

# **ROAD CONTROLLING AUTHORITIES FORUM STORMWATER GROUP SURVEY OF KNOWLEDGE AND PRACTICE ON STORM WATER TREATMENT BY ROAD CONTROLLING AUTHORITIES**

## **ANALYSIS OF RESPONSES TO STORMWATER QUESTIONNAIRE**

### **EXECUTIVE SUMMARY**

The objectives of the survey were to identify the range of stormwater treatment devices in use, the extent of monitoring occurring and current and emerging issues for road controlling authorities and stormwater managers.

Responses were returned from sixty four territorial authorities. Road asset managers completed fifty six responses and storm water managers returned seventeen. In the absence of any duplicate response, for returns from forty seven road asset managers and eight storm water managers, the information provided cannot be verified within the survey analysis?

The questionnaires were analysed within four groups: urban territorial authorities; rural North Island territorial authorities; rural South Island territorial authorities; and Transit New Zealand.

Forty six out of seventy eight responses, reported the use of devices or techniques to treat storm water. Environmental reasons and consent compliance were the main reasons for treating storm water. Eight territorial authorities reported that the issue had never been considered, but cost and lack of observed need were the main reasons for not treating.

Sedimentation, bio-filtration, filtration and infiltration techniques are being used. The limited sample provided constrained useful comparisons between the devices being used. Estimates of volumes treated were provided by two urban authorities, two rural South Island authorities and one Transit New Zealand return.

Multiple, more intensive, storm water and road run-off treatment techniques are being used by nineteen of eighty three road controlling authorities surveyed, and are in effect for no more than ten percent of the networks operated by those authorities.

Six authorities had no maintenance regime in place. Twelve authorities had a maintenance regime in place for some devices, but not all. Twenty eight authorities had a maintenance regime in place for all treatment devices.

Twenty one authorities reported that monitoring is being undertaken. Testing for turbidity, hydrocarbon residues, heavy metal residues and stream bio-diversity is being undertaken by four road controlling authorities, out of the twenty one undertaking monitoring and forty six that employ some type of treatment device.

Eleven authorities do not use monitoring to determine the effectiveness of devices. Fourteen authorities do not use information from their monitoring in the selection of devices and thirteen do not use it in planning the maintenance of the devices being monitored.

Fifteen authorities undertaking monitoring of devices treating storm water and road run-off fail to use the information from that monitoring in determining the effects of road run-off on the environment or the community. Eighteen authorities do not use the information from their monitoring in environmental reporting.

Fifteen authorities supplied figures for installation costs for devices. Six responses indicated that the cost was not known.

Twenty five authorities provided device maintenance cost figures. Four returns reported the cost as unknown. Five authorities that reported having a maintenance regime in place reported a nil cost for maintenance.

Twelve authorities provided costs for monitoring. Three returns reported that the cost was unknown. Seven authorities reporting that monitoring was being undertaken reported a nil cost for monitoring.

Sixteen returns reported that developer contributions had been used and twelve returns provided estimates of the level of contribution.

Two rural South Island authorities and one urban authority that are not now treating storm water reported an intention to begin treatment within five years. A further three rural South Island authorities plan to begin treating storm water in five to ten years. Three rural North Island authorities, one urban authority and one Transit New Zealand office also reported plans to treat storm water in five to ten years.

Obtaining funding and political support for the investment required was identified as the most significant problem to be addressed in treating storm water by many responses. Besides these, five problems of water quality that were likely to be most significant were: heavy metals, sediment, waterway contamination, chemical levels and disposal of treated residues.

Only two respondents reported that they were unaware of the objective of ensuring environmental sustainability in the NZ Land Transport Strategy.

Public awareness of storm water issues was reported to be low in fifty returns, or 64.1 percent of the total. Comparison of the reported intentions of authorities that are not treating storm water with their reported perception of public awareness suggests a correlation between the two.

Three returns from Transit New Zealand, three from rural North Island authorities and two from urban authorities indicated that the responding authority had objectives for managing road run-off within its asset management plan or business plan.

Sixty three authorities reported that no training at all was available in their area.

Almost two thirds of the respondents' concerns related to treatment devices, and those concerns fell almost equally into three between the cost of the devices, the cost of maintaining them and understanding their effectiveness and capacity.

Further information was sought by eighteen authorities.

## INTRODUCTION

The Road Controlling Authorities Forum Stormwater Group was established to advise RCA Forum members on best practice in dealing with road run-off and storm water. The Stormwater Group's role is to identify best practice, gaps in best practice and developments in best practice, to ensure that road asset managers' interests are represented in the development of policy and best practice dealing with storm water, and to help to resolve tensions between road asset managers and water asset managers within Forum member authorities as they address storm water issues.

In order to fulfil the role given to it, the Stormwater Group was instructed to review the current situation and to identify the needs and concerns of Forum members. At its meeting on 27 October 2005 the Stormwater Group decided that this review required a survey of all road controlling authorities. An initial set of questions was prepared and refined by the Group during November 2005.

On 1 December 2005 the convenor of the Stormwater Group wrote to territorial authority road asset managers and storm water managers, and to Transit New Zealand regional managers to set out the aims of the Group itself and of the questionnaire that was attached to that letter, as follows:

*“The Stormwater group of the RCA Forum exists to assist road controlling authorities on issues relating to stormwater and road run-off. This includes:*

- *Putting best practice in the hands of practitioners*
- *Identifying the gaps in best practice and addressing these gaps.*

*Its membership comprises local authorities, Transit New Zealand and Land Transport New Zealand.*

*The purpose of the attached questionnaire is to undergo a stocktake of knowledge and practices currently being used. Specifically, the Stormwater Group wishes to identify:*

- *The range of stormwater treatment devices in use so it can identify possible gaps in knowledge or training needs*
- *What monitoring of stormwater treatment devices is occurring*
- *Current and emerging issues for road controlling authorities and stormwater managers*

*The results will help the Group to prioritise its activities for the coming year so that they meet the needs of the widest range of road asset managers and stormwater managers.”*

All recipients were asked to complete the two page questionnaire and return it by 31 January 2006, by post or fax, or by completing it on-line on the RCA Forum website. The territorial authorities were also asked to allow both road asset managers and storm water managers to complete the questionnaire.

## THE QUESTIONNAIRE

Answers were sought to twenty three questions, although several contained additional questions conditional on prior answers. The questions sought to identify what treatment devices were in use and what the motivation was for their use, and how and why the devices were being monitored.

The full list of questions is as follows:

1. Within your road network, are any techniques or devices used to improve the quality or reduce the quantity of stormwater (other than kerb and channel)?
  - Is this for road run-off only?
  - Is this for stormwater from other sources only?
  - Is this for stormwater from any source?
2. [If not] why not?
3. Why does your organisation use stormwater treatment techniques or devices?
4. What techniques does your organisation use to address stormwater and road run-off?
5. How many treatment devices does your organisation have in place for stormwater and road run-off?
6. What types of treatment devices do you use, and what is the estimated volume treated?
7. Approximately, what proportion of your network has treatment devices?
8. Do you have a maintenance regime in place for road run-off treatment devices?
9. Is any monitoring being undertaken to determine the effectiveness of any treatment devices?
10. Who undertakes the monitoring?
11. What is being monitored?
12. Does the monitoring have any impact on your business?
13. What is the approximate annual cost of:
  - Installing treatment devices
  - Maintaining treatment devices
  - Monitoring treatment devices
14. Has your organisation used developer contributions to help fund installation or maintenance of treatment devices? If yes, approximately how much?
15. Are you intending to treat stormwater and road run-off in the future? If yes, in what timeframe?
16. What problems do you expect to address?
17. What resources do you estimate will be needed?
18. Is your organisation aware of the objective of ensuring environmental sustainability in the NZ Land Transport Strategy?
19. What is the level of public awareness of stormwater and road run-off issues in your area?
20. If your organisation has its own objectives for managing road run-off, please enclose a copy?
21. What training activities are underway in your area relating to managing stormwater and road run-off?
22. What are your key concerns on road run-off?
23. What further information [would you like]?

## **SURVEY RESPONSE**

These questions were put to the road asset managers and stormwater managers of seventy three territorial authorities and to the managers of Transit New Zealand's seven regions and three sub-regions. The responses were returned from mid-December 2005 until the end of April 2006. The survey was considered to be completed on 30 April 2006.

Responses were returned from sixty four territorial authorities. This represents an 87.67 percent sample of the territorial authorities. Of the nine territorial authorities that did not return a completed questionnaire, three were urban authorities, two were rural North Island authorities and four were rural South Island authorities. Transit New Zealand returned completed questionnaires from all of its regions and sub-regions.

Road asset managers completed fifty six responses and storm water managers returned seventeen. Only nine authorities returned responses completed by both road asset managers and storm water managers. Of these dual returns, five authorities appear to have coordinated the returns to ensure consistency in the responses, while the responses from the remaining four were evidently not coordinated and exhibit substantial inconsistencies.

These four pairs of inconsistent responses are the most significant and thought provoking returns from the survey. It is not simply a matter of one return being more or less correct than the other, or of reverting to the four authorities to request a new, coordinated return from each one. The road asset managers and storm water managers from four urban territorial authorities provided, it must be assumed, what they believed to be correct and appropriate answers to the survey questions, and yet the returns appear to describe eight different regimes.

The question raised by these returns must be: why is the information available to the road asset manager apparently so dissimilar from the information available to the storm water manager in these four authorities? Also, what is the relationship between road management and storm water management in these authorities, that such inconsistent and confusing responses could be returned from the same questions?

More significant for the survey, however, is the implication inherent in the returns. In the absence of any duplicate response from a territorial authority, whether coordinated or not, for returns from forty seven road asset managers and eight storm water managers, how much reliance can be placed on the information provided?

This is not a question of the veracity of these managers, but of the extent of the asset information that might be available to them and of the effects of compartmentalised structures or systems on efforts to deal with a wider issue.

A summary and comparison of the four pairs of uncoordinated returns is set out in the following table.

		TA #4	TA #11	TA #52	TA #32
		R. W.	R. W.	R. W.	R. W.
1	Road or Water manager Techniques or devices used:				
	none			yes	yes
	for road run-off only	yes	yes		
	for road and other sources		yes	yes	yes
2	If not used, because:				
	no legal requirement			yes	
	no observed need				yes
3	If used, because:				
	used for consent compliance	yes	yes		yes
	used for environmental objectives	yes	yes		yes
	used for maintenance objectives		yes		
	used for other objectives			yes	
4	Types and numbers used:				
5	dams, ponds, basins & rain gardens	yes	53	12	1
6	traps and booms		39		
	filters	8	10	47	1
	catchpits		26000	000's	
	sumps and soakholes	yes	2060		
	berms and swales		yes	yes	
7	Proportion of network treated (%):	1	40	0.14	<0.1
8	Maintenance regime in place:				
	for all devices		yes	yes	yes
	for some devices	yes			yes
9	Monitoring being undertaken:	no	yes	no	no
10	in-house		yes		yes
11	Monitoring being done for:				
	total suspended solids		yes		
	polycyclic aromatic hydrocarbons		yes		
	copper		yes		
	lead		yes		
	zinc		yes		
	temperature		yes		
	stream biodiversity		yes		
	"don't know"			yes	yes
12	Reason for monitoring:				
	device effectiveness		yes		yes
	device selection			yes	
	device maintenance		yes		
	compliance reporting		yes		

13	Costs of:							
	installation	10-40K	?			0		450K
	maintenance	10K	610K	1645		0		12000
	monitoring	0	70000	0		0		1500
14	Used developer contributions:	yes	yes	yes	yes	no		no
	for what percent	?	?	100				
15	Plans to treat stormwater:			no		no		no
	within 1-2 years		yes			yes		
	within 1-5 years							yes
	within no timeframe	yes						
16	Plans expect to address:							
	waterway contamination							yes
	sediment							yes
17	Aware of LTS environment objective:	yes	yes	yes		yes	yes	yes
18	Local public awareness of issue:							no
	none					yes		yes
	low	yes		yes	yes			yes
	medium		yes	yes		yes		
19	LTA has own strategy for stormwater	no	no	no		no	no	no
20	Training available in area:							
	none	yes		yes	yes	yes	yes	yes
	in-house		yes					yes
21	Key concerns are:							
	impact of adjacent land uses	yes						
	capital cost of devices				yes	yes	yes	yes
	operating cost of devices	yes	yes		yes	yes	yes	yes
	understanding devices	yes		yes	yes	yes	yes	yes
	consent conditions						yes	
22	More information requested on:							
	training	yes						
	best practice guides						yes	
	nothing		yes	yes	yes	yes	yes	yes

Table 1

If every return is considered as giving an accurate insight into the responder's knowledge, the issues of interest to the Stormwater survey would appear to be that three of the four road asset managers were unaware of plans to begin treating storm water within five years, two road asset managers were unaware of in-house training available on the management of storm water and two road asset managers were not aware of in-house monitoring of storm water treatment devices in their areas. One road asset manager and one storm water manager are unaware of the use, maintenance and monitoring of treatment devices within their areas. It should be noted, too, that the storm water managers listed several concerns where information seems to be an issue, but none requested further information on anything.

## SURVEY ANALYSIS

The questionnaire returns were analysed within four simple groupings: those from urban territorial authorities; those from rural North Island territorial authorities; those from rural South Island territorial authorities; and those from Transit New Zealand. Although some time was spent in testing for regional patterns that might cross or connect these groupings, few significant patterns emerged and no superior means of accessing and configuring the data within the returns was suggested.

There are twenty five urban territorial authorities. Responses were received from twenty two of these, with nineteen returns completed by road asset managers and nine returns completed by storm water managers. Responses were received from twenty six of the twenty eight rural North Island territorial authorities, with twenty three returns completed by road asset managers and six returns completed by storm water managers. Of the sixteen returns from the twenty rural South Island territorial authorities, fourteen were completed by road asset managers and two were completed by storm water managers. The Transit New Zealand returns were all from road asset managers.

### Question 1: USE OF STORM WATER TREATMENT TECHNIQUES OR DEVICES

“Within your road network, are any techniques or devices used to improve the quality or reduce the quantity of stormwater (other than kerb and channel)?

- Is this for road run-off only?
- Is this for stormwater from other sources only?
- Is this for stormwater from any source?”

Of the seventy eight responses to this question, forty six reported the use of devices or techniques to treat storm water. Sixteen of these were for the treatment of road run-off only. Use of techniques or devices to treat only non-road run-off storm water was reported in only one return, for a rural North Island territorial authority.

The distribution of the answers to these four questions across the four analysis groups is summarised in the table below.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
No techniques or devices used:	8	16	7	1	<b>32</b>
Used for road run-off only	4	4	5	3	<b>16</b>
Used for non-road run-off only	0	1	0	0	<b>1</b>
For stormwater from all sources	14	5	4	6	<b>29</b>

Table 2

It is immediately clear that there is no simple division between urban and rural on the use of storm water treatment techniques or devices. While Transit New Zealand might have been expected to follow a pattern consistent with urban territorial authorities, the marked difference in the distribution of returns between Transit New Zealand and the urban territorial authorities indicates significant differences in approach to this issue within the latter group.

The differing distribution within the four groups is shown simply in this graph:

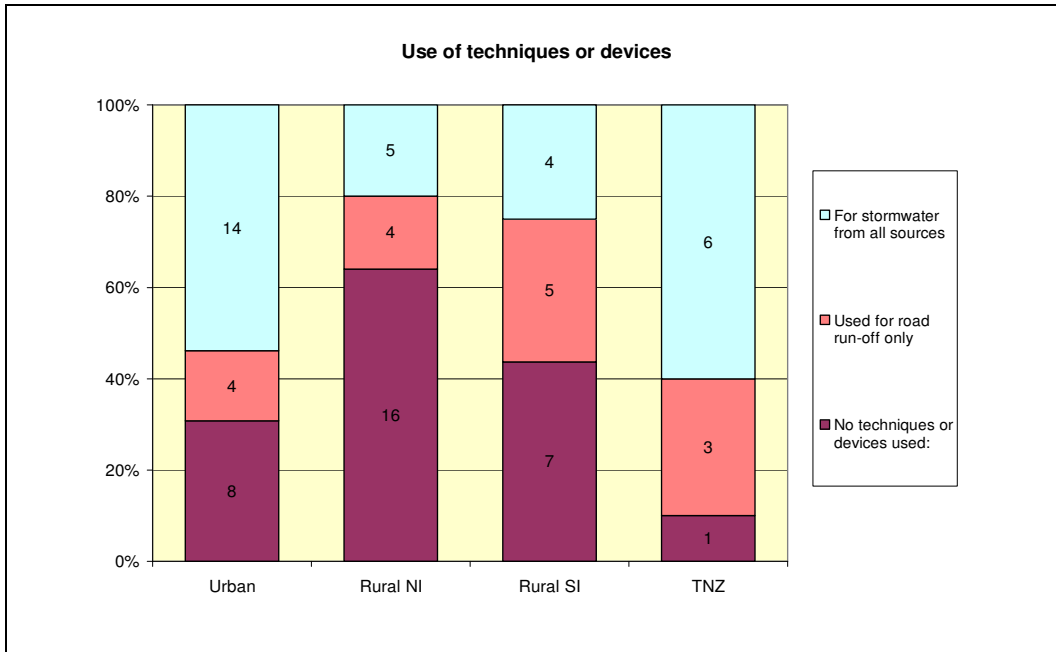


Chart 1

An alternative presentation of the same data, in the chart below, shows the use of treatment techniques or devices for storm water from all sources relative to that from road run-off only and use of no techniques or devices for stormwater treatment, with a breakdown of the last category across the four groups.

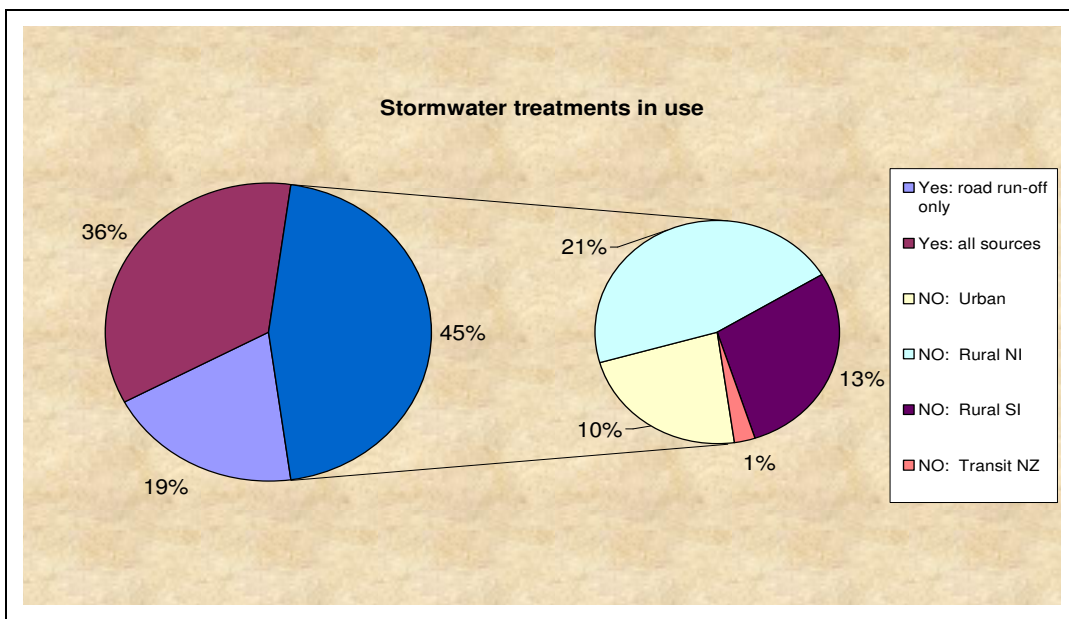


Chart 2

Techniques or devices are used to improve the quality or reduce the quantity of storm water, whether from road run-off only or from other sources also, by fifty five percent of the responding road controlling authorities. Of those authorities not using devices or techniques, 22.22 percent were urban, 46.67 percent were rural North Island and 28.89 percent were rural South Island authorities.

Those answering “No” to question 1 in the questionnaire were requested to list the reasons for this at question 2.

## Question 2: REASONS FOR NOT TREATING STORM WATER

Seven reasons were provided by road controlling authorities for not using storm water treatment devices or techniques. Eight territorial authorities reported that the issue had never been considered, so the exercise of completing this survey might in itself have raised a consciousness of this issue for those authorities.

The following table summarises the distribution of the reasons provided by the four groups. As several returns listed several reasons, the total of the responses does not correlate with the total number of authorities not using treatment techniques or devices.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
never considered this issue	1	7	0	0	<b>8</b>
no legal requirement	1	3	2	0	<b>6</b>
no observed need	4	3	1	1	<b>9</b>
low traffic volume	2	3	1	0	<b>6</b>
low rainfall	0	0	1	1	<b>2</b>
high rainfall	0	0	1	0	<b>1</b>
cost	2	6	3	0	<b>11</b>

Table 3

The pattern of reasons within each analysis group is again quite distinct. This is shown clearly in a chart of the figures above, as here:

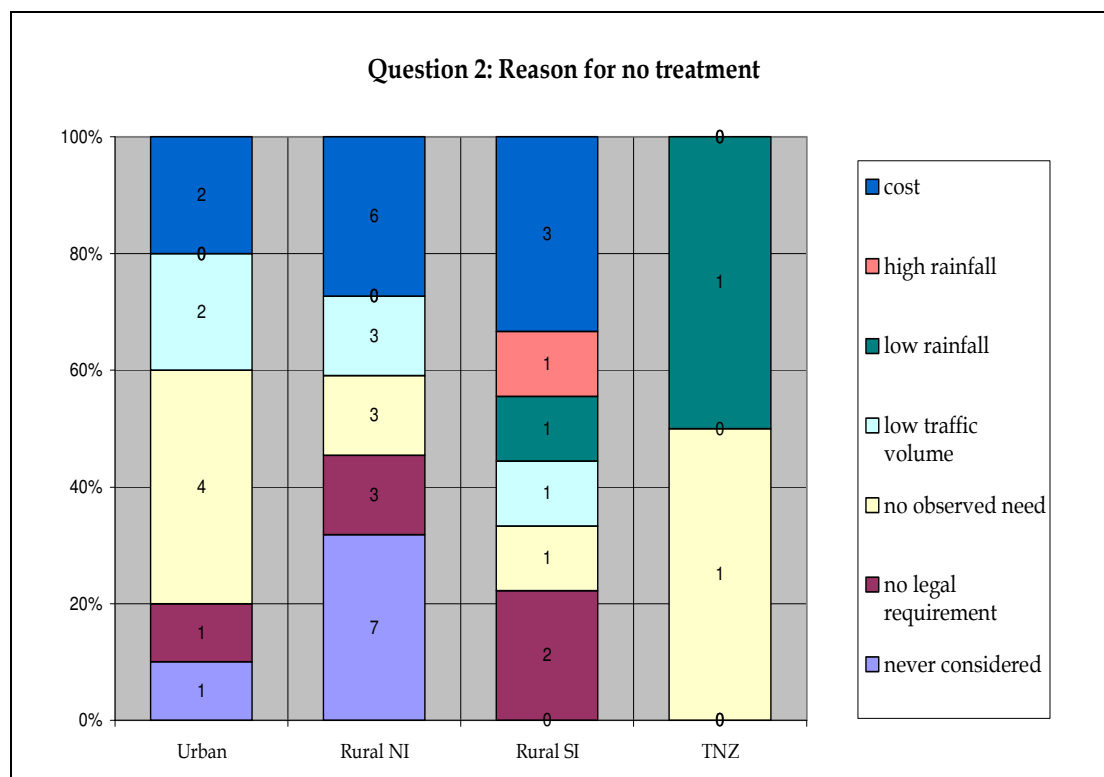


Chart 3

The two reasons citing high or low rainfall were not expected, as it is generally thought that New Zealand lacks the extremes in rainfall that would be sufficient in themselves to remove the need to address, for instance, the issue of storm water quality from road run-off.

It would appear that many authorities have made an informed decision, based on the lack of an observed need for treatment of stormwater. The issue then becomes one of confidence in the process of observation. In the absence of testing or monitoring, the lack of an observed need might simply be the result of inadequate observation. One territorial authority citing no observed need for storm water treatment did return a copy of the monitoring report that demonstrated the process of observation, but none of these authorities (including the one that provided the monitoring report) completed any of the questions relating to monitoring in the questionnaire.

The relative incidence of the reasons cited in Question 2 for all four groups can be shown graphically, as below.

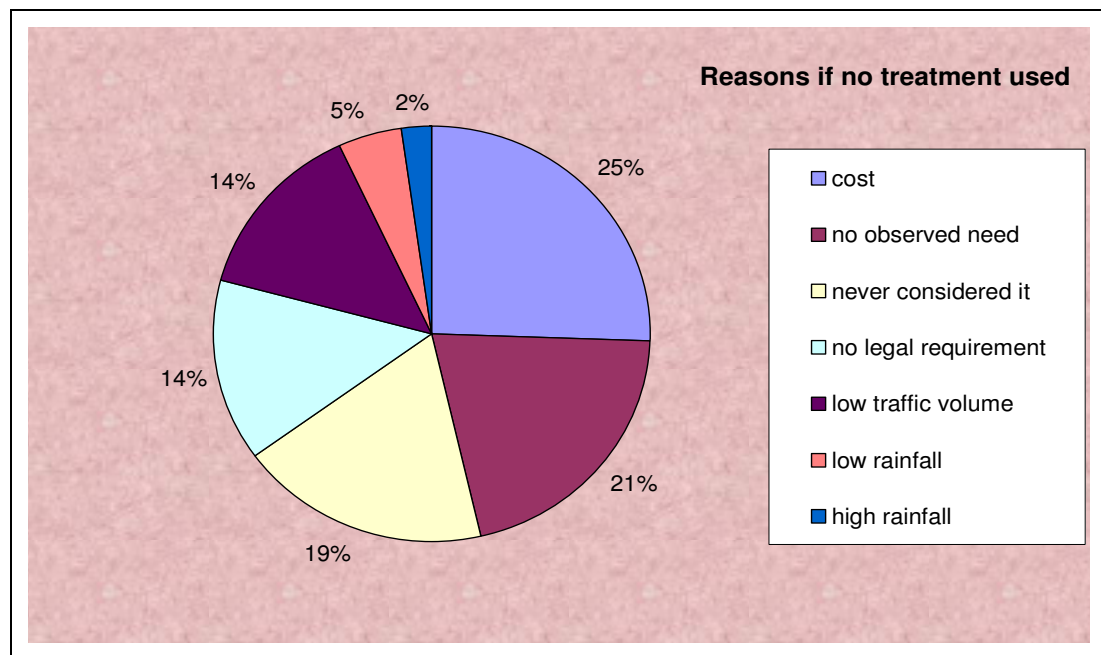


Chart 4

This chart gives a clearer indication than the analysis of the separate groups earlier that cost is the main reason cited for not using treatment devices or techniques, while the lack of a legal requirement for road controlling authorities to treat storm water from road run-off was cited slightly more than half as often.

Never having considered this issue or having observed no need for treatment comprise forty percent of the reasons cited by road controlling authorities for not using storm water treatment. The work being undertaken by the Road Controlling Authorities Forum Stormwater Group and the presence now of an environmental sustainability objective in the Land Transport Strategy could become significant for those who cited these reasons. It is now necessary for authorities to consider the effects of road run-off and to ensure that the standard against which any need for treatment is judged is robust and transparent.

### Question 3: REASONS FOR USE OF STORM WATER TREATMENT

“Why does your organisation use stormwater treatment techniques or devices?”

- compliance with consent conditions
- environmental objectives
- maintenance objectives
- other – please state”

Consent compliance was cited as a reason for the use of storm water treatment devices or techniques in twenty eight returns. Environmental objectives were cited as a reason in thirty two returns. Maintenance objectives were cited in twenty returns. Four other reasons were given in the responses to question 3. In each case the reason was cited in only one return. These reasons were: customer demand, convenience, trial of treatment devices, and aesthetic reasons.

Without further details, it is unclear whether a significant distinction exists between ‘customer demand’ or ‘aesthetic reasons’ and environmental objectives, or between ‘trial of treatment devices’ or ‘convenience’ and maintenance objectives

The responses to this question are summarised in the following table.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
consent compliance	13	5	2	8	<b>28</b>
environmental objectives	13	4	8	7	<b>32</b>
maintenance objectives	8	5	3	5	<b>20</b>
other objectives	2	1	1	0	<b>4</b>
customer demand	1	0	0		
trial of devices	1	0	0		
convenience	0	1	0		
aesthetic reasons	0	0	1		

Table 4

The national totals indicate thirty three percent of returns cited compliance with consent conditions, thirty seven percent cited environmental objectives and twenty five percent cited maintenance objectives.

Within the national totals, however, there are again distinct differences between the four groups. For Transit New Zealand, consent compliance represents forty percent of the reasons for treatment, whereas it was cited by only fourteen percent of rural South Island territorial authorities. Consent compliance was cited in thirty six percent of urban territorial authorities’ returns and in thirty three percent of returns from rural North Island territorial authorities.

For rural North Island territorial authorities, treatment of storm water to meet maintenance objectives is relatively more important. Maintenance objectives were cited by thirty three percent of these authorities. For urban territorial authorities the figure was about twenty two percent and for rural South Island authorities it was slightly less (22.2 and 21.4 percent respectively). Transit New Zealand returns cited maintenance objectives in twenty five percent of the responses.

Environmental objectives were cited by Transit New Zealand and by urban authorities in similar proportions: thirty five percent for the former and thirty six percent for the

latter. For rural North Island authorities environmental objectives were markedly less often cited than consent compliance or maintenance objectives and were given as a reason for storm water treatment in 26.67 percent of their returns. This contrasts very strongly with the returns from rural South Island authorities, where, at fifty seven percent, environmental objectives were cited more than twice as often.

The differences between the groups and between them and the national totals can be seen clearly in the following charts.

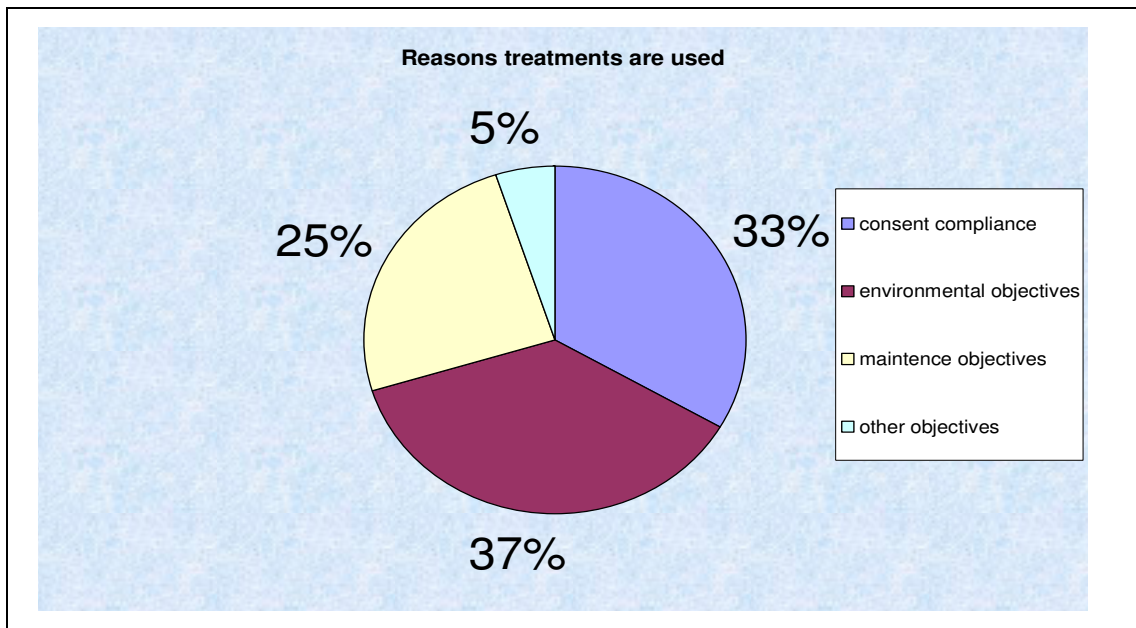


Chart 5

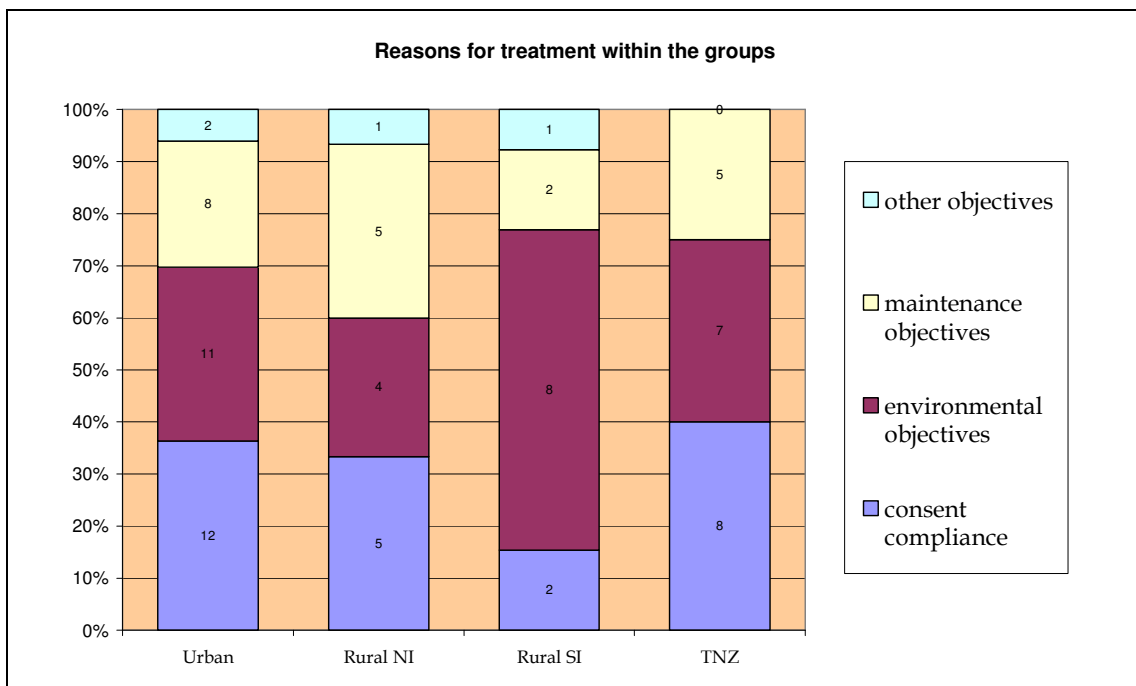


Chart 6

#### **Question 4: TECHNIQUES USED TO ADDRESS STORM WATER**

“What techniques does your organisation use to address stormwater and road runoff?”

Questions 4, 5 and 6 of the questionnaire were designed to discover exactly what techniques and devices were being used. To this end question 4 addressed only the techniques being used, while question 5 sought the number of devices and question 6 sought the types of devices being used. Few returns recognised this distinction between a technique and a device.

At both question 4 and question 5, too, several responders appear to have changed their minds. Having answered “Yes” to question 1 and given the reasons for their use of treatment techniques or devices at question 3, they answered “None” to question 4 or question 5.

Despite a remarkable and confusing variety of names for local variants, four treatment techniques recur in the returns for question 4: settling or sedimentation, using micro-filtration or bio-filtration through planted soil, using mechanical filtration techniques, and using sumps and soaks to contain and dispose of storm water.

‘Settling’ involved the use of dams, ponds or tanks. These were called sedimentation ponds, detention areas, polishing ponds, silt or mud tanks and attenuation areas. This technique is employed relatively more frequently by Transit New Zealand and urban authorities, at thirty five percent and 27.3 percent respectively. It was listed by rural North Island authorities in four returns (twenty percent) and listed by only one rural South Island authority (8.3 percent). The national usage is twenty five percent of the survey responses.

Bio-filtration involves the use of grassed berms, swales, rain gardens, soaks and wetlands. This treatment technique was listed in thirty percent of the returns for question 4, but is significantly more frequently used by rural South Island authorities (41.6 percent) and Transit New Zealand (thirty five percent), whereas it was listed by only 24.2 percent of urban authorities.

For urban authorities, the predominant treatment technique is mechanical filtration, listed in 33.3 percent of returns. Mechanical filtration techniques were described as the use of ‘sqids’ or sand filters, basket, bag or sock filters, or “enviropods”, cage filters or sump traps and gross pollutant traps. This technique is used less extensively by rural North Island authorities (twenty five percent) and Transit New Zealand (twenty percent), and was listed by only one rural South Island authority (8.3 percent). It represents twenty five percent of the national totals.

The use of gravel swales, soak pits and soak trenches appears to rely on infiltration and dispersal to treat storm water. Many returns listed sumps, catchpits, natural channels and open drains as treatment techniques. Sumps and soak holes were listed by twenty percent of all returns, but represent 41.6 percent of rural South Island authorities’ treatment, in contrast to Transit New Zealand, which listed their use in only ten percent of returns. For urban authorities the figure was fifteen percent and for rural North Island authorities it was twenty five percent.

The following table and accompanying charts show the relative use of these four techniques nationally and between the four groups.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
none	0	0	2	0	<b>2</b>
settling ponds	9	4	1	7	<b>21</b>
bio-filtration	8	6	5	7	<b>26</b>
mechanical filtration	11	5	1	4	<b>21</b>
sumps and soaks	5	5	5	2	<b>17</b>

Table 5

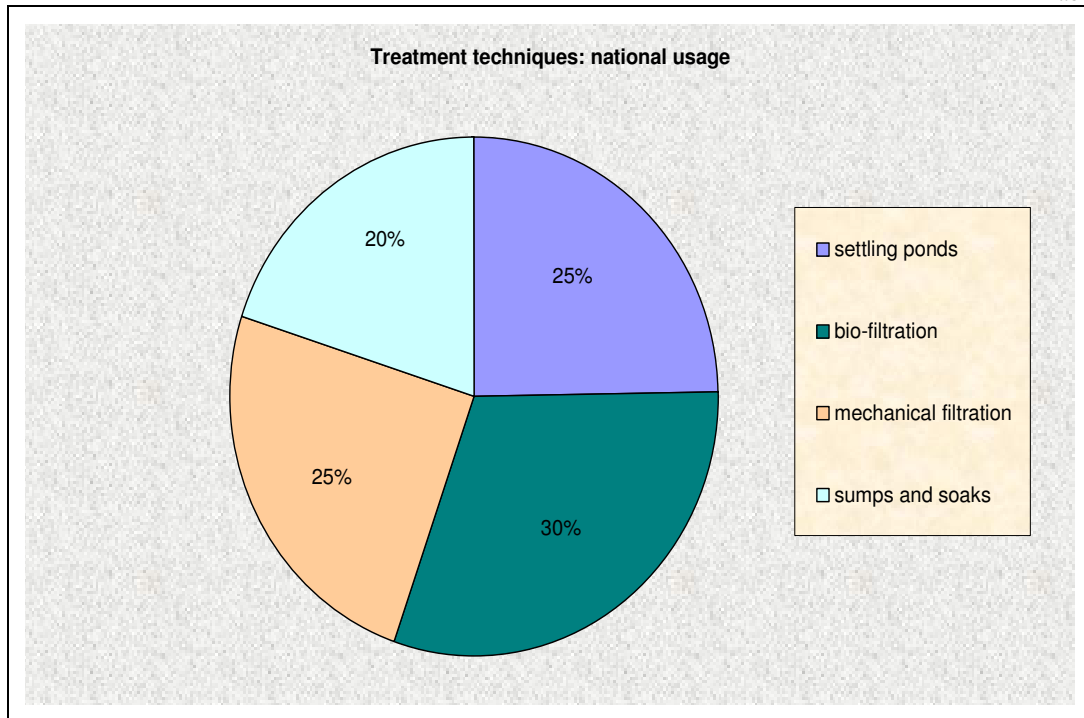


Chart 7

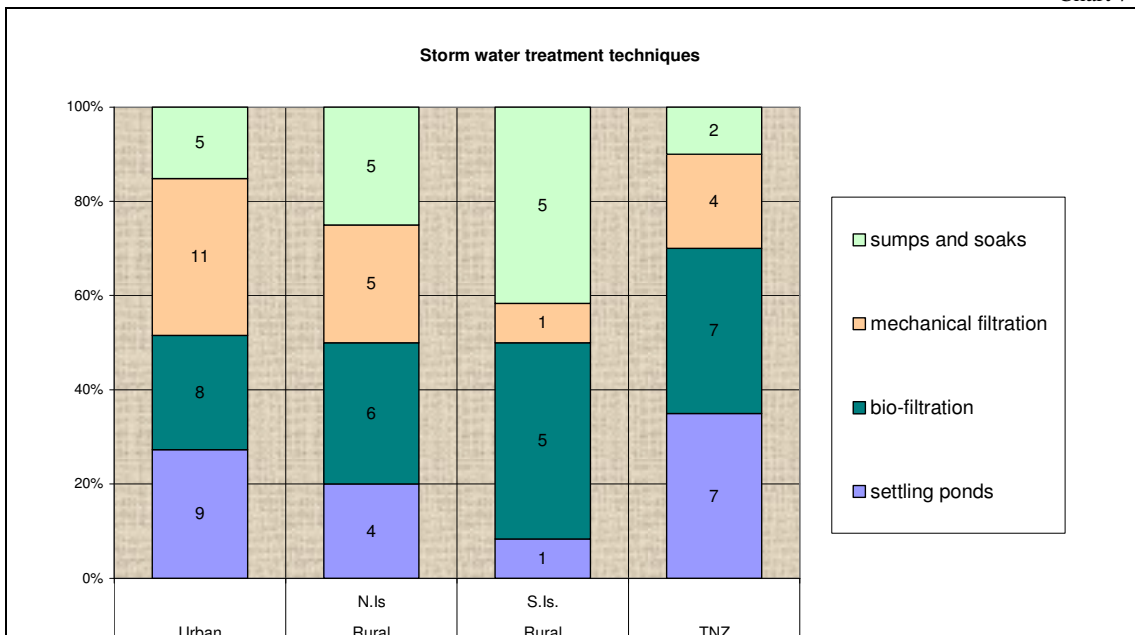


Chart 8

Of those returns listing mechanical filtration techniques used to treat storm water, six listed sand filters or “sqids”, four listed cages, seven listed baskets or “enviropods” and five listed “bags” or “socks”. This distribution is shown in the chart below.

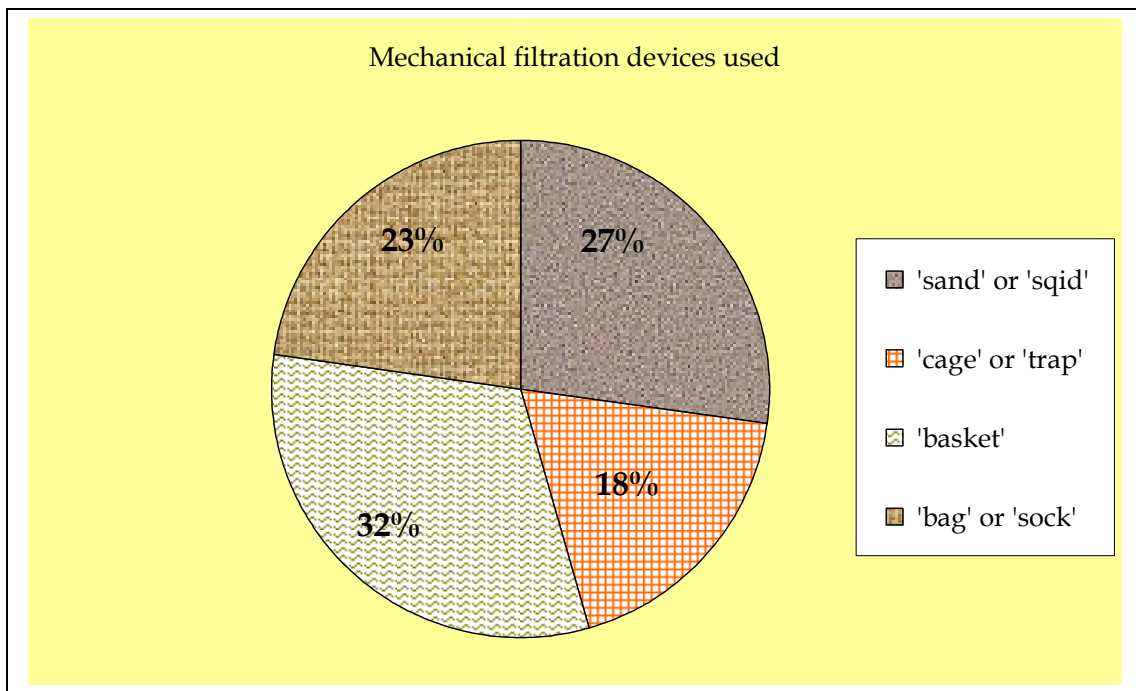


Chart 9

**Question 5: NUMBERS OF DEVICES IN USE**

“How many treatment devices does your organisation have in place for stormwater and road run-off?”

Three returns responded to question 5 by ticking “None”. Eighteen responses gave no specified numbers. Returns of “numerous”, “00’s” and “000’s” offered limited useful information, especially when combined with “various” to describe the devices being used. Figures were provided in twenty six returns.

The limited sample provided by the response to question 5 constrains the usefulness of comparisons between the groups and between devices. Only three returns gave a figure for the number of “catchpits” used, so a total of 27,099 has very little statistical value. Seven returns provided figures for “sumps”. While sump and catchpit appear to be interchangeable terms, the returns have been kept separate. Three urban authorities’ returns account for 92.76 percent of the total number of sumps listed.

Six returns listed numbers of settling devices, which include dams, ponds, tanks and underground silt chambers. A total of 217 of such devices were listed. Figures for numbers of traps were provided by four returns and four returns listed numbers for the use of soak pits and infiltration trenches. Numbers for the use of filters were given in eight returns.

A summary of these returns is provided in the table on the following page.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
none	0	0	3	0	<b>3</b>
unspecified number	7	3	4	4	<b>18</b>
"don't know"	1	3	0	0	<b>4</b>
figures provided	13	4	3	6	<b>26</b>
totals from provided figures:					
ponds and dams	74	100	0	43	<b>217</b>
traps	31	400	0	2	<b>433</b>
filters	100	0	1	3	<b>104</b>
soakpits	2,072	0	1	2	<b>2,075</b>
sumps	17,748	500	883	0	<b>19,131</b>
catchpits	26,000	0	0	1,099	<b>27,099</b>
returns providing figures:					
ponds and dams	4	1	0	1	<b>6</b>
traps	2	1	0	1	<b>4</b>
filters	5	0	1	1	<b>7</b>
soakpits	2	0	1	1	<b>4</b>
sumps	4	2	1	1	<b>8</b>
catchpits	1	0	0	2	<b>3</b>

Table 6

For filter devices, it is possible to derive some further details from the returns to show how devices are employed or combined, and to give numbers for different types of devices, but these are derived from a very limited sample.

Of the one hundred filters listed by urban authorities, forty seven were specified as fabric baskets or “enviropods” and ten were sand filters, while forty three were listed as unspecified “sump filters”. The rural South Island authority that listed a filter described it as a “cyclone filter fabric type device”.

The Transit New Zealand return that listed the use of three filters provided details of their use. A Hynds FloGard Catchpit Filter® is used with a settling tank. An Ingal Enviropod Gully Pit Insert® is employed in conjunction with a sand filter.

### **Question 6: TYPES OF DEVICES AND VOLUMES TREATED**

“What types of treatment devices do you use, and what is the estimated volume treated?”

Very little additional information was provided in responses to question 6. Estimates of volumes treated were provided by two urban authorities, two rural South Island authorities and one Transit New Zealand return. These estimates were not related to specific devices, but for the two urban authorities the estimates appear to relate to sediment settling ponds. In one return, two sediment ponds are estimated to treat fifteen cubic metres per second. In the other, a single pond is estimated to treat three cubic metres per second.

Both returns from rural South Island authorities providing estimates of volumes being treated appear to relate to swales. One gave an estimate of ten cubic metres per second, while the other return estimated a volume of fifty cubic metres per second, but neither provided an estimate of the length or area of swale involved.

The Transit New Zealand return estimated a treated volume of twelve hundred cubic metres per second for forty eight devices employing settling, filtration, bio-filtration and infiltration techniques.

Most of the returns for this question re-listed the devices or methods already listed for question 4 without supplying any new data. For many returns the lists were slightly different.

**Question 7: PROPORTION OF NETWORK BEING TREATED**

“Approximately, what proportion of your network has treatment devices?”

Estimates of the proportion of the road network with storm water treatment devices in place were provided in thirty three returns. The range in estimates was from 0.01 percent to one hundred percent. For the thirteen urban authorities providing estimates the range was 0.14 to 100 percent. The range for the estimates from six rural North Island authorities was comparable at 0.10 to 100 percent. Six rural South Island authorities also provided estimates, which had a range of 0.01 to 50 percent. Transit New Zealand provided eight estimates, with a range of less than one percent to twenty five percent.

The following table provides a summary of the returned estimates from each of the four analysis groups, with the arithmetic mean and range median calculated for each series.

	Urban	Rural NI	Rural SI	TNZ
% treated	0.14	0.1	0	0.6
	0.4	0.5	0.01	2
	0.7	0.7	0.5	5
	0.85	5	2	7
	1	90	25	8
	2	100	50	8.5
	5			13
	15			25
	40			
	45			
	85			
	100			
	100			
Mean	30.392	32.717	12.918	8.638
Median	5.00	2.85	1.25	7.50

Table 7

Comparison of estimates in each return with the treatment techniques and devices listed in response to questions 4 and 5 revealed a different distribution pattern. Eight of these returns listed sumps or catchpits as the only storm water treatment used. For

this group the mean estimated treatment was 46.238 percent and the median was thirty five percent. Four returns providing estimates of the proportion of their network treated indicated that only settling devices were used. For this group the mean estimated treatment was 47.525 and the median was forty five percent.

These figures contrast markedly with those where only mechanical or man-made filtration techniques were listed or where multiple techniques were employed. For the six returns providing estimates where only mechanical filtration was used, the mean was 0.992 percent and the median was 0.9 percent. For the twelve returns that had listed multiple treatment techniques, the mean of the proportion of the networks treated was 10.158 percent and the median was six percent. This pattern is shown in the following table.

Sumps only	settling only	bio-filters only	filters only	multiple techniques
0.5	0.1	0	0.01	0.6
0.9	5	50	0.14	0.6
8.5	85		0.8	0.7
25	100		1	2
45			2	5
90			2	5
100				7
100				8
				13
				25
				40
				15
46.238	47.525	25.000	0.992	10.158
35	45	25	0.9	6

Table 8

This pattern in the estimates of what is being treated would suggest that comparison of differing estimates of treatment can be of only limited use without a widely agreed meaning for the term “treatment”. In the meantime, these estimates reveal widely differing perceptions of storm water treatment.

It is reasonable, however, to conclude from the returns to questions 4, 5, 6 and 7 in this survey that multiple, more intensive, storm water and road run-off treatment techniques are being used by nineteen road controlling authorities, out of the potential survey total of eighty three, and are likely to be in effect for no more than ten percent of the networks operated by those authorities.

The national figure, therefore, must reflect the use of multiple treatment techniques on approximately ten percent of about twenty three percent of the road network.

## Question 8: MAINTENANCE OF DEVICES

“Do you have a maintenance regime in place for road run-off treatment devices?”

A response to this question was provided in forty six returns. Six authorities had no maintenance regime in place. Twelve authorities had a maintenance regime in place for some devices, but not all. Twenty eight authorities had a maintenance regime in place for all treatment devices. The following chart shows the distribution of these returns.

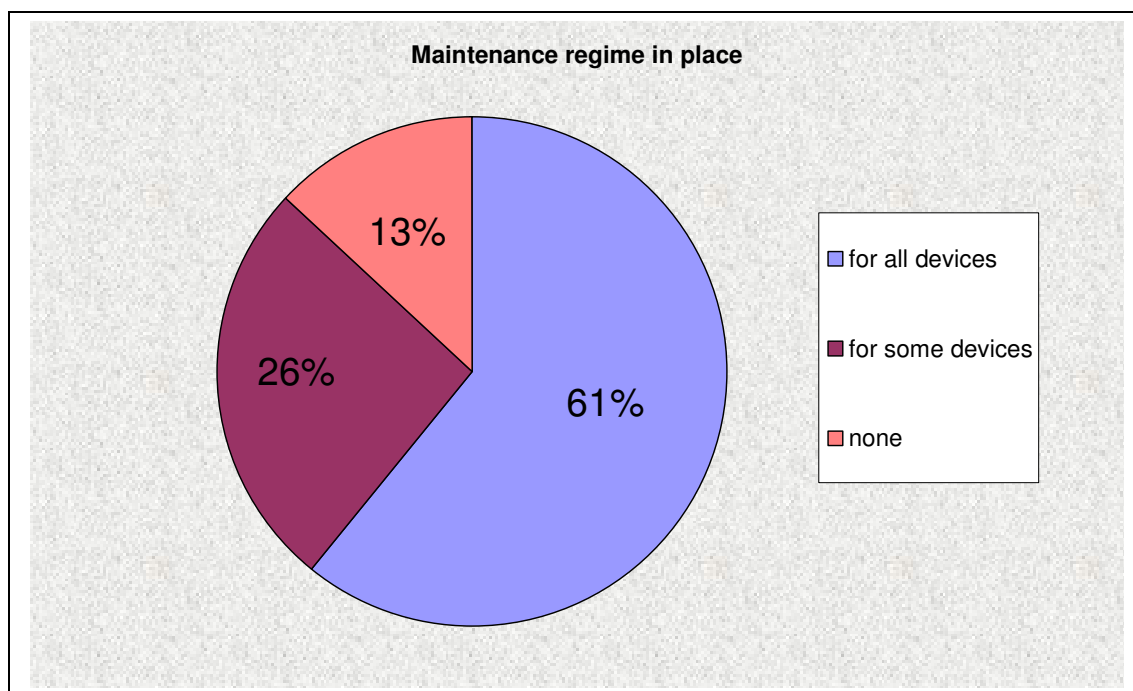


Chart 10

The distribution of responses within and between the four analysis groups is shown in the following table.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
Maintenance regime for all devices:	13	2	6	7	<b>28</b>
Regime for some devices:	4	6	1	1	<b>12</b>
No maintenance regime:	1	1	3	1	<b>6</b>

Table 9

The pattern of distribution within the urban authorities and Transit New Zealand was again broadly similar, with approximately seventy two percent of urban authorities and almost seventy eight percent from the Transit New Zealand returns having maintenance regimes in place for all devices.

The pattern for the rural South Island authorities has sixty percent of returns having a regime for all devices and thirty percent having none at all. Two thirds of the rural North Island returns on this question reported a maintenance regime in place for some treatment devices, but only 22.2 percent had regimes in place for all devices.

In three of the four groups the absence of a maintenance regime correlated with the use of bio-filtration techniques, but in the rural North Island authority reporting no maintenance regime the treatment technique employs filters in sumps.

### **Question 9: MONITORING OF DEVICE EFFECTIVENESS**

“Is any monitoring being undertaken to determine the effectiveness of any treatment devices?”

Four questions within the survey addressed the issue of monitoring treatment devices. Twenty one authorities reported that monitoring is being undertaken. Nine urban authorities reported monitoring treatment devices. Of these nine, five reported having maintenance regimes in place for all devices, two had maintenance regimes for some devices and two reported having no maintenance regime in place.

Six rural North Island authorities reported the use of monitoring. Three of these six had maintenance regimes for all treatment devices and two had regimes for some devices. One authority reported using monitoring, but uses no devices and has no maintenance regime.

Monitoring is being undertaken by two rural South Island authorities. Both have maintenance regimes in place for all devices.

Transit New Zealand reported monitoring treatment devices in four returns, three of which had reported having maintenance regimes in place for all devices and the fourth had a regime in place for some devices.

Twenty of the forty six authorities using storm water treatment devices of some type are monitoring the effectiveness of those devices. This represents 43.48 percent. One authority not yet treating storm water is monitoring it.

### **Question 10: “WHO UNDERTAKES THE MONITORING?”**

Monitoring can be undertaken in-house only, by the appropriate regional council alone or with the road controlling authority only or with an outside organisation as well as or instead of the road controlling authority, or by an outside organisation only.

Eleven returns reported that monitoring was done in-house only. One return reported that a regional council carried out the monitoring alone. Four returns indicated that the monitoring was done in-house and by the regional council. Three returns reported that monitoring was done by the regional council and an outside organisation, without in-house involvement. Two returns reported that all monitoring was done only by an outside organisation.

Of the five returns where an outside organisation was listed, the organisation was a private contracting organisation in four returns. The National Institute of Water and Atmospheric Research was reported as the monitoring organisation in only one return. No other research organisation was cited in the returns.

The table on the following page shows the pattern of monitoring across the analysis groups.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
Monitoring being done:	9	6	2	4	<b>21</b>
"Who undertakes the monitoring?"					
in-house only	6	2	1	2	<b>11</b>
in-house + regional council	2	2	0	0	<b>4</b>
regional council only	0	0	1	0	<b>1</b>
with other organisations	1	1	0	1	<b>3</b>
other organisations only	0	1	0	1	<b>2</b>

Table 10

### Question 11: "WHAT IS BEING MONITORED?"

The questionnaire identified seven tests that might be used in monitoring the effectiveness of storm water treatment devices. These were tests for: turbidity or total suspended solids in the sampled water; fuel and road residues or polycyclic aromatic hydrocarbons; heavy metal residues –specifically copper, lead and zinc; sample temperature; and measured stream bio-diversity.

Eighteen returns responded to this question. Four reported that they did not know what was being monitored. The returns have been analysed to identify the number of authorities using each test. This is summarised in the first table below. The returns have then been analysed to identify the tests being used by each authority. This is summarised in the second table below.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
total suspended solids (TSS)	7	3	1	0	<b>11</b>
polycyclic aromatic hydrocarbons (PAH)	6	3	0	0	<b>9</b>
copper (Cu)	7	2	1	0	<b>10</b>
lead (Pb)	5	1	1	0	<b>7</b>
zinc (Zn)	7	2	1	0	<b>10</b>
temperature (T!)	1	1	0	0	<b>2</b>
stream biodiversity (SBD)	4	1	0	1	<b>6</b>
"don't know"	2	0	0	2	<b>4</b>

Table 11

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
TSS only	0	<b>1</b>	<b>1</b>	0	<b>2</b>
PAH only	0	<b>1</b>	0	0	<b>1</b>
Cu+Pb+Zn only	0	0	<b>1</b>	0	<b>1</b>
SBD only	0	0	0	<b>1</b>	<b>1</b>
TSS+Cu+SBD only	<b>1</b>	0	0	0	<b>1</b>
TSS+PAH+Cu+Zn	<b>1</b>	<b>1</b>	0	0	<b>2</b>
TSS+PAH+Cu+Zn+Pb	<b>2</b>	0	0	0	<b>2</b>
TSS+PAH+Cu+Zn+Pb+SBD	<b>2</b>	0	0	0	<b>2</b>
TSS+PAH+Cu+Zn+Pb+SBD+T!	<b>1</b>	<b>1</b>	0	0	<b>2</b>

Table 12

This second analysis has then been tied to the responses to question 10 to ascertain whether any relationship exists between who undertakes the monitoring and what is monitored. This is shown in the following table.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
TSS only	0	<b>I</b>	<b>I</b>	0	<b>2</b>
PAH only	0	<b>RO</b>	0	0	<b>1</b>
Cu+Pb+Zn only	0	0	<b>R</b>	0	<b>1</b>
SBD only	0	0	0	<b>I</b>	<b>1</b>
TSS+Cu+Zn+SBD	<b>I</b>	0	0	0	<b>1</b>
TSS+PAH+Cu+Zn	<b>IR</b>	<b>I</b>	0	0	<b>2</b>
TSS+PAH+Cu+Zn+Pb	<b>I, IRO</b>	0	0	0	<b>2</b>
TSS+PAH+Cu+Zn+Pb+SBD	<b>I, I</b>	0	0	0	<b>2</b>
TSS+PAH+Cu+Zn+Pb+SBD+T!	<b>I</b>	<b>IR</b>	0	0	<b>2</b>
"don't know"	<b>I, I</b>	0	0	<b>I, O</b>	<b>4</b>
monitoring, but didn't answer	0	<b>IR, O</b>	0	<b>RO</b>	<b>3</b>

Table 13

The table above shows the monitoring tests being done in-house only (I), in-house and with the relevant regional council only (IR) or with an outside organisation as well (IRO), by the regional council only ® or with an outside organisation (RO), and by an outside organisation only (O).

The three authorities that reported undertaking monitoring in question 10, but returned no response to question 11, have been included in the table, as well as the four returns that reported that the respondent did not know what was being monitored. All seven are assumed not to know what was being monitored, although four had already reported that the monitoring is being undertaken in-house. If the monitoring serves any purpose the information should have been readily accessible.

The tendency for returns reporting outside organisations undertaking the monitoring to also be least informed about what monitoring is being undertaken is very clear. The survey did not address the flow of data from monitoring storm water treatment devices, which in theory should be the same regardless of who undertakes the monitoring, but it appears less likely to have reached the respondents if undertaken by an outside agency.

The pattern of distribution showing the most intensive monitoring being undertaken by the urban authorities, followed by two of the rural North Island authorities, is clear in both the above table and the previous one. Transit New Zealand appears to be undertaking very limited monitoring, but it is disproportionately represented in the returns that could not say what was being monitored, so these figures do not preclude the possibility that Transit New Zealand is undertaking more intensive monitoring.

From the answers to this survey it would appear that testing for turbidity, hydrocarbon residues, heavy metal residues and stream bio-diversity in monitoring the effectiveness of treatment devices is being undertaken by four road controlling authorities, out of the twenty one undertaking monitoring and forty six that employ some type of treatment device. Monitoring for one or a limited combination of these tests is more common.

## Question 12: PURPOSES OF MONITORING

“Does the monitoring have any impact on your business?”

This question sought to identify the reasons for monitoring of storm water treatment devices and the use made of the data from that monitoring. Respondents were asked if the monitoring had an impact on determining the effectiveness of devices, or on influencing the selection of devices, or on planning the maintenance of devices. They were also asked if the monitoring affected reporting of compliance with consent conditions, or of the state of the environment, or in determining the effect of road run-off on the environment or the community.

The responses are summarised in the table below to show, first, the distribution of positive answers to each item, second, the incidences where only one reason was indicated and, third, the distribution of negative answers to each item. From this it is possible to see the use being made of the monitoring being undertaken and also to see the extent to which the monitoring is not being used.

	Urban LA's	Rural North Is.	Rural South Is.	Transit NZ	<b>TOTAL NZ</b>
determining device effectiveness	5	2	2	2	<b>11</b>
influencing device selection	4	0	2	2	<b>8</b>
device maintenance	4	2	2	1	<b>9</b>
reporting consent compliance	6	2	1	3	<b>12</b>
determining run-off effects	4	1	1	1	<b>7</b>
environmental reporting	3	0	0	1	<b>4</b>
determining device effectiveness only	1	0	0	0	<b>1</b>
influencing device selection only	1	0	0	0	<b>1</b>
device maintenance only	1	1	0	0	<b>2</b>
reporting consent compliance only	0	0	0	1	<b>1</b>
none	0	3	0	0	<b>3</b>
not determining device effectiveness	5	1	0	2	<b>8</b>
not influencing device selection	6	3	0	2	<b>11</b>
not device maintenance	6	1	0	3	<b>10</b>
not reporting consent compliance	4	1	1	0	<b>6</b>
not determining run-off effects	6	2	1	3	<b>12</b>
not environmental reporting	7	3	2	3	<b>15</b>

Table 14

Two returns reported that the monitoring had no impact. It would seem pointless to undertake monitoring that has no affect at all on the operations of the business. In each case only a single type of test was being undertaken. For these two authorities, unused monitoring would appear to be useless monitoring. The third authority did not respond to this question and is assumed to derive no practical return from its monitoring of total suspended solids, polycyclic aromatic hydrocarbons, copper and zinc.

Although twenty one of forty six authorities using treatment devices reported that monitoring was being undertaken “to determine the effectiveness of any treatment devices”, eleven authorities do not use monitoring to determine the effectiveness of

devices. Fourteen of the twenty one authorities do not use information from their monitoring of devices in the selection of devices and thirteen do not use it in planning the maintenance of the devices being monitored.

Fifteen authorities undertaking monitoring of devices treating storm water and road run-off fail to use the information from that monitoring in determining the effects of road run-off on the environment or the community. Eighteen of the twenty one authorities do not use the information from their monitoring in environmental reporting.

Of the two authorities using all seven tests listed in the survey, neither one used the results in determining the effectiveness of devices, or in the selection of devices, or in environmental reporting. One authority used the information from monitoring for the maintenance of the devices, but the other did not.

Of the returns where the respondent did not know what was monitored, the resultant data was used for device maintenance by two authorities and a third used the testing results to determine device effectiveness, plan maintenance, report compliance with consent conditions and determine the effects of road run-off.

It would appear from the responses to this survey that very few road controlling authorities are extracting full value from their investment in monitoring road run-off treatment devices.

### **Question 13: COSTS OF STORM WATER TREATMENT**

“What is the approximate cost of installation, maintenance and monitoring?”

Thirty four returns provided a response to this question. Three returns reported nil for all three categories and one responded “?” to each category. Three returns that reported having maintenance and monitoring regimes failed to complete any part of this question.

Fifteen returns supplied figures for installation costs. Thirteen returns left this category unanswered or reported a nil cost. Six returns indicated that the cost was not known.

Twenty five returns provided maintenance cost figures. Five returns gave a nil cost and four returns reported the cost as unknown. Five authorities that reported having a maintenance regime in place reported a nil cost for maintenance.

Twelve returns provided costs for monitoring. Nineteen returns gave a nil cost and three returns reported that the cost was unknown. Seven authorities reporting that monitoring was being undertaken reported a nil cost for monitoring.

The marked difference in the returns for installation costs and maintenance costs appears to indicate a situation where road controlling authorities have relatively less input into selection and installation of treatment devices, but assume responsibility for their maintenance.

The distribution of these returns is summarised in the following table.

	Urban TA's	Rural North Is.	Rural South Is.	Transit NZ	<b>TOTAL NZ</b>
installation					
figures provided	6	2	3	4	<b>15</b>
nil provided	2	4	2	5	<b>13</b>
cost unknown	3	2	1	0	<b>6</b>
maintenance					
figures provided	11	5	2	7	<b>25</b>
nil provided	0	2	1	2	<b>5</b>
cost unknown	0	1	3	0	<b>4</b>
monitoring					
figures provided	5	1	2	4	<b>12</b>
nil provided	5	6	3	5	<b>19</b>
cost unknown	1	1	1	0	<b>3</b>

Table 15

The rural South Island authorities were the only group not to conform to a pattern that had the cost of maintenance substantially more likely to be known than the cost of installation. This could be indicative of difficulties in estimating maintenance costs for berms and swales, or a reflection of relatively greater involvement by these authorities in the selection and provision of storm water treatment.

The actual figures provided in these returns are of limited use, however, because the level of detail provided in responses to earlier questions is insufficient to allow valid comparisons to be made across more than a few returns, whether between techniques, devices or authorities.

With sumps, for example, the returns provide several apparently precise figures. One return stated that the installation cost of sumps was \$1,450 each, while another put the cost at \$10,000 to \$20,000 each. A third return gave a figure of \$20,000. As this appears to apply to 883 sumps, it would appear to be the individual installation cost.

For maintenance costs for sumps, one return states a cost of \$15 each while another gives a cost of \$10,000 to maintain one hundred sumps (at a unit cost of \$100 each). Two others give maintenance costs of \$1,645 for forty seven sumps and \$30,000 for 883 (at comparable unit costs of \$35 and \$34 for each sump, respectively). A fifth return, however, gives a figure of \$5,000 for the maintenance of four hundred catch-pits (at a unit cost of \$12.50).

For filters there is only one return that provides sufficient detail to extract a unit cost, against there is then nothing to compare it. An installation cost of \$10,000 to \$40,000 and maintenance cost of \$10,000 is reported for eight filters, of unknown type. This indicates unit costs of \$1,250 to \$5,000 to install and \$1,250 for annual maintenance.

One return provides a figure of \$30,000 for the maintenance of a settling pond, while another gives a figure of \$300,000 to \$500,000 to maintain twenty ponds. In contrast to these, another return reports a maintenance cost for “ponds” and “filters” as being only \$12,000.

The following table provides a summary of these figures by using the descriptions of treatment devices provided in questions 4-6.

Description	Installation	Maintenance	Monitoring
8 filters	10,000-40,000	10,000	
47 sumps		1,645	
[?]	1000 per filter	100-150 each	
20 ponds	millions	300,000-500,000	
Sumps	1450 each	31,000	
swales + berms + sumps	250,000	25,000	10,000
ponds + filters	450,000	12,000	1,500
ponds + swales + sumps	150,000	10,000	
sumps	10,000-20,000 each		
[none]	50,000		
883 sumps	20,000 [each?]	30,000	
1 soakpit	15,000	1,200	500
soaks + sumps		2,000	
[?]		76,000	2,500
pond		30,000	2,000-3,000
400 catchpits		5,000	
[?]		15,000	16,000
100 sumps		10,000	
sumps		15 each	
10 filters, 30 traps, 51 ponds			
2060 soaks, 26000 sumps		610,000	70,000
[?]		10,000	5,000
filters + swales	150,000	1,000	500
sumps		30,000	
filters + ponds	30,000	60,000	5,000

Table 16

A slightly different analysis can be made of the monitoring costs figures to identify what was being monitored, and by whom, for the reported costs. This is shown in the following table.

TSS+PAH+Cu+Zn+Pb+SBD	in-house	10,000
"don't know"	"don't know"	1,500
TSS only	in-house	1,000
Cu+Pb+Zn only	regional council	500
TSS+Cu+Zn+SBD only	in-house + r.c.	2,500
TSS+PAH+Cu+Zn+Pb+SBD	in-house	2000-3000
TSS+PAH+Cu+Zn+Pb+SBD+T!	in-house + r.c.	16,000
TSS+PAH+Cu+Zn+Pb+SBD+T!	in-house + r.c.	70,000
no data	no data	5,000
SBD only	in-house	500
not monitoring	n/a	5,000
"don't know"	in-house	5,000

Table 17

Perhaps the most startling discovery from this comparison of three different questions dealing with monitoring of treatment devices is that one road controlling authority reported an annual cost of \$5,000 for undertaking an activity that it had repeatedly reported that it was not undertaking. The frequency with which authorities appear to be investing in monitoring about which they appear to have no further information is also surprising.

When the limited use that many authorities reported making of the information from monitoring is considered against the expenditure that several authorities are making, it is clear that authorities could obtain greater benefit from this investment. For the authority that spends \$1,000 annually to monitor turbidity and makes no use of the data at all, the current investment is a total loss, but investments of \$16,000 and \$70,000 that do not use the results in the selection of devices or in determining the effects of road run-off on the environment also fail to realise their maximum potential.

#### **Question 14: USE OF DEVELOPER CONTRIBUTIONS**

“Has your organisation used developer contributions to help fund installation or maintenance of treatment devices? If yes, approximately how much?”

Sixteen returns reported that developer contributions had been used and twelve returns also responded to the second question. Only one return from Transit New Zealand reported using developer contributions. No figure was provided. Two rural South Island authorities reported that each had used a developer contribution of one hundred percent. One rural North Island authority reported a developer contribution of ninety five percent. Two others reported using developer contributions, but could not provide a figure. Ten urban authorities reported using developer contributions. Three provided no figures, three were unable to provide a figure and three reported a contribution of one hundred percent. One urban authority reported a developer contribution of sixty percent.

As no return provided further details, it has been assumed that the developer contribution funded the installation, rather than the maintenance, of the treatment devices. The distribution of the returns, if this is the case, can be related readily to the distribution within the answers to question 13, where urban authorities were more likely to be unaware of installation costs. The relatively lower incidence of major development within rural South Island authorities’ territories must be considered as a reason for a greater certainty about installation costs in these authorities.

The following table provides a summary of the use of developer contributions.

	Urban LA's	Rural North Is.	Rural South Is.	Transit NZ	<b>TOTAL NZ</b>
yes	10	3	2	1	<b>16</b>
100%	3	0	2		<b>5</b>
other	60%	95%	0		<b>2</b>
unknown	3	2	0		<b>5</b>

Table 18

**Question 15: INTENTIONS TO TREAT, IF NOT DOING SO**

“[If no techniques or devices are being used to treat storm water] Are you intending to treat stormwater and road run-off in the future? If yes, in what timeframe?”

Two rural South Island authorities and one urban authority that are not now treating storm water and road run-off reported an intention to begin treatment within five years. A further three rural South Island authorities plan to begin treating storm water, but not within five years. The same number of rural North Island authorities plan to begin treating within a similar timeframe. One urban authority and one Transit New Zealand office also reported plans to treat storm water, but not within five years.

Six urban authorities, thirteen rural North Island authorities and two rural South Island authorities are not treating storm water and road run-off now and report no intention to begin treatment. The national figure, therefore, is twenty one of thirty two road controlling authorities not treating storm water, or approximately two thirds of them, have no plans to begin doing so.

For the rural South Island authorities not treating storm water, the proportion not intending to begin treatment within a timeframe of the next ten years is only 28.6 percent. For the rural North Island authorities, that figure is 81.25 percent and for the urban authorities it is seventy five percent.

This distribution of responses is shown in the following chart.

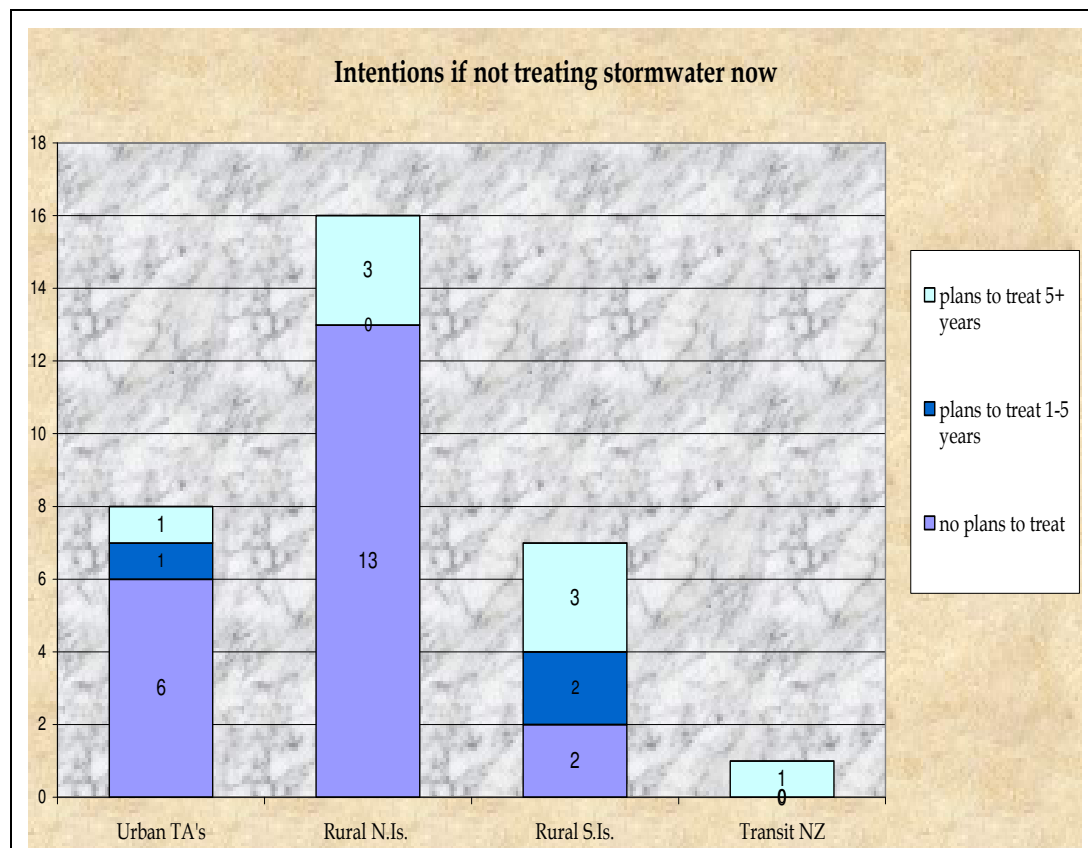


Chart 11

### Question 16: PROBLEMS TO BE ADDRESSED BY TREATMENT

“What problems do you expect to address?”

This question was possibly too brief, because there was a strong division within the responses between those who read it to mean storm water problems that would need to be addressed and those who read it to mean problems that would be encountered in attempting to begin to treat storm water.

This latter group was unanimous in identifying obtaining funding and political support for the investment required as the most significant problem. The former group had identified five problems of water quality that were likely to be most significant. These five issues were: heavy metals, sediment, waterway contamination, chemical levels and disposal of treated residues. There is an obvious overlap between some of these; while chemical levels might describe heavy metal residues, it would also include hydrocarbon residues and, possibly, nitrate and phosphate enrichment.

The distribution of the responses is shown in the following table. There are again marked differences between the four groups. The perception that heavy metals will be a problem to be addressed is entirely absent from the rural returns, while the issue of disposal of treated residues appears to be a problem foreseen only by rural authorities. Sediment is a problem that all four groups appear to perceive equally, although waterway contamination was not identified as a problem to be addressed in rural South Island returns. Only Transit New Zealand identified chemical levels as a problem to be addressed.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
heavy metals	8	0	0	2	<b>10</b>
waterway contamination	8	3	0	4	<b>15</b>
sediment	7	3	2	4	<b>16</b>
disposal issues	0	1	1	0	<b>2</b>
chemical levels	0	0	0	2	<b>2</b>

Table 19

### Question 17: RESOURCES REQUIRED

“What resources do you estimate will be needed?”

A response to this question was given in twenty one returns. One return reported that no resources would be required. Two returns indicated that the resources required were unknown. One return reported that advice would be required and one return said that staff would be needed. All of the remaining sixteen returns indicated that the resource required would be funding.

Of these returns, ten provided no specific figure. For the remaining six returns, the estimated funding requirements were: \$18 million; \$65,000; \$40 million; \$100,000; \$100,000 per annum; and a fifteen percent increase in annual rates.

### Question 18: ENVIRONMENTAL SUSTAINABILITY OBJECTIVE IN NZLTS

“Is your organisation aware of the objective of ensuring environmental sustainability in the NZ Land Transport Strategy?”

There were seventy three responses to this question and only two reported that they were unaware of this objective. Of these two, one was an urban authority storm water manager and one was a rural North Island authority road asset manager.

### Question 19: PERCEPTIONS OF PUBLIC AWARENESS

“What is the level of public awareness of stormwater and road run-off issues in your area?”

This question is not a valid measure of public awareness; it is a measure of the perception of public awareness within road controlling authorities.

An estimate of public awareness within their area was provided in seventy eight returns. Public awareness was reported to be low in fifty returns, or 64.1 percent of the total. Nineteen returns reported medium public awareness of the issue, or about 24.4 percent. High public awareness was reported in only three returns, half the number that reported no public awareness of the issue at all.

The following chart shows the relative distribution of reported public awareness.

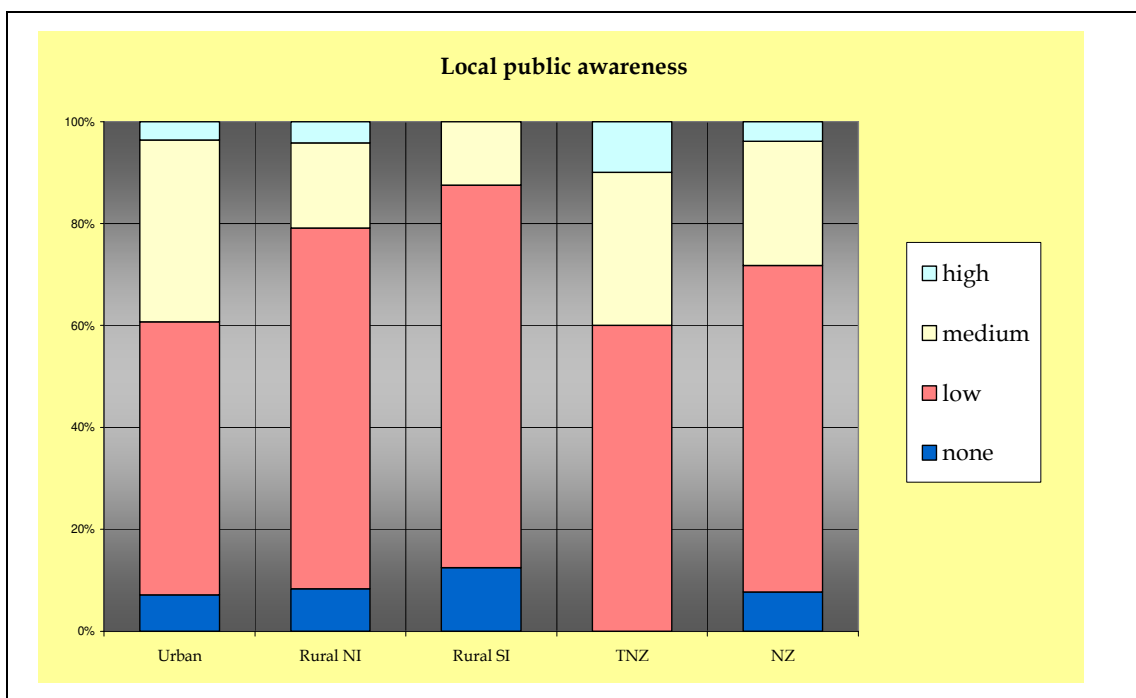


Chart 12

The returns within each group for each level of awareness are summarised in the table on the following page.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	<b>TOTAL NZ</b>
none	2	2	2	0	<b>6</b>
low	15	17	12	6	<b>50</b>
medium	10	4	2	3	<b>19</b>
high	1	1	0	1	<b>3</b>

Table 20

There was little significant difference in perceptions of either high public awareness or of none at all between the analysis groups. No rural South Island authority reported a high public awareness. No return from Transit New Zealand reported no public awareness.

There was, however, a very distinct pattern in the perceived public awareness across the four groups where public awareness was seen as low or medium. This is shown in the following table.

	Urban TA's	Transit NZ	Rural N. Is.	Rural S. Is.	<b>TOTAL NZ</b>
none	7.14%	0.00%	8.33%	12.50%	<b>7.69%</b>
low	53.57%	60.00%	70.83%	75.00%	<b>64.10%</b>
medium	35.71%	30.00%	16.67%	12.50%	<b>24.36%</b>
high	3.57%	10.00%	4.17%	0.00%	<b>3.85%</b>

Table 21

Note that Transit New Zealand lies between the urban authorities and the rural authorities, but that there is then a steady increase in the perception of low public awareness from urban authorities to rural South Island authorities. This trend is matched by an inversely proportionate decrease in the perception of medium public awareness.

It appears that the perception by an authority of public awareness of this issue is a measurable influence on the intentions of that authority. The perception of high local public awareness appears to be of less significance than the perception of overall public awareness. A “tipping point” seems to be reached when approximately a quarter of the public appear to have at least a medium awareness of the issue.

It could be a valid argument, too, that the perception of public awareness will reflect the extent to which the issue of storm water has been raised publicly and that low public awareness reflects the relative lack of any need to treat storm water and road run-off.

Comparison of the charts on the following page, which combine the reported intentions of authorities that are not treating storm water with their reported perception of public awareness, suggests a correlation.

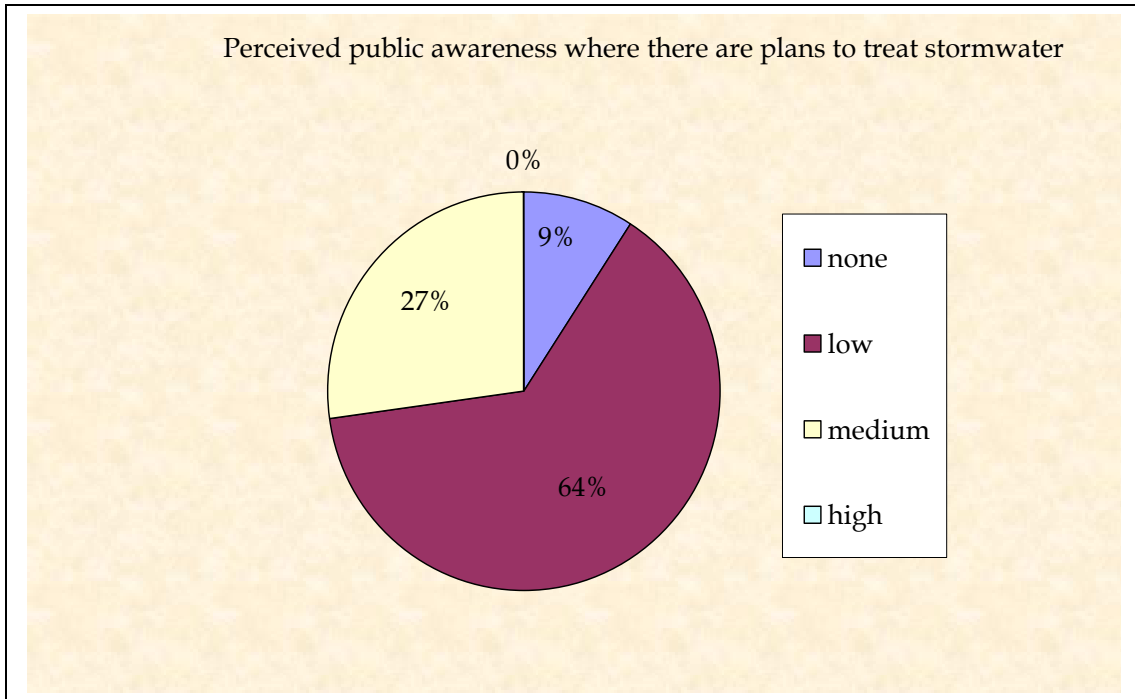


Chart 13

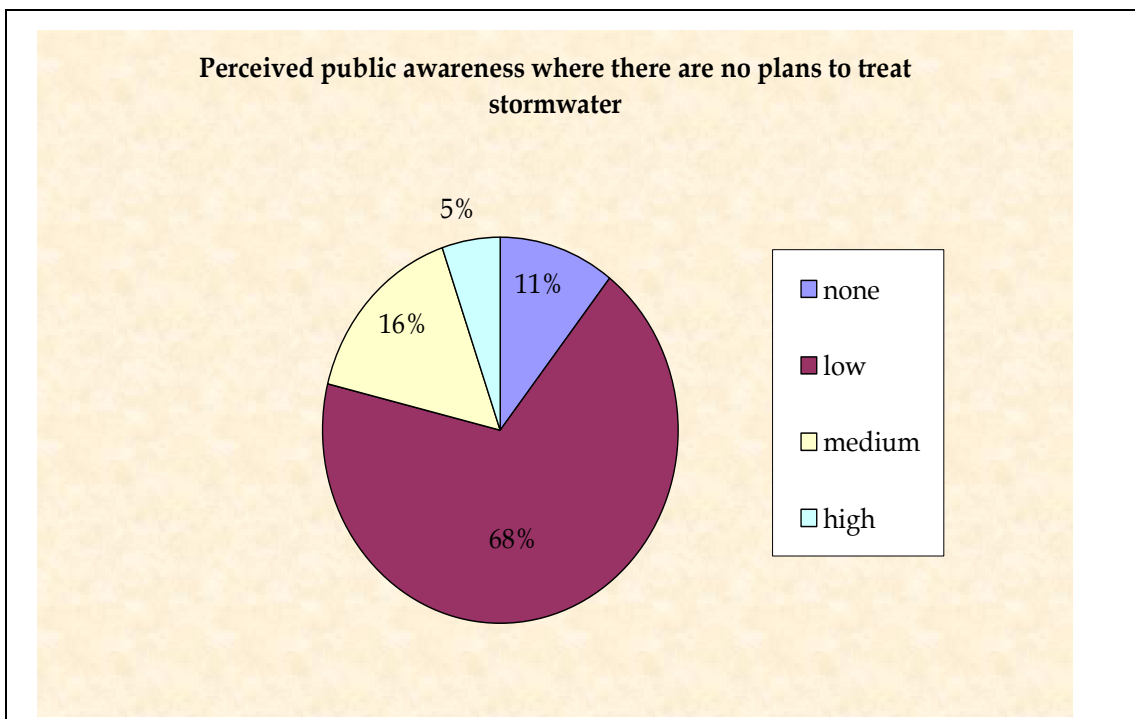


Chart 14

**Question 20: OWN OBJECTIVES FOR MANAGING ROAD RUN-OFF**

“If your organisation has its own objectives for managing road run-off, please [provide a copy].”

Eight returns indicated that the responding authority had objectives for managing road run-off within its asset management plan or business plan. Of these eight, three were

from Transit New Zealand and three were from rural North Island authorities. The remaining two were urban authorities.

No response to this question included a copy of the objectives or a reference to where they might be found.

### **Question 21: TRAINING IN STORM WATER MANAGEMENT**

“What training activities are underway in your area relating to managing stormwater and road run-off?”

This question was asked with the objective of ascertaining the availability of training, but the nature of the survey means that the response is a measure of the awareness of road asset managers, in particular, and storm water managers in road controlling authorities of training that might be available to them. It has already been noted that returns from different managers within the same authority can give widely differing responses on the availability of training, even to the extent of being totally unaware of training available in-house. The returns, therefore, do not provide definitive data on the extent of training available on this subject.

Seventy five returns provided a response to this question and sixty three of those reported that no training at all was available in their area. Eight returns reported that in-house training was available and four returns were aware of regional council training available on managing storm water and road run-off. This response is shown in the following chart.

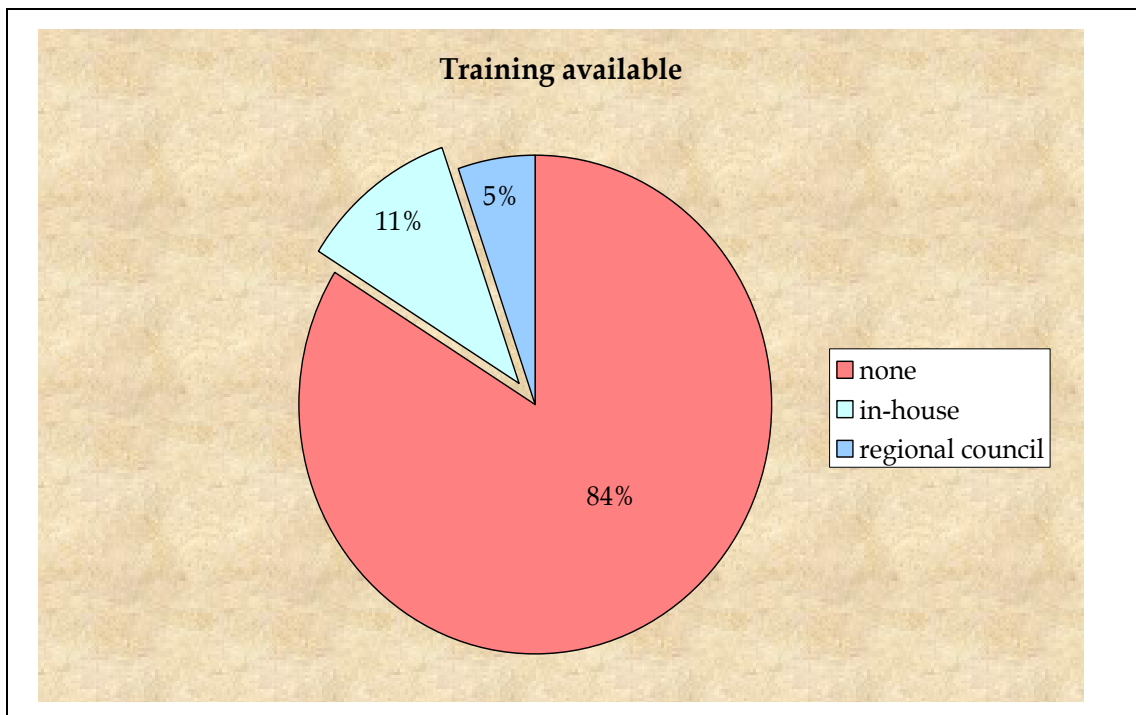


Chart 15

The distribution of returns within the analysis groups is shown in the table on the following page.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	TOTAL NZ
None	20	21	15	7	<b>63</b>
In-house courses	5	1	1	1	<b>8</b>
Regional Council courses	1	0	0	3	<b>4</b>

Table 22

For Transit New Zealand the returns show no training available in seventy percent of its areas, in-house training available in ten percent and regional council training available in thirty percent of its areas. Although it should follow logically that a similar level of regional training should be reported by other authorities, it is not. The urban authorities report a regional council training availability of four percent and the rural authorities report none at all.

The rural authorities are almost indistinguishable, with ninety five or ninety four percent having no training and five or six percent having in-house training. The response from the urban authorities, reporting that no training is available in seventy seven percent of their returns, is comparable with the returns from Transit New Zealand, but the urban authorities report in-house training being available in nineteen percent of returns. The in-house training of five urban authorities represents, therefore, almost forty two percent of all the training in the management of storm water and road run-off that road asset managers and storm water managers know to be available. Lack of training available on this issue is not, however, apparently a key concern of the respondents.

#### **Question 22: KEY CONCERNS**

“What are your key concerns on road run-off?”

This question listed seven potential key concerns. These were: the impact of adjacent land uses, the capital cost of treatment devices, the maintenance cost of devices, understanding the effectiveness of devices or the capacity of devices, disposal issues and consent conditions.

The distribution of concerns expressed within the four analysis groups is shown in the following table.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	TOTAL NZ
impact of adjacent land uses	7	12	8	6	<b>33</b>
capital cost of devices	16	16	12	5	<b>49</b>
maintenance costs of devices	19	14	12	7	<b>52</b>
effectiveness of devices	14	6	6	3	<b>29</b>
capacity of devices	6	4	5	2	<b>17</b>
disposal issues	4	10	6	6	<b>28</b>
consent conditions	9	7	7	3	<b>26</b>

Table 23

The following chart shows these key concerns.

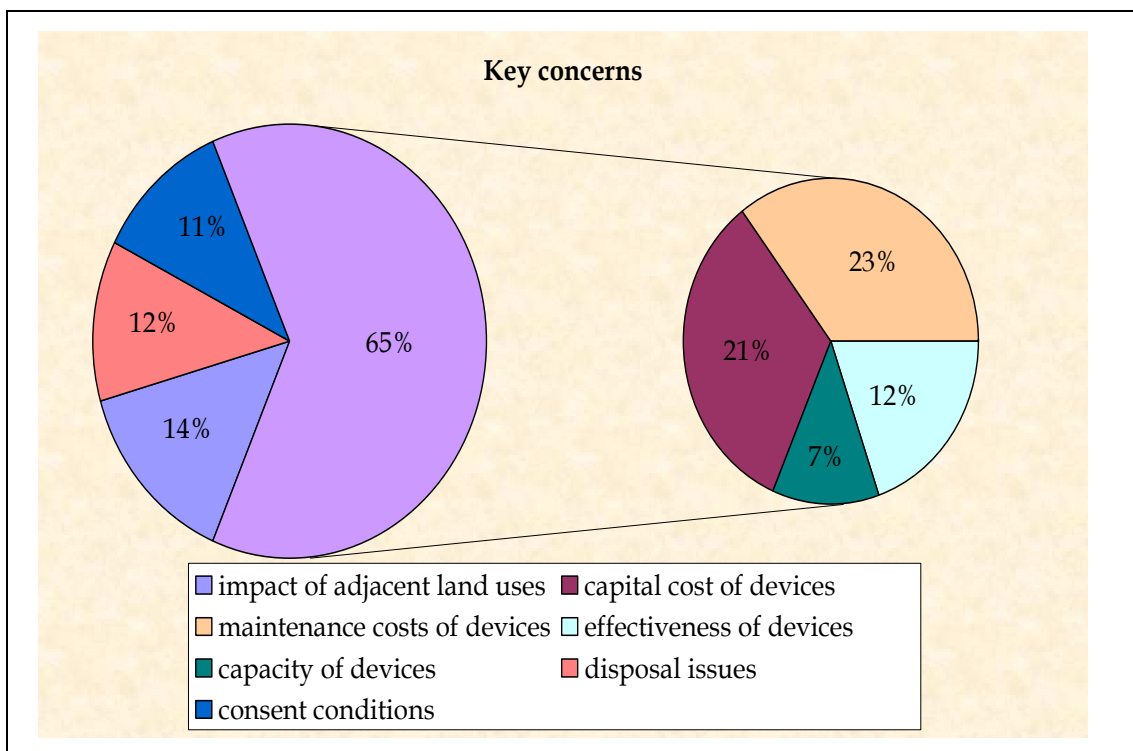


Chart 16

Almost two thirds of the respondents’ concerns were related to treatment devices, and those concerns fell almost equally into three between the cost of the devices, the cost of maintaining them and understanding their effectiveness and capacity.

Only two additional concerns were mentioned. One was the issue of ownership of run-off coming from multiple sources, for example both roads and industrial properties. The other was a very strong concern over the potential for over-zealous application of standards for storm water and road run-off. Both concerns were added in returns from urban authorities.

The impact of adjacent land uses was of greatest concern to Transit New Zealand, at 18.7 percent, and rural North Island authorities, at 17.4 percent, followed by rural South Island authorities at 14.3 percent and urban authorities at 9.3 percent. Transit New Zealand was significantly less concerned about the capital cost of devices, at only 15.6 percent compared to 21 and 23 percent for the other groups.

The maintenance costs of devices was the major concern of urban authorities, at 25.3 percent, compared with 20.3 percent, 21.4 percent and 21.9 percent for the other three authorities respectively. Concerns about understanding the effectiveness of devices was approximately twice as high in urban authorities as in the three others, at 18.7 percent compared to 8.7 percent, 10.7 percent and 9.4 percent respectively.

This contrasts noticeably with the concerns of the urban authorities over disposal issues. For Transit New Zealand this concern was equal to the impact of adjacent land uses, at 18.7 percent. For rural North Island authorities it was 14.5 percent and for rural South Island authorities it was 10.7 percent, but for urban authorities it was a concern for only 5.3 percent. Despite these concerns, remarkably few returns requested any further information on any of these matters.

### Question 23: FURTHER INFORMATION SOUGHT

The questionnaire finished with a request for respondents to list any information needs they might have. Requests were received in eighteen returns. Five came from Transit New Zealand, seven came from rural North Island authorities and six came from urban authorities. The following table is a summary of the information requested by each group.

	Urban TA's	Rural N. Is.	Rural S. Is.	Transit NZ	TOTAL NZ
Interested in further information	6	7	0	5	<b>18</b>
devices	3	6	0	4	<b>13</b>
maintenance & monitoring	2	5	0	4	<b>11</b>
training	3	5	0	3	<b>11</b>
disposal	2	6	0	3	<b>11</b>
funding	1	1	0	0	<b>1</b>
best practice	1	1	0	0	<b>1</b>

Table 24

The lack of interest in further information on any aspect of treating storm water and road run-off among rural South Island authorities is the most noticeable feature. This is in contrast to rural North Island authorities, which sought further information on all aspects in the most numbers. Interest in further information on devices represented twenty seven percent of total requests. Additional information requests on training, maintenance and monitoring of devices and disposal issues each represent twenty three percent of the total.