



## STAFF REPORT

**TO:** Environment & Planning Subcommittee

**FROM:** Andrew Burton, Resource Scientist

**REFERENCE:** L213

**SUBJECT:** **SOILS INFORMATION IN THE TASMAN DISTRICT – REPORT EP06/05/11** – Report Prepared for 10 May 2006 meeting

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### 1. INTRODUCTION

The intention of this report is to outline the need and importance of information of our most precious resource in the district, the current information available on our soil resource and the requirements for better information as necessitated by Council's responsibility to maintain and ensure the wise use that resource.

Soils have many important functions. Perhaps the best appreciated in the Tasman District is the function to support the growth of agricultural, horticultural and forestry crops. Soil is the medium in which growth and ultimately the yield of crops occurs. They are also essential for maintaining natural vegetation and play a fundamental role in the quality and distribution of our water resources. Soils have been recognised as having a key role in modifying and ameliorating the risks and effects of climate change. Soil organic matter is one of the major pools of carbon in the biosphere and is important both as a driver of climatic change and as a response variable to climate change, capable of acting both as a source and sink of carbon.

To understand a soil's function we need to know about its basic physical make up, its limitations and how it reacts to stresses we place on it. Knowing these limitations is vital if we, as council, are to assist the community to manage our soils and land sustainably.

*"To be a successful farmer one must first know the nature of the soil.*

- Xenophon, Oeconomicus, 400 B.C.

The emphasis in this report is placed on the soils function to support the growth of agricultural, horticultural and forestry crops.

### 2. EXISTING PUBLISHED INFORMATION

Two main soil surveys exist for the Tasman district. They are:

- The "General Soil Survey of the South Island." (1968) this was carried out to give an overall picture of soil pattern and to provide basic information for predicting future land use and broad fertility needs on a national basis. It was carried out at a scale of 4 miles to 1 inch. (1:250,000).

- “Soils and Agriculture of the Waimea County” (1966). This report is a culmination of a number of surveys and maps carried out and compiled over the years dating back to the 1920’s. It included surveys of the flood plains and lower terraces to classify soils for tobacco culture and also included reconnaissance surveys for the General Soil Survey of the South Island. The Soils and Agriculture of the Waimea County was published at a scale of 1:127,000.

The Waimea County does not include all of the Tasman District but in those areas it does cover, the Waimea and Motueka catchments in general, field maps exist for the plains and valleys at a scale ranging from 1:15,840 to 1:36,000. Some of these do not have keys and the textural information they display, by itself is, of limited value. However they potentially are a very useful base to develop new maps from.

In 1977 the New Zealand Land Resource Inventory (NZLRI) was published. This classification used soil information from the two surveys described above as the base information. The “mappers” of the NZLRI refined some of the soils data by simply interpreting landscape patterns. Little, if any on-site assessment was carried out to ground truth these refinements. However the result is a slightly more detailed soil map.

### **3. LIMITATIONS OF THIS INFORMATION**

The General Soil Survey of the South Island has limited use at a regional level simply because of the scale it was mapped at. Even with the refinements carried out under the NZLRI exercise, the soils information for the Upper Buller and Golden Bay area, in particular, is not of adequate detail to provide information for land use or planning exercises.

The “Soils and Agriculture of the Waimea County” (1966) does provide good information on the soil types and includes general information on land use and limitations of the soils to use. Soil chemical analysis of most soils is also provided. Although this information is accurate the scale limits its use and there must be a lot of information on these soils and their productive potential that has been gathered over the last 35 years. As with any data base updating of the information is important.

In compiling the Soils of the Waimea County publication, field maps were produced at a scale of 1:15,840. These were not published with that report. The published map was produced at a scale that offers better definition than the South Island Soil map but still is not suitable for planning purposes today or in the future. As an example, the “Classification System for the Productive Land in the Tasman District” (Agriculture New Zealand) that was produced in 1994 used as part of its classification process, this survey information. It is described in the report that one of the limitations of the classification system is the “coarseness” of the original soil maps. One of the comments made in the report is *“Boundary lines are only as accurate as the underlying soil and topographical maps. In some cases, boundaries shown on the district map will be accurate. However, in many cases the boundary may not be determined accurately until a field inspection is known”*. Obviously a more useful classification system could be achieved with better baseline information and a greater degree of user confidence gained without the need for constant field visits.

The soils information for Council's planning purposes and consent processing is being requested more often and at greater detail.

As described, the existing soil information is used as a base data set for a number of other information sets and planning tools such as the Classification System for the Productive Land in the Tasman District, the NZLRI, and the Environmental Domains classification. The quality of all these classification systems will be influenced by the quality of the soils data used.

In summary:

- For the Upper Buller and Golden Bay areas the soil information has been mapped at a scale of 1:250,000 with some minor refinements made since publication. The information has major limitations for regional planning and on-farm management use.
- For the Waimea and Motueka catchments the published maps are at a scale of 1:126,000. These maps have limitations to use for regional planning needs. The supporting information is of good quality but can and should be updated. The field maps are of a scale and at a detail that may provide excellent information for regional planning and on-farm use but also require some further field work and analysis to make the information complete.

#### **4. TODAY'S SOIL INFORMATION REQUIREMENTS**

In the Tasman district there are two main users of soil information: landowners and entrepreneurs who want to use the land for productive purposes: and the Council with its requirements to achieve sustainable land use in the region through plan development and environmental monitoring. The scale and detail of information required does differ between these two needs. The landowners, etc who wants information to assess productive potential may deal with a wide scale range of maps and detail of information. Scales between 1:1,000 and 1:50,000 may be used depending if they want to, for example, gain information on an individual property, or, want to assess the potential of a particular crop that is suited to a particular soil type in a particular climate range in the district.

The Council has a wide range of uses for soils information. Soils information is used when formulating and reviewing policies such as the required review of the Rural 1/Rural 2 zone boundaries. This review almost completely relies on land productivity information which is based primarily on soil and climate factors. The problems facing Council Policy Planners with the existing boundaries is one its inaccuracy which relates back to the underlying soils dataset.

Consent Planners require a good detail of information, ideally at a farm scale, when dealing with resource applications such as rural subdivisions, boundary relocations and land use changes.

To carry out environmental monitoring on land use effects, the base information used has to be of a standard in both its accuracy and detail to make valid judgements. The latest soil health monitoring evaluations highlighted the inaccuracy of the existing published maps and data. Consequently the extrapolation of the results from this

evaluation is dictated by the quality of the regions soil information. As this improves so too will the value of the monitoring.

The Council's information requirements cover a varying range of scales and degree of detail. Looking at other recent soil mapping work carried out, primarily for planning purposes, for other Regional Council's in New Zealand the scale of these mapping exercises is generally in the 1:20,000 to 1:50,000 range. The Topoclimate project carried out in Southland was also carried out on a 1:20,000 scale. This project aimed at providing information for landowners as part of a Regional Councils/District Councils assisted initiative to stimulate rural production and growth. The recent "Crops for Rural Dunedin" soil surveys were also carried out at 1:20,000.

### **Recent Soil Survey Work in the District**

Council has been active in developing new soil information. The first basic requirement is better detailed and more accurate soil maps.

### **Motueka and Riwaka Plains**

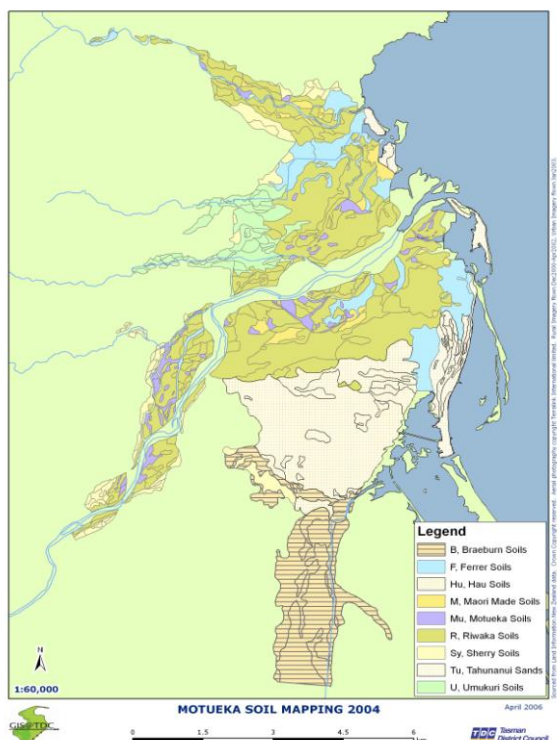
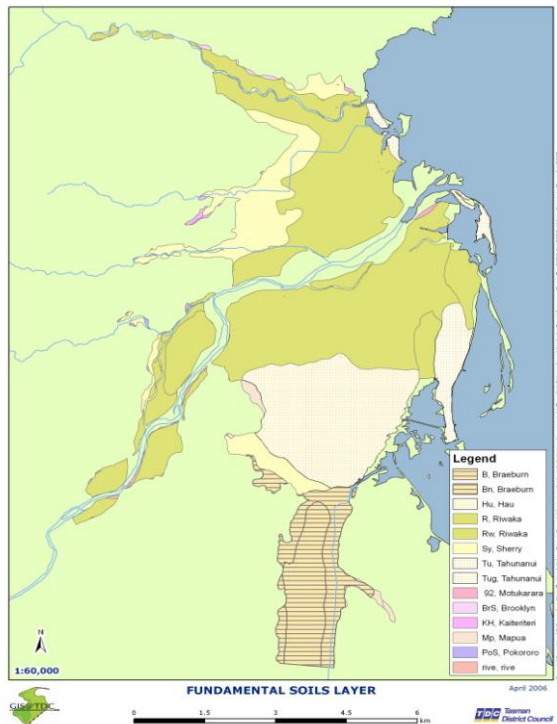
In 2003 Council contracted Massey University to carry out a study of the unpublished field maps that exist as part of the "Soils and Agriculture of the Waimea County". (1966) survey. A Masters student carried out the study as part of his degree requirements. Under that contract the maps covering the Motueka and Riwaka plains were digitized to produce electronic georeferenced maps and stored on the Councils GIS database.

In the field the accuracy of the soil boundaries on the maps were checked and found to be accurate. The existing soils data which contained primarily information on the texture of the topsoil and subsoil was also checked for accuracy and additional data on the soils was completed. Rather than trying to complete a comprehensive coverage of the entire study area, intensive examinations of selected sites were carried out to assess the variability within soil types as well as provide comprehensive descriptions for the existing map units. Soil physical and chemical analysis was carried out on the four most extensive, in area, and intensively used soils (Riwaka, Umukuri, Sherry and Ferrer soils) The information gathered from the site examinations included those parameters in the Councils "Protocol for assessing the value of productive land," Being:

- drainage and permeability,
- soil structure and texture,
- rooting depth,
- fertility,
- water holding capacity.

These parameters are also required to define the soils with regard to the New Zealand Soil Classification (Hewitt, 1998). This new classification is based around those features of the soil that dictate plant growth. Variables such as depth to gravels or water table, and the presence of impeding features such as pans have been considered in defining new classes. Hence aligning Council's survey work with the New Zealand Soil Classification (Hewitt, 1998) has major advantages.

The final outcome of this contract with Massey University was a Thesis document: "Soil Mapping, Compilation and Land Evaluation of the Motueka, Riwaka and Moutere Valleys." The detail of the mapping is intensive and remained at the original scale, (1:36,000) of the unpublished field maps. Two new soil series, the Ferrer and Motueka soils, were defined and an obsolete soil series, the Umukuri soils, was reinstated. The detail of the new maps is compared to the 1966 maps below.





The new mapping also distinguishes between soil types within each series. For example the Ferrer soil series comprises of six soil types, being:

- Ferrer coarse sand
- Ferrer medium sandy loam over gravel
- Ferrer fine sandy loam over gravel
- Ferrer silt loam
- Ferrer silt loam over gravel
- Ferrer clay loam.

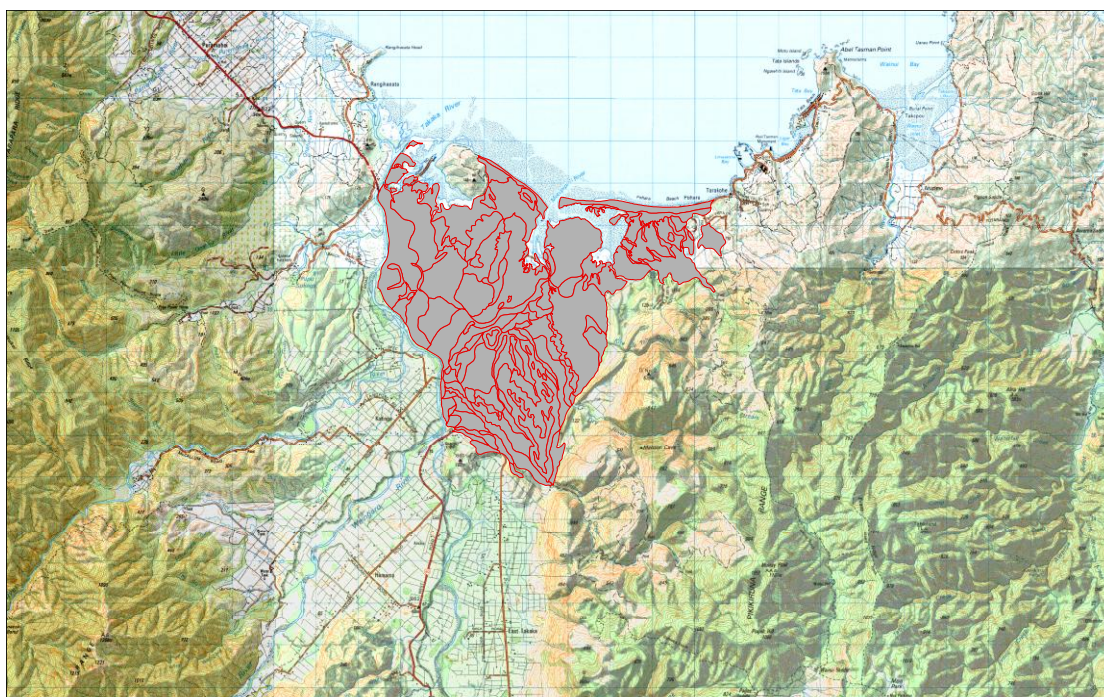
As a consequence of this new mapping, boundaries between soil series are more accurate, the definition between soil types within the series is now defined and the detail of the soils physical and chemical properties is more extensive.

Some additional work will be carried out by Massey University to provide a comprehensive description of the Hau and Braeburn soil series to complete the soils description for this area. This will be carried out at no cost to the Council.

The thesis also described geology, climate and the current land use of the study area. It also evaluates some soil types with regard to versatility and crop suitability. Although this evaluation is limited to only three soil types it is useful in demonstrating the range of versatility classes present in the study area.

### **Takaka Valley Mapping**

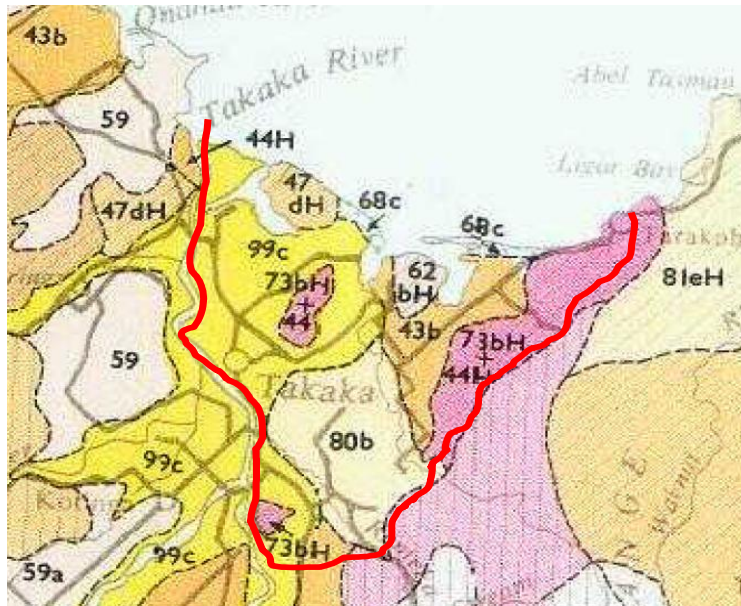
In 2005 the Council contracted Dr Iain Campbell to carry out soil mapping over approximately 3,270 hectares of land at the seaward end of the Takaka Valley. The area included those areas, namely the flood plains and lower terraces in the Motupipi, Clifton, Takaka township, Waitapu and Rototai area as indicated on the map below.



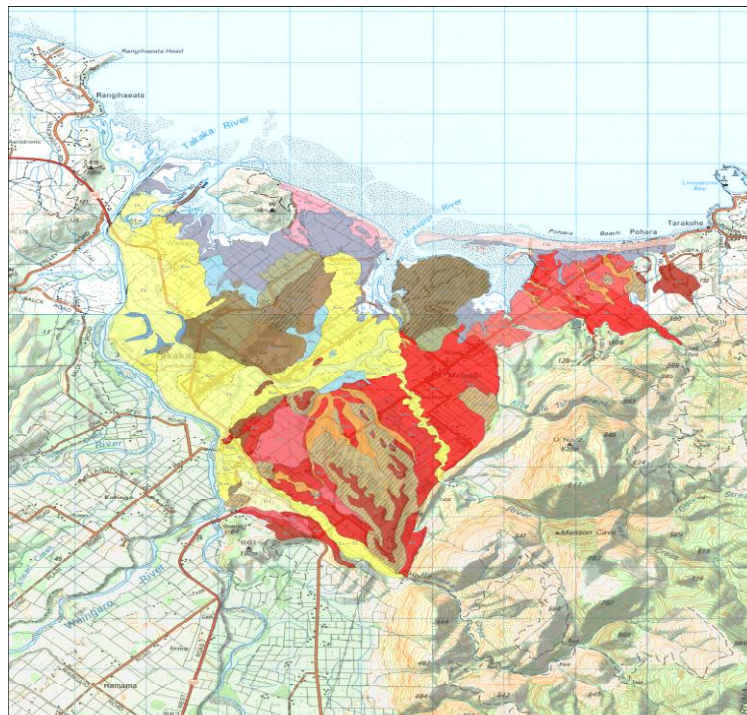
Takaka Valley Mapping Area 2005 (grey area with red borders)

Mapping was carried out at a scale of 1:20,000. Soil boundaries were mapped and soil descriptions were produced for each soil type. This area of the Takaka Valley was selected as a priority due to the potentially high versatility of some of the soils in the area, the presence of some unique microclimates and the pressure of subdivision and land fragmentation in this area. The cost of this programme was \$42,000.

Within this area 31 soil types and 122 discrete soil units have been identified and mapped. This compares to the 7 soil types and 10 discrete units of the "General Soil Survey of the South Island." (1968). The difference in detail between the two maps is demonstrated below.



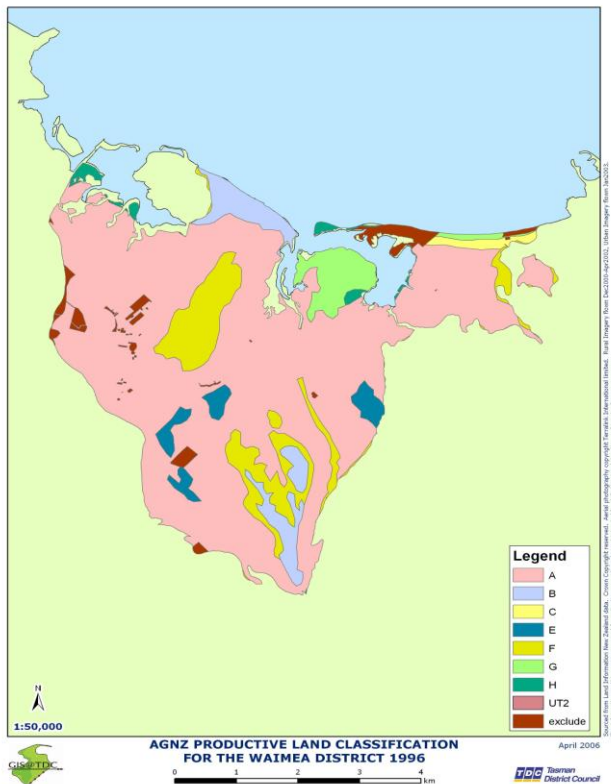
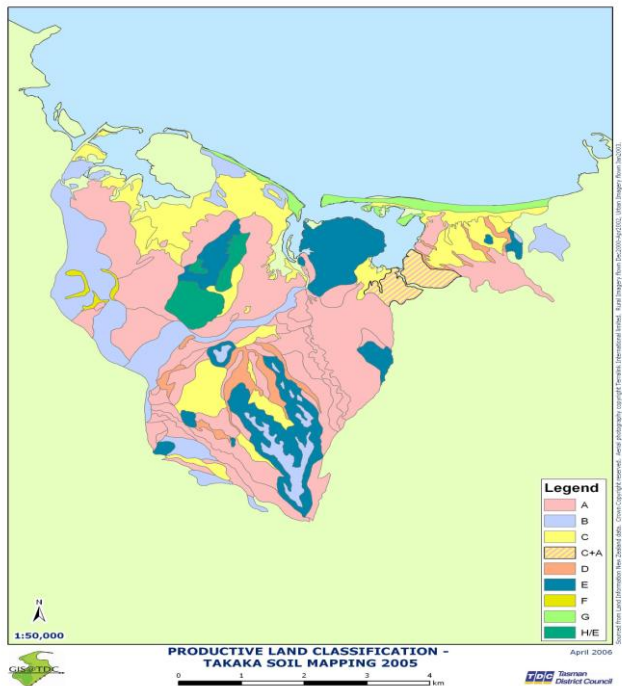
"General Soil Survey of the South Island." (1968): 7 soil types and 10 discrete units



Takaka Valley Mapping Area 2005: 31 soil types and 122 discrete soil units



The information gathered on each soil included a profile description and land productivity rating. This rating was carried out in the same manner as the “Agriculture New Zealand Classification System for Productive Land in the Tasman District” to provide continuity between the ratings. The difference between the “Agriculture New Zealand Classification System for Productive Land in the Tasman District” (1994), which used the old published soils maps as a base data, and the rating carried out as part of the new soils mapping is demonstrated below.



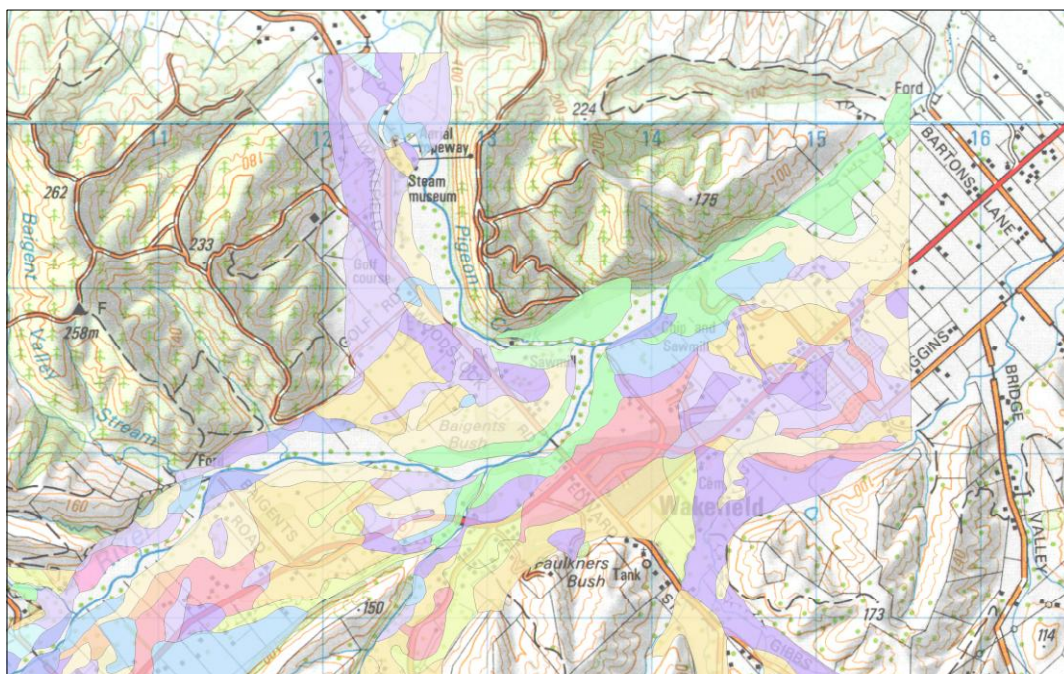


The soil mapping information for this area has been compiled in a report titled: “Soils of the Lower Takaka Valley” by Dr Iain Campbell, Land & Soil Consultancy Services. This report requires adoption by Council prior to Council use. Also as soil surveys of this type are used by the general public its publication is beneficial. This forms part of the recommendation of this report. The report can be accessed by the link: [file:///A:/TSRVFILE/E&P\\$/Environmental/Andrew\\_Burton/Soil\\_Mapping\\_Tasman\\_General/Takaka\\_Soil\\_Mapping/TDC\\_SOIL\\_SHEETS.doc](file:///A:/TSRVFILE/E&P$/Environmental/Andrew_Burton/Soil_Mapping_Tasman_General/Takaka_Soil_Mapping/TDC_SOIL_SHEETS.doc) or a copy can be requested from the writer

### Waimea County Field Maps.

As discussed earlier, the “Soils and Agriculture of the Waimea County” (1966) survey also included a set of unpublished field maps, these exist for the plains and valleys at a scale of 1:15,840. Some of these do not have keys and, textural information by itself is of limited value. The majority of these maps have been digitized and are on the Council’s GIS. The Motueka and Riwaka Plains map was invaluable for the Massey University work carried out in that area. Evaluation on the maps covering the Motupiko Valley as part of the water augmentation study currently being carried out indicated that there were major limitations to their use. The mapped soil boundaries did not relate well to topographical features and the boundaries on the published maps.

The history behind these maps, who mapped them and for what specific purpose, is unknown, hence there may be some variability between field maps. Some work on these maps is required to assess their value. An example of one of the maps is shown below highlighting the degree of detail present. The scale is at 1:15,840 and the area covers is part of the Wai iti Valley.



Field map of the Wai iti valley overlaid on topography 50K GIS imagery.

## **Proposed Soil Survey Work in the District**

As outlined earlier, information on soil through the district is essential for a number of Council functions, namely policy and planning, consent processing and environmental monitoring. The recent work has been carried out at scales and to the detail required to carry out these functions. There are many other areas in the district where soils information should be improved.

### **Takaka Coastal: Rangihaeata, Puramahoi, Parapara area**

Mapping of an area adjoining the Takaka Soil Mapping 2005 area to the west along the Puramahoi coastal zone has been budgeted for and will be carried out in the 2006/7 financial year. Again this area has some very high quality soils present and the current information and mapped detail in this area is very limited. Because of its coastal location this area is also being targeted for rural subdivision and development. The area is approximately 2,300 hectares. The "elite" soils on the plains and terraces will be targeted.

The mapping will be carried out at a scale of 1:20,000 and detailed soil descriptions will be produced. Field mapping will be completed by September 2006 and the maps and soil description report completed by November 2006. The cost for this programme is \$29,500. The budget for the 2006/7 financial year for soil mapping is \$20,000. The shortfall of \$9,500 to complete this programme will hopefully be made up from external funding through the Landcare Research "S-map" project.

### **Mid Takaka Valley**

This area, including Waikoropupu, Kotinga, Hamama, and East Takaka, will be targeted in 2007/8. The total area is 4,700 hectares. This area has high quality soils and the climate, although less favourable than some of the coastal areas for growing a wide range of crops, it is still favourable for a reasonable range of crops.

The mapping will be carried out at a scale of 1:20,000 and detailed soil descriptions will be produced. Field mapping, map production and the soil description report will be completed in the 2008/9 financial year. The estimated cost for this programme is \$61,000.

### **Upper Takaka Valley**

This area covers the Uruwhenua and Upper Takaka Valley area. The total area is 1,850 hectares. This area is almost solely used for pastoral farming, primarily due to climate limitations having a combination of higher rainfall and lower sunshine hours due to shading from the hills. Being situated away from the coast and the Takaka township there appears to be little pressure on this area with regard to subdivision and development. The area is intensely farmed and more detailed information would assist in land management and state of the environment monitoring.

The mapping could be carried out at a scale of 1:50,000 and detailed soil descriptions produced at an estimated cost of \$20,350. This is not a high priority area.

## **Aorere Valley**

Environmental effects and soil health issues are the key driver for more detailed soils information in this area. This is influenced primarily by the combination of intensive land use (dairying) and high annual rainfall. Like other areas in the Golden Bay the quality of the existing mapping is inadequate.

Mapping could be carried out adequately at a scale of 1:50,000 and soil description and classification should include structure vulnerability indexing and infiltration and drainage classifications rather than land productivity and versatility parameters. Even though this scale would not be appropriate for farm or paddock scale use, it would still provide very useful information to landowners to include into their on farm management systems. Particularly in relation to fertilizer use and land based dairy shed effluent disposal.

The area covers 5,400 hectares. Mapping, soil description and categorization could be produced at a cost of \$59,400. This work is of moderate priority.

## **Murchison and St Arnaud**

This area covers large alluvial flats associated with major river systems. Approximately 12,000 hectares of flat land classed as D, (there being no A, B or C class land present) are intensively farmed. The majority of it is being farmed as sheep and beef with some dairying concentrated around the Murchison area. Climate is the major limitation to the versatility and productive potential of this area hence upgrading of the soil mapping presently would not provide very useful information for Council. There is not the pressure on this area with regard to intensive subdivision or other planning issues. This work is of very low priority and an estimate of costs has not been made.

## **Moutere Valley and Upper Motueka Catchments**

The Moutere, Orinoco, Dove, Stanley Brook, Tadmor, and Motupiko Valleys are covered to a large extent by the old existing field maps at a scale of 1:15,840. As discussed earlier these are unpublished field maps that were used when compiling the "Soils and Agriculture of the Waimea County" (1966) survey. Most have no keys. Most have been digitized in order to capture the data for future use. These maps need to be assessed for their usefulness. There appears to be differences between maps with regard to the colour and numerical codes, hence each map may have to be checked and decoded.

This initial assessment is estimated to cost approximately \$12,000. After this assessment it will be necessary to carry out further field work. It is predicted that most of the information on these existing field maps is based around textural differences. Additional information on soil depth, water holding capacity and permeability are also required to build up a picture on the soils productive potential.

Much of these valley areas are mapped as class B land and is zoned Rural 1 under the Tasman Resource Management Plan indicating their high value. The current need to review the Rural 1/Rural 2 zone boundaries in most of these places means that there is a high priority to get this initial assessment underway. This has been identified as a Rural Futures need by RMPC.

Until this initial assessment of the field maps is carried out, an estimate of costs on the additional work cannot be accurately made.

### **Waimea Plains and Wai iti Valley**

1:15,840 unpublished field maps exist for both the Waimea Plains and Wai iti Valley. The Waimea map still requires digitizing but has an existing key and it has been used in the past to a limited extent for specific project work. This work has indicated that the information on the map is accurate and only requires some additional field work to provide Council with useful information. The cost of carrying out the assessment and fieldwork over the 6,000 hectares of the plains is \$37,200. The priority to do this work is moderate to high. Although the plains are already intensively subdivided there is still pressure on the high quality land through rezoning for urban and industrial growth.

The Wai iti Valley map has been digitized but also requires the initial assessment and further field mapping to provide useful information. The cost of doing this initial assessment over the 1,750 hectares is \$5,250. The priority to do this work is moderate to high. The review of the Rural 1/Rural 2 zone boundaries in this area will depend on this information and the follow up field work.

## **5. SUMMARY OF COSTS**

### **Expenditure to date:**

|                           |          |          |                |
|---------------------------|----------|----------|----------------|
| Motueka and Riwaka Plains | 4,350 ha | 2003/4   | \$20,000       |
| Takaka Valley (coastal)   | 3,265 ha | 2004/5/6 | \$42,000       |
|                           |          |          | Total \$62,000 |

### **Proposed Programme:**

|                            |          |          |           |
|----------------------------|----------|----------|-----------|
| Takaka Coastal (Puramahoi) | 2,300 ha | 2006/7   | \$29,500  |
| Mid Takaka Valley          | 4,700 ha | 2008/9   | \$61,000  |
| Upper Takaka Valley        | 1,850 ha | 20010/11 | \$20,350  |
| Aorere Valley              | 5,400 ha | 2009/10  | \$59,400  |
| Moutere/Upper Motueka*     | 6,800 ha | 2007/8   | \$12,000  |
| Waimea Plains              | 6,000 ha | 2007/8   | \$37,200  |
| Wai iti Valley*            | 1,750 ha | 2007/8   | \$5,250   |
|                            |          | Total    | \$224,700 |

(\* initial assessment of field maps)



## 6. RECOMMENDATIONS

That this report be received

That the report: "Soils of the Lower Takaka Valley" by Dr Iain Campbell  
Land & Soil Consultancy Services be adopted by Council for use and publication.

Andrew Burton  
**Resource Scientist (land).**