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1 THE REGIONAL DRAINAGE POLICIES

The Greater Dublin Strategic Drainage Study (GDSDS) requires the recommendation of policies for the future provision and management of drainage services in the Greater Dublin Area (GDA). The GDA includes the Local Authorities in Dublin City, Fingal, South Dublin, Dun Laoghaire Rathdown, Meath, Wicklow and Kildare.

These drainage policies are to assist Local Authorities in complying with their legal responsibilities, their planning and development objectives and are to, in so far as practicable, conform to good international practice. A particular requirement from the Study is that Drainage Policies adopted across the region should facilitate a uniform and consistent approach to urban drainage infrastructure planning, design, construction and operation. The drainage policies should also result in improved customer service.

This document is the Overall Policy Document, entitled “Regional Drainage Policies – Volume 1.” This document summarises the drainage policies for the GDA. The background and details of the drainage policies are contained in separate Technical Documents, which are:

- Volume 2 - New Development
- Volume 3 - Environmental Management
- Volume 4 - Inflow, Infiltration and Exfiltration
- Volume 5 - Climate Change
- Volume 6 – Basements

Volumes 2 to 6 of the Regional Drainage Policies thus should be read in conjunction with this Overall Policy Document.

1.1 Interaction between the Regional Policies

The major existing drainage infrastructure is interconnected, with the greater part of the foul sewer network catering for Dublin City, South Dublin and parts of Fingal, Meath, and Dun Laoghaire Rathdown, draining to Ringsend WwTW for treatment. The management of this interconnected system requires each Local Authority (LA) to have consideration of the needs and drainage requirements of the other local authorities. Most of the other treatment plants cater for discrete catchments covering one or two LA's.

The rivers and streams in the region cross LA administrative boundaries, and thus discharges to watercourses in one area will impact on areas downstream.

It is therefore a necessity that the future management of all drainage in the GDA is integrated across the seven local authorities in the region and across the various disciplines within those authorities, in order to bring conformity of approach in drainage matters to Councils across the region.

The policies are intrinsically linked and cover a number of key areas, including:

- Existing Drainage Infrastructure; or how to best utilize the existing assets and minimize their impact on the regions watercourses;
- New Development; or how to minimize the impact of future development on the environment, particularly its watercourses;
- Basements; or how to protect basements from sewer flooding;

- Climate Change; or what, if anything, should be done to prepare for higher sea levels and greater rainfall intensities - the predicted outcome of climate change.

Figure 1.1 depicts the interrelationship of these key areas.

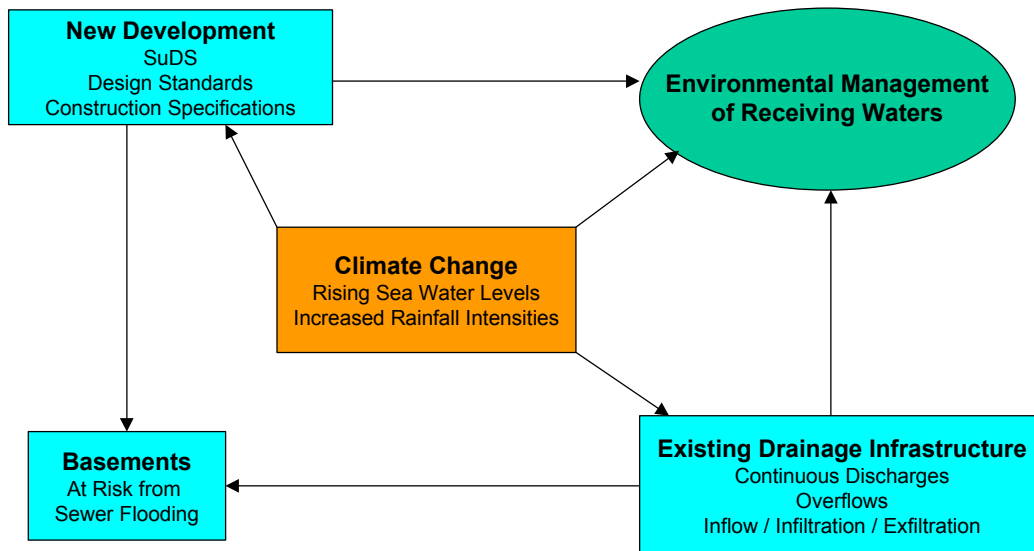


Figure 1.1 Relationship Between the Regional Drainage Policies

New development produces increased levels of urbanization, potentially leading to:

- decline in the quality of our surface, ground, estuarine and coastal waters;
- loss of biological diversity, amenity and habitat;
- accelerated run-off response leading to higher flood levels and loss of ground water re-charge.

The impacts of climate change will reduce the level of service of drainage systems, due to increased rainfall intensity and sea level. The presence of substantial inflow, infiltration and exfiltration flows will continue to compromise the capacity of sewerage and treatment systems to service future development. Any work undertaken on the existing drainage network and all future development should consider the potential impact on basements at risk from sewer flooding.

2 NEW DEVELOPMENT POLICY

The Local Authorities currently have different practices in place as to how new development is managed. These practices have developed over recent years, but are now proving inadequate to address the rapid growth of development in the Dublin Region, and the need for control of the resulting pollution of the environment.

The adverse effects of current practices include:

- Building in floodplains, with increased risk of flooding of developments;
- Discharge of high flows and pollution to watercourses from stormwater runoff;
- Presence of substantial amounts of inflow and infiltration in the foul system;
- Inefficient record keeping of drainage asset information

The Local Authorities also have different requirements for the design, construction and taking-in-charge of drainage facilities associated with those developments. The New Development Policy provides uniform approaches, in accordance with best local and international practice, and supporting environmental legislation, such as the Water Framework Directive and the proposed New Water Services Bill.

Among the issues addressed are:

- ◆ Legal requirements regarding new development, in particular the Planning and Development Act, 2000;
- ◆ Existing drainage regulations, in particular the Local Government (Sanitary Services) Acts 1878 to 1964 and the Building Regulations, 1997;
- ◆ Liaison between Council Departments to promote similar approaches;
- ◆ Procedures for drainage aspects of new development, involving Council Departments and developers;
- ◆ Design, materials and construction specifications to promote similar standards.

The departments principally involved in the new development process are the Planning Department, Drainage Department, Building Control, and Roads Department. The Parks Department will be involved in stormwater management, using Sustainable Drainage Systems (SuDS). The level of co-ordination needed depends on the size of the Authority, and will vary from the largest, Dublin City Council, to the smallest, Bray Urban District Council. However the principles and procedures constituting the policy should be uniform across the region, and independent of size of Council.

The policies must be practical, capable of support, and compatible with the objectives of the other Regional Drainage Policies, in particular the policy for Environmental Management.

2.1 Objectives of New Development Policy

The policy objectives are to meet the requirements of efficient management of the process of planning, construction and taking-in-charge, and also to provide best practice in minimising environmental impact of development. The detailed objectives include:

- Emphasis on the role of drainage management in addressing environmental legislation, such as the Water Framework Directive, and systems set up to promote that role;

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- Emphasis to developers and the public at large that sustainable drainage systems are mandatory, as a corner-stone for achieving environmental improvement of the region's watercourses
 - Implementation of new design approaches to support SuDS and stormwater control;
 - Liaison between Council Planning and Drainage Departments ensuring that drainage infrastructure for new developments will be co-ordinated;
 - Management of planning applications, and that drainage involvement will be co-ordinated;
 - Ensuring that planning approvals will only be given to sustainable developments, avoiding floodplains, overloaded drainage systems and the like;
 - Taking in charge procedures and requirements will be consistent;
 - Taking in charge requirements for sustainable urban drainage systems will be consistent;
 - Specifications and practices for design, materials and construction will be consistent;
 - Drainage construction quality will be improved, thus reducing the current high occurrence of illegitimate flows in the drainage system;
 - Drainage standards and practices will be periodically reviewed to take account of changes in technology, industry practices and local requirements;
 - Promoting electronic management of drainage matters, such as planning applications and taking-in-charge, to improve efficiency within the Council departments, and provide better service to the public;
 - Promoting drainage systems as assets to be understood, protected and preserved for the environment and future generations

2.2 Planning Implications

The principle of sustainable development required in the Planning and Development Act, 2000 is to remain. The Regional Policies seek to fully support this principle, and the Act's requirement that drainage considerations be included in the planning process.

The Act also seeks to systemise the planning application process, which these Policies support. The objectives of the policy are thus to:

- Ensure that the Planning Department maintains control of the planning process, and manages developments through use of a planning database;
- Ensure that proposed development is compatible with existing and proposed drainage infrastructure;
- Ensure that the Drainage Department agrees the requirements for the new development;
- Ensure that the Planning Department understands any constraints imposed by the Drainage Department on new development, especially development in or near floodplains;
- Ensure that the Planning Department imposes any requirements specified by the Drainage Department related to new development;
- Ensure that the Developer understands any requirements for the design, construction and taking-in-charge of new development;

- Ensure that all drainage construction complies with satisfactory design and construction standards;
- Ensure that all records of new development are satisfactorily managed

The Policy includes four procedures, corresponding to the phases in the life of a typical development.

The first procedure for **Development Plan Liaison** deals with the involvement of the Drainage Department (and other utility departments) in the production of the Council's Development Plan.

The second procedure for **Planning Application Procedures and Approvals** covers the selection and review of planning applications by the Drainage Department, and the approval by the Local Authority of the Developer's Planning Application.

The third procedure for **Drainage Construction and Connection** is concerned with the checking and approval of site work, the making of connections to the public system and associated certification.

The fourth procedure for **Taking in Charge** deals with the taking over of drainage from the developer, the final inspections and completion of agreements.

The purpose of the procedures, and their linkage to the proposed Regional Drainage GIS, is to systemise the flow of information relating to planning decisions. The management of information will allow drainage engineers to reach decisions in the shortest period, and with the greatest confidence in the correctness of their advice.

2.3 Drainage Design

Drainage best practice has undergone a dramatic shift in emphasis in the last decade in Europe. This is generally termed BMPs (Best Management Practices) or SuDS (Sustainable Drainage systems), the latter being the term applied in UK. It has been recognised for some time that separation of drainage systems (foul and surface water systems), although dealing with much of the drainage needs of the urban environment, have some significant limitations. The primary issues are:

- Surface water runoff is very rapid and tends to pass rainfall-runoff downstream, exacerbating flooding from networks or rivers;
- The diffuse pollution of rivers and streams caused by surface water runoff is now recognised as being a significant problem, which will prevent the effective implementation of the Water Framework Directive.

To address these problems, a range of drainage methods, which involves emphasis on retention and infiltration at source, has been developed which will both reduce runoff volumes, slow runoff rates and partially treat the effluent. These SuDS methods are summarised in Regional Drainage Policy Volume 2 – New Development, and are detailed more fully in Regional Drainage Policy Volume 3 - Environmental Management.

Due to the fact that these systems have been developed relatively recently, there are two issues that are important to recognise, being:

- New design criteria are needed to ensure that consistent design of the systems is achieved;
- Lack of experience in both construction and management of these systems means that there is some uncertainty and therefore some concern over their long term performance and maintenance needs

These aspects have both been addressed with design criteria defined, and an illustration appended to the New Development Technical Document to assist drainage engineers. SuDS is mandatory

for all new developments, except where the developer can demonstrate that its inclusion is impractical due to site circumstances. Where SuDS cannot be provided, the developer must provide alternative means of dealing with pollutants.

2.3.1 Specific Recommendations

Acceptance of new policies for urban drainage across the region will require implementation at various levels, as follows:

Drainage Departments: Council departments to raise their profiles in planning and management of drainage infrastructure, including flood risk assessment and stormwater management;

Drainage Involvement in Planning: Council Departments should adopt the policies and procedures to co-ordinate drainage infrastructure with new development;

Development Plans: should make allowance for drainage aspects, including provision of drainage infrastructure, risk of flooding and isolation of basements;

Council Liaison: Liaison Committee to be maintained to implement Study recommendations with the ongoing role of agreeing future drainage matters for the region;

Public Liaison: The application of Sustainable Drainage systems (SuDS) is mandatory for all new development, and will be promoted by the setting up of a Regional Working Party of all stakeholders;

Design: Design standards and Codes of Practice to be co-ordinated, to ensure co-ordinated and consistent implementation of drainage systems;

Construction: requires that appropriate specifications be developed for the construction of drainage systems to satisfactory quality standards, including testing/acceptance procedures and standards of completion;

Drainage Department Management: Most critical of all will be the effect on the Local Authority Drainage Departments of the policies on monitoring of construction, requiring additional staff resources or the use of agencies. The setting up of a Drainage Inspectorate on a Regional basis should be considered

2.3.2 Further Information

The Regional Drainage Policy Volume 2 - New Development Technical Document contains supporting information, in particular the procedure flow diagrams, design parameters and methodology for foul and stormwater system design, and specifications.

3 ENVIRONMENTAL MANAGEMENT POLICY

The requirement for a new drainage policy for Environmental Management relates to the prime functions of a local authority and the belief that the existing practices are not effective. This new policy requires a regional application because of the interconnection / interdependency of the existing drainage infrastructure.

A Local Authority fulfils many prime functions, including those of Planning Authority and Sanitary Authority. The first function is responsible for Planning and Policies and the second function is responsible for Drainage Policies and their Implementation.

As Planning Authority, the Local Authority has a duty to promote, encourage and facilitate future development. In promoting future development the Local Authority has already enshrined in the most recent Development Plans a commitment to “sustainable” future development and a commitment to protect and enhance the built and natural environment.

As Sanitary Authority, the Local Authority has a duty to facilitate future development through the provision of drainage infrastructure. However, there are concerns over the adequacy of the existing drainage infrastructure to cater for existing flows and loads, never mind the flows and loads from future development. There is also concern over the deteriorating quality of the water bodies in the region and the impact that drainage discharges have in this deterioration. In providing solutions for these concerns there is a desire to introduce best national and international management practice (BMP) to drainage undertakings.

3.1 Policy Recommendations

3.1.1 General Principles

The environmental management policy focuses on the commitment to protect, maintain, improve and enhance the natural environment and to make features in the natural environment, such as watercourses, to be focal points of future development. The key focus is the development of Integrated Water Management Plans across the region and the implementation of best management practice in all aspects of sustainable drainage, addressing water quantity and water quality objectives on a catchment/river basin scale. These policies generally fall into the medium to long-term objective category. Specific policy recommendations that relate to natural amenities and recreation are given below.

3.1.2 Specific Recommendations

Natural Amenities and Recreation

Policies in the area of Natural Amenities and Recreation include:

- the development of Integrated Water Management Plans across the Region, looking at water quantity and quality issues at the Catchment /River Basin level in order to effectively manage, in a sustainable manner the entire life cycle of water in the region;
- to promote the implementation of Water Quality Management Plans for ground, surface, coastal and estuarine waters in the county as part of the implementation of the EU Water Framework Directive;
- to establish a working group to oversee the preparation of a guide on Irish river rehabilitation and a public education programme.

However, in order to achieve these objectives it will be necessary to implement the following actions in the short to medium term:

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- to pilot the development and implementation of Integrated Water Management Plans in priority catchments in order to facilitate the development of Policy relating to integrated water management across the Region;
 - to promote access, walkways and other recreational uses of public open space associated with watercourses, subject to a defined strategy of nature conservation and flood protection;
 - to establish, where feasible, riparian corridors, free from development, along all significant watercourses;
 - to restrict, where feasible, the use of culverts on watercourses;
 - to evaluate all watercourses in the region for rehabilitation potential, particularly in conjunction with sustainable drainage measures;
 - to seek the continued improvement of water quality, bathing facilities and other recreational opportunities in the coastal, estuarine and surface waters in the Region;
 - to minimise the number and frequency of storm overflows of sewage to watercourses and to establish a consistent approach to the design, improvement and management of these intermittent discharges to ensure that the needs of the region's receiving waters are met in a cost effective manner;
 - to improve the licensing of discharges to surface waters, through a central body, involving review of existing licenses, and imposition of discharge standards on all large sources of non-domestic pollution;
 - to support the mandatory use of sustainable drainage systems which balance the impact of urban drainage through the achievement of control of run-off quantity, control of run-off quality and amenity / habitat enhancement;
 - to impose effective control of development, especially in or near the natural flood plain of watercourses;
 - to minimise the impact of development on watercourses by requiring flood impact assessments to be undertaken and sediment and water pollution control plans to be in place prior to the commencement of any development.

3.2 Further Information

The Regional Drainage Policy Volume 3 – Environmental Management Technical Document and Executive Report contain further information on this policy.

4 INFLOW, INFILTRATION AND EXFILTRATION POLICY

Inflow and Infiltration both cause increases in the legitimate flows in the sewerage system. Inflow is where surface waters enter the foul sewerage system directly, and Infiltration is where the increased flows are due to groundwater entering the foul system through faults in the pipework, manholes and chambers. Inflow and Infiltration cause reduced capacity for legitimate sewage flows, increase pressure on treatment capacity and encourage structural deterioration and damage. The most significant effect for the Dublin Region is that the capacity of the foul system and treatment facilities is compromised, resulting in restrictions in their ability to service new developments.

Exfiltration causes reduced flows in the foul system, due to leaks and outflows from faults and openings in the pipework, manholes and chambers. Exfiltration of foul flows results in contamination of the surrounding soils and possible pollution of groundwater.

Since both Infiltration and Exfiltration involve flows passing through physical defects in the sewerage fabric, they often occur together in conjunction with fluctuating groundwater levels. This continuing flow mechanism can result in erosion of surrounds and foundations to pipes and manholes. In serious cases failure of the asset or ground subsidence has resulted.

4.1 Evidence of Inflow and Infiltration

The Drainage Departments in the Dublin Region have long suspected that there are substantial quantities of inflow and infiltration in the sewerage systems of the Region. These suspicions have been confirmed by verification of the hydraulic models under the GDSDS.

Existing approximate infiltration flows for the Ringsend WwTW catchments are:

Catchment	Infiltration Flows in l/s
Grand Canal System	615
City Centre/ Docklands	558
Dun Laoghaire	338
Rathmines & Pembroke High Level	500
Total Infiltration Flow	2011 l/s

The flow to full treatment at Ringsend WwTW is 11m³/s; 2011l/s comprises 18% of this flow. At a daily sewage discharge per household of 650 litres, 2011l/s corresponds to 267,300 households.

4.2 Overall Approach Needed

At around 2011l/s, infiltration in the Ringsend WwTW catchments is approximately 50% of dry weather flow. Comparing the above figures with those included in the 1996 CIRIA survey of UK catchments would place the Ringsend system in the worst 9% of catchments of the 1646 examples studied. The Ringsend system could therefore be classified as being on the high end of the range of infiltration commonly found.

Information on achievement of reductions in Inflow, Infiltration and Exfiltration (I/I/E) is limited, with the USA providing the most examples. Reductions of 50% to over 80% have been achieved by thorough rehabilitation programmes. However the cost-effectiveness of such programmes is less clear, and we would predict that a cost-effective level of reduction for Dublin would be considerably lower, say around 25%.

The Local Authorities should conduct a pilot study into I/I/E reduction to establish the cost-effectiveness of such reduction programmes in the Dublin area. This pilot scheme should

concentrate on the areas with various levels of I/I/E as identified by the GSDSDS. The objective would be to establish typical rates of reduction actually achieved, together with the associated costs. Such information would then be used to manage the I/I/E reduction programme for the Region.

It must be recognised that I/I/E is difficult and expensive to identify, locate and reduce. It is therefore far more cost-effective to minimise its occurrence in the first place. The overall approach must therefore include measures to improve the quality of drainage construction and maintain its condition for as long as possible. This approach is one of the cornerstones of the Regional Drainage Policy for New Development.

4.3 Policy Recommendations

4.3.1 General Principles

Most I/I/E occurs in relatively small quantities throughout the extent of the sewerage system, and is hence difficult, time-consuming and expensive to identify. For that reason the recommended policy is for reiterative reduction of flows, based on homing-in from the general area to particular significant sources. The largest sources would be tackled first, then progressing to smaller sources. Where flows are small, or the sources are diffuse through the system, it may be more cost-effective to discontinue the process. This approach is similar in principle to that carried out successfully for reducing leakage in the water supply system in the Dublin Region (Water Conservation Project).

The most cost-effective policy is to minimise I/I/E in the first place. This can best be done by strictly controlling the quality of new and renovated sewerage installations, and by ensuring that best quality materials and construction techniques are used, to provide a long-lasting leak-free system. Connections must also be correctly made, and private drains and abandoned sewers managed to minimise the risk of leakage. Rigorous monitoring by Council Inspectors will ensure that sewerage construction will achieve its maximum life without defects.

Since private drainage systems can cause similar or worse problems due to lack of maintenance, it is recommended that this policy apply to both public and private drainage.

4.3.2 Specific Recommendations

New Water Industry Specification for Ireland, covering materials, installations, construction, testing and inspection to improve the standard of drainage assets.

Strengthened Drainage Inspectorate to ensure that the highest practical standards of drainage assets are achieved. Their remit would include inspection of both public and private drainage systems.

Inflow/Infiltration/Exfiltration Procedure to be adopted to reduce non-legitimate flows in the most cost-effective manner, including strengthening of the current misconnections programme.

Drainage Operation and Maintenance Practices to include particular emphasis on minimising opportunities for non-legitimate flows to enter and leave the systems, such as through missing manhole covers and faulty flap valves.

Maintenance of Hydraulic Models and Databases to support the above procedures by providing geographically based asset and performance information for the identification of non-legitimate flows.

Register of Water Source Boreholes to enable the interface between water sources and drainage systems to be established and hence allow management of risks of cross-contamination

Survey and Renovation of Private Drains, as a condition of sale.

The Regional Drainage Policy for New Development has similar objectives in improving the quality of drainage construction, such as new specifications and strengthened inspectorate, so both policies are mutually supportive.

4.4 Further Information

The Regional Drainage Policy Volume 4 – Inflow, Infiltration and Exfiltration Technical Document contains further information on this policy.

5 CLIMATE CHANGE POLICY

Climate change is of considerable concern to all engineering professionals whatever their discipline, as well as being a popular topic for general discussion. It is acknowledged by nearly all scientists that climate change is already taking place, and that the chief culprit is emission of gases related to man's activities. Although Ireland is taking measures to achieve reductions of "greenhouse gases", such emissions are a global problem. Ireland will therefore inevitably experience the changed conditions being forecast for increasing global temperatures and possible significant changes in rainfall over the next 100 years. Changes in rainfall require consideration by drainage engineers and appropriate actions must be taken now to ensure satisfactory management of drainage systems in the future.

The forecast for Ireland is for drier summers, wetter winters and warmer average temperatures throughout the year. Although rainfall events are predicted to become heavier, the uncertainty of the quantification of these predictions is such that care should be taken in making any dramatic changes in current drainage policy, whilst ensuring that appropriate changes are made to minimise the risk of severe consequences occurring in due course. Emphasis is therefore to be placed on deriving policies that are effective in mitigating and adapting to possible changes in rainfall characteristics.

5.1 Climate Change Policy in Ireland

Ireland has recognised the reality of this situation, through its involvement in the Kyoto Protocol to control emissions on greenhouse gases, and the establishment of the National Climate Change Strategy (NCCS) to manage the process.

The current debate relates to the accuracy of predictions and their implications. There are quite a number of climate change models and each is run with a number of scenarios, resulting in a wide scatter of predictions. However this situation helps draw attention to the level of uncertainty and the need to take a precautionary and flexible response to the impending changes.

Apart from the NCCS, the Climatology Department of the National University of Ireland, Maynooth (NUIM) has also carried out work on climate change and it is understood that the Met Office is also carrying out work in this area. Currently the emphasis on climate change policy is on the wider issues relating to the occurrence of climate change and in particular the issue of addressing greenhouse gas emissions. To date there have been no firm policy decisions relating to the effects of climate change on drainage design criteria for use in Ireland.

5.2 Climate Change Model Predictions for Sea Level and Rainfall

There are quite a number of GCM (General Circulation Models) of the world climate. The Hadley model and their RCM3 model results, based on the Medium – High scenario, have been used by the University of East Anglia, who are part of the GSDSDS team. These results were reviewed by the NUIM.

The projected increase in temperature over the next century will cause expansion of the water column and result in an increase in sea level. The change in storm conditions will also affect surge and wave heights, the latter also being affected by the increase in water depth.

By the end of the century, the predicted rise in sea level in the UKCIP02 model, taking into account surge, is in the order of 300mm to 400mm with an additional 30mm due to the relative land movement. Due to the very slow process of expansion of the oceans, it should be noted that this trend will continue for up to 1000 years resulting in sea level changes of between 1m to 3m depending on a range of assumptions. Work carried out by NUIM, which looked at eight GCM models, predicts a sea level rise change of 480mm by the end of the century. In spite of these differences, it is acknowledged that sea level rise is predicted with much greater certainty than rainfall change due to climate change.

Daily rainfall data from the Hadley RCM3 model for the Dublin region has been analysed suggesting that the 2 year return period event has an increase in depth of around 10 percent, rising to nearly 25 percent for the 100 year event. However the findings by NUIM are less extreme, with little increase in rainfall on the East coast. Drainage engineers are more interested in hourly rainfall, but at this stage information at this resolution is unavailable.

The rise in sea level and increase in rainfall will result in the future in periods of much greater flood risk in some low-lying areas. This leads to much greater importance in understanding the level of risk for combinations of both activities occurring. At present it is not known what the level of dependency is in the Dublin region between the joint occurrence of significant tide and rainfall events.

5.3 Policy Recommendations

The EPA sponsored project carried out by NUIM is involved in reviewing policy on climate change. Their findings have been considered and taken into account in this policy.

Climate Change Policy covers all the principal effects of climate change on the Greater Dublin Region (GDR), in terms of the main factors affecting drainage, particularly sea level and rainfall. The Policy contains modification factors for drainage engineers to apply to their usual design parameters.

A periodic review of the GDSDS Climate Change Policy, in particular the modification factors, should be made following any reviews carried out by NCCS, NUIM and such bodies involved in climate change in Ireland.

5.4 Specific Recommendations

The following recommendations are proposed for drainage criteria to be applied in the Dublin region.

1. The results of the Hadley Centre models are to be used for climate change policy for the Dublin region. In particular, the UKCIP02 Medium – High (A2) SRES scenario should be used for climate change policy until further work is carried out;
2. The projections for 2080 – 2100 should be applied to all infrastructure design unless design lives are considered to be short (30 years or less). Linear interpolation of the recommendations might then be applied.
3. Sea level rise for 2080 in the Dublin region will be assumed as being between 400mm to 480mm.
4. The 200-year return period should be used for coastal flooding design and this level is 3.4m Malin AOD. Strategic very long term Dublin area planning and highly sensitive areas to use 4.0m Malin AOD.
5. The design sea levels refer to the Dublin Port gauge, and higher levels will occur up river estuaries;
6. A pragmatic approach to joint probability analysis for combinations of events can be taken initially, but more detailed joint probability analysis should be applied where costs are significant or other reasons require greater accuracy in assessing performance or flood risk. The following event combinations are proposed, based on providing combined return periods greater than 100 years for river flooding affected areas and 30 years for flooding from sewerage systems affected by river or tidal levels.

River flooding evaluation (100 years):

- MHWS tide with 100 year river;
- 1 year tide with 5 year river;
- 5 year tide with 1 year river.

Sewer system flooding evaluation, with tides (30 years):

- MHWS tide with 30 year drainage;
- 1 year tide with 1 year drainage;
- 5 year tide with 0.25 year drainage.

Sewer system flooding evaluation, with rivers (30 years):

- 0.25 river with 30 year drainage;
- 1 year river with 5 year drainage;
- 5 year river with 1 year drainage.

7. In cases where there is a potential for life-threatening situations to develop from rapid inundation due to breach of sea or river defences, then a standard of protection greater than the 1:200 year event should be considered. This may be as high as 1:500 or more depending on the level of risk involved.
8. River flow changes in the future should be determined individually for catchment planning. However for the purposes of CSO drainage system performance evaluation, the following precautionary position should be taken:
 - River baseflows could reduce by as much as 40%.
 - River flood flows are likely to increase by around 20%
9. Present day design rainfall depths for all durations and return periods are to be increased and factored by 1.1.
10. A new time series rainfall should be produced which represents future rainfall conditions
11. Present day time series rainfall are to be modified separately for summer and winter series
 - Summer rainfall intensities to be factored by 0.9, except for the top 5 events
 - The number of summer rainfall events is to be reduced by 40%.
 - Winter rainfall intensities to be factored by 1.10
12. It is recommended that a future stochastic rainfall time series should be produced in the medium term to properly reflect the projected change in seasonal rainfall pattern across the Dublin region.
13. New drainage schemes should be evaluated using these recommended criteria, but should also carry out risk and cost – benefit analysis. The consequence of “failure” should specifically be considered and may well influence scheme selection due to this uncertainty. However major rehabilitation or modification of the networks should still be based on evidence of need rather than the predicted reduction in level of service.

14. Explicit advice is not provided on issues relating to changes in infiltration, and other secondary effects that are likely to occur due to climate change. All these issues should be considered and allowed for, if thought appropriate, when designing drainage schemes.
15. Ireland should decide whether to rely upon the UKCIP (or other modelling) work in the future, or carry out work on climate change modelling to support its policies dealing with future change.
16. Rivers and their quality are a very important issue for Ireland. The uncertainty with regard to river flows has far reaching implications for Ireland (water resources, fisheries, tourism) and although this document is focused on drainage issues, it is suggested that a climate change evaluation and policy is needed to address these issues.
17. The dependency for joint probability analysis between tide, river and rainfall events should be evaluated to enable a better understanding of the level of service being provided. This is important, as tide levels will have an increasing influence on drainage for large areas of the Dublin region.

5.5 Further Information

The Regional Drainage Policy Volume 5 - Climate Change Technical Document contains further information on this policy.

6 BASEMENTS POLICY

Many older properties in the study area have basements with connections from basement level to old sewers and culverts. These can be prone to flooding at times of high flow and sewer surcharge. New developments or modification to the existing drainage networks could result in existing basements being exposed to a higher risk of flooding.

Basements flooding incidents could increase due to the impacts of climate change where both increased rainfall intensities and sea level rise are predicted.

6.1 Why Basements Flood

When flows to the sewer exceed the capacity of the system, flows are released at the first opportunity. As basement drains are frequently constructed below the surcharge levels in the public sewer, sewage will often discharge into basements before overflowing at manholes. Basement flooding can be caused by a variety or combination of problems with the external sewer system, or with private drains where there are localised deterioration problems or poorly designed and constructed drainage.

6.2 Basement Locations

There is no asset database showing the location and use of basements throughout the Dublin Region. Dublin City Council has prepared a database of properties with basements in the city centre area between the canals. Bord Gais have a database of basements limited to streets that were serviced by old cast iron gas mains.

Using this information the number of basements identified in the study area is 16,200. Given the limited data available the total number of basements is expected to greatly exceed this figure.

Without knowledge of the location and drainage of the basements, the risk of flooding cannot be fully assessed when designing modifications to the drainage system, or approving upstream developments.

6.3 Policy Recommendations

6.3.1 General Principles

The most cost-effective method of protecting basements from flooding is known as surcharge management. Basements can be protected from backflows from surcharged sewers through the installation of small pumping stations or Anti Flooding Devices (AFDs) on the basement drainage system before it connects to the public sewer.

Surcharge management measures can be conditioned on new developments subject to the Planning and Development Act 2000. On existing basements the owners are often unaware of the risk of flooding. It is the responsibility of the basement owner to provide protection against flooding. By installing pumping stations or AFDs, owners can provide protection against flooding at relatively low costs.

6.3.2 Specific Recommendations

The following policy recommendations are proposed:

- Establish a database of basements and flooding incidents.
- Use the Planning and Development Act to condition developers to provide protection against basement and underground car park flooding in all new developments.

- Incorporate basement protection requirements into the Building Regulations.
- The installation of pumps is recommended in preference to Anti Flooding Devices (AFDs) to protect basements.
- Embark on a public awareness campaign to inform homeowners of the causes of flooding and the methods of protection. The insurance industry should be approached to assist with the campaign.

6.4 Further Information

The Regional Drainage Policy Volume 6 - Basements Technical Document contains further information on this policy.

7 IMPLEMENTATION OF POLICIES

The overall policy principles have been adopted by the Councils, and included in their current Development Plans.

The arrangements to implement the detail of the Policies are shown in Figure 7.1.



Figure 7.1 Flow Chart for Implementation of Regional Drainage Policies

The individual policy documents contain further information on the composition, objectives and methodology for the various bodies needed to take the policies forward. The general principles are:

- The liaison group established during the GSDSDS should be maintained to drive the implementation of policies;
- The implementation must be adequately resourced and financed;
- The policies must be publicised to all stakeholders, especially those beyond the Council departments, including developers and the general public.