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**DOWN WITH THE DRAIN:
LOOKING AFTER OUR URBAN RUNOFF AND WATERWAYS IN THE
ERA OF SUSTAINABLE MANAGEMENT**

A Thesis presented in partial fulfilment of the requirements

**for the degree
of Master of Philosophy**

in

**Resource and Environmental Planning
at Massey University**

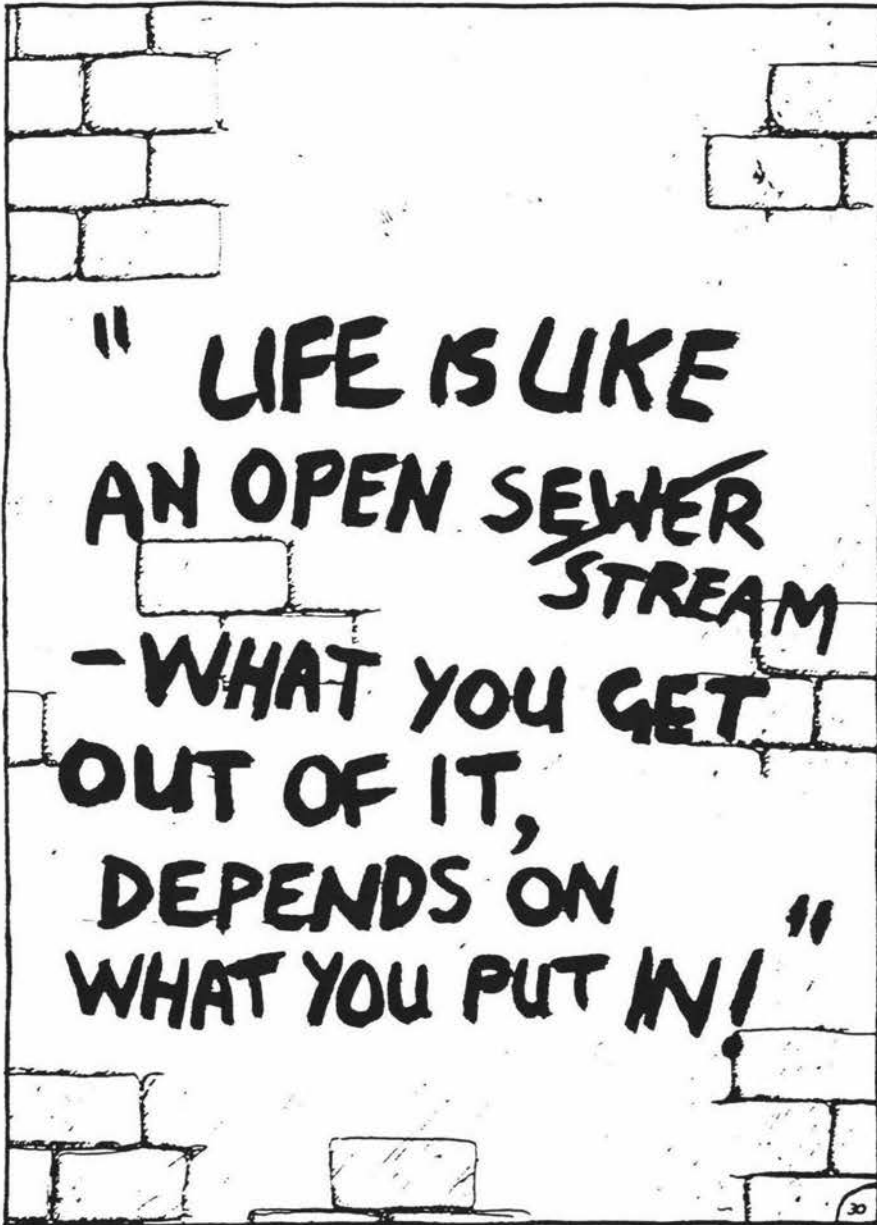
Hamish Nigel Barrell

1997

And it shall come to pass that... “Swarms of living creatures will live wherever the river flows. There will be large numbers of fish, because this water flows there...

But the swamps and marshes will not be fresh; they will be left for salt. Fruit trees of all kinds will grow on both banks of the river. Their leaves will not wither, nor will their fruit fail. Every month they will bear because the water from the sanctuary flows to them. Their fruit will serve for food and their leaves for healing.”

Ezekiel 47: 9-12



ABSTRACT

Recent reforms of environmental and local government legislation have radically changed the nature of environmental management in New Zealand. There is a new mandate for the “sustainable management” of natural and physical resources. This thesis examines how environmental considerations are currently being incorporated into the management of urban runoff and waterways in New Zealand.

Three case studies of urban councils were conducted. Two main data collection methods were employed. Interviews were conducted with the relevant council staff and this information was supplemented by an analysis of regional policy statements, regional plans and district plans that employed a method of plan coding. This sought to establish what policies and programmes the councils were involved in, whether this was different from the late 1980s, and the extent to which they were carrying out various types of innovative solutions to environmental problems.

The research findings suggest that councils vary considerably in their approach to urban runoff and waterways. It showed that urban streams in New Zealand have suffered levels of degradation including pollution and channel modification that are consistent with many urban areas overseas. Recently, elements of a new philosophy have been applied to their management, which has coincided with the introduction of the Resource Management Act (RMA). Following overseas trends, there has been a recognition by managers of our waterways and stormwater systems that former practices in managing urban runoff have neglected environmental issues and natural resource conservation. This research suggests that stormwater management practices are taking on board the considerations of water quality, quantity and biodiversity to a greater extent than that which happened in the past. The extent to which this is happening in any particular area depends on the scale of the issues, the sensitivity and utility of affected resources, and the level of commitment by both community and council to changing traditional practices.

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TABLE OF CONTENTS

ABSTRACT	vii
ACKNOWLEDGEMENTS	ix
TABLE OF CONTENTS	x
LIST OF FIGURES	xiv
LIST OF TABLES	xv
LIST OF MAPS	xvi
GLOSSARY	xvii
CHAPTER ONE: INTRODUCTION	1
Background	1
Thesis aims, objectives and research questions	3
Overall Aim	3
Thesis objectives	3
Development of urban runoff management in New Zealand	5
Thesis structure and chapter outline	6
CHAPTER TWO: LITERATURE REVIEW	9
Urbanisation and the runoff process	9
Approaches to managing urban stormwater	11
The Traditional Engineering approach	11
The Stormwater Management approach	17
The Ecological Design approach	18
The Integrated Stormwater Management Approach	19
Sustainable urban runoff management	20
Sustainable Development	21
Ecological sustainability	22
Sustainability and the urban environment	26
Sustainability and technology	28
Sustainability and partnerships	31

CHAPTER THREE: INSTITUTIONAL ARRANGEMENTS	33
Past Institutional Arrangements	33
The power to manage	33
The Soil Conservation and Rivers Control Act	34
Early legislation to manage pollution	35
The Water and Soil Conservation Act	36
Links between land-use control and water management	37
Comprehensive planning for stormwater management	38
Barriers to comprehensive water and land planning	39
Local government reform	40
Institutional reform	41
The Resource Management Act	41
Organisational responsibilities	42
Change of ethos in the RMA	44
Devolution of power	46
Water quality standards	46
Implementation of policy	47
Resource consents	48
Economic instruments	50
Evaluation of the RMA	51
CHAPTER FOUR: METHODOLOGY	53
Information gathering	53
Documents	53
Case study selection	55
Case study one: Auckland city isthmus	56
Case study two: Christchurch City	59
Case study three: Palmerston North City	63
Plan Analysis	66
Interviews	69
Selection of regional council interviewees	70
Selection of district council interviewees	70

Interview structure	71
Analysis	73
Data reduction and organisation	73
Interpretations	74
CHAPTER FIVE: FINDINGS	77
Plan interview results	77
Plan coding results	106
Environmental elements referred to in policies and plans	106
Policies and methods in regional and district plans	108
CHAPTER SIX: ANALYSIS AND DISCUSSION	111
Management style	111
Integrated Management	113
Environmental strategies	113
Urban runoff and waterway planning	114
Monitoring	115
Source control	116
Source controls and Flooding	116
Source controls and Pollution prevention	118
Riparian management	120
Source control inadequacies	121
Storage	121
The function of storage facilities	122
Retro-fitting	122
Soft drainage	123
Waterway restoration	124
Artificial wetlands and Swales	125
Public participation	125
Council initiatives	127
Non-notification of resource consents	127
Problems for public participation	127

Maori participation	128
Re-use/Utilisation	129
Re-use of urban runoff and rainwater collection	129
Utilisation of urban waterways	130
Sustainable urban runoff/ waterway management	132
The needs of present generations	132
The needs of future generations	132
CHAPTER SEVEN: CONCLUSIONS	137
Overview of research aims, objectives and findings	137
Recommendations and considerations	139
Planning of urban runoff and waterways	140
Flooding and stormwater disposal	141
Pollution Control	142
Improvements for future research	143
Reflections on the Research	144
APPENDIX 3.1: Minimum water standards	145
APPENDIX 4.1: List of interviewees	146
APPENDIX 4.2: Interview schedule for regional councils	147
APPENDIX 4.3: Interview schedule for district council planners	150
APPENDIX 4.4: Interview schedule for stormwater managers	153
REFERENCES	157
LIST OF STATUTES CITED	168
LIST OF PLANS AND POLICY STATEMENTS CITED	168

LIST OF FIGURES

Figure 1.1:	Thesis structure	7
Figure 2.1:	Hydrological changes resulting from urbanisation	10
Figure 2.2:	Possible impacts of urbanisation via hydrological change	13
Figure 2.3:	The storage approach	28
Figure 2.4:	Technology based on "linear systems"	29
Figure 2.5:	Appropriate technology: Systems that are "regenerative"	30
Figure 3.1:	The relationship of legislation to the urban runoff system	43
Figure 5.1:	Environmental elements referred to in policies and plans	107
Figure 5.2:	Policies and methods in regional and district plans	109
Figure 6.1:	Shirley Stream before enhancement (Sept. 1994)	126
Figure 6.2:	Shirley Stream after enhancement (May 1996)	126

LIST OF TABLES

Table 2.1:	Theoretical approaches to managing urban runoff and waterways	12
Table 2.2:	The main groups of contaminants found in Auckland stormwater	16
Table 2.3:	Criteria for the sustainable management of stormwater	24
Table 3.1:	Restrictions on classes of activities as set up through plans	49
Table 3.2:	Restrictions on activities as set up by the RMA	50
Table 4.1:	Coding scale used for plans	67
Table 5.1:	Major urban runoff and waterway issues	78
Table 5.2:	Environmental goals	80
Table 5.3:	Environmental projects for urban runoff/ waterway management	82
Table 5.4:	Use of source controls	84
Table 5.5:	Use of structural best management practices and retrofitting	86
Table 5.6:	Public participation	87
Table 5.7:	Maori participation	88
Table 5.8:	Monitoring	90
Table 5.9:	Change in practices since the RMA	92
Table 5.10:	Agency co-ordination since local government reform and the RMA	94
Table 5.11:	The RMA and the restoration of urban waterways	95
Table 5.12:	Stormwater re-use	96
Table 5.13:	Role of urban streams and runoff	98
Table 5.14:	Environmental Techniques	100
Table 5.15:	Mitigation approach to reducing flooding	101
Table 5.16:	Council Interaction	102
Table 5.17:	The future approach to stormwater management by councils	104

LIST OF MAPS

Map 4.1:	Auckland City Isthmus	57
Map 4.2:	Christchurch City	60
Map 4.3:	Palmerston North City	64

GLOSSARY

Best Management Practices (BMP): “Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters...” (Dennison, 1996, 367). BMPs can be used at any stage of the pollution cycle, for instance to prevent or treat pollution, and include both structural and non-structural controls.

Biodiversity “is the variety of the world’s organisms, including their genetic diversity and the assemblages they form...The breadth of the concept reflects the interrelatedness of genes, species and ecosystems” (Reid and Millar, 1989 in Gaston, ed., 1996).

BOD: Biological Oxygen Demand: the removal of dissolved oxygen in water by decaying matter.

Catchment: “The total area from which a single river collects surface runoff.”

Otherwise known as the “watershed” or “drainage area” (Whittow, 1984, 88).

Design Storm, flood: “The storm or flood which is used as the basis for design, i.e., against which the structure is designed to provide a stated degree of protection or other specified result” (Whipple et al., 1983, 220).

Drain: means a sewerage drain or stormwater drain, usually in the form of a pipe laid underground.

First flush: “Commonly observed phenomenon in which the concentration of pollutants is higher in the earlier stages of a storm event” (Whipple et al., 1983, 221).

Greywater: the water and waste products from sinks, showers and baths (Bell, 1994).

Mulch: “A natural or artificial layer of plant residue or other material covering the land surface”. It is useful in retarding runoff, conserving moisture and preventing soil erosion (Dennison, 1996, 375).

PAH: polynuclear aromatic hydrocarbon- a particular type of contaminant often found in urban runoff.

Ponding: There are several types. “Detention basins” are described by Ferguson and Debo (1990) as slowing the passage of runoff as it moves towards the receiving waters thereby suppressing flood peaks. The most common of detention basin is the “dry pond” which, as the name suggests, holds water temporarily (ASCE, 1992). As dry

ponds hold water only for a short space of time they are not effective at improving the water quality. Improving water quality requires the use of “retention basins” that are designed to hold runoff for a longer time period than detention ponds. They require a storage capacity larger than the expected volume of runoff and are therefore bigger and consequently more expensive than detention basins (ASCE, 1992). The ponds are normally “wet ponds” where water is held permanently. Removal is accomplished by a number of physical, chemical and biological processes. Particulate pollutants are removed by gravitational settling. Pollutants such as BOD and pathogenic bacteria can be removed by the use of aquatic plants and other micro-organisms.

Porous pavement: Porous pavement is pavement that allows for the infiltration of surface runoff due to a higher porosity than a similar impervious asphalt or concrete mixture. Another variation is concrete grid pavements where modular, interlocking blocks with openings of permeable cover in-between are used to allow water to seep through to the subsoil (Urbonas and Roesner, 1993).

Retrofit: Upgrading or adding on to the existing stormwater system which is exclusively referring to the addition of treatment devices for improving water quality (Dennison, 1996).

Rivers: “means a continually or intermittently flowing body of fresh water; and includes a stream and modified watercourse; but does not include any artificial watercourse (including an irrigation canal, water supply race,...farm drainage canal)” (s2 RMA). For the purposes of this thesis it includes all urban waterways.

Source controls: The preventative means whereby pollution and contaminants are kept separate from rainfall/ and or stormwater (Urbonas and Rosner, 1993). For examples of the various techniques used see Table 2.3.

Stormwater: The water that runs off the ground surface of a catchment. The main cause of stormwater is the inability of rainwater to infiltrate the surface.

Stormwater system: Programs which deal with conveying urban runoff downstream. It can include everything from roof top drains through to outfall channels. There are always two parts- primary and secondary paths. The primary path is that which is intended to most often carry the flow and consists of pipes and open channels. The secondary path is the route that the runoff takes when the primary path can

no longer contain the flow due to either blockages or a exceedance of the hydraulic capacity.

Street sump: A chamber which is installed in the drain and incorporates features to intercept and retain silt, gravel and other debris” (Building Industry Authority, 1992, viii).

Swales: These are channels, typically lined with grass or other vegetation that are constructed to convey runoff. The vegetation retards the flow velocity and can act as a partial treatment mechanism (ARC, 1992).

Urban runoff: For the purposes of this research it can be interpreted as being equivalent to stormwater. It is the stormwater that runs off an urban catchment and also the non-point sources of pollution that accompany it.

