

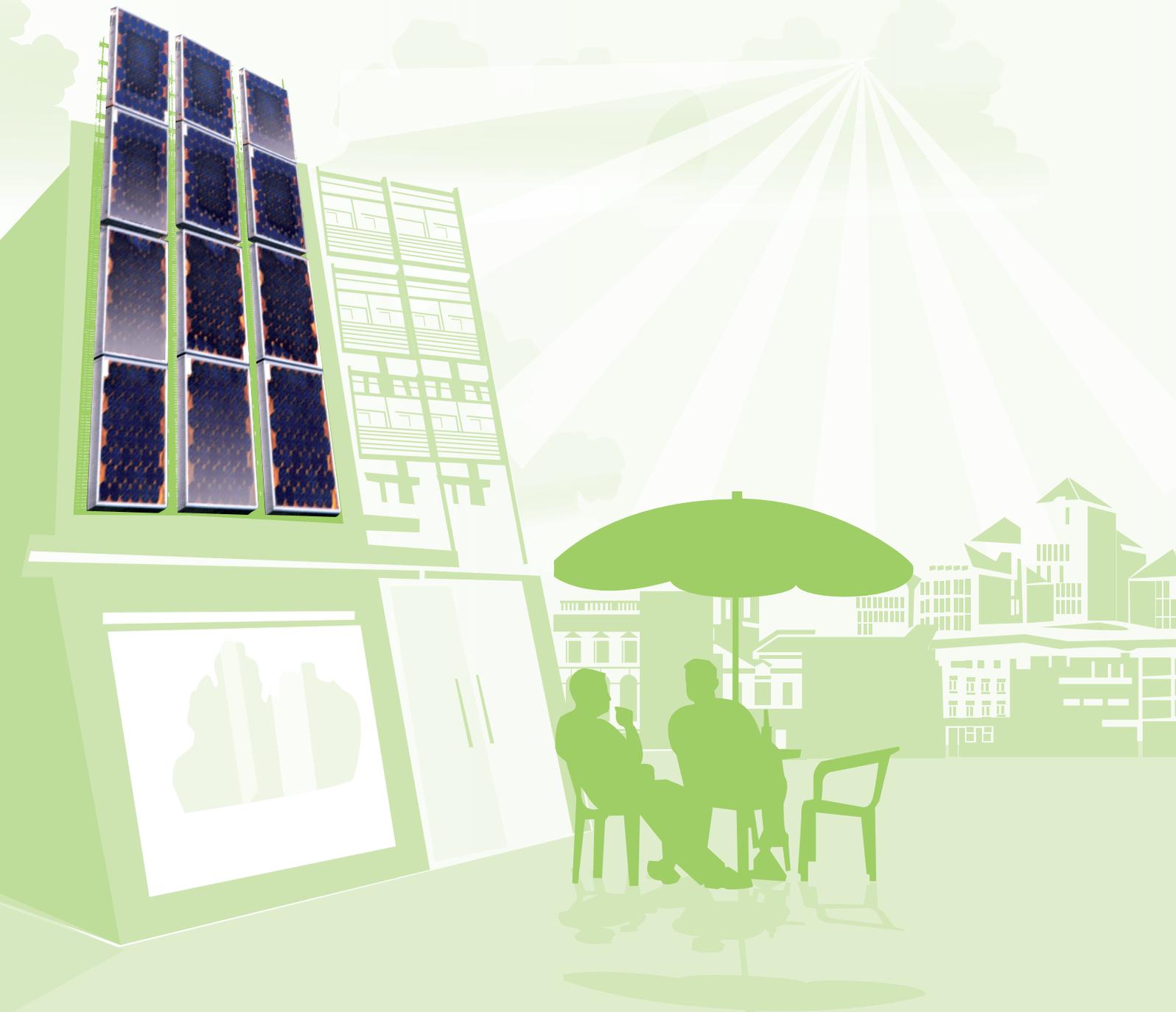


Dublin City Council
Comhairle Cathrach Bhaile Átha Cliath



Environmental Report for Dublin City Sustainable Energy Action Plan 2010-2020

Version 2.0





Environmental Report for

Dublin City Sustainable Energy Action Plan 2010-2020

Report Prepared in association with Dublin City Council by

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Non Technical Summary

Codema acting as Dublin City Council's energy and sustainability consultants have prepared a *Sustainable Energy Action Plan* (SEAP) for the Dublin City area (not limited to the activities of the council). Codema is required to conduct a strategic environmental assessment of the SEAP under the SEA Directive (2001/42/EC). As well as the environmental report this non technical summary is required by the Directive.

Methodology

In order for a determination to be made as to the environmental impacts of a plan or program under the SEA Directive, a clear process has been designed. The first step is to screen the plan to determine if it needs to undergo the SEA process, secondly the plan is 'scoped' in order to narrow the focus of the SEA to areas likely to be affected, thirdly an environmental report is compiled (and this non technical summary drafted) and lastly a SEA statement is issued referring to the findings of the environmental report.

Screening

Article 3 of the SEA Directive details the types of 'plans and programmes' to which the provision of the Directive shall apply, according to this article, environmental assessment is required for plans or programmes that:

- *'are prepared for agriculture, forestry, fisheries, **energy**, industry, transport, waste management, telecommunications, tourism, town and county planning or land use and which set the framework for future development consent of projects listed in Annexes I and II to the Environmental Impact Assessment Directive'*

Scoping

A scoping report is not a mandatory requirement under the Directive; however it is considered good practice to undergo the process in order to focus the environmental report onto the areas of greatest relevance. In this regard Codema attended several meetings with the Dublin City Council SEA team to gather opinion from the relevant departments, had several meetings with the SEA section of the EPA and numerous internal meetings. In addition the advice submitted by the three relevant authorities was taken into consideration, most agreed that the plan would have little significant environmental impact but that an SEA should be carried out as a matter of good practice.

Environmental Report

The environmental report is the main bulk of the SEA and is separated into several sections. Firstly the condition of the receiving environment is established, in this case Dublin city. The criteria under which the environment is examined is set down in the Directive, the headings are population and human health, biodiversity, flora and fauna, soil, water, air, climatic factors, material assets and cultural heritage, heritage and landscape. After this a set of environmental objectives for the plan are set and the plan compared to these to see possible impacts. Alternatives to the plan are also examined. If any negative impacts are established a process of mitigation is needed to offset or eliminate them. Then indicators and monitoring protocols are stated.

The SEAP

Dublin City Council realises that the current trend of energy consumption within the city is unsustainable and a clear and ambitious plan was needed to both halt and reverse this trend of rising energy consumption. In order to develop a SEAP for Dublin city a baseline of current consumption needed to be developed as none existed at the time, Codema produced *Energy for Dublin*, a comprehensive analysis of the current (2006) consumption

of energy in the city in the residential, transport and commercial sectors. The resulting data was then utilised to form a number of actions in each sector to reduce energy consumption and associated CO₂ emissions.

The overall objectives of the SEAP are to

- Reduce the economic expenditure on energy for citizens, council and business
- Reduce Dublin's per capita CO₂ emissions
- Reduce Dublin's dependence on imported fuel
- Make Dublin a more competitive and attractive destination for business through modern and efficient energy infrastructure and pricing
- Increase Dublin's share of renewable and sustainable energy systems
- Encourage an environment that fosters and supports wellbeing for its present and future citizens

The contents of the SEAP

- Examines the current situation in Dublin City with regards to energy consumption in the three sectors of residential, commercial and transport
- Examines Dublin City Councils energy use
- Identifies the potential for energy savings in the three sectors through an number of actions
- Calculates the CO₂ abatement costs for each action
- Sets Targets for short term and long term measures
- Sets a number of scenarios these actions can be grouped into
- Sets a schedule of actions
- Identifies fiscal incentives

Existing Environment and Possible Impacts

Population and Human Health

Dublin City Council, one of four planning authorities in the Dublin Region, covers 115 sq.km and has a population of 506,211 persons and an overall density of 4,400 persons per sq.km, which accounts for 45% of the population of the Dublin Region. The population of the city continues to grow, although at a lower rate than the region as a whole. Population has risen by 10,430 persons since 2002 equating to a population increase of 2.1%. During the same period, population increase in the state was 16.9% and 5.7% for the region. However, the figures for the city mask the population increase in the inner city which has increased by 50% since 1991. Even from 2002 – 2006, some areas such as South Docks have experienced population growth of 36%, whereas there has been a decrease in population in Rathmines and Grangegorman.

Existing Environmental Issues Relating to Population and Human Health

- Maintain a viable population in the city in order to encourage sustainable development and energy efficiency
- Traffic related air emissions
- Energy related air emissions
- Transboundary issues relating to air pollution
- Existing green spaces as carbon sinks and oxygen release
- Greater transboundary cooperation in terms of infrastructure e.g. district heating

- Greater transboundary cooperation in terms of mitigation measures e.g. flood defense
- Issues relating to fuel poverty and associated health problems

Negative Impacts of the SEAP

There were no perceived negative impacts.

Biodiversity, Flora and Fauna

Dublin city and its bay, as a natural harbour at the confluence of several river basins, contain a variety of ecosystems which are biologically diverse and of international and national importance for the species which inhabit them and their associations.

The main habitat types of Dublin City include

- Sand dunes (CD1, CD2, CD3)
- Annual vegetation of drift lines (LS1)
- Coastal lagoon (CW1)
- Saltmarsh (CM1, CM2)
- Mud flats and sand flats
- Estuary
- Semi-natural grasslands
- Hedgerows (WL1)
- Reed and large sedge swamps (FS1)
- Lakes (FL)
- Other artificial lakes and ponds (FL8)
- Depositing lowland rivers (FW2)
- Canals (FW3)
- Drainage ditches (FW4)

There are many potential threats to the management of biodiversity, flora and fauna they are

- Potential increased flood risk from changed land-use patterns, climate change and predicted sea rise level could result in loss or alteration of habitats through erosion and alteration of water levels.
- Increased volumes of surface water run-off due to conversion of permeable landscapes to impermeable. This can lead to increased flooding, erosion and alteration and direct loss of habitat. Increased frequency of high rainfall events due to climate change can result in sudden elevated levels of pollutants contaminating aquatic habitats.
- Changes in temperature and precipitation levels due to climate change resulting in some species being replaced or under stress.
- Loss of connectivity of habitats for wildlife by development which interrupts or is too close to existing green corridors.
- Need to ensure biodiversity interests taken into account in earliest stages of planning of new developments.
- Demolition of older structures (buildings, walls, out-buildings) due to rapid growth results in loss of habitat for fauna
- Lack of survey and research data limits tools for decision-making in planning for biodiversity
- Greater co-ordination with the other planning authorities in the Greater Dublin Region to respond to shared regional issues

- Balance between accommodating future development, recreational, heritage and biodiversity needs of Dublin City.
- Protection EU and Irish designated sites especially Dublin Bay.
- Protection of areas, sites and natural features of high biodiversity quality not designated under EU or national legislation
- Importance of ecological corridors to maintain biodiversity
- Incorporation of biodiversity into development proposals e.g. greenway, roof gardens etc.

Negative Impacts of the SEAP

There were no perceived negative impacts of the SEAP an appropriate assessment will accompany this report.

Air

Air quality in Dublin is currently good. In particular years Dublin's air quality has shown significant improvement in the levels of black smoke, lead, sulphur dioxide, benzene, and carbon monoxide (CO). This is due largely to the success of the regulatory ban on the sale of bituminous coal in the Dublin region and the elimination/reduction of other substances in vehicle fuels. Oxides of nitrogen dioxide (NO_x) during the 1990's nitrogen dioxide levels were exceeded. While the current results are in compliance with the annual limit value the levels are sufficiently high to be of concern in relation to compliance in the future. PM₁₀ and PM_{2.5} concentrations remain a threat in terms of exceeding limit values at some locations, should a combination of factors (including unfavorable weather conditions and traffic emissions) occur.

Negative Impacts of the SEAP

There were no perceived negative impacts, although there may be some issues as highlighted by the EPA with particulate matter and biofuels, the non implementation of the SEAP and the 'business as usual' scenario would lead to an upward trend of private vehicle use and energy consumption in residential and commercial sectors.

Climatic Factors

The baseline was calculated between three sectors; Residential (32%), Commercial/Manufacturing (43%) and Transport (25%). Waste and agriculture are not big emitters within the city boundaries. In 2006, Dublin City (12% of national population), released approximately 5 million tonnes of CO₂ (10.5% of all Irish emissions). On average a Dubliner releases 9.7 tonnes of CO₂ per year, less than the national average which is 11.3 tonnes. Dublin City currently (2006) consumes 22.3 TWh of primary energy per year, the equivalent to 1.9 million tonnes of oil in the form of electricity, oil, natural gas and renewable energy (2006).

Existing environmental conditions

- Best practice methods for energy efficiency, energy conservation and water conservation e.g. district heating network, combined heat and power systems. action plan on energy to be taken into account.
- Feasibility of renewable energy sources throughout the city.
- Reduction of CO₂ emissions.
- Rising sea levels.
- Pluvial (rainfall) flood risk.
- Importance of city vegetation / landscape to act as a carbon sink.
- Greater co-ordination with the other planning authorities in the Greater Dublin Region to respond to these shared regional issues set out.

Negative Impacts of the SEAP

There were no perceived negative impacts.

Water (Flood Risk)

Depending on the scope of the SEA the water section can take into account a broad range of issues, such as drinking water quality, bathing areas etc. It was decided due to the specific nature of the SEAP that the issues relating to it are confined to flood risk. Flooding is a natural process that can happen at any time in a wide variety of locations and plays a role in shaping the natural environment. It is recognised that the risk of flooding has increased due to climate change and sea level rise. There are three types of flooding events, which can arise separately or in combination; coastal flooding arising from the sea or estuary, fluvial flooding arising from rivers or streams and pluvial flooding arising from extreme rainfall.

Existing environmental conditions

- City Council area traversed by a number of key regional river systems; future development within the city area should not have a deleterious effect on the ecological status of these systems.
- Existing and proposed flood defense structures to be identified for protection in the development plan.
- Potential increased flood risk from changed land use patterns, climate change and predicted sea rise level.
- Government guidelines on the planning system and flood risk management to be taken into account.

Negative Impacts of the SEAP

There were no perceived negative impacts.

Material Assets (Transport)

The Dublin City Council region covers an area of approximately 115Km² and is populated by 506,211 people. Within its boundaries there are just over 31Km of Irish Rail track and just less than 13Km of LUAS track. The entire rail track within the Dublin City Council area is designated as major rail. There is approximately 1280km of roads, 16% of which was designated as Major Road i.e. carrying more than 16,438 vehicles per 24 hours. The existing public transport network currently comprises bus, DART and the LUAS tram lines. There are currently 200km of bus lanes passing through the area, with more QBCs planned and under construction. To date a total of c.199km of cycle lanes has been provided within the Dublin City Council area. Between 1997 and 2007 private car commuters reduced from 49.85% to 35.1% of the am modal split. Over the same period, public transport mode share rose from 34.91% to 50.04%. This took place against a background increase of 13.5% in a.m. commuting peak numbers since 1997. Between 2003 and 2007 bus passenger numbers declined from 67,792 to 57,201. Bus share is now at 28.05% of the modal split. Rail passengers increased over the same period from 21,416 to 35,692. The Rail share is now 17.5% of the modal split. When LUAS is included the total rail mode split comes to 22%.

Negative Impacts of the SEAP

There were no perceived negative impacts.

Landscape and Soil

Landscapes and Soils were not deemed to be directly influenced by the SEAP and therefore were eliminated at the scoping stage

Cultural Heritage

Cultural Heritage will be integrated through current legislative process and communication with the Department of the Environment, Heritage and Local Government, but has been scoped out of the SEA at this stage.

Alternatives

There are three alternatives to a full SEAP; the first is a business as usual model that will lead to increases in energy consumption and GHG emissions. The second is a low cost scenario with 'low hanging fruit' actions, that is, actions that are easy to implement both in terms of cost and complexity. They can help to reverse the upward trend of the current energy consumption in Dublin city. The third is a higher cost longer term scenario. Neither alternative was preferable to the full SEAP which is a combination of the second and third scenarios.

Mitigation

There were no negative impacts associated with the SEAP and therefore no mitigation methods were needed, thresholds are hard to define in the context of energy and GHG's but indicators such as species and temperatures etc have been noted.

1 Introduction

1.1 Background

Codema acting as Dublin City Council's energy and sustainability consultants have prepared a sustainable energy action plan (SEAP) for the Dublin City area (not limited to the activities of the council). Codema are required to conduct a strategic environmental assessment of the SEAP under the SEA Directive (2001/42/EC).

1.2 Description and Objectives of the SEAP for Dublin

Dublin City Council realises that the current trend of energy consumption within the city is unsustainable and a clear and ambitious plan was needed to both halt and reverse this trend of rising energy consumption. In order to develop a SEAP for Dublin city a baseline of current consumption needed to be developed as none existed at the time, Codema produced *Energy for Dublin*, a comprehensive analysis of the current (2006) consumption of energy in the city in the residential, transport and commercial sectors. The resulting data was then utilised to form a number of actions in each sector to reduce energy consumption and associated CO₂ emissions. The overall objectives of the SEAP are to

- Reduce the economic expenditure on energy for citizens, council and business
- Reduce Dublin's per capita CO₂ emissions
- Reduce Dublin's dependence on imported fuel
- Make Dublin a more competitive and attractive destination for business through modern and efficient energy infrastructure and pricing
- Increase Dublin's share of renewable and sustainable energy systems
- Encourage an environment that fosters and supports wellbeing for its present and future citizens

These objectives fulfil the three criteria of sustainability, economic, environmental and social and the subsequent actions are aimed towards the most sustainable solutions to the current problems. A '*Climate Change Strategy for Dublin City*', covering the years 2008-2020, was prepared by the Environment & Engineering Strategic Policy Committee of Dublin City Council in association with Codema. It was adopted by the City Council in May 2008. In the strategy a set of actions was proposed, aimed at reducing Dublin's carbon footprint. The '*Dublin Sustainable Energy Action Plan*' aims to prioritise and elaborate on the main energy-related actions arising from the climate change strategy. This report is fully in accordance with the *National Energy Efficiency Action Plan 2009-2020* (NEEAP) '*Maximising Ireland's Energy Efficiency*', published by the Department of Communications, Energy and Natural Resources, May 2009.

The first part of the '*Dublin Sustainable Energy Action Plan*' reviews the potential for reducing Dublin City's carbon footprint and the associated costs. The second part sets out a schedule of concrete actions that are currently being delivered, or are planned for implementation in the near future. The major part of this first report is directed towards energy efficiency, as a first step. Future versions of the plan will develop and expand the medium-term vision for a sustainable and smart Dublin. The SEAP incorporates a variety of actions, some are part of the national process such as Transport 21, others are citywide and the rest will be for the councils own activities. All come under the umbrella heading of a SEAP for Dublin city and the relevant actions will be subject to the SEA process, national actions or ones that require their own SEA will be mentioned but will not be subject to this environmental report.

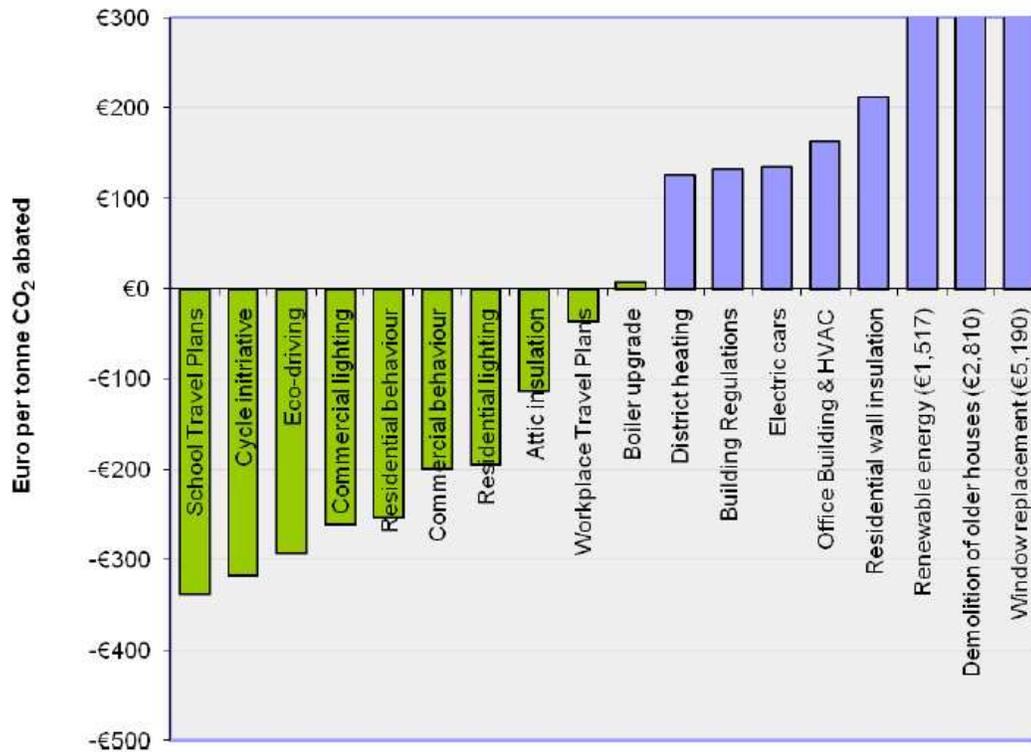


Figure 1: SEAP actions and associated costs

1.2.1 Contents of the SEAP for Dublin City

- Examines the current situation in Dublin City with regards to energy consumption in the three sectors of residential, commercial and transport
- Examines Dublin City Councils energy use
- Identifies the potential for energy savings in the three sectors through an number of actions
- Calculates the CO₂ abatement costs for each action
- Sets Targets for short term and long term measures
- Sets a number of scenarios these actions can be grouped into
- Selects preferred scenario
- Sets a schedule of actions
- Identifies fiscal incentives

2 SEA Methodology

2.1 Screening

In determining the need for an SEA, the primary concern (as set out in article 3 of the Directive) is to determine whether the plan is likely to have significant environmental effects. This determination is made having regard to the criteria set out in annex II of the Directive and in consultation with the designated authorities (as required by article 6 of the Directive)

Article 2 of the SEA Directive details the type of plans or programmes to which the Directive shall apply, by way of their administrative nature, as those which:

- *'are subject to preparation and/or adoption by an authority at national, regional or local level or which are prepared by an authority for adoption, through a legislative procedure by Parliament or Government'*

It is noted that the responsibility for preparation of the plan lies with Dublin City Council (in association with Codema) a local authority.

Article 3 of the SEA Directive details the types of 'plans and programmes' to which the provision of the Directive shall apply, according to this article, environmental assessment is required for plans or programmes that:

- *'are likely to have significant environmental effect'*
- *'are prepared for agriculture, forestry, fisheries, energy, industry, transport, waste management, telecommunications, tourism, town and county planning or land use and which set the framework for future development consent of projects listed in Annexes I and II to the Environmental Impact Assessment Directive'*

The SEAP for Dublin city falls within the Energy sector for the purposes of the Directive. It was therefore determined that it was both required and good practice to perform an SEA on the SEAP for Dublin city.

2.2 Scoping

The scoping stage of an SEA determines the level of detail to be considered in the environmental report. Under article 5.2 of the SEA Directive (2001/42/EC) (hereafter referred to as the Directive) the level of detail should be related to the current knowledge and methods of assessment and the content and level of detail of the plan. A scoping report is not a mandatory requirement under the Directive; however it is considered good practice to undergo the process in order to focus the environmental report onto the areas of greatest relevance. In this regard Codema attended several meetings with the Dublin City Council SEA team to gather opinion from the relevant departments, had several meetings with the SEA section of the EPA and numerous internal meetings. In addition the advice submitted by the three relevant authorities was taken into consideration, most agreed that the plan would have little significant environmental impact but that an SEA should be carried out as a matter of good practice.

2.3 Baseline Data

Baseline data is a requirement of the SEA process to establish the current state of the environment area that may be affected by the plan. This process was carried out in tandem with the Dublin City Council city (hereafter referred to as DCC) development plan 2011-2011 SEA team as the receiving environment is identical in both cases. The data was collected in accordance to the receptors in annex 1(f) of the Directive which are population and human health, biodiversity, flora and fauna, soil, water, air, climatic factors, material assets and cultural heritage, heritage and landscape. The DCC baseline process was extensive and was sufficient for the needs of the SEAP.

2.4 Setting Environmental Objectives

SEA objectives, referred to as Environmental Protection objectives, are a recognised way of testing the environmental effects of the development plan. They serve a different purpose from the objectives of the SEAP, though in some cases they may overlap. The environmental protection objectives are used to demonstrate whether the development plan will have a negative, positive or no impact on the environment, to compare the environmental effects of alternative plan scenarios and to suggest improvements if necessary. For the purposes of the SEA of the SEAP, relevant environmental protection objectives were set by the Codema having regard to environmental protection objectives established in law, policy, other plans or programmes and from an in-depth knowledge of existing environmental issues to be addressed. Each environmental receptor has environmental protection objectives. For each objective a target was assigned along with measurable indicators which allow for monitoring.

2.5 Consideration of Alternatives

Alternatives to the preferred plan are part of the environmental reporting process. These alternatives were considered as part of the plan making process and take the form of individual scenarios and short and long term actions; the plan itself is the amalgamation of all these scenarios and actions.

2.6 Assessment of the Environmental Impacts of the SEAP

This assessment results in the environmental report and lists the likely effects the SEAP may have on the receiving environment. The impacts will be assessed as positive, negative and neutral under the environmental criteria set out in annex 1(f) of the Directive and discussed in section 2.3.

2.7 Mitigation

Mitigation measures were devised during the SEA process as the impacts of the SEAP on the receiving environment were assessed and took the form of actions aimed at reducing or neutralizing these impacts where necessary.

2.8 Monitoring

As part of the SEA process a program of periodic monitoring needs to be established, this was not an issue for the SEAP as a monitoring schedule was already part of its remit.

3 Relationship of the SEAP with Other Plans and Programs

3.1 Introduction

The SEAP sits within a hierarchy of European, national, regional and local planning policies. A number of plans, policies, programmes and Directives at European, national, regional and local level have been identified and taken on board in the preparation of the SEAP. The list below sets out the main plans, policies, programmes and Directives identified and gives a brief summary of their main objectives

3.1.1 EU Level

- **EU SEA Directive (2001/42/EC):** Under the SEA Directive the SEAP requires an SEA. The SEAP must take into account protection of the environment and integration of the plan into the sustainable planning of the country as a whole.
- **Kyoto Protocol:** Objectives seek to alleviate the impacts of climate change and reduce global emissions of GHGs. The formulation of the SEAP gives regard to the objectives and targets of Kyoto and aim to reduce green house gas (GHG) emissions from the management of residential, transport and commercial development. Harnessing energy from natural resources is considered to reduce overall GHG emissions.
- **EU Directive (96/62/EC) (Air Quality Directive):** Objective is to improve air quality by controlling the level of certain pollutants and monitoring their concentrations.
- **EU Floods Directive (2007/60/EC):** Aim is to reduce and manage the risk that floods pose to human health, the environment, cultural heritage and economic activity.
- **EU Habitats Directive (92/43/EEC):** Protects over 1000 animals and plant species and over 200 'habitat types' which are of European importance.
- **Covenant of Mayors:** Dublin ratified the covenant on the 25th of March 2009. 1200 European cities have signed up to go beyond the EU 2020 targets for 20% reduction in CO₂ emissions.
- **Directive 2006/32/EC** of the European Parliament and of the Council of 5 April 2006 on energy end-use efficiency and energy services
- **IEE Minus 3% project:** DCC in partnership with Codema are participating in the project with 6 other European cities and their associated energy advisors to formulate actions to increase energy efficiency towards 3% per year over three years.
- **Energy Performance of Buildings Directive (2002/91/EC):** The Directive requires that all buildings built or rented require a certificate of their energy performance. Public buildings also require a display energy certificate (DEC) of their annual energy performance.

3.1.2 National Level

- **National Climate Change Strategy 2007-2012:** The strategy sets out measures by which Ireland will achieve its commitments under the Kyoto protocol and associated EU commitments.
- **National Spatial Strategy:** 20-year national planning framework to achieve more balanced social, economic and physical development across Ireland based on Gateways and Hubs.
- **National Development Plan 2007-2013:** €184 mil infrastructural investment plan to build a prosperous country for Ireland's population.

- **Transport 21:** €34 billion transport capital investment framework under the NDP to address past investment backlogs and continuing growth in transport demand
- **National Biodiversity Plan, 2002, subsequent review 2005 and draft 2008 – 2012 plan submitted to government summer 2009:** Objective to promote the conservation and sustainable use of biodiversity.
- **National Energy Efficiency Action Plan 2009-2020:** Sets out the government’s actions to achieve 20% energy efficiency savings from increased efficiencies.
- **Sustainable Residential Development in Urban Areas – Guidelines for Planning Authorities 2008:** Objective to produce high quality sustainable development which includes the integration of schools, community facilities, employment, transport and amenities in a timely and cost effective manner.
- **Grid 25:** A strategy for the development of Ireland’s electrical grid for a sustainable and competitive future.
- **National Renewable Energy Action Plan:** The National Renewable Energy Action Plan (NREAP) sets out the Government’s strategic approach and concrete measures to deliver on Ireland’s 16% target under Directive 2009/28/EC.

3.1.3 Regional Level

- **Review of the Regional Planning Guidelines 2004 – 2016 and preparation of new Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022 (draft):** Aims to direct the future growth of the GDA over the medium to long term involving sustainable planning and through the protection of environmentally sensitive or important locations.
- **DTO Strategy 2000 – 2016 A Platform for Change:** Integrated, multi-modal transportation strategy for the GDA
- **2030 Vision, DTO (yet to be published):** To identify areas of accessibility within the Dublin Region and the most appropriate locations for intensification.
- **River Dodder Catchment Flood Risk Assessment and Management Study:** Examination of the Dodder catchment area.
- **Fingal and East Meath Flood Risk Assessment and Management Study (FEMFRAM):** Flood risk management plan.

3.1.4 Dublin City Level

- **Dublin City Council Biodiversity Action Plan 2008:** Aims to achieve the objectives of the Development Plan relating to quality of life, green spaces, amenity provision, planning development and protection of the natural heritage in the city as well as working towards the world target the “achievement by 2010 of a significant reduction in the current loss of biological biodiversity”.
- **Green City Guidelines – Advice for the Protection and Enhancement of Biodiversity in Medium to High-Density Urban Developments 2008:** Provides practical guidance to planners and developers on how to integrate biodiversity into new developments, specifically medium to high density housing developments in urban areas.
- **Climate Change Strategy for Dublin City 2008 – 2012:** Focuses on the continuation of the implementation of a range of measures across key areas involving a cross-cutting approach and includes targets in energy, planning, transport, waste management.
- **Dublin City Draft Development Plan 2011 – 2017:** The Draft Development plan sets out a planning strategy and framework to steer the future development of the city, including a spatial framework that

consolidates the city by land use intensification and integration of transport infrastructures.

4 Characteristics of the Existing Environment of Dublin City

This section describes the current state of the existing environments that may be affected by the SEAP. In the scoping process it was decided that there are certain areas of the criteria that would not be affected by the SEAP Areas such as cultural heritage and landscapes and soil were considered not to be adversely affected by the SEAP and any areas that may relate to them such as soil degradation through raised frequency of flooding will be dealt with indirectly in the water section, a brief description will be given of the current state of both of these criteria but they will be omitted from the subsequent evaluation. Similarly some sections within criteria that are assessed will not be relevant e.g. wastewater, mains water etc. So the scoped in list will be

- Population and Human Health
- Biodiversity, Flora and Fauna
- Water (issues of flooding as a result of climate change)
- Air
- Climatic Factors
- Material Assets (transport)

4.1. Population and Human Health

Dublin City Council, one of four planning authorities in the Dublin Region, covers 115 sq.km and. has a population of 506,211 persons and an overall density of 4,400 persons per sq.km, which accounts for 45% of the population of the Dublin Region. The population of the city continues to grow, although at a lower rate than the region as whole. Population has risen by 10,430 persons since 2002 equating to a population increase of 2.1%. During the same period, population increase in the state was 16.9% and 5.7% for the region. However, the figures for the city mask the population increase in the inner city which has increased by 50% since 1991. Even from 2002 – 2006, some areas such as South Docks have experienced population growth of 36%, whereas there has been a decrease in population in Rathmines and Grangegorman.

There has been uneven growth across the city with some Electoral Divisions (EDs), mainly in the inner city, experiencing sharp increases in population while others declined. A recent trend evident in Dublin is that people are moving out to the suburbs and the Greater Dublin Area. A further question therefore for the SEAP is whether it should encourage some of those in the 30 – 50 year age group to move into the city centre. This option has its own benefits in terms of energy conservation and sustainability. Currently one in four people in the city are in their 20's and one in five is over 55.

Average household size in Dublin City is also declining. The average household size is 2.59 in the City compared to the State average of 2.81. This is also evident in the steady rise of one-person households. This demographic trend has potential implications for the size and type of new households. Occupancy levels will also result in greater demand for number of housing units.

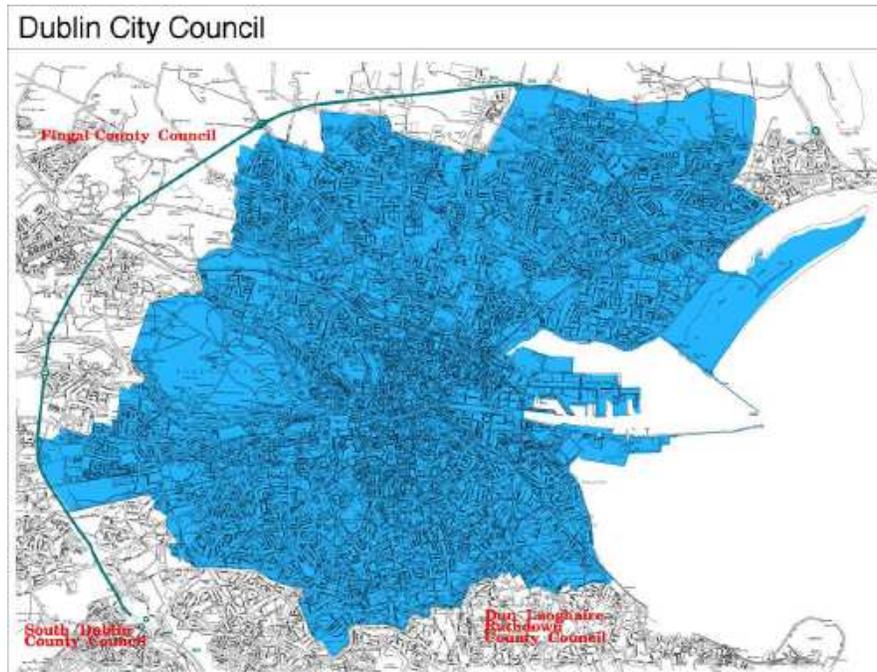


Figure 2: Map of the Dublin City Council Boundary

Notwithstanding the economic downturn it remains a key objective to consolidate the city and maximise efficient use of land. This approach is in accordance with the emerging settlement strategy under the forthcoming Regional Planning Guidelines 2010 – 2022, which places a strong policy emphasis for the metropolitan area to gain maximum benefit from existing assets – public transport, social infrastructure through the continuation of consolidation and increasing densities within the existing built-up footprint of the Metropolitan Area. This consolidation and intensification of land use is deemed to be energy efficient in terms of infrastructure for district and other heating systems, decreasing losses in the transportation of energy and the reduction of private transport modes towards public transport use, the city area is historically compact and so has not seen the overdevelopment of isolated residential estates and commercial centres that are common in the other county councils.

ED	Absolute change	% change
Overall	10,430	2.1
Dublin City South	6,422	3.1
Dublin City North	4,008	1.4
South Dock	1,359	36.1
Arran Quay C	1,339	56.4
Pembroke west A	1,021	31.5
Ashtown A	898	13.2
Grange B	732	34.2
Rathmines East C	-296	-8.0
Rathmines West E	-296	-8.3
Rathmines East A	-300	-6.6
Grange C	-368	-10.0

Table 1: Population change in Dublin City electoral divisions (ED)

4.1.1 Human Health

The human health impacts relevant to the SEA are those which arise as a result of interactions with environmental receptors (i.e. environmental components such as air, water or soil through which contaminants or pollutants, which have the potential to cause harm, can be transported so that they come into contact with human beings). Impacts upon human beings arising as a result of social and economic conditions are not a matter for SEA.

4.1.2 Existing Environmental Issues Relating to Population and Human Health

- Maintain a viable population in the city in order to encourage sustainable development and energy efficiency
- Traffic related air emissions
- Energy related air emissions
- Transboundary issues relating to air pollution
- Existing green spaces as carbon sinks and oxygen release
- Greater transboundary cooperation in terms of infrastructure e.g. district heating
- Greater transboundary cooperation in terms of mitigation measures e.g. flood defense
- Issues relating to fuel poverty and associated health problems

4.1.3 Non Implementation of the SEAP

If the SEAP were not implemented there would be a continued unsustainable growth in energy use and associated greenhouse gas emissions (GHG) leading to increased air pollution from domestic and commercial energy consumption and private car use. In addition the over reliance on imported fuel would leave the city vulnerable to price increases which would lead to an increase in fuel poverty. Fuel poverty is the situation where a household must spend a disproportionate amount of the household income on fuel, this can either lead to inadequate heating of the house associated health issues or a reduction in overall quality of life.

4.2 Biodiversity, Flora and Fauna

What concerns the SEAP and therefore the SEA is the effect on biodiversity from non implementation with regards to habitat and species degradation through climate change and the benefits of these areas as carbon sinks. A carbon sink is any organic material (flora or fauna) that absorbs CO₂ and stores it, therefore reducing the atmospheric concentration and creating oxygen. It is therefore relevant for this SEA to describe the current biodiversity in the city.

Dublin City and its Bay, as a natural harbour at the confluence of several river basins, contain a variety of ecosystems which are biologically diverse and of international and national importance for the species which inhabit them and their associations and eco system services. The ecological value of these areas is a resource for Dublin's citizens and also remarkable for such an urbanised capital city. There is an objective to promote connectivity of habitats and the enhancement of green corridors of public open space both for biodiversity and amenity values. The system of freshwater streams, rivers, estuarine habitats and beaches provides a network of connected natural areas, the green infrastructure of Dublin City. To protect and enhance this natural asset, several management plans have been prepared (by DCC) for all aspects, including biodiversity and flora and fauna for the Dodder, Tolka, Liffey and North Bull Island. Habitat management plans have also been prepared for a number of city parks including Bushy Park and Le Fanu Park. The SEAP will operate within the parameters of these and the other biodiversity plans set down by the council.

4.2.1 Appropriate Assessment

As part of the SEAP process an assessment under Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Fauna (commonly referred to as "The Habitats Directive") is being conducted. The purpose of this Appropriate Assessment is to determine whether the SEAP is likely to have any significant impacts on the conservation objectives or qualifying features of twenty two European Designated Natura 2000 sites identified within a 15 kilometre buffer of Dublin City Council's administrative boundary. The assessment process has resulted in a conclusion that the SEAP will have no adverse effects on the aforementioned sites and that no mitigation measures are necessary.

4.2.2 Overview of Habitats

The main habitat types of Dublin City include those of international, national and local importance under the Habitats Directive. These are classified according to the Heritage Council's classification system:

- Sand dunes (CD1, CD2, CD3)
- Annual vegetation of drift lines (LS1)
- Coastal lagoon (CW1)
- Saltmarsh (CM1, CM2)
- Mud flats and sand flats
- Estuary
- Semi-natural grasslands
- Hedgerows (WL1)
- Reed and large sedge swamps (FS1)
- Lakes (FL)
- Other artificial lakes and ponds (FL8)
- Depositing lowland rivers (FW2)
- Canals (FW3)
- Drainage ditches (FW4)

Other habitat types not listed above can be present and offer important areas for wildlife, including protected flora and fauna.

4.2.3 Protection of the City's Natural Heritage

There is a level of protection afforded to sites of biodiversity which are zoned Z9 (Amenity / Open Space Lands) with the stated objective "to preserve, provide and improve recreational amenity and open space." Sites of international and national importance are protected under legislative designations. However, where there are areas of local importance or within other zoning designations, protection may be limited. Dublin City includes a number of designated sites. There are also Natura 2000 sites which are outside the City Council boundary but could be impacted (transboundary). These will need to be taken into consideration for any objectives and plans within the SEAP, under EU and Irish laws on the effects of plans and proposals on associated sites. Because of the transboundary nature of air pollution and climatic effects a wider view must be taken on such sites. It is not envisioned that any of the projects within the SEAP will have a direct impact on any protected sites.

4.2.4 Special Areas of Conservation (SAC)

North Dublin Bay is a Candidate SAC. This includes North Bull Island. The site straddles both Dublin City and Fingal County Council administrative areas and covers the inner part of North Dublin Bay, the seaward boundary extending from the North Bull Wall Lighthouse to the Martello Tower at Howth Head. South Dublin Bay is also Candidate SAC. This site includes Booterstown Marsh, along the City Boundary and straddles both Dublin City and Dun Laoghaire-Rathdown County Council administrative areas. The site lies south of the River Liffey and extends from the South Wall to the West Pier at Dun Laoghaire. The new habitats at Merrion Gates and just south is becoming increasingly important for roosting waterfowl and includes embryonic dunes and a sand spit. The largest stand of eelgrass on the east coast occurs within this designated area at Merrion Gates.

4.2.5 Special Areas of Protection

SPAs are sites which are legally protected for birds under the EU Birds Directive. There are two in Dublin City: Sandymount Strand/Tolka Estuary and North Bull Island.

4.2.6 Natural Heritage Areas

Dublin City Council manages several proposed Natural Heritage Areas: North Bull Island, South Dublin Bay, Mooring 'Dolphins', Dublin Docks near Pigeon House Harbour, the Royal Canal and the Grand Canal. These are designated under the Wildlife Act as of national importance for the habitat / species which are present.

4.2.7 Ramsar Sites

North Bull Island is the only listed site in Dublin City under the RAMSAR Convention (1971) as wetlands of international importance. It is a voluntary treaty of which Ireland is a signatory.

4.2.8 Special Amenity Area Order Sites (SAAO)

North Bull Island is a designated SAAO. There is a proposed SAAO under consideration for the River Liffey Valley. While these sites are designated by Ministerial Order on the basis of their outstanding amenity values, it is the natural heritage of both locations which provides the resource for recreation and amenity. Protection of biodiversity, flora and fauna is therefore a contributing factor to amenity potential.

4.2.9 National Nature Reserves

North Bull Island (1988) is designated a Reserve under the terms of the Wildlife Act.

4.2.10 Flora Protection Order Sites

The making of a Flora Protection Order under the Wildlife Act provides protection for nationally important sites for protected plants. North Bull Island is listed for Lesser Centaury, Hemp Nettle and Meadow Saxifrage. Royal Canal is listed for Opposite-Leaved Pondweed.

4.2.11 Conservation Areas

This designation is for sites of local importance as listed in the current city development plan. It includes the rivers Dodder, Tolka and Liffey.

4.2.12 Ecological Networks

The importance of ecological networks is recognised in the Habitats Directive under Article 10, which requires connectivity of ecological networks, including those habitats outside of designated sites, is maintained.

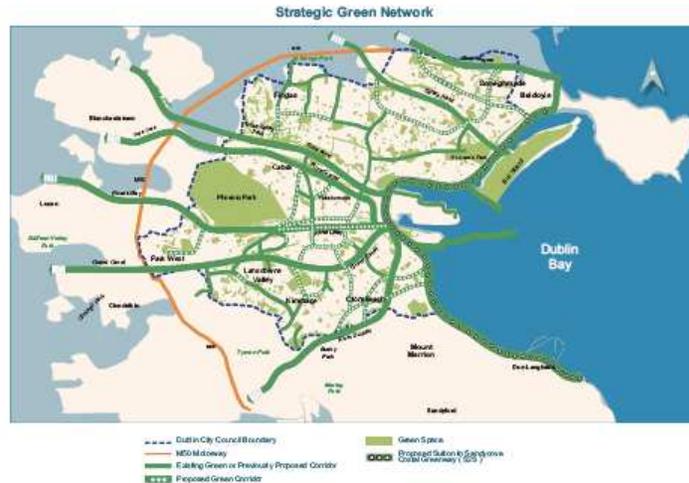


Figure 3: Dublin City green networks

4.2.13 Biodiversity Action Plan and Dublin City Development Plan 2011-2016

The Biodiversity Action Plan (BAP) was produced by Dublin City Council as an objective of the Development Plan 2005 - 2011 and as part of the Countdown 2010 initiative of the 5th Environment for Europe Ministerial Conference to demonstrate pan-European commitment to take necessary actions to prevent loss of biodiversity by 2010. It also fulfils an objective of the Irish National Plan for Sustainable Development for local authorities to integrate sustainability into policies and functions.

The BAP lists actions for:

- Collection and management of data.
- Increasing community awareness of biodiversity through education, dissemination and interpretation.
- Developing plans and policies to protect biodiversity.
- Identifying, protection and implementing management programmes for biodiversity in public parks and open spaces.
- targeting resources

The BAP lists all flora, fauna and habitats in Dublin City protected by European and Irish legislation. Additionally, it lists invasive and pest species for flora and fauna which threaten the City's biodiversity.

The Council has an objective in the existing development plan to promote connectivity of habitats and the enhancement of green corridors of public open space both for biodiversity and amenity values. The system of freshwater streams, rivers, estuarine habitats and beaches they manage provides a network of connected natural areas, the green infrastructure of Dublin City. To protect and enhance this natural asset, Dublin City Council has prepared several management plans for all aspects, including biodiversity and flora and fauna, during the current Development Plan for:

- Dodder
- Tolka
- Liffey
- North Bull Island

By implementing Objective R012, the Parks and Landscape Services Division has produced habitat management plans for individual parks:

- Bushy Park
- Le Fanu Park
- Springdale Park
- St. Anne's Park
- St. Kevin's Park

The Master Plan for Cardiffsbridge Park includes a habitat survey of flora and fauna carried out on behalf of DCC Parks and Landscape Services Division, which showed the potential for a range of mammals and amphibians protected under the Habitats Directive along this portion of the river Tolka. As noted above, the Water Framework Directive aims to ensure good ecological status of rivers. Dublin City Council has initiated some plans to further this objective. A Draft Fishery Enhancement Plan for Phase 1 of Cardiffsbridge Park, Finglas (2006) was prepared as part of the Master Plan for Cardiffsbridge Park.

4.2.14 Current Environmental Monitoring Information

Dublin City Council currently surveys and monitors the habitats and species of the landscape of Dublin City fulfilling the statutory obligations under Irish and European legislation. This also assists in the management of public parks and open spaces. Furthermore, the information is vital for the assessment of planning applications and for the making of local area plans. The information is still contained in different park management plan reports, as listed above and in surveys by individual habitat/species, as described below. Data has also been merged into GIS. This is vital for the monitoring of indicator species such as butterflies that are sensitive to changes in climate.

4.2.15 Survey and Monitoring by Habitat

A number of habitat surveys have been undertaken by Dublin City Council. They provide a baseline for monitoring by habitat types and ensure compliance with the Habitats Directive and the Wildlife Act. These will be updated on a regular basis and be used for the purpose of monitoring the effects of climate change and air quality within the city. All of these surveys were mapped in GIS in 2008. In 2009 - 2010, a GIS database will be established for all parks and open spaces, to align biodiversity mapping with design and planning of the city landscape and to inform the SEAP.

4.2.16 Survey and Monitoring by Species

A Butterfly Monitoring Scheme for public parks commenced in 2008 on a city-wide basis, to provide data for parks management and to contribute to the national Irish Butterfly Monitoring Scheme. A Survey of Invasive Species is currently being conducted, which will be completed in 2009. The study area includes all watercourses in Dublin City, as the primary zone through which invasive plants can spread. It is hoped to expand this to include several key parks and open spaces in 2009-2010. The information obtained will be

used to monitor the composition, extent and nature of invasive species and to the SEAP as invasive species can be an indicator of climate fluctuations.

4.2.17 Non Implementation of the SEAP

The SEAP will not directly affect biodiversity in the city, the intensification of landuse which is conducive to sustainable energy practices will be monitored and design within the parameters of the new city development plan and the protective measure that have been set out therein. Because energy and climate change is such a transboundary and global phenomenon non implication of a local SEAP cannot be directly attributed to the climatic fluctuations or biodiversity degradation, however local air quality can be monitored and its affect on local biodiversity quantified.

4.2.18 Existing Environmental Issues Relating to Biodiversity, Flora and Fauna. Both Climatic and Demographically Related

There are many potential threats to the management of biodiversity, flora and fauna inherent in the pressures of the high density of population and development of Dublin City and the naturally diverse heritage of Dublin Bay and its associated riverine ecosystems. The following broad range of issues have been identified, which include localised as well as more strategic issues:

- Potential increased flood risk from changed land-use patterns, climate change and predicted sea rise level could result in loss or alteration of habitats through erosion and alteration of levels.
- Increased volumes of surface water run-off due to conversion of permeable landscapes to impermeable. This can lead to increased flooding, erosion and alteration and direct loss of habitat
- Increased frequency of high rainfall events due to climate change can result in sudden elevated levels of pollutants contaminating aquatic habitats.
- Changes in temperature and precipitation levels due to climate change resulting in some species being replaced or under stress.
- Loss of connectivity of habitats for wildlife by development which interrupts or is too close to existing green corridors.
- Need to ensure biodiversity interests taken into account in earliest stages of planning of new developments.
- Demolition of older structures (buildings, walls, out-buildings) due to rapid growth results in loss of habitat for fauna
- Lack of survey and research data limits tools for decision-making in planning for biodiversity
- Greater co-ordination with the other planning authorities in the Greater Dublin Region to respond to shared regional issues
- Balance between accommodating future development, recreational, heritage and biodiversity needs of Dublin City.
- Protection EU and Irish designated sites especially Dublin Bay.
- Protection of areas, sites and natural features of high biodiversity quality not designated under EU or national legislation
- Importance of ecological corridors to maintain biodiversity
- Incorporation of biodiversity into development proposals e.g. greenway, roof gardens etc.
- Light and noise pollution
- Drought

4.3 Air

The Air Quality Framework Directive 96/62/EC has been transposed into Irish Law by the Air Quality Standards Regulations 2002 and the Ozone Regulations 2004.

4.3.1 Dublin City Air Quality

Air quality in Dublin is currently good. In particular years Dublin's air quality has shown significant improvement in the levels of black smoke, lead, sulphur dioxide, benzene, and carbon monoxide (CO). This is due largely to the success of the regulatory ban on the sale of bituminous coal in the Dublin region and the elimination/reduction of other substances in vehicle fuels. The legislation dealing with banning sales of bituminous coal has been so successful that its application has now been further extended to cover another 15 cities and large towns around Ireland. There may be significant air pollution from the port activities and this is something that should be monitored under the overall air quality program.

As can be seen from the Figures 3 and 4 below the improvement in respect of a number of pollutants has been profound, sustained, and compares favorably with other urban centres in Ireland.

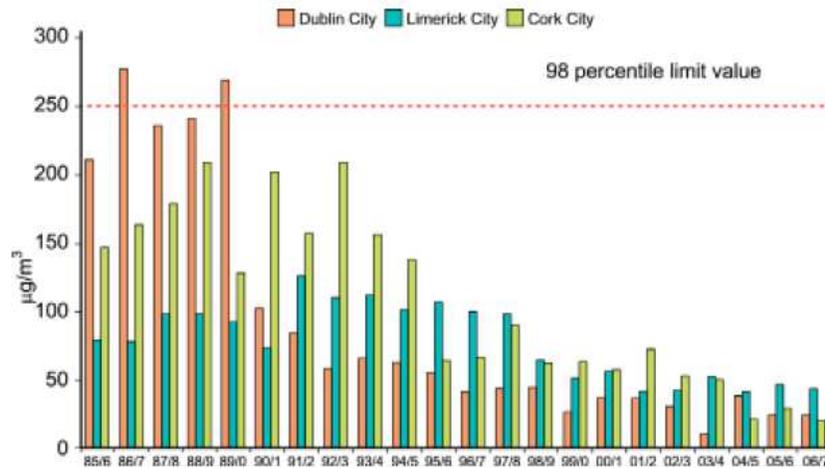
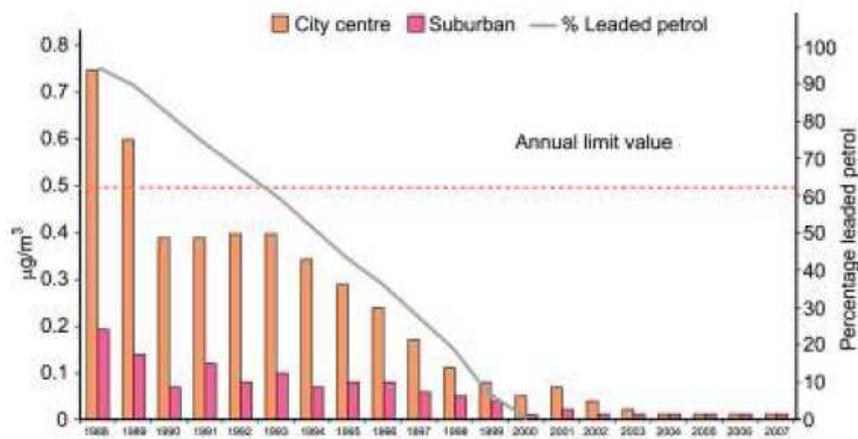


Figure 4: National trends in black smoke levels in ambient air 1985-2007



Note: Leaded petrol was completely phased out in 1999.

Figure 5: Trends in lead levels in ambient air in Dublin 1988-2007

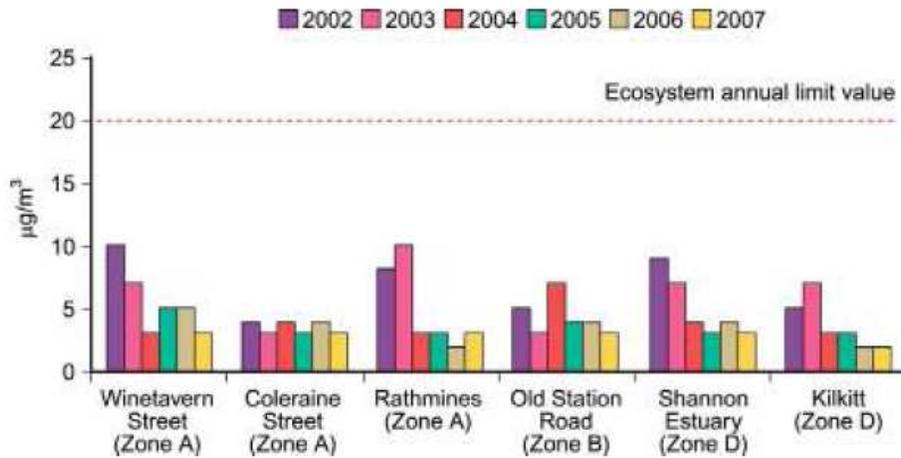


Figure 6: National trends in sulphur dioxide levels in ambient air 2002-2007

According to the National Development Plan the key challenges in relation to air quality are Nitrogen Oxides (NO_x) and Particulate Matter (PM₁₀).

Oxides of nitrogen dioxide (NO_x) during the 1990's nitrogen dioxide levels were exceeded. While the current results are in compliance with the annual limit value the levels are sufficiently high to be of concern in relation to compliance in the future.

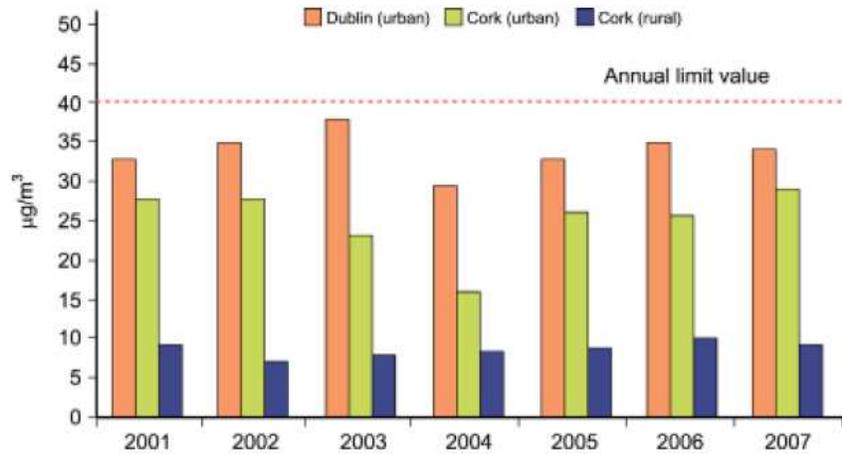


Figure 7: National levels of nitrogen dioxide in ambient air 2001-2007

PM₁₀ and PM_{2.5} concentrations remain a threat in terms of exceeding limit values at some locations, should a combination of factors (including unfavorable weather conditions and traffic emissions) occur. It should be noted though that from a national perspective the highest PM₁₀ levels during 2007 was recorded in Ennis, Waterford and Navan.

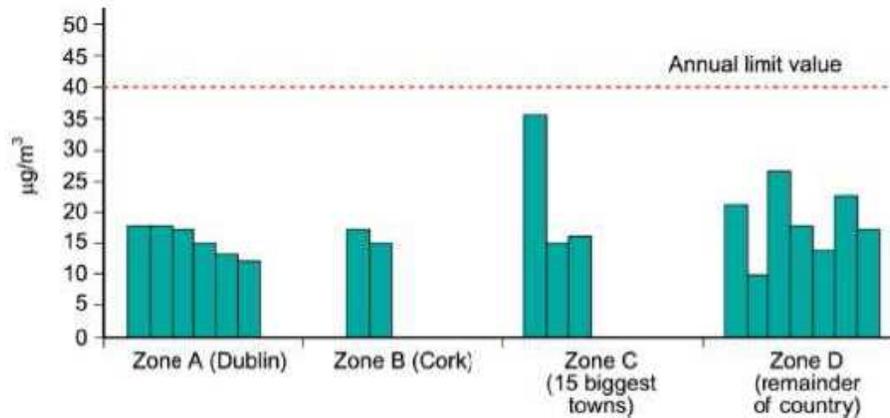


Figure 8: National trends of pm₁₀ levels in ambient air 2007

The energy and transport sectors are major contributors to the emissions of these air pollutants. The pollutant emissions emanating from vehicular sources are also those to which the public may be most readily exposed, and they present a considerable risk in terms of their potential to contribute to breaches in air quality standards in areas subject to heavy traffic. Although the emissions from individual vehicles will continue to fall as a result of technological advancements and cleaner fuel as advised in the SEAP, improvements in the case of NO_x have to date largely been offset by the increase in the number and size of vehicles on the road.

Emissions from the transport sector are the main, but not the only threat to air quality in the Dublin region. Other issues include the construction industry, uncontrolled burning of waste, and localised emissions from a small number of industries.

According to the Environmental Protection Agency's (EPA) 4th State of the Environment Report published in 2008:

"Emissions of air pollutants, particularly PM10 and NO_x, from road traffic remain the main threat to air quality in urban areas. While new standards for car emissions and the resultant cleaner technology have curbed emissions from individual vehicles, this has been offset by the increasing number and bigger engine sizes of vehicles on Ireland's roads. Air quality issues must therefore be an integral part of traffic management and planning processes, and there needs to be a modal shift from the private car to high-quality public transport".

The SEAP should directly benefit the soon to be updated 'Dublin Regional Air Quality Management Plan' which will address air quality issues, including emissions from the transport sector.

Another issue raised by the Environmental Protection Agency (EPA) in response to the consultation phase on the Draft Air Quality Management Plan also has significance in the context of preparing the development plan:

"some climate change solutions can impact negatively on air quality with many biofuels having higher emissions of air pollutants than the conventional alternative. In particular, changing fuel from gas to wood can increase particulate emissions tenfold and also increase particulate emissions of dioxins. Greater emphasis on the need to integrate air quality and climate change policies would be welcome",

This issue will be highlighted in the objectives and possible impacts sections of the SEA.

4.3.2 Non Implementation of the SEAP

Although there may be some issues as highlighted by the EPA with particulate matter and biofuels, the non implementation of the SEAP and the 'business as usual' scenario would lead to an upward trend of private vehicle use and energy consumption in residential and commercial sectors. This increased consumption of fossil fuels would lead to degradation in air quality on a regional level and a severe degradation on a citywide level due to the enclosed and intensive nature of the city layout.

4.4 Climatic Factors

This is the most important impact with regards to the SEAP as it has been formulated to reduce Dublin city's GHG emissions. There was no data on the energy consumption or CO₂ emission rates of the three sectors of residential, commercial and transport in Dublin city, so Codema conducted an analysis entitled *Energy for Dublin* this will be included with the SEAP for consultation. Therefore the following data is a brief summary of some of that data.

4.4.1 Current Climatic Environment

The baseline was calculated between three sectors; Residential (32%), Commercial/Manufacturing (43%) and Transport (25%). See figure 8 below. Waste and agriculture are not big emitters within the city boundaries. In 2006, Dublin City (12% of national population), released approximately 5 million tonnes (10.5% of all Irish emissions). On average a Dubliner releases 9.7 tonnes of CO₂ per year, less than the national average which is 11.3 tonnes

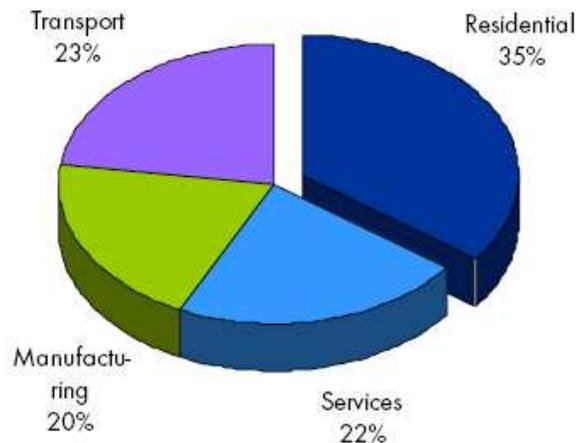


Figure 9: Primary energy consumption for Dublin City 2006

Dublin City currently (2006) consumes 22.3 TWh of primary energy per year, the equivalent to 1.9 million tonnes of oil in the form of electricity, oil, natural gas and renewable energy (2006).

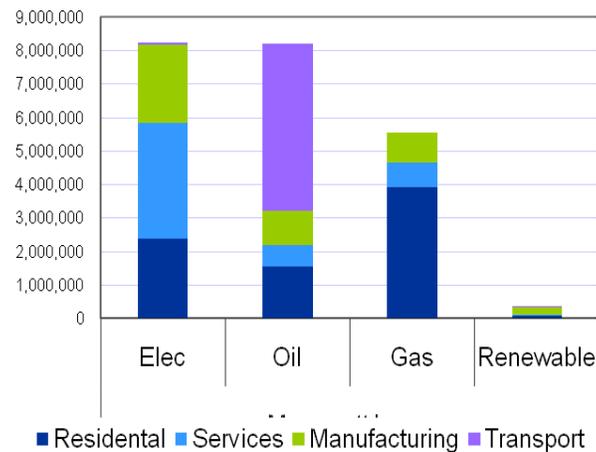


Figure 10: Energy, fuel type in TWh per sector for Dublin city 2006

4.4.2 Monitoring Information

With the adoption of the Dublin City Climate Change Strategy there will be a framework in place to monitor CO₂ emissions from several activities. In addition it is good practice to update the 2006 baseline on a periodic basis. This is envisioned to be on an annual basis or if the information is not available on the basis of when that information becomes available e.g. census data.

4.4.3 Non Implementation of the SEAP

It is projected that if no measures were taken to reduce CO₂ emissions, a business as usual model, that the increases in CO₂ emissions in the three sectors will be as follows, Residential 17%, Commercial/Manufacturing 30% and Transport 32%. There would be little evidence of this increase on the city's microclimate specifically but as part of the broader climate change scenario there may be many negative climatic impacts.

4.4.4 Existing Environmental Conditions Relating to Climatic Conditions

The following broad range of issues has been identified, which include localised as well as more strategic issues:

- Best practice methods for energy efficiency, energy conservation and water conservation e.g. district heating network, combined heat and power systems. action plan on energy to be taken into account.
- Feasibility of renewable energy sources throughout the city.
- Reduction of CO₂ emissions.
- Rising sea levels.
- Pluvial (rainfall) flood risk.
- Importance of city vegetation / landscape to act as a carbon sink.
- Greater co-ordination with the other planning authorities in the Greater Dublin Region to respond to these shared regional issues set out.

4.5 Water – Flood Risk

Depending on the scope of the SEA the water section can take into account a broad range of issues, such as drinking water quality, bathing areas etc. It was decided due to the specific nature of the SEAP that the issues relating to it are confined to flood risk, it is accepted that climatic change will put pressure on water assets.

4.5.1 Flood Protection

The most significant development in this area is the publication of the *Government Guidelines on the Planning System and Flood Risk Management*.

These Guidelines are specifically aimed at linking Planning and Development with Flood Protection and Flood Risk Assessment. It is a requirement of the Guidelines that all future Planning Decisions have regard to the Guidelines.

There are three separate strands to Dublin City Council's flood protection policy –

- (i) Coastal Flooding
- (ii) River Flooding
- (iii) Pluvial Flooding

In relation to coastal flooding Dublin City Council planning policy is based on the 2005 report by Royal Haskoning on the Dublin Coastal Flood Protection Project. This study is likely to be reviewed and updated during the lifetime of the new city Development Plan. Certain coastal flood protection projects are either constructed or planned. The implementation of the recommendations of the DCFPP and any subsequent review, particularly in the light of revised data on sea level rise, are currently being considered as possible policy options by Dublin City Council.

Current City Council policy is to examine the feasibility of off shore flood protection options – referred to as *Projects 2030 and 2050*. Policy to further progress these studies would be desirable.

In relation to flooding away from rivers and coastal areas arising from intense rainfall i.e. pluvial flooding, Dublin City Council has entered into a partnership with a number of EU partners in the Resilient Cities Project. This seeks to incorporate flood planning into the very centre of urban planning, in this regard, all new developments in the City Council area, including proposed roads, parks and open space developments proposed by Dublin City Council, should be assessed as to their compliance with the best practice standards being developed under this project. It is recognised that the new development plan will need to place a strong emphasis on Sustainable Urban Drainage (SUDs) and include a range of policies and standards to ensure that all new development is undertaken in accordance with best practice.

In relation to Flood Protection generally, Dublin City Council has constructed and will continue to construct a number of flood defense or flood routing structures around the city. These are not often recognised as such and are subject to alteration in later years without reference to their flood protection role. It is proposed that these flood protection structures or identified flood routes are identified in the new city development plan to ensure their protection and long term viability. Although the SEAP concentrates on preventive measures, mitigation to the effects of sea level rise and increased precipitation must be considered.

4.5.2 Strategic Flood Risk Assessment and the SEA

This section looks at the responsibilities of Dublin City Council in regards to flood risk management and the national and regional policy that formulates its response. As the SEAP is a Dublin City Council document any flood risk assessment of projects will go through the same channels as any other project proposed in the City Development Plan. The SEAP aims at reducing the possibility of flooding through an overall policy of GHG reduction, but as this is a global phenomenon there must be measures in place for the possibility of sea level rise and increased precipitation and storm events.

Flooding is a natural process that can happen at any time in a wide variety of locations and plays a role in shaping the natural environment. It is recognised that the risk of flooding has increased due to climate change and sea level rise. There are three types of flooding events, which can arise separately or in combination; coastal flooding arising from the sea or estuary, fluvial flooding arising from rivers or streams and pluvial flooding arising from extreme rainfall.

National Policy Guidance

The Office of Public Works (OPW) is responsible at a national level for monitoring and addressing flood risk and along with the Department of Environment, Heritage and Local Government has published a draft national policy guidance document on the consideration of flood risk within planning and development management. The Guidelines recommend a clear and transparent assessment of flood risk at all stages in the planning process including the preparation of development plans and in the development management process. The regional authorities will be required to prepare regional level strategic flood risk assessment by the end of 2016 and subsequently at a city level the new flood risk assessment system will be aligned with the existing Strategic Environmental Assessment (SEA).

The Key guiding principles are to:

- Avoid the risk, where possible.
- Substitute less vulnerable uses, where avoidance is not possible.
- Mitigate and manage the risk, where avoidance and substitution are not possible.

Regional Policy Guidance

The emerging *Draft Regional Planning Guidelines for the Greater Dublin Area 2010-2022* states that Dublin city is vulnerable to two key sources of flooding- fluvial and coastal; effective management of flood risk coupled to wider environmental, sustainability and economic considerations mean that it is possible to facilitate the continued consolidation of the development of the existing urban structure of the GDA. As the national capital, largest city and a national and international gateway, the guidelines outline measures through which both the flood risk and the continued development of the City can be reconciled. The guidelines also set out the key policy recommendations regarding avoiding and managing flood risk within the Greater Dublin Area (GDA) along with actions to be included in the Regional Planning Guidelines with respect to flood risk assessment, which are as follows;

- 100% completion, in co-operation with all local authorities in the GDA, of CFRAM Studies covering the GDA by 2016, including a review of long term flood risk management options and consideration of appropriate land use policies.
- All Local Authorities to have completed Strategic Flood Risk Assessments (SFRAs) for all Development and Local Area Plans by 2016.
- The proportion of newly zoned housing lands located in areas classified as Flood Zone A or B that are not within flood protection scheme areas would decrease to a minimal level during the life of the RPGs.

- Inclusion in Development Plans of policies and objectives on requiring non-sensitive uses and designs which provide flood protection for ground floors of buildings in flood vulnerable locations within existing urban centres.

Current approach to Flood Risk Assessment – Dublin City Council

The OPW are currently involved in preparing catchment-based flood risk management plans (Flood Risk Assessment and Management Studies (FRAMs)) with the relevant local authorities, the Environmental Protection Agency (EPA) and other key agencies, providing an integrated and proactive approach to flood risk and the mechanism through which predictive flood maps and Catchment Flood Risk Management Plans (CFRMPs) are being developed. These CFRAM Studies when completed will establish a prioritised set of flood risk management measures for their relevant areas, including the use of physical and management responses. Dublin City Council has built up a high level of expertise and centre of excellence in urban flood risk management and also cutting edge drainage solutions. The three types of flooding outlined above have been addressed by various measures and policies including:

- Dublin Coastal Flood Protection Project 2005
- A new tidal early warning system to deal with coastal tidal surges
- River Tolka Flood Risk Reduction Scheme
- Spencer Dock advanced protection works/tidal gate scheme (which will allow for the reopening of the Royal Canal to navigation)
- River Dodder Flood Risk Reduction Scheme (under construction)

Dublin City Council is currently involved in two EU INTERREG funded flooding projects, the SAFER project - *Strategies and Actions for Flood Emergency Risk Management and the Flood Resilient City Project*. The SAFER project aims to develop computing flood hazard maps, develop flood emergency management systems and develop flood partnerships between the four participants, Gewässerdirektion Neckar, Germany, Forestry Commission Scotland, Federal Office for Water & Geology, Switzerland and École Polytechnique Fédérale Lausanne, Switzerland. The Flood Resilient City project is a flood risk management best practice project consisting of 11 partner organisations from 8 major European cities each with an interest in promoting flood resilience in the urban environment. The project is to run until 2012 and is developing a flood risk management model based on engagement with politicians & and policy makers, professional and the public to address the threat to Dublin from pluvial flood risk, the residual flood risk and how to adapt new resilient construction techniques. In the longer term Dublin as a coastal city will be impacted on by gradual rise on mean sea level. Dublin City Council, mindful of the potential impacts, has already commissioned a pre-feasibility study for a project called "Project 2030" that will investigate the potential for tidal barrages to protect the city and region.

Flooding and the Draft Dublin City Development Plan 2011-2017

The Vision for the City and the Strategic Approach translate into a Core Strategy which will ensure effective realisation of the National Spatial Strategy (NSS), Regional Planning Guidelines (RPGs) and consequent Local Area Plans (LAPs). The core strategy takes account of national and regional population targets and provides the policy framework for Local Area Plans. It represents a spatial expression of the delivery of essential infrastructure and services within an over-arching sustainable framework. It is also part of the core strategy, which includes the SEAP to consolidate the city and achieve a compact city, which makes optimum use of urban land and existing or proposed public infrastructure. by supporting and encouraging the consolidation of the City it is considered that this approach will ensure that areas of the Dublin metropolitan area particularly those along floodplains do not suffer from development pressures and can be protected for reasons of flood risk management.

Dublin City Council is actively seeking to prevent, control and manage flooding. Dublin City Council at present is working with the OPW in preparing *Catchment Flood Risk Management Plans (CFRAMS)* and regard to their provisions/recommendations will be had when available in due course and incorporated into the development plan by way of Variation if required. It is envisaged that Flood Risk Mapping will be completed by 2013 at a national level and could be used to assess developments at risk from water level rise. In the longer term, future development plans will have regard to the *Flood Risk Management Plan* arising from the *Catchment Flood Risk Management Plans*, which are currently being prepared and are to be completed by 2013-2015.

4.5.3 Existing Issues Relating to Flood Risk

- City Council area traversed by a number of key regional river systems; future development within the city area should not have a deleterious effect on the ecological status of these systems.
- Existing and proposed flood defense structures to be identified for protection in the development plan.
- Potential increased flood risk from changed land use patterns, climate change and predicted sea rise level.
- Government guidelines on the planning system and flood risk management to be taken into account.
- Risk to critical infrastructure

4.5.4 Non Implementation of the SEAP

Again the SEAP is a citywide plan and climate change is a global issue, if the SEAP was fully realized but other cities and countries remained inactive there would be consequences for Dublin. By non implementation of the plan we include a global trend of non implementation and its consequences for Ireland and specifically the East coast and Dublin.

Rainfall

Wetter winters will bring a 5-10% increase in rainfall by mid-century and 15-25% increase by 2100. Summers will be correspondingly dryer, especially in the east and south, leading to water shortages in Dublin in the summer months unless demand is reduced and/or new sources of supply are found (see figure 10).

Risk of Flooding

The mean sea level in the Irish Sea is rising at a rate of about 2.7 cm per decade. This trend, if it continues, is consistent with the IPCC prediction of a rise of 0.18 – 0.59m rise by the end of the century. Recent research suggests that the rise in sea level may actually be greater than predicted as glaciers and ice caps are melting at increasing rates. Ocean modeling results indicate an increase in storm surge events around the Irish coast, with extreme wave heights also likely to increase. Additional to this are the changes in precipitation leading to a rise in winter stream flows and increasing the risk of flooding (see figure 12).

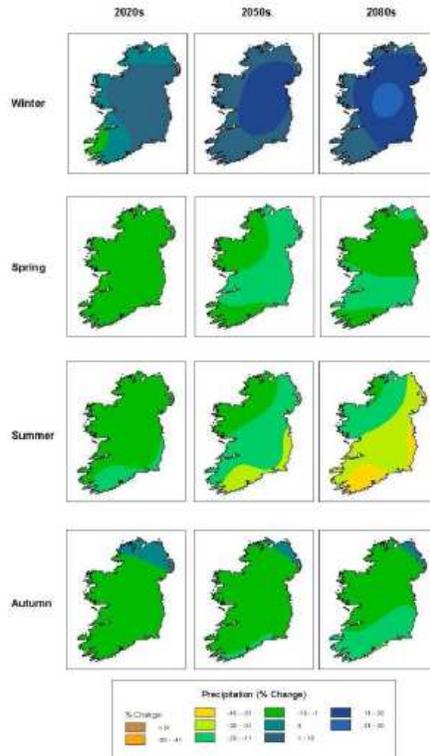


Figure 11: Mean Seasonal Precipitation Changes Projected for 2020, 2050 and 2080

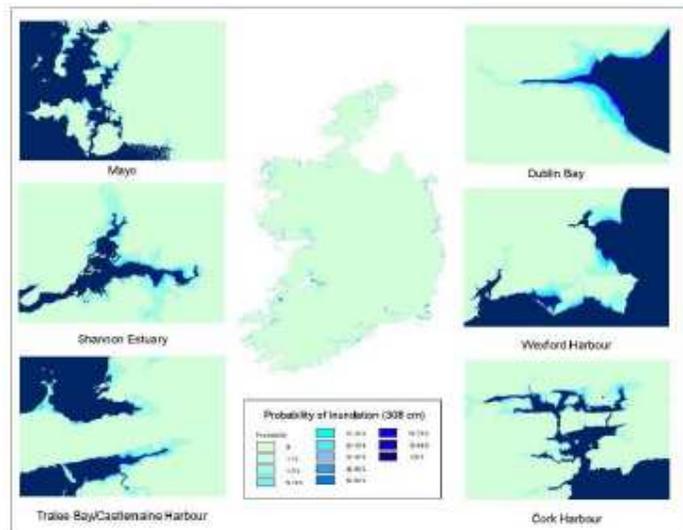


Figure 12: Probability of Coastal Inundation Associated with a Sea Rise of 0.48 m and a Storm Surge of 2.6 m

4.6 Material Assets

For the purpose of this SEA material assets will refer to the transport infrastructure of Dublin city and will not include waste management as this is not in the remit of the SEAP.

4.6.1 Transport

The Dublin City Council region covers an area of approximately 115Km² and is populated by 506,211 people. Within its boundaries there are just over 31Km of Irish Rail track and just under 13Km of LUAS track. The entire rail track within the Dublin City Council area is designated as major rail. There is approximately 1280Km of roads, 16% of which was designated as Major Road i.e. carrying more than 16,438 vehicles per 24 hours.

4.6.2 Existing Road Network

A total of c.1200km of road is currently in the charge of Dublin City Council. The roads are of varying quality and are maintained on a demand/priority basis. Most of the information readily available relates to the city centre i.e. the area within the canals. We know that over 200,000 people access the city centre in the morning peak by all modes. We also know that 25,000 people per hour access the city centre by car. The network within the city centre (i.e. the canals) is full at 20,000 cars. The road network is generally at capacity where private cars are concerned. Increasing road space has been and will continue to be given over to public transport, cyclists and pedestrians

4.6.3

SCATS is a traffic management system that integrates the management of traffic signals and the coordination and timing of junctions in real time. Currently 618 junctions and pedestrian crossings are linked to the SCATS system. It is intended, subject to funding, to link all junctions and pedestrian crossings to the SCATS system. The system is monitored on a 24-hour basis by Dublin City Council and a contractor. Maintenance is under contract to SERCO with agreed response time and level of service.

4.6.4 Existing Public Transport Network

The existing public transport network currently comprises bus, DART and the Luas tram lines. There are currently 200km of bus lanes passing through the area, with more QBCs planned and under construction.

The DART line runs through the Dublin City Council area from Malahide in the North (Fingal County) to Greystones in the south (Wicklow County).

There are two existing Luas tramlines running through the Dublin City Council area. The Red Line, which is 15km in length, links Tallaght in the south (South County) to Connolly Station in the city centre. The Green Line, which is 10km in length, links Sandyford in the south (Dun Laoghaire/Rathdown) to St. Stephen's Green in the city Centre. The following extensions to the red line are currently under construction – Line A1 to Saggart and Line C1 to Docklands. Line B1, which extends the green line to Cherrywood, is also currently under construction.



Figure 13: Integrated transport network

4.6.5 Existing Cycle Network

To date a total of c.199km of cycle lanes has been provided within the Dublin City Council area. This is made up of both segregated lanes and combined bus and cycle lanes. The cycle lanes provided form part of a citywide cycle network. Over 1000 cycle stands have been provided within the canals to date. The Dublin bike scheme is also in operation with positive feedback thus far.



Figure 14: Dublin City cycle network

4.6.6 Pedestrian Network and Environment

It is estimated that there is approximately 2,400km of footpath within the City Council area. This is of varying quality and it is maintained on a demand/priority basis. Work is underway on a *Public Realm Strategy* for the city council area that seeks, among other things, to improve the pedestrian experience. A Wayfinding Strategy is also currently being prepared for the city centre.

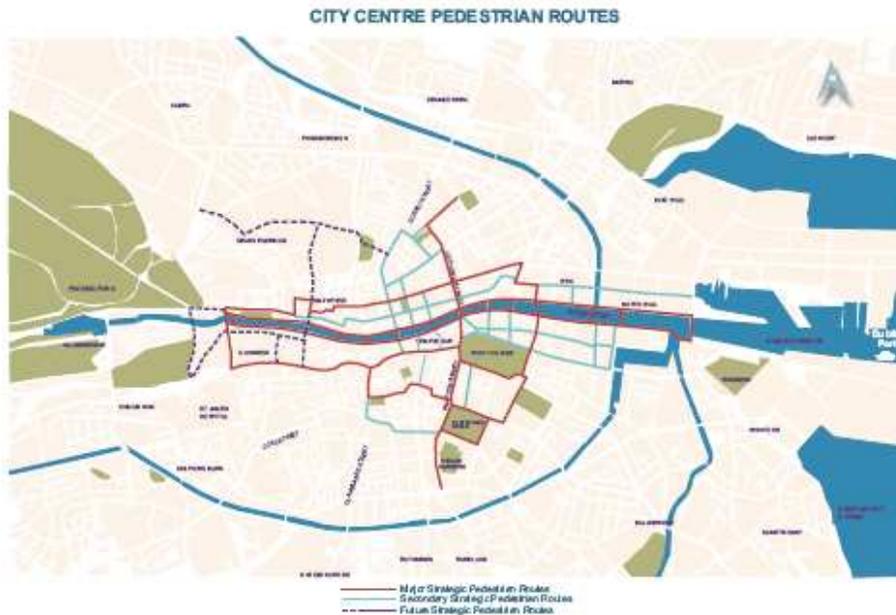


Figure 15: Dublin City pedestrian routes

4.6.7 Modal Split

The modal split figures available relate predominantly to the city centre area. The change in modal split for the city centre over the past 10 years has seen a rise in the use of public transport. Between 1997 and 2007 private car commuters reduced from 49.85% to 35.1% of the AM modal split. Over the same period, public transport mode share rose from 34.91% to 50.04%. This took place against a background increase of 13.5% in a.m. commuting peak numbers since 1997. Between 2003 and 2007 bus passenger numbers declined from 67,792 to 57,201. Bus share is now at 28.05% of the modal split. Rail passengers increased over the same period from 21,416 to 35,692. The Rail share is now 17.5% of the modal split. When Luas is included the total rail mode split comes to 22%.

Cyclist numbers declined from 5,616 in 1997 to 3,941 in 2004. However since then cyclists numbers have been increasing (5,676 in 2007).

The 15% plus shift away from private cars has been achieved through increased public transport supply but also through pro-active travel demand management policies. The removal of free parking in the city and restrictive parking policies has been particularly influential in achieving a shift to more sustainable forms of transport.

4.6.8 Environmental Monitoring

The following information is available which can assist in monitoring the environment from a movement point of view. Some monitoring is carried out on an annual basis for the same area. Other information is ad hoc and relates to particular sites or junctions:

- Annual Cordon Counts (for all modes crossing the canals);
- Traffic Counts – carried out on an ad hoc basis and relate to particular junctions/streets etc.
- Traffic Impact Assessments and Transport Assessments on a site basis;
- Mobility Management Plans – on a site basis;
- ITS – day to day monitoring of junctions and pedestrian crossings by DCC and a contractor;
- Noise & Air Pollution Monitoring – There is an existing 'Action Plan Relating to The Assessment and Management of Environmental Noise October 2008 - November 2013. This action plan will be reviewed on a 5-year basis.

The Dublin Transport Authority's model also provides information on a regional basis.

4.6.9 Key Projects Likely to Influence the Environment

There are several large-scale projects that will effectively transform the city and its movement networks over the next few years. These projects will have significant effects on the environment. There are several proposals as part of Transport 21 that will impact significantly on the Dublin City Council area. These are of national and regional importance and include:

- The provision of Metro
- The extension of the Luas network
- The provision of DART Underground i.e. the Interconnector
- The Kildare Route Project
- The extension of Quality Bus Network

These projects will provide significantly increased capacity on the public transport network. At a regional/inter county level there are also projects/plans coming on stream, which will influence the environment of the Dublin City Council area. The Regional Planning Guidelines and the DTO Regional strategy are currently being reviewed with drafts due by the end of the year. The implementation of the City Centre Transportation Plan will impact significantly on the environment of the city centre. These projects will require their own individual SEA and other environmental assessments.

The City Bikes Scheme and the Wayfinding project will also influence the environment of the city centre

4.6.10 Non Implementation of the SEAP

Because of the transboundary nature of transport solutions, it tends to be the responsibility of a national or regional authority to implement large scale projects such as transport 21 etc. Therefore, although these projects form an essential part of the SEAP they are out of the control of the local authority, in this case Dublin City Council. Smaller behavioural projects and work place travel plans are influenced by the council or the SEAP. In general if none of the projects in the SEAP were implemented it would lead to the continued upward trend of private vehicles on the road, slower commute times, increased congestion and an increasing trend of GHG emissions and other pollutants.

4.7 Landscape and Soil

Although this criteria has been scoped out it is good practice to give a brief overview of the current conditions in Dublin City.

4.7.1 Landscape

The city landscape consists of the public and private landscape of the city. It fulfils an array of environmental, ecological, social, recreational and aesthetic functions of the developing city. The modern city has developed over the original natural landscape of the lower reaches of the river Liffey and the coastline. Typically this would have included climax vegetation covering the relatively low-lying land around the Liffey and its tributaries. Over time the intervention of man has modified the original landscape initially through agriculture and then more widely through urbanisation. The growth of urban Dublin has not included comprehensive city-wide landscape planning so that today's format reflects the organic growth of the city through the years.

The city park system forms one of the most recognisable components of the modern city landscape. This has evolved primarily from lands that were originally in private ownership, such as the Phoenix Park and the keyholder squares such as Mountjoy Square followed later by provision by public bodies. Today opportunities for new parks are more restricted due to the almost complete development of the city administrative area, however they do arise within redevelopment (e.g. docklands) and development densification (e.g. institutional land developing surplus lands).

4.7.2 Protection of the City Landscape

Growth and densification of urban areas requires the protection of its landscape, which can be lost or marginalised by development pressure. The following landscape specific measures currently apply:

The European Landscape Convention (Florence 2000)

This convention, which Ireland is a signatory to, aims to promote landscape protection, management and planning and to organise European co-operation on landscape issue. Ireland, as a party to the treaty is required to undertake general measures to recognise landscapes in law, establish landscape policies with public participation and to integrate landscape into its existing policies, such as regional and town planning.

Planning & Development Act (2000) Development Plan

Development plan land-use zonings that primarily relates to landscape protection are Z8 Conservation Areas, Z9 Amenity/Open Space and Z11 waterways. Open space, however, is a component of other zonings' permissible uses.

Landscape Conservation Areas

Landscape Conservation Areas (LCAs) can be made by order for the preservation of the landscape. There are no LCAs within the city administrative area. However the Phoenix Park, the North Bull Island, the Botanic Gardens and St Anne's Park are under consideration for this designation.

Environmental Impact Assessment

Landscape & visual impact assessment as part of EIA requirements for scheduled projects assesses the likely impact on landscape and visual baseline resources and propose mitigation measures to residual impact.

Tree Preservation Orders

Tree Preservation Orders can be made in the interest of amenity or the environment and allow for the protection of individual or groups of trees. There are currently 3 Tree Preservation Orders (TPOs) in the plan

area, namely in Darmouth Square Ranelagh, Bettyglen Estate Raheny and in Goldenbridge Inchicore. These trees have been designated due to their landscape, amenity and ecological value. The trees may only be removed if they are a risk to public health and safety or in the interest of design.

4.7.3 Existing Environmental Issues Relating to Landscape

The following broad range of issues has been identified, which include localised as well as more strategic issues:

- Provision of an accessible public landscape that meets the perception and demands of a European capital city, in particular in the quality of planning and design of the public landscape
- Creating landscape linkages within an urban fabric that has reached almost full development
- Balancing competing demands or incompatible uses within the public landscape, such as between biodiversity and recreational uses
- Provision of universal accessible facilities for users of public landscape
- Promoting sustainable landscape solutions (e.g. green roofs, green walls, permeable pavement, SUDS) in the city landscape
- Development & environmental impacts on public landscape (e.g. road noise, air quality and services)
- Changes in the private landscape through development and densification, from small-scale removal of front residential gardens for parking to larger scale changes in the landscape associated with institutional facilities when redeveloped
- Protecting designated landscapes or elements of the landscape (e.g. urban trees)

4.7.4 Soils and Geology

Soil is defined as the top layer of the earth's crust. It is comprised of mineral particles, organic matter, water, air and living organisms. It is an extremely complex, variable and living medium which acts as the *interface* between the earth, air and water.

Soil performs a number of key environmental, social and economic functions that are vital for life. It has a socio-economic and environmental role as a habitat and gene pool, a platform for human activities (including food production), landscape and heritage and as a provider of raw materials. This vital resource is non-renewable, and measures for soil conservation are required to sustain its functions.

The proposed Soil Framework Directive (COM [2006] 232) identifies seven main environmental, economic, social and cultural functions performed by soil that need to be preserved. These functions are:

- Biomass production, including in agriculture and forestry
- Storing, filtering and transforming nutrients, substances and water
- Biodiversity pool, such as habitats, species and genes
- Physical and cultural environment for humans and human activities Source of raw materials
- Acting as carbon pool
- Archive of geological and archaeological heritage.

4.7.5 Soils and Climate Change

The function of soils in abating climate change is particularly important in a regional context for cities such as Dublin experiencing rapid growth beyond city boundaries. The conversion of greenfield sites and sealing of soils can release CO₂ into the atmosphere and further reduce areas of 'carbon sinks'. Soils contain about three times the amount of carbon globally as vegetation, and about twice that in the atmosphere. Land use planning must target the use of brownfield sites. According to European Commission research, given that land use change is often driven by demand and short term economic revenues, the most realistic option for soil management strategies is to improve soil carbon stocks is to a) protect the carbon stocks in highly organic soils such as peats mostly in northern Europe, and b) to improve the way in which the land is managed to maximise carbon returns to the soil and minimise carbon losses²

4.7.6 Overview of Geology

The landscape of Dublin has been largely defined by the bedrock formations of the area, with limestone to the north and granite to the south. The more easily solubilised, less resilient limestone has eroded gradually, leaving a well-defined bay. The bay is restricted to the north and south where the limestone meets more resistant rocks (granite to the south and shale and conglomerate to the north). The changes in the bedrock geology are fault-controlled to the south of the Bay. A large fault, known as the Rathcoole Fault forms the southern margin of the basin, where there is an unconformity between the granite and the limestone. To the north of the Bay, there is a natural succession from the muddy limestones to the north into the Calp limestone around the area of Sutton Cross. Much of Dublin is dominated by rocks of Carboniferous age. During the early Carboniferous period, the eastern part of Ireland underwent uplift and erosion. Following this, there was a period of general subsidence in the area. This subsidence permitted the sea to invade the lower ground from the south during the Carboniferous age. Continued subsidence resulted in shallow and then deeper marine sediments accumulating across most of Dublin city and county. The depth of the sea and type of seabed varied from place to place, as did the rate of sedimentation and so a variety of carbonate sediments were produced in the area. The Calp limestone, which covers most of Dublin was deposited in the basins that formed over 300 million years ago. Thick sequences of muds and muddy limestones accumulated in the basins, sometimes showing graded bedding. The Calp Limestone itself is comprised of dark grey, fine-grained, graded limestone with interbedded black, poorly fossilised shales. Most of the Carboniferous rock, i.e. the limestone, forms low ground, and is covered by a thick layer of Quaternary sediments. The deposits along the northern section of the Bay are predominantly sand overlying gravels and clay. As one moves along the route towards the city centre, the depth of the deposits increases and depths of 10m or greater, of sands, gravels and estuarine muds have been recorded in Ringsend and East Wall.

4.7.7 Overview of Soils

The soil of Dublin is derived from glacial till of Irish Sea origin, with limestone and shale and is largely Grey Brown Podzolics. Grey Brown Podzolic soils are usually formed from a calcareous parent material (limestone). The lighter-textured Grey Brown Podzolics are good all purpose soils, while the heavier-textured members are highly suited to pasture production, responding well to manurial and management practices. The coast of Dublin has a layer of alluvium overlying the topsoil, which is a result of the low-lying status of the city. This sequence of soils is only remaining in undisturbed areas of the coast. As Dublin is a very built-up city, much of the topsoil and alluvium have long since been removed.

4.7.8 Protection of Soils and Geology

Soil Framework Directive

There is no specific European legislation on soil protection. The proposed Soil Framework Directive will establish a strategy for the protection and sustainable use of soil, and soil concerns will be integrated into policies of member states. The main themes in the proposed Directive are:

- Soil sealing
- Erosion
- Organic matter decline
- Compaction
- Salinisation
- Landslides

Pesticides Framework Directive

The proposed Pesticides Framework Directive (2009) will control the storage, use and disposal of pesticides to minimise risk to health and environment from their usage. The Directive includes measures which relate to soil management strategies in land use planning:

- Soils as media for pesticides to travel through and knowledge of the 'fate and behaviour' of specific pesticides in soils with regard to persistence in soils
- Use of soil treatment products to be included in controls
- Soil as part of the environment receiving impacts and effects on biodiversity
- Knowledge of soil types before determination of buffer zones.

Habitats Directive (1992/43/EEC)

Soil types are included for many of the habitats listed under Annex I of the Habitats Directive as they influence the range of vegetation types associated with them. Soil is also a living resource. It is one of the most diverse habitats on earth and contains one of the most diverse assemblages of living organisms. Soil organisms have important effects not only on soil properties but also on the functioning of the ecosystem.

Water Framework Directive (2000/60/EEC)

The Directive includes issues related to soil such as increased siltation in waterways and water contamination. Disturbance of contaminated soils in urban areas could result in potential for increased water pollution, as many pollutants (e.g. heavy metals, pesticides) are bound to organic matter.

Designated or proposed conservation areas

A site has been identified by the Geological Heritage Programme of the Geological Survey of Ireland as of geological importance, opposite the junction of Clontarf Road and Castle Avenue. There is an old lead mine on the shore along Clontarf Road. Nothing is visible on the surface at present; all of the structures are below ground.

Biodiversity Action Plan (2008-2012)

The Biodiversity Action Plan is described in Section 3.3.2.11 (Pages 15-16). It includes specific actions with regard to geology and geomorphology:

- Collation and collection of information
- Raise awareness and make information available

- Protection and enhancement measures, including protection from inappropriate development

It is an objective of the Biodiversity Action Plan for Dublin City Council to liaise with the NPWS in seeking designation as Earth Science pNHA's for the geological heritage sites determined by the GSI. It is also planned to map the sites digitally.

Existing Environmental Issues Relating to Soils and Geology in Dublin City

The following broad range of issues have been identified, which include localised as well as more strategic issues:

- Potential increased flood risk from changed land use patterns, climate change and predicted sea rise level could result in loss of soil organic matter through erosion and alteration of levels
- Increased volumes of surface water run-off due to conversion of permeable landscapes to impermeable causes increased flooding, erosion and alteration of soils and their associated habitat
- Lack of protection and mitigation of impacts of construction on soils, causing soil structural degradation and compaction
- Replacement of existing soil with inferior soil or soil contaminated with invasive species due to improper land management practices
- Release of contaminants bound to organic matter in soils due to disturbance, dredging and removal of soils
- Contamination of soils by improper storage of materials, pesticides and waste
- Direct contact, inhalation and ingestion of contaminated soils and uptake through plants causing adverse effects on human health
- Reduced water-holding capacity through compaction by construction, causing increased risk of erosion and flooding
- Damage or loss of the historic environment (e.g. cultural soils)
- Reduced groundwater re-charge and loss of supply and quantity to surface waters by increased soil impermeability from development
- Changes in hydrological regimes of rivers by increased soil impermeability from development
- Recreational uses can result in pressures on soils and their habitats, including erosion
- Alteration of catchments of rivers can result in increased erosion, loss of sediments downstream and in coastal environments
- Transboundary effects of air pollution from elsewhere in Europe could lead to soil contamination/acidification due to alteration of climate and weather patterns
- Increases in extreme rainfall events leading to increased soil erosion and landslides
- Effects on foundations of built infrastructure by increased erosion
- Continued co-operation with Drainage to further DCC objectives for sustainable urban drainage systems (SUDS) for public open spaces in existing and future developments
- Use of Flood Risk Assessment for projects where erosion is a potential impact
- Lack of detailed mapping of soils and groundwater data limits tools for modeling and decision making in planning
- Greater co-ordination with the other planning authorities in the Greater Dublin Region to respond to these shared regional issues set out in RPG's

4.8 Cultural Heritage (including archaeological and architectural heritage)

Dublin is an ancient city with many sites of archaeological, architectural and cultural heritage importance. As a vibrant and expanding city, there is a need to balance the aims of the SEAP with protection of the cultural resource that is so much a part of the fabric of Dublin and one of the key draws for our tourism industry.

Within Dublin City, there are a number of methods to protect the integrity of cultural assets including appropriate zonings (Z2 and Z8), Architectural Conservation Areas (ACAs), Record of Protected Structures (RPS) and Record of Monuments and Places (RMPs), Zones of Archaeological Interest and Conservation Areas (for example along the Liffey Quays). Conservation grants are also available to owners of protected structures and particularly to owners of protected structures which are on the Buildings at Risk Register. Dublin City Council works with outside agencies e.g. DoEHLG and the Heritage Council, to protect the Cultural Heritage resource of Dublin City.

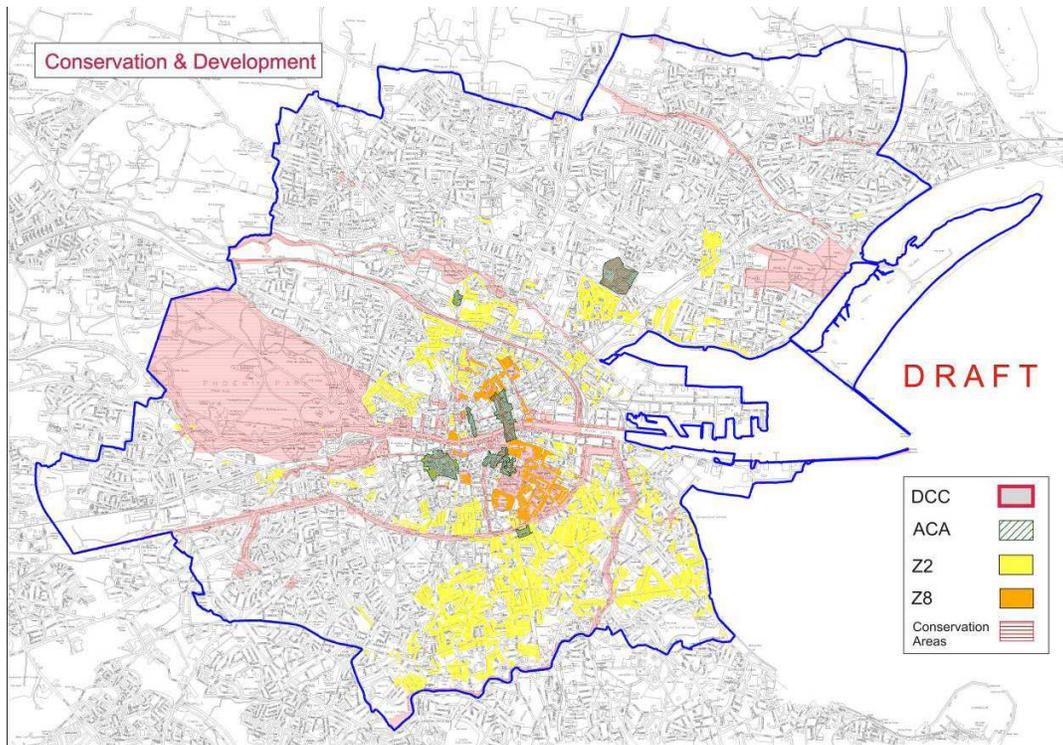


Figure 16: Conservation Zones for Dublin City

4.8.1 Record of Protected Structures

There are currently just over 9000 structures listed for protection in the Record of Protected Structures. These structures include individual houses, warehouses, shopfronts, churches, boundary walls, bridges, building exteriors etc. A considerable number of these buildings are considered to be of Local Importance under the National Inventory of Architectural Heritage (NIAH) Guidelines.

In addition to the Record of Protected Structures, structures of architectural heritage merit, although not put forward for inclusion in the Record of Protected Structures (RPS) may be of local value and may continue to contribute to the identity of a particular area of the city. The Development Plan will include a statement to

actively seek to protect buildings/structures of heritage value, which may not be protected, but which make a positive contribution to the area and identity of the city. Dublin city is unique in form and character.

4.8.2 Architectural Protection Areas

An Architectural Conservation Area (ACA) is a place, area, group of structures or townscape, taking account of building lines and heights, that is of special architectural, historical, archaeological, artistic, cultural scientific, social or technical interest or that contributes to the appreciation of a Protected Structure, and whose character is an objective of a development plan to preserve. There are currently 7 ACAs in Dublin city. These include Grafton Street and environs, O'Connell Street and Dartmouth Square, Marino, South City Retail Quarter, Capel Street and Prospect Square De Courcy Square.

Residential Conservation Areas – Z2

Lands zoned Z2 in Dublin City Council's existing development plan consist mainly of housing areas, but also in limited cases can include a limited range of other secondary and established uses. These residential conservation areas have extensive groupings of buildings and associated open spaces with an attractive quality of architectural design and scale. The general objective for such areas is to protect them from unsuitable new developments or works that would have a negative impact on the amenity of architectural quality of the area. Z2 areas make up 7% of the city's land area.

Conservation Area - Z8

Lands zoned objective Z8 in Dublin City's existing development plan, incorporate the main conservation areas in the city, primarily the Georgian Squares. The aim of this zoning objective is to protect the architectural design and overall setting of such areas. Z8 areas make up 0.8% of the city's land area.

Conservation Areas

In addition to the Z2 and Z8 zoned areas of the city, conservation areas are also denoted by red hatching delineated on the accompanying zoning objective maps for the development plan. The River Liffey and its quays is a designated conservation area.

Archaeological sites and archaeological zones of interest are identified by a recorded monument reference number on the land use zoning maps.

4.8.3 Archaeology

The archaeological heritage includes national monuments in the care of the state, archaeological and architectural monuments, sites in the record of monuments and places and the register of historic monuments, zones of archaeological potential in historic towns; the underwater archaeological heritage, including historic wrecks; unknown and unrecorded archaeological sites (including subsurface elements with no visible surface remains); potential sites located in the vicinity of large complexes of site or monuments, present or former wetlands, unenclosed land, rivers or lakes, or the inter-tidal zone.

Dublin City Council is rich in archaeology and has a diverse range of monuments covering a number of historic eras. Dublin originated first as two separate monastic enclosures (Átha Cliath and Linn Dubh), and then as a Viking ship fortress the Liffey. After the Anglo Norman invasion of 1170 the walled city expanded, reclaiming land at wood quay and large suburbs developed to the North (Oxmantown), to the South and West around Ship Street and St Patrick's Cathedral and the Liberties. Outlying were villages such as Chapelizod and Finglas, Donnybrook etc. Much of the medieval city was still intact in 1610 when John Speed mapped it for the first time. During the 18th century however the Wide Streets Commission reshaped the old medieval city, and

created a network of main thoroughfares by wholesale demolition or widening of old streets or the creation of entirely new ones. The result is that it is difficult to grasp the form of the old city or to understand the context of surviving medieval fabric/street patterns at ground level. Nevertheless, much remains that is of value and which can be reinforced or stitched back together and presented in the city's renewal. A clear strategic vision is required for the oldest part of the city. The City Walls conservation plan goes some way to addressing this but should be extended to address the suburbs as a second phase. Attempts have been made to tackle some of the issues faced by renewal of the medieval city. Framework Plans have been commissioned for Ship Street and the Markets Area and the City Walls Conservation Plan has proved an important tool in unlocking funding for signage, virtual reconstruction and the presentation of the city wall, which is Dublin's largest civic monument. Archaeological sites and archaeological zones of interest are identified by a recorded monument reference number on the land use zoning maps.

4.8.4 Industrial Heritage

Ireland's industrial heritage is being changed and destroyed at an unknown rate. Over the past decade there has been a growing public awareness of Ireland's industrial heritage, as seen in a number of sites which have been restored by enthusiasts and are now open to the public as tourist and educational attractions. The Canal in Dublin City is an example of tourist and educational attraction based on Industrial Heritage in Ireland.

From around 1750 onwards numerous large-scale industries developed in Dublin, which had a profound effect on the city's economy and society, and which contributed greatly to the physical character of today's city. The term industrial heritage covers everything from the extraction of raw materials, manufacturing and processing into usable forms or finished products, public utilities, transport, communications and energy production. In some contexts it also includes military maritime and institutional functions. The importance of Industrial Heritage in the shaping of Dublin City cannot be underestimated. The Guinness brewery is one of Dublin's most important industrial heritage sites and Guinness is identified as a significant brand internationally and is inextricably linked with the capital. With the exception of Guinness however, industry is currently a critically underutilised and undervalued aspect of Dublin's built heritage.

A key issue in the conservation of the city's built heritage is recording and conserving Dublin's unique industrial heritage, a substantial portion of which has already disappeared without record. Industrial buildings are not always of high architectural significance and so are poorly represented on the Record of Protected Structures for this reason. The National Monuments Act (amended) protects sites and monuments down to, but not after, 1700 AD. In this way, Industrial Heritage has continually fallen between the two primary statutory instruments for protection of built heritage. Dublin City Council has undertaken an inventory of industrial heritage. The Dublin City Industrial Heritage Record (DCIHR) and the SEAP will have regard to this record.

4.8.3 Protection of the City's Cultural Heritage

The current development plan contains a policy to protect the buildings and features of industrial heritage in situ, and their related artifacts and plant where appropriate. However, until now, there has been no accurate public record of these sites and many have been demolished without being recognised as worthy of record. Such loss cannot be sustained going forward. It has resulted in a cultural deficit and a loss or degradation of character.

There is a continuing need to balance the needs of a consolidating city with the need to protect its cultural character. The retention and adaption of historic buildings must proceed, while protecting their intrinsic character. Dublin's tourism industry relies heavily on its built heritage.

In the northern part of the city, some of buildings in the Georgian squares and nearby historic streets are suffering from vacancy and underuse. Parts of the Liberties are similarly affected. Such areas would benefit from greater investment and enhancement. In addition, the upper floors of protected structures are vacant or underutilised in successful commercial streets. These problems are likely to worsen if investment and initiatives are not forthcoming.

A key issue for the City's built heritage is recording and conserving Dublin's unique industrial heritage. The network of the city's churches and graveyards represents an important aspect of its character. While some of the deconsecrated churches and graveyards have been maintained and managed as public parks, some are used as pocket parks resulting in the removal of monuments from their contexts, while many have suffered from vandalism or have been landscape inappropriately, resulting in further heritage loss. (DCIHR)

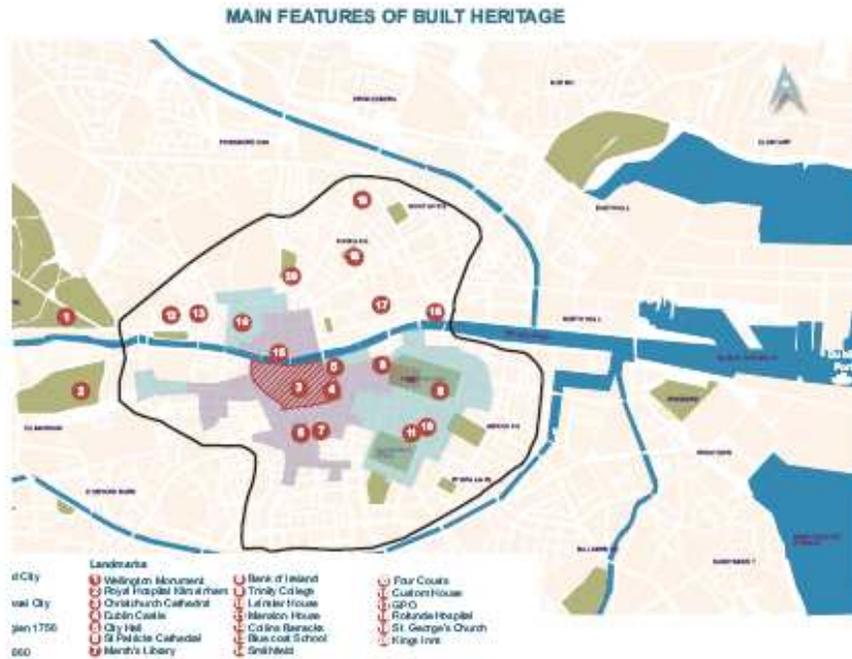


Figure 17: Built heritage of Dublin City

4.8.4 Key Projects Likely to Influence Cultural Heritage in the City

- Recording and conserving of Dublin's unique industrial heritage
- Additional Architectural Conservations Areas designated in the City
- Review of the RPS with a view to reducing the number of former List 2 buildings (prior to 2000 Planning and Development Act) and replacing them with ACAs
- Addition of significant late 20th century buildings to the RPS
- Introduction of a policy on significant Views and Prospects
- Heritage Projects, in conjunction with the Heritage Council – including final phase of Dublin City Industrial Record Heritage, and Urban Tree Survey

4.8.5 Environmental Issues Affecting Cultural Heritage

The following broad range of issues has been identified for cultural heritage in the city. These include localised as well as more strategic issues

- Impact of major infrastructural projects on protected structures
- Difficulty / expense in providing thermal protection to protected structures

4.8.6 SEAP and Cultural Heritage

There are no objectives within the SEAP that are directly related to Dublin's cultural heritage as it is ostensibly an energy plan and therefore has been scoped out of the SEA. The SEAP projects concentrate either on internal retro fit programmes, behavioural campaigns or modal shifts and so are not impacting greenfield sites or historic structures. However the importance for the protection of all cultural heritage is such that statements of intent and procedures should be stated within the SEA, these are as follows.

4.8.6.1 General Policies relating to archaeological heritage

- The SEAP and its relative planning authority will protect archaeological heritage from damage, this includes any previously unrecorded sites

4.8.6.2 Specific objectives relating to recorded monuments and any other archaeological features

It will be the objective of the SEAP and the relevant planning authority to secure the preservation *in situ* of, or preservation of:

- The archaeological monuments included in the Record of Monuments and Places as established under section 12 of the National Monuments (amended) act 1994
- Any sites and features of historical and archaeological interest
- Any subsurface archaeological features that may be discovered during the course of infrastructural/development works in the operational area of the SEAP

Where proposed development (excluding individual residential home units) includes a monument or site included in the Record of Monuments and Places within the development area the SEAP and the relevant authority will ensure that:

- The commissioning of an archaeological assessment to establish the extent of archaeological material associated with the monument or site. This assessment shall also define the buffer area or area contiguous with the monument which will preserve the setting and visual amenity of the site
- The area of the monument and buffer should not be included as part of the open space requirement demanded of a specific development but should be additional to the required open spaces
- Should a monument or place included in the Record of Monument and Places lie within the open space requirement for a development, a conservation plan for that monument should be produced as part of the landscape plan for that proposed open space
- Should a monument or place included in the Record of Monument and Places be incorporated into a development, the monument and attendant buffer area should be ceded to local authority ownership once the development and associated landscaping works are complete so the future protection of the monument can be assured

4.8.6.3 Archaeological monuments within areas zoned for future development

- Please refer to *Dublin City Development Plan Volume 3 Record of Protected structures*

4.8.6.4 Department of the Environment, Heritage and Local Government policy in regards to the preservation of in-situ archaeological remains

The Department states:

“There should always be a presumption in favour of avoiding development impacts on the archaeological heritage. Preservation in-situ must always be the first option to be considered rather than preservation by record in order to allow development to proceed, and preservation in-situ must also be presumed to be the preferred option.” (Framework and Principles for the Protection of the Archaeological Heritage, Dúchas The Heritage Service 1999)

4.8.6.5 Archaeological Assessment

- Any developments that may (due to their size or location or nature) have implications on the archaeological heritage should be subject to archaeological assessment.
- Any developments located at or close to an archaeological monument or site
- Those that are extensive in area (1/2 hectare) or length (1 km or more)
- Developments that require an environmental impact statement

4.9 Data Gaps

The information provided by DCC is quite extensive for the Dublin City area; the main data area of concern directly for the SEAP is that of climatic factors and energy use. There was no information available on energy use in Dublin city and so Codema had to conduct this study, the first in the country for such a specific area. The information gained is the best at present but nonetheless has data gaps that need to be either solved or improved upon for the next study, these include

- Accurate information on passenger numbers for the city
- Accurate information on employee numbers and activities
- Accurate information on commercial floor space
- Full BER database for the city

5 Environmental Protection, Targets and Indicators

5.1 Environmental Objectives

SEA environmental protection objectives are measures used to show whether the objectives of the SEAP are beneficial to the environment, to compare the environmental effects of alternatives, or to suggest improvements. If complied with in full, the environmental objectives set should result in an environmentally neutral impact from implementation of the SEAP. The environmental protection objectives, which usually express a desired direction of change, are established for each of the environmental receptors and are often aspirational in nature. They serve a different purpose from the objectives of the SEAP, though they may overlap with them in a lot of cases.

The SEA Directive requires the identification of objectives relevant to the plan only, so a process of selection was necessary. Objectives set have been adapted to the local circumstances and environmental issues of Dublin city. The environmental protection objectives set for the SEA have been derived from environmental protection objectives which have been established in law, European, national and local policies, other plans and programmes and from a review of baseline information and the environmental problems identified.

Targets sets aims and thresholds which should be taken into consideration to effectively assess the impact of the SEAP on the environment. These targets once breached would require remedial action.

Indicators are those measures used to track the achievements of the environmental protection objectives towards the particular targets set and to monitor the impact of the SEAP on the environment.

Environmental Receptor	Environmental Protection Objective	Target	Indicator
Population and Human Health	Reduce fuel poverty	No Increase in the occurrence of fuel poverty and ideally a marked reduction	Energy ratings from the (draft) Dublin City Council Housing Action Plan
	Promote healthier commutes through cycling and walking initiatives	Extension and improvement of the cycling and walking network	% Change in modal split Number of pedestrians and cyclists crossing the canals as measured by the canal cordon survey
	More compact city to encourage use of public transport	Sustainable densities achieved in new residential / mixed-use schemes	Average residential housing densities
Biodiversity, Flora and Fauna	Protect and where possible increase areas of biodiversity as a carbon sink resource	No adverse impacts on designated habitats or species or any possible	Total area of designated sites (Natura 2000 and

	<p>Preserve species as indicators for climate change</p> <p>Protect good air quality status and minimise the output of Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀)</p>	<p>carbon sink</p> <p>No adverse impact on indicator species</p> <p>No increase in Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀) From biofuels or other fuel sources</p>	<p>pNHA's)</p> <p>Total area of Conservation Areas</p> <p>Survey and monitor street trees of Dublin City</p> <p>Total 'green' areas in the city</p> <p>Survey and monitor the extent of invasive species</p> <p>Survey and monitor the distribution of butterfly populations</p> <p>Values of monitored pollutants in the air, including the levels of Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀)</p>
<p>Air</p>	<p>Increase energy efficiency and renewable energy production</p>	<p>Meet and exceed the targets set down in NEEAP, minus 3% IEE project and increase the citywide renewable share</p> <p>Fulfill housing action plan in regards to energy efficient refurbishments</p> <p>Citywide housing refurbishment program</p> <p>Citywide behavioral campaign for commercial sector to reduce energy</p>	<p>Total share of renewable energy for heat</p> <p>Total share of renewable energy for public buildings and installations, including traffic</p> <p>Number of (social) housing units, public buildings and community centres connected to district and group heating systems</p> <p>Number of CHP units within the private housing</p>
<p>Climatic Factors</p>			

Water	Minimise GHG emissions	<p>Citywide commercial lighting upgrade</p> <p>20-30% Reduction by 2020</p>	<p>and commercial sectors</p> <p>Number of A and B rated buildings within the social and private residential sector and as a percentage of the total stock</p> <p>Number of A and B rated buildings within the commercial and public buildings sector and as a percentage of the total stock</p> <p>Average energy consumption of new residential housing stock</p> <p>Tonnes CO₂/capita/year</p>
	Reduce and manage the risk of flooding (through the new city development plan as planning is not the remit of the SEAP)	<p>Compliance with the Floods Directive and with OPW / DoEHLG 'Flood Risk Management in the Planning Process' standards</p> <p>Avoid new development in flood prone areas or where this is unavoidable require that flood resilient measures be incorporated into new developments</p> <p>Avoid the development risk of destruction of flood defences, flood defence structures and features</p>	<p>Number of incidences of flooding to property</p> <p>Number of developments incorporating flood risk avoidance and flood risk alleviation measures categorised under</p> <p>A. 'Hard' defences B. 'Soft' or 'Green'</p> <ul style="list-style-type: none"> ■ defences including: ■ SUDs ■ WADIs ■ Swales ■ Detention Ponds ■ Bio Retention Cells etc <p>Number of flood defences, flood defence structures and features</p>

Material Assets (Transport)	To reduce traffic levels by encouraging modal change from car to more sustainable forms of public transport and encourage non-car dependent development	Identify Sustainable Urban Drainage Systems (and features which are identified as having a flood defence function) in all new developments	identified in the development plan Number of Sustainable Urban Drainage Systems and flood defence features identified
		Extension and improvement of the cycling and walking network	% change in modal split
	Reduce GHG's and other pollutants	Workplace travel plans	Number of pedestrians and cyclists crossing the canals as measured by the annual cordon survey
		School travel plans	
		Eco Driving	
		Electric vehicles	% Electric vehicles
		Bio vehicles	% Bio vehicles

Table 2: Environmental Objectives, Targets and Indicators

6 Evaluation of SEAP Alternatives

6.1 Introduction

Article 5 of the SEA Directive requires the Environmental Report to evaluate the alternatives identified i.e. “.....reasonable alternatives taking into account the objectives and geographical scope of the plan or programme, are identified, described and evaluated.”

Three alternatives to the full SEAP have been identified and examined during the preparation of the SEAP, these have been included in the text of the plan but will be evaluated here under the environmental protection objectives. The alternatives are

1. A do nothing business as usual model
2. Short term easy to implement and relatively low cost actions, referred to in the SEAP as scenario 1
3. Longer term harder to implement higher cost actions, referred to in the SEAP as scenario 2

6.2 Alternative 1 – ‘do nothing’ or business as usual scenario

This scenario is self explanatory in that it requires no action or the non implementation of the SEAP, this is a trend that was calculated on the energy consumption of Dublin city in 2006 and thus will include some of the effect transport 21 but NEEAP and the new city development plan are not accounted for. It is relevant to show the scale of the upward trend that will result if no action is taken outside of the national and regional policies. The business as usual model in the three sectors are:

6.2.1 Residential

Business As Usual is the continuation of current building practices in relation to the new housing stock and no action on existing housing stock. This means that all new dwellings constructed between 2007 and 2020 will be constructed to Building Regulations Part L 2005. No energy efficient refurbishments are made to the existing housing stock Business As Usual offers a shift in BER to the B3range but there are still significant numbers of E1 rated houses. The B1 shift is mainly made up of newly constructed houses with the corresponding reduction in E1 rated dwellings due to the demolition of older houses. The Business As Usual Scenario does not address the poor energy performance of the existing stock. The numbers of dwellings in the C1 to D2 range remains unchanged.

6.2.2 Commercial (Services and Manufacturing)

This refers to a continuation of the present situation up to 2020, as all calculations for the sector are made per head of employee future trends are dependent on growth in the sector, which at present has stagnated but is expected to continue to rise in the medium term. To this end an estimated employment growth trend was applied to the sector and its future energy and CO₂ trends extrapolated. This produced an increase of 30% in both energy consumption and CO₂ emissions.

6.2.3 Transport

In Ireland the primary energy consumption of the transport sector increased by 167% and CO₂ emissions related to transport increased by 168% between 1990 and 2006. A 2% annual growth is applied for the period 2006 to 2020 according to a forecast made by SEI. The projection of this trend shows that both

primary energy consumption and CO₂ emissions increase by an additional 32% between 2006 and 2020 resulting in a primary energy consumption of 6.6 TWh and 1,640 ktonnes CO₂ emissions respectively.

6.3 Alternative 2 – Short Term Lower Cost Measures

The actions of 'scenario 1' can be described as the 'low hanging fruit' actions, that is, actions that are easy to implement both in terms of cost and complexity. They can help to reverse the upward trend of the current energy consumption in Dublin city and the emissions reductions can be represented as follows:

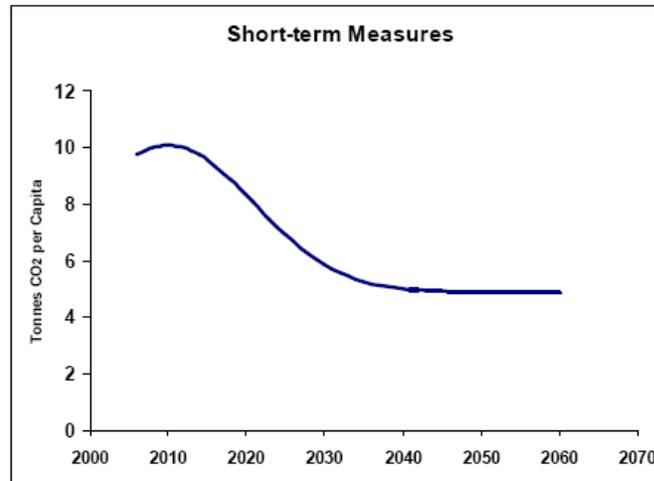


Figure 18: CO₂ savings corresponding to scenario 1 actions

6.3.1 Residential scenario 1 low cost refurbishment and new building standards

Existing Housing Stock

Low cost refurbishment of the existing housing stock consists of two actions; installing low energy light bulbs in every house in the city by 2008 and installing extra attic insulation in every house by 2011. This is completed on a phased basis tackling the older housing units first.

New Housing Stock

All new housing units are subject to improved building standards. All new units constructed prior to 2009 must be of a B1 standard and an A3 thereafter. New housing units will also incorporate renewable energy for space heating and hot water; this is introduced on a phased basis, starting at 10%, culminating to 50% of units by 2020. Scenario 1 also sees the introduction of district heating and group heating systems providing space heating and domestic hot water for 11% of dwellings by 2020. In addition to these actions it is assumed that a 20% reduction, due to user behaviour improvement, can be achieved. This is introduced on a phased basis between 2008 and 2020.

Low cost refurbishment actions and improved building standards offer savings of 18% and 20% of energy and CO₂ respectively. Of this, low energy lighting and attic insulation account for a small part of the savings, while improved building standards and user behaviour account for the remainder. If the reduction in energy consumption due to improved user behaviour was omitted, energy consumption under Scenario 1 would continue to rise, thus highlighting the importance of actions targeting wasteful energy behaviour. This also highlights that improving building standards alone will not achieve significant reductions in energy and CO₂ compared with current consumption levels.

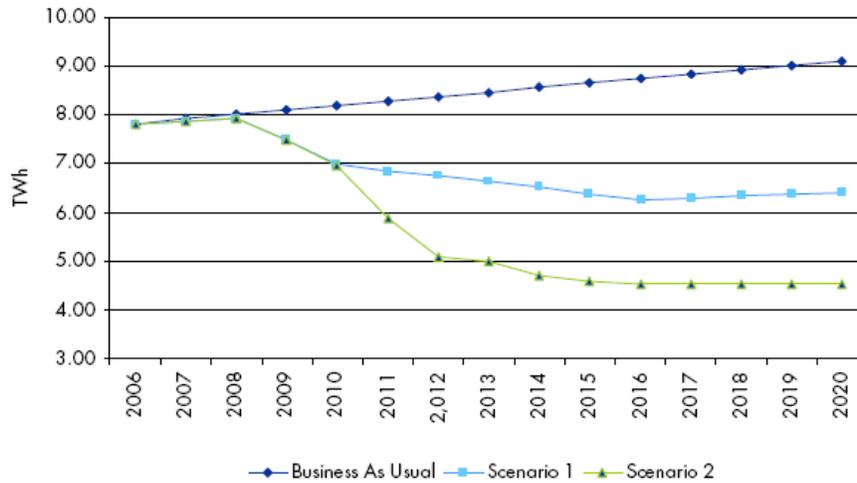


Figure 19: Dublin City Residential Energy Consumption (primary) 2006 – 2020 (1269 Demolitions per Annum), scenario 2 is the full SEAP

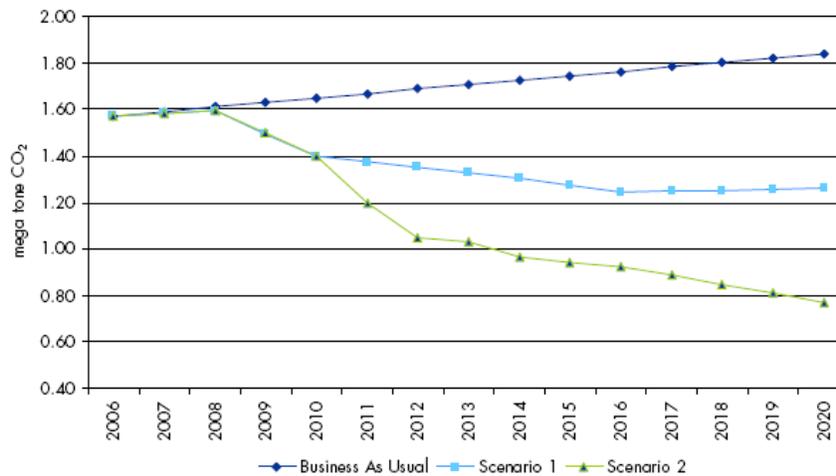


Figure 20: Dublin City Residential CO₂ emissions 2006 – 2020 (1269 Demolitions per Annum) , scenario 2 is the full SEAP

6.3.2 Commercial (Services and Manufacturing) – Scenario 1

Low Energy Lighting and Behavioural Changes

Lighting accounts for between 15% and 50% of total electrical consumption (depending on the activity and based on traditional lighting systems). In this low cost scenario it was assumed that there could be a 10% saving in electricity demand through upgrading lighting systems to low energy fluorescents and spot bulbs. This is a modest assumption compared to larger savings that have been quoted (up to 40% savings on lighting). The new lighting should be installed when previous conventional bulbs have reached the end of their lifecycle. In tandem with an upgrading of the lighting system is the opportunity for behavioural change and training within companies, behavioural change has shown a possible improvement of up to 20% on energy demand. To make this figure more conservative it was assumed that activities such as retail and hospitality would have less control over the energy use compared to office based activities. Therefore a saving of 5% was estimated for all non office based activities in electricity demand and a 20% saving in all office based activity electricity

demand. A saving of 10% in oil and gas consumption was estimated as it was assumed that these fuels were mostly used for space heating. The scenario was gradually introduced over the period of 2009 – 2014 and any electricity savings from a behavioural change took into account the changes to low energy lighting.

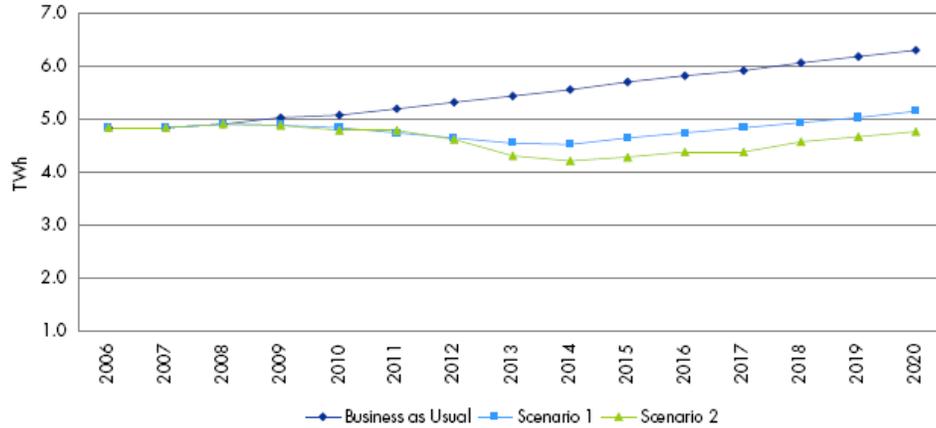


Figure 21: Projections for Energy Demand in the commercial sector showing Business as Usual and Scenarios 1 and full SEAP, 2006-2020

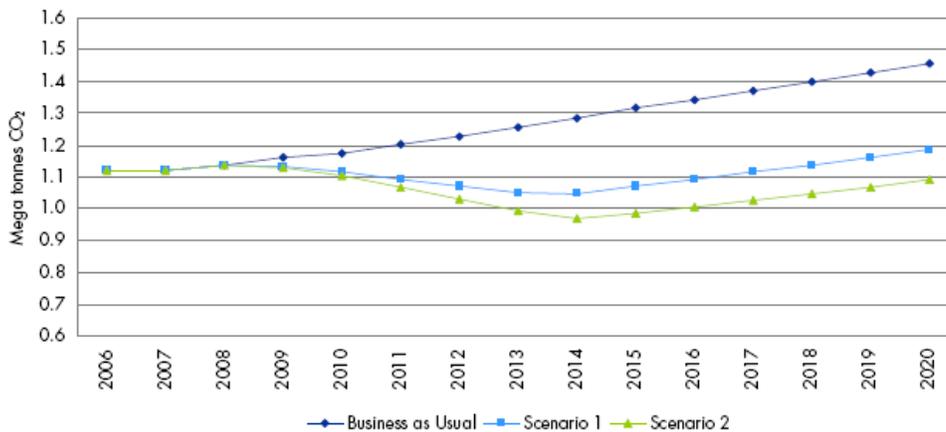


Figure 22: Projections for CO2 Emissions in the commercial sector showing Business as Usual and Scenarios 1 and full SEAP, 2006-2020

6.3.3 Transport – Scenario 1

Workplace Travel Plans

There are only a few workplace travel plans implemented in Dublin because this is a relatively new feature in Ireland. Public sector bodies should be the ones at the cutting-edge, starting the process by establishing successful workplace travel plans for their own staff. Private companies would soon become aware of the benefits of taking the responsibility for their commuting employees, such as retention of key staff. Workplace travel plans can induce a reduction of car trips to the workplace by 15% as international experience shows.

School Travel Plans

Most pupils live within walking and cycling distance of their school. Even so, the share of pupils travelling by car to school (including students travelling by car to university) has increased in the Dublin Region from 20% in 1996 to 30% in 2006. School travel plans can support the reversal of this trend by addressing the travel

behaviour of the pupils. Pilot projects have shown that, depending on the budget allocated, reductions in car use by up to 22% can be achieved. International experiences indicate a reduction of car use by 8-15% on average. The Irish Green Schools, a programme and award scheme that deals with various environmental issues has potential to build the link for the implementation of school travel plans. Schools should be targeted firstly because they function as multiplier and secondly, because the behaviour established in childhood is the key determination of adult behaviour. There is certainly a long term effect; the pupils taken by car to schools today are the car drivers of tomorrow.

Cycling Traffic

The share of people cycling to work or to education has declined in the last years and is now as little as 2% in the GDA and 4% in the City of Dublin . The reasons for not cycling are various as are the initiatives that would motivate people to cycle to work, as a survey on car commuters undertaken by the Dublin Transportation Office (DTO) shows. This indicates that investments in soft measures as well as in hard measures are needed.

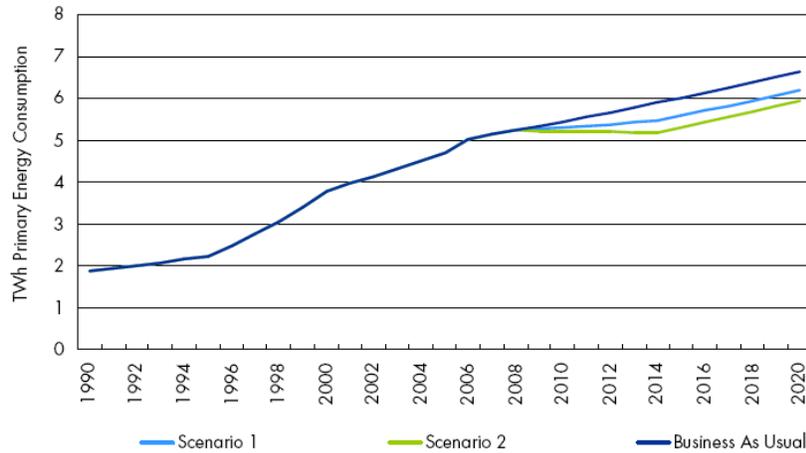


Figure 23: Primary Energy Consumption of Transport in Dublin City 1990 – 2020, Business As Usual, Scenario 1 and Full SEAP

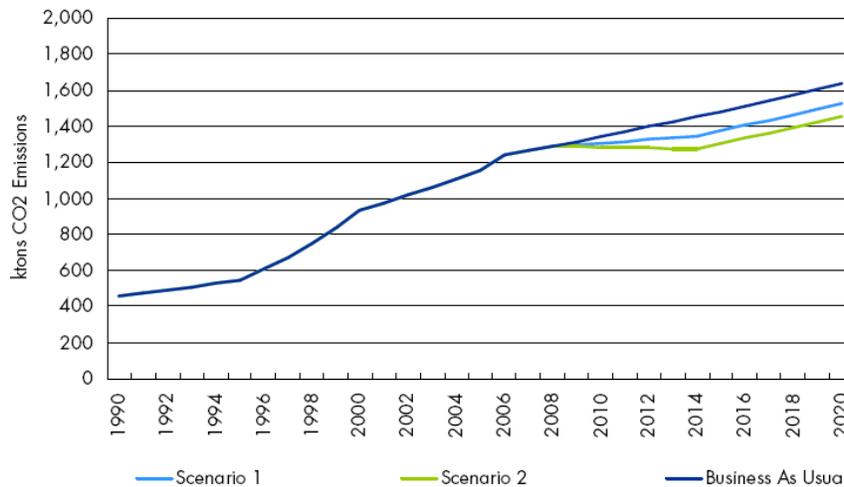


Figure 24: CO2 Emissions of Transport in Dublin City 1990 – 2020, Business As Usual, Scenario 1 and Full SEAP

6.4 Alternative 3 – Longer Term Higher Cost Measures

6.4.1 Residential Sector Higher Cost Scenarios

Existing Housing Stock

A complete refurbishment of the existing housing stock, this involves all the measures from scenario 1 plus high efficiency boilers and energy efficient windows, once these measures have been phased in renewable energy options (such as solar panels) should be rolled out to account for 40% of housing units by 2020.

New Housing Stock

All new housing stock are subject to improved building standards. All new units constructed prior to 2009 must be a B1 and A3 thereafter. New housing units will also incorporate renewable energy for space heating and hot water; this is introduced on a phased basis, starting at 10%, culminating to 50% of units by 2020. Scenario 2 also sees the introduction of district heating for existing dwellings providing space heating and domestic hot water for 30% of dwellings by 2020. A 20% reduction, due to user behaviour improvement, is also assumed.

In order to achieve significant reductions in energy and CO₂ emissions, refurbishment actions as in Scenario 2 must be considered. In Scenario 2 a 42% reduction in energy consumption and a 51% reduction in CO₂ emissions are possible. In addition to the actions adopted in Scenario 1, Scenario 2 also include boiler upgrades, wall insulation, window replacement along with renewable energy and district heating for existing dwellings. The most significant energy savings are gained by changes in user behaviour, followed by actions such as boiler upgrades, wall insulation, improved building regulations and attic insulation. Together, user behaviour and boiler upgrades account for 53% of the potential savings in the residential sector.

6.4.2 Commercial (Services and Manufacturing) Scenario 2

This scenario is based on an upgrade to the heating, ventilation and air conditioning systems (HVAC) as well as improved thermal efficiency of the building fabric. The estimations and technical information are based on a UK model of office refurbishment as no studies have been done in Ireland to date, but the climatic conditions and general fabrics are very similar. Office refurbishment to this level can be highly disruptive to day to day activities and as such it was estimated that only 50% of premises would consider this process and in an ideal situation would take at least 5-6 years to implement. In addition all new build commercial buildings over 1000m² according to variation 22 of the Dublin City Development plan will be required to meet a BER standard of B1 by July 2008 and A3 by 2009. The increase in this efficiency has not been incorporated into future trends of energy and CO₂ but should be noted that this may have a positive affect on these trends.

6.4.3 Transport Scenario 2

In addition to the above actions the following are included in scenario 2:

Eco-Driving

Smart, smooth and safe driving techniques are termed as 'eco-driving' and lead on average to fuel savings of 5-10%. Cost savings and fewer accidents as well as reductions in emissions and noise levels are other benefits. Drivers are in general not aware of the benefits of eco-driving. On the contrary engine idling is a common habit among drivers of private cars, but also among professional drivers such as bus and truck drivers. An awareness and education campaign for the public as well as measures such as eco-driving courses for professional drivers would help to address this wasteful behaviour and to realise the potential for fuel savings of 5-10%. Dublin City Council could also realise these savings by educating its drivers.

Electric Vehicles

There are three types of electric vehicle; battery electric vehicles, hybrid electric vehicles and plug-in hybrid electric vehicles. Battery electric vehicles (BEVs) are powered by electricity, which is derived from batteries in the vehicle, and employ electric motors and motor controllers instead of internal combustion engines. Hybrid electric vehicles (HEVs), in turn, are powered by a combination of electricity and conventional fuels (petrol, diesel) bonding internal combustion engines with electric engines. Plug-in hybrid electric vehicles (PHEVs) are hybrid vehicles with batteries using petrol or diesel engines and stored electricity for electric motors alternatively. All types are more energy efficient than conventional ones and therefore imply reductions of primary energy consumption, fuel costs and emissions; whereas the cuts on CO₂ emissions of BEVs exclusively depend on the carbon intensity of the electricity used for the battery charging. This means that BEVs can be operated at zero emissions provided that the electricity is sourced from renewable energy.

6.4 Assessment of SEAP Alternatives

Below is a table showing the two alternatives and their assessed impact on each environmental receptor, the impacts are represented as

- + for a positive impact
- 0 no foreseeable impact either positive or negative
- potential for a negative impact

Environmental Receptor	Environmental Protection Objectives	Business as Usual Scenario	Scenario 1	Scenario 2
Population and Human Health	Reduce fuel poverty	-	+	+
	Promote healthier commutes through cycling and walking initiatives	-	+	+

<p>Population and Human Health (cont'd)</p>	<p>More compact city to encourage use of public transport</p>	<p style="text-align: center;">-</p> <p>Places of work / education and residences less likely to be within sustainable travel distances of one another</p>	<p style="text-align: center;">+</p> <p>(Through new city development plan) Possible to provide for mixed-use developments in a medium density format, with higher densities along public transport corridors, ensuring that people have the choice to live in close proximity to their work / places of education etc.</p>	<p style="text-align: center;">+</p> <p>(Through new city development plan) Possible to provide for mixed-use developments in a medium density format, with higher densities along public transport corridors, ensuring that people have the choice to live in close proximity to their work / places of education etc.</p>
<p>Biodiversity, Flora and Fauna</p>	<p>Protect and where possible increase areas of biodiversity as a carbon sink resource</p>	<p style="text-align: center;">0</p> <p>Apart from global climatic factors there will be no measurable local impacts from this scenario</p>	<p style="text-align: center;">0</p> <p>Apart from global climatic factors there will be no measurable local impacts from this scenario</p>	<p style="text-align: center;">0</p> <p>Apart from global climatic factors there will be no measurable local impacts from this scenario</p>
<p></p>	<p>Preserve species as indicators for climate change</p>	<p style="text-align: center;">0</p> <p>Apart from global climatic factors there will be no measurable local impacts from this scenario</p>	<p style="text-align: center;">0</p> <p>Apart from global climatic factors there will be no measurable local impacts from this scenario</p>	<p style="text-align: center;">0</p> <p>Apart from global climatic factors there will be no measurable local impacts from this scenario</p>
<p></p>	<p>Protect good air quality status and minimise the output of</p>	<p style="text-align: center;">-</p> <p>There will be an increase in</p>	<p style="text-align: center;">+</p> <p>There will be a decrease in</p>	<p style="text-align: center;">+</p> <p>There will be a further decrease</p>

<p>Air</p>	<p>Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀)</p>	<p>Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀)</p>	<p>Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀)</p>	<p>in Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀)</p>
<p>Climatic Factors</p>	<p>Increase energy efficiency and renewable energy production</p>	<p>- Continued rise in GHG emissions, dependency on imported fuel and increases in Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀)</p>	<p>+ Stabilization of GHG emissions, reduction in Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀) (depending on biofuel used, increases in diesel can lead to increases in (PM₁₀) and this should be noted)</p>	<p>+ A reversal trend of GHG emissions and reductions in Nitrogen Oxides (NO_x) and Particulate matter(PM₁₀)</p>
<p>Water</p>	<p>Minimise GHG emissions</p>	<p>- Will increase GHG</p>	<p>+ Will stabilize GHG</p>	<p>+ Will reduce GHG trends</p>
<p>Material Assets (transport)</p>	<p>Reduce and manage the risk of flooding (through the new city development plan as planning is not the remit of the SEAP)</p>	<p>0 Apart from global climatic factors there will be no measurable local impacts from this scenario</p>	<p>0 Apart from global climatic factors there will be no measurable local impacts from this scenario</p>	<p>0 Apart from global climatic factors there will be no measurable local impacts from this scenario</p>
	<p>To reduce traffic levels by encouraging modal change from car to more sustainable forms of public transport and encourage non-car dependent development</p>	<p>- There will be an increasing trend toward private vehicle use for commutes</p>	<p>+ There will be a stabilization and reduction of private vehicles used for commutes</p>	<p>+ There will be a reduction of private vehicles used for commutes</p>

	<p>Reduce GHG's and other pollutants</p>	<p style="text-align: center;">-</p> <p>Increasing trend in GHG emissions and Nitrogen Oxides (NO_x) and Particulate matter (PM₁₀)</p>	<p style="text-align: center;">+</p> <p>Stabilisation and reduction in GHG emissions and Nitrogen Oxides (NO_x) and Particulate matter (PM₁₀) (depending on biofuel used, increases in diesel can lead to increases in (PM₁₀) and this should be noted)</p>	<p style="text-align: center;">+</p> <p>Reduction in GHG emissions and Nitrogen Oxides (NO_x) and Particulate matter (PM₁₀)</p>
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Table 3: Assessment of SEAP Alternatives

6.4.1 Assessment of the alternatives

Business as Usual (BAU)

BAU sees the trajectory of CO₂ emissions continue along the rising trend line from 1990 to 2006. This scenario amounts to a minimal compliance with legal requirements, with no long-term vision. Although in some cases there is no direct local effect from non implementation, such as in flooding frequency, habitat destruction or species extinction, the SEAP must be viewed in the global hierarchy of GHG reduction. GHG emissions from the city do not have a direct affect on the local climate or cause local flooding; this is a more complex issue of global climatic patterns but non implementation must be seen as an overall rise in GHG concentrations and therefore increases the risk of flooding and biodiversity degradation. Pollutants such as lead, particulates and NO_x will affect the local air quality and so have an immediate measurable affect.

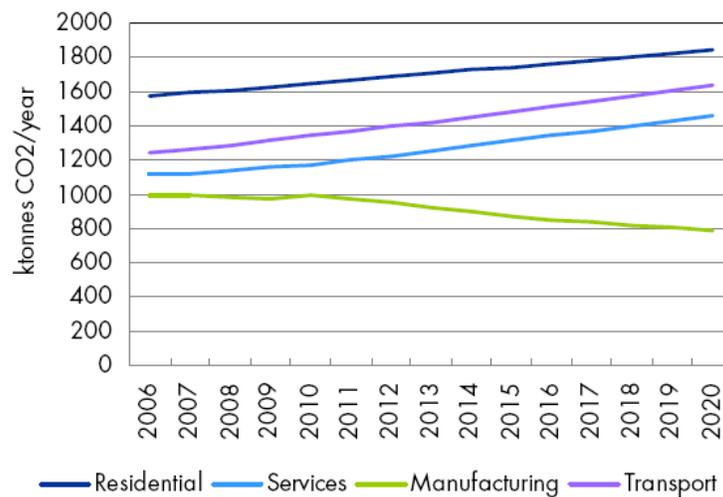


Figure 25: Business as Usual CO₂ projections to 2020

Scenario 1

Scenario 1 comprises 'the low hanging fruit' measures, that are generally very cost-effective (but not at zero cost, as is sometimes assumed) and that can be applied immediately. Again this scenario must be viewed at the global level in terms of GHG emissions and their ability to cause local flooding and biodiversity degradation. This scenario will stabilize but not reverse the upward trend of energy consumption and CO₂ emissions, it should also improve air quality in terms of particulates and NO_x, but it must be noted that some biofuels and diesel have higher particulate emissions than traditional fuel types. This must be considered in any change of fuel and should be assessed in conjunction with the city development plans air quality aims and any associated legal requirements. This will achieve some of the aims of the SEAP but not the longer term vision.

Scenario 2

Scenario 2 includes all the measures listed under Scenario 1, plus major additional measures using existing technologies that are either not common in Ireland at present or are not cost-effective.

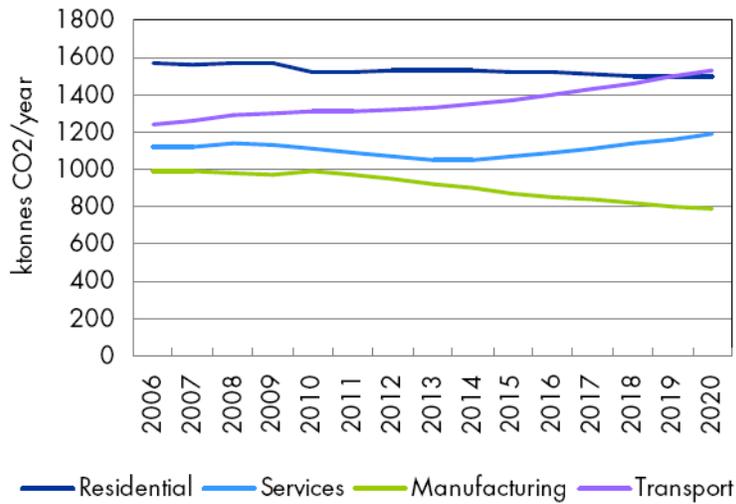


Figure 26: CO2 Emissions Projection to 2020 under Scenario 1

6.5 Preferred Alternative

It is obvious that scenario 1 is preferred to a business as usual non implementation of the plan. Scenario 1 will stabilize the upward trend of CO₂ emissions and energy consumption but will not reverse it. Scenario 1 is a good starting point for the SEAP, indeed the SEAP is built on a combination of scenario 1 and scenario 2, many of the actions in scenario 2 depend on the implementation of the actions in scenario 1 and hence why scenario 2 was not treated as an individual alternative. In a worse case situation the actions of scenario 1 could be used to stop the upward trend of energy consumption, but without the long term infrastructure proposals of both scenario 2 and the national plans of transport 21 et al, then scenario 1 is nothing more than a stop gap solution.

7 Evaluation of the Significant Environmental Effects of the SEAP

7.1 Introduction

The environmental report is required to include information on the likely significant effects of the SEAP on the environmental criteria, in this case population and human health, biodiversity, flora and fauna, air, climatic factors, water, material assets (transport) and cultural heritage. In order to assess the impact a matrix was designed that includes all the environmental objectives of the SEAP and the corresponding actions. The actions were measured against the objectives as to whether they have a positive **+**, neutral **0**, or negative **-**. As a result of this it is possible to identify possible actions that will have significant negative environmental effects and either choose an alternative or design mitigation measures to reduce these.

7.2 Population and Human Health

Nearly every aspect of most plans will have some affect on human health and population as plans are designed with the population of that area in mind. Thus with the SEAP most of the actions will directly or indirectly affect the population, either through altering travel patterns or more directly through health and wellbeing. The actions in the plan that relate to the improvement of residential accommodation and indigenous supply of energy will directly affect fuel poverty and its associated health and issues. Fuel poverty can be defined as *the inability to heat a home to an adequate (ie safe and comfortable) temperature due to low income and energy inefficient housing* (www.combatpoverty.ie) a third factor which should be added to this is the unavailability of a reasonably priced fuel. The SEAP tackles this issue on several fronts, firstly by informing the householder through behavioural campaigns the efficient means to heat their home to an adequate level, secondly by putting forth actions to improve the thermal efficiency of the building fabric which will retain heat for longer periods and reduce heat loss and thus need less fuel to heat. Thirdly by promoting the construction of infrastructure for indigenous sustainable and renewable energy generation gives greater control over the pricing of fuel and less likely to fluctuate according to international markets. The only possible negative effect on human health is the possible rise in particulate matter (PM10) from increased use of diesel and biofuels, this will be dealt with in the Air section. Other positive effects on human health are the reduction in congestion and air pollution through renewable energy generation and modal shift to public transport, in addition the promotion of walking and cycling as a commute option will also have positive health benefits.

7.3 Biodiversity, Flora and Fauna

There are no direct actions in the SEAP that pertain to actually preservation or increase in biodiversity, flora and fauna, that is the remit of the new city development plan and Dublin City Biodiversity Plan. But habitats are vital, in the narrow parameters of climate change, to act as carbon sinks. Carbon sinks are any natural organism that stores carbon either indefinitely or releases it at natural pace, examples of carbon sinks are trees, plants, algae and waterbodies. In addition to storing carbon a lot of these organisms release oxygen thus creating a healthier environment for associated biodiversity. Species within these habitats can also act as good indicators for any climatic fluctuations, a good example is butterfly's who are not tolerant to climate change and thus are a good early indicator of climate change. Climate change is a global issue and weather and climatic cycles act on this level, the implementation or non implementation of a local SEAP will not have any direct affect on local environments in terms of temperature fluctuations, sea level rise, and extreme weather or flooding, thus none of the actions can said to have any effect on Dublin's biodiversity within the parameters

of the SEA but it will go towards our national and international commitments in relation to climate change. In broader terms it will have affect on climate change in general. The reduction of pollutants from inefficient 'dirty' fuel through some of the SEAP actions should have a positive affect on biodiversity as will the reduction in road traffic. Larger projects such as housing refurbishment and district heating will occur in areas that are not habitat sensitive.

7.4 Air

On a local level air, along with human health and transport is one of the environments that may be impacted most by the SEAP, unlike climatic factors that are globally influenced, air quality tends to be impacted most by local emissions. Pollutants such as Nitrogen Oxide (NOx) and particulate matter (PM10) can have direct detrimental affects on biodiversity and human health. The actions within the SEAP will have a mostly positive affect on air quality through the reduction of 'dirty' fuels or technologies towards cleaner renewable sources. Renewable technologies such as solar panels, geothermal and CHP have much lower emissions than traditional technologies and in the case of solar panels, none at all. CHP increases the efficiencies of electricity and heat production and therefore even if using traditional fuels such as gas it will need a much lower quantity of fuel for the same delivered energy. Similarly the improvements in the thermal efficiencies of building fabric and reductions in energy use from behavioural change will also result in less demand. The demand for energy is so intense in Dublin City that it cannot be met by local production and so outlying power generation stations need to fulfill that demand; this means that some of the benefits may not be solely local; this is the transboundary nature of energy and should be seen as a positive impact on a regional level. The sector that has the potential to see the most immediate and obvious positive impact is transport, through actions that encourage modal shift and electric vehicle use it is hoped that there will be a reduction in private car use and thus congestion towards public transport, cycling and walking. It has been seen recently in Dublin City that the altering of traffic patterns, in this case the five axle truck ban from the city centre, can lead to dramatic and positive impacts on air quality. Dublin port should also be examined in terms of air pollution. A point that should be noted is that some fuels although they have less potential to release GHG's they have a higher particulate concentration this is equally relevant for energy production. Measures should be put in place that will ensure that switching fuels to more climatically friendly options does not result in detrimental impacts on local air quality in terms of particulates.

7.5 Climatic Factors

As stated previously climate change is a global issue and weather and climatic cycles act on this level, the implementation or non implementation of a local SEAP will not have any direct affect on local environments in terms of temperature fluctuations, sea level rise, and extreme weather or flooding. But increased emissions of GHG's will impact the general environment and thus should be seen as a 'local' impact. The SEAP is specifically structured to reduce energy consumption and therefore related emissions, the remit of the SEAP is not specifically to reduce GHG's, this is dealt with in the *Dublin City Climate Change Strategy*, but they are closely related and mutely advantageous. All of the actions reduce GHG emissions and energy consumption and none have a negative impact on climatic factors

7.6 Water (Flooding)

The SEAP has no significant effects on water quality, any impacts that may occur will be a positive improvement in water quality due to the reduction in air pollution and it's potential to pollute an aquatic environment. Again the implementation of a local SEAP will have little effect to global climatic conditions and the potential for sea level rise, increased extreme weather occurrences and increased precipitation, the city is

subject to overall global fluctuations. No actions in the SEAP deal with flooding as this is not its remit. No actions within the SEAP have adverse negative impacts on water.

7.7 Material Assets (Transport)

Transport within the city is one of the major contributors to air pollution, noise and GHG emissions, all actions in the SEAP are aimed at the reduction of pollution and emissions and do not deal specifically with noise. All of the actions in the SEAP have a positive or no significant affect on the receiving environment. Larger projects which form part of the SEAP such as Transport 21 are subject to their own environmental assessment process and are not the remit of this SEA.

7.8 Cumulative Effects in Association with Other Plans

The SEAP has been design to complement similar plans on energy and emissions, the actions of the SEAP are informed by Dublin's commitment to the Covenant of Mayors, similarly the monitoring and actions are in harmony with Dublin City Councils Climate Change Strategy. It is difficult to gauge the cumulative effects of the SEAP in association with other plans outside these as localized information on National and Regional plans is unavailable. It can be stated that any cumulative effects will be positive and not impact any of the scoped in criteria negatively.

7.9 Matrix of Possible Environmental Impacts of the SEAP

In order to get an overarching view of the possible impacts the SEAP may have on the receiving environment, it is necessary to create a matrix that will cross reference all of the possible impacts against the environmental objectives of the SEAP, shown in table 2 below, the symbols represent:

- + Positive effect on the environmental criteria
- 0 Negligible or no effect on the environmental criteria
- Negative effect on the environmental criteria

From this matrix of results the determination was made as to the individual action's effect on the environment and subsequently the need for alternative actions or mitigation to reduce any negative impacts.

	Reduce Fuel Poverty	Promote healthier commutes through cycling and walking initiatives	More compact city to encourage use of public transport	Protect and where possible increase areas of biodiversity as a carbon sink resource	Preserve species as indicators for climate change	Protect good air quality status and minimise the output of Nitrogen Oxides (NOx) and Particulate matter (PM10)	Increase energy efficiency and renewable energy production	Minimise GHG emissions	Reduce and manage the risk of flooding	To reduce traffic levels by encouraging modal change from car to more sustainable forms of public transport	Reduce GHG's and other pollutants
Residential Sector Actions											
Improve User Behavior in Energy Use	+	0	0	0	0	+	0	+	0	0	+
Low Energy Light Bulbs	+	0	0	0	0	+	0	+	0	0	+
Attic Insulation in Existing Homes	+	0	0	0	0	+	0	+	0	0	+
All New Houses to be A rated on the BER Scale	+	0	0	0	0	+	+	+	0	0	+
Major Refurbishment of Existing Houses, Including Wall Insulation, Windows, Boilers and Renewables	+	0	0	0	0	+	+	+	0	0	+
District Heating Phase 1, with Renewable Energy Sources	+	0	0	0	0	+	+	+	0	0	+
Commercial Sector Actions											
Behavioral Campaigns to Reduce Energy	0	0	0	0	0	+	0	+	0	0	+
Low Energy Lighting Systems and Controls	0	0	0	0	0	+	0	+	0	0	+
Upgrading of Heating, Ventilation and Air Conditioning	0	0	0	0	0	+	0	+	0	0	+
Insulations of the Fabric of the Existing Buildings	0	0	0	0	0	+	0	+	0	0	+
All New Commercial Buildings Over 1000m2 to be A Rated	0	0	0	0	0	+	+	+	0	0	+
Transport Sector Actions											
Workplace Travel Plans for Commuters	0	+	0	0	0	+	0	+	0	+	+
School Travel Plans	0	+	0	0	0	+	0	+	0	+	+
Cycle Initiative	0	+	0	0	0	+	0	+	0	+	+
Ecodriving Training for Professional Drivers of Buses, Taxis and Trucks	0	0	0	0	0	+	0	+	0	0	+
Electric Cars (including plug in hybrids) at 10% Penetration	0	0	0	0	0	+	0	+	0	0	+

Table 4: Matrix of possible impacts of the SEAP on the environmental objectives

8 Mitigation

8.1 Introduction

After the SEAP has been scoped and initial environmental receptors analysed for their impacts on the receiving environment it is necessary to develop mitigation measures to offset any negative impacts that those actions may have. There were no perceived negative impacts on the receiving environment and therefore mitigation measures are not required.

9 Monitoring

9.1 Introduction

This section sets out the proposed monitoring measures in accordance with Article 10 of the SEA Directive which requires that “significant environmental effects of the implementation of plans and programmes in order, inter alia, to identify at an early stage unforeseen effects, and to be able to undertake appropriate remedial action”. Monitoring is required as part of the SEAP (and the climate change strategy) in order to quantify the impact the actions are having on Dublin’s energy consumption. In addition monitoring systems that have been initiated for the new development plan can be utilized to re-enforce these.

Environmental Receptor	Environmental Protection Objective	Target	Indicator	Data Source	Frequency
Population and Human Health	Reduce fuel poverty	No increase in the occurrence of fuel poverty and ideally a marked reduction	Energy ratings from the (draft) Dublin City Council Housing Action Plan	Dublin City Housing Action Plan	Ongoing
	Promote healthier commutes through cycling and walking initiatives	Extension and improvement of the cycling and walking network	% Change in modal split	Canal cordon count	Annual
			Number of pedestrians and cyclists crossing the canals as measured by the canal cordon survey	Canal cordon count	Annual

Biodiversity, Flora and Fauna	More compact city to encourage use of public transport	Sustainable densities achieved in new residential / mixed-use schemes	Average residential housing densities	Census	4 Yearly
	Protect and where possible increase areas of biodiversity as a carbon sink resource	No adverse impacts on designated habitats or species or any possible carbon sink	Total area of designated sites (Natura 2000 and pNHA's) Total area of Conservation Areas Survey and monitor street trees of Dublin City Total 'green' areas in the city	Dublin City Development Plan	5 Yearly

Air	Preserve species as indicators for climate change	No adverse impact on indicator species	Survey and monitor the extent of invasive species	Dublin City Biodiversity strategy	Ongoing
	Protect good air quality status and minimise the output of Nitrogen Oxides (NO _x) and Particulate matter(PM ₁₀)	No increase in Nitrogen Oxides (NO _x) and Particulate matter(PM ₁₀) From biofuels or other fuel sources	Values of monitored pollutants in the air, including the levels of Nitrogen Oxides (NO _x) and Particulate matter(PM ₁₀)		
Climatic Factors	Increase energy efficiency and renewable energy production	Meet and exceed the targets set down in NEEAP, minus 3% IEE project and increase the citywide renewable share	Total share of renewable energy for heat	Climate Change Strategy and SEAP	Annual

		<p>Fulfill housing action plan in regards to energy efficient refurbishments</p>	<p>Total share of renewable energy for public buildings and installations, including traffic</p>		
		<p>Citywide housing refurbishment program</p>	<p>Number of (social) housing units, public buildings and community centres connected to district and group heating systems</p> <p>Number of CHP units within the private housing and commercial sectors</p> <p>Number of A and B rated buildings within the social and private residential sector and as a percentage of the total stock</p> <p>Average energy consumption of new residential housing stock</p>	<p>Climate Change Strategy and SEAP</p>	<p>Annual</p>
		<p>Citywide behavioral campaign for commercial sector to reduce energy</p>	<p>Number of A and B rated buildings within the commercial and public buildings sector and as a percentage of the total stock</p>	<p>Climate Change Strategy and SEAP</p>	<p>Annual</p>

Water	Minimise GHG emissions	Citywide commercial lighting upgrade	Tonnes CO ₂ /capita/year	Climate Change Strategy and SEAP	Annual
	Reduce and manage the risk of flooding (through the new city development plan as planning is not the remit of the SEAP)	20-30% Reduction by 2020 Compliance with the Floods Directive and with OPW / DoEHLG 'Flood Risk Management in the Planning Process' standards	Number of incidences of flooding to property Number of developments incorporating flood risk avoidance and flood risk alleviation measures categorised under A. 'Hard' defences B. 'Soft' or 'Green' ■ defences including: ■ SUDs	Dublin City Development Plan	5 Yearly

		<p>Avoid new development in flood prone areas or where this is unavoidable require that flood resilient measures be incorporated into new developments</p> <p>Avoid the development risk of destruction of flood defences, flood defence structures and features</p> <p>Identify Sustainable Urban Drainage Systems (and features which are identified as having a flood defence function) in all new developments</p>	<ul style="list-style-type: none"> ■ WADIs ■ Swales ■ Detention Ponds ■ Bio Retention Cells etc <p>Number of flood defences, flood defence structures and features identified in the development plan</p> <p>Number of Sustainable Urban Drainage Systems and flood defence features identified</p>	Dublin City Development Plan	5 Yearly
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<p>Material Assets (Transport)</p>	<p>To reduce traffic levels by encouraging modal change from car to more sustainable forms of public transport and encourage non-car dependent development</p> <p>Reduce GHG's and other pollutants</p>	<p>Extension and improvement of the cycling and walking network</p> <p>Workplace travel plans</p> <p>School travel plans</p> <p>Eco Driving</p> <p>Electric vehicles</p> <p>Bio vehicles</p>	<p>% change in modal split</p> <p>Number of pedestrians and cyclists crossing the canals as measured by the annual cordon survey</p> <p>% Electric vehicles</p> <p>% Bio vehicles</p>	<p>Canal cordon counts and DTO and DOT statistics</p>	<p>Annual</p>
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Table 5: Environmental objectives, targets and indicators with data sources and monitoring frequency

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