

**Guidelines for
Implementing Total Management Planning**

Asset Management

**SEWER INFILTRATION/INFLOW MANAGEMENT
Implementation Guide**

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LIST OF ACRONYMS

EPP (Water)	Environmental Protection (Water) Policy 1997
I/I	infiltration/inflow
KPI	key performance indicator
SWOT	strengths, weaknesses, opportunities, threats
TMP	Total Management Plan
WSP	Water Service Provider

1 PURPOSE

This guide is intended to provide guidance for water service provider (WSP) practitioners and their consultants on the processes involved in establishing and implementing effective sewer infiltration/inflow strategies and procedures and developing associated documentation.

2 INTRODUCTION

Outcomes

Outcomes from implementing an effective sewer infiltration/inflow (I/I) strategy include:

- minimising environmental impacts;
- reducing customer complaints;
- reducing hydraulic loading on the collection system and treatment plant;
- deferral of asset augmentation;
- better knowledge of the wastewater collection system, and its condition and performance; and
- reduced energy costs.

Outputs

Outputs from the sewer I/I process include:

- a Sewer Infiltration/Inflow Management Plan (TMP sub-plan); and
- reports on specific infiltration/inflow studies.

3 BACKGROUND

Sewer infiltration/inflow involves the entry of surface water and groundwater into a wastewater collection system, causing hydraulic overloading of the system. This can result in:

- surcharging of manholes and house connections, causing raw sewage to flow over properties, with potential public health impacts;
- overflow of sewage from wet wells and bypassing of treatment plants, causing environmental and public health problems;
- overloading of the treatment processes, causing a deterioration in effluent quality;
- excessive pumping costs and increased pump wear; and
- premature and expensive system augmentations.

The components of infiltration/inflow are illustrated in Figure 1.

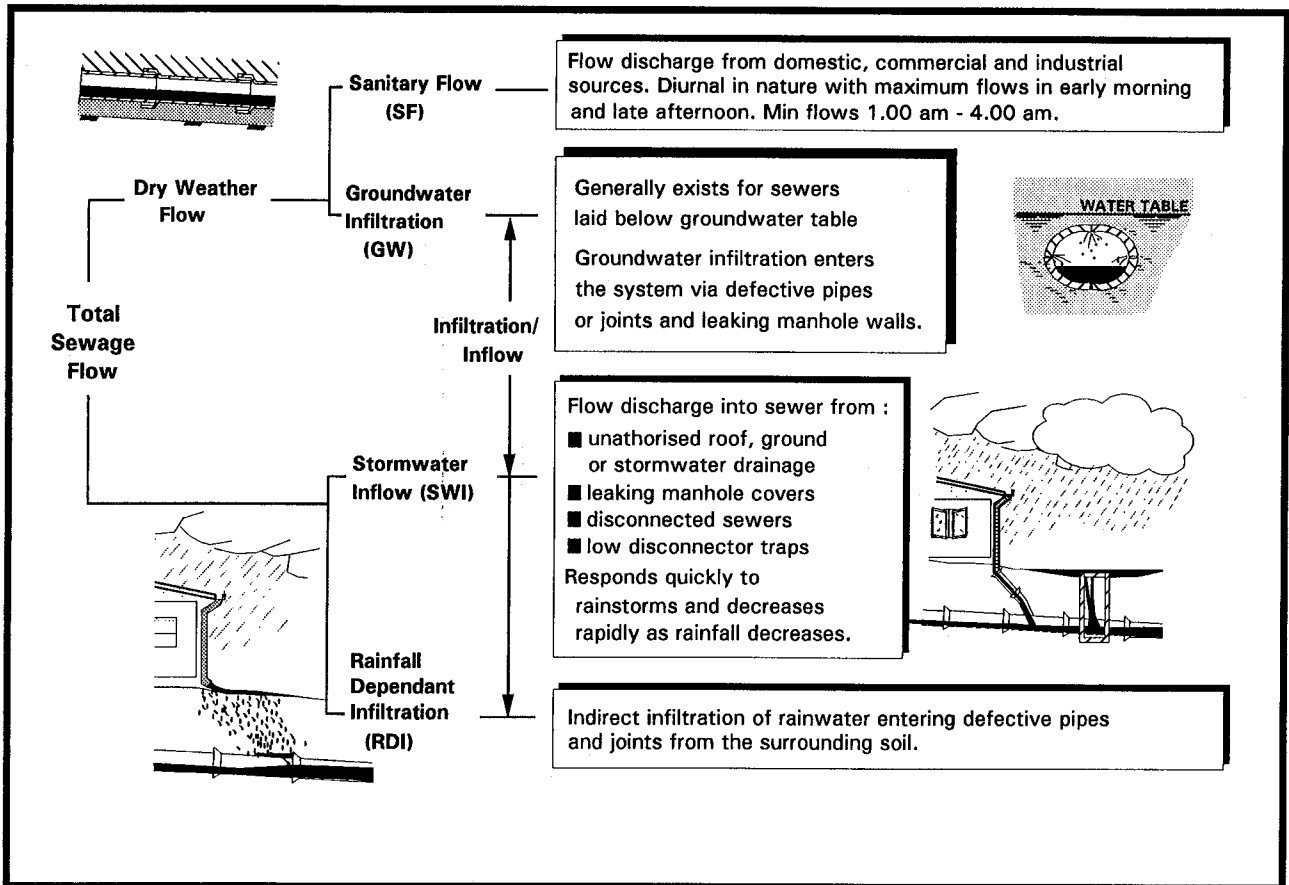


FIGURE 1: Components of total wastewater flow

4 THE SEWER INFILTRATION/INFLOW MANAGEMENT PROCESS

The process for sewer infiltration and inflow management is illustrated in Figure 2.

The process needs to address the whole collection system rather than just identified problem areas. Root causes of problems should be identified and remedial actions undertaken at the most appropriate locations (which may not be the locations where the problems are evident).

A rational approach to infiltration/inflow management is outlined in guidelines listed in 'References and further reading'. The rational approach considers, as far as possible, all factors relating to the generation and transportation of wastewater flows in a wastewater system. This approach is based on the assessment of actual rather than theoretical data related to the wastewater system, and attempts to locate the cause of system problems.

This approach assumes that a Pareto effect will exist at all levels of a wastewater system. The Pareto effect, in the context of a wastewater system, assumes that the source of the major extraneous flows will be located in a relatively small part of the system, and that a cost-effective and long-term solution can be achieved by locating and rectifying these major sources of flow. This Pareto effect has been identified and effectively utilised by a number of water authorities 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 infiltration and inflow problems; otherwise valuable resources may be wasted on ineffective strategies.

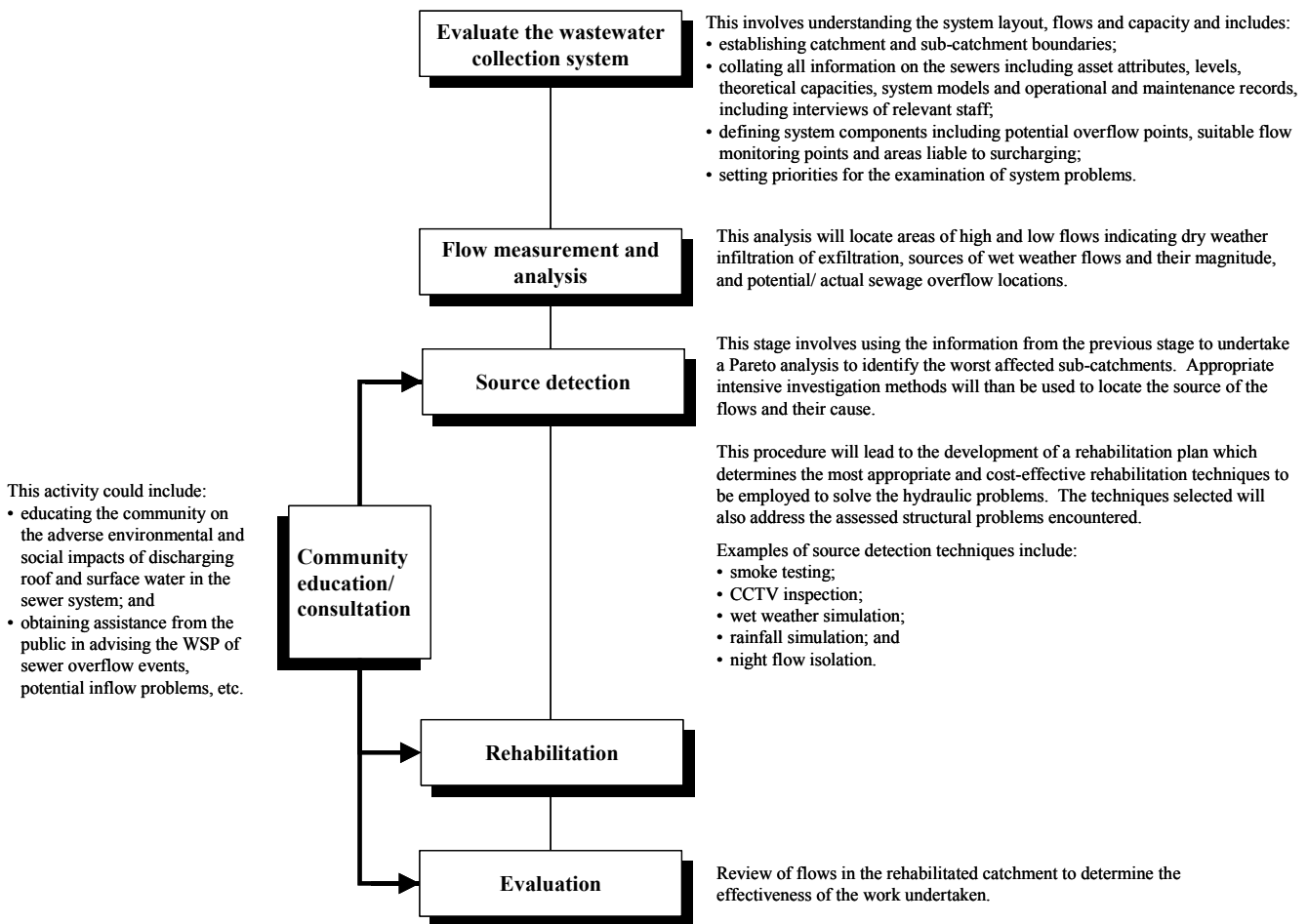


FIGURE 2: Sewer infiltration and inflow management

5 ENVIRONMENTAL PLAN REQUIRED UNDER EPP (WATER)

Under the EPP (Water), each local government that operates a sewerage system is required to develop and implement an environmental plan for sewage management to minimise unnecessary flows entering the system. This statutory requirement is discussed in more detail in the Environmental Sustainability Implementation Guide. As described in that Guide, a local government can meet these requirements by preparing an appropriate sub-plan as an adjunct to a Total Management Plan.

6 RISK ISSUES

Potential risks associated with infiltration and inflow management include:

- environmental impacts of overflows;
- public health impacts of overflows/property flooding;
- customer complaints;
- accuracy and reliability of raw data;
- over-estimation of success of the infiltration/inflow reduction program; and
- ineffective infiltration/inflow reduction strategies.

7 TMP REQUIREMENTS

Each WSP's Total Management Plan (TMP) should include an outline of key issues and identified strategies addressing these issues for the WSP's services in respect of sewer I/I management. Appendix A provides indicative content and appropriate TMP development level for this sub-plan.

A hierarchy has been established to define the level to which a WSP should develop its plan under total management planning. This is discussed in more detail in the TMP Development Guide. The development level depends on the size of the WSP (in terms of the replacement cost of its assets).

REFERENCES AND FURTHER READING

New Zealand Infiltration and Inflow Control Manual, NZ Water and Wastes Association, September 1996.

Total Management Planning – Urban Water-related Services: Management Issues, Department of Primary Industries (Water Resources), Brisbane, 1994.

APPENDIX A: Content and development level of sub-plan

TABLE A1: Indicative sub-plan content

Sub-plan features	Sewer Infiltration/Inflow Management Plan content
Issues covered in sub-plan	<ul style="list-style-type: none"> ▪ Health risks from sewage overflows. ▪ Sewage flow and rainfall monitoring. ▪ Sewer condition assessment. ▪ Inflow source detection and regulation. ▪ Amelioration benefit/cost analysis.
Purpose of plan	<p>For WSPs operating sewerage systems:</p> <ul style="list-style-type: none"> ▪ to provide an overview of current infiltration/inflow (I/I) problems and their management; and ▪ to outline future objectives and initiatives for managing I/I.
Policies that may be required	<ul style="list-style-type: none"> ▪ Prioritisation of I/I amelioration works.
Other Total Management Plan elements that are intimately linked to this sub-plan	<ul style="list-style-type: none"> ▪ Asset Evaluation and Renewal Plan: provides for sewer/manhole condition assessment programs. ▪ Environmental Management Plan: regulation of sewage overflows.
External issues contributing to the current operating environment that need to be considered	<ul style="list-style-type: none"> ▪ Requirements of the EPP (Water) for preparation of local government environmental plans on sewage management (focusing on I/I reduction). (This sub-plan should be formulated so as also to meet these requirements.) ▪ The Local Governing Bodies Capital Works Subsidy Scheme provides subsidies for approved I/I reduction studies. ▪ Sewage overflows caused by excessive I/I are subject to licensing under the Environmental Protection Act.
Issues that need to be considered in summarising the status of current operations	<ul style="list-style-type: none"> ▪ Status of I/I assessment studies. ▪ Status of I/I rectification programs. ▪ Inflow source detection and enforcement programs. ▪ Condition assessment programs. ▪ Sewage overflow statistics. ▪ Broad SWOT analysis of relevant operations.
Strategic basis of the plan	<p>The strategic elements forming the basis of the plan should include:</p> <ul style="list-style-type: none"> ▪ goal for asset management; ▪ objective(s) for I/I management; ▪ adopted KPIs; and ▪ management strategies and performance targets. <p>The management strategies developed will be based on the identified key strategic issues and SWOT findings, including risk assessment, in respect of sewer I/I management, and on the required TMP development level.</p> <p>Many WSPs are likely to require strategies for carrying out prioritised I/I assessment studies; developing prioritised rectification/rehabilitation programs; monitoring the performance of I/I reduction measures; and enhancing source detection programs.</p> <p>The strategies should be supported by detailed action plans that would cover a period of up to 3 years.</p>
Suggested performance measures	<p>Outcome:</p> <ul style="list-style-type: none"> ▪ Number of wet weather sewer overflows. ▪ Number of sewer flooding overflow complaints. <p>Output:</p> <ul style="list-style-type: none"> ▪ Ratio of maximum day flow to average day flow. ▪ Rainfall-dependent I/I (%).

Sub-plan features	Sewer Infiltration/Inflow Management Plan content
Supporting documentation	This will depend on the WSP, but typically would include: <ul style="list-style-type: none"> ▪ I/I assessment reports; ▪ instrumentation evaluation reports; ▪ rehabilitation works planning reports; and ▪ environmental management reports on licensed sewer overflows.

TABLE A2: Required sub-plan development level

Development level ¹	Target management mechanisms of Sewer I/I Management Plan
3	<ul style="list-style-type: none"> ▪ A strategic/rational approach to infiltration/inflow management exists. ▪ Flow measurement and analysis program undertaken. ▪ Sewer rehabilitation program addresses infiltration/inflow reduction. ▪ Source detection integrated into overall planned maintenance strategies. ▪ Community education on rainwater discharge into sewers.
2	<ul style="list-style-type: none"> ▪ A strategic/rational approach to infiltration/inflow management exists. ▪ Sewer rehabilitation program addresses infiltration/inflow reduction. ▪ Source detection integrated into overall planned maintenance strategies. ▪ Community education on rainwater discharge into sewers.
1	<ul style="list-style-type: none"> ▪ A systematic approach to infiltration/inflow management exists. ▪ Community education on rainwater discharge into sewers.

¹ Defined in Section 4.2 of TMP Development Guide.