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Dear Susie

## **NRC Coastal Aquifers Study - Matauri Bay**

### **Introduction**

Sinclair Knight Merz (SKM) was commissioned by Northland Regional Council (NRC) to undertake hydrogeological reviews of ten coastal aquifers in the Northland region, with particular emphasis on determining likely groundwater recharge rates and reviewing aquifer management boundaries. The work was commissioned to partially fulfil NRC's knowledge requirements following the release of a discussion document by the Ministry for the Environment's (MfE) in March 2008 on Proposed National Environmental Standard (NES) on Ecological Flows and Water Levels.

The Proposed NES sets interim default allocation limits for shallow coastal aquifers of, whichever is the greater of,

- *15% of the average annual recharge as calculated by the regional council; or*
- *The total allocation from the groundwater resource on the date that the standard comes into force less any resource consents surrendered, lapsed, cancelled or not replaced.*

This report presents the results of the hydrogeological review undertaken for the **Matauri Bay greywacke aquifer**.

### **Methodology**

The review of the aquifer management areas and determination of the recharge rate was achieved through compilation and review of various data sources, primarily provided by NRC. These datasets are summarised as follows:

- Geological borelogs;
- Geological maps;



- Legal property boundaries (cadastral);
- Topographical contours;
- Rivers;
- Meteorological data; and
- Existing NRC aquifer management boundaries.

In addition to these site specific datasets, a compilation of recharge estimates from previous coastal aquifer studies in the Northland region has been undertaken to categorise the range in likely recharge rates by aquifer type. This data is presented in **Appendix A** and has been used to assist recharge calculations within the current study, particularly in those areas where there is insufficient local data (e.g. stream flow records) to permit more detailed analysis such as the development of a Soil Moisture Water Balance Model (SMWBM), or other method with similar outcomes.

For the purpose of this study, aquifer management boundaries have been refined where appropriate to coincide with cadastral boundaries. This was implemented to avoid potential conflict with and between landowners resulting from future management decisions based on these extents.

### **Aquifer Description**

Matauri Bay is located approximately 12 km north-east of Kaeo township. The geology for the area is described on the 1:250,000 Geological Map Sheet 1 for North Cape (Kear and Hay, 1961). The aquifer predominantly comprises Waipapa Group greywacke and argillite basement rocks, overlain by a thin strip of undifferentiated Quaternary alluvial along the low lying coastal fringe.

Three geological borelogs were available for review. The approximate locations of the boreholes are shown in **Figure 1** and summary geological and bore construction information is provided in **Appendix B**.

- **Figure 1. Matauri Bay Aquifer Management Map**  
(See A4 attachment at rear)

In general the borelogs correlate with the geological map with the majority of bores intercepting greywacke at or near the ground surface. Greywacke is generally low permeability, other than in areas where there is strong faulting.

Where greywacke is exposed, high surface runoff is expected with little percolation of rainfall into the greywacke. At locations where alluvials overlie the greywacke, a higher infiltration rate of rainfall percolating through the permeable alluvials and into the greywacke may be expected, although this is governed more so by flatter slope than the permeability of the greywacke in these locations.



The bores drilled within the Matauri Bay greywacke range in depth between 18.0 and 68.0 metres below ground level (mBGL), with all bores abstracting from this hard rock aquifer.

Static groundwater levels were recorded in one bore (201484) with an artesian measurement of 0.3 metres above ground level (mAGL).

The available testing information indicates that the greywacke has low yields of 36.3 m<sup>3</sup>/day (0.42 L/s) produced during test pumping of one bore.

### **Aquifer Extent**

The previous aquifer management area for Matauri Bay (obtained from NRC) was based on the overlying undifferentiated alluvium which covers an area of 0.15 km<sup>2</sup>. Following review of the three borelogs in the Matauri Bay area, a larger revised management area for the greywacke aquifer has been delineated. This management area is shown in **Figure 1** and comprises an area of approximately 2.84 km<sup>2</sup>. It has been defined by the geology and anticipated groundwater recharge area (topographic divide), and adjusted to coincide with the cadastral boundaries.

The groundwater recharge area based solely on geology and topographic divide is approximately 37% larger at 3.89 km<sup>2</sup>. This is also shown in **Figure 1** (red dashed line) and has been used in the recharge estimations in the following sections.

### **Recharge Estimate**

Groundwater recharge is a function of the rainfall and evapotranspiration regimes, as well as geomorphological characteristics of a catchment (e.g. slope, soil and land cover characteristics, etc.).

Local rainfall data was obtained from a rainfall station (station 1034, Matauri Bay) located approximately 250 m south of the study area (**Figure 1**). The data is for the period between 1964 and 1987, and indicates the following annual rainfall statistics:

- Minimum: 1,157mm (1965)
- Maximum: 1,981mm (1971)
- **Average: 1,450 mm**

In the absence of streamflow data to calibrate a Soil Moisture Water Balance Model (SMWBM) groundwater recharge has been estimated for Matauri Bay greywacke aquifer from previous results for the Russell greywacke aquifer located approximately 30 km to the south east. This study (SKM, 2001) utilised the SMWBM, which was adjusted during calibration of a numerical groundwater model to provide the most likely estimate of groundwater recharge in accordance with measured aquifer hydraulic properties assigned in the groundwater model. The resulting groundwater recharge estimate was between **1-5 % of annual rainfall** which is also applied to this study.



Likely annual groundwater recharge to the Matauri Bay greywacke aquifer based on the local rainfall record and the groundwater recharge area, as a percentage of annual rainfall is given in **Table 1**.

■ **Table 1. Matauri Bay groundwater recharge volume**

Average Annual Rainfall (mm/yr)	Recharge Area (km <sup>2</sup> )	Total Recharge Volume (m <sup>3</sup> /yr)	% GW Recharge	GW Recharge Volume (m <sup>3</sup> /yr)
1,450	3.89	9,178,500	1% (min.)	56,405
1,450	3.89	9,178,500	5% (max.)	282,025

The groundwater recharge assessment for the Matauri Bay greywacke aquifer indicates that annual recharge is likely to be between 56,405 and 282,025 m<sup>3</sup>/year for the 1% and 5% recharge proportions, respectively. Accordingly, the interim default allocation limit under the Proposed NES (15% of groundwater recharge) would be between **8,461** and **42,304 m<sup>3</sup>/year**.

Yours sincerely

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## Appendix A. Summary of recharge rates by aquifer type

Aquifer	Type	Recharge estimate	Recharge Method	Reliability	Source
Glenbervie	Weathered Taheke Basalt	5 - 15%	Estimate	LOW Calculated using annual average rainfall and recharge coefficient estimates from previous experience pro-rated by area.	SKM (2005a)
Coopers Beach	Tangihua Basalts	5 - 15%	Estimate	LOW Calculated using annual average rainfall and recharge coefficient estimates from previous experience pro-rated by area.	SKM (2005c)
Tara	Parahaki Volcanics?	7 - 10%	Estimate		NRC Report
Kaikohē	Horeke or Taheke Basalt	13.2%	SMWBM	HIGH Calibrated to stream flow.	SKM (2007a)
Monument Hill	Horeke or Taheke Basalt	16.5%	SMWBM	HIGH Calibrated to stream flow.	SKM (2007a)
Maungakaramea	Taheke Basalt	22 - 44%	Estimate	LOW Calculated using annual average rainfall and recharge coefficient estimates from previous experience pro-rated by area.	SKM (2006a)
Three Mile Bush	Taheke Basalt	28 - 49%	Estimate	LOW Calculated using annual average rainfall and recharge coefficient estimates from previous experience pro-rated by area.	SKM (2006b)
Maungakaramea	Scoria Cone	55 - 65%	Estimate	LOW Calculated using annual average rainfall and recharge coefficient estimates from previous experience pro-rated by area.	SKM (2006a)
Ruawai	Alluvium	30%	Estimate	LOW Calculated using annual average rainfall and recharge coefficient estimates from previous experience pro-rated by area.	SKM (2003)

<b>Aquifer</b>	<b>Type</b>	<b>Recharge estimate</b>	<b>Recharge Method</b>	<b>Reliability</b>	<b>Source</b>
Awanui	Alluvium	4.2%	SMWBM	MODERATE Calculated indirectly during calibration of a groundwater model.	SKM (2007b)
Awanui	Dune Sands	43.7%	SMWBM	MODERATE Calculated indirectly during calibration of a groundwater model.	SKM (2007b)
Mangawhai	Sand	10.2 - 16%	Estimate	LOW Calculated using annual average rainfall and recharge coefficient estimates from previous experience pro-rated by area.	SKM (2005b)
Russell	Gravel	26 - 52%	SMWBM	MODERATE Calculated indirectly during calibration of a groundwater model.	SKM (2001)
Mangawhai	Sandstone	1 - 10%	Estimate	LOW Calculated using annual average rainfall and recharge coefficient estimates from previous experience pro-rated by area.	SKM (2005b)
Russell	Greywacke	1 - 5%	SMWBM	MODERATE Calculated indirectly during calibration of a groundwater model.	SKM (2001)

## Appendix B. Summary of geological borelogs

Bore #	Location **	Geology		Total Depth	Casing / Screen Details	Screened Geology	Additional Testing Information
		Depth (m)	Lithology				
200145 a	P4 941-852	0.0 – 26.0 26.0 – 28.0	Clays and soft brown greywacke Brown to blue greywacke	28 m	<i>Unknown</i>	<i>Greywacke</i>	Q = 36.3 m <sup>3</sup> /day
200145 b	P4 941-852	<i>Unknown</i>	Sand (depth not specified)	?	<i>Unknown</i> (hole abandoned)	<i>Sand</i>	<i>n/a</i>
200145 c	P4 941-852	0.0 – 11.5 11.5 – 18.0	Sands, gravels and clay Brown greywacke	18 m	<i>Unknown</i>	<i>n/a</i>	Q = 45.4 m <sup>3</sup> /day ( <i>Unknown lithology</i> )
200146	P4 942-855	0.0 – 19.0	Waipapa greywacke (sandstone)	>19 m	Galvanised steel (0 – 15.2 m) Open hole (15.2 – 19.0 m)	Greywacke	
201484	P4 941-856	0.0 – 4.0 4.0 – 68.0	Fill Very hard greywacke	68 m	Casing (0 – 11.0 m) Open hole (11.0 – 68.0 m)	Greywacke	SWL = 0.3 mAGL

**Notes:** \*\*Locations are approximate only. *Italics* refer to incomplete information given on borelogs. **SWL** is static water level measured in metres below ground level. **Q** is discharge rate measured during test pumping. **Sc** is specific capacity.



## References

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