Introduction:

For the first time in human history, the majority of the world's population now lives in cities (Baird, 1999). However, despite the fact that the majority of most people's social and environmental concerns are similarly urban, the design of cities for sustainability has not been a focus within mainstream discourse until comparatively recently (Haughton and Hunter 1995). Alternative forms of housing which attempt to achieve greater sustainability remain largely outside the average experience. This is changing as more communities, faced with a rapidly deteriorating physical and social urban environment, have begun to develop housing which attempts to address sustainability issues. These innovations in housing have grown out of local considerations of local needs. Under the umbrella of 'sustainable housing' some communities have focussed on the need for affordable housing, others on stronger communities, and still others on the need for a healthy urban environment. All of these elements are, however, inextricably intertwined, and can never be addressed completely separately.

This paper seeks to establish a basis for future research and the eventual implementation of specific sustainable housing ideas and techniques in Peterborough. A review of why sustainable housing is needed is given along with case studies of communities' actual experiences with these different types of alternative housing, in Peterborough and elsewhere. The pros and cons of each approach to sustainable housing in the Peterborough context are discussed. From these research findings is drawn a preliminary assessment of the applicability of these alternatives to Peterborough. The major barriers to change are highlighted, along with possible directions for future research.

What is sustainability?

'Sustainability', in the context of 'sustainable development' is most commonly defined as "meet[ing] the needs of the present without compromising the ability of future generations to meet their own needs" (from *Our Common Future*, quoted in Nozick 1992). This definition has frequently and justly been criticized as vague. It can be and has been interpreted in a narrowly economic fashion which defines sustainable development only as sustained economic growth, often on a fairly broad scale. However, most authors agree that any action toward sustainability must incorporate economic, social, and environmental considerations (e.g., Nozick 1992, Haughton and Hunter 1994). These three aspects interrelate on too many levels for true sustainability to be achieved through a focus on only one of these. On an economic level, a sustainable approach to housing might incorporate accessibility to all income levels, which would sustain a healthy community social structure, inclusive of all its members. On a social level, sustainable housing design could attempt to strengthen the social connections between these diverse members, perhaps through a community garden. This in turn would have environmental benefits, increasing city green space and reducing all the various aspects of food distancing, along with member's food costs. Though this is only a very simplistic sketch, it is illustrative of the multiple benefits that can accrue from even basic efforts toward sustainability.

There is no one 'ideal' model of sustainable housing. What is 'sustainable' is defined by a particular community's needs, values, environment, and abilities. However, there are many different levels of experimentation with housing alternatives, which demand varying levels of commitment from members. To some extent, one could place these along a continuum of sorts, from a coop which demands only a minimal level of involvement from its members to an ecovillage run entirely by consensus. However, as was implied above, one of the reasons that the term 'sustainable' is so popular is that it is to a great extent self-defined, and so a continuum of sustainability can have only limited

validity. However, we can profitably discuss the different methods communities have used to make their housing choices more sustainable economically, socially, and environmentally. From all of these we can then draw together a model for our own community in Peterborough, specific to our own community's special interests, abilities, and needs.

Why sustainable alternatives are needed:

1. The need for affordability:

Currently the strongest focus for alternative housing is the continuing effort to keep housing affordable. Homelessness, particularly in this era of budget cuts, is a large and growing problem, and the use of homeless shelters is increasing astronomically. In 1997, the Ontario Non-Profit Housing association estimated that a 67% increase in the use of Metro Toronto shelters that winter over the previous year was not unrealistic (ONPHA 1997/98). If people are not adequately housed, it becomes difficult for them to find or keep a job, to care for a family, or to deal with all the small concerns of day_to_day living (ONPHA 1997/98). There exists a large and growing proportion of the population whose income, age, social, or health needs prevent them from finding or keeping adequate housing. Average market rents are simply not affordable for many people, particularly for those who are dependent on government transfer payments, or for the working poor. 28 % of Peterborough residents pay more than 50% of their income toward housing, and 55% pay more than the 30% generally deemed 'acceptable' (ONPHA 1997/99). Housing market planning continues to be geared toward the nuclear family, despite the fact that increasing numbers of people, many of them with very low and inflexible incomes, are living outside of that model (Cooper and Rodman 1992). Aside from the direct social costs, there are also less obvious problems which result from increasingly unaffordable housing prices in urban centres. Market-driven housing prices drive people to live increasingly far from where

they work (Roseland 1992: 89), leading to both social and environmental consequences. The social support networks of inner-city neighbourhood communities are lost, as are agricultural lands built over in the suburban expansion. The growth of low density suburbs with low income residents pushed out of the city core also has a number of less direct environmental costs, most obviously in the increase in fossil fuel pollution.

2. The need for community:

As was mentioned briefly above, projects which successfully achieve housing affordability tend to have strong community benefits as well. The idea of the benefits of community, not simply for low-income groups, is one which has received a good deal of attention in recent years. ‘Community' has been defined in nearly as many ways as has 'sustainability', but generally it encompasses a group of people living and interacting within a specific area, who share common ties (Lyon 1989). Like sustainability, 'community' is a nebulous concept whose buzz word status sometimes obscures its crucial importance. A 'sense of community', reflective of a connection to place, to people, and to a certain history, gives a sense of personal identity and with it, personal strength, which is being rapidly lost in the rise of the 'global village' to whom everyone and no-one belongs (Nozick 1992). Because neither people nor economies are frequently tied to a particular place, all three aspects of sustainability suffer. The power, the will, and the funds to preserve and nourish the local environment are all subsumed under the needs of 'the market'. As has been often noted, not all market participants are created equal. Differential economic and political power, not an abstract 'invisible hand', determine what gets built where, who benefits, and who pays (Cooper and Rodman 1992).

People living in this global village are increasingly isolated and marginalised, particularly those in need of the greatest support. The elderly, the single parents, the unmarried, the divorced: these

are all groups whose numbers are growing and whose need for a supportive community in which to live is simply not being met (Cooper and Rodman 1992). Another group whose needs are increasingly being left outside the mainstream of our disconnected society are those people with disabilities. A local example is Towerhill Village, a Peterborough non-profit housing development with full community accessibility for disabled residents. Towerhill has a waiting list 525 households long - far more than it can accommodate anytime in the foreseeable future - but as of 1997/98 no new wheelchair-accessible housing was being built in the Peterborough area (ONPHA 1997/98).

3. The need to live within environmental limits:

While community and affordability are important aspects of sustainability in terms of development, what springs most readily to mind when "sustainability" is mentioned is the environment. Certainly, it is a crucial issue, though affordability has been by far the primary focus for housing researchers. Canadians are among the world's most inefficient per capita consumers of energy and material resources, and the way we house ourselves is a vivid example of this (Roseland 1992: 85). One graphic way in which the ecological impact of housing has been demonstrated is ecological footprint analysis, an approach designed by Canadian researchers. Ecological footprint analysis translates the ecological impact of a specific housing type into the area of land required to support the necessary associated resource consumption (Walker and Rees 1997). This includes not only the physical land area on which homes rest, but also less obvious impacts, such as the building's share of the area infrastructure (roads, sewers, street lights, etc). Other impacts include the forest products used in construction as well as the use of additional forested land as a carbon sink to absorb the carbon dioxide generated by heating the house (Walker and Rees 1997). The average Canadian's ecological footprint is 4.2 hectares, of which around 1.5 hectares is related to housing. This is clearly

unsustainable globally. If the world's total present population used the Earth's resources at this same level, at least 2 additional Earths would be required to support their needs (Draper 1998). When our use overshoots the land available, as it now does, we can say that we, as a society, are in 'ecological debt', and no longer living within nature's means (Walker and Rees 1997). A shift in the type of housing the majority of Canadians choose to live in could, however, substantially reduce our present ecological debt burden. Detached homes, in which the majority of Canadians live, use more heat, materials, vehicle transport, and infrastructure, than do more compact housing types. The small increase in density embodied in the average walk up apartment results in a ecological footprint per occupant which is 64% smaller than that of the standard detached house (Walker and Rees 1997). The ecological footprint of housing can also be reduced through the use of renewable or recycled construction materials, increased energy efficiency, and reduced dependence on outside infrastructure, as will be detailed further on in this report.

Different approaches to alternative housing:

What is being done in Peterborough now:

While further sustainability in housing is much needed, in Peterborough and elsewhere, it is important to recognize the valuable and innovative work that is currently being done here in Peterborough. The three principal approaches/agencies active in Peterborough in improving the local physical housing stock in terms of social, economic, or environmental sustainability are therefore outlined below, along with a brief comment on one other agency which is peripherally involved in the issue.

Peterborough Green-up:

Low income weatherization and basic installation services.

One of the perennial environmental problems of low income housing is maintaining energy efficiency. Often, the houses are owned by absentee landlords who have little interest in investing in the property, so long as it continues to generate income. Despite the higher energy costs, transient renters are similarly unlikely to invest the time and money in energy upgrades in a home which is not their own. In any case, renters rarely have the expertise needed to evaluate what should be done and how to do it. Even the most basic improvements, such as adequate weatherstripping around doors, is unlikely to be done. Larger investments, in such things as energy efficient windows and appliances, are almost unheard of until absolutely necessary, and even then long term energy efficiency is unlikely to take precedence over immediate cost. This negligence can have more serious environmental costs than most of us likely are aware: according to one Toronto study, housing in Toronto contributes more greenhouse gases (30%) than even the city's many vehicles (20%) (Mittelstaedt 2001).

Peterborough Green-up has a number of programs which attempt to address this problem in low income housing. First, the Basic Installation Service, provided in partnership with Peterborough Utilities Services and the City of Peterborough, which offers free of charge the installation of water- and energy-conserving hardware, such as high efficiency shower heads. Basic information and tips to reduce utility bills, conserve energy and water, reduce waste and eliminate household hazardous waste are also provided. Often, Green-up provides this and other services as part of a paid home visit, but it is also offered on its own to students and tenants (GCA 2000).

In addition, Green-up recently began a Low-Income Weatherization program, in partnership with Environment Canada, Peterborough Utilities Services, and the City of Peterborough. The program provides weatherization, water and energy conserving devices, EnerGuide for Houses, and an

introduction to climate change to a limited number of low income homeowners and tenants, given the homeowner's permission. A similar program, Stop Draft, is targeted at senior citizens and physically challenged adults. This program provides a home check-up complete with an energy audit and recommendations, with Community Care Peterborough following up on the recommendations (GCA 2000).

Another program which has the potential to be both affordable and environmentally friendly is Peterborough Green-up's solar water heater pilot program, developed in collaboration with Generation Solar. Only nine households were targeted in last year's pilot program, but the program does have promise (GCA 2000). The average solar hot water system can, by one estimate, offset enough energy requirements to pay for itself in under five years, and over its entire lifetime accumulates a return on investment of between 15 and 20% (Generation Solar 2000).

Pros and Cons:

The energy efficiency of low income housing is a significant environmental problem, and at the moment is being addressed largely through programs such as these. However, there are some negative aspects to these types of programs. Instead of getting landlords, those largely responsible, to pay to solve these problems, they must be attacked with direct grants. As a result, these programs are at the mercy of budget cuts, and likely unsustainable, changing with the political climate. Other programs, where fees are charged in home consultations to higher income groups, are much more likely to survive, despite the fact that they don't address the worst of the energy efficiency problem. However, Green-up's low-income programs are partly sponsored by Peterborough Utilities Services, which shows promise of a more sustainable partnership. "Demand-side management," such as these programs, can generate significant long-term economic benefits for the utility, staving off further

capital investments to meet growing demand. Other approaches are perhaps more important, though also more difficult. More direct incentives for energy-inefficient housing owners to 'clean up their act' could be implemented, for instance by charging a premium for energy use above a certain level through property tax bills.

Peterborough community housing development corporation:

Creation of affordable rental housing.

The most common form of social housing in Ontario is 'non-profit housing,' which focusses on the provision of affordable housing to low income tenants. This is generally supported by significant government funding, though this has become more restricted in recent years. Run by either public or private groups, non-profit housing supports over 135,000 Ontario households. (ONPHA 1997/98). The Peterborough Community Housing Development Corporation (PCHDC) is Peterborough's non-profit housing group. Without operating subsidies, the PCHDC has revamped derelict properties into affordable rental homes, marshalling together donated houses, discounted materials, donated labour, as well as cash contributions from the City and numerous individuals and businesses in the community (ONPHA 1997/99). With the increased value of the properties, PCHDC now has equity to lever financing for further projects.

While environmental goals are not the main focus for the PCHDC, they have worked with Green-up on all of their housing projects (Martyn 2001). The PCHDC takes over ownership and renovates, using donated materials and labour, while Green-up deals with the energy efficiency aspect, surveying the houses with the EnerGuide for Houses process (as it does on its paid home visits as well as through the low-income weatherization program), which suggest measures such as draft proofing

and new windows. In at least one case when the renovation was complete the house's energy use (and heating bills) had been cut by 50% (Greig 1999).

Pros and Cons:

The affordable housing situation in Peterborough is truly in crisis at the moment, with over half of Peterborough households experiencing affordability problems, paying more than 30% of their income in rent (Dunphy et al 1999: 79). To inexpensively provide low income housing is very important, and the PCHDC does this with no ongoing government subsidies, an impressive achievement (ONPHA 1998/99). The PCHDC's renovations also improve the quality of Peterborough's low-income housing stock, gaining important environmental benefits through increased energy efficiency while still maintaining affordability. On the negative side, however, it might be hard to implement the program on a large scale. The PCHDC has completed only 5 affordable housing units to date, relying heavily on donations of buildings scheduled for demolition or otherwise unwanted, a source which is likely to be limited in scope, though 4 more units are in process (Martyn 2001). In addition, the PCHDC provides rental housing, not ownership, which is a benefit in that it allows them to maintain affordability, but a drawback in that it doesn't give low income households independence. They don't have an investment in the home, and they don't have capital, which is a crucial asset at times, to borrow against and also just to have something to leave to their children. The tenants have secure tenure, but without a real investment in the homes it is difficult to foster a commitment to the neighbourhood and the Peterborough community, assuring a higher level of community stability. However, the PCHDC is trying to develop a land trust of sorts which would enable families to rent to own without risking the homes' affordability.

Peterborough area co-operative homes:

Affordable community housing.

Co-operative housing, or co-ops, are another common form of social housing support available here in Peterborough. Structurally, they are very similar to non-profit housing, though there is more of an emphasis on member participation in planning and running the community. In this way, co-ops attempt to build a more cohesive community which is reflective of the needs and values of its members (Cooper and Rodman 1992). About half of all co-op households pay a monthly charge geared to their income. Government funds cover the difference between this payment and the market price, but still co-op households on average cost the government less to support than both non-profit housing and public housing (19 and 71 % less, respectively) (citing a 1992 CMHC study, Co-operative Federation of Canada 2000).

There are three co-operatives in Peterborough, housing around 240 households (estimated from McQuaid 2001; Bailey 2001). They make a substantial contribution to housing affordability in Peterborough, with government support enabling 67 and 45 units to pay no more than 30% of their income in rent at Leta Brownscone and Kawartha village co-ops respectively, which is well over half the units in each case (McQuaid 2001; Bailey 2001). The co-operative structure also allows for more environmentally friendly living. In both the co-ops spoken to, lawnmowers and other garden tools were shared, so that every household could both save money and lower the impact of their personal consumption on the environment (McQuaid 2001; Bailey 2001). Kawartha Village Co-operative Homes also has banned pesticide use within the co-op, and members' environmental education is facilitated by speakers brought in periodically from groups such as Peterborough Green-up (Bailey 2001). The social structure of the co-ops facilitates this kind of exchange of communication, so that

members are more likely to become involved in social and environmental issues inside and outside the community (McQuaid 2001; Bailey 2001).

Pros and Cons:

Co-operative housing, as detailed above, makes a substantial contribution to affordable housing in Peterborough. In addition, the sharing of information and material goods facilitated by the co-op's close community structure are environmentally beneficial. On the negative side, however, the affordability of the co-ops, though a savings for the government over other forms of social housing, is still vulnerable to spending cuts. More crucially, the co-ops are a fairly small community with a very long waiting list. It would take a lot more co-ops to find places for all of those with housing affordability problems in Peterborough. In addition, membership in a co-op does require some degree of co-operation and commitment to the community, which may be a problem for some, though this is the aspect of the co-ops which gives them a degree of environmental sustainability. While the environmental aspect of the co-ops is limited at the moment, the use of alternative construction materials and methods as well as more internalized affordability could greatly enhance their sustainability within the basic structure of co-operative housing.

Youth Build II (Human Resources Development Canada program, sponsored by the John Howard society):

Non-profit housing renovation.

While Youth Build II is only peripherally a housing program, it seemed important to include it as a valuable possible asset for a future sustainable housing venture. The program is a six month full

time skill development and work experience program for young people, aged 16 - 24, who are out of work and out of school (John Howard Society of Peterborough 2001). Through Youth Build II youth gain work experience while benefiting Peterborough community groups, including some involved in housing. For instance, program participants assisted the PCHDC in renovating a derelict building into a duplex, though largely by painting and other low skill tasks.

Pros and Cons:

The youth involved participate in numerous community activities, gaining valuable skills and experience, but the program is basically relevant here as a possible source of labour support for a sustainable housing venture. Since the participants in Youth Build II are involved in a number of different activities, they are unlikely to be able to learn the more challenging aspects of housing construction. However, the sustainability aspect may still raise some interest in the participants, and prompt further investigation of sustainable alternatives in housing as well as other aspects of life.

Analysis/summary:

Current efforts toward sustainable housing in Peterborough are very important and innovative. However, in addition to far more need than these organizations can hope to satisfy, there are aspects of housing sustainability which aren't being addressed at present in Peterborough. For instance, the needs of and need for affordable owner-occupied housing are not being filled. Due to the confluence of a number of factors, high levels of owner-occupancy are thought to lead to more stable communities. When low income families own their own homes, they can build equity and self-respect in caring for their own homes and communities. The economic outflow from low income communities is stemmed,

and the housing stock is improved. Communities are less dependent on outside agencies to keep up energy efficiencies, leading to higher cost efficiencies because owners, unlike landlords, have an incentive to maintain improvements. All of these factors are currently being addressed to some extent, but still it is another avenue which might be profitably explored. Similarly, the subsidized boosting of low income housing energy efficiency is important, but the short term subsidized nature of the contact makes it difficult to address problems in a holistic and efficient way.

The experiences of other communities:

Creative new ideas in sustainable housing are always emerging as the need to live within the means of the local community and environment is increasingly felt. This section details examples of a few of these experiments in sustainability from various communities which may be applicable to the Peterborough context. Some of the case studies focus more on affordability while others bring out the environmental aspect of sustainability. All contain some elements of each, and were included because they showed potential to be combined in order to enhance aspects of sustainability that others lacked.

Innovative construction:

Many of the ways in which communities have attempted to reduce the ecological footprint of housing are based on alternative housing construction. This can involve the use of alternative construction materials, which are often local and inexpensive, such as straw bales or mud (adobe). Recycled materials, such as old tires or salvaged wood, can also be used. In addition, housing can be constructed so as to be more compact, increasing density and decreasing the community's 'ecological footprint.' Reduction in the level of use of the earth's resources, such as energy and clean fresh water,

can also decrease housing's ecological footprint, as can more ecological treatment of those wastes which are created.

The R-40 house, Montreal:

Straw bale construction.

One of the most popular alternative building methods in this area, where straw is plentiful, is straw bale construction. Although urban straw bale houses are very rare, they are beginning to be built, and rural straw bale homes are becoming almost common. One of the few urban straw bale houses is the R-40 house in downtown Montreal, designed by architect Julia Bourke. It is a two and a half storey single family home, located on a small lot, approximately 175 square feet. Originally the site was part of a larger lot bordered by two streets, with an existing house at one end. Current zoning regulations did not allow the subdivision of the lot in two, nor the construction of a second, independent structure on the same lot, so legal amendments were required to permit construction. Sponsored in part by Affordability and Choice Today (ACT), a joint initiative of the Canadian Mortgage and Housing Corporation and a number of other groups, the project sought to introduce straw bale construction to the urban Canadian context and also to demonstrate the potential of small lot housing to revitalize older neighbourhoods and to improve housing affordability, choice and quality (Bourke 1999).

Strawbale infill was used, along with a stucco exterior and plaster interior finish, producing walls 18 to 20 inches thick, which fit in well with the architecture of the historic local neighbourhoods. The simplicity of installation and low cost of materials permitted savings of 15 to 20% as compared to conventional construction methods. These savings were increased further with the installation of the straw bales by the future occupant/owner. In addition, workshops were held on site during the

construction phase to familiarize the larger community with the techniques and construction implications of strawbale as well as reduce labour costs (Bourke 1999).

Pros and Cons:

Straw bale construction has numerous economic and environmental benefits. In terms of affordability, one of the major benefits of the method is its technical simplicity. Weekend or week long workshops in straw bale construction are common, and the majority of straw bale homes are at least partly owner-built (Whitton 1998/99). This is empowering for the future home-owners, but it also makes this style of construction much more affordable. The average percentage of owner labour is 75%, and with labour costs on average representing about 50% of the total cost of a house, owner participation is the best way to reduce building costs (Whitton 1998/99). In addition, it is possible to reduce labour costs through wall-raisings with unskilled participants (Whitton 1998/99). For this reason, sweat equity (the contribution of labour equity in place of economic contributions) could be fairly easily used to allay the costs of a straw bale project for prospective home-owners without economic capital. In addition, straw bales are inexpensive and environmentally fairly benign. They are a locally available renewable resource, which is much easier on the land than an equivalent amount of logging, especially since straw is a by-product of grain farming and is rarely if ever produced for its own value. With just one acre of land enough straw can be grown in a year for the average straw bale house (Greig 2000). The use of straw bale both supports local farmers and avoids long distance transportation costs and impacts, though some wood is required for framing the structure (Whitton 1998/99). Straw bales are excellent insulators, with an R value of 35 to 50, and therefore straw bale homes cost half as much to heat and cool as the average stud-frame home with an R-value of 19 or 20 (Priesnitz 1996; Greig 2000; Mack 2001). They are also beneficial to human health, allowing a gradual

transfer of air through the walls and thereby promoting good indoor air quality. In addition, straw bale homes are extremely soundproof, last indefinitely, and are twice as resistant to combustion as most wood-frame homes (Draper 1998: 433).

This is an impressive list of benefits, but there are a few drawbacks to the technique. While straw bale homes do not require years of experience to build, they still require some level of care and skill. One problem which has been fairly extensively researched is that of moisture getting into walls before they are sealed off. In addition, while the bale raising can be completed in a single weekend with a few volunteers, the preparation for the plaster coating can take some time. The bales must be covered with fencing wire and essentially sewn together, which can be more work than novice builders expect (Mack 2001). Also, the cost savings and the ease of volunteer participation may have been overstated. Habitat for Humanity affiliates (all in the southern states, unfortunately, so the climate is not comparable) have used the building method with mixed success. Some found it was "volunteer friendly," but others found the material difficult to work with and won't be returning to it. In addition, four out of the five affiliates who experimented with the method found it around 10 % more expensive than their usual homes, though these are usually substantially cheaper than the average commercially-built house (Peacock 2001: 3, 23-26). In addition, since they are so rare, urban straw bale homes may face regulatory barriers. As Chris Magwood of Camel's Back Construction put it, "right now, the only downside to building a strawbale house is that your family, banker, and neighbours think that you're crazy" (quoted in Greig 2000).

In addition, the insulation value of the straw bale walls will not necessarily hold for the entire house, since not everyone puts on an R-40 roof, appropriate windows, etc. (Mack 2001). Also, straw bale homes have little to no thermal mass, like traditional wood houses, so that they cannot collect heat independently (Potts 1999: 190). While the insulation value of the houses is the most important factor

in our northern climate, straw-clay construction or pressed adobe bricks applied on the inside of the straw insulating layer are two alternative methods which could give the homes greater thermal mass without sacrificing insulation (Priesnitz 2000, Potts 1999: 190). Earthships, built largely of old car tires filled with rammed earth, have excellent thermal mass, but only a few have been built in this climate, since they must be well insulated to withstand our cold winters (Buchan 1995). They are excellent in the south because the heat from the day radiates from the walls at night, but to function this heat must then be renewed the next day. Earthships are environmentally attractive, because they use toxic and bulky waste tires in useful way, and are a well known alternative construction material, but straw bale seems better suited to our climate here in Peterborough.

SPROUT:

Flexible and affordable infill housing.

The previous case study, the R-40 house, was detailed in order to highlight the possibilities of the straw bale construction method. However, it is also an example of infill housing, which is another innovation in housing construction which promises to increase the sustainability of our city cores, both economically, socially, and environmentally. Infill homes are more affordable both for cities, since they use existing infrastructure such as roads and sewers, and for their owners, since they are more compact and cost less to maintain (CMHC 2001). They bring in more residents, helping to support inner-city communities, and they make environmentally friendly transport options more accessible and attractive. These however, are not the only benefits of the SPROUT design, which has been built as a demonstration home in downtown Montreal.

The house is designed to be affordable and adaptable to the needs of families as they grow and change. Built in three parts, it allows easy and affordable expansion over time as finances allow and needs dictate from a small 'starter home' to a larger house able to accommodate extra bedroom or office space or even additional apartments. However, since this was to be a demonstration home, the house was built in its expanded form, illustrating the complete concept (Moyes 1997: 8). The original two and a half storey home would be less than 100 m^2, the relatively small land and construction costs improving the home's accessibility to young families. As the family grew, the house was designed so that the basement could easily be finished, then the attic, and finally an addition could be added over the garage (Moyes 1997: 6; see page over for diagram).

In addition, the house is Quebec's first 'EnviroHome', a designation which encompasses both a high degree of energy efficiency (R-2000 certification), improved indoor air quality and materials conservation (Moyes 1997: 18). Products such as natural fibre carpeting and water-based paints were chosen to reduce the potential for stimulating allergic sensitivities. An innovative heating system, which incorporated in-floor radiant heating and a heat recovery ventilator, reduced energy use and increased air quality and building comfort. Environmental considerations were also incorporated in the choice of bamboo, a rapidly-renewable resource, for flooring the second storey and composite load-bearing beams and joists to reduce wood waste and over cutting (Moyes 1997: 18).

Pros and Cons:

From the environmental perspective, there are a number of significant benefits to the higher urban densities which are fostered by infill projects like SPROUT. One of the most important is a reduction in urban sprawl and concomitant car dependency (Saunders 1997). However, there are many other economic and environmental reasons to promote higher densities whenever feasible, including

increased pedestrian and bicycle traffic, more efficient public transit, and cheaper public services like garbage and snow removal. The SPROUT demonstration home's EnviroHome status also has important environmental and economic benefits, since its energy efficiency saves natural resources and investment by both the individual homeowner and the public. In terms of social sustainability, SPROUT's adaptability could lead to increased community stability, as families would need to move less frequently (Moyes 1997: 6).

While there are some benefits to the SPROUT concept, there are also some significant drawbacks. Even in the original 'starter home' form, SPROUT would not be all that inexpensive, being largely limited to families earning over $40 000 (Moyes 1997: 8). In addition, the environmental innovations incorporated are fairly limited, restricted to efficiencies on the existing system rather than experimentation with energy alternatives. Still, the SPROUT model contains worthwhile lessons for traditional suburban expansion. Regulatory issues would likely be the most significant drawback to this design. Various building codes, including height restrictions, restrictions on habitable storeys, or inflexible zoning which doesn't allow one, two, and three units on the same lot could all be problematic. Setbacks are also often inflexible, so that a house may have to be built larger to match those next door, making it difficult to take the best advantage of the small lot. Also, minimum parking requirements for each unit can be a serious problem in infill lots (Moyes 1997: 12).

Alberta sustainable house:

Conventional stud-frame house designed to be sustainable using proven technologies.

While it would be a rare architect who would consciously design an unsustainable house, the collective impact of many small design choices, each made without knowledge or concern for their

environmental effects, can be significant (Canadian Architect 1996). Few architects are able or willing to recognize these problems, particularly since sustainability is not a priority for the average Canadian consumer. Many important variations can be made within the traditional wood stud-frame construction framework. Better insulation, to increase the efficiency of energy usage, is one of the primary ways in which construction approaches the problem of sustainability. Another increasingly popular possibility for lowering unsustainable housing energy impacts is the active and/or passive use of solar energy. Reducing waste by designing buildings to reduce their use of materials, to reuse salvaged materials, and to more easily recycle their components in the future is also of key importance (Canadian Architect 1996).

The Alberta Sustainable House was built to illustrate some of these possibilities. Located in a suburb of Calgary, the house looks conventional enough. However, the only connection to the city system is an electricity line to export, not import, energy to the grid. Funded by a conventional mortgage, the 3 bedroom, 169 square metre home is sustainable and autonomous (Checora 1996: 5). A number of different well-proven sustainable technologies are incorporated into the house. 60 % of the house's heat, in Calgary's very cold but sunny climate, is provided simply by passive solar energy which is captured by a substantial thermal mass in the form of a five inch thick concrete slab covered in dark ceramic and glass tiles (Checora 1996: 5). The heat is kept within the house with walls and a roof insulated with cellulose to R- 50 and R-74 respectively. R-3 to 17 windows and two door mudrooms complete the building's 'envelope' (Noble and Swartman 1995: 39). Additional heat is provided by a highly efficient wood-burning masonry stove, which also heats part of the house's hot water and will eventually provide electricity, through a small steam turbine. Active and passive solar energy heat the rest of the house's water, and photovoltaics contribute the majority of the electricity, though experimentation with geothermal energy, cogeneration, and solar hydrogen fuel cells is under

way. Water, whose source is collected rainwater, is also highly conserved, with ultra-low flush and waterless toilets. Experimentation with greywater reuse and treatment is in progress (Noble and Swartman 1995: 39; Checora 1996: 6).

Pros and Cons:

Reducing energy consumption is usually more cost-efficient than expanding supply, which expands revenues, but is also accompanied by long term debt, higher operating expenditures, and the risk that demand may not be sustained (Roseland 1998: 82). However, in North America expansion continues to be the most common response to growing demand, and the expanded supply has generally not been in the form of renewable energy (Roseland 1998: 81). In many communities 75 cents of every dollar spent on energy leaves the community, so that when less money is spent on energy, it recirculates far longer within the local economy (Roseland 1998: 82). Often much of this money escaping the community is spent by those with lower incomes, because they tend to live in the most energy-inefficient housing stock, with drafty rooms and inefficient appliances and heating systems (Roseland 1998: 83). The Alberta Sustainable House (ASH) shows how unnecessary this destructive system is. With conscious environmental design, self-sufficiency is possible, even in the midst of the urban environment.

However, innovation, as always, takes commitment and research. Learning to adapt to a new way of doing things is often difficult. People are frequently afraid of, or uncomfortable with, the unfamiliar. To live more sustainably is a radical change from our current lifestyles. For the change to be successful, we need to be flexible, willing to put up with occasional inconveniences, and self-reliant, which are not skills we tend to cultivate in our urban societies. In addition, the initial cost of sustainable technologies will be higher, even if there are substantial savings in the long run. While the

ASH was funded via a conventional mortgage, many of the technologies the ASH incorporates were donated (Checora 1996: 5). The cost would no doubt be higher if all components of such a structure were obtained commercially.

Conservation Co-op (Ottawa):

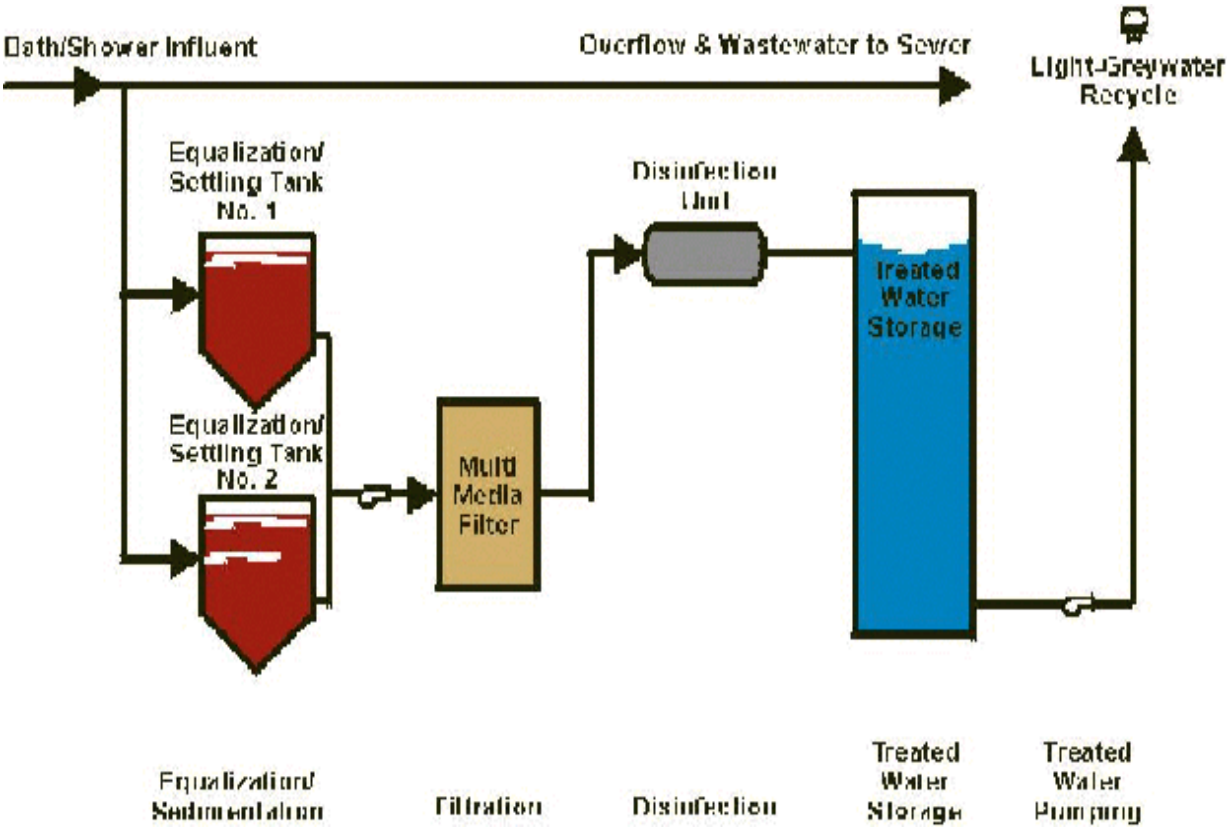
Greywater recycling.

Another aspect of construction in which alternative ideas may be incorporated is in the use of water. Water is one of our most essential resources, but only a tiny fraction of the world's water supply is fresh and available for human use. Of this small fraction of potable water, very little is actually drunk, going instead to lawns, washing machines, toilets and drains. Thus far, low flat-rate water prices in Canada have allowed us to ignore how it is wasted in our modern society, but there are hidden costs to all this waste. Consumers may not always realize it, but communities must pay to treat all those extra litres of water as well as for the significant capital costs of expanding treatment services, even if the connection with their personal water bills is not a direct one. In addition, water is often not completely purified before it is discharged back into the environment, since tertiary treatment is expensive and the environmental costs of pollution can be ignored, at least in the short term (Roseland 1998: 59 - 60).

The Conservation Co-op, a residential co-op in Ottawa, is attempting to address the first part of this problem, the routine residential wastage of purified water. They have developed an innovative greywater recycling pilot project with the aid of the CMHC (Canadian Mortgage and Housing Corporation), as well as the city of Ottawa-Carelton and the Ontario Ministry of the Environment. In eight of the co-op's 84 units a dual plumbing system has been constructed. 'Light greywater,' the used

water from showers and the rinse water from clothes washers and dishwashers, has a separate set of effluent pipes which direct it to a minimal treatment facility in the basement of the building. From there, the water is returned to the apartments via separate supply lines and reused for flushing the toilets, saving 640 L of purified water every day, around a quarter of the apartments' total daily water use (CMHC 2000).

The treatment system is fully automated, designed to operate unattended except for any necessary cleaning and general maintenance. It is comprised of equalization/sedimentation tanks, multi-media filtration, and a disinfection unit, as illustrated in the following figure:



This does not bring the water up to potable standards. Rather, new standards were developed in consultation with the Ministry of the Environment as well as Municipal officials, which were accepted by the Regional Health Department on the understanding that the water would be used only for toilet flushing. Suspended solids, E. coli, turbidity, colour, iron, and manganese levels were all tested and found to be well within the treatment objectives set by the standard (CMHC 2000). The system cost, including design, materials, installation, and commissioning, was just under $29 800. In addition, there will be an estimated annual power cost of $73, and some operation, maintenance, and monitoring costs (CMHC 2000).

Pros and Cons:

While the co-op's recycling system is still in the experimental stage, it shows promise for cutting down the level of residential potable water use substantially, especially in multi-unit buildings. The fact that it is a closed system, with little maintenance required, makes the system more attractive and more likely to be accepted widely. Both the environmental and economic costs of water treatment and new capital investment could be reduced significantly if this system is more generally adopted. However, it is still unknown how well the system could handle the light greywater from all 84 units of the housing co-op, which is a substantial increase from the eight presently serviced by the system.

However, widespread adoption of this system is unlikely if incentives are not adopted to encourage it. At present, flat-rate water pricing hides the cost of waste and would heavily discourage investment in a greywater recycling system, with its substantial direct costs. In addition, regulatory issues may be a significant barrier to the adoption of greywater recycling outside the pilot project context. Other options do exist, such as ultra low flush or composting toilets. Composting toilets reduce water use further than either of the other two options. However,

they do require a higher level of commitment. The compost must be emptied once or twice a year, though it is "beautiful and sweet smelling" according to at least one user (Potts 1999: 13). In addition, composting toilets are very likely to encounter regulatory problems in an urban setting.

Bear River, Nova Scotia:

Ecological sewage treatment.

Sustainable water management encompasses not only reducing the amount of water used but also the way it is treated. Conventional methods of water treatment are often incomplete, so that the water leaving urban water system is of a lower quality than that which entered it, leading to a gradual degradation of local water bodies (Roseland 1998: 60). However, there are alternatives which are simple, local, cheaper, and more environmentally sustainable, integrating human development with support for natural systems. A sewage treatment plant seems an unlikely tourist draw, but the new ecological sewage treatment plant in Bear River, Nova Scotia, has drawn 1,500 new visitors to the small community yearly (Roseland 1998: 64). Located in a greenhouse in the heart of town, the “living machine,” sweet-smelling and full of flowers and light, seems nothing like a conventional sewage treatment plant (Kelly and Redwood 1996; Roseland 1998: 64; Nozick 1992: 90). Instead of chemicals algae, protozoa, snails and plants clean the wastewater in gradual stages (Kelly and Redwood 1996). The sequence begins with a closed underground ‘blending tank,’ where air bubbles and bacteria are added to the sewage mixture. Gradually the wastewater moves on to a series of clear plastic tanks, ‘solar silos,’ where plants suspended in the nutrient rich solution provide both a habitat for bacteria, algae and protozoa, and absorb toxins too large for the smaller organisms to break down (Kelly and

Redwood 1996; Nova Scotia Environment and Development Coalition 1995). As of 1997, the plants were composted, but eventually, once the treatment plant expands to its full capacity of 50,000 L/day, ornamental flowers will be grown for sale (McDonald 1997). From the 'solar silos' the wastewater moves through a clarifier which diverts the little sludge that remains to compost in a reed bed while the clearer water heads for the next stage, an indoor pond. From the pond the water is directed through a small engineered marsh outdoors, there mainly for demonstration purposes, since the phosphates and ammonia the marsh is designed to treat, generally from industrial sources, are not present in this small village. Finally various filters remove the last of the suspended solids, and a UV light disinfects water clean enough to drink (though not regulated as such), which is expelled into the ocean (McDonald 1997).

See over for a diagram of a living machine, this one located in the Body Shop, Toronto (from Noble and Swartman 1995: 91).

Pros and Cons:

> "The industrial system is based on a linear model which assumes natural resources have no value in themselves. The result is an economy which processes large amounts of resources into waste as quickly as possible. A green economy would question superfluous consumption and seek to 'close the loops,' to mimic cyclical natural systems so that waste becomes food, nothing is thrown away, and symbiosis replaces competition."
>
> (Kelly and Redwood 1996)

There are a number of significant benefits, both economic and ecological, to this kind of symbiosis which innovative sewage treatment systems like Bear River's exemplify. Especially promising is the possibility of reducing the externalized costs of continuing urban expansion, such as the added load on sewage and other infrastructure, though limiting this expansion is important for other reasons. In addition, these facilities are affordable at the community level,

cheaper to build and maintain than a regular treatment facility. The Bear River facility cost $660,000 initially, with an additional $165 sewage tax per residence (McDonald 1997). It can even become a truly community-based commercial enterprise, growing tropical flowers or raising fish, as is done in connection with some other solar aquatic sewage systems (Nozick 1992: 89). Environmentally, the ecological treatment system is very positive, as the process deals well with nutrients as well as bacteria without resorting to toxic chemicals such as chlorine, so that the algae, contained, are the treatment, not the problem so pervasive in our lakes (Nozick 1992: 90). As always, the primary negative concerns are the regulatory issues. While numerous solar aquatic sewage systems have been built in the United States, they have so far been established only on a small scale in Ontario, namely at the Boyne Natural Science School near Allison and in the form of a "living wall" at the Body Shop in Toronto. The current Ontario government is not very supportive of projects such as these, and several have fallen through recently due to budget cuts at various levels (McDonald 1997).

Innovative social or economic structures:

While alternative approaches to housing construction are an important method of achieving sustainability, alone they are not sufficient. Sustaining communities and local economies is integral to sustaining local environments. Environmentally friendly housing is not sustainable unless it is affordable as well, accessible to the community as a whole. In addition, cluster-based housing and the community ties it fosters can facilitate both affordability and environmental sustainability as resources are shared and reused.

Windsong Cohousing Community:

Increasing community isolation is one of the problems that alternative housing is best equipped to solve. Nearly all of the diverse approaches to sustainable housing are cluster-based, in contrast to the traditional single-detached home. Cluster-based housing makes sense not just because it tends to foster the formation of social ties, but also for economic and environmental reasons. Many of the problems of our cities, whether they are social, economic, or environmental, are based on the modern assumption that we all live independently, and that this is as it should be. We build our housing in isolated units, and in most cases we live as if we must inevitably be as isolated our homes. Consider the duplication of resources in the average urban block, where every household owns a lawn mower, ladder, and one or even two vehicles. Cohousing, an innovative form of collaborative housing, questions whether this type of duplication is truly necessary. In a cohousing community, each household has its own private self-contained residence, but this is generally fairly small, because each household also shares common facilities and resources with other residents. These include areas such as common kitchens, workshops, and guest rooms, as well as all kinds of items not used on a daily basis, many of which, such as photocopiers or industrial sanders, few households could afford on their own (Kathleen Mancer Consulting et al. 2000: ix; Mawby 1996). In addition to saving money, cohousing allows people to reduce their consumption and personal impact on the environment at the same time as they improve their quality of life.

As of May 2000, only five purpose-built completed cohousing communities existed in Canada, but many are in various stages of development (Kathleen Mercer Consulting et al 2000: ix). Windsong Cohousing, in Langley, BC, is one example of this relatively new movement. Approximately a one hour commute from Vancouver, Windsong houses 106 people in 34

townhouses as well as a common house (Windsong Cohousing 1999). These include a variety of household types (seniors, young families, single people, couples without children) and a variety of occupations, from policemen to doctors (Kathleen Mercer Consulting et al 2000: 76). Windsong is an intentional community, designed by consensus among the residents as a collective whole through a long and arduous development process (Kathleen Mercer Consulting et al 2000: 77, 82). Typical of a cohousing community, this design includes extensive common facilities, with the individual units used primarily as retreats. Common facilities include a large common dining room and kitchen, a children's play area, a guest suite, a variety of meeting rooms, an office, a common laundry room, a craft room, and a store operated by one of the residents, which provides items such as organic vegetables at wholesale cost (Kathleen Mercer Consulting et al 2000: 78). Several residents share cars as well as a range of services from gardening to childcare, and are expected to contribute 4 hours a month to the operation of the community (Kathleen Mercer Consulting et al 2000: 78-79, 82). A number of environmental features were also integrated into the community design, such as low flush toilets and a large community garden area (McIntyre 2001). In addition, 4.5 acres of the 6 acre site are designated part of an environmentally sensitive area on which development is prohibited (Kathleen Mercer Consulting et al 2000: 78).

Pros and Cons:

Most cohousing residents, at Windsong and elsewhere, have a very strong sense of satisfaction with their lives in the community. Community feeling is very strong, due to shared space and values. The community is also stable, since people tend to stay in cohousing developments for twice as long as they do in other housing types. Those outside the community

also find cohousing desirable. While the rest of the Vancouver market has been in a downturn for a number of years, Windsong's units are holding their original value (Kathleen Mercer Consulting et al 2000: 81) From an environmental perspective, cohousing certainly has its benefits. Windsong homes have a smaller ecological footprint due to their size and higher level of sharing of resources, but also due to the social dynamics of cohousing. These "social technologies" are arguably just as environmentally important as those incorporated into the building design. In a close knit community people shop for groceries, rent videos, walk dogs and exercise *together*, all of which cumulatively reduces the use of cars (McIntyre 2001).

There are some downsides to cohousing, however. Primary among these is the significant commitment which cohousing requires of its members, due to the large proportion of shared space and the consensus decision-making model. In addition, cohousing can be financially quite risky because it requires up-front investment, and cohousing is not necessarily very affordable. The units at Windsong are more expensive than neighbouring condo units, with the one bedroom and den units selling for approximately $160,000. However, residents are willing to try and accommodate those without sufficient funds. For instance, recently residents themselves provided a family with 3% second mortgage financing because they didn't have enough for a down payment (Kathleen Mercer Consulting et al 2000: 80).

Land Trusts:

The kind of community ownership embodied in cohousing communities can be taken a step further and made affordable with the formation of a land trust. The most inflationary part of housing is the land, which in Peterborough typically makes up between 25 and 30 % of the total

cost of a property (Peterborough Sustainable Housing Group 2000; Oliver 1999). If land is taken out of the housing equation, it becomes far more possible for decent housing to be truly affordable for low income groups, particularly over the long term. Through an urban community land trust it is possible to do just that. Community land trusts are democratically_controlled, non_profit corporations with open memberships and elected boards of trustees, supported but not controlled through both public and private sources. Typically they acquire and hold land within the community, often through a long term lease, but sell the buildings on the land to low income community members for an affordable price (Peterson 1996). The new owners gain secure housing and a home to pass on to their children (Peck 1993). In turn, the land trust will generally incorporate some kind of "limited equity" policy into the home buyer's contract (Peterson 1996). An appreciation formula is used which adjusts the initial purchase price for inflation, and includes the value of any improvements made to the property, so that homeowners are encouraged to invest in their homes and are able to build some equity while at the same time preserving long_term affordability (Davis 1996). In this way, community control is built into the provision of housing, so that affordability is never limited to the same time span as the program funding, as is frequently the case with other types of social housing provision (Nozick 1992). Another important benefit largely limited to land trusts is that trusts, in contrast to most co-ops or other types of social housing, allow members to own their own homes, while barring absentee ownership or rental of land trust homes (Peck 1993). This emphasis on ownership greatly increases the stability of neighbourhoods, eliminating of absentee landlords and land speculators who can significantly contribute to the deterioration of inner city neighbourhoods. They also prevent gentrification of neighbourhoods by wealthier groups, who increase property values and therefore rents, pushing out the lower income community to less desirable locations (Nozick

1992). Instead, neighbourhoods can be refurbished by the residents themselves whose ownership gives them the ability and the reason to do so, without the loss of community connections and, typically, a downtown location (Chasnoff and Cohen 1996).

Community land trusts, because they are locally controlled, vary widely in their focus and in the emphasis they place on various issues, though their basic methods are the same. Two different examples are illustrated here to show something of their possible diversity. First, the Burlington Community Land Trust, a large (county-wide) and well-established trust closely connected with and support by the local municipal government. *Manos Unidos* Community Land Trust is the subject of the second case study. Quite different from the Burlington Trust in context, methods, and goals, *Manos Unidos* is an urban inner city land trust which relies more on the sweat equity its members contribute than government support.

Burlington Community Land Trust:

The Burlington Community Land Trust (BCLT), which operates throughout Chittenden County, Vermont, is one of the largest community land trusts in the United States (LISC 2001; Non-Profit Pathfinder 2001). Incorporated in 1984, the trust's expressed purpose is to remove land from the speculative market, keep housing affordable, and preserve public access to open land (LISC 2001; Roseland 1992: 94). The BCLT has a particularly strong relationship with the municipal government, with the city giving priority to the BCLT in the distribution of public funds in order to support the purchase or construction of housing on BCLT land (Roseland 1992: 93). The BCLT is active in a diverse range of activities apart from housing ownership attainment. These include rental housing, condominiums, tenant-owned cooperatives, including Vermont's first affordable artists' housing cooperative, transitional housing, a community health centre, a

community home for formerly homeless women, The Chittenden Emergency Food Shelf, Vermont Legal Aid, downtown facilities for nonprofits serving the homeless and low-income population, and a pocket park. In addition, the trust also operates a Homeownership Centre, through which the BCLT provides workshops in home buyer education, credit and budget counselling, financing assistance, home rehabilitation services, and maintenance education (Non-Profit Pathfinder 2001). In 1998, the trust produced 38 units of affordable housing; of which 23 went to new homeowner families, and owned and/or managed 412 units (Neighbourhood Reinvestment Corp. 1999).

Using a ground lease with limited equity provisions, the BCLT works to ensure the initial and future affordability of homes, to slow the gentrification of inner-city neighbourhoods, and to reduce the need for ongoing public subsidization of affordable housing (LISC 2001). With the help of grants from public and private sources as well as a revolving loan fund, the BCLT, through a down-payment grant program, helps families buy their own homes while bringing more land and affordable homes into the land trust system (Neighbourhood Reinvestment Corp. 1999). Grants average $12,500, and vary based on the availability of funds and the given family's income. It is also possible for low income residents to buy a BCLT home through the resale of a property that is already part of the land trust system. These resale properties remain affordable because to buy a BCLT home, an agreement must be signed to sell the home with ‘limited equity,’ at a price based on what they originally paid plus 25 percent of the increase in the value of that portion of the home’s total price (Non-Profit Pathfinder 2001).

Manos Unidos Community Land Trust (Philadelphia):

Manos Unidos is a much smaller land trust than the BCLT, having rehabilitated only 46 units of housing (Shanker 1999). In its run-down neighbourhood, Manos Unidos ends up being as much a housing developer as a land trust (Nozick 1992: 125). North Philadelphia's Kensington, where *Manos Unidos* operates, is a very poor neighbourhood, with a high housing vacancy rate and a similarly high crime rate, with 45 homicides in 1990 alone. Drug and/or alcohol dependency is rampant, and only 25% of students in the neighbourhood graduate from high school (Nozick 1992: 124). In this 'disinvested' neighbourhood, the community land trust invests in rehabilitation. With the help of government subsidies, low interest loans, and the sweat equity labour of members of the trust, *Manos Unidos* is attempting to create a new type of home-owner and a new community. The trust is there to enable local low income people become homeowners, thereby investing in the community instead of allowing the money to flow out to absentee landlords without a social commitment to the neighbourhood. Typically, the land trust homes cost less than half in mortgage payments what was paid in rent for substandard, insecure housing (Nozick 1992: 125).

To obtain these homes, however, the land trust demands extensive participation from prospective homeowners. They must attend an orientation, participate in running the organization by joining a standing committee, and save $500 as a down payment (Nozick 1992: 126). In addition, members must also contribute 'sweat equity' to their new home, accumulating work time in lieu of economic contributions to the house. This is a frequent instrument used by land trusts to allow those without capital to invest in housing themselves through their own labour. It can also be collective, as in the case of *Manos Unidos*, so that labour on another home within the community can also be counted as a contribution (Peterborough Sustainable Housing Group

2000, Nozick 1992: 126). Despite the fact that contributing the time sweat equity requires can be difficult for people who work long hours simply to keep financially afloat, it can have a number of benefits. The training given as part of sweat equity programs gives new home buyers the skills they will need to care for their new homes, in addition to potentially increasing their employability (Peterborough Sustainable Housing Group 2000). It also strengthens personal relationships between often isolated members of the community, building support networks which continue well after the sweat equity projects are completed. When *Manos Unidos* finishes rehabilitating a home and turns it over to a new family, a community street party is held, building a sense of community responsibility and pride (Nozick 1992). This sense of pride and accomplishment, for both individuals and communities, is one of the most important facets of projects involving sweat equity. It encourages community cohesion and confident action which moves well beyond housing and often, in the end, does much more for the community as a whole than the provision of housing alone could ever do.

Pros and Cons:

There are a number of benefits to land trusts, many of which have been highlighted above. The most important, of course, is that the structure of the land trust ties subsidies to property rather than people, allowing public money to serve successive occupants (Roseland 1992: 95). It is a flexible instrument, as well, which can be used to build community or to support local activism and the arts as well as provide continually affordable housing. In this diversity of holdings it is possible to integrate preservation of natural areas with care for affordable housing, so that bike paths, conservation areas, and community gardens could also fit under a land trust's management. On the downside, land trusts, at least in the form discussed here, may not be

possible in Peterborough. An attempt is currently being made by the Peterborough Community Housing Development Corporation to develop a community land trust for Peterborough. However, because of various clauses in the tenant protection act intended for trailer parks, which are run under land leases, it is not possible at the moment to set up the same kind of legal mechanism as exists in the United States. The idea is still being examined, but at the moment the exact form the final product will take is unknown. Under current Ontario legislation it is not possible to incorporate affordability when the homeowner sells their home, a crucial part of the land trust concept (Attridge 2001). In addition, while land trusts increase affordability, the sweat equity concept used by the Manos Unidos Community Land Trust is fairly crucial in making homes accessible to all comers. For the Burlington CLT the minimum income of applicant households is generally U.S. $20,000, and all applicants must have a stable source of income, good credit, and a reasonable amount of debt, which eliminates a substantial number of prospective applicants (Non-Profit Pathfinder 2001).

Analysis/Conclusions:

The diversity of approaches to the problem of urban sustainability found in different communities is dizzying. All in all, it is inspiring to examine all the possibilities, the endless creativity and energy that is the most valuable resource of communities everywhere. In order to usefully apply all these ideas, however, it is necessary to step back and look at the barriers that these projects have faced elsewhere and anticipate what similar problems may be faced here. One of the problems which came up most frequently when these studies were evaluated was that of the regulatory climate, particularly at the municipal and provincial levels. This is true both in

terms of misplaced incentives for unsustainable practices and barriers to innovation and change. Many of the regulatory problems faced are likely to be unintentional on the government's part, but this generally does not make changing the regulations much less expensive and difficult.

The second most commonly cited barrier to implementing change is individual levels of comfort with alternative housing innovations. Implementation of innovations is only possible if it is what the people themselves want, and are willing to adapt their lifestyle to accommodate. It is possible that fairly "invisible" methods of reaching for sustainability, such as the recirculation of groundwater, are those most likely to be accepted by the public. This is not made any easier by the fact that the costs of change, especially up-front, are often higher than might be expected, particularly when the method or technology is unfamiliar. Experimental examples are often cheaper because they are generally subsidized in some way. Still, funding for social programs, experimental or not, is as always a perennial problem. New and innovative programs are often those most vulnerable to budget cuts. In addition, even when funding is available, it is generally limited enough that it is difficult to help those most in need. Subsidies for those who require only partial support go so much further that it is easy to overlook those truly at the bottom of the ladder. Reaching enough people to make a significant difference is difficult in any case. Too often these programs seem only a drop in the barrel. One way to deal with this could be working out a project pay back estimate detailing when energy efficiencies, for instance, would pay for themselves. A long term pay back scheme based on this might make alternatives more attractive (Clapp 2001).

In the course of this research a number of areas for future investigation have come to light. As mentioned above, many of the principal problems found when considering the experiences of other communities are regulatory in nature. Documentation of the externalized

costs to the community of traditional housing policies and technologies could aid in convincing the municipality to facilitate efforts to achieve sustainability in housing. Similarly, an investigation of the barriers to the acceptance of alternative housing methods and technologies, regulatory or otherwise, could be very useful. Specifically, levels of acceptance of the closer community living which sustainable housing alternatives often entail could be documented. It is assumed that this could be a significant barrier, but there is little concrete support for such an assumption. A survey of the opinions of the people these programs are actually aimed at on the issue could be quite useful, though it is likely that most would overestimate in such a survey. Co-operation tends to sound attractive, but when people are faced with making real change, old habits die hard. An analogy can be made to the difference between surveys attempting to estimate the level of citizen support for spending on issues such as the environment, and the real life situation of campaigners asking for the funds directly. Which brings up the problem of uncertain funding for social programs. In order for sustainable housing programs to become truly sustainable, they must be able to sustain themselves without external supports. This is a perpetual issue, but an important one, and it could use as much investigation as possible.

Another issue which bears on the problem of housing affordability and environmental sustainability but which has not as yet been adequately investigated was suggested by Ian Attridge (2001). Little effort has thus far been put into investigating where affordable housing is located and its relationship with natural areas. Here in Peterborough affordable housing tends to be located next to old railway corridors or on vacant lots, close to the few remaining urban natural areas. Mediating this relationship and mitigating the possible conflicts of interest it entails has thus far been a largely unacknowledged problem. Some kind of provision could perhaps be made for naturalizing the grounds of affordable housing developments so that valuable natural

areas are not lost when other needs, such as that for affordable housing, are addressed. At the moment this is not a problem in Peterborough. This situation may be changing, however. The Bonnacord community garden, located just by Jackson Creek Park, has recently been rezoned for housing, partly out of consideration for Peterborough's severe affordable housing shortage. However, the site's current use as a community garden has substantial economic, social and environmental benefits for the Peterborough community. In addition, the garden is directly adjacent to the Trans-Canada trail, and building housing could impact on the natural and scenic value of the trail, as potentially could the garden. How the interests of these three diverse groups, supporting affordable housing, community gardens, and urban natural areas, could be co-ordinated bears investigation (Attridge 2001). All three perspectives have something valuable to bring to the community, but nothing can be accomplished if all their energy and resources are spent in conflict with one another. Community green space was not a topic which was highlighted in the current research, mainly because most such programs are not connected to specific housing projects, though they do build community. However, despite its omission here, it is still an element which should be considered in any attempt at achieving sustainability in housing.

The most crucial message that can be drawn from this research is the importance of a holistic approach, which integrates diverse innovations into all aspects of housing construction and a community's socioeconomic structure. Economic, social and environmental factors are all interrelated within society. Whether sustainability is first addressed from the perspective of affordability or environmental preservation, the answers are surprisingly similar. A recognition of the importance and value of our local surroundings and an emphasis on both mutual interdependence and self-reliance underlie the responses of many who have attempted to

creatively address the sustainability of our daily lives. While many of these attempts to increase the sustainability of our housing, in Peterborough and elsewhere, are still outside of the mainstream, it is a growing and vibrant movement with much promise for the present as well as a more sustainable future. If we, as a society and individually, recognize that alternatives to our present society do exist, we can begin to make conscious choices about how we wish to live. However, it is important to realise that making changes requires a substantial commitment. To successfully implement alternatives, it is essential that we believe in what is being done and are able to defend it, not just to government officials but also to family, friends, and the larger community. In addition, it is important to recognize that the housing crisis has complex causes, many of them with roots outside the local community. Globalization and economic disparities both within and between communities are increasing worldwide. Changing the way we house ourselves is important, but in many ways it only addresses the symptoms of a much larger problem. The root, systemic causes of inequality, overconsumption and isolation must be recognized and challenged through education and political change as well as by individual lifestyle choices.

Contact information for organizations and projects:

Towerhill Village:
contact Katherine Blackwood, Property Manager, Kawartha Participation Projects, at kawparticipationprojects@on.aibn.com.

Peterborough Green-up:
contact at 745 - 3238; greenup@greenup.on.ca; www.greenup.on.ca.

Peterborough Community Housing Development Corporation:
contact John Martyn at jnmart@nexicom.net.

Peterborough area co-operative homes:
Leta Brownscone co-operative homes contact at 749-5707.
Kawartha village co-operative homes contact at 748-5188.
Peterborough co-operative homes contact at 742-5142.

Youth Build II:
contact Dave Haw, project coordinator, at 743-8331.

The R-40 House:
contact Julia Bourke, architect, at (514) 522-8280; Fax (514) 522-8280 or (514) 931-7503; arjb@musica.mcgill.ca.

SPROUT:
contact Sevag Pogharian Design at (514) 935-5210; 3705 St. Ambroise Street, Montréal, PQ H4C 2C4; Fax (514) 935-9672; sevag_pog@bigfoot.com; www.bigfoot.com/~sevag_pog/.

Alberta Sustainable House:
contact Jorg and Helen Ostrowski or Orian Low at A.S.H. Inc., (403) 239-1882; 9211 Scurfield Dr. N. W., Calgary, AB, T3L 1V9; Fax (403) 547-2671; ash@freenet.calgary.ab.ca.

Conservation Co-op:
contact Totten Simms Hubiciki associates at (613) 592 - 7070; 240 Terence Matthews Crescent; Kanata, Ontario, K2M 2C4; Fax (613) 592 - 7702.

Bear River sewage treatment:
contact Dr. John Todd, original developer of solar aquatic sewage treatment, at the Centre for the Protection and Restoration of Waters at Ocean Arks International at (508) 540-6801; 1 Locust St., Falmouth, MA, USA 02540; Fax (508) 540-6811.
or contact Ecological Engineering Associates, who have purchased the rights to the solar aquatics system, at (508) 748-3224; 13 Marconi Lane, Marion, MA, USA 02738; Fax (508) 748-9740.

Windsong Cohousing Community:

contact Valerie McIntyre, Canadian Cohousing Network coordinator and Windsong resident, at valandgreg@windsong.bc.ca; http://www.cohousing.ca/cohsng4/windsong/.

Burlington Community Land Trust:

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United Hands Community Land Trust:

contact Maria Colon, Acting President, at (215) 425-7602; 2200 N. 2nd Street, Philadelphia, 19133.

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