

Illustrative Sewer Infiltration/Inflow Management Plan and Guide for Preparation

**Prepared to assist local governments
meet their obligations under the
*Environment Protection (Water) Policy 1997***

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LIST OF ACRONYMS

CCTV	closed circuit television
EPA	Environmental Protection Agency
EPP (Water)	<i>Environmental Protection (Water) Policy 1997</i>
GWI	groundwater infiltration
I/I	Infiltration/Inflow
NR&M	Department of Natural Resources and Mines
STP	sewerage treatment plant
TMP	Total Management Plan
WQOs	Water quality objectives

1 INTRODUCTION

This provides guidance on preparing a Sewer Infiltration/Inflow (I/I) Management Plan as a sub-plan of a Total Management Plan (TMP) which will meet the requirements of Section 40 of the *Environmental Protection (Water) Policy 1997* (EPP (Water)).

Section 40 requires that:

- (1) *A local government that operates a sewerage system must develop and implement an environmental plan about sewage management that minimises unnecessary flows entering the system.*
- (2) *In developing its plan, the local government must consider –*
 - (a) *the water quality objectives for a water to which a release of waste water may occur; and*
 - (b) *the maintenance of acceptable health risks.*
- (3) *The local government must consider including the following measures in its plan –*
 - (a) *ways of reducing infiltration to sewers;*
 - (b) *ways of avoiding unintended stormwater inflow to sewers;*
 - (c) *alternatives to expansion or remediation of an existing system and to construction of a new system, including, for example –*
 - (i) *chemical and composting toilets; or*
 - (ii) *domestic on-site waste water treatment systems and recycling or disposal of waste water.*

The User's Guide to Queensland's *Environmental Protection (Water) Policy 1997*, published by the Department of Environment (Reference 1), indicates that in developing a model (i.e. illustrative) local government environmental plan for sewage management (and also for trade waste management, urban stormwater management and water conservation), consideration will be given to a number of relevant issues.

The same issues will need to be considered by local governments in developing their own environmental plans. These issues are:

- *community consultation, involvement and education;*
- *integration into existing local government programs, plans and infrastructure;*
- *balanced consideration of environmental objectives along with health, economic, social and safety issues, such as flooding, cost-effectiveness of measures and efficient use of resources;*
- *different considerations for implementation in new and existing urban areas;*
- *suitability to local conditions, such as topography, rainfall, other climatic conditions, soil types and vegetation;*
- *technical guidelines, such as the design, operation, maintenance and monitoring of composting toilets, use of rainwater tanks, and in-stream methods for stormwater management;*
- *performance criteria, such as kilometres of sewers inspected and maintained, per capita reductions in water usage, number of sewage overflows per unit length of sewer, and milestones for specific goals to be achieved;*
- *environmental priorities and timetable for implementation of plans; and*
- *approval and review of plans and reporting procedures.*

The issues listed above represent preparation and assessment criteria for any Sewer I/I Management Plan doubling as an environmental plan for sewage management, over and above the applicable TMP assessment criteria.

The scope of an environmental plan for sewage management, as defined above, must be confined to matters within the control of local governments, and even then includes only those aspects of sewage management most likely to impact on the environment.

However, when developing their TMPs and environmental plans, local governments should be mindful of the broader environmental considerations involved in sewage management, whether or not they are covered by Section 40 of the EPP (Water) or fall outside the control of local governments.

Examples of these broader considerations might be the local government's policy on food waste disposal units (garbage grinders) and the conditions of its environmental licences issued by the Environmental Protection Agency (EPA) under the *Environmental Protection Act 1994*.

It is important to note also that the scope of an environmental plan for sewage management as defined by Section 40 of the EPP (Water) is confined primarily to existing sewerage systems.

Consideration must also be given to alternatives to constructing a new system, for example, to replace a derelict system no longer meeting minimum service standards.

The intent of Section 40 is threefold:

- to minimise the environmental impact of excessive inflows being experienced by some existing systems, regardless of whether the local government concerned proposes to reduce them for other reasons;
- to ensure that, before automatically rehabilitating or replacing a system of derelict sewers with similar technology, the local government will objectively consider the comparative viability and desirability of less-conventional approaches to sewage management, such as chemical and composting toilets, domestic on-site wastewater treatment systems, and on-site recycling or disposal of treated wastewater; and
- to broaden the scope of a local government's TMP to include strategies (for example within a Infrastructure Plan sub-plan) under which no new sewerage system or augmentation of an existing system would be initiated or approved by the local government unless a comparative assessment of all alternative sewage management technologies was carried out. This would be likely to occur only as a consequence of an active local government policy.

2 NATURE AND SCOPE OF SEWER I/I MANAGEMENT PLAN

The main factors determining the nature and scope of the I/I Management Plan will be:

- the size and condition of the sewerage system(s);
- the local government's progress to date in characterising and addressing excessive I/I in the system(s); and
- the local government's policies on the application of alternative sewage management technologies, including chemical and composting toilets, domestic on-site wastewater treatment systems, and on-site recycling or disposal of treated wastewater.

In general, the larger the sewerage system(s) and/or the poorer the condition of the assets, the greater the likely scope and complexity of the plan and the cost of implementing it. As a general rule, and other things being equal, the plan can be expected to be more elaborate and demanding of resources for:

- higher rainfall areas;
- areas of high water table, unstable soils, complex topography and/or high seasonal loadings;
- schemes with sewers, manholes, etc. in poor condition; and
- higher environmental risks (e.g. sensitive receiving waters).

Where the local government has made little or no progress in addressing I/I or developing a policy on alternatives to conventional sewerage, the initial management plan will be fairly high level and strategic in nature.

It will concentrate on initiating whatever investigations are needed to clarify the problems, establish policies and formulate strategies as the basis of detailed action plans.

Where the local government has already made substantial progress, either at the time of preparing its initial I/I Management Plan or as a result of implementing its initial plan, its current I/I Management Plan can be expected to be at a lower and more detailed level.

Each local government will have to decide what is an appropriate I/I Management Plan for a particular sewerage scheme.

No typical plan can be suggested as a model for use by all local governments or for different categories of scheme, geographical location, or climatic conditions.

The illustrative plan included in Appendix A is therefore presented merely to demonstrate one approach which under particular circumstances should meet the requirements of both a TMP and an environmental plan for sewage management.

3 PLAN PREPARATION CHECK LIST

To satisfy EPA requirements for an environmental plan for sewage management, the Sewer I/I Management Plan will need to address the two sets of criteria listed in Section 1. The following check list gives an indication of how these criteria might be approached.

3.1 Matters that must be considered

Water quality objectives

Under Sections 40, 42 and 43 of the EPP (Water), a local government preparing a related environmental plan must consider the water quality objectives (WQOs) for any water potentially affected by the subject activity.

Part 4 of the EPP (Water) provides for the Chief Executive of EPA to determine the WQOs for particular waters, but few have been determined to date.

A local government may also determine WQOs under the EPP (Water), following the procedure established in Part 3 of the EPP (Water) and explained further in the User's Guide.

Because consideration of WQOs is common to the management of several local government functions, it would be convenient to document their determination separately from individual environmental plans.

The Sewer I/I Management Plan could therefore either cross-reference a separate WQO document or include determination of the WQOs in the scope of the plan.

In the latter case, an example of how the determination of WQOs may be approached can be found in the Model Urban Stormwater Quality Management Plans and Guideline (Reference 2). The illustrative plan follows the former approach.

Maintaining acceptable health risks

It can be assumed that health risks will be maintained at acceptable levels if:

For conventional sewerage:

- (a) overflows within premises and from other unauthorised overflow points, such as manhole covers, are eliminated under the plan;
- (b) acceptable performance criteria are established under the plan, in terms of frequency of overflows from licensed overflow points; and
- (c) strategies are implemented under the plan to achieve (a) and (b).

For on-site sewerage facilities:

- (a) the design and installation of treatment and disposal facilities comply with requirements of the Interim Code of Practice prepared by Department of Natural Resources (Reference 3) or relevant local government law, as applicable;
- (b) such facilities are operated and maintained at all times in accordance with any manufacturer's recommendations and conditions of the permit issued by the local government; and

- (c) the responsible householder is adequately trained to operate the facilities and aware of their responsibilities and legal obligations and liabilities under terms of their permit and the applicable environmental legislation.

Including ways of reducing infiltration and avoiding unintended overflows

This is the main focus of any Sewer I/I Management Plan, and consideration of such measures will be central to development of the plan.

Alternative measures to expanding or remediating an existing system and to constructing a new system

Example measures cited in Section 40 of the EPP (Water) are:

- chemical and composting toilets; and
- domestic on-site wastewater treatment systems and recycling or disposal of wastewater.

Such measures are possible alternative solutions to new sewerage systems, and which would allow a poorly performing and/or environmentally risky sewerage system to be phased out. A local government must consider these measures for possible inclusion in the I/I plan.

The local government would need to develop a policy on the application of such alternatives. Should it decide as a matter of policy that such alternatives must be investigated in particular circumstances, it would need to consider the technical and economic feasibility and local community acceptance of each applicable alternative.

This would need to be done whenever a new system was considered or a significant part of its existing sewerage system became unserviceable and major rehabilitation or reconstruction would otherwise be necessary. Local governments can provide for such measures in the Sewer I/I Management Plan.

Such consideration should draw on available technical guidelines, such as the Low Cost Sewerage Options Study report published by the Australian Water Resources Council (Reference 4).

Community consultation, involvement and education

The Sewer I/I Management Plan should provide for consulting with the community on environmental public health, social and economic priorities and preferences when the local government is considering policies and strategies for investigating I/I and/or alternatives to sewer rehabilitation or reconstruction.

The program could also address such issues as illegal connections, benefits, costs and impacts on charges for various I/I management strategies, options for addressing I/I on private property and on-site sewerage systems.

The consultation, information and education programs should be linked to the TMP sub-plan dealing with customer relations.

Guidance on community consultation can be found in, *Steps to develop community communication programs* and *Getting Started: A consultation guide for Queensland Local Government*. (References 5 and 6)

3.2 Matters that should be considered

Integrating with existing programs, plans and infrastructure

Integrating the plan into a TMP by definition should address this, but appropriate linkages should nevertheless be demonstrated in the plan.

Balanced consideration of environmental objectives

This should be incorporated in the process of identifying and prioritising prospective Sewer I/I management strategies. Specifically, considering economic issues will involve benefit-cost analysis.

Implementation in new and existing urban areas

This consideration will be inherent in identifying problem areas and prioritising amelioration strategies.

Suitability to local conditions

These will be reflected in the identification and prioritisation of I/I problem areas, and in determining the potential for on-site sewerage systems.

Technical guidelines, performance criteria

These should be addressed either in Section 3.1 or elsewhere in the TMP. Technical codes and guidelines relevant to on-site sewerage systems have been noted in the References.

Environmental priorities and plan implementation timetable

Each strategy and action plan under the I/I Management Plan should have specified time lines and budgets which reflect the local government's priorities and present commitments.

Approval/review of plan and reporting procedures

The plan will be prepared within the context of the prevailing approval process involving both the Department of Natural Resources and Mines (NR&M) and EPA. Administrative responsibility and reporting procedures should be stated within the plan.

4 ILLUSTRATIVE SEWER I/I MANAGEMENT PLAN

The illustrative Sewer I/I Management Plan is included in the Appendix A. It indicates that substantial progress has been made by the hypothetical local government ("Sunnyside City Council"), as reflected in the appended list of referenced supporting documents.

It also indicates that the Council has already adopted a policy on alternative sewage management technologies, following appropriate community consultation.

This process and resulting policy essentially represent the consideration of such alternatives required under Section 40 of the EPP (Water), for purposes of the illustrative plan.

It should be noted that following such consideration, real local governments may equally decide as a matter of policy not to require investigation of alternative technologies.

The scope of the plan has been determined so as to allow the matters in the preparation check list in Section 3 to be generally addressed.

REFERENCES

1. *User's Guide to Queensland's Environmental Protection (Water) Policy 1997*, Department of Environment, January 1997.
2. *Model Urban Stormwater Quality Management Plan and Guideline*, Environmental Protection Agency, March 2001.

3. *Interim Code of Practice for On-site Sewerage Facilities*, Department of Natural Resources, 1999.
4. *Low Cost Sewerage Options Study, Water Management Series No. 14*, Australian Water Resources Council, 1988.
5. *National Water Quality Management Strategy Implementation Guidelines “Appendix D: Steps to develop community communication programs”*, Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ) and Australian and New Zealand Environment and Conservation Council (ANZECC) (1998).
6. *Getting Started: A consultation guide for Queensland Local Government*, Local Government Association of Queensland Inc. Queensland Department Local Government and Planning, Queensland Transport and Regional Development 1998.

APPENDIX A

ILLUSTRATIVE SEWER INFILTRATION/INFLOW (I/I) MANAGEMENT PLAN

To meet the requirements of:

- total management planning; and
- the *Environmental Protection (Water) Policy 1997* for an environmental plan for sewage management.

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REFERENCES

1 PURPOSE OF PLAN

The plan is intended to:

- provide an overview of Council's current sewer infiltration/inflow (I/I) management practices and direction for its future initiatives in sewage management ; and
- meet Council's obligations under Section 40 of the *Environmental Protection (Water) Policy 1997* (EPP (Water)), for the preparation of an environmental plan for sewage management.

2 COUNCIL POLICY

Council's goals for operation of its sewerage system and for environmental management are set out in its Corporate Plan 1997–2000 (Reference 1).

Council endorsed the following formal strategic policy statement on sewage management on 21 January 1998, based on achieving the above goals (Reference 2):

Strategic Policy No. SP 3/98 – Sewage management

Council will manage the community's sewage so as to:

- comply with relevant State and Council environmental and health objectives and Environmental Protection Agency (EPA) requirements;
- recognise community preferences regarding the conservation of natural resources; and
- meet associated performance targets.

To this end, Council will:

- develop and implement a cost-effective program for infiltration and inflow reduction;
- report within Council's annual environmental report on sewer overflow and treatment plant bypass events; and
- formulate and keep under review a Council policy on the application of alternative sewage management technologies to conventional sewerage, for purposes of Section 40 of the EPP (Water).

Council conducted a series of structured community consultation programs in accordance with its Strategic Policy No. SP 6/97 – community consultation, communication and education (Reference 3) conducted on a major sewerage catchment basis across the City. Council subsequently endorsed the following management policy on alternative sewage management technologies on 3 April 1998 (Reference 4):

Management Policy No. MP 4/98 – Alternative sewage management technologies

Prior to formulating strategies for ameliorating the adverse effects of high infiltration and inflow to Council's sewerage systems, Council will consider the relative public health, environmental, social and economic merits of implementing on a sub-catchment-wide scale the following sewage management technologies, as alternatives to rehabilitation or replacement of derelict sewers with conventional sewerage:

- chemical toilets;
- composting toilets;
- domestic on-site sewage treatment systems;
- on-site recycling of treated sewage; and
- on-site disposal of treated sewage.

In order to facilitate such consideration in respect of a particular sub-catchment, Council will consult with the community within the affected and adjacent sub-catchments, to ascertain local priorities and preferences in respect of the public health, environmental, social and economic consequences of implementing the alternative technologies.

3 KEY LINKAGES TO TOTAL MANAGEMENT PLAN (TMP)

The Sewer Infiltration/Inflow Management Plan supports, and is supported by, a number of management initiatives in other sections (sub-plans) of Council’s TMP for sewerage services, as indicated in the following table. Only those key linkages which are critical to ensuring integrated implementation of the TMP are highlighted in the table.

Sub-plan	Key linkage
Service standards	Community responsibilities for curtailing I/I and addressing its financial consequences; consultation on implementing alternative sewage management technologies.
Financial management	10 year financial projections will incorporate costs of I/I management initiatives.
Asset evaluation and renewal	Asset registers will provide data on age, material and condition of sewers and manholes.
Maintenance management	Incorporation of I/I management strategies into preventive maintenance programs for sub-catchments.
Infrastructure plan	Design flow factors determined from I/I studies will be input to planning studies, or to strategies developed to reduce I/I to design levels.
Environmental management	Regulatory restrictions on sewage overflows.
Effluent management	I/I management will reduce effluent volumes for recycling and/or disposal.
Information management	Data capture/analysis/reporting of wastewater flows, overflow events, I/I source detection data, etc.
Risk Management	Risk management associated with structural failure of assets, public health and environmental impacts of sewer surcharging, and with non-compliance with legislation.

4 EXTERNAL CONTEXT

Causes of I/I

Sewer infiltration/inflow results from:

- infiltration of groundwater through leaky joints and structural defects; and
- inflow of surface stormwater resulting from design, construction defects or unsealed manholes, and from illegal stormwater connections.

Consequences of I/I

Excessive I/I resulting in hydraulically overloaded sewers can cause a number of significant problems including:

- premature or needless augmentation of the collection system and/or treatment plant, which in turn can have a significant impact on the cost of sewerage services and on sewerage rates levied;
- surcharging of manholes and house connections causing wet weather sewage overflow within properties, resulting in potential public health and environmental hazards as well as a poor public image of sewerage authorities;
- overflowing of sewage from pumping station wet wells and other designated overflow points and by-passing of sewage treatment plant flow into watercourses, with potential to cause environmental and public health problems;
- hydraulic overloading of sewage treatment plants, which may upset some processes and cause a deterioration of effluent quality and failure to comply with licence conditions; and
- excessive pumping costs and increased pump wear.

Statutory regulation of I/I

The following legislative provisions are relevant to sewer I/I management:

- Pumping stations are included in the definition of sewage treatment works in Schedule 9 of the *Environmental Protection Regulation 1998*. A sewage treatment works is a Level 1 Environmentally Relevant Activity under Schedule 1 of the Regulation, and subject to regulation by EPA;
- Designated overflow points are generally subject to the provisions of S37(2) of the *Environmental Protection Act 1994*, which sanctions any resulting environmental harm if the overflow is covered by an environmental authority such as a licence;
- Excessive rainfall is usually cited in licences as a legitimate cause of overflow. However, licences also usually require the instigation of procedures to investigate the cause of any overflow and, where necessary, implement remedial actions to reduce the likelihood of recurrence; and
- The EPP (Water) requires local governments operating a sewerage scheme to develop environmental plans on a number of aspects of water supply and sewerage management. A local government may comply with the requirements for an environmental plan for sewage management by preparing a suitable plan under a TMP, such as a sewer I/I Management Plan which substantially complies with the requirements of Section 40 of the EPP (Water).

It is likely that environmental considerations will be a major driver for I/I reduction in future years.

State Government support for I/I reduction

The Local Governing Bodies' Capital Works Subsidy Scheme allows local governments to submit for consideration proposals for subsidies for infiltration/inflow studies.

Community involvement in sewage management

Growing numbers in the community are concerned over the continued use of conventional sewerage systems, due to their impact on the aquatic environment and relatively high costs. The community should therefore have the opportunity, through appropriate consultation mechanisms, to consider alternative systems before existing sewerage infrastructure is replaced.

Council will involve the community in determining water quality objectives (WQOs) for waters potentially impacted as a result of excessive I/I, and give it a more direct role in minimising I/I and addressing its financial consequences. This may involve a program of community information and education on reducing superfluous inflows and to a lesser extent infiltration, and on the benefits and costs of amelioration.

5 WATER QUALITY OBJECTIVES

A major review was carried out for Council in 1995 of the incidence of sewerage system overflow and treatment plant bypassing events over the previous 10 years, and of the documented public health and environmental consequences (Reference 5). This report highlighted serious water quality impacts on a number of sensitive aquatic ecosystems resulting from many of these incidents.

Surface waters potentially impacted by sewage overflows from Council’s sewerage systems are as follows:

Catchment (STP)	Waters	Category
Northville	Reedy Creek	Freshwater
	Lake Pleasant	Freshwater
	Sandy Inlet	Marine
Southville	Plains River	Freshwater
	Rocky Creek	Freshwater
	Pacific Ocean	Marine
Westside	Brown River	Freshwater
	Deep Creek	Freshwater
Eastpoint	Tea Tree Swamp	Freshwater
	Windy Bay	Marine

WQOs for all waters within the City have previously been determined, in accordance with provisions of the EPP (Water), as documented in the consultancy report by Smith & Associates (Reference 6). For the waters listed above, the adopted WQOs are as set out in Table 1.

TABLE 1: Water quality objectives for surface waters in Sunnyside City

(Note: The notional WQOs in Table 5 are examples for purposes of the Illustrative Sewer I/I Management Plan only. For real applications, WQOs arrived at by due process may vary substantially from these examples.)

Parameter	Units	Marine waters	Freshwaters
Total-Phosphorus [Dry season]	µg/L	<20	<50
Total-Phosphorus [Wet season]	µg/L	<100	<500
PO ₄ Phosphorus	µg/L	<10	
Total Nitrogen	µg/L	<20	<500
Chlorophyll-a	µg/L	<1	<15
Clarity		Black disc >1.6m horizontally	<10% change in euphotic depth
Faecal coliforms	Organisms/ 100mL	Median <150; 80% samples <4000	Median <150; 80% samples <4000
Dissolved Oxygen	mg/L	>6 (>80-90% saturation)	>7 (>80-90% saturation)
pH		6.5 – 9.0	<0.2pH unit change
Salinity	mg/L		<1000 (about 1500 µS/cm)
Suspended particulate matter/turbidity		<10% change in seasonal mean concentration	<10% change in seasonal mean concentration
Toxicants, heavy metals		As per ANZECC AWQG	As per ANZECC AWQG

Source: Reference 6

6 CURRENT STATUS OF SEWER I/I MANAGEMENT

Previous Studies

Based on flow measurement and operational experience, it appears that the following treatment plant catchments experience significant infiltration/inflow:

- Southville – containing the oldest catchments with mains over 60 years old;
- Westside; and
- Eastpoint.

An infiltration inflow study was undertaken in the Southville catchment by Ace Consulting Engineers in 1985/86 (Reference 7). The study found that groundwater infiltration (GWI) accounted for 45 percent of dry weather flows. Fifty percent of the GWI was found in sub-catchments S8 and S9. A cost-effectiveness study (I/I reduction: rehabilitation cost) indicated that catchments S8 and S9 had cost-effectiveness ratios of 1.5 and 1.3 respectively.

Between 1993 and 1996, a pilot source detection program was undertaken in sub-catchment S8. The sub-catchment was found to be in a state of deterioration. A three-stage rehabilitation program was recommended at a cost of \$14 million (1996) (Reference 8).

A flow monitoring program was commenced by Council in sub-catchment S8 in 1997 (Reference 9). The proposed program was divided into two stages as follows:

Stage 1

Flow monitoring to be carried out downstream of the main trunk sewer sub-branch. The main aim of this stage was to identify which of the sub-catchments were subject to high level I/I to determine the need for further investigation. This stage has been completed and processing of the data is currently underway. A report on the results of the study was completed in early 1998. The study found very high groundwater infiltration in sub-catchments S3, S8 and S9 with high inflows suspected in sub-catchments S6, S7, S8 and S9. The proposed I/I reduction program includes closed circuit television (CCTV) and manhole inspection, along with smoke testing. This will enable a cost-effective rehabilitation program to be developed.

Stage 2

This stage will follow the completion of Stage 1. The level of monitoring is dependent on the results from Stage 1. The main aim of this stage is to:

- identify the systems which have high levels of I/I;
- sources of I/I; and
- provide information for the analysis of the catchment sewer system.

Recent flow estimation undertaken by Council's operational staff indicates that the Eastpoint catchment has an infiltration level of approximately 26 percent.

The Sewerage Master Planning Study, commenced in October 1997, requires the overall I/I level in each catchment to be assessed and an indicative I/I investigation program to be developed (Reference 10).

Asset Condition Assessment

The telemetry system is connected to 37 sewage pump stations, with the remaining pump stations to be connected over the next two years. The telemetry system is a potentially valuable source of data for I/I identification once it is fully operational.

Council officers utilise CCTV inspections on a planned basis for condition evaluation. The data is recorded in a standard format consistent with the Australian Conduit Condition Evaluation Manual. The inspections identify structural defects and groundwater infiltration entry (Reference 11).

Smoke testing equipment has recently been purchased and will be utilised as part of Council's preventive maintenance program for sub-catchments. Priority sub-catchments (with respect to I/I) are being targeted for preventive maintenance.

Manhole inspections have been undertaken for about 70 percent of manholes.

Statutory Management Plans

Council, under its EPA licence requirement, is developing Site-Based Management Plans for its sewage treatment plants and associated pump stations. These plans will include contingency plans and emergency procedures to deal with foreseeable risks which include overflows.

Council officers have developed Environmental Management Programs for sewage pump stations in the Southville and Eastpoint catchments (References 12 and 13). These documents address contingency plans for sewer overflows arising from surcharging caused by I/I and those caused by problems in the pump station itself.

7 STRATEGIC BASIS OF PLAN

7.1 Related TMP elements

The related strategic elements of the TMP framework are:

Key result area:	Asset Management
Goal:	To manage Council's water supply and sewerage infrastructure to meet agreed customer service standards at minimum lifecycle cost

7.2 Key elements of plan

Objectives:	<ul style="list-style-type: none"> To ensure adopted water quality and health objectives are met To reduce wet weather overflow events To ensure full compliance with statutory requirements
Management strategy:	IIS1 Develop and implement a focussed I/I reduction program

8 PERFORMANCE TARGETS

Strategic Targets

- Identify sub-catchments with high I/I flow (i.e. RDI/I¹ > 5 percent) by December 2000.
- All sub-catchments with RDI/I > 10 percent rehabilitated by December 2003.

¹RDI/I = Rainfall dependent infiltration and inflow. The return ratio (R) (expressed as a percentage) is the proportion of rainfall that finds its way into the collection system as RDI/I.

Operational Targets

Council proposes to confirm a number of related operational performance targets based on the findings and recommendations of the Sewer I/I Management Plan. The relevant performance indicators and the respective targets previously adopted by Council are as follows:

Operational performance indicator	Interim target
Number of uncontained sewage overflows from licensed overflow points	15 per 100 km of sewers per annum
Kilometres of sewers inspected per annum	250
Number of smoke tests per annum	3000

9 IMPLEMENTATION OF PLAN

9.1 Overview

A number of guidelines on I/I reduction have been produced. A more recent guideline is the New Zealand Infiltration and Control Manual (1996), from which the following discussion has been largely extracted.

The most current approach to determining wastewater system capability and to rectifying operational and capacity problems looks at the whole of the system rather than identified problem areas. It identifies the root causes of capacity problems and defines remedial actions at the most appropriate locations, which might not be the locations where the problems are being observed. This new approach is gaining favour around the world.

The rational approach considers as far as possible all factors relating to the generation and transportation of wastewater flows in a sewerage system. This approach is based on the assessment of actual rather than theoretical data related to the system, and attempts to locate the cause of system problems.

The approach assumes that a Pareto effect* will exist at all levels of a sewerage system. It further assumes that the causes of system problems can be identified easily and their impact quantified, and that a plan can be developed to address the issues that will return the most benefit.

The major disadvantage of this approach is the effort required to establish the Pareto curve and to locate the most significant causes. However, this extra effort will, in most cases, be rewarded by significantly lower total project costs and much higher probability of success.

The Pareto effect assumes that the source of the major extraneous flows will be located in a relatively small part of the system and that by locating and rectifying these major sources of flow, a cost-effective and long-term solution can be implemented. This Pareto effect has been identified and utilised by a number of water authorities around the world with good effect and has provided demonstrable results. It has also been demonstrated that the effect can exist at all levels down to the smallest catchment.

It is therefore critical that a rational, well planned approach is taken to reducing I/I, otherwise valuable resources may be wasted on ineffective strategies.

*For infrastructure projects the Pareto Principle predicts that in most cases a relatively small number of items will contribute the bulk of the “cost”.

9.2 Action plan

The scope of the various steps in the Action Plan is as follows (Refer attached Table 2 for Action Plan details):

Develop and implement a focussed I/I reduction program

The action plan assumes that the following will continue:

- programmed work in sub-catchment S8; and
- rehabilitation works undertaken in response to defects identified through planned and reactive maintenance.

The Sewerage Master Plan is required to produce the following outputs:

- assessment of the overall I/I level in each catchment; and
- development of an indicative I/I investigation program.

The Master Plan should also identify missing data (e.g. flow records, etc.).

The I/I reduction strategy will develop the relevant outputs from the Master Plan into detailed strategies which will address:

- efficient collection of flow, rainfall and overflow event data;
- flow measurement and analysis;
- source detection and analysis;
- cost estimates; and
- I/I reduction evaluation.

This reduction strategy will be used as a basis for a subsidy submission to the State Government.

Flow measurement and analysis

This stage will involve the collection and analysis of data on actual flows under all conditions in the collection system, and the assessment and location of possible sources of I/I. This analysis will locate areas of high and low flows indicating dry weather infiltration or exfiltration, sources of wet weather flows and their magnitude, and potential/actual sewage overflow locations, and confirm watercourses potentially impacted at each overflow location.

Source detection and analysis

This stage involves using the information from the previous stage to undertake a Pareto analysis to identify and prioritise the worst affected mini-catchments, on the basis of potential social, economic and environmental impacts and benefits of I/I reduction. Appropriate intensive investigation methods will then be used to locate the source of the flows and their cause.

This procedure will include appropriate benefit-cost analyses and lead to the development of a rehabilitation plan which determines the most appropriate and cost-effective rehabilitation techniques to be employed to solve the hydraulic problems. The techniques selected will also address the assessed structural problems encountered.

Examples of source detection techniques include:

- smoke testing;
- CCTV inspection;
- wet weather simulation;
- rainfall simulation; and
- night flow isolation.

Cost estimates for any rehabilitation works will be tentatively incorporated in Council's 10 year infrastructure investment program.

Assessment of alternative technologies

For any sub-catchments identified where rehabilitation or replacement of 50 percent or more of sewers is otherwise indicated, consideration will be given to implementing alternative sewage management technologies in accordance with Council's Management Policy No. MP 4/98 (see Section 2).

As provided in the Policy, appropriate community consultation will be carried out within any affected and adjacent sub-catchments prior to any decision being made on future sewage management in the affected sub-catchment. This is further discussed below.

Rehabilitation

This stage will involve the preparation and execution of a plan of rehabilitation works for rectifying the problems identified, where Council has resolved not to implement any alternative sewage management technologies. These works will be aimed at minimising the resources required to achieve the hydraulic result, while also addressing and identifying structural problems.

Evaluation and reporting

This stage will involve a review of flows in the rehabilitated catchment to determine the effectiveness of the work undertaken, as well as preparation of an audit report to provide a basis for recommendations to Council on operational performance targets and any further work considered necessary.

It will also involve confirmation or modification of details on overflow and emergency response plans currently included in Council's environmental licence.

Community consultation and education program

A targeted community consultation, information and education program will be initiated through Council's Community Services Department. It will be aimed particularly at raising and maintaining community awareness of the causes and consequences of I/I and regulatory provisions regarding illegal connections, etc., and at canvassing community views on alternative technologies where sewer replacement or major remediation is otherwise likely.

A summary of how the program will be structured is given below:

Target group	Information objective	Typical methods
Wider community	Raise general awareness	Public media launch Rates notice inserts
Specific areas to be investigated	Inform local residents about proposed activities and seek views on technical options	Local advertisements Brochures, displays Questionnaires Work signs Resident meetings
Individual householders	Why property to be tested, and follow-up	Letters Work signs Officer/contractor contact

9.3 Monitoring and review of plan

Monitoring of Action Plan	-	Quarterly
Reporting to Council	-	Annually
Updating of Sub-Plan	}	- Annually or as required (at least every 3 years) As required under Section 39 of the EPP (Water)
Reporting to NR&M (if plan is in TMP)		
Reporting to EPA (if plan stands alone)		

9.4 Management responsibility

Overall management responsibility	}	Manager, Water Supply and Sewerage
Reporting to Council		
Reporting to NR&M (if plan is in TMP) Reporting to EPA (if plan stands alone)		
Monitoring of Action Plan	}	Technical Officer, Water Supply and Sewerage
Updating of Sub-Plan		

TABLE 2: Action Plan IIA1

Strategy IIM1: Develop and implement a focussed I/I reduction program

(a) Action Plan

Action	Target date	Responsibility
Develop detailed implementation plan based on Master Plan outputs	31/8/98	Sewerage Engineer
Develop infiltration/inflow reduction strategy	31/12/98	Sewerage Engineer
Address missing data	31/12/98	Sewerage Engineer
Prepare submission for State Government subsidy	28/2/99	Manager, Water Supply and Sewerage
Flow measurement and analysis	31/12/00	Sewerage Engineer
Source detection and analysis	31/12/01	Sewerage Engineer
Sewer rehabilitation	Ongoing	Project Engineer
Evaluation	Ongoing	Sewerage Engineer
Community education program	31/12/99 and ongoing	Sewerage Engineer
Consultation on alternative technologies	As required	Manager, Water Supply and Sewerage

(b) Required Budget

Financial year	97/98	98/99	99/00	Budget required to complete Action Plan
Total		\$165,000	\$220,000	\$340,000

REFERENCES

1. *Corporate Plan 1997–2000*, Sunnyside City Council, June 1997
2. *Strategic Policy No. SP 3/98 – Sewage Management*, Sunnyside City Council, January 1998
3. *Strategic Policy No. SP 6/97 – Community Consultation, Communication and Education*, Sunnyside City Council, June 1997
4. *Management Policy No. MP 4/98 – Alternative Sewage Management Technologies*, Sunnyside City Council, April 1998
5. *Review of Sewage Pollution Incidents in Sunnyside City, 1985–1995*, Metropolitan Environmental Consultants, October 1995
6. *Water Quality Objectives for Waters of Sunnyside City*, Smith and Associates, February 1998.
7. *Infiltration/Inflow Reduction Strategy*, Ace Consulting Engineers, March 1985/86
8. *Pilot Source Detection Program – Sub-Catchment S8*, Sunnyside City Council, 1996
9. *Sewerage Catchment S8 – Flow Monitoring Study – Stage 1 Results*, January 1998
10. *Sunnyside City Sewerage Master Planning Study, Phase 1 Report*, May 1998
11. *Sewer Condition Assessment Program*, Sunnyside City Council, November 1996
12. *Environmental Management Program – Southville Sewerage Catchment Pump Stations*, 1997
13. *Environmental Management Program – Eastpoint Sewerage Catchment Pump Stations*, 1997