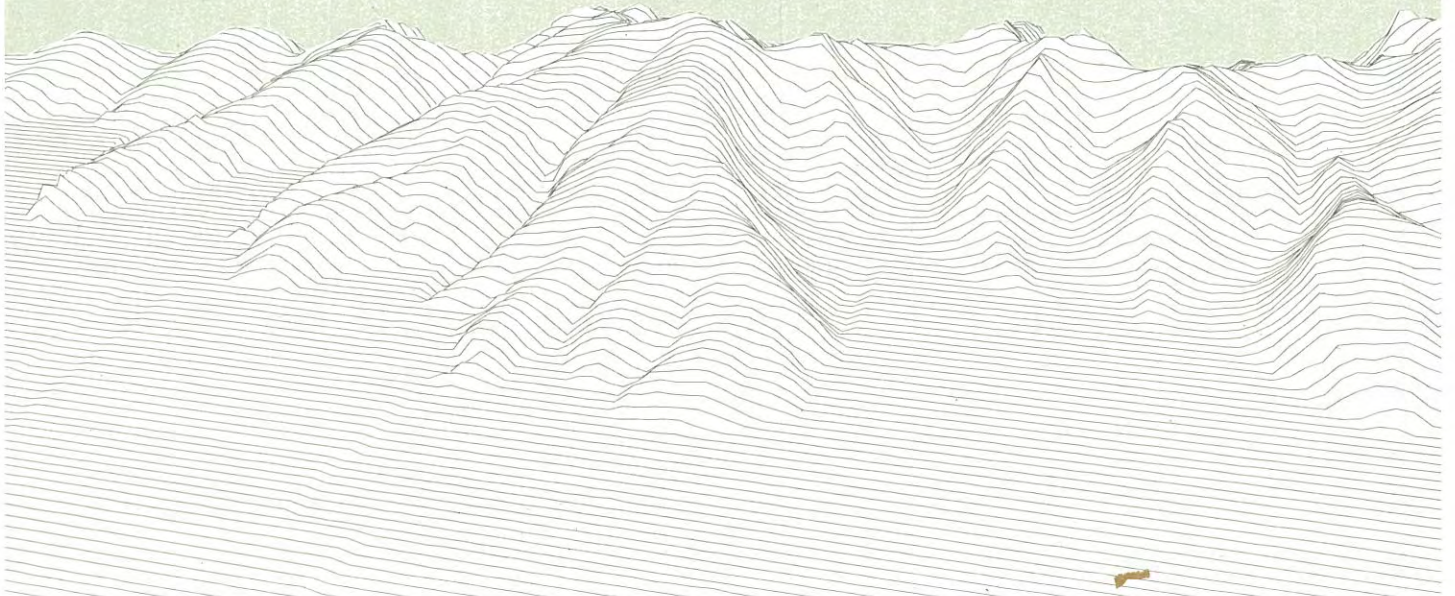


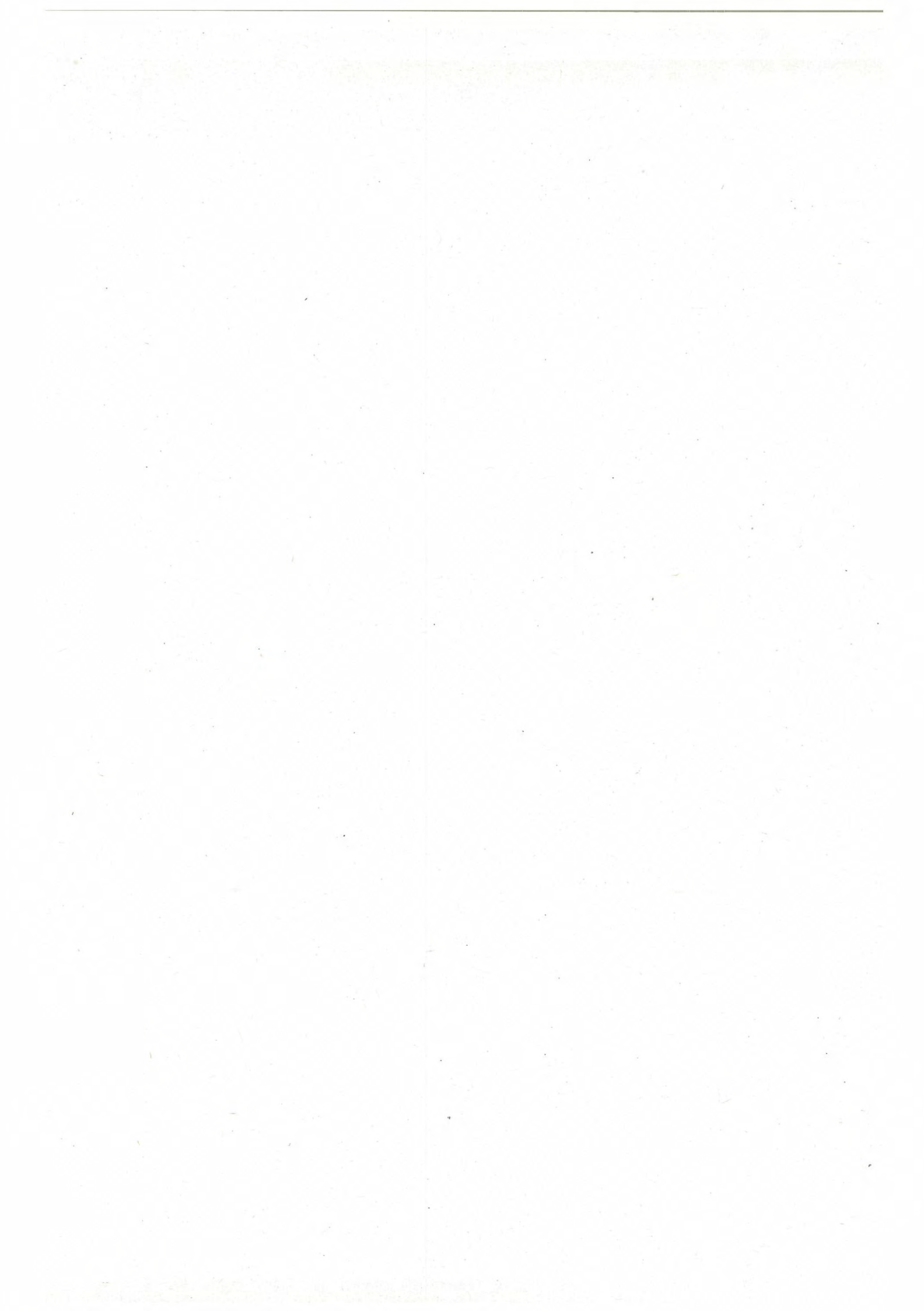


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**Maps of total soil concentrations (background levels)  
of chromium, copper, lead, nickel, vanadium, and zinc  
in the Taranaki Region**

Harry Percival and Anne Sutherland





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## 1. Map features (one map per metal)

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### *Soil Orders*

All the soils of the geographical area covered by the Taranaki Region have been aggregated into the relevant Soil Orders (as defined in Hewitt AE. 1992. *New Zealand Soil Classification. Landcare Research Science Series No.1*). Their spatial distribution, as shown on the maps, was derived from the Land Resource Information System (Spatial Data Layers) held by Landcare Research.

The nine Soil Orders represented in the Taranaki Region, and listed in the map legend, are Allophanic, Brown, Gley, Melanic, Organic, Pallic, Pumice, Raw, and Recent. Mountain soil refers to alpine and sub-alpine areas (including bare rock) with soils not classified into Soil Orders.

Soils in the Allophanic Order cover the largest geographical area, followed by those in the Brown and Recent Orders, with those in the remaining Orders being minor contributors.

### *Concentration ranges for chromium, copper, lead, nickel, vanadium, and zinc*

Available heavy metal data for the soil depth interval 0–20 cm (topsoil) were extracted from the National Soils Database held by Landcare Research. These data are in the form of total concentrations (mg/kg metal, on oven-dry weight basis) in the soils as determined by X-ray fluorescence spectroscopy techniques.

Because of the somewhat limited data available (see Section 2), the ranges of metal concentrations given in the map legend should be considered to be reasonable estimates for each Soil Order. The estimates have been derived so that there is a high probability (at least 90%) the heavy metal concentration in any soil in a named Soil Order in the Taranaki Region will fall within the specified range.

In terms of the most abundant heavy metal in the group of metals mapped for the Taranaki Region, it appears that vanadium is generally the highest in concentration overall, followed by zinc, chromium and copper, nickel and lead.

### *Map colours*

In each map, each Soil Order has been assigned a colour depending on its ranking with respect to metal concentration ranges as shown in the map legend. Gradation in colour and intensity varies with the maximum values in the metal concentration ranges, from highest to lowest.

Orders with the highest estimated maximum values in their ranges have been assigned the most intense colours, starting with red. For example, in the copper map, the highest copper concentrations are shown as likely to be found in the intensely red-coloured area defined in this instance by the Allophanic Soil Order, while much lower concentrations are in the pale yellow area defined by the Brown Soil Order.

The Pumice and Raw Soil Orders, and Mountain soil, are coloured grey in the maps because there are insufficient metal data, or no data at all.

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## 2. Source and reliability of data for maps

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### *Soils from the Taranaki Region*

Nineteen Taranaki Region soils, for which there were relevant data for the selected heavy metals in the National Soils Database, were identified. Because of the “patchy” distribution of soils with metal data within the Region, only six of the nine Soil Orders were represented by such soils.

### *Soils from external regions*

To gain better estimates of metal concentration ranges in Soil Orders not well represented by soils with metal data, we included where possible relevant metal data for other soils in the same Soil Order from other North Island areas, in Manawatu, Horowhenua, Waikato, and Wellington. No metal data were available at all for the Pumice and Raw Soil Orders, even from the above external sources.

### *Contributions to Soil Order data consideration*

The list below indicates the sources of data considered for each Soil Order. The Orders in bold contribute to the largest geographical areas in the Taranaki Region.

**Allophanic** Order – eleven Taranaki Region soils, eight external region soils

**Brown** Order – one Taranaki Region soil, fifteen external region soils

Gley Order – two Taranaki Region soils, fourteen external region soils

Melanic Order – two Taranaki Region soils, no external region soils

Organic Order – one Taranaki Region soil, seven external region soils

Pallic Order – five external region soils only

Pumice Order – no data

Raw Order – no data

**Recent** Order – two Taranaki Region soils, nine external region soils.

Some concentration ranges will be more reliable than others, primarily due to differences in amount of data available (the more the better). Fortunately, the largest Taranaki Region data set available is that for the Soil Order covering the largest geographical area (Allophanic Order).

Concentration ranges mainly derived from Soil Order data external to the Taranaki Region will have a lower reliability than those largely derived from Taranaki Region data. However, the reliability is considerably better than if no comparisons had been made with the same Soil Orders in neighbouring areas. Reliability could be further improved by additional soil sampling and analysis in the Taranaki Region.



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### 3. Comparison of metal concentrations with national levels, and with contaminated site guidelines

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Taranaki Region metal concentrations were compared with those in the National Soils Database for all New Zealand soils for which there were metal data. They were also compared with the 1992 Australian and New Zealand Environment and Conservation Council (ANZECC) guidelines which help assess and manage contaminated sites (ANZECC 1992. Australian and New Zealand guidelines for the assessment and management of contaminated sites. Australian and New Zealand Environment and Conservation Council, National Health and Medical Research Council). These guidelines provide a set of "Environmental Investigation" levels for flagging possible contamination levels that *may* need some remedial action. The guidelines stress "the values are intended as a guide and site specific factors need to be taken into account in reaching a decision on the nature and intensity of any investigations that may be required".

#### *(a) Comments on Chromium*

There is a wide variation of chromium concentrations across the Region, ranging from 10 to 120 mg/kg. The highest overall concentrations are in Gley soils, the lowest in Recent and Allophanic soils.

The highest concentrations of chromium in the Taranaki Region are among the higher natural concentrations found in New Zealand (at least as recorded in the National Soils Database), but they occur only in a relatively small proportion of the Region.

The ANZECC "environmental investigation" value is set at 50 mg/kg, so a number of Taranaki Region soils will exceed this value, especially some soils in the Gley Order.

#### *(b) Comments on Copper*

There is a wide variation of copper concentrations across the Region, ranging from 2 to 120 mg/kg. The highest overall concentrations are in Allophanic soils, the lowest in Brown and Pallic soils.

The highest concentrations of copper in the Taranaki Region are among the highest natural concentrations found in New Zealand, and occur in a large proportion of the Region. This is due to a major soil parent material being the andesitic volcanic ashes.

The ANZECC "environmental investigation" value is set at 60 mg/kg, so a number of Taranaki Region soils will exceed this value, especially some of those in Allophanic and Organic Orders.

#### *(c) Comments on Lead*

There is not much variation of lead concentrations across the Region, ranging from 2 to 30 mg/kg. The highest overall concentrations are in Melanic soils, the lowest in Recent soils.

The highest concentrations of lead in the Taranaki Region are among the highest natural concentrations found in New Zealand, but they occur only in a very small proportion of the Region.

The ANZECC "environmental investigation" value is set at 300 mg/kg, and all the Taranaki Region soils are well below this value.

#### *(d) Comments on Nickel*

There is little variation of nickel concentrations across the Region, ranging from 2 to 25 mg/kg. The highest overall concentrations are in Recent and Brown soils, the lowest in the other soil Orders.

The highest concentrations of nickel in the Taranaki Region are significantly lower than the highest natural concentrations found in New Zealand.

The ANZECC "environmental investigation" value is set at 60 mg/kg, and all the Taranaki Region soils are well below this value.

*(e) Comments on Vanadium*

There is a very wide variation of vanadium concentrations across the Region, ranging from 50 to 550 mg/kg.

The highest overall concentrations are in Recent soils, the lowest in Pallic soils. The highest concentrations of vanadium in the Taranaki Region are among the highest natural concentrations found in New Zealand, and occur in a significant proportion of the Region.

There are no ANZECC criteria for vanadium.

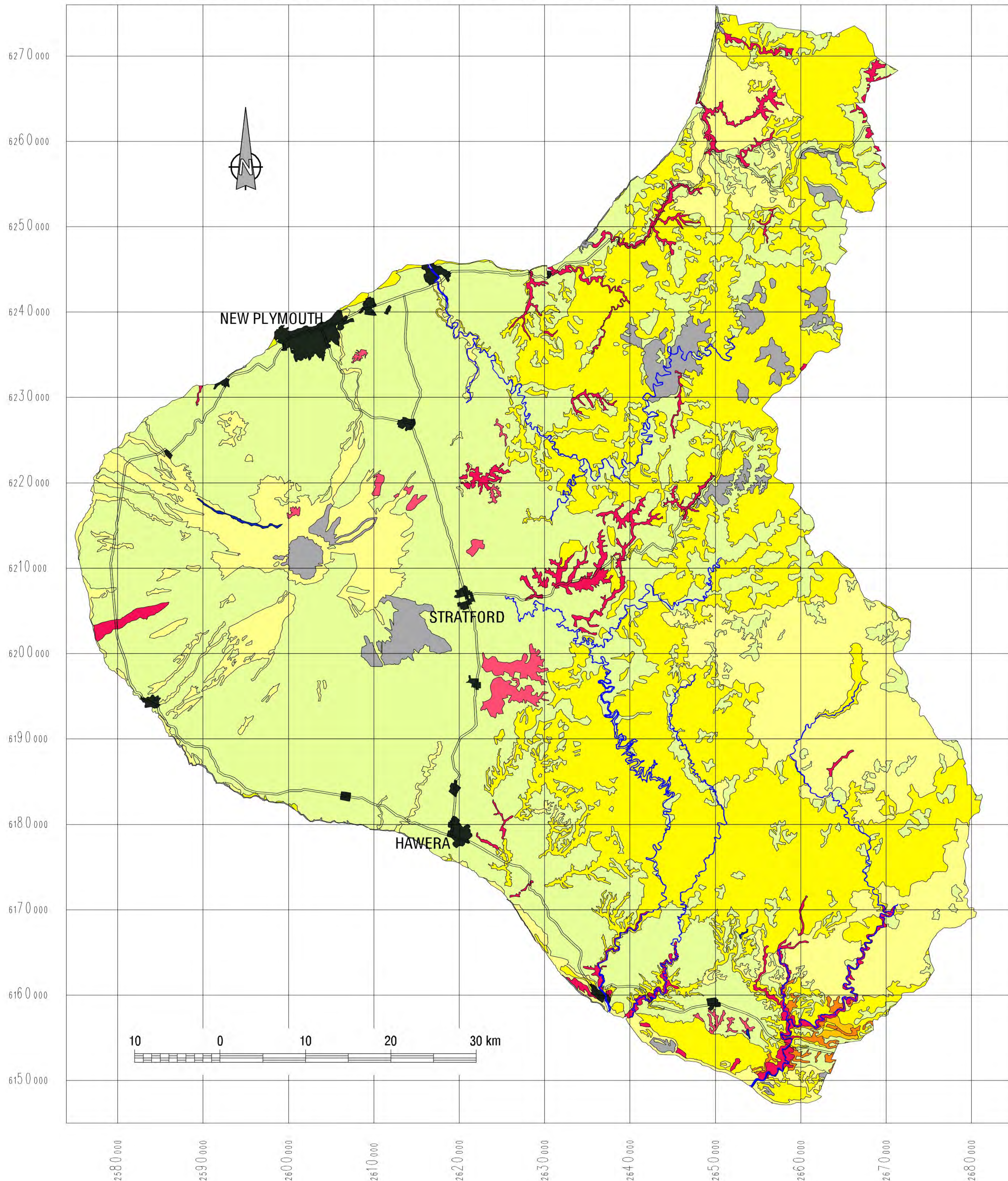
*(f) Comments on Zinc*

There is a wide variation of zinc concentrations across the Region, ranging from 20 to 170 mg/kg. The highest overall concentrations are in Recent soils, the lowest in Pallic soils.

The highest concentrations of zinc in the Taranaki Region are among the highest natural concentrations found in New Zealand, and occur in a significant proportion of the Region.

The ANZECC "environmental investigation" value is set at 140 mg/kg, so a number of Taranaki Region soils will exceed this value, especially some in Recent and Melanic Orders.

# TOTAL CHROMIUM 0-20cm IN SOILS OF TARANAKI REGION



## LEGEND

Total Chromium (mg/kg on oven-dry weight)

Soil Group	0-20cm depth
Gley	5-120
Organic	5-60
Melanic	30-50
Pallic	25-50
Brown	20-50
Recent	10-50
Allophanic	10-45
Pumice Raw Mountain soil	No data

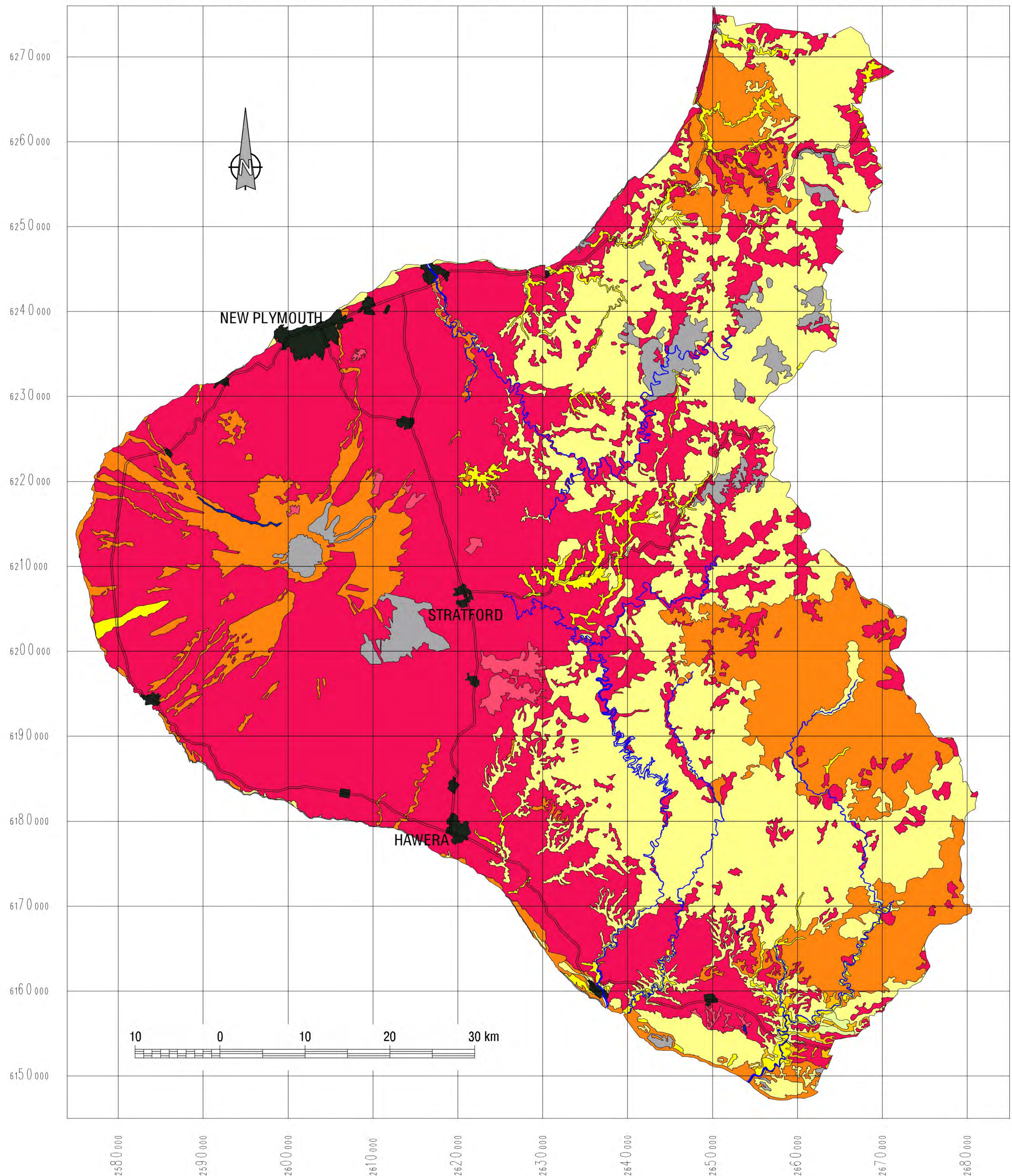
See accompanying notes on soil groupings and ranges of background metal concentrations

## Topographic Reference

- Major roads
- Major hydrological features
- Urban



# TOTAL COPPER 0-20cm IN SOILS OF TARANAKI REGION



## LEGEND

Total Copper (mg/kg on oven-dry weight)

0-20cm depth	
Allophanic	50-120
Organic	50-100
Recent	40-60
Melanic	30-50
Gley	30-50
Brown	10-40
Pallic	5-30
Pumice Raw Mountain soil	No data

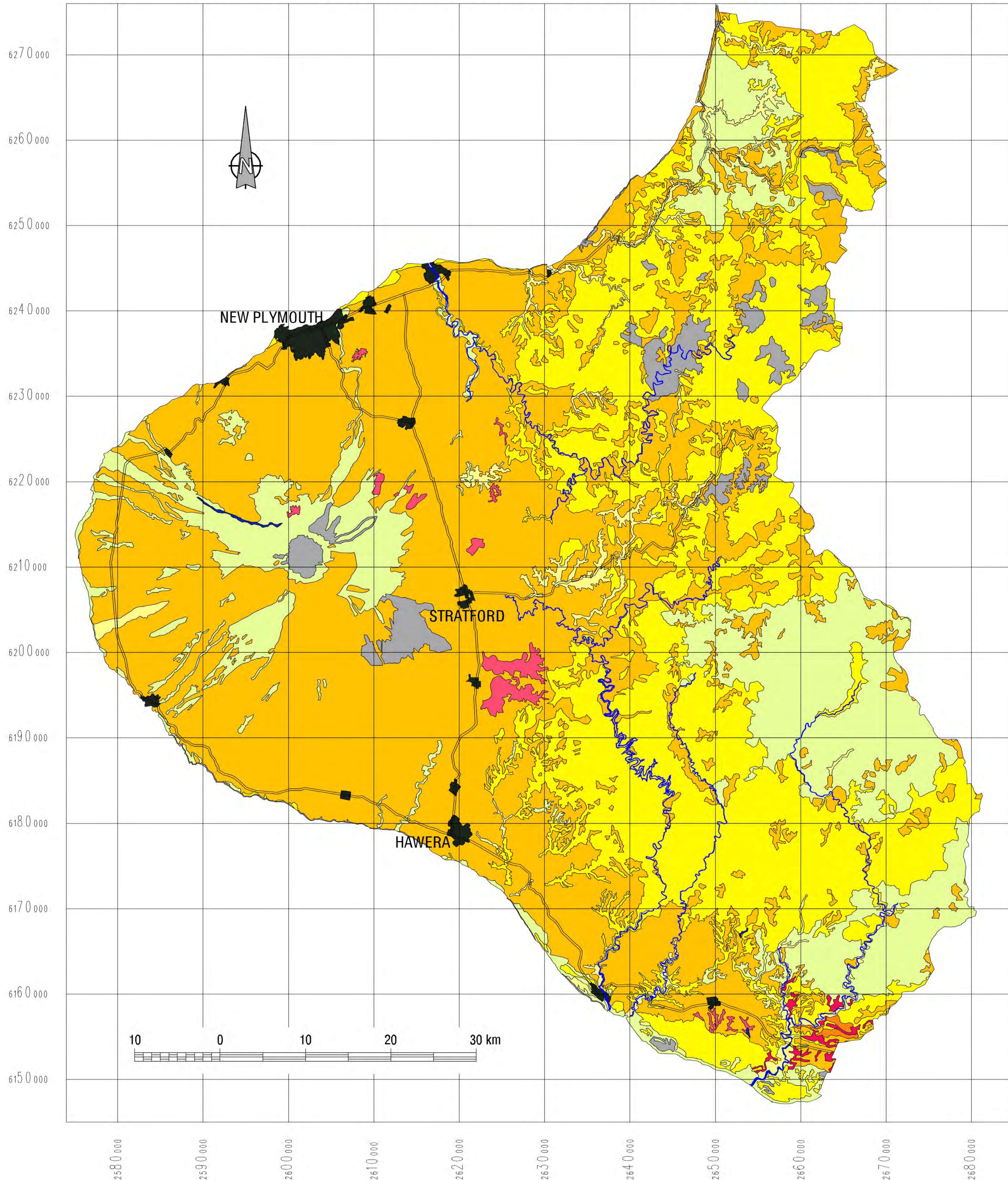
See accompanying notes on soil groupings and ranges of background metal concentrations

## Topographic Reference

- Major roads
- Major hydrological features
- Urban



# TOTAL LEAD 0-20cm IN SOILS OF TARANAKI REGION



## LEGEND

Total Lead (mg/kg on oven-dry weight)

0-20cm depth

Melanic		15-40
Organic		5-25
Pallic		5-25
Allophanic		2-25
Brown		2-25
Gley		2-20
Recent		2-15
Pumice Raw Mountain soil		No data

See accompanying notes on soil groupings and ranges of background metal concentrations

## Topographic Reference

- Major roads
- Major hydrological features
- Urban

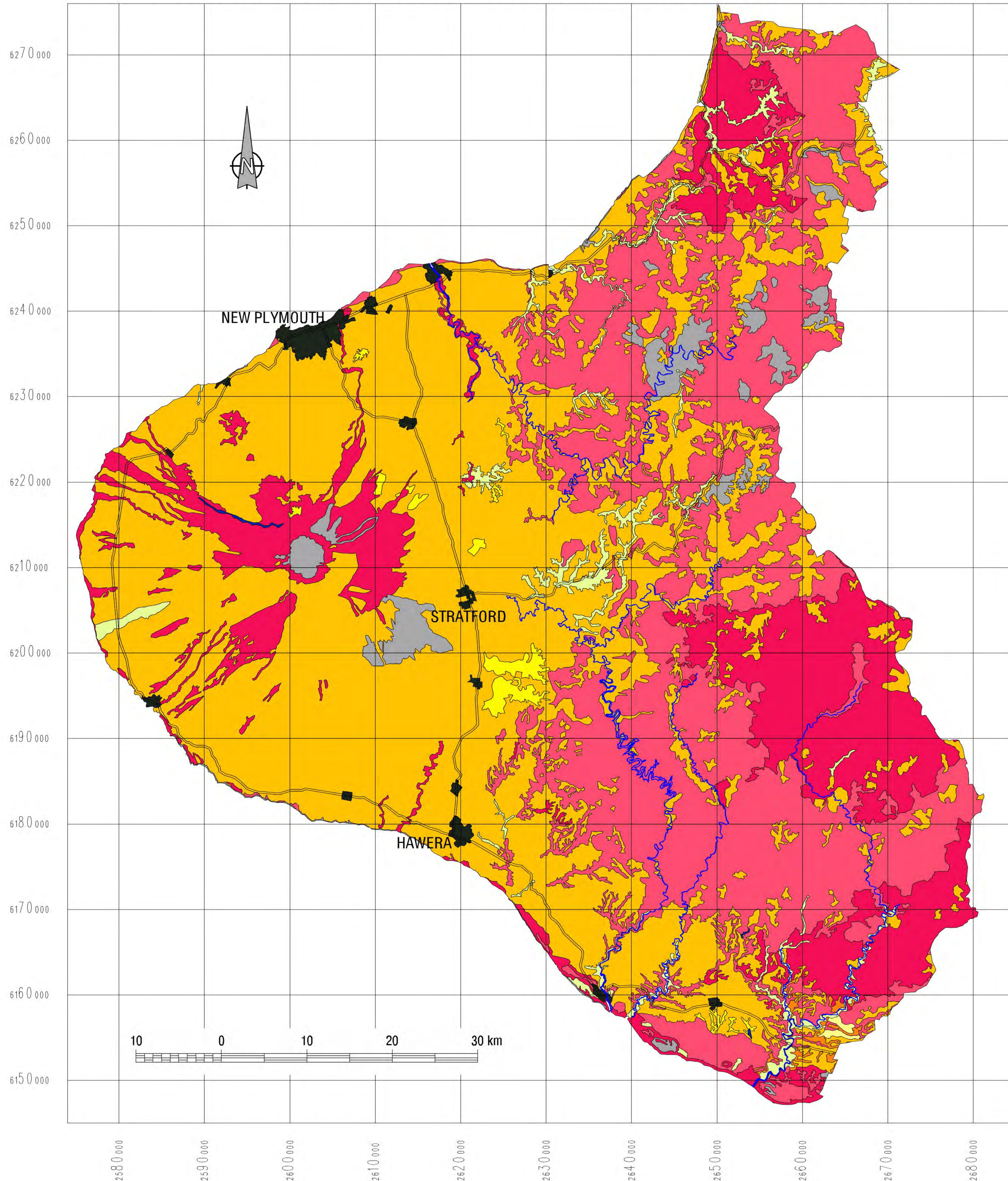


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Map Reference Code: /data/landcare-jobs/mas/heavymet/leadnzsc20.gra

# TOTAL NICKEL 0-20cm IN SOILS OF TARANAKI REGION



## LEGEND

Total Nickel (mg/kg on oven-dry weight)

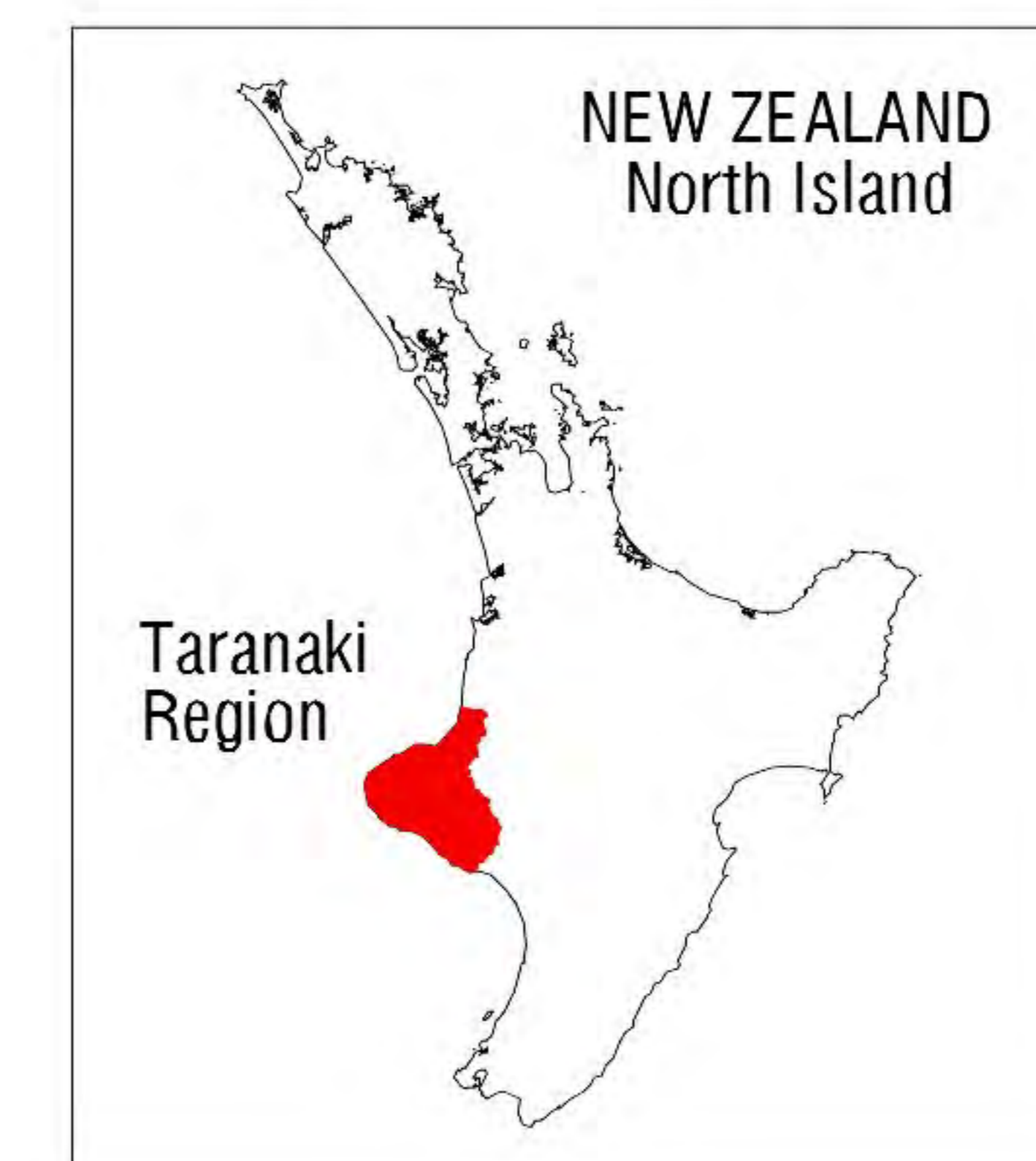
0-20cm depth

Recent		5-25
Brown		2-20
Melanic		5-15
Allophanic		2-15
Organic		2-15
Pallic		2-15
Gley		2-15
Pumice Raw Mountain soil		No data

See accompanying notes on soil groupings and ranges of background metal concentrations

## Topographic Reference

- Major roads
- Major hydrological features
- Urban

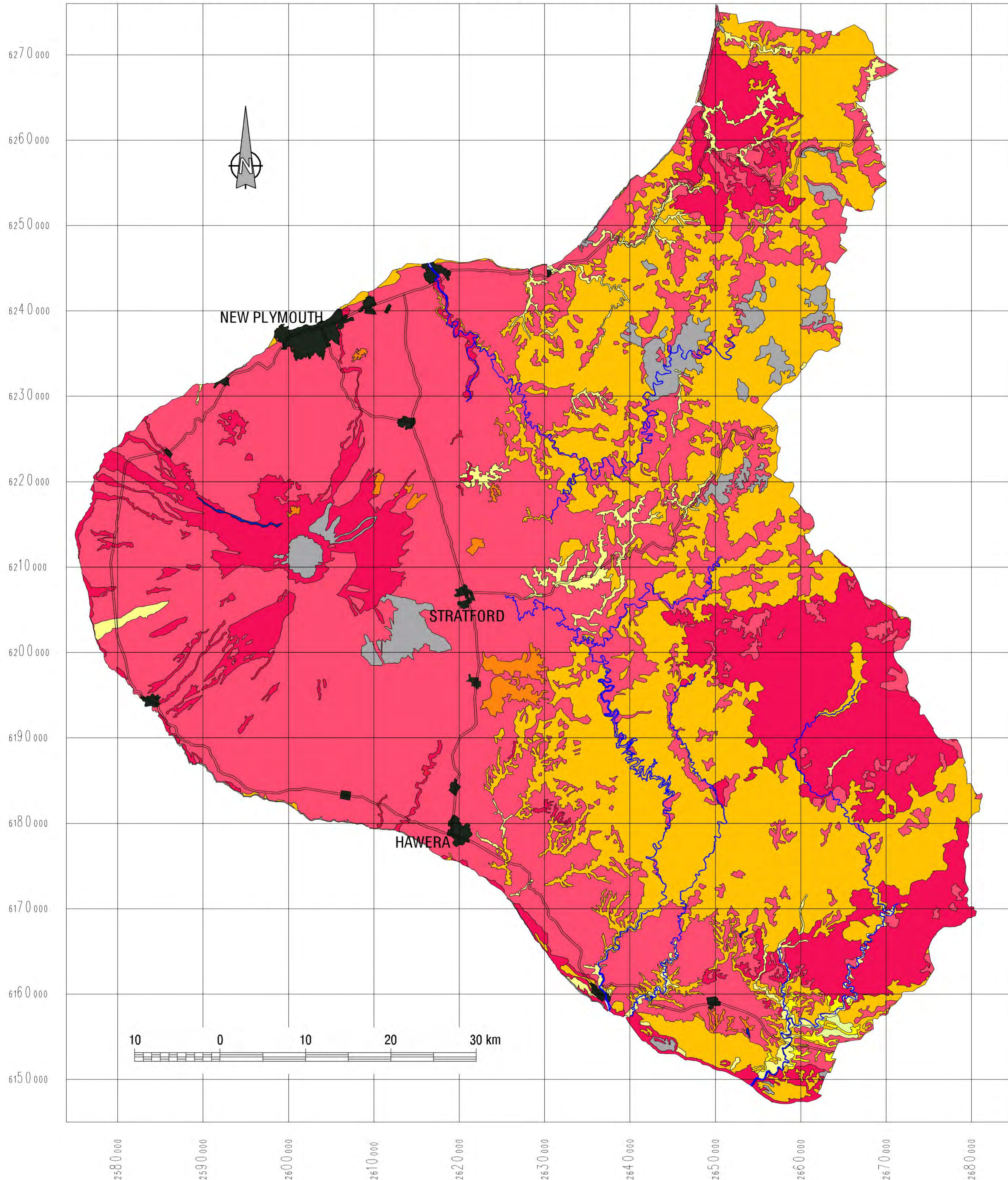


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Map Reference Code: /data/landcare-jobs/mas/heavymet/nicknzsc20.gra

# TOTAL VANADIUM 0-20cm IN SOILS OF TARANAKI REGION



## LEGEND

Total Vanadium (mg/kg on oven-dry weight)

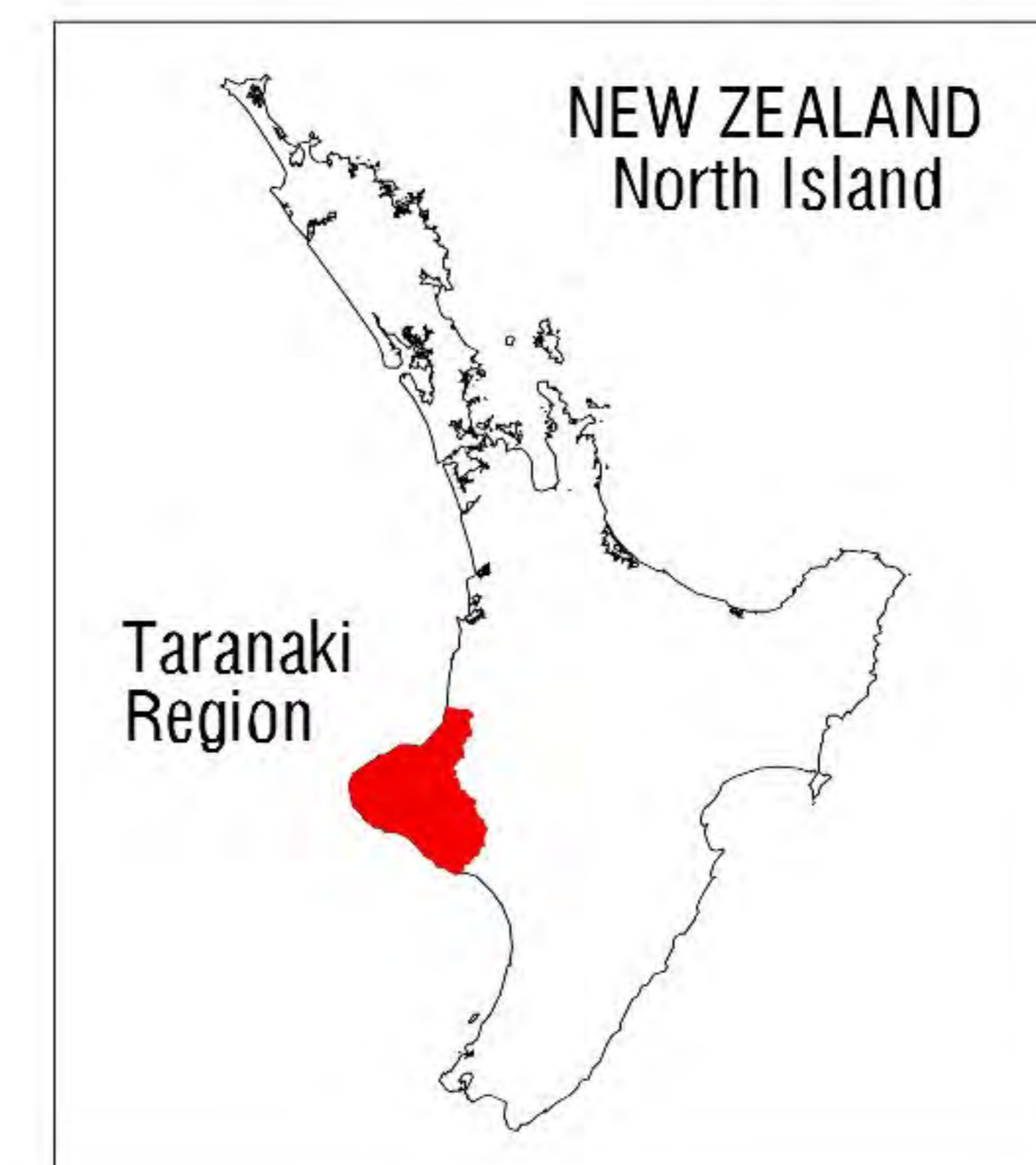
0-20cm depth

Recent		250-550
Allophanic		150-300
Organic		150-250
Brown		50-230
Melanic		160-220
Gley		60-180
Pallic		50-100
Pumice Raw Mountain soil		No data

See accompanying notes on soil groupings and ranges of background metal concentrations

## Topographic Reference

- Major roads
- Major hydrological features
- Urban

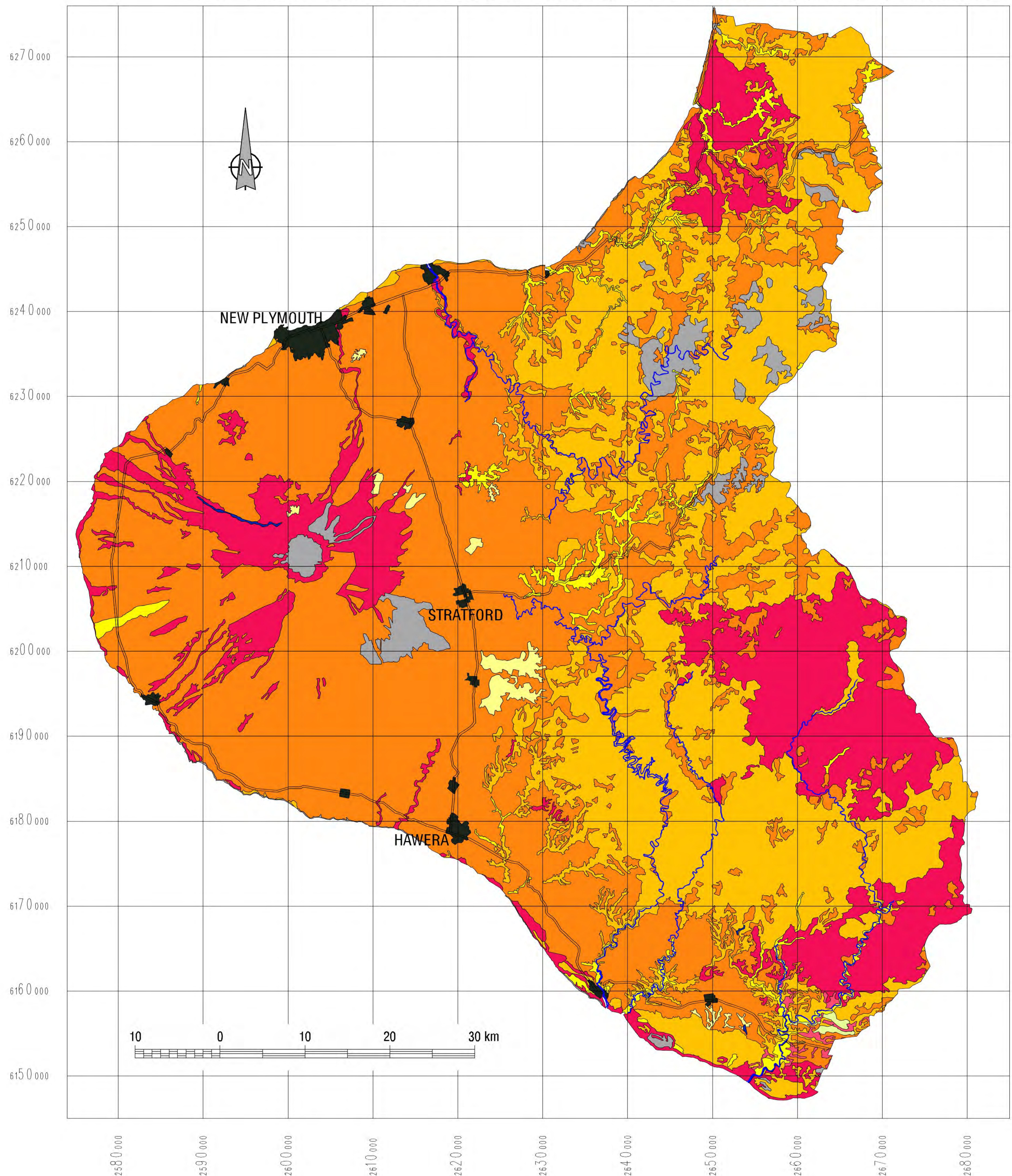


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Map Reference Code: /data/landcare-jobs/mas/heavymet/vananzsc20.gra

# TOTAL ZINC 0-20cm IN SOILS OF TARANAKI REGION



## LEGEND

Total Zinc (mg/kg on oven-dry weight)

	0-20cm depth
Recent	100-170
Melanic	110-150
Allophanic	70-140
Brown	40-110
Gley	40-110
Organic	30-90
Pallic	20-70
Pumice Raw Mountain soil	No data

See accompanying notes on soil groupings and ranges of background metal concentrations

## Topographic Reference

- Major roads
- Major hydrological features
- Urban

