10 Metal load budgets for the study catchments

The metal loads from roads, roofs, building walls and uncontaminated soils, derived as described in the previous sections of this report, are compared below with the total loads for each catchment.

10.1 Zinc

The mass budgets for zinc in the three catchments are shown in Table 20.

Table 20. Zinc mass budget (kg a^{-1}) for each catchment. Differences are also shown as percentages of the total catchment loads. * includes only the component trapped on "near building" soils, excludes the component draining directly to the stormwater network.

Catchment	Roofs	Roads	Building walls*	Natural soil	Sum of sources	Total catchment load	Difference (Total –Sum)
Central Business District	**46.4 ± 3**	**5.75**	**0**	**0.58**	**52.7 ±3**	**47.0**	**-2.7 to -5.7 (6 to 12%)**
Mission Bay	**12.0**	**3.96**	**2.7**	**1.86**	**20.5**	**26.0**	**+5.5 (21%)**
Mt Wellington	**146**	**1.19**	**0.7**	**1.06**	**149**	**176**	**+27 (15%)**

Three obvious conclusions can be drawn from these results:

1. Given the likely errors (probably 20 to 30%) in these mass budgets, complete mass budgets were obtained for all catchments. This indicates that the sources identified are the only major sources of zinc.
2. Roof run-off contributes almost all of the zinc in stormwater draining from the commercial (CBD) and industrial (Mt Wellington) catchments and contributes a large proportion, 46%, in the residential (Mission Bay) catchment.
3. Road run-off is a very small contributor to the total catchment zinc loads for all land uses, the highest being 15% in the Mission Bay catchment.

Efectively complete mass budgets were obtained for the commercial (CBD) and industrial (Mt Wellington) catchments.

For the Mission Bay catchment if it is assumed that the roof, road and natural loads are correct, then for the difference in the mass balance to reduce to zero the yield would need to be about 440 g ha^{-1} a^{-1} rather than the best fit value of 573 g ha^{-1} a^{-1}. Although

this 23% error in the modelled load is certainly possible, model fits to the monitoring data for this catchment that produce a yield of 440 g ha^{-1} a^{-1} are considerably inferior to the fit for a yield of 573 g ha^{-1} a^{-1}.

At this stage, we have no convincing explanation for the 21 to 25% difference in the zinc mass balance for the Mission Bay catchment. It is quite possible, however, that the three identified sources are the only significant contributors of zinc to stormwater and that the difference in the Mission Bay mass balance is simply due to error in one or more of the various loads.

10.2 Copper

The mass budgets for copper shown in Table 21 are very poor for all landuses particularly commercial and industrial for which the identified sources account for 30% or less of the copper in the catchment stormwater. The mass balance for the residential catchment is a little better with about 41% accounted for by the identified sources.

At this stage we have no explanation for the discrepancies in the mass budgets for copper. There would appear to be no substantial sources of copper in these catchments other than roads, building roofs and uncontaminated soils and it is difficult to believe that the combined errors in the loads from these sources could be as large as 500%. It is also difficult to believe that the modelled total catchment loads are high by this amount. It is obvious, however, that either there are other unknown sources of copper or one or more of the loads is very much in error.

Table 21. Copper mass balance (kg a) for each catchment. Differences are also shown as percentages of the total catchment loads.

Catchment	Roofs	Roads	Building walls	Natural soil	Sum of sources	Total catchment load	Difference (Total –Sum)
Central Business District	**0.11**	**1.00**	**0**	**0.15**	**1.26**	**4.21**	**+3.0 (70%)**
Mission Bay	**0.27**	**0.69**	**0**	**0.53**	**1.49**	**3.57**	**+2.1 (58%)**
Mt Wellington	**0.24**	**0.21**	**0**	**0.41**	**0.86**	**4.59**	**+3.7 (81%)**

10.3 Lead

The mass balances for lead shown in Table 22 are somewhat better than those for copper. All of the lead in stormwater from the residential catchment can be accounted for by the four sources with building walls and natural soils making the major contributions. Although building walls in the Mt Wellington catchment are not expected to contribute greatly to the lead load for the reason mentioned above, this is

not necessarily the case for the CBD. Some of the older buildings in this catchment could have lead-based paints on their walls and this could be still contributing lead directly to the stormwater network.

As is the case for copper, the individual source loads for lead are all quite small and relatively small adjustments to any one load e.g. when new information becomes available, could substantially change the relative importance of each source.

Table 22. Lead mass budgets (kg a^{-1}) for each catchment. Differences are also shown as percentages of the total catchment loads. * includes only the component trapped on "near building" soils, excludes the component draining directly to the stormwater network.

.Catchment	Roofs	Roads	Building walls*	Natural soil	Sum of sources	Total catchment load	Difference (Total –Sum)
Central Business District	**0.27**	**0.87**	**0**	**0.36**	**1.50**	**3.73**	**+2.23 (60%)**
Mission Bay	**0.08**	**0.60**	**1.2**	**1.06**	**2.94**	**2.71**	**-0.23 (8%)**
Mt Wellington	**0.61**	**0.18**	**0**	**0.24**	**1.03**	**4.59**	**+3.56 (78%)**

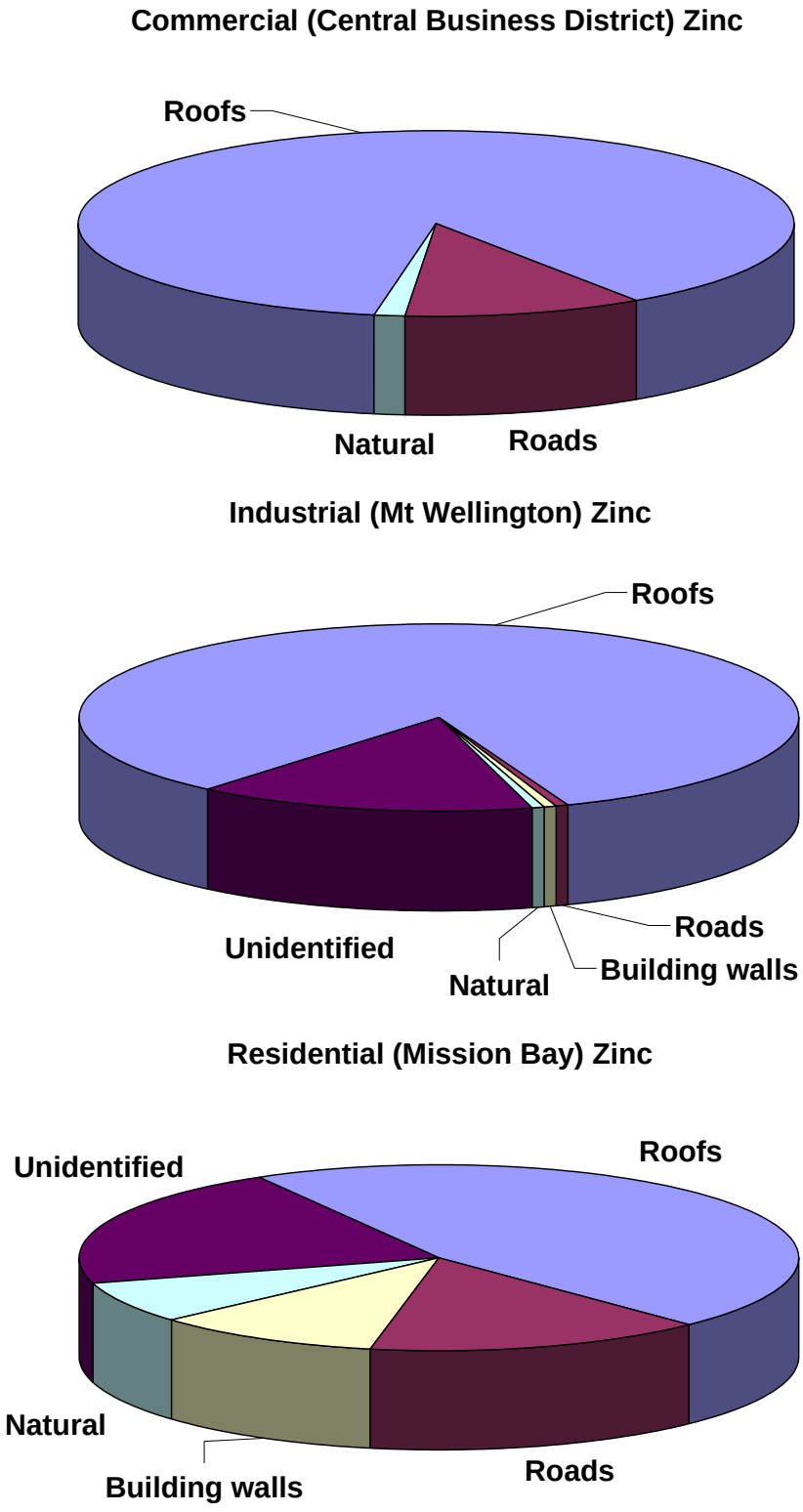

Figure 18. Mass budgets for zinc in the three study catchments.

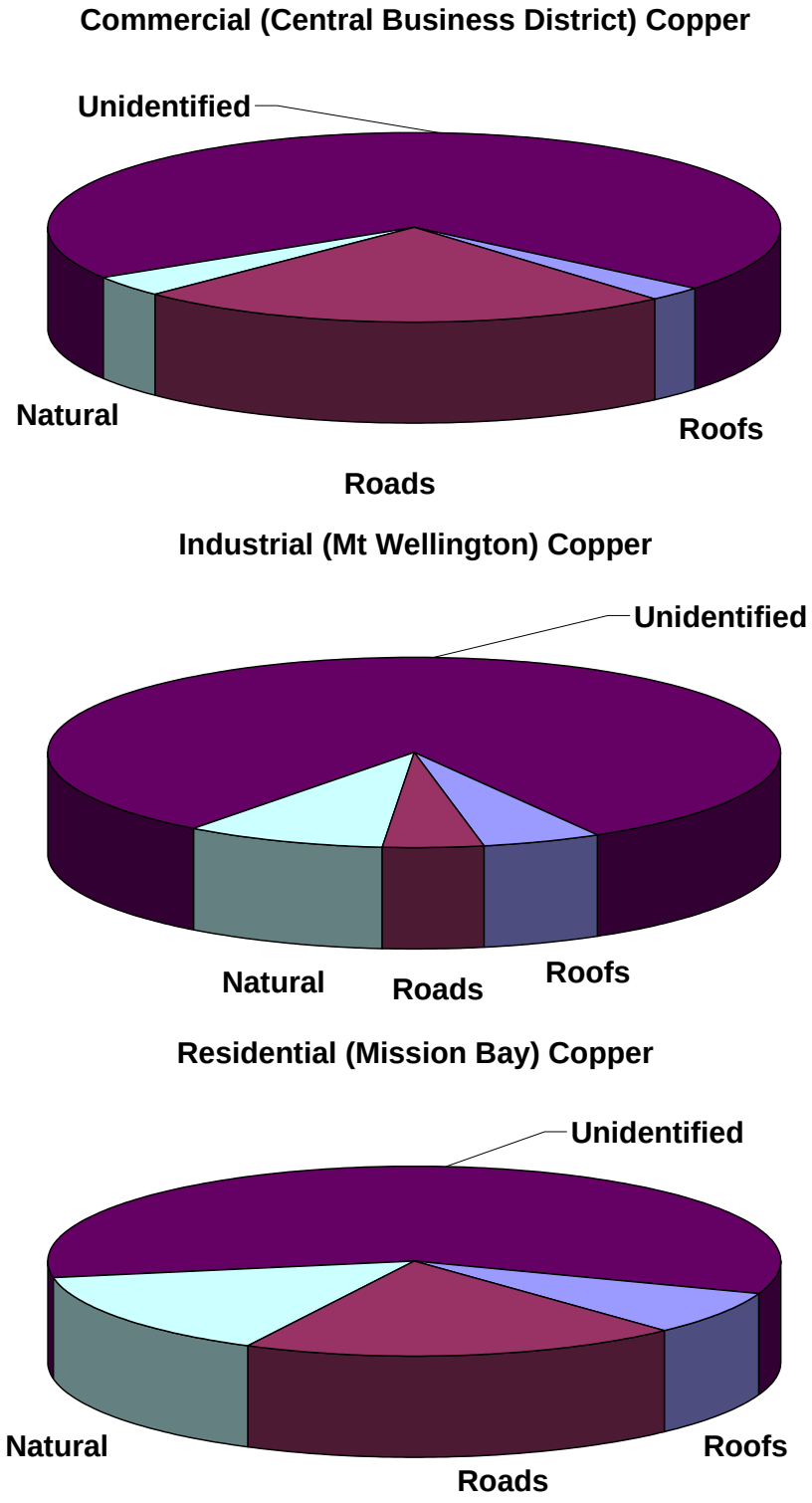

Figure 19. Mass budgets for copper in the three study catchments.

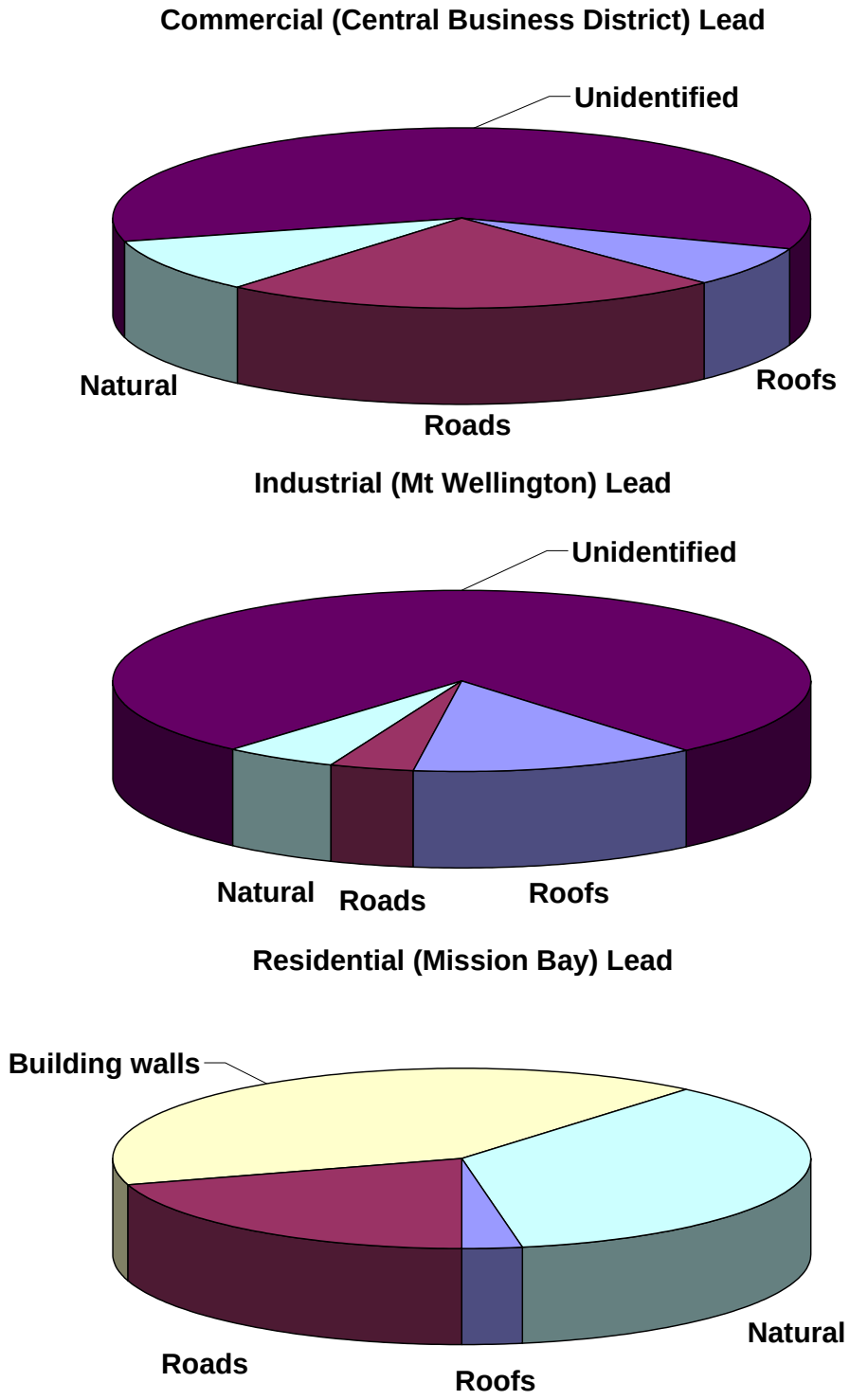

Figure 20. Mass budgets for lead in the three study catchments.