

Sustainability Review

**for the
Toronto Waterfront
Revitalization Corporation**



Swedish Expert Team
on behalf of
Swedish Trade Council

December 2004

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Introduction

The Sustainable City Concept and Hammarby Eco-cycle Model (see Appendix 1 and 2) illustrate that there are excellent opportunities to integrate sustainability into all phases of Toronto waterfront revitalization. An integrated systems approach is crucial to ensure that community building actions are combined in a way that optimizes sustainability. In this review, special attention is given to using urban planning as a framework for developing synergies between infrastructure systems and other sectoral systems and strategies.

The following sentences from the *Making Waves*¹ express the City of Toronto's ultimate hopes for the waterfront area:

“A dream of transforming and re-energizing its waterfront into one of the great waterfronts of the world. A dream of building a spectacular gateway to this city, this province and this country.”

Sustainability in its broadest sense may be achieved by *“building successful communities that combine long-term viability with the interlinked goals of economic, environmental and social gains”* (Sustainability Framework, Draft) One challenge for the waterfront area is to express the link between economic, ecological and social dimensions of sustainability in a clear way.

The Swedish Ministry for Foreign Affairs – through the Swedish Trade Council – works in partnership with Swedish industry to share Swedish knowledge and technology worldwide. During a Federation of Canadian Municipalities study tour to Sweden for municipal leaders, the Toronto Waterfront Revitalization Corporation was introduced to an integrated systems approach to designing, building and operating cities, widely practiced in Sweden. The approach is recognized globally as leading the way in innovative and exemplary sustainability practice.

The Swedish Trade Council organized a delegation of university researchers, municipal officials and sustainability practitioners from Sweden to undertake a sustainability review of Toronto Waterfront revitalization to date. The results of the exercise will allow the TWRC to ensure that all planning and projects, both underway and proposed, are consistent with international best practice in sustainability.

The Sustainability review of the waterfront area is to a large extent based on visions and ideas presented in the Sustainable City Concept, launched by the Swedish Ministry of Foreign Affairs, the Swedish Ministry of the Environment and the Swedish Environmental Technology Network (see Appendix 1). The City of Stockholm has recently revitalized a neglected waterfront area- Hammarby sjöstad. This example is a valuable reference case for integrated sustainability design, planning and implementation (see Appendix 2).

The Swedish model of sustainable city building is characterized by a holistic and integrated systems approach to land-use planning, major infrastructure development, building and public space design, cultural features, architectural distinction and community programming and education.

There are excellent opportunities to capture environmental, economic and social benefits using a sustainability approach to waterfront revitalization. This Review contains many suggestions designed to result in strong and sustainable communities on the Toronto waterfront. While the

¹ City of Toronto (2001) *Making Waves: Principles for Building Toronto's Waterfront*

Review team completed a five-day visit to the Toronto waterfront site in October 2004, many of the ideas contained in this review may need to be tested in more detail for feasibility in the local setting.

As well, leadership in sustainability is not absolutely dependent on implementing all of the suggestions included here. What is important is to ensure that a sustainability approach is applied to those activities that do go forward. As well, some of the suggestions in the review may be too costly or unsuitable for implementation on the Toronto waterfront, in the short-term at least. However, it must be borne in mind that it is much more cost-effective to build sustainability into planning and design from the very beginning rather than proceeding with more conventional approaches and then adding on sustainability features at a later date. Cost-effective solutions are, in fact, a vital component of a sustainability approach.

The observations and recommendations in this review are presented according to four areas of focus:

- Precinct Planning (Section 2)
- Municipal Infrastructure (Section 3)
- Building Design (Section 4)
- Implementation (Section 5)
- Exemplary Initiatives (Section 6)

It should be emphasized, however, that all of these areas are interrelated and that a sustainability approach to waterfront revitalization must reflect an understanding of the relationships between different components such as site and building design and decisions concerning major infrastructure.

Suggestions for leading sustainability initiatives are highlighted throughout the review but several major ones are also included in Section 6.

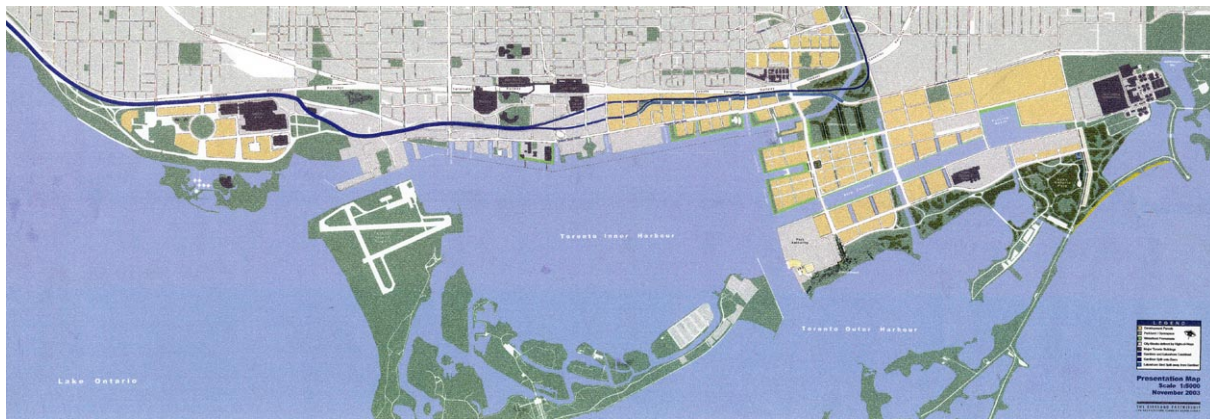


Figure S1 – An overall Plan of the Toronto Waterfront Area

Sustainable Precinct Planning on the Toronto Waterfront

Both the East Bayfront Precinct Plan and the West Don Lands Precinct Plan present a set of proposals and commitments that, to a large extent, are well aligned with sustainability principles. The current plans go a long way towards addressing environmental, social, cultural and economic considerations as part of land use development. At present, there is no direct link between the environmental commitments made in the plans and more detailed site and building design but the plans do appear to support the type of sustainability policy outlined in the TWRC's draft Sustainability Framework. The value of the plans as sustainability tools will

be dependent on future detailed site design and planning and the way in which sustainability principles and practice are integrated into all phases of the revitalization process.

Ideally from a sustainability perspective, precinct planning would not have gone ahead until information was available and decisions made regarding the most sustainable form of major infrastructure across the waterfront. Infrastructure decisions traditionally go hand-in-hand with decisions about commitment of major financial resources and are notorious for requiring years of study and debate before a resolution is reached.

In order for the Toronto Waterfront Revitalization Corporation to move forward with waterfront revitalization, land use planning for the site was the most reasonable path to take. Early work on site planning did not rule out sustainable infrastructure options. It may have added to the costs of implementing sustainable infrastructure solutions due to the need to work with predetermined block and street layouts rather than starting from a completely blank slate.

Almost all of the discussion throughout this review has implications directly and indirectly for the precinct land use plans, which are commented below.

East Bayfront

The East Bayfront Precinct Plan East would be improved by placing the Gardiner expressway underground and decking and building over the railway. These measures would radically change the conditions for land use planning in the northern part of East Bayfront.

In a SWOT-analysis of the precinct plan, strengths and weaknesses are outlined in more detail in Chapter 2. In our view the main strengths of the plan are:

- The current precinct plan presents an excellent environmental program on four charts, including seven principles of sustainable development: energy; harmful discharges; materials; biodiversity; water; indoor environment; human participation. Strategies for achieving each principle are listed.
- Clear and succinct objectives are set for sustainable community services including a proposed affordable housing strategy
- The area between Queens Quay and the waterfront is designed in a manner that supports sustainability.
- The central public transportation spine has the potential to be an attractive link between different areas of the waterfront. Better links to the rest of the City should be explored.
- The prerequisites are in place for using solar radiated energy for heating, lightning and electricity generation and for utilizing wind for natural ventilation and electricity generation.
- The prerequisites for linking the blocks to district heating and cooling systems are favourable due to the high urban density
- There are good options for installing a vacuum transportation system for source separated waste and for installing a dual storm water system
- The zoning of the waterfront promenades is a feature with great sustainability merit.
- The idea of louvered covered walkways that open and close depending on the season is a powerful design concept.

Chapter 2 includes an analysis of some of the weaknesses of the current plan from a sustainability perspective and addresses these weaknesses as a basis for further improvement of the plan.

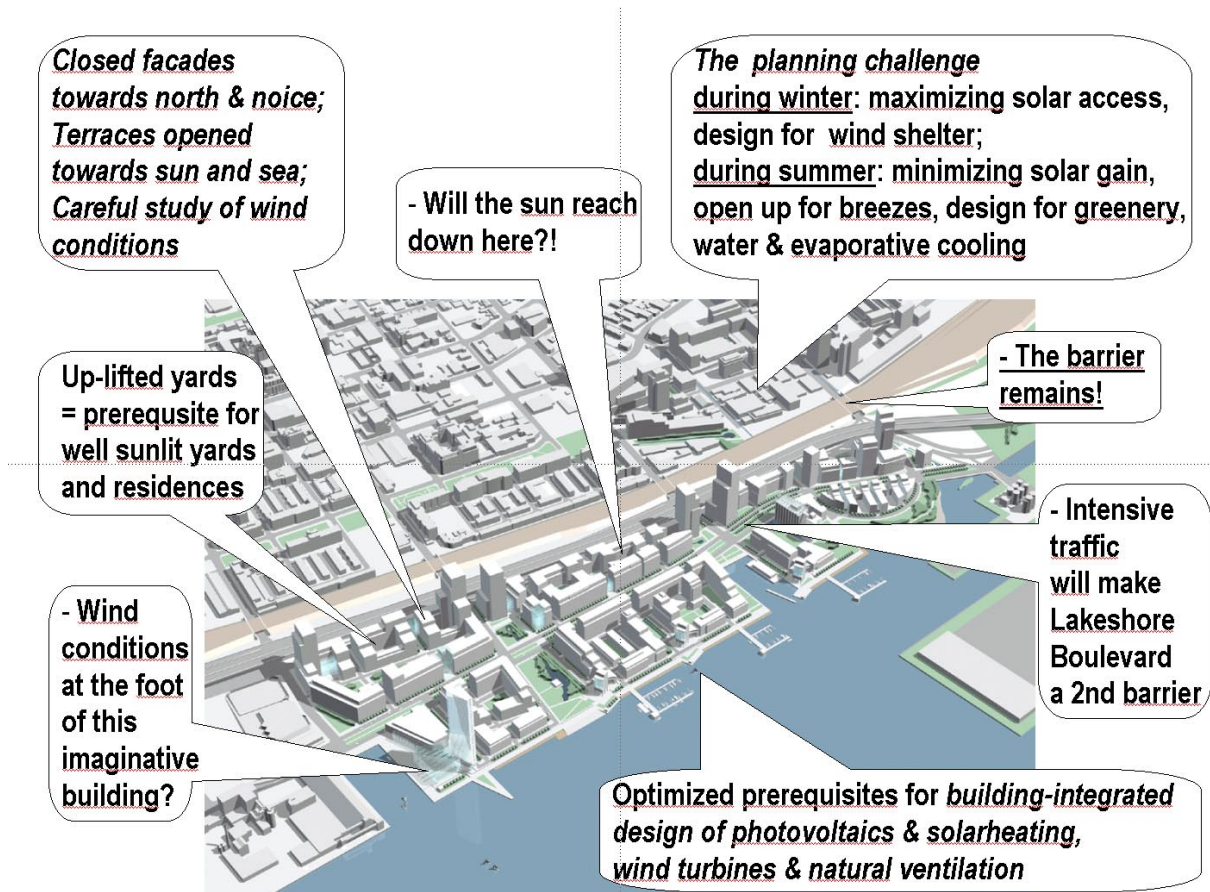


Figure S2 East Bayfront Precinct Plan – some important Issues

West Don Lands Precinct Plan

The West Don Lands Precinct Plan present a well-thought out, almost traditional, street plan that is well adapted to the conditions and requirements of the site. The plan places buildings within the blocks in a way that is compatible with sustainable building practices. The potential for capturing the energy benefits of allowing sunlight into residential spaces and inner courtyards is adequately planned for although passive and active use of solar energy and wind energy are not clearly addressed.

In a SWOT-analysis of the precinct plan strengths and weaknesses are summarized. According to our view the main strengths of the plan are:

- The overall plan includes an analysis, public consultation framework, and proposal for private development guidelines and neighborhood character that set the stage for a strong response to several sustainability issues.
- The design of Front Street and Mill Street with generous spaces for walking and relaxation is a good prerequisite for community vibrancy.
- The northern and western parts of the area are well integrated in the cityscape. The distillery area is an integral part of the plan.
- The recommended transit service with an exclusive streetcar line on Cherry street gives excellent public transportation access to the central part of the West Don Lands.
- The prerequisites for linking the blocks to district heating and cooling systems are favorable due to the high urban density.
- There are good options for installing a vacuum transportation system for source-separated waste in the area.

- There are also good options for installing a dual storm water system.
- The overall landscape design of green spaces especially the Don River Park provides potential for detailed design and for the protection of the area from the eastern bow of the railway.
- The relatively low scaled buildings and closed yards within the blocks may contribute to wind-protected areas. Greenery and trees along the streets contribute to wind protection and good air quality.
- The overall plan provides good potential for expressing sustainability architecturally for example by integrating photovoltaic cells and/or small windmills into the roofs and walls of buildings.

In Chapter 2 some of the weaknesses of the precinct plan are also addressed as a basis for further improvement of the plan.

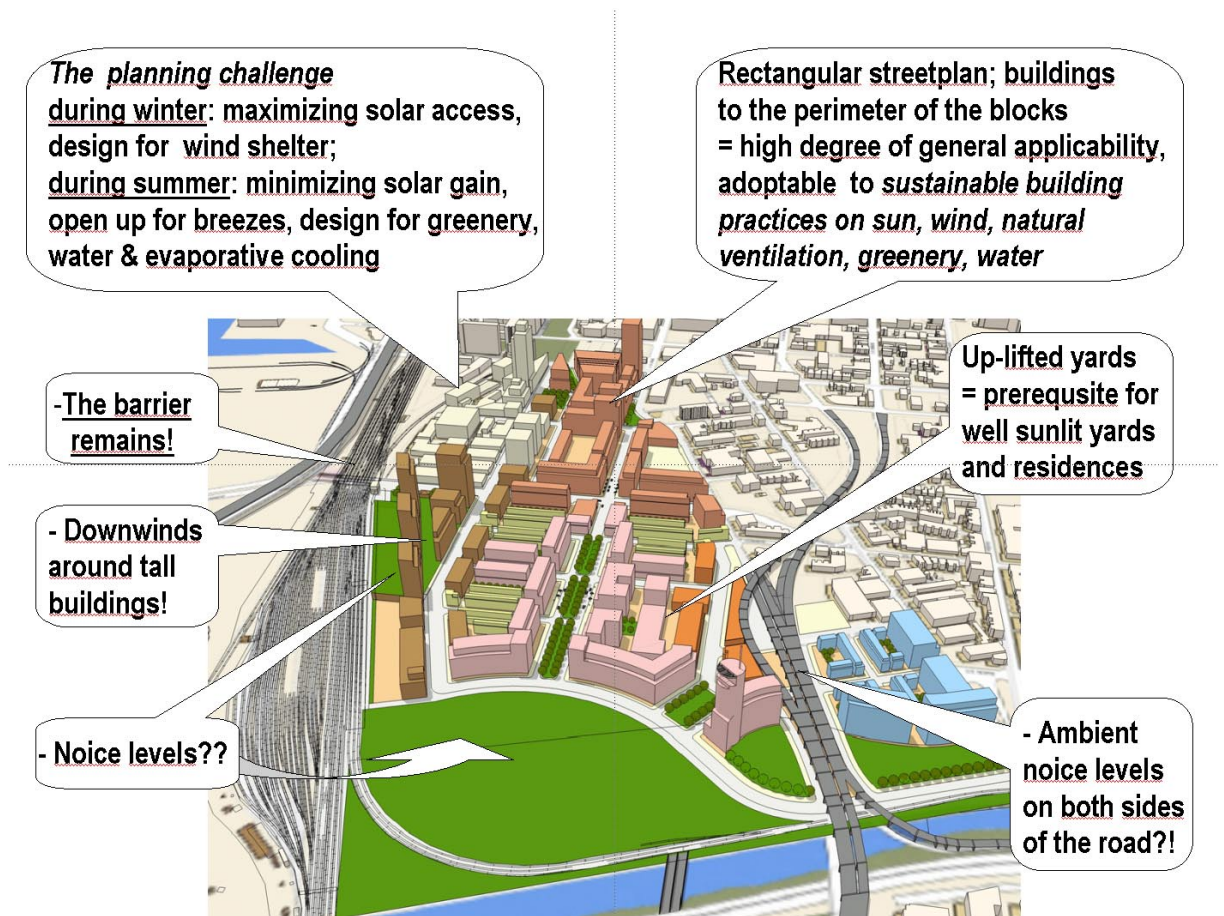


Figure S3 – West Don Lands Precinct Plan – some important Issues

Sustainable Transportation

Sustainability is strengthened when urban planning and design discourage use of the automobile and make public transportation, bicycling and walking more accessible and comfortable. This element of a sustainable city is evident in the current precinct plans. A public transportation, bicycling and walking spine should be developed along the main streets of the waterfront areas – Queens Quay, Cherry Street, Commissioner Street and Unwin Avenue. The public transit stops should be designed as climate-protected mini-terminals with information clearly displayed.

The public transit stops should be located in mixed-use areas with reduced parking ratio but have direct, climatically protected access to cycling and walking links to adjacent blocks. Car-pools for cars fuelled by biogas and bicycle storages should be placed at reasonable intervals throughout the waterfront. Public transit by boat is also possible.

Sustainable Green Areas and Public Spaces

Four notions underlie the achievement of sustainable green areas and public spaces, most of which are addressed in some form in the Central Waterfront Public Space Framework. However, to strengthen the sustainability of the Central Waterfront Public Space framework it is recommended that the following issues be explored further:

- Public spaces and the green areas as social meeting areas.
- The micro-climate and energy savings impact of green areas along the waterfront in tandem with consideration of wind directions in wintertime and provision of shade in the summer time.
- Connecting the waterfront in an east-west direction to the same extent as the north-south axis currently evident in the precinct plans. This could be accomplished through a sequence of public places and green areas as well as the installation of integrated cycling and walking paths.
- Development of the Don River Park as an urban ecological and recreational park and its integration with the Tommy Thompson park and the rest of the waterfront without the highway and railway barriers currently in place.

General Recommendations for Precinct Planning:

Plan the Waterfront Area as Whole – An appraisal of urban planning and urban design concepts on the Toronto waterfront from a sustainability perspective dictates that the separate planning areas (or precincts) on the Toronto waterfront be considered as a single piece of the urban fabric. It is understandable from a phasing and scale perspective why the three precincts of East Bayfront, West Don Lands and the Portlands are being planned separately but maximum sustainability will depend on linking the three waterfront areas when making decisions regarding issues such as energy and transportation infrastructure, and green areas and public spaces.

Remove the Physical Barriers – As has been acknowledged in the Central Waterfront Plan and the plans for East Bayfront and West Don Lands, the waterfront must be better connected to the rest of the City of Toronto. For example, the existing physical barriers such as the highway and the railway corridors that separate the West Don Lands from the city should be removed for example by tunneling the highway and by decking and construction over the railway. This is the type of suggestion that would need to be evaluated locally based on economic, socio-cultural, ecological and spatial sustainability criteria but removing the physical barriers is key to ensuring integration with the City as a whole.

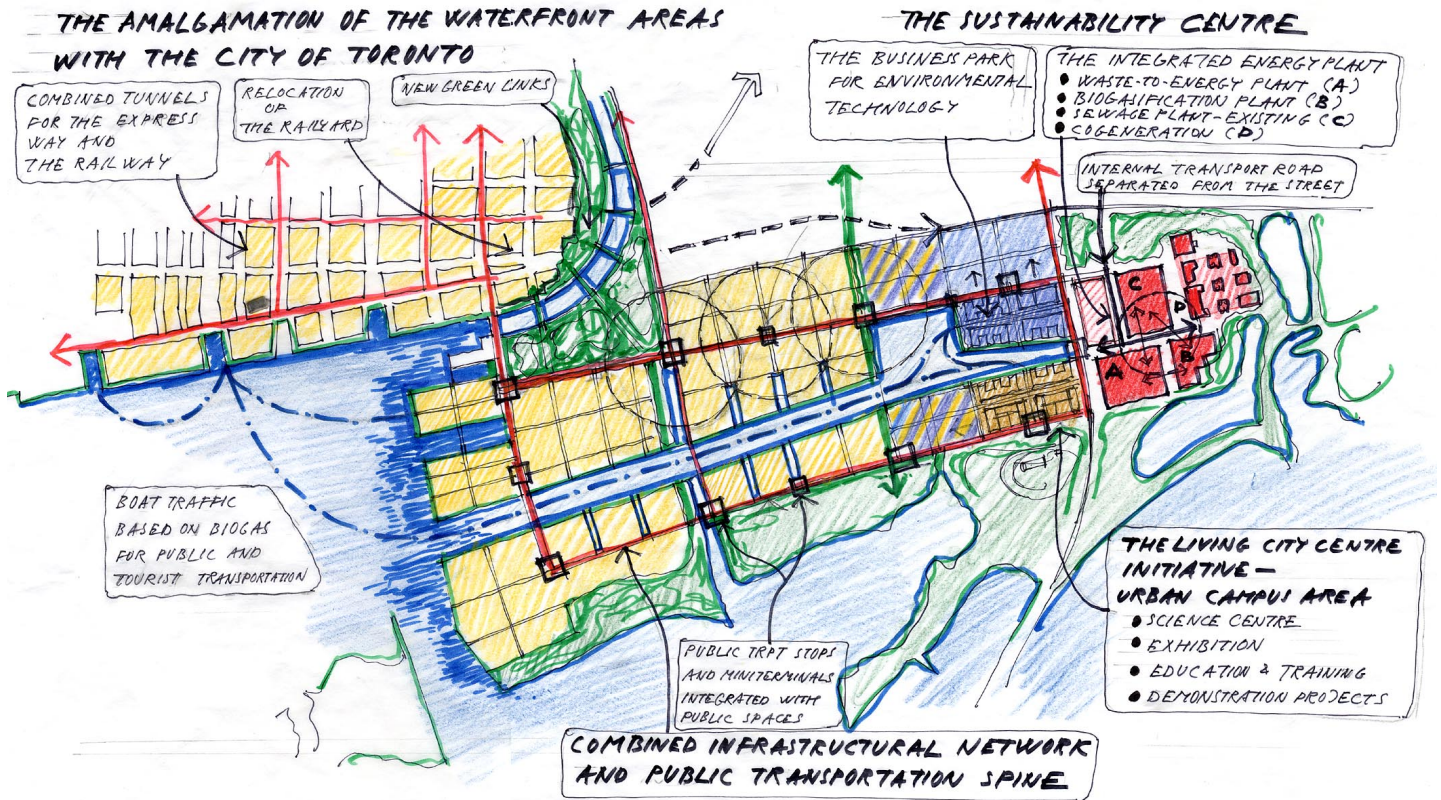


Figure S4 An overall Vision of the Waterfront Area. The figure should not be seen as a detailed land-use planning proposal. It points out some of the issues which are discussed in sections 2,3 and 6 of the report

Sustainable Municipal Infrastructure and District Systems

An eco-cycle model is a strategy for minimizing energy demand and optimizing a coordinated, sustainable energy supply. It is an approach that has been widely applied in Sweden and is relevant for the Toronto waterfront. Initial work relevant to an eco-cycle model can be found in the Toronto Waterfront Scan and Environmental Improvement Strategy Study, particularly the chapter dealing with energy. The model is based on the integration of energy from waste and energy from wastewater as well as from other renewables such as solar and wind energy and energy for cooling from the lake. Three problems have to be considered when developing the model:

- Supply shortage of electricity in the province of Ontario
- Toronto's ongoing landfill in Michigan
- The low costs in Canada for electrical energy as well as for gasoline compared to the European cost levels

Every facet of infrastructure development requires consideration of how to integrate sustainability principles into design, construction and operation.

Building an Infrastructure Network

Sustainability on the waterfront will be strengthened by the placement of an infrastructure network that is coordinated with the precinct land use plans. The infrastructure network should include a series of pipes designed for a variety of uses including district heating and cooling, the vacuum transportation of organic waste, and transport of drinking and wastewater. The pipes should be located side-by-side and placed below traffic and green space corridors. In addition, ducts should be laid for the distribution of energy, broadband communication and other services.

Sustainable Energy

Sustainable energy planning is based on widespread implementation of energy efficiency measures at each stage of revitalization coupled with maximizing the use renewable energy sources and minimizing the use of fossil fuels.

Five steps must be taken on the Toronto waterfront to meet international standards for sustainable energy production and use:

Step 1 – Reduce electricity consumption.

The most important component of a sustainable energy strategy is the application of deep lake water cooling (DLWC) as summer cooling demand in Toronto downtown area constitutes as much as 55% of the total electricity load. As these solutions will drastically reduce electricity consumption in the Toronto area we question the establishment of a new natural gas fired energy plant. Instead, the issue should be to utilize DLWC so efficiently that plants for production of electricity could be closed down.

Step 2 – Increase energy efficiency of the building stock and infrastructure

The four principles for energy planning presented under the heading Building Design (below) and addressed in more detail in Section 4 should be applied.

Step 3 – Apply renewable energy supply technologies

Technologies for renewable electricity generation, such as wind turbines, must be given greater priority. A feasibility study of the concept of wind turbines offshore is of high interest as 25

units producing 250 GWh can meet electricity needs for the entire waterfront if we assume the application of DLWC system for cooling of both apartments and offices.

Step 4 – Evaluate integrated energy production

An energy plant located adjacent to and coordinated with the Ashbridges Bay Sewage Treatment Facility has the potential for producing both heat and electricity from waste and wastewater. The size of the plant should be optimized in relation to other renewable resources such as wind and solar energy. If the energy efficiency of the building stock is increased (step 2), DLWC is applied and wind energy is captured then options for waste-to-energy facilities could be discussed.

Step 5 – Infrastructure for district heating and cooling

Due to the planned densities on the waterfront district heating and cooling are the superior options from both a long-term sustainability perspective and short-term environmental perspective. A district energy system is also the most economically feasible alternative, even with the currently low price of various energy sources in Canada.

Deep lake water cooling is also key to a significant reduction in electricity demand in the summertime.

Sustainable Water Management

The review supports TWRC's plans to extend the existing City distribution network to the waterfront as a whole. Small-scale systems or private systems are not recommended.

Experience in Sweden has demonstrated that household metering systems that track the quantity of hot and cold water used and provide that information immediately back to the household can have a dramatic effect on reducing water consumption. The Ashbridges Bay wastewater treatment plant is a well-functioning secondary treatment plant with a capacity to receive water from waterfront communities. For the Toronto waterfront at large, it is suggested that:

- systems for capturing the nutrients at the plant are investigated, and that experiences from other countries are studied;
- there is little to be gained from separating urine or black water systems in new waterfront buildings. However, the technology is suitable for inclusion in demonstration buildings in each precinct.
- a program is launched with the objective of tracing sources of environmentally hazardous substances that end up at WWTP, with a subsequent action plan to eliminate or reduce these sources.

With respect to stormwater management, a dual stormwater system is proposed. The main advantages are:

- The polluted stormwater from traffic areas can be treated in properly designed oil separators and settling tanks underground.
- The relatively clean water from roofs and open spaces can be treated in a pond, inside or outside the planned flood protection berm in West Don Lands. The ponds could be designed as an integral part of the green spaces across the site.

Sustainable Waste Management

There are already existing and proven systems for source separation of packaging, paper,

cardboard and organics in place in the City of Toronto. Some of the systems have to be further developed, especially the source separation systems for apartment buildings. In new areas, such as the Toronto Waterfront, it is recommended that a centralized vacuum collection system (CVC-system) be installed for the collection of waste and separated fractions. A preliminary environmental impact analysis comparing the operational impact of a CVC-system with conventional rear loading waste collection trucks for the area shows that the air emissions, the traffic load and the ground level area needed will be considerably less if a CVC-system is used.

There will be a need for an increased capacity of biological treatment as a result of the increasing collection of source-separated organics. Locating a biogasification plant in Portlands would give a total capacity in Toronto for the biological treatment of about 300,000 tons of organics, locally and in central treatment plants.

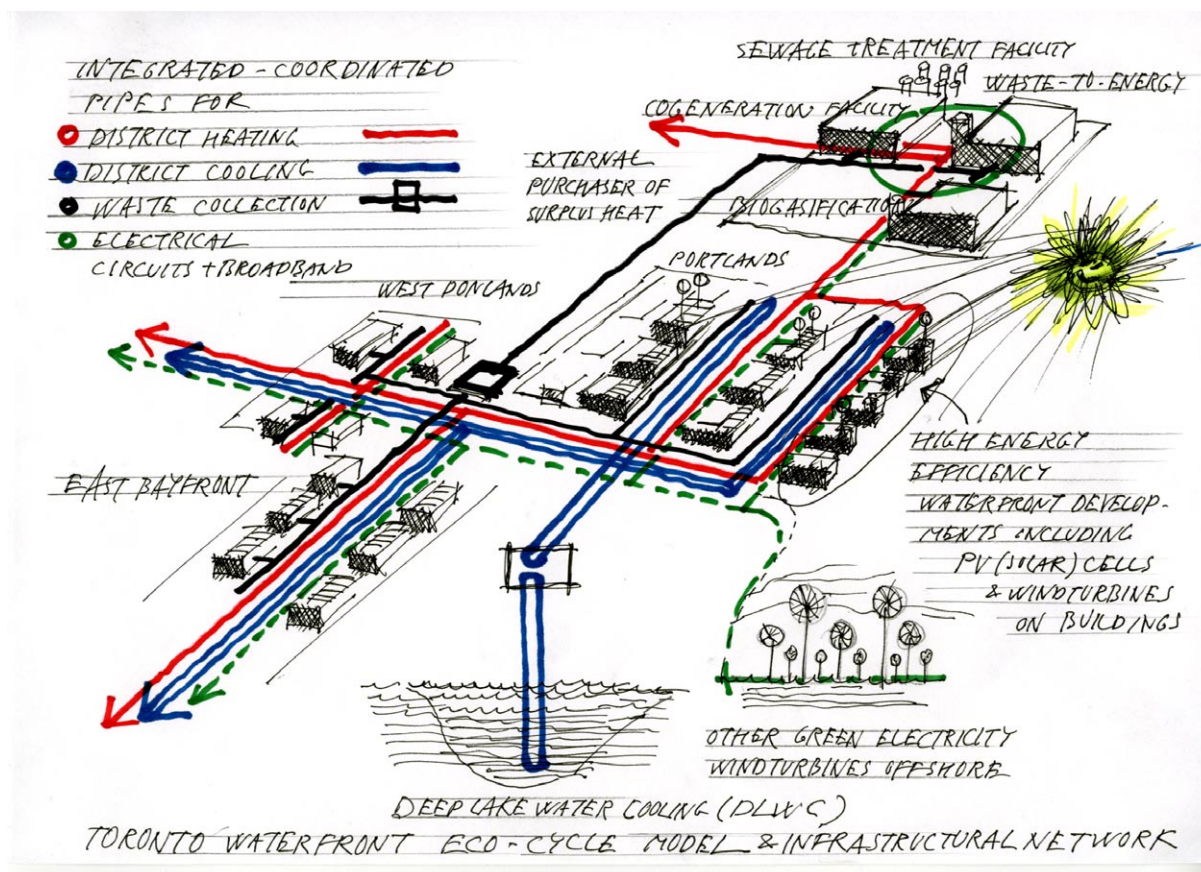


Figure S5 The proposed integrated Infrastructure Network for the entire Waterfront

Sustainable Building Design

The opportunity to achieve high standard sustainable buildings across the site is dependent on integrating sustainable design principles into the detailed planning for the precincts and site-wide infrastructure and in identifying and implementing a suitable set of sustainable building standards for all built form on the waterfront.

In general, the sustainability of buildings is related to:

- Environmental impact caused by **energy consumption during operation**;
- Environmental impact caused by **materials use**, including waste treatment, during construction and operation;

- Use of **environmentally harmful materials** during construction and operation – materials harmful to ecosystems and human health; and
- Impact on **air quality and noise level** in homes and premises, caused by the design, construction, operation and maintenance of buildings elements and systems.

The **energy issues** are addressed in the planning and infrastructure development stages through:

- Layout of the areas and its buildings, streets and squares with regard to sun and wind;
- Minimization of energy demand by way of architectural means;
- Use of renewable energy sources, with priority for passive solar systems and for active solar systems.
- Use of best available technologies for meeting energy efficiency goals.



Figure S6 A Swedish Reference Example of Sustainable Building Design: Gårdsten in Gothenburg and Mälarstrand in Stockholm

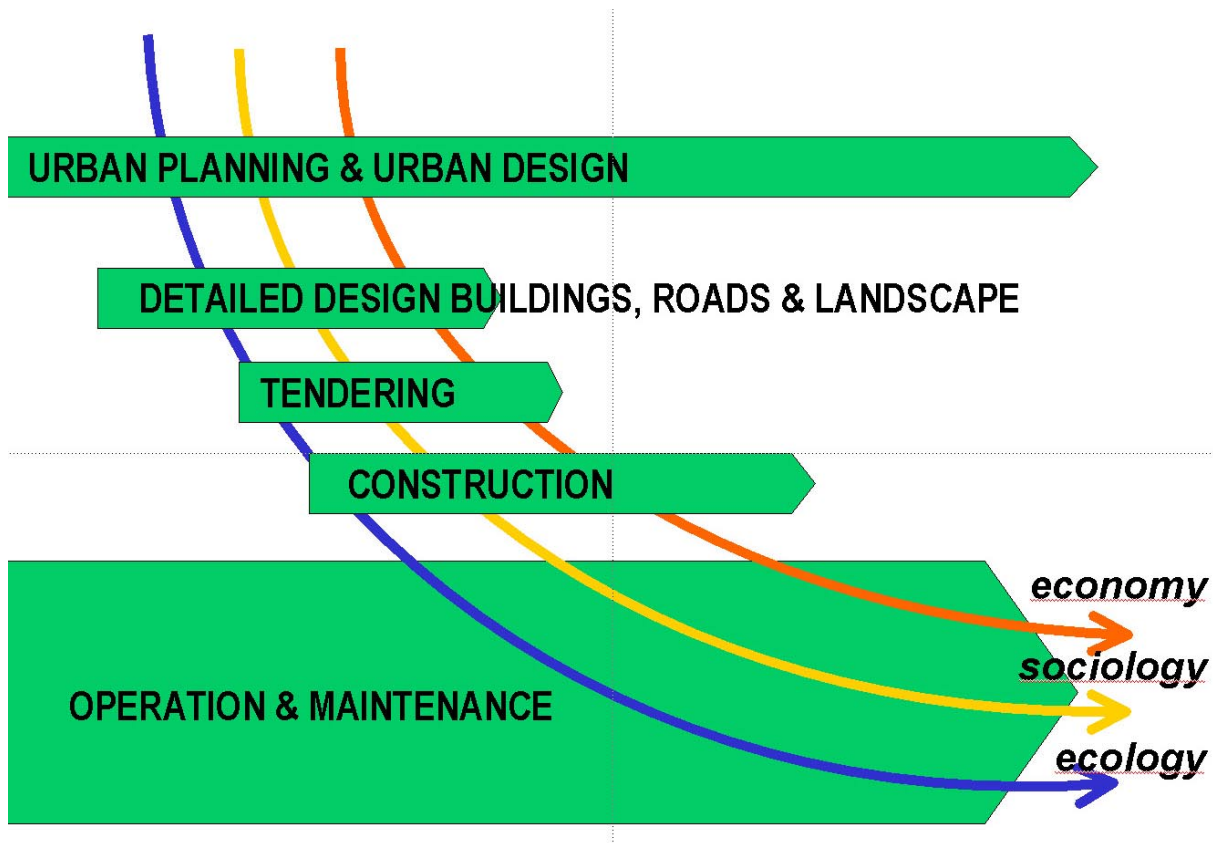


Figure S7 – Sustainability Issues have to be integrated in all Phases of the transformation Process

Managing and Implementing Sustainability

The TWRC Sustainability Framework is the crucial document for achieving the goal of making the city’s waterfront both a national and a global model for sustainability, setting new standards for best practices not only in Canada but throughout the world. The Framework presents a broad and holistic sustainability vision, a wide analysis of the sustainability challenge and a concrete action plan with important guidelines for the Toronto Waterfront Area.

Support for the Sustainability Framework from the three governments is a prerequisite for success. It is also essential that a change of government and short-term policies do not interfere with the TWRC’s sustainability policies or process for sustainability implementation.

It is recommended that a summary of policies, goals and targets contained in the Sustainability Framework be produced and updated at regular intervals over the next 20 years. The essential messages of the framework must be clearly and succinctly communicated to assist the public and other major players on the waterfront with understanding and remembering the TWRC’s sustainability objectives. The Swedish Sustainable City concept may be useful as a source of inspiration on how to introduce the framework to a wider audience.

In Section 3 of the framework, it would be useful to separate objectives and targets from proposed actions and technical solutions. This will allow development of alternative innovative technologies and strategies beyond those currently known.

The specifics of the "practical integration of sustainability issues into all phases of the waterfront revitalization process" need to be developed further. It is important to identify the crucial sustainability issues in each phase of waterfront development such as: comprehensive and detailed urban planning and design, design, tendering and construction of buildings, roads and parks and maintenance and operation. A sustainability checklist should be developed for each phase. The checklist for *Hammarby sjöstad* could serve as a model for this task. It is, however, important to point out that the development of the checklist should be part of an intense dialogue between the local experts and stakeholders in order to take local conditions into account.

It is sometimes difficult to directly transfer detailed technical solutions developed in one context to another due to differences in institutional, economical and social conditions. Strategies, approaches and working tools, however, can more easily be used in different contexts as they focus more on the process, the dialogue, desired outcomes and the general working procedure than specific local details.



Figure S8 – Swedish Reference Examples of Exhibitions communicating Sustainability Issues – The Information Centre of Hammarby Sjöstad and the World Culture Museum in Gothenburg

Exemplary Sustainability Initiatives

A *Sustainability Center* should be established in the Portlands area based on an integrated energy plant and based on the eco-cycle principle. A business park focused on environmental and energy technologies and an urban campus area based on the Living City Center initiative should also be developed as integral parts of this centre. By locating the center physically at the site of the Ashbridges Sewage plant this area at the far end of the Portlands will be a focal point for sustainable urban development that will contribute to the overall urban quality of both the waterfront areas and the City of Toronto.

The three elements of the center reflect economic- technological, socio-cultural and ecological perspectives on sustainable urban development. The energy plant includes production of energy for heating and electricity (cogeneration) from renewable resources such as waste, wastewater or bio-fuels combined with solar energy and wind-energy from wind turbines offshore. The emissions to the surrounding environment can be reduced to a negligible level by modern technology. The size of the plant can be optimized in order to cover the needs of the waterfront development or additionally to supply energy for other parts of the City of Toronto.

The business park can practically illustrate that environmental protection and energy efficiency can promote economical growth and be a vehicle or lever for economical progress.

A waterfront campus of the Toronto and Region Conservation Authority's *Living City Centre* initiative could be seen as an urban satellite of the main campus area north of the City of Toronto. A science center, exhibitions, education and training functions as well as demonstration projects for objectives such as renewable energy in connection with the energy plant should be developed and built. The centre could be the place where sustainability demonstration projects for the entire waterfront area are organized and coordinated. Citizens of Toronto, the region, the province, the country and the rest of the world could be drawn to the waterfront to see the on-going, innovative examples of sustainability in action.

Concluding remarks

It has been a real challenge for the Swedish Expert Team to evaluate the comprehensive and excellent planning, design and sustainability policy documents prepared for the Toronto waterfront. In our opinion, the basic approach to waterfront revitalization is sound and, in most ways, is consistent with high standards for sustainability

We have tried to emphasize the issues that we have found critical for both short-term and long-term success towards the ultimate goal of becoming a leading edge sustainability example for the world. Our main efforts have focused on:

- Appraisal of the precinct plans as they relate to integrated land-use, infrastructure, transportation, landscape and buildings vis-à-vis the economic, socio-cultural and ecological aspects of sustainability
- Providing suggestions and examples of procedures, programs, methods and tools for achieving sustainability on Toronto's waterfront.
- Identifying leading edge sustainability initiatives for the waterfront such as the integrated infrastructure and energy approach focusing on the synergies between waste, water and energy and the interplay with high energy efficiency developments and renewable energy resources such as wind and solar energy

We hope that some of our recommendations will contribute to the process of integrating sustainability issues into all phases of waterfront revitalization. We fully realize that ideas with roots in a European and Scandinavian context may not so easily be adapted in a Canadian context with its differing legislation and policies and differing local conditions. We would consider it a honour if there were potential for further dialogue and exchange of experiences between Sweden and Canada in the effort of transforming and re-energizing the Toronto waterfront into one of the great waterfronts of the world and to make the dream sustainable in its broadest sense.

1. Introduction

1. Introduction

1.1 Background

Toronto is a culturally diverse Canadian city of over 2 million people located on the banks of Lake Ontario, in northeastern North America. Like many cities situated on water, Toronto's waterfront has historically been very important to the city. Over time, the area of the city adjacent to the lake has shifted from being the focus of industrial and economic activities to becoming a part of the city characterized by tracts of abandoned, and in some cases, contaminated land. Access to most of the water's edge is not easy and it has often been said that over the last fifty years the City has turned its back on the waterfront.

In 2001, the Federal Government of Canada, the Province of Ontario and the City of Toronto established the Toronto Waterfront Revitalization Corporation (TWRC) to:

Transform the Toronto waterfront for the use and enjoyment of the people of Toronto, Ontario and Canada, to foster economic growth and to re-define how the city, province and country are perceived by the world.²

The City Planning Division within the City of Toronto has completed a general plan focused on 800 hectares along the Central Waterfront³ that anticipates over 40,000 new housing units for over 68,000 people. The TWRC has been carrying out more detailed planning for several districts within the waterfront area and work has also begun on energy and transportation strategies along with parks and open space planning.

Implementing Sustainability

The TWRC has recently completed a draft sustainability framework that lays out a set of principles, targets and actions for ensuring that sustainability principles are integrated into all facets of waterfront revitalization. The TWRC, along with the three levels of government involved in revitalization efforts, is strongly committed to maximizing the sustainability opportunities on the Toronto waterfront. The TWRC views a sustainability approach as the only way to ensure innovative and progressive waterfront revitalization that will result in dynamic livable communities that provide a wide range of economic, environmental, cultural and social benefits to the people of Toronto, the province and to Canada as a whole.

At the time the three levels of government gave their commitment to waterfront revitalization, several waterfront projects were launched- largely independently of each other - before a senior management team was put in place. These projects began before corporate policies on sustainability were developed.

Swedish Involvement in the Sustainability review

The Swedish Ministry for Foreign Affairs- through the Swedish Trade Council- works in partnership with Swedish industry to share Swedish knowledge and technology worldwide. During a Federation of Canadian Municipalities study tour to Sweden for municipal leaders, the Toronto Waterfront Revitalization Corporation was introduced to an integrated systems approach to designing, building and operating cities that are widely practiced in Sweden. The approach is recognized globally as leading the way in innovative and exemplary sustainability practice.

² Toronto Waterfront Revitalization Corporation (2001). Corporate Mission Statement

³ see City of Toronto (2003) Making Waves: Central Waterfront Secondary Plan, (http://www.toronto.ca/waterfront/waterfront_part2.htm)



Figure 1:1 The Sustainable City – A Systems Approach on Sustainability (see Appendix 1 for further presentation)

The Swedish Trade Council has organized a delegation of university researchers, municipal officials and sustainability practitioners from Sweden to undertake a sustainability review of Toronto waterfront revitalization. The results of the exercise will allow the TWRC to ensure that all planning and projects, both underway and proposed, are consistent with international best practice in sustainability.

1.2 Purpose of the review

Two main tasks were completed:

A review of sustainability opportunities across the waterfront from the perspective of infrastructure and related planning for energy, waste, water and wastewater, and transportation. The emphasis is on how to combine infrastructure systems to maximize economic, environmental and community benefits. The principles driving the completion of this task are consistent with the relevant objectives, targets and actions within the TWRC's draft Sustainability Framework.

An appraisal of the West Don Lands Precinct Plan and of the East Don Lands Precinct Plan to determine the extent to which each one supports the TWRC's sustainability goals and the opportunities for maximizing sustainability as determined during Task 1.

An overall focus of the work was to identify what it is possible to do to strengthen the integration of sustainability in all planning, design, tendering, construction and operation. The starting-point for the work was the comprehensive material already produced. From there the approach was to try to identify relatively new or refined strategies and technical solutions for achieving sustainability on the waterfront from the short-term, medium-term and long-term perspectives.

1.3 Evaluation strategy

In order to fulfill the overall objective of the review to maximize the sustainability opportunities presented by the Toronto waterfront we have applied an evaluation strategy that is primarily based on a systematic methodology for sustainable spatial and urban planning and combined that with the conceptual framework of "the Sustainable City" project.

The following steps have been carried out during the review. Each step includes systematic benchmarking activities, best-practice examples of methods, tools, solutions and systems from Sweden as well as analysis and suggestions regarding how to implement Swedish experience.

Step 1: Institutional arrangements and policies for the future

Step 2: Analysis of external and internal conditions

Step 3: Formulation of overall visions and goals, objectives targets and indicators

Step 4: Further development of planning proposals, technical systems and technical solutions

Step 5: Analysis of the consequences of plans, programs and projects (strongly linked to Step 3)

Step 6: Strategies for implementation of plans and projects

Each step may be applied to the following areas; urban governance; community planning; community consultation; systems integration; transportation and traffic; parks and open spaces; energy infrastructure; integrated waste management; water and waste water; soil remediation and building and site design.

1.4 Organization

The Swedish project team includes the following five experts:

Prof. Ulf Ranhagen, Technical University of Luleå and chief architect at SWECO FFNS, Team leader for the Swedish expert group

Mr Håkan Rylander, CEO SYSAV and President ISWA 1996-98

Ms Kerstin Blix, Senior Advisor, the National Rail Administration (former Environmental Manager, Hammarby Sjöstad)

Mr Henrik Berg von Linde, Senior Architect and expert on sustainable buildings, SWECO FFNS

Prof. Per-Arne Malmqvist, University of Chalmers in Gothenburg, Head of the MISTRA Urban Water program

Mr Rutger Engvall, Vice President of the Swedish Trade Council in Stockholm has been the Head of the Swedish Delegation and has also been deeply involved in the planning and organization of the review in collaboration with Mr Johan Ögren, President of the Swedish Trade Council in Canada and Angelica Ingerdal at the Swedish Trade Council in Stockholm.

Other experts who have been consulted are:

Prof. Thorbjörn Andersson, University of Life Sciences, Ultuna

Mr Gunnar Nordberg, Master of Engineering and energy expert, SWECO Energuide

Mr Jonas Thörnblom and Mr Yngve Forsgren, ENVAC

Mr Björn Kvist, Master of Engineering and expert on tunnel construction, SWECO VBB

Mr Sverker Hanson, Master of Engineering and expert on traffic planning, SWECO VBB

Our main contact persons at TWRC have been Mary MacDonald, Director, Sustainable Development Systems and John Campbell, President and CEO of TWRC
 Robert W. Webb, Senior Vice President of Marshall, Macklin Monaghan has been involved in the discussions of the technical parts of the material. During our visit to Toronto in October we took part of several presentations/discussions, including but not limited to:

- The precinct plans; Pino Di Mascio and Joe Berridge, Urban Strategies, Joe Lobko UDA associate
- Municipal Services and transportation; Steve Willis, Marshall Macklin Monaghan, City of Toronto staff and Province of Ontario staff
- Natural Heritage Issues across the waterfront including Aquatic and Terrestrial Habitat
- Toronto and Region Conservation for the Living City
- Enwave District Energy Limited

1.5 Implementation of the Review

The work was carried out during October – December 2004 in the following phases:

- Phase 1 Preparation
- Phase 2 Local study
- Phase 3 Conclusions
- Phase 4 Final delivery

In the following figure presents major tasks for each phase of the work:

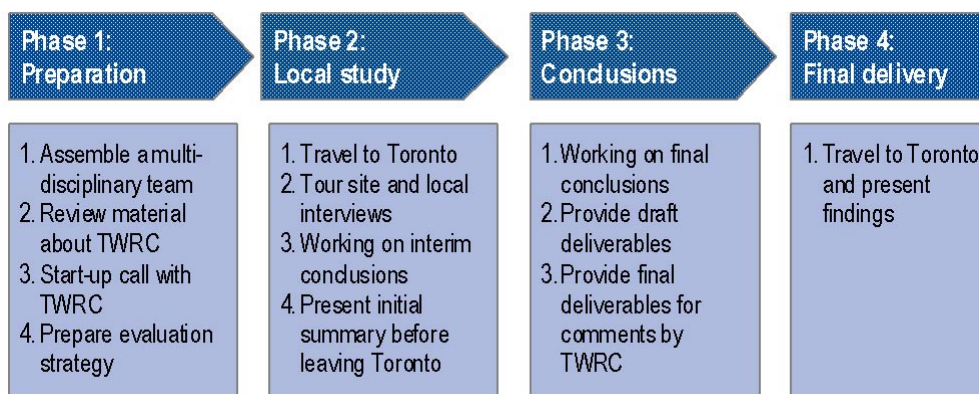


Figure 1:2 Major Tasks for each phase of the Work

2. Sustainable Precinct Planning on the Toronto Waterfront

2. Sustainable Precinct Planning on the Toronto Waterfront

To begin, it is important to realize that the sustainability of the precinct plans will be determined by several factors. For example, the sustainability of a new building or block of buildings on the waterfront will be influenced by the extent to which sustainability principles have been incorporated into site planning, infrastructure planning, waterfront-wide planning and prevailing City of Toronto plans and policies as well as the plans and policies of provincial and federal agencies. *The sustainability potential for the two precincts are thus dependent on a coordinated infrastructure concept including an integrated energy concept for the waterfront – concepts which have not yet been developed.* Therefore, as commented on in more detail in Section 3, *the sustainability of these concepts and their application to precinct planning cannot currently be evaluated.*

An evaluation of the potential for sustainability and sustainable buildings within the context of the West Don Lands and East Bayfront precinct plans has to take into account all aspects of sustainability, that is, environmental, economic, social and cultural. However, *this part of the review will to a large extent be confined to the technical aspects of environmental performance evaluation*, when commenting on the proposed built environment of the two precinct plans. At the end of this section, we put forward general ideas concerning sustainability issues in a broader sense for the waterfront as a whole.

Secondly, the sustainability of the precinct plans is, in part, dependent on the environmental programs laid out in the two plans. The **East Bayfront** Precinct Plan presents a well thought-out *environmental program* on four charts, including seven principles of sustainable development: energy; harmful discharges; materials; biodiversity; water; indoor environment; and public consultation. Proposed strategies for implementing each principle are listed. The **West Don Lands**, on the other hand, presents one chart on the theme of sustainability, which mainly refers to future work to be done according to the TWRC Sustainability Framework. (The expert group finds the TWRC draft Framework, as commented on in Section 5 of this review, to be an excellent, carefully prepared document.)

The environmental programs, such as the one in the East Bayfront plan and in the TWRC Framework, are indispensable prerequisites for sustainability planning and design as are a waterfront-wide infrastructure plan that includes a strategy for achieving sustainable energy objectives. Our judgment is that there are good options for strengthening the connections between the proposed environmental programs and the two precinct land use plans.

2.1 East Bayfront Precinct Plan

The East Bayfront area has extraordinary sustainability potential, not only with regard to its lakeside location and view, but also due to wide exposure to the south. The extensive southern exposure provides excellent access to energy from the sun, which is strengthened by the sun's reflection in the nearby water. The precinct is also well-positioned from the perspective of wind power and natural ventilation.

The East Bayfront Precinct Plan would be improved with the removal of the Gardiner Expressway and the railway. An underground localization of the Gardiner expressway and a railway tunnel or decking of the railway would radically change the conditions for the layout

of the blocks in the northern part of East Bayfront. The Bayfront area is influenced along its entire length by the Gardiner expressway which means that the northern blocks are seemingly jammed, affected by traffic noise and traffic exhausts.

The review team felt that the building schemes for Option A, B and C presented in the model photos and discussed in accompanying written material give the impression of being rather roughly outlined.

However, it is possible to interpret that the plan proposed relatively low buildings along the shoreline and successively raised building heights to the north, allowing views over Lake Ontario and allowing sun into the buildings. Car parking under raised yards in the northern part of the blocks raises the above ground yards into the sun. Closed, wind sheltered yards are to be combined with sightlines over the lake. The possibilities of passive and active utilization of sun energy are immense, as well as utilization of wind for energy and natural ventilation. The idea of louvered covered walkways, that open and close depending on the season, is a powerful design concept that would place the Toronto waterfront on the world map for sustainability, if applied along the entire quay.

Conceptual systems for water management in East Bayfront are discussed in Section 3 of this report (see 3.3.4 Water Management in East Bayfront).

A summarized judgment of the Swedish expert team is that the layout of the building schemes within the blocks must be designed in greater detail to ensure the necessary consistency with sustainability principles. However, the proposed precinct plan has great potential in this regard. The restrictions given by the northern barriers of the Gardiner and the railway pose an on-going problem. The extraordinary sustainability opportunities of the lakeshore site must be convincingly exploited.

Aspects	Strengths	Weaknesses
<i>Principles of sustainable development, methodology</i>	Goals and ambitions summarized in seven principles of sustainability. The evaluation of alternatives regarding water, wastewater, stormwater and utility corridors and transportation alternatives give a good basis for further design	There is no comprehensive evaluation of the three urban planning and design options A, B and C with regard to stated goals and ambitions
<i>Social aspects</i>	Clear and succinct objectives for sustainable community services, demography and proposed affordable housing strategy	Except for the buildings along the water's edge there are no analyses or spatial illustrations on commercial, cultural and social service functions with housing and work-places within the proposed blocks in options A, B and C The illustrated structure of the courtyards seems somewhat messy and accidental with no clear division of public, semi-public and private spaces
<i>Sustainable urban planning – functional aspects</i>	The area between Queens Quay and the waterfront appears very functional due to the rectangular or square proportions of the blocks	It may be difficult to obtain flexible and well functioning blocks in the northern part of the area due to the narrow, oblong and triangular shape of the area between Queens Quay and the Gardiner expressway. The north facades along the expressway must be designed to protect the Bayfront area from traffic noise and to resist accidental impact.

Aspects	Strengths	Weaknesses
<i>Mobility – sustainable transportation</i>	The central public transportation spine has good potential for being an attractive link between the waterfront areas	The options for connecting the area with the city should be further investigated; there is too much emphasis on the east-west axis.
<i>Sustainable buildings</i> <i>Energy aspects</i>	<p>There are good options for a variety of building types in the blocks along the water edge that should be systematically investigated</p> <p>Good potential for utilizing solar radiated energy for heating, lightning and electricity generation respectively for utilizing wind for natural ventilation and electricity generation. This later possibility requires a feasibility evaluation.</p> <p>The prerequisites for linking the blocks to district heating and cooling systems are favorable due to the high urban density. The realization of this potential will depend on the next stages of detailed design and planning.</p>	<p>The triangular and oblong shape of the area north of Queen’s quay limits to a certain extent the options for designing the buildings in a sustainable way</p> <p>The layout of the blocks and the orientation of buildings should be studied more in detail in order to maximize the options for passive and active solar systems. The northern part of the area has a large amount of shaded building space.</p>
<i>Waste and water</i>	There are good options for installing a vacuum transportation system for source-separated waste in the area. There are also good options for installing a dual stormwater system. The realization of this potential will depend on the next stages of detailed design and planning	
<i>Green areas</i>	The zoning of the waterfront promenades in three zones for flexible uses, recreational cyclists and inline skaters and walkways for pedestrians is a meritorious feature with good options for further development consistent with sustainability principles.	There is a lack of clarity concerning the overall green structure .The principles for the green areas should be further developed to reflect the notions and hierarchies of public spaces, ecological content, green spaces and recreational opportunities. Ecological and hydrological issues should be considered as an integral part of the green areas
<i>Outdoor climate</i>	<p>The idea of louvered covered walkways that open and close depending on the season incorporating energy efficient design features has the potential to be a leading global example of sustainability practice.</p> <p>Wind conditions provide for well ventilated streets with the air quality of the lake.</p>	
	<p>Microclimatic/wind simulations are necessary as a basis for further design of both buildings, parks and streets</p> <p>Solar access and solar shading must be simulated during the design process</p>	
<i>Visual aspects – interplay between built environment, street design and landscape design</i>		The preliminary proposals do not seem to be based on an analysis of the townscape of the City of Toronto and do not adequately address architectural expressions of sustainability. This is important in order to raise awareness of sustainability as a real and substantial dimension of daily living.

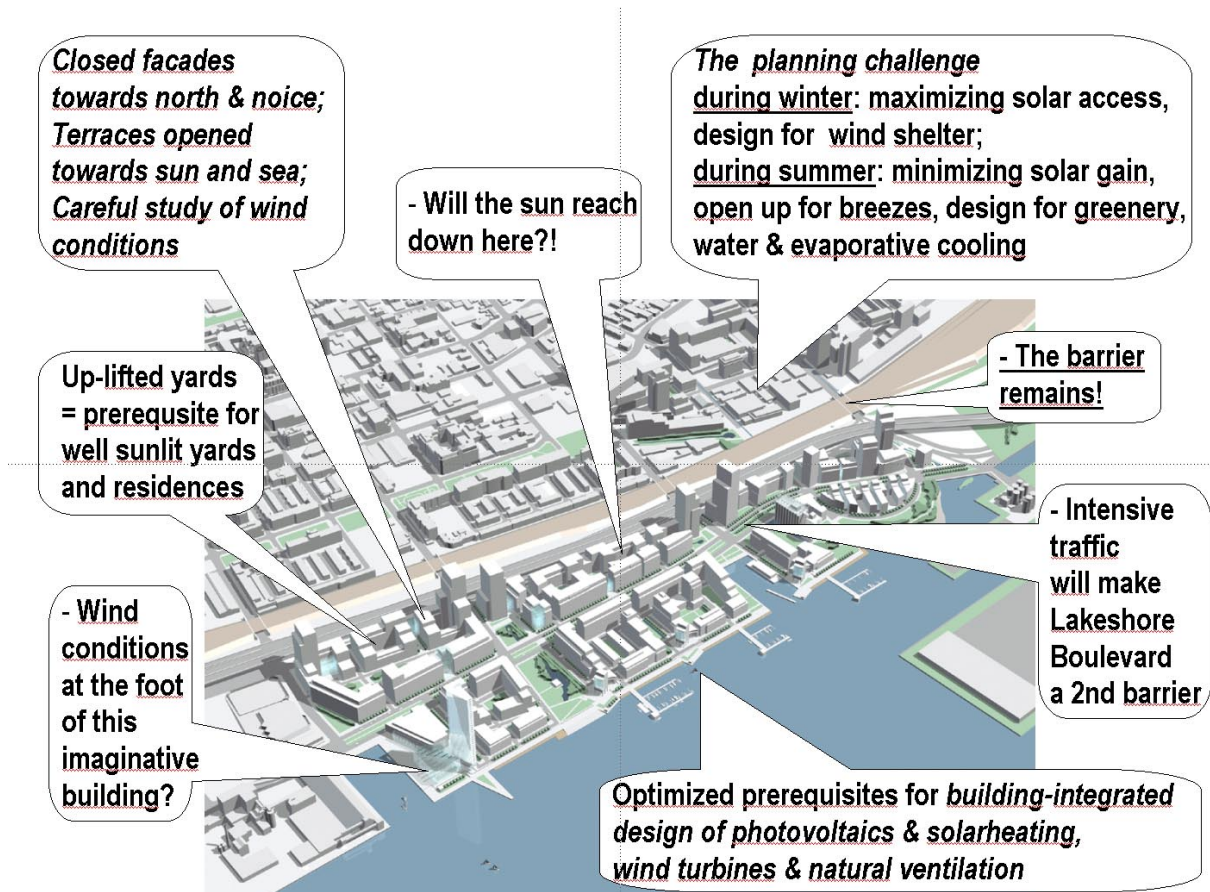


Figure 2:1 East Bayfront Precinct Plan – some Issues to consider

2.2 West Don Lands Precinct Plan

The West Don Lands Precinct Plan presents a well-thought out, almost traditional, street plan that is well adapted to the conditions and requirements of the site.

A main objective of the planning layout is to connect the Don Lands precinct to the surrounding city area. In this respect the existing railway area and the Gardiner connections constitute obstacles to integrated Waterfront revitalization. In addition, the blocks adjacent to the railway will have to cope with high ambient noise levels and this could influence the south facades of the buildings. These same building façades need to be open to the sun and to views of the waterfront.

The plan presents building layouts of mainly rectangular blocks with buildings around the perimeter. This bodes well for applying sustainability building practices from the perspective of working with the building volumes and designing the technical infrastructure.

The suggestion for raising yards above car parks and placing business and commercial space in the lower stories of buildings on the perimeter means a well sunlit inner yard and residences with good sunlight conditions.

The buildings should be designed to minimize the need for mechanical heating, cooling and ventilation by means of the building envelope and its appliances – as stated in the environmental program of East Bayfront precinct plan and in the TWRC Sustainability Framework. Electrical cooling devices and on-site natural gas heating should not be permitted if the waterfront is to pursue a sustainability energy strategy.

Aspects	Strenghts	Weaknesses
<i>Principles of sustainable development, methodology</i>	The overall plan includes an analysis, public consultation framework and proposal for private development guidelines and neighbourhood character that set the stage for a strong response to several sustainability issues.	The presentation of sustainability objectives as they relate to the precinct plan need to be developed
<i>Social aspects</i>	<p>Social issues such as affordable housing and community facilities have a greater emphasis than other issues</p> <p>There is a distinct division of public, semi-public and private spaces. The design of Front Street and Mill Street with generous spaces for walking and relaxation provide good prerequisites for community vibrancy.</p>	<p>The retail areas and the areas for offices and institutions are concentrated to the western, northern and southern parts of the area. The blocks along the eastern part of Front street are purely residential which could result in a socially less vibrant environment</p> <p>Some of the courtyards are small and oblong which may promote privacy but prevent vibrant social life – this could be both an advantage and a disadvantage.</p>
<i>Sustainable urban planning – functional aspects</i>	A well thought out, grid plan with blocks surrounded by traditional streets provides good general applicability. The northern and western parts of the area are well integrated in the cityscape. The distillery area is an integral part of the plan.	The block between Mill Street and the railway yard lacks some flexibility due to its special form. The Eastern Avenue separates four blocks in the northern part of the area from the rest of the area
<i>Mobility – sustainable transportation</i>	<p>Transportation (streets, pedestrian and bike circulation) has been thoroughly investigated in the report</p> <p>The recommended transit service with an exclusive streetcar line on Cherry street gives excellent public transportation access to the central part of WDL</p>	Options for providing the eastern part of WDL with good access to public transportation an east-west street-car line or a bus line passing by Mill Street or Front Street should be investigated
<i>Sustainable buildings Energy aspects</i>	<p>There are good options for a variety of building types along the perimeters of the blocks but also on the raised parking yards</p> <p>The prerequisites for linking the blocks to district heating and cooling systems are favorable due to the high urban density</p> <p>The realization of this potential will depend on the next stages of detailed design and planning.</p>	<p>The buildings below Eastern Avenue have been designed without special consideration for vibrations and noise</p> <p>The layout of the blocks and the orientation of buildings have to be studied in more detail in order to maximize the options for passive and active solar systems. The high urban density in many of the blocks results in a large amount of shaded building facades</p>
<i>Waste and water</i>	<p>There are good options for installing a vacuum transportation system for source-separated waste in the area. There are also good options for installing a dual stormwater system.</p> <p>The realization of this potential will depend on the next stages of detailed design and planning.</p>	

Aspects	Strenghts	Weaknesses
<i>Green areas</i>	The overall landscape design of the green areas especially Don river Park provides good prerequisites for the detailed design and for the protection of the area from the eastern bow of the railway. The tree plantings along the streets contribute to a pleasant environment	The overall principles for green areas should be further developed to reflect the notions and hierarchies of public spaces, ecological content, structured green and recreational content. Ecological and hydrological issues should be considered as an integral part of the green areas
<i>Outdoor climate</i>	The relatively low scaled buildings and closed yards within the blocks blocks may contribute to wind-protected areas. Greenery and trees along the streets contribute to wind protection and good air quality	The high-rise buildings along the railway yard and in other part of the area may result in high wind speeds at the ground level and the production wind-tunnel effects
	Microclimatic/wind simulations are necessary as a basis for further design of both buildings, parks and streets Solar access and solar shading must be simulated prior to the detailed design process	
<i>Visual aspects – interplay between built environment, street design and landscape design</i>	The planning proposal seems to be based on an analysis of the townscape of the City of Toronto whereby the perspectives reflect an ambition to obtain clear spatial relationships between buildings, green areas and streets as well as overall visual harmony and a variety of the building design. The overall design provides prerequisites for a detailed design expressing sustainability architecturally for example by integrating PV-cells into the roofs and walls and small wind turbines on the roofs.	

The building blocks adjacent to streets should be carefully studied and deliberately designed with regard to sun and wind conditions. The planning challenge during winter months is to maximize solar access and wind shelter, and during summer months to minimize solar gain, open up for summer breezes and to make use of greenery for transpiration and water for evaporative cooling.

Tall buildings bring downwind as is well known in Toronto. Thick buildings may mean one-sided apartments, which must be studied carefully regarding sun and wind. Concepts for daylighting inner green yards and for natural ventilation should be considered.

Conceptual systems for water management in West Don Lands is discussed in Section 3 of this report (see 3.3.5 Water Management in West Don Lands).

2.3 Sustainable Transportation

The overall goals formulated in the Sustainability Framework provide clear direction on the measures needed to achieve sustainable transportation: “Make alternative transportation options such as walking and cycling and public transit the natural choice for residents and visitors to the waterfront area”. The Framework presents strategies actions and targets linked to objectives to “minimize car use” and “increase walking, cycling and public transit use”.

On the overall City level, nine main attributes of a transportation vision are presented in the City’s Official Plan including reducing car dependence – transportation options for the City of Toronto and transportation building blocks for the Official Plan. Activities that support a sustainable approach to transportation and alternative mobility include:

- Integrated land use and urban design that leads to fewer and shorter trips;
- Public transit service that is more competitive with the private automobile; and,
- Traffic engineering and street design that encourage walking and cycling.

In the plan for an environmentally sustainable Toronto the importance of sustainable transportation is underlined, a sustainable transportation vision for Toronto is presented and moves towards sustainable transportation are identified: information, infrastructure, integration, involvement, investment, implementation, innovation and indicators. In the report “Making Waves” plans for removing barriers and making connections are elaborated.

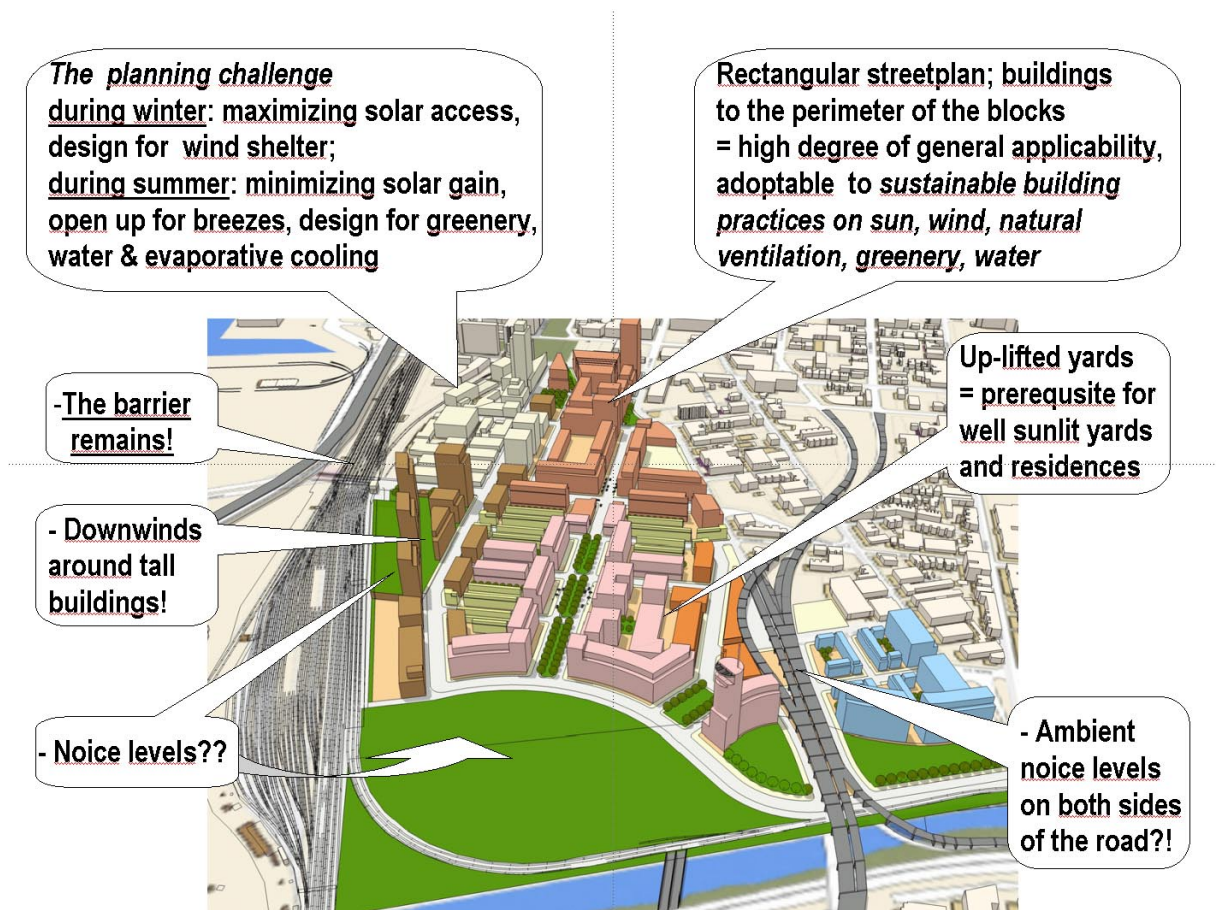


Figure 2:2 West Don Lands Precinct Plan – some Issues to consider

The challenge is to transform the overall goals and objectives into reality. A lot of transportation proposals are presented in a variety of documents. The comments here focus on issues that have not explicitly been discussed.

It is very important to develop *an attractive environment for public transportation* as well as for bicycling and walking. The proposed tunneling of the Gardiner expressway and the railway presented in section 2.6. should contribute to better integration of all the Waterfront areas and reduce barriers for pedestrians and bicyclists.

A public transportation, bicycling and walking spine should be developed along the main streets of the water front area – Queens Quay, Cherry Street, Commissioner Street and Unwin Avenue. The term spine indicates that the design of the environment for public transportation, bicycling and walking should be accentuated so that it will encourage and attract people to choose these sustainable transportation modes.

The stops along the public transportation system should be designed as climate protected mini-terminals with clear traffic information, nice seating places and arts integrated into the area. The Curitiba example in Brazil illustrates options for a dramatic increase in the modal shift towards public transportation (25-50 times increase in public transportation within a few years period of time). The location of the stops should be carefully studied in order to maximize the accessibility from both residents and work places within 100 – 350 m distances.¹

The stops should be integrated in market areas with shops, restaurants and other service facilities demanded by the travelers during both weekdays and holidays. Thus the size of the waiting areas may be reduced and used more efficiently. The spacing of the stops should take into consideration options for optimizing the number of bus lines passing a certain stop by proper scheduling the lines. A bus stop dimensioned for two buses (18 m length) at the same time may serve 5-6 bus lines. The size of such a efficiently used bus-stop is approximately 40m x 3.5m.



Figure 2:3a Sustainable Public Transportation – Swedish Reference Examples. Tvärbanan – a light-rail Line in Stockholm connecting Hammarby Sjöstad with the Subway System of the City of Stockholm.

¹ Swedish and Danish research shows that the share of people choosing public transportation (regional trains) is twice higher when the distance to a station is 100 m compared to a distance of 400 m.



Figure 2:3b Sustainable Public Transportation – Swedish Reference Examples. A light-rail Line in a separate lane in the City of Norrköping.



In the areas surrounding public transportation stops the parking ratio should be reduced. In order to increase the number of people traveling by public transport the areas around stops and mini-terminals should be planned for mixed uses. Connected paths for pedestrians and bicyclists should have direct links with bicycle parking and storage at the stops. It should also be possible to bring bikes on buses or on streetcars. Incentives for shifting transport mode from cars to public transportation and walking should be introduced for example:

- To avoid free car-parking in office buildings in the area but instead encourage public transportation by offering free public transit for employees.
- To encourage the use of step-counters and trip meters on bicycles as a part of health programs and contests regarding sustainable transport modes.

As an alternative to the traditional streetcars or buses automated or *semi-automated transport systems* on the ground or elevated above street level should be investigated and compared with the traditional systems. A modern system of this kind could at least be planned and built as part of a demonstration project in the sustainability center connecting the business park, the Living City Center and the demonstration projects of the energy plant (see Section 6).

Such a system could be an inspiring showcase for future-oriented transport technology based on renewable energy. A prerequisite for such a system is that it be integrated in the environment in an attractive way for example by letting the track go right through development blocks or shopping malls. It is also very important to have narrow construction, which is considerably smaller than a raised highway corridor. One interesting example of this solution is the light-rail line through the shopping areas of Canary wharf in London.



Figure 2:4 The Curitiba Example in Brazil. A Bus-Stop along a separate Lane for Express Buses.

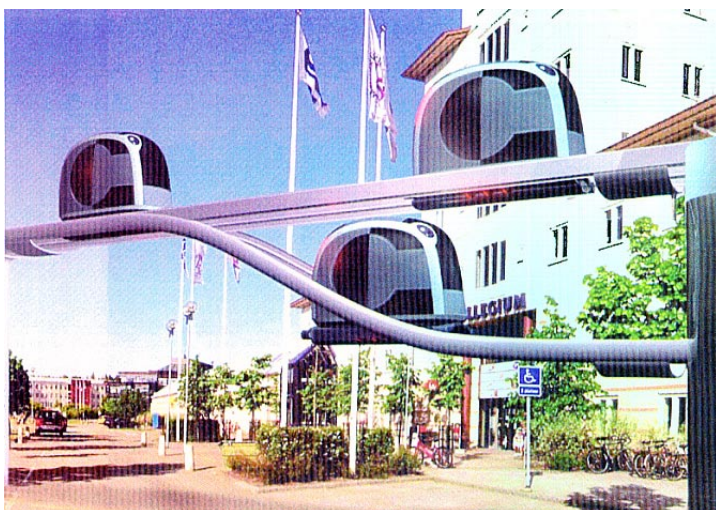


Figure 2:5 Example of an automated Public Transportation System.

Car-pools or car sharing systems can be organized in the community districts of the waterfront area. The cars should be fuelled by renewable energy, preferably biogas or hydrogen cells. Tank-stations should be located adjacent to car-pools. European programs for improving the traffic situation in European cities that might be of relevance for the waterfront project are “Trendsetter”, “Moses” and “Cute” (Clean urban transport).

The wide channel through the Portlands area facilitates boat traffic (using renewable fuels like biogas) between East Bayfront and the proposed Sustainability Center with a number of other stops along the route.

In our opinion, the width of the *redesigned Lakeshore Boulevard* with 2x4 car lanes will make the street a considerable barrier between the city and the waterfront. Swedish experience indicates that a street of this kind can have a maximum width of 2x2 lanes of car traffic and still be considered as an integral part of the urban environment. A wider street is experienced more as a major highway. If it is not possible to reduce the width of the street, we propose it be divided in two lane-sections separated by narrow green areas and a wider green areas with rows of trees in the central part of the street . It is also important to reduce the average traffic flow as much as possible, to attempt to cap the velocity of cars and buses or street-cars at 30 kilometers per hour.

If the Gardiner Expressway is relocated to ground level and the railway is kept at its present level, two options for pedestrians and bicyclists should be investigated:

- A number of wide bridges for pedestrians and bicyclists
- A number of wide tunnels for pedestrians and bicyclists

The design of bridges or tunnels must take people’s security and comfort as its starting-point. Swedish examples that may be a source of inspiration are Knutpunkt Hjalmar in Gothenburg (a wide well-lit tunnel for pedestrians and bicyclists) and Haga Norra (a bridge for pedestrians and bicyclists).



Figure 2:6 Knutpunkt Hjalmar in Gothenburg – An Example of a Tunnel for Pedestrians and Bicyclists

As for the streets throughout the waterfront area, 2x1 lanes of car traffic should be investigated as compared to the already proposed 2x2 lanes in order to establish public transportation, bicycling and walking as the main transport modes. Separate bicycling paths should be arranged both along the main streets and along the water's edge and through the green corridors.

Our experience is that *separate bicycle* lanes should be located adjacent to pedestrian paths and located parallel to roadways in order to facilitate access to shops and other functions located along busy streets. For this reason, bike lanes are not normally moved to protected routes since no noticeable increase in traffic safety has been observed. Separate cycling lanes along the water's edge should be designed for rapid commuter bicycling thus promoting the bicycle as a convenient transport modes to and from the City. Important quality indicators for bicycling and walking paths are: directness of route, continuity, easy orientation and minimized barriers.



Figure 2:7 An example of a separate Path for Pedestrians and Bicyclists centrally located in a Street Space. Erik Dahlbergsgatan in Stockholm.

2.4 Sustainable Green Areas and Public Spaces

A basic document for the planning of green areas and public spaces is the Central Waterfront Public Space Framework. The purpose of the framework is to come to a more detailed understanding of the nature, character and relationships of public spaces, new and proposed, along the central waterfront. It establishes the public realm as the foundation for the central waterfront's overall revitalization. A series of 10 principles provide a foundation for the central waterfront public space framework. These principles should direct the detailed resolution of the waterfront's public spaces.

In a sustainable city, a landscape design to capture the rejuvenating power of nature is more or less implicit. Furthermore, this fundamental principle should be formulated and interpreted in ways that address the specific project area, its problems and its qualities.

In addition, designed landscapes should supply a variety of features and experiences and create character in the city. In the case of the Central Waterfront, the relationship with the landscape can be expressed in four categories each having its individual validity. These categories all support a sustainable approach to designing green space and are suggested as guidelines for landscape design in this area:

1 Notion of public space.

The landscape, except for private gardens, represents and embodies *public space*. Streetscapes, bicycle paths, walkways, parks, plazas are all examples of public space that strengthen social life and evoke human contact. Such landscapes enhance the structure of public space in the city.

Site example: The north-south Toronto streets each face a point where they end up at the water. These spots can be developed into a sequence of public spots in attractive locations.

2 Notion of ecological content.

The landscape supplies *ecological content*. Proximity to nature, presence of flora and fauna and experience of natural processes are nowadays considered valuable parts of daily living especially in urban surroundings. Landscape design can also improve technical solutions to environmental problems such as storm water treatment and wind/climate considerations.

Site example: If the Don River mouth is restored it can be developed into a city park on a scale that permits natural habitats to develop

3 Notion of "Green Structure".

Greening of a modern city is based on connecting different parts of the city including parks and open spaces along a safe *green network*. The parameters of a green network can also help define city districts or, on the Toronto waterfront, communities.

Site example: The east-west south-facing quay can connect to the restored park at the mouth of the Don River which in turn can be connected to Tommy Thompson park.

4 Notion of recreational content.

Recreation and physical exercise is essential for the general health of city dwellers and is also an important leisure activity. A well-designed landscape provides for spaces that support such activities. In this respect, the designed landscape should address the needs of all types of citizens including young and old; physically fit as well as disabled.

Site example: The park at the mouth of the Don River with its central location is ideal for establishing a large recreational area close to developing areas of the city.

The points at which 16 of Toronto's main north/south streets meet the waterfront creates an opportunity to introduce a series of distinctive public spaces – the “foot of Toronto places” (notion no 1). This provides opportunities for the planning and design of very attractive spots for all citizens of Toronto. To strengthen the north/south axis for car traffic is not the most important issue. This axis should also be planned for high-standard bicycling and pedestrian paths. It is also important to connect the public spaces and the separate areas of the waterfront in an east/west direction with high-standard bicycling and walking paths (notion no 3).

The planning and design of green areas has a considerable impact on the microclimate and on the energy consumption of buildings since vegetation and other landscape features influence the intensity of winds in the area (**notion no 2**). Stormwater flows may also be considerably decreased and detained by a series of control measures related to the planning and design of green areas such as ponds and wetlands, porous paving and green roofs (see section 3.3. for further discussion of stormwater). These issues are not explicitly discussed in the framework but should be considered in more detail.

The use of public spaces and green areas and their potential for becoming social meeting-points and nodes for waterfront activities (**notion no 1**) are dependent on their connection and integration with adjacent housing and employment areas. Planning and design for recreational, sports and cultural events will also influence the intensity of use.

The area between West Don Lands, East Bayfront and the Portlands raises critical issues with regard to the quality of the green areas (**notion no 4**). The re-naturalized river mouth will connect a series of wetlands with trails along the development edge and may provide the opportunity for active recreation in Commissioners Park and within West Don Lands. The rail yard south of West Don Lands as well as the eight lane wide expressway is an extreme barrier between the City and the Portlands area.

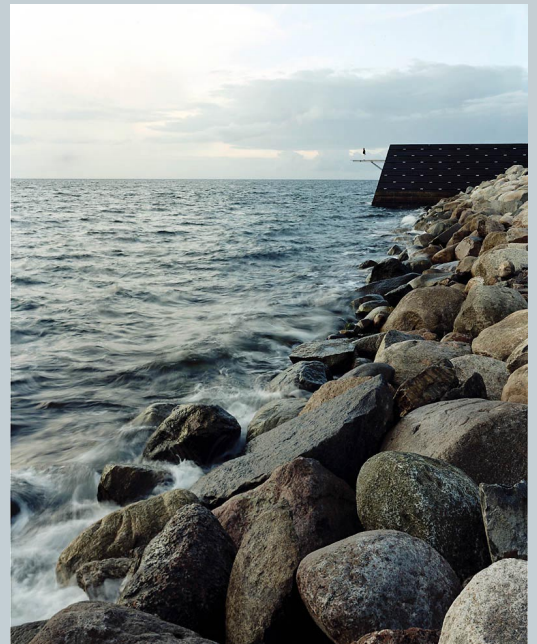
The major road and rail barriers dramatically reduce the recreational value of the whole area and might also be a threat to many species that otherwise would find the wetlands an attractive environment. The barriers make it more difficult to develop attractive paths for bicycling and walking between West Don Lands and Commissioners Park as long tunnels or bridges are needed under or over the rail yards and the expressway. The proposed tunnels and the relocation of the rail yard (see above) could considerably improve this important green link (notion no 3) between the city and the Portlands area as well as the recreational value of the Commissioners Park.

Case study: Dania Park

Dania Park is situated in the so-called western harbour in Malmö, the third largest city in Sweden. The area is a former harbour, now transformed into a city district. The large-scale park embraces the sweeping contours of the landscape in this equally windswept and magnificent location. The location at the edge of the sea encompasses certain duality – a desire to approach the water coupled with a need for shelter from the brisk ocean winds.

A protective wood palisade has therefore been erected along the shoreline's rough stone embankment. This palisade is in turn punctuated by three sloping concrete troughs, called “the Lookouts”, that seem to empty into the sea. Dania Park is an example of how to dramatize a landscape due to proximity to the sea, with use of the very special design features.

Dania Park and the Western Harbour was awarded the Swedish Association of Landscape Architects' Siena Prize for the year's best outdoor environment in 2001 (Landscape Architecture for the Dania Park by Thorbjörn Andersson and PeGe Hillinge).



Figures 2:8 The Dania Park is situated in the western Harbour of Malmoe in the southern part of Sweden.



2.5 General Recommendations for planning of the Waterfront area as a whole

Consider separate planning areas as a single piece of urban fabric

The Central Waterfront Plan is built on four core principles. These are:

1. Removing Barriers/Making Connections
2. Building a Network of Spectacular Waterfront Parks and Public Spaces
3. Promoting a Clean and Green Environment
4. Creating Dynamic and Diverse Communities

It is a great challenge to fulfill these core principles by amalgamating the different planning areas – the Portlands area, the East Bayfront Area and the West Don Lands area to a unified but varied urban fabric. Obstacles to realizing these visionary core principles include current location of the Gardiner Expressway, the rail corridor through the city center and the rail yard south of West Don Lands.

These barriers prevent the West Don Lands from being an integral part of the waterfront as it is isolated from both the Portlands and the East Bayfront area. The barriers also make it difficult to realize fully integrate the East Bayfront into the City of Toronto. The barriers also interfere with implementing urban design that is based on sustainability principles due disruptions to the microclimate, noise, and spatial and social connections. Without removing these barriers at least in the medium-term or long-term it is doubtful if the Toronto waterfront can become one of the great waterfronts of the world with fulfillment of inter-related economic, social and ecological goals.

In order to remove the barriers we propose three options to be further investigation and evaluation:

1. An expressway tunnel through the central part of the area;
2. Decking and construction over the railway in the central area of Toronto but also in the East Bayfront areas and in the West Don Lands, including the rail yard.
3. A railway tunnel combined with the relocation of the rail yard.

Option 1 may be combined with Option 2 and Option 3. We consider that the most advantageous solution taking into account functional, social and visual aspects would be a combination of Options 1 and 3. In our first draft of this report we proposed coordinated highway and railway tunnels as a way to remove the barriers between the City and the waterfront. These options give the most favorable connections for walkways and bicycle lanes between the City and the waterfront areas.

After receiving feedback from our Canadian colleagues, we acknowledge that the combined tunnel approach may be considered as too complicated and too costly. One reason is that lowering the railway would exacerbate the problem of flooding. Other obstacles are the required grades of the railway, the distance required to slope up and down, the impact on current operations and, significantly, the cost.

As for Option 2, we have been informed that there has been discussion for the last 30 years regarding decking and construction over the railway. The decking of the central areas has generally been considered more feasible than in the West Don Lands and East Bayfront since in the downtown the railway is depressed relative to Front Street and the land values are much higher than in the areas to the east.

Our opinion is that options for erecting buildings at the border of a deck along East Bayfront and along the railway yard south of West Don Lands should be further investigated and evaluated from a sustainability perspective. The proposed building row towards the Gardiner expressway in the precinct plan for the East Bayfront could be moved to the edge of such a deck thus improving the microclimatic, ecological, social, functional, and visual qualities of these blocks. In the West Don Lands a deck over the railway yard makes it possible to erect buildings that bridge the barrier.

Ideally, the rail yard should be relocated and integrated with rail yards located in the outskirts of the city. Our understanding is that the railway yard is currently being transferred from general railway operations to commuter train operations. It is necessary to store commuter trains in the downtown area for travel to the outlying areas in the afternoon peak period. In any event, alternative storage locations within approximately 5 km from the West Don Lands should be investigated and compared with the West Don Lands rail yard from a sustainability perspective. This is important, as the railway is an extremely strong barrier between West Don Lands and the Portlands.

However, the most important message is that the removal of the barriers using one or more of the suggested options would bring significant sustainability benefits to the Toronto waterfront. These include:

Economic benefits

With removal of the barriers, a new centrally located area would become available for mixed-use development including floor space of approximately 240 000 sq m ground area (2000 m x 120 m), which means approximately 1 000 000 sq m of space, supposing an exploitation rate on the ground area of $e = 4.0$. The total potential revenue from this type of densification and development should be investigated and related to the total investment costs of barrier removal. Cost calculations should consider not only at economic profitability but also cost savings due to environmental improvements.

Toronto waterfront revitalization is of great importance not only to the city but to the province and the country as well. The land values of the surrounding areas will also increase which in turn will facilitate new investments. The other benefits – some of which are listed below – are qualitative in nature but may also be expressed in monetary terms.

Social and cultural benefits

- The social benefits will be considerable as very attractive locations for new housing, work places and services functions can be offered to citizens.
- The links and connections between all areas in the waterfront will be improved which will promote public life along the waterfront and also contribute to the social integration of the waterfront communities with the adjacent areas in the City. The potential for the central waterfront network of public spaces can be realized on a higher quality level than is possible with the existing barriers
- The recreational value of existing and planned green corridors, the natural and designed park areas as well as the public spaces and market places can be improved due to higher quality natural environment.
- Possibilities to arrange cultural events and gatherings in the open spaces will be enhanced

Ecological and environmental benefits

- Noise reduction and improved air quality will improve public health - physically and mentally
- Reduced traffic flows will result in enhanced traffic safety and accessibility for all – including children and the elderly.
- There will be better opportunities to establish green corridors with high biodiversity for all parts of the waterfront area.

Phasing of the development taking the removal of the barriers into consideration

Planning and design as well as the phasing of the development in the waterfront area as a whole should take the removal of the barriers into consideration. For example:

- By starting the development in the Portlands area and by postponing the development of the East Bayfront and the West Don Lands until the barriers have been removed.
- By starting the development of East Bayfront area along the lake and then postponing development of the northern blocks until the barriers have been removed.
- By elevating the area south of Mill Street in the West Don Lands in order to prepare for a connection of the area with a deck over the railway yard.

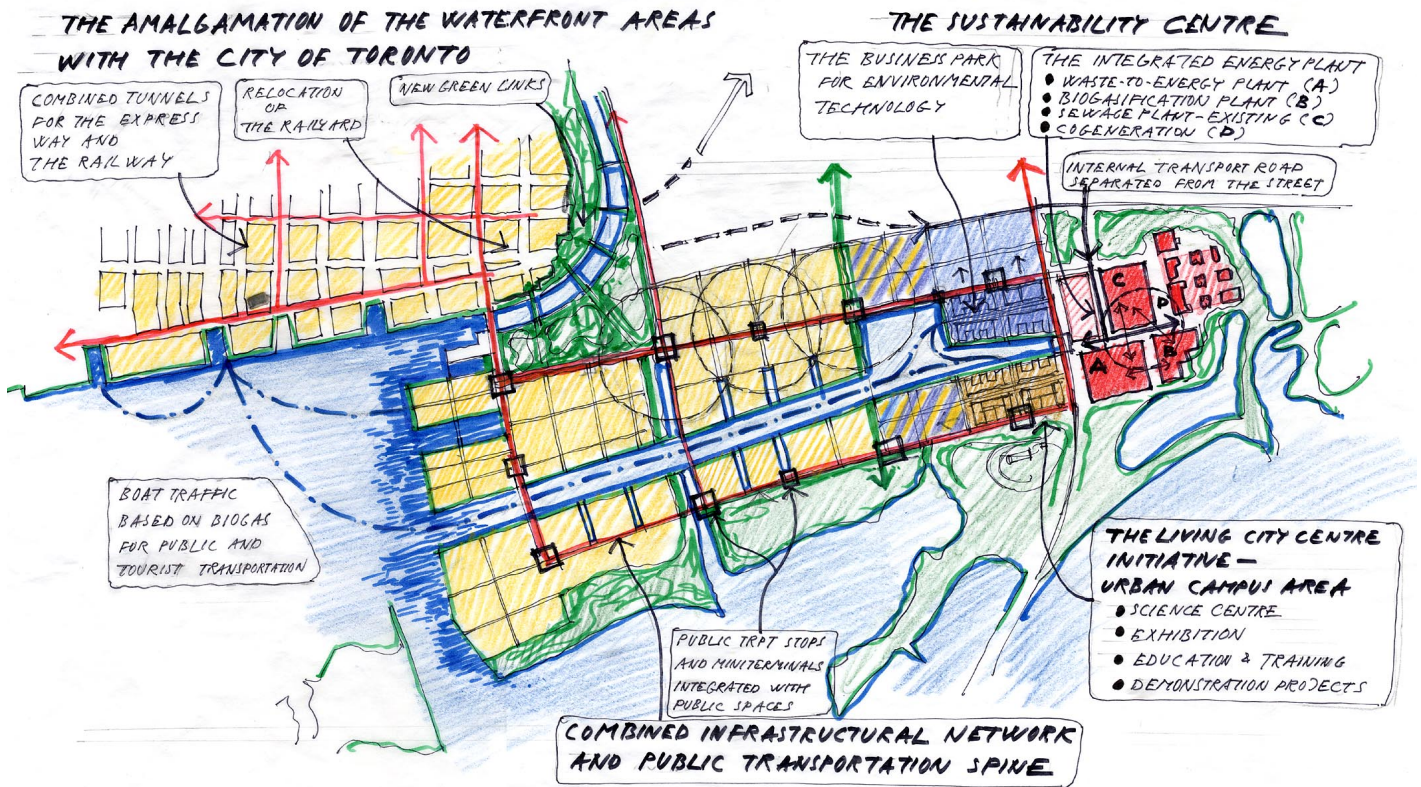


Figure 2:10 An overall Vision of the Waterfront Area. The figure should not be seen as a detailed land-use planning proposal. It points out some of the issues which are discussed in sections 2,3 and 6 of the report.



Figure 2:9 The Southern Link – a newly inaugurated Highway Tunnel in Stockholm.

Examples of infrastructure solutions in Stockholm aimed at reducing or eliminating barriers which may serve as sources of inspiration for the revitalization of the Toronto waterfront include:

- Stockholm area Södra Länken (The southern link – a newly inaugurated highway tunnel, 3.6 km length)
- Norra Länken (The northern link – a highway tunnel being designed at the moment)
- Södra station (The south station – a new urban district for approximately 4000 apartments and 4000 work places built on a deck over a railway and a diminished railway yard)
- Norra station (The north station – a new urban district for approximately 5000 apartments and 5000 work places is being planned on a deck over a railway yard in order to remove a barrier between the inner city of Stockholm and the Karolinska hospital area).

