CASE STUDIES OF POTENTIAL APPLICATIONS OF INNOVATIVE RESIDENTIAL WATER AND WASTEWATER TECHNOLOGIES

Introduction

As part of the goal to promote sustainability within the housing sector, CMHC has initiated much research in the areas of water and wastewater management. A number of projects demonstrating alternative water-treatment technologies are under way across Canada, including the Far North, Vancouver, Ottawa, and Toronto. The Toronto Healthy House is one of the most ambitious projects to date and includes a rainwater treatment system for potable use, and recycling of all household wastewater for non-potable uses.

The research project discussed in this report examines the application potential of water-reuse technology and assesses the Toronto Healthy House technologies in five case study sites in Nova Scotia. The life-cycle costs of these technologies were compared with costs of traditional infrastructure: municipal water supply and wastewater collection or wells and on-site sewage disposal systems.

The objectives of this project were to identify and describe opportunities for use of innovative water supply and wastewater systems for residential buildings, to compare costs and benefits of traditional and innovative systems, and to propose solutions that could lead to more cost-effective and environmentally friendly housing.

Research Program

Five sites were selected in Nova Scotia:

Millwood - a new urban development serviced by central water and wastewater systems;
Kingswood - a new development with on-site services;
Harrietsfield and Williamswood - an existing non-urban area where new wells, new on-site systems, and a cluster system are proposed to replace failing on-site systems and contaminated wells;
Glen Arbour - a new non-urban development served with public water and on-site wastewater systems; and
Pomquet - a community where a central sewerage system has been proposed to replace failing on-site systems.

Although the case studies were done in Nova Scotia, conclusions based on the results of these studies were to be applicable to other areas of Canada.

The alternative scenario examined the implications of applying the Toronto Healthy House technologies. The source of potable water in the Healthy House system, which is supplied to kitchen and bathroom sinks, is a rainwater cistern system (RWCS) that collects and treats water from roof surfaces. All other water demands are met by renovated and recycled wastewater, which is obtained by treating all grey water and black water. The treatment of wastewater used in the Healthy House includes a specially designed septic tank, followed by a biofilter, sand filtration, and ozonation.

Results

In cost-comparison terms, the main findings of this study were the following:

Table 1
Findings

Findings	Situations	Condition/Comment
Healthy House technologies considered might be competitive or less costly	Millwood or Kingswood	If fire protection by municipal hydrants was not required
Healthy House technologies considered might be competitive or less costly	Harrietsfield-Williamswood	As an alternative to a cluster system
Healthy House technologies considered might be competitive or less costly	Pomquet	As an alternative to a remedial central system
Healthy House technologies would NOT be cost-competitive	Where fire protection provided by a public distribution system is required	
Healthy House technologies would NOT be cost-competitive	Where it is possible to install or replace on-site wells and septic tank systems with conventional on-site systems.	

Market demand may decrease the cost of the Healthy House technologies and subsequently alter these conclusions.

Not all situations were recognized in the above scenarios. In general, the Healthy House technologies have potential applications in any situation where water supply from public supplies or groundwater or wastewater disposal capacity via a public or on-site system is limited, not available, or expensive. The technologies are useful for the following reasons:

- Rainwater cistern systems (RWCS) provide an alternative water source to a public system or private well;
- Wastewater recycling and reuse improve wastewater quality and expand disposal options; and
- Wastewater recycling and reuse along with water conservation measures reduce water demand and wastewater production, thereby widening the application of RWCS and on-site disposal systems or reducing demands on public systems.

Although cost is an important issue when considering the use of the Healthy House water and wastewater technologies, other issues, including technological, management, regulatory, public and political, may also have to be addressed. Table 2 summarizes these issues:

Table 2
Issues

TECHNOLOGICAL	Ability to meet health and environmental-quality criteria Reliability – risk Reliability – level of service Operation and maintenance requirements Monitoring and control
MANAGEMENT	Responsibility – public or owner Institutional options – public or private
REGULATORY	Responsibility – federal, provincial, municipal Requirements -performance or specifications -quality criteria -conditions for use Instruments – water-quality criteria, health codes, building codes
PUBLIC AND POLITICAL	Acceptance -health -aesthetic: real or perceived water quality -level of service Vs "flush and forget" -resale of homes Land-use and infrastructure planning Fire protection

The technological issues that should be addressed in planning and design of reuse systems include water use, wastewater quality, essential water-quality parameters, renovated wastewater quality for various uses, design flow, process eligibility and its relationship to multiple treatment units, distribution system safety, and system expandability and system testing. These are further discussed in the CMHC report "An Application Guide to Water Reuse Systems."

Wastewater recycling and reuse systems are complex. The management of these systems by persons with the required level of understanding, commitment, and capability must be assured prior to their installation.

The regulatory instruments that may affect the use of water and wastewater systems include legislation, regulation, and criteria. All levels of government may have a role to play in the application of regulatory issues. The CMHC report "Regulatory Barriers to On-site Water Reuse" identifies the key issues concerning various levels of government across Canada.

Public and political issues include public acceptance, land-use and infrastructure planning issues, and fire protection. Many factors influence the acceptance of the Healthy House technologies as alternatives to conventional systems. These factors include the resale value of a property that is serviced by an unconventional system and concern about the health implications of using reclaimed wastewater. Land-use and infrastructure planning issues will concern municipal planning officials and will, in turn, influence the cost-effectiveness of the Healthy House water and wastewater reuse technologies. Fire protection must be considered in areas where a municipal water system is not available.

Implications for the Housing Industry

Based on this case study, the Toronto Healthy House technologies can be cost-competitive in the following situations:

- In an urban or suburban subdivision if fire protection is not required;
- In a non-urban area as an alternative to a cluster system; and
- In a non-urban area as an alternative to a remedial central system.

It has also been determined from this study that successful implementation of any of these technologies requires that the technological, management, regulatory, and public and political issues be recognized and addressed.

Regulatory and market demands will further the development of wastewater renovation technologies; however, public or publicly controlled management systems must be devised to insure reliability of service and protection of individual health and the environment. Regulatory obstacles to the adoption of these systems should be addressed by additions or changes to codes, standards, and regulations.

This information needs to be communicated to planners, designers, developers, regulators, politicians, and prospective property owners. Land-use and infrastructure planning implications of the adoption of these technologies should be recognized and addressed.

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Research Report: Case Studies of Potential Applications of Innovative Residential Water and Wastewater Technologies

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A full report on this project is available from the Canadian Housing Information Centre at the address below.

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