2.2 THE ROUTE

The route is shown in Figure 2.1, and has been overlaid on a topographic map and includes approximate kilometre marks starting at the proposed Kiwi Burn terminus. The kilometre marks are used for describing particular positions along the route. The route passes through land administered by the Department for approximately the first 29.5 kilometres.

The mountain bike track is yet to be as accurately defined from 29.5km onwards (refer red dotted line in Figure 2.1).

The following photos show the route and terrain type through the conservation land proceeding from the proposed Kiwi Burn terminus.

Figure 2.4 A schematic of the Kiwi Burn terminus shown in the centre.

Figure 2.5 Kiwi Burn terminus location is on the far right. The route follows grass and tussock covered terraces on the true left of the Mararoa River until it crosses to the true right near the bottom of the photo.

Figure 2.6 **After following grass and tussock covered terraces on the true right of the Mararoa River, the route cuts through beech forest before emerging downstream onto open terraces again. The route is still on the true right of the Mararoa River.**

Figure 2.7 **The route leaves the Mararoa Valley and enters Kiwi Burn, crossing the grass and tussock covered valley past the existing hut. The route then climbs through beech forest towards the saddle.**

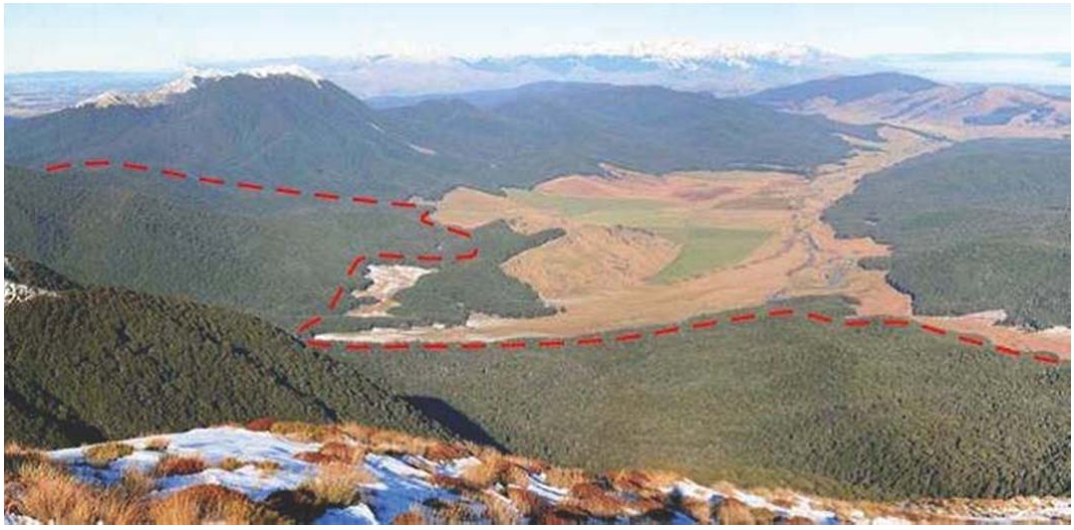

Figure 2.8 **The route descends from the saddle at the head of Kiwi Burn (far left) before climbing to a low saddle near Limestone Hill, which is the low mound in the centre of the photo. After descending and crossing the Whitestone River (mid-photo on left), the route climbs onto a terrace on the true right of the Whitestone River and passes through forest following a narrow band of tussock grassland and sedgeland along a tributary of the Whitestone River locally referred to as "the finger" (right of photo).**

Figure 2.9 **The route travels through beech forest up the edge of "the finger" towards the head of an unnamed tributary of the Upukerora River referred to here as "Ascension Creek".**

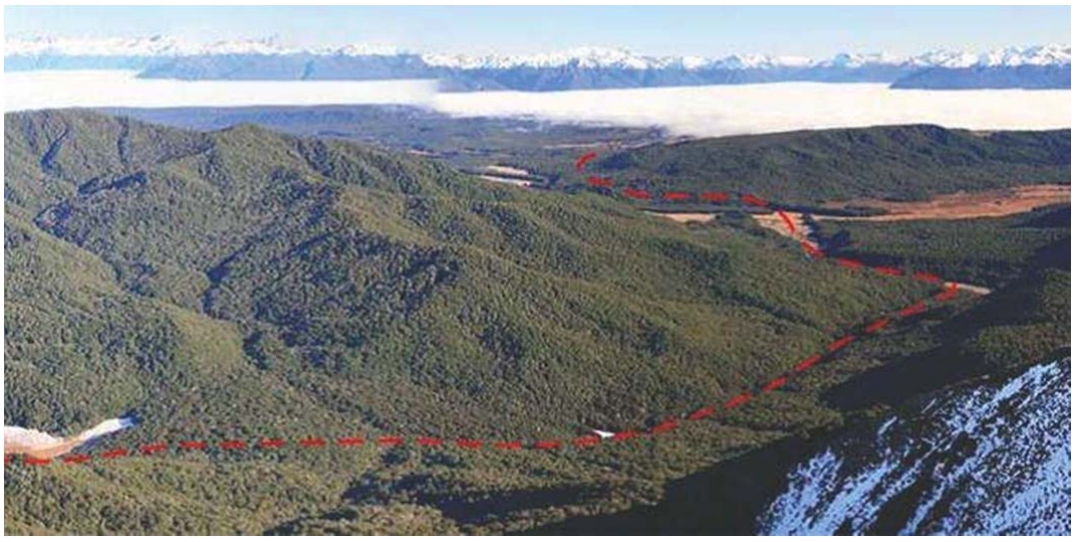

Figure 2.10 **The route ascends through beech forest to the head of "Ascension Creek".**

Figure 2.11 **The route descends along the true right of "Ascension Creek" tributary before crossing to the true left of "Ascension Creek" and then crossing a steep section on the true left bank of the Upukerora River shown in the centre of this photo. The route then follows open terraces on the true left and then true right of the Upukerora River and passes Dunton Swamp and then enters forest again before "Bluff slip".**

Figure 2.12 Once emerging from Ascension creek the route follows the true left of the Upukerora River and then crosses to the true right where it travels through grassland on the river terraces past Dunton Swamp and enters the forest again shortly before the 24 km mark.

Figure 2.13 Area of instability at "Bluff Slip" on the true right of the Upukerora River at 25.5km (just downstream of Dunton Swamp).

Figure 2.14 **The route descends from above Bluff Slip on the True Right of the Upukerora (right of photo). The route follows the lower slopes of the Beech Forest and avoids the wetland areas covered by tussock grassland.**

Figure 2.15 **The route emerges from the DoC estate into privately owned land at the edge of the forest (at the 29.5km mark). This photograph depicts the Chartres land in the foreground, and Lake Te Anau in the midground.**

Figure 2.16 **The Te Anau Down terminus is superimposed onto the photograph of the Fiordland National Park Lodge site (existing buildings to the right of the photograph) and Lake Te Anau in the mid ground. State Highway 94 is in the foreground, over which the monorail will travel to the Te Anau Downs terminus.**

2.3 LAND STATUS

Crown land and conservation areas administered by the Department of Conservation which are traversed by the proposed monorail and mountain bike track are held under the Conservation Act 1987. The various land parcels traversed by the monorail and mountain bike track are identified as follows (and attached as **Appendix D**):

- The majority of the monorail and construction/mountain bike track will be within land held for Conservation Purposes as part of the Snowdon Forest Conservation Area (LINZ Parcel ID 3245738 Sec 1, SO 12090).
- On the south side of the Whitestone River the route crosses Crown land designated as marginal strip being Block IV Snowdon Survey District (LINZ ID 3239454).
- The Kiwi Burn terminus and first part of the monorail before it crosses the Mararoa River will be within Sec 1 SO 11218 (LINZ ID 3239451).
- That part of the mountain bike track which will deviate from the monorail (around the 29km mark) continues within Sec 1 SO 12090 until it will cross into the following land parcels:
  - Sec 3 SO 12090 (LINZ Parcel ID 3275141),
  - Sec 1 SO 11756 (privately owned land, LINZ Parcel ID 3274452, CT SL12A/910) via a Crown easement (at two locations),
  - Sec 4 SO 12090 (LINZ Parcel ID 3240854),
  - Sec 2 SO 12090 (LINZ Parcel ID 3206130),
  - Sec 8 SO 11339 (title SL10A/651, LINZ Parcel ID 3241610).
- The Te Anau Downs end of the monorail and mountain bike track and terminus will be sited over three pieces of land, namely Secs 6, 8 and 9

Block III Eglinton Survey District (LINZ Parcel IDs 3240042, 3210815 and 3261683 respectively).

Once the monorail exits Crown land (around the 29km mark), it will enter private land, being Sec 8 SO 11339 (title SL10A/651, LINZ Parcel ID 3241610) and Sec 1 SO 11756 (LINZ Parcel ID 3274452).

The minister has power to grant concessions over conservation areas in the form of leases, licenses, permits or easements in respect of any activity, as the minister considers appropriate (Section 17Q).

Particular considerations apply to concessions or leases over marginal strips (Section 17B) but these do not preclude the granting of a concession in such a form as the minister considers appropriate in relation to marginal strips traversed.

Section 62(2) of the Act expressly provides for granting concessions over Stewardship Land.

Concessions may be granted for land use in National Parks, the process being essentially that in Part IIIB of the Conservation Act. The minister must also be satisfied that the concession can be granted without permanently affecting public rights in respect of the Park, and the concession is not inconsistent with Section 4 of the National Parks Act 1980 which requires parks to be maintained in a natural state and members of the public to have right of entry.

3. EXISTING ENVIRONMENT

THE PHYSICAL ENVIRONMENT

This section describes the existing environment within which the proposed monorail would be established and identifies the values of each key aspect of the environment. The impacts of the proposal, both positive and negative, on these values are assessed in Section Eight and appropriate mitigations are considered in Section Nine.

3.1 TOPOGRAPHY

The proposed monorail and construction/mountain bike route generally follows the southern edge of the Livingstone and then Dunton Ranges and traverses the lower sub-alpine slopes between 202 and 675m above sea level (Figure 2.1). Topographically there is a transition from the rugged foothills of the north-trending Livingstone Mountains and Dunton Range in the east to rolling terrain of low relief on the sloping lake terraces adjacent to Lake Te Anau.

The monorail route traverses approximately 29.5km across Crown land and crosses the toeslopes and basins of the Livingstone Mountains and Dunton Range, and the Mararoa River, Whitestone River and Upukerora River. Once the monorail leaves Department land, the mountain bike track will continue through the bush prior to exiting around Henry Creek, following sloping terraces to Te Anau Downs.

The proposed route crosses a range of topographical features including outwash terraces, toe-slopes, colluvial fans, valley floor depressions, gullies and low passes. The route also crosses two concealed seismic fault traces which are not considered to be active. One of these is the Hollyford Fault, to the immediate west of Dunton Range and running north/south through Dunton Swamp, the other is the Moonlight Fault which runs along the Mararoa River valley past the proposed Kiwi Burn terminus site.

The rivers along the route consist of semi-braided alluvial channels, some with relatively wide flood plains. The relatively flat sections of terrain have varying levels due to alluvial terraces and the undulating nature of the topography.

The topography of the route is shown in Figure 2.1.

3.2 CLIMATE

The climate of this area is dominated by frequent, strong, westerly winds which make the weather changeable and often dramatic. Windflow of more than 60km/h occurs from the northwest for 150 days per year on average at Kiwi Burn and for 80 days per year on average at Te Anau Downs (Riverstone Holdings 2006). Moisture laden air from the Tasman Sea is forced to rise quickly over the mountainous terrain of Fiordland where it cools quickly creating heavy rain and snow. Annual rainfall varies from around 1200mm in Te Anau to 8000mm in Milford Sound. Rain falls in Fiordland on more than 200 days each year.

The mean rainfalls over the region of the proposed monorail route are remarkably uniform (Table 3.1). All estimates of mean rainfall lie within the range 990-1360mm per annum (NIWA 2009a). The mean value for the gauge closest to the Kiwi Burn terminus (the Oreti at Three Kings rain gauge, 10.7km northwest of the proposed terminus site) is 1170mm per annum, while the mean value for Te Anau Downs is 1220mm (NIWA 2009a, J. Hoyle pers. comm.).

Table 3.1 Mean annual flows for gauges in the Fiordland Region (from NIWA 2009).

Name	Year start	Year end	Mean annual rainfall (mm)
Te Anau Downs	1951	1980	1220
Te Anau	1951	1980	1150
Kakapo Rd, Dale Farm	1951	1980	1030
Te Anau Kakapo Rd	1951	1980	1030
Plains Station	1951	1980	1040
The Key Whitestone	1951	1980	990
Chimneys Flat	1951	1980	1300
The Haycocks	1951	1980	1130
Secretary Island AWS	1994	2003	4090
Manapouri Aero AWS	1992	2008	1100
Upstream Mavora Lakes	1998	2005	1360
Queenstown AWS	1990	2008	710
Gorge Ck	1975	2005	1130
Three Kings	1988	2005	1170
Lumsden AWS	1994	2003	910

The mean annual temperature at Kiwi Burn is around 7°C, whilst at Te Anau Downs it is 12°C with 1800 and 1500 hours of annual sunshine respectively. Te Anau Downs experiences around 14 days per annum when the average maximum temperature is greater than 25°C, while Kiwi Burn only experiences eight such days per annum (Riverstone Holdings 2006).

3.3 GEOLOGY AND GEOMORPHOLOGY

In spite of its very steep slopes and proximity to the active Alpine Fault (approximately 70km distant from the monorail route), Fiordland has remarkably few major landslides, due in part to the strength of the rocks in the area (Turnbull 2000). The route passes through an area that does not seem particularly prone to landslides, however there is a large historic landslide in the upper Upukerora River valley which provides an ongoing source of bed material

to the river, but is well upstream of the proposed route (Turnbull 2000, NIWA 2009a).

North-northeasterly movement of the Fiordland block relative to the Takitimu mountains is producing oblique compression within the Te Anau Basin, against the Livingstone and Humboldt mountains (Turnbull 2000).

The route passes through the Te Anau depression, which lies between the Takitimu, Eyre and Livingstone Mountains and eastern Fiordland. This sedimentary basin was formed by subsidence along the Moonlight and Hollyford fault systems. Ice from the Greenstone valley travelled into the Mararoa catchment earlier in the Quaternary period where it deposited terminal and lateral moraines (boulders, stones, or other debris carried and deposited by a glacier) at Mavora Lakes and outwash gravels into the Te Anau depression (Turnbull 2000). An extensive blanket of till (unstratified soil consisting of sand, clay, gravel and boulders mixed together and deposited by a glacier) which is sometimes known as the Whitestone Formation covers much of the Te Anau depression, with associated outwash gravels draining south into the Waiau catchment. The route consists primarily of these outwash gravels and tills, that is boulders, cobbles, gravels, sands, silts and clays.

The base rock varies along the route as follows:

- Livingstone volcanic overlain by morainic and river gravels as far as the Kiwi Burn hut.
- From the Kiwi Burn hut to the edge of the Whitestone valley, firstly Tapara and then Winton formation argillite/sandstone.
- From the edge of the Whitestone valley to the end of the route on conservation land Arnold series marine felspathic sandstone with outcrops of limestone at Limestone Hill and around 21km where the route leaves “Ascension Creek”.

Geomorphic processes play a key role in river ecosystem functioning since spatial and temporal variability in the geomorphic template controls the type, range and abundance of physical and hydraulic habitat and the persistence of that habitat over time. The dynamics of a river system are reflected in its channel pattern and channel pattern is a strong predictor of how a river will respond to disturbance. Hillslope instabilities and gullying also provide potential sediment sources to these river systems. Riverstone Holdings commissioned NIWA to assess the existing geomorphology of rivers crossed by the proposed route. The NIWA report on geomorphology is attached as **Appendix F** (NIWA 2009a).

Within the reach of the proposed route the Mararoa River is a low sinuosity meandering gravel bed river which exhibits well defined overflow channels that short-cut each bend of the river. There is also a side braid that splits from the main channel approximately 1km upstream from the Kiwi Burn confluence. Channel braids are typically mobile and this is likely to be a site of regular change in channel alignment. The river ranges from 10m wide by the

swingbridge to 300m wide where the channel braids. Typically the channel is 60m wide. The bed material ranges from gravels to small boulders.

Kiwi Burn is a meandering single-thread gravel stream with a moderate-high sinuosity which ranges from 60 – 300m wide and the channel has freedom to adjust within these valley margins. The bed material is dominated by gravels and cobbles with localised finer sandy deposits. There is widespread bank erosion on the outside of meander bends in the Kiwi Burn and the channel is actively meandering.

The proposed route also crosses a major tributary of Kiwi Burn, as well as Kiwi Burn itself. The tributary is highly sinuous and ranges from 2 – 10m wide. This tributary is also laterally active.

The Whitestone River is a semi-braided gravel river with typically one or two dominant channels. In the reach where the route is proposed the valley starts to open up and the river has freedom to adjust laterally before becoming constrained on the true left bank further downstream. The width of the active channel ranges from 50 – 150m and the banks are typically low. The bed of the main channel(s) was typically armoured with cobbles and small boulders, although fine gravels and loose cobbles were often stored in mid-channel bars.

The proposed route runs alongside the Upukerora River for at least 5km and may cross it twice (Opus 2009). The Upukerora River is typically a braided gravel bed river, but in places near the proposed monorail route it has a single wandering channel. The valley width ranges from 50 – 550m wide and for most of the reach where the monorail would be it has freedom to adjust laterally and there is clear evidence of abandoned river channels across the full extent of the floodplain. The bed material ranges from sand and small gravels to small boulders, but is dominated by cobbles.

All of the rivers surveyed can be described as gravel bed rivers that are adjusted to a relatively high supply of sediment and relatively frequent reworking by flood flows. They should all be considered as laterally mobile and subject to fluctuations in bed level due to both downstream and lateral bar migration. The Upukerora has two significant areas of hillslope instability that provide ongoing sources of bed material.

Although unable to walk the whole route NIWA staff identified one area of hillslope instability that will directly influence the proposed monorail route. This is shown in Figure 2.13 (Section 2.2) and identified as “Bluff Slip”. LiDAR survey will provide a means of assessing the true extent of this instability and a wider envelope (300 m) is proposed for approximately 2.3km in this area to allow alternative routes to be explored before finalising the route at this locality (approximately 25.5km).

3.4 SOILS

Surficial materials or regolith (the layer of loose rock resting on bedrock) lying on bedrock include loess (windblown deposit of fine-grained, calcareous silt or clay), weathered rock and soils. Generally soils overlying base materials are

the result of weathering and decaying vegetation cover since the last glaciation. The thickness of this soil varies from nil to hundreds of millimetres, but soils are often thin, diffuse and complex and are generally immature with poor fertility (Turnbull 2000, Riverstone Holdings 2006). At some localities, particularly on higher and steeper slopes, the regolith is predominantly slopewash and locally derived scree and debris from small landslides (Turnbull 2000).

Four major soil types are found in the area administered by the Department of Conservation (Riverstone Holdings 2006):

- Eglinton Steepland. Soils of the Livingstone Mountains are yellow-brown earths developed under forest, and especially liable to sheet and scree erosion where the vegetation cover is disturbed or removed.
- Borland Hill. Soils on the tertiary sediments are lowland yellow-brown earths developed under forest. They have a very low nutrient status and on steep terrain are susceptible to erosion when bared.
- Dunton. Soils are yellow-brown loams formed on moraines and gravels. They are often stony or bouldery and low in nutrients.
- Manapouri Glen. Soils are found on river flooplains and in low lying areas among moraines. They are peaty, sandy or silty loams forming swamps and wetlands, with very impeded drainage and a low nutrient status.

3.5 FRESHWATER

The project lies entirely within the headwater tributaries of the Waiau River and includes the Mararoa River, Kiwi Burn, Whitestone River, Upukerora River and Dunton Stream. The proposed route crosses at least 13 streams and rivers on Department of Conservation land ranging from unnamed small first and second order streams to large rivers. Riverstone Holdings Limited commissioned NIWA to assess and report on the river environments along the route. The full NIWA report is attached as **Appendix G** (NIWA 2009b).

In May 2009 NIWA staff undertook field surveys in rivers and streams along the proposed monorail route. Overall the headwater catchments of the Upper Waiau system are relatively pristine and provide a variety of habitats for aquatic organisms. Physico-chemical parameters measured throughout the catchment were similar, with a pH of between 6.7 and 7.9 and conductivity between 18 and 68 µS/cm. Water temperature ranged from 4.0 °C to 9.2 °C.

Despite relatively poor sampling in similar sized streams elsewhere, most of the periphyton taxa found were known from rivers or wetlands elsewhere in the South Island. The communities within each sampling site were extremely variable. Taxon richness was generally low, reflecting the low algal biomass, probably because the samples were collected relatively soon after a large flood. The invasive diatom *Didymosphenia geminata* (Didymo) was present in all the large rivers (Mararoa, Kiwi Burn, Whitestone and Upukerora) but was not found in smaller tributary streams. The Mararoa River at Kiwi Burn is thought to be the introduction point for the species into Southland, if not the South Island as a whole (NIWA 2009b).

Invertebrate communities are a vital component of food-webs in rivers and streams. Their importance lies in transferring the plant based organic carbon (leaves, periphyton, wood) into animal based organic carbon making it available to higher predators like fish and birds. Almost all freshwater invertebrates are native to New Zealand, and many are endemic (that is, found nowhere else in the world). The invertebrate communities present in the rivers and streams surveyed were diverse and generally consisted of a high proportion of "pollution intolerant" EPT (Ephemeroptera, Plecoptera and Trichoptera) taxa, which reflects the quality of the instream habitat available.

Eighty two invertebrate taxa were found from 17 invertebrate groups. The EPT richness varied between 2 and 17 across all sites and the %EPT ranged from 5 – 94%. Thirteen of the 15 tributary sites had a macroinvertebrate community index ('**MCI**') score of over 100 indicating they provide "good" to "excellent" habitat for aquatic invertebrates. The Mararoa River gave biotic indices that indicated the freshwater invertebrate habitat was "fair" while all other main-stem sites were "good" to "excellent" habitat. The presence and abundance of didymo may explain the lower quality scores in the Mararoa River. There was no statistically significant difference in biotic scores between the different sampling sites but main-stem sites had significantly larger substrate sizes, reflective of the high energy environment of these rivers where frequent flooding washes any accumulated sediment downstream.

Aquatic bryophytes (mosses and liverworts) are important habitat for invertebrate communities. The growth form of Bryophytes (often prostrate and small) is resistant to high velocity water and these plants may increase streambed stability by lowering the drag of the rocks on which they grow (NIWA 2009b). Thirty two bryophyte taxa were identified and bryophytes were found at 22 of the 24 sampling sites although most sites had very low cover. Some of the small tributary streams surveyed were found to support a very diverse community of bryophytes, although this was not true of the larger rivers. The distribution of aquatic bryophytes is controlled mainly by substrate stability, reflecting the fact that these plants have very slow growth rates and do not persist where streambed material regularly overturns.

Electrofishing by NIWA staff showed that non-migratory galaxiids were widespread and in some places common or abundant. Their abundance and distribution is most likely limited by the presence of introduced brown trout (*Salmo trutta*) which were present at almost all the sites surveyed, often in abundance. Five species of native fish and two species of introduced fish were encountered during the survey. Native species included lamprey (*Geotria australis*), longfin eel (*Anguilla dieffenbachii*), flathead galaxias (*Galaxias depressiceps*), Gollum galaxias (*Galaxias gollumoides*) and upland bully (*Gobiomorphus breviceps*).

Lamprey are regarded as threatened (Hitchmough et al. 2007) because adult lamprey are sparse throughout New Zealand. One juvenile lamprey was caught in the Mararoa River. Longfin eels are widespread and relatively common, but are regarded as being in decline and the species is regarded as threatened (Hitchmough et al. 2007). Eight longfin eels were caught at two Mararoa River

sites. In the past recruitment of juvenile eels into the upper reaches of the Waiau River was not possible because of human built barriers. Modifications to these and introduction of fish passes in recent years have facilitated the migration of more juvenile eels into the upper catchment, but they are still not common. A total of 20 flathead galaxias were observed in the Mararoa and Whitestone Rivers and Kiwi Burn. One hundred and eighty nine Gollum galaxias were observed in the Mararoa and Whitestone Rivers and Kiwi Burn with most of them (113) found in a tributary of the Whitestone River. Four upland bullies were found, three in the Upukerora River and one in a tributary of the Whitestone River.

Introduced fish included brown and rainbow trout (*Onchorhynchus mykiss*). The two species of introduced fish combined comprised 66% of the total catch and many of the sites sampled provided good habitat and conditions for trout spawning, rearing and growth. Brown trout were widespread within the upper Waiau River and a total of 130 were caught, most (125) of which were juveniles. A total of 296 rainbow trout were caught and again nearly all were juveniles less than 100 mm in length.

Overall the headwater catchments of the upper Waiau system are relatively pristine and provide a variety of habitats for fish. Brown and Rainbow trout are widespread and generally common throughout the area and occupy habitats ranging from swiftly flowing large rivers with gravel substrates through to muddy bottomed streams. Non-migratory galaxiids are widespread, and in some places common or abundant. Migratory fish are uncommon, probably because the sites surveyed are beyond, or close to, the limits of inland penetration for those species.

3.6 AIR

The air quality appears typical of a backcountry area with clear air and low pollution levels. There is likely to be some dust at the edge of the Mavora Lakes Road during summer generated by vehicles travelling on the gravel road.

At Te Anau Downs the monorail and mountain bike route is adjacent to State Highway 94, which is sealed and has a higher traffic volume, so there is probably low level vehicle pollution apparent, particularly near the road.

3.7 NOISE

Riverstone commissioned Marshall Day Acoustics to measure ambient noise measurements. Marshall Day staff flew to several of the remote parts of the monorail route and walked the Kiwi Burn loop track. The Marshall Day Acoustics report is attached as **Appendix H**.

There is a lack of human generated noise on most of the land surrounding the monorail route. Despite the remoteness and apparent tranquillity of the area ambient noise measurements showed that the walking tracks and routes in the area were not particularly quiet. Because the tracks often follow streams and rivers, water noise is always present. The background noise level (L_{A90}) at the quietest locations was always greater than 27dB and at locations close to water it was up to 70dB. Areas well away from rivers and streams would probably

have lower noise, but these locations are also well separated from the proposed monorail route.

3.8 TERRESTRIAL ECOLOGY

Riverstone commissioned Mitchell Partnerships Limited to assess and report on terrestrial ecology issues. The Mitchell Partnerships Limited report is attached as **Appendix I.** Mitchell Partnerships Limited staff undertook surveys of the vegetation and birds along the portion of the monorail route located on Crown Land and reported on the findings of their own and previous surveys, described the ecological significance of the vegetation and fauna found to date and ranked the habitats in order of significance. They also devised ecological criteria for selection of the final monorail and construction track routes. This is discussed in greater detail in the Mitchell Partnerships Limited report (refer to **Appendix I**). This work comprised seven days of field work for two staff which included walking the whole of the route on land administered by the Department of Conservation and surveying plants and birds. It also involved a literature review to inform the presence and likely distribution of lizards, bats and threatened plants.

The route lies within the Mavora Ecological Region and crosses the steep broken country of the Livingstone Ecological District in the east and the more gentle hills and rolling country of the Upukerora Ecological District in the west. The route terminates near the boundary with the Te Anau Ecological District. Much of the Livingstone Ecological District remains unmodified and good populations of forest birds are present. The Upukerora Ecological District is more modified and much of the district is grazed. Tussock grasslands dominated by red tussock (*Chionochloa rubra*) were once widespread, but are now rare (McEwen 1987).

The route lies almost entirely within the Te Anau Basin landscape unit identified in the Mainland Southland – West Otago CMS (Department of Conservation 2000).

The route passes through Snowdon Forest Conservation Area (46, 750ha) which is part of the South West New Zealand World Heritage Area. The land at Te Anau Downs where the monorail terminates is within Fiordland National Park and is governed by the Fiordland National Park Management Plan (Department of Conservation 2007).

3.8.1 Vegetation

In all, 294 species of vascular plant have been recorded along the route, 41 (14%) of which are exotic. Exotic species found along the root are mainly herbaceous dicots such as ragwort (*Senecio jacobaea*) and thistles (*Cirsium* spp.).

Threatened plants

Only one threatened plant (the yellow mistletoe, *Alepis flavida*) has been identified along the proposed monorail route. Yellow mistletoe has a conservation status of “At risk: declining” and is considered chronically

threatened (de Lange *et al*. 2009). The possibility exists that rare plants are present but remain undetected (because of their rarity) along the route. The threatened plants considered likely to occur along the route are shown in Table 3.1.

Vegetation

In general the vegetation crossed by the route can be divided into four broad types shown in Figure 3.1

- **Mountain beech forest:** This was by far the most common vegetation type, occurring on cold valley floors, thin soils and on exposed spurs.

- **Red beech forest:** This vegetation type occurred in bands and in isolated patches along moderate slopes and raised terraces on deep, well-developed soils.

- **Mixed beech forest:** This included varying proportions of silver and mountain beech with occasional red beech also present. This vegetation type was found from the Whitestone River along the "finger", and near the saddle between Kiwi Burn and the Whitestone Valley.

- **Grassland:** Dry open areas of grassland occurred on frost flats and river banks.

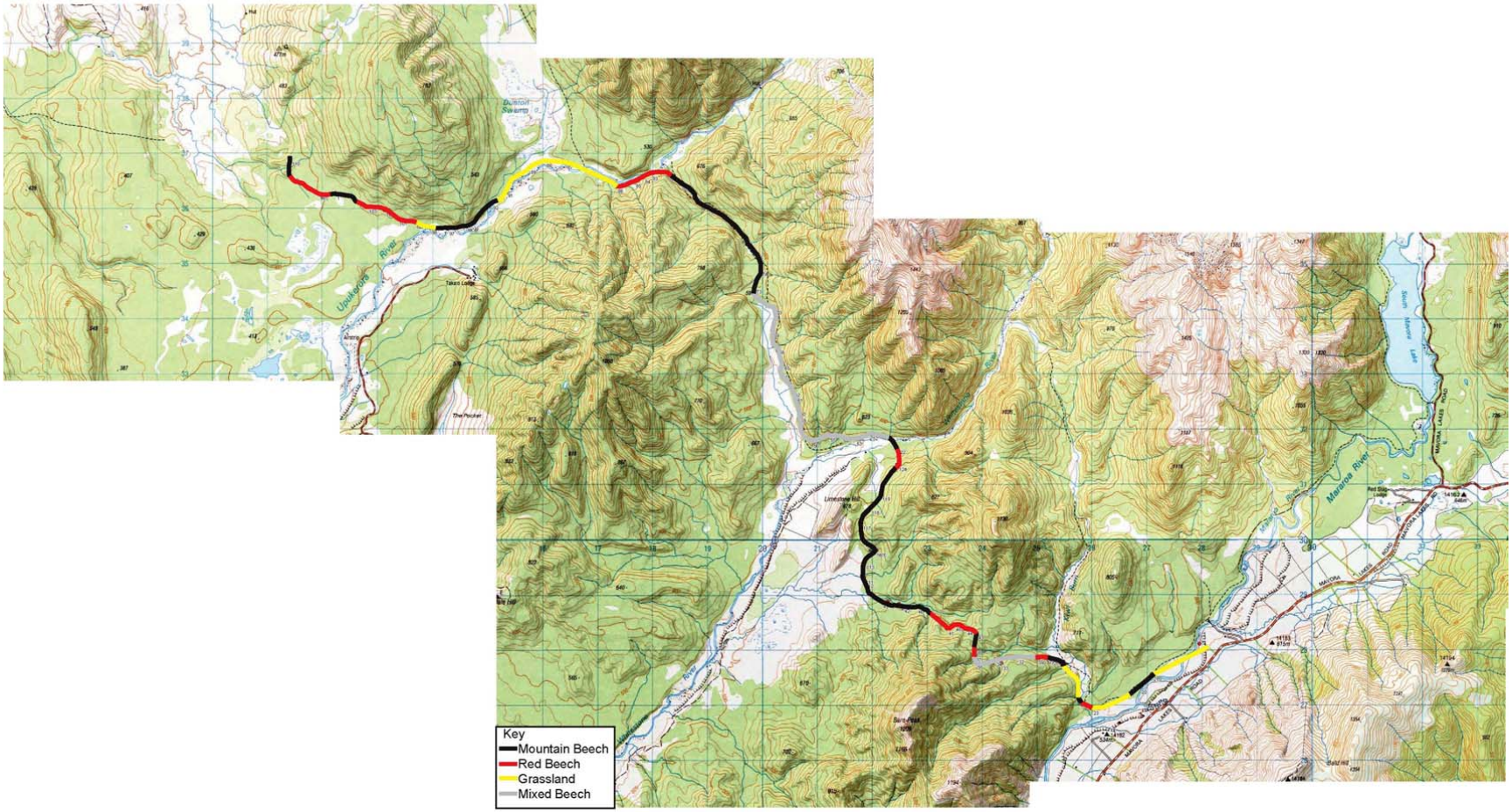

Figure 3.1: The monorail route colour-marked for each of the four general vegetation types surveyed along the route, from Kiwi Burn Terminus to near the 29.5 km mark.

These four broad vegetation types can be categorised into the following general habitat types:

- Tall, open forest with numerous cavity-bearing trees.
- Moderately tall, dense forest with few cavity-bearing trees.
- Regenerating forest (shrubland).
- Forest edges.
- Native tussock grassland
- Grassland dominated by exotic species.
- Small springs and seeps.
- Streams and rivers.

3.8.2 Fauna

Forest birds showed an east-west trend with greatest richness in the west. The most important forests for bird habitat were considered to be the tall red beech dominated forest occurring near Dunton Swamp although the shorter mountain beech forest was good habitat for rifleman (*Acanthisitta chloris*) and perhaps robins (*Petroica australis*). Twenty nine species of bird were heard during May 2009 surveys and a total of 44 bird species are expected from the area (Robertson *et al*. 2007). The threatened species either known or thought to use the habitats along the proposed monorail route are shown in Table 3.1.

No formal lizard surveys have been carried out yet, but a survey is planned for spring/summer 2009/2010 when the animals can be expected to be active. A literature review suggests that five species of lizard may be found in the proposed monorail area including the common skink (*Oligosoma nigriplantare polychroma*), green skink (*O. chloronoton*) and possibly the "Otago/Southland large gecko" (*Hoplodactylus* aff. *maculatus*). The cryptic skink (*O. inconspicuum*) and jewelled gecko (*Naultinus gemmeus*) may also be present. There has been one unsubstantiated record of the jewelled gecko from Te Anau Downs. This species is diurnal and arboreal, and could be present at beech forest edges that are fringed by manuka and/or Coprosma shrubland (M. Lettink pers. comm.). Threatened species of lizard are shown in Table 3.1.

Long-tailed bats (*Chalinolobus tuberculatus*) are likely to be present in the area, given their relatively high abundance in the nearby Eglinton Valley in forest types similar to those along the route (Sedgeley & O'Donnell 1999). Short-tailed bats (*Mystacina tuberculata*) are also found in Eglinton valley and may be present in suitable habitat along the monorail route. The Eglinton valley floor is dominated by tussock grasslands surrounded by temperate beech forests on lower hill-slopes, opening up to the low rolling hill country around Te Anau Downs. No formal bat survey has been carried out along the route line, and a survey will be carried in spring/summer 2009/2010 when these animals are more active.

No invertebrate survey has been undertaken along the route and a survey is proposed for spring/summer 2009/2010.

Table 3.2 Threatened species found in the vicinity of the proposed monorail route

Common Name	Scientific Name	Threat Status*	Likely to be present / Location
Bats			
Long tailed bat	*Chalinolobus tuberculatus*	Nationally endangered	Probably/ Forest edges and shrublands
Short tailed bat	*Mystacina tuberculata*	Nationally endangered	Possibly/ Forest interior
Birds			
Grey duck	*Anas superciliosa superciliosa*	Nationally critical	Yes/ Mararoa River
South Island kaka	*Nestor m. meridionalis*	Nationally endangered	Yes/ Red beech forest
Black-fronted tern	*Chlidonias albostriatus*	Nationally endangered	Possibly/semi-braided rivers
New Zealand falcon	*Falco novaeseelandiae*	Nationally endangered	Probably/forest and open areas
Black-billed gull	*Larus bulleri*	Nationally endangered	Possibly/semi-braided rivers
Yellowhead (mohua)	*Mohoua ochrocephala*	Nationally vulnerable	Yes/ Red beech forest
Rifleman	*Acanthisitta chloris chloris*	At risk: declining	Yes/ Widespread
Black shag	*Phalacrocorax carbo novaehollandiae*	At risk: naturally uncommon	Yes/ Mararoa and Whitestone Rivers
Long-tailed cuckoo	*Eudynamys taitensis*	At risk: naturally uncommon	Probably/forest interior and edges
Lizards			
Jewelled gecko	*Naultinus gemmeus*	Gradual decline	Survey required/ Forest, scrub, tussock grassland.
Green skink	*Oligosoma chloronoton*	Gradual decline	Survey required/ Tussock grassland, scrub and boulder fields.
Cryptic skink	*Oligosoma inconspicuum*	Gradual decline	Survey required/ Prefers areas of herbs and shrubs rather than grasslands. Tolerates damp substrates.
Otago/Southland large gecko	*Hoplodactylus* aff. *maculatus*	Gradual decline	Survey required/ Inhabits rock tors, outcrops and screes, native forest, and occasionally shrubland.
Plants			
Hook sedge	*Uncinia strictissima*	Nationally endangered	Possibly/Not recorded yet
Yellow mistletoe	*Alepis flavida*	At risk: declining	Yes/ Possibly widespread
Tufted hair-grass	*Deschampsia cespitosa*	At risk: declining	Possibly/Not recorded yet
Red mistletoe	*Peraxilla tetrapetala*	At risk: declining	Possibly/Not recorded yet
Scarlet mistletoe	*Peraxilla colensoi*	At risk: declining	Possibly/Not recorded yet
Slender purei	*Carex tenuiculmis*	At risk: declining	Possibly/Not recorded yet
	Ranunculus ternatifolius	At risk: naturally uncommon	Possibly/Not recorded yet

Note: *****Threat status after de Lange *et al*. (2009) for plants, Miskelly *et al*. (2008) for birds and Hitchmough et al. *et al.* (2007) for other fauna.

Evidence of introduced pests (particularly deer (*Cervus elaphus*) and pigs (*Sus scrofa*) was common along the route. A number of introduced mammals and other pests, or their sign, have been recorded along the route or are likely to occur there. These pest species are shown in Table 3.2. Suppression pests are those that are widespread in suitable habitat throughout mainland Southland. The goal of the Regional Pest Management Strategy ('**RPMS**') is to

suppress these pests so that impacts on the community and the environment are minimised.

Table 3.3 Pest animal abundance and distribution near the proposed route (after Lee & Elliott 1995)

Species Name	Status in RPMS	Upukerora	Whitestone	Kiwi Burn
House cat	Suppression	-	-	Open
Ferret	Suppression	-	-	Open
Stoat	Suppression	Forest/Open	Forest/Open	Forest/Open
Red deer	Suppression	Forest/Open	-	Forest
Feral pig	Suppression	Forest	Forest	-
European rabbit	Suppression	-	-	Open
Brown hare	Suppression	Open	-	Open
Magpie	Suppression	Open	Open	Open
Possum	Suppression	Forest/Open	Forest/Open	Forest/Open
Cattle	-	Open	Open	-
Rodents	Suppression	Forest/Open	Forest/Open	Forest/Open
Wasps	Suppression	No information	No information	No information

The proposed monorail route crosses a broad area of mountain, red and silver beech forest with short excursions into the grassland and tussock grassland along the river flats of the Mararoa, Whitestone and Upukerora valleys. The surveys undertaken to date, including Lee and Elliott (1995), Boffa Miskell (2006) and the May 2009 survey by Mitchell Partnerships Limited, indicate that the forest supports a variety of threatened bird species and crosses important habitat.

Parts of the route, including the tussock grasslands, are of international importance which is recognised in the World Heritage status of the site. Other habitats along the route such as the tall red beech forest are of national importance and the Snowdon Forest Conservation area generally is regarded as regionally important. The route has been modified to avoid some important habitats such as Dunton Swamp and further modification to the route will aim to avoid significant habitats.

The following habitats are considered to be of conservation significance along the route:

- Red beech forest which is tall and open with numerous cavity-bearing trees. This forest provides the most important habitat for threatened fauna within the area including nesting sites for kaka, yellow-crowned parakeet and yellowhead, and roost sites for long-tailed bats. Trees greater than 80 cm dbh and located within 500m of a forest edge are especially important for long-tailed bat roost sites (Sedgeley & O'Donnell 1999, Blakely & Didham 2008).

- Moderately tall, dense beech forest with few cavity-bearing trees which provides habitat for insectivorous bird species; rifleman in particular appear

to favour this habitat. This was the most common habitat present along the route.

- Regenerating forest which is used by numerous bird species and supports the highest diversity of species for forested habitat types. Fruiting shrubs and mistletoe probably provide a significant food source for frugivorous birds, which are not common along the route. This is also the most dynamic habitat where processes such as succession lead to high species turnover. This habitat is adversely affected by the presence of deer.

- Forest edges, which are important areas for both species diversity and forest stability. Such areas provide stability for the forest by creating a zone resilient to disturbance which buffers the forest edge from extreme climatic events. Species diversity is usually high in these areas. Many fruiting shrub species flourish in forest edges, which attract frugivorous birds and lizards (especially jewelled geckos).

- Indigenous grassland, which provides food for granivorous bird species and supports the highest species diversity of all the vegetated habitat types. Lizards, especially skinks, are likely to favour this habitat with common gecko favouring rocky areas. Lee & Elliot (1995) suggested that the key areas of significant grasslands were:

    - Red tussock grassland – this habitat occurs particularly in the valley floor grasslands of Kiwi Burn and near Dunton Swamp. The presence of red tussock grassland was partly behind the decision to include this area in the World Heritage area, also because of presence of an east – west altitudinal gradient.

    - Short tussock grassland – particularly along the Mararoa River flats. The presence of this type of habitat also probably contributed to the World Heritage Status. This habitat type includes silver (Poa cita) and hard (*Festuca novae-zelandiae*) tussock amongst the species found within it.

- Lower elevation wetlands (at approximately 150m asl) which are found where the route passes closest to the rivers in the Mararoa, Whitestone and Upukerora River Valleys. The route generally avoids these areas in the Whitestone and Upukerora valleys but crosses some wetland areas in the Kiwi Burn area (LENZ Environment L1.1c).

- The mature matagouri shrubland in the Upukerora River Valley is also considered important because of the size and age of the plants present. The area is small, less than one hectare in extent, and is located on the true right of the Upukerora River just south of Dunton Swamp (between the river and the proposed monorail route). The current route avoids this area of mature matagouri shrubland.

- Bog pine shrublands because of their lack of protection in the area. The current route avoids bog pine shrublands present in the Whitestone valley.

3.9 LANDSCAPE

Riverstone commissioned Stephen Brown Environments Limited to assess and report on the landscape issues. The Stephen Brown Environments Limited report is attached as **Appendix J**. This assessment was made in May 2009 and included site visits to a range of locations around the Von Valley, Mavora Lakes and Milford Sound and a variety of rural landscapes between Queenstown and Te Anau. These visits revealed a diversity of landscapes within, and at the edge of Fiordland National Park. The assessment involved analysis of the proposed monorail route in the field and 'subdivision' of the corridor into 21 segments, each of which have a particular biophysical and visual landscape character that differentiates them from adjacent sections of the route.

The landscapes traversed by the proposed monorail route are part of wider continuum of subalpine terrain that is imbued with many of the qualities normally associated with outstanding landscapes including:

- high levels of naturalness
- high levels of endemic values / 'New Zealandness' (related to sense of place)
- strong landscape structure
- strong landscape patterns
- visual drama
- visual diversity

When viewed at close hand, the landscape framing the monorail route is part of a wider forest/montane landscape that is undoubtedly conspicuous, eminent and, in many respects, exceptional. Although such epithets might not necessarily appear to apply at the strictly regional level – within an exceptional part of New Zealand – they more clearly do at the national level.

Furthermore, even though the route occupied by the proposed easement would skirt parts of the Whitestone Valley and river terraces near the Dunton Swamp and Upukerora River that are more modified, this remains a relative term. Indeed, these 'openings' in the monorail corridor provide opportunities to better appreciate the natural and scenic values of the wider landscape, and the monorail route would still follow the edge of an identified wilderness area – to the point where the forest / river / wetland / tussock landscapes which physically embrace that route cannot therefore be readily distinguished from that wilderness environment focused upon Snowdon Forest. As a result, it is considered that all of the route – apart from that part crossing the SH94 and entering the lodge grounds – can be regarded as passing through an Outstanding Natural Landscape.

The Te Anau Downs site and Fiordland National Park Lodge is an existing node of development along the state highway. This node also embraces the nearby jetty, but is otherwise isolated from other development north of Te Anau. This is a distinctive and physically discreet entity that complements the use and appreciation of the National Park, but displays none of the values – natural, aesthetic, or otherwise – that the National Park is recognised for. This is

recognised in the Conservation Management Plan which treats this location differently from all other parts of the National Park.

THE SOCIAL AND CULTURAL ENVIRONMENT

3.10 TOURISM

Riverstone commissioned J & H Moriarty Limited to undertake an assessment of the impact the proposed monorail and mountain bike track is likely to have on tourism at a local, regional and national level. The Moriarty Limited Report is attached as **Appendix K**. The Experience is oriented towards visitors to the Queenstown Lakes District and Fiordland regions. The basis of the experience is travel through spectacular landscapes which is either sufficient in itself or enables visitors to connect with other lake or road based opportunities.

New Zealand currently hosts about 2,440,000 visitors per annum. Visitor purpose is estimated to be 48% holidays (including independent free travellers ('**IFT**') and groups), 31% visiting friends or relations ('**VFR**'), 10% business and 11% other. The largest sector is made up of holiday makers (IFT, VFR and groups) who account for about 80% of all visitors. International tourism is nominally estimated to generate 5% of GDP, with domestic tourism contributing a similar amount. Total visitor expenditure for 2007 was $20.1 billion (Moriarty 2009).

New Zealand's arrival profile is highly seasonal. There are about 2¼ times as many peak visitors in December as there are trough visitors in June. This effect is even more pronounced for holiday makers (approximately three times as many in December as in June). Visitor seasonality is less pronounced at Milford Sound than it is for New Zealand generally (peak-trough ratio of 174%) probably due to the high number of visitors to Queenstown for winter activities such as skiing or the Winter Festival who travel on to Milford.

Regional tourism areas do not collect visitor data with reliability approaching that of the ports of entry into New Zealand and estimates of volume, visitor mix and purpose vary depending on the source. Queenstown is the main visitor centre for the lower South Island and international and domestic visitor itineraries depend on the availability of accommodation, attractions and activities within its environs. Milford Sound is one of these attractions. Although Milford Sound is only 75km from Queenstown by air most of the visitors from Queenstown travel a 570km road journey which takes up to 13 hours.

On the peak day the population of Queenstown comprises mostly people who are not permanent residents, *viz* around 1/3 of all people are residents, around 1/3 absentee owners and visitors staying in private residences and 1/3 visitors staying in commercial accommodation or day visitors.

During 2007 470,000 visitors travelled to Milford Sound, with 95-96% of these reaching the area by road. The majority of these visitors travel by coach from Queenstown which is close to a five hour trip each way. Coaches depart from Queenstown between 7am and 8.30am and most coaches arrive at Milford between 12 noon and 1.30pm. Most visitors then do a boat trip out to the edge

of Milford Sound, which takes between one and a half and two and a half hours. Thus most visitors depart from Milford between 3 and 4pm and arrive back in Queenstown between 7pm and 8.30pm. For people arranging their own transportation the timing is similar.

The number of visitors to Milford Sound is forecast to grow to 488,000 by 2012. About 18% of all international arrivals to New Zealand visit Milford Sound, and about 30% of people who visit Queenstown go on to Milford indicating the widespread appeal of the Milford Sound to visitors in the region. The facilities installed at Milford in 1992 were designed to cater for 4,000 visitors per day. This number is probably reached on a few peak days during the high season at present.

Conservation of Milford Sound will take precedence over recreational access if demand continues to rise in its current form. The absolute number of visitors that could be accommodated per day if the noon peak was spread between 0830 hours and 1800 hours is 4000. This provides an annual capacity much higher than currently recorded, but the noon peak limit of 2500 daily visitors between 1100 and 1400 hours is capable of being exceeded in summer. Time efficiency gains in long distance excursions such as the trip to Milford offer the potential to use resources more efficiently, create new economic value and improve the overall quality of the visitor's stay in the region.

Walking, sightseeing and visiting scenic or natural attractions are a priority for international visitors to New Zealand and visitor numbers are predicted to grow by around 2.3% per annum between 2009 and 2012 (Moriarty 2009). Visitor purpose in the Queenstown Lakes and Fiordland regions is predominantly recreation and sightseeing. Visitor expenditure is expected to be higher in Queenstown than the national average of $28 per hour and tourists currently spend in the vicinity of $600 million dollars per annum in the Queenstown region.

3.11 RECREATION

Riverstone commissioned Rob Greenaway & Associates to assess and report on the recreational uses and values of the area. The report from Rob Greenaway & Associates is attached as **Appendix L**. The Mainland Southland – West Otago CMS and the Fiordland National Park Management Plan 2007 are the prime documents defining the recreation setting and relevant management activities within the study area.

The monorail and mountain bike route is largely confined to the Mavora Lakes and Te Anau Basin Landscape Units defined by the Mainland Southland-West Otago CMS, but also includes an extremely small part of Fiordland National Park, at Te Anau Downs.

Nine recreation sites were identified from the proposed monorail route, only seven of which are within the Department of Conservation estate, including:

1. The Kiwi Burn parking area, including the immediate Mararoa River area and its access and access to Kiwi Burn Track.

2. Part of the Kiwi Burn Loop track and the start of the Snowdon Forest route.
3. Where the monorail intersects with Army Hut 4WD access and Takaro Lodge walks in the Upukerora River valley.
4. Whitestone River to Retford Stream.
5. Snowdon Forest hunting area.
6. Lake Mistletoe.
7. Snowdon Forest area generally, particularly Snowdon Peak and southern Dunton Range. This area is generally well-away from the monorail route but was identified in the 2007 peer review as requiring assessment.

The Snowdon Forest falls within the Te Wahipounamu (South-West New Zealand) World Heritage Area. The CMS defines the management activities required to sustain this status. In addition, the Fiordland National Park Management Plan 2007 refers to the need to manage visitors and visitor services to sustain the integrity of the World Heritage setting.

The proposed monorail route supports a variety of recreation opportunities and a number of concession holders (walking, guided fishing and some hunting). In terms of levels of use, these opportunities are centred on the Mavora Lakes camping area, which extends its influence to the Kiwi Burn round trip day walk (3½ hours).

Some recreational activity is recorded in all parts of the study area including:

- Fishing on the Mararoa River.
- Recreational driving to Mavora.
- Day walking on the Kiwi Burn round trip.
- Walking to Mistletoe Lake.
- Kayaking in the Mararoa River.

3.12 TANGATA WHENUA VALUES

Riverstone commissioned Te Ao Marama Incorporated to assess the spiritual and cultural relationship of Ngāi Tahu with the proposed monorail route in 2004. The findings of that report were confirmed by Te Ao Marama in June 2006. They are currently updating their report to reflect any changes since that date. Te Ao Marama Incorporated represents Te Rūnaka o Awarua, Oraka/Aparima Rūnaka, Waihopai Rūnaka and Hokonui Rūnaka Incorporated Society. Their report was compiled on behalf of Nga Rūnanga o Murihiku, who are members of Te Rūnanga o Ngāi Tahu and administer Ngāi Tahu interests in their traditional takiwa (region or district) which includes the proposed monorail route. The Te Ao Marama report is attached as **Appendix M**.

Te Ao Marama Incorporated used published sources and interviews with kaumatua and members of Ngā Rūnanga whanau whanui to provide insight into issues of concern to tangata whenua.

The association of tangata whenua with the Murihiku area extends back to the first settlement of Te Waipounamu by Waitaha, Ngāti Mamoe and Ngāi Tahu people. Archaeological evidence suggests that moa hunting camps were

established in the area from about the 12th Century although occupation may date back to the 10th Century (Te Ao Marama 2004). The Murihiku area was and remains well known to Ngāi Tahu. Historically they travelled great distances for the collecting of resources and accessed many of the lakes of the region by ancient trails (ara tawhito). Milford track was one such ara tawhito and provided access to the west coast where greenstone was collected.

Early māori settlers had knowledge of various routes from the Waiau, Oreti and Mararoa rivers to the interior and made annual, seasonal journeys to Mavora Lakes (Manawapopore/Hikuraki) before crossing over to the Greenstone valley. From there it was easy to access nephrite in the Greenstone River, Caples River, Scott's Creek and the Routeburn, Rockburn, Slipstream and Dart Rivers.

There will be a number of archaeological sites along the traditional routes and trails that will confirm traditional use of the area. Not all of these are known at present and there will be unrecorded sites of significance to tangata whenua. As well as archaeological sites there are wāhi tapu/wāhi taonga (places which hold the respect of the people in accordance with custom or history) and mahinga kai (places where food or other natural resources such as weaving materials are or were gathered).

The introduction of pests, domestic animals and pastoral farming along with the degradation of waterways means that Ngāi Tahu have lost many of their traditional mahinga kai.

Tuna (Longfin eel), kanakana (lamprey), kōkopu (native galaxiids), kokopara (bully), many plants and most native bird species are all highly valued by members of Ngāi Tahu as either mahinga kai or as a cultural icon.

The Ngāi Tahu Claims Settlement Act (1998) gives effect to the deed of settlement signed by the crown and Te Rūnanga o Ngāi Tahu to achieve final settlement of Ngāi Tahu historical claims against the crown. Within the settlement act are Statutory Acknowledgements which are an acknowledgement by the Crown of the special relationship that Ngāi Tahu have with the place named therein. The Mavora Lakes and Lake Te Anau are both identified within the Statutory Acknowledgements (Schedule 39 and 58 respectively, Te Ao Marama Incorporated 2006).

3.13 EUROPEAN CULTURAL VALUES

The New Zealand Archaeological Association confirmed that there are currently no recorded archaeological sites near or adjacent to the proposed monorail route (Nicola Molloy email, 23 September 2009).

Most of the focus for European cultural heritage in the Otago-Southland area is focused on gold mining activities or in coastal areas where whaling and sealing occurred. Neither of these activities occurred along the proposed monorail route.

Hodge's Stock Track is located within Snowdon Forest and the proposed route may run within a few hundred meters of the stock track alignment. This track is not maintained and the impacts are expected to be less than minor.

It is possible that there are unrecorded archaeological sites within the vicinity and all pre-1900 archaeological sites, recorded or unrecorded, are protected against disturbance under the Historic Places Act 1993. An accidental discovery protocol is proposed to protect any undiscovered archaeological sites along the route.

3.14 FARMING

The proposal passes close to a number of farming operations. In the vicinity of the Department of Conservation administered land at Kiwi Burn there is Hikuraki Station owned by Landcorp and south of the Department of Conservation boundary in the Whitestone Valley is Glen Echo Station. As well as traditional sheep and beef farming Glen Echo Station also runs significant numbers of deer. The proposed monorail does not enter either Hikuraki or Glen Echo Station.

At around 29.5km the monorail route exits the Department of Conservation estate and travels over farmland owned by Te Anau Downs Station. The route re-enters conservation land at Te Anau Downs.

3.15 TRAFFIC

Riverstone commissioned Traffic Design Group to assess and report on traffic issues. The Traffic Design Group report is attached as **Appendix N**. The road transportation network surrounding the proposal includes sections of the designated State Highway Network including State Highway 6A from central Queenstown to Frankton, State Highway 6 between Frankton and Five Rivers, State Highway 97 between Five Rivers and Mossburn and State Highway 94 between Mossburn and Te Anau Downs. Other roading links in the area include Centre Hill Road and Mavora Lakes Road which connect State Highway 94 and Kiwi Burn, the Mount Nicholas Road, The Von Road and a short section of the Mount Nicholas Station access road connecting to the proposed catamaran wharf facilities on the shores of Lake Wakatipu. None of these roads are located within the Department of Conservation Estate but State Highway 94 at Te Anau Downs and the Mavora Lakes Road at Kiwi Burn approximately 1.9km south of the Mavora Lakes turn off are adjacent to the Crown administered land.

The section of Mavora Lakes Road between State Highway 94 and Kiwi Burn is used by an estimated less than 50 vehicles per day comprising a combination of farming operations, residents in the valley, recreational trips to and from the Kiwi Burn track and Mavora Lakes to the north of Kiwi Burn.

There is a two way volume of approximately 600 vehicle movements per day on State Highway 94 between Te Anau and Milford Sound.

Summer (December) volumes are typically 2 – 4 times higher than winter (August) volumes on the road to Milford. Cars and vans make up the greatest

proportion (83%) of the total daily two-way traffic flow. Various kinds of medium and heavy vehicles (including coaches) make up the remaining 17%. The expected daily coach volume would typically be 20 – 72 coach movements per day at the State Highway 94 semi-continuous count station at Mararoa.

Traffic growth during the period 2004 – 2008 at Retford Stream was -1%, and 1% at Mararoa.

4. FACILITIES AND INFRASTRUCTURE

4.1 OVERVIEW

This section contains an overview of all the components of the proposal. This overview aims to provide the context for the monorail sector for which a concession is sought. More in-depth information is provided on the operation and construction of the monorail which would occur on land administered by the Department of Conservation.

Once the easement is confirmed by the Department, Riverstone will partner with the selected monorail supplier and the Department to work through the detailed design phase for rolling stock and the rail itself. A brief summary of details regarding the catamaran and all terrain vehicles is attached as **Appendix O**. The Operations and Environmental Management Plan (refer outline in **Appendix C**) will be developed with these parties, and will cover aspects including frequency of trips, hours of operation, health and safety.

4.2 THE MONORAIL

The electrically powered straddle monorail would carry 160 passengers plus crew and make between three and six trips a day depending on the season, demand and daylight hours. The concrete riding rail would have a smoothed surface. The monorail cars would run on rubber pneumatic tyres which would reduce noise and increase the comfort of the passengers. The trip would pass though tussock land, forest, and farmland and cross a number of significant rivers offering expansive views at various points.

The design of the monorail trainset would be finalised after the concession application is completed. The following information is indicative:

Capacity	160 plus crew
Length	68 metres
Speed maximum	90km/h (at 4% grade)
Speed average	75kph
Sector distance	43.8km
Sector travel time	33 min
Maximum grade	6.5% (1:15.4)
Turning	30m radius at 15km/h
Vehicle Height	2.4m above rail
Vehicle Width	2.4m - 2.6m
Power	Electricity 1000kVA at 11000 volts
Track Construction period	30 months

4.2.1 Monorail Track

The monorail track would comprise a single generally pre-stressed hollow concrete box section rail track. The beam that will make up the rail track will be approximately 1.0m wide and 1.0m deep. However the beam dimensions may be varied to train supplier requirements but the beam weight would remain the same.

The supporting piers cross-section would be approximately 500mm wide by 400mm. These smaller section precast support piers will generally be at 20m intervals. The structure would only depart from the standard design where larger possibly steel spans are required for crossing rivers, for small radius curves or softer ground that requires the line to have a greater number of supporting piers. A mix of 95% concrete and 5% steel rail has been estimated for the purpose of capital expenditure forecasts.

The top of the rail would be generally one to two metres above the ground. This height would vary from one to six metres above ground level to allow vehicular or pedestrian access and as necessary to establish a consistent grade, pass waterways and ground undulations avoiding excavation along the rail route.

The track could initially cater for one train and there would be a turning circle at each end. The turning requirement is a circle with a 30m radius at 15km/h. To provide for expansion of the FLE capacity the ability to run up to four train sets on the track at any time is required. This possibility would be catered for by installing passing bays which in effect are additional sections of track approximately 100m long. These extra sections of track for passing bays will be installed during the initial construction phase. Up to three passing bays would be required at approximately the 10, 20 and 30km marks, (the quarter points), along the route.

4.2.2 Appropriateness of Monorail

The monorail mode is preferred over other options such as light rail or road. Factors such as its lower environmental impact due to smaller footprint, lack of substantial earthworks, mode of power and noise levels make it an attractive option for the route selected. Low operating costs, viewing quality and marketing appeal further support its selection.

The project proposal is based on the straddle monorail systems produced for example by Bombardier Company, Scomi Group Bhd and others. Tenders will be sought for the supply and associated engineering of the monorail. The option provided will be evaluated and a preferred alternative and supplier selected.

4.3 DESCRIPTION OF BUILDINGS

A number of facilities will be required to support the operation and movement of passengers through the three transport modes provided by the Experience. In addition to the permanent facilities there will be a number of temporary construction facilities required. Only the termini proposed at either end of the monorail route at Kiwi Burn and Te Anau Downs will be located on land administered by the Department of Conservation and are the subject of this concession application. Riverstone commissioned Salmond Architecture to design terminus buildings for the project and their report is attached as **Appendix P**.

4.3.1 Kiwi Burn Terminus

Figure 4.2 Image of Kiwi Burn Terminus see from foot footbridge

Figure 4.3 Image of North Façade of Kiwi Burn Terminus

The Kiwi Burn terminus is located in a natural valley formed by the Mararoa River. The building site is screened from the southern approach from the road because it is located on a lower glacial terrace than the road. The building site is also screened from the northern approach by shelter belts and the topography. The building will be seen against the backdrop of the high ground behind the building, rather than against the skyline and the narrow width of the building minimises the visual impact from the road and from the swing bridge approach.

Buildings in the surrounding area are typically agricultural in purpose and have long low forms. The terminus building will be approximately 80 m long and 13 m wide and will be located on piles so as to connect lightly to the site. The form of the building has been broken up to give five small roof plans rather than one large one. This reduces the apparent length and scale of the structure to make it consistent with other buildings in the area. The use of different cladding materials (corrugated steel, timber) further breaks up the form of the building. Materials will be coloured to be recessive in the landscape and a combination of light and shade created by using a combination of natural materials will further minimise the visual impact of the building on the surrounding area.

The terminus building will provide shelter and the necessary amenities for travellers. Screens and printed glass panels will be used inside the terminus to provide interpretive material for visitors. The building allows for choice about the level of shelter depending on the weather conditions and individual preference. Toilets will be accessible from inside and outside the terminus building and toilet areas will be naturally ventilated by vents in the floor and at

high level and lit by translucent roofing material. Water and waste management will be designed to have a neutral impact on the environment.

The design is flexible to allow for expansion or variation in height and location as required and inside the building there will be spectacular views and a good connection to the landscape.

4.3.2 Te Anau Downs Terminus

Figure 4.4 Image of Te Anau Downs Terminus seen from lodge

The exact site of the Te Anau Downs terminus and its relationship to other buildings on the site will be confirmed during the detailed design phase of the project. The Te Anau Downs site slopes away from the road towards the lake and the buildings will be concealed from view from the road except for a brief glimpse on approach. The terminus will be visible from the monorail as it crosses the road to the site. Retaining walls, vegetation and contours will be used to screen vehicles from view.

The Te Anau Downs terminus will be larger than the Kiwi Burn terminus, potentially incorporating a cafe and kiosks. The design will be similar and the form and scale of the building will be designed to blend in with other buildings in the landscape and connect with the landscape in a sympathetic manner. The materials for the building will be natural and recessive in colour and passive environmental design will maximise the natural advantages of the site. The building services will have a neutral impact on the environment.

4.4 PASSENGER CONSOLIDATION AND CAR PARKING FACILITY

The applicant is prepared to fund the construction and operation of a vehicle consolidation facility at Te Anau Downs. This provides the opportunity for developing a facility at Te Anau Downs where visitors to Milford Sound/Piopiotahi could consolidate from private vehicles (cars and campervans) into coaches for the road between Te Anau Downs and Milford Sound/Piopiotahi. Secure parking facilities would be provided and an area developed where people transitioned from car to coach.

There are a number of potential benefits from adopting this initiative. From a visitor experience perspective, all people arriving by car, including the driver, would be able to enjoy the spectacular scenery along this section of the route.

Passengers could also get greater knowledge of the area through the commentary provided on all or some coaches. From a conservation and tourism perspective there would be less pressure on car parking facilities at Milford Sound/Piopiotahi. It could also facilitate a new approach to manage the scheduling of vehicles at stops along the Milford Road thereby reducing the congestion that currently occurs at the popular sites. Certain coaches could schedule to stop at some attractions on the way to and from Milford Sound/Piopiotahi. From a safety and congestion perspective this consolidation would mean there would be largely professional and experienced drivers on this difficult sector of road. Accidents would be less likely to occur and the traffic flow would be improved.

The planning, design and construction programme would be integrated with that of the Te Anau Downs terminus.

4.5 OTHER INFRASTRUCTURE

4.5.1 Roading

The existing network of roads is considered adequate to cope with traffic of the type generated by this proposal.

It is proposed to form and seal the access road to the Kiwi Burn terminus and the intersection of the terminus access road with Mavora Lakes Road. This vehicle access road will be approximately 200m in length (including a turnaround loop) and at least 6m wide. Seal would extend for at least 50m either side of the junction on Mavora Lakes Road. This will reduce dust generation and allow easy manoeuvring of vehicles adjacent to the terminus building.

At Te Anau Downs the intersection of State Highway 94 and the Fiordland National Park Lodge would require a separate, marked right turn bay to safely separate turning and through traffic. The details of this intersection, its construction and operation would be the subject of future, detailed negotiation and agreement with the New Zealand Transport Authority.

4.5.2 Power Supply

A 1000kVA power supply will be required at 11,000 volts at the termini at either end. This will require upgrading of the present 2 phase and 3 phase power to 11Kv power.

The 11,000 volt mains power supply will be reticulated along the track to package type transformers. These transformers will be located at suitable pier sites at intervals along the track.

The risk of power failure or interruption would be mitigated by having a backup generator housed in a building at Te Anau Downs. This generator would be sized to power the trains at a reduced speed. A 300kVA generator is currently being assumed for the project capital expenditure estimates. Although normal power supply is via both ends of the track, emergency power supply would only be required at one end of the track.

4.5.3 Water Supply

An estimated 15,000 litres of water per day is required to service the Kiwi Burn terminus. This could be taken from the nearby Mararoa River, with the intake location and structure to be confirmed during the detailed design phase. Water will be pumped from the river to the building and stored in tanks which can be situated below the building or otherwise screened.

4.5.4 Sewage Disposal

The Kiwi Burn terminus will contain toilet and handwashing facilities available for use by both monorail passengers and day visitors to the area. Wastewater generated there will be treated using a septic tank based system with a packed media bed reactor system or similar for effluent polishing. The tanks can be buried adjacent to the terminus building.

The treated effluent will be discharged to a disposal area. Options for disposal include drip irrigation fields, an evapo-transpiration system, or a sand trench system. A suitable system can be selected once detailed investigation of soil types and infiltration rates is carried out as part of the detailed design phase of the project. Based on initial user numbers a disposal field area of approximately 2000 m^2 is expected to be required for treated effluent disposal. There is sufficient suitable land available within the site for treated effluent disposal even if numbers grow as projected, although adjoining landowner approval will be required (Opus 2009).

4.5.5 Stormwater Disposal

Stormwater from the roof of the Kiwi Burn terminus will be captured and discharged directly to ground or to surface water via downpipes. Stormwater from hardstand, car park and roads would be directed into adjacent grassed swales to provide some treatment before discharge. During construction of the Kiwi Burn terminus, erosion and sediment control measures will be required to prevent discharge of sediments to the surrounding environment.

4.5.6 Communications

There will be telecommunications to the Te Anau Downs terminus, where the control station will be located. An existing telephone service to Te Anau Downs already exists. There will be public phones available at this terminus in addition to lines for operations staff.

There will need to be a reliable communication system and a backup for communication with the monorail trains, termini and ATV's. There will also be a communication link to monitor the rail for any serious disturbance such as cracking, breakage or other structural fault. One potential method is to fix a telecommunication cable inside the monorail track. The choice of technology and operation will be decided post the concession process as part of the detailed final engineering work.