1. INTRODUCTION

This document comprises Volume 3 of the Regional Policies being developed as part of the Greater Dublin Strategic Drainage Study (GDSDS) and is entitled "Environmental Management". Within this volume, the implications of current and developing legislation for environmental management in the context of urban drainage systems are developed. This includes consideration of the impacts of combined sewer overflows and surface water discharges on water quality recognising that the achievement of sustainable development demands the use of Best Management Practices (BMP). Among the issues considered are:

- The legislative requirements, EU and National Policy criteria to be considered in developing regional policies for environmental management of urban drainage systems;
- The fundamental principles of urban drainage including separation of foul and surface water drainage, interception of first flush from surface systems and the impact of illegal connections to the foul sewerage system and to the surface water drainage network;
- Effluent from Wastewater Treatment Works (WwTW);
- Establishing appropriate criteria for stormwater drainage having regard to the nature and types of development served, the characteristic of receiving water environments, flooding risk and its mitigation; and
- Definition of minimum standards for stormwater run-off discharges from new development.

The objective of the GDSDS is the development of an integrated policy framework, applicable within the Greater Dublin Region, across its various local authorities with the endorsements of the separate Engineering, Planning, Parks, Environment, Roads and Pollution Control/enforcement departments in each. The policies must, therefore, be complementary and consistent and must support public policy.

1.1 Historical Perspective and Scope

The development of urban sewerage systems was initially based on a single pipe (combined) system which collected stormwater as well as foul sewage. As discharges were intercepted for treatment, the principle of a multiple of Dry Weather Flows (DWFs), typically 6, to be conveyed for treatment was adopted, with combined sewer overflows (CSOs) introduced to spill excess flows in times of rainfall to convenient watercourses. This recognised the practical capacity limitations of pipe networks, pumping and treatment systems. At the same time, it resulted in significant pollution at overflows, depending on the nature and beneficial uses of the receiving water, volume ratios of receiving water to discharge and dispersion characteristics.

The evolution of separate systems was considered to be a significant step forward in excluding stormwater from the foul system, thereby reducing foul flows and facilitating full treatment before discharge. However, in its practical implementation, the twin pipe (separate) system has serious limitations:

- **Foul sewers:** inevitably attract a degree of stormwater misconnection with the result that flows of 5-6 times DWF are frequently experienced and where infiltration and stormwater connections are relatively uncontrolled, foul flows can exceed the capacity of pipe networks, pumping and treatment systems with the result that overflows become necessary to prevent flooding. Such overflows are likely to be less dilute than would occur in a combined system and are therefore even less environmentally acceptable.
- **Storm systems:** stormwater discharge directly to receiving waters from separate stormwater drainage pipe networks has been found to have substantial pollution potential associated with high levels of suspended solids, organic matter and other pollutants washed off during rainfall, together with misdirected foul connections, most frequently associated with washwater (washing machines, dishwashers, etc). A particular problem arises in "first flush" situations, where early run-off following a dry spell can result in pollution concentrations higher than those in typical foul sewers.

Water quality monitoring and reported studies demonstrate the negative water quality impact of intermittent pollution from stormwater discharges in terms of:

- Sediment accumulation in the stream bed covering up vegetation, organisms and breeding sites;
- Loss of biological species and diversity due to pollutants which can include hydrogen sulphide, ammonia, metals and other toxins;
- Loss of amenity due to nutrient enrichment and directly from sewage derived debris;
- Significant hydrogeological impact due to accelerated run-off response giving higher flood levels and corresponding loss of groundwater re-charge giving reduced low flows in rivers, thereby increasing environmental vulnerability.

These well established conditions are inconsistent with the concept of sustainable development, with the result that alternative drainage policies are clearly required into the future. Such strategies will involve:

- Development of Sustainable Drainage Systems (SuDS) based on Best Management Practices (BMP's) from international experience;
- Development of criteria, based on Best Management Practice, for the design of such systems as an integral part of urban drainage design;
- Development of operational and maintenance criteria to ensure that such facilities can operate effectively and in accordance with general amenity and health and safety requirements.

1.2 Legal Requirements

The Water Framework Directive (WFD), was incorporated into Irish law on 22 December 2003 under the European Communities (Water Policy) Regulations *(S.I. 722, 2003*). The WFD requires as an objective the achievement of "good ecological status" for all waters by 2015. A key tenet of this policy document is that the requirements of the WFD cannot be met unless sustainable drainage systems (SuDS) are implemented.

Implementation of the WFD will involve the development of catchment management strategies incorporating Stormwater Management Plans (SWMP) which will address volume and water quality objectives. Such strategies will be applied on a River Basin District (RBD) basis and will incorporate best environmental practice for land uses generally, including urban development. It follows that a future policy for urban drainage must be in accordance with best environmental practice. The Eastern RBD is relevant for the Greater Dublin area.

1.3 Sustainable Drainage Systems (SuDS)

This document defines the objectives and design criteria for SuDS. The terminology Sustainable Drainage Systems (SuDS) is adopted throughout this document rather than Sustainable Urban Drainage Systems (SUDS), as such systems are not limited to strictly urban environments. SuDS require a considerable change in thinking on the part of engineering, planning and other professionals involved in development. In time, they may also require new thinking in regard to the legal framework for delivering water services, issues of responsibilities and liabilities, as discussed below.

In the first place, where traditional drainage practice involved conveying run-off from rainfall to the receiving river as quickly as possible through efficient pipes and channels, SuDS are intended to have the opposite effect, namely to slow down the run-off of rainfall to receiving rivers in order to mirror what happens in the pre-existing undeveloped catchment, i.e.:

- Rainfall on the natural catchment is intercepted by vegetation and infiltrates to the soil to a large degree with surface run-off only occurring when the catchment is thoroughly wet. Even then, the tortuous path of run-off through vegetation and ditches can delay the river response for many hours or even days, in a large catchment.
- Such natural processes involve re-charge of groundwater following rainfall while the slow surface velocities reduce the extent of erosion and sediment transfer and the associated transport of pollutants from natural surfaces to the river system.

It follows that the systematic implementation of SuDS solutions will involve the following hierarchy of options.

- Slower run-off collection through overland flow to vegetated interception swales, ditches and filter drains.
- Promotion of infiltration through the use of swales, assisted by filter drains and infiltration basins such as porous pavement options beneath car-parks, etc.
- Storage systems for both volume attenuation and treatment whereby ponds and wetlands are used to hold back discharges to streams and rivers to reduce flows and facilitate removal of solids and pollutants through sedimentation and other processes, both physical and biological.

Assuming that SuDS solutions are generally required to be an integral part of each development, it follows that ideally a single sewerage pipe should emanate from new development conveying foul flows only. Inevitably, such sewers will have some stormwater component, as at present, due to inadvertent or unavoidable connections.

The practical issues associated with the adoption of these principles include:

- Technical criteria for design, construction and operation of SuDS appropriate to each type of development and to enable satisfactory standards of design and implementation for all developments.
- Acceptance by planning and other sections of the Local Authority of SuDS drainage systems for all new developments, thereby ensuring that they are properly designed into the scheme at the pre-planning stage.
- Agreement on the responsibilities and procedures for operation and maintenance of SuDS facilities.

An important function of SuDS is their acceptance and treatment of the first flush. Current design criteria take this into account.

1.4 Regulatory Framework

It has been recognised that the key to implementation of improved management strategies in urban drainage will be its integration into strategic and local development planning. UK studies have shown that SuDS systems must be an integral part of strategic development plans, if they are to be successfully implemented. In particular, such planning must provide for:

- Protection of rivers and floodplains, including as a minimum a riparian corridor along all significant rivers and streams to ensure that they are retained as natural systems, along with their riparian habitats, which act as barriers for pollution and to facilitate maintenance.
- Appropriate arrangement of open space to suit SuDS and stormwater drainage management, including consideration of the interaction between developments in relation to such systems.
- Provision for long term operation and maintenance and having regard to health and safety and general public concerns.

Accordingly, the following regulatory hierarchy for implementation of these policies should apply:

- Adoption of SuDS policies in principle at National Level (DoEHLG and EPA) and at Local Authority level by general provisions in the County/City Development Plan.
- Development of an agreed approach to SuDS implementation between the drainage department of each Local Authority and other relevant departments including Planning, Parks/Environment, Roads, etc. Each Local Authority would be required to adopt detailed policies for promoting Sustainable Drainage Systems in local plans, requiring developers to adopt Sustainable Drainage Systems through the use of appropriate planning conditions or by planning agreements (refer **Volume 2, New Development Policy)**.

At local level, Local Authorities must be in a position to promote sustainable drainage through planning policy and through advice to developers and to their designers.

Among the detailed policies are the following general principles:

- Promotion of infiltration through swales and infiltration systems is a primary form of SuDS and is likely to deliver maximum benefits in terms of attenuation and water quality protection where it is achievable. For most development, adoption of these techniques would be deemed to comply with the principles of SuDS.
- The provision of retention ponds and wetlands would be considered acceptable for all developments and essential for Industrial Estates and other high risk categories of development. The provision of below ground engineered structures for storage and attenuation should be resisted as they are inconsistent with the principles of SuDS in that no significant water quality benefits would be derived from such solutions and the long term operational issues associated with them are likely to become a burden on Local Authorities ultimately inheriting such systems.

Subject to these considerations, responsibility for developing the detailed drainage proposals for each development is a matter for individual developers and their designers/advisers. Experience demonstrates that high quality amenity and technical design as an integral part of overall development planning and design leads to effective systems which achieve general acceptance from the public. Poorly conceived and designed options are likely to give rise to difficulties of public acceptance and ultimately impaired performance. This document considers in depth the policy criteria which should be adopted.

1.5 Combined Sewer Overflows

The development of network modelling techniques has facilitated better understanding of the performance of overflow structures in sewer networks. These models can predict overflow frequency and spill volumes. The models can be further developed to predict quality impacts of overflows, subject to a high level of monitoring and verification. This policy document defines criteria for the limiting of spills to safeguard the receiving environment through the use of storage and more satisfactory overflow arrangements, incorporation of measures to contain detritus and where practicable by excluding stormwater and infiltration from the system.

1.6 Policy Implementation

The implementation of improved environmental management principles in Urban Stormwater Drainage, therefore, require a number of steps including:

- Adoption of consistent policies on a regional basis incorporating SuDS principles.
- Systematic implementation of these policies in County Development Plans and in the development of strategic plans throughout the region.
- Development of design methods and criteria for satisfactory implementation of SuDS solutions by developers, ensuring high quality design for amenity and sustainable performance of the systems.
- Co-ordinated and agreed approach to the taking in charge, management, maintenance and operation of SuDS within the context of drainage, roads and parks/open spaces infrastructure.
- Overall policy of river and floodplain protection and maintenance to promote conservation of river eco-systems, reduction in pollution risk and protection against littering and general degradation of the river environment.
- Planning and management strategies should incorporate provisions for monitoring of quantity and quality as part of the overall management of water resources systems.

1.7 Report Format

This policy document is intended to support the preparation of plans or strategies for the management of stormwater in urban areas and the assessment of urban stormwater current management practices.

An Executive Report is provided as a separate document. This report summarises the issues surrounding the implementation of Sustainable Drainage in Greater Dublin and highlights the main policy recommendations arising from the main document.

This introduction provides an appreciation of the key issues surrounding sustainable drainage and provides a guide to the rest of the document. Chapter 2 presents an overview of the Environmental Legislation which drives the requirement for a change in Urban Drainage Management. The framework of stakeholders with responsibility for the provision and management of drainage infrastructure in the Greater Dublin Area is also provided. **Appendix B** provides supplementary detail on legislation and stakeholder roles.

Chapter 3 assesses **existing water quality** in the Greater Dublin Area against legislative requirements and brings into focus the non-sustainable nature of current drainage practices.

Chapter 4 examines traditional **drainage practices** from the earliest provision of combined sewerage pipes to the present day network. Existing drainage policies of the individual Local Authorities are documented with particular reference to sustainable drainage components. Finally recent changes in approach to address drainage issues are discussed.

Chapter 5 discusses the broad spectrum of **interconnected sustainable drainage issues** including water quality, flood control, riparian corridors, biodiversity, landscape and community well being.

Chapter 6 introduces the available **SuDS techniques** which comprise structural and non structural best management practices. Guidance on the selection of structural SuDS is provided as well as discussion on the issues associated with SuDS such as cost effectiveness, maintenance and responsibility. The key elements in the design of SuDS for stormwater volume control are outlined however, this aspect of SuDS is dealt with in more detail in a separate volume of the regional policies (**Volume 2: New Development**). Design considerations for stormwater volume control can also be found on the SuDS information sheets contained in **Appendix E**.

Chapter 7 deals with **intermittent discharges** to receiving waters from the urban wastewater system. It describes the key drivers for improvement and describes appropriate methodologies to achieve that improvement.

Chapter 8 deals with **continuous discharges** to watercourses, i.e. final effluent discharge from municipal Wastewater Treatment Works (WwTW) and discharges from trade and industrial premises and makes recommendations with respect to licensing of discharges and general improvements required to achieve sustainability.

Chapter 9 outlines the guiding principles and methods by which the policy recommendations identified throughout this document can be practically implemented.

1.8 References

Dublin Drainage Consultancy, 2003 Greater Dublin Strategic Drainage Study. ***Regional Policies – Volume 3. Environmental Management. Executive Report.***
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Dublin Drainage Consultancy, 2003 Greater Dublin Strategic Drainage Study. ***Regional Policies – Volume 4. Inflow, Infiltration and Exfiltration.*** Consultation Document.
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EC (European Commission) 2000. "***Council Directive for Establishing a Framework for Community Action in the Field of Water Policy***." (Water Framework Directive) (2000/60/EC).

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