

## 3 Study design

In Auckland we have now reached a situation where three separate projects together provide most of the data required to enable metal sources in urban catchments of different landuses to be identified and quantified. These projects are:

**Project 1.** A large programme of stormwater quality and quantity monitoring and modelling in Auckland City. (Metrowater and Auckland City Council contracts to NIWA).

**Project 2.** A research project to quantify vehicle contributions of metals to road run-off reaching urban stormwater networks (Foundation for Research, Science and Technology contract to NIWA. C01X0217 for 2002-2003).

**Project 3.** An investigation of roof run-off quality (ARC contract to Diffuse Sources Ltd and Kingett Mitchell Ltd).

The following sequence of tasks explains how the study described in this report was undertaken and how the data provided by these three projects were utilised.

1. Three catchments, each of a different urban land use, i.e., residential, commercial and industrial, were selected from a suite of 8 catchments (some of mixed landuse) included in project 1 above. For these three catchments, good estimates of annual stormwater total suspended solids and metal loads have been made using a stormwater quality model calibrated with monitoring data.
2. The numbers of vehicles moving along most roads in each catchment each day were recorded by Auckland City Council. For some of the roads not monitored as part of this study, vehicle counts were obtained from the Auckland City website. From these data, the lengths of the roads contributing to the catchment stormwater, and the results from Project 2 above, the road run-off contribution of contaminants to the catchment stormwater was estimated. The results from Project 2 were obtained with road-side catchpits that had been cleaned out immediately before the project started. On average, over the whole of Auckland City the catchpits would be partially full of sediment and the average city-wide retention efficiency for sediment would be less than was observed in Project 2. An estimate was made from available data of the city-wide retention efficiency and this was applied to the calculation of metal loads in road run-off.
3. For as many buildings as possible in each of these catchments, the roof area and surface material were determined. These data together with that from Project 3 were then used to estimate the annual metal loads in run-off from the roofs.
4. Soil washing into the stormwater network carries a natural load of metals. Estimates of catchment stormwater suspended solids loads from project 1 above combined with measurements of the natural metal concentrations in the soils of each catchment were used to estimate the natural metal loads associated with soil.
5. The only other obvious source of metals not explicitly included in the catchment metal load mass budgets is the leaching of metals from building walls. In the CBD, most building walls drain directly onto impervious surfaces and then into the stormwater

network so it is not possible to easily survey these loads. In the Mission Bay residential catchment the walls of many buildings drain either directly or indirectly onto soil. The metal concentrations in the soils close to buildings were surveyed to give an indication of the quantities of metals leached from the building walls. Some building walls in the industrial catchment also drain onto soils and these soils were surveyed.

6. Finally, for each catchment, the contributions from roads, roofs, soils and building walls where this was possible, were summed and compared with the total stormwater loads estimated in Project 1.

## 4 Study catchments

Three stormwater catchments in Auckland City were selected for intensive study of contaminant sources and loads. The descriptions and locations of these catchments and the monitoring sites are given in Table 2 and shown in Figure 1.

**Table 2.** Stormwater monitoring sites

| <b>Site</b>               | <b>Land use</b>    | <b>Location</b>   | <b>Manhole</b> | <b>Monitoring period</b>  |
|---------------------------|--------------------|---|----------------|---|
| <b>CBD (Aotea Square)</b> | <b>Commercial</b>  | <b>Between Aotea Centre and Ferguson Building</b>       | <b>AF060</b>   | <b>November 2000 – March 2002</b>                                 |
| <b>Mission Bay</b>        | <b>Residential</b> | <b>Beside Aotea Reserve</b>                             | <b>AA150</b>   | <b>November 2000 – December 2001</b>                              |
| <b>Mt Wellington</b>      | <b>Industrial</b>  | <b>University of Auckland Tamaki Campus, Glen Innes</b> | <b>BN220</b>   | <b>February 2001 – July 2001</b><br><b>April 2002 – July 2002</b> |



**Figure 1** Auckland City showing the locations of the stormwater monitoring sites