smells arises. These transitions occur in the autumn (April-May) and the spring (September-November).

The NCC's waste water engineer reported that the plant operates to strict effluent discharge standards<sup>10</sup> which meet all the requirements for contact recreation outside the designated mixing zone, even when the plant is overloaded.

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<sup>9</sup> When the industrial sources of waste water, particularly the meat works, are discharging at full capacity, the loads on the WWTP are equivalent to 100,000 population equivalents. Latterly, the meatworks operators implemented some waste water pre-treatment on site to reduce BOD and suspended solids levels. However, the WWTP operator pointed out that this tended to result in greater volumes of sludge being dispatched.

<sup>10</sup> Average daily discharge = 20,000cu.m; BODs = 50g/cu.m; Suspended Solids = 150 g/cu.m; Total dissolved nitrogen = 600kg/day; Total dissolved phosphorus = 150kg/day; faecal coliform levels = 100,000/cu.m.

## **Liaison between the facility and the host community**

Residents of Bests Island were invited to visit the WWTP early on in the upgrade activity in 1996. However, since that time there has been no formal liaison arrangement with these residents as a group, although there has been considerable informal contact with some individuals involved in logging odour events. The NRSA has also consulted with the Bests Island Golf Club over the use of effluent for spray irrigation on the golf course.

Since the WWTP services areas in both Nelson City and Tasman District, those wishing to get information or make complaints about the plant contact either territorial local authority. Both local authorities maintain records of complaints.

## **Monitoring**

The WWTP is equipped to carry out its own monitoring on an automatic and continuous basis. This covers measurements of inflows, outflows, COD, BOD, suspended solids, faecal coliforms counts.

The Cawthron Institute provides independent monitoring as well. This focuses on monitoring the quality of effluent discharge twice a year, and monitoring the status of water quality at various points around the Estuary at five-yearly intervals.

# C: The host community

## Overview

The location of the Bells Island WWTP - on an island in the middle of the Waimea Estuary - means that the host community is somewhat more diffuse and segmented than in most other case studies<sup>11</sup>. Geographically, it incorporates residential communities all around the Estuary - on the east side (Monaco Peninsula, Stoke), the south side (Richmond), and the west side (in the vicinity of Queen Street, SH60, and Redwoods Road) - as well as on Bests Island and Saxton Island, located in the Estuary itself. Parts of the Waimea Estuary and neighbouring Rabbit Island are also important recreational areas, both locally and regionally. As noted earlier, in Section B, there is a significant industrial presence around the edges of the Estuary. Thus the Estuary brings together recreational and residential interests in close proximity with industrial interests.

There are nine small streams discharging into the Estuary, as well as the Waimea River. These water flows link the condition of the Estuary with activities spread over a wide catchment area across the Waimea Plains.

## Residential areas

The closest residential area to the WWTP is on Bests Island, most of which lies within 1 km to the W/SW. Locals describe it as “*quite a stable community*” which began with a collection of baches but has become progressively a place of permanent residents. Several years ago there were plans to develop a new sub-division on Bests Island, but these did not proceed when agreement could not be reached over legalising roads, some parts of which are not on public land. All houses on Bests Island are on septic tanks.

Saxton Island is a privately-owned island in the middle of the Estuary, about 1 km SE of the WWTP. Two households live there. Nearby Monaco Peninsula is a long-established, closely-settled residential area 2-3 km E/SE of the WWTP.

Stoke and Richmond have major concentrations of suburban residential development close to the shores of the Estuary. Both have experienced considerable growth in recent years. The density of rural residential development further west around the fringes of the Estuary, extending along either side of SH60 towards Mapua, has been increasing with the conversion of farmland to a variety of uses, including horticulture, vineyards and rural lifestyle blocks.

These trends are indicated in the data presented in Table 1 following.

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<sup>11</sup> The Kaiapoi case study involves a similar situation.

## Population change 1986-96

Population growth in the area around the (east) Waimea Estuary was steady over the period 1986-1996 at just less than 20%, as shown in Table 1. However, there were some pockets of very high growth in certain localities during this period, particularly west of Stoke and north of Richmond.

**Table 1: Growth in Usually Resident Population - 1986-1996**

Area	UR population 1986	UR population 1996	Population change 1986-1996	Comments
Area around the Waimea Estuary <sup>12</sup>	24,348	29,043	+ 19.3%	
Bests Island	72	117	+ 62.5%	From baches to permanent residents
Monaco Peninsula	219	267	+ 21.9%	In-fill development, land area constrained
West Stoke	192	792	+ 413%	new residential sub-division
North Richmond	33	237	+ 718%	new residential sub-division
Queen St-SH60	204	225	+ 10.3%	Mix of lifestyle and commercial uses

Permanent occupancy of Bests Island rose significantly as properties converted from being baches to being permanent residences. The resident population of Monaco Peninsula increased, but growth was constrained by the limited land available - essentially limited by the degree of in-fill development. However, nearby the suburban area of Stoke expanded rapidly to the west, towards the Estuary. Similarly, Richmond was expanding rapidly to the north towards Stoke. To the west of Richmond, high-value productive land on the Waimea floodplain exhibited only modest population growth, with more emphasis on productive diversification.

## Industrial and commercial development

The Waimea Estuary is ringed around with significant industrial and commercial sites. Nelson Airport lies 4 km to the east of the WWTP. Further south is the ENZA fruit juicing plant and the Nelson Bays Meat Producers plant<sup>13</sup> between Stoke and Richmond. Nelson Pine operates a medium density fibre board plant near the shore at the head of the Estuary and there is also a large fertiliser manufacturing plant nearby. Some of these big industrial sites (fruit, meat and wood processing and fertiliser manufacture) have generated strong odours at times. Indeed, Tasman District Council staff interviewed reported that up till 1997, complaints suggest that the meat works was by far the most worrisome odour source in the vicinity, producing particularly pungent odours from its rendering plant. The fruit, meat and wood processing plants also used to be major polluters of the Estuary with

<sup>12</sup> 18 statistical area units from Tahunanui round to Ranzau, which encircle the Waimea Estuary. These will include significant proportion of the resident population of the Bells Island WWTP source area. However, some more remote parts further in the Tasman District are not included.

<sup>13</sup> This plant has closed since the case study field work was completed.

point discharges of untreated wastes, high in organic content. When the Bells Island WWTP was established, these industries transferred their liquid discharges from the Estuary to the WWTP. Several people interviewed, who remember the condition of the Estuary before the WWTP was commissioned, described the pollution in various ways - “*serious nutrient enrichment*”; “*the blood and offal from the meatworks used to attract sharks*”.

## Other land uses

Rural land around the Estuary has attracted a wide range of commercial land uses. Traditional pastoral farming has given way increasingly to horticulture, viticulture, and forestry has been a major form of land stabilisation on Rabbit Island for some years. Some rural land uses in the vicinity of SH60, such as pig and poultry farming also cause periodic strong odours when manure is spread.

## Recreational activity

The Waimea Estuary discharges into the sea between two important recreational destinations - the beaches at Tahunanui and on Rabbit Island. A recent survey of 401 Nelson residents (NRB, 2000) indicated that almost three-quarters of the City’s residents visit the beach at least fortnightly over the summer, while half the City’s residents swim at the beach at least fortnightly over the summer. At a local level, the most popular locations for swimming are the main seaward beaches at Tahunanui and Rabbit Island, while both Monaco Peninsula and Bests Island residents swim nearby in the Estuary.

A series of recreational water quality monitoring studies<sup>14</sup> indicate that recreational water quality measured at a number of sites of recreational interest<sup>15</sup> is generally of a good standard. The exceptions occur during or shortly after rain events when there is an elevated health risk from bacterial contamination. The reports suggest that the water quality at swimming beaches is most strongly influenced by run-off from the nine streams and the Waimea River discharging into the Estuary. Furthermore, a study of the impacts of the Bells Island WWTP discharge (Cawthron, 1999) concluded “Results of bacteriological water quality surveys carried out (1995-1998) indicate that the effects of the Bells Island effluent discharge were restricted to an area within the boundaries of the non-compliance (mixing) zone suggested by Bell et al. (1995).” This matter will be discussed further in Section E.

The same report also commented that “Concentrations of faecal indicator bacteria in seawaters and shellfish suggest that all sites surveyed (with the exception of the northwest end of Rabbit Island beach) were at times unsuitable for the gathering of shellfish. This is consistent with the Community Health Services policy and advice to the public, which has been unchanged “*for quite a few years*”, that they should not gather shellfish from estuarine areas. If people persist in gathering shellfish, they should avoid doing so for at least seven days after rain, to allow shellfish to flush out with cleaner

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<sup>14</sup> TDC-NCC-NMAHB, 1993; TDC, 1997; NCC, 2000; TDC, 2000 - for full details, see References.

<sup>15</sup> Rabbit Island Main Beach, Rabbit Island Back Beach, Monaco Peninsula, Tahunanui (several sites).

water. The public health concern is focussed primarily on river run-off contaminated after rain with faecal coliforms from farm land.

Tasman Bay has in the past been very popular for both commercial and recreational fishing (Recreational Fishing Assn, 2000). In the 1940s and 1950s, commercial fishing boats took large tonnages of snapper all the year round and from all parts of the Bay<sup>16</sup>. This cumulative extreme pressure has resulted in the bottom of Tasman Bay now being bare. Small snapper are reported but there are few places for juvenile fish to mature. Paddle crabs have become dominant, no longer eaten by snapper or rig. The last major snapper spawning was reported as being in 1986, with a lighter spawning in 1991. In the 1980s, recreational fishing still provided good returns along most of the coastline from Nelson to Farewell Spit for anglers in small boats or surf casting. By 2000, most of these locations were no longer worth going to fish and surf casting has all but died out. Nowadays, the places that remain popular at a local level are the front beach on Rabbit Island and the Boulder Bank for snapper, while Blind Channel is fished for brim and snapper. Nevertheless, recreational fishing take is now very low indeed<sup>17</sup>. The recreational fishing resource within the Waimea Estuary has been minimal in recent years, reflected in the very small numbers of boats observed<sup>18</sup>.

Interviewing generally supports the view that significant levels of shellfish gathering and fishing in the Estuary ceased a long time ago. As one observer described it *“the commercial boats took the main haul; recreational fishers cleaned up the residue; then there’s the damage to the seabed from the commercial boats as well.”*

One further point to note, on the question of background water quality in the Waimea Estuary, is that bacterial water quality or nutrient status and water clarity are not the same. Many of the observations of bacterial water quality in 1999/2000 reported the visible condition of water in the Estuary and nearby beaches as ‘murky’. This probably reflects the dynamic nature of the water environment - strong tidal flows and frequent onshore breezes. Some of the recreational users of the Estuary interviewed also commented about this - *hard to comment on water colour - it’s usually not possible to see the bottom even at low tide; murky water is not unusual in the Estuary*; *“water has never been very clear here anyway.”*

The only boat launching facility within the eastern end of the Waimea Estuary is the boat ramp at the southern tip of Monaco Peninsula. Water skiing is provided for in a dedicated ski lane between Rabbit Island and Bells Island which is usable for one and a half hours either side of the high tide. Interviews with a sample of eight water skiing parties suggest that typical frequency of use is once a week to once a fortnight over the summer months. Residents of Monaco Peninsula described small boat activity nearby when the tide is in, as did residents of Bells Island.

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<sup>16</sup> The long-time fishing representative recalled that as many as 30 boats trawled 25,000 tonnes of snapper a year from Tasman and Golden Bay combined. Boats were able to catch half a tonne a day.

<sup>17</sup> One indication given was of 40 young snapper in the whole of the Estuary for one season, from September to April.

<sup>18</sup> Estimated as typically no more than two or three at any one time, *“generally taking children out fishing”*.

As noted above, the Estuary long since ceased to be a major locus for recreational fishing and shell-fish gathering. Blind Channel is about the closest area still in use for surf casting.

The other significant recreational activity within the Estuary is the Green Acres Golf Club on Bests Island.

## **Rabbit Island**

Rabbit Island is a major recreational destination nearby Bells Island, and has the additional association that bio-solids are disposed of there. In contrast, the long-time manager of the Tahunanui Motor Camp commented that the camp and beach are much more oriented towards the City than the Estuary.

Apart from the forest ranger, no one lives on Rabbit Island. No commercial or retail activities are permitted there, no buildings (except public toilets) and no dogs. Peak-day visitor numbers in the summer can reach as high as two thousand. The ranger noted that there are some people who visit practically every day. Rabbit Island beach is used throughout the year - for fishing, walking and summertime swimming. The ranger reported that visitor numbers appear to have been steady over the past six years, since he has been there.

# D: Coverage of consultation and Interviews

## Numbers and categories of interviewee

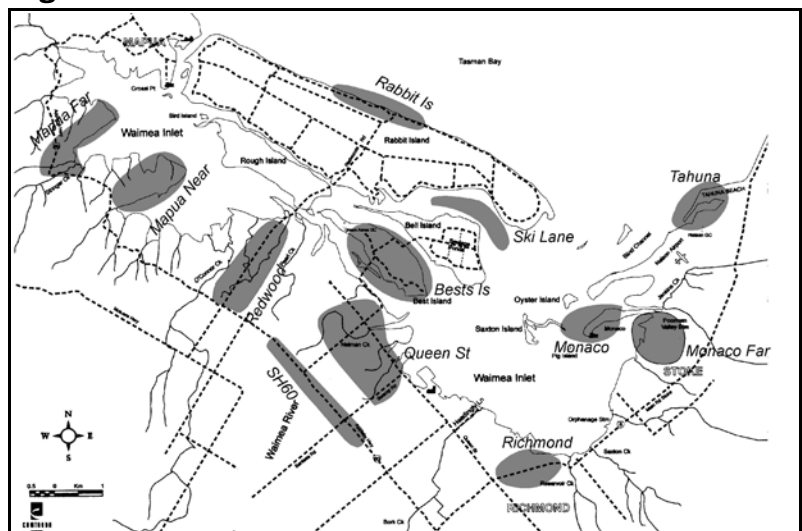
The main focus of this case study has been on neighbours' experience of the WWTP over the past four years, since the last major upgrade in 1996 (the introduction of the ATAD unit).

In all, 141 interviews were conducted for this case study. The main episode of fieldwork took place during 9-12 February 2000. Supplementary interviews were held during the feedback visit over 24-27 July 2000, at the same time as feedback meetings were held with local residents (see below). Two types of interviews were employed. In-depth interviews aimed at identifying the full range of effects experienced, as well as detailed descriptions of these effects were carried out with people living, working and recreating relatively close to the WWTP site (N=70). Rapid appraisal interviews were carried out in order to provide a spatial dimension to the analysis of effects (N=61). In addition, ten key informant interviews were undertaken (see below).

## Areas of interviewing

Interviews with residents and businesses in the vicinity of the Bells Island WWTP were structured to provide responses across a range of separation distances, labelled "close", "middle" and "far". Greater emphasis in the use of in-depth interviews was placed on those in the "close" and "middle" zones. The distribution of interviews (by location and type of interview method) is shown in Table 2 and Figure 5 on the following pages.

**Figure 5: Location of Interviews**



## List of other key informants

- The WWTP operator
- Nelson City Council - Engineer: Waste Water Monitoring
- Nelson City Council - Environmental Health Officer
- Tasman District Council - Water Quality Monitoring
- Tasman District Council - Resource Consents Officer
- Representative from Community Health Services
- Cawthron Institute
- Representative of the Recreational Fishermen's Association
- Rabbit Island forest ranger
- Tahunanui Beach Motor Camp Manager.

## Feedback meetings

Two feedback meetings were held with neighbouring residents of the Bells Island WWTP for the purposes of discussing the preliminary findings of the field research. The first took place on Tuesday 25 July 2000 with 21 residents of Monaco Peninsula, and the second on Wednesday 26 July 2000 with 10 residents from the vicinity of Bests Island, as well as the motel owner and the Golf Club manager.

Both meetings endorsed the preliminary findings as accurate.

**Table 2: Summary information for interviews**

<b>Zone</b>	<b>Locality</b>	<b># interviews</b>	<b>Description of locality</b>
Close (0-2 km)	Bests Island	11 total 11 full	Includes Deadmans Island Nearest residential area - mostly within 1 km of the W/SW of WWTP
	Ski Lane	8 total 7 full 1 rapid	Between Rabbit Island and Bells Island Nearest recreational area Intense use over brief episodes in the summer
Middle (2-4 km)	Queen Street	10 total 9 full 1 rapid	Northern end of Queen St + north eastern end of Landsdowne Rd within 2-3.5 km in W/SW direction from the WWTP
	Redwood Road	7 total 1 full 6 rapid	within 3-4 km in W direction from the WWTP
	Rabbit Is	5 total 5 full	Northern/central beach of Rabbit Island
	Monaco	27 total 27 full	Includes Saxton Island Long-established intensive residential area within 2-3.5 km in E/SE direction from WWTP
Far (>4 km)	SH60	7 total 4 full 3 rapid	Businesses along SH60
	Mapua Near	5 total 5 rapid	Between 6-7 km in W direction from WWTP
	Mapua Far	11 total 11 rapid	Between 8-9 km in W direction from WWTP
	Tahuna	15 total 6 full 9 rapid	Residential/recreational area Between 4-6 km in E direction from WWTP
	Monaco Far	18 total 18 rapid	Newly-established intensive residential area within 4-5 km in E/SE direction from WWTP
	Richmond	7 total 7 rapid	Intensive residential development area 4-5 km in S direction from WWTP
<b>Whole sample</b>	<b>All localities</b>	132 total 71 full 61 rapid	

## **E: Operational effects of the WWTP on neighbours**

Off-site effects experienced by neighbours and users of the Waimea Estuary are dominated by unpleasant odours which are experienced mostly in plumes to the west/southwest and to the east of the Bells Island WWTP. At distances greater than about 2 km from the plant, odours from other sources begin to merge with odours experienced from the WWTP.

Off-site odour has been a relatively common experience for neighbours of the Bells Island facility and the Waimea Estuary. Residents observations suggest that odour effects were not as bad in the early 1990s, but became more intrusive when some of the major industrial plants around the estuary caused the WWTP to overload. The introduction of the ATAD units at the plant was not without its problems, but neighbours have experienced some improvement since then. The frequency with which near neighbours make an effort to complain, coupled with the level of impact severity that they still experience, suggest that existing operations are pushing the limits of their tolerance and that neighbouring residents wish to see further improvements made in facility management to reduce off-site odour effects.

The next most common observations of off-site effects relate to symptoms of the effluent discharge and various perceived consequences of this, near the discharge point, near Best Island and at other locations around the Estuary. Effects perceived by some as linked to the WWTP effluent discharge are also confounded by other discharges into the Estuary, mainly from run-off into the Waimea River and numerous streams. While perceptions are mixed, there is some acknowledgement that the WWTP has contributed to an overall improvement of water quality in the Estuary.

Other minor off-site impacts reported by very small numbers include loss of a recreational area, and visual intrusion.

## Effects projected and reported

The following table provides a summary analysis of the effects reported during the community-based fieldwork, and compares neighbours responses with expert projections.

**Table 3: Effects projected and reported**

Effects projected	Effects reported unprompted	Effects reported after prompting	Effects projected but not reported or without corroboration <sup>19</sup>	Effects reported but not projected
<ul style="list-style-type: none"> <li>• odour</li> <li>• loss of recreation amenity</li> <li>• impacts on ecology, food gathering and human health</li> <li>• visual effects</li> </ul>	<ul style="list-style-type: none"> <li>• odour</li> <li>• loss of recreation amenity</li> <li>• impacts on ecology, food gathering and human health</li> <li>• visual effects</li> <li>• traffic</li> <li>• noise</li> </ul>	<ul style="list-style-type: none"> <li>• odour</li> <li>• loss of recreation amenity</li> </ul>		<ul style="list-style-type: none"> <li>• traffic</li> <li>• noise</li> </ul>

In unprompted questioning, 66% of all respondents had observed no effects at all, while in prompted questioning 40% still recalled no observations of effects.

In unprompted questioning, 60% of recreational respondents (Rabbit Island and boating from Monaco) had observed no effects at all, while in prompted questioning 53% still recalled no observations of effects.

## Structure for reporting the effects experienced

Detailed analysis of each effect experienced by neighbours of the Bells Island WWTP is reported under the following sub-headings:

What effect do they notice? Source of effect?  
 Timing; frequency; trends?  
 Mitigation attempts?  
 Impacts?  
 Summary evaluation

With a very few exceptions, the observations of off-site effects from the Bells Island WWTP described by nearby residents and businesses, and recreational users of the Waimea estuary related to discharges to air (unpleasant odours = 51% of respondents) and discharges to water in the estuary (effluent = 21%). A few neighbours in nearby areas commented on noise and visual effects, and traffic while several recreationalists reported the loss of space due to physical structures.

<sup>19</sup>

Corroborated observations means cases where there are observations from more than two individual local observers, or where an individual observation can be corroborated by other sources of data.

In the case of Bells Island WWTP, the buffer zone around the treatment plant coincides to a large extent with the Waimea Estuary and the coastal margins of the Estuary which are the location of a number of major industrial activities described in Sections B and C, many of which have also had significant impacts on the quality of the air and water environment in the Estuary.

The pattern of effects observations correlates well (inversely) with the pattern of nil responses (i.e. locations where substantial numbers of those interviewed reported no effects at all). This is demonstrated in the following table, where 'odour responses' are used as an indicator of location-specific effects.

**Table 4: Pattern of observations**

Zone	Locality	% odour responses	% nil responses	Comments
Close (0-2 km)	Bests Is	91	0	Closest permanent residents; within 1 km, downstream of prevailing NNE wind
	Ski Lane	13	50	Episodic recreational users, passing close to effluent discharge zone; few odour problems
Middle (2-4 km)	Queens St	90	0	Residents and businesses; 2-3.5 km, downstream of prevailing NNE wind
	Monaco	70	26	Permanent residents; within 2-3.5 km, on the edge of eastwards odour plume
	Redwood	86	14	Rural-residential area; within 3-4 km, on the edge of southwestwards odour plume
	Rabbit Is	0	100	Recreational users only; very uncommon wind direction; north side of the Island is remote from the effluent discharge point
Far (> 4 km)	Monaco Far	56	44	Permanent residents; within 4-5 km, on the edge of eastwards odour plume
	Tahuna	7	60	Residential and recreational users; within 4-6 km downstream of prevailing WSW wind
	Richmond	57	43	Permanent residents; 4-5 km; uncommon wind direction
	SH60	86	14	Businesses downstream of prevailing NNE wind
	Mapua Near	20	80	Rural-residential area: within 6-7 km; uncommon wind direction
	Mapua Far	0	100	Rural residential area; 8-9 km uncommon wind direction

## Odours

Analysis of observations on off-site odour effects displayed a marked spatial pattern, with two dominant odour catchments (or plumes) for the WWTP, both exhibiting a lessening of intensity with increasing distance from the facility. Experience of sewerage-related odours were also reported in the Richmond area but these were more likely to be confounded by other strong and closer odour sources.

It should also be remembered when reading this analysis that on some occasions in the past, when there have been particular episodes at the WWTP, reports have come in from many parts of Nelson City, well beyond the area that would be thought of as the immediate host community of this facility. However, observers described these as unusual circumstances, and not indicative of current operating experience.

With respect to the observed ‘plumes’ alluded to above, the various odour catchments are represented by corresponding areas of interviewing, as follows:

**Table 5: Percentage odour responses by location**

‘Plume’/odour catchment	Locality	% odour responses	Comments
Whole sample	ALL	52	
W/SW plume	Bests Is	91	Odours dominated by WWTP; highest frequency of observation; greatest awareness of changes; most severe impacts
	Queens St	90	WWTP odours mixed with other sources; rare experience
	Redwood	86	WWTP odours mixed with other sources; rare experience
	SH60	86	WWTP odours mixed with other sources; rare experience
	Mapua Near	20	At the limit of the odour catchment
	Mapua Far	0	Beyond the odour catchment
E plume	Monaco	70	WWTP odours mixed with other sources; very occasional or rare
	Monaco Far	56	WWTP odours mixed with other sources; very occasional or rare
	Tahuna	7	
Other areas:			
S	Richmond	57	WWTP odours mixed with other sources; very occasional or rare
N	Ski Lane	13	WWTP odours rare because of occupancy pattern and wind direction
NW	Rabbit Is	0	Not in odour catchment because of wind direction

Of the twenty entries in the NCC Odour Complaint Register between November 1998 and January 2000 that were confirmed as being linked to the WWTP, 16 came from Bests Island residents, three from the area sampled as “Monaco Far”, and one from the area sampled as “Queen Street”.

*What effect do they notice? Source of effect?*

**In the W/SW plume:** Residents of Bests Island described “*a real stink*”, “*very unpleasant sewage smell*”, “*like turning a switch - suddenly a revolting smell*” which they attributed unhesitatingly to the WWTP facility. One respondent described particularly smelly loads being emptied at the facility, such as those from septic tank contractors. Odours were described as permeating the dwellings and being noticed “*most places on the Island on extreme days*”.

In the “Queen Street” area, residents described equally “*sickening and offensive smells*”, “*pungent sewer smells*”, something “*pungent*” or “*manurey*” but also *very noxious smells, like fermenting fruit*”. While some residents were certain of the WWTP as the source, one-in-three acknowledged

other strong sources of odour even more locally, like silage or “*something coming from the south*” (i.e from farmland in the opposite direction from the WWTP). Observations from further afield (“SH60” and “Redwood”) were generally more neutral in tone.

**In the E plume:** Comments from residents in Monaco demonstrate that, while they definitely experience off-site odours from the WWTP on Bells Island - “*sewage smell*”, “*sulphurous, nauseating*”, “*ponds not functioning properly*”, “*strong sewage smell*” - they also experience odours from other sources close by - “*the estuary can smell at times*”, “*shellfish or algal bloom dying*”, “*some other discharge into the estuary*”. Indeed, several residents also point to the nearby pumping station, which dispatches sewage from the city over to Bells Island, as an occasional source of odour. The city’s waste water engineer confirmed that a bio-filter was being installed at the pump station to reduce odour risks, in response to local residents’ complaints.

Experience in the “Monaco Far” area, while definitely still related to sewerage - “*like a broken drain*”, tends to be more muted in intensity - “*a faint sewerage smell*”, “*is strong enough to notice*”, “*like a septic tank*”, “*usually faint*”. They also report other sources such as “*smell the freezing works to the south and this is a different smell*”, “*more an estuary smell*”, “*It’s a smell of rotten fish and comes when the sun is on the estuary after the tide goes out*”.

*Timing; frequency; trends?*

To assist in comparisons, it is helpful to distinguish different frequencies of occurrence by relating some quantitative indicators to the qualitative descriptors used by respondents, as in the following table.

**Table 6: Frequency bands for observing effects**

Level - descriptor	Frequency range	Frequency on a monthly basis
0 No observations reported		
1 Rare, irregular	Few times a year	<0.5x/month
2 Very occasional	Once a month	1x/month
3 Occasional	Twice a week to twice a month	2-8x/month
4 Frequent	Several times (>2x/week)	8-30x/month
5 Very frequent	Daily	30x/month

**In the W/SW plume:** At Bests Island, the odours were reported as typically occurring later in the day - afternoons, evenings or night time<sup>20</sup>, and lasting “*always a few hours*” but “*sometimes a whole day*”. During the period of field work (Februaury 2000), residents of Bests Island were most likely to describe odours as occasional or very occasional (i.e. levels 2 and 3). However, they were also the most consistent in their reporting of distinct improvements in recent years. Several years ago, they would have been most likely to report experiencing odours frequently or even very frequently (i.e. levels 4 and 5) and that the incidents of intrusive odour used to last longer. Several mentioned that “*the major upgrade had a lot of teething problems*”, “*after lots of expenditure, the smell got*

<sup>20</sup>

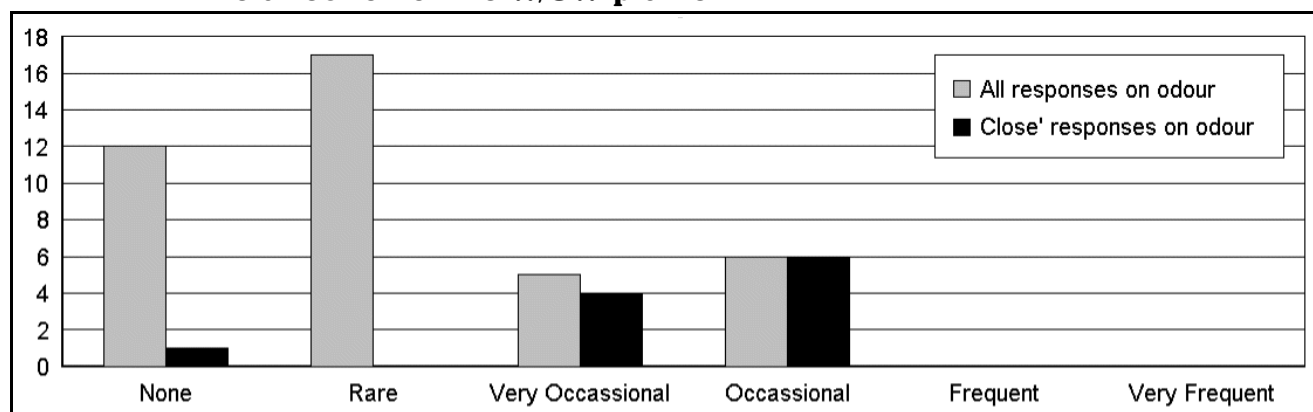
This pattern could reflect the incidence of on-shore breezes.

worse!”but that this had now been sorted out and some of the expected improvements in plant performance achieved.

In the “Queen Street” area, odours from the WWTP were invariably reported as occurring only rarely (i.e. level 1). There were some who described the later-in-the-day pattern, but it was not as consistent in this area. About half these respondents reported a significant improvement in the last two years, with the others reporting no noticeable change. In both “Redwood” and “SH60” areas, odour incidents were reported as occurring only rarely, with other sources of odour also being reported.

For all those interviewed in the W/SW plume areas<sup>21</sup>, the distribution of frequencies is shown in Figure 6. Corresponding data for the “close” area of Bests Is. are included for comparison. These data refer to people’s experience in the past few years, since the ATAD unit was properly commissioned.

**Figure 6: Frequency of experiencing off-site odours from the Bells Island WWTP in the direction of the W/SW plume**



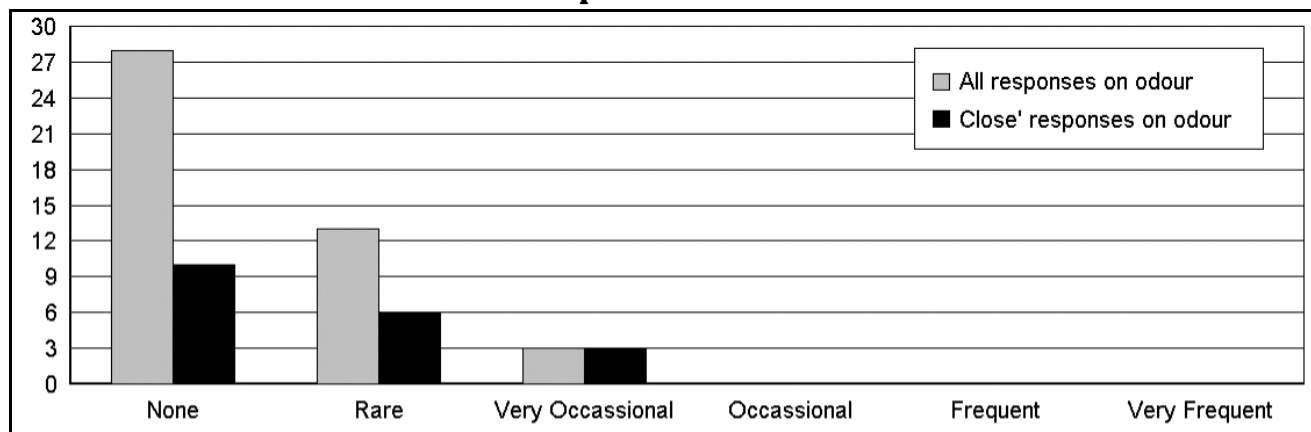
In the E plume: In the “Monaco” area, odours tend to be experienced rarely or very occasionally, with the few more frequent experiences mingled with other estuary-related sources. The same pattern is reflected in observations from the “Monaco Far” area. Because of the other sources of odour, there has not been such a consistent reporting of improvements over the past few years, as was reported from Bests Is. Semi-permanent occupants of Tahunanui Motor Camp over the last six years have never complained or chosen to relocate because of an odour problem.

For all those interviewed in the E plume areas<sup>22</sup>, the distribution of frequencies is shown in Figure 7. Corresponding data for the “close” area of Monaco are included for comparison. As above, these data refer to people’s experience in the past few years, since the ATAD unit was properly commissioned.

<sup>21</sup> i.e. in Bests Is., Queen St., Redwood, SH60 and Mapua Near.

<sup>22</sup> i.e. in Monaco, Monaco Far and Tahunanui.

**Figure 7: Frequency of experiencing off-site odours from the Bells Island WWTP in the direction of the E plume**



The WWTP operator confirmed a range of distinct odour sources related to different steps in the treatment process -

- The aeration basin produces strong odours if it is overloaded and begins to turn anaerobic. This is not easily predictable since it is a condition the operators are always striving to avoid. However, with the plant running at close to capacity for much of the time, and over capacity some of the time, this is a risk.
- The clarifier can produce similar odours when the aeration basin is under pressure.
- The ATAD unit can give off odour from the vents on the tanks or the open bio-solids storage tank from time to time. This occurs only when the unit is not running properly.
- The facultative ponds are likely to generate odour on a seasonal basis, with the change of algae that occurs at these times. Their large surface area means that a lot of odour can be generated at times. The operator commented that pond #3 appears to be the most affected by this, and it is closest to Bells Island.

The operator confirmed residents' experiences of odour on calm, foggy days - "*it can drift in pockets*". He also described his perception of the trends in odour releases, as follows -

- Odour events from the aeration basin and clarifier are much less frequent now than they were in 1996 and 1997, due to industry pre-treatment of their wastes<sup>23</sup>.
- Odours from the ATAD units were caused originally by inadequate aerators in the tanks. These were modified in 1997 and bio-filters added to the vents on the tanks, resulting in much less risk of odour now.

<sup>23</sup>

This has occurred at the meat, wood and fruit processing plants, and the operator remarked that the District Council has been vigilant in ensuring compliance with higher standards.

- The situation with the facultative ponds has not changed. The seasonal disturbances cannot be avoided.

This description by the operator suggests that WWTP odour is not a continuous phenomenon, and that the frequency of unpleasant odours off-site has reduced somewhat in the past four years. It also suggests that most events being experienced in recent years are the result of capacity limitations at the plant, particularly in the aeration basin.

#### *Mitigation attempts?*

The WWTP owners and operators have implemented a range of measures between 1996 and 1997 to reduce the likelihood of unpleasant odours being experienced off-site. These include -

- improved ATAD aerators
- installation of bio-filters
- reductions in aeration basin loading rates
- additional mechanical aerators in the aeration basin
- careful control of plant operations by the staff

While it is acknowledged that these measures have lead to improvements for neighbours, they still experience a range of impacts from continuing off-site odour.

#### *Impacts?*

Once again, to assist comparisons, it is helpful to distinguish varying degrees of impact, based on respondents' descriptions.

**Table 7: Spectrum of impact severity for odour effects**

Level	Description	Comments
0	No observations reported	
1	No impact at all	
2	Noticeable, but not unbearable	- you just notice it, put up with it
3	Loss of personal residential amenity; very unpleasant	- have to retreat indoors - can't eat outside - have to close windows/doors
4	Social discomfort or embarrassment	- visitors offended/comment - deterred potential tenants
5	Impacts on personal health and well being	- feelings of nausea - have to leave my property

**In the W/SW plume:** On Bests Island, practically all the residents interviewed described impacts at levels 3-5, the more severe end of the spectrum, with the sample of responses spread evenly across these three levels. They describe “closing the doors and burning incense - masks the smell to a point”, “can't leave my windows open at weekends”, “at its most intense, I have to go inside”, “it's horrible for visitors”, “it's embarrassing when friends come round”, “we'd leave for the day because of it”. One resident expressed the view that all the curtailments on normal living and the usual

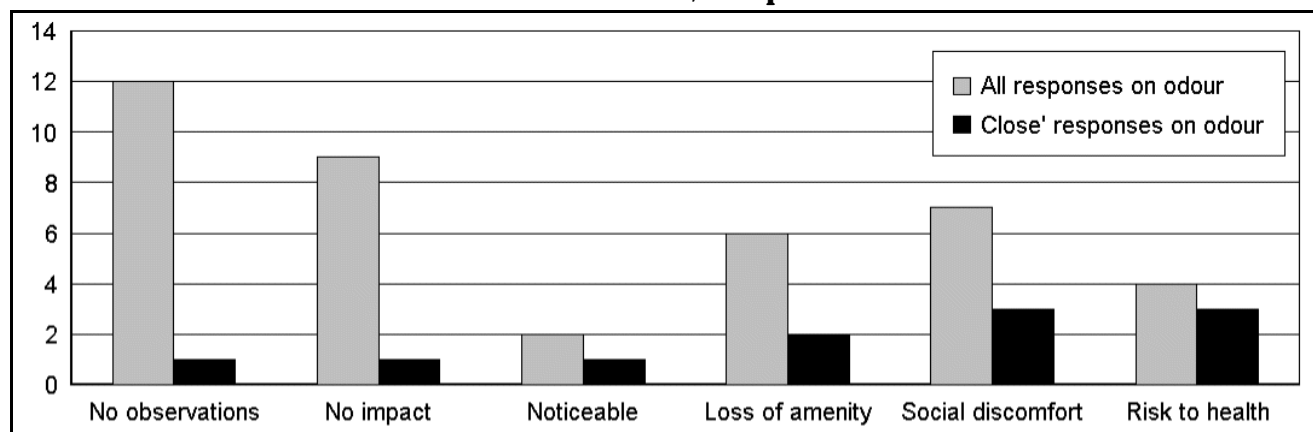
enjoyment of a property combine to create a level of stress that affects the sense of well being and health. Another commented that while *“it’s never put us off wanting to live here, the children’s friends tend to react more”*. It was reported that the smells have deterred people from joining the Green Acres Golf Club on Bests Island.

More than half of those interviewed had complained about odours either to the WWTP operator, the Nelson City Council or the Tasman District Council.

In the “Queen Street” area the dominant level of impact severity was level 3, with a few either above or below this level. More than half of these residents had complained to the Tasman District Council. In the “SH60” area, the businesses interviewed described mainly level 4 impacts (e.g. potential deterrent to customers) - *“have to close the shop windows it is so bad”*, *“customers come and ask what the smell is”*, *“customers complain - visitors don’t expect it”*, *“can be a shock to visitors, coming to an attractive area”* - and most had complained to the Tasman District Council.

For all those interviewed in the W/SW plume areas, the distribution of severity experienced is shown in Figure 8. Corresponding data for the “close” area of Bests Is. are included for comparison. As before, these data refer to people’s experience in the past few years, since the ATAD unit was properly commissioned.

**Figure 8: Severity of odour impacts experienced off-site from the Bells Island WWTP in the direction of the W/SW plume**

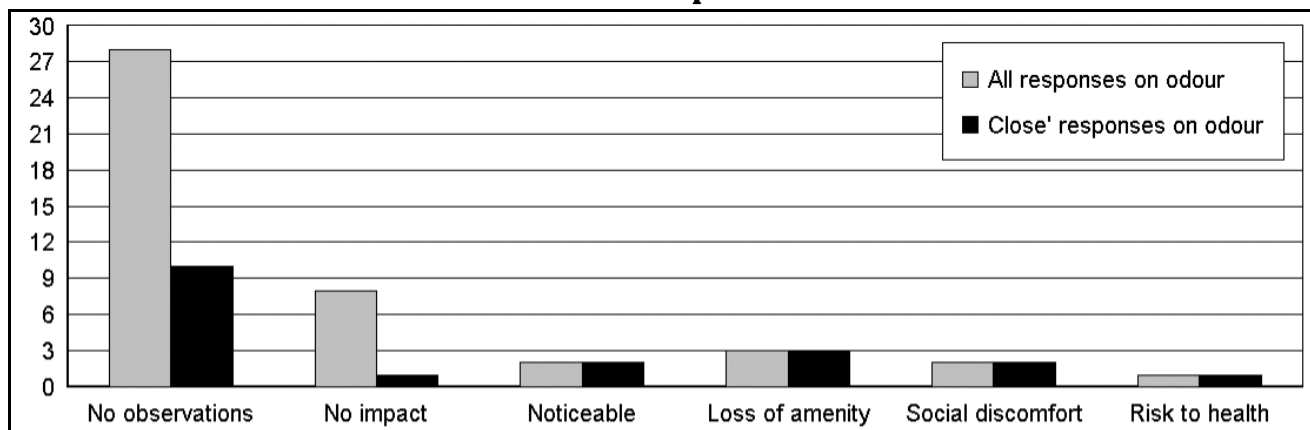


**In the E plume:** The majority of respondents from the “Monaco” area reported no negative impacts at all specifically related to the Bells Island WWTP, with a small number of respondents spread across the range of impact severity - *“not pleasant”*, *“have to shut the windows”*, *“close the shop and house doors”*, *“affects trade in beer”*, *“customers mentioned it”*, *“felt sick - had to shut up”*. Only one resident of Monaco (out of the 19 interviewed) had ever complained to the facility operator.

For all those interviewed in the E plume areas, the distribution of severity experienced is shown in Figure 9. Corresponding data for the “close” area of Monaco are included for comparison. As above, these data refer to people’s experience in the past few years, since the ATAD unit was properly commissioned.

Comparison of results suggests that off-site impacts from WWTP odours are greater in the direction of Bells Island, both in terms of frequency (compare Figures 6 and 7) and severity (compare Figures 8 and 9). This is probably the result of shorter separation distances and localised wind patterns.

**Figure 9: Severity of odour impacts experienced off-site from the Bells Island WWTP in the direction of the E plume**



#### *Summary evaluation*

Off-site odour has been a relatively common experience for neighbours of the Bells Island facility and the Waimea Estuary. Odours specific to the WWTP are most often noticed by those in closest proximity to the plant, and these residents experience the most severe impacts on their lifestyles and amenity levels. They also appear to be most aware of the changes in WWTP operations and the particular incidents that lead to off-site odours. Awareness of WWTP odours reduces with greater distance, and the existence of other odour sources becomes more prevalent (beyond about 2 km). A distance of no more than about 6 km appears to be the limit of the odour catchment for the Bells Island WWTP. Residents observations suggest that odour effects were not as bad in the early 1990s, but became more intrusive when some of the major industrial plants around the estuary caused the WWTP to overload. The introduction of the ATAD units at the plant was not without its problems, but neighbours have experienced some improvement since then. The frequency with which near neighbours make an effort to complain, coupled with the level of impact severity that they still experience, suggest that existing operations are pushing the limits of their tolerance and that neighbouring residents wish to see further improvements made in facility management to reduce off-site odour effects.

## **Effluent discharge and its effects on ecology, recreational amenity, food gathering and risks to human health**

The effects of discharging treated effluent into a large volume of moving water are not easy to discern with the naked eye, and therefore not easily detected by human observation. The potential sources of effects and impacts - elevated nutrient levels, the presence of pathogens and other bacteriological species - are invisible. Only the gross aspects of liquid discharge - bubbles and discolouration would be evident.

Nevertheless, people have perceptions based on observing various phenomena, and there is no doubt that perceptions alone can alter people's behaviour patterns. At certain locations around the

Waimea Estuary - Bests Island, Monaco Peninsula and the water ski lane by Rabbit Island - local people are in frequent and close contact with the estuarine waters.

Overall, of the 46 people interviewed on Bests Island, Monaco Peninsula and users of the water skiing lane, fourteen (30%) passed comment about matters associated with treated effluent discharge and possible consequences.

*What effect do they notice? Source of effect?*

Two visible phenomena were reported associated with the discharge of effluent into the estuary channel on the outgoing tide. In the vicinity of the diffuser itself, a couple of observers gave contrasting reports of their experience - *"bubbling up of the effluent discharge - more a bubbling than a discolouration"*, and *"effluent in the water when fishing - you see a dark billow of effluent in the tide when the tide turns"*.

However, people were more inclined to report observations of things they thought of as indications of poor water quality. At several locations around the Estuary - Bests Island, Monaco and Tahuna - there were a number of reports of 'scum' - *"a brown foamy scum"*, *"a grey, bubbly scum"*, *"scum on the shore or in streaks in the water"*, *"a white brown scum"*, *"brown fluffy scum"*, *"scum on the beach"*, *"brownish scum on the water surface"* - on the water surface or around the water's edge. These were all unprompted responses. While some observers were inclined to link this to the treated WWTP effluent - *"I don't see it elsewhere"*, *"looks exactly like what is in the book on sewage discharge"* - others acknowledged the variety of sources of effluent and run-off entering the Estuary from time to time - *"see similar scum coming from the direction of the meatworks and the apple processing area - direct discharges?"*, *"the fruit factory and the freezing works as well as the sewerage plant"* or linked the scum to unidentified discharges. Tasman District water quality monitoring staff remarked that they have never received complaints about the Bell's Island discharge, but they do get complaints from other places (e.g. Talleys fish processing factory) when scum is reported.

Several other local residents made comments about reduced levels of fishing or shellfish gathering within the Estuary.

The WWTP operator reported having seen extensive accumulations of algal scum at several points further up the Estuary - at the causeway leading to Bells Island and up as far as the Appleby River. These had occurred during the height of summer, from January to March in recent years. Recent ecological monitoring by the Cawthron Institute (Gillespie and Asher, 1997) into possible impacts of nutrient enrichment resulting from WWTP effluent discharges<sup>24</sup> drew the following conclusions - "Major changes (1991 vs 1996) were observed in plant and animal communities of the intertidal zone in the vicinity of the Nelson (Bells Island) Regional Sewerage Scheme outfall. A majority of the changes observed can probably be explained by the natural variability of key species. This variability is likely dictated by climatic factors and the rigorous physical regime (tidal currents, storm effects, etc.). In most cases the observed changes indicated a reduction in enrichment status, while indications of increased enrichment were limited to two sites immediately up-channel from the outfall. The slight enrichment observed along the channel in a landward direction from the outfall

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We do not infer that surface phenomena such as scum and benthic changes are linked; merely that the WWTP effluent discharge does not appear to be causing significant ecological change in the Estuary.

was more localised in 1996 compared to the 1991 assessment. The results suggested, overall, that the outfall was favourably sited to preclude or minimise any detectable eutrophication of benthic habitats during the 5-year monitoring period. No other effluent-related impacts (e.g. microbial mats, oil slicks, odours, plastic debris, etc.) were observed on the sampling occasion."

The waste water engineer notes that there are no records of the number of breaks in the sewerage pipes crossing the Estuary, since the WWTP began operation. However, the last break in the main that caused a discharge into the Estuary of untreated sewage or industrial effluent was in 1998. This section of pipe has since been replaced.

### *Mitigation attempts?*

As noted earlier in Section B, The NCC's waste water engineer reported that the plant operates to strict effluent discharge standards which meet all the requirements for contact recreation outside the designated mixing zone, even when the plant is overloaded.

### *Impacts?*

Several local observers suggested that there has been a reduction in the amount of recreational fishing in the estuary - *"particularly snapper and flounder"* and one resident of Bests Island commented that the beach *"used to be all sand - now it's turning to mud"*. However, even more comments suggested there has been an improvement in the water quality and the ecological status of the Estuary since the WWTP started operating - *"it's a positive that it has cleared up - used to be really bad"*, *"better now that there is the WWTP"*, *"some improvement - but still some bad episodes"*, *"can be clearer on some days"*, *"much better since the upgrade, but I still get annoyed now and again"*.

While a few of those interviewed described negative impacts for them personally - *"feel uneasy about it"*, *"chosen not to swim locally"*, *"don't eat the shellfish from the estuary any more"*, *"aesthetic loss"*, *"swimming is dicey - personally, I will not"*, *"decided not to flounder and gather shell fish because of the health risks"*, *"dead krill and dead crabs in the thousands on the point - always after scum"*, and reported perceptions of negative impacts on their health - *"inflamed cuts"*, *"itchy skin a few times"* - these were by no means attributed particularly to the WWTP effluent. Furthermore, it is apparent that many continue to use the Waimea Estuary for contact recreation without undue concerns. Several who used to fish near the discharge point, reported either ceasing to fish in the Estuary at all, or simply shifting their location by a couple of hundred metres. Tasman District water quality monitoring staff said that they often sample water from the ski lane, and that it has always been well within contact recreation standards for bacteriological quality.

The Cawthron study referred to earlier (Cawthron, 1999) concluded "Although a slight increase in the numbers of faecal indicator bacteria was detectable within approximately 100m of the outfall, the effluent was not seen to impact on the classification of 'designated bathing area' at any of the sites surveyed". The fact that the public has been discouraged from gathering shellfish from the Estuary for many years, has already been noted. Scientists monitoring the estuarine water quality trends seem more inclined to be concerned about effects which arise from uncontrolled land-based run-off than about the WWTP discharge.

A Community Health Services representative interviewed noted that the tests which have been carried out in the past, indicate that the effluent plume from the WWTP passes directly down the main Estuary discharge channel and does not affect water quality at the main Tahunanui beach (Cameron, 2000). Cawthron Institute testing showed that sometimes in the early days - prior to 1992 - the operators had problems timing their discharges. On occasions, discharges begun before the turn of the tide resulted in nutrient enrichment upstream. However, the same testing confirmed that this has not been the case since 1995.

### *Summary evaluation*

Treated sewage effluent has been discharged daily on the outgoing tide for the past 17 years. It is generally agreed that the long-term trend for the Estuary in recent years - since the WWTP was built and since the requirements on other discharges were tightened up - has been an improvement. It is very difficult to separate out the effects and impacts of the WWTP effluent discharge from other discharges such as general stormwater discharges which may carry significant quantities of pollutants with it.

Perceptions of poor water quality do affect people's behaviour - and have. This occurred in the Waimea Estuary long before the WWTP was built. Overall, relatively few of those interviewed raised this as an issue and very few actually reported observations of negative changes in the water quality of the Estuary attributable to the WWTP. Nevertheless, users of the Estuary would like to see further improvements in its water quality in the long run. One possible response to this situation might be to include representatives of local residents and other users of the estuary in a water sampling and monitoring programme as has been initiated in other parts of the country. This would enable residents' and users' perceptions to be more closely linked to measured results.

While this case study research has confirmed a level of community concern about the issue of the effluent discharge on the local recreational amenity, a more wide-ranging study (of epidemiological proportions) would be necessary to establish the nature and extent of such impacts with certainty and over time.

## **Other effects observed**

Very small numbers of respondents commented about specific recreational amenity loss, visual impacts from the WWTP structures, and the noise of aerators. Single, uncorroborated observations about truck traffic associated with the WWTP and noise from aerators were not analysed any further. However, discussions in the residents' feedback meetings confirmed experiences of both truck traffic effects (spillages from sludge tankers, and above-normal frequency of trucks bringing waste into Bells Island from Wakapuaka) and noise from aerators (especially for residents on the northern side of Bests Island, and especially at night).

### *Amenity loss:*

Two water skiers interviewed noted the loss of the water skiing circuit which they used to take around Bells Island itself. This is no longer possible, after the construction of the concrete causeway between Bests Island and Bells Island. This represented a permanent loss of recreational amenity to a few traditional users.

Visual impact:

Two residents of Bests Island commented on the visual impact of the WWTP structures, registering their slight annoyance at “*the unnecessary visual impact on the view from Bests Island back to the City*”. One said they had never been shown any sketches of the proposed structures, which had become more obvious with the arrival of the ATAD unit. They noted that this is something which could be mitigated if the structures were painted a different colour to be less visually obvious.

## Summary of responses

The following table provides a summary of the proportions of those interviewed who discussed particular effects in their responses to the structured questionnaire. It is important to note that these percentages do **not** represent the proportions of neighbours who experienced significant off-site impacts.

**Table 8: Summary table of responses from residential neighbours (N=131)**

Effect reported	% Unprompted	% Unprompted + Prompted
Odours	35%	52%
Effluent discharge <sup>(*)</sup>	22%	30%
Visual impact <sup>(*)</sup>	4%	4%
Recreational amenity loss <sup>(*)</sup>	2%	4%

(\*) Percentages are based on sub-sample of near neighbours/users of the Estuary - Bests Island, Monaco and ski-lane users; N=46

Distance and direction-related patterns have been described in detail earlier in this section.

## **F: Longer-term effects of the WWTP on settlement patterns and development in the locality**

In exploring the longer-term effects of the Bells Island WWTP, residents of the host community were asked for their observations on -

- the major changes that have occurred in settlement pattern in the locality over recent years, and
- whether the location of the WWTP had influenced the way in which the community had developed.

### **Major changes in land use and settlement**

Trends differ between the various areas of settlement closest to the WWTP - Bests Island, Monaco Peninsula, and land either side of Richmond.

As noted earlier in Section C, the main development on Bests Island has been the gradual conversion of baches to permanent residences on the Island. Locals report very few new dwellings in the past decade - perhaps one or two at most.

On the Monaco Peninsula, which is essentially residential in nature, two sorts of development have occurred. Firstly, there has been the gradual infilling of residential properties on the Peninsula itself. More recently, extensive sub-division has moved westwards from Stoke towards the base of the Monaco Peninsula.

Two kinds of residential sub-division have continued apace in the vicinity of Richmond, along areas close to the shores of the Estuary. North of Richmond, extensive areas of suburban sub-division have been developed, although these are separated from the Estuary by the main Richmond by-pass road. West of Richmond, rural lifestyle development has continued relatively slowly, particularly on land between Queen Street and SH60.

As the statistics presented in Section C show, residential development in and around the Waimea Estuary has not been slow over the first thirteen years of the WWTP's operation. The most recent published Census of Population and Dwellings contains data for 1996. Thus analysis of more recent trends will have to await publication of the 2001 Census.

## The influence of the WWTP on the settlement pattern in the locality

With the relatively dispersed nature of the residential community around the Estuary, it was difficult to achieve any clear and coherent picture overall. However, the comments elicited in interviews do appear to reflect the differences described above.

On Bests Island, more than half of those interviewed were not prepared to venture a judgement on this question. Several thought that the WWTP did not particularly affect Bests Island prospects -

*“Doesn’t seem to”*

*“ if the smell’s bad here, it’s also bad in Appleby and Richmond”*

while a contrary view expressed was -

*“There is a definite perception that we are on the same Island” (as the WWTP)*

At the feedback meeting on Bests Island, several residents made the point that they did not wish to draw too much attention to any possible influence the WWTP may have on their locality, for fear of prejudicing property values.

Residents of Monaco Peninsula were much more likely to express the view that the WWTP has not had a detrimental affect on the way their locality has developed -

*“We have views and the Estuary is lovely to live near”*

*“People still live here”*

*“Originally the WWTP got an award - but now they’re allowing overloading; when there’s an offensive smell, we shouldn’t have to put up with it”*

*“Wind is normally in the wrong direction”*

*“No effect at all”*

*“Not as bad as the by-pass and the overbridge”.*

Residents west of Richmond, in the area either side of Queen Street, were also more inclined to this viewpoint -

*“Not in the last three years”*

*“No, no bearing”*

*“Only when the smell is evident - but that is a short-term thing”*

*“No effect”*

although one expressed a contrary view -

*“Wish we’d known, we wouldn’t have bought here”.*

# References

- Beca Steven (1992): Assessment of Effects on the Environment, December 1992, prepared for the Nelson Regional Sewerage Authority.
- Cameron (2000): Pers Comm.
- Cawthron Institute (1999): Impacts of the Bell Island Regional Sewerage Scheme on Waimea Inlet: Bacteriological Water Quality, prepared for the Nelson Regional Sewerage Authority. February 1999.
- Environmental Inspections Ltd (2000): Report on Recreational Water Monitoring Programme - Nelson City Council, for 1999/2000 Summer Season, prepared by Stephen Lawrence for the Nelson City Council.
- Fenemor, A.D. et al. (1993): Bathing Waters Survey: Nelson and Tasman Regions, Summer 1992/93, carried out on behalf of the Nelson-Marlborough Area Health Board, the Tasman District Council and the Nelson City Council.
- Gillespie, P.A. and Asher, R.A. (1997): Impacts of the Nelson (Bell Island) Regional Sewerage Scheme on Waimea Inlet: Part 1. benthic enrichment (July 1996 survey), prepared for the Nelson Regional Sewerage Authority. August, 1997.
- MacGibbon, J. (1997): Recreational Waters Survey - Tasman Region, Summer 1996/97, carried out for the Tasman District Council. March 1997.
- National Research Bureau (2000): Survey of Residents, 2000 carried out for the Nelson City Council.
- Nelson Regional Sewerage Authority (undated): The Nelson Regional Sewerage Scheme - Information pamphlet.
- Nelson Regional Sewerage Authority (1993): Assessment of consent application for coastal discharge - NN925584 - Nelson Regional Sewerage Authority.
- Recreational Fishing Association (2000): Clelland, pers. comm.

*BELLS ISLAND*

**View looking west towards Bests Island (nearest dwellings)**



**View looking south east towards Saxton Island**



**Overview of Bells Island site**

