# ASSESSMENT OF ECOLOGICAL EFFECTS FOR THE PROPOSED SUBDIVISION FOR TRADING CORPORATE LIMITED

A Report Prepared for Trading Corporate Ltd

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#### Executive Summary

This report provides an assessment of ecological values on Lot 1 DP 177316 and Lot 2 DP 352547) at Raumanga Heights Drive, Whangarei. The proposal is to subdivide this property into a high density residential subdivision. The ecological survey investigates the terrestrial and freshwater values on site and downstream, and the potential ecological effects of the proposed development.

The site is divided by a central north-south ridge into eastern and western catchments.

#### Eastern Catchment

The botanical values of the eastern catchment are moderate and are confined to the gully systems. These gullies will be largely protected by the reserve proposal of the development.

The freshwater streams in the eastern catchment are first order tributaries with variable aquatic values. A short section of the stream in the northern gully is perennial but has marginal ecological values. The southern tributary stream has some good perennial habitat values both on and off the site. The on site effects of increased stormwater and earthworks on streams in the eastern catchment will be limited due to the buffering effects of the proposed reserves around all tributaries; the implementation of appropriate stormwater and earthworks effects on the more sensitive receiving environment of the southern tributary should be avoided.

The proposed soil disposal area in the northern gully of the eastern catchment will not cause a significant loss of quality botanical or freshwater habitat, on site or downstream.

#### Western Catchment

The western catchment of the property contains large areas of regenerating native vegetation with potential to moderate botanical significance values. Vegetation clearance in the western catchment should be minimised and areas unaffected by the final scheme proposal permanently protected. Vegetation clearance in the riparian zone of the Waiponamu Stream should also be avoided.

The western catchment supports the Waiponamu Stream and Raumanga Stream beyond. The instream habitat quality is perennial and of moderate quality on site and good quality downstream. The concentrated development within this catchment necessitates careful implementation and monitoring of stormwater and sediment control to avoid significant adverse effects. This is emphasised where works occur in the riparian zone of the Waiponamu Stream. Instream values and fish passage will be maintained in the Waiponamu Stream with adequate design and installation of the proposed crossing.

Avifauna recorded in both catchments include a range of common indigenous and exotic birds. The presence of New Zealand woodpigeon is of note. The presence of kiwi is possible but unlikely and has not been confirmed.

Site enhancement and on going management has been proposed that will help to protect and reconnect the major ecological features on the property.

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#### 1. Introduction

Trading Corporate Limited seek to subdivide their property (Lot 1 DP 177316 and Lot 2 DP 352547) at Raumanga Heights Drive, Whangarei.

The proposal to Whangarei District Council (RC 39650) is to subdivide the subject site into 257 residential allotments; a future Living 1 development area, 1 rural allotment and 7 reserves to vest. The subdivision will take place in 8 stages over a suggested period of 10 years.

The proposal to Northland Regional Council is for subdivision works requiring a land use consent to undertake 587,000 cubic metres of cut and fill earthworks; a discharge permit to discharge stormwater to land and water during the period of disturbance activities; and a water permit to divert stormwater from land disturbance activities. The proposal also indicates the diversion a stream that transects the Soil Disposal Area as marked on the bulk earthworks and roading plan. We presume that a consent application will be made to the Northland Regional Council to divert surface water (a discretionary activity under Rule 24 or the Northland Water and Soil Plan).

Poynter & Associates Environmental Ltd and AB Ecology Ltd were commissioned to undertake an assessment of the existing ecological values present on the site and to outline the potential effects of the proposed subdivision development on those values. The Plan information requirements and assessment criteria have been addressed with recommendations for avoidance, remediation and mitigation measures.

The survey was undertaken using the information currently available regarding the subdivision proposal. This includes a subdivision layout and landscape concept plan provided by Littoralis Landscape Architecture (dated November 2006) and the Subdivision Suitability report produced by Cook Costello Ltd (dated 05 May 2006) plus a plan of the proposed bulk earthworks and roading (dated 17 November 2007 and the updated revision in 02 July 2007) supplied by consulting engineers, Cook Costello Ltd.

The main ecological field survey was carried out during early January 2007. Clearance had begun on the ridges of the property at that time but there had been no clearance in the northern gully.

#### 2. Site Description and Sampling Programme

A site map with property boundaries, topography and a layout of the watercourses is shown in Figure One in <u>Appendix One.</u>

#### 2.1 Site Overview

The subject property encompasses moderate rolling hill slopes in two distinct catchments divided by a central north-south ridge watershed. The eastern catchment contains a series of four vegetated ridge and gully systems running from west to east. First order tributary streams are shown on the NZMS 260 Q07 topographical map series as rising within each gully. The southern three gully systems confluence on the adjacent property to the east and eventually feed into Limeburners Creek. The northern stream exits the property and is piped under Hedley Place and Fairburn Street and ultimately diverted into Limburners Creek just after it crosses under SH1.

The western catchment is a long north-south valley originating in the Otaika Reserve to the south. The first order stream within this catchment is Waiponamu Stream which feeds into Raumanga Stream to the north of the property.

Most of the property is a Notable Landscape Area with a sensitivity rating of 6. This ranks it as a "highly sensitive" landscape. Policy 15.4.3 of the Proposed Whangarei District Plan states that landscapes with this sensitivity rating should be protected against inappropriate subdivision, use and development. Control is reserved over the levels of vegetation clearance and earthworks permitted.

The vegetation on the property has not been identified by the Department of Conservation as being part of a significant natural area (e.g. PNA, SES, SSBI etc.). However, it does provide a vegetative link between two significant natural areas of Raumanga Valley (Q07/048) and Otaika Valley Bush (Q07/023), (DOC, 2001).

#### 2.2 Sampling Rationale

The objectives of the ecological survey are as follows:

- To describe the native vegetation on the property and its botanical and habitat significance to plants and animals including birds and skinks and geckos.
- To determine the ecological effect of the proposed vegetation clearance and to establish recommendations for reserves, riparian buffering areas and vegetated corridor linkages within and between the eastern and western catchments.
- To describe the aquatic habitat, fauna and water quality of the two main unnamed tributaries in the eastern catchment and the Waiponamu Stream in the western catchment and provide a brief overview of the remaining first order tributaries on the property and the general downstream receiving environment of Limeburners Creek and Raumanga Stream.
- To assess the effects of the proposed earthworks and earthworks disposal area in the northern gully system of the eastern catchment, and the effects of proposed stormwater discharges to the gully systems throughout the property.
- To assess the presence/absence of birdlife on the property and the habitat values of the vegetation.
- To discuss the animal and plant pest management issues on the property in the context of the proposed subdivision.
- To identify avoidance, remedial or mitigatory measures that could be implemented to offset adverse ecological effects and to outline recommendations for a monitoring programme.

#### 2.3 Survey Locations

The botanical survey was carried out over the entire property with no specific survey locations.

The freshwater sampling locations were investigated as follows and GPS positions of the sampling areas are shown on Figure Two in <u>Appendix One.</u>

- **Site 1 –** Eastern catchment, northern tributary, end of Tauroa Street (Grid ref:NZMS 260 Q07 283049).
- Site 2 Eastern catchment, southern tributary in southern gully system (Q07 280043). This site is actually on the neighbouring property immediately to the east. It was selected because at the time of the survey there was no fish passage to the upstream areas and very limited physical access for surveying. The habitat at Site 2 is similar to the upstream environment.
- Site 3 Western catchment, Waiponamu Stream (Q07 272047).

Brief visual assessments of freshwater values were carried out in the following areas:

- The central two tributaries in the eastern catchment at accessible points close to their confluence with the southern tributary.
- The downstream receiving environment of the eastern catchment immediately to the east of Fairburn Street and Tauroa Street and then upstream and downstream of the crossing under SH1.
- The downstream receiving environment of the western catchment in the Raumanga Stream in Raumanga Valley Reserve at the western end of Raumanga Valley Road.

Bird observations were carried out at various accessible vantage points around the property.

#### 3. Field Survey Methodology

#### 3.1 Botanical Survey

Due to the difficult access on this property a botanical description of the existing site vegetation was determined through a "canopy typing" exercise from various vantage points on and around the property. This was verified from the air via a helicopter survey with native vegetation being mapped using an onboard GPS system – Garman GPS Agric Plotter. There was no detailed survey of species present in the understorey.

A botanical significance assessment using Schedule 16a of the Whangarei District Amended Proposed District Plan (APDP) was completed for each area of native vegetation. These criteria rank indigenous vegetation and habitat into five categories, these being Outstanding, High, Moderate High, Moderate or Potential. In terms of Section 6(c) of the Resource Management Act 1991, the Plan interprets 'significant vegetation or fauna' to include any areas ranked in the Moderate category and above.

The species list of canopy trees for this site is presented in <u>Appendix Two</u> of this report.

#### 3.2 Avifauna Survey

Bird observations were carried out at various accessible vantage points around the property. Birds will move freely between the eastern and western catchments therefore presence/absence data was collected for the entire property.

The habitat values of the property were also researched by referencing the Department of Conservation (DOC) report "Natural Areas of the Whangarei Ecological District".

#### 3.3 Freshwater Physical Habitat Assesment

A physical habitat assessment was undertaken at Sites 1, 2 and 3. The assessment protocol was developed by the Auckland Regional Council (ARC) and evaluates instream morphological characteristics and habitat opportunities. Results from this assessment are useful in interpreting the results of the macroinvertebrate and fishery data collected at each site.

The assessment requires a visual evaluation of the water quality in the stream section, i.e. levels of sedimentation and nutrients, and the general nature of the aquatic environment such as habitat abundance, diversity, riparian margins, shading, bank structure and water dynamics. Each criterion is scored on a scale of 1-20, and when summated produces a total score which is out of a possible maximum of 140 points. The completed assessment sheets are presented in <u>Appendix Three</u>.

The ARC have not developed quality thresholds for individual physical habitat assessment scores. However, some gauging reference can be made from a series of studies carried out on in a range of Auckland streams with differing levels of disturbance (ARC, 2006). The following general observations were made from this data:

- Soft-bottomed streams with a moderate to high level of disturbance scored in the range of 0 to 100 points.
- Soft and hard-bottomed streams with a low level of disturbance scored between 100 and 120 points.
- Hard-bottomed streams at undisturbed reference sites scored 120+ points.

Stream types in Auckland are similar to those found in Northland.

#### 3.4 Freshwater Macroinvertebrate Survey

#### 3.4.1 Sampling Protocols

Freshwater macroinvertebrate samples were collected at Sites 1, 2 and 3. A 50 metre stretch of representative habitat was sampled at Site 1 and a 100 metre stretch was sampled at Sites 2 and 3. The reduced sampling area at Site 1 reflects the restricted access and limited permanent water and habitat available for sample collection.

Sample collection used the sampling protocols developed by the New Zealand Macroinvertebrate Working Group (Stark *et al.*, 2001). This methodology outlines separate protocols for semi-quantitative sampling of hard-bottomed and soft-bottomed streams therefore acknowledging the inherent differences in morphology and community composition found therein. The habitats sampled at all thee sites were all categorised as soft-bottomed, therefore Protocol C2 (Soft-bottomed Semi-quantitative) was followed.

The sample was collected (using a 500-micron mesh net) from a fixed area of approximately 3 m<sup>2</sup> composed of ten replicate unit efforts of 0.3 m<sup>2</sup>. Sampling effort was concentrated within the main habitat types (bank margins, submerged woody debris and aquatic macrophytes) in proportion to their occurrence. Invertebrate fauna that were dislodged from the habitat types were emptied into the collecting jar between replicate units to avoid clogging or loss of macroinvertebrates. Each sample was preserved in 80% ethanol until it was processed.

Sample processing followed the procedure as outlined in Protocol P1 of the NZ Macroinvertebrate Working Group report. All organisms and their relative numbers were recorded as they were observed in the sorting tray. Each taxon was assigned one of five

coded abundance scores these being: - R = Rare (1-4 individuals); C = Common (5-19 individuals); A = Abundant (20-99 individuals); VA = Very Abundant (100-499 individuals); XA = Extra Abundant (500+ individuals) per sample. Up to 5 representatives of each taxon were retained from each sample to confirm identification by microscopic examination.

The level of taxonomic identification utilised was sufficient to allow the use of the standard bio-assessment metrics (Stark *et al.* 2001). The taxonomic keys utilised are as found in Winterbourn, Gregson & Dolphin (2000).

The samples were collected on 08/01/2007. This was after a prolonged period of dry weather and flow levels within the watercourses were normal to low.

#### 3.4.2 Data Analysis

The data obtained from the samples was analysed to describe the community assemblages that were residing within the streams at each sampling site and provide some information on the water quality and biological health of each watercourse.

- *Taxonomic Richness* measures the biodiversity and community composition by recording the number of different taxa at each sampling site and describing the community structure.
- Percentage of Ephemeroptera, Plecoptera and Trichoptera (EPT) Taxa is a metric that is useful alongside taxonomic richness. These three orders of Insecta are generally considered to be more pollution sensitive and therefore a high percentage EPT score is an indication of better water quality. Note that the purse caddisfly (*Oxyethira* and *Paraoxyethira*), are routinely left out of EPT scores because they are effectively two of the "tolerant" taxa.
- The Macroinvertebrate Community Index (MCI-sb) is the newly developed MCI scoring system for soft-bottomed streams (Stark and Maxsted, 2004). It works by using macroinvertebrates as indicator species and linking their presence / absence with low / high levels of organic loading. Together the MCI and percentage of EPT taxa metrics are considered to be of particular use for rapid bio-assessment protocols in lowland streams (Boothroyd and Stark 2000).

A species list and summary of the results of the bio-assessment metrics for the three sample sites are shown in <u>Appendix Four</u>.

#### 3.5 Freshwater Fishery Survey

Freshwater fish values were assessed along a 50 metre stretch of representative habitat at Site 1 and a 100 metre stretch at Sites 2 and 3. As for the macroinvertebrate sampling, there was restricted access and little available permanent habitat at Site 1, therefore the sampling area was reduced.

5 baited box traps were deployed at Site 1 and 10 traps at Sites 2 and 3. All the traps were left for a 24 hour period and then collected with all trapped fish being identified, measured and released. Freshwater fish database forms were completed for each site (Appendix Five).

The results of the survey will provide information on the fish community residing within the main tributary streams on the property. It will also help to determine whether or not there are blockages to fish passage downstream.

A search of the New Zealand Freshwater Fish Database (NIWA-Hamilton) was carried out to ascertain if any other surveys had been carried out within the catchments.

#### 3.6 Water Quality Measurements

Physico-chemical measurements were taken at Sites 1, 2 and 3. Dissolved oxygen (DO), pH, conductivity and temperature levels were recorded. A pre-calibrated 90 FLMV water quality meter was used to collect this data.

Some representative site photographs are provided in <u>Appendix Six</u> of this report.

#### 4. Survey Results

#### 4.1 Botanical Survey

Figure Three (Appendix One) outlines the areas of vegetation surveyed on the property. The areas encompassed by the coloured outlines (GPS shape files) contain vegetation with good botanical and habitat values. The balance of vegetation on the site has low botanical and habitat values.

#### 4.1.1 Area One

Area One in the western catchment is a continuous area of regenerating indigenous vegetation with emergent wattle, pine, woolly nightshade, pampas and eucalypts along the eastern and northern edges. It provides riparian vegetation to the Waiponamu Stream and is dominated by kanuka shrubland comprising kanuka, manuka, mahoe, hangehange, cabbage tree, pate, mapou, ponga and mamaku. Emergent totara are common, especially on the western edge of the area, as are emergent kahikatea. The canopy ranges from 6 to 12 metres tall.

Despite the pockets of weed trees in the canopy this area provides a good example of regenerating bush. The understorey is generally intact with regenerating natives. Fantail, grey warbler and kingfisher were all recorded within this area.

The significance evaluation of this vegetation using Schedule 16a of the APDP best fits the 'Potential' category due to the dominance of regenerating shrubland vegetation, i.e.

"All areas of some biological significance, whose biological values are limited by heavy modification, or other factors, but which would have increased biological value if left to regenerate or if managed or developed, (may include wildlife habitat which functions as a corridor, or which is sub-optimal habitat that may be necessary for maintaining genetic diversity)."

Consequently this part of the vegetation in Area One is not strictly assessed as being botanically significant. In contrast, the vegetation in Area One along the north western property boundary is more mature and would be ranked as 'Moderate', i.e. significant.

*"All sites supporting good numbers of species which are typical of a widespread habitat within an ecological region, and which have not been heavily modified by human influence."* 

#### 4.1.2 Area Two

The vegetation of the northern gully in the western catchment is less disturbed and comprises a maturing canopy of totara, kahikatea, mamaku, kanuka, tanekaha and the occasional rewarewa. Wattle and eucalyptus are common on the northern banks of the gully (outside of the property margins). The canopy height of the vegetation ranges from 12 to 15 metres tall. This vegetation is continuous and provides good quality riparian vegetation to the stream within the gully.

Under Schedule 16A of the APDP this vegetation has Moderate Value and is significant. New Zealand woodpigeon was recorded in this area which elevates its significance value to 'High' because it is a high value species appearing in Schedule 16B of the APDP.

#### 4.1.3 Area Three

The gully is dominated by a mature canopy of indigenous vegetation with kanuka totara, towai, tanekaha and rimu. Mapou, mahoe, cabbage tree and ponga are also common. The vegetation is continuous and does not show signs of past disturbance.

Under Schedule 16a of the APDP this vegetation has Moderate Value and is significant.

#### 4.1.4 Area Four

Area 4 includes four pockets of good quality vegetation. The gully vegetation comprises a mature native canopy with totara, rimu, rewarewa, tanekaha, mamaku, taraire, puriri and the occasional kahikatea. A distinct pocket of towai covers the northern eastern edge of this area at the property boundary. Area Four is surrounded by wattle and eucalypts on the ridgelines.

Under Schedule 16a of the APDP this vegetation has Moderate Value and is significant.

#### 4.1.5 Area Five

The southern gully is the largest area of continuous native vegetation. It supports mature kanuka with abundant emergent rimu, kahikatea, puriri, matai, rewarewa and towai throughout the gully. The lower slopes to the east have been cleared in the past but a regenerating kanuka/manuka mix dominates with nikau, cabbage trees and kahikatea. A distinct area of mature kowhai in the gully base is of note.

The uppermost edges of this area are dominated by pines and wattle. Notwithstanding this, there is some reasonable native regeneration in the lower tiers.

Under Schedule 16a of the APDP this vegetation has Moderate Value and is significant.

#### 4.1.6 Area Six

A wetland area has formed on alluvium on the true right bank of the stream. This supports a canopy of manuka scrub, kahikatea, nikau and cabbage trees with a sedgeland understorey including *Baumea rubiginosa*, *Eleocharis acuta*, *Cyperus ustulatus* and *Bamea juncea*. Swamp kiokio is common along with shrubs such as mapou, mahoe, karamu and swamp coprosma. Pampas, Japanese honeysuckle and Mexican devil are common weed species within the wetland.

Under Schedule 16a of the APDP this wetland has Moderate-High value as a habitat that is rare in the Ecological District. It is significant vegetation despite being disturbed by weeds.

The uppermost edges of this large bowl are dominated by pines and wattle. Notwithstanding this, there is some reasonable native regeneration in the lower tiers.

#### 4.1.7 Other Areas

Much of the ridgeline vegetation had been cleared prior to the vegetation assessment. However, from the observations of the initial site inspection undertaken by the ecologist and landscape architect in November 2006, and from the aerial photos from the late 1970s, it is possible to determine that these areas have all been previously cleared in the last 25 years and were dominated by a weed field of wattle, eucalypts and gorse.

The whole of the northern gully of the eastern catchment was also open ground in the late 1970s but is now a weed field dominated by wattle, with abundant tree privet, pampas, gorse, Chinese privet and other exotic tree species.

The botanical values of these areas are minimal.

#### 4.2 Avifauna Survey

Bird observations on the property were common. A range of common indigenous and exotic forest and urban species were recorded. Of particular note was the presence of New Zealand Woodpigeon (*Hemiphaga novaeseelandiae*). This is a declining species that has high conservation status in Schedule 16B of the APDP. Table One details the bird species recorded.

Table One:

Common name	Latin name
Australian magpie	Gymnorhina tibicen
Australasian harrier	Circus approximans
Blackbird	Turdus merula
Californian quail	Lophortyx californica
Eastern rosella	Platycercus eximius
Fantail	Rhipidura fuliginosa
Grey warbler	Gerygone igata
NZ Kingfisher	Halcyon sancta
NZ Pigeon/kukupa	Hemiphaga novaeseelandiae
Myna	Acridotheres tristis
Pukeko	Porphyrio porphyrio

The vegetation in the western catchment forms a link between the Natural Areas of Otaika Valley Bush (Q07/023) and Raumanga Valley (Q07/048) (DOC, 2001). Both natural areas have been designated as significant habitat for New Zealand woodpigeon (Category B threatened species). Otaika Valley Bush has also been recorded as habitat to North Island brown kiwi (Category A threatened species) in the past and also kakariki /red-crowned parakeet (Regionally significant species).

These records have not been formally updated by DOC since 1998 but the connectivity between the subject site and Otaika Valley Bush means that, if present, it is possible that kiwi and kakariki could use the eastern or western catchment of the property as part of their habitat range. Notwithstanding this, the presence of kiwi, in particular, on this site is still unlikely based on the high level of habitat modification and the proximity of the site to the

urban area. No kiwi survey was carried out as part of this ecological assessment since effective kiwi survey is limited to the breeding season (June) when kiwi are most vocal. Ideally, a verification study would be a necessary part of a complete Assessment of Ecological Effects.

The study brief recognises the need for consideration of herptofauna, as geckos and skinks can be an important component of the fauna of such areas. Due to difficult access on the site and the intense and specialised nature of surveys for herptofauna, the values of the site have only been assessed against the known habitat range and niche requirements of geckos and skinks known to be in the Whangarei Ecological District.

Based on this, any of the following species may be present:

Pacific gecko (*H. pacificus*) Forest gecko (*H.granulatus*) Copper skink (*Cyclodina aena*) Ornate skink (*C. ornata*)

Pacific gecko is listed on the New Zealand Threat Classification Systems List, 2002 (Department of Conservation) as a species in human induced gradual decline. It is listed as widespread in the Whangarei Ecological District but nowhere common. Ornate skink is listed as present on Maunu Mountain and copper skink is widespread in the Ecological District. Forest gecko is known from the edge of Pukenui Forest.

It is noted that no records of herptofauna have been recorded in either of the neighbouring natural areas, i.e. Otaika Valley Bush or Raumanga Valley.

#### 4.3 Freshwater Physical Habitat Assessment

#### 4.3.1 Site 1

The stream at Site 1 runs through the northern gully of the property. This gully was clear, open pasture in the late 1970s and has been left to regenerate in recent years. The resulting vegetative cover is dominated by weed species as outlined in Section 4.1.6 of this report. This vegetation provides a wide riparian buffer to the stream and some overhead shade. However, the quality of the organic input it provides to the stream is limited due to its exotic nature. The vegetation is continuous to the upper parts of this catchment where it is encompassed by residential land use of Raumanga Heights Drive, Isola Street and Tauroa Street.

The dense weed field in the northern gully constrained the search for the stream channel. However, it was located upstream and downstream of the southern end of Tauroa Street (See Figure Two). Upstream of Tauroa Street the stream was a narrow, dry, shallow, mud channel with the occasional stable pools. Furthermore, the channel was not continuous with some parts being completely overgrown with pampas and becoming a wetland area.

Moving downstream of Tauroa Street there were some stable pools, a short piped section (about 5 metres), a perched culvert where the pipe finished and then approximately 50 metres of stream channel before returning to wetland/weedfield with no channel. The physical habitat assessment was concentrated in this 50 metre section of the stream where there was permanent freshwater habitat.

The stream channel in this area was steep sided and deep with a soft clay substrate and some small patches of sand and coarse gravel. Instream sediment was common from

eroding, unstable channel banks. The steep and uniform banks offer few specific habitat features and appeared unnatural having most likely been "cleaned" as drains when the land was pastoral.

The flow levels were normal at the time of survey and the low gradient meant flows were slow. The stream takes a relatively straight course in the surveyed section with a mix of runs with deep pools and a channel width averaging 0.7 metres wide and 0.4 metres deep. Water clarity at the time of survey was clear with no colouration. Woody debris and sediment was present in the deep pools. There were some signs of eutrophication with occasional patches of floating algae, an anaerobic smell in the sediment and some oily sheens on the water surface.

The score for the physical habitat characteristics present at Site 1 is 54 out of a possible maximum score of 140 for a perennial stream (<u>Appendix Three</u>). This score is low and representative of a soft-bottomed stream that has suffered a high level of disturbance having lost its natural structure and surrounding native vegetation through previous land use. This coupled with low flow rates, possible organic enrichment and limits on available permanent habitat significantly restricts its habitat values for macroinvertebrate and fish fauna.

#### 4.3.2 Site 2

The dense pampas in the lower parts of the northern gully on the subject property originally constrained the search for this tributary stream. However, it was determined from the helicopter and subsequent ground survey (with better access) that the watercourse originates as patches of wetland in the upper parts of the gully and then forms a well defined channel in the lower parts. The stream channel provides excellent, undisturbed habitat opportunities in its upper sections and is a moderate sized first order stream with fast flowing sections and a series of runs, waterfalls and pools.

When the stream crosses the eastern property boundary it becomes a lower gradient stream with similar habitat types but less hydrological diversity. A crossing on the neighbouring property prevents fish passage to the good habitat at the head of this catchment (Figure 2, Appendix 1).

Due to poor access the physical habitat assessment was carried out in the freshwater habitat at Site 2 on the neighbour's property. The riparian vegetation in this area comprises a strip of exotic and native shrub. The trees provide shade and a large amount of organic input. The riparian vegetation extends between 10 to 30 metres beyond the stream channel. Beyond this is a low density residential subdivision and some open waste ground.

The stream substrate is soft clay with small areas of sand, coarse gravel and exposed bedrock. Woody debris was common in the pools along with some rooted submergent macrophytes. The banks are moderately stable and natural. They offer some good habitat opportunities with deep undercuts and side hollows. Bank side vegetation also overhangs the stream.

Stream flow at the time of survey was normal to low and flow rate was slow. The stream is dominated by medium sized pools linked by short, slow runs. The average width is approximately 1 metre with an average depth of 0.4 metres. Water clarity was good at the time of survey and there were normal levels of silt build up on the stream substrate. There were no signs of eutrophication.

The physical habitat assessment score is 91 out of 140. This score is indicative of softbottomed stream with a moderate level of disturbance. In this case, most aspects of the habitat values are reasonable but slightly sub-optimal.

#### 4.3.3 Site 3

The Waiponamu Stream is a perennial watercourse rising in Otaika Reserve upstream of the property and passing through the western catchment on the property. Site 3 is a representative section of this stream. The western catchment is well vegetated with continuous regenerating kanuka-ponga shrubland and emergent totara and kahikatea. Some weed species are also present. This vegetation provides a wide riparian buffer to the stream.

The immediate streamside vegetation is continuous on the true right bank and intermittent on the true left bank. The vegetation gaps on the left bank provide open areas of floodplain with exotic grasses and some raupo. Consequently, overhead shade from streamside vegetation varies but there is sufficient canopy on the true right bank to provide reasonable organic input to the watercourse.

The stream substrate is soft clay with small areas of sand and coarse gravel. The banks are stable and natural although they were moderately steep in the open areas. The banks did provide undercut areas that can offer fish habitat. Woody debris was also common in the deeper pools. The flow level was normal at the time of survey and flow rate was slow. The stream is relatively straight and dominated by long runs with large pools placed at intervals.

The stream averages about 1.2 metres wide and ranges from 0.3 metres deep in the runs to 0.6 metres deep in the pools. Water clarity was slightly turbid at the time of survey and there was evidence of silt build up in the pools. There were some signs of eutrophication in this stream with floating and rooted, emergent algae recorded as common.

The overall score for the physical habitat characteristics is 86 out of 140. This score is indicative of soft-bottomed stream with a moderate level of disturbance. As with Site 2 most aspects of the habitat values are sub-optimal and the streamside vegetation on the true left bank is limited in parts.

#### 4.3.4 Other tributary streams and downstream receiving environments

Two other tributary streams confluence with the southern stream in the eastern catchment. Both were inspected at accessible points close to their confluence with the southern tributary. The stream channel was narrow (<0.5metres wide) and shallow (< 0.3 metres deep) in both tributaries and no further survey was conducted as both were entirely dry at the time of survey. Notwithstanding this, it is likely that both streams do support stable pools higher up the catchment and flow intermittently.

The northern and southern tributaries of the eastern catchment confluence to form Limeburners Creek and ultimately flow into the Hatea River. Downstream the southern tributary is characteristic of a disturbed urban stream with weed infested riparian margins and inorganic debris common. Notwithstanding this, there is little instream sediment, the flow is good and there is a variety of pools and runs that offer habitat opportunities. There is some evidence of eutrophication. A large culvert with raised weir under Tauroa Street may prevent fish access for some non-climbing species into the upper parts of the catchment.

The downstream environment of the northern tributary is more disturbed with large sections of it being piped or overgrown wetland with no obvious stream channel. Flow levels were low

at the time of survey and sediment was common on instream features where they occurred. There are few, instream habitat opportunities.

The downstream receiving environment of the Waiponamu Stream is Raumanga Stream. This is a good quality gravel bottomed stream. It has native riparian vegetation and is a wide, stable channel with few stability issues and good habitat opportunities. There is a range of flows with slow and fast runs, riffles and a significant waterfall. There is no evidence of sedimentation or eutrophication. The waterfall will provide a blockage to fish passage for all but the strongest climbing species.

#### 4.4 Freshwater Macroinvertebrate Values

A summary of macroinvertebrate data collected and derived indices (metrics) is presented in <u>Appendix Four.</u>

#### 4.4.1 Site 1

The macroinvertebrate community at Site 1 has a relatively low level of taxonomic richness with a total of 12 different taxa recorded. The sample was dominated by a super abundance of freshwater snails (*Potamopyrgus*). Other abundant taxa include waterbugs (*Microvelia*), seed shrimp (Ostracoda) and pea shell mollusc (Sphaeriidae). Worms (Oligochaeta), amphipods and damselfly (*Xanthocnemis*) were all common in the sample. All these species are moderate to low sensitivity taxa when found within soft-bottomed streams.

Only 8% of the sample comprised sensitive EPT taxa and this was attributed to the presence of the Trichopteran, *Triplectides.* This result suggests that instream habitat and/or water quality conditions are poor.

The MCI-sb score of 78 is indicative of probable severe level of organic pollution (Boothroyd and Stark, 2000). Many of the taxa present are moderate to low scoring and have a relatively high level of tolerance to organic enrichment or environmental perturbation. There were some signs of eutrophication recorded in the physical habitat assessment with areas of floating algae, oily surface water sheens and an anaerobic smell in the sediment. The physical habitat assessment also recorded a high level of habitat disturbance. This would help explain the low MCI-sb score.

#### 4.4.2 Site 2

The macroinvertebrate community at Site 2 recorded a low level of taxonomic richness with a total of 11 different taxa recorded. Freshwater snails (*Potamopyrgus*) dominated the sample but the mayfly (*Zephlebia*) and amphipods were also abundant. Freshwater shrimp (*Paratya*) and freshwater crayfish (*Parenophrops*) were also common. These taxa have moderate to high levels of sensitivity when found within soft-bottomed streams. A range of other taxa including damselfly, waterbugs, case-less caddisfly, beetles and true flies were also present but in low numbers.

18 % of the sample comprised sensitive EPT taxa. This included the Ephemeropteran larvae (*Zephlebia*) and one Trichopteran larvae (*Polyplectropus*). The presence of these taxa suggests reasonable water quality conditions.

The MCI-sb score of 114 is indicative of possible mild organic pollution. The relatively low % EPT score also suggests that there is some level of instream disturbance that limits the macroinvertebrate fauna present. The limited riparian vegetation may contribute to this but

instream sedimentation is at normal levels and there were no obvious signs of organic enrichment.

#### 4.4.3 Site 3

The macroinvertebrate community at Site 3 is relatively diverse with 19 taxa recorded. The most abundant taxa are mayfly larvae (*Zephlebia*), damselfly (*Xanthocnemis*) and freshwater snails (*Potamopyrgus*). Other taxa that were common in the sample were caddisfly larvae (*Polyplectropus, Triplectides*), waterbugs (*Microvelia*) and truefly larvae (Tanypodinae). A variety of other taxa were present in low numbers. The taxa present in the sample cover a range of sensitivities to disturbance.

16% of the sample comprised sensitive EPT taxa. This included 1 Ephemeropteran (*Zephlebia*) and 2 Trichopeterans (*Polyplectropus, Triplectides*). All these taxa were present in good numbers and are indicative of moderate to good water quality conditions in softbottomed streams.

The MCI-sb score of 93 is indicative of probable moderate pollution or environmental perturbation. This is in line with the results of the physical habitat assessment that observed some limitations on riparian vegetation and some evidence of eutrophication and sedimentation.

#### 4.5 Fishery Values

#### 4.5.1 Site 1

The fish traps set at Site 1 did not return any fish, but one mosquito fish was found in the macroinvertebrate sample. Freshwater shrimp were common. The lack of fish could be attributed to a number of causal factors. It is quite likely that there is a blockage to fish passage in the downstream environment since a large section of the stream is piped under the housing of Hedley Place and Fairburn Street and again under SH1 and to the confluence with the southern tributary beyond.

Furthermore, the watercourse downstream of Site 1 is most commonly disturbed wetland and weedfield with no defined channel that could provide fish habitat or passage. Finally the habitat that was sampled at Site 1 is sub-optimal and limited in area.

#### 4.5.2 Site 2

The fish traps set at Site 2 did not return any fish. However, freshwater shrimp were common and two koura were recorded. The koura were medium sized (75mm) and were found in the deeper pools of the sampled section.

The fish habitat at Site 2 is reasonable quality. Some fish might have been expected at Site 2 and the culvert and weir downstream under Tauroa Road would not prevent access to climbing fish species. There may be some other blockage to fish passage that is unknown. The crossing just upstream of Site 2 prevents fish access to the excellent quality habitat at the head of this catchment.

#### 4.5.3 Site 3

The fish traps set at Site 3 recorded 1 long-fin eel (750 mm), 1 koura (85mm) and common freshwater shrimp. The habitat at this site was reasonable and fish passage is likely to be available to climbing species because of the presence of the eel. Other climbing species, i.e. banded kokopu and bullies, would also have been expected but were not recorded.

#### 4.5.4 Freshwater Fish Database Search

A summary of the relevant fish records from the New Zealand Freshwater Fish Database held by NIWA for the Hatea River catchment is presented in Table Two.

For the western catchment of the subject property, the database does not hold any information on the Waiponamu Stream itself. However, one record was found for the Ruamanga Stream, collected in September 1981, and one for the Te Hihi Stream, a tributary of the Raumanga Stream to the north of the Waiponamu Stream, in February 1987. Both sites are downstream of a large waterfall on the Raumanga Stream. Waiponamu Stream is upstream of this waterfall and the falls are expected to pose a blockage to fish passage to all but the best climbers. Of the species on this list the eels and bullies might be also be expected in the Waiponamu Stream.

The tributaries in the eastern catchment of the property feed into Limeburners Creek and then the Hatea River. There were no records for any of the Limeburners Creek catchment.

Genus Species		Common name	No. of sites
Anguilla	Dieffenbachia	Longfin eel	2
Cheimarrichthys	Fosteri	Torrentfish	2
Galaxias	Maculates	Inanga	1
Gobiomorphus	Cotidianus	Common bully	1
Paranephrops	Planifrons	Koura	1
Gobiomorphus	Huttoni	Redfin bully	1

Table Two: Fish species and frequency at the Ruamanga Stream and the Te Hihi tributary

#### 4.6 Water Quality

In situ measurements are presented in Table Four in Section 5 below. The data is summarised as follows:

- Dissolved Oxygen (DO) levels indicates a variable oxygenation of the stream waters ranging from low (<6g/m<sup>3</sup>) at Site 3 to good (>8g/m<sup>3</sup>) at Sites 1 and 2. These are all running water sites. These measurements indicate that only the waters at Site 3 were experiencing any DO limitation at the time of sampling.
- pH at Sites 2 and 3 was within the normally accepted 'healthy' range of 6.5-9. The pH at Site 1 was slightly low (6.17) but within a range that could cause detrimental effects to stream health.
- Water temperature at Site 1 was relatively high at 19.4°C. Sites 2 and 3 had lower temperatures of 15.7°C and 15.8°C respectively.
- The conductivity was low at all of the sites ranging from 51.3  $\mu$ Scm<sup>-1</sup> to 67.3  $\mu$ Scm<sup>-1</sup>.

#### 4.7 Existing Ecological Threats

Pest plant species are also present in significant proportions on the property. The majority of dense weed infested areas coincide with previously cleared areas, i.e. the ridgelines and the northern gully of the eastern catchment. However, weeds are also common at disturbed edges along the property boundaries. A number of threatening weed species were recorded and are presented in Table Three below. Other weed species are likely to be present but were not recorded due to poor access.

Possum sign was observed around the site and it is highly likely that rats, mustelids and feral cats are also present.

Common name	Latin name
Blackberry	Rubus fruticosus
Chinese privet	Ligustrum sinense
Convolvulous	Calystegia silvatica
Eucalyptus	Eucalyptus sp.
Ginger	Hedychium sp.
Gorse	Ulex europaeus
Japanese honeysuckle	Lonicera japonica
Mexican devil	Ageratina adenophora
Mistflower	Ageratina riparia
Pampas	Cortaderia spp.
Pine	Pinus spp.
Tree privet	Ligustrum lucidum
Wattle	Paraserianthes lophantha & Acacia mearnsii

#### Table Three: Weed species recorded on the property

#### 5. Summary

The results of the investigation into the botanical and aquatic values of the eastern and western catchments on the property are summarised in Table Four below.

#### 5.1 Eastern Catchment

- Three of the four gully systems of the eastern catchment support reasonable native vegetation with moderate to moderate-high botanical significance values. The northern gully is dominated by weed species.
- All four gully systems contain first order streams. The northern tributary has a short section of perennial stream just to the south east of Tauroa Street (Site 1). Upstream and downstream of this it flows intermittently and has sections of overgrown, weed field and degraded wetland. The southern tributary is perennial. The central tributaries were dry at the survey points at the time of inspection but are likely to support stable pools and will flow intermittently.
- The northern tributary (Site 1) has marginal physical habitat, reasonable water quality, limited macroinvertebrate fauna and no native fish. The southern tributary downstream of the property boundary (Site 2) has some good physical habitat, good water quality, a moderately sensitive community of macroinvertebrates but recorded no fish. Fish

passage is blocked to excellent physical habitat in the upper catchment of the southern tributary, i.e. on the subject property.

- The downstream receiving environment of the northern tributary is dominated by piped sections and overgrown weedfield and wetland with limited habitat.
- The downstream receiving environment of the southern tributary is a moderately disturbed urban creek but has some habitat values and no obvious sedimentation or organic pollution issues.

#### 5.2 Western Catchment

- The main gully system of the western catchment supports reasonable native vegetation with Potential to Moderate botanical significance values.
- The Waiponamu Stream is perennial and has some physical habitat opportunities. It has limitations on water quality, i.e. low dissolved oxygen levels, but it supports a moderately sensitive community of macroinvertebrates. Long fin eel were recorded in the stream but no other fish species.
- The downstream receiving environment is Raumanga Stream which is a high quality stony substrate stream with good habitat and no evident issues of sedimentation or eutrophication.
- Birds recorded in both catchments include a range of common indigenous and exotic, urban and forest birds. The presence of New Zealand woodpigeon (Category B threatened species) is of note. The presence/absence of kiwi is possible but has not been confirmed.

Survey Area	E	astern catchm	Western Catchment	
	Site 1	Site 2	Other tributaries	Site 3
Botanical Values	Vegetation in northern gully is weed field	Vegetation in Southern gully is moderate to moderate- high value	Vegetation in central gullies is moderate value	Vegetation in western gully is potential to moderate value
Avifauna	A range of com	mon indigenous kukupa (Cate	and exotic, urban an egory B threatened s	d forest birds. Presence of pecies)
Freshwater Physical Habitat Score	54 Marginal	91 Sub-optimal	-	86 Sub-optimal
Macroinvertebrate Survey				
Taxonomic richness	12	11	-	19
% EPT Taxa	8	18	-	16
MCI score	78	114	-	93
Comment	Poor instream health	Good instream health	-	Moderate instream health
Fish Survey				
No. of Species	1	0	-	1
Species	Mosquito fish	0	-	Long fin eel
No. of Specimens	1	0	-	1
Water Quality				
DO (g/m <sup>3</sup> )	8.43	10.86	-	5.3
рН	6.17	7.5	-	6.98
Temp (°C)	19.4	15.7	-	15.8
Conductivty (µScm <sup>-1</sup> )	54.4	67.3	-	51.3

 Table Four.
 A Summary of Ecological Values in the eastern and western catchments of the Whangarei Heights property.

- means no records were taken for this ecological parameter

#### 6. Potential Effects and Recommended Mitigation

The following ecological effects of the proposed subdivision are identified with recommendations for mitigation where more than minor effects are anticipated.

#### 6.1 Vegetation Clearance

#### Central Ridgeline

Vegetation clearance on the central ridgeline between the eastern and western catchment had already been undertaken at the time of the ecological survey. It is understood that the clearance was limited to weed field vegetation previously cleared in the late 1970s. There is limited loss of botanical values associated with this vegetation clearance but there may be some loss of habitat values in terms of vegetative cover, buffering function to better quality vegetation, an increase in edge effects and a loss of connectivity between the eastern and western catchments.

Enhancement buffer planting is recommended along the newly exposed edges of the remaining vegetation in the two catchments. Furthermore, there should be a provision to restore vegetative corridors to link between the eastern and western catchments. Ideally this would take place at the northern and southern ends of the property and the corridors should have a minimum width of 50 metres.

#### Western Catchment

Vegetation clearance in the western catchment will be substantial according to the proposed subdivision scheme plan. Under Schedule 16A of the APDP most of this vegetation would be assessed as having 'Potential' botanical value. As such it is not considered as botanically significant. However, some parts of the catchment have 'Moderate' value, and aside from botanical values, the loss of large areas of this vegetation will reduce cover and limit viable habitat through fragmentation for those bird species recorded on the site, which includes New Zealand Woodpigeon. The connective link between the natural areas of Otaika Valley Bush and Raumanga Valley will also be reduced.

Further to this, the slopes of the western catchment are moderately steep and stability issues have been identified on this site. In addition to the botanical loss, the loss of large areas of this vegetation may increase the likelihood of soil erosion and slope instability and sedimentation in the receiving environment of the Waiponamu Stream. Such effects are of particular concern where they to occur in the riparian zone of the stream. Avoidance of these effects in this zone usually requires generous riparian buffer widths on steep slopes. It is therefore recommended that, wherever possible, vegetation clearance in this catchment is limited and all vegetation not affected by the finally approved scheme is permanently protected.

#### Eastern Catchment

Vegetation clearance in the eastern catchment will occur on the main ridgelines and also the soil disposal area of the northern gully. As with the central ridgeline, the ridges have been cleared previously and are dominated by wattle and other exotic tree species. Loss of this vegetation will not cause a loss in botanical values but there will be a loss of buffering function and connectivity between the gully systems. Enhancement buffer planting is recommended along the newly exposed edges of the remaining vegetation. Protected vegetative links with a minimum width of 50 metres are recommended between each gully.

Clearance for the proposed soil disposal area in the northern gully is unlikely to cause significant botanical or habitat loss due to the highly disturbed vegetation here.

#### 6.2 Fragmentation and Edge Effects

The vegetation clearance on the property has the potential to generate effects that extend beyond botanical loss. The most significant concerns are the 'edge' effects associated with removal of vegetation and wider fragmentation of plant and animal habitats.

Forest fragmentation occurs when a contiguous forest ecosystem is separated into two (or more) subunits by an abrupt transition or 'edge', such as a cleared building site, road or track. The 'edge' can act as a barrier to individual plant and animal species. The effect of isolating habitats in this way can result in the complete loss of constituent biota or severely reduced populations over time. Local extinctions can occur and are particularly common in the invertebrate fauna – a group that is pivotal to food chains and to efficient nutrient recycling in New Zealand terrestrial ecosystems.

'Edge' effects arise from habitat fragmentation and exposing the forest interior to changes in abiotic and biotic conditions. Abiotic 'edge' effects refer to physical differences in the microclimate. An extended or new cutting or edge in the bush allows more light and sun to reach the ground with resulting variations in the air temperature, air moisture content, soil moisture and the like. These variations can affect the natural processes of regeneration and cause localised shifts in species composition.

The increase in incident light also produces biotic 'edge' effects in the form of enhanced plant growth for some species, particularly any weeds present or being blown or carried by other means into the area. Plants at exposed edges are also more prone to damage from wind throw and many New Zealand forest animal species tend to avoid to newly formed edges. 'Edge' effects are especially important when the areas to be affected are characterised by forest interior conditions.

The vegetation clearance required for the proposed subdivision divides the bush remnants into distinct vegetation parcels that are effectively disconnected. The proposed reserves in Lots 264 and 265 are both a reasonable size and will provide viable core habitat. However, connectivity will be significantly reduced and edge effects will increase.

Fragmentation and edge effects can be reduced by limiting vegetation clearance in the western catchment; ensuring that there are viable linkages of at least 50 metres wide between the eastern and western catchments and reserve areas within these catchments; enhancement of the bush buffer areas along the edges of each of the reserve areas to provide a transitional zone between the habitat interior and the edges; and providing lots with a reserve edge within them with information on weed species to avoid planting and the need to avoid dumping garden waste in the bush.

#### 6.3 General Earthworks and Sediment Control

The plan of the proposed bulk earthworks and roading shows cut and fill areas for the various stages of the development. For Stage 1 and 2 the cut and fill areas are concentrated along the central ridgelines and eastern catchment ridgelines to create flatter sections. Future stages will require cut and fill on the slopes of the western catchment and in the riparian management zone of the Waiponamu Stream. The plan shows that excess soil will be dumped in a soil disposal area placed in the northern gully of the eastern catchment.

Earthworks associated with site clearance and the construction of houses and infrastructure on this scale have the potential to generate and mobilise significant amounts of sediment. This coupled with the site topography, i.e. rolling hill country and inherent site instability, increases the risk of sediment losses to the freshwater environment.

Such sediment losses potentially reduce water clarity and can have a range of undesirable effects on macroinvertebrates and fish and habitat (eg reduced feeding efficiency, increased macroinvertebrate drift rate and smothering of habitat.

For the eastern catchment, the proposed earthworks on the ridgelines are generally well removed from the watercourses. Adverse effects downstream are avoidable with the implementation of appropriate sediment/ erosion control measures; stabilisation of the fill areas; and retention of buffering vegetation along the riparian margins.

For the western catchment the proposed earthworks are on steep sloping ground and there will be large areas of fill stabilisation. This includes works within the riparian management zone of the Waiponamu Stream and a stream crossing. The receiving environment of the Waiponamu Stream has moderate sensitivity and habitat values. Furthermore, the Raumanga Stream further downstream has high sensitivity and habitat values. The potential for adverse effects is significant and the proposed engineering mechanisms to limit this risk need close scrutiny and careful monitoring at the implementation stage as does the site rehabilitation and revegetation plan.

All excavated material should be appropriately managed to ensure that it does not smother the root systems of native flora that is retained in reserve areas or on individual lots.

#### 6.4 Soil Disposal Areas

There is limited information regarding the management of the proposed soil disposal area on which to consider ecological effects. The engineer (Philip Cook) has provided the following general written comment:

"The toe of the disposal areas will have a shear key approximately 4m wide keyed into the underlying rock. Any seepage will be tapped and drained from the base of the fill area. The fill slope will be compacted and be probably 5m high at 45° with 4m benches or similar. This has not been confirmed yet as the contour information is not accurate enough to fully design the dump. Benches will be top soiled and planted in vegetation. The water course will be diverted around the fill area. On completion it is considered the total area will be covered with the mulch from the site and vegetation established".

The stream that passes through the proposed soil disposal area of the northern gully is an intermittently flowing watercourse/wetland in the upper part of the gully and a perennial watercourse / weed wetland in the lower gully. The degraded nature of this stream is such that there will be limited loss of quality freshwater habitat if a section of the stream is piped or diverted to allow for a soil disposal area. There will be no significant loss of fish passage because the intermittent flow and lack of continuous channel already limits connectivity. The downstream receiving environment of this tributary is also low quality or piped. If the disposal areas are constructed, stabilised and managed to avoid sedimentation, then any downstream effects should be minor.

#### 6.5 Fish Passage

Many of New Zealand's indigenous fish species are diadromous and undertake at least one, seasonally timed migration to and from the sea as a necessary part of their lifecycle. To allow for

this and maintain adult populations in inland waters it is important that upstream migration remains unimpeded.

The erosion and sediment control plan shows that access to Stage 8 of the development will require a stream crossing over the Waiponamu Stream. The provision is for the crossing to be an 11 metre wide carriageway with a piped culvert. Fish passage will be maintained if the culvert is correctly positioned within the watercourse, i.e. the lip of the pipe is placed at stream bed level and with minimal slope. Any other effects will be minor.

The Boffa Miskell peer review audit report for the proposed subdivision application (Dec 2006) noted that dirt tracks have been recently cut through the lower catchment of the eastern slopes and have damaged a tributary stream with no properly constructed crossing. Site investigations found that this disturbance is on the boundary line with the property to the east.

This crossing has smothered the stream channel in sediment. The issue of fish passage may not be significant because this stream appears to be ephemeral upstream of the crossing. However, intermittent flows and stable pools upstream which could provide seasonal habitat and in any case a crossing with no culvert may pose a risk for wash out and sedimentation downstream.

Fish passage to the good quality fish habitat in the upper parts of the southern tributary is currently blocked by poorly constructed crossings. Restoring fish passage to the upper catchment would provide mitigation for some of the disturbance effects of the proposed subdivision.

#### 6.6 Stormwater Treatment and Disposal

Stormwater volume and discharge rates will increase during the construction and operation phases of the proposed subdivision. There is a potential for slope erosion and for sedimentation and scour within stream channels which have potential impact on instream habitat and biota.

The proposed development will also cause an increase in pollutants that can be carried in stormwater runoff. Pollutants include organic material with a high oxygen demand, nitrogen and phosphorus, heavy metals (i.e. zinc, copper and lead), petroleum hydrocarbons (e.g. oil and grease), human waste, pesticides, solvents and herbicides etc. These pollutants can build up in a catchment over time with chronic effects on instream ecology.

The layout of the proposed subdivision means that most stormwater will be directed into the southern gullies of the eastern catchment and the main gully of the western catchment.

The central two tributaries of the eastern catchment appeared to be ephemeral but access was poor and some of the upper areas may have stable pools and sections of stream. The southern tributary has some good freshwater habitat values. All freshwater values need to be protected in any proposed stormwater management system.

The same risks apply to the western catchment, although stormwater effects may be intensified here due to the higher concentration of proposed lots and the higher ecological values of the downstream receiving environment - Raumanga Stream. There is no specific engineering information upon which to assess how the stormwater risks are proposed to be managed. Nonetheless, the stormwater design should be such as to achieve the Northland Regional Council's required narrative standards and the reduction in concentrations of suspended solids and other contaminants prior to discharge, as defined in Rule 21.1.2 (e) and Rule 22 of the Regional Water and Soil Plan (RWSP).

#### 6.7 Sewage Treatment and Disposal

Presumably sewage will be connected to the municipal system which pre-empts a direct concern re ecological and water quality effects.

#### 6.8 Mitigation and Enhancement Proposal

The subdivision mitigation and enhancement planting concept plan produced by Littoralis Landscape Architecture outlines a possible enhancement proposal for the property. This includes the creation of reserves to vest, covenanted bush areas, areas of buffering bush to be enhanced, specimen street tree planting and areas of roadside indigenous revegetation. The concept plan also allows for vegetated links between the gully systems of the eastern catchment.

The reserves and proposed covenanted areas generally coincide with the best areas of bush (see Figure Three, Appendix One) and the riparian margins of all the tributary watercourses. The exception to this is the large contiguous area of regenerating bush in Area One and the southern part of Area Five in the southern gully.

This enhancement proposal will help to protect many of the good areas of vegetation on the property, the streams and their riparian margins and also provide linkages in the eastern catchment and a thin link along the length of the Waiponamu Stream.

In order to further mitigate the potential effects of the development the following additional enhancement recommendations could be considered:

- Retention and protection of the maximum area possible of the good quality vegetation in the western catchment / Area One. This may involve a reduction in lot number and/or limited vegetation clearance on individual lots with the balance protected by covenants. If the latter, then clearance on individual lots should be structured to retain contiguous areas of bush between lots that can provide useful habitat and linkages. Protection of this vegetation will limit habitat loss and fragmentation effects (and assist in minimising soil erosion and stability issues). Of particular importance, the proposed reserve along the riparian margins of the Waiponamu Stream should be widened.
- Consider protection of more of the good quality bush in Area Five in the southern gully.
- Providing for links across the central ridgeline between the reserves in the eastern and western catchments. Additional links over the ridges of the eastern catchment will also be beneficial to improve ecological connectivity and lessen landscape impact. To be viable habitat corridors, the links should be at least 50 metres wide.
- All indigenous enhancement planting should comprise vegetation associations that are representative of similar habitat and landform within the Ecological District.
- A management plan should be prepared to effectively monitor and limit the ecological impacts of the various stages of the development. This would identify ecological thresholds/targets and include provisions to monitor the extent of vegetation clearance, identify any erosion and sedimentation effects of ecological relevance and provide ecological restoration advice in enhancement areas. The management plan would also include an integrated weed and pest management plan for the property in the operational phase of the development.

- The weed control programme should be implemented within the reserves, covenanted areas and other enhanced areas and also in the soil disposal area. The latter are likely to become weed infested because the soil from the cuts on the ridges will be contaminated with seed from wattle and other weed tree species that were previously abundant there.
- In the absence of a coordinated pest animal control programme it is highly likely that a population of animal pests already exists on and around the property. Signs of possum were evident during the site survey and mustelids and rats are likely to be present in the wetland areas. Implementation of a comprehensive pest control programme throughout the retained bush on the property will enhance habitat quality and mitigate some of the potential habitat disturbance effects associated with the subdivision.
- The introduction of cats and dogs onto this area is likely to have an effect on any resident terrestrial fauna within the bush remnants. This is largely unavoidable due to the type of high density residential land use the area is zoned for. However, there may be an opportunity to reduce their adverse effect by providing information to future property owners regarding the potential sensitivity of the bush areas and the need to control domestic pets as far as is possible.

#### 6.9 Alternative Options

Alternative options to help protect the botanical and habitat values of the site have already been discussed in the mitigation section of this report

#### 7. Conclusions

#### Eastern Catchment

Three of the four gully systems of the eastern catchment support reasonable native vegetation with moderate to moderate-high botanical significance values. A large part of these areas will be protected by the reserve proposals of the development. The northern gully is dominated by weed species.

The effects of vegetation clearance on the ridgelines of the property can be reduced by implementing appropriate enhancement proposals to link reserves within and across the catchments and provide buffer planting and weed management to newly exposed edges.

Controlled vegetation clearance in the northern gully for the soil disposal area will not cause a loss in botanical or habitat values.

The aquatic values of the four, first order streams in the eastern catchment are variable. The northern tributary has a short section of perennial stream with marginal physical habitat, limited macroinvertebrate fauna and no native fish. Aquatic habitat effects in this gully are not significant. The downstream receiving environment of the northern tributary (off site) is dominated by piped sections and overgrown weed field and a small highly degraded wetland with limited habitat.

The southern tributary is perennial and there is some good physical habitat on and off the subject property. The tributary has a moderately sensitive macroinvertebrate community. Fish passage is blocked to good habitat in the upper catchment and no fish were recorded at the survey site despite the presence of good habitat. Further downstream, the southern tributary is a moderately disturbed urban creek but has some habitat values.

The proposed earthworks on the ridgelines are well removed from the streams of the eastern catchment. Appropriate sediment/ erosion control measures and retention of buffering riparian vegetation should minimise any adverse effect on these receiving environments.

The proposed soil disposal area in the northern gully will not cause a significant loss of quality freshwater habitat on site or downstream.

Fish passage should be restored to the upper catchment of the southern tributary. Restoring fish passage to the central tributaries of the eastern catchment may be less important as the upstream environments appear to have intermittent flows. However, stabilising crossings will be advantageous to control instream sedimentation.

It is important that all stormwater related activities within this site protect the freshwater habitat values that have been documented in all the tributaries of the eastern catchment, particularly the southern tributary on and beyond the site boundaries.

#### Western Catchment

The western catchment contains native vegetation with potential to moderate botanical significance values.

Vegetation clearance in the western catchment should be minimised and areas unaffected by the final scheme proposal permanently protected. Vegetation clearance in the riparian zone of the Waiponamu Stream should also be avoided. This appears to be proposed in the scheme plan but the width of the zone needs to be widened.

The Waiponamu Stream in the western catchment is perennial and provides habitat opportunities. It supports a moderately sensitive community of macroinvertebrates. Long fin eel were recorded in the stream but no other fish species. The offsite downstream environment is the Raumanga Stream, which is a high quality stony substrate stream with good habitat and no issues of sedimentation or eutrophication.

The proposed future earthworks in the western catchment are on steep sloping ground within and around the riparian zone of the Waiponamu Stream. The consequential risks of erosion and sedimentation issues are greater here due to the proposed higher concentration of lots. Particular attention will need to be paid to the successful implementation and monitoring of stormwater and soil control to avoid significant effects.

The works required to provide the stream crossing over the Waiponamu Stream will cause a small loss of habitat, but the adverse effect on the fish or invertebrate community will not be more than minor. Fish passage will be maintained in the Waiponamu Stream through the proper design and installation process of the culvert.

#### <u>General</u>

Avifauna recorded in both catchments include a range of common indigenous and exotic birds. The presence of New Zealand woodpigeon is of note. The presence of kiwi is possible but unlikely and has not been confirmed.

Site monitoring proposals should be developed as a condition of consent to confirm that all works meet recommended environmental standards and effects remain within the minor range.

The site enhancement proposal will help to protect many of the good areas of vegetation on the property, the streams and their riparian margins and also provide linkages in the eastern catchment and along the length of the Waiponamu Stream

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## **APPENDICES**

## Appendix One Site Maps





Figure 2: Watercourses on the property with site locations



Figure 2: Watercourses on the property with site locations

#### **Appendix Two** Botanical Species List (Canopy Species only)

#### Native trees and shrubs

#### Maori / Common Name

#### **Botanical Name**

Cabbage tree
Hangehange, Maori privet
Kahikatea, White pine
Kanuka, Teatree
Karamu
Kowhai
Mahoe, Whiteywood
Manuka
Mapou, Red matipo
Nikau palm
Pate
Puriri
Rewarewa, NZ honeysuckle
Rimu, Red pine
Taraire
Tanekaha
Totara
Towai

Cordyline australis Geniostoma rupestre Dacrycarpus dacrydiodes Kunzea ericoides Coprosma robusta Sophora microphylla Melicytus ramiflorus Leptospermum scoparium Myrsine australis Rhopalostylis sapida Schefflera digitata Vitex lucens Knightia excelsa Dacrydium cupressinum Beilschmiedia taraire Phyllocladus trichomanoides Podocarpus totara Weinmannia silvicola

#### Native ferns

#### Maori / Common Name

Mamaku, Black tree fern Ponga, Silver fern

#### **Botanical Name**

Cyathea medallaris Cyathea dealbata

## Appendix Three Physical Habitat Assessments

Macroinvertertet	orate Results Tal	Site 1	Site 2	Site 3	
Whangarei Heigh	nts AEE	MCI-Sb			
Ephemeroptera	Zephlebia	8		А	А
Trichoptera	Polyplectropus	8		R	С
	Triplectides	5	R		С
Odonata	Xanthocnemis	2	С	R	А
Hemiptera	Anisops	3			R
	Microvelia	5	А	R	С
	Sigara	3			R
Coleoptera	Antiporus	5			R
	Hydrophilidae	6		R	R
Diptera	Chironomus	4	R		
	Culex	3			R
	Orthocladiinae	3			R
	Paradixa	8		R	R
	Polypedilum	7	R	R	R
	Tanypodinae	6	R		С
	Zelandotipula	4			R
Crustacea	Amphipoda	5	С	А	R
	Ostracoda	3	А		
	Paranephrops	8		С	
	Paratya	4		С	R
Mollusca	Physa	1	R		R
	Potamopyrgus	2	XA	VA	А
	Sphaeriidae	3	А		
Oligochaeta		4	С		
Taxonomic Rich	ness		12	11	19
% of EPT taxa			8	18	16
МСІ		78	114	93	

## Appendix Four Freshwater Macroinvertebrate Data

## Appendix Five Freshwater Fish Database Forms

NZ FRESHWATER FISH DATABASE FORM	PLEASE RETURN TO: FISH DATABASE	FRESHWATER	
Date 8/01/07	Catchment system HATEA RIVE	R	Catchment 055.000 Number
Time 11.00AM	Sampling locality LIMEBURNERS	CREEK TRIBUTARY	
Observer AB & RB	Access notes SITE 1, ACCESSE	D FROM END OF TAUROA STREET	Altitude (m) 40
Organisation. AB Ecology	NZMS260 map Q07	Coordinates 283049	Inland 3 distance (km)
Fishing Method KBT	Area fished (m <sup>2</sup> ) or Number of nets used 5	Number of electric fishing passes	Tidal yes/ <u><b>no</b></u> /unknown

## HABITAT DATA

\M/atan	Colour blue/green/tea/ <u>uncoloured</u> /other:			Clarity <u>clear</u> /milky/dirty			Temp.	pН	
water	Average Average depth		Average depth (r	e n) 0.4	Maximum depth (m) 0.6			Conductivity (ms/m)	
Habitat type (%)	Still	Backwa	ter	Pool 40	Run 60	Riffle		Rapid	Cascade
Substrate type (%)	Mud 90	Sand	5	Fine gravel	Coarse 5 gravel	Cobble		Boulder	Bedrock
Fish cover (yes/no)	Weed Algae	Instrean Debris	n YES	Undercut Banks	Bank YES Vegetation	Large wood debris	ly		
Catchment vegetation (%)	Native Forest	Exotic forest	80	Farming	Urban 20 area	Scrub		Swamp land	Other
Riparian vegetation (%)	Native Forest	Exotic forest		Grass Tussock	Exposed bed	Scrub 100 Willow (wee	ed)	Raupo Flax	Other
Type of river/stream/lake 1 <sup>st</sup> order stream									
Water level lo	ow/ <u>normal</u> /high/un	known	Dow	nstream blockage	<u>yes</u> /no/unkr	nown Pol	llution	<u>nil</u> /low/moderat	e/high
l anna invantaturat	- fauna		Koui	Koura abundant/common/occasional/rare/nil/unknown or numbers observed					
Large invertebrate fauna			Para abur	Paratya shrimp abundant/common/occasional/rare/ <b>nil</b> /unknown			reshwater mussels <u>nil</u> /present/unknown		esent/unknown
Small benthic invertebrate fauna Predo low/moderate/high/unknown mayfili			Predominant species mayflies/caddis/snails/combination/other Permanent water yes/ <u>no</u> /unknown			unknown			
Purpose of work AEE FOR PROPOSED RESIDENTIAL DEVELOPMENT									

## FISH DATA

Species and life stage	Abundance*	Length data	Habitat/comments
No species recorded			
Comments			
*Use numbers observed or abundant/common/occasional/rare	)		

NZ FRESHWATER FISH DATABASE FORM	PLEASE RETURN TO: FISH DATABASE		FRESHWATER	
Date 8/01/07	Catchment system HATEA RIVE	R		Catchment 055.000 number
Time 12.00AM	Sampling locality LIMEBURNERS	CREEK TRIBUTARY		
Observer AB & RB	Access notes SITE 2			Altitude (m) 35
Organisation. AB Ecology	NZMS260 map Q07	Coordinates 282044		Inland 3 distance (km)
Fishing Method KBT	Area fished (m <sup>2</sup> ) or Number of nets used 10	Num! fishin	ber of electric ng passes	Tidal yes/ <u>no</u> /unknown

### HABITAT DATA

\M/atax	Colour blue/green/tea/ <u>uncoloured</u> /other:			Clarity <u>clear</u> /milky/dirty		Temp.	рН		
water	Average Av width (m) 1.0 de		Average depth (r	e m) 0.4	Maximum depth (m) 0.5			Conductivity (ms/m)	
Habitat type (%)	Still	Backwate	er	Pool 65	Run 35	Riffle		Rapid	Cascade
Substrate type (%)	Mud 85	Sand 5		Fine gravel	Coarse 5 gravel	Cobble	)	Boulder	Bedrock 5
Fish cover (yes/no)	Weed Algae	Instream Debris Y	ΈS	Undercut Banks YES	Bank YES Vegetation	Large v debris	woody		
Catchment vegetation (%)	Native Forest U/S	Exotic Forest C	TREE NPY	Farming	Urban 20 area	Scrub		Swamp land	Other
Riparian vegetation (%)	Native Forest 50	Exotic Forest 5	50	Grass Tussock	Exposed bed	Scrub Willow		Raupo Flax	Other
Type of river/stream/lake 1 <sup>st</sup> order stream									
Water level low/ <u>normal</u> /high/unknown Do		Dow	Downstream blockage yes/no/ <u>unknown</u>		Pollution <u>nil</u> /low/moderate/high				
			Kou	Koura abundant/common/occasional/rare/nil/unknown or numbers observed					
		Para abur	Paratya shrimp abundant/ <b>common</b> /occasional/rare/nil/unknown			Freshw	Freshwater mussels <u><b>nil</b></u> /present/unknown		
Small benthic invertebrate fauna low/moderate/high/unknown			Prec may	Predominant species mayflies/caddis/snails/combination/other Permanent water <u>yes</u> /no/unknown			/unknown		
Purpose of work AEE FOR PROPOSED RESIDENTIAL DEVELOPMENT									

#### FISH DATA

Species and life stage	Abundance*	Length data	Habitat/comments
Parane	2	75 MM	POOLS
Comments	•	•	

\*Use numbers observed or abundant/common/occasional/rare

NZ FRESHWATER FISH DATABASE FORM	PLEASE RETURN TO: FISH DATABASE	FRESHWATEF	2
Date 8/01/07	Catchment system HATEA RIVE	R	Catchment 055.000 number
Time 2.00PM	Sampling locality WAIPONAMU S	TREAM	
Observer AB & RB	Access notes SITE 3, ACCESSE	O FROM END OF RAUMANGA HEIGHTS RD	Altitude (m) 70
Organisation. AB Ecology	NZMS260 map Q07	Coordinates 274048	Inland 4 distance (km)
Fishing Method KBT	Area fished (m <sup>2</sup> ) or Number of nets used 10	Number of electric fishing passes	Tidal yes/ <u><b>no</b></u> /unknown

#### HABITAT DATA

Water	Colour blue/green/tea/ <u>uncoloured</u> /other:			Clarity clear/ <u>milky</u> /dirty		Temp.	pН
Water	Average Average deviation of the second seco		e m) 0.3	Maximum depth (m) 0.6		Conductivity (ms/m)	
Habitat type (%)	Still	Backwater	Pool 30	Run 70	Riffle	Rapid	Cascade
Substrate type (%)	Mud 90	Sand 5	Fine 5 gravel	Coarse gravel	Cobble	Boulder	Bedrock
Fish cover (yes/no)	Weed Algae YES	Instream Debris YES	Undercut Banks YES	Bank YES Vegetation	Large woody debris		
Catchment vegetation (%)	Native Forest 80	Exotic forest	Farming	Urban 20 area	Scrub 20	Swamp land	Other
Riparian vegetation (%)	Native Forest 30	Exotic forest	Grass Tussock 65	Exposed bed	Scrub Willow	Raupo Flax 5	Other

Type of river/stream/lake  $1^{st}$  order stream

Water level low/ <u>normal</u> /high/unknown	Downstream blockage yes/no/unknown	Pollution nil/l <u>ow</u> /moderate/high			
Lorgo invertebrato found	Koura abundant/common/occasional/ <u>rare</u> /nil/unknown or numbers observed				
	Paratya shrimp abundant/ <b>common</b> /occasional/rare/nil/unknown	Freshwater mussels <u>nil</u> /present/unknown			
Small benthic invertebrate fauna low/moderate/high/unknown	Predominant species mayflies/caddis/snails/combination/other	Permanent water <u>ves</u> /no/unknown			
Purpose of work AEE FOR PROPOSED RESIDENTIAL DEVELOPMENT					

#### FISH DATA

Species and life stage	Abundance*	Length data	Habitat/comments		
Par ane	1	85 MM			
Ang die	1	750 MM			
Comments					
*Use numbers observed or abundant/common/occasional/rare					

## Appendix Six Site Photographs

<u>**Photo 1**</u> – Vegetation in Area 1 (western catchment)



<u>Photo 2</u> – Stream at Site 3 in western catchment.



<u>**Photo 3**</u> – Weed field in northern gully, eastern catchment. Proposed soil disposal area.



<u>**Photo 4**</u> – Stream Site 1, northern gully, eastern catchment.



<u>Photo 5</u> – Southern gully, eastern catchment. Part of this area is a proposed reserve.



<u>**Photo 6**</u> – Stream Site 2, southern gully, eastern catchment.



<u>Photo 7</u> – Downstream receiving environment leading to Limeburners Creek.

<u>Photo 8</u> – Downstream receiving environment of Raumanga Stream.



